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Property Protection Factor

AUSTRALASIAN FIRE AUTHORITIES COUNCIL

An Interactive Qualifying Project Report

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by

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1 Abstract

The objective of this project was to form recommendations on whether or not to explicitly include property protection into the Building Code of Australia (BCA). Numerous discussions were held with key professionals in Australia's fire industry, along with examination of statistics and relevant case studies to provide the recommendations. The project team came to the conclusion that there is currently not enough data to support an objective change to the BCA, and more research must be conducted.

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3 Authorship

For this report, all team members, Bryan Douglass, Mark Verrochi, Eric Montplaisir, and Jason Gamache, have agreed all work was divided evenly.

Bryan Douglass was responsible for the majority of the relevant case studies. He gathered most of his information from Rob Llewellyn, other key stakeholders, and the internet. Bryan was also responsible for finding and researching the current acts and regulations for Western Australia, and the Northern Territory.

Mark Verrochi was responsible for the majority of editing and putting the paper together as a whole, along with gathering the conclusion. Mark was also responsible for finding and researching the current acts and regulations for New South Wales, Australian Capital Territory, and South Australia.

Eric Montplaisir was responsible for the majority of the writings on the advantages/disadvantages of including explicit property protection into the BCA. Eric was also responsible for finding and researching the current acts and regulations for Queensland.

Jason Gamache was responsible for the majority of the writing on statistics and the definition of property protection. Jason was also responsible for finding and researching the currents acts and regulations for Tasmania, and Victoria.

All sections not noted in the above paragraphs were worked on together as a group. Whenever individual work was done, the other three group members read and edited the work, so that all members had input into every section.

4 Executive Summary

In 1996 the Australian Building Codes Board introduced the Performance Based Building Code which is still being used today. There have been several arguments as to whether or not the Building Code of Australia (BCA) should include explicit property protection. Currently there are no explicit property protection objectives in the BCA. In November 2004, the Productivity Commission submitted a report titled the "Reform of Building Regulation." One of the report's recommendations was the question whether or not property protection should be an explicit objective of the BCA.

As a follow-up, the Australasian Fire Authorities Council (AFAC) proposed a project to examine the current fire legislations in Australia. Also on the agenda was to study the Productivity Commission Report to investigate the issue of including explicit property protection[1] in the BCA.

The main goal of this project was to develop a clear recommendation for including or not including explicit property protection objectives in the BCA. The methodology involved the following steps:

- Achieve background information on Australian fire legislation by obtaining the current legislative bases for all states/territories
- Contact key stakeholders and evaluate their views on the issue
- Gather and review case studies and statistics
- Form final recommendation regarding the issue of property protection

Australia's states/territories legislation as well at the Productivity Commission Research Report were reviewed at Worcester Polytechnic Institute (WPI). Studies on acts and regulations from the United States were also conducted to get a basic knowledge of

[1] For this project, the term property protection refers to a complete automatic sprinkler system.

fire codes, building codes, and standards. Local fire brigades and the National Fire Protection Association (NFPA) were contacted for information on legislations.

When the project team arrived in Melbourne, Australia, the research on the state/territory legislation done at WPI was verified. To confirm whether those acts and regulations were correct, representatives from all states and territories were contacted. After confirmation, a table was formed and given to AFAC which included references to all of the latest pieces of fire legislation.

Before contacting key stakeholders, the BCA and the Productivity Commission Research Report were looked at. A submission list to the Productivity Commission Report was also obtained and examined. From the submission list, key stakeholders were chosen. The stakeholders were contacted, and interviewed via phone or in person. They were asked several questions regarding property protection and several of their comments are listed throughout the report.

Once the key stakeholders were interviewed, several case studies were examined. Many of the case studies used were introduced to the project team by the stakeholders. The case studies and statistics were important to put an approximate value on property protection, making it easier to form a recommendation. The case studies examined in this report involved school fires, hostel fires, and the Windsor building fire. All summaries of the case studies displayed numbers for approximate direct and indirect costs.

There were papers about the case studies obtained that showed views from both sides of the issue. Along with case studies, the project team obtained specific statistics. The statistics involved the cost of fires (sprinklered and non-sprinklered), and number of deaths/injuries in sprinklered and non-sprinklered properties. The project team asked

stakeholders and statisticians to gather the statistics. Only a few stakeholders/statisticians were able to obtain the statistics asked for. The statistics were examined and summarized. They showed surprising numbers that were clearly skewed and inappropriate. The statistics showed that the average cost of fire, and death rate were higher in sprinklered buildings. The reasons for the skewed analysis were identified. As a result one of the project's recommendations is to form a more detailed national database.

. With the stakeholders' views on the current BCA objectives, the case studies evaluated, and the statistics obtained, the project team came to the conclusion that more research into the issue is needed. There was not enough evidence to clearly say that explicit property protection should or should not be explicitly included in the BCA. Instead the information showed the need for more research, and a more detailed national and local database, including more involvement with fire brigades.

5 Nomenclature

This is a list of the abbreviations used in this report:

ABCB-Australian Building Codes Board
ACEA- Association of Consulting Engineers Australia
ACT-Australian Capital Territory
AFAC- Australasian Fire Authorities Council
AIB- Australian Institute of Building
AIRS- Australasian Incident Reporting System
AMCA- Air Conditioning and Mechanical Contractors Association
AMUBC-Australian Model Uniform Building Code
AUBRCC-Australian Uniform Building Regulations Coordinating Council
BCA- Building Code of Australia
CFA- Country Fire Authority
CFC-Certificate of Classification
DTS- Deemed to satisfy
EA- Engineers Australia
FESA- Fire and Emergency Services Authority of Western Australia
FPAA- Fire Protection Association of Australia
HIA- Housing Industry Association
ICA- Insurance Council of Australia
IDAS-Integrated Development Assessment System
ISCUBR-Interstate Standing Committee on Uniform Building Regulations
MFB- Metropolitan Fire Brigade
NFIA- National Fire Industry Association
NFPA- National Fire Protection Association
NSW-New South Wales
NT-Northern Territory
SA-South Australia
TFS-Tasmania Fire Service
WA-Western Australia
WPI- Worcester Polytechnic Institute
WSAA- Water Services Association of Australia

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1 Introduction

This project was set up by Worcester Polytechnic Institute (WPI) and sponsored by the Australasian Fire Authorities Council (AFAC) to research the controversy between state fire legislations and the Building Code of Australia (BCA) concerning property protection. The main legislation controversy is the difference between the objectives of the BCA versus those of fire legislations in each state/territory of Australia. Property protection is not currently an explicit objective of the BCA however it is a current objective of state/territory fire legislations. Another controversy is that stakeholders claim that the vague nature of some terms in the BCA allows for many different interpretations which do not support national consistency. Definitions of certain terms included in the BCA objectives need to be set. Depending on which way these terms are defined, property protection in the BCA may or may not be necessary. Some groups claim that the BCA does not meet community expectations or take into account other concerns of the community such as the environment. Other groups claim that the cost of including property protection aspects into the BCA would far exceed the monetary benefit and the methods that would be employed to protect property are not 100 percent guaranteed.

Basically, there are two opposing sides to this argument, those who want property protection to be made an explicit objective of the BCA and those who want the BCA to stay how it is and keep property protection as an implicit objective.

There are issues that surround both of these cases and this report will outline those issues. This report will research both sides of the argument and present the facts that support explicit property protection objectives in the BCA and those that do not support them. It will state the consequences and repercussions of both.

2 Literature Review

2.1 History of the Building Code

The development of the Building Code of Australia began shortly after the completion of World War II. The Interstate Standing Committee on Uniform Building Regulations (ISCUBR) was formed to potentially create uniform building regulations across Australia. The ISCUBR created the Australian Model Uniform Building Code (AMUBC) which was released in the early 1970's. The AMUBC was intended to be used as a model for the states and territories as a base for their building regulations. The Model was not used by many states/territories because it was insufficient in areas, so several variations were needed, and in 1980 the Australian Uniform Building Regulations Coordinating Council (AUBRCC) was created. In 1990, the AUBRCC created the Building Code of Australia (BCA) and it successfully became a useable building guideline across the nation. One reason the BCA was successful was because it allowed for variations amongst the states and territories (Australian Building Codes Board History)[2].

In 1989 the Council of Australian Governments established a Building Regulatory Review Task Force to examine the system and identify its problems. After the review in 1991, the Task Force found problems that were costing the industry hundreds of millions to one billion dollars a year, and in 1994 the Government created the Australian Building Codes Board (ABCB). The ABCB intended to fix the problems from the first BCA and in 1996 introduced the performance-based BCA. In 2003 a decision was made to create an annual amendment cycle to the BCA (Australian Building Codes Board History).

[2] Refer to reference list for citation information

2.2 Current Building Code of Australia

Today, the Building Code of Australia is used as an outline document ("model code" in the US sense) for the six states and two territories in Australia. This is a set of performance-based guidelines for the design and construction of new buildings. The BCA is only a law when there is legislation written by states and/or territories that enable it.

2.3 Productivity Commission Research Report

In November 2004, the Australian Government's Productivity Commission published a report titled Reform of Building Regulations to record the input that reform of building regulation has made to the productivity of the building industry and economic efficiency. The report was completed by the Productivity Commission because of a request made by the Parliamentary Secretary to the Treasurer, on behalf of the Australian Government. To gain a national view on the building industry issues, the Productivity Commission consulted with various organizations ranging from the Australian National Government to State and Territory agencies (Productivity Commission, III).

Included in the report are Finding 6.4 and Recommendation 6.9, which are the focus of this project. The findings state how the BCA varies from state fire authority legislation. The recommendation asks the question, "should the BCA contain property protection requirements with respect to fire?"

Finding 6.4 states "the degree of property protection from fire in the objectives of the BCA is different to that generally required by fire authorities' legislation (and some insurance companies) in relation to building performance, particularly for commercial buildings (Productivity Commission, XLV)."

Recommendation 6.9 states that "the ABCB should work, in consultation with interested parties (including fire authorities), towards determining whether the BCA should contain property protection requirements with respect to fire and, if so, resolving differences in the level of protection provided across jurisdictions. This should be done using rigorous impact analysis (Productivity Commission, XLV)."

2.4 State Acts and Regulations

Australia is made up of six states (New South Wales, Queensland, South Australia, Tasmania, Victoria, and Western Australia) and two territories (Australian Capital Territory and Northern Territory). Each of the states and territories has their own government which creates acts and regulations that enable the BCA. Other acts and regulations dealing with fire legislation include items such as property protection, environmental safety, and fire fighter safety. The following is a brief summary of each act and regulation that is related to the BCA and the fire legislations dealing with property protection, environmental protection, and fire fighter safety. See table in appendix for consolidated list.

2.4.1 New South Wales

In New South Wales, the relevant acts are the Environmental Planning and Assessment Act of 1979, the Fire Brigades Act of 1989, and the Rural Fires Act of 1997. Under each of these acts there is the Environmental Planning and Assessment Regulation 2000, the Fire Brigades Regulation 2000/2003, and the Rural Fires Regulation 2002 respectively. These acts and regulations are the specific legislation that calls up the BCA and deal with fire brigades.

2.4.1.1 Environmental Planning and Assessment Act of 1979

The Environmental Planning and Assessment Act of 1979 addresses the powers of fire brigades and fire safety inspections. The acts state how authorized fire officers can inspect buildings for fire safety. Fire officers may give orders to the owner of the building if it fails inspection. The orders that can be given range from simply repairing a building, to evacuating a building, or even demolishing a building if it completely fails inspection (NSW Environmental Planning and Assessment Act).

The Environmental Planning and Assessment Act also addresses other issues concerning the environment and the conservation of resources. The threatened and endangered species are two issues currently addressed in the act. It also addresses the issues of brush fires and fire safety inspections. It states the condition and maintenance of affordable housing as well (NSW Environmental Planning and Assessment Act).

2.4.1.1.1 Environmental Planning and Assessment Regulation 2000

The Environmental Planning and Assessment Regulation 2000 is the legislation under the Environmental Planning and Assessment Act of 1979. This regulation enables the BCA. It also addresses environmental impacts and development applications (NSW Environmental Planning and Assessment Regulation).

2.4.1.2 Fire Brigades Act of 1989

The Fire Brigades Act of 1989 lists the duties and the authorities of fire brigades. It states that the duty of the fire brigade is to take all practical measures for preventing and extinguishing fires. It also states that their duty is to protect and save life and property in the case of fire. It also states that the commissioner of New South Wales may

establish fire departments when necessary, with approval from the minister (NSW Fire Brigade Act).

The Fire Brigades Act of 1989 also deals with going to fires and hazardous material incidents. The act states that the fire brigade must proceed with all speed to the fire or incident to stop it and save any lives and property that may be in danger. This also gives fire officials the power to close off hazardous public roads or places during an emergency. Another section of the act includes the laws for establishing fire departments in New South Wales. This section talks about how the commissioner can staff the fire department and that all staff is his responsibility and must be disciplined and in good conduct at all times (NSW Fire Brigade Act).

2.4.1.2.1 Fire Brigade Regulations

The Fire Brigade (charges) Regulation 2000 and the Fire Brigade (general) Regulation 2003 deal with fire fighters. The former regulation talks about what are the charges for fire brigades to attend a fire. The latter regulation talks about all of the duties, responsibilities, and function of fire fighters and fire brigades (NSW Fire Brigade Regulation 2000; NSW Fire Brigade Regulation 2003).

2.4.1.3 Rural Fire Act of 1997

The last act in New South Wales that deals with fire legislation is the Rural Fire Act of 1997. The act talks about fire fighter responsibility to protect life, property and the environment. It talks about the prevention and suppression of brush fires and other local fires. This act also talks about the functions of the rural fire services in New South Wales (NSW Rural Fires Act).

2.4.1.3.1 Rural Fire Regulation 2002

The regulation that supports this act is the Rural Fire Regulation 2002. The act talks about issues related to fire prevention. It also deals with the issuing of notices for brush fire incidents and bush fire management. The act also talks about constitutions of fire brigades (NSW Rural Fire Regulation).

2.4.2 Queensland

The main legislations governing Queensland are The Building Act of 1975, The Fire and Rescue Service Act of 1990, and The Integrated Planning Act of 1997. In Queensland before 1975, if someone were to build a building, very few restrictions applied. When buildings were built, the only thing that builders had for standards was various local government rules. In order to get a Certificate of Classification (CFC) the builder had no fire requirements. Instead, the local fire authorities could make a recommendation as to the best way to make the building safe from fire. If the builder did not want to take this advice there was no penalty.

In 1974 there was a night club fire that killed sixteen people. The fire initiated the creation of The Fire Safety Act of 1974 and The Building Act of 1975. From 1975 until 1992 builders had to refer to the above acts and only the local government could verify that those acts were met. The only person that could issue a CFC was a government official until 1997 when the Integrated Planning Act 1997 said that a private certifier could issue a CFC. The Integrated Planning Act 1997, also adopted the performance based BCA. As illustrated in Appendix 1, the various major acts have several regulations listed under them. All of the regulations reference the major acts which in turn reference the BCA. The following is a list of fire legislation in Queensland.

2.4.2.1 Fire and Rescue Service Act of 1990

The Fire and Rescue Service Act of 1990 defines various legalities and start up information for fire services. It defines the two parts of membership of a fire service as being a commissioner and a fire service officer. The commissioner is responsible for the way the service performs its functions. The act uses the example that the chief executive is entitled to establish performance measures for fire services. The commissioner also has the power to issue, amend, or revoke a code of practice. The chief executive has the power to employ a necessary work force. The act states various powers granted to authorize fire officers. The statement of these powers can be defined basically as the fire officer can take any reasonable measure to protect people, property, and the environment from fire (Queensland Fire and Rescue Service Act).

2.4.2.1.1 Fire Regulations

The Building Fire and Safety Regulation of 1991 is a regulation that lists requirements of what occupiers of buildings do in the event of a fire and how to maintain it safely to keep evacuation ways clear (Queensland Building Fire and Safety Regulation).

The Fire and Rescue Service Regulation of 2001 goes through the specific funding of fire brigades and where specifically the money will come from as well as the salaries of persons in the fire brigades (Queensland Fire and Rescue Service Regulation).

2.4.2.2 Integrated Planning Act of 1997

“The Integrated Planning Act of 1997 is an act for a framework to integrate planning and development assessment so that development and its effects are managed in

a way that is ecologically sustainable, and for related purposes." The act was the first in Queensland after the performance-based BCA was introduced. Before the performance-based BCA, the only way to build a building was to use the "deemed to satisfy" method. This method had specific codes and standards that a developer had to follow to meet specific performance criteria or else the building would not be approved for completion. This act enabled developers to have more flexibility in the way they built and also helped them to find their own innovative ways to save money. Now, under the performance-based building code, a developer can either chose to use the "deemed to satisfy" method which meets the performance requirements of the BCA, or use an alternate route as long as he can prove it meets the performance requirements of the BCA. The new BCA makes it much easier to save money on buildings and allows buildings to be more unique (Queensland Integrated Planning Act).

2.4.2.2.1 Integrated Planning Regulation of 1998

The Integrated Planning Regulation of 1998 is basically an extension of the Integrated Planning Act of 1997. There are various add-ons and updates from the previous year listed in this regulation (Queensland Integrated Planning Regulation).

2.4.2.2.2 Planning and Environment Court Rules of 1999

The Planning and Environment Court Rules of 1999 tell the basic procedures for court hearings and provide rules when prosecuting persons for not following fire and building codes and standards (Queensland Planning and Environmental Court Rules).

2.4.2.2.3 Integrated Development Assessment System

The Integrated Development Assessment System (IDAS) falls under the Integrated Planning Act 1997 and calls up the Building Act 1975 which eventually goes on to enable the BCA.

2.4.2.3 Building Act of 1975

"The Building Act of 1975 is an act to authorize the making of standard laws about the erection of buildings and other structures, to provide for building certifying, and for other purposes." The Building Act of 1975 is a result of the nightclub fire which occurred in 1974 killing sixteen people. This act enables the BCA in Queensland (Queensland Building Act).

2.4.2.3.1 Building Fire Safety Regulation of 1991

The Building Fire Safety Regulation of 1991 is a regulation that lists requirements of what occupiers of buildings do in the event of a fire and how to maintain it safely to keep evacuation ways clear (Queensland Building Fire and Safety Regulation).

2.4.2.3.2 Standard Building Regulation of 1993

The Standard Building Regulation of 1993 adds onto the BCA and specifies how to build structures that will meet codes and requirement. This regulation goes into considerable depth on what exactly to do to meet the performance requirements. Again, this act calls up the BCA; therefore, it has no property protection requirements other than those of the surroundings (Queensland Standard Building Regulation).

2.4.2.3.3 Building Regulation of 2003

The Building Regulation of 2003 discusses fines and fees for non compliance with building inspections (Queensland Building Regulation).

2.4.3 South Australia

In South Australia, there are three acts which refer to fire services and enabling legislation of the BCA. The legislations are the Development Act of 1993, the South Australian Metropolitan Fire Service Act of 1936, and the Country Fire Act of 1989. Under the Development Act of 1993 is the Development Regulation of 1993. The acts and regulation are key legislation in the fire services of South Australia.

2.4.3.1 Development Act of 1993

The Development Act of 1993 deals with the fire safety of buildings. The act states that an authorized person may enter any building at a reasonable time and determine whether or not the building is unsafe. If the fire safety of the building is not adequate, the owner of the building receives a notice that tells them what needs to be done to fix the problem. Any building owner that fails to comply with the fire safety official's order is subject to a penalty or fine from the appropriate authorities. Another item that this act addresses is the regulation of building work (SA Development Act).

2.4.3.1.1 Development Regulation of 1993

The Development Regulation of 1993 is the legislation that supports the Development Act of 1993. This regulation is the legislation that enables the BCA. The regulation also talks about the application, referral and consultation for development plans (SA Development Regulation).

2.4.3.2 South Australian Metropolitan Fire Service Act of 1936

The South Australian Metropolitan Fire Service Act of 1936 deals with the fire service in South Australia. Under this act was the establishment of the corporation or South Australian Metropolitan Fire Service. The corporation is in charge of providing efficient service in fighting fires and dealing with other emergencies. The act allows for the establishment of fire stations and fire brigades (SA Metropolitan Fire Service Act).

The act also talks about the creation of salvage corps and part four discusses the aspects of volunteer fire departments. These acts enable volunteer fire departments to be created. These salvage corps and volunteer fire departments have the ability to assist the fire brigades (SA Metropolitan Fire Service Act).

Another section in the South Australian Metropolitan Fire Service Act of 1936 deals with officers and their responsibilities. This part deals with the different officers and employees of the corporation. The officers include the Chief, Deputy Chief, and other officers appointed by the corporation. The governor must approve of the Chief and the Deputy Chief. The jobs of the Chief include the control and discipline of fire brigades and implementation of the policies of the corporation (SA Metropolitan Fire Service Act).

2.4.3.3 Country Fire Act 1989

The last act in South Australia that will be discussed is the Country Fire Act of 1989. The Country Fire Act of 1989 addresses the issues of protecting life, property, and the environment from fire. It also proscribes the role of country fire services and the fire

authorities. The last items that the act deals with are fire danger seasons and duties to prevent fire (SA Country Fire Act).

2.4.4 Tasmania

Fire legislations from Tasmania consist of Acts and Regulations. The fire legislations from Tasmania which are most pertinent to the project include: the Fire Service Act 1979 with Fire Regulations 2000; the Building Act 2000 with Building Regulations 2004; and the Work Place Health and Safety Act 1995 with Regulations 1998. The previous legislations will be summarized in the following sections and the legislation which enables the BCA will also be noted.

2.4.4.1 Fire Service Act of 1979

One of the main legislative bases in Tasmania is the Fire Service Act of 1979. According to the Australasian Legal Information Institute:

> The Fire Service Act of 1979 is an Act to amalgamate fire services in the State, to consolidate and amend the law relating to preventing and extinguishing fires and the protection of life and property from fire, to make provision with respect to incidental matters, and to amend and repeal certain enactments.

With the Fire Service Act 1979 also came the Tasmania Fire Service (TFS). The Tasmania Fire Service (TFS) is established under section six of the Fire Service Act of 1979. The TFS is under the control of the State Fire Commission which is established under section seven of the Fire Service Act of 1979. There is now a TFS website (http://www.fire.tas.gov.au) as well. Thus residents can now assess fire risks through the website at will (Tasmania Fire Service Act).

The Fire Service Act of 1979 is the legislation which essentially makes it possible to create several fire services and offices in order to deal with all of Tasmania's fire

problems. The Fire Service Act of 1979 is the legislation which tells fire fighters to go into a burning building and protect life, property, and environment from fire

2.4.4.1.1 Fire Regulations 2000

The Fire Regulations 2000 fall under the Fire Service Act of 1979. The Fire Regulations 2000 list all of the regulations which occur under the Fire Service Act 1979 (Tasmania General Fire Regulations).

2.4.4.2 Building Act of 2000

Another important act in Tasmania is the Building Act of 2000. According to the Tasmanian legislation, "Building Act 2000 is an Act to regulate the construction and maintenance of buildings and building and plumbing matters and to provide for permits, enforcement matters and resolution of disputes." The Building Act 2000 is also the prevailing act in Tasmania. As stated in the act under part one, section five:

> This Act prevails over the provisions of any other Act or any regulation, rule, by-law, guidelines, planning instrument, standard, condition, determination or directive made under any other Act relating to the design of any building, building work or plumbing work (Department of the Premier and Cabinet, TAS).

One of the most pertinent parts of the act is division two which is the Building Regulation Advisory Committee. The Advisory Committee consists of the Director, who is the chairperson; and at least nine other members appointed by the Minister from nominations made under subsection three, who between them have knowledge and expertise in all of the following areas: "building surveying, architecture, engineering, building plumbing, local government, firefighting and fire safety, the interests of the community, environmental and public health." Thus the Act covers fire fighter safety, environmental, and public health (Department of the Premier and Cabinet, TAS).

The Building Act 2000 states that Building work and the use and maintenance of buildings are to comply with the Building Code of Australia and this Act. Thus this is the enabling legislation.

Division two is the Protection of adjoining properties. The act protects adjoining property for property protection as shown in Division two section 121, “An owner who is required by the Building Regulations to carry out protection work must notify the adjoining owner and the building surveyor of the proposed building work and the proposed protection work (Department of the Premier and Cabinet, TAS).”

2.4.4.2.1 Building Regulation of 2004

Along with the Building Act of 2000 also comes the Building Regulation of 2004. The Building Regulation of 2004 states the revised regulations which occur under the Building Act of 2000 (Tasmania Building Regulation).

2.4.4.3 Workplace Health and Safety Act of 1995

. The Workplace Health and Safety Act of 1995 is an “Act to provide for the health and safety of persons employed in, engaged in or affected by industry, to provide for the safety of persons using amusement structures and temporary public stands and to repeal certain enactments.” When dealing with the prevention of accidents and risks to health the Workplace Health and Safety Act of 1995 states,

> The responsible officer may monitor the health of persons employed or engaged at the workplace, monitor at a workplace under the employer's control or management conditions likely to affect the health and safety of any person, prepare and implement a safety management plan that conforms with relevant standards of any prescribed authority, and prepare a written health and safety policy.

The Workplace Health and Safety Act 1995 does not have a lot of legislation dealing with life safety from fire. However the legislation mentioned above does show that there is appointed persons dealing with evacuations (Department of the Premier and Cabinet, TAS).

2.4.4.3.1 Workplace Health and Safety Regulation of 1998

Along with the Workplace Health and Safety Act of 1995 is the Workplace Health and Safety Regulation of 1998. The Regulations 1998 states the revised regulations which occur under the act (Tasmania Workplace Health and Safety Regulation).

2.4.5 Victoria

The fire legislations from Victoria which are most pertinent to the project parameters include: the Building Act of 1993 with Building Regulation of 1994; the Country Fire Authorities Act of 1958; and the Metropolitan Fire Brigade Act of 1958. The previous legislations will be summarized in the following sections and the legislation which enables the BCA will also be noted.

2.4.5.1 Building Act of 1993

The main purpose of the Building Act of 1993 is to provide for the regulation of building and building standards. The Building Act 1993 is also the enabling legislation of the BCA. The objectives of the Act are to:

> Establish, maintain and improve standards for the construction and maintenance of buildings; to facilitate the adoption and efficient application of national uniform building standards; and to facilitate the accreditation of building products, construction methods, building designs, building components and building systems (Victoria Building Act).

Essentially the main objective of the Act is specific to enhancing convenience and protecting the safety and health of the people who use buildings and places of public entertainment (Victoria Building Act).

Section 28 applies to new building work that is carried out at these buildings however the primary emphasis of this section is to retain the historical significance of the building. The secondary emphasis of this section relates to structural adequacy and the reasonable provision for the amenity of the building and the safety and health of people using the building (Victoria Building Act).

When it comes to property protection, part seven of the act comes into play. This is not a fire specific section but relates to the issue of protecting the adjoining property during construction. Part eight of the act pertains to the enforcement of safety and building standards. Part eight also incorporates section 102 to 126. Sections 102 to 126 are used by Municipal Building Surveyors when inspecting existing buildings for matters relating to fire safety, amenity, structural adequacy, protection of the adjoining property, etc. Finally Section 160 and 160A is a request to the fire authorities by the Building Appeals Board to provide an opinion relating to the application of a particular regulation or fire related performance requirement. In providing this opinion, the fire authorities are bound by the Metropolitan Fire Brigade (MFB) Act of 1958 and Country Fire Authority (CFA) Act of 1958 to protect life and property and through delegation, the environment (Victoria Building Act).

2.4.5.1.1 Building Regulation of 1994

The Building Regulation of 1994 is found under the Building Act of 1993. The objectives are as follows:

> To prescribe standards for the construction and demolition of buildings; prescribe standards of safety for places of public entertainment; prescribe matters relating to the use and maintenance of buildings and places of public entertainment; prescribe matters relating to the accreditation of building products, construction methods, designs, components and systems; prescribe qualifications and other matters relating to registration of building practitioners; consolidate the provisions of statutory rules which control the design, construction and use of buildings and places of public entertainment; and prescribe fees in respect of matters before the Building Appeals Board, Building Practitioners Board and Building Regulations Advisory Committee (Victoria Building Regulation).

The first three objectives stated are relevant links to life and property safety though they are significantly broad statements (Victoria Building Regulation).

2.4.5.2 Metropolitan Fire Brigade Act of 1958

The MFB Act of 1958 is an act to, “Consolidate the Law relating to the Protection of Life and Property from Fire in the Metropolitan Fire District.” The main objectives of the Metropolitan Fire Brigade Act of 1958 are to provide for fire safety, fire suppression and fire prevention services and emergency response services in the metropolitan fire district; and to establish a Metropolitan Fire and Emergency Services Board (Parliament of Victoria).

The act has implemented a Metropolitan Fire and Emergency Services Board. The functions of the board include: “providing fire suppression and fire prevention services in the metropolitan fire district, providing for emergency prevention and response services in the metropolitan fire district, carrying out any other functions conferred on the Board by or under this Act or any other Act (Parliament of Victoria).”

2.4.5.3 Country Fire Authority Act of 1958

The Country Fire Authority (CFA) Act of 1958 is an act “to control the prevention and suppression of fires in the country area” as stated in Part II section 14. The main parts of the legislation which pertain to the given parameters include: Part I- Constitution of Country Fire Authority; Part II- Fire Control Regions, Officers; Part III- Country Fire Control; and Part IV- Regional and Municipal Fire Prevention Committees. Part III also includes important divisions: Division 2- Fire Suppression and Division 3- Fire Prevention (Victoria CFA Act).

2.4.6 Western Australia

In Western Australia, the Local Government (Miscellaneous Provisions) Act, is the main document controlling buildings constructed everywhere with a few exceptions. The Act is supported by the Building Regulation 1989, which calls up the BCA. Other acts considered important to the paper are the Fire Brigade Act 1942 and the Health (Public Buildings) Regulations 1992, both of which are described below.

2.4.6.1 Local Government (Miscellaneous Provisions) Act of 1960

The Local Government (Miscellaneous Provisions) Act of 1960, which is supported by the Building Regulations of 1989, and the Local Government Act of 1995, was created to amend the Local Government Act of 1960. The only buildings these documents do not control are government buildings (Federal and State), and buildings constructed over water. The Building Regulations call up the BCA. The Local Government Act (Miscellaneous Provisions) of 1960 was created to provide for a system of local government in Western Australia. Ranging from the management of rangers to

the regulations of fire escapes, private swimming pools, and buildings, the Local Government Act 1960 provides for several miscellaneous matters (WA Local Government Act).

Some important sections of the Act include Sect. 347C, 413, and 433. Section 347C titled: Classification of Buildings states that a building shall have a classification in accordance with local laws. Part five of Section 347C states: “an owner of a building shall not use the building or permit it to be used, otherwise than for the purposes appropriate to its classification (if any).” The section goes on to state that the penalty for such an activity is $5000 plus a daily penalty of $100 for each day during the offence continues. Another very important section of the Act is 413 (Fire Escapes). It states that:

> If a local government is of opinion that a building is so constructed that there would in case of fire be a danger to persons using it because of the lack of adequate provision of fire escapes, it may serve upon the owner of the building a written requisition to install or erect in or on the building fire escapes to the number and specification set out in the requisition (WA Local Government Act).

Another important section of the Local Government Act 1960 includes Building Local Laws (433) which gives a local government the permission to create laws for buildings such as regulating the plans and levels of sites for buildings. The Act includes several other sections relating to building regulatory such as removal of neglected and uncompleted buildings (Sect. 408, 409 respectively), and thus allowing of surveys of dangerous buildings (Sect. 403) (WA Local Government Act).

2.4.6.1.1 Building Regulations of 1989

The document that calls up the BCA in Western Australia is the Building Regulations of 1989. The Building Regulations also calls up the Fire Brigade and requires that all plans for Class 2-9 buildings be submitted to the Fire and Emergency

Services Authority of Western Australia (FESA) for evaluation beside the Fire Requirements of the BCA. FESA “aims to reduce injury, loss of life and destruction of property in our community through proactive measures. FESA helps the West Australian community prepare, prevent (where possible) and respond safely to disasters.” FESA does not have direct power in the building approval process because that is solely up to the local government. Also found in the Building Regulations is a requirement that the local government building surveyors must communicate with FESA before issuing a building license. Unlike some other states, all building licenses in Western Australia are issued by building surveyors in the area the building is being constructed instead of private building surveyors (WA Building Regulation).

2.4.6.2 Fire Brigade Act of 1942

Another act in Western Australia that involves the safety of people in buildings is the Fire Brigade Act 1942.The Fire Brigades Act contains provisions for the inspection of public buildings to determine if egress provisions are being met (WA Fire Brigade Act).

2.4.6.2.1 Health (Public Building) Regulations of 1992

The Health (Public Building) Regulations of 1992 are intended to address some matters where the BCA is considered inadequate for the protection of public health or safety in and around a public building. Buildings in Western Australia must comply with the BCA and the Health (Public buildings) Regulations. However, where there is conflict between the two, the Health (Public Buildings) regulations prevail (WA Health Regulations).

2.4.7 Australian Capital Territory

The Australian Capital Territory has two acts and two regulations that deal with fire legislation and enabling legislation of the BCA. These acts are the Emergencies Act of 2004 and the Building Act of 2004. Under each of these acts are the Emergencies Regulation of 2004 and the Building Regulation of 2004.

2.4.7.1 Emergencies Act of 2004

The Emergencies Act of 2004 deals with the issues of fire and ambulance services. It also talks about the protection of life, property, and the environment. Another issue that this act deals with is the management of emergencies and who has authority. The Emergencies Act of 2004 also talks about the establishment of fire brigades. It talks about fire services, bushfires, fire bans, and fire prevention. Finally, this Act talks about is the offenses related to fire (ACT Emergencies Act).

2.4.7.1.1 Emergencies Regulation of 2004

The Emergencies Regulation of 2004 is the legislation under the Emergencies Act of 2004. This regulation addresses the issues missed in the act. The issues that it covers are steam engines, internal combustion engines, attendance by fire brigades at public events, and offences against this regulation and criminal punishment (ACT Emergencies Regulation).

2.4.7.2 Building Act of 2004

The Building Act of 2004 is the enabling legislation of the BCA. This act includes the construction, demolition, insurance, and certification of buildings. It also includes how to apply for building approval and building construction (ACT Building Act).

2.4.7.2.1 Building Regulation of 2004

The Building Regulation of 2004 talks about bushfire prone areas. It also discusses more detail about building approval and buildings exempt from the Building Act 2004. Another item that this regulation addresses is stages of building work and what items need to be completed and in what order (ACT Building Regulation).

2.4.8 Northern Territory

The four significant acts and regulations from the Northern Territory pertaining to this research are the Building Act, Building Regulations, Fire and Emergency Act, and the Fire and Emergency Regulations. The Building Regulations is the document that adopts the BCA.

The legislative base for the Northern Territory that adopts the BCA is the Building Regulations Part 2 Building Standards Section 4.1. The interpretation (section 2) states "'The Building Code' means the Building Code of Australia 1996 published by or on behalf of the Australian Building Code Board as amended from time to time (NT Building Regulations)."

Both the Building Regulations and the Building Act include sections relating to inspection and certification of buildings, protection of adjoining property, building permit

requirements, and enforcement of building/safety standards. The Building Act is stated as:

> An act to provide for the establishing of technical standards for buildings, the registration of building practitioners and certifiers, the regulation of building matters, the granting of building and occupancy permits and the establishing of a building appeal process, and for related purposes (NT Building Act).

The Fire and Emergency Act is "An act to provide for the establishment of the Northern Territory Fire and Rescue Service, the operational and emergency response activities of the Service, the protection of life, property and the environment against fires and other emergencies and for related purposes." According to section 8.2a, the director has the function to:

> Make provision in every emergency response area, so far as the capacity and resources of the Fire and Rescue Service permits, for the effective response to all incidents, including preventing, suppressing and extinguishing fires or dealing with emergencies and for the safety of people and property endangered by fire or other emergencies (NT Fire and Emergency Act).

The act also gives the powers of the incident commanders to the emergencies, the powers of fire investigators, and the responsibilities of occupiers land in a fire. The act was last amended on July 28, 2004 (NT Fire and Emergency Act).

2.5 Stakeholders

There are many groups/organizations that would be affected by a change in the level of property protection required by the BCA. It is important to review and consider the opinions of these stakeholders before making a decision as to what level, if any, of property protection should be explicitly included in the BCA.

To determine the prime stakeholders, one must first look at all of the possible stakeholders. Many of the stakeholders on the national, state, and local levels can be

found on the ABCB website. Many of the organizations listed on the ABCB site such as the building codes institution have a concern regarding what level of property protection should be required in the BCA. Even more organizations, most of which are duplicates of the ones on the ABCB site, have made contributions to the Productivity Commission. We will define the primary stakeholders group as those organizations and associations who made written submissions to the Productivity Commission.

Originally, there was a large amount of stakeholders that were identified. Upon further research two groups were formed: Government Organizations and National Representative Groups. At first there were groups such as contractors, engineers, and head fire officials. However instead of reading through a plethora of comments by engineers, the views of Engineers Australia for example, which is a national representative group, was taken into account. Instead of reading comments by individual building contractors, the views expressed by Master Builders Australia Inc, Green Building Council, and Australian Institute of Building was accounted for. With that being said, more eliminations were made from the sample of stakeholders if their submissions had nothing to do with property protection, life safety, environmental protection, or fire/building codes. For example the National Electrical and Communications Association is a national representative group, however their submission makes no reference to the BCA and its rules on property protection so therefore they were be eliminated as a primary stakeholder. A box was now drawn around the list of primary stakeholders that helped complete this research in an appropriate manner. The following is a list of our primary stakeholders, and a summary of their views expressed regarding the topics of fire fighter safety, life safety, property protection, and environmental

protection in their submission to the productivity commission. See appendix for a condensed list.

2.5.1 Association of Consulting Engineers Australia

The Association of Consulting Engineers Australia believes that nationally consistent building codes are important in making Australia's building industry efficient and cost effective. They believe that national consistency is vital to meeting community expectations for health, safety, and amenity. Many ACEA firms are dealing with major differences across national boundaries with respect to time and costs required to apply varying codes and standards to building design (Ridgway).

2.5.2 Victorian Government

The Victorian Government believes that the BCA objectives and fire authorities' regulations are similar in regards to human safety but differ in property protection requirements. They also believe that this is a topic that should be addressed in future BCA amendments. In relation to environmental issues, the Victorian Government believes that water efficiency, reuse of materials, and energy efficiency should also be considered (Victorian Government).

2.5.3 Property Council of Australia

The Property Council of Australia recommends that the "role of the Building Code be reviewed in relation to property protection from fires." They believe that if property protection requirements are added to the BCA, the requirements developed should be minimal. The Property Council of Australia also believes that there should be more environmental issues addressed in the BCA like eco-efficiency objectives. "Eco-

efficiency can be defined as being achieved by the delivery of competitively priced buildings that satisfy human needs and improve quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle of said buildings." Examples of eco-efficiencies include energy and water efficiency, renewable energy use, waste, air quality, and the reuse of materials (Property Council of Australia).

2.5.4 The National Fire Industry Association (NFIA)

The National Fire Industry Association (NFIA) conveys the point that there should be a uniform national code with very few state/territory to state/territory exceptions due to various environment related issues. They say that right now the BCA is bringing the minimum level of safety and that does not even come close to equating to the community expected level of safety. The NFIA submission makes it clear that the BCA does not address the issue of life safety as it may apply to fire fighters in responding to fire call outs. The recommendations by the NFIA say that Building Design and Regulation should properly address the life cycle requirements of all buildings. There are decisions taken at the design stage which will result in an inefficient building which imposes increased maintenance/lifecycle costs on a building for successive owners. These should be detailed fully, and clearly stated to the owner before a building is commenced, and when a building is sold. The NFIA is a primary stakeholder and they support a new system of Australian codes (Coate).

2.5.5 The Housing Industry Association

The Housing Industry Association (HIA) recognizes the conflict in their submission and even states specific sections and acts of the BCA and fire brigade

regulations that conflict. The recommendation by the HIA when asked how this problem could be resolved was:

> A possible option would be to have those alternative solutions that are currently required to be referred to the Brigades, to be peer reviewed by a panel that included representatives of the Brigades as well as other appropriate industry practitioners. Under this proposal, while the Brigades could contribute to the assessment of an alternative solution, the proposal could not be dismissed on their view alone (HIA).

2.5.6 The Green Building Council

The Green Building Council believes a national building code is even more relevant and important today to ensuring State and Territories administer national regulation contributing to a coordinated administrative system. They say that Australia needs nationally consistent building codes, standards and regulatory systems. It says that the ABCB is the best way to fix and fund the problem of a non-uniform building code (Green Building Council).

2.5.7 The Air Conditioning and Mechanical Contractors Association

The Air Conditioning and Mechanical Contractors Association (AMCA) is in support of the performance-based code. They say in their submission

> As a general principle, the AMCA supports a performance-based approach to the code. The performance-based approach caters for, and to some extent, encourages parties in tendering for various packages in a project, to innovate and develop unique engineering solutions. There is only one danger to this model. That is, when viewed in the context of the way in which the tendering process is often abused. A performance-based code provides increased scope for those who set out deliberately to abuse the system (Eynon).

2.5.8 Fire Protection Association of Australia

The Fire Protection Association of Australia (FPAA) believes that there is a conflict between the building code and fire service legislation. They also believe that the

idea of property protection should be included in Building Regulations. They think that it should be fixed by using theories comparable to those contained in the International Codes Council guidelines (FPAA).

The FPAA also submitted another letter during the first draft of the report. The FPAA much like the AMCA wants to see a performance-based code rather than a deemed-to-satisfy code. Their submission states:

> An approach Australia may consider is property protection regulation based upon community importance, following the principles incorporated in the ICC Performance Based Building Code (USA) and used in the BCA and USA for seismic design regulation. It is known that this approach is being considered by ABCB in the development of the "Future BCA. It is considered critical that this issue be addressed, canvassed widely with all sectors of industry to get a community view, articulated clearly in forthcoming BCA amendments, and implemented consistently in all building code and state regulations (Hodge).

Although they do bring up some positives about the DTS code (some parts help increase evacuation time) the FPAA still supports the performance-based code but wishes to include property protection based on building importance. The recommendation of the FPAA is to stay with a performance-based code (Hodge).

In a third letter by the FPAA, there is no comment on Finding 6.4 and Recommendation 6.9, in the submission by the Fire Protection Association Australia (FPAA), however, they refer to similar recommendations (5.5, 7.2, and 6.8) of the draft report of the Productivity Commission. FPAA makes it clear they strongly welcome Recommendations 5.5 and 7.2. FPAA supports these recommendations to have a "throughout the life" approach to maintaining a building. FPAA also strongly supports Recommendation 6.8 on Asset Protection except for the omission of stand-alone building, and they offer the following amendment:

5.A Asset Protection - Stand Alone Residential Buildings Draft Recommendation 6.8 FPAA is concerned with the Productivity Commission recommending that stand-alone residential buildings not be included in their recommendation to increase the asset protection objective of the BCA. The Association believes there is an essential need for consideration to also be given to residential buildings particularly as there is an increasing trend for building in non-traditional type suburban environments. It should also be noted that a high percentage of deaths and serious injuries from fire occur in residential buildings. Many non-suburban/rural areas have experienced phenomenal building growth in recent years, as well as a growing interest in enclave style developments. Housing constructed in these environments often does not have access to usual services such as reticulated water and is considered to be high-risk to bushfire as well as not providing convenient access for traditional fire-fighting applications. FPA Australia receives numerous calls from homebuilders or owners in such areas seeking advice on how they can better protect their homes. FPA Australia is of the view that there is a compelling argument for considering stand-alone residential buildings to be included in draft recommendation 6.8 and requests the Productivity Commission review amending this recommendation to include this class of building (FPAA Reform of Building Regulation).

2.5.9 Master Builders Australia Inc

Master Builders Australia believes that the work of the ABCB should remain focused on developing nationally consistent building codes, standards and regulatory systems that are the minimum acceptable and which are cost-effective. The Master Builders Australia believes that the recent performance of buildings strongly suggests that, in terms of health, safety and amenity, no major problems exist in relation to the current code. Master Builders Australia does not believe that the BCA should include property protection. Master Builders Australia believes that the cost of compliance across Australia, in the event that one day a building may catch on fire, would be prohibitive. Master Builders supports the current framework with some suggested amendments within the document. Thus it is determined that the Master Builders Australia Inc. is a primary stakeholder. Master Builders Australia does not agree with the property protection being included in the BCA (Master Builders Australia).

2.5.10 Standards Australia

Standards Australia and the ABCB have a memorandum of understanding. The ABCB and Standards Australia wish to consolidate their already effective working relationship both to enhance consistency between the Building Code of Australia and the Australian Standards which it references, and to assist both organizations in their tasks of reflecting community, industry and Government needs and requirements. The Memorandum of Understanding is intended to provide the basis for co-operation between the ABCB and Standards Australia in the development of Australian Standards. Since the memorandum of understanding is in place until June 2005, Standards Australia agrees with the ABCB (Blair).

2.5.11 Australasian Fire Authorities Council

The Australasian Fire Authorities Council (AFAC) is described as the peak representative body for fire and emergency services and land management agencies in the Australasian region. AFAC has engaged with the Australian Building Codes Board to achieve regulatory reform through its participation on the Building Codes Committee and a range of other ABCB and Standards Australia technical committees and working parties. The Australasian Fire Authorities Council believes the BCA should include property protection, environment protection, fire fighter safety, and community sustainability (AFAC).

2.5.12 South Australian Government

The submission by the South Australian Government explains how The South Australian Government has been, and remains, a strong supporter of the national reform

agenda through its representation on the Board and the Building Codes Committee. On the matter of property protection The South Australian Government believes that the BCA fails to recognize the broader community interest in ensuring the ongoing functionality of buildings. The South Australian Government believes that some buildings (such as hospitals, fire stations and other facilities for essential services) perform a critical role in the provision of services to a community and should be considered accordingly. They also believe that a more holistic view of impacts on the community from building losses needs to be recognized. On the matter of fire safety the South Australian Government believes that the fire authorities have a broader charter than just life safety. They believe that the BCA needs additional objectives. The South Australian Government believes that there is scope for a greater degree of consistency (SA Government).

2.5.13 Queensland Government

The Queensland Government has been, and remains, a strong supporter of the national reform agenda through its representation on the board and the Building Codes Committee. The Queensland Government believes that there may be benefit in consolidating the objectives of fire authorities into the BCA. Queensland Government also believes that the fire authority objectives are State laws and need to be complied with in spite of the BCA being a lesser standard in regard to property protection. The answer to fire safety shows that the Queensland Government supports property protection in the BCA (Queensland Government).

2.5.14 Engineers Australia

Engineers Australia (EA) is the peak body for engineering practitioners in Australia and represents all disciplines and branches of engineering. EA fully supports the need for national consistency on building regulations, and finds the Board (ABCB) to be a success and much needed in the future. EA offered several comments on the Productivity Commission Draft Report, one of the main comments being the need for a specific recommendation with regard to accreditation and/or licensing of building certifiers on a national basis. EA supports recommendation 6.9, however they did not make reference to whether they think property protection should be involved in the BCA. In their letter commenting on the Productivity Commission report they mention:

> In recent decades, there has been a growing appreciation of the need to provide adequate solution and standards for the protection of lives and property in the case of fires in buildings. Again, professional engineers have led the way in applying basic scientific principles to achieve practical solutions that now form the basis of codes of practice and standards in this area (Engineers Australia).

2.5.15 Water Services Association of Australia

In the Water Services Association of Australia (WSAA) letter commenting on the Productivity Commission Draft Report they show their disappointment that the report fails to address issues relating to water. They show the importance of their concern by displaying the fact that most of Australia has been in a drought for over eight years, and the fact that the population in major cities are expected to grow past 4 million by 2030. In the letter by the WSAA, they write:

> It should be remembered that retrofitting existing houses and developments is extremely expensive and the most cost effective opportunity to 'hard wire in' water efficiency is at the development stage. This is why building regulations have such an important role to play in encouraging the adoption of water efficient buildings across Australia (Young).

> The way of the future will be to recycle water within buildings or within sub-divisions for use for purposes that do not require water of a potable standard, such as garden watering and toilet flushing. This new way of configuring water infrastructure will make household plumbing more complex and if plumbing regulations and building codes are not aligned there will be a greater risk of public health and environmental objectives being compromised through cross connections and inappropriate discharges to the environment. The WSAA is mainly concerned about the future environment problems Australia may endure, and want to see building regulations fix such problems (Young).

2.5.16 Insurance Council of Australia Limited

The Insurance Council of Australia (ICA) believes that the BCA objectives should equally concentrate on the protection of property and other assets. The ICA believes that a national licensing and training regime needs to be introduced. The ICA also believes that having an agreed and accepted national approach will support efficiencies and ensure overall cost effectiveness is achieved. The ICA supports the position put forward by the Australian Fire Authorities Council (AFAC). Since AFAC believes the BCA should include property protection, environment protection, fire fighter safety, and community sustainability ICA also believes the same (ICA Submission to Productivity Commission).

The Insurance Council of Australia (ICA) also wrote a brief letter commenting on the Productivity Commission Draft Report and show their main concern is that they have representation on the Board of the ABCB. In the letter by the ICA they write:

> ICA believes that due to the need to raise the standards of the Building Code of Australia, we require urgent representation on the Board of the ABCB. This would ensure the appropriate consultation with all stakeholders is undertaken, for example in relation to the purposes of asset protection. ICA also supports the Australasian Fire Authorities Council (AFAC) holding representation on the Board of the ABCB (ICA Comments on Reform of Building Regulation).

2.5.17 Australian Institute of Building

In the Australian Institute of Building (AIB) brief submission on the Productivity Commission Draft Report they focused on Durability, Weather tightness, Quality, Practitioner accreditation, and Training. The most related variable to this report would be Durability. In the letter by the AIB they write how the BCA does not require any buildings to have a minimum standard of durability. The AIB writes:

> Whatever the reasons, we now have buildings that are designed for twenty years but are left standing far longer than that. Can society afford twenty-year buildings? This is the overarching question for our community's regulators to deal with, but the practical problem being faced now is what we do with the prematurely aging and sick buildings that our low-price quick-turnover mentality has produced. Can we afford to keep allowing these buildings to proliferate (Lewer)?

These questions the AIB brings up strongly relate to property protection in the fact that if buildings are built more durability to began with, if a fire occurs, the building has a better chance of withstanding, therefore protecting the property, and possibly the life of a fire fighter (Lewer).

2.5.18 The ABCB Chairman

The ABCB Chairman states that a priority of the ABCB is to review life safety versus property protection issues such as the issue of buildings of community importance. The recommendation of the chairman; if issues concerning the regulation of life safety/property protection are to be reconciled, it would be necessary for the States and Territories to require the centralized development of technical provisions to meet fire service legislation objectives. Alternatively, better coordination of the roles of the fire service and building/planning legislation would assist (Laver).

When asked the question: "Is there a conflict of objectives between the BCA and the fire authorities' regulation in the States and Territories? If so, how could this be resolved?" The chairman responds:

> Generally, the objectives are aligned in regards to life safety in fires. They differ in regard to property and environmental protection. The BCA focuses on life protection and not, primarily on property protection. As it stands, building proponents need to comply with all legal requirements. What is at issue is whether both elements ought to be regulated through the BCA. Ministers would need to agree that this matter be covered in future BCA amendments (Laver).

The Chairman of ABCB also commented on many of the findings and recommendations of the Productivity Commission Draft Research Report in another letter that he sent. He comments on Recommendation 6.8 which is very similar to Recommendation 6.9 of the Productivity Commission Research Report. He comments:

> Research on the regulation of asset protection in Australian buildings is limited. The research available supports the status quo. For example, studies undertaken by researchers at Victoria University, Melbourne concluded that mandating sprinklers in schools would cost more than three times the property that would be saved from fire damage if sprinklers were installed. If the concept was to be introduced applying different standards to different types of buildings within the same building Class (depending on use, location or lack of alternative accommodation in the event of loss), it would introduce considerable ambiguity into the BCA...The structural sufficiency provisions (Section B Structure) of the BCA adopt the concept of building importance. Buildings with a high level of importance e.g. post disaster recovery centers, are designed to a higher level of performance than a low importance level building such as a farm building. The Northern Territory variation to E1.5 of the BCA adopts this approach for fire safety, by requiring fire sprinkler systems to be installed in all hospitals over one storey (over 25m for rest of Australia). This requirement is in recognition of the fact that hospitals in the Northern Territory are sparsely located, and loss of a hospital would have a major impact on the health and safety of the community. Asset protection for commercial purposes (for the individual or organization) is considered to be controlled by the market, and therefore is not considered to be a BCA objective (Laver).

The Chairman's comments seem to show he believes in property protection in only "important" buildings or that it should be up to the market when dealing with commercial buildings (laver).

2.6 Case Studies

2.6.1 School Fires

There are arguments that the BCA should protect buildings from property damage. But should all buildings contain property protection? One suggestion to include property protection into the BCA is protecting only property considered important, or essential to a community. Presently in Australia there is a major revision in progress called BCA21. BCA21 is a revision that intends to include new performance requirements that require important buildings to have property protection. As of now, the revision is not included into the Building Code, and arguments are present from both sides of the case (Clancy, 1).

The main argument for not including property protection into the BCA is cost. All those against property protection seem to suggest that it will cost too much. It is true that installing additional property protection such as an automatic sprinkler system will cost the builder or owner extra money, but the exact amount is difficult to calculate. The best way to approximate the cost may be to look at a specific example. Take for example a school building, an important community structure. In Mark Potter's (Acting Manager Community Infrastructure CFA) paper titled "Why is property protection so important to the Fire Services?" he cited specific examples of important building fires and what effects they had on the community. The fire he wrote about involving a school was the Cowes Primary School. Cowes Primary School is one of only two Primary Schools on

Philips Island. A fire occurred at the school during a two week holiday break in September 2003. The result of the fire was the total destruction of the main school building which contained classrooms, a library, offices, and IT infrastructure. The projected damage of the school building was approximately $1.6 million, and the loss associated with the building contents was $240,000 and a clean up bill of $400,000.

A paper on school fires from the opposite perspective as Potter's was written by Paul Clancy, Lata Satyen, and Ian Thomas. Their paper titled "Property Protection: School Buildings" contains some similarities to Potter's paper, and many differences. Potter explains in his paper that there are several indirect costs the fire has brought upon the community. Potter lists the costs:

> • The entire 125 year school and surrounding community history was lost.
> • Numerous student records including assessments which were then required to be re-completed were destroyed by the fire.
> • Additional teaching staff at a cost to the school to allow for specialist teachers to be released to re-establish systems (e.g. library, IT, etc.)
> • Staff parking was severely reduced due to construction of new portable buildings.
> • An anticipated 18 month delay for the new school building to be constructed.
> • The impact on teachers and students who had to share the school hall for approximately 4 weeks until portable classrooms were available.
> • The significant loss of teaching resources utilized by a number of teachers (Potter, 5).

Along with direct and indirect cost from the fire, there was a social impact on the children which was measured via a survey of the teachers. Some of the comments included: "initially students settled well but closer to mid term 4 the behavior changes indicated possible impact from the fire. In general increased tiredness, altercations, some students displaying out of characters responses to incidents e.g. tears, violence."

"Students whose behavior was already problematic tended to get worse (Potter, 5)."

similar to Potter's paper, Clancy, Satyen, and Thomas' paper explains there are several other "ancillary and indirect costs" in addition to building asset costs. The three authors list these costs as:

> • Marketability of the school
> • Retention rates for students and staff
> • Resources of other agencies involved
> • Political costs
> • Additional pressure on education department services
> • Distress to children in losing assignments, artworks and a place of belonging.
> • Loss of teaching materials that may have been developed over 20-30 years.

They also state that:

> It is difficult to quantify all of these costs. A typical estimate is that ancillary and indirect costs are about three times the cost of lost building assets. Allowing for the inclusion of ancillary and indirect costs, the average cost of fires 0.30% of the total assets.
> Some may argue that there are further indirect costs; for example, insurance and the cost of running the fire brigade. However, these costs are either arrangements to mitigate fire costs to an individual by sharing it amongst the wider community, or are the cost of fire safety systems. These costs are not due to fire losses but rather the management of fire risks (Clancy, 2).

The two papers have two indirect costs in common; distress to children because of loss of work, and loss of teaching materials. The indirect costs listed by Potter can be grouped into minor and major categories. The cost of losing some parking spaces for the teaching staff, which may have led them to park on streets, is minor. The loss of a 125 year history could also be considered minor. In fact, perhaps that is too old for a school and it needed to be remodeled. There are some indirect costs, listed in both papers that do seem significant. The loss of teaching resources, and classrooms (in the Cowes case, teachers and students shared the school hall for four weeks), must have caused several distractions for students which in turn affected learning. In the Cowes school case, the

social impact on the children probably came from the distractions and discomfort of being in the hallways.

The CFA, whom Potter works for has recently developed a draft policy titled "Performance based design within the built environment". The main objective of the policy is for the CFA to communicate with the community and stakeholders its requirements when regarding performance based designs. The CFA draft lists a number of criteria that performance based designs must meet. The draft criterion is:

> • The CFA is required under its Act (S20) to prevent and suppress fire, and to protect life and property.
> • CFA is committed to protection of life, property and the environment through the delivery of a cost effective fire and emergency service for the people of Victoria.
> • CFA's community safety objectives are measured in terms of reduction in life, injury and property loss as a result of fire.
> • Structure fires are the workplace of firefighters, and the design of fire safety systems must address firefighter safety.
> • Due to its legislative requirement to protect life and property, the CFA does not support any proposal where a building is "designed to burn".
> • Building designs should address the Victorian Government's triple bottom line, which is aimed at considering the elements of social, economic and environmental impacts in construction.
> • Alternative solutions to BCA "Deemed to Satisfy" requirements must provide an equal or greater level of performance.
> • Arson must be considered when assessing a performance based design if it is identified as a credible scenario.
> • The impact of dangerous goods storage within a building must be considered in a building design. (Potter)

In analyzing the CFA's draft policy, starting with the first criteria listed, the CFA is required to protect property, but only within reason. If the fire is too large or the building is already seriously damaged, they will not go into the building to extinguish the fire. When protecting property, a fire brigade will tend not to send their firefighters into an unsafe building, and this can be seen by the low number of firefighter deaths in Australia. Also listed in the CFA's draft criteria is that they do not support any proposal where a

building is “designed to burn”. One could argue that all buildings are “designed to burn”. Once a fire is ignited, there are several contents in a building that will fuel the fire, and the building will burn. The last listed criteria one could scrutinize is that stating that arson must be considered when assessing a performance based design. If all important buildings should be protected against arson, should all buildings be built to take the impact of a terrorism attack too? The problem is constructing a building to contain life and property protection, and then on top of that providing protection from arson and perhaps other rare situations, the costs keep rising.

What is extremely difficult to define for Australian fire services, including AFAC, is the “total cost of fire”. The total cost of fire must include all direct and indirect costs, including societal consequences. The direct costs are much easier to estimate than the indirect costs which could include things such as psychiatrist bills from students after a school fire. Because of the trouble of estimating the total cost of a fire, it is hard to know if it is worth putting property protection into a building. Because of the Cowes Primary School fire and others, fire services will continue to identify community important buildings and what can be done to protect them against the same type of consequences (Potter 7-8).

Again, there are the contrary views of Paul Clancy, Lata Satyen, and Ian Thomas. In their paper they come to the conclusion that property protection costs far too much, and is not worth having in school buildings. The paper begins by explaining fires do occur in school buildings and some are severe. “On average a fire causing more than one million dollars damage to school buildings occurs every two weeks in Australia

(population 20 million) (Clancy, 1).” The paper then proceeds to explain that the decision to protect school property is the community’s through political processes.

Clancy, Satyen, and Thomas’ paper analyzes the costs of fire hazards in Victoria, one of the largest Australian states. In Victoria there are 2317 schools, 1615 which are government-run having assets totaling $8.34 billion. In 2003 the cost of building assets lost due to fire in Victoria schools was $12 million. This was abnormally high, as in the years of 2001-2003 the cost of fires amounted to an average of $6.33 million per year.

Compared to apartment building, and office buildings, the paper shows that educational buildings have fire hazards within community-accepted levels of risk, and low fire costs in relation to asset value. According to Bob Alexander of the New South Wales Fire Brigade, the cost of installing sprinklers into a 50m x 40m school during building construction is $125,000, about 4% of the cost of the building. By unit, this cost would be $62.50 per square meter. The Victorian Education Department confirms this approximation by stating the unit costs to be between $60 and $66 per square meter. The authors do state that according to Eric Bower, a prominent sprinkler contractor, the value of $60 per square meter is excessive for some schools. Bower’s estimate for ordinary response sprinklers and concealed heads in an urban school with good water supply and low rise construction is approximately $35 per square meter. For retro-fitting sprinklers into existing school buildings however the cost is estimated to be as high as $90 per square meter Using that value, the estimated cost of retro-fitting all schools in Victoria is about $390 million. With a fifty year service life, after the annual depreciation, amortization rate, and maintenance, the cost of sprinklers on an annualized basis would be $26 million. If the sprinklers were put into buildings when they were new, the

annualized cost would be about $10.1 million (Clancy, 2-5). If all 2317 Victorian school buildings were new, and 200 per square meter in size, using Bower's approximation, the costs would be approximately $162 million. This cost may be reasonable, but all schools in Victoria are not planned to be demolished and rebuilt. Thus it would be more reasonable to use the estimated cost for retrofitting sprinklers.

The effectiveness of sprinklers can be found from; Effectiveness equals efficacy multiplied by reliability. According to Table 1 in the Clancy paper, sprinklers alone reduce average fire costs enough to reach an effectiveness of 64%. By reducing the average annual fire costs by 64% in Victoria, using the average of $6.3 million in fire costs; $4 million would be saved. With this saving, the approximate average annual school fire costs per year in Victoria would be $2.3 million. Added to the annualized cost of sprinklers in schools would make a total cost of $28.3 million, which far exceeds the potential savings of $4 million. Because of this, Clancy and his colleagues believe sprinklers are simply not cost-effective (Clancy, 5-9).

2.6.2 Hostel Fires

School fires are brought to widespread attention by the media because of the many people they affect. Another emergency that brings almost equally as much attention is hostel fires. A hostel, or backpacker inn, is a low-budget accommodation building, and many are quite aged. One of the most devastating and well-known hostel fires in Australia is The Palace Backpackers Hostel fire in Childers. The Palace Backpackers Hostel was an ageing hotel that was converted into a backpacker accommodation in 1993. The fire started on the ground floor at about 12:30am in June 2000. The hostel was filled to capacity the night of the fire, which took firefighters over an hour to control. Fifteen

people perished in the blaze; 6 Britons, 4 Australians, 2 Dutch, 1 Irish, 1 Korean, and 1 from Japan (Emergency Management Australia). The victims had very little time to escape from the 2 story wooden building.

From the years of 1981-2000, 28 people have died in fires at backpacker hostels. Of the 28, nine in 1981 at Rembrandt Apartments (Sydney), six in 1989 at Downunder Hostel (Sydney), and 12 at Palm Grove Hostel (NSW) in 1991. There were also fires in low-budget facilities in Rockhampton in 1996 and Melbourne and Fremantle in 1997, with no deaths, just close calls (Philips).

Two years after the fire in Childers, another low-budget accommodation fire occurred in Queensland. The fire was at Seabreeze Lodge in Sandgate, also a two storey wooden building. Three people were killed (Fickling).

These two Queensland fires have stirred a lot of worry in Australia, particularly in Queensland. According to a key stakeholder from Queensland the two fires may lower tourism in the area (Thom). Both hostels did not have sprinkler systems (Blake; Philips). The fire alarms and smoke detectors in the Childers fire did not work.

> Queensland Fire and Rescue spokesman Bob Hook has stated that smoke detectors are not compulsory for pre-existing buildings under Queensland law. Buildings only had to meet the fire standards in place at the time they were constructed. Nor were annual fire inspections compulsory for many of the state's backpacker hostels because of different local government regulations (Blake).

Extra fire safety laws have been made to deal with hostel fires in Queensland and should be considered in all other states/territories. Sprinkler systems would be an excellent option in hostels, but could be too expensive for the owner and perhaps not worth the cost of the building if it is too old. Working smoke alarms and fire extinguishers should be required in low-budget accommodations and there should be

laws in all states and territories to have safety checks to maintain them. Survivors of the Childers fire in the trial to convict the man who set the fire revealed how they had to smash through windows, squeeze through security bars and unblock fire exits to escape the inferno (Barkham).

2.6.3 Windsor Fire

On February 13, 2005 the Windsor Building in Madrid, Spain endured the city's worst fire. The 106 meter office tower was heavily damaged but did not collapse. The city cordoned off the skyscraper days after in fear of a collapse. The fire fortunately started at night when the building was unoccupied. It started on the 21st and 22nd floor, and the cause is yet unknown but guessed to be because of an electrical short circuit. The fire caused several upper floors to collapse on the lower to mid floors, causing even greater increase in the risk of collapse (CNN). Before the fire, four companies were working on upgrading its fire prevention system to comply with new regulations including ventilation, water deposits, and a network of sprinklers. Architectural experts have said the building did not have an extensive sprinkler system that would extinguish a fire caused by an electrical short circuit. According to the US association of sprinkler system producers, 90 percent of fires are put out by at least four sprinklers (Elkin).

One of the companies working on improving the Windsor buildings fire prevention system said they had put in fire resistant paneling, but did not begin to install anything in the 21st and 22nd floors (Elkin).

The direct and indirect costs of the Windsor fire will be immense. The building was valued at approximately €80 million in 2003. Subways, trains, and streets were closed around the area in fear of a collapse. Because of the closures, the Monday after the

fire approximately 600,000 people faced commuting delays. The mayor also ordered all adjacent office buildings to remain closed. El Corte Ingles, Spain's signature department store stayed closed Monday, telling its 2000 employees to go home. Along with El Corte Ingles, dozens of other business were closed, leaving thousands of workers at home until the building was considered stable. The fire occurred too recently to approximate the total direct costs, but they will be substantial. The indirect costs as well will be considerable (CNN; Elkin).

2.7 Statistics

In order to justify whether or not property protection should be incorporated into the BCA, a cost benefit analysis needed to be done. A valid way of performing a cost benefit analysis is through use of national statistics. Key statistics were needed in order to analyze the issue of property protection and document conclusions. Statistics that were needed included: total number of fires, fire fighter injuries in sprinklered buildings, fire fighter injuries in non sprinklered buildings, fire fighter deaths in sprinklered buildings, fire fighter deaths in non sprinklered buildings, dollar loss due to fire in sprinklered buildings, and dollar loss due to fire in non sprinklered buildings. The statistics attained were for the dates of July 1, 1997 to June 30, 2002 and included all building types but excluded incendiary fires. Also, not all fire services contribute to the national database, which makes it incomplete. Of those fire services who do report, some exclude responses from their rural/volunteer brigades. The following figures are the statistics used in the analysis.

Fire Injuries/Deaths Occurring in 1997 to 2002						
Years	Sprinklers	Total Number of Fires	Civilian Injuries	Civilian Fatalities	Fire Fighter Injuries	Fire Fighter Deaths
1997 to 2002	Yes	3,201	170	22	8	0
	No	33,861	3,240	199	283	0
	Not Reported/ Undetermined	45,358	685	64	11	0
Total		**82,420**	**4,095**	**285**	**302**	**0**

Figure 1Fire Injuries and Deaths

Dollar Loss Comparison			
Year	Sprinklers	Fires recorded	Dollar Loss (AU$)
1997 to 2002	Yes	1,811	134,705,701
	No	27,325	1,014,656,743
	Not Reported/ Undetermined	11,590	207,764,641
Total		**40,726**	**1,357,127,085**

Figure 2 Fire Dollar Losses

2.8 AIRS Data

In order to find out where national statistics originated, research into the national database was completed. The process of recording statistics was also researched in order to analyze how accurate the process actually is. With research done on the history and process of recording statistics into the national database, it became clear as to how accurate the national database is.

The national database of Australia was not incorporated until the early 1990s. In order to understand the logistics of the national database the history of Australian databases needs to be reviewed. In the early 1950s fires in New York and Chicago

prompted the United States to incorporate fire records in order to document, analyze, and help to prevent future fires Australia also adopted a record system. Initially Australian agencies each had their own primitive systems. In the 1950s-1970s the agencies used a card based recording system. Around the 1980s when computers and technology advanced, the card based system was then converted to computers. In the 1980s agencies started using the D-base database software. In the past five years, the emergence of legislation that protects the identification of individuals has been enacted. Privacy statements make it difficult to release information which means that the national database needs to hide private information. The information is publicly available to agencies, but not available to the general public (Collett).

Many Australian agencies had different sets of data systems from each other at the time. Some agencies recordings were much more advanced and in depth than others. In the early 1990s it became clear a uniform system was needed for better analysis. Agencies decided to develop a national database. The agencies were encouraged by Standards Australia to up come with definitions and codes that all the agencies would agree on. This resulted in a uniform system for recording national data called the Australasian Incident Reporting System (AIRS). AIRS was developed to include different blocks of data. The blocks of data include:

- General information for all Incidents,
- Automatic Fire Alarms,
- Hazardous Materials Incident,
- Casualties, Rescue and Evacuation,
- Ignition (All Fires),
- Fire Fighting,
- Wildfires,
- Dollar Loss Fires,
- Incidents Involving Mobile Property, and
- Structure Fires (Collett).

Included in the AIRS database is the block K - structure fires which is shown in Figure 3.

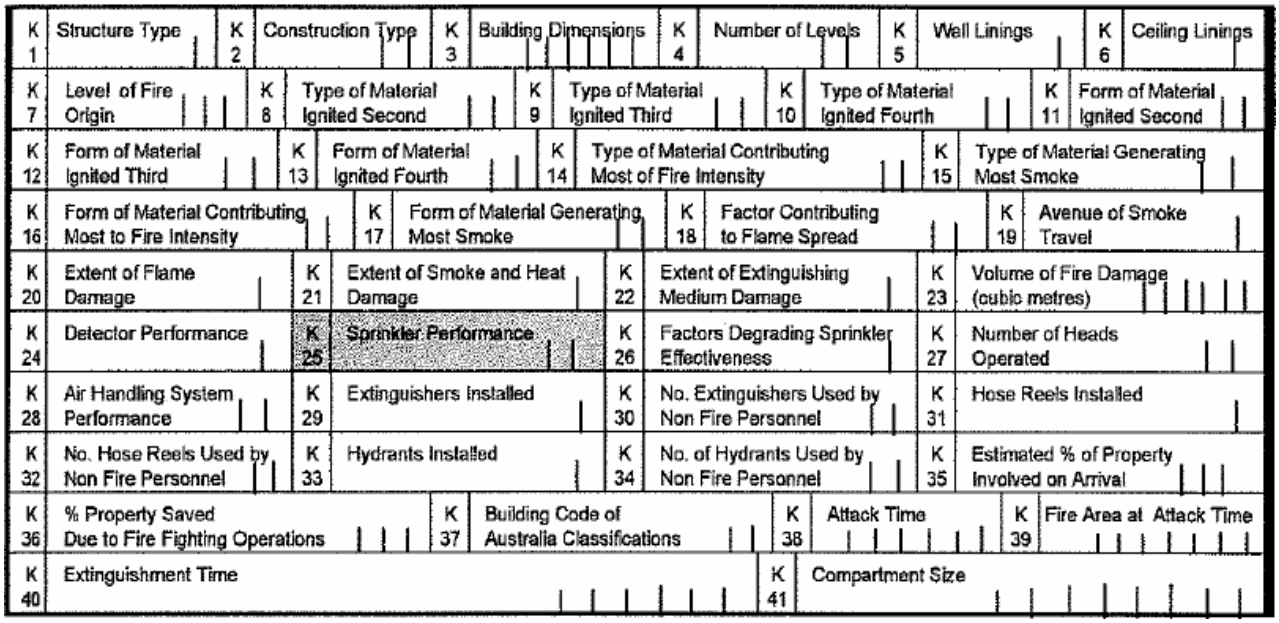

Figure 3 AIRS Structure Fires Block K

This chart is what a fire officer fills out following a fire. Specific sections of importance are the following blocks:

K20 - extent of flame damage
K21 - extent of smoke and heat damage
K22 - extent of extinguishing medium damage
K23 - volume of fire damage (cubic meters)
K25 - sprinkler performance
K26 - factors degrading sprinkler effectiveness
K27 - number of heads operated
K35 - estimated percent of property involved on arrival
K36 - percent property saved due to fire fighting operations
K38 - attack time
K39 - fire area at attack time
K40 - extinguishment time

The following is the fire fighting chart which contains details about specific means of extinguishment:

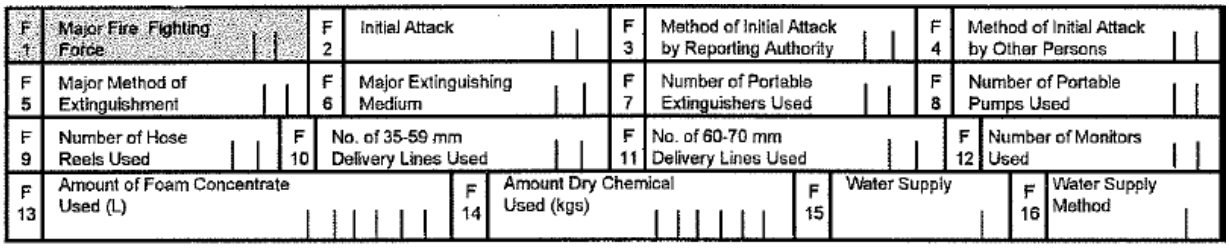

Figure 4 AIRS Extinguishment Block F

This chart is very important to determine the total cost of fire. Including items such as "amount of foam concentrate used" and "water supply" helps to determine the total cost of fire that includes environmental costs as well as fire fighter and supply costs. All of the other tables can be seen in our appendix.

2.8.1 National Database

One item looked into as a result of the small amount of data obtained is the National Fire Protection Association standard 901. NFPA 901 provides a model for a national database. NFPA 901 was used to look at possible recommendations for improving or changing the current national database.

The NFPA 901 suggests four objectives for setting up a database. They are:

(1) To provide for the collection of data required for legal record purposes and control of the fire problem
(2) To provide local fire service management with information to indicate trends; to measure the effectiveness of fire prevention, fire suppression, and emergency mitigation procedures currently being used; to evaluate the impact of new materials and methods; and to indicate those areas that could require further attention
(3) To provide a pre-fire inventory of property in a fire service district so that future needs for fire protection resources and codes or regulations can be anticipated and potential problems corrected before a fire
(4) To provide uniform data to regional, national and international fire and emergency organizations for the following aims:

a. To make the full extent of the fire and emergency problem known
b. To reveal facts that require action on these levels
c. To guide the effective development and administration of codes and standards

d. To guide fire prevention, fire protection, emergency medical treatment, and hazardous materials handling research (NFPA 901, Chapter 1).

It also deals with the identification and location of an incident. It talks about the events of an incident and keeping track of how much time it takes for detection of a fire, arrival time of the fire brigade, etc (NFPA 901, chapter 3).

NFPA 901 also deals with the issues of property use. This is an important statistic to allow for a determination as to which properties are experiencing the most fires. If one type of property is experiencing more fires than others, a potential solution could lead to property protection in that type of building structure. Another important part of NFPA 901 deals with building codes. “Knowing how the occupancy of the building was classified by the building code helps in understanding the presence or absence of certain fire protection requirements (NFPA 901, Chapter 4.5).”

NFPA 901 discusses building characteristics. It addresses the issue of how the building was built, dimensions of the building, and materials inside the building (ranging from interior finish to furniture). Number of occupants and their age and physical ability are also mentioned as well as any obstacles in the building that interfered with fire fighter operations (NFPA 901, chapter 5).

NFPA 901 has a section that addresses the room of origin. It talks about where the fire started, how the fire started, etc. Also, it discusses what piece of equipment started a fire and what item was ignited (NFPA 901, chapter 6).

In addition, NFPA 901 provides a uniform way of identification of growth and spread of fire. It addresses the issues of flame development and smoke development. It also talks about travel of smoke and flames. Another section in the standard deals with

fire detection and reporting to a fire brigade and which ways were used to do these tasks (NFPA 901, chapter 7).

NFPA 901 goes in depth on the subject of fire brigade intervention. It talks about everything that the fire brigade does during a fire. The items that it addresses are conditions of fire, actions taken by fire brigade, method of extinguishment, and resources to the disposal of fire fighters (NFPA 901, chapter 9). It addresses the people that were involved in the incident. It talks about the demographics of people and if people escaped or got trapped. It also talks about factors preventing escape (NFPA 901, chapter 10).

"Property and Human Loss" is the title of one of the sections. This section addresses the extent of damage of the fire incident. Some of the subsections include money loss, number of people temporarily homeless, and number of businesses made unsafe because of a fire (NFPA 901, chapter 11).

Another section addresses casualties. It explains the process for recording fire injury and death data. It also explains types of casualties and how injuries and deaths occur to both civilians and fire fighters (NFPA, chapter 12).

The NFPA has valuable information regarding the collection and the completeness of the data. This document will be referenced in the recommendation section of our report.

2.9 Conclusion

State/territory acts and regulations, the productivity commission, the BCA, and statistics were all analyzed. After being analyzed, the purpose of the project became evident. The purpose of the project was to discuss the controversy and objectives between the state/territory legislations and the BCA. The BCA enabling legislations of each

states/territories was found and Finding 6.4 and Recommendation 6.9 of the Productivity Commission Report were analyzed. Finding 6.4 states the difference between state/territory legislations and the BCA. Recommendation 6.9 asks the question whether or not property protection should be explicitly included in the BCA. The statistics were documented and the results can be found in the results section of the report.

3 Methodology

3.1 Overview

The project was first defined by the members of AFAC from the Built Environment Subgroup. The project's objective was to create a plan for determining whether or not explicit property protection should be included in the BCA. The approach to achieving this objective required the following steps:

- Researching the Productivity Commission Research Report
- Researching the Building Code of Australia
- Researching state/territory legislation
- Comparison of state/territory legislation with the BCA
- Reduction of stakeholders to narrow the search for information
- Interviews completed with stakeholders
- Statistics gathering from Australia National Database
- Case studies analysis
- Attending a fire chat (focus group discussion)
- Results were compiled and a presentation was completed

The sections below describe in detail, the procedure used.

3.2 Important Literature

The first step was to understand the Productivity Commission Research Report Finding 6.4 and Recommendation 6.9 (Productivity Commission, XLV). This report provided the background for the project. It also provided the project's goal statement.

This was followed by developing an understanding of the Building Code of Australia. The BCA was used to develop a background on the topic.[3]

The next item that had to be completed was a review of Australian State and Territory Legislations. There were several pieces of legislation from all of the different

[3] BCA 2004 was used because the 2005 version had not become law in all of the states and territories at the time of the study.

states and territories that needed to be reviewed so that the most recent pieces good be inserted into the updated table. If legislation was outdated or if wrong, the specific outdated/wrong piece was replaced by the most recent one. The original table provided by AFAC listed the existing known fire and building legislations for each state. This table provided a good starting point, but the table was not up to date. The table was updated as part of this project. The updated table made the differences in objectives between state/territory fire legislations and the BCA apparent.

To locate preliminary legislation information, various sources were consulted such as government websites and the pieces of legislation themselves. Many state representatives had to be contacted to verify the correctness of the new table. These individuals were chosen by contacting members of the AFAC Built Environment Sub Group and the Fire Engineering Group. The table is now complete (see Appendix 1). The information gathered from the BCA was compared to the set of state/territory legislation. The BCA was found to focus on life safety (although it does contain some property protection, mostly implicit), while the state/territory legislation contained provisions for both life safety and property protection.

3.3 Stakeholders

A major step was to narrow down the stakeholders to primary stakeholders. Originally, a large number of stakeholders were identified. Upon analysis two groups were identified: government organizations and national representative groups. Only groups and organizations that made submissions to the productivity commission were analyzed. Each submission provided a summary of their views about the topic of property

protection in the BCA. In order to limit the analysis to a reasonable number of people and organizations, other possible stakeholders listed on the ABCB website were disregarded.

The number of stakeholders' opinions were further limited by restricting them to groups instead of individual contractors, engineers, head fire officials, etc. Individuals and individual companies were not explicitly included in the analysis because their basic views were already expressed through their national organization and summarizing their views as well as the view of the group they belong to would be redundant. So, instead of evaluating comments by individual engineers, the views of Engineers Australia for example, which is a national representative group, was taken into account. Instead of reading comments by individual building contractors, the views expressed by Master Builders Australia Inc, Green Building Council, and Australian Institute of Building were used. More eliminations were made if submissions had nothing to do with property protection. For example the National Electrical and Communications Association is a national representative group that made a submission to the productivity commission, however, their submission made no reference to the BCA and its rules on property protection so therefore their submission was eliminated and they were not considered a primary stakeholder.

3.4 Interview Process

Stakeholders' were interviewed to gain a clear understanding of their written comments. Interviews were used to see the representatives face to face in order to get a better idea of how strong a representative's opinions were and to clarify any outstanding issues. Some stakeholders were not interviewed because enough information was present in their letters to the Productivity Commission. A list of contacts for representatives of

the key stakeholders was supplied by Fire Safety Coordinator Rob Llewellyn. Through more research and recommendations by Rob Llewellyn, individuals who represented the primary stakeholders were then contacted and interviews were conducted. The questions asked related to the BCA and property protection. Every representative was asked the same set of questions (refer to appendix 3) in order to see the differences in opinion and in order to gain a clearer understanding of where the stakeholders stand. The representatives who were interviewed included: Executive Manager of Community Safety for Queensland Fire and Rescue Service Graeme Thom, Manager Building Fire Safety for Queensland Fire and Rescue Service Bob Hook, Executive Manager of the Community Safety Technical Department of the MFB Jarrod Edwards, Building Surveyor MFB Tass Georgas, Manager of Research and Fire Safety, Australian Building Codes Board Brian Ashe, and National Manager ARUPS Australasia Peter Johnson.

3.5 Fire Chat

A fire chat, hosted by Jarrod Edwards, was conducted on February 10, 2005 relating to issues related to those of property protection in the BCA. The opportunity to attend the chat provided great insight into the differing opinions of individuals. The fire chat is a monthly focus group designed to discuss different topics each month. The fire chat this month focused on fire brigade intervention and fire brigade operation. There were many opinions regarding changing the BCA to include definitions of these items. The people at the chat included Society of Fire Safety members and invitees.

3.6 Case Studies

Through contacting members of several fire authorities across Australia (by email, phone, or in person), reports of case studies, and statistics were received. After obtaining as much information as possible, the next step was to filter out the important reports and papers needed to achieve the goal of the project. Some interviewees commented on the case studies that were found. Comments were taken into consideration, but were not used to form a biased opinion on the matter. The two papers received that were most conflicting, and gave the report the best data were; "Property Protection: School Buildings (Clancy)," and "Why is property protection so important to the Fire Services (Potter)?" Both papers gave statistical data and involved a common subject, school buildings. In Clancy, Satyen, and Thomas' paper (Clancy) school buildings were the only structures considered where as in Potter's paper (Potter), several structure fires were considered, one being a school fire. Comparing the papers one can see that the authors do not agree with each other. Clancy, Satyen, and Thomas do not believe property protection should be put into school buildings, while Potter strongly suggests property protection for school buildings is needed. The two papers were read and compared and key points were identified.

The papers contain statistics on approximate fire costs and indirect or ancillary costs. The numbers from both papers were compared, and new approximate statistics were obtained.

In addition to the two papers on school fires, reports of other building fires were obtained. After some examining of the cases, the project team decided the most important and relevant case studies were those of the school buildings, the Windsor Building fire in

Madrid, Spain, and some hostel fires. A final conclusion on all statistical data from the case studies was developed and summarized.

3.7 Statistics

In this report statistical data from fires such as number of deaths (occupants and firefighters) in alarmed and unalarmed buildings, property loss in dollar amount of alarmed and un-alarmed buildings, and the approximate costs of installing sprinkler systems were also reviewed. All of the statistics were once again summarized and discussed. The statistics and case studies give views from both sides of the confliction, and allow for better judgment as to if property protection should or should not be put into the BCA.

In order to attain statistics, representatives of the primary stakeholders were contacted. Statistics for national fire data were attained from Nick Nicolopolous and Helen Danaskos of the New South Wales Fire Brigade. Nicolopolous and Danaskos supplied the most comprehensive statistics, which were vital for showing exactly how many fires, civilian injuries, civilian fatalities, fire brigade injuries, fire brigade fatalities, and amount of dollar loss occurred in sprinklered buildings compared to non sprinklered buildings. All of the statistics were summarized and discussed. The statistics allow for better judgment as to if explicit property protection should or should not be included into the BCA.

3.8 Advantages and Property Protection

Based on all of the information gathered from research, a list of advantages was created. The list enumerates advantages for and against property protection in the BCA.

This list was intended to create an unbiased outlook on the issue of explicit property protection objectives in the BCA and to lay out key issues. The list of advantages was compiled, and an analysis was completed based on these advantages. This was done by comparing the list with reasons for and against property protection.

3.9 Conclusion

The project's methodology started with a definition of the project given by AFAC. Once the project's objective of investigating whether property protection should be included in the BCA was developed, background research into the Productivity Commission Research Report, the BCA, and state/territory fire legislations was completed. Finding 6.4 and Recommendation 6.9 were then interpreted and were recognized as goal statements. Updated fire legislation was then constructed in order to compare state/territory legislation to the BCA.

Stakeholders were found from the ABCB website and then were limited. Interviews and fire chats were held in order to attain a better understanding of stakeholder opinions. Case studies and statistics were researched and results were found and analyzed. Finally a list of advantages of property protection was compiled, and an analysis was completed based on the advantages.

4 Results

4.1 Definition of Property Protection

The definition of property protection can be interpreted in several different ways. However, there is no clear definition of property protection in the BCA. Many individuals interpret property protection differently. Due to different interpretations, confusion arises between states and individuals which hinders national consistency. One example of a professional opinion is that of Acting Manager Community Infrastructure, Country Fire Authority's Marc Potter. Potter believes that property protection encompasses a range of areas including:

- Maximizing a business' ability to operate without major loss of earnings and customer base.
- Allowing community groups to continue to operate without loss of community spirit.
- Reducing the direct and indirect costs associated with a building fire (Potter, 2).

Marc Potter believes, "The key to developing an appropriate definition for property protection is to identify the community's expectations in relation to building fires." Potter believes that in order to have an appropriate level of property protection, categories of buildings should have increased fire safety systems. The categories include:

- Businesses that have a large market share within their industry
- Community important buildings
- Businesses that provide employment to a large number of community members (Potter, 2)

Potter recommends that the Australian Building Codes Board identify property protection as a valid community expectation and develop this position in conjunction with all key stakeholders (Potter, 3).

Another professional opinion is that of National Manager of Arup Fire, Peter Johnson. Johnson said, "My definition of Property Protection is the building and management systems provided in a facility to minimize the loss of asset value of the facility and its contents. It does not relate to life safety or provisions required for business continuity."

Another professional opinion is that of Graham Timms of Arup Fire. Timms said,

> My definition would be the building structure/fabric and the contents – as the 'property'. Business interruption, business closure, loss of employment, and etc. are not property protection by my definition – and these are not considered (by my understanding) by the BCA.

Timms also feels that the deemed to satisfy (DTS) provisions do provide inherent property protection even though the degree of property protection required by the performance requirements is the subject of hot debate. Timms goes on to say that the property protection provided by the DTS provisions would also minimize other losses (business interruption etc) but that is even less again when considering the performance requirements of the BCA. Finally Timms feels that property protection, business interruption, etc would be another objective for the client to have addressed by the fire engineer if desired, but it is not a focus of BCA compliance.

Because there is no clear definition of property protection in the BCA, there will continue to be debate and interpretation issues. Until this definition is set, the BCA will not support national consistency.

4.2 Statistics

It is shown in Figure 1 that the amount of fires in sprinklered buildings was far less then that of non sprinklered buildings. The reason for the difference is because all

building types are included in the statistics and the majority of fires in Australia are residential. Most residential buildings are not sprinklered in Australia. However, it is also shown that the number of undetermined fires is more than half of the total amount of all fires. Thus the database is not very complete with fire situations, but this does not preclude an analysis.

From Figure 1 it can be seen that the number of injuries in sprinklered buildings (170) is almost miniscule compared to the number of injuries in non sprinklered buildings (3,240). There were significantly less reported sprinklered fires however. Evaluating the injuries per fire helps to clear up the lopsided numbers. The number of injuries that occur in a sprinklered fire is 53 injuries per thousand fires, whereas the number of injuries that occur in a non sprinklered fire is 96 injuries per thousand fires. In the reported cases the statistics show that personnel injuries are almost half when sprinklers are in use.

From Figure 1 it is shown that the number of fatalities in sprinklered buildings (22) is again far less than the number of fatalities in non sprinklered buildings (199). Evaluating the fatalities per fire however, shows that 69 fatalities per ten thousand fires occur in a sprinklered building, whereas 59 fatalities per ten thousand fires occur in a non sprinklered building. The results show that the fatality rate happens to be less in non sprinklered buildings. This analysis however is not true. Again the reason for the skewed analysis is due to the majority of fires in Australia being residential and none of those buildings include sprinkler systems.

From Figure 1, the number of brigade personnel injuries per ten thousand fires in sprinklered buildings is 25, compared to 83 brigade personnel injuries per ten thousand fires in non sprinklered buildings. The results of this statistic show that brigade injuries

are far less in sprinklered buildings. From Figure 1 the number of brigade fatalities in the given years for sprinklered buildings and non sprinklered buildings is zero, so no analysis will be done for fire brigade personnel fatalities.

From Figure 2, the dollar loss per sprinkler fire is $74,381.94, whereas the dollar loss per non-sprinkler fire is $37,132.91. The statistic shows that the dollar loss per sprinkler fire is more than twice as much as the dollar loss per non sprinkler fire. The skewed analysis is due to the majority of sprinkler systems are in large, expensive buildings.

The statistics and results found suggest a skewed analysis. In the areas of civilian and fire brigade injuries, the statistics favor sprinklered buildings. In the areas of personnel fatalities and dollar loss the statistics favor non sprinklered buildings. Many unknown factors go into the statistics which may be why the analysis was skewed. When it comes to undetermined fires, there is no way to know whether or not the fires were sprinklered or not. The statistics exclude incendiary fires which may add up to a great deal of fires, or they may add up to hardly any fires at all. The majority of all fires occur in residential housing. No residential homes have sprinklers. Also when $37,000 damage is done in a non-sprinklered fire, it could be half a home, rather than a room in an office building. Also the dollar loss might be higher in sprinklered fires because the sprinklers are put in larger more expensive buildings, such as high rise office buildings. The dollar loss is also usually a field estimate done by a fire official that just assesses the situation and casts his best judgment which may or may not be close to the actual cost to fix the damage. The sprinklers most likely prevent a higher dollar loss. For example the fire in Madrid would have had substantially less dollar loss if there had been sprinklers (CNN;

Elkin). Instead the building was not sprinklered and damages totaled over €80 million in damages. Deaths might be greater in sprinklered buildings because they are normally large buildings and the means of escape are generally further apart than residential homes for example.

Due to the unknown factors (non-reported fires, not all brigades reporting, etc.) it is easy to see that a fair and accurate analysis of the statistics is a challenge. The statistics show that injuries will be less in sprinklered buildings, but fatalities will be greater and the dollar loss will be greater.

4.3 Case Studies

4.3.1.1 School Fires

Fires in schools can be severe and can be a huge inconvenience to a community. The risks that school fires pose to life safety are quite low, but the risks to property can be significant. As in the Cowes Primary School fire, the total cost of the building damage, building contents, and clean up bill came to $2.24 million. According to Clancy's paper the approximate cost of putting in a sprinkler system into a 50m x 40m building is about $125,000. He also says the effectiveness of sprinklers alone in buildings is about 64%. When using that effectiveness on the total cost of the Cowes fire, it would bring the total cost down to about $806,000. The savings from that would be over $1.4 million, making the $125,000 sprinkler system well worth it. In the case of Cowes, the sprinkler system would have been worth the cost, but that is just one fire, and it also does not include the maintenance fees. The question now is whether or not enough large school fires like Cowes happens enough to invest in property protection. As stated before on average a school fire causing more than one million dollars damage occurs every two weeks in

Australia. That means about 26 fires costing over $1 million occurs every year in Australia. In Victoria alone there are 2,317 schools. To say confidently that investing every school in the country with sprinklers would be worth the cost is quite difficult. With the numbers from Clancy's paper, the savings created by installing sprinklers into schools seems miniscule compared to the large projected annual expenditure (in Victoria). Although in Clancy's paper it is unknown just how much he includes in his term "building assets" as he does not explain if the assets are all contents in the building such as furniture, books, and computers. Both papers do agree that there are some indirect or ancillary costs that are difficult to quantify. Indirect costs such as distress to a child or the overtime pay to the firefighters are both examples where it is hard to quantify the cost. Knowing that a large fire in a particular school building will happen, it is easy to say a sprinkler system is worth the cost. However, there are too many schools, many of which will not have fires in their whole existence. The Cowes Primary School was established in 1874, and did not have a significant fire till 2003. Spending millions of dollars per state to assure every one of Australia's schools will be better protected does not seem cost-effective (Clancy; Potter).

4.3.2 Hostel Fires

Along with school fires, hostel fires have brought much attention to Australia. The comments from the Childers fire (mentioned in Literature Review) show that the hostel in Childers was not safe for occupants. Although it should not be necessary to have all buildings protected from arson attacks, the building should be safe enough to exit if one does occur. Along with safe exiting, some property protection should be looked at, whether it is sprinklers, smoke and movement detectors, or extra fire extinguishers. Many

hostels are aged and may not be cost-effective to retrofit with automated sprinkler systems, though some efforts to increase property protection should be made. Retrofitting hostels with sprinkler systems, or requiring sprinkler systems into new hostels should be looked at with more statistical data to see if it is cost-effective. Further laws and regulations should be considered to better protect the lives of occupants in hostels throughout Australia.

4.3.3 Windsor Fire

Mentioned in the literature review is the Windsor Building Fire. The fire caused tremendous direct and indirect costs. The fire showed that property protection is very important, and could potentially save millions of dollars. The fact that the U.S. association of sprinkler systems claim 90 percent of fires are put out by at least four sprinklers shows the Windsor Building could have been saved with sprinklers (Elkin). If the Windsor Building had a sprinkler system on the 21st and 22nd floors, the incident resulting in several millions dollars may have been prevented. So in Australia should all skyscrapers have sprinklers installed? Well the BCA states that all buildings over 25 meters are to have sprinklers installed. No problem then right? Not necessarily, as builders have gotten away from this rule in medium sized office buildings by constructing them to be just less than 25 meters (up to 24.9 meters). A 24 meter building could collapse and cause some significant damage to a community. Some damage it could cause would be to adjoining property, which in the BCA is supposed to be protected. A 24 meter 5 storey building could contain several companies and hundreds of workers, and if it were to burn down, would cost those affected greatly.

4.4 Issues with BCA concerning property protection

4.4.1 Property Protection

The main advantage of including property protection in the BCA is protecting property. With increased property protection devices such as sprinkler systems, the risk of fire spreading beyond the origin will be reduced. If a building has property protection requirements, the chances of it surviving a fire are much higher. If a building survives a fire rather than collapsing, this will save the owner/occupier much more money than the owner/occupier spent on protecting the property in the first place. When including sprinklers in a building design, other fire safety factors can be left out. Different things such as fire windows, doors, or curtains can be avoided if automatic sprinklers are employed. How much can be saved from this, and how much extra fire equipment is no longer necessary has not yet been calculated. A major argument against inserting property protection explicitly in the BCA is the overwhelming monetary cost. This is why it is so important to see which aspects of life safety already in the BCA are actually protecting property. If for example when protecting life, 60% of property is already being protected by the BCA, then including explicit property protection objective into the BCA will be 60% cheaper than anticipated by building designers.

It is cheaper to fight a fire in a sprinklered building. Fire brigades use less resources and manpower on fires that have sprinklers. This is another thing that needs to be quantified to see how many resources would be saved and how much money would be saved by cutting back those resources (Gilman, White, Woodward). Having automatic sprinkler systems in a building can suppress a fire and allow for longer distances to exits hence encouraging more innovative building designs. Fire brigades can meet the

requirements of their legislation and save property much more effectively if there are sprinklers in buildings.

Although similar statistics are not properly analyzed for Australia, New Zealand has made a comparison dealing with the correlation between sprinklered and non-sprinklered buildings. It was calculated that significant property damage (more than 20%) occurred in structure fires only 12% of the time if the building was sprinklered, and 46% of the time if the building was non-sprinklered. In New Zealand, nearly half of the structure fires that occur in buildings that are non-sprinklered lead to an excess of 20% of the building damaged (Challands). An example of this is a fire which occurred in a shopping center in August 2004 in South Australia. There was an estimated $20 million in fire damage to the non-sprinklered section of the shopping center. The operation of one or two sprinkler heads would have no doubt contained and extinguished the fire resulting in minor fire/water damage (Fisher).

4.4.2 Fire Fighter Life Safety

Another important advantage to including property protection is fire fighter safety. In Australia, deaths of fire fighters in action are very low according to Figure 1. Figure 1 shows that fire fighter injuries are lower in sprinklered buildings. Therefore, including property protection objectives into the Building Code would in fact reduce the risk of injury and perhaps death by even more. Fire fighters will have a better chance of safely putting out a fire if they are going into a building already equipped with fire fighting methods. If property protection objectives were included in the BCA, the fire brigades would be extinguishing fires in buildings which were built to coincide with fire authorities' legislation. The building would be build with property protection in mind,

and the fire brigades would put the fire out with property protection in mind; therefore it would become much safer for fire fighters to fight fires.

With the addition of property protection, it would coincidently increase the amount of life safety. An example of this is the additional life safety due to the use of sprinkler systems as shown in Figure 1. Also, no more than three occupants have died in a fully sprinklered building where the system was properly designed for the hazard, and functioning, anywhere in the world (Barnett).

As stated above, Australian fire fighter deaths are rare. According to Figure 1, fire injuries are rare also. In monetary terms, the cost of a fire fighters life is approximately $2-3 million (Wall Street Journal), which clearly does not offset the price of including explicit property protection objectives into the BCA. To sprinkler one single new building of 4,000m^2, the cost is approximately $140,000-$260,000. Granted a fire fighters life is worth more than this approximation, this is only one small building in Australia. The cost of a fire fighter's life would be multiplied by the amount of fire fighter deaths which according to Figure 1 is zero from 1997 to 2002. The sprinkler cost approximation would be multiplied several times to compensate for each building. In the end at worst case scenario in this example, $260,000 would be multiplied by however many buildings of that size were build from 1997-2002. That dollar amount would be compared to the value of fire fighters lives lost from 1997-2002 which is zero. The factor that is not included when calculating the cost of fire fighters safety is how much it costs to hospitalize injured fire fighters, and train replacements. Hospital bills could add up to a substantial amount but at this point it can not be argued either way.

The main fire fighter safety issue comes into play when community importance is taken into account. When a fire fighter or several fire fighters are injured or killed it has effects on the community. Community anguish can not be measured nor can emotional trauma to families of fire fighters. Until a dollar amount can be applied to those concerns, a strictly monetary approach to making property protection an explicit objective of the BCA using fire fighter injuries/lives as the issue must be done with caution.

The fact that very few fire fighters have been injured in fires does not mean that it could not happen. An example of this occurred in Massachusetts, United States of America. On December 3, 1999, six fire fighters died in a Cold Storage Facility in Worcester (Cygnus Business Media). Prior to this event, it had been about 40 years since a fire fighter was killed on duty. The incident affected the community greatly as evidenced by the 10,000 civilians and 30,000 fire fighters world wide who attended their memorial service. It is unacceptable to overanalyze the statistics and say that just because it has not been occurring that it could not occur. One must take into account all direct and indirect costs before drawing a conclusion. Also one must keep in mind that quantifying indirect costs have not done as part of this report nor reported in the literature.

4.4.3 Unemployment

As well as helping to protect fire fighters, adding property protection to the BCA would create a number of jobs in the building industry. With more safety installations to be done, more workers are needed to install sprinklers, fire doors, air handling systems, smoke venting systems, fire mains and hydrants, fire dampers, fire shutters, etc. Taking into account the booming building industry of Australia these jobs would help to boost the economy. Not only would it help the building industry, but also the fire protection

industry. More fire protection engineers would be needed to inspect buildings and more fire protection products would be needed for building construction.

Even though adding property protection into the BCA would create more jobs in the fire protection industry it may reduce the number of jobs overall. The major reason for a reduction in jobs is the monetary cost of property protection. When companies are forced to incorporate property protection components such as sprinkler systems into their buildings, the companies will have less money to spend on factories and office spaces. Spending more money may lead to lay-offs therefore reducing the amount of jobs available. If property protection aspects were included in residential housing the costs of housing might rise because building costs would go up. How much this increase in cost will be is unknown at this point in time. Is the price of including property protection into residential housing going to hurt the industry and to force people to be homeless? Will the extra amount of money owners are required to spend to protect their property be significant enough to cause lay-offs? These are questions that have yet to be answered and more research needs to be done to make a case on either side of these issues.

4.4.4 Environment

A concern of various fire authorities is that of environmental protection (Thom). As a fire burns, the fumes of the burning building pollute the environment. Water from fire brigade's hoses can run off and pollute surrounding bodies of water. Also, after a fire, the issue of clean up comes into play. Almost all of the materials that went into the building are ruined. The earth has a limited number of resources that need to be conserved and they are destroyed when a building is destroyed. However, to what extent building fires are polluting the air and water has not yet been quantified; nor has exactly

how many resources are being used and the cost of those resources. Whether or not there is a substantial amount of pollution and destruction to the environment to justify explicit property protection objectives in the BCA can not be determined at this time.

4.4.5 Building Functionality

Another advantage to having property protection in the BCA is that it would increase the functionality of a building. For example if a company built a new building to make a product such as ball bearings, there might not be a need for sprinklers. However if the company went out of business and another company such as a manufacturer of chemicals came in, the building would have to be significantly renovated in order to add sprinklers. The functionality of a building is thus increased when property protection is added from the start.

4.4.6 National Consistency

Fire fighter safety provisions already exist in the BCA such as section CO1 of the BCA which states that one of the main objectives of the BCA is to: “facilitate the role of emergency services personnel, such as the fire brigade, if it becomes necessary for them to undertake such operations as fire-fighting and search and rescue;” Aside from including fire fighter safety the BCA also has property protection aspects such as in section CP2 (iv): “A building must have elements which will, to the degree necessary, avoid the spread of fire - (iv) in a building” An issue with the BCA that is almost universally agreed upon is with national consistency. The above objective is one of the main issues. The issue of fire fighter life safety should not even be an issue when a designer reads this statement. Upon first read, it would seem that this objective alone

would be enough to protect fire fighters. The problem surfaces because this statement is too vague and States develop their own interpretations of this and the performance-based BCA allows developers to do so as well. If the BCA gave a guideline to these terms rather then leaving them open, it would improve upon natural consistency (Australian Building Code Board).

On the same topic of understanding terminology, various other sections in the BCA are open to interpretation. Section CF1 (b) "a building is to be constructed to maintain structural stability during fire to allow for fire brigade intervention." This statement would imply that if a building collapses while fire brigades are "intervening" then the building did not meet the performance requirements of the BCA when it was first built. A similar statement is made again with section CF2 (b) "a building is to be provided with safeguards to prevent fire spread to allow for fire brigade intervention." The problem is not in the statements themselves. The problem lies in the fact that there is no definition for "fire brigade intervention". States and engineers following the fire engineering guideline can reach their own conclusions as to what fire brigade intervention actually is.

> The confusion is manifested by the words *maintain structural stability during a fire* in CP1 and *avoid the spread of fire ...(c) between buildings; and (d) in a building* in CP2. Does this mean *maintain structural stability for the duration of the fire* (CP1) irrespective of whether the building has been evacuated and occupants are safe, or just for the period of time required for evacuation? Similarly, does *fire cannot spread within or between buildings* (CP2) mean for the duration of the fire, or just whilst occupants are evacuating? (Timms, Johnson)

Another term that has caused a fair bit of dispute is the term "occupant." Sections of the BCA such as CF1 (A) state: "A building is to be constructed to maintain structural stability during fire to allow occupants time to evacuate safely." Once a fire fighter enters

a building, is he then considered an occupant? If so, then the same level of protection should be in place for him. Some may argue that the BCA protects an occupant when evacuating a building. The statement does not protect an occupant when entering a burning building. Section CF2 (a) again states: “A building is to be provided with safeguards to prevent fire spread so that occupants have time to evacuate safely without being overcome by the effects of fire. Different definitions of occupant can produce different results when determining how much protection is needed for fire fighters (Australian Building Code Board).

4.5 National Database

The national database was used as the primary source for collecting statistics. Referring to Figure 3, it appears that most categories and information are available for onsite inspection to be made. Thus the data should be collected and recorded correctly and the national database should be accurate for the items already listed. However, the current national database is not completely accurate.

The first problem lies in the fact that individuals who fill out reports on site do not do a very thorough job (Hook). Usually the individual reporting is a fire brigade official, who often guesstimates on items (such as dollar value of property lost to fire), and the information from the job site is not as accurate as it should be (Thom).

Another reason why the national database is not as accurate as it should be is because not all of the fire brigades report. If more fire brigades reported to the national database a more complete database would then be achieved. Also, the database is developed mainly to include structural fires and therefore wildfires are not very well accounted for. All of the reasons make for an incomplete national database.

The final two reasons the database is not as accurate is because it does not include enough data and the data is not current. The current database is not thorough. More items should be added to the fire brigade table as well as the database. Also the data that is available from the national database only is from 2002 and before. It does not include recent fires and statistical data.

Due to the incomplete database and some poor fire brigade reporting, it is easy to develop a skewed analysis of the available statistics. If the national database is more complete than it is today, and a more accurate database is achieved, future decisions based on statistics will carry much more influence.

5 Conclusion

Based on the results, a conclusion whether or not explicit property protection should be included in the BCA cannot be made at this time. There are many factors that have led to this conclusion. The first is that there are not an overwhelming number of stakeholders that support one side of the issue. The key stakeholders considered in this project were divided on both sides of the issue. Second, the statistics that were gathered are not in full support of either side and some of the statistics show apparently skewed results. When the project team presented a PowerPoint to the Built Environment Subgroup, many present were surprised by the analysis of the statistics. The project team explained to the Subgroup that the analysis was mostly skewed because of the number of residential fires included. Without more detailed and confirmed statistics, a conclusion cannot be made whether or not to change the current BCA's objectives. The project team also agrees that in order to draw a clear conclusion, more databases need to be consulted.

The case studies that were found also support both sides of the argument. As mentioned by Graeme Thom of the Built Environment Subgroup, someone could show Clancy, Satyen, and Thomas' paper to a head government official and they would come to an easy conclusion that property protection is not needed in school buildings (Thom). Then on the other side of the issue, there are papers such as Mark Potter's that support property protection, but do not have enough detailed analysis of costs to persuade someone to change the current BCA. Without enough evidence that property protection should be explicitly put into the BCA, a conclusion to do so cannot be made.

Another item to address is that the BCA already contains implicit property protection. Is this enough? To answer this question, analyses must be made on buildings that contain implicit property protection versus buildings that do not contain property protection.

Cost is another item that has not been quantified to support either side of the issue. The costs of fires can be substantial. The costs of including an automatic sprinkler system in a building can also be substantial. It is also too difficult to quantify the value of all indirect costs. There is no set value on certain indirect costs, and possibly never will be. The direct costs of fire can also be inaccurate when they are estimated by a fire official. In the paper "Why is property protection so important to the fire services?" it states the need to define the "total cost of fire (Potter)." Should the total cost of fire include all direct, indirect, and societal consequences? How can numerical values on indirect and societal consequences be obtained? Another value not easily obtained is that of environmental damage. How much environmental damage is done by a fire? Currently there are too many arguments on costs to come to a conclusion on explicitly including property protection in the BCA.

Along with total cost of fire, there are other terms that need to be defined. Some undefined terms in the BCA that create problems on forming a conclusion are "fire brigade intervention" and "occupant." The defining of these terms would create a clearer understanding of the BCA and increase national consistency.

Based on the stakeholder submissions, statistics, case studies, and undefined terms, a conclusion cannot currently be made. The differences between fire legislation and the building industry in Australia as represented by the BCA objectives is still very

much alive, and will most likely continue for some time. Without further detailed analysis, a conclusion will not be made at this time. The project team has developed some recommendations on how to reach a conclusion in the future.

6 Recommendation

As an outcome of the results, a proposal has been created. This proposal outlines the necessary steps needed in order to determine the amount of property protection, if any, that should be included in the BCA. It includes the recommendations that have been developed. The proposal being submitted is only a guideline for what could be done. This proposal could lead to further WPI Interactive Qualifying Projects.

This proposal contains short term and long term recommendations. The short term recommendations describe the items needed to gain more information about the issue. These recommendations are necessary for the determination as to whether or not the BCA should contain explicit property protection. The long term recommendation is more in depth and involves more planning and detailed implementation in order to be put in place. This recommendation would allow for more thorough analysis of the building code in the future. The recommendations include:

- Gather more information from current national database and interpret data
- Define terms in the BCA
- Collect and analyze more case studies
- Collect international data
- New/modified Australian National Database

The first short term recommendation is to gather more information from the current national database and carefully interpret it. As seen in Figure 3, some information is available. Qualified individuals need to take this information and analyze it appropriately. The major data element that needs to be compared with others is Block K25 – “sprinkler performance”. That block says how sprinklers performed and can then be cross-referenced with other blocks such as K36 – “Percent property saved due to fire fighter operations”. If data is recorded properly by qualified individuals, correlations such

as this one can be very effective in determining what the explicit objectives of the BCA should be.

Referencing Figure 3, Block K26 – “Factors degrading sprinkler effectiveness”, needs to be looked at closer. If a substantial amount of money is spent to install sprinkler systems in buildings, then it should be shown that they have a high level of effectiveness. If a closer analysis of this block shows that there are many factors that contribute to degrading sprinkler effectiveness and they occur often, then it may be determined that sprinklers are not reliable.

Figure 3 deals with fire fighting operations. An approach can be taken to combine the information in this figure as well as Figure 4 to determine the total cost of fire. A monetary comparison needs to be made to argue for/against property protection. Although many of the issues supporting property protection are difficult to quantify, an attempt must be made. The previously discussed figures address various resources used by the fire brigades to extinguish a fire. The cost of fire can more easily be determined with information like blocks K27 and K40 in Figure 3. These blocks tell people how many fire fighters were employed and how long they worked for. The value of these services can be attached and a comparison can be made. Figure 4 defines which specific methods are used to extinguish the fire and what resources were consumed. These items need to be included when determining the total cost of fire. Finally, there is a need to further analyze the blocks of importance mentioned in the literature review to develop an appropriate cost comparison.

Because some of the current analysis is skewed, for example the proportion of deaths in sprinklered versus non sprinklered buildings for all buildings, more data needs

to be collected and carefully and thoroughly analyzed. This step could provide insight as to how buildings have reacted to fires in the past. An alternate approach for gathering relevant data would be to conduct an analysis on state/territory databases and compare them rather than gathering national data as a whole.

The next short term recommendation is to look at the Building Code of Australia and find terms that need to be more clearly defined. The terms “to the degree necessary,” “occupant” and “fire brigade intervention” are just some examples of the wording used that is not clearly defined. If these items are defined in the future, it would increase national consistency. Depending on the way these terms are defined, this could also result in an increase in fire fighter safety and more implicit property protection.

The third short term recommendation is to collect and analyze more case studies in Australia to examine the results of fires and prevention measures. The case studies can be gathered to look at comparisons between similar types of buildings with and without items such as sprinkler systems. Multiple case studies can provide trends to support the statistics.

The final short term recommendation that should be done is to look at international information related to fires. If the statistics are not available in Australia, one might use international information to help determine whether or not explicit property protection should be included in the BCA. Taking a look at other countries’ building and fire codes as well as international codes, could also provide some insight for this subject.

The long term recommendation to help determine whether or not property protection should be included in the BCA is to create a new national statistics database or

update and fix the old database. The updated database can be used to collect more data from current fire incidents. Currently, minimal data is available from fires on a national level. The database that is available only contains information gathered from and before 2002. The database should include more specific details of all structural fire incidents as well as what is currently available. An updated national database could be an excellent way of collecting all fire data in one location.

A recommended resource for creating a new database or updating the old database is the National Fire Protection Association (NFPA). The section that deals with creation of a fire database is Standard 901. “This document describes and defines data elements and classifications used by many fire departments in the United States and other countries to describe fire damage potential and experience during incidents (NFPA 901, Chapter 1.1).” This source is recommended because it contains almost everything relating to fire incidents.

The statistical information gathered from an updated national database could lead to a review of the BCA as well as state and territorial legislations. Additionally, a new or updated national database could improve national consistency in relation to reporting fire incidents as well as dealing with fires and learning from past occurrences. A new/updated database could provide more updated statistics. After the creation/modification of the database, an analysis should be completed. This analysis should compare the affects of fires in different types of structures and determine if property protection is needed or if the BCA should remain as is.

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8 Appendix

8.1 Updated Fire Legislation

State/ Territory	Legislative base	Fire safety standards	Additional requirements for existing buildings	Type of enforcement
New South Wales	1) Environmental Planning and Assessment Act 1979 - Environmental Planning and Assessment Regulations 2000 (enables BCA) 2) Fire Brigades Act 1989 - Fire Brigades Regulation (charges) 2000 - Fire Brigades Regulation (general) 2003 3) Rural Fires Act 1997 - Rural Fire Regulation 2002	Uses the provisions of the Building Code of Australia as guidance on fire safety. Upgrades of existing building should, as near as possible, meet the BCA but this will not be achievable in all cases.	Orders may be served on a building owner to do non-structural rectification to achieve a level of fire safety. These orders are non-appealable when served by a NSWFB Officer.	Enforcement through the issue of orders, possible closure and procedures through the courts. Infringement notices can be served for breaches of fire safety.
Queensland	1) Fire Service and Rescue Act 1990 - Building Fire Safety Regulation 1991 - Fire and Rescue Service Regulation 2001 2) Building Act 1975 (enables BCA) - Building Fire and Safety Regulation 1991 - Standard Building Regulation 1993 - Building Regulation 2003 3) Integrated Planning Act 1997 - Integrated Planning Regulation 1998 - Planning and Environment Court Rules 1999 - Integrated Development Assessment System (IDAS)	New building constructed since 1992 must comply with the requirements of the BCA applicable at the time of construction. Buildings build between 1975 and 1992 must comply with the requirements of the Queensland Building Act 1975 and the Queensland Fire Safety Act 1974. Buildings built before 1974 must comply with the requirements imposed at the time of construction. All buildings must also comply with the requirements of the FRSA and the Building Fire Safety and Regulation. 1991. Uses the provisions of the Building Code of Australia as a guide for a standard to recommend buildings upgrade to for fire safety. Requirements for occupiers of buildings to maintain means of escape, prescribed fire safety installations, and have a fire and evacuation plan.	Yes if QFRS Officers believe a building, or part/elements of a building need to be upgraded this can be achieved by applying a section 69 notice to upgrade (this notice currently has no appeal provisions).	Enforcement through the issue of notices, including On the Spot Fines (OSF) possible closure and procedures through the courts.
South Australia	1) Development Act 1993 (enables BCA) - Development Regulations 1993 2) SA Metropolitan Fire Service Act 1936 3) Country Fire Act 1989	Uses the provisions of the Building Code of Australia as the standard for fire safety.	Yes. Building Fire Safety Committees under Section 71 of Development Act 1993 and SAMFS Act 1936.	Enforcement through the issue of BFSC Notices to upgrade fire safety or use of SAMFS Act to issue Rectification or Closure Order.

Fire Legislation Continued

Tasmania	1) Fire Service Act 1979 - General Fire Regulations 2000 2) Building Act 2000 (enables BCA) - Building Regulations 2004 3) Work Place Health and Safety Act 1995 - Regulations 1998	Calls up provisions of BCA plus those specified in the Tasmania appendix for all new building work. Report issued to building surveyor on suitability of fire safety requirements at building planning stage and again prior to occupancy. Both new and existing buildings required to maintain essential health and safety features and measures. Specified buildings such as those used for health care, school and accommodation are required to have an evacuation plan developed and approved by the Chief Officer. Authority to enter any building or land for the purposes of inspecting for fire safety compliance.	Applies to portable fire fighting equipment and fire detection and alarm systems in high risk buildings.	Enforcement through issue of notices and through the courts. Infringement notices or orders to vacate issued by local Government.
Victoria	1) Building Act 1993 (enables BCA) - Building Regulations 1994 2) CFA Act 1958 3) MFB Act 1958	High level of fire safety requirements at building stage and the regulations refer to the fire services and local government.	Especially for building with high risk to life from fire, including backpackers, boarding houses and hostels.	Infringement notices and procedures through the courts.
Western Australia	1) Fire Brigades Act 1942 - Fire Brigades Regulation 1943 2) Local Government Act (Miscellaneous Provisions) 1960 - Health (Public Buildings) Regulations 1992 - Building Regulations 1989 (enables BCA)	Uses the provisions of the Building Code of Australia as the standard for fire safety.	No	Enforcement through the issue of notices, possible closure and procedures through the courts.
Australian Capital Territory	1) Emergencies Act 2004 - Emergencies Regulation 2004 2) Building Act 2004 (enables BCA) - Building Regulation 2004	Uses the provisions of the Building Code of Australia as the standard for fire safety.	No	Enforcement through the issue of notices, possible closure and procedures through the courts.
Northern Territory	1) Fire and Emergency Act - Fire and Emergency Regulations 2004 2) Building Act 2004 (enables BCA) - Building Regulations 2004 3) Public Health Act 1997	Backpackers required to be licensed. Uses the provisions of the Building Code of Australia as the standard for fire safety.	No	Enforcement through the issue of notices, possible closure and procedures through the courts.

8.2 Primary Stakeholders

Primary Stake Holder	Include Property Protection in BCA		Comment
	Yes	No	
Association of Consulting Engineers Australia	X		Believes that national consistency is vital to meeting community expectations.
Fire Protection Association of Australia	X		Think that it should be fixed by using theories comparable to those contained in the international codes council guidelines.
Victorian Government	X		In addition, they believe that water efficiency, reuse of materials, and energy efficiency should also be considered.
Property Council of Australia	X		Property protection requirements added must be minimal. BCA should also address more environmental issues: "eco-efficiencies"
The National Fire Industry Association	X		Current BCA is bringing minimal level of safety which is not meeting community expectations.
ABCB Chairman		X	Just review issues in Buildings of Importance.
The Housing Industry Association		X	Puts pressure of changing codes on the fire brigades.
The Green Building Council	X		Advocates a nationally consistent code, say the best way to do it is through the ABCB.
The Air Conditioning and Mechanical Contractors Association		X	Supports the current performance-based code, says that it encourages innovative and unique engineering solutions.
The Fire Protection Association Australia	X		Recommends property protection based on the community importance of a building.
Master Builders Australia Incorporated		X	The ABCB should continue to concentrate on a nationally consistent code which meet the 10 mission statements and are cost-effective.
Standards Australia		X	Believes that they should consolidate efforts with the ABCB for a national consistency, property protection should not be a primary objective.
Australasian Fire Authorities Council	X		In support of environmental protection, fire fighter safety, and community sustainability.
South Australian Government	X		Escalating insurance premiums and severe social dislocation due to loss of large buildings.
Insurance Council Australia	X		
Queensland Government	X		Notes that fire authorities objectives are state laws that need to be obeyed despite the BCA being a lesser standard in property protection
Australian Institute of Building	X		Biggest concern is the durability of buildings and buildings need to stand for more than 20 years.

8.3 Questions to Interviewees

a. If property protection was incorporated in the BCA, what kind of affect would it have on the building industry?
b. What level of property protection should be included in the BCA if any?
c. Should the BCA include property protection or should the state acts include it? Why?
d. Why should we change the BCA rather than changing the fire brigade legislations?
e. In the United States, building codes are “deemed to satisfy” or “recipe” codes and it does not seem to affect buildings in the U.S., why is it such an issue here?
f. Explain national consistency. Will adding property protection to the BCA help or hinder national consistency?
g. Many say that including property protection standards would set the building industry back horribly and cost the industry millions. How would you respond to that?

8.4 Extent of Flame Damage

EXTENT OF DAMAGE

The following three Items provide a means of measuring the extent of damage to the building from fire, smoke and extinguishment activities.

The classification that defines the largest area of the building is to be recorded. For example, a fire in a single story building that destroys the building would be classified as *confined to the structure of origin*, not *confined to the story of origin*.

⚠ NOTE: *Extended Beyond the Structure of Origin* is only recorded when the flame, smoke or water damage spreads to other property external to the structure.

K20 EXTENT OF FLAME DAMAGE

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

20.1 Definition

The extent of the area burned or charred by flame impingement.

20.2 Purpose

This Item can be used to measure the magnitude and severity of the fire. It also can measure the effectiveness of:

- built-in fire protection features and fire suppression equipment, and
- the fire suppression force relative to the conditions faced.

20.3 Implementation

The area of actual flame impingement is sought. *Browned* and similar areas scorched by heat but not attacked by flame are recorded in **Extent of Smoke Damage**.

Table K20 details the codes for the extent of flame damage for this field. Select the most appropriate code from the table and complete the entry.

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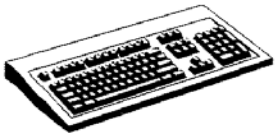
8.5 Extent of Flame Damage Continued

Table K20 Extent of Flame Damage Codes

CODE	FLAME DAMAGE
1	Confined to the object of origin
2	Confined to part of room or area of origin
3	Confined to room of origin
4	Confined to fire compartment of origin
5	Confined to the floor of origin
6	Confined to structure of origin
7	Extended beyond structure of origin
8	No damage of this type/not applicable
9	Extent of damage not classified above
0	Extent of damage undetermined
Blank	Extent of flame damage not reported

20.4 Computer Entry



Field - numeric
Length - 1
Default - blank

K 20	Extent of Flame Damage

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8.6 Extent of Smoke and Heat Damage

K21 EXTENT OF SMOKE AND HEAT DAMAGE

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

21.1 Definition

The extent of the smoke and heat scorch or *browned* damage to the structure.

21.2 Purpose

This Item provides another means to asses the severity of the fire and the effectiveness of compartmentation and fire resistance requirements. It can also measure the fire service's effectiveness in limiting this type of damage.

21.3 Implementation

Record the extent of smoke and heat scorch to the building.

Table K21 details the codes for heat and smoke damage for this field. Select the most appropriate code from the table and complete the entry.

Table K21 Smoke and Heat Damage Codes

CODE	SMOKE/HEAT DAMAGE
1	Confined to the object of origin
2	Confined to part of room or area of origin
3	Confined to room of origin
4	Confined to fire compartment of origin
5	Confined to the floor of origin
6	Confined to structure of origin
7	Extended beyond structure of origin
8	No damage of this type/not applicable
9	Extent of damage not classified above
0	Extent of damage undetermined
Blank	Extent of flame damage not reported

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8.7 Extent of Extinguishing Medium Damage

K22 EXTENT OF EXTINGUISHING MEDIUM DAMAGE

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

22.1 Definition

The extent of the damage to the building and contents or beyond caused by water or other extinguishing agents.

22.2 Purpose

This Item provides a means of assessing the effectiveness of extinguishing medium application and clean up measures taken.

22.3 Implementation

Record the extent of extinguishing medium damage to the building. Table K22 details the codes for the extent of extinguishing medium damage for this field. Select the most appropriate code from the table and complete the entry.

Table K22 Extent of Extinguishing Medium Damage Codes

CODE	EXTINGUISHING MEDIUM DAMAGE
1	Confined to the object of origin
2	Confined to part of room or area of origin
3	Confined to room of origin
4	Confined to fire compartment of origin
5	Confined to the floor of origin
6	Confined to structure of origin
7	Extended beyond structure of origin
8	No damage of this type/ not applicable
9	Extent of damage not classified above
0	Extent of damage undetermined
Blank	Extent of flame damage not reported

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8.8 Volume of Fire Damage in Cubic Meters

K23 VOLUME OF FIRE DAMAGE IN CUBIC METRES

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

23.1 Definition.

The volume of damage to the structure by flame and heat, in cubic metres (m^3).

23.2 Purpose

This information provides a measure of the severity of the fire and the amount of damage occurring due to flame and heat. It can also measure the effectiveness of building design, installed protection and firefighting operations.

23.3 Implementation

Record the volume, to the nearest cubic metre, of that part of the structure that is damaged by flame and heat i.e. where charring and/or heat scorching has occurred. Ignore smoke damage. Where the damage is less than 1 m^3, record 1 m, if no damage of this type has occurred, record zero.

Example 1

A fire occurs in a kitchen which results in charring and heat scorching to kitchen cupboards and the wall and ceiling. The damage extends across 2 m of the cupboards, a further 3 m up the wall to the ceiling and out from the wall approximately 1 m.

The volume of damage would be recorded as 6 m^3 in this case - 2 x 3 x 1 m.

Example 2

A storage shed, 6 by 10 m and 4 m high is completely destroyed by fire. The volume of fire damage would be recorded as 240 m^3 - 6 x 10 x 4 m.

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8.9 Factors Degrading Sprinkler Effectiveness

K26 FACTORS DEGRADING SPRINKLER EFFECTIVENESS

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

26.1 Definition

Those factors that adversely effect sprinkler performance.

26.2 Purpose

To identify those factors that cause sprinkler systems to fail to operate within design specifications.

26.3 Implementation

Table K26 details the codes for the factors degrading sprinkler effectiveness for this field. Select the most appropriate code from the table and complete the entry.

Table K26 Sprinkler Performance Codes

CODE	SPRINKLER PERFORMANCE
1	High severity of fire
2	System disconnected
3	Inadequate water supply (at the time of fire)
4	Obstruction of system
5	Faulty component in system
6	Premature closure of valve
7	Fire started in un-sprinkled area
8	Not applicable
9	Factor degrading sprinkler effectiveness not classified above
0	Factor degrading sprinkler effectiveness undetermined
Blank	Factor degrading sprinkler effectiveness not reported

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8.10 Sprinkler Performance

K25 SPRINKLER PERFORMANCE

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

25.1 Definition

The status and operation of sprinklers in the structure involved in fire.

25.2 Purpose

To identify those premises that have sprinklers installed; their status at the time of the incident and their effectiveness in controlling the fire.

25.3 Implementation

Table K25 details the codes for the sprinkler performance for this field. Select the most appropriate code from the table and complete the entry.

Table K25 Sprinkler Performance Codes

CODE	SPRINKLERS
11	Extinguished fire
12	Prevented spread, but did not extinguish
13	Did not prevent spread
19	Equipment operated, performance not classified above
21	Equipment should have operated but did not
31	Equipment present but fire too small to require operation
80	No equipment present in room or space of fire origin
99	Performance of equipment not classified above
90	Sprinkler performance; insufficient information available to classify further
00	Performance of equipment undetermined
Blank	Sprinkler performance not reported

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8.11 Number of Heads Operated

K27 NUMBER OF HEADS OPERATED

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings		
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second				
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke						
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel						
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)						
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated						
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed						
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival						
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time						
K 40	Extinguishment Time	K 41	Compartment Size										

27.1 Definition

The number of sprinkler heads that operated during the fire.

27.2 Purpose

This information can indicate the magnitude and intensity of the fire and the suitability of the protection installed.

27.3 Implementation

Record the actual number of heads that operated. Record **0** where no heads operated, **99** where that number or more operated.

27.4 Computer Entry

Field - numeric
Length - 2
Default - blank

K 27	Number of Heads Operated

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8.12 Number of Hydrant Used by Non-Fire Personnel

K34 NUMBER OF HYDRANTS USED BY NON-FIRE PERSONNEL

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

34.1 Definition

Number of hydrants used by non-fire personnel

34.2 Purpose

This Item provides information on the fire fighting equipment installed and its use by occupants.

34.3 Implementation

Record number used.

34.4 Computer Entry

Field - numeric
Length - 2
Default - blank

K 34	No. of Hydrants Used by Non Fire Personnel

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8.13 Estimated Percentage of Property Involved on Arrival

K35 ESTIMATED PERCENTAGE OF PROPERTY INVOLVED ON ARRIVAL

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

35.1 Definition

The reporting officers estimation of the percentage of the structure involved on arrival of the first Reporting Authority unit.

35.2 Purpose

This information is used as an indication of the property saved and the effectiveness of fire fighting operations.

35.3 Implementation

Record percentage.

35.4 Computer Entry

Field - numeric
Length - 3
Default - blank

K 35	Estimated % of Property Involved on Arrival

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8.14 Percentage of Property Saved Due to Fire Fighting Operations

K36 ESTIMATED PERCENTAGE OF PROPERTY SAVED DUE TO FIRE FIGHTING OPERATIONS

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

36.1 Definition

The percentage of the property saved from fire that can be attributed to fire fighting operations and salvage work carried out. When calculating the percentage of property saved, use area of property not the value.

36.2 Purpose

This information is used only as an indication of the property saved by fire fighting operations.

36.3 Implementation

The reporting officer should consider the percentage of the property that would have been destroyed by the fire should no fire fighting have taken place and from this, deduct the percentage of damage occurring. The resulting amount will be the percentage of the property saved.

36.4 Computer Entry

Field - numeric
Length - 3
Default - blank

K 36	Estimated % of Property saved due to Fire Fighting Operations

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8.15 Attack Time

K38 ATTACK TIME

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

38.1 Definition

The time the initial fire fighting attack force first places extinguished medium on the fire.

38.2 Purpose

Performance-based building codes require sufficient structural adequacy for, amongst other things, the operation of fire services in the event of a fire. The determination of this structural adequacy is partly based on the severity of certain design fires and the time taken for a fire service to deal with such a fire. Consequently, information needs to be gathered on fire fighting operations time in relation to fire severity. A considerable amount of time can be lost after arrival at a fire before the fire is actually located and sufficient equipment is brought to bear on the fire. A fire can grow significantly in this time. Therefore, it is important to know at what point an actual attack was made on the fire. This, and other information such as an estimate of fire severity and extinguishment time enables a determination of appropriate structural adequacy components of fire resistance level at the design stage of building.

38.3 Implementation

Record the time, using a 24-hour clock, at which the first firefighters directly attack the fire with water (or other extinguishing medium).

38.4 Computer Entry

Field - numeric
Length - 6 hhmmss
Accept up to 240000 and 999999

K 38	Attack Time

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8.16 Fire Area at Attack Time

K39 FIRE AREA AT ATTACK TIME

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time	K 41	Compartment Size								

39.1 Definition

The floor area actually involved in flaming combustion as found at the time of direct fire attack.

39.2 Purpose

An estimate of the area involved in flaming combustion together with information on the types and forms of material ignited allows an estimate of the fire severity in terms of its heat output. Knowledge of this severity can be compared with the time from attack to extinguishment which is useful in setting requirements under performance-based building codes.

39.3 Implementation

An estimate of the area (in metres) of the fire base. If more than one fire, the value reported should be the sum of all areas. When a fire is confined to a single item, the dimensions of the item would normally be appropriate if the item is fully involved. For example, a single mattress alight would be typically 2 m x 1 m = 2 m. The fire area for a post-flashover room fire would be the floor area of the room unless the fire has spread beyond the room. If a building is completely involved in fire, then the appropriate fire area is given by the dimensions of the building.

39.4 Computer Entry

Field - numeric
Length - 7
Default - blank

K 39	Fire Area at Attack Time

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8.17 Extinguishment Time

K40 EXTINGUISHMENT TIME

K 1	Structure Type	K 2	Construction Type	K 3	Building Dimensions	K 4	Number of Levels	K 5	Wall Linings	K 6	Ceiling Linings
K 7	Level of Fire Origin	K 8	Type of Material Ignited Second	K 9	Type of Material Ignited Third	K 10	Type of Material Ignited Fourth	K 11	Form of Material Ignited Second		
K 12	Form of Material Ignited Third	K 13	Form of Material Ignited Fourth	K 14	Type of Material Contributing Most of Fire Intensity	K 15	Type of Material Generating Most Smoke				
K 16	Form of Material Contributing Most to Fire Intensity	K 17	Form of Material Generating Most Smoke	K 18	Factor Contributing to Flame Spread	K 19	Avenue of Smoke Travel				
K 20	Extent of Flame Damage	K 21	Extent of Smoke and Heat Damage	K 22	Extent of Extinguishing Medium Damage	K 23	Volume of Fire Damage (cubic metres)				
K 24	Detector Performance	K 25	Sprinkler Performance	K 26	Factors Degrading Sprinkler Effectiveness	K 27	Number of Heads Operated				
K 28	Air Handling System Performance	K 29	Extinguishers Installed	K 30	No. Extinguishers Used by Non Fire Personnel	K 31	Hose Reels Installed				
K 32	No. Hose Reels Used by Non Fire Personnel	K 33	Hydrants Installed	K 34	No. of Hydrants Used by Non Fire Personnel	K 35	Estimated % of Property Involved on Arrival				
K 36	% Property Saved Due to Fire Fighting Operations	K 37	Building Code of Australia Classifications	K 38	Attack Time	K 39	Fire Area at Attack Time				
K 40	Extinguishment Time					K 41	Compartment Size				

40.1 Definition

The time at which the fire has been reduced to a smouldering stage where its continued minor heat output poses no further threat to the structural adequacy of the building.

40.2 Purpose

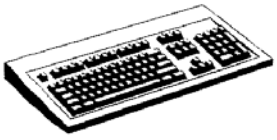
This time is used to determine the time taken for firefighters operations up to the point at which the fire is essentially extinguished i.e. the structure is in no danger of further collapse from any additional heat load. This time is then analysed in conjunction with such factors as fire size and the size and nature of the building. Such information is important in determining the amount of time the fire service requires to safely carry out its functions, so that adequate provisions for structural adequacy can be incorporated at the design stage of a building.

For a particular incident, the extinguishment time may be the same as the stop time, duties completed time , or both; however in general, it will lie somewhere between the stop time and duties completed time.

40.3 Implementation

Record the time at which the fire was extinguished using a 24 hour clock.

40.4 Computer Entry



Field - numeric
Length - 6 hhmmss
Accept up to 240000 and 999999

K 40	Extinguishment Time

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8.18 Major Fire Fighting Force

The following Items provide an overall view of the manner in which extinguishment was accomplished and are only required when an uncontrolled fire occurs.

F1 MAJOR FIRE FIGHTING FORCE

F 1	Major Fire Fighting Force	F 2	Initial Attack	F 3	Method of Initial Attack by Reporting Authority	F 4	Method of Initial Attack by Other Persons
F 5	Major Method of Extinguishment	F 6	Major Extinguishing Medium	F 7	Number of Portable Extinguishers Used	F 8	Number of Portable Pumps Used
F 9	Number of Hose Reels Used	F 10	No. of 35-59 mm Delivery Lines Used	F 11	No. of 60-70 mm Delivery Lines Used	F 12	Number of Monitors Used
F 13	Amount of Foam Concentrate Used (L)	F 14	Amount Dry Chemical Used (kgs)	F 15	Water Supply	F 16	Water Supply Method

1.1 Definition

The authority or class of people who were primarily responsible for extinguishing the fire.

1.2 Purpose

To classify the personnel principally involved in extinguishing the fire which in turn assists in determining personnel and resources development and allocation.

1.3 Implementation

Record the personnel primarily involved in extinguishing the fire or who contributed most to the extinguishment.

Fire service brigades\units includes all brigades\units of authorities whose primary function is the control and extinguishment of fire.

Fire brigades\units are, for the purposes of this Item, classified according to their staffing when responded to the incident. The following codes are to be used when an Authority brigade\unit is the major fire fighting force, the specific code depending on the status of the brigade/unit at the time:

(a) **Code 11 Permanent full time** - a brigade/unit that is comprised of permanent officers and members. This unit does not rely on the attendance of the auxiliary firefighters to make up the full strength of the unit.

(b) **Code 12 Composite brigade/unit** - a brigade/unit that has a permanent officer and/or permanent member/s attached part of the time along with auxiliary firefighters and the permanent officer and/or permanent member/s has responded to the incident. This unit relies on the attendance of the auxiliary firefighters to make up the full strength of the unit.

(c) **Code 13 Volunteer (Retained) brigade/unit** - a brigade/unit that has responded with retained (paid) part-time members only.

(d) **Code 14 Volunteer (Non-Retained)** - a brigade/unit that has responded with non-retained (non-paid) members only.

Table F1 details the codes for the fire fighting force for this field. Select the most appropriate code from the table and complete the entry.

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8.19 Major Fire Fighting Force

Table F1 Fire Fighting Force Codes

CODE	FIRE FIGHTING FORCE
11	Permanent, full time
12	Composite brigade/unit. A unit comprising permanent and retained or non-retained auxiliaries
13	Volunteer, (retained) brigade/unit
14	Volunteer, (non-retained) brigade/unit
19	Fire brigade/unit, not classified above
10	Fire brigade/unit; insufficient information available to classify further
21	Land management authority
31	Industrial fire crew
41	Defence force personnel
51	Civilians
08	Not applicable, not fought
99	Major fire fighting force not classified above
90	Major fire fighting force. Insufficient information available to classify further
00	Major fire fighting force undetermined
Blank	Major fire fighting force not reported

1.4 Computer Entry

Field - numeric
Length - 2
Default - blank

F 1	Major Fire Fighting Force		

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8.20 Major Extinguishing Medium

F6 MAJOR EXTINGUISHING MEDIUM

F 1	Major Fire Fighting Force	F 2	Initial Attack	F 3	Method of Initial Attack by Reporting Authority	F 4	Method of Initial Attack by Other Persons
F 5	Major Method of Extinguishment	F 6	Major Extinguishing Medium	F 7	Number of Portable Extinguishers Used	F 8	Number of Portable Pumps Used
F 9	Number of Hose Reels Used	F 10	No. of 35-59 mm Delivery Lines Used	F 11	No. of 60-70 mm Delivery Lines Used	F 12	Number of Monitors Used
F 13	Amount of Foam Concentrate Used (L)	F 14	Amount Dry Chemical Used (kgs)	F 15	Water Supply	F 16	Water Supply Method

6.1 Definition

The medium that had the major effect in extinguishing the fire.

6.2 Purpose

To assist in identifying the frequency and effectiveness of various extinguishing mediums for various types and forms of fire.

6.3 Implementation

Record the medium, if any, which was most effective in extinguishing the fire.

Table F6 details the codes for the major extinguishing medium for this field. Select the most appropriate code from the table and complete the entry.

Table F6 Extinguishing Medium Codes

DIVISION	CODE	EXTINGUISHING MEDIUM
1		WATER
	11	Water only
	12	Water with wetting agent
	13	Water with retardant
	14	Water with A class foam
	19	Water with additive not classified above
	10	Water; insufficient information available to classify further
2		FOAM
	21	Low expansion foam-protein
	22	Low expansion foam-AFFF (Aqueous Film Forming Foam)
	23	Low expansion- alcohol resistant (ATC)
	24	Medium expansion foam
	25	High expansion foam
	26	Non aspirated foam
	29	Foam not classified above
	20	Foam; insufficient information available to classify further
3		SOLIDS
	31	Sand
	32	Soil
	39	Solids not classified above
	30	Solids, insufficient information available to classify further

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8.21 Major Extinguishing Medium Continued

Table F6 (Cont.) Extinguishing Medium Codes

4		**CHEMICAL**
	41	Dry chemical B(E)
	42	Dry chemical AB(E)
	43	Dry chemical D
	44	Wet chemical
	49	Chemical, not classified above
	40	Chemical, insufficient information available to classify further
5		**CARBON DIOXIDE**
	51	Carbon dioxide
6		**VAPOURISING LIQUID**
	61	Vapourising liquid
7		**STEAM**
	71	Steam
9		**OTHER EXTINGUISHING MEDIUM**
	99	Other extinguishing medium not classified above
	90	Other extinguishing medium; insufficient information available to classify further
0		**UNDETERMINED OR NOT REPORTED**
	08	Major extinguishing medium not applicable
	00	Major extinguishing medium undetermined
	Blank	Major extinguishing medium not reported

6.4 Computer Entry

Field - numeric
Length - 2
Default - blank

F 6	Major Extinguishing Medium

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8.22 Number of Fire Service Extinguishers, Pumps and Delivery Lines Used by the Reporting Authority

NUMBER OF FIRE SERVICE EXTINGUISHERS, PUMPS AND DELIVERY LINES USED BY THE REPORTING AUTHORITY.

Items **F7** to **F14** identify the number of Fire Service extinguishers, portable pumps and delivery lines, and amount of foam concentrate used to extinguish the fire.

F7 NUMBER OF PORTABLE EXTINGUISHERS USED

F 1	Major Fire Fighting Force	F 2	Initial Attack	F 3	Method of Initial Attack by Reporting Authority	F 4	Method of Initial Attack by Other Persons
F 5	Major Method of Extinguishment	F 6	Major Extinguishing Medium	F 7	Number of Portable Extinguishers Used	F 8	Number of Portable Pumps Used
F 9	Number of Hose Reels Used	F 10	No. of 35-59 mm Delivery Lines Used	F 11	No. of 60-70 mm Delivery Lines Used	F 12	Number of Monitors Used
F 13	Amount of Foam Concentrate Used (L)	F 14	Amount Dry Chemical Used (kgs)	F 15	Water Supply	F 16	Water Supply Method

7.1 Definition

Item F7 identifies the number of fire service extinguishers, used to extinguish the fire. Item F7 is to be recorded if **F1** is **coded 10** to **40**, **90** or **00** or if **F2** is **coded 10** to **40**, **90** or **00**.

7.2 Purpose

This information indicates the size of the fire and subsequent demand on resources.

7.3 Implementation

Record the actual number of extinguishers used on the fire.

7.4 Computer Entry

Field - numeric
Length - 2
Default - Blank

F 7	Number of Portable Extinguishers Used

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8.23 Number of Portable Pumps Used

F8 NUMBER OF PORTABLE PUMPS USED

F 1	Major Fire Fighting Force	F 2	Initial Attack	F 3	Method of Initial Attack by Reporting Authority	F 4	Method of Initial Attack by Other Persons
F 5	Major Method of Extinguishment	F 6	Major Extinguishing Medium	F 7	Number of Portable Extinguishers Used	F 8	Number of Portable Pumps Used
F 9	Number of Hose Reels Used	F 10	No. of 35-59 mm Delivery Lines Used	F 11	No. of 60-70 mm Delivery Lines Used	F 12	Number of Monitors Used
F 13	Amount of Foam Concentrate Used (L)	F 14	Amount Dry Chemical Used (kgs)	F 15	Water Supply	F 16	Water Supply Method

8.1 Definition

Item F8 identifies the number of portable pumps used to extinguish the fire. Item F8 is to be recorded if **F1** is **coded 10** to **40**, **90** or **00** or if **F2** is **coded 10** to **40**, **90** or **00**.

8.2 Purpose

This information indicates the size of the fire and subsequent demand on resources.

8.3 Implementation

Record the actual number of portable pumps used on the fire.

8.4 Computer Entry

Field - numeric
Length - 2
Default - blank

F 8	Number of Portable Pumps Used

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8.24 Amount of Foam Concentrate Used

F13 AMOUNT OF FOAM CONCENTRATE USED (IN LITRES)

F 1	Major Fire Fighting Force	F 2	Initial Attack	F 3	Method of Initial Attack by Reporting Authority	F 4	Method of Initial Attack by Other Persons
F 5	Major Method of Extinguishment	F 6	Major Extinguishing Medium	F 7	Number of Portable Extinguishers Used	F 8	Number of Portable Pumps Used
F 9	Number of Hose Reels Used	F 10	No. of 35-59 mm Delivery Lines Used	F 11	No. of 60-70 mm Delivery Lines Used	F 12	Number of Monitors Used
F 13	Amount of Foam Concentrate Used (L)	F 14	Amount Dry Chemical Used (kgs)	F 15	Water Supply	F 16	Water Supply Method

13.1 Definition

Item F13 identifies the amount of foam concentrate used to extinguish the fire. Item F13 is to be recorded if **F1** is **coded 10** to **40**, **90** or **00** or if **F2** is **coded 10** to **40**, **90** or **00**.

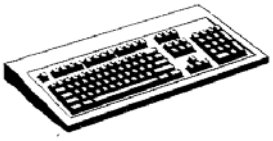
13.2 Purpose

This information indicates the size of the fire and subsequent demand on resources.

13.3 Implementation

Record the amount of foam concentrate used in litres on the incident.

13.4 Computer Entry



Field - numeric
Length - 6
Default - blank

F 13	Amount of Foam Concentrate Used (L)

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8.25 Amount of Dry Chemicals Used

F14 AMOUNT OF DRY CHEMICAL USED (KILOGRAMS)

F 1	Major Fire Fighting Force	F 2	Initial Attack	F 3	Method of Initial Attack by Reporting Authority	F 4	Method of Initial Attack by Other Persons
F 5	Major Method of Extinguishment	F 6	Major Extinguishing Medium	F 7	Number of Portable Extinguishers Used	F 8	Number of Portable Pumps Used
F 9	Number of Hose Reels Used	F 10	No. of 35-59 mm Delivery Lines Used	F 11	No. of 60-70 mm Delivery Lines Used	F 12	Number of Monitors Used
F 13	Amount of Foam Concentrate Used (L)	F 14	Amount Dry Chemical Used (kgs)	F 15	Water Supply	F 16	Water Supply Method

14.1 Definition

Item F14 identifies the amount of dry chemical used in (Kilograms) to extinguish the fire. Item F14 is to be recorded if **F1** is **coded 10** to **40**, **90** or **00** or if **F2** is **coded 10** to **40**, **90** or **00**.

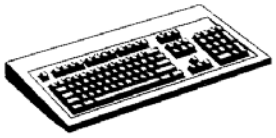
14.2 Purpose

This information indicates the size of the fire and subsequent demand on resources.

14.3 Implementation

Record the amount of dry chemical used in kilograms on the incident.

14.4 Computer Entry



Field - numeric
Length - 6
Default - blank

F 14	Amount of Dry Chemical Used (Kgs)

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8.26 Water Supply

F15 WATER SUPPLY

F 1	Major Fire Fighting Force	F 2	Initial Attack	F 3	Method of Initial Attack by Reporting Authority	F 4	Method of Initial Attack by Other Persons
F 5	Major Method of Extinguishment	F 6	Major Extinguishing Medium	F 7	Number of Portable Extinguishers Used	F 8	Number of Portable Pumps Used
F 9	Number of Hose Reels Used	F 10	No. of 35-59 mm Delivery Lines Used	F 11	No. of 60-70 mm Delivery Lines Used	F 12	Number of Monitors Used
F 13	Amount of Foam Concentrate Used (L)	F 14	Amount Dry Chemical Used (kgs)	F 15	Water Supply	F 16	Water Supply Method

15.1 Definition

This Item provides the status of the water supply available for fire fighting operations.

15.2 Purpose

Provides information on the adequacy of the water supply available for fire fighting.

15.3 Implementation

Record the most significant factor, if any, effecting the supply of water for fire fighting.

Table F15 details the codes for the water supply used for this field. Select the most appropriate code from the table and complete the entry.

Table F15 Water Supply Codes

CODE	WATER SUPPLY CODES
1	No reticulation in proximity and no on-site supply available
2	No reticulation in proximity and limited on-site supply available
3	Reticulation available, insufficient main
4	Reticulation available, damaged main
5	No water used
8	No problem with water supply
9	Water supply problem not classified above
0	Water supply problem undetermined
Blank	Water supply problem not reported

15.4 Computer Entry

Field - numeric
Length - 1
Default - blank

F 15	Water Supply

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