Department of Building and Housing
Te Tari Kaupapa Whare

Briefing to the Royal Commission of Inquiry into building failure caused by the Canterbury Earthquakes

The building regulatory framework

May 2011

Contents

1 Introduction

1.1 Purpose

1.1.1 The purpose of this briefing note is to provide an overview to members of the Royal Commission about the building regulatory framework in New Zealand.

1.1.2 The briefing note covers:

- The building regulatory system

  The building regulatory system consists of the Building Act and the Building Regulations. A description of the history and the rationale for the various components of the system are described in section 2. The proposed new system is also described.

- The development of seismic design and standards in New Zealand

  The history of seismic design and the current loading standards are described in section 3.

- Building Act tools for upgrading structural performance of buildings

  The Building Act includes a number of provisions that relate to existing buildings and are designed so that, over time, the existing building stock is upgraded to ensure that people can use buildings safely. Section 4 describes the Building Act provisions relating to dangerous, insanitary and earthquake buildings and the requirements for upgrading when the use of a building changes.

- The post earthquake assessment of buildings

  Territorial authorities have a responsibility to manage post disaster building safety. Section 5 describes the guidance available to territorial authorities for post disaster building evaluations and the transition required back to the Building Act provisions once a state of emergency is terminated.

- The Department's investigation into the building collapses

  The Department is conducting a technical investigation of four buildings in the Christchurch central business district. Section 6 describes the process that is to be used for the technical investigation.

2 The building regulatory system

2.1 The history of the building regulatory system

2.1.1 The following history of the building regulatory system provides a context for the varying standards of buildings built across New Zealand during the last century.

2.1.2 The first building legislation in New Zealand was the Raupo House Ordinance 1842 which levied for the construction of new buildings. When local authorities (then territorial authorities) were first formally established under the Municipal Corporations Act 1867, they were authorised, but not required, to regulate building through their bylaws. However, that authorisation was essentially limited to fire separations between buildings and similar requirements to prevent the spread of fire.

2.1.3 From 1886, the authorisation was widened by successive Acts until it eventually covered building bylaws ‘for any purpose concerning the construction, alteration, and repair of buildings, as defined in the bylaws’. By 1935, most (but not all) local authorities had their own building bylaws. Initially, the larger local authorities had adopted United Kingdom bylaws, such as those of the City of London, but eventually most wrote their own. Coverage gradually widened from preventing the spread of fire to sanitation, fire safety of occupiers, structural matters, and so on. There were wide variations between the bylaws of different local authorities, but they generally required building owners to obtain building permits from the local authority for significant building work in respect of specified types of buildings. There was no formal sign-off when a building had been completed.

2.1.4 Following the 1931 Napier earthquake, the government asked the New Zealand Standards Institute (now Standards New Zealand) to draft model building bylaws for local authorities to adopt. The resulting New Zealand Standard 95 (‘NZS95’) was issued in 1935 and included the requirement ‘that no person shall erect or commence to erect any building without first obtaining a building permit’.

2.1.5 It was entirely up to each local authority whether it adopted the model building bylaws. In practice, by the 1970s almost all local authorities had adopted the model bylaws, although often with significant local amendments (for example, many rural local authorities exempted all farm buildings).

2.1.6 Private sector building controls were set by local authorities under their building bylaws and provided that a building permit had to be obtained before a building could be constructed. There were also relevant central government regulations, such as the Plumbing and Drainage Regulations applied to private sector buildings. Crown buildings were not subject to local authority bylaws. This meant that state housing, hospitals, prisons, schools, courts and government offices, facilities and infrastructure did not need building permits.

2.1.7 The model building bylaws were continually amended and revised (published as NZS 1900) until the passing of the Building Act 1991. By that time, NZS 1900 covered much the same areas of building technology as the current Building Code.

2.1.8 Prior to 1991, building controls operated through four distinct systems:

- Government departments – there were 19 departments with powers under more than 60 different Acts, plus various codes of practice and guidelines
- Local authorities – the majority of local authorities had adopted the New Zealand Standard Model Building Bylaw NZS 1900
- Standards Association of New Zealand – had the general function of developing national standards and promoting their use
- Other public and private agencies – many other agencies had building control duties, for example, the Liquor Control Commission and the New Zealand Fire Service Commission.

2.1.9 As a result, building works were subject to controls from a number of different sources and requirements differed depending on location.

2.1.10 In 1986, the government set up the Building Industry Commission to consider the whole building sector regulatory framework and 'in those areas where it is considered that such objectives are best achieved through minimum performance standards, prepare an appropriate, simplified, uniform, performance orientated national building code, which will bind the Crown'.

2.1.11 The Building Industry Commission review resulted in, amongst other things:

- the introduction of the Building Act 1991 (its requirements would apply nationally, doing away with the dispersed system of controls spread throughout central and local government)
- Crown buildings became subject to the building control regime and therefore Crown agencies were required to obtain building consents
- the introduction of a nationally applicable, performance-based Building Code confined to the essential safeguards for building users (the performance criteria were not prescribed and were thereby open to innovation and new technology and practices)
- the establishment of the Building Industry Authority as the one source of referral and review for the building control system
- local authorities being charged with the administration of the building controls including the building consent system.

2.1.12 The Building Act 1991 was the first national building legislation and the Building Industry Authority was the government agency responsible for the implementation of this Act. Local authorities carried out building control functions and private building certifiers carried out some building consent approval and inspection functions.

2.1.13 In 2002, the Building Industry Authority commissioned the Weathertightness Overview Group to enquire into the weathertightness of New Zealand buildings. Although the Building Act 1991 had been subject to review for some time, this process was accelerated as a result of concerns about leaking homes. The group produced the Report of the Overview Group on the Weathertightness of Buildings (commonly known as the Hunn Report). The Hunn Report outlined systemic failures in the building industry that led to inadequate building practices causing leaking and called for far-reaching changes across the construction industry.

2.1.14 The Building Act 2004 was subsequently passed and become fully effective from April 2005 and the Building Act 1991 was repealed. The Building Act 2004 introduced several new initiatives to improve building practices and compliance procedures.

2.2 The Building Act 2004

2.2.1 The Building Act 2004 (the Act) sets out the current law on buildings and building work in New Zealand and provides the framework for building controls, with the following objectives:

- People can use buildings safely and without endangering their health.
- Buildings have attributes that contribute appropriately to the health, physical independence and wellbeing of the people who use them.
- People who use a building can escape from the building if it is on fire.
- Buildings are designed, constructed and able to be used in ways that promote sustainable development.

2.2.2 The Act sets up a framework to promote good quality decision making during the building process. It covers the licensing of building practitioners, the registration of Building Consent Authorities, review of the Building Code, consumer protection, product certification, and the processes for the construction, alteration, demolition and maintenance of new and existing buildings. The Act sets standards and procedures for people involved in building work, and covers how building work can be done, who can do it, and when it needs to be inspected. The Building Regulations (made under the Building Act 1991 and confirmed and in force by the Building Act 2004) contain the Building Code, which describes the minimum performance requirements that buildings must achieve.

2.2.3 The Department of Building and Housing (the Department) is the government department responsible for building policy and regulatory functions. Local councils (local authorities) have responsibilities as territorial authorities under the Act to carry out building control functions in their district. Territorial authorities must be accredited and registered as building consent authorities in order to carry out building consent authority functions. Private organisations can also attain registration as a building consent authority.

2.2.4 Disputes about buildings, proposed building work, and the Act and Building Code can be referred to the Department for resolution by Determination. Determination decisions are binding on the parties involved.

2.2.5 The Building Act 2004 is philosophically the same as the Building Act 1991. However, the Act introduced the following changes:

- The Building Industry Authority was dissolved, and the Department was created.
- A review of the Building Code was initiated to provide clarity about building standards and guidance about how to meet those standards.
- Licensing of building practitioners was introduced to improve certainty that people doing building work have the skills for the job. From 1 March 2010, certain design and building work (restricted building work) has to be undertaken or supervised by a licensed building practitioner.[1]

[1] Licensing classes are set out in regulations and administered by the Department of Building and Housing. Complaints can be made about licensed building practitioners and heard by an independent board.

- Local authorities or other organisations wishing to undertake regulatory building control functions are required to become accredited and registered for that role. Building consent, inspection and approval work is accredited by a building consent accreditation body (International Accreditation New Zealand (IANZ)) against the standards and criteria in the Building (Accreditation of Building Consent Authorities) Regulations 2006. Accredited building consent authorities are registered by the Department against the standards and criteria in the Building (Registration of Building Consent Authorities) Regulations 2007.
- Consumer protection measures in residential construction were introduced:
    - Warranties are implied in all building contracts for household units, including the expectation that work will be done competently using suitable materials, completed within a reasonable time, and that the household unit will be suitable for occupation.
    - Residential property developers are not able to sell household units without code compliance certificates.
- Introduction of product certification as a means by which products can be certified as complying with the Building Code. Third party certification bodies must be accredited to undertake product certification. Accreditation is a joint scheme between Australia and New Zealand done by Joint Accreditation System of Australia and New Zealand (JAS-ANZ)[2].

2.3 The Building Code system and the Building Code

2.3.1 The Building Code system sets out and supports building performance requirements. It interfaces with other systems supporting building quality, in particular, the design system (the development of construction proposals by designers) and the building consent system through which regulatory requirements are administered. The Building Code system includes:

- setting performance requirements (the Building Code)
- developing or approving means of complying with the Building Code (Verification Methods and Acceptable Solutions) which reflect current knowledge and are appropriate to the materials and building technologies being used, including New Zealand Standards
- developing guidance issued by the Department or recognising industry-developed information intended to assist compliance with the Building Code
- commissioning and using research evidence to underpin building performance criteria and the means of complying
- delivering the information contained in and associated with the Building Code in a way that supports users to understand and meet their accountabilities for building performance.

[2] JAS-ANZ is the government-appointed accreditation body for Australia and New Zealand responsible for providing accreditation of conformity assessment bodies (CABs) in the fields of certification and inspection.

2.3.2 The Department is responsible for the Building Code. Standards New Zealand is responsible for preparing and publishing New Zealand Standards. BRANZ[3] provides significant input into the research basis for the Building Code related to building performance.

2.3.3 The Building Code is central to the building control system. It 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.

2.3.4 The Building Code is performance-based and sets out the minimum performance requirements for buildings. It contains two clauses of general provisions and 35 clauses of technical requirements. Unlike a prescriptive code, it does not specify how to achieve this performance (i.e. there are no detailed requirements for design and construction).

2.3.5 Performance-based regulation focuses on the outcomes that are envisaged for a building and less on specific materials, assemblies, construction and installations. In practice, this means there can be many ways of meeting the requirements. The Building Code allows flexibility and enables and encourages designers and the industry to develop innovative and cost effective solutions.

2.3.6 The Building Code system also provides for the publication of prescriptive information (Compliance Documents[4]) about designs that provide one way of meeting the relevant Building Code requirements. Buildings built using the method described in a Compliance Document must be accepted as complying with the Building Code. Compliance Documents may be:

- Verification Methods, which are tests and calculations by which a design may be evaluated for compliance with the Building Code
- Acceptable Solutions, which are a prescriptive means of complying with the Building Code.

Other methods can be used provided they demonstrate that the performance requirements of the Building Code have been met. They are often referred to as Alternative Solutions.

2.3.7 Compliance documents can cite standards that have been developed by internationally recognised standard setting bodies, including Standards New Zealand. These standards set agreed specifications for products, processes, services, or performance.

2.3.8 An overview of building regulation as it relates to the Building Code system is shown in Figure 1.

[3] BRANZ is an independent and impartial research, testing, consulting and information company providing services and resources for the building industry.
[4] The Building Amendment Bill Number 4 proposes to replace the term Compliance Documents with the terms Acceptable Solution or Verification method as appropriate.

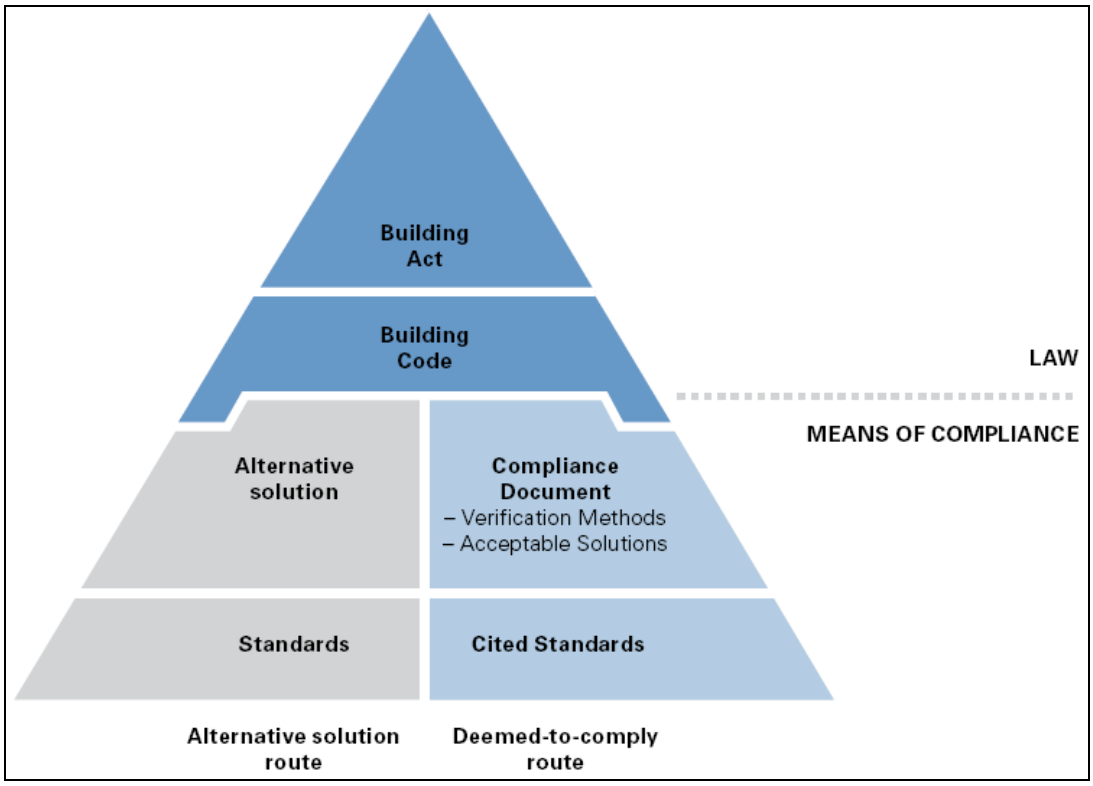

Figure 1: An overview of building regulation as it relates to the Building Code system

2.3.9 New Zealand's building regulatory system is comparable with a number of countries, such as Australia, Austria, Canada, China, England, Japan, Norway, Scotland, Singapore, Spain, Sweden, Wales, and the United States. A report providing additional information and detailing the principles and experiences of countries implementing performance-based building regulatory systems is attached in Appendix A.

2.3.10 The Department is currently reviewing the Building Code system (as part of the Building Act review, discussed in section 2.5). The purpose of this review is to recommend changes to the current system to enhance:

- the fit of the Building Code system with implementation of the government's policy objectives as set out in the decisions on the Building Act review
- current knowledge about materials and building technologies and the ability to respond to change to building methodologies as they evolve
- the presentation of the Building Code and associated documents to the needs of the users who are accountable for applying it
- support for productivity and innovation in the building and construction sector
- the cost efficiency and effectiveness of the Building Code system.

2.3.11 It is expected that the review will lead to the Department reporting to Cabinet on proposals for improving the integration and presentation of, and access to information supporting the Building Code, including New Zealand Standards. The review will also consider the interface with the project on the design of the consenting system (refer to paragraphs 2.6 and 2.7) and will inform the design of an information technology system to support the regulation of building in New Zealand.

2.4 The building consent system

2.4.1 A building consent is an approval granted by the building consent authority that must be obtained for most building work before it is started. The Act sets out certain building work ('exempt work') that does not require a building consent. However all building work, whether or not it requires a building consent, must meet the standards of performance set by the Building Code.

2.4.2 The building consent authority reviews the submitted plans and technical literature and will issue a building consent only when it is satisfied the proposed building work will meet the requirements of the Building Code. When the building work is completed and the building consent authority is satisfied it complies with the building consent, a code compliance certificate for the building work is issued.

2.4.3 Additional requirements apply to buildings with specified systems (mainly commercial, public, or multi-unit residential buildings) to ensure that building systems such as lifts and sprinklers are adequately maintained. These requirements are set out in a compliance schedule issued by a territorial authority and a building warrant of fitness stating compliance schedule requirements are met. A building warrant of fitness is issued by an owner about their building.

2.4.4 Building consent documentation provides a historical record when further building work, alteration, repair, or maintenance is required, or when the property is sold to a new owner.

2.4.5 The courts have decided that local authorities have a special duty of care to home owners in carrying out their building control functions. The same duty of care does not apply for commercial and industrial buildings where it is assumed that owners have access to greater expertise and knowledge in building procurement.

2.4.6 An overview of the basic building consent process is shown in Figure 2. The same basic consent and inspection process applies whether building a new home, commercial building or structure, or for renovations, additions, alterations or demolition.

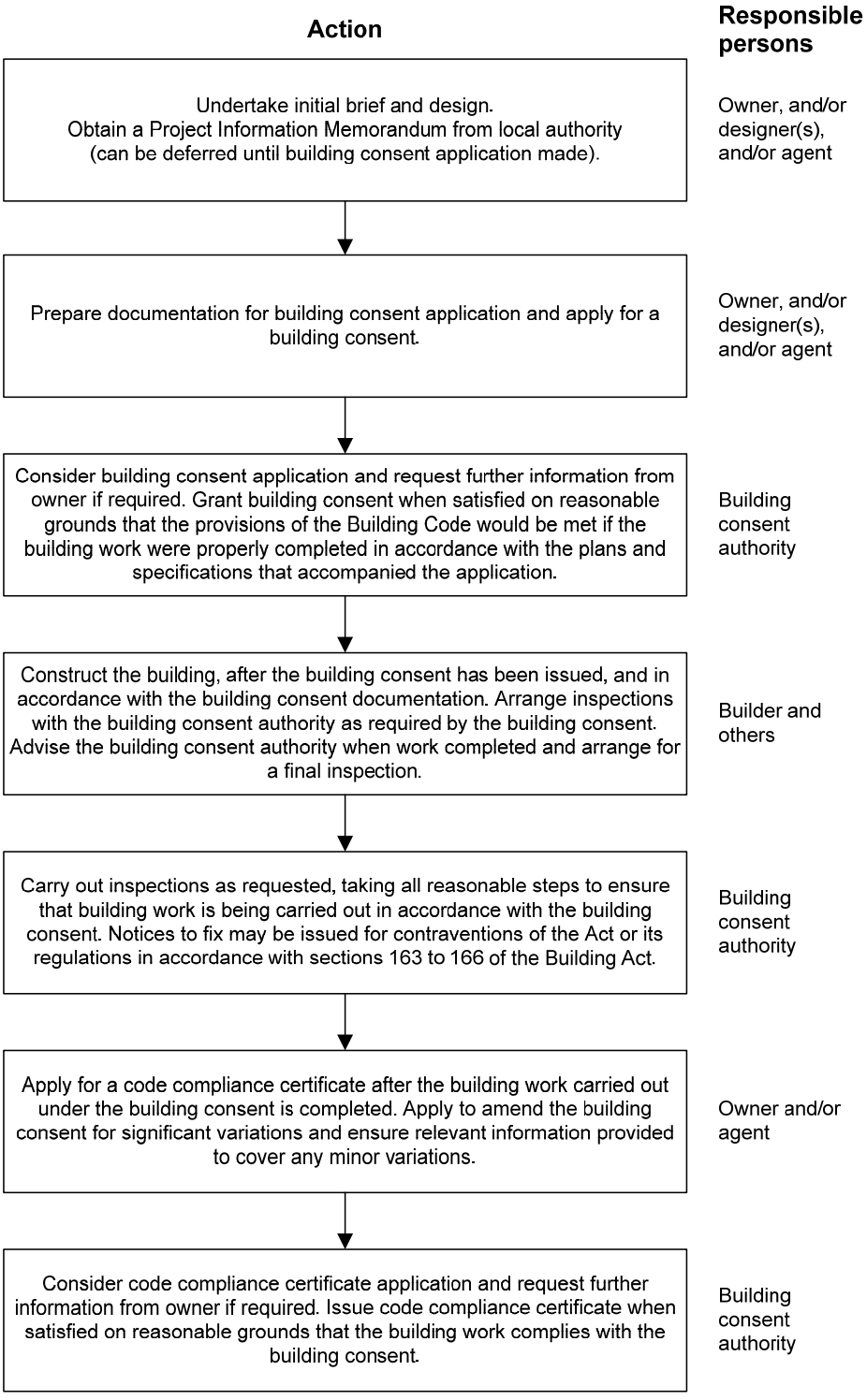

Figure 2: An overview of the building consent process

2.5 Future changes to the building regulatory system

2.5.1 The Act has undergone a review and the Building Amendment Bill (No 3) is currently being considered. One of the changes proposed is the introduction of risk-based consenting. This section outlines the future changes to the building regulatory system.

2.5.2 Since the Building Act 2004 came into force, there has been a general improvement in building quality. In 2009, the government initiated a review of the Act, its associated regulation and its administration, to reduce the costs but not the quality of the building control system.

2.5.3 The review concluded that:

- regulatory reform is needed to help achieve improvements in the productivity, efficiency and accountability of the building and construction sector, alongside other initiatives to improve skills and capability
- those best placed to ensure the quality of building work (by ensuring it complies with the Building Code) are those directly involved in its design and construction
- Building Code requirements and supporting information on how to comply with them need to be clear and easily accessible to designers and builders
- regulatory requirements should be administered in ways that reinforce the accountability of those designing and constructing building work for the work that they do.

2.5.4 The Department has a programme of work in place to implement the review but legislative change is also required. The Building Amendment Bill (No 3) is currently being considered and is expected to be passed in 2011. The changes proposed in the Bill are intended to encourage those working in the sector to improve their skills and capability, to ‘build right first time’ and increase efficiency and productivity.

2.5.5 The Building Amendment Bill (No 3) is the first of two bills to implement the Government’s decisions on the review of the Building Act. The Bill:

- introduces a risk-based approach to how building consent and inspection requirements are administered so the role of building consent authorities is aligned to the level of risk involved in achieving building quality
- more clearly signals the responsibilities of participants involved in building design and construction, including homeowners and building consent authorities
- enhances accountability under the licensed building practitioners regime
- provides for an owner-builder exemption from the restricted building work provisions of the Building Act
- repeals the offence, for buildings built between 1992 and 2005, of allowing the public use of a building without a code compliance certificate
- makes a number of changes to enhance and clarify the building warrant of fitness regime.

2.6 Risk based consenting

2.6.1 The Act provides a process for checking whether building work complies with the Building Code. It includes the following core elements:

- a list of building work that is exempt from the requirement to obtain a building consent (Schedule 1 of the Act)
- a consenting process that involves building consent authorities checking plans and specifications for Building Code compliance and issuing a building consent
- powers for building consent authorities to carry out inspections to check building work is being carried out in accordance with the consent
- a certification process where building consent authorities:
    - confirm the building work is complete
    - check consent requirements have been met
    - issue a code compliance certificate
- a monitoring/record-keeping process, where owners and prospective owners of a property can search council records for evidence of compliance with the Act.

2.6.2 The review of the Act found that building consent authorities take a risk-averse approach to consenting building work because of concerns about their liability and the high reliance placed on them by building professionals and trades people and consumers. This has led to unnecessary checks and inspections for certain building work where the risk to public health and safety is relatively low (for example, low complexity building work where there is a competent building practitioner involved). As a result, for low risk work, compliance costs are higher than necessary. The review also identified opportunities to broaden the range of building work not requiring a building consent to include more work that has low probability and consequence of failure for health and safety.

2.6.3 As a result of the review, Cabinet agreed to changes to the building consent system to introduce a risk-based system of regulatory oversight, where the role of building consent authorities would be aligned with the risk involved. In particular, how building consent authorities discharge building consent and inspection requirements would be prescribed in law for low-risk building work (for example, the maximum number of inspections around critical points in the building process). Appropriate controls would be put in place, such as requirements for a licensed building practitioner to undertake the work. For residential building work of moderate-to-high risk and complexity, current consent and inspection requirements would remain in place until it is clear that regulatory oversight can be further reduced without negative effects.

2.6.4 The first of the amendments to the Act was to broaden the range of exempt building work not requiring a building consent. As a result new exemptions from building consent requirements were added to Schedule 1 in December 2010. The remaining amendments contained in the Building Amendment Bill (No 3) are:

- a new streamlined process for some low-risk work that only checks certain conditions are met (for example, that the work is undertaken by a licensed building practitioner), involves almost automatic consent and no inspections

- a new simplified process for low-risk residential building work (for example, simple single-storey houses with low structural and weathertightness risks), putting more reliance on the skills and experience of licensed building practitioners but retaining some involvement of building consent authorities in compliance checking
- retaining the existing process for moderate-to-high risk residential building work until evidence from the sector shows regulatory oversight could be further reduced without compromising quality
- an alternative process for commercial building work (refer to paragraph 2.7).

2.6.5 While the sector has been broadly supportive of the proposed risk-based system, caution has been expressed about the readiness of the sector to accept accountability for regulatory compliance. Specifically, concern has been raised about whether the skill base within the sector is adequate to produce Building Code compliant work with limited oversight by building consent authorities, especially in the residential sector. For these reasons the government does not intend to introduce regulation implementing risk-based consenting until some time after the Building Amendment Bill (No 3) is passed.

2.6.6 The Department will monitor skill levels and performance of the sector for a period after the Building Amendment Bill (No 3) is enacted. When there is evidence the sector is ready for the new risk-based system, and therefore when it is appropriate to bring the risk-based consenting provisions of the Act into force, this will be reported to government.

2.6.7 The government also anticipates the scope of work dealt with under the new processes could be expanded over time, as confidence grows in builders' and designers' capacity to accept responsibility for Building Code compliance. Accordingly, the government proposes to put some of the details of the new processes, and the building work they apply to, into the Building Regulations. This will provide flexibility for the risk-based system to evolve over time and enable changes in the sector to be responded to in a timely manner.

2.7 Commercial consenting

2.7.1 Commercial buildings are currently subject to the same building consent requirements as residential homes. They go through a standard process of obtaining a building consent, undergoing inspection at key stages during construction, and getting a code compliance certificate on completion of the work.

2.7.2 In practice, many of these commercial buildings are commissioned by well-informed consumers and are designed, built, supervised and peer reviewed by experienced, contractually accountable professionals. Further, building consent authorities often lack the in-house technical expertise to carry out detailed design checks and inspections and instead rely heavily on third-party review of design and specifications.

2.7.3 Some building consent authorities have moved to accepting producer statements (i.e. signed statements of compliance from the professionals involved in design and/or construction) and requiring third-party review by qualified professionals. Where large commercial builders have quality assurance systems in place, building consent authorities have a higher level of confidence in doing this. The courts have not found that building consent authorities owe a duty of care to commercial building owners. Commercial building owners are therefore highly incentivised to manage building quality risks.

2.7.4 Consultation with the sector during the review (including with building consent authorities) confirmed the view that building consent authorities' current involvement in commercial building consenting duplicates and adds little value to the process of third-party review utilised by most large commercial builders. However, use of third-party peer review is not universal and there is general unease with the notion of totally removing independent oversight of commercial building by building consent authorities. In particular, building consent authorities are seen as playing an important role at the building commissioning stage of the process (for example, in relation fire safety, evacuation, accessibility etc).

2.7.5 Third-party review is central to ensuring Building Code compliant building work of commercial buildings and quality assurance systems play an important verification role in the process. Most large commercial building companies routinely use third-party quality assurance, particularly during the building design stage, because of the potential liability they face if things go wrong. Quality assurance also makes good commercial sense (i.e. third-party review often identifies design improvements and/or savings that can be made and leads to improvements in building design and construction).

2.7.6 Provided certain controls are in place, including an acceptable degree of independent oversight by a regulator, it makes good sense to explicitly provide in the Act for recognition of third-party review and supporting quality assurance systems as a means of providing assurance of Building Code compliance. As noted above (refer to paragraph 2.7.4), to a large degree this would formalise existing best practice and broaden its application.

2.7.7 Building Amendment Bill (No 3) contains provisions to introduce this approach for commercial building consents. The Department will report back to government on the final design and proposed scope of the commercial consenting process in 2012.

2.8 Supplementary information

2.8.1 The following document is attached in Appendix A to provide further information:

(i) Performance-Based Building Regulatory Systems, Principles and Experiences: A Report of the Inter-jurisdictional Regulatory Collaboration Committee February 2010

3 The development of seismic design and standards

3.1 Structural design and the loading standard

3.1.1 For several decades, New Zealand has been at the forefront of earthquake engineering design and construction practice.

3.1.2 The Building Code is designed to minimise harm to people, rather than to save buildings. The aim is to construct buildings that act like modern cars (i.e. which incorporate crumple zones with a central cage that limits harm to passengers). In earthquakes as severe as a '1 in 500 year event', building requirements are intended to ensure that parts of a newer building may deform in a controlled way but should not collapse.

3.1.3 The performance requirements of the Building Code strike a balance between risk and cost. With regard to seismic design, the Building Code requires structures to:

- safeguard people from injury caused by structural failure
- safeguard people from loss of amenity caused by structural behaviour
- protect other property from physical damage caused by structural failure.

3.1.4 The current loading standard[5] for structural design is NZS 1170: 2005, which was cited in the Verification Method of Clause B1 of the Building Code in 2008.

3.1.5 The importance of buildings is taken into account in seismic design. Most buildings are designed to resist ground shaking for a one in 500 year probability event. However more important buildings are designed either for a one in 100 year probability event (30% greater capacity) or one in 2500 year probability (80% greater), depending on how critical they are to the community.

3.2 The history of the loadings standards

3.2.1 Requirements for earthquake design were first introduced following the Napier earthquake. The first loadings standard to include provision for earthquake design was published in 1939 (NZS 95:1939).

3.2.2 In 1965 a new loadings standard was introduced (NZS 1900 Chapter 8: 1965). The standard split the country into three seismic zones and required that buildings be designed with adequate ductility[6], although no details were given on how to achieve this.

3.2.3 The design requirements were progressively developed as more was learnt about the nature of earthquakes and how to design buildings to resist them. Further changes occurred in 1976, 1984, and 1992 (following the introduction of the New Zealand Building Code in 1991). The latest changes to earthquake design were introduced in 2008.

3.2.4 The publishing of the loadings standard in 1976 (NZS 4203:1976) brought about the requirement that the standard was to be used in conjunction with revised material standards (steel, reinforced concrete, timber, and reinforced masonry) which all required specific detailing for ductility. Unreinforced masonry was explicitly prohibited as a building material[7].

[5] The Loading standard provides designers with general procedures and criteria for the structural design of structures. It outlines a design methodology that is applied in accordance with established engineering principles.
[6] Ductility is the ability of a material to maintain its load carrying capacity as it deforms beyond its elastic limit.
[7] An unreinforced masonry building is made of brick or stone with no reinforcing steel.

3.3 The relationship between regulation, structural design, standards and materials

3.3.1 The diagram provided as Exhibit A (affixed to this document) shows the relationship between building regulation, structural design and standards, requirements for upgrading existing buildings, and building materials and design practices since the Napier earthquake.

3.4 Post earthquake changes to seismicity[8] risk in Canterbury

3.4.1 The Department has been advised by leading seismologists that the sequence of earthquakes has increased the seismicity risk in parts of Canterbury, particularly Christchurch.

3.4.2 In response, the Department has taken immediate action to amend the structure-related Compliance Documents to increase the seismic resistance requirements for buildings in the affected areas. The amendments involve raising Canterbury's seismic hazard factor from 0.22 to 0.30. The amended Compliance Documents were released on 19 May 2011 and had immediate affect.

3.4.3 The urgency of the amendments was required as designers, engineers and affected owners await decisions from the Department before they can facilitate repairs and begin reconstruction on earthquake affected buildings.

3.4.4 Cabinet approval has been given for the Department to prepare a discussion document on whether the Building Code structure clause should be changed to clarify and increase the specificity of design requirements for seismicity risk. This discussion paper will be released for public comment in June/July 2011.

3.5 Supplementary information

3.5.1 The following document is attached in Appendix A to provide further information:

(ii) Overview timeline of Standards relating to determination of loads and methods of determining loads, compiled by Standards New Zealand 2011

[8] The frequency or magnitude of earthquake activity in a given area

4 Building Act tools for upgrading structural performance of buildings

4.1 Tools for upgrading existing buildings

4.1.1 The Building Act covers the control of existing buildings. The intent of the provisions of the Act that relate to existing buildings is to ensure that, over time, the existing building stock is upgraded and people can use buildings safely. In general, the Act does not provide for retrospective compliance with the Building Code. However, the upgrading of existing buildings is considered when building work is proposed on those buildings. This upgrading requirement may result from building work that alters the existing building, or when the use of the building is changed. The triggers which require building owners to upgrade the structural performance of buildings are if:

(i) a building undergoes a change of use (refer to paragraph 4.2).

(ii) a building is deemed to be earthquake-prone (refer to paragraphs 4.3)

4.1.2 The Act also has provisions for local authorities to address issues associated with dangerous and insanitary buildings. Dangerous buildings are those likely to cause injury or death in the ordinary course of events (excluding the occurrence of an earthquake), by collapse, fire or other means. Insanitary buildings are those that are offensive or likely to be injurious to health because of the location, construction, state of disrepair, defective provision against moisture penetration, or insufficient provision of potable water or sanitary facilities.

4.1.3 If a building is dangerous or insanitary, the Act provides local authorities with the power to attach a notice warning people not to approach the building. The local authority can also fence off access to the building and give notice requiring work to be done to reduce or remove the danger or to make the building sanitary.

4.2 Changes of use in existing buildings

4.2.1 The Act has specific requirements for when an owner proposes to change the use of a building. Every building or part of a building is deemed to have a use, and this use, along with ‘change of use’ is defined within the Building Regulations. A building owner intending to change the use of an existing building must give written notice to the local authority.

4.2.2 The Act requires[9] that when there is a change of use the structural performance of buildings be upgraded to a standard ‘of as nearly as is reasonable practicable’ to that of a new building.

4.2.3 The question of whether a building complies ‘as nearly as is reasonably practicable’ with particular provisions of the Building Code involves balancing the sacrifices and difficulties of upgrading against the advantages of upgrading. The High Court has considered the requirement and interpreted it in this way.

4.2.4 Compliance with the Building Code can be difficult and expensive to achieve. Local authorities need to balance issues of safety and the cost of improvements to building owners with community interests.

[9] Section 115(a) and 115(b)(i) of the Building Act 2004

4.3 Earthquake-prone buildings

4.3.1 The objective of the Act in respect of earthquake-prone buildings is to reduce the level of earthquake risk to people and target the most vulnerable buildings.

4.3.2 Under the Act, an earthquake-prone building is defined as one that would have its structural capacity exceeded in a moderate earthquake. Regulations have defined 'moderate' as being an earthquake that would generate shaking which is one third as strong as the shaking that would be factored into the design of a new building at the same site. This requirement is referred to as the "one third rule".

4.3.3 The definition of moderate earthquake is critical for making decisions about the need for remedial work to be undertaken on existing buildings to reduce heath and safety risks associated with the collapse of buildings from earthquakes.

4.3.4 Strengthening buildings to improve their ability to withstand earthquake shaking involves cost to territorial authorities, building owners and the community generally. One of the purposes of the Act's provisions requiring local authorities to have earthquake-prone building policies is to provide for local economic, social and other factors to be taken into account by territorial authorities when implementing the earthquake-prone building provisions in the Act.

4.3.5 The Act requires local authorities to have a policy for the management of earthquake-prone buildings in their areas and to review this policy every five years. The Act requires local authorities to develop, consult on, and publish a policy that sets out its approach to exercising its powers in relation to earthquake-prone buildings.

4.3.6 Policies for earthquake-prone buildings cover the amount of time given to owners to upgrade their buildings so that they are no longer earthquake-prone (i.e. a timeframe is imposed in which the owner needs to ensure that the building meets the "one third rule").

4.3.7 When determining an appropriate time frame for this earthquake strengthening, most policies take into account factors such as heritage, local economies and building use (including frequency of use). Some local authorities are more proactive than others in identifying earthquake-prone buildings in their communities.

4.3.8 Enforcement of upgrading of earthquake-prone buildings lies with local authorities because they are (seen by government to be) best placed to balance community interests (for example, in preserving heritage buildings) with issues such as safety and the cost of improvements to building owners.

4.3.9 The New Zealand Society for Earthquake Engineering[10] recommendations assist local authorities to fulfil their responsibilities under the Act. These recommendations set out the following broad process for local authorities to assess the earthquake-prone buildings (EPB) in their area.

[10] New Zealand Society for Earthquake Engineering (NZSEE); website www.nzsee.org.nz

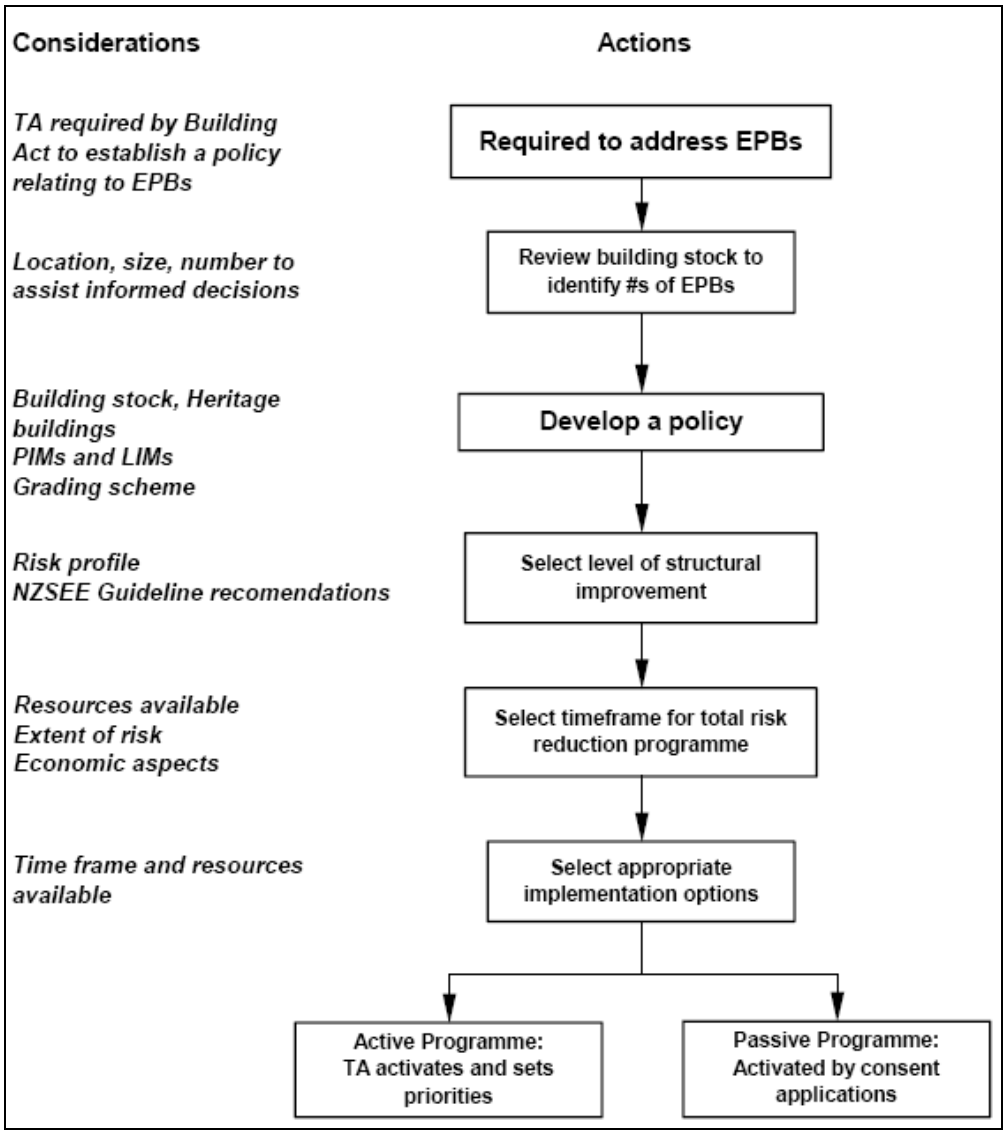

Figure 3: Implementation options and processes (Figure 2.2. of The New Zealand Society for Earthquake Engineering recommendations)

4.4 Legislating for earthquake-prone buildings

4.4.1 In New Zealand, awareness of the vulnerability to earthquakes of unreinforced masonry buildings started with the Napier earthquake in 1931, and from overseas earthquakes, particularly in California. In 1968, legislation was introduced to deal with buildings of high earthquake risk. The 1968 legislation applied to buildings failing to meet one half of the full loads from the 1965 Standard (NZS 1900 Chapter 8: 1965).

4.4.2 The Local Government Act 1974 gave responsibility to deal with earthquake-prone buildings to local authorities. The term earthquake risk buildings related only to unreinforced masonry buildings. An unreinforced masonry building is made of brick stone work that is not braced by reinforcing beams. Earthquake-prone buildings were those that failed to meet half of the loads specified by NZS 1900 Chapter 8: 1965 for a new building.

4.4.3 The Building Act 1991 replicated the same requirements of the Local Government Act 1974 with respect to earthquake-prone buildings.

4.4.4 Scientific knowledge progressed and the awareness of the vulnerability of pre-1976 buildings developed. It was recognised that a building just meeting the standard set in the Building Act 1991 represented more than 25 times the risk of a new building. In response, consideration of earthquake-prone buildings extended the earthquake-prone provisions to all types of construction. The Building Act 2004 refers to earthquake-prone buildings as any situation where the building is considered to not be capable of an adequate seismic performance.

4.5 The relationship between regulation, structural design, standards and materials

4.5.1 The diagram, listed as Exhibit A (affixed to this document), shows the relationship between building regulation, structural design and standards, requirements for upgrading existing buildings, and building materials and design practices since the Napier earthquake.

4.6 Supplementary information

4.6.1 The following documents are attached in Appendix A to provide further information:

(i) Earthquake-Prone Building Provisions of the Building Act 2004 – Policy Guidance for Territorial Authorities, Department of Building and Housing

(ii) Assessment and Improvement of the Structural Performance of Buildings in Earthquakes: Recommendations of a NZSEE Study Group on Earthquake Risk Buildings, New Zealand Society for Earthquake Engineering June 2006

5 The post earthquake assessment of buildings

5.1 Rapid assessment of buildings during a state of emergency

5.1.1 The New Zealand Society for Earthquake Engineering Building Safety Evaluation Guidelines provide guidance for local authorities to prepare for, implement and manage building structural safety evaluation activities after a major earthquake or other disaster, and for engineers and others assisting with the process in the field. This is not a Building Act matter but is covered by the Civil Defence Emergency Management Act 2002.

5.1.2 The objective of the Guidelines is to rapidly assess buildings in the aftermath of an earthquake or other disaster, to evaluate the safety of buildings and determine whether or not they are suitable for access and occupancy.

5.1.3 During a state of emergency, the people responsible for carrying out inspections require authorisation from the controller to carry out inspections, issue placards, and evacuate buildings or limit entry to buildings and places.

5.1.4 Rapid evaluation placarding of buildings is a way to 'triage' the structural condition of buildings in the aftermath of an earthquake:

- Red carded buildings are considered unsafe to enter
- Yellow carded are considered suitable only for restricted use or access until repairs are completed
- Green carded buildings are considered safe to enter and appear to be in much the same structural condition as prior to the earthquake.

5.1.5 The placarding system was adapted by the New Zealand Society for Earthquake Engineering from a system used in the United States of America and was first used in New Zealand after the Gisborne earthquake in 2007. It was refined by a team of New Zealand engineers working in Padang in Indonesia after the earthquake there in 2009 and the during the Christchurch earthquakes of 2010 and 2011.

5.2 Post state of emergency evaluation and remedial work

5.2.1 The placards posted on buildings during the rapid assessment stage of the building safety evaluations do not have a status under the Building Act. When the state of emergency is lifted, building safety provisions transition from the Civil Defence and Emergency Management Act to the Building Act. The Building Act provides general powers of inspections to local authorities, including entering land and buildings for the purpose of inspecting the building or determining whether the building is dangerous, earthquake-prone, or insanitary (section 222 of the Act).

5.2.2 This transition to the Building Act was first tested during the Gisborne earthquake in 2007. In that situation, once the state of emergency was lifted, Dangerous Building Notices were immediately issued for all damaged buildings (those with yellow and red placards) under the Building Act (section 124).

5.2.3 The same process was applied in Canterbury but the volume of damaged buildings made this transition administratively difficult. Therefore an Order in Council was issued to facilitate the transition by giving the yellow and red placards temporary status of section 124 Dangerous Building Notices.

5.2.4 Dangerous buildings are defined under section 121 of the Building Act. The assessment of the structural stability of a building, as to whether a building is dangerous, must be considered in terms of whether the structure of a building that has been weakened has been compromised so that it can no longer carry loads that could be reasonably expected in the ordinary course of events (i.e. this assessment does not include anticipating a future event such as an earthquake).

5.2.5 The assessment of whether a building is earthquake-prone of a building under section 122 of the Act allows for the issue of a notice under section 124 of the Act if a building is considered earthquake-prone. After an event such as an earthquake, a building's structure may have been weakened so the assessment of the structural stability of a building, as to whether a building is earthquake-prone, must be considered in terms of whether the residual strength of a building is less than one-third the strength of a new building.

5.2.6 The process followed to reoccupy buildings following the Canterbury earthquakes highlighted the lack of guidance for structural engineers to carry out detailed engineering evaluations of buildings.

5.2.7 Following the September 2010 earthquake in Canterbury, the Earthquake Commission and then the Department engaged leading engineers (the Engineering Advisory Group to develop guidance to assist with the recovery. Guidance on house repairs and reconstruction was published by the Department in December of 2010. The guidance primarily focused on re-levelling and improving the performance of house foundations because of the extensive liquefaction.

5.2.8 Following the February 2011 earthquake, the Department widened the scope of the Engineering Advisory Group to develop guidance for the engineering evaluation of commercial and larger residential buildings. A draft copy of this guidance has been circulated to structural and geotechnical engineers in Canterbury for trial and comment.

5.3 Supplementary information

5.3.1 The following document is attached in Appendix A to provide further information:

(i) Building Safety Evaluation During a State of Emergency – Guidelines for Territorial Authorities, New Zealand Society for Earthquake Engineering, August 2009

6 The Department's investigation into the building collapses

6.1 Technical Investigation

6.1.1 The Department is conducting a technical investigation of four buildings in the Christchurch central business district. The findings from this investigation will contribute to the work of the Royal Commission of Inquiry into building failure caused by the Canterbury Earthquake.

6.1.2 The focus of the technical investigation is the Canterbury Television (CTV), Pyne Gould Corporation (PGC), Forsyth Barr, and the Hotel Grand Chancellor buildings.

6.1.3 As outlined in the Terms of Reference (attached), the investigation is not intended to address issues of culpability or liability arising from the collapse of each building. Instead it aims to establish the cause/s of each building's failure, to better understand the reasons why some buildings collapsed, and the possible impact of liquefaction on foundations.

6.1.4 Through a selected tender process, the Department engaged the following expert engineers to undertake the technical investigation:

- Hyland Fatigue & Earthquake Engineering, led by Clark Hyland, together with StructureSmith, led by Ashley Smith, will jointly investigate the CTV building.
- Beca Consultants, led by Rob Jury, will investigate both the PGC and Forsyth Barr buildings.
- Dunning Thornton Ltd, led by Adam Thornton, will investigate the Hotel Grand Chancellor.

6.1.5 In addition, a panel of expert construction professionals has been established to provide guidance on the methodology of the investigation, and to review the investigative work. The Chair of the panel is Sherwyn Williams and the Deputy Chair is Dr Nigel Priestly. Other panel members include Dr Helen Anderson, Associate Professor Stefano Pampanin, Peter Miller, Peter Fehl, George Skimming, Marshall Cook, Adam Thornton, Rob Jury and Dr Clark Hyland.

6.1.6 Records of building design and construction are being used to support the investigation. As this is a technical investigation there are no public hearings. However, evidence has been invited from building owners, local councils, building users and members of the public to assist with the investigation.

6.1.7 The investigations are progressing with the engineering consultants having completed their site inspections. To date, the expert panel have met twice and, on both occasions, the engineering consultants have presented interim information on the structural design of the buildings and their construction that may have influenced the performance of each building during the 22 February earthquake.

6.1.8 The expert panel is next scheduled to meet on 24 May 2011.

6.1.9 The Department's final report will contain its observations on the outcome of the investigations, implications for building controls issues, and other matters relevant to the Department's role as the regulator responsible for the Building Act and Building Code.

6.1.10 Below is an indicative timeline for the completion and reporting of the technical investigation:

- 20 June 2011 – Consultants present their technical reports to the expert panel on each building
- 11 July 2011 – Expert panel presents its report to the Department
- 29 August 2011 – Department submits the panel's report, consultants' reports and a covering report to the Minister.

6.2 Supplementary information

6.2.1 The following document is attached in Appendix A to provide further information:

(i) Terms of Reference for the Technical Investigation into the Performance of Buildings in the Christchurch CBD in the 22 February Christchurch Aftershock.

Exhibit A

(i) The relationship between building regulation, structural design and standards and building methods since the Napier earthquake (referred to in paragraphs 3.3 and 4.5).

Appendix A

Section 2: The building regulatory system

(i) Performance-Based Building Regulatory Systems, Principles and Experiences: A Report of the Inter-jurisdictional Regulatory Collaboration Committee February 2010

Section 3: The development of structural design and standards

(i) Overview timeline of Standards relating to determination of loads and methods of determining loads, compiled by Standards New Zealand 2011

Section 4: Building Act tools for the upgrading of the structural performance of buildings

(i) Earthquake-Prone Building Provisions of the Building Act 2004 – Policy Guidance for Territorial Authorities, Department of Building and Housing

(ii) Assessment and Improvement of the Structural Performance of Buildings in Earthquakes: Recommendations of a NZSEE Study Group on Earthquake Risk Buildings, New Zealand Society for Earthquake Engineering June 2006

Section 5: Rapid assessment of buildings during a state of emergency

(i) Building Safety Evaluation During a State of Emergency – Guidelines for Territorial Authorities, New Zealand Society for Earthquake Engineering, August 2009

Section 6: The Department's investigation into the building collapses

(i) Terms of Reference for the Technical Investigation into the Performance of Buildings in the Christchurch CBD in the 22 February Christchurch Aftershock.