Department of
Building and Housing
Te Tari Kaupapa Whare

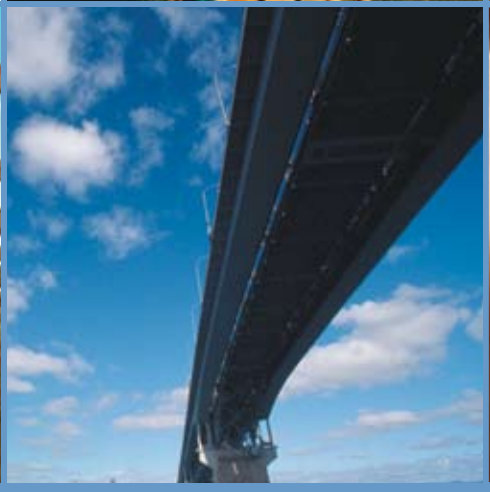
Building for the 21st Century

Report on the Review of the Building Code








Foreword

I am pleased to present this report on the Department of Building and Housing's review of the Building Code, the first full review of the Code since it was written in 1992.

The report is the outcome of a high level of engagement over the past three years with the building and construction sector and with other stakeholder groups – including the general public. We sought and listened to their views on how the Code might be improved, to meet the needs of society and our built environment in the immediate and long-term future.

The recommendations are forward-looking. They reflect the fact that society is ever-changing and the standards we require of our buildings must be flexible, pragmatic and responsive to changing needs.

The housing and building sector is important economically, socially and environmentally.

We all live somewhere. The built environment impacts on:

- our wellbeing
- our communities
- our cities
- how we see ourselves – and how other people see us.

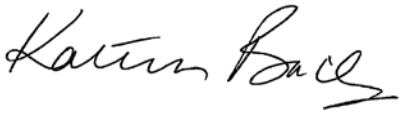
In looking at the standards we require for our buildings, the review also addresses the importance of fostering sustainability, so that what we do in our built environment today is sustainable for the communities of tomorrow.

The Department of Building and Housing is committed to continuing to engage with the building and construction sector as we move forward from this review.

This reflects our desire to show leadership in:

- achieving better-quality buildings
- providing guidance to the sector through technical guidance material and targeted education
- regulating in a way that is sensible, cost effective, enhances the sector and protects consumers.

The recommendations of this review present a significant step forward in thinking about the future buildings of New Zealand and the quality we want for our homes and living environment.



Katrina Bach
Chief Executive

November 2007

Report on the review of the Building Code

1 Purpose

This document reports on the review of the New Zealand Building Code.

The report has nine parts and three appendices.

- Part 1 provides an executive summary.
- Part 2 provides background to the review.
- Part 3 explains the New Zealand Building Code.
- Part 4 sets out the requirements and focus of the review.
- Part 5 summarises the findings and recommendations arising from the review.
- Part 6 presents how the review was carried out.
- Part 7 presents the findings of the review.
- Part 8 presents recommendations for amendments to the Building Code.
- Part 9 presents recommendations for implementation.

Appendices include the:

- synopsis of submissions on the 2006 discussion document
- responses to the 2007 discussion document
- tables for performance requirements.

2 Executive summary

This document reports on the review of the New Zealand Building Code, as required by section 451 of the Building Act 2004. It recommends amendments to the Building Code – after considering the extent to which the Building Code meets the requirements of the Act, and contains enough detail to give clear guidance on the related performance standards.

The Department has considered how to address key issues such as the changing needs of people, a forecast ageing population, affordability, risks from forecast climate change, energy efficiency and sustainable development. It also considered the particular needs of people living in high-rise apartment buildings, such as aspects of fire safety, noise and accessibility.

It has considered how to meet the needs of building owners and users through performance standards in the Building Code, and through other non-regulatory tools such as guidance to the sector and consumers.

The review began in 2004 with research into the future needs of the built environment and international developments in expressing performance requirements for buildings.

The review has listened to the views of building users, owners, the building industry, local and central government, individuals and community organisations, through workshops, focus groups and submissions on two discussion documents released by the government for public comment, in May 2006 and August 2007.

The Department worked with technical experts from industry, research, sector organisations, design companies, territorial authorities and other government departments.

The key findings of the review are that:

- the Building Code largely complies with and meets the requirements of the Building Act 2004, but does not adequately address some areas
- some parts of the Building Code are not stated in sufficient detail to provide clear guidance on the performance standards buildings must meet to ensure compliance with the Building Code
- the additional requirements of the 2004 Act can be incorporated in the Building Code with relatively minor amendments
- some refinements to the structure of the Building Code would improve the usability of the Code for a wider range of users
- Compliance Documents are relied on by a large percentage of the sector for guidance and technical specificity.

The review recommends, in respect of the Building Code:

- amendments to the Building Code to clarify some performance requirements
- further consultation on proposals to change some performance requirements
- amendments to the structure, statement of objectives and functional requirements in the Building Code
- investigation and collaboration with the sector on some possible performance requirements such as for fire safety, space and connection to the outdoors. These would address issues arising from some poor-quality, high-density housing, and would enhance the quality of the built environment, particularly in intensified urban areas.

To provide guidance to the sector on the performance requirements of the Building Code, the review recommends:

- investigating whether the development of an Acceptable Solution for Housing could reduce the costs for typical house construction
- the preparation of guidance material such as non-mandatory Compliance Documents, New Zealand Standards and other information
- a comprehensive programme to educate designers, builders and building consent authorities about changes to the Building Code and Compliance Documents.

The recommendations in this report set the foundation for building standards in New Zealand for the 21st century. They provide a framework for a Building Code that is:

- clear (it helps smooth the way for getting a building designed and consented)
- performance-based (it allows efficient and cost-effective and innovative construction)
- able to deal with changing demographics, the needs of an ageing population and uncertain risks associated with climate change, such as severe storms.

Addressing sustainable development underpins many of the recommendations. A proposal to further investigate annual CO_2 emissions is an innovative approach to considering resource efficiency. Living in intensified urban environments is likely to become increasingly common as a response to land prices and transport costs, and the recommendations on noise control, fire safety, and space and access in apartment buildings are an important contribution to having a good-quality built environment.

Good, comprehensive Compliance Documents that provide approved construction details and methods of design are an important tool in helping the sector meet the requirements of the Building Code, while reducing design and consenting costs. These must be supported with targeted education to ensure the smooth implementation of changes to the Building Code.

3 Background

3.1 BUILDING AND HOUSING SECTOR – AN OVERVIEW

The building and housing sector is an important contributor to New Zealand's economic and environmental performance and social wellbeing, employing about 190,000 people and contributing around 5 percent to gross domestic product. It affects every person in New Zealand – where they live and work, and how their communities function.

The sector covers physical building and construction, building professionals and local authorities, through to home and building owners, investors, landlords, tenants and property managers. It has a key role to play in long-term, sustainable strategies for the economy, society, environment and culture.

The government influences overall sector performance, the quality of building and housing, and the built environment. The government's interest in the sector is a consequence of the drive to build a sustainable economy, and to sustain family and community living standards.

3.2 DEPARTMENT OF BUILDING AND HOUSING

The Department of Building and Housing is the government agency responsible for delivering on the government's building sector policies.

The Department was established in November 2004, bringing together as a one-stop shop the building and housing sector policy, and related regulatory functions and dispute resolution services, from a range of government agencies.

The Department's establishment arose from concerns in the late 1990s over the weathertightness of many buildings. These concerns led the Building Industry Authority (a Crown entity set up in 1991 to administer the Building Act 1991) to commission an inquiry, which led to a report (known as the Hunn report). The inquiry found widespread quality issues, some of them of considerable concern.

The inquiry determined that these issues were caused, not just by poor performance of individual builders or designers, but by systemic failure within the building control system.

The government enacted the Building Act 2004 and established the Department of Building and Housing.

The vision in establishing the Department was to give the people of New Zealand access to quality homes and buildings at reasonable cost, provided by a capable and vibrant building sector and rental market. This includes ensuring homes and buildings reflect the New Zealand environment and contribute to a sustainable New Zealand.

The Department operates amid ongoing changes in society, the economy and the physical environment.

- The population is projected to grow to 5.05 million by 2051.
- Net migration has increased demand for housing.
- The population is ageing – ie, the percentage of older people is growing.
- Urbanisation is increasing.
- House prices continue to rise, with affordability issues resulting in a decrease in home ownership and increase in the number of people renting.
- Climate change is increasingly becoming an issue, particularly in terms of its effect on the built environment.

3.3 BUILDING AND HOUSING SECTOR REFORMS

The government has instigated wide-reaching building and housing sector initiatives, including:

- a review of tenancy law, to clarify and balance the rights and obligations of landlords and tenants
- a review of the Unit Titles Act 1972, to bring it into line with current trends in multi-unit accommodation
- work to ensure leaky homes are fixed, with effective disputes resolution processes, and future homes are weathertight
- bringing together government agencies to address the issue of housing affordability
- major reforms of the operation of the building and construction sector.

The Department of Building and Housing leads these initiatives, in particular implementing reforms provided by the Building Act 2004. These reforms address the whole process of building, looking at each of the different stages – design, consenting, construction and inspection.

Their overarching aim is to ensure that buildings are designed and built right first time.

Specific reforms are:

- the introduction, from 1 November 2007, of a licensing system for building practitioners, to ensure the sector is skilled, competent and accountable, and has the confidence of consumers
- the accreditation and registration of building consent authorities, to strengthen decision-making processes at the critical building consent and inspection stages
- the first full review of the New Zealand Building Code since its introduction in 1992 (the subject of this report)
- the development of a voluntary certification scheme for building products, so manufacturers can have their products certified as being Building Code-compliant if used properly
- an investigation of consumer warranties for building work.

The reforms reflect that, to build right first time, all parts of the building process must be robust.

4 The New Zealand Building Code

4.1 BUILDING CODES – AN OVERVIEW

Building codes are used in most developed countries to limit the likelihood of undesirable or unacceptable outcomes for people in buildings. They cannot eliminate risk, but provide a means of limiting risk.

Some undesirable events are natural and cannot be controlled – for example, natural hazards like earthquakes and storms. Codes provide rules to make sure buildings can cope with such hazards, and to limit damage so that people in them are safe in all but the most severe event. Codes are also intended to prevent some undesirable events happening in the first place – for example, the spread of diseases or illness because of poor sanitation.

Building codes have traditionally been important for the safety and health of people in buildings. In some countries they are also a means to address other issues such as energy efficiency, environmental protection, economic growth and social outcomes. This is true in New Zealand, where the purpose of the Act requires the Building Code to address wellbeing and sustainable development, as well as the safety and health of people.

4.2 NEW ZEALAND BUILDING CODE

The New Zealand Building Code was first written in 1991 as part of the implementation of the now-repealed Building Act 1991. That Act was enacted in response to a 1990 report by the Building Industry Commission. The Commission was set up in 1986 by government to 'determine within a suitable framework … the most appropriate legal and regulatory provisions for buildings and building construction and maintenance consistent with the public interest (including health, safety and amenity aspects)'.

The establishment of the Building Industry Commission arose from widespread dissatisfaction with New Zealand's lack of a coherent regime of building controls. There was a view that local building control regimes administered by individual councils should be replaced by a more unified, nationally applicable set of standards.

These standards, including the Building Code, were embodied in the Building Act 1991, which has since been replaced by the Building Act 2004. The 2004 Act led to the Department of Building and Housing taking over the functions of the Building Industry Authority, which was disestablished.

4.3 HOW THE BUILDING CODE WORKS

The New Zealand Building Code defines the functional requirements and performance criteria for buildings to provide basic protection for the people who use them, and to achieve national or social goals such as energy efficiency and access for people with disabilities.

The Building Code applies to the construction of all new buildings and to alterations or renovations to existing buildings.

'Buildings' include housing, community facilities, commercial and industrial structures, outbuildings, and structures such as bridges, platforms and dams.

The standards set out in the Building Code balance quality, cost, affordability and accessibility.

To allow flexibility and to encourage innovation, the Building Code is performance-based rather than prescriptive – that is, it specifies the requirements for building work through functional requirements (describing the required outcomes) and performance requirements (the level to which those outcomes are to be achieved). It does not prescribe how buildings are to be constructed.

The Building Code is fundamental to the operation of a building sector that:

- delivers buildings and homes that perform well in the New Zealand environment and contribute to sustainability
- delivers homes and buildings that meet the changing needs of New Zealanders and contribute to strong, effective communities
- is strong and well-performing with skilled building and housing professionals
- ensures building and home owners, tenants and users are confident and value well-designed, well-built, warm, safe and healthy homes and buildings.

Other key elements in the building system include:

- a well-functioning building industry, including skilled building professionals such as designers, architects, builders, tradespeople and manufacturers, and informed consumers
- a sound legal framework for conducting business so all parties can be held accountable for their actions
- reliable standards, testing and design guides for materials and processes used in construction
- warranties and insurance to provide reassurance to building owners
- education and training to provide knowledge and skills to those involved in the building process.

Diagram 1:
Documents that support the Building Code

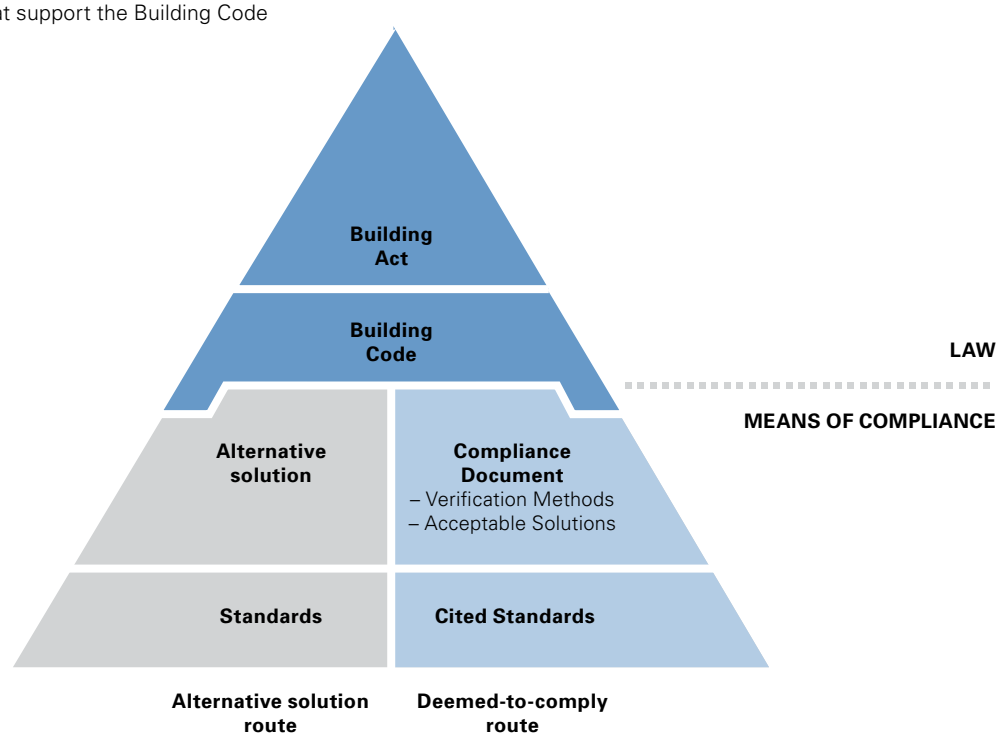


Diagram 1 shows how the Building Code fits into the building system. The Building Code is supported by Compliance Documents, which may be:

- Verification Methods (tests and calculation methods by which a design may be evaluated for compliance with the Building Code), and/or
- Acceptable Solutions (a prescriptive, low 'transaction' cost means of complying with the Building Code).

Buildings built using the method described in a Compliance Document are automatically deemed to comply with the Code. They are sometimes referred to as 'cookbook' solutions, because they prescribe a 'recipe' for ensuring compliance.

Alternative ways of building, known as alternative solutions, may be used if it can be shown that they meet the performance requirements set out in the Building Code.

New Zealand or Australian Standards and other publications may be cited in the Acceptable Solutions and Verification Methods, and may also be cited as part of an alternative solution.

Compliance Documents are an integral part of the building system and must be aligned with the Building Code for the system to be effective. They are widely used by the sector for a large proportion of the building work designed and undertaken.

The Building Code sets a stake in the ground for the wider building controls system. It directly provides the framework for the sector's intellectual knowledge contained in Compliance Documents, Standards and other guidance information. It also sets up the innovation framework for research and product development to efficiently deliver cost-effective solutions to building users.

5 Building Code review requirements

The review of the New Zealand Building Code is a key initiative in moving towards better practices in building design and construction, to ensure buildings contribute to vibrant, healthy, safe and sustainable rural settlements, towns and cities.

Section 451 of the Building Act 2004 requires the Chief Executive of the Department of Building and Housing to review the Building Code and to prepare a report for the Minister for Building and Construction on the outcome of the review within three years of the section coming into force (that is, by 30 November 2007).

The Chief Executive's report is required to include recommendations setting out any amendments to the Building Code believed necessary or desirable, after considering the extent to which:

- the Building Code meets the requirements of the Act
- the Building Code is stated in sufficient detail to provide clear guidance on the related performance standards.

While different clauses within the Building Code have been revised since 1992 when it was first written, this has been the first top-to-bottom review.

5.1 REVIEW CONSIDERATIONS

The review of the Building Code focuses on:

- whether the Building Code addresses everything the Act requires, and
- whether its requirements are clearly stated.

5.2 REVIEW RECOMMENDATIONS

Recommendations from the Building Code review are aimed at ensuring:

- a performance-based Building Code that sets clear performance standards that can be supported by Compliance Documents and guidance material
- a Building Code that retains those parts of the existing Code that are working well
- a Building Code that will help bring about innovation without compromising confidence in the standard achieved
- a Building Code that is accessible to a wider range of people
- building standards that are robust, evidence-based and take into account both benefits and costs
- building standards that balance performance with affordability
- building standards that allow for different levels of performance in different environments, based on risk and consequences
- accessible and comprehensive Compliance Documents and guidance material available in a range of media.

Recommendations about the content of the Building Code have been classified as Type 1, 2 or 3.

Type 1 recommendations are **recommendations to amend the Building Code** to clarify and update the performance requirements that are currently in either the Building Code or supporting Compliance Documents. These amendments would not directly require any changes in construction methods or materials, and their intent is to clarify the current requirements. It is expected there would be no impact on construction costs, and a small reduction in design and compliance costs.

Type 2 recommendations are **recommendations to consult on proposals** to amend the Building Code involving new performance requirements, changes to the scope of requirements, or different approaches to describing requirements. These would be prepared in conjunction with Compliance Documents to provide guidance to the sector, and would be subjected to benefit/cost analysis, a regulatory impact assessment, and consulted on with Cabinet approval before being finalised.

Type 3 recommendations are **recommendations to investigate and collaborate** on possible performance requirements that are conceptual at this stage. They require development and collaboration with the sector before they could be considered for approval for consultation as amendments to the Building Code.

6 Key findings and recommendations

6.1 SUMMARY OF FINDINGS

In summary, the review found that:

1. the Building Code largely complies with and meets the requirements of the Building Act 2004, but does not adequately address some areas
2. the Building Code does not adequately set performance standards for buildings to ensure that:
   - people who use buildings can do so safely and without endangering their health, with respect to:
     - protection from hot surfaces and substances (in certain circumstances)
     - sanitation requirements for water to address potential health issues that could arise from the use of raw water and greywater
     - having warm, dry homes that are energy-efficient
     - protection from excessively loud alarms to avoid possible hearing damage
     - construction that is consistent with the requirements of the Hazardous Substances and New Organisms Act 1996
   - they have attributes that contribute appropriately to the health, physical independence and wellbeing of the people who use them, with respect to:
     - space
     - connection to the outdoors
     - noise control
     - access to communal facilities for people with disabilities
   - people who use a building, can escape from it if it is on fire
   - buildings are designed, constructed, and can be used in ways that promote sustainable development, with respect to:
     - the energy used over the whole lifecycle of a building
     - efficient use of materials, water, waste
     - the durability of building materials and building elements
3. some parts of the Building Code are not stated in sufficient detail to provide clear guidance on the performance standards that buildings must meet to ensure compliance with the Building Code
4. the additional requirements of the 2004 Act can be incorporated into the Building Code with relatively minor amendments
5. some refinements to the structure of the Building Code would improve the usability of the Code for a wider range of users
6. Compliance Documents are relied on by a large percentage of the sector for guidance and technical specificity (which the Department must recognise).

6.2 RECOMMENDATIONS ON THE BUILDING CODE STRUCTURE

It is **recommended** that the Building Code be set out as follows.

- **Section 1 – General**: containing the general principles for building performance, the performance framework for buildings, and requirements for maintenance and durability.
- **Section 2 – Structural performance**: containing the requirements for the integrity and stability of buildings against the events and physical conditions they may be subjected to.
- **Section 3 – Fire and emergency safety**: containing the requirements to safeguard people (including firefighters) and neighbouring property against fire and other related hazards, prevent the spread of fire, and provide means of escape from fire and other emergencies.
- **Section 4 – Features for wellbeing and physical independence**: containing requirements for the wellbeing and physical independence of people, including access, space, noise control, light and connection to the outdoors.

- Section 5 – Environment: containing requirements for a healthy and appropriately comfortable environment for people, including moisture, indoor air quality, indoor temperature, and control of moisture from internal and external sources.
- Section 6 – Safety of users: containing requirements for the safety of users and protection from the risks of injury encountered by people in and around buildings.
- Section 7 – Sanitation: containing requirements to safeguard people from illness caused by exposure to human or domestic waste, by consumption of contaminated water, and by inadequate facilities for personal hygiene, laundering and food preparation.
- Section 8 – Resource efficiency: containing requirements for the efficient use of resources for buildings including materials, energy, water and waste.

6.3 RECOMMENDATIONS ON THE SCOPE OF THE BUILDING CODE

It is **recommended** that:

- objective statements be retained in the Building Code and be amended to clearly align with the new purposes of the Act
- the following objectives and functional requirements define the scope of the Building Code.

  Objectives
  - Safety: to limit the probability that, as a result of the design, construction, use or demolition of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury.
  - Health: to limit the probability that, as a result of the design, construction, use or demolition of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of illness.
  - Wellbeing: to limit the probability that, as a result of the design, construction, use or demolition of the building, a person in or adjacent to the building will be exposed to an unacceptable loss of wellbeing.
  - Physical independence: to limit the probability that, as a result of the design, construction, use or demolition of the building, a person in or adjacent to the building will be exposed to an unacceptable loss of physical independence.
  - Sustainable development: to promote sustainable development.

  Functional requirements

  The objectives of this Building Code are achieved by buildings or their elements having features that:

  Section 1 – General
  - limit impacts from events and physical conditions to tolerable levels
  - meet Building Code requirements for the intended life of the building

  Section 2 – Structural performance
  - maintain structural integrity, remain stable and do not collapse under the effects of foreseeable events and physical conditions throughout the life of the building, including during construction and demolition

  Section 3 – Fire safety
  - limit the risk of an accidental fire or explosion occurring
  - limit the risk of fire or explosion impacting areas beyond its point of origin
  - limit the risk of fire safety and other emergency systems failing to function as expected
  - limit the risk of people being delayed from moving to a place of safety during a fire or other emergency
  - limit the risk of firefighters or other emergency services personnel being delayed in or impeded from assisting in evacuation and performing firefighting operations

– limit the risk to firefighters or other emergency services personnel during evacuation and firefighting operations
– limit the risk of adverse effects to other property[1]
– limit the risk of the release of stored hazardous substances in a fire
– limit the risk of injury due to exposure to high levels of sound from alarm systems

Section 4 – Features for wellbeing and physical independence
– facilitate access to, within and from the building by all people, including people with disabilities
– facilitate access to facilities and services by all people, including people with disabilities
– facilitate connection to the outdoors
– provide space for personal activities
– limit exposure to noise originating from a source within the building
– limit exposure to noise transmitted from a source outside the building

Section 5 – Environment
– limit the risk of unwanted moisture indoors from moisture originating outside the building
– limit the risk of unwanted moisture indoors from moisture originating within the building
– limit the risk of water overflow penetrating to an adjoining property
– limit the risk of illness or loss of wellbeing caused by indoor air contaminants
– limit the risk of illness or loss of wellbeing caused by thermal conditions
– limit the risk of illness or loss of wellbeing caused by internal moisture

Section 6 – Safety of users
– limit the risk of injury due to slipping, falling, drowning or collision
– limit the risk of injury due to inadequate lighting
– limit the risk of injury due to exposure to hot surfaces and substances
– limit the risk of injury due to hazardous agents on site
– limit the risk of injury or illness due to exposure to hazardous substances

Section 7 – Sanitation
– facilitate the sanitary disposal of wastewater
– facilitate the sanitary disposal of solid waste
– facilitate the safe disposal of industrial liquid waste
– facilitate personal hygiene
– facilitate laundering
– facilitate hygienic food preparation
– facilitate cleaning in commercial and industrial buildings
– limit the risk of contamination of water supply systems
– limit the risk of consuming contaminated water
– limit the growth of legionella in heated water
– limit the risk of illness from greywater

Section 8 – Resource efficiency
– facilitate the conservation and efficient use or reuse of energy
– facilitate the conservation and efficient use or reuse of water
– facilitate the conservation and efficient use, reuse, or disposal of materials.

1 Other property means any land or buildings, or part of any land or buildings, that are not held under the same allotment; or not held under the same ownership; and includes a road.

6.4 RECOMMENDATIONS ON THE PERFORMANCE REQUIREMENTS OF THE BUILDING CODE

6.4.1 Type 1 recommendations to amend the Building Code to clarify performance requirements

It is **recommended** that the Building Code be amended:

- to clarify that variability and uncertainty are to be taken into account, and an overall safety level must be achieved
- to clarify that lighting and other helpful devices (in addition to signs) are to be provided in buildings (except detached dwellings, or within household units of multi-unit dwellings) to identify, for people, including people with disabilities:
  - escape routes
  - emergency-related safety features
  - potential hazards
  - accessible routes and facilities for people with disabilities
- to use the expression *wastewater* in place of *foul water*
- to be specific about where sanitation facilities are to be available, ie:
  - toilets and hand-washing facilities are to be available where people live or are accommodated, work, or consume food or drink on the premises
  - showering or bathing facilities are to be available where (other than ancillary buildings, outbuildings and back-country huts):
    - people live or are accommodated
    - people engage in active recreation
    - children under five are supervised or educated
- to clarify that 'sufficient number' means the time to queue for a toilet, on average, is less than one minute (which is the basis of the present Acceptable Solution)
- to be specific about where laundering facilities are to be available, ie, in:
  - detached dwellings or separate household units that accommodate three or more people
  - early childhood centres
  - group dwellings
  - aged care facilities
  - multi-unit dwellings
  - camping grounds
- by deleting reference to workcamps (for laundering and food preparation facilities).

6.4.2 Type 2 recommendations to consult on proposals to change performance requirements

It is **recommended** that amendments to the Building Code and related Compliance Documents be prepared for consultation on **proposals**:

- to include in the Building Code a statement of these general principles:
  - *effects on adjacent buildings*: a building or building work should not cause adjacent buildings to be affected by any of the design events that impact on buildings
  - *disproportionate consequences:* the failure of an element or system should not result in a consequence disproportionate to the event or physical condition that caused the failure
  - *consequences of failure*: building elements should be constructed in a way that makes due allowance for the consequences of failure
  - *effects of uncertainties:* building elements should be constructed in a way that makes due allowance for the effects of uncertainties arising from design and construction processes, including variations in the properties of building materials, workmanship, site conditions and the demands on buildings

- that designers consider the events and physical conditions stated in Table 1 (see Appendix 3)
- that buildings be designed and constructed to avoid surface water (flood) with a 1 percent annual exceedance probability (AEP) entering them
- that buildings be classified into performance groups according to Table 2 (see Appendix 3)
- that performance group 4 and 5 buildings (see Table 2 in Appendix 3) be designed and constructed to withstand tsunami where a tsunami risk has been identified in District Plans
- that a table of tolerable impacts related to events and physical conditions and performance groups be introduced to the Building Code
- that the design of buildings must be such that there is at least 90 percent confidence that buildings will meet the applicable tolerable impact requirements, according to the performance group and range of events to be considered
- that all buildings must meet the 'Insignificant' tolerable impact requirement for physical conditions that could affect buildings all the time
- that a building must be designed, constructed and capable of being maintained to provide confidence that it will comply with the performance requirements of the Building Code throughout its life
- that the designer should state an 'intended life' for a building and demonstrate that it is expected to meet the requirements of the Building Code for that time. An 'intended life' of at least 100 years will be required where the building or building work has 'permanent' effects on other property[2]
- that the Building Code incorporate the physical conditions likely to affect the performance of a building over its intended life, as in Table 2 (see Appendix 3)
- that building designers clearly show how the physical conditions that affect buildings have been considered and allowed for
- that building designers state the frequency of maintenance or replacement of building systems and how this should be done, to satisfy the building consent authority that the proposed maintenance and replacement arrangements are practicable and a viable means of achieving compliance for the life of a building
- that information about maintenance be included in the documentation provided in a building consent application, to make it available to future building owners
- that a performance framework as described above be applied to the requirements for structural performance requiring the designer to consider:
  - the physical conditions that affect the structural performance of the building
  - the chances of an event occurring
  - the performance group of the building
  - the impacts that can be tolerated for a range of circumstances
- that the Building Code be amended to clarify the requirements for addressing concurrent events and physical conditions
- that, for all buildings where alarms used for evacuation are required, the audible signal in a place of safety be not more than LAmax 100 dBA at any normally accessible point in the room at a height of 1.8 m, or no more than 15 dBA greater than the ambient noise, whichever is the greater
- that:
  - at least one access route with features for people with disabilities be provided in multi-unit dwellings
  - common spaces in multi-unit dwellings be accessible

2 Other property means any land or buildings, or part of any land or buildings, that are not held under the same allotment; or not held under the same ownership; and includes a road.

  - where shared facilities for access, parking provisions and sanitary facilities are provided in buildings, they should be accessible for people with disabilities (inclluding shared laundry facilities at hostels, motels and multi-unit dwellings, required only for camping grounds at present)
- that, for residential buildings and teaching spaces:
  - insulation against airborne noise be based on 80 percent population satisfaction (PPS) (likely to satisfy 80 percent of the population)
  - insulation against impact noise be based on 80 PPS
- that the reverberation time (expressed in seconds for specific teaching spaces) be specified
- that the maximum design levels for the most common contaminants of indoor air be as set out in Table 3 (see Appendix 3)
- that:
  - habitable spaces of buildings where people work and live be able to maintain a thermal environment based on 85 PPS
  - the energy demand for habitable spaces of buildings where people work and live takes account of an 85 PPS thermal environment
- that:
  - the maximum relative humidity in occupied spaces not exceed 70 percent for more than six hours a day in habitable spaces
  - the time required for condensation on surfaces in occupied spaces (eg, bathrooms) to evaporate must be limited to less than three hours
- that access to surfaces or substances of a temperature higher than 50°C (except for cooking elements) be restricted in early childhood centres, schools, aged care facilities, care facilities for people with disabilities, and hospitals
- that the temperature of heated water leaving the outlet of personal hygiene facilities be less than 50°C (to avoid the likelihood of scalding)
- that construction requirements for buildings used for storing or using hazardous substances be consistent with the requirements of the Hazardous Substances and New Organisms Act 1996 (HSNO Act)
- that for commercial and industrial buildings, multi-unit dwellings and detached dwellings where there is no independent access or private open space at ground level, space must be provided for safe, hygienic storage before collection of waste and recyclable waste, and access for collection
- that:
  - where shared laundry facilities are provided in buildings (eg, multi-unit dwellings, motels, camping grounds) they must be suitable for use by people with disabilities
- that space and facilities for the hygienic use and storage of cleaning equipment be provided in commercial and industrial buildings
- that:
  - terminology be changed from potable to drinking water (and correspondingly, from non-potable to non-drinking water)
  - water supplied at outlets of fixtures (including laundry tubs) and appliances intended for human consumption, utensil washing, food preparation, oral hygiene and personal washing meet the health quality requirements of the New Zealand Drinking Water Standard 2005
- that:
  - raw water that is supplied from springs, bores and tank rainwater may be used for laundry, toilet flushing or irrigation
  - raw water used for these purposes is to have low risk to human health from direct contact
  - the level of microbial indicators is not to exceed 10 *E.coli*/100ml

  - raw water supplied at outlets of fixtures and appliances intended for human consumption, utensil washing, food preparation, oral hygiene and personal washing, is to meet the health quality requirements of the New Zealand Drinking Water Standard 2005
- that water pipes with non-drinking water be continuously identified
- that:
  - greywater may be re-used within a building to flush toilets
  - the level of pathogens in greywater stored for re-use as measured by microbial indicators must be less than 1 *E.coli*/100ml
  - the quality of stored greywater must be monitored and the system maintained as a specified system
  - greywater may used for subsoil irrigation where that is permitted under the Resource Management Act 1991
  - greywater directly distributed for subsoil irrigation does not need to be treated.

6.4.3 Type 3 recommendations to investigate and collaborate on possible performance requirements

It is **recommended** that:

- assessing the resources used by buildings through the carbon dioxide (CO_2) emissions associated with their construction, operation, maintenance and demolition be investigated. This could include specifying a maximum design annual CO_2 emission using a metric yet to be developed
- specifying fire design scenarios and performance requirements to be taken into account when designing for fire safety be investigated. These would be in line with the structural design process that specifies events and physical conditions on the structural performance of buildings such as wind, earthquake and snow
- specifying that buildings be designed and built to allow space for 'household activity and access' be investigated
- specifying that all habitable spaces should achieve no less than 30 lux of natural light at floor level for 75 percent of a standard year,[3] and no less than a set level on a 'connection to the outdoors' scale, be investigated.

6.5 RECOMMENDATIONS FOR IMPLEMENTATION

It is **recommended** that a programme of staged releases of changes be followed.

It is **recommended** that Compliance Documents affected by changes to the Building Code be amended and released concurrently with changes to the Building Code.

It is **recommended** that the development of an Acceptable Solution for Housing be investigated. This could provide details for typical house construction for designers, builders and building consent authorities, and be applicable to about 80 percent of the house construction in New Zealand.

It is **recommended** that the release of changes to the Building Code and Compliance Documents be accompanied by a comprehensive sector education programme.

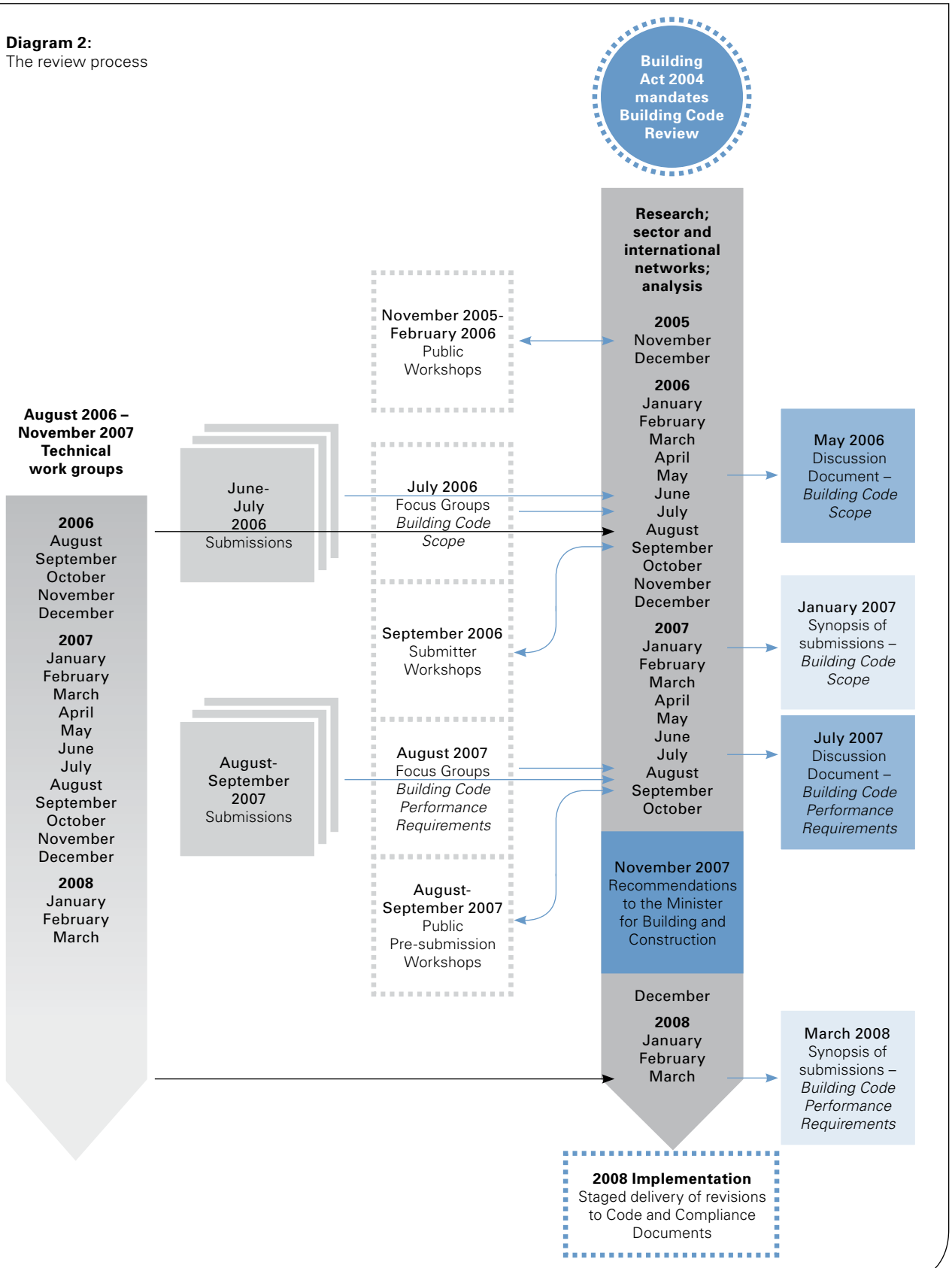
It is **recommended** that guidance be provided to designers, builders and building consent authorities by way of Compliance Documents (and other information) to minimise the impact on compliance costs.

It is **recommended** that designers have both guidance on features that improve the general accessibility and adaptability of buildings, and some possible solutions.

3 For the purposes of determining natural light, the standard year is the hours between 8 am and 5 pm each day with an allowance for daylight saving.

7 The review process

Diagram 2:
The review process



The review started in 2004 with a period of research on the future needs of the built environment and international developments in expressing performance requirements for buildings.

More than 500 building users and representatives from industry and government met in a series of four workshops in 2004 and 2005 to find out what people wanted from the Building Code.

Based on that research and the outcomes of those workshops, a discussion document on the scope of the Building Code was released for public comment in May 2006.

After the 2006 discussion document was released, focus groups were held with local and national community organisations, and workshops were held with individuals and organisations who had made submissions. The Department received 265 submissions from the building industry, local and central government, individuals and community organisations.

A report summarising the submissions on the 2006 discussion document, including the workshops and focus groups, was published in January 2007. Both the discussion document and the synopsis of submissions are available on the Department's website: **www.dbh.govt.nz**

In December 2006, the Department established technical work groups to help it develop specific performance requirements for the Code. Work group members included researchers, industry experts, designers, Departmental advisors and people from territorial authorities and government departments.

A second discussion document on the performance requirements for the Building Code was released for public comment in August 2007.

Focus group meetings were reconvened with local and national community organisations, and workshops held to provide context for individuals and organisations intending to make submissions. More than 200 submissions were received.

7.1 RESEARCH ON CURRENT AND FUTURE REQUIREMENTS OF THE BUILT ENVIRONMENT

The Building Code will influence buildings that may be in use for the next 100 years or more.

The Department considered factors that influence current and future requirements of the built environment, including population and dwelling trends, the environment, and changing technology.

Population and dwelling trends

New Zealand's population is just over four million people and is predicted to increase by 2051 to just over five million.[4]

New Zealand had 1.45 million households at the 2006 Census, up 8 percent on 2001 figures. The number of households owned is increasing, but at a slower rate than the growth in the number of households renting. This has meant a decline in the proportion of households owning their own home from 74 percent in 1991 to 66.9 percent in 2006, with the most marked decline in the 35–54 age group. The only age group to experience an increase in home ownership was 75 years and over. The strong population growth areas of Auckland, Canterbury, Bay of Plenty and the Waikato show the greatest growth in the number of owner-occupier households.

A major trend has been the increase in inner city and apartment living, particularly in Auckland. The trend reflects the change in household composition, with a decrease in the average number of people per household. In the immediate future most new households will be couples with no children or one-person households. The Building Code must take into account the requirements of people living in higher-density environments in terms of noise levels, space requirements, indoor air quality, connection to the outdoors and other features that affect wellbeing.

4 The source for population and dwellings trends is Statistics New Zealand.

Households are becoming smaller and women are having children later in life. The population is also becoming better educated and working patterns are changing. Increased mobility affects assumptions about how long people are likely to stay in buildings, and implies a higher turnover in building owners and occupants. Changing patterns of work, including the blurring of home and work, will require different functions and services in both places of work and housing.

While the average number of people per household has been dropping, the average size of houses and apartments has been increasing, with correspondingly higher construction costs.

Increasing ethnic diversity means the Building Code should allow for any special traditional and cultural aspects of the intended use of a building, within the overall objectives of health, safety, wellbeing, physical independence and resource efficiency.

It is predicted that by 2051 one person in four will be over 65 years. Housing design and construction will need to take into account the requirements of an ageing population. Mechanisms that will enable people to stay in their homes as they get older, such as adaptable or universal designs, are an increasing focus. The Act requires the Building Code to ensure buildings have attributes that contribute appropriately to the physical independence of building users.

The environment

The Building Code was written before climate change became a major concern, but it does contain provisions for the efficient use of energy sourced from a network utility operator or a non-renewable energy source.

Climate change is likely to result in more frequent extreme weather conditions. Buildings should be designed and constructed to take account of the effects of current and future climate change on the natural environment. The construction, operation, maintenance and demolition of buildings require significant resources such as energy, water and materials, and often produce waste.

Climate change is largely attributed to the emissions of greenhouse gases. CO_2 – released from burning fossil fuels like coal, petrol and oil – accounts for around 90 percent of greenhouse gas emissions from buildings. Levels of CO_2 in the atmosphere are higher than they have been at any time in the past 400,000 years.

Emissions from buildings come from embodied energy consumption (manufacturing of materials, construction, transport and maintenance), operational energy consumption and refrigerant leakages (commercial only).

Changing technology

Construction technologies and knowledge of building products and performance have advanced significantly since the Building Code was introduced 16 years ago. It is difficult to predict the future requirements of buildings when innovations can be quickly overtaken by newer developments. The advent of wireless networks, for example, quickly followed on from physical cabling for computer networks.

Mechanisms are required to accommodate technological and other changes.

Related government policy and strategies

The review of the Building Code contributes to the government's three key themes:

- economic transformation: by supporting the development of a sustainable economy based on innovation and quality
- families – young and old: by sustaining family and community living standards
- national identity: by supporting innovation and good design in the built environment.

Four ways in which the Building Code contributes to these themes are through:

- buildings and homes that perform well in the New Zealand environment and contribute to sustainability
- a strong, well-performing sector with skilled building and housing professionals
- homes and buildings that meet the changing needs of New Zealanders and contribute to strong, effective communities
- confident building and home owners, tenants and users who value well-designed, well-built, warm, safe and healthy homes and buildings.

As far as the Building Act allows, the review aligns with and contributes to related government policy and strategies such as the:

- New Zealand Housing Strategy **www.hnzc.co.nz/nzhousingstrat/**
- work on Sustainable Cities and the Urban Design Protocol, which is part of the Sustainable Development for New Zealand Programme of Action **www.mfe.govt.nz/issues/urban/sustainable-cities/**
- New Zealand Energy Efficiency and Conservation Strategy 2007 **http://www.eeca.govt.nz/eeca-library/eeca-reports/neecs/report/nzeecs-07.pdf**
- New Zealand Waste Strategy **www.mfe.govt.nz/publications/waste/wastestrategy-mar02/**
- New Zealand Disability Strategy **www.odi.govt.nz/nzds/**
- Positive Ageing Strategy **www.osc.govt.nz/positive-ageing-strategy/**
- Healthy Housing Programme **www.hnzc.co.nz/aboutus/publications/brochures/2005/fs%20Healthy_Housing.pdf**
- National Civil Defence and Emergency Management Strategy.[5]

7.2 CONSULTATION

7.2.1 Consultation on Building Code user and societal expectations (2004–2005)

The first phase of the review established the objectives and the building work features the Building Code should address to meet the requirements set out under the purposes and principles of the Building Act 2004.

The Department engaged with a wide range of industry, government and consumer representatives in workshops in 2004 and 2005 to find out what people wanted from the Building Code. The workshops informed the review about expectations that:

- buildings should
  - be better quality, and fit for their purpose
  - healthy
  - safe
  - accessible to everyone
- the Code should:
  - be visionary, taking into account future needs
  - take measurable steps forward
  - be flexible and encourage innovation
  - be cost-effective
  - be simple enough for people to understand how to achieve the required standards
  - be accessible, with plenty of guidance documents and in a variety of media
  - be linked to a comprehensive training programme
- performance requirements should:
  - be appropriate to the type of building and the risks involved
  - take account of local circumstances.

There also needs to be confidence that standards are actually being achieved.

5 The National CDEM Strategy 2003-2006 is under review. The final National CDEM 2007 is expected to be released in February 2008.

7.2.2 Consultation on scope for the Building Code (2005–2006)

A discussion document, released in May 2006, addressed the scope, content and structure of the Building Code and received 265 submissions from the building industry, local and central government, individuals and the community.

Key points raised included:

- that the Building Code should provide a clear lead in setting performance requirements for buildings
- support for a performance-based Building Code (with different interpretations of what this meant)
- the need to balance new provisions with affordability and careful consideration of costs and benefits
- that the Building Code should be aligned with other legislation (submitters specifically referred to the Resource Management Act 1991)
- that buildings should be designed to cope with the rigours of climate and weather change patterns, but warning systems rather than engineering solutions were considered more appropriate for less frequent hazards such as tsunami, volcanic eruption and wildfire
- widespread support for a more sustainable and energy-efficient approach to building.

Workshops with organisations and people who had made submissions were held in Auckland, Wellington and Christchurch.

In August 2006, the Department held a series of 11 focus groups around New Zealand, to invite community feedback on the discussion document.

A report summarising the submissions to the 2006 discussion document, including associated workshops and focus groups, was published in January 2007. The discussion document and the synopsis of submissions are available on the Department's website: **www.dbh.govt.nz**

A more extensive list of points from the submissions is presented in Appendix 1 of this report.

7.2.3 Consultation on performance requirements for the Building Code (2006–2007)

In the second phase of the review, performance criteria for proposed building work features were drafted for consultation.

From August 2006, the Department set up eight work groups to develop specific performance requirements for the Building Code. Work group members were drawn from the building sector, universities, territorial authorities and government.

A second discussion document released in August 2007 consulted on the draft performance requirements.

Workshops were convened for prospective submitters in Auckland, Wellington, Christchurch and Dunedin to provide context for the preparation of their submissions.

In August 2007, the Department reconvened a series of 11 focus groups around New Zealand to invite community feedback on the discussion document.

Key points raised by submitters in the 2007 consultation included:

- comments that the sector was going through a lot of change and any further Building Code changes needed to be well supported with appropriate guidance material/Acceptable Solutions
- general support for the suggested recommendations in the discussion document, and no significant issues with highly polarised views
- general support for further investigating the proposed Type 3 changes (CO_2 emissions, fire safety, space and connection to the outdoors) and an interest in being informed about (or being involved in) future development work
- in some areas, debate about the proposed technical requirements and rationale for performance standards. No significant anomalies were found

- some misunderstanding about the current Building Code provisions, leading to incorrect interpretation of some of the proposed technical requirements.

A more extensive list of key points from submissions, focus groups and workshops is presented in Appendix 2 of this report.

7.2.4 Summary of substantive changes following the 2007 discussion document

The 2007 discussion document presented for comment considerations likely to be advanced as proposed amendments to the Building Code. The Department sought comment on these. It was understood that some would require further analysis before a recommendation could be made. The submissions helped the Department in considering what it would put forward as recommendations to amend the Building Code.

In response to the submissions made on the discussion document, and other analysis, the following substantive differences from the discussion document have been reflected in the recommendations in this report.

Structure of the Building Code

An alternative structure for the Building Code was presented in the discussion document. There was both support for and opposition to the structure. After consideration, the Department concluded that a wholesale change to the structure of the Building Code was not necessary to achieve clarity or ease of use. It also concluded that it would not be desirable in terms of impact on the sector, and the cost and ease of implementation.

Section 1 – General
- No significant changes to recommendations.

Section 2 – Structural performance
- No significant changes to recommendations.

Section 4 – Safety in use
- The barrier requirements have been removed because the changes proposed are not significantly different from the current Code clause (F4), which was recently reviewed.
- Specified coefficients of friction for slip resistance have been removed.
- Considerations about the performance requirements for artificial lighting have been removed because they are essentially the same as the current Code.

Section 5 – Environment
- Glass fibres and ozone have been removed from the list of contaminants of indoor air quality.

Section 6 – Sanitation
- The wording of the requirements for personal hygiene facilities has been changed from 'be provided' to 'be available'.
- Reference to reliability requirements for component parts of wastewater disposal systems and industrial liquid waste disposal systems has been captured in the durability requirements in the General section.
- Consideration of a minimum water supply capacity has been removed.
- Performance requirements for the use of greywater for subsoil irrigation and reuse for toilet flushing have been specified.
- The current requirement for control of legionella bacteria has been retained.

Section 7 – Features for wellbeing and physical independence
- No significant changes to recommendations.

Submissions made about the fire safety, resource efficiency and features for wellbeing and physical independence Type 3 changes will be considered in detail as these topics are further developed.

8 Principal findings of the review

8.1 EXTENT TO WHICH THE BUILDING CODE MEETS THE REQUIREMENTS OF THE ACT

The Department undertook a top-down assessment of various parts of the purpose (Section 3) and principles (Section 4) of the Act, to assess the extent to which the Building Code meet the requirements of the Act.

Section 3 contains the purpose of the Act.

Section 4 contains the principles that must be taken into account in setting the requirements of the Building Code.

Section 3 of the Building Act 2004

Purpose
The purpose of this Act is to provide for the regulation of building work, the establishment of a licensing regime for building practitioners, and the setting of performance standards for buildings, to ensure that—

(a) people who use buildings can do so safely and without endangering their health; and
(b) buildings have attributes that contribute appropriately to the health, physical independence, and well-being of the people who use them; and
(c) people who use a building can escape from the building if it is on fire; and
(d) buildings are designed, constructed, and able to be used in ways that promote sustainable development.

Section 4 of the Building Act 2004

Principles
(2) In achieving the purpose of this Act, a person to whom this section applies must take into account the following principles that are relevant to the performance of functions or duties imposed, or the exercise of powers conferred, on that person by this Act:
(a) when dealing with any matter relating to 1 or more household units,—
  (i) the role that household units play in the lives of the people who use them, and the importance of—
    (A) the building code as it relates to household units; and
    (B) the need to ensure that household units comply with the building code:
  (ii) the need to ensure that maintenance requirements of household units are reasonable:
  (iii) the desirability of ensuring that owners of household units are aware of the maintenance requirements of their household units:
(b) the need to ensure that any harmful effect on human health resulting from the use of particular building methods or products or of a particular building design, or from building work, is prevented or minimised:
(c) the importance of ensuring that each building is durable for its intended use:
(d) the importance of recognising any special traditional and cultural aspects of the intended use of a building:
(e) the costs of a building (including maintenance) over the whole of its life:
(f) the importance of standards of building design and construction in achieving compliance with the building code:
(g) the importance of allowing for continuing innovation in methods of building design and construction:
(h) the reasonable expectations of a person who is authorised by law to enter a building to undertake rescue operations or firefighting to be protected from injury or illness when doing so:
(i) the need to provide protection to limit the extent and effects of the spread of fire, particularly with regard to—
  (i) household units (whether on the same land or on other property); and
  (ii) other property:
(j) the need to provide for the protection of other property from physical damage resulting from the construction, use, and demolition of a building:

(continued over)

Section 4 of the Building Act 2004 (continued)

(k) the need to provide, both to and within buildings to which section 118 applies, facilities that ensure that reasonable and adequate provision is made for people with disabilities to enter and carry out normal activities and processes in a building:
(l) the need to facilitate the preservation of buildings of significant cultural, historical, or heritage value:
(m) the need to facilitate the efficient use of energy and energy conservation and the use of renewable sources of energy in buildings:
(n) the need to facilitate the efficient and sustainable use in buildings of—
  (i) materials (including materials that promote or support human health); and
  (ii) material conservation:
(o) the need to facilitate the efficient use of water and water conservation in buildings:
(p) the need to facilitate the reduction in the generation of waste during the construction process.

Both the purpose and principles focus on the needs of consumers (defined as occupiers of housing and other dwellings) and on recognising the special place that houses have in people's lives by providing shelter and protection from the elements. The concept of durability is introduced as a principle, to ensure a building will continue to meet standards throughout its intended life.

8.1.1 Safety

The Act requires (section 3) that people who use buildings can do so safely.

Safety is not a new requirement of building regulation. The Department looked at current safety requirements in terms of clarity, societal expectations, sustainability and alignment with other regulations. Some of the findings are addressed in other parts of this report.

Safety can be divided into three parts from the perspective of building features: structural performance; fire and emergency safety; and safety of users.

Structural performance

Structural performance refers to the maintenance of structural integrity, stability, means of support, and the limitation of damage and loss of amenity of buildings.

The Department found that, in general, the Building Code performed adequately to achieve the safety purpose in terms of structural safety, but would be improved by lifting the safety and reliability metrics contained in the Compliance Documents into the Code itself. The Department also considered it necessary to revise performance groups and introduce tolerable impact levels as a means of defining performance requirements.

Recommendations on structural performance are described in sections 9.3.1 and 9.4.2 of this report.

Fire safety

Fire safety refers to safeguarding people and neighbouring property against fire and other related hazards, preventing the spread of fire, and providing means of escape from fire and other emergencies.

The Department found that the Building Code fire safety requirements were unclear. The lack of clarity in both the Code and Compliance Documents has led to inconsistent interpretation by fire engineers and territorial authorities, and disputes about the safety of fire designs for proposed buildings.

Recommendations on fire safety are described in sections 9.4.3 and 9.5.2 of this report.

Safety of users

Safety of users refers to the risks encountered by people in and around buildings. These include: slips, trips, falls, collisions; burns and scalds; electrocution; explosions; being trapped or injured by mechanical means; drowning; hazards from brittle elements; and hazards from building materials.

The Department found that, in general, the Building Code addresses safety of user features, but does not fully address protection from hot surfaces and substances, nor does it address the risk of harm from excessively loud alarms. It also found that Building Code requirements on hazardous substances and the Hazardous Substances and New Organisms Act 1996 should be aligned.

Recommendations on safety of users are described in sections 9.3.3 and 9.4.6 of this report.

8.1.2 Health

The Act requires (section 3) that people who use buildings can do so without endangering their health, and that buildings have attributes that contribute appropriately to the health of people who use them.

Health is not a new requirement of the Act. The Department looked at health requirements in terms of clarity, societal expectations, sustainability and alignment with other regulations.

The quality of the indoor climate and provisions of sanitation features influence the health of people in buildings.

Indoor climate

Indoor climate refers to the quality of indoor air, the moisture conditions that contribute to poor air quality, and the indoor air temperature required for health and comfort.

The World Health Organization (WHO) recommends a minimum indoor temperature for health of 18°C, with up to 20–21°C for more vulnerable groups such as older people and young children.

The recently completed 10-year household energy end use project (HEEP) has found that houses in New Zealand do not meet WHO-recommended temperatures.[6] Winter excess mortality for people over 65 years of age is greater in New Zealand than in Northern Europe, which may reflect differences in the quality of housing.[7]

The Department identified inadequacies in the Building Code's requirements for indoor temperatures, which address the heating requirements of young children and older people in certain buildings, but not the population in general.

The HEEP study shows that the temperatures required in the Code are inadequate for health.

Recommendations on indoor climate are described in sections 9.4.5 of this report.

Sanitation

Sanitation addresses the risks of illness due to insanitary conditions caused by exposure to human or domestic waste, consumption of contaminated water, and inadequate facilities for personal hygiene, laundering and food preparation.

The Department found that, in general, the Building Code addresses sanitation requirements (hygiene, water quality), but does not address sanitation requirements for water and waste recycling that would be required if these were introduced to address sustainable development outcomes.

Recommendations on sanitation are described in sections 9.3.4 and 9.4.7 of this report.

8.1.3 Wellbeing and physical independence of buildings users

The inclusion of wellbeing and physical independence in the purpose of the Act gives greater emphasis to building users and the special place that buildings have in people's lives.

The Building Code incorporates these concepts in an *amenity* objective which parallels health and safety objectives. *Amenity* is described as 'an attribute of a building which contributes to the health, physical independence, and wellbeing of the building's users but which is not associated with disease or specific illness'.

6 Isaacs N et al. (2006) Energy use in New Zealand Households report on the year 10 analysis for the household energy end use project (HEEP), Branz Limited.
7 Isaacs N and Donn M (1993) Health and housing – seasonality in New Zealand mortality, *Australian Journal of Public Health* 17(1), 68-70.

Wellbeing and physical independence are influenced by factors such as space, protection from noise, light, connection to the outdoors, and access.

The Building Code includes provision for space in aged-care facilities only. There are no requirements for space in other types of buildings.

Concerns were expressed during consultation that the size of apartments being provided in some new developments did not provide enough space for owners/occupiers to meet their needs for wellbeing and comfort.

The Building Code has requirements for noise transmitted between adjacent occupancies, but not for noise transmitted from an external source outside the building, or noise transmitted between habitable spaces and other parts of the building in 'mixed use' buildings that house other functions, such as a gymnasium.

The Building Code has natural light requirements, and buildings are required to provide visual awareness of the outside environment. With the trend to more intensive urban development, concerns have been raised about how apartments in particular connect to the outdoors in relation to natural light and sunlight, balcony size, blocking of views and the adequacy of current requirements.

To meet the physical independence objective, the Act contains provisions on access to buildings by persons with disabilities in sections 117 to 120. The Act defines a 'person with a disability' as a person who has an impairment or a combination of impairments that limits the extent to which the person can engage in the activities, pursuits, and processes of everyday life, including, without limitation, any of a physical, sensory, neurological or intellectual impairment, or a mental illness. The term 'impairment' is preferred to 'disability' in the NZ Disability Strategy.

An ageing population brings an increasing focus on mechanisms that will enable people to live in their homes as they get older, such as adaptable or universal designs. The Department recognises the need to 'future proof' to meet emerging needs.

The growth in apartment dwelling also creates a need to consider how people enter and leave apartments in multi-level dwellings.

The Building Code has provisions for access routes and mechanical installations for access. These are detailed prescriptive requirements that do not fit readily with the concept of a performance-based Code, but the requirements are clear.

Section 119 cites New Zealand Standard NZS 4121 Design for Access and Mobility, Buildings and Associated Facilities as a means of compliance with the Building Code. Schedule 2 of the Act lists the buildings that require access and facilities for people with disabilities. The citing of NZS 4121 in the Act as a means of compliance is unique, and can cause confusion and problems for compliance.

The Building Code requires some buildings to be provided with wayfinding features and other features to assist people with impairments, such as listening systems for people with a hearing impairment. The Department considered wayfinding and other features for people with other impairments.

Some submitters raised concerns about the means of compliance for access and mobility, and whether these were capable of meeting the future needs of all building users, including disabled people, in an ageing society.

Recommendations on features for wellbeing and physical independence are described in sections 9.3.2 and 9.5.3 of this report.

8.1.4 Sustainable development

The 2004 Act incorporated in its purpose for the first time the requirement that buildings be designed, constructed and able to be used in ways that promote sustainable development.

The internationally accepted definition of sustainable development, used in the government's Sustainable Development Programme of Action, is 'development which meets the needs of the present, without compromising the ability of future generations to meet their needs'.[8]

The principles in the Act provide a reference point for the interpretation of sustainable development as it applies to building work. People applying the Act must take account, where relevant, of:

- the importance of the provisions of the Building Code as they relate to household units
- prevention or minimisation of harmful effects on human health from buildings methods, products, work and designs
- durability
- recognising any special traditional and cultural aspects of the intended use of a building
- the costs of a building (including maintenance) over the whole of its life
- the importance of allowing for continuing innovation in methods of building design and construction
- the protection of other property[9] from physical damage resulting from the construction, use, and demolition of a building
- provision for people with disabilities
- preservation of buildings with significant cultural, historical or heritage value
- facilitating the efficient use of energy and energy conservation, and the use of renewable sources of energy in buildings
- facilitating the efficient and sustainable use in buildings of materials and material conservation
- facilitating the efficient use of water and water conservation in buildings
- facilitating the reduction in the generation of waste during the construction process.

Taking a longer-term view is an important aspect of sustainable development. The Department has considered trends and predictions of change as well as assessing the implications of these trends for the way that buildings are used. These were discussed in section 3 of this report.

The Building Code addresses some, but not all, of these principles. It attempts to limit the energy used for operating new buildings on a day-to-day basis by requiring designers to address energy efficiency. It sets limits on the design energy demand for heating housing and commercial buildings (which leads to the installation of insulation and, in some cases, double glazing), has energy efficiency requirements for domestic water heating systems, and has requirements for the efficiency of lighting in commercial buildings. Amendments to the Building Code to further improve energy efficiency of space heating and commercial lighting were recently announced by the government.[10]

The Building Code does not account for the energy used over the whole lifecycle of a building. (Energy is used in the construction, operation, maintenance and demolition of the building, and is used directly or indirectly to produce and transport building materials.)

Nor does the Building Code have any requirements for the efficient use of material for minimising waste from construction and demolition, or for conserving water or using it more efficiently.

8 Sustainable Development for New Zealand Programme of Action, January 2003, DPMC.
9 Other property means any land or buildings, or part of any land or buildings, that are not held under the same allotment; or not held under the same ownership; and includes a road.
10 See www.dbh.govt.nz/news-index

The Building Code is not clear about durability requirements for buildings. It requires building elements to last for a certain length of time with normal maintenance. These time periods do not necessarily reflect how consumers expect buildings to perform. They can also provide a disincentive for the building industry to develop products that last longer. The term 'normal maintenance' is not clearly defined in the Building Code, which leads to uncertainty about what should be expected for durability.

The Department concluded that the Building Code did not adequately address the purpose of promoting sustainable development.

Recommendations on resource efficiency are described in section 9.5.1 of this report.

8.2 EXTENT TO WHICH THE BUILDING CODE IS CLEAR AND EASY TO USE

The Department considered whether the Building Code was clear and easy to use in terms of how it was structured, and how clearly the performance requirements were stated.

8.2.1 Clarity of Code Structure

The Building Code is currently set out under sections A to H:

- A General Provisions
- B Stability
- C Fire Safety
- D Access
- E Moisture
- F Safety of Users
- G Services and Facilities
- H Energy Efficiency

The Department found that the Building Code structure was clearly understood by those who used the Code daily. However, the structure does not clearly align the sections with the safety, health, wellbeing and sustainable development purposes of the Act, and would need to be amended to accommodate some of the new performance requirements recommended in this review.

The Department considered whether a separate section on building features for people with impairments would improve outcomes for people who rely on those provisions. It heard a diverse range of opinions about this.

It concluded that, on balance, performance requirements should meet society's expectations for people, including those with impairments, even though different solutions may be required to meet particular needs. It concluded that addressing the performance requirements throughout the Building Code, for example in each of the fire safety, sanitation and features for wellbeing and physical independence sections, would improve the 'mainstreaming' of these provisions.

Recommendations on the structure of the Building Code are described in section 9.1.1 of this report.

8.2.2 Clarity of Building Code format

Section 400 of the Building Act requires that the Building Code prescribe functional requirements for buildings and the performance criteria that buildings must comply with in their intended use.

The Building Code contains an Objective statement for each clause. The Act does not require the Code to contain Objective statements, but these statements provide a useful link between the Code's functional requirements and the purposes of the Act.

There is some confusion in the Building Code between functional statements and performance requirements. Performance requirements are often just expanded functional requirements.

Proposed functional statements are set out in section 9.1.3. It is **recommended** that objective statements be retained in the Building Code and be amended to clearly align with the new purposes of the Act.

8.2.3 Clarity of performance requirements

The Building Code uses unclear expressions such as 'adequate' and 'reasonable' to describe its performance requirements. These requirements should be clearly specified and, where possible, quantified to avoid ambiguity.

Being specific about performance requirements should not be confused with prescription. It is the performance that is being specified and clarified, not the means of achieving the performance.

The Type 1 recommendations in section 9.3 are intended to clarify the current requirements.

8.2.4 Access to the Building Code and related documents

The Department found that the Building Code and its Compliance Documents were readily available on the Department of Building and Housing website at no cost. Key Standards cited in Compliance Documents are available for inspection at the offices of the Department.

The Department also considered that alternative arrangements of functional requirements and performance criteria could be available to meet the diverse requirements of stakeholders.

Further proposals are discussed in section 9.1.3 of this report.

9 Detailed recommendations for amendments to the Building Code

9.1 Building Code structure and scope

In the following section, a structure for the Building Code is proposed that:

- refines the present structure
- aligns the functional and performance requirements in the Building Code with the safety, health, wellbeing and sustainable development objectives of the Building Act
- provides a flexible framework for the future
- is broadly in line with building codes being developed under European Union directives.

The changes to the present structure are considered minor, and able to be incorporated over time.

9.1.1 Building Code structure

Internationally, building codes are structured in many different ways. A prescriptive code specifying how a building should be built could be organised around the various elements and functions of a building. Similarly, a performance-based code, which sets requirements for how buildings should perform, could be organised around the outcomes required.

The approach to describing the functional requirements and performance criteria, and developing a structure for the Building Code, was firstly to consider the outcomes required by the Act for people using buildings, and then to consider the attributes of building elements that would deliver those outcomes. For example, the requirements for a healthy indoor environment can be described by performance criteria for temperature, humidity and air quality.

The 2006 discussion document, which looked at the scope and content of a new Building Code, organised code objectives under the safety, health, wellbeing and sustainable development purposes of the Act.

The 2007 discussion document presented for consideration a structure for the Building Code that was broadly in line with building codes being developed under European Union directives.

In consultation, it was clear that many current users wanted the Building Code structured in a way that reflected their practical needs, particularly those of designers and building consent authorities. However, the diversity of views expressed on what that arrangement could be highlighted the Building Code's wide range of stakeholders and potential users.

Submissions on the 2007 discussion document expressed both support and opposition to the structure it presented. Many found the structure logical and easy to follow, while others questioned the rationale for changing the structure at all. Many of those opposed to a new structure commented that the sector was only now adjusting to the Building Code introduced in 1992, and that current changes in the sector (such as licensing of building practitioners and the accreditation of building consent authorities) would adversely affect its ability to cope with a change to the Building Code structure.

The Department considered all these views, and concluded that a wholesale change to the structure of the Building Code was neither necessary to achieve clarity and ease of use, nor desirable in terms of impact on the sector, and the cost and ease of implementation. It determined that only minor amendments to the structure of the Building Code would be needed to provide a framework for the amendments recommended.

It is **recommended** that the Building Code be set out as follows.

- Section 1 – General: containing the general principles for building performance, the performance framework for buildings, and requirements for maintenance and durability. This section is an expansion of Section A (General provisions) of the current Building Code.
- Section 2 – Structural performance: containing the requirements for the structural integrity, stability, means of support, and the limitation of damage and loss of amenity of buildings. This section corresponds to Section B (Stability) of the current Building Code.
- Section 3 – Fire and emergency safety: containing the requirements to safeguard people, including firefighters, and neighbouring property against fire and other related hazards, preventing the spread of fire and providing means of escape from fire and other emergencies. This section corresponds to section C (Fire Safety) of the current Building Code.
- Section 4 – Features for wellbeing and physical independence: containing requirements for the wellbeing and physical independence of people, including access, space, noise control, light and connection to the outdoors. This section is an expansion of the current section D (Access) and incorporates some of the wellbeing requirements currently in section G (Services and Facilities)
- Section 5 – Environment: containing requirements for a healthy and comfortable environment for people, including moisture, indoor air quality, indoor temperature and control of moisture from internal and external sources. This section is an expansion of the current section E (Moisture) and incorporates some of the indoor environment requirements currently in Section G (Services and Facilities).
- Section 6 – Safety of users: containing requirements for the safety of users and the risks of injury encountered by people in and around buildings. This section corresponds to the current section F (Safety of users).
- Section 7 – Sanitation: containing requirements to safeguard people from illness caused by exposure to human or domestic waste, by consumption of contaminated water, and by inadequate facilities for personal hygiene, laundering and food preparation. Sanitation requirements are in the current section G (Services and Facilities).
- Section 8 – Resource efficiency: containing requirements for the efficient use of resources for buildings including materials, energy, water and waste. The energy efficiency requirements are in the current section H.

9.1.2 Profile of weathertightness

Some submissions suggested the Building Code should have a separate section for the weathertightness of the building envelope. The awareness of weathertightness arises from high-profile problems with weathertightness, which prompted the reforms set out in the Building Act 2004. Some submitters expressed concern that weathertightness would not be adequately addressed if it did not have sufficient profile in the Building Code.

International practice in addressing weathertightness and the building envelope in performance-based codes varies. Some codes do have separate sections dealing with moisture penetration – for example, England and Wales, and the United States ICC model code.

The Building Code does not currently have a separate section for the building envelope or weathertightness, but the requirements are addressed in clauses B1 Structure, B2 Durability, E1 Surface Water and E2 External Moisture.

In the structure recommended, weathertightness and the building envelope are addressed under the 'general', 'structural performance' and 'environment' sections.

Consistent with the review's focus on outcomes, the approach taken was first to consider the outcomes for people using buildings, and then to consider the attributes of building elements that would deliver those outcomes. The outcome of a healthy indoor environment can be described by performance requirements for temperature, humidity and air quality. Achieving the performance requirements for temperature, humidity and air quality would, in most circumstances, require a weathertight building envelope which would be prescribed in Compliance Documents.

The Department concluded that the structure as recommended would provide clarity about the performance requirements to provide a healthy and safe environment for people, and that guidance about achieving a weathertight and durable building envelope would be most effectively delivered through Compliance Documents and other guidance material. The Department has released a guide to weathertightness remediation.[11]

9.1.3 Building Code format

Section 400 of the Building Act requires the Building Code to prescribe functional requirements for buildings and the performance criteria that buildings must comply with in their intended use.

The Building Code contains an Objective statement for each clause. It is proposed that, in order to demonstrate the link between the Act and the Building Code requirements, objective statements are included to link the functional and performance requirements with the purpose of the Act.

It is **recommended** that the following objectives and functional requirements define the scope of the Building Code.

Objectives

- **Safety**: An objective of this Building Code is to limit the probability that, as a result of the design, construction, use or demolition of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury.
- **Health**: An objective of this Building Code is to limit the probability that, as a result of the design, construction, use or demolition of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of illness.
- **Wellbeing**: An objective of this Building Code is to limit the probability that, as a result of the design, construction, use or demolition of the building, a person in or adjacent to the building will be exposed to an unacceptable loss of wellbeing.
- **Physical independence**: An objective of this Building Code is to limit the probability that, as a result of the design, construction, use or demolition of the building, a person in or adjacent to the building will be exposed to an unacceptable loss of physical independence.
- **Sustainable development**: An objective of this Building Code is to promote sustainable development.

Functional requirements

The objectives of this Building Code are achieved by buildings or their elements having features that:

Section 1 – General

– limit impacts from events and physical conditions to tolerable levels
– meet Building Code requirements for the intended life of the building

Section 2 – Structural performance

– maintain structural integrity, remain stable and not collapse under the effects of foreseeable events and physical conditions throughout the life of the building, including construction and demolition

11 *External moisture – A guide to weathertightness remediation.* Available from: www.dbh.govt.nz

Section 3 – Fire safety

- limit the risk of an accidental fire or explosion occurring
- limit the risk of fire or explosion impacting areas beyond its point of origin
- limit the risk of fire safety and other emergency systems failing to function as expected
- limit the risk of people being delayed from moving to a place of safety during a fire or other emergency
- limit the risk of firefighters or other emergency services personnel being delayed in or impeded from assisting in evacuation and performing firefighting operations
- limit the risk to firefighters or other emergency services personnel during evacuation and firefighting operations
- limit the risk of adverse effects to other property[12]
- limit the risk of the release of stored hazardous substances in a fire
- limit the risk of injury due to exposure to high levels of noise from alarm systems

Section 4 – Features for wellbeing and physical independence

- facilitate access to, within and from the building by all people, including people with disabilities
- facilitate access to facilities and services by all people, including people with disabilities
- facilitate connection to the outdoors
- provide space for personal activities
- limit exposure to noise originating from a source within the building
- limit exposure to noise transmitted from a source external to the building

Section 5 – Environment

- limit the risk of unwanted moisture indoors from moisture originating outside the building
- limit the risk of unwanted moisture indoors from moisture originating within the building
- limit the risk of water overflow penetrating to an adjoining property
- limit the risk of illness or loss of wellbeing caused by indoor air contaminants
- limit the risk of illness or loss of wellbeing caused by thermal conditions
- limit the risk of illness or loss of wellbeing caused by internal moisture

Section 6 – Safety of users

- limit the risk of injury due to slipping, falling, drowning or collision
- limit the risk of injury due to inadequate lighting
- limit the risk of injury due to exposure to hot surfaces and substances
- limit the risk of injury due to hazardous agents on site
- limit the risk of injury or illness due to exposure to hazardous substances

Section 7 – Sanitation

- facilitate the sanitary disposal of wastewater
- facilitate the sanitary disposal of solid waste
- facilitate the safe disposal of industrial liquid waste
- facilitate personal hygiene
- facilitate laundering
- facilitate hygienic food preparation
- facilitate cleaning in commercial and industrial buildings
- limit the risk of contamination of water supply systems
- limit the risk of consuming contaminated water
- limit the growth of legionella in heated water
- limit the risk of illness from greywater

Section 8 – Resource efficiency

- facilitate the conservation and efficient use or reuse of energy
- facilitate the conservation and efficient use or reuse of water
- facilitate the conservation and efficient use, reuse, or disposal of materials

12 Other property means any land or buildings, or part of any land or buildings, that are not held under the same allotment; or not held under the same ownership; and includes a road.

9.2 TYPES OF RECOMMENDATIONS ABOUT THE CONTENT OF THE BUILDING CODE

Recommendations about the content of the Building Code have been classified as Type 1, 2 or 3 and are detailed in the following section of this report.

Type 1 recommendations are **recommendations to amend the Building Code** to clarify and update the performance requirements that are currently in either the Building Code or supporting Compliance Documents. These amendments would not directly require any changes in construction methods or materials. The intent is to clarify the current requirements. No impact on construction costs is expected, and only a small reduction in design and compliance costs.

Type 2 recommendations are **recommendations to consult on proposals** to amend the Building Code involving new performance requirements, changes to the scope of requirements, or different approaches to describing requirements. These would be prepared in conjunction with Compliance Documents to provide guidance to the sector. They would also be subjected to benefit/cost analysis, a regulatory impact assessment, and consulted on with Cabinet approval before being finalised.

Type 3 recommendations are **recommendations to investigate and collaborate** on possible performance requirements that are conceptual at this stage. They require development and collaboration with the sector before they could be considered for approval for consultation as amendments to the Building Code.

9.3 TYPE 1 RECOMMENDATIONS TO AMEND THE BUILDING CODE TO CLARIFY PERFORMANCE REQUIREMENTS

Type 1 recommendations are **recommendations** to amend the Building Code to clarify and update the performance requirements currently in either the Building Code or supporting Compliance Documents.

These amendments would not directly require any changes in construction methods or materials. The intent of these amendments is to clarify the current requirements, and it is expected that there would be no impact on construction costs, and a small reduction in design and compliance costs.

9.3.1 Structural performance

Structural performance means the maintenance of structural integrity, stability, means of support, and the limitation of damage and loss of amenity of buildings.

Some variability and uncertainty is always associated with design and construction processes – for example, in the quality of building materials and workmanship, in site conditions and in the level of demand, such as wind load. Structural design must allow for this variability and uncertainty in both capacity and demand.

The Building Code does not explicitly address variability and uncertainty in the design and construction process. This is currently allowed for in the detailed requirements of the loadings and materials standards cited in the Compliance Documents.

It is **recommended** that the Building Code be amended to to clarify that variability and uncertainty are to be taken into account, and an overall safety level must be achieved.

9.3.2 Features for wellbeing and physical independence

Wayfinding

The Building Code sets out general requirements for wayfinding under 'Signs'. These requirements are intended to:

- safeguard people from injury or illness resulting from inadequate identification of escape routes or of hazards within or about the building
- safeguard people from loss of amenity due to inadequate direction
- ensure that people with disabilities are able to carry out normal activities and processes in certain buildings.

It is **recommended** that the Building Code be amended to clarify that:

- lighting and other helpful devices (in addition to signs) be provided in buildings (except detached dwellings, or within household units of multi-unit dwellings) to identify for people, including people with disabilities:
  - escape routes
  - emergency-related safety features
  - potential hazards
  - accessible routes and facilities for people with disabilities.

9.3.3 Safety of users

Slip resistance

Currently the Building Code requires that access routes 'have adequate slip-resistant walking surfaces under all conditions of normal use'. The Building Code does not specify what is meant by 'adequate' in terms of slip resistance, but the Compliance Document specifies the coefficient of friction of walking surfaces in level access routes to which the public have access.

The coefficient of friction is determined by the specific combination of the material properties of the walking surface, and the properties of the material in contact with the walking surface (shoe material or foot). It can be affected by a contaminant such as water or fine powder. The Building Code can only affect one of these influences – the walking surface. It is not possible therefore to state in the Building Code an explicit coefficient of friction.

9.3.4 Sanitation

9.3.4.1 Wastewater disposal

Wastewater is the domestic (not industrial) effluent that comes from bathrooms, kitchens, laundries and toilets. The Building Code contains provisions for foul water plumbing and drainage.

The term *wastewater* is now the standard terminology used by other government departments and local government.

It is **recommended** that the Building Code be amended to use the expression *wastewater* in place of *foul water*.

9.3.4.2 Personal hygiene facilities

The requirements for personal hygiene facilities in the Building Code are that a sufficient number of personal hygiene facilities are provided, and that they meet a certain standard. The Building Code does not specify the buildings where personal hygiene facilities are to be provided.

It is **recommended** that the Building Code be amended to specify that:

- toilets and hand washing facilities are to be available where people live or are accommodated, work or consume food or drink on the premises
- showering or bathing facilities are to be available where (other than ancillary buildings, outbuildings and back-country huts):
  - people live or are accommodated
  - people engage in active recreation
  - children under five are supervised or educated.

The Building Code does not specify what constitutes a sufficient number. The Compliance Documents contain tables that specify the number of toilets required in particular circumstances. The performance basis of these tables is an expectation that, on average, the time to queue for a toilet is less than one minute.

It is **recommended** that the Building Code be amended to clarify that 'sufficient number' means the time to queue for a toilet is, on average, less than one minute.

9.3.4.3 Laundering facilities

The requirements in the Building Code for laundering facilities are that laundering facilities are provided (in certain circumstances) and that they meet a certain standard.

The functional requirement is that buildings shall be provided with adequate spaces and facilities for laundering, but the size of household units to which this applies is not stated. The current Acceptable Solution sets the benchmark at providing laundry facilities for detached dwellings or separate household units that accommodate three or more people.

It is proposed to clarify this in the Building Code.

The Building Code also requires laundering facilities in work camps. As this term is now redundant it is proposed that the reference to work camps be deleted.

It is **recommended** that the Building Code be amended to specify that:

- laundering facilities are to be provided in:
  - detached dwellings or separate household units that accommodate three or more people
  - early childhood centres
  - group dwellings
  - aged care facilities
  - multi-unit dwellings
  - camping grounds.

Type 2 recommendations for the Sanitation section address a change in scope of application for shared laundry facilities.

9.3.4.4 Food preparation facilities

The Building Code requires that food preparation facilities are provided (in certain circumstances), and that they meet a certain standard.

Currently food preparation facilities are required in work camps. As this term is now redundant it is proposed that the reference to work camps be deleted.

It is **recommended** that the Building Code be amended by deleting reference to work camps.

9.4 TYPE 2 RECOMMENDATIONS TO CONSULT ON PROPOSALS TO CHANGE PERFORMANCE REQUIREMENTS

Type 2 recommendations are recommendations to consult on proposals to amend the Building Code involving new performance requirements, changes to the scope of requirements, or different approaches to describing requirements. These would be prepared in conjunction with Compliance Documents to provide guidance to the sector, subjected to benefit/cost analysis, a regulatory impact assessment, and consulted on with Cabinet approval before being finalised.

It is **recommended** that amendments to the Building Code and related Compliance Documents be prepared for consultation on the **proposals** in the following section.

9.4.1 General

It is proposed to add to the General section some requirements to apply to all aspects of new buildings or building work.

9.4.1.1 General principles

General principles are proposed that should be stated as requirements in the Building Code.

It is **proposed** to include in the Building Code a statement of these general principles.

- *Effects on adjacent buildings*: a building or building work should not cause adjacent buildings to be affected by any of the design events that impact on buildings.
- *Disproportionate consequences*: the failure of a building element or system should not result in a consequence disproportionate to the event that caused the failure.
- *Consequences of failure*: building elements should be constructed in a way that makes due allowance for the consequence of failure.
- *Effect of uncertainties*: building elements should be constructed in a way that makes due allowance for the effects of uncertainties arising from design and construction processes, including variations in the properties of building materials, workmanship, site conditions and the demands on buildings.

9.4.1.2 Performance framework

The Building Code is not clear about which impacts society will tolerate.

A performance framework has been developed that relates performance requirements for buildings to the events and physical conditions that buildings might be subject to. The performance framework also considers the impacts society would be prepared to tolerate for different types of buildings.

Design events and physical conditions

The Building Code does not specify the events and physical conditions that designers must consider.

It is **proposed** to include in the Building Code the events and physical conditions stated in Table 1 (see Appendix 3) that designers must consider buildings to be subjected to.

In practical terms, the performance framework would be incorporated in Compliance Documents.

Analysis of the tsunami risk for coastal areas indicates it to be at least as significant to New Zealand as seismic risk and, for coastal areas, probably much higher. The Building Code cannot economically mitigate the risk of tsunami for all buildings. However the 'essential services' nature of performance group (PG) 4 buildings, and the strategic nature of, and the large population at risk associated with, PG 5 buildings suggests these should designed to be more resilient. (Performance groups are defined in Table 2, Appendix 3.)

It is **proposed** that PG 4 and 5 buildings be designed and constructed to withstand tsunami where the tsunami risk has been identified on District Plans.

The Building Code requires that 'surface water (flood) with a 2 percent Annual Exceedance Probability (AEP) must not enter buildings 'to prevent the risk of flooding affecting a building'. Some regional councils require that 'surface water with a 1 percent AEP must not enter buildings'.

A 1 percent AEP (1-in-100-year flood) is a more stringent test than a 2 percent AEP (1 in 50 year flood) because it anticipates a higher surface water level. A 1 percent AEP reflects the planning controls generally adopted by regional and local councils, and provides a precautionary approach to the impact of more-frequent and higher-intensity rain predicted as a result of climate change.

It is **proposed** that buildings be designed and constructed to avoid surface water (flood) with a 1 percent AEP entering them.

Where land use is based on 1 percent AEP, this change would not result in any cost impact. In local authorities where land use is based on 2 percent AEP, there could be additional costs to ensure floor levels are higher than at present.

The Department intends to work with regional councils and territorial authorities to establish the likely impact of this proposed change and the subsequent construction costs, and to prepare a benefit/cost analysis before finalising this proposal.

Tolerable impacts

The Building Code aims to provide reasonable protection from the effects of demands on buildings. However, building codes cannot eliminate all risk. To attempt to do so would result in a restrictive code and expensive buildings: more expensive than society would be prepared to pay.

Society therefore tolerates some impacts on buildings in some circumstances. The impacts that are tolerated depend partly on the size of the event that caused them: a small amount of damage may be tolerated in a small earthquake and a large amount of damage tolerated in a large earthquake. Society's tolerance of impacts also depends on the likelihood that an event will happen. The Building Code is not clear about which impacts society will tolerate.

Table 4 (see Appendix 3) describes impact levels ranging from 'insignificant' to 'extreme'. These set out what society might tolerate in terms of:

- impacts for occupants
- economic impacts
- social impacts
- environmental impacts.

It is **proposed** that a table of tolerable impacts related to events and physical conditions and performance groups be introduced to the Building Code.

It is **proposed** that the design of buildings must be such that there is at least 90 percent confidence that buildings meet the applicable tolerable impact requirements, according to the performance group and range of events to be considered.

It is **proposed** that all buildings must meet the 'Insignificant' tolerable impact requirement for physical conditions that could affect buildings all the time.

These proposals would provide a framework for the preparation of Compliance Documents and any Standards that might be cited in them, and are not likely to add to design, compliance or construction costs.

Classifying buildings for performance

Society's tolerance of impacts also depends on how vulnerable the people in the building are and how important the building is to society.

Table 2 (see Appendix 3) classifies different types of buildings into five main performance groups depending on factors such as the:

- function of the building
- proportion of time the building is occupied by people
- familiarity of occupants with the building
- number and/or density of people likely to be in the building
- vulnerable or special populations using the building.

This classification of buildings is based on performance groups developed by the International Codes Committee (ICC), a body that provides model building codes. Buildings that are not normally occupied, such as farm buildings, would be in the lowest performance group. Buildings expected to continue functioning after a very large event, such as hospitals or emergency services buildings, would be in PGs 4 and 5. Most buildings in New Zealand would fall within PG 2.

The proposals for amendments to the Building Code recognise the special nature of some New Zealand buildings. For example, back-country huts (such as some Department of Conservation huts) and some farm buildings are classified as PG 1 to recognise the low risk to people because they are typically for transitory or occasional use.

It is **proposed** that buildings be classified into performance groups according to Table 2 (Appendix 3).

The Department has, independently of this review, consulted on citing in the Compliance Documents AS/NZS 1170 Structural Design Actions, which in effect includes these performance groups.

9.4.1.3 Meeting the performance requirements for the intended life of the building

The principles of the Act include the requirement to take into account:

- the importance of ensuring that each building is durable for its intended use
- the costs of a building (including maintenance) over the whole of its life.

Performance for intended life, durability and maintenance

Buildings are made up of individual elements, but also of systems, such as a roof or cladding, where individual elements work together to perform a building function. If buildings are to continue to perform over time, it is important that both the individual elements and systems of a building are durable and suitable for the environment where the building is located. This requires designers to take account of the physical conditions that affect building performance over time.

The Building Code is not explicit about the physical conditions affecting the performance of buildings that need to be considered. It requires building elements to last for a certain length of time with normal maintenance: five years, 15 years, or for the life of the building, depending on whether or not:

- the element is easy to access and replace
- failure of the element would go undetected during use or maintenance
- the element performs a structural function.

These time periods do not necessarily reflect how consumers expect building elements to perform. They can also provide a disincentive for the building industry to develop products that last longer. The term 'normal maintenance' is not clearly defined in the Building Code, leading to uncertainty about what should be expected for durability.

It is **proposed** that a building must be designed, constructed and capable of being maintained to provide confidence that it will comply with the performance requirements of the Building Code throughout its life.

It is **proposed** that the designer state an 'intended life' for a building and demonstrate that it will meet the requirements of the Building Code for that time. An 'intended life' of at least 100 years will be required where the building or building work has 'permanent' effects on other property.[13]

It is **proposed** that the Building Code incorporate the physical conditions that are likely to affect the performance of a building over its intended life, as in Table 1 (see Appendix 3).

It is **proposed** that building designers state the frequency of maintenance or replacement of building systems and how this should be done, to satisfy the building consent authority that the proposed maintenance and replacement arrangements are practicable and are a viable means of achieving compliance for the life of a building.

It is **proposed** that information about maintenance be included in the documentation provided in a building consent application, so that it is available to future owners of the building.

13 Other property means any land or buildings, or part of any land or buildings, that are not held under the same allotment; or not held under the same ownership; and includes a road.

The intent of these proposals is to give building owners information about the intended life for the building and confidence that maintenance and replacement of building elements is practicable.

Submitters commented that producing the documentation required for this information would add significantly to the cost of design and obtaining a building consent. It is recommended that guidance be provided to designers by way of Compliance Documents (and other information) to minimise the impact on compliance costs.

9.4.2 Structural performance

9.4.2.1 Performance framework for structure

The Building Code specifies general performance requirements for the structural design of buildings and building elements. It sets out the physical conditions likely to affect the integrity and stability of buildings over their intended lives, but it does not quantify what is acceptable building performance under the influence of these physical conditions. This information is currently implicit in the Standards cited in the Compliance Documents. Setting the performance level more explicitly in the Building Code would improve consistency in how the safety requirements are expressed.

It is **recommended** that the designer for structural performance consider:

- the physical conditions that affect the structural performance of buildings
- the chances of an event occurring
- the performance group of the building
- the impacts that can be tolerated for a range of circumstances.

These proposals would provide a framework for the preparation of Compliance Documents and any Standards that might be cited in them, and are not considered to add to design, compliance or construction costs.

9.4.2.2 Concurrent events and physical conditions

Events and physical conditions on buildings, such as earthquakes or people loads, do not happen in isolation. A designer will often need to take into account combinations of such events.

The Building Code does not clearly set out which events and physical conditions need to be considered as acting concurrently, nor how they need to be considered. This information is included in the joint New Zealand and Australian Standard AS/NZS 1170 Structural Design Actions, but it does not cover all likely concurrent scenarios.

It is **proposed** that the Building Code be amended to clarify the requirements for addressing concurrent events and physical conditions.

9.4.3 Fire and other emergency

9.4.3.1 Exposure to high levels of sound from alarms used for evacuation

Excessively loud alarms can harm people who are unable to evacuate a building unaided and may be required to remain in a place of safety until they can be helped from the building. For example, hearing can be impaired after one minute at 112 dB(A), after eight minutes at 103 dB(A), or after 15 minutes at 100 dB(A).

While this is a risk that could be tolerated in the event of an emergency, that is likely to be very rare. Trial evacuations and false alarms are more likely, and harm is less tolerable. This hazard is not addressed in the Building Code.

In some situations, ambient noise is very loud (eg, in a factory or at a night club). If the alarm sound level is too low, it will by masked by operational sound and will not be readily detected. So in loud spaces alarm levels must be higher to be heard.

It is **proposed** that for all buildings where alarms used for evacuation are required, the audible signal in a place of safety be not more than L_{Amax} 100 dBA at any normally accessible point in the room at a height of 1.8 m, or no more than 15 dBA greater than the ambient noise, whichever is the greater.

This is not considered to alter what is current practice, and would therefore have no cost implication. It would provide protection in the future where an evacuation scheme explicitly provides for people to remain in a place of safety during evacuation.

9.4.4 Features for wellbeing and physical independence

9.4.4.1 Access to, within and from a building

Access requirements to, within and from buildings include, but are not restricted to, access for people with disabilities. Schedule 2 of the Building Act 2004 lists the buildings that require access and facilities for people with disabilities. This means not only wheelchair users, but also people with any kind of physical or sensory impairment or limitation, permanent or temporary, including people on crutches and people with infants in pushchairs.

The Building Code has provisions for access routes and mechanical installations for access. These are detailed prescriptive requirements, which do not fit readily with the concept of a performance-based code, but they are clear. The New Zealand Standard NZS 4121 Design for Access and Mobility, Buildings and Associated Facilities provides a means of compliance with the Building Code and is cited in section 119 of the Building Act.

Support was expressed in consultation for 'adaptable' designs. An 'adaptable' home has features that can be adjusted easily and cost-effectively in the future to provide features for people with disabilities – for example, designing walls to allow for the attachment of grab bars at a later date. This would also include meeting the changing needs of older people so they are able to remain in their own homes for longer.

Support for universal design principles was also expressed in consultation – that is, that all elements and spaces should be accessible to, and usable by, people of all ages and abilities to the greatest extent possible. However, it was suggested that these should be issued as guidelines rather than Building Code requirements.

The principles of adaptability and universal design have informed several of the Building Code proposals:

- the framework for fire safety takes into account the movement times for people with disabilities
- a proposed requirement for space for mobility in household units
- wayfinding provisions for people, including people with disabilities
- a general principle that where shared facilities are provided in buildings they should be accessible for people with disabilities.

It is **proposed** that:

- at least one access route with features for people with disabilities be provided in multi-unit dwellings
- common spaces in multi-unit dwellings be accessible
- where shared facilities for access, parking provisions and sanitary facilities are provided in buildings, they should be accessible for people with disabilities. This would be applied to shared laundry facilities at hostels, motels and multi-unit dwellings (this is required only for camping grounds at present).

The Department heard comments through submissions that having NZS 4121 and Acceptable Solutions could cause confusion and problems for compliance.

It is **recommended** that all Compliance Documents and guidance materials be reviewed during the course of the implementation of this review.

It is **also recommended** that guidance on features that will improve the general accessibility and adaptability of the buildings be published for designers.

9.4.4.2 Noise control

Population density in New Zealand is increasing. People are increasingly living closer to one another and in situations where noise can become a serious problem.

The Building Code includes provisions for noise from internal airborne sound and internal impact sound, but does not contain provisions for protection against:

- environmental noise in specified noise zones (such as near traffic, airports, ports and industry)
- noise from building services, such as plumbing services and air-conditioning equipment
- noise from common spaces, such as corridors, courtyards or lobbies
- noise from occupied spaces that do not directly adjoin the household unit under consideration
- noise that enters rooms through flanking paths such as pipes or junctions
- the noise characteristics of non-residential occupancies.

Surveys of apartment residents have shown that the Building Code requirements are insufficient to achieve an indoor noise environment that is acceptable to many residential occupants.

It is **proposed** that, for residential accommodation in apartment buildings and teaching spaces:

- insulation against airborne noise be based on 80 Percent Population Satisfaction
- insulation against impact noise be based on 80 Percent Population Satisfaction

An initial assessment is that the additional cost for a two bedroom multi-unit apartment would be $6,000 with a benefit/cost ratio of 1.4:1. The benefits are derived from an assessment of willingness to pay for noise control, and improved health outcomes resulting in fewer doctors' visits and admissions to hospital.

There are no Building Code requirements for noise protection in teaching spaces such as classrooms, drama rooms, assembly halls and gymnasiums. Children are particularly sensitive to the effects on intelligibility created by sound reflections off surfaces in teaching spaces and the masking effects of extraneous noise. Improving the acoustic environment in teaching spaces would improve educational outcomes for New Zealand students and the health and wellbeing of teachers.

It is **proposed** that the reverberation time (expressed in seconds for specific teaching spaces) be specified.

An initial assessment is that the additional cost compared with the present Building Code would be approximately $10,000 per classroom, with a benefit/cost ratio of 68:1.

The Ministry of Education already specifies that construction for state schools should comply with AS/NZS 2107: 2000 Acoustics – Recommended design sound levels and reverberation times for building interiors, which is very similar to the proposed performance requirement. For integrated and independent schools, the Ministry uses the same measure as recommendations and guidelines. The proposal for the Building Code would have only a minor impact, if any, compared with construction to the Ministry of Education guidelines.

9.4.5 Environment

Indoor climate covers the respiratory quality of indoor air, the indoor air temperature and the moisture conditions required for health and comfort.

9.4.5.1 Indoor air quality

The Building Code addresses indoor air quality by requiring spaces within buildings to have a means of ventilation with outdoor air that will provide an adequate number of air changes to maintain air purity, but it does not describe the level of purity required.

The Compliance Documents state that the acceptability of indoor air purity for workplaces may be verified by demonstrating that contaminant levels do not exceed the limits recommended in the Workplace Exposure Standards and Biological Exposure Indices for New Zealand 1992.

In 2005, the World Health Organization (WHO) stated that 'It is reasonable now to propose using the same air quality guidelines for both indoor and outdoor exposures'. Table 3 (Appendix 3) sets out the maximum contaminant exposure levels based on New Zealand ambient standards or guidelines that are consistent with levels published by the WHO or Health Canada standards, which are internationally recognised.

It is **proposed** that the maximum design levels for the most common contaminants of indoor air be as set out in Table 3 (Appendix 3).

There would be no requirement for the indoor air to be measured to determine the concentrations of these contaminants. Compliance Documents would provide methods to calculate the volume of fresh air required to satisfy these requirements.

For indoor air quality where other contaminants are present (such as from industrial processes), it is proposed to cite the Workplace Exposure Standards effective from 2002 and the Hazardous Substances and New Organisms Act 1996 in the Building Code.

9.4.5.2 Thermal control

The Building Code has a requirement that a minimum indoor air temperature of 16°C is able to be maintained in aged care facilities and early childhood centres only. The Building Code does not specify a minimum indoor air temperature requirement for other buildings, and there is no requirement for a maximum indoor temperature.

The World Health Organization recommends a minimum indoor temperature for health of 18°C, with up to 20–21°C for more vulnerable groups, such as older people and young children.

The performance requirements for thermal conditions should acknowledge the interactions between temperature (air, radiant), humidity and air velocity (draught), as well as how much clothing is worn and the level of activity undertaken by building occupants.

The proposals set a level of building thermal performance that would require specific consideration of energy-efficient design.

It is **proposed** that:

- habitable spaces of buildings where people work and habitable spaces where people live be able to maintain a thermal environment that is likely to satisfy 85 percent of the population (85 PPS)
- the energy demand for spaces of buildings where people work and habitable spaces where people live takes account of an 85 PPS thermal environment.

Compliance Documents would provide guidance to designers about how this performance could be achieved. A Verification Method would provide design methods, and an Acceptable Solution would provide straightforward means of satisfying the performance requirement.

9.4.5.3 Moisture control

This section addresses unwanted moisture indoors as it affects health and comfort, including the likelihood of water penetrating the building envelope into habitable spaces.

Unwanted moisture can come from many sources. It can originate outside a building from rainwater, snow, hail, flooding, leaks and spills and can enter a building through the building envelope. Or it can be caused by overflow from an adjoining household unit – for example, a leak from an apartment to the one below.

Unwanted moisture can also originate from within a building as a result of activity such as breathing, cooking, showering and clothes drying. Dampness and condensation promote the growth of harmful bacteria, pathogens and allergens, and mould and fungi in the air, affecting health. When the relative humidity is high enough, harmful organisms, such as mould can grow.

The Building Code requires that residences have an adequate combination of thermal resistance and ventilation in all habitable spaces, bathrooms, laundries and other spaces where moisture may be generated. The Building Code does not specify a measure for the level of humidity required.

Mould only grows where there is a supply of moisture. In buildings, this is either where there is liquid moisture or air with high relative humidity. Air with relative humidity of less than 70 percent is considered to provide an adequate safeguard against conditions that promote the growth of moulds.

It is **proposed** that:

- the maximum relative humidity in occupied spaces not exceed 70 percent for more than six hours a day in habitable spaces
- the time required for condensation on surfaces in occupied spaces (eg, bathrooms) to evaporate shall be limited to less than three hours.

Compliance Documents would prescribe how these conditions could be achieved through heating, insulation and ventilation.

[Type 2 recommendations for the General section address the effects of external moisture on building elements (typically durability and structural integrity).]

9.4.6 Safety of users

9.4.6.1 Protection from hot surfaces and substances

The Building Code addresses protection of people from temperature extremes for water and piped services, but does not address other hot surfaces. Injury Prevention Research Unit statistics show that burns are one of the five major causes of injury in New Zealand. The young, older people and the infirm are more susceptible than others to the risk of burns from hot surfaces.

Below 50°C the risk of burns is low.

It is **proposed** that access to surfaces or substances of a temperature higher than 50°C should be restricted, except for cooking elements, in early childhood centres, schools, aged care facilities, care facilities for people with psychiatric or physical disabilities, and hospitals.

Water temperature for personal hygiene

The Building Code requires that heated water for personal hygiene must be delivered at a temperature that avoids the likelihood of scalding. The Compliance Document specifies that the delivered hot water temperature at any sanitary fixture used for personal hygiene shall not exceed:

- 45°C for early childhood centres, schools, old people's homes, care facilities for people with psychiatric or physical disabilities, hospitals, and
- 55°C for all other buildings.

These figures have been reviewed and a single value of 50°C for the maximum temperature can be specified. This provides adequate protection and is easier to apply.

It is **proposed** that the temperature of heated water leaving the outlet of personal hygiene facilities must be 50°C or less (to avoid the likelihood of scalding).

9.4.6.2 Hazardous substances

The Building Code sets out performance requirements for buildings where hazardous substances and processes exist. However, the storage and use of hazardous substances is also subject to the Hazardous Substances and New Organisms Act 1996 (HSNO Act). Buildings used for storing or using hazardous substances must comply with this legislation as well as the Building Code, and the Building Code cannot have less stringent provisions than Regulations under the HSNO Act.

It is **proposed** that construction requirements for buildings used for storing or using hazardous substances be consistent with the requirements of the Hazardous Substances and New Organisms Act 1996 (HSNO Act).

9.4.7 Sanitation

9.4.7.1 Solid waste disposal

A number of submitters suggested that sanitation features should take sustainable development objectives into account, and that in multi-unit dwellings there was often inadequate storage space for waste and recyclables.

The Building Code has requirements for space and facilities for the collection and safe, hygienic holding before disposal of solid waste arising from the intended use of the building.

It is **proposed** that for commercial and industrial buildings, multi-unit dwellings and detached dwellings where there is no independent access or private open space at ground level, space must be provided for safe, hygienic storage before collection of waste and recyclable waste, and access for collection.

9.4.7.2 Laundering facilities

The Building Code requires laundry facilities to be accessible to people with disabilities only in camping grounds. However, laundry facilities may be shared in other situations, such as hostels, motels or multi-unit dwellings.

It is **proposed** that where shared laundry facilities are provided in buildings (eg, multi-unit dwellings, motels, camping grounds) they shall be suitable for use by people with disabilities.

9.4.7.3 Facilities for cleaning

The Building Code does not make provision for facilities for cleaning in commercial and industrial buildings, although earlier regulations did require these. These facilities are usually cleaners' cupboards with a tub for filling buckets and rinsing mops. These facilities are provided in many buildings. In buildings where they are not provided, it is not uncommon for hand basins to be used, which compromises the hygiene of the sanitary facility.

It is **proposed** that space and facilities for the hygienic use and storage of cleaning equipment be provided in commercial and industrial buildings.

9.4.7.4 Water supplies

The Building Code is concerned with the safety of water for people, as it is delivered at the point of use (generally a tap) whether for drinking or some other purpose.

Storage and distribution of water in tanks and pipes within buildings up to the point of use (generally a tap) is governed by the Building Code. The Code takes over responsibility for water once it leaves a public networked supply and enters a property (usually at the water toby), and also applies to water distributed within a building from its own supply (for example a roof tank or bore).

Capacity of water supply systems

The Building Code has a requirement that buildings provided with water outlets, sanitary fixtures, or sanitary appliances must have safe and adequate water supplies. There is no explicit required capacity for water supply systems. If a water supply system is not able to meet the requirements for personal consumption and sanitation, there is a risk to the health and wellbeing of building occupants.

The minimum amount of water required to meet essential health and sanitation requirements for the short term has been assessed by the Ministry of Health to be 90 litres per person per day. Reported usage ranges from 60 to 260 litres per person per day.

The Department has no evidence of any failure to provide buildings with sufficient water to meet personal use and sanitation requirements. Many submitters commented that water conservation should be encouraged and, in some cases, recommended consumption levels lower than the minimum supply capacity considered in the discussion document. The Department recommends that development of proposals for resource efficiency (see section 9.5.1) should address whether a backstop supply capacity provision is required to address a possible perverse effect from excessive water conservation measures.

Drinking water

The Building Code requires drinkable water for human consumption, food preparation, utensil washing or oral hygiene. The Building Code does not require water that is used for personal washing, clothes washing and toilet flushing to be safe to drink, but it must be of a standard and provided in a manner that avoids the likelihood of illness.

The Australian Health (Drinking Water) Amendment Act 2007 require that water for personal washing and water for laundry tubs (which may be used for washing dishes and food preparation) must be safe to drink.

The Health (Drinking Water) Amendment Act 2007 and international jurisdictions use the expression *drinking* water for what the Building Code defines as *potable* water (and correspondingly, *non-drinking* for *non-potable water*).

It is **proposed** that:

- terminology be changed from *potable* to *drinking water* (and correspondingly, from *non-potable* to *non-drinking* water)
- water supplied at outlets of fixtures (including laundry tubs) and appliances intended for human consumption, utensil washing, food preparation, oral hygiene and personal washing meet the health quality requirements of the NZ Drinking Water Standard 2005.

Raw water for other uses

Water supplies for 13 percent of New Zealanders come from non-network sources such as springs, bores and tank rainwater. Untreated raw water may or may not be contaminated.

It is **proposed** that:

- raw water that is supplied from springs, bores and tank rainwater may be used for laundry, toilet flushing or irrigation
- raw water used for these purposes is to have low risk to human health from direct contact
- the level of microbial indicators is not to exceed 10 *E.coli*/100ml
- raw water supplied at outlets of fixtures and appliances, intended for human consumption, utensil washing, food preparation, oral hygiene and personal washing, is to meet the health quality requirements of the New Zealand Drinking Water Standard 2005.

Distinguishing between drinking and non-drinking water systems

It is important that building users be informed about tap water that is not known to meet drinking water requirements – for example, in back-country huts and other places where the water has not been supplied by a network utility operator. The Building Code has requirements for water outlets provided with non-drinking water to be clearly identified.

It is also important to be able to differentiate between the pipes, valves and outlets that are used to distribute water that is safe to drink and water that is not safe to drink.

It is **proposed** that water pipes with non-drinking water be continuously identified.

Greywater use

Greywater is water that comes from bathrooms, kitchens and laundries; *blackwater* comes from toilets and urinals. Domestic wastewater plumbing is usually combined at the sewer, so that grey and black waters are disposed of together using a shared sewerage system.

Greywater requires a high level of treatment to be safe for human contact because of the wide range of possible microbial contamination and the possible public health consequences if it is not properly treated.

Greywater could be stored and used in commercial, industrial and other buildings where treatment and monitoring can take place as part of a compliance regime. Continuous monitoring of stored greywater is required to ensure treatment is maintained. But the management of greywater recycling in domestic buildings may not be adequate to safeguard against disease transmission. The performance of treatment systems would need to be verified.

The same indicator is used as for raw water – *E.coli*/100ml. *E.coli* is a measurable indicator of pathogens. However, the level set for greywater is more stringent than for raw water. The different values take into account the greater risk of associated pathogens (bacteria and/or viruses).

Greywater used for subsoil irrigation does not need to be treated as it does not come into contact with humans. However the discharge of greywater in this manner would need to be a permitted activity under a District Plan, or otherwise consented under the Resource Management Act 1991.

The use of greywater as a water conservation measure received considerable support in consultation.

It is **proposed** that:

- greywater may be re-used within a building to flush toilets
- the level of pathogens in greywater stored for re-use as measured by microbial indicators shall be less than 1 *E.coli*/100ml
- the quality of stored greywater must be monitored and the system maintained as a specified system
- greywater may used for subsoil irrigation where that is permitted under the Resource Management Act 1991
- greywater directly distributed for subsoil irrigation does not need to be treated.

9.5 TYPE 3 RECOMMENDATIONS TO INVESTIGATE AND COLLABORATE ON POSSIBLE PERFORMANCE REQUIREMENTS

Type 3 recommendations are r**ecommendations to investigate and collaborate** on possible performance requirements that are conceptual at this stage. They require development and collaboration with the sector before they could be considered for approval for consultation as amendments to the Building Code.

9.5.1 Resource efficiency

Part of the purpose (section 3) of the Building Act is 'to promote sustainable development', and the principles (section 4) include the need to facilitate:

- the efficient use of energy, energy conservation and the use of renewable sources of energy in buildings
- the efficient and sustainable use in buildings of materials and material conservation

- the efficient use of water and water conservation in buildings
- the reduction in the generation of waste during the construction process.

It is recommended that assessing the resources used by buildings through the carbon dioxide (CO_2) emissions associated with their construction, operation, maintenance and demolition be investigated. This could include specifying a maximum design annual CO_2 emission using a metric yet to be developed.

Operating energy is the only resource that the Building Code addresses. The Building Code attempts to limit the energy used for operating new buildings on a day-to-day basis by requiring designers to address energy efficiency. It sets limits on the design energy for heating housing, and has insulation requirements for residential and commercial buildings, energy efficiency requirements for domestic water heating systems, and requirements for the efficiency of lighting in commercial buildings.

The Building Code does not account for the energy used over the whole lifecycle of a building. Energy is used in the construction, operation, maintenance and demolition of the building, and is used directly or indirectly to produce and transport building materials.

The Building Code has no requirements for the efficient use of materials, minimising waste from construction and demolition, or conserving water or using it more efficiently.

In consultation, there was support for suggested objectives for conservation and efficient use of materials, and for addressing environmental impacts throughout the life of materials, although there was concern that this might be difficult to implement. There was also support for addressing waste minimisation.

The Department looked at ways to incorporate performance-based requirements for:

- the efficient use of materials
- promoting the use of recycled and sustainable materials
- minimising construction and demolition waste.

If included in the Building Code, any such requirements would need to be assessed when a building consent was sought and/or a subsequent code compliance certificate issued on completion of the building work. *Direct* requirements, such as setting limits on water consumption, could be impractical and expensive to administer effectively. The proposed approach looks at *indirectly* achieving outcomes in these areas.

The Department considered two significant questions on how the Building Code could address resource efficiency.

- How can the Building Code address the resources used during the whole life of the building?
- Is energy the best measurement or would something else be more appropriate?

For a complete picture of resource efficiency, the whole life of a building should be considered, including the resources used in the construction, operation, maintenance and demolition of the building, and the energy used directly or indirectly to produce building materials – a lifecycle assessment.

Burning fossil fuels (gas, coal, oil) to generate electricity and using gas, coal or wood directly for heating produce CO_2 emissions, which contribute to the greenhouse gases linked with climate change. CO_2 emissions can therefore be considered to more directly measure the impacts of using resources than energy: it is the CO_2 emissions associated with the generation and use of energy that are unsustainable because of their contribution to climate change, rather than energy use itself.

CO_2 emissions are proposed, rather than other greenhouse gas emissions, because CO_2 is the most significant greenhouse gas associated with buildings, and established criteria for assessing the CO_2 associated with various forms of energy used in buildings already exist.

Lifecycle assessment can be used to assess the CO_2 emissions associated with a building for the whole of its life. This could consider:

- emissions used on a day-to-day basis to run the building
- emissions that arise from the materials used to construct and maintain the building
- emissions arising from the construction, maintenance and demolition of the building.

One-off CO_2 emissions, such as the CO_2 emissions associated with building materials, could be divided up over the design life of a building. The designer would need to consider what the optimum intended life for the building would be.

For the purpose of assessing the ongoing CO_2 emissions associated with operating a building, some assumptions about how buildings would be used need to be made. For example, if the Building Code had a requirement that the building should be able to maintain indoor air temperature within a particular range, then the CO_2 emissions would be assessed on that temperature range (regardless of whether the building users actually operated the building to those conditions).

Another activity which creates CO_2 emissions is in supplying drinking water and removing storm water and wastewater. The CO_2 emissions come from the energy used to treat raw water and pump it around distribution networks.

Embodied CO_2 emissions are also associated with the network infrastructure. Assessing the CO_2 emissions from water could facilitate water efficiency without prescribing specific solutions. It could also help to promote rainwater harvesting and use of non-potable water where people's health would not be compromised.

If CO_2 emissions could be practically assessed, the Building Code could set limits on annual CO_2 emissions, on the basis of a design value, not an actual in-use value. The annual maximum design CO_2 emission could be set at different levels for different types of buildings so that they were designed and constructed to be more environmentally and economically sustainable.

Another aspect is the maximum heating or cooling needed to keep the indoor temperature within a particular temperature range. Insufficient heating would mean the temperature would never reach the target temperature, regardless of how long a heater was on for. But a bigger heating source than necessary would place excessive demand on power generation and transmission systems.

It is **proposed** that buildings be designed and constructed so that the heating or cooling (ie, the power) calculated to maintain indoor temperatures within the comfort range when modelling annual or lifetime energy demands in buildings is less than a specified level.

If this approach could be implemented practically, it would mean that a designer could choose the most effective and economical means of limiting CO_2 emissions for a building for the whole of its lifecycle through, for example, choice of materials, construction methods, systems for running the building and strategies for demolition.

Because this approach would take account of the emissions from materials and resources used for construction, maintenance and demolition as well as the CO_2 emissions used to run a building, it could address several of the sustainable development objectives of the legislation.

Assessing CO_2 emissions in this way, and other proposed changes, would form an integral part of the Building Code. For example:

- Under the General section it is recommended that designers demonstrate that a building will meet the requirements of the Building Code for the building's intended life. Considering resource efficiency in the context of building life could deter designers from specifying materials and systems that require frequent replacement. Dividing the emissions from construction over the period of the intended life could deter designers from specifying a short intended life.
- Considering resource efficiency together with the proposal under Environment that the temperature in residential buildings would need to be able to be kept within a range of temperatures could ensure that designers install appropriate heating systems that are also energy-efficient to run.
- Sanitation requirements facilitate the use of raw (untreated) water where appropriate.

This proposal would also link closely with the recently announced New Zealand Energy Efficiency and Conservation Strategy, which aims to: maximise energy efficiency and renewable energy; promote sustainability; improve quality of life; and drive economic transformation in business. The strategy also aims to save 5 to 6 million tones of CO_2 emissions per year by 2025 and the Building Code would contribute to this reduction.

The incorporation of a CO_2 emissions measure in the Building Code may be considered an ambitious approach.

- The assessment of emissions associated with the materials (known as 'embodied emissions') and construction of buildings would be a new measure in building codes internationally and there are differing approaches to its assessment. Further work would be needed to propose a suitable methodology.
- Analysing the environmental impacts of buildings through their whole lives from construction through to demolition (known as 'lifecycle analysis') is also relatively new and there are differing approaches to its assessment. Again, further work would be required to propose a suitable methodology.
- Work is required to determine how to assess the CO_2 emissions associated with various forms of energy and different construction materials so that designers and regulators have the information they need to apply this approach.
- This concept uses complex ideas and is technically difficult. Further work to develop this concept would draw on expert input. Detailed consultation would also occur as part of this process.

9.5.2 Fire safety

'Fire safety' refers to safeguarding people and neighbouring property against fire and other related hazards, preventing the spread of fire and providing means of escape from fire and other emergencies.

The Building Code sets out performance requirements for fire and emergency safety design, but these are not quantified. The Compliance Documents have not provided specific requirements to fire engineers about performance requirements, design scenarios or design fires. This has led to inconsistent interpretations about the implied requirements of the Building Code, and disputes about the safety of fire designs for proposed buildings.

The performance requirements for multi-storey residential buildings, and the provisions for means of escape, have been the subject of several determinations by the Department.

It is **recommended** that specifying fire design scenarios and performance requirements to be taken into account when designing for fire safety be investigated. These would be in line with the structural design process that specifies events and physical conditions on the structural performance of buildings such as wind, earthquake and snow.

Under the framework the Building Code would:

- specify performance requirements for fire design
- specify fire design scenarios and design fires that must meet performance requirements
- define fire design scenarios including:
  - fire parameters
  - occupant behaviours
  - active and passive fire systems.

Specified fire scenarios would provide examples of the types of fire a building might be required to withstand. They would be developed to ensure all the elements of building design currently regulated in the Compliance Documents would continue to be addressed in a performance-based design.

The proposed approach would permit flexibility and innovation in design, but ensure a more consistent outcome for fire safety.

9.5.3 Features for wellbeing and physical independence

9.5.3.1 Space

The Building Code includes provision for space for activity in access routes, kitchens, laundries, and space for activity, furniture, sanitary and mobility aids in aged care facilities only. There are no requirements for space in other types of buildings.

Consultation threw up considerable comment that the Building Code should ensure sufficient space in dwellings (in particular, apartments) for occupants to be able to move with ease in their dwelling, and to be able to move furniture into and out of their dwelling. This was commonly expressed by specifying a minimum size for an apartment.

The Department has also heard considerable support for the concept of universal design, but also comments questioning the practicability of some measures and the effect on affordability of housing.

The 2007 discussion document did not propose 'universal design' for all housing, but did propose a 'design furniture' standard as a means of achieving space and accessibility. Some submitters took this to mean a standard for furniture, which was not intended, and the expression 'performance standard for space and accessibility' is used to clarify the intent in this report.

The solutions that enable a performance standard for space and accessibility to be met could remove the need for one of the more difficult aspects of future adaptability, where doorways and corridors need to be widened. The performance standard could require doorways and corridors to be wide enough to meet the needs of people with physical disabilities, particularly wheelchair users, without further modification.

The proposals mean a minimum size for apartments would not need to be specified. A performance standard for space and accessibility would give designers the flexibility and incentive to make efficient use of space while ensuring residential buildings would provide adequate space for occupants to move around and use them to their expectations.

Further work would be required to assess whether it is feasible to introduce a performance-based standard for space and accessibility and how this would work in practice.

It is **recommended** that specifying that buildings be designed and built to allow space for 'household activity and access' be investigated.

9.5.3.2 Light and connection to the outdoors

Connection to the outdoors arises from a complex combination of physical conditions, such as availability of natural light, access to views of the natural or built environment, views of the immediate outdoors, natural ventilation, views of the approaches to the building, and access to outdoors areas.

The Building Code has natural light requirements (30 lux at floor level for 75 percent of the *standard year*)[13] for habitable spaces in housing, old people's homes and early childhood centres. These buildings are required to provide adequate openings for natural light and visual awareness of the outside environment.

Ways of addressing connection to the outdoors through different combinations and types of availability of both natural light and views of the outdoors for particular spaces in buildings are being considered.

A rating scale of qualitative measures (Table 5, see Appendix 3) is proposed for connection to the outdoors, incorporating the following features.

- Natural light and direct sunlight
- Proximity to adjacent buildings
- Visual awareness of the sky
- Visual awareness of the ground
- Visual awareness of the neighbourhood

This would be a new type of performance measure for the New Zealand Building Code, but this tool has been used internationally in the management, performance and serviceability of buildings and building-related facilities.

This tool would allow designers flexibility, particularly on restricted sites, while still ensuring building users had adequate connection to the outdoors. For example, limited views could be offset with good access to daylight.

Windows potentially provide solutions to a number of the Building Code requirements, including many of the requirements for connection to the outdoors. If the level of natural lighting was sufficient for general lighting, then that could be taken into account in the assessment of design annual CO_2 emissions for resource efficiency (see 'resource efficiency' above). Natural ventilation provided by opening windows could similarly qualify for the assessment of design annual CO_2 emissions.

More work is required to develop:

- a 'connection to the outdoors' rating scale
- a design tool(s) that allows design professionals and regulators to assess their building against the rating scale.

It is **recommended** that specifying that all habitable spaces should achieve no less than 30 lux of natural light at floor level for 75 percent of a standard year,[14] and no less than a set level on a 'connection to the outdoors' scale be investigated.

9.5.4 Buildings with cultural, historical or heritage value

The Building Act 2004 recognises the need to facilitate the preservation of buildings with significant cultural, historical or heritage value. Heritage buildings are identified through statutory processes by the New Zealand Historic Places Trust and local authorities. There are no unique provisions for these buildings in the Building Code.

Under the Building Act, any alterations to buildings, including heritage ones, must comply as nearly as is reasonably practicable with the Building Code in relation to means of escape from fire and to access and facilities for people with disabilities. Buildings must also continue to comply with the other provisions of the Building Code to at least the same extent as before the alteration.

14 For the purposes of determining natural light, the standard year is the hours between 8 am and 5 pm each day with an allowance for daylight saving.

This provision allows for waivers or modifications to Code compliance to ensure the unique nature and characteristics of heritage buildings are maintained if a building is altered.

The Building Act also refers to the importance of recognising any special traditional and cultural aspects of the intended use of a building. New buildings with cultural and traditional uses – for example, wharenui, churches, temples and mosques – must, like all buildings, meet the performance requirements of the Building Code. The performance requirements should achieve health, safety, wellbeing, physical independence and resource efficiency without compromising the traditional or cultural value of the building.

In consultation, a distinction was made between heritage or historic buildings, and new buildings with a cultural purpose. It was considered that new buildings should be required to fully meet the Building Code requirements, while heritage and historic buildings may require special dispensation. For heritage and historic buildings, the current waiver or modification approach provides the flexibility needed to address the unique nature of these buildings case by case.

It is proposed to develop Compliance Documents, including Acceptable Solutions, specifically for heritage or historic buildings to assist with decision-making.

10 Implementing the changes

The changes have been described above as being Type 1, 2 or 3 depending on whether they are to clarify existing requirements, are new requirements or require further development before a definite proposal can be made.

Most of the Building Code would be unchanged.

10.1 TIMING

The 2007 discussion document sought comment about how changes to the Building Code could be implemented.

Some submissions favoured delaying implementation until all major changes were settled. Others favoured a staged, ongoing introduction of changes as they become ready.

Some submissions and feedback from workshops indicated apprehension from some in the sector about the possible extent or complexity of changes. Some submissions commented that the sector was going through a lot of change and any further Building Code changes needed to be well supported with appropriate guidance material/Acceptable Solutions.

It is **recommended** that a programme of staged, incremental releases of changes be followed.

10.2 COMPLIANCE DOCUMENTS

Many submissions were received to the effect that the Building Code must be adequately supported by Compliance Documents. Submitters commented that Building Code changes should be introduced in stages and in tandem with changes to the Compliance Documents.

As stated earlier, Compliance Documents are an integral part of the building controls system and must be aligned with the Building Code for the system to be effective. Many Compliance Documents cite, or incorporate by reference, New Zealand Standards (and Standards from other countries), and these need to be aligned.

More than 200 New Zealand Standards are directly incorporated and more than double that number are referred to in the directly referenced Standards. Such Standards specify products, systems, processes or design methods, and can be useful for providing a means of compliance with the Building Code. They are developed by sector representatives on a consensus basis. The connection between Compliance Documents and Standards is such that reference to Compliance Documents implies reference to associated Standards.

The citing in the Act of New Zealand Standard NZS 4121 Design for Access and Mobility, Buildings and Associated Facilities as a means of compliance with the Building Code is unique, and can cause confusion and problems for compliance.

The 2006 discussion document presented for comment the possibility of an Acceptable Solution for Housing. This would provide details for typical house construction that meet the Building Code for designers and builders. Submissions on this were overwhelming supportive.

It is **recommended** that Compliance Documents affected by changes to the Building Code be amended and released concurrently with changes to the Building Code.

It is **recommended** that the arrangement of Compliance Documents related to features for physical independence be reviewed.

It is **also recommended** that an Acceptable Solution for Housing be prepared.

10.3 SECTOR EDUCATION

There was widespread comment from sector submissions about the need for education programmes to accompany the release of changes to the Building Code and Compliance Documents.

The strength of these submissions, and other observations by the Department, suggest that sector education about the Building Code and Compliance Documents will be critical to the successful implementation of changes.

It is **recommended** that the implementation of changes to the Building Code and Compliance Documents be accompanied by a comprehensive sector education programme.

11 Appendix 1 – Synopsis of submissions on 2006 discussion document

This appendix summarises submissions received in response to the public discussion document *Building for the 21st Century: Review of the Building Code* (the 2006 discussion document), which the Department of Building and Housing (the Department) published in late May 2006.

The full report *Building for the 21st Century: Review of the Building Code Synopsis of Submissions* is available from: **www.dbh.govt.nz**

11.1 GENERAL COMMENTS

- Submitters wanted alignment of the Building Code with other legislation, particularly the Resource Management Act.
- There was support for balancing any new provisions with affordability and cost.
- A significant number of submissions appeared to confuse the Compliance Documents (Acceptable Solutions and Verification Methods) with the Building Code.
- The style of the Objective Statements was described as being too complex and better framed in language that is more positive.

11.1.1 Performance criteria and Building Code structure

- Most segments of the sector offered mixed support for the Building Code to be organised by outcome. However, design professionals showed significant opposition, preferring the status quo (organised by building component).
- There was strong support for a performance-based Code, but different interpretations of what this meant and the level in the hierarchy at which the performance should be stated.
- There was general support for expressing performance requirements as 'what', 'how much' and 'where', but strongly expressed views from those not in favour. Some submitters thought this would be too prescriptive.
- There was a range of views about 'best practice' and 'minimum acceptable practice'.
- 'Acceptable Solutions' for particular types of building were generally supported, and suggestions were made that the requirements within the Acceptable Solutions should be arranged by building component or trade.

11.1.2 Safety

- Submitters noted the possible effects of climate change and commented that its impact on buildings needed considering in the Building Code, particularly for disaster events such as flooding.
- Most submitters agreed that buildings should be designed for the hazards identified in the discussion document, but many questioned whether the Building Code should address less frequent hazards such as tsunami, volcanic eruption and wildfire. Most submitters commented that adequate warning systems were a better method for addressing these less frequent hazard events. Few practical engineering solutions are available to ensure structural integrity against these hazards, and they are unlikely to reduce risk without high financial and/or environmental costs.
- Some submitters would like importance levels introduced that categorise different levels of acceptable risk for different types of building. It was suggested that these importance levels could be based on those in AS/NZS 1170 Structural Design Actions.
- The Building Code requires buildings to be designed for a 1-in-50-year storm event, but some regional councils use the higher level of a 1-in-100-year storm event or an alternative based on a flood-risk assessment. Submitters would like this inconsistency dealt with.
- Nearly all submitters supported the proposed objectives for fire safety.
- Submitters held differing views about whether escape routes accessible for people with disabilities should be required in the Building Code. Some thought it an essential requirement, while others thought this would create an unreasonable financial burden on building owners.

- Generally, submitters supported the proposed objectives and features for safety in use, but a mixed response was received on the proposals to protect building occupants against fire alarm noise and from hot and cold surfaces.
  - Opponents of the proposals to protect building occupants against fire alarm noise said the critical issue was that the alarms were loud enough to be heard by occupants.
  - In the case of hot and cold surfaces, some submitters said that education was a more effective solution or that the issue should be dealt with by other organisations, such as ACC or OSH.

11.1.3 Health

- The proposed objectives and features were not new and were generally supported.
- There was support for including sustainable development concepts for disposing of waste and water; for example, space for waste and recyclables in multi-unit dwellings and commercial/industrial buildings.
- Submitters noted the need to align water requirements with health legislation and new drinking water legislation in preparation, as it is the Building Code's responsibility to ensure the water that comes out of the tap is not contaminated.
- There was support for the Building Code providing for storage space for waste and cleaning equipment in multi-unit dwellings, and commercial or industrial buildings. These provisions are not in the Building Code, but were in the earlier regulations.
- Some submitters suggested that laundering and cleaning facilities requirements should vary depending on the building type; in other words, there could be a communal laundry in an apartment building.
- In terms of the 'Contact with hazardous materials, substances and processes' feature, submitters said there was a need to raise awareness of materials that caused health problems. Some submitters questioned the role of the Building Code in reducing the use of toxic products.
- Submitters linked health outcomes to thermal performance and energy-efficient design, and stated that the Building Code should set a level of building thermal performance that required conscious consideration of energy-efficient design.
- Submitters supported the use of star rating schemes, such as the Home Energy Rating System, to focus homeowners on energy usage and design.
- Some submitters commented that the need to circulate air outweighed any benefits of preventing draughts, and they did not want requirements that led to sealed houses.
- Limiting the minimum and maximum indoor temperature was not widely supported. Many submitters thought the Building Code was attempting to regulate the temperature at which people maintained their homes. They thought that temperature was a personal preference and this was a matter for the occupier to decide.

11.1.4 Wellbeing

- There was support for universal design/lifetime design principles (wide doorways, lever door handles, lever handles on taps), but as guidelines rather than Building Code requirements. Some felt that this was an education issue and that designers were already incorporating these principles in their work. Some submitters felt that the disability needs of the future could not be predicted and that, therefore, provisions should not be made in the Building Code for adaptability.

- Submitters supported providing for people with visual and intellectual disabilities and there were many suggestions on ways to do this. It was also noted that the Building Code needed to avoid conflicting requirements for the various disabilities.
- Submitters questioned the practicality of providing accessible routes to all occupied buildings, particularly in areas with challenging topography, and linked this to possible increases in the cost of compliance.
- Some submitters pointed out that section 118(1) of the Building Act 2004 had particular requirements about reasonable and adequate access being provided to ensure people with disabilities could visit or work and carry out normal activities and processes in buildings.
- Submitters also suggested that factories and industrial buildings where fewer than 10 people were employed should not be exempt from section 118(1), as they are at present.
- Views differed on whether accessibility provisions should be in one section or throughout the Building Code.
- Submitters supported the Building Code covering the indoor noise environment. Some submitters noted that it was the responsibility of other agencies (such as territorial and regional authorities) to control the outside noise environment, and that the Building Code could not prevent excessive external noise.
- Submitters suggested that the Building Code should cover the problem of buildings obscuring natural light and views. Connection to the outdoors is an issue for apartment development and views being built out.
- There was support for some regulation of unwanted entry (a new feature) by the Building Code, for example, with strengthened doors and windows.
- There was support for the Building Code requiring workplaces that contain personal hygiene facilities to provide hot water. Submitters noted that providing hot showers would promote walking and cycling as modes of transport to work, which is linked to sustainable development through reducing transport energy consumption.
- Views were divided on minimum space requirements in residential buildings.

11.1.5 Sustainable development

- Several submitters noted that New Zealanders are making durability decisions based on trends and aesthetics, rather than what material was best for the climate it was being built in.
- Submitters noted that affordability of high-quality durable materials could be a problem, but that the upfront costs were often less than those for the ongoing maintenance of lower quality products.
- Submitters generally supported the idea of a maintenance plan, but many noted that it would be difficult to enforce. Several suggestions were made about enforcing maintenance plans. Many submitters said that educating homeowners on home maintenance was necessary. Others felt that owners should be responsible for their own maintenance (personal responsibility).
- Increasing the design life of a building was suggested. The current design life is 50 years. Submitters stated that this would result in an improvement in the material used to build houses and lead to fewer low-quality buildings/houses.
- Comments about the objectives for materials were wide-ranging. Some felt that the objectives were too vague and needed more detail, while others were supportive, but felt that the objectives would be difficult to implement.
- Submitters noted that the whole-of-chain environmental impacts areas, while good in theory, would be difficult to implement in a Building Code. They also noted that New Zealand did not have enough information in this area yet.

- There was a general feeling of wanting more government guidance and intervention in the energy efficiency area. Suggestions included incentives, low-interest loans, tax credits, and so on.
- Many submitters focused at the solution level (for example, mandatory solar water heating, increasing insulation values, double-glazing). These solutions could be used to achieve the objectives and will be useful for the next stages of the review.
- A number of submissions commented on the link between energy, and health and wellbeing.
- A range of views was expressed on water conservation and efficiency, ranging from views that water conservation should apply in all instances, regardless of the location or type of building, to views that the market was the best mechanism to decide the efficient use of water.
- There was widespread comment that too much water was wasted both residentially and commercially. Submitters noted that water was becoming an increasingly scarce resource and that there was an environmental cost to its use and disposal, which was exacerbated by inefficient use.
- Reuse and recycling of water was suggested frequently as a solution, but submitters also noted that these suggestions should be balanced with affordability and minimising the health risks.
- Some submitters called for a broader approach to waste minimisation, beyond the use of waste management plans. Some submitters noted that waste management should be included at the design and specification stages.
- Enforcement of waste management plans was raised as an issue, and submitters cautioned against additional bureaucracy.
- Some submitters suggested that education, incentives or using other legislation, such as District Plans or the New Zealand Waste Management Strategy, would minimise waste more effectively.
- It was also noted that infrastructure would be required for re-use and recycling regulations to be practical.
- Some submitters questioned whether protection of other property was the role of the Building Code and suggested the Resource Management Act might be more appropriate.
- Submitters noted that people should have the assurance that their property will not be damaged by surface water, fire, construction and demolition waste, and failed utility networks.
- Several people commented that they wanted to be protected from neighbouring developments obscuring natural light and views.
- There was also a call for control of site-works and landscaping to ensure the stability of adjacent property was not compromised.
- Many submitters agreed that historic, heritage and cultural buildings needed to be treated differently to preserve their value. A distinction was made between heritage/historic buildings and new buildings with a cultural purpose. Generally, submitters felt that new buildings with cultural significance should have no concessions from Building Code requirements.
- Submitters noted that there should be flexibility to allow these buildings to be assessed on a case-by-case basis, for example, for seismic upgrades, handrails, disabled access, fire egress and insulation. However, there should be no compromise on health and safety, regardless of the building's heritage and cultural value (people first).

11.2 MAIN POINTS BY SECTOR SEGMENT

Where the segment of the sector submitters came from was known or could be inferred, submissions were analysed to determine any particular segmentation of responses.

11.2.1 Local government

- Submitters felt tsunami, volcanic activity and wildfire risk was best dealt with under the Resource Management Act and was not a Building Code issue.
- There was support for the proposed accessibility features.
- There were mixed views on requiring the front door of every residential unit to be accessible, as well as on adaptability and universal design provisions, and features helping people with intellectual disabilities.
- The proposed noise objectives and features generated widespread support from this segment.
- Provisions for natural ventilation, natural light and connection to the outdoors were strongly supported.
- However, proposals for minimum indoor temperature and security against unwanted entry were not widely supported.
- In the facilities area, all features were strongly supported, except provision for storage facilities for personal effects.
- There was strong support for proposals for durability, energy and water.
- In areas where there were overlaps with the Resource Management Act (waste management, protection of other property, water efficiency in areas of water shortage and historic/heritage buildings), there was no obvious common view among local authorities and polarised views were presented (but there was still majority support).
- This segment offered mixed views about how the Building Code should be arranged. Some favoured basing the Building Code structure on the principles and purposes of the Building Act 2004, while others felt it should be a practical tool based on building elements. The model for performance criteria was strongly supported.

11.2.2 Architects/designers/engineers

- Submitters felt tsunamis were best dealt with through warning systems, rather than Building Code regulation. The occurrence of volcanic activity and wildfire was deemed too infrequent to warrant inclusion in the Building Code.
- Submitters supported the proposed objectives and features for indoor conditions for health. Provisions for minimum and maximum indoor temperatures were not supported by this group, and there was moderate support for the proposed accessibility features.
- In common with other groups, there was no support for requiring the front door of every residential unit to be accessible and including adaptability and universal design provisions in the Building Code.
- In the noise area, all proposed features were supported.
- In the facilities area, all features were supported, except provision for storage facilities for personal effects and provision for habitable spaces for activity, furniture and personal needs, which drew a mixed response.
- Of the low number of submitters in this area, there was very strong support for the sustainable development objectives and features. There were no areas with significantly polarised views.
- Architects, designers and engineers felt that the structure of the Building Code should be based on its practical application, for example, by building element. Some felt that the 'what', 'how much' and 'where' model would be too prescriptive.

- Building designers favoured the proposed Housing Acceptable Solution, but expressed concerns about whether it would become a prescriptive solution.
- The majority of submitters from this category felt there should be one acceptable level of performance. It was felt that a tiered approach was not appropriate for the Building Code and that it would ultimately confuse users.

11.2.3 Builders

- Builders were opposed to including tsunami, volcanic activity and wildfire requirements.
- All submitters from the building industry were in favour of the fire safety proposals, but there was little support for the additional safety-in-use proposals about fire alarms and hot and cold surfaces.
- While there was mixed support for a minimum indoor temperature, a maximum indoor temperature provision was not supported.
- There was good support for the proposed objectives and features for accessibility, except requiring the front door of every residential unit to be accessible and including adaptability and universal design provisions in the Building Code.
- This group supported the proposed noise provisions.
- Provisions for security against unwanted entry received mixed support.
- Submitters in this group strongly supported provisions for natural ventilation, natural light and connection to the outdoors.
- Proposals on the location and number of sockets/light switches were the only items under 'services' that received divided views.
- In the facilities area, all features were supported, except provision for storage facilities for personal effects.
- On sustainability, views were divided on minimising water consumption from network utility operators in areas of water shortage, banning non-sustainable materials, and about historic/heritage buildings area.
- An appropriate education programme was considered an important component of implementing the Building Code.
- Builders generally supported the performance model, but also expressed concerns that it could lead to de facto prescriptive solutions.
- Submitters felt that the Building Code should stipulate the acceptable minimum level and that market forces were the best determinant of the level of building quality.

11.2.4 Not categorised

- Submitters opposed including tsunami, volcanic activity and wildfire under the Code because of the relative infrequency of these events and the financial burden of designing buildings to mitigate these risks.
- All submitters were in favour of the proposed fire safety objectives and features.
- Several submitters questioned the need for regulation of noise emitted by fire alarms and protection from hot and cold surfaces.
- Unlike other groups, requiring the front door of every residential unit to be accessible and including adaptability provisions in the Code did have a majority support.
- Support for universal design provisions was mixed, with those against slightly in the majority.
- This group supported the proposed noise provisions.
- There was less agreement on increasing the protection of other property provisions (from those already included in the Code) and water efficiency in areas of water shortage (although, paradoxically, this group was strongly in favour of minimising consumption of water from network utility operators in areas of water shortage).
- No clear preference for the arrangement of the Code was able to be determined from this group. The model for performance criteria was not widely supported by this group. It was felt it would be difficult to implement practically.

11.3 FOCUS GROUPS

In August 2006, the Department held 11 focus groups around New Zealand to invite community feedback on the discussion document. In doing so, the Department sought to:

- understand what consumers from within the community wanted from their built environment and the Building Code
- ascertain what priorities people set for the Building Code when balancing conflicting items, such as energy-efficient features against affordability
- encourage participants to use their networks to promote responses to the discussion document.

The focus groups sought to reflect the diverse cultural, economic and social needs of building occupants. This was achieved by inviting participants from a range of local and national community groups and varying ethnicities, and by holding the focus groups in a mixture of metropolitan, provincial and rural locations.

Focus group discussion centred on the issues of sustainable development and wellbeing aspects of buildings, which are considerations required under the Building Act 2004, to help the Department appreciate the level of societal expectation in these areas.

Participants were asked to come up with a range of sustainable development and energy efficiency initiatives and to consider whether they were matters that should be regulated under the Code or left up to personal choice. Participants also discussed a comprehensive list of building wellbeing features and were asked to prioritise rankings based on their own views and those of the people they represented.

There was a high standard of dialogue and some of the consistent themes that arose included:

- government taking a leadership role to encourage the wider use of sustainable development building practices
- ensuring New Zealand buildings, particularly homes, were healthy for their occupants
- improving the sustainability of homes through the installation of energy-efficient appliances, more efficient use of water systems and recycling of household and building waste
- improving use of sustainable energy sources at the domestic level, such as the installation of solar water heating systems
- using universal design practices where possible to enable the physical independence of users
- maintaining performance-based standards so that building owners may exercise personal choice to achieve Code requirements
- considering region-specific climate conditions and avoiding a 'one-size-fits-all' approach
- considering an increase in the design life of buildings.

The key issues varied across the focus groups, highlighting region-specific considerations. Desire for measures to ensure more sustainable homes and building practices was particularly strong in Nelson and Christchurch. In Westport, the substantial effects of coastal erosion were a major issue, and participants in Gore requested better education and information about sustainable energy practices. Affordability of housing was a primary concern in both Kaikohe and Gisborne, while the Kapiti Coast focused on sustainable water practices. In Auckland, cultural considerations were raised, given the large ethnic population, and accessibility issues were prominent in both Auckland and Tauranga.

11.4 WORKSHOPS

As part of the ongoing engagement with stakeholders for the development of the Building Code review, the review team held three stakeholder workshops. Individuals and organisations that made submissions on the discussion document were invited to attend. The workshops were held in late October and early November in Auckland, Wellington and Christchurch and feedback from these has been incorporated into this report.

The key themes to emerge from the workshops were as follows.

11.4.1 Code structure and performance criteria

- There was general support for a performance-based Building Code.
- There were mixed views on whether the Code should be structured by outcome or by building element.
- Attendees would like the Code to be structured in an easy, user-friendly format.
- People commented that any new provisions would need to be affordable for homeowners.

11.4.2 Sustainable development

- Attendees noted that sustainable development was a good concept, but hard to include in the Building Code.
- There was support for including energy and water efficiency, and conservation in the Building Code.
- Submitters would like the Department to do more work in the area of environmental impacts of materials. They commented that regulations about this would be hard to enforce given the limited detailed knowledge about this at present.
- There were mixed views on maintenance – some were in favour of regulation, while others wanted a voluntary, information-based system.

11.4.3 Safety

- A number of comments were made on the cost of regulation compliance versus the possible risk.
- There were mixed views on whether escape routes should be accessible for people with disabilities.
- It was noted that most deaths and injuries from fire occur in residential properties and attendees suggested that we need better regulations in this area.
- It was also noted that consistency was needed between the Building Code, Resource Management Act and the rules governing the New Zealand Fire Service.

11.4.4 Health

- Submitters felt that consideration should be given to combining health and wellbeing proposals.
- They stated that the ability to heat and cool homes to a minimum or maximum air temperature is important for good health.
- Submitters saw a need to ensure homes had access to 'fresh air' because this was good for health, ventilation and preventing moisture build-up.

11.4.5 Wellbeing

- Views differed on whether wellbeing should be part of the Building Code, with some noting that many of the wellbeing issues overlap with the health provisions.
- Views were mixed on provisions for universal and adaptable design. Some supported these being mandatory, while others thought they should be guidelines only.
- There was uncertainty about whether provisions for ensuring natural light (to ensure light is not obscured by neighbouring buildings) should be a Building Code issue or a planning issue under the Resource Management Act.

12 Appendix 2 – Response to 2007 discussion document

12.1 SUMMARY OF SUBMISSIONS

12.1.1 Structure of the Building Code

Submissions on the 2007 discussion document expressed both support for and opposition to the structure presented in that document. Many found the structure logical and easy to follow while others questioned the rationale for change.

Many of those opposed to a new structure commented that the sector was only now adjusting to the Building Code introduced in 1992, and that the changes the sector was undergoing (such as licensing of building practitioners and the accreditation of building consent authorities) would adversely affect the sector's ability to cope with a change to the Building Code structure.

12.1.2 Type 1 changes

Structural performance

- The majority of submissions supported the proposed changes for structural performance.
- Some submitters commented that that this would duplicate an existing loadings code AS/NZS 1170 Structural Design Actions. Some noted that practitioners already use this Standard and that two similar documents in the sector could result in confusion. Others objected because they did not want additional safety factors introduced.
- Some submitters suggested refinements (eg, clarifying terms such as 'Established Engineering Limits') and commented on the difficulty and cost of designing for disproportionate collapse (and suggested the scope be limited); and potential liability issues about designing for impact on neighbouring properties.
- Some commented that the requirements could result in increased engineering fees.

Variability and uncertainty in the design process

- Submitters generally supported this section of the discussion document. Some commented on:
  - checking that safety factors are not compounded leading to excessive 'over-design'
  - the importance of quantifying uncertainty for landslides in the Code
  - a call for the Code to specify a materials uncertainty test method, so that manufacturers and on-site materials testing is consistent and not arbitrary.
- Some submitters thought this section was duplicating AS/NZS 1170 Structural Design Actions, and could lead to increased building cost due to additional design work and buildings requiring stronger structural elements (as a consequence of a greater factor of safety).

Safety in use

- Submissions for this section supported the proposed requirements and comments generally related to issues of clarity and rationale.
- Some submitters questioned the height and strength requirements for barriers. Others suggested that the proposed requirements were too prescriptive and should be included at an Acceptable Solution level.
- Submitters generally agreed with the intent of the slip resistance proposal, but some queried the rationale for the suggested minimum mean coefficients of friction for public and private access routes.
- While there was no specific question about the fencing of swimming pools, a number of submitters requested that the Code (and Building Act 2004) requirements be aligned with the Fencing of Swimming Pools Act 1987, and that NZS 8500: 2006 be referenced in the Building Code.

Indoor climate

- Submitters noted that the external moisture requirements from the current Code were now included in this section. It was acknowledged that moisture entering buildings was a significant issue in New Zealand.
- Some submitters recommended that weathertightness and external moisture issues should be kept as a separate requirement, as they considered that the impact and importance could become less significant and lessen the focus on a key issue for the building sector.
- Other submitters were supportive of the proposed changes and inclusion of external moisture within the indoor climate section

Sanitation

Wastewater disposal
This area generated a large number of submissions. Many were concerned that the proposed requirement that wastewater must be connected to a sewer where this is available would prevent the use of greywater and composting toilet systems in urban areas.

Solid waste disposal
This was strongly supported.

Industrial liquid waste disposal
No significant issues were raised in relation to this area.

Personal hygiene facilities
Submitters supported the intent of the changes in this section, but raised some issues of definition and scope. These included comments that requiring:

- showers in places of active recreation would be too stringent if there was a place to shower in close proximity instead
- showers in places where people may get dirty (eg, building sites) would be too stringent
- toilets and hand washing facilities in any building where people live, work or consume food would be too stringent if there was access to them nearby.

Laundering facilities
There were a number of comments regarding the rationale for providing a laundry in household units with three or more people. Some submitters questioned this requirement as they felt owners/tenants of properties with fewer than three people would be disadvantaged because they may not have a laundry within their house (although this is an existing requirement). They were concerned that people may use their sinks for laundering.

Food preparation facilities
No significant issues were raised about food preparation areas.

Protection of water quality
No significant issues were raised about protection of water quality.

Distinguishing between drinking and non-drinking water systems
No significant issues were raised about distinguishing between drinking and non-drinking water systems. Some submitters commented that signage should be appropriate for people with disabilities.

Preventing the growth of harmful organisms in stored heated water
No significant issues were raised about preventing the growth of harmful organisms in stored heated water. One submission noted that water did not need to be stored above 60°C at all times to prevent the growth of harmful organisms.

Features for wellbeing and physical independence

- There were no major issues about features for wellbeing and physical independence.
- The comments were generally supportive, although the term 'all abilities' was questioned. Many felt this was too difficult to achieve and that a better term was required.

- Other comments included suggestions on types of wayfinding guides to use and examples of international best practice. Others were both positive and negative about the requirements not applying to housing or detached dwellings. Two submissions commented that wayfinding requirements should not apply to buildings except to facilitate emergency egress, or access to heath and safety related facilities.

12.1.3 Type 2 changes

General

Factors that affect performance

- Submitters to this section of the discussion document expressed a mixture of support and opposition.
- Objections included:
  - factors that impact performance are covered by B1 and B2 of the current Building Code, AS/NZS 1170 Structural Design Actions, and the Resource Management Act (RMA)
  - what is proposed does not make it clearer for designers nor more easily enforceable by building officials. It increases the number of factors for designers and building officials to consider. It is also unclear which aspects of the factors are to be considered; they are too broad. This will result in increased design fees and compliance costs.
- Some were supportive, but with qualifications. They:
  - suggested more examples (termites, chimney fumes) or factors (eg, avalanche)
  - wanted factors removed (eg, effects on neighbouring property, because it is covered by insurance)
  - commented that provisions for weathertightness appeared to be lost
  - commented that applying all factors to every building element would be unnecessary.
- One submitter suggested that the specific effects on buildings (implied by the factors) that designers must consider when designing specific buildings be described in detail.

Approach to tsunami risk

- There was a variety of responses to this section.
- Most supported protecting performance group 4 and 5 buildings, from tsunamis; some thought all buildings should be protected; a few that none should. Some considered that some performance group 3 buildings should be considered for tsunami risk.
- Some considered land use planning through District Plans under the Resource Management Act (RMA), or insurance as being more appropriate mechanisms for tsunami protection. Others felt mitigation could be through warning systems or educating future owners about the risks.
- Others argued that the RMA process was inadequate (one submitter commented on the effect of zoning on property values). One submitter commented that it was the role of councils to identify tsunami risk areas, as designers could not do this on a building-by-building basis. Another stated that dealing with tsunami in both the Building Code and the RMA could result in confusion and extra compliance cost.
- Some noted that design scenarios for tsunami and methods for designing to withstand tsunami would be required.

Requirements for flooding

Most submissions supported the proposals in this area, but some commented that:

- the proposed change would not adequately deal with the uncertainty of climate change and the fast-changing weather trends that climate change is likely to bring/has brought. The approach is simply more cautionary, but not sufficient

- the cost associated with remapping flood planes from 2 percent to 1 percent annual event probability would be prohibitive. In some cases 1 percent annual exceedance probability data was not available, and records insufficient to reach an agreed value
- flooding is not a life safety issue and is dealt with under the RMA, so should not be in the Code. It is an issue for owners and their insurers
- annual exceedance probabilities should be determined locally and not be the same across New Zealand. They should be in a Compliance Document and not in the Building Code
- requirements should vary by building performance group (eg, be different for hospitals than for garages).

Tolerable impacts

There was a variety of responses to this section. Submitters who agreed with the proposals in the discussion document also made the following comments/questions.

- Return periods are geographically specific – so what applies to one part of the county may not apply to another.
- Tolerable impacts should only apply to effects on buildings, and not people – performance groups should account for non-building factors.
- An opportunity should be taken to add return periods for some further specified events, such as landslips.
- Post-disaster failure modes should be looked at and what is required of the building to meet these determined.

Submitters who opposed the proposals:

- viewed them as either competing with or being too similar to AS/NZS 1170 Structural Design Actions, and hence creating confusion
- saw an unwieldy combination of factors, performance groups, impact levels, and return periods, resulting in excessive design work and compliance costs
- felt society's expectations should not erode owners' discretion
- thought the information was already included in other Code clauses.

Assignment of buildings to performance groups

Most submissions supported this, but some commented that:

- some performance group (PG) 2 buildings should be reconsidered as PG 3 (eg, aged care facilities); some back-country huts should be PG 2
- building categorisation could be community-specific (eg, in a small town with one super-market or hospital, these buildings may require a higher performance rating in recognition of their important role in the community, unlike a city, which can have several alternate suppliers)
- flexibility with performance groups is required (eg, a building being in a particular performance group because it meets one requirement (such as earthquake safety) but not another (eg, flood) introduces unjustifiable cost)
- buildings of historical and cultural value were not mentioned
- tunnels and bridges were not mentioned.

Some submitters saw it as an unnecessary duplication of AS/NZS 1170 Structural Design Actions.

Performance framework

Submitters commented that:

- the tolerable impacts table should only apply for performance group 4 and 5 buildings
- events, outcomes and performance groups are not equally applicable to all of New Zealand
- some return periods, performance groups and definitions should be further developed
- a cost/benefit analysis was needed to understand and make an informed comment (especially for non-engineers) – not enough information was supplied to understand how it will be implemented

- it was good that it aligned with current design Codes
- it was clear and logical
- it duplicated AS/NZS 1170 Structural Design Actions and that the current Building Code was adequate
- designers would need a lot of support to be able to use this framework.

Structural performance

Submitters were concerned that it would be difficult to meet the requirements of the Code during building alterations, and would probably be impossible to design for every possible future alteration.

Some opposed the inclusion of compliance with the Code during construction, stating it was covered by the Health and Safety in Employment Act 1992. It was noted that calculating stability during construction would be onerous.

Others felt there is no need to go beyond the design objectives of AS/NZS 1170 Structural Design Actions – but the Code must make these clear. Others rejected it on the basis that AS/NZS 1170 was adequate.

Some supportive submissions included comments that:

- materials standards would need to be updated to include serviceable life
- 'demonstrating' compliance with the Code throughout intended life must be limited to compliance with the Code at the time the consent was issued.

Concurrent events and physical conditions

Most submissions supported the concept. Some commented that:

- the integration between the loadings standard (AS/NZS 1170 Structural Design Actions) and the Code was not clear
- live and dead loads were not included as concurrent demands in the performance matrix
- there should be different probability-based trigger points for considering concurrent loads for different performance groups
- fire following earthquake could be a concurrent design scenario
- the concept was too technical, and the extra complexity and cost offered no real gain
- there was not enough probabilistic data for events in New Zealand to make it work
- engineering commonsense was adequate to address probabilistic concurrent demands.

Requirements for the structural performance framework

Most submissions supported the concept. Some commented that:

- it was complex to follow and apply, and that a simpler framework would be preferable
- the definitions of some impact levels needed development
- non-engineers would find it difficult to comment on the significance of the proposed changes
- it appeared to be a duplication of AS/NZS 1170 Structural Design Actions, and that the current framework worked.

Safety in use

- There were no significant issues raised in relation to this section.
- There was general agreement with the requirements for protection from hot surfaces and hazardous substances.
- Some submissions commented on the proposal for exposure to high levels of sound from alarms used for evacuation, with suggestions for the types and placement locations of alarm systems in buildings.

Indoor climate

Internal moisture control
Submissions generally supported the proposed requirements for internal moisture control, although a number of submitters commented that the relative humidity criterion could mean that a mechanical solution (eg, air conditioning) would be required in some parts of the country.

Indoor air quality
Submissions generally supported the proposed requirements for indoor air quality. A few submissions provided feedback on the proposed maximum contaminant exposure levels in buildings, querying the rationale for glass fibres, formaldehyde and particulate levels, and how these could be calculated.

Thermal comfort
The concept of 85 Percent Population Satisfaction seemed a challenging concept for some submitters. A number suggested it should be made simpler by using only the World Health Organization (WHO) recommendations for air temperature in homes. One submission questioned the validity of the WHO research and suggested that health of building occupants may be more related to ventilation and humidity than temperature.

Sanitation

Solid waste disposal
No significant issues were raised in relation to this area.

Water temperature for personal hygiene
No significant issues were raised in relation to this area. The majority of submissions supported the 50°C proposal for water for personal hygiene.

Laundering facilities
No significant issues were raised in relation to this area.

Facilities for cleaning
No significant issues were raised in relation to this area.

Capacity of water supply systems
Many submitters commented that a minimum 250 litres per person per day for domestic use would be far more than is necessary and would conflict with considerations of water efficiency and conservation.

Drinking water
No significant issues were raised in relation to this area.

Raw water for other uses
No significant issues were raised in relation to this area.

Distinguishing between drinking and non-drinking water systems
No significant issues were raised in relation to this area.

Greywater reuse
A large number of submissions were made about greywater reuse.

Submitters commented that the proposed requirements did not promote greywater recycling and would make it too hard for people to conserve and use water more efficiently.

The submissions focused predominately on three issues.

- Allowing for greywater re-use in toilets and for outdoor use only would be too restrictive and prevent households from using greywater for other uses.
- The *E.coli* level was too stringent.
- Requiring greywater quality to be monitored would be too onerous and discourage people from installing greywater systems.

Features for wellbeing and physical independence

Submissions generally supported the proposal that multi-unit dwellings should provide an accessible route for people with disabilities, but some suggested that they could apply to only multi-storey buildings (ie, excluding semi-detached) or that they could be for a percentage of units in a building rather than all units. Some submitters suggested that this should be a guideline only.

12.1.4 Type 3 changes

Resource efficiency

- Submitters generally supported the intent of the discussion document's proposals and were positive about improving the resource efficiency of buildings. The support ranged from full endorsement to qualified support or support in principle.
- Submitters noted that this was a complex area and needed further development work.
- Some submitters commented that the promotion of resource efficiency in the construction and use of buildings was achievable but wanted to include all greenhouses gases (or CO_2 equivalents) in the assessment.
- Using a Life Cycle Assessment approach was widely supported and submitters suggested that this should include all CO_2 emissions, both positive and negative, from the entire product life cycle. This would include mining and transporting raw materials, and manufacture as well as the resulting energy consumption required in operating the building and demolition.
- A number of submissions noted that, given the complexity of this area, it would be important to get the building science behind it correct. They wanted a robust and scientifically based system that will be easy to administer.
- Submissions from local government authorities and designers commented that ease of use would be an important factor in the success of this performance requirement.
- Some submitters were concerned about the consumption and waste of resources through the operation of the building over its lifetime. They noted that these can produce significantly larger environmental impacts. Some suggested having additional, but separate, energy, water and waste measures as well as the CO_2 emissions standard.
- Some submitters suggested having interim resource efficiency measures such as energy and water efficiency until the CO_2 measure was introduced.
- The predominant comment from submitters not supporting the proposal was that it would be too complex and difficult to administer. Comments included a suggestion that resource efficiency should be left to the market to regulate. Others noted that they felt this was a Resource Management Act issue, rather than a Building Code regulation.
- Other submitters suggested that the Department partner with the Green Building Council, EECA or BRANZ to make use of existing rating tools and expertise. Other suggestions were made about what to measure/what not to measure.

Fire safety

- Submissions generally supported the fire safety proposals, but some submissions queried the robustness of the technical methodology. There were also some expectations that the Code should regularly review the fire provisions to keep up to date with changes in building design.
- Several submissions raised concerns that the proposals did not apply to residential buildings and some submitters perceived that the proposals disadvantaged people with disabilities. Some submitters advocated installation of sprinklers as a fire safety solution.

Features for wellbeing and physical independence

Submissions generally supported for the proposals for Features for wellbeing and physical independence, although some commented they may be difficult for local authorities to administer.

Space

- Submissions supported the concept of a 'design furniture' test for space in buildings. There was a common acknowledgement that it was difficult in some buildings, and units within buildings, to get furniture in and out of lifts, up and down stairwells, and through doorways.
- There was, however, a common misunderstanding that this proposal was about introducing minimum space sizes for apartments/houses. Some submitters felt that the rules would be very complex, and preferred District Plans to stipulate minimum room or apartment sizes.
- Some submitters expressed concern that the government was intervening in the market and that it was an individual's choice to live in a small apartment or room. They commented that regulation in this area was not necessary.

Connection to the outdoors

- Submissions were supportive of this concept and many made the connection between the outdoors and health and wellbeing. Submitters stated that natural light was important and needed to be provided in habitable spaces in residential dwellings.
- Others noted that commercial buildings should also have wellbeing aspects, as people spend more daylight hours at work than at home. Others commented positively about the flexibility of design that this proposal would allow. One submitter cautioned about increasing in energy costs due to larger windows being provided for connection to the outdoors.
- Others noted that, while an outdoors connection was important, it may not be everyone's prime need. Affordability and choice are also important. A few submissions also felt that this was a District Plan issue.

12.1.5 Introducing changes to the Building Code and Compliance Documents

- There were many general comments about introducing changes to the Building Code and Compliance Documents. These included concerns that any Building Code changes be introduced in stages and in tandem with changes to the Compliance Documents. Recognition of potential compliance costs was raised in some submissions. The capacity of the industry to adopt the new Code provisions was also identified as an issue, with several submissions advocating a need for education programmes to accompany these (funded and implemented by the Department of Building and Housing).
- A variety of views were expressed about the desirability of reviewing Building Code provisions. Some submissions felt regular general reviews were desirable while others felt these should only be undertaken in response to specific issues as these become apparent as problems. Recommended review periods varied from three to five years.
- There was interest in ensuring that proposed changes were based on sound professional advice, but also that Verification Methods and Acceptable Solutions were given appropriate attention to ensure innovation. The needs of the disabled were frequently raised as an issue, with recommendations that the Building Code regularly review these provisions to ensure they continued to receive consideration.

12.2 FOCUS GROUPS

This is a summary of findings from 11 focus groups held in different locations in New Zealand in August 2007. The focus groups discussed two of the performance requirements under consideration in the discussion document: connection to the outdoors and resource efficiency. The groups also raised other points in relation to the Building Code.

Connection to the outdoors

- Participants felt strongly that buildings should connect to the outdoors and that this was necessary for health and wellbeing.
- The most important aspects of connection to the outdoors were natural light, natural ventilation and sunlight.
- Connection to the outdoors was seen as being part of 'New Zealandness', which should not be compromised by higher-density development.
- It was felt that most rooms in a home should connect to the outdoors as should all types of housing, including apartments.
- Participants felt that the way in which buildings connected to the outdoors was a matter of personal preference and also that people were prepared to make tradeoffs between different aspects of this, for example choosing a view over direct sunlight.

Resource efficiency

- Participants generally supported the approach set out in the discussion document and felt it was important to make buildings more sustainable.
- Some concerns were expressed about the practicality of the approach, in particular that it could lead to increased bureaucracy.
- It was felt that measuring carbon emissions should be easy to understand and that there was a need for education and information at all levels including designers, building inspectors, builders and the public. Participants felt it was particularly important to have information on materials and durability.
- Some participants wanted incentives to build to a higher level of sustainability than the minimum set out in the Building Code, for example through ratings schemes.
- Participants generally agreed that it was better to pay more upfront to get a building that would cost less to run, but they were also concerned about whether the carbon emissions standard might make housing unaffordable.

Comments on other areas of Building Code

- Many participants were concerned about building accessibility. This partly reflects the make-up of some of the focus groups, which included representatives from community groups for older and disabled people. Participants felt that buildings should be designed to meet the needs of people at all stages of their lives and of all abilities. There was also concern about the accessibility of public buildings, particularly community buildings.
- Participants also raised concerns about fire safety, including fire prevention measures such as smoke alarms and sprinklers, as well as the need for safe exits from fire.
- Some participants expressed a lack of confidence in builders and building inspectors and felt that modern houses were built to poor standards.

12.3 WORKSHOPS

This is a summary of findings from four workshops held in Auckland, Wellington, Christchurch and Dunedin during August 2007. The workshops discussed the proposals in the discussion document relating to resource efficiency and implementation of a new Building Code. There was also an open forum session where participants could ask any questions relating to the discussion document.

Findings – key overall themes

- The key theme to come out in the workshops was the continuing need to engage openly and transparently with the sector. Participants wanted information readily available and wanted to be involved in the next stages of the Building Code development. They will need realistic lead times and support to ensure the new Building Code is implemented well.
- There is still a lack of understanding about what the Building Code is and what a Compliance Document is (prescription versus performance). While understanding has improved since the last consultation period (August – October 2006), some people still do not fully understand performance requirements as opposed to prescriptive requirements. This is expected to be reflected in the submissions.
- There was discontent with the consenting processes administered by territorial authorities. Many of the open forum questions related to council processes, consistency of decision-making and delays processing applications. While these concerns are outside the scope of the Building Code review, it is important to note that they exist and that the implementation of a new Building Code could impact further on these issues.
- There was general support in principle for the carbon emissions target, but many questions about how the Department would develop this further, and a desire to have more information before giving it their full support. The support in principle was not universal. Detractors felt it was too ambitious and that the Building Code should focus on energy efficiency, water efficiency, waste minimisation and so on as separate performance measures.

Resource efficiency

- The carbon emissions target received general support, in principle, but many questioned how the Department would develop this further and wanted more information before giving it their full support. Participants wanted to know whether it would apply to all buildings and building work, including renovations; what the threshold would be; how the Department would calculate the CO_2 emission content of material; and what material would be included in the calculations (eg, would they have to count every nail, screw and so on).
- Some detractors felt it was too ambitious a performance standard for the Building Code. Some were concerned that without a specific focus on energy efficiency, water efficiency, waste minimisation and so on (as separate performance measures), the overall carbon target would not have a sufficient impact on these areas. A small number did not agree with a carbon emissions target. They questioned whether climate change was occurring and whether a Building Code should be regulating this at all.

Implementation

- *Simplicity* was very important, including the need for simple, clear language. Everyone (territorial authorities, builders, designers, homeowners) needs to understand the information and be aware of the timeframes. The information will therefore need to be well publicised and readily available.
- *Timing* will be the key. The sector will need realistic lead times and will need to know how long the transitional phase will last (ie, when new requirements will take effect). It will also be important that the Department sticks to the agreed timetable and doesn't let any dates slip.

- *Access to information* will be important. There needs to be one place to go to for all the information. The Department needs to take responsibility for ensuring the information is available and easy to find.
- *Support for the sector* is imperative. They would prefer a 'step change' rather than a 'big bang' approach to implementing the new Building Code. They would like the Department to update all the supporting documents (Compliance Documents) and ensure these are available at the same time as amendments to the new Building Code are released. They also commented that the intensity of the changes could be quite overwhelming for some organisations. The Department also needs to engage with the sector to 'enable, align and bind' them to the amended Building Code.

Open Forum – Comments on other areas of Building Code

- Most questions during the open forum session sought clarification or further information about the proposed performance requirements in the discussion document. These ranged from those relating to the CO_2 emissions measure, to greywater to accessibility.
- There were also questions and comments relating to the Building Code review process, including:
  - whether the new Building Code would increase the cost of compliance
  - what the process for the Building Code review was from here
  - performance versus prescriptive Codes.

It should be noted that some participants were still confused about the difference between a performance-based and a prescriptive Code, and the Building Code versus Compliance Documents.

13 Appendix 3 – Tables

TABLE 1: PHYSICAL CONDITIONS AND EVENTS THAT AFFECT HOW BUILDINGS PERFORM	
Physical conditions	**Example of effects on buildings**
Specific events that affect how buildings perform	
Construction/demolition activity	Vibration, impact, loss of support, dust, noise
Earthquake	Fault movement, ground shaking, landslip, liquefaction
Tsunami	Collapse
Impact	Vehicles, machines, ships
Explosion	Internal explosion, external explosion
Land/ground movement/ landslip	Loss of support
Volcanic activity	Ground vibration, lava flow, lahar, ash fall, corrosion, geothermal activity
Wind	Pressure, moisture penetration, noise, vibration, fatigue
Snow, hail, ice	Moisture penetration, decay, weight, hailstone impact, wind-resistance
Rain	Flooding, rain penetration in storm events, initial construction moisture
Fire	Radiation, smoke, heat, fire spread
Physical conditions that could affect buildings all the time	
Gravity – permanent	Self weight of permanent items, removable contents, creep
Gravity – transient	People, vehicles, machines, fatigue, removable contents
Earth pressure	Pressure behind retaining wall
Land/ground movement	Settlement, subsidence, swelling, freezing
Temperature	Temperature variation, expansion/contraction, freezing, condensation, inadequate temperature for health, energy use
Water and other fluids	Moisture penetration, condensation, humidity, scour, mould growth, shrinkage/expansion, fluid pressure, ponding
Vibration	Machinery, wind, building use, fatigue
Shrinkage/expansion	Wetting and drying, thermal movement
Machinery	Weight, noise, vibration

TABLE 1: PHYSICAL CONDITIONS AND EVENTS THAT AFFECT HOW BUILDINGS PERFORM (CONTINUED)	
Physical conditions	**Example of effects on buildings**
Physical conditions that could affect buildings all the time (continued)	
Human activity	Washing, physical impact, moisture, noise
Humidity	Moisture from use, weather
Noise	External noise, noise from building services
Environment	Toxic emissions, non-renewable energy use, material selection and disposal, water use, carbon emissions
Physical conditions that could affect the ability of a building to respond to the demands placed on it over a long period of time	
Water and other fluids	Corrosion, decay
Reversing or fluctuating effects	Induced vibration, fatigue
Groundwater	Moisture penetration, decay, pressure, ground stability
Biological organisms	Fungi, mould, mildew, wood borer decay, vermin, disease, viruses and pathogens
Chemical action	Corrosion, sea spray, compatibility of materials
Humidity	Decay, mould growth
Sun	UV effects, effects on materials, over-heating, energy use
Contaminants	Hazardous substances, mould, toxic substances, contaminated air and water

TABLE 2: PERFORMANCE GROUPS		
Performance Groups	Description of building types	Specific structure(s)
PG 1	Buildings posing low risk to human life or the environment, or a low economic cost, should the building fail. [These are typically small non-habitable buildings, such as sheds, barns, and the like, which are not normally occupied, though they may have occupants from time to time.]	• 'Ancillary buildings' meaning not for human habitation • Minor storage facilities • Back country huts
PG 2	Buildings posing normal risk to human life or the environment, or a normal economic cost, should the building fail. [These are typical residential, commercial and industrial buildings.]	• All buildings and facilities except those listed in PGs 1, 3, 4 and 5
PG 3	Buildings of an increased level of societal benefit or importance, or with higher levels of risk-significant factors to building occupants. These buildings have increased levels of performance as they may house large numbers of people, vulnerable populations, or occupants with other risk factors, or fulfil some role of increased importance to the local community or to society in general.	• Buildings where more than 300 people congregate in one area • Buildings with primary school, secondary school, or day-care facilities with a capacity greater than 250 • Buildings with tertiary or adult education facilities with a capacity greater than 500 • Health care facilities with a capacity of 50 or more residents but not having surgery or emergency treatment facilities • Jails and detention facilities • Any other building with a capacity of 5000 or more people • Buildings for power generating facilities, water treatment for potable water, wastewater treatment facilities, and other public utilities facilities not included in PG 4 • Buildings not included in PG 4 or 5 containing sufficient quantities of highly toxic gas or explosive materials capable of causing acutely hazardous conditions that do not extend beyond property boundaries

TABLE 2: PERFORMANCE GROUPS (CONTINUED)		
Performance Groups	Description of building types	Specific structure(s)
PG 4	Buildings that are essential to post-disaster recovery or associated with hazardous facilities.	• Hospitals and other health care facilities having surgery or emergency treatment facilities • Fire, rescue and police stations, and emergency vehicle garages • Designated emergency shelters • Designated emergency preparedness, communication, and operation centres and other facilities required for emergency response • Power-generating stations and other utilities required as emergency back-up facilities for PG 3 structures • Buildings housing highly toxic gas or explosive materials capable of causing acutely hazardous conditions that extend beyond property boundaries • Aviation control towers, air traffic control centres, and emergency aircraft hangars • Buildings having critical national defence functions • Water treatment facilities required to maintain water pressure for fire suppression • Ancillary buildings (including, but not limited to, communication towers, fuel storage tanks or other structures housing or supporting water or other fire suppression material or equipment) required for operation of PG 4 structures during an emergency
PG 5	Buildings whose failure poses catastrophic risk to a large area (eg, 100km^2) or a large number of people (eg, 100,000).	• Major dams • Extreme hazard facilities

TABLE 3: MAXIMUM CONTAMINANT EXPOSURE LEVELS IN BUILDINGS			
Group	Contaminant	Maximum long-term level (mass, volume) Time average	Maximum short-term level (mass, volume) Time average
Oxides	CO CO_2 NO_2 SO_2	10mg/m^3 – 8 hr 6300mg/m^3 – 8 hr 40µg/m^3 – annual 20µg/m^3 – 24 hour	30mg/m^3 – 1 hr 200µg/m^3 – 1hr 500 µg/m^3 – 10 minute
VOCs	Formaldehyde		100 µg/m^3 – 30 mins
Particulates	(≤=10µm)	50µg/m^3 – 24 hr	
Particulates	(≤=2.5µm)	25 µg/m^3 – 24 hr	
Asbestos		No safe level	

TABLE 4: SCALE OF IMPACT LEVELS						
TIL 0	TIL 1	TIL 2	TIL 3	TIL 4	TIL 5	TIL 6
Insignificant	Mild	Moderate	High	Severe	Very severe	Extreme
No significant effects on building elements, occupants or functions	Minimal consequence for loss of human life, or very small economic, social or environmental consequences	Low consequence for loss of human life, or small or moderate economic, social or environmental consequences	Medium consequence for loss of human life, or considerable economic, social or environmental consequences	High consequence for loss of human life, or very great economic, social or environmental consequences	Severe consequence for loss of human life, or very severe economic, social or environmental consequences	Extreme consequence for loss of human life, economic, social or environmental consequences

TABLE 5: CONNECTION TO THE OUTDOORS		
1	2	3
No view	Partial view of distant landscape, extensive views of near landscape	Full view of distant and near landscape
No ability to observe external surroundings	Partial ability to observe external surroundings	Full ability to observe external surroundings
No direct sunlight in any part of the habitable unit	Future partial blocking of access to daylight is possible and probable	Future blocking of daylight to any part of the unit is very unlikely or not possible
Living room has access to daylight; no direct access to daylight for any habitable rooms other than a living room; service rooms do not have access to daylight	Living room has direct access to daylight; first bedroom has direct access to daylight; other bedrooms (if any) have borrowed access to daylight; kitchen has direct access to daylight; other service rooms do not have access to daylight	All habitable rooms have direct access to daylight; kitchen has access to daylight; other service rooms have access to daylight or borrowed daylight
Daylight in the living room enables occupants to read without eyestrain and without using artificial light, in 20 percent of floor area; borrowed daylight to habitable rooms is sufficient for occupants to move around safely during daylight hours without using artificial light		Average-sighted occupants can read using daylight only during daylight hours in all habitable rooms in 50 percent of the floor area of each room; sufficient daylight in the kitchen to allow safe use during 4 daytime hours, without using artificial light

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