

A Risk-Based Building Classification & Inspection System

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Preliminary Note:

This is a conceptual instrument that is designed for consideration and discussion and is not meant for legislative promulgation until the legislature has brought to bear independent peer reviewing and approval of this conceptual instrument. The figures used in the table (to denote, for example, rise in storeys and floor space area) are examples only and are to an extent arbitrary; they would need to be reviewed by qualified technical experts (such as engineers, building certifiers or building officials).

A preminent fire engineer after having reviewed this instrument stated that definitions of risk are often based on statistical considerations and are often complemented by expert opinion. The preminent fire engineer added that in the case of the BCA, the definition of risk that leads to the building classification is one based on expert opinion. Expert input in building classifications is usually provided in regards to the quantification of the triggers that bind a classification. Expert opinion is particularly relevant in determining the measures that are to be implemented within the classification to manage risk (or consequences). Classification triggers and countermeasures must be very closely related to building methods and typologies in a given jurisdiction.

Throughout this piece, the writer refers to the building classification system under the Building Code of Australia as reference is made to this system in the World Bank publication titled “What Role Should Risk-Based Inspections Play in Construction – Doing Business”. The paper includes a part of the building classification system (table 5.2 in the piece) under the heading “Australia and France: Two Examples of Good Practice”.

Introduction

Risk-based building classifications offer a calibrated medium through which mandatory inspections may be targeted and the resources for same appropriately directed according to need. This conceptual instrument outlines what may be entailed in a good practice risk-correlated building industry mandatory inspection regime.

The Current Building Classes under the Building Code of Australia are largely descriptive, with less of a focus on risk. Naturally, some of the classes separate out extraordinary/unusual structures like hospitals, bushfire shelters, aged care buildings and some buildings over a certain floor space.

The BCA also categorises buildings according to their ‘type of construction’ which adds another aspect of risk correlation. However, the ‘type of construction’ categories differentiate only up to a rise in storeys of four – all builds higher than that are considered to be within the same type of construction.

This means that the likes of Skyscrapers are not accounted for. Neither is the new trend of ‘landscaper’ accounted for – which is very popular with large corporations for their commercial headquarters. Such innovations in building warrant consideration in building codification systems. Moreover, in light of recent climatic disasters, such as the bushfires in Australia, it is also important that public refuge centres requiring substantial consideration of safety risks are singled out as a building class.

Below is a revised table/matrix that attempts to grapple with this issue by incorporating some additional risk-based elements/considerations to the existing Building Classes under the Building Code of Australia.

The mandatory inspection matrix will by and large be located in the administrative regulations such as the Building Acts but nevertheless the regulations that govern the mandatory inspection processes must be calibrated with the building classification systems in the National or Regional Building Codes. The system will only work in an optimum fashion if the code classifications cross-jurisdictionally are calibrated with the mandatory inspection regimes that are promulgated in the enabling acts of parliament. This is particularly important for federal jurisdictions where there needs to be inter-governmental collaboration.

Mandatory Inspections

The mandatory inspection regime for low consequence buildings will be fairly simple. It will entail the building official reviewing plans, issuing the building permit and carrying out a thorough final inspection to ensure compliance with original plans and the building code, and thereafter issuing an occupancy permit.

When it comes to intermediate and high risk buildings, it is the domain of technical experts to advise parliamentary policy makers in determining which buildings require what amount of inspections and at which stages of the build. For instance, a laboratory, whilst a fairly high risk building will not necessarily require as many inspections as a multi-residential building or skyscraper. Such larger buildings would often be built in separate building stages, each with their own building permit, and each stage would ordinarily require its own inspections.

Some Examples of Existing BCA Classes that may not be Risk-Based in their Classification Criteria

The current BCA *Class 8* building category is very ambitious in that it covers a great many bases and its ambit is very broad in terms of the types of building uses contemplated. The phrase '*A laboratory or building*' again is very broad in its ambit in that a laboratory could be a medical laboratory, viral diseases laboratory, or a pharmaceutical laboratory which would ordinarily harbour greater potential for harm than a '*building used for packing*'.

By definition, if a risk-based appraisal is used for a laboratory, it would be high consequence. Conversely, a building, as contemplated by Class 8, '*that is used for packing*' may be better suited within the context of a Class 7b, as a packing facility would ordinarily be fairly benign in terms of the potential prejudice that might flow from such a facility, particularly where that packing facility did not house machinery that may be hazardous to occupants.

It is submitted if a risk-based approach was adopted, that the subcategories in the table titled "**Model Building Code Risk-Based Classifications for Buildings (Derived and Adapted from the existing Building Code of Australia Classifications)**" (or equivalent categories) could be afforded consideration.

Definitions of Low, Intermediate and High Consequence Builds

Low Consequence

Low Consequence buildings pose minimal or negligible risk of injury to life, limb or health, or of negative economic impacts when used for their codified intended purposes. Low consequence buildings will have characteristics, such as the following:-

- Minimal usage (i.e. not used for residential purposes or used to supply goods or services to members of the public, and ordinarily utilised by a very limited number of persons).
- A structure or building consisting of simple building works.
- Low demands on egress, utilities, essential services on account of low occupant density and minimal usage.
- Small building structures, with a small useable floor space area and a low height or rise in storeys.
- Meeting the prescriptive provisions of the Building Code.
- Not containing or storing hazardous items, fixtures, machinery or processes (such as toxic chemicals, biohazards, or gantries).
- Not situated within a high risk natural disaster zone, such as wet tropics or dry fire-prone regions.

Intermediate Consequence

Intermediate consequence buildings pose a potential higher level of risk than low consequence buildings to life, limb, or economic impacts when used for their codified intended purposes, in the event of building failure or defective works, but can be managed with a lower level of regulatory oversight and continuing maintenance than high risk buildings. Some characteristics of intermediate risk buildings are as follows:-

- Greater size, land footprint, floor space and/or height than low consequence buildings, but not as large as high consequence buildings.
- A building that ordinarily is occupied by an intermediate number of occupants.
- A building used for residential purposes or commercial purposes.
- May have alternative solutions to non-structural and non-fire retardant aspects of the building.
- Not containing or storing hazardous items, fixtures, machinery or processes (such as toxic chemicals, biohazards, or gantries).
- Not situated within a high risk natural disaster zone, such as wet tropics or dry fire-prone regions.
- Essential safety systems with intermediate complexity, with greater demands on egress, utilities, essential services on account of higher occupant density and greater building usage.

High Consequence

High risk buildings harbour the potential for significant prejudice to life, limb and economic impacts in circumstances where there is a compromised construction or essential safety maintenance outcomes. Some characteristics of high risk buildings are as follows:-

- A building with large proportions including large floor space, height, rise in storeys and occupied land mass (for example, a building with, say, over 3000m² of occupiable floor space or a rise in storeys of 10 or more).
- A building that poses design and construction challenges that are more characteristic of high consequence buildings in light of their height, size and higher concentration of occupants.
- A building that ordinarily is occupied by a high number of occupants (such as a residential building with, say, over 50 sole-occupancy units).
- A building containing or storing any hazardous items, fixtures, machinery or processes.
- A building that makes use of alternative solutions for fire retardant aspects of the building.
- A building situated within a high risk natural disaster zone, such as wet tropics or dry fire-prone regions.

- A building requiring essential safety systems that are complex or highly complex; requiring rapid egress and evacuation solutions, air conditioning and internal climatic control solutions, complex hydraulic engineering solutions and fire engineering solutions.

Associated definitions in regards to risk classifications

'Consequence' refers to the magnitude of prejudice to life, limb and economic impacts that is likely to flow from compromised construction outcomes.

Consequence-correlated building classification criteria are to be used as a regulatory mechanism and tool to determine the number and type of inspections and relevantly qualified inspectorial actors that will be legislatively mandated to ensure that the number and types of inspections calibrate with the consequence classification in order to reduce loss of life and compromised construction outcomes.

The consequence based mechanism is designed from the outset to be read and operate in conjunction with mandated inspection regimes. It follows that it's promulgation as a codified regulatory classification system would not occur until statutory administrative regulations are amended and promulgated simultaneously.

Building Code of Australia Current Classes of Building

(Under the **Building Code of Australia**, extracted from: <https://www.qbcc.qld.gov.au/building-codes-australia-bca-classes-buildings>)

Class 1	Class 1a	A single dwelling being a detached house, or one or more attached dwellings, each being a building, separated by a fire-resisting wall, including a row house, terrace house, town house or villa unit.
	Class 1b	A boarding house, guest house, hostel or similar building with a total area of all floors not exceeding 300m ² , and where not more than 12 reside, and is not located above or below another dwelling or another Class of building other than a private garage.
Class 2	A building containing 2 or more sole-occupancy units each being a separate dwelling.	
Class 3	A residential building, other than a Class 1 or 2 building, which is a common place of long term or transient living for a number of unrelated persons. Example: boarding-house, hostel, backpackers accommodation or residential part of a hotel, motel, school or detention centre.	
Class 4	A dwelling in a building that is Class 5, 6, 7, 8 or 9 if it is the only dwelling in the building.	
Class 5	An office building used for professional or commercial purposes, excluding buildings of Class 6, 7, 8 or 9.	
Class 6	A shop or other building for the sale of goods by retail or the supply of services direct to the public. Example: café, restaurant, kiosk, hairdressers, showroom or service station.	
Class 7	Class 7a	A building which is a car park.
	Class 7b	A building which is for storage or display of goods or produce for sale by wholesale.
Class 8	A laboratory, or a building in which a handicraft or process for the production, assembling, altering, repairing, packing, finishing or cleaning of goods or produce is carried on for trade, sale or gain.	
Class 9	A building of a public nature.	
	Class 9a	A health care building, including those parts of the building set aside as a laboratory.
	Class 9b	An assembly building, including a trade workshop, laboratory or similar building, in a primary or secondary school, but excluding any other parts of the building that are of another class.
	Class 9c	An aged care building.
Class 10	A non-habitable building or structure.	

	Class 10a	A private garage, carport, shed or similar building.
	Class 10b	A structure being a fence, mast, antenna, retaining or free standing wall, swimming pool or similar building.
	Class 10c	A private bushfire shelter.

The following adapted table takes its form from the above Building Code of Australia classification system, but attempts to incorporate a greater risk-based nuance.

Model Building Code Risk-Based Classifications for Buildings (Derived and Adapted from the existing Building Code of Australia Classifications)¹

KEY:

	Low Consequence
	Intermediate Consequence
	High Consequence

Class 1	<i>Houses and Permanent Single Dwellings</i>		
	Class 1	A single dwelling being a detached house, or one or more attached dwellings, each being a building, separated by a fire-resisting wall, including a row house, terrace house, town house or villa unit. ²	<u>Intermediate Consequence</u>
Class 2	A multi-residential building; A building containing 2 or more sole-occupancy units, each being a separate dwelling. ³		
	Class 2a	<i>A building containing multiple sole-occupancy units, each being a separate dwelling, and with a rise in storeys of 10 or more.</i>	<u>High Consequence</u>
	Class 2b	<i>A building containing 30 or more sole-occupancy units, each being a separate dwelling.</i>	<u>High Consequence</u>
	Class 2c	<i>A building containing 2 or more sole-occupancy units, but less than 30 sole-occupancy units, each being a separate dwelling, and with a rise in storeys of less than 10. (i.e. Multi-residential buildings other than Classes 2b and 2a)</i>	<u>Intermediate Consequence</u>
Class 3	A residential building, other than a Class 1 or 2 building, which is a common place of long-term or transient living for a number of unrelated persons. <i>Including:</i> boarding-house, guest-house,		

¹ Please note that this is a DRAFT risk-based *adaptation* of the existing building classes under the Building Code of Australia. New subcategories of building class have been added to reflect further risk considerations or to bolster clarity. **THESE SECTIONS ARE IN ITALICS and RED.** Please also see the associated risk-correlated inspection regime which is contained within a graphic below this table. The figures in this table require technical expert consultation and risk-analysis, particularly those pertaining to building height and floor space.

² Taken directly from the BCA.

³ Taken directly from the BCA.

	hostel, backpacker's accommodation or residential part of a hotel, motel, <i>or</i> school. or detention centre.⁴		
	Class 3a	<i>A residential building, other than a Class 1 or 2 building, which is a common place of transient living for a number of persons, with a rise in storeys of more than 10.</i>	<u>High Consequence</u>
	Class 3b	<i>A residential building, other than a Class 1 or 2 building, which is a common place of transient living for a number of persons, with a total floor space of more than 600m².</i>	<u>High Consequence</u>
	Class 3c	<i>A residential building, other than a Class 1 or 2 building, which is a common place of transient living for a number of persons, with a total floor space of not more than 600m², and with a rise in storeys of less than 10.⁵</i>	<u>Intermediate Consequence</u>
Class 4	<i>Permanent residence in a commercial or transient-residential building</i>		
Class 4	A dwelling in a building that is Class <i>3a, 3b, 3c, 5, 6, 7, 8, 9 or 15b</i> if it is the only <i>permanent</i> dwelling in the building. ⁶		<u>Either Intermediate or High Consequence, depending on the building it is contained within or a part of</u>
Class 5	An office building used for professional or commercial purposes, excluding buildings of Class 6, 7, 8 or 9.⁷		
	Class 5a	<i>An office building used for professional or commercial purposes, excluding buildings of Class 6, 7, 8 or 9, and with a rise in storeys of more than 10.</i>	<u>High Consequence</u>
	Class 5b	<i>An office building used for professional or commercial purposes, excluding buildings of Class 6, 7, 8 or 9, and with a total floor space of more than 1500m².</i>	<u>High Consequence</u>
	Class 5c	<i>An office building used for professional or commercial purposes, excluding buildings of Class 6, 7, 8 or 9, with a total floor space of</i>	<u>Intermediate Consequence</u>

⁴ Taken directly from the BCA, save for the deletion of 'detention centre' and the insertion of 'or'.

⁵ This category will absorb the existing class 1b.

⁶ Taken directly from the BCA. This category forms part of another kind of building – the risk category of the other building must determine the risk category of this building class. The floor for the consequence rating is 'medium' as a class 4 is a residential dwelling.

⁷ Taken directly from the BCA.

		<i>less than 1500m², and a rise in storeys of less than 10.</i>	
Class 6		A building for the sale of goods by retail or the supply of services direct to the public. Example: café, restaurant, kiosk, hairdressers, or showroom or service station. ⁸	
	Class 6a	A shop or other building for the sale of goods by retail or the supply of services direct to the public, <i>with a rise in storeys of 10 or more.</i>	<u>High Consequence</u>
	Class 6b	A shop or other building for the sale of goods by retail or the supply of services direct to the public, <i>with a total floor space of more than 1000m².</i>	<u>High Consequence</u>
	Class 6c	A shop or other building for the sale of goods by retail or the supply of services direct to the public, <i>with a total floor space of less than 1000m², and with a rise in storeys of less than 10.</i>	<u>Intermediate Consequence</u>
Class 7		A building which is <i>exclusively</i> a car park. ⁹	
	Class 7	A building which is <i>exclusively</i> a car park.	<u>Intermediate Consequence</u>
Class 8		A building which is <i>used for the storage, packing, sale, or display of goods or produce for sale by wholesale.</i> ¹⁰	
	Class 8a	A building which is for storage, <i>packing</i> , or display of goods or produce <i>except goods or produce that are hazardous due to combustibility, toxicity or their potential to cause harm or substantial economic loss. (Such as warehouses storing furniture, or garden sheds).</i>	<u>Low Consequence</u>
	Class 8b	A building which is for storage, <i>packing</i> , or display of goods or produce <i>where those goods or produce are hazardous due to combustibility, toxicity or their potential to cause harm or substantial economic loss. (Such as chemical waste storage warehouses)</i>	<u>High Consequence</u>
Class 9		A building in which a handicraft or process for the production, assembling, <i>manufacturing, testing</i>, altering, repairing, <i>packing</i>, finishing or cleaning of goods or produce is carried on for trade, innovation, or research. ¹¹	
	Class 9a	<i>A building used for the production, assembling, manufacturing, altering, repairing, finishing, or cleaning of goods or produce, where such a building may contain hazardous materials or chemicals,</i>	<u>High Consequence</u>

⁸ Taken directly from the BCA, save for the deletion of 'service station' and insertion of 'and with a rise in storeys of three or less'.

⁹ Taken directly from the BCA.

¹⁰ Taken directly from the BCA, with the section in *red* which has been added.

¹¹ Taken directly from the BCA, with the section in *red* which has been added.

		<i>particularly if those materials or chemicals are combustible.</i>	
	Class 9b	<i>A building used for the production, assembling, manufacturing, altering, repairing, finishing, or cleaning of goods or produce, where such a building will contain fixed machinery that may pose a hazard to occupants.</i>	High Consequence
	Class 9c	<i>A fuel service station or petroleum facility.</i>	High Consequence
	Class 9d	<i>A laboratory containing dangerous goods, produce, devices, materials, specimens, liquids, gases, samples or items (such as a medical, pharmaceutical, pathological, chemical, or biological research laboratory).</i>	High Consequence
Class 10	A building of a public nature.¹²		
	Class 10a	A health care building, <i>such as a hospital or quarantine facility</i> , including those parts of the building set aside as a laboratory ¹³	High Consequence
	Class 10b	An assembly building, including a trade workshop, laboratory or similar building, in a primary or secondary school, but excluding any other parts of the building that are of another class. ¹⁴	High Consequence
	Class 10c	An aged care building. ¹⁵	High Consequence
	Class 10d	<i>A penitentiary or detention centre.</i>	High Consequence
	Class 10e	<i>A public refuge building, such as a public fire, cyclone, flood or disaster shelter/refuge.</i>	High Consequence
	Class 10f	<i>A place of general public assembly, such as a stadium, concert hall, theatre, town hall, church or sports facility.</i>	High Consequence
Class 11	A <i>secondary</i> building or structure on a domestic/residential property.¹⁶		
	Class 11a	A private garage, carport, shed or similar structure. ¹⁷	Low consequence

¹² Taken directly from the BCA.

¹³ Taken directly from the BCA.

¹⁴ Taken directly from the BCA.

¹⁵ Taken directly from the BCA.

¹⁶ Taken directly from the BCA.

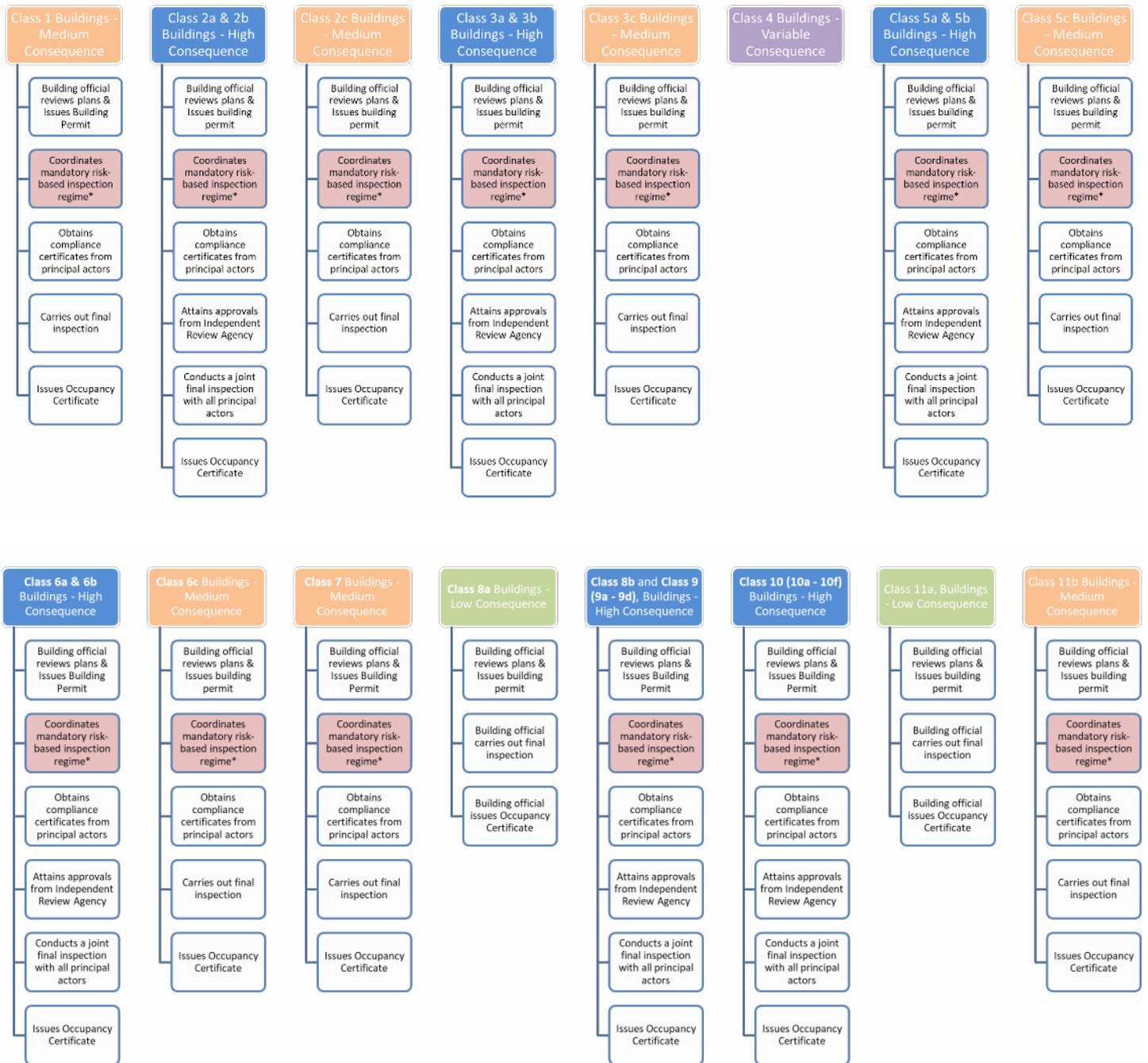
¹⁷ Taken directly from the BCA.

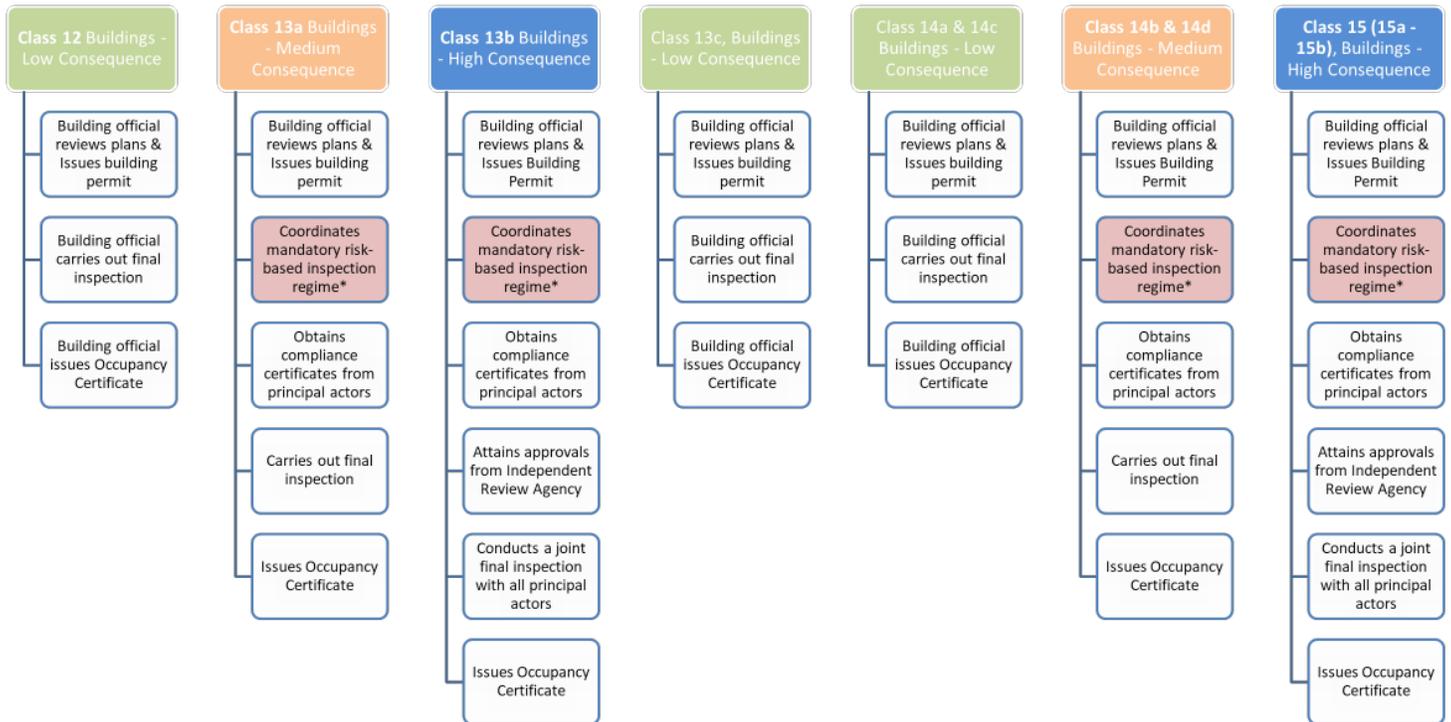
	<i>Class 11b</i>	A private bushfire shelter. ¹⁸	<u>Intermediate consequence</u>
Class 12	Antennas or satellite dishes, masts, signs, fences (save for pool fences)		
	<i>Class 12</i>	<i>Antennas (less than 5m) or satellite dishes (less than 5m), masts, signs, fences (save for pool fences)</i>	<u>Low Consequence</u>
Class 13	A swimming pool and associated structures		
	<i>Class 13a</i>	<i>A domestic swimming pool, its associated features, its water purification/cleaning systems, and the building, fence or structure containing it.</i>	<u>Intermediate Consequence</u>
	<i>Class 13b</i>	<i>A commercial swimming pool/facility, its associated features, its water purification/cleaning systems, and the building, fence or structure containing it.</i>	<u>High Consequence</u>
	<i>Class 13c</i>	<i>A standalone fixed-in-place Jacuzzi, spa-pool or water feature/pond, and the building, fence or structure containing it.</i>	<u>Low Consequence</u>
Class 14	Free Standing Walls and Retaining Walls		
	<i>Class 14a</i>	<i>A free standing wall with a surface area of less than 200m².</i>	<u>Low Consequence</u>
	<i>Class 14b</i>	<i>A free standing wall with a surface area of 200m² or more.</i>	<u>Intermediate Consequence</u>
	<i>Class 14c</i>	<i>A retaining wall with a surface area of less than 100m².</i>	<u>Low Consequence</u>
	<i>Class 14d</i>	<i>A retaining wall with a surface area of 100m² or more.</i>	<u>Intermediate Consequence</u>
Class 15	Super High Rises (or 'Skyscrapers')		
	<i>Class 15a</i>	<i>A residential building with a rise in storeys of 50 or greater, or with a height of 150m or greater.¹⁹</i>	<u>High Consequence</u>
	<i>Class 15b</i>	<i>A commercial or office building with a rise in storeys of 50 or greater, or with a height of 150m or greater.</i>	<u>High Consequence</u>

¹⁸ Taken directly from the BCA.

¹⁹ Due to the substantial innovation associated with skyscrapers, this has been singled out as a separate category. The category does not discriminate between commercial or domestic buildings. Some skyscrapers in the world are now effectively vertical suburbs, and it follows that in such circumstances, building inspection and regulation requires substantial innovation.

Figure 1: Risk-correlated Building Approval, Inspection & Certification Regime





***Note re: Mandatory Inspection Regimes outlined in the above flowcharts**

The mandatory inspection regime for low consequence buildings will be fairly simple. It will entail the building official reviewing plans, issuing the building permit and carrying out a thorough final inspection to ensure compliance with original plans and the building code, and thereafter issuing an occupancy permit.

However, when it comes to legislative promulgation of mandatory inspections for intermediate and high risk buildings, it must be the domain of technical experts to determine which building classifications will require what amount of legislatively mandated inspections and at what stage of construction. For instance, a laboratory, whilst a fairly high risk building may not require precisely as many inspections as a multi-residential building or skyscraper. Such larger buildings would often be built in separate building stages, each with their own building permit, and each stage would ordinarily require its own inspections.