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Research of BCA 1996 Building Classification Reform

An Interactive Qualifying Project Report

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by

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Abstract

The Australasian Fire Authorities Council commissioned the project team to gather the opinions of various stakeholders concerning the need for reform to the classification system within the Building Code of Australia. In the Building Code of Australia 1996 buildings are classified by use alone, and fail to consider fire load and occupant behavior when specifying various life safety and fire protection systems. Through interviews with stakeholders the authors have exposed opinions regarding possible reforms to the current classification system.

Executive Summary

The Building Code of Australia (BCA) is the model code adopted by all Australian states and territories. In the BCA, regulations are assigned to buildings depending on the structure's classification. The BCA building classification system currently categorizes buildings in terms of their intended use. For example, all office buildings are placed into class 6 and all factories are placed into class 8. In all, there are ten classes or categories that span a wide variety of building types. The building classification system used in the BCA has remained virtually unchanged since the inception of building regulation in the country of Australia.

Since the implementation of the latest version of the BCA in 1996, a growing number of professionals in the fire safety and building communities have begun to question if the current classification system can satisfy the ever-changing building industry. Through the sponsorship of the Australasian Fire Authorities Council (AFAC), this project collected and assessed the opinions of various professionals regarding the need for a reform of the BCA classification system along with their suggestions for reform and the possible impacts that a change may have.

In order to understand the issues dealing with this project, a literature review of pertinent information was carried out. Since the BCA is a duel system of a prescriptive code, also known as deemed to satisfy, and a performance-based code, both code styles were researched. The classification system of the BCA was thoroughly examined and documented. Research was carried out on other building codes, including codes found in the United States and Canada, so an understanding of other classification systems could be achieved. It was also determined that classification systems from codes other than national building codes needed to be

examined. To do so, sprinkler codes and the National Fire Protection Association's Life Safety Code were researched. It was also necessary to gain an understanding of various methods that assess the different risks associated with certain types of buildings. The research of these risk assessment methodologies gave an insight of other building and occupancy characteristics besides the intended use, which could be used to further classify structures.

Since the goal of this project was to document the opinions of professional regarding reform, the major step in this project was to conduct interviews. Once all of the background research was completed and documented, a questionnaire was formulated. A semi-standardized format of interviewing was used, where a standard set of questions was asked and then followed by a group of specialized questions depending on the flow of the interview and the area of expertise of the interviewee. A list of professionals to be interviewed was created through discussions with the AFAC and by asking interviewees for the names of other professionals that should be interviewed. Through interviewing a variety of professional groups, a wide range of opinions was documented.

The first objective of the interview questionnaire was to extract from the interviewees their opinions regarding why a reform of the classification system is, or is not, necessary. A majority of the interviewees believe the classification system requires major alterations while others agree that only a few small changes are required. The most common reasons given to validate the call for a reform of the building classification system were the age of the system in comparison to major developments in industry and the fact that many buildings that have become common do not fit easily into the system. Another argument for reform frequently mentioned was the subjectiveness of the system, which results in unclear boundaries between

categories. These ambiguities lead to the beliefs that multipurpose buildings are not adequately addressed in the current classification system and that the system neglects the wide range of risk levels possible in some categories. There were other rationales for reform given that, although valid, were not as frequently cited.

Although all the professionals interviewed feel that a reform of the classification system found in the BCA is necessary, several were able to point out advantages of the current system. The most prevalent of these was the simple format of the classification system that results in its ability to be easily used. Many of the interviewees warned that this might be lost if the system is changed. They also stated that over complicating the categories would lead to a system that is hard to utilize as well as possibly cause problems with code enforcement. Some interviewees pointed out that changing the classification system would require the entire BCA to be revised since it is the starting point for all deem to satisfy requirements. Some stated that the low number of actual deaths due to incidents of fire each year would be hard to improve. This might make a labour intensive or costly reform difficult to justify. In spite of the insight into the advantages of the current system given by several of the interviewees, they all held the personal opinion that some sort of reform was necessary.

The second group of questions asked the professionals what suggestions they had for specific reforms of the current classification system in order to alleviate the problems that they described. Similarities were discovered between the suggestions given by the forty interviewees. There were five major groups of reform suggestions that could be determined. Except for a few minority suggestions, each of the professionals interviewed could be placed in one main suggestion groups as follows:

- Addition of more categories
- Sub-classification of existing categories
- Risk assessment approach to building classification
- Adoption of the NFPA 101 classification system
- Research the need for reform

Other suggestions that didn't fall into one of these groups included having building regulations driven by building and occupant characteristics and the implementation of lists of example buildings for each category.

More than fifty percent of all the interviewees suggested either a sub-classification of existing categories in terms of various risk factors or a move to a risk assessment approach to building classification. The major difference between these reform approaches is that some were described as short-term or "band-aid" solutions, while other reforms would be a long-term fix. It was the suggestion of many of the professionals that regardless of what reform is carried out, thorough research must be conducted to determine the exact measures necessary. Research must also be completed ensure that any modification to the current system would have a minimal negative impact on various issues that are encircled with the BCA and its classification system.

The third focus of the interview questionnaire was to determine the impacts that might arise from a change to the classification system. Any reform made must be examined to minimize its negative effects on the fire and life safety of the community, its impact on professionals, and on the cost associated with such a reform. The life safety of the community should be the focal point of any reform of the classification system. If a proposed reform has a negative effect on the life safety it would be hard to justify adopting it no matter how great the economic benefits may become. Provided the reform either has a positive or negligible effect on the community it is

then important to determine the effect of a reform on the professionals who use the code. If endless classification and requirements severely complicate their jobs then an investigation on the true benefit of a new system must be undertaken. The overall success of a system can be measured in many ways and economics always play a role in determining the validity of a potential classification system.

Any cost impact of a reform to the classification system can be qualified into one of three major groups; capital cost, lifecycle cost, and the cost of altering behaviors. A change in classification will allow some buildings to decrease the amount of protection that their building provides while at the same time requiring more protection to be added to other more hazardous buildings. It is the opinion of most professionals that the net impact on capital cost will be negligible. Life safety systems are becoming more heavily relied on with each passing year , as a result the cost of maintaining these systems has increased.

As a whole lifecycles cost can be expected to increase with any change in the classification system as a result of stricter regulations on building owners to maintain their protection systems. The cost of altering behaviors to gain a certain level of certainty in design is one that is not easily calculated. The key to minimizing the impacts of a reform to the classification system will be to examine what professionals and the general public are doing already and to try to employ this knowledge in the new system.

With the information collected from the interviews conducted, conclusions and recommendations could be made. It was concluded that a two step reform process might be the best possible solution. This process would include developing and instituting a short-term solution like a sub-classification system based on factors other than building use. While this is being done a long-term solution could be

developed. This long-term solution could involve replacing the current BCA classification system with a new risk assessment system. Regardless of the reform decided upon, the process must include a research component to ensure the new system minimizes negative impacts.

Authorship

The project team members, Laura Bradbury, Patrick Dow, and Keith Lepine, agree that all work done on this report was equal in distribution unless otherwise stated.

Laura Bradbury was responsible for contacting all forty professionals spoken with to schedule interviews, as well as obtaining directions and transportation, when necessary, to each meeting. She also contacted a majority of the interviewees regarding permission to use direct quotes within this report. Laura conducted a small portion of interviews and took notes to be used for reference at the others. She also aided in the editing of the Introduction as well as the Conclusions and Recommendations section.

Patrick Dow was responsible for writing the one page summary of each interview conducted. In addition to taking notes during the interviews to be used for reference, Patrick aided in the editing of the Introduction as well as the Conclusions and Recommendation section. He also contacted professionals regarding permission to use direct quotes within this report. Patrick also maintained the project Internet site.

Keith Lepine was responsible for actually conducting a majority of the interviews. He also wrote the Introduction as well as the Conclusions and Recommendations section. Keith was responsible for recording all interviews and organizing all tapes generated. He also constructed all of the original graphics included in this report in addition to tabulating necessary percentages.

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1 Introduction

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In the Building Code of Australia (BCA), building regulations are assigned to various groups of buildings defined by a system of building classification. The current BCA building classification system differentiates buildings in terms of the purpose for which they are designed, constructed, or modified. The format of this system, which is similar to that used in building codes throughout the world, has remained unchanged since the creation of the Uniform Building Regulations (UBR) in 1973 (UBR, 1974)[1]. The UBR preceded the Victorian Building Regulations (VBR) and the VBR was replaced by the current BCA in 1990 when it was adopted as the model building code for all of Australia. The current system of building classification within the Building Code of Australia fails to consider the actual fire load of a building and its occupants' behavior when determining the level of required fire protection.

Proper classification is necessary to ensure that appropriate regulations are applied to the building. This allows for the safety of the occupants in and around premises without unnecessary additions to the cost of construction. Since the specific building regulations stem from the category a structure falls under, a misclassification could result in the wrong set of regulations being applied. This could produce either unneeded construction costs or a building that does not provide a safe environment for its occupants. For example, if a building is wrongfully classified it may be placed into a category that does not require sprinklers. After evaluating the building to issue an occupancy permit it may be determined that sprinklers are needed. In this case it is

[1] See References for all citations

very likely that it would be more expensive to retrofit sprinklers in the finished building than it would have been to install them during construction. The implementation of performance-based regulations into the BCA has allowed the building designer to stray away from the prescriptive requirements. Often designers rely on performance solutions to meet the requirements determined by the classification of the building. If the building is wrongly classified then inappropriate performance solutions may be implemented. Due to its importance, the BCA building classification system must be a functional, flexible, and useable means of categorizing every type of building construction and placing similar regulations on similar building types.

Since the implementation of performance-based code into the BCA in 1996, stakeholders have started to question whether the current building classification system meets the requirements of a growing building industry. Through the sponsorship of the Australasian Fire Authorities Council (AFAC), it is the goal of this project to document the opinions of various groups of professionals on the need for building classification reform. During the interviews the project team was able to examine the opinions of the stakeholders regarding the classification system within the BCA. Through this process several common problems with the current system, suggestions for classification reform, and the possible impacts due to suggested changes were compiled.

Building classification is a complex issue with many ramifications; any change in the building classification could affect the corresponding fire, building and sprinkler codes. The belief of the authors is that improvements can be made to the classification system while minimizing the negative effects on interrelated regulations. This report discusses improvements that take into consideration the

impacts on people who deal with the classification system. The problems encountered by the user should be examined when reviewing the advantages of a more concise classification system so that it is easier to prepare professionals for a change.

In order to be able to analyze the results of the interviews conducted on this topic it was important to gain an in-depth understanding of the functionality of building codes and building classification. This allowed the project team to easily identify similar themes throughout the interviews. Both performance-based and prescriptive codes were examined so that the authors understood the functionality of each system. The building classification systems of the BCA as well as those found in the United States and Canada were also documented. This was done so information dealing with building classification given in interviews could be followed and easily discussed when talking to experts in the field of fire safety.

With the advent of performance-based code, more and more fire safety professionals are beginning to examine the overall risk of a building rather than just looking at its use. Due to this, background research has been completed on risk assessment techniques. Various examples of risk assessments were reviewed and some of the advantages and disadvantages of these techniques were documented. This information is important because it was believed that professionals interviewed could suggest a risk assessment approach to building classification.

2 Literature Review

2 Literature Review

The goal of this project is to determine the stakeholders' perce ptions of the need to change the current system of classifying buildings within the Building Code of Australia and implications that may arise from such change. Stakeholders are fire service agencies, building owners, building surveyors, regulators, government (State and Federal), fire safety engineers and property managers. Various building classification systems will be examined before soliciting the expert opinions of professionals in the fields of building and fire codes.

In the sections that follow the two main types of code, prescriptive and performance based, are examined to develop an understanding of the differences between the two and the goals each is meant to accomplish. The building codes of the United States and Canada are reviewed to form a knowledge base. Next the Australian classification system is examined in depth. This allows for the explanation of various approaches to classification. Information on sprinkler codes is also presented to promote the understanding of relationships between this type of code and building code. Finally, risk assessment methodologies are reviewed for possible incorporation into a classification system.

The advice of experts in Australia will be sought to determine the need for improvement of the Australian system and the possible effects of these reforms. Through collaboration with AFAC, the Melbourne Fire Brigade, and experts in the fields of fire and building code regulations, several options for code improvement and reform will be exposed.

2.1 Prescriptive Code:

Prescriptive codes are regulations that achieve a certain safety goal by simply dictating a combination of specific requirements such as materials, dimensions, or protection systems like sprinklers. This type of code is predominant in most building and fire regulations. However, it allows little freedom in the construction of buildings. Historically, these codes received revision after significant disasters such as fires revealed insufficiencies. Originally, the codes therefore were based on known material properties, hazards presented by the occupancy, and lessons learned from previous experience (Cote & Grant, 1997). While codes outline the way to construct various buildings, they do not state specific the safety goals.

2.1.1 Prescriptive Building Classification:

Buildings in the United States and around the world are classified in prescriptive building codes as to use. Use is defined by the International Code Council as, "the purpose for which a building, or part thereof, is used or intended to be used." Using this definition of occupancy the codes classify buildings first into use groups and then into different subgroups based on their intended occupancy. Buildings falling outside of the set definition of use groups are assigned to the group that they most resemble. This lack of clarity is what Australia is trying to avoid in its classification system. By properly coding the buildings that fall between the cracks in the Australian classifications and other countries' codes it will be possible more clearly define what the building safety requirements are of each individual building.

2.2 Performance-Based Code:

Performance-based code allows all parties involved in building construction, contractors, architects, and engineers, freedom in the selection of materials and designs of buildings our concerned. These types of regulations state a safety goal very precisely. They then provide a clear definition of the levels of safety and risk that are acceptable. Projected solutions should are stated in quantifiable terms so that achievement of the goal is demonstrable and measurable (Puchovsky, 1997). Any solution proven to meet these requirements is permitted. Previously analyzed methods for attaining the safety goal are usually included in the regulation or standard as a reference or guide, but parties involved in the construction are not limited to these methods. This method of design intends to offer a solution that attains a certain safety goal for a specific use.

2.2.1 History of Performance-Based Code:

The basic concepts of fire safety engineering emerged in the United States at the 1971 International Conference on Fire Safety in High Rise Buildings held by the General Services Administration. For the next several years growing concerns about fire safety promoted professional interest in performance-based fire safety design. When the Department of Environment in London England released *The Building Regulations* in 1985, this document represented the first time performance-based codes were used in a government standard. Performance-based fire safety regulations emerged in the 1980's in England, Japan, and Australia. Shortly thereafter government agencies as well as private firms in Sweden and the United States started to research the development of performance-based codes and standards. By 1996 Canada, Finland, France, The Netherlands, New Zealand, Norway, Poland, Spain, The

International Organization for Standardization, and the International Council for Building Research and Documentation were also either using or developing performance-based code and related methods of engineering (Custer & Meacham, 1997).

2.2.2 Importance of Performance-Based Code:

Performance-based code allows for more cost-efficient construction. A prescriptive code might specify that walls in a certain type of building must be made of concrete. If the price of concrete has recently skyrocketed the project becomes economically infeasible. Performance-based code simply states the safety goal that concrete walls achieve without limiting the builder to using one specific material. The builder can then select a material that meets the safety goal and the construction budget. Significant cost reductions in building are possible. These and growing fire safety concerns have advanced the interest in and development of performance-based codes and regulations.

Performance-based code encourages the investigation of alternate materials for use in building construction. This in turn promotes major advances in fire safety. A material not currently used in construction must be analyzed before it can be considered an acceptable option. This research may find the material exceeds, or fails to meet, fire safety expectations as they stand. The recording and publication of this information increases the general knowledge of fire safety pertaining to construction materials. It also increases the amount of proven materials options used as solutions to a fire safety goal.

2.2.3 Problems with Performance-Based Codes:

Although performance-based seems a more logical regulation method than prescriptive based code, problems with the use of these types of regulations exist. The prescriptive codes provide a more straightforward regulation method that requires less initial effort than their counterpart. The prescriptive method is also much easier to enforce, as it simply requires a visual inspection. Some countries are currently limited in their fire engineering tools, data, and technology significantly deterring the movement from prescriptive to performance-based code. In addition, the relationships between fire resistance, life safety, and suppression systems are extremely complicated and lack concise definition. These topics are essential to understanding and manipulating performance-based codes.

Most experts agree that eventually the result will be a combination of the two codes. These regulations would include both types of code for each regulation allowing the use of either method. Dual code regulations will provide a document that supports performance-based design and verifications processes by identifying specific fire safety goals and providing needed guidance regarding selection and use of fire safety criteria, assumptions, fire scenarios, and calculation methods (Puchovsky, 1999). A mixed code method may also prove beneficial to building classification systems.

2.3 Review of Current Building Classifications:

This section will review the current building classification systems used by countries outside of Australia. We are particularly interested in the strengths of the codes of other countries that could be implemented in the BCA.

2.3.1 United States Building Codes and Classification Systems:

The research of classification systems began with an examination of the building codes of the United States (U.S.). This is primarily because the U.S. codes were more readily available and also because the group had a working knowledge of the codes before the project began. The United States Government unlike some other governments has no authority over the building codes of the nation. Statutory powers lie within the individual states and in turn with the municipalities within those states. The United States does however have three independent organizations, each with its own code.

The three organizations are the International Conference of Building Officials (ICBO), the Building Officials and Code Administrators International (BOCA), and the Southern Building Code Congress International (SBCCI). The International Conference of Building Officials (ICBO) produces the Uniform Building Code (UBC), which is the most widely used model building code in the United States. It is used almost exclusively in the western part of the country where it is modified to fit the specific requirements of each state. The Building Officials and Code Administrators International (BOCA) produces the Basic Building Code (BBC) which is primarily used in the northeastern part of the country. The Southern Building Code Congress International (SBCCI) produces the Standard Building Code (SBC), which is used almost exclusively in the southeastern part of the country. Since 1972 the ICBO, BOCA, and SBCCI have been under an umbrella organization called the Council for American Building Officials (CABO). In November of 1997 the CABO was incorporated to the International Code Council (ICC), which is now the frontrunner in the unified building code movement in the United States (ICC, 2000).

2.3.2 International Code Council:

The ICBO, BOCA, and SBCCI established the International Code Council in1994 as a non-profit organization dedicated to developing a single set of comprehensive and coordinated national codes. (ICC, 2000) In the past contractors found it difficult to move around the U.S. and adapt to thee three different model codes adopted by different regions. The ICC is currently reviewing and publishing a system that will contain a complete set of construction codes without regional limitations- the International Codes (ICC, 2000).

2.3.3 Building Codes of Canada:

The National Building Code of Canada, like the Australian code, is controlled by the federal government. It is a nationally recognized document that each province adopts and then adapts through amendments to better suit its needs. The code and classification system contained within the National Building Code of Canada is a prescriptive system. One that unlike the Australian code is based on use, the actual function of the building (i.e. school, hospital, etc), and occupancy, who or what resides in the structure, rather than on use alone.

2.4 United States and Canadian Classification Categories:

Within most prescriptive based building codes there is a list of different occupancy classification categories. The general occupancy or use categories for most U.S. and international codes are Assembly, Business, Educational, Factory Industrial, Hazardous, Institutional, Mercantile, Residential, and Storage.

2.4.1 Assembly Classification:

Assembly buildings are described by most prescriptive building codes as places of gathering for religious, social or other group activities. The BOCA Basic Building Code begins to break down the Assembly category, category A, into five subcategories. Each subcategory is dependent upon the physical nature of the structure, the number of occupants the structure is intended to hold, as well as the intended use of the structure. The ICBO Uniform Building Code breaks down the Assembly section of its codes into four subcategories. Much like the BOCA code, these subcategories are largely dependent upon the number of potential occupants and the physical aspects of each individual assembly space. The SBCCI Standard Building Code breaks down the Assembly section into two subcategories based on the physical aspects of each space, its intended use, and the overall building capacity. The National Building Code of Canada subdivides its Assembly section into four categories based solely on intended use, with no criteria for the number of occupants or the physical nature of the structure.

2.4.2 Business Classification:

The Business classification in most prescriptive systems is the hardest to define. Neither BOCA code nor the SBCCI have any subcategories for the classification of business buildings. The ICBO Uniform Building Code accounts for four different subcategories based on the type of business being transacted. The National Building Code of Canada separates its business classifications in two subcategories, one for mercantile business and the other a general business category that encompasses all other forms of business transacted.

2.4.3 Educational Classification:

The age and number of students in a school were the primary criteria for different educational classifications in the prescriptive code systems examined. The BOCA Basic Building Code and the SBCCI Standard Building Code leave the Educational classification as one broad category that covers everything except schools past the twelfth grade. Both the BOCA Basic Building Code and the SBCCI Standard Building Code consider anything past the twelfth grade a business occupancy. The ICBO Uniform Building Code has three categories in its classification of educational occupancies. All subcategories in the UBC are based on number of occupants and age level. The UBC also considers any school above the twelfth grade a business occupancy. The National Building Code of Canada does not even have an educational classification in its building codes. Instead it classifies all educational buildings under the Assembly classification. The Canadian Code, like the American codes, considers any educational building that teaches past the twelfth grade to be a business classification.

2.4.4 Factory Industrial Classification:

The Factory Industrial classification of buildings is intended by most prescriptive codes to apply to assembling and disassembling plants, repairing, fabricating, finishing, manufacturing, packaging, or processing operations (SBCCI, 1988). The SBCCI categorizes all Factory Industrial building under one broad classification. The BOCA Basic Building Code breaks the Factory Industrial classification down into two subcategories, moderate hazard and low hazard. The ICBO Uniform Building Code and The National Building Code of Canada do not have a Factory Industrial classification but rather classify building of this nature under different subcategories of their hazardous classification.

2.4.5 Hazardous Classification:

The hazardous occupancy classification applies to all buildings whose principal use, or part thereof, involves the storage or use of hazardous, toxic, combustible, or explosive materials, or materials that have inherent characteristics that constitute a high fire hazard (UBC, 1991). The SBCCI Standard Building Code classifies hazardous building into one broad category that encompasses all hazardous materials and the buildings in which they are stored. The ICBO Uniform Building Code breaks hazardous classifications down into seven divisions based on the use and or storage of different hazardous materials and the amount of those hazardous materials in use or in storage. The BOCA Basic Building Code breaks the hazardous building classifications in to four groups that, much like the UBC, are based on the amount of hazardous materials present and their use and storage.

The National Building Code of Canada has three subcategories for hazardous building classification: high, medium, and low hazard industrial occupancy. These three sub-classifications involve more than just hazardous material and any building considered a hazardous classification in the United States would fall into the high-hazard industrial occupancy classification in Canada.

2.4.6 Institutional Classification:

The institutional classification in prescriptive building codes is based on the classification of buildings whose occupants have physical limitations. These include conditions arising from physical or mental illness and from penal detainment. The BOCA Basic Building Codes categorizes different types of institutions into 3 main categories based on the type of occupant and their physical limitations. The third classification, for penal institutions, is then broken down into four occupancy conditions based on the access to exits and the ability for free movement within parts

of the building. The SBCCI Standard Building Code classifies Institutional buildings as either restrained or unrestrained. Within each category are occupancy conditions, similar to the BOCA code, based on ability of movement, physical ability of occupants, and means to exit. The ICBO Uniform Building Code divides Institutions in to four categories much like the other model codes based on the occupants' physical ability and their level of restraint and free movement about a building. The National Building Code of Canada does not have a classification for specific Institutions but rather the Canadian code classifies each institution under the category that it most resembles.

2.4.7 Mercantile Classifications:

The Mercantile Classification in prescriptive building code is the classification of buildings used for the display and sale of goods. The three model codes of the United States all have one broad classification for mercantile buildings. The National Building Code of Canada however classifies mercantile buildings under a subcategory of its Business Classification group.

2.4.8 Residential Classification:

The groups of residential classifications in a prescriptive building code are used to categorize all buildings with sleeping accommodations not covered by the Institutional Classification. The SBCCI classifies residential building into one category of buildings if they are not covered in the Institutional Classifications section of the SBC. The BOCA Basic Building Code splits the residential classification of buildings into four subcategories based on the type of residence, the number of dwellings in a residence and the overall size of a residence. The ICBO Uniform Building Code breaks the residential classifications into two subcategories based on

type of occupancy and maximum number of potential occupants. The National Building Code of Canada categorizes all non-institutional buildings, with sleeping accommodation, into one broad residential category.

2.4.9 Storage Classification:

The Storage Classification in most prescriptive codes is used to classify buildings used for storage that are not covered in any of the hazardous classifications. The ICBO Uniform Building Code accounts for all storage areas under its hazardous building classifications and therefore has no specific storage classifications. The BOCA Basic Building Code as well as the SBCCI Standard Building Code both classify storage areas in two subcategories based on the low or moderate hazards they house. The National Building Code of Canada like the ICBO Uniform Building Code accounts for all storage areas under its classifications of hazardous buildings.

2.5 Building Codes of Australia:

The Building Code of Australia (BCA) is the national building code for Australia and is the principle source of building regulations for the country. The BCA was created through an inter-government agreement by the Australian Uniform Building Regulations Coordinating Council (AUBRCC) in 1990. Unlike the United States codes, the BCA is overseen by the national government through the Australian Building Codes Board (ABCB) and is used by every state and territory in Australia. Each state and territory may have slightly different interpretations of the BCA thus some regulations may vary, but for the most part, regulations stated in the BCA are national standards. (BCA, 1998)

As of 1996, the Building Code of Australia moved towards a dual system of both the older prescriptive code and the newer performance-based code. The building designer now has the option whether to use the old deem to satisfy system with set regulations based on building classification or the performance system. The new performance-based regulations allow the designer to take an alternate approach from the deem to satisfy regulations as long as it is agreed that the design meets the performance criteria. The designer also has the choice to use a mix of the prescriptive and performance code to further help with the optimization of the design. (ABCB, 2000)

The prescriptive regulations in the BCA are designated to a building accordin g to the building's classification. In section A3 of the BCA, the system of building classification is listed and described. The BCA states that the purpose for its classification system is to be able to group certain buildings together that have similar characteristics such as risk, occupancy, use, and hazard levels. Each category has its own set of prescriptive building and fire regulations and once a registered building surveyor places a building into a category it must meet the regulations for its category. (BCA, 1998)

The following section will give a short overview of the categories within the BCA building classification system. The BCA system consists of 10 categories, each of which group similar building types. Some buildings may have multiple classifications. In this case, the building must comply with the category that has the stricter regulations. (BCA, 1996)

2.5.1 Class 1:

Class 1 is separated into two categories, class 1a and class 1b. Class 1a buildings are single occupancy residential buildings. These buildings may be more

than one story, but may only house one group of related persons. These buildings may not be above or below another separate residency. Class 1b buildings consist of small guesthouses or boarding houses. These buildings may only house up to twelve occupants and may not have a floor area over 300 m^2. (BCA, 1998)

2.5.2 Class 2:

Class 2 consists of buildings that contain more than one residency. Each of these residencies are occupied by a separate group of people. An example of this is a duplex. If two residencies are joined together with a common area, the building is considered to be in class 2. These buildings may be attached to a building of a different class. (BCA, 1998)

2.5.3 Class 3:

This category contains buildings that accommodate more occupants than allowed for a class 1b. Any residency building that doesn't fall within class 1 or 2 is placed in class 3. These buildings include the residential sections of a hotel or motel, dormitories, and large hostels or guesthouses. This category also includes buildings that house the elderly, disabled or children. The staff accommodations for a health-care facility are also considered to be a class 3 building. (BCA, 1998)

2.5.4 Class 4:

Class 4 includes residencies that are located within a class 5-9 building. An example of this would be a residency that is located above a shop or restaurant. A class 4 building may not be located in a class 1, class 2 or class 3 building and there can only be one class 4 residency in any one given building. (BCA, 1998)

2.5.5 Class 5:

Class 5 consists of office buildings for the use of business or commercial purposes. Some examples of class 5 buildings are government offices, professional offices, advertising agencies, etc. Any building that may be classified as a class 6, 7, 8 or 9 must be excluded from class 5. (BCA, 1998)

2.5.6 Class 6:

This category includes all buildings, which purposes are to sell or supply goods to the public at retail. These buildings include restaurants, cafes, dinning rooms, market places, showrooms, hairdresser's shop and the shopping parts of a hotel. This category also includes service stations for the selling of fuel and other goods, but not those stations that focus on car repairs. (BCA, 1998)

2.5.7 Class 7:

Class 7 consists of three different types of buildings. The first is a carpark or a parking garage. The second type of building is a warehouse, which is used for the storage of various goods. The last building type in this class is a building that sells various goods at wholesale to other businesses or trades. These buildings may not sell goods to the public, or they will be considered as a class 6 building. (BCA, 1996)

2.5.8 Class 8:

Class 8 includes all buildings that fit the description of a factory. This consists of buildings that are used for the production of goods, altering and repairing of machines, and the cleaning and packaging of goods. As long as the products are not sold directly to the public from the building, it will be classified as a class 8 building. Laboratories also fit into this category. These buildings tend to incorporate a high level of risk. (BCA, 1998)

2.5.9 Class 9:

Class 9 buildings are separated into two different groups. Class 9a consists of health-care facilities, surgery facilities and procedure units. If a laboratory is attached to a class 9a building, the lab will be classified as a class 9a. Class 9b includes all types of assembly buildings. These include cinemas, theatres, halls, churches, pre-schools, and childcare centers. Class 9b also includes sports complexes, stadiums, and bus and train stations. This category rules out all parts of the structure that fall into a category outside of class 9b. (BCA, 1996)

2.5.10 Class 10:

Class 10 is also broken up into two sub-categories. Class 10a includes non-habitable buildings such as sheds and carports (private garages). Class 10b consists of non-habitable structures such as fences, swimming pools, masts, retaining or freestanding walls, and various other structures similar to the ones listed. The major difference between class 10a and 10b is the fact that 10a structures are considered as buildings and 10b can be any other type of free structure. (BCA, 1998)

2.5.11 Multiple Classifications:

According to A3.3 (a) in the BCA, if on a given floor space there is a section that conforms to a different category than the rest of the building, that section will be classified in the same category as the rest of the building. The exception is that the section must be no more than 10 % of the total floor space. Laboratories do not follow this rule. If the section is more than 10 %, then the section will be classified separately from the rest of the floor. A3.3 (b) states that classes 1a, 1b, 9a, 9b, 10a, and 10b can never be combined into one classification. A3.3 (d) allows for boiler

rooms, machine rooms, lift motor rooms, and plant rooms to be classified the same as the building that they are located in. (BCA, 1998)

2.6 NFPA 101 Life Safety Code:

The National Fire Protection Association's 101: Life Safety Code was written to provide the minimum requirements for a building to maintain an adequate level of safety for its occupants. The requirements are set to minimize the exposure of occupants to the effects of fire and other related hazards. NFPA 101 provides requirements for proper egress along with all other considerations that impact the life safety of people in the building. Regulations are set to provide safety without causing disruption or inconvenience with the use of the building. (NFPA, 1988)

The building classification system used in NFPA 101 is similar to the U.S. building codes, with buildings categorized by the name of the occupancy use. In all there are 11 categories including Assembly, Educational, Health Care, Detention and Correctional Facilities, Residential, Mercantile, Business, Industrial, Storage, and Special Structures. Under each category, there is an explanation of the characteristics that make up a building in that group. These characteristics include a wide range of risk factors such as building use, occupant number and occupant abilities. Then a list of building examples is given. Any exceptions to each category are also included in each description. Each category refers to a group of chapters, where the regulations for that particular occupancy group are given. There is a separate set of regulations for new and old buildings in each of the occupancy categories, which allows new construction to have stricter requirements then are written for existing buildings. (NFPA, 1988)

Within the building classification system in NFPA 101 is a classification of hazard contents. Hazardous contents are defined as the following.

> "The hazard of contents, for the purpose of this code, shall be the relative danger of the start and spread of fire, the danger of smoke and gasses generated, and the danger of explosion or other occurrence potentially endangering the lives and safety of the occupants of the building or structure. (NFPA, 1988)"

The classification of hazard of contents is broken up into three groups including Low, Ordinary, and High Hazard depending on the factors mentioned in the definition of hazard of contents. The hazard classification is used to further separate buildings in the same group, which contain different fire loads and amounts of hazardous materials. (NFPA, 1988)

Any degree of broadness that exists in the eleven occupancy categories is reduced by the use of the hazard of content classification. Due to this reduction of each category, a more specialized set of regulations can be set for each building. This makes for an effective system, where both the occupancy and building characteristics are considered.

2.7 Sprinkler Codes:

Building and fire codes are not the only regulatory devices that use forms of building classification. Sprinkler codes also use building classification to differentiate various building types. An examination of the way in which buildings are classified in various fire sprinkler codes as a means of documenting other forms of building classification was conducted. The following is a description of the US and Australian sprinkler code classification systems.

2.7.1 United States Automatic Sprinkler Systems Handbook:

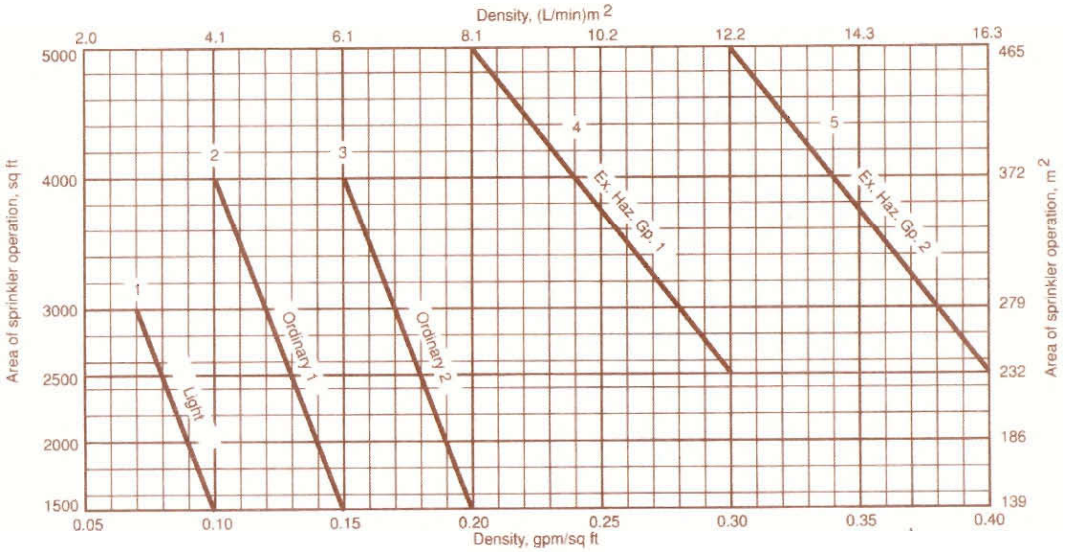
According to the National Fire Protection Association (NFPA) Automatic Sprinkler Handbook, *NFPA 13*, occupancy classifications are used to determine the required supply of water (lpm/m ^{2}) depending on the floor area of sprinkler operation (m^2). *NFPA 13* separates buildings into six categories:

- Light Hazard
- Ordinary Hazard Group 1
- Ordinary Hazard Group 2
- Extra Hazard Group 1
- Extra Hazard Group 2
- Special Occupancy Hazard

Each occupancy group has a designated curve on the Area vs. Density Curve Comparison Diagram shown in Figure 2.7.1.1. From these curves the proper supply of water can be determined depending on the floor area of the building (NFPA, 1994, p. 325-330).

The occupancy groups are categorized in terms of combustibility, quantity, and arrangement of the building's contents. The expected heat release due to fire is another factor that further differentiates the groups. Here is a short description of these occupancy classifications as adapted from *NFPA 13*.

Figure 2.7.1.1: Area vs. Density Curve Comparison Diagram



Source: National Fire Protection Association (1994). Automatic Sprinkler Systems Handbook. Robert E. Solomon, ed. Quincy, MA: NFPA: 330.

Light Hazard:

Buildings in the light hazard group pose the least problem to sprinkler systems. This group includes buildings that have low quantity and combustibility of contents, and are expected to produce low levels of heat release.

Ordinary Hazard:

The ordinary hazard category is broken up into two groups because of the various demands of the buildings in this group place on sprinkler systems. Group 1 includes buildings that contain a medium quantity and combustibility of contents, and are expected to produce medium levels of heat release. Group 2 includes buildings that contain a medium to high quantity and combustibility of its contents, and are expected to produce medium to high levels of heat release. Separation of the two groups also depends on the maximum height of combustible material stockpiles. Group 1 allows a height of up to 2.4 meters (8 ft) and group 2 allows up to 3.7 meters (12 ft).

Extra Hazard:

This category includes both buildings that contain a very high quantity of combustible material, as well as those which are expected to produce high levels of heat release. These building contain highly flammable materials, which include fluids, dust, lint, and other combustible solids. The presence of these materials will increase the rate of fire growth. The extra hazard category is also broken into 2 groups. Group 1 includes buildings that contain flammable fluids that are kept enclosed within machinery, piping, or containers. Buildings that contain dust and lint in the air are also classified under Group 1. Group 2 incorporates buildings that contain high amounts of flammable liquids that are exposed to the air and are allowed

to evaporate. This group also includes buildings in which the sprinkler system is significantly blocked by occupancy.

Special Occupancy Hazard:

The special occupancy hazard category is for buildings that fall under one of the categories above, but contain hazards that make them more of a risk than other buildings in its respective group. These buildings can be moved up to another hazard category depending on the type and amount of a certain combustible material as well as the way that the material is stockpiled. The classification modification due to the storage of these materials can be found in section 1-4.7.4.2.1 of NFPA 13 (NFPA, 1994, p. 47-56).

In determining which category a building belongs in, the respective expert must examine the room or section of the building that has the highest hazard level. This room or section must be separated with walls or other barriers with a fire rating required by the respective occupancy group. Examining the section of the building with the highest hazard helps with multiple occupancy buildings. In this case all other occupancy types within the building that have smaller levels of hazard than the highest occupancy type are disregarded (NFPA, 1994, p.336). Figure 2.7.1.2 lists examples of buildings that fall into each of the occupancy categories.

NFPA 13 states that its form of building classification is not meant for a general means of categorizing occupancy types for the use in a overall building and fire code (NFPA, 1994, p. 47). Some benefit may be gained from an understanding of the NFPA system. The NFPA 13 classification system appears to be a user-friendly and explicit system. It does rely some on subjective judgement, however the person placing a building into a category may need some knowledge of fire science.

Figure 2.7.1.2 Examples of Buildings in each Occupancy Category

Light Hazard	Ordinary Hazard		Extra Hazard	
	Group 1	Group 2	Group 1	Group 2
Churches	Bakeries	Cereal Plants	Aircraft hangers	Asphalt Saturating
Clubs	Canneries	Distilleries	Die casting	Flow Coating
Hospitals	Electronic Plants	Dry Cleaners	Metal Extruding	Open Oil Quenching
Residential	Glass Manufacturing	Feed Mills	Saw Mills	Plastics Processing
Educational	Automobile Parking	Leather Production	Textile Picking	Solvent Cleaning
Institutional	Laundries	Machine Shops	Rubber Reclaiming	Paint Dipping
Theaters	Dairy Producers	Mercantile	Upholstering	Liquid Spraying
Offices		Post Offices		
Museums		Textile Manufacturing		

Adapted from: National Fire Protection Association (1994). Automatic Sprinkler Systems Handbook. Robert E. Solomon, ed. Quincy, MA: NFPA, p. 330

2.7.2 Australian Automatic Fire Sprinkler System Standards:

The Automatic Fire Sprinkler Systems Standard is the national sprinkler code for the country of Australia. The sprinkler code was written and is maintained by Standards Australia. Its system of building classification is much like that of the NFPA 13 sprinkler code where buildings are categorized by their estimated hazard levels. The classification system is listed as follows:

- Light Hazard Occupancies
- Ordinary hazard Occupancies
  - OH 1
  - OH 2
  - OH 3
  - OH 4
- High Hazard Occupancies
  - High Hazard-Process Risks
  - High Hazard-High Piled Storage Risks
    - Category 1
    - Category 2
    - Category 3
    - Category 4

Within each category, a list of specific buildings is given. The Light Hazard Occupancies are buildings that are deemed to have low fire loads and require the least support from sprinkler systems. The Ordinary Hazard Occupancies are broken up into four groups of buildings, each group having a slightly hire fire risk than the previous group. The High Hazard Occupancies are broken up into two groups. The process risk group includes manufacturing buildings that have a high fire load. The high-piled storage risk group includes buildings that store materials on a larger scale. This group is further sub-categorized depending on the hazard level of the material, which is stored in the building. (Standards Australia, 1995)

This system of classification is straightforward due to the list of specific buildings stated under each occupancy category. Once the occupancy group for a building is determined, the sprinkler code regulations can be followed for that particular category. The code explains that if a building has a mixed occupancy or there is any uncertainty with classifying the building, the case must be brought up to a regulatory for a decision. (Standards Australia, 1995)

2.8 Catalyst for Classification Reform:

Research should not be limited to only cover the building classification systems that are currently used in various countries but should instead also look into other methods that are not currently used as classification systems. These alternative methods may be used to develop a more explicit means of categorizing buildings. Due to the implementation of a performance-based building and fire code in Australia, risk assessment of buildings using various measurement techniques may allow for a new system of building classification.

William Koffel's article, *Are Occupancy Classifications Outdated?* (1997), states that those who believe that the US occupancy classification system is obsolete believe that a new system lies in the context of performance-based fire codes and the risk assessment techniques that fire safety experts use to determine the fire risk of certain buildings. Koffel uses a comparison of an elementary school and a high school to give an example of how some parts of the current occupancy classification system is insufficient. Both schools are in the same occupancy group, but the risk from fire isn't the same for both buildings. The occupancy system does not address all of the risk factors that would differentiate the two schools (Koffel, 1997, p.28). Some of these factors include the fact that younger students may react differently in a fire scenario than older high school students and the high school will have a different fire load then the elementary school. "Performance-based design requires an evaluation to identify these characteristics and features" (Puchovsky, 1996, p.48). The use of these codes therefore may require more quantified data on risk factors for different building types.

The following section will describe the ways in which risk factors are accumulated by the use of various risk assessment techniques and their advantages and disadvantages. Since performance-based codes may require the amassing of quantifiable data on risk factors, it may be valid to use risk assessment techniques as a means to a more explicit building classification system.

2.9 Risk Assessment Techniques

The use of risk assessment for determining the chance and severity of a fire in a certain type of building may bring to light differences in various types of

occupancies. Certain occupancy types, which are currently are hard to separate, may be grouped more specifically based on the evidence determined by various risk assessment techniques. More important, new ways of classifying buildings, in terms of risk assessment, may be plausible due to these methods. Placing a value on the amount of risk in a building cannot be done until the term "risk" is properly defined. Risk, as it pertains to fire protection, is a measurement of the frequency and level of exposure to fire of people, property, and the environment. It is also a measure and evaluation of the extent of the negative effects caused by fire. Risk assessment methodologies calculate the extent of loss due to a fire as well as the probability of a fire occurring over any given amount of time. (Cornelissen, 1993, p.4)

In his article, *Risk Analysis and Fire Engineering* (1998), Hakan Frantzich explains that risk assessment methods can be broken up into three levels of involvement according to the amount of detail required in analysis. Qualitative methods involve identifying only the worst-case scenarios in a certain building design. These methods require the least amount of effort; fire risks analyzed this way are not ranked according to severity or frequency. A combination of qualitative and quantitative methods is used to rank these risks in terms of probability and consequences. This ranking can be used to create an index of relative fire risks. Quantitative methods are the most involved methods in terms of labor intensity and the detail of analysis. These methods are used to determine and examine the variety of fire scenarios that could take place in a certain building (Frantzich, 1998). Because of more frequent use of performance-based codes, it will be important to determine the quantified values on which these codes are based. Quantitative methods should be used to evaluate risk in order to come to quantified values of performance (Wolski, 1999).

Over the past few decades various members of the fire protection community all over the world have developed a variety of risk assessment methodologies. Some methodologies have been adopted from other applications of risk management and re-formatted to fit a fire risk assessment approach. Since it is redundant and far too time consuming to describe all methodologies that have been used or are currently being developed, only a select few will be discussed. The following methodology reviews give a good representation of the kind of methods available to aid in the ability to understand the possible use of risk assessment in building classification.

2.9.1 Risk Factor Approach:

The risk factor approach may be the answer to the call for a new system of building classification. This concept was studied and further developed by Rasmussen Litai in his paper *The Public Perception of Risk.* Whereas prescriptive codes are formatted by a series of occupancy type groups, performance-based codes may allow building classification based on use and perceived risk of fire. A building can be distinguished, in terms of fire risk, by the use of quantifiable values called risk factors. (Wolski, 1999)

Risk factors are scalable variables, which are differentiated from the overall risk of a building. These factors describe different aspects of overall risk in terms of severity, volition, and controllability. In all, nine factors can be used to calculate perceived risk. Each of these factors has alternative options under the scale. For example, volition is broken up into voluntary and involuntary risk. A voluntary risk may be described as entering an arena to see a concert, whereas an involuntary risk may involve sitting in a crowded high school classroom (Wolski, 1999). The rest of the risk factors, including their scale, are shown in Table 2.9.1.1.

Table 2.9.1.1 Risk Factors[2]

Risk Factors	Scale
Volition	Voluntary-Involuntary
Severity	Ordinary – Catastrophic
Effect Manifestation	Immediate – Delayed
Familiarity	Common (Old) - Dread (New)
Controllability	Controllable – Uncontrollable
Benefit	Clear – Unclear
Necessity	Necessary – Luxury
Exposure Pattern	Continuous – Occasional
Origin	Natural - Man-Made

Once an authority in fire protection designates the risk factors of a building, these factors may be compared to another set of factors from a different building type. This is done by the use of Risk Conversion Factors (RCF). The RCF quantifies which alternative of the scale the fire protection community accepts over the other. For example if a voluntary risk is depicted as 100 times more acceptable than an involuntary risk, the RCF value is 100. These values are derived from past information on fire statistics. The use of RCF values is a good tool in ranking the overall risk of a certain type of building. (Wolski, 1999)

[2] Source: Wolski, Armin (1999). Addressing Building Fire Safety as an Acceptable Risk Problem: A guide for Developing Performance-Based Fire Safety Regulations. Worcester, MA: WPI. P. 161.

Risk factors can now be used to categorize different buildings. According to the Nordic Committee on Building Regulations, once buildings are categorized, they can be placed into groups called "safety classes". The Nordic Committee ranks buildings as having low, normal, high, or extra high levels of safety. Each one of these safety levels describes buildings with similar combinations of risk factors and RCF. A building with risk factors that denote an ordinary (non-catastrophic) and controllable fire risk may be put into the low safety class, where as a high safety class would cover those buildings described as uncontrollable and possibly catastrophic fire risks. (Wolski, 1999)

The advantage of using this type of classification system is that fire authorities may avoid the problems of mixed-occupancy buildings. With the risk factor method, mixed-occupancy buildings can be placed into the proper safety group, integrating the different occupancy types into a set of risk factors. This system would also help setting up relative performance criteria for buildings in different safety classes using "adjustment factors". (Wolski, 1999)

2.9.2 Engineering Method:

The Engineering Method, developed by Worcester Polytechnic Institute (WPI) professor Robert Fitzgerald, is a risk assessment method that "examines the interrelationships and interdependencies of the building itself, the occupants, and any processes within the building" (Leblanc, 1993, p.10). In other words, it is a means to an understanding of how a building will perform after the start of a fire.

> "This understanding allows one to recognize the role of the important details on building fire performance so that the impact of existing conditions or posed changes can be recognized clearly and communicated effectively among individuals who influence design, construction, approval, and operation of the building" (Fitzgerald, 2000).

Evaluations can be carried out using quantitative or qualitative methods, but quantified data is more useful. The evaluator uses computer models in some cases to aid with evaluation. The Engineering Method incorporates a variety of evaluation tools, which are all integrated into complete risk assessment. These tools include event, fault, and success trees. Fault and event trees use a flow chart to depict whether or not a fire will be suppressed, either through self-termination, automatic system suppression, or manual suppression. The Engineering Method also stresses the use of computer fire and smoke models to aid in the compiling of mass amounts of data and calculations (LeBlanc, 1993).

The Engineering Method can be used for a variety of purposes, which work well with performance-based codes. The method can be used for evaluating equivalencies of new fire suppression techniques in relation to set code requirements from the older prescriptive fire and building codes. Fire authorities and building designers can use this system in order to compare different design strategies that arise due to the new performance-based regulations. Most important is that the Engineering Method could be used to compare and rank different buildings in terms of fire safety. Some of the terms of fire safety include; automatic and manual suppression systems, flame and smoke movement, structural performance, and the effects of fire in terms of people, property, and the environment (LeBlanc, 1993).

This method is dependent on a decisive and rigorous probability analysis of certain fire scenarios. Since these probabilities are not pre-determined or set values, the authority involved in the analysis must have a strong understanding of the Engineering Method and the principles incorporated with fire protection (LeBlanc, 1993). This may quickly narrow down the group able to use this method successfully. If greater emphasis on fire protection education were implemented by academics in

the fire protection field, the Engineering Method could be applied more effectively and more frequently. This might open the way to a new fire probability-based building classification system.

2.9.3 Risk Ranking of Buildings for Fire Safety:

In 1997, J.W. Boyes developed a thesis describing a way in which buildings could be ranked in terms of fire risk. In his thesis, Boyes examines fast and effective methods of assessing risk in different building types. Some of the methods Boyes examined are the Gretner Method, Dow's Fire and Explosion Index, the Rapid Fire Risk Assessment, and two methods used by the Australian Fire Services (New South Wales Fire Service Risk Mapping Classification System and the Queensland Mapping System).

In his combination of qualitative and quantitative methods, he developed a series of checklists that deal with various aspects of fire safety. Some of these aspects included:

- Occupant number
- Whether the occupants have limitations hampering the time for egress
- Whether the occupants sleep in the building
- Number of stories in the building
- Exit assessment
- Smoke and fire spread assessment
- Presence of hazardous materials
- Fire management practices assessment
- Presence of sprinklers, smoke detectors, heat detectors, manual notification devices, fire service connections

These factors can be ranked with either a positive or negative number. The final ranking is the summation of all the factor values determined through the checklists. This final number is multiplied by the probability of a fire, determined by the use of another checklist, in order to come up with an overall risk ranking (Boyes, 1997, p.19-61). The complete version of Boyes' Building Fire Risk Assessment Check Sheet can be found in Appendix B. Appendix B also contains an example of the check sheet being used to evaluate a hypothetical building.

The original use of the risk assessment system was to rank buildings in terms of risk to life safety, but this method could also be reformatted to assess buildings in terms of property protection, risk to the environment and risk to the community (Boyes, 1997). Currently this method is based on subjective data determined by experienced and knowledgeable members of the fire safety community. Although this method may not be fully effective until set standards are proposed, it is a good foundation for a finalized system of risk assessment classification.

2.9.4 Warren Centre for Advanced Engineering:

The Warren Centre for Advanced Engineering, in Sydney, Australia, conducted a project entitled, *Fire Safety and Engineering* in 1989. Seventy leading researchers and engineers who were led by Vaughn R. Beck completed this study. The project determined that building costs could be reduced while keeping efficient fire safety through the development of a quantifiable approach to building fire safety using the risk assessment model (RAM). The project also determined that designers and regulatory officials needed a better understanding of fire science and fire protection engineering techniques. The main aspect of the Warren Centre's efforts was the development and application of the RAM (Beck et al, 1992).

The risk assessment model is comprised of several subordinate models, each determining the level of performance for one of the fire subsystems. These subsystems are a list of factors that influence the risk from fire including the nature of occupancy, fire growth and development, active sub-systems, passive sub-systems, occupancy avoidance, and fire fighting. The RAM was used to determine the minimum amount of fire suppression systems that needed to be incorporated so that the building could achieve an adequate level of safety. If a building only had the minimum amount of fire suppression systems, then the cost of the building would go down with no further risk to life, property or environment. (Beck et al, 1992)

The Warren Centre's project looked into the building classification system of Australia. The researchers and engineers discovered that the limited and generic classification system wasn't sufficient for determining occupancy factors needed for the risk assessment model. "The assumption that similar hazard characteristics apply to all occupancies within each occupancy classification is not often valid" (Beck et al, 1992, p. 213). The RAM needed a more explicit list of occupancy characteristics so that buildings in the same classification group could be further distinguished. These characteristics included:

- combustible contents
- elements of construction
- energy services
- ignition sources
- installed fire suppression equipment
- fire management
- fire cover
- occupant characteristics

The researchers used fire statistics to determine quantitative values for each occupancy characteristic so these values could be factored into the risk assessment model.

The other four sub-systems were broken down into quantifiable values. Fire growth and development was quantified in terms of scenarios determined by computer models of fire and smoke flow through a building. Active sub-systems, including sprinklers and any other device that reacts to the presence of fire, were quantified by their performance characteristics in field tests and their distribution in a building. Passive sub-systems, including fireproof walls and architectural configurations that limit fire progress, had their values quantified in the same way as active sub-systems. The performance of the fire brigade was factored into the RAM in terms of how long it took for the brigade to commence fire suppression with relation to the severity of the fire growth. The final sub-system was occupancy avoidance or the behavior of people as they exit a building during a fire. This was quantified by analyzing fire statistics on the number of people exposed to untenable conditions and the probability of certain responses to fire alarms and other notification devices. (Beck et al, 1992)

The RAM offers another example of a technique that could be used to rank buildings in terms of fire risk towards occupants, property, the community and the environment. The Warren Centre project also showed that the current classification system used in Australia may be insufficient for the use of the RAM and other risk assessment techniques. The RAM as well as all the other risk assessment techniques are not problem free. The next section explains some of the major problems or concerns with the risk assessment techniques described in our report.

2.9.5 Problems with Risk Assessment:

The main problem associated with the use of these risk assessment methodologies is that evaluations come almost entirely from subjective values. LeBlanc states that the validity of the probability values determined depend solely on the evaluator carrying out the study and how detailed and structured the study was. Where the risk assessment methods are applied as a structured approach, it is the responsibility of an experienced member of the fire safety community to make good engineering judgments (Leblanc, 1993). Due to the small number of experienced fire safety engineers in Australia, these techniques may be difficult to implement as national regulation.

Another problem with risk assessment methods is that, apart from the Warren Centre's RAM, human behavior is not systematically factored in. Whether or not a person responds to a fire alarm in the right way may depend on their behavior patterns. The presence of panic and confusion in a person or group of people will also affect orderly egress (Gohsh, 1996). Although experts in the fire protection community realize that human behavior influences the risk assessment of a building, it is a complex factor to quantify (Boyes, 1997). This makes it difficult to include human behavior in a structured methodology.

Yet, within these risk assessment techniques may lie a way to improve the current building classification system used in Australia. It is a matter of simplifying these techniques so that all members of the fire safety community, building designers, building owners and operators will be able to understand and use risk assessment. If these methods cannot be simplified, then more responsibility will be placed on experienced fire safety experts if a risk assessment approach to building classification is used in Australia.

2.10 Summary:

The research conduct has allowed the gain of a background in the fields related to building classifications. The difference between prescriptive and performance-based codes was determined through investigation of code history and use. This led to the discovery of the goals that each type of code is meant to achieve and the means by which they accomplish their purpose. An understanding of the classification systems found in a variety of building codes from different countries including the United States, Canada, and Australia was developed. Sprinkler codes, as a means of fire safety regulation, were also examined. This provided another view of building classification systems and their use.

Through the examination of various risk assessment techniques the knowledge of other approaches to categorize buildings not previously used within regulatory codes was gained. This has shed light on the various factors that constitute safety for life, property, community, and the environment. It is possible that the techniques examined could be formulated into a classification system unlike those currently used. This background information will aid in the formulation of the questionnaire while allowing for an understanding of the opinions of various stakeholders as well as the reforms that they suggest.

3 Methodology

3 Methodology

The main goal of this project was to determine if stakeholders believe the current building classification system found within the Building Code of Australia (BCA) is in need of reform, what specific changes they suggest, and the possible effects if those reforms are implemented. To accomplish this goal the group compiled a literature review including archival research on the building codes of Australia and the United States as well as on the risk assessment methods used by fire safety engineers. This research helped formulate the interview questionnaire. This questionnaire was used to conduct the interviews with the stakeholders, including experts in the fields of fire protection and in building codes and classifications.

The forty interviews were conducted with several fire safety engineers, academics in the field of fire safety, fire service agencies, government officials, building surveyors, regulatory officials, and property managers. Each group provided insight into how their respective professions use the codes. More importantly, the group asked each professional for their suggestions on how the classification system in Australia can be reformed to improve fire protection of people and property.

3.1 Further Examination of Classification Systems:

Researching the classification systems of Australia was beneficial. The project sponsor, the Australasian Fire Authorities Council (AFAC) was able to provide the necessary resources that included information about building codes not available during our preliminary research. The project goal required that the group gather and report the opinions of the stakeholders on the need of classification reform and approaches for this change of the building classification system within the BCA.

The completion of this task required a profound understanding of the building classification system within the BCA and how it functions. Thorough research allowed the group to ask intelligent questions and obtain as well as understand the information and opinions given by the respondents.

3.2 Expert Opinion of Building Classification Reform:

The major portion of the work conducted in Australia consisted of interviews with professionals in the various fields that pertain to the formation and use of the building classification system with the BCA. The information received from these interviews gave the group strong evidence as to whether or not the current classification system used in Australia is perceived as requiring reform. It also helped to develop a list of possible modifications based on the suggestions of each interviewee. These professionals have the experience and expertise in dealing with the classification of buildings, thus their opinions become extremely valuable to the project group.

It was important to develop questions that cover the same concepts for each of the professional groups, but were formatted to the specific knowledge of the respective expert. The most vital questions included:

To what extent are members of your profession involved with the formation, use and upholding of the Australian building classification system?

What are some of the advantages and disadvantages of the current building classification system used in Australia?

Is there a need to reform the current classification system?

What are the reasons for changing the current system?

What can be done to improve the way buildings are classified and how could these improvements be carried out?

What will be the impact on the fire safety professions and the community if the current classification system is changed?

These questions are general as stated above and needed revising so that each inquiry coincided with the profession of the expert being interviewed. The final questionnaire can be found in Appendix C. The next section describes each of the profession groups that the group interviewed. An understanding of each of these groups lead to a proper delivery for each question, while assuring that the same concepts were covered throughout the entire sample of professionals.

3.2.1Stakeholders:

Fire Safety Engineers:

Fire protection engineers work with and have the knowledge of many of the risk assessment methods described in our review of the literature. They use these methods regularly as tools for determining the fire suppression systems that should be used in different types of buildings. Many have an understanding of the way fire behaves in certain scenarios and their strong engineering background allows them to determine the fire risk of a building in an organized, quantifiable manner. Since most fire protection engineers work as contractors, interviewing them would allowed the private sector point of view to be included.

Academics in the Field of Fire Protection :

Academics in the field of fire protection posses a specialized background in the fire sciences. In most cases, a PhD is required to earn an academic position at an institution. Academics may be more up to date than engineers with innovative risk assessment methods (including their own methods) and with the latest building fire

code revisions. Some were familiar with the history surrounding the creation of the current building classification system used in Australia.

Fire Service Agencies:

The members of fire service agencies that needed to be intervie wed included the fire chiefs, building inspectors and station officers in and around the cities of Melbourne, Sydney, and Canberra. These professionals are responsible for the fire fighters in their brigades as well as the safety of the community in which they serve. They are also responsible for the investigation of every fire in their district. They therefore have an in-depth knowledge of the causes of fires and the consequences of these fires in different building types. The fire service agencies that they work for must act on a range of concerns that include life safety, property protection, social and environmental impact.

Government (Sate and Local) Officials:

Government officials are responsible for the composition of the national codes of Australia (BCA) as well as the interpretations of these codes at the state and local level. It is the duty of this group to make sure these codes are up to date through the creation of amendments and code reforms. Since the national government plays a major role in the process of writing and revising codes, it was to the benefit of the group to get government officials' perspective on the status of the current building classification system.

Building Surveyors:

Building surveyors work in collaboration with build ing designers to ensure that the building meets the requirements stated in the Building Code of Australia (BCA). These professionals are now allowed to leave the confinement of the government and work as private consulting surveyors. Building surveyors must have

a good understanding of the BCA. Some may stick with using the deemed to satisfy code, while others may option to use the new performance-based regulations. This could bring about a wide variety of opinions on the current classification system within the surveying profession.

Regulatory Officials:

This government group is also responsible for making sure that all buildings meet the regulations set by the Building Code of Australia (BCA). However only this group decides whether a building receives its occupancy permit. Work that is done by private building surveyors must meet the approval of the regulatory officials upon request by the government. The regulatory body in Melbourne is the Building Controls Commission (BCC). Like private building surveyors, this group must have a complete understanding of the BCA and the building classification system.

Property Managers:

Property managers may not be directly involved with the use of building classification, but they are effected by the outcome. This group is responsible for maintaining the fire safety systems within their buildings and making sure that all of the occupants and the property are protected at all times. Any problems dealing with the classification or regulations of their building will have a direct effect on the property manager. Thus, it is in the best interest of property managers to make sure that the building classification system is effective for placing the necessary regulations on the building for which they are responsible.

3.2.2 Locating and Contacting Potential Interviewees:

It was important when going through the process of selecting potential interviewees that the group compiled a list of experts with diverse opinions and knowledge of building classification. The group had to avoid simply requesting the

names of other experts in the field from those professionals whom were already interviewed. In doing so, the group prevented the chance that all the experts interviewed have a common opinion or have the same range of knowledge. In some cases, experts interviewed only direct others to professionals who support the opinions they express. Experts in specialized fields may only have knowledge of other people in their own field of study.

The group had to go about selecting experts to interview in a manner that did not lead to biased results. In order to do this group contacted professional organizations within Melbourne and other locations. These professional organizations included experts from each of the categories discussed in the previous section. By contacting these organizations, access to a diversely opinionated group of professionals was gained. Organizations that were contacted include:

- Australasian Fire Authorities Council (AFAC)
- Metropolitan Fire Emergency Service Board
- Country Fire Authority (CFA)
- New South Wales Fire Brigade
- Australian Building Codes Board (ABCB)
- CSIRO
- Ove Arup and Partners
- Australia Capital Territory Fire Brigade (ACTFB).

These organizations served as gatekeepers, allowing the group to create an adequate list of potential interviewees.

Once the list was compiled, the group contacted the professionals by telephone and e-mail. The group gathered a small number of professionals to contact before arriving in Melbourne through previous discussions with our sponsor and with experts located in Worcester, Massachusetts. While the group attempted to contact

professionals through the organizations described above, interviews were conducted with this small group. This ensured interviews were continually taking place once the group arrived in Melbourne. By beginning the interview process early on, the group interviewed the greatest number of professionals possible in the given time.

3.2.3 Interviewing:

The interview program allowed the group to gather a broad range of data. At the beginning of each interview the group discussed with the interviewee the confidentiality of their personal interview and on the nature of the project statement as well as its ultimate goal. The implementation of a semi- standardized format for each interview was planned. The advantage of the semi- standardized interview in the project was the ability to collect the necessary quantitative data while at the same time allowing for the collection of qualitative data, which may or may not deal specifically with our project statement. This also allowed the experts in each individual field introduce issues that were not anticipated throughout the initial research.

Determining the types of questions to ask and their order t hroughout the interview was very important. Because a semi-standard interview style was being utilized it was best to arrange questions in a funnel design. This allowed for the collection of common responses without losing valuable information. The funnel design method of arranging interview questions consists of questions relating to the main project focuses before moving into groups of questions that correspond directly to the issues particular professionals may want to address.

Some questions focused specifically on the utility of building classifications. These questions queried each interviewee about their experience with the current systems of classification both in Australia as well as abroad. Their responses informed the group about the perceived effectiveness of the building classification

system within the Building Code of Australia. The remaining questions focused on the reasons a reform may be needed, extracting specific suggestions for improvements to the current classification system within the BCA, and the possible impacts these reforms having on the various fire safety professions and the community.

3.3 Documentation of Results:

Upon the completion of the interviews a brief summary of each interview was written and the tapes were stored for future reference. Copies of these summaries are located in Appendix E. The final report categorizes the results in terms of the three focus topics of the interview questionnaire; reasons in support of or opposing reform, specific suggested changes, and possible impacts caused by reform. This type of documentation allowed for a comparison of the opinions expressed by each professional in response to the standardized portion of our interview questionnaire. The documentation emphasized the majority opinions of each profession and also carefully examined any minority opinions or variations from the majority.

4 Results and Analysis

4 Results and Analysis

In this chapter the results from the interviews conducted will be presented and analyzed. In all, forty professionals in the fire safety and building communities were interviewed. A brief summary of each interview can be found in Appendix E at the end of the report. This chapter is broken down into three sections; justification of classification reform, specific suggested reforms, and the possible impacts of reform. Through the analysis of the interviews, similarities between the opinions of the interviewed professionals were determined. Opinions that were found to have similarities were grouped together so that they could be explained. Opinions that did not fit in a particular grouping are discussed at the end of each section.

4.1 Opinions Regarding the Need for Classification Reform:

The primary focus of this project was to extract fro m the interviewees their opinions regarding code reformation. The first group of question focuses on the reasons given by professionals as to why the classification system currently found in the BCA should or should not be changed. A majority of the professionals contacted believe the classification system requires major alterations. The most common reasons given to validate the call for a reform of the building classification system were:

- age of the system in comparison to major developments in industry
- broad classes within the system
- negligence of the system regarding some building types
- lack of consideration for the range of risks in a class
- limitations the system places on performance-based design.

While the level of reform thought to be necessary varied, every professionals interviewed agreed that some form of change or updating is essential.

Several advantages of the current system were exposed during the interviews. The most prevalent of these was the simple format of the classification system that results in its ability to be easily used. Many of the interviewees warned that this might be taken away if the system is changed. They also stated that over-complicating the categories would lead to a system that is hard to utilize. Some interviewees pointed out that changing the classification system would require the entire BCA to be revised. Some stated that the low number of fire related incidents that have occurred under the current system supported the current system. While several professionals gave insights to the advantages of the current system they all held the personal opinion that some sort of reform was necessary.

4.1.1 Support of Reformation:

In 1974, the Victorian Government published the Uniform Building Regulations (UBR). Chapter 6 of this document contains an occupancy based building classification system that mirrors the current system found in the Building Code of Australia (BCA). Several of the professionals interviewed believe that a system for categorizing buildings that was developed over twenty-five years ago can not accurately define the buildings that are common to construction today. Peter

Johnson, a principal at the consulting firm of Ove Aurp & Partners worries that the classes are based on an "archaic" system that has not changed much over the years. Jane Blackmore of CSIRO in Sydney, Philip Chun, Director of the building consulting firm Philip Chun, and Associates, and Wayne Bretherton, formerly of the ABCB and currently an associate at BGSM Consulting Building Surveyors voiced similar concerns. Chun stated, "the system for classifying buildings has remained unchanged while the world of building design and construction has grown in leaps and bounds".

Many professionals also felt that the current classificati on system neglects to classify several types of buildings that have become more common in modern construction. Multipurpose buildings have areas that, when considered separately, would be placed in different BCA classes making them difficult to categorize. Some professionals feel that this topic is not properly addressed in the classification system. Stephen Kip, Building Manager of the Building Control Commission of Victoria, sighted several sports complexes and mega malls constructed as examples of hard to classify multipurpose venues. Jane Blackmore of CSIRO in Sydney and Jon Lynch, the Building Codes Officer of the Department of Urban Affairs and Planning in Sydney, and others also mentioned that the current system does not adequately discuss how to handle multipurpose buildings.

Several professionals feel that the classification system should be reformed because the broad categories lead to issues such as misclassification or conflict over interpretation. Sam Aloi, an associate at the consulting firm Norman Disney & Young stated that many of the classes have very ambiguous definitions. Aloi mentioned that the classification of aged care facilities is a major issue. Ray Joppich, Manager Fire Risk Management Study, and Roger Bobbera, Project Manager, who both work for

the Department of Human Services in Melbourne along with several others also sighted these facilities as well as other hospital type and assisted care buildings as problem areas. They alluded to the ambiguity with tenant buildings for the elderly. These facilities provide some care but are much different in terms of risk than both normal tenant building, a class 3 in the BCA, and a full hospital, a class 9, yet they are usually classified as one of the two (Joppich, 2000).

The ambiguity of the classification system, many of the interviewees think, results in a wide range of interpretations that can lead to conflict and misclassification. Several of the professionals feel that the classification system does not take into account the wide range of risk that can occur in the classes. According to many professionals, buildings placed in a class have the same requirements under the building classification system in the BCA yet the needed protection can vary greatly. Neil Bibby, Director of Community Safety at the Country Fire Authority (CFA) summarized this concern by saying, "A warehouse containing concrete garden gnomes and a warehouse containing polystyrene cups have the same requirements under the BCA. Yet, it is obvious that their risk, and the level of protection necessary, is very different."

The professionals who believe that the prescriptive nature of the classification system limits performance-based design also favored reform. In his interview, Stephen Durnford, Assistant Director of the Department of Urban Affairs and Planning, stated that, "a more flexible system would allow for more innovative designs." Bruce Thomas of the building consulting firm Bruce Thomas & Associates and several others interviewed feel that the classification system is holding back the advancement and improvement of performance-based solution. Wayne Bretherton

stated that, "the restrictive nature of the current system prevents productivity on the part of the designers".

There were several other reasons supporting reform mentioned by smaller groups of the interviewees. Some of the professionals contacted feel that the classification system as it stands neglects the ability level of the people within a building. Ray Lacey, Director of the consulting company Lincolne Scott, stated that the BCA should look at the role of human behavior and ability levels of tenants in classifying buildings. Jarrod Edwards of the Major Hazards Unit of WorkCover Safety, Stephen Kip, and Wayne Bretherton all raised similar issues. Rod Sinclair, the Fire and Safety Systems manager at the Crown Casino and Alan Host, Team Leader at the Department of Urban Affairs and Planning, pointed out that if the use of a building changes it could very well require re-classification. Something that neither thought the BCA addresses properly, especially in regards to buildings with a performance-based design. These buildings contain engineered solutions to regulatory requirements. The solutions implemented may be inappropriate if the use of the building is changed. Another less frequently cited reason for reforming the building classification system was the increased cost-effectiveness a reformed system might provide (Chun, Blackmore, 2000). Both felt that if the system allows for buildings to be tailor-made it could greatly reduce the construction cost of most buildings.

The *United Nations Fire Statistics Study* released in 1999 by the World Fire Statistics Centre compares the fire statistics of major nations. This report shows that in comparison to the other countries examined, Australia has room for improvement in terms of life safety during incidences of fire. The statistics show that from 1994 to 1996 the nation had 0.82 deaths due to fire per 100,000 people. This

ranks the country fifth out of eleven. The countries examined were Austria, Australia, Germany, Italy, Netherlands, New Zealand, Spain, Switzerland, the United Kingdom, and the United States. From this study it is apparent that not only should a reform be considered because of the support given by the professionals interviewed but because statistics show there is a need for improvement of fire safety in Australia as well.

All of the professionals spoken with maintain that a reform of some sort is needed. In spite of the call for reform by the interviewees and the data reported in the *United Nations Fire Statistics Study*, several of the professionals contacted were able to cite advantages of the current system. They feel the building classification system as it stands contains some positive aspects that should not be lost in the reform.

4.1.2 Advantages of Current System:

The current system of classifying buildings found in the Building Code of Australia (BCA) is, in the minds of most of the professionals interviewed, easy to use in a majority of building scenarios. Paul England, Managing Director of Warrington Fire Research said, "the current BCA is reasonably close to optimum and is written in a manner that is easy to use". Some interviewees stated that in general, the system is ease to use and understand.

Another reason given to avoid reforming the classification system is that any change would require the entire BCA to be revised. The classification of a building is what determines the building code requirements. Stephen Hudson, Project Manager at the Australian Building Codes Board, and Stephen Durnford, Assistant Director of the Department of Urban Affairs and Planning, feel that a change of the classification system would probably be accompanied by a reorganization of the BCA. This is because many provisions of the code relate to the classification of a building.

Another, less frequent, reason given to leave the system as it stands is that the interviewees believe the number of fire related incidents in Australia is very low. Paul England stated, "it would be difficult for a change in any part of the BCA to significantly affect the life safety of the community". This leads to the question as to whether or not the intense effort required to produce a positive change would be worthwhile. John Clampett a former employee of the Australian Building Codes Board and currently Director of Fire Safety Research at the Building Research Association of New Zealand voiced similar concerns. However, the statistics found in the *United Nations Fire Statistics Study* show that there is a definite need for improvement in Australia.

Many people involved in code regulation warned that adding several subcategories accompanied by their own set of regulations would make the code significantly harder to regulate. Other professionals involved in applying the code cited that moving toward a risk assessment based classification system could easily become too subjective. This would lead to additional conflicts due to varying interpretations of the BCA than currently exist.

Some professionals stated that the code itself is fine and all problems that arise are due to human error. While some of the Australian states require certain education levels of professionals who use the code, there is no federal standard. Stephen Wise, Managing Director of Stephen Grubits & Associates ACT feels that a movement toward demanding a common level of higher education from the professionals who apply the code will eliminate most problems present.

Several of the interviewees went into detail regarding solutions to the problems they feel present in the classification system. These suggested reformations are another main focus of this project. Through the interview questionnaire developed

the group was able to expose the steps each professional feels necessary to make reform in the code in the areas they specified. The following section explains in detail the reforms proposed throughout the interview process.

4.2 Suggested Reform of the BCA Classification System:

The second group of questions that professionals were asked in the interviews concerned their opinion as to whether the current BCA building classification system needs reform and their suggestions as to what changes should be made. Within the group interviewed there were some similarities in the suggested approaches towards the reform of the system. Even though each suggestion varied in some way from the others, a group of repeating themes was discovered. The professionals' opinions were then brought together and analyzed. Figure 4.2.1 shows the breakdowns of opinions towards each of the possible reform solutions of the BCA classification system. The chart gives the percentages of both the overall interview group and each individual profession group that suggested certain reform solutions. These numbers only express the opinions of the professionals interviewed for this project and are not meant to express the opinion of the entire Australian representation in each profession.

Figure 4.2.1: Breakdown of Suggested Reforms

Professional Group	Sug. 1	Sug. 2	Sug. 3	Sug. 4	Sug. 5	Other
Overall	13%	35%	30%	8%	20%	15%
Fire Safety Engineers	11%	28%	33%	11%	6%	11%
Academics *	-	-	100%		-	-
Fire Service Agency Members	18%	55%	9%	9%	-	9%
Building Surveyors	10%	20%	30%	-	20%	10%
Regulatory Officials	-	-	33%	-	67%	-
Property Managers *	-	-	-	-	-	100%

* Only one academic professional and two property managers were interviewed resulting in the skewed percentages shown above.

In figure 4.2.1, suggestions one through five represent the five groups of similar reform solutions. These five suggestions include the following:

- Suggestion 1: Addition of Categories
- Suggestion 2: Sub-Classification of categories
- Suggestion 3: Risk Assessment Approach to Classification
- Suggestion 4: Adoption of the NFPA 101 Classification System
- Suggestion 5: Research the Need for Reform
- Other: Other Suggestions

Some of these reform suggestions seemed to be "band-aid" or short-term solutions, while others could be described as long-term solutions. In this section, the suggested reforms are explained focusing on the groups of similar reform suggestions previously listed. Unique solutions and isolated opinions are described towards the end of this section.

4.2.1 Addition of More Categories:

A number of the professionals interviewed suggested adding categories on top of the existing ten categories in the current BCA classification system. Additional categories will allow buildings that are currently difficult to assign to one of the current category to be placed in a more specialized classification. Kevin Comerford, Director of Fire safety at the Australian Capital Territory Fire Brigade, feels that it is impossible to classify all building types within the current ten categories and the addition of more categories would alleviate some of this problem.

Paul England, Managing Director at Warrington Fire Research Pty. Ltd., thought that the current system under the BCA is reasonably close to optimum and all that needs to be done is to fine tune the system with additional categories. He stated that he "wouldn't throw what we got in the bin; doing so would cause problems for

practitioners". England explained that the difficulty would be in finding the proper number of categories so that the classification system would be improved and would not become overly complicated for the fire safety professionals. This reform theme was not limited to one particular professional group. Members from the fire safety engineering, fire service, and building surveying and consulting professions were represented in the suggestion of additional categories.

4.2.2 Sub-Classification of Categories:

The next similarity between suggested reforms was the idea of implementing a set of sub-classifications into the current categories found in the BCA. Approximately a third of the professionals interviewed expressed interest in moving towards this type of system. The current BCA already contains some sub-classification; classes 1, 9, and 10 are broken up into two sub-classifications. The professionals who suggested this form of modification wanted a more explicit set of sub-classifications than what is currently described in the BCA. One with more categories that are separated by factors other than just the intended use of the building. Robert Marsicovetre, a private building surveyor for the Metropolitan Fire Brigade, believes that the sub-classification categories will help to eliminate buildings that are either misclassified or that may fall through the cracks of the current system.

Commander Trevor Perkins of the MFB Major Hazard Facility Unit stressed the implementation of a sub-classification system based on hierarchy of risk assessment for retail premises, factories, and warehouses. This hierarchy would incorporate the use of the building as well as a hazard assessment and determination of risk, where the probability and possible consequence of a risk related incident would be determined (Perkins2, 2000). Perkins feels this system would help account for buildings that do not fit nicely into categories and also allow the BCA to cover

other issues besides life safety like environmental safety and community impact. There are building designers that do not realize that their buildings are impacted by other legislation such as Australian hazardous materials and dangerous goods acts, Perkins stated. If a dangerous goods classification was built into the BCA, then designers could not overlook these vital regulations and the subsequent impact on buildings such as fire rating of elements of the structure and fire safety systems. (Perkins1, 2000) Ray Joppich of the Department of Human Services also believes that a sub-classification based on risk assessment would be the best solution to the problems of the current BCA system. Joppich stressed that clear checklist risk assessment would have to be developed so that subjectivity in the application of the new classification system would be avoided.

Philip Chun of Philip Chun and Associates has a slightly different approach to the implementation of sub-classification. Chun suggests that a sub-classification based on a standard risk assessment matrix be used. The major difference with Chun's solution is that the current ten categories would be reduced to two or three broader categories. For example, Chun stated, "It's not necessary to separate all of the residencies". The breakdown of residencies would be done by the sub-classification system. The other two major categories could be commercial and industrial buildings, in which they would be broken up the same way as the residencies. Stephen Grubits, Managing Director of the fire engineering firm Stephen Grubits and Associates, agrees with the use of a risk assessment matrix format of sub-classification. He stated that factors such as occupancy density and "whether the occupants are familiar with their surroundings" would determine which sub-group the building is placed in.

Trinh Lew, an engineer with the MFB Fire Safety Department, also believes that a risk assessment matrix form of sub-classification would work. With this, the variations of risk within each of the ten categories would remain and would be based on the sub-classification (Lew, 2000) With this system of sub-classification the variations of risks could be identified and regulations could be assigned to certain risk groups. By holding onto the current categories described in the BCA, the flexibility given to building designers through the use of performance code would not be lost.

4.2.3 Risk Assessment Approach to Building Classification:

One of the more prevalent suggestions for reform was the idea of replacing the current BCA system with a brand new building classification based on risk assessment rather than just the use of the building. This suggestion is similar to the sub-classification based on risk assessment, with the one main difference being that the current categories defined in the BCA would be completely replaced with a brand new categorization scheme. About a quarter of the professionals interviewed suggested this idea for the reform of the BCA building classification system.

Neil Bibby of the Country Fire Authority suggests that the current classification system needs to be left behind and a new risk assessment and ranking system be developed. He states, "Fixing the definition (of the current BCA classification system) is just flopping around the edges. By sticking to the same system and just changing the definitions, it would be fundamentally flawed in even thinking along those lines". In Bibby's system, buildings would be assessed by a standard risk ranking system in terms of various building and occupancy characteristics. This risk ranking system could be done by computer programs or by a simple checklist format depending on the complexity of the building. Once the building is assessed it would be placed in a risk category. For example, there would

be ten risk categories with one being the lowest risk buildings and ten being the highest. (Bibby, 2000)

Bruce Thomas, managing Director of the building consulting firm Bruce Thomas and Associates, personally prefers the use of risk assessment and believes it is the most logical solution. The type of risk analysis that he describes is based on the product of probability and consequence, which is a level three analysis in the Fire Engineering Guidelines written by the Fire Code Reform Center. Ray Lacey of Lincolne Scott feels that the use of a risk assessment matrix or Venn diagrams would be his choice for classification reform. Lacey wants the new classification system to look at more than just the "bricks and mortar" of a building, but also occupant behavior and management impacts on risk. "If you assume that the building does it all and the people that occupy the building are not active players in all of this, then the present classification system may be fine (Lacey, 2000)." Yet, Lacey stated that the belief that building characteristics are the only factors that influence risk is subject to great challenge.

Many of the professionals interviewed expressed their desire to have the current BCA classification system modified to a risk assessment based system. Alan Host, Team Leader at the Department of Urban Affairs and Planning in Sydney, said that the categories should entail more than just the overall use of the building and a possible solution would be to have the new system defined by a risk assessment matrix. John Clampett, Director of the Fire Safety Division of the Building Research Association of New Zealand, also backed the idea of moving towards a risk assessment building classification. Clampett said with a risk assessment classification system, a building would be more accurately classified while retaining the benchmark of the deemed to satisfy code.

It is the view of all the professionals that suggested a risk assessment approach to building classification that a standard risk assessment technique or system would need to be developed in order to remove the subjectivity involved with placing a building in a category. Roger Bobbera of the Department of Human Services stated "You would need some guideline, a checklist would be good, so you could get some consistency in the way that the people do the assessments". This would avoid two building surveyors classifying the same building in two different categories (Bobbera, 2000).

This solution can be described as more of a long-term solution. It would take some time to develop the system of risk assessment. A few of the professionals that made the risk assessment suggestion feel that it would be better to spend some time developing a completely new system then work around the current BCA building classification. As stated by Neil Bibby, "Fixing the existing system will not give the fundamental change we need to look at all of the other peripheral issues that relate to identifying what the buildings are about".

4.2.4 Adoption of the NFPA 101 Classification System:

The interviews revealed that some professionals look at the National Fire Protection Association (NFPA) classification style as a possible suggested approach to reforming the BCA classification system. In particular, the building classification system used in the NFPA 101 Life Safety Code was depicted as a model that the BCA should try to incorporate. Gary Martin, Commander of Dangerous Goods for the MFB, said he would move the BCA classification more towards the format of the NFPA 101 code because it already contains a built-in risk approach to building classification. Martin stated, "The life safety NFPA 101 code is a fairly good example of how to look at occupancy, people, and the construction". The way

hazards are assessed in the NFPA 101 is similar to the way the Dangerous Goods Department calculates risks and classifies hazardous materials (Martin, 2000).

Richard Custer, the Technical Director for the Fire Codes Reform Centre, also suggested this type of reform. Custer believes that the NFPA 101 code would be a good starting point for the Australian Building Codes Board in their process to reform the current BCA. The ABCB could determine which parts the NFPA 101 classification system could be beneficial to Australia and then adopt those parts into the BCA (Custer, 2000). Scott Young, a senior consultant fire engineer at Warrington Fire Research Pty. Ltd., feels that a restructuring of the BCA classification system to match the format of NFPA 101 would produce more specific categories. This would limit the requirement of extensive sub-classifications (Young, 2000).

The suggestion of adopting the NFPA 101 classification format into the BCA is very similar to the suggestion that a risk assessment approach to classification be created. Both suggestions have their respective categories based on risk factors other than just the intended use of the building. With the classification of occupancy coupled with the hazard of contents classification, the NFPA 101 life safety code may produce an adequate assessment of a buildings risk and cover a lot of the limitations that professionals in the fire safety community believe are in the current BCA.

4.2.5 Research the Need for Reform:

There is a group of professionals that were interviewed who believe that a worthwhile reform of the BCA building classification cannot be made without extensive research into the effectiveness of the current system. Steve Hudson, Project Manager at the Australian Building Codes Board, stated that it was the opinion of the board and him that the best way to go is to conduct a thorough research into the need for reform. Hudson is currently gathering information from overseas building codes

along with the opinions of states, territories, industry and the professionals in Australia about the status of the current BCA. Through this approach, a balance between life safety and many of the economic impacts can be made before the reform is developed. It also allows the board to determine whether a reform would actually improve the current system. "If we develop the best system in the world, but unfortunately it doubles our construction costs, it needs to be looked at (Hudson, 2000)."

Steve Durnford of the Department of Urban Affairs and Planning stated, "If you want to do any reform, you should step away from the code itself and try to clearly articulate your objectives. In relation to the issue of classification and what you expect from a classification system and the purpose such must achieve in relation to the BCA, what do you want, and then the results from the reformed classification system". Durnford believes that the term reform does not always mean you end up with a change. The reform process should allow for the understanding of what the goals are and whether certain changes would help to reach that goal. It may be found through this process that the current BCA classification is the best system you can get. (Durnford, 2000)

Members of the building surveying profession also expressed the suggestion of research before reform. Mark Boswell, Director of BGSM Consulting Building Surveyors, explained that any reform project needs to be supported by a research component. This research component would identify the problems with the current system and support or oppose the need for reform (Boswell, 2000). John Koloadin, a building regulation consultant of Tyco, suggested a review of the BCA be done every two to three years. The review would research whether the current BCA is up to date

with the changing building industry. The suggestion of research would insure that reform of the current classification system was an appropriate procedure.

4.2.5 Other Suggestions:

With forty interviews, it was hard to place all suggested reforms into one of the previous groupings. Some of the professionals interviewed had a different, but just as interesting and effective, suggestion for the reform of the BCA building classification system. Some of these suggestions came form Jane Blackmore of CSIRO, Stephen Wise of Stephen Grubits and Associates ACT, and from Sam Aloi of Norman Disney and Young.

Jane Blackmore does not believe that the classification system should be the "driving force" in the BCA; rather the building and occupant characteristics themselves should lead to the required regulations. Blackmore suggested the creation of a purely electronic BCA either through CD-ROM or the Internet. In this new approach, the current classification system would be replaced with a menu driven program requiring the designer and practitioner answer questions regarding the building and occupant characteristics. The program would then use the characteristics to produce a specialized set of regulations for that particular building. There is already a CD-ROM version of the BCA, but the program that Blackmore suggested would be a completely interactive process that would take the user through all the steps and could eventually lead to approvals over the Internet. (Blackmore, 2000)

Stephen Wise suggested that a list of buildings referenced to each category could be added on to the BCA or the Guide to the BCA. This is similar to way example buildings are given in both the NFPA 101 and 13 classification systems. Another suggestion given by Sam Aloi was to add more explicit definition to the existing categories. He feels that better definitions of terms within the category

descriptions, like the term "aged care" will help to remove some of the ambiguity that exists in the current system of classification.

The entire list of suggestions that was received through the interviews consists of both short term and long term solutions. The short-term or "band-aid" approach involves sticking with the current system of classification and making modifications. These suggestions included the addition of more categories and the further definition of the existing categories through a form of sub-classification. The suggestions that could be grouped as long-term approaches included instituting completely new systems of classification. These include the suggested move to a risk assessment approach to classification and the adoption of the NFPA 101 code format. The following section will discuss the interviewee's opinions regarding the impact that both the short and long term reforms could have on the various areas of concern.

4.3 Impact of Suggested Reforms:

Once the problems with the classification system have been identified and after potential solutions are examined it is then vital to the reform process to determine the possible impact of each reform. If a new system is to be implemented then it must first be examined to expose possible affects not only on the life safety of the community but also its impact on the professionals who apply it in their everyday work. The potential economic issues of a new system must also be examined to determine its impact on the capital, life cycle, and living costs.

The life safety of the community is of paramount importance when examining a switch to a new classification system. The safety of both peoples' lives and of valuable resources often rests on the success or failure of a classification system. It is

the building block from which the entire BCA starts. It single-handedly decides what each building's requirements are from structural integrity to fire safety. If the classification system stays relatively similar to the existing system but adds more definition and more sub-classification it is the opinion of many professionals that the life safety of the community would increase but only slightly. Dave Nicholson, of the Metropolitan Fire Brigade, feels that, "A reform of the classification would hopefully reduce the risk not only to the brigade but the people and the environment as well." While Ray Joppich from the Department of Human Services feels that a risk ranking classification system is better and that its implementation would, "bring about more community awareness about the risk involved with fire. This change in attitude will improve the overall fire safety." However, John Clampett of the Building Research Association of New Zealand points out that no matter which system is adopted, "Australia's numbers are low in comparison with other countries, it would be hard to quantify any significant improvement brought about by a change in the classification system." With the overwhelming opinion that a new system could only bolster life safety numbers it now becomes important to investigate the impact that a reform would have on professionals who would be applying and interpreting the new classification system.

It is the belief of most professionals who deal with the classification system that something needs to be done to improve upon its definition and occasionally subjective nature. The discrepancies in opinion come when examining which classification system should be implemented. The professionals are split almost directly in half on what should be done but they all know that changes in their jobs can be expected from any change implemented.

While most feel that a change in classifications will not have as large an impact as the addition of performance did in 1996, they do realize that some practitioners may have trouble keeping educated about changes. Paul England, of Warrington Fire Research, feels that, "for the major practitioners this will not be a problem but some of the lower level or average practitioners will have trouble in keeping up to date on changes in the code and its application." When asked about possible implications of a risk assessment classification system Jarrod Edwards felt that the regulatory officials will have trouble keeping up. He stated, "At this stage the personnel and the infrastructure that the authorities have wouldn't be able to cope with the workload produced by a switch to a risk assessment classification system. A move to risk assessment would require more of the fire authorities and other regulators."

It is the opinion of most professionals that the addition of sub-classifications and better definition will have less of an effect on the professionals. Scott Young, of Warrington Fire Research, believes, "a move to a more clearly defined code will make the jobs of professionals who deal with the code a lot easier. It will erase some of the ambiguity associated with certain classifications." All professionals agree that no matter what the outcome of reviewing the classification system provides in the way of reforms; education will be necessary. Richard Custer, of the Fire Code Reform Center, feels that, "there will be a learning curve with any new classification system much like there has been while adapting to performance-based codes. He feels that as a whole the professionals involved with the application of the BCA will be able to adapt without major concern for their jobs." Mark Boswell of BGSM on the other hand believes that many of the older professionals dealing with the BCA will simply stick to the old system as long as they can and eventually be out of a job.

Once the effects on life safety and on the professionals have been assessed it is important to examine the economic effects of a possible change in the classification system. Ray Lacey, of Lincolne Scott, sees a need for the examination of three distinct groups of economic impacts. The first and most obvious is the capital cost associated with a change in the classification system. This includes the effects on construction and design costs brought about by a change. The second is the lifecycle cost, or the cost associated with maintenance of systems over the life of a building. The third and perhaps most important is the cost to the community.

Most professionals feel the effect on capital cost associated with a reform to the classification system would be almost entirely beneficial. Scott Young feels that, "a new system would obtain a similar level of fire safety at a much reduced cost. The building industry will avoid implementing unnecessary fire protection systems." Rod Sinclair warns however of the possible problems in reducing construction costs. He points out that, "you can save millions in the construction of a building but in the end the cost is eventually transferred to the owner in the maintenance over the life of the building." He feels that this increase in the lifecycle cost far out weigh the initial savings over the life of the building. Dave Nicholson does see the increase in lifecycle cost as a large one but still maintains, "The cost of a fire far outweighs the cost of insuring that a building is properly protected."

It is Lacey's opinion that most of the past reviews of the BCA have focused on only the capital costs. He feels that, "When you add in the people equation there is a whole different set of economics. There is a cost of imposing a behavior on people, and then a cost of managing this behavior so that it provides the same certainty that you can get out of a building." Lacey feels that the difficulty for the ABCB will be to invent a new system that takes advantage of the behavior patterns that people already

exhibit. This will be the most effective way of reducing the costs associated with a reform to the BCA.

It is clear from the interviews conducted that there are three areas that need to be examined when considering a reform to the classification system. The first is the actual need for a reform as perceived by the community of professionals who interpret and apply the BCA. The second is to examine the possible reforms that can be made from a temporary band-aid approach to a complete rewrite of the current system. The third and perhaps most complicated issue is that of cost. When determining the ultimate value of a proposed classification system the long ranging impacts of such a system on the community are hard to determine in a quantitative manner. Determining exactly where to set the limits of cost both on the industry as well as with regards to life is a difficult task. The section that follows is an outline of the conclusions and recommendations, which have been derived from the information obtained through interviews completed with a wide range of professionals who deal with the BCA and its classification system on a daily basis.

5 Conclusions and Recommendations

5 Conclusions and Recommendations

5.1 Achievement of Project Goals:

Over a four-month period, several activities were completed so that the goals set forth at the start of this project could be achieved. Most of these activities revolved around the interviews that were necessary to make this an informative and substantial report. The first stages of this project were carried out at Worcester Polytechnic Institute (WPI). While at WPI archival research was completed in order to gain an understanding of the topics involved with this project such as the classification systems of various building codes and risk assessment techniques. A preliminary methodology was developed that covered various steps to be taken so the goals of the project could be reached. These steps included additional preliminary research, selection of interview techniques, developing an interview questionnaire, and determining the professions that needed to be interviewed.

Once in Australia, the methodology and project objectives were discussed and finalized with the Australasian Fire Authorities Council. Next the activities described in the finalized methodology were completed. A list of possible interviewees was created and then each professional was contacted via telephone or e-mail so that an interview could be scheduled. Travel plans were made to Sydney and Canberra in order to interview professionals in those locations. Interviews were then conducted in the greater Melbourne area followed by those carried out in Sydney and then Canberra for a total of forty. Next, all of the interviews were summarized and the results were analyzed. These results were presented to the Australasian Fire Authorities Council (AFAC) and other industry representatives, a discussion regarding suggestions for

data presentation ensued. The final step was to contact all professionals interviewed to be sure that the quotations and information taken from their interviews were correct so that liability concerns could be avoided. After presenting the results and recommendations of the project group to the sponsor and professionals interviewed, a final written report was given to AFAC to distribute as they see fit.

The completion of all these steps steered the project group towards the achievement of the predetermined objectives. The wide range of professionals interviewed helped the project team to develop a sense of the need to reform the current classification system of the BCA. The interviews allowed the group to identify the overall scope of major issues and opinions present in the debate of building code reform. With the information obtained through the interviews and preliminary discussions with AFAC and other industry representatives, recommendations were formed by the group members for possible future work relating to the reform of the classification system within the BCA.

The project team encountered some obstacles during the interview process. The most common of these was keeping the interview focused on the building classification system within the Building Code of Australia (BCA). Many of the interviewees possessed strong opinions about the content and organization of the entire regulatory document. Often, the professional being spoken with would explain not only what they felt was wrong with the classification system but with the document as a whole. The same situation arose when the interview topic shifted to the specific reform suggestions of the interviewee.

This affected the group when trying to extract the opinions expressed by the professionals from their taped interview. An interviewee may have expressed a view concerning the BCA as a whole when the question was focused on the classification

system alone. In order to account for this, the project team compiled a one-page summary of each interview based on the recording made and notes taken. These summaries were then sent to the interviewee to give them an opportunity to check the document for accuracy. This ensured that all views would be expressed appropriately in all sections of this report.

5.2 Recommendations for Future Work:

In light of the information received during the interviews, it is apparent to the authors that a demand for the reform of the BCA building classification system is present. This need also can be determined by examining the data revealed in the *United Nations Fire Statistics Study* released by the World Fire Statistics Centre (WFSC, 1999). Looking at the reforms suggested by these professionals, distinct similarities were discovered which allowed for the grouping of five different reform solutions. During the forty interviews only a small number of suggestions fell outside of the five main groups. Therefore the project team believes these five solutions are the majority opinions regarding possible classification reform.

As explained in the previous chapter, these five suggestion groups can be placed into two broader groups depending on whether it is a short or long-term reform solution. It seems that it is the overall belief of the professionals interviewed that the current system of classification needs to be expanded in some way so that the reformed system covers the buildings that are currently troublesome to classify. The classification system, in their perspective, should also incorporate more of the building and occupancy characteristics that influence the perceived risks of each particular building.

Through the opinions and information that were identified in the interviews and discussions with AFAC, a general recommendation for the reform of the BCA classification system can be made. However, before any reform is done, further research should be conducted regarding the need for change and possible reform solutions. Currently, the Australian Building Codes Board (ABCB) is undertaking a project to produce the next version of the BCA. This project is divided into several steps. The ABCB is currently on the first of these steps. This process consists of gathering information from various groups both in Australia and around the world. In the authors' opinion, no change to the BCA can ever be justified without the support of thorough research and development.

Since the opinions of many of the professionals interviewed suggested both short and long-term solutions, it was determined that a reform project incorporating both of these approaches is most likely the best solution. The reform of the BCA classification system would be a two-step process by which a short-term solution would be implemented to alleviate some of the major problems expressed in this report. While this solution is being implemented, a long-term solution should be researched and developed so that it could eventually be merged into the next version of the BCA. This may ensure that some of the problems with the current classification system could be fixed almost immediately while research would be a constant process throughout the reform.

The first step of this reform, as stated above, would be to implement a short-term or "Band-aid" solution. Using this report as a basis, the research and development of this reform could most likely be done in the first two to three years of the reform project. This change would not fully replace the current classification system, but rather keep the categories and expand them to temporarily meet the needs

of professionals. In the opinion of the authors, since nearly one third of all the professional interviewed suggested that the development of sub-classification under the current BCA building categories would be a good solution, this form of reform should be implemented as the temporary fix. The ABCB is currently working on expanding the existing sub-classification of class 9 so that "aged care" facilities will have their own category. The addition of class 9c will help to solve the problem of the proper placement of these "aged care" facilities. This sub-classification is still based on use. It may be beneficial to develop a sub-classification system under the current BCA building categories based on different risk factors other that just the intended use of each building.

It is the belief of some of the professionals that certain categories have a greater need to sub-classify then others. For example, members of the various fire service agencies think that classes 7 and 8 (warehouses and factories) have the widest range of risk within their category. It may be beneficial to address these categories first and then spread the sub-classification over other trouble spots for the two years of developing the short-term reform. The group believes that all reforms to the classifications systems should be subjected to an Australia wide consultation. This will ensure planned reforms are acceptable to all parties concerned. These reforms can then be implemented into the BCA though the amendment process of the ABCB.

In the authors' opinion, the short-term part of reform would only temporarily solve some of the problems with the current classification system. This is why during the implementation of the sub-classification system; another research group should begin to look into possible long-term solutions. This research should examine and potentially develop a new system based on risk assessment methodologies to replace the current system as they examine more than building characteristics. A risk

assessment approach to classification seems to be the most supported suggestion for long-term reform. This will most likely be a labor-intensive process requiring many resources to research and develop. However, it is feasible to develop such a system for use in the new version of the BCA.

The authors believe the first step in the development of a new risk assessment classification system would be a comparison of the economic effects with the fire safety effects. It has been stated by some of the professionals interviewed that the costs of buildings that are currently over regulated would decrease with this type of reform. It has also been exposed, however, that those buildings that are currently under regulated would have cost increases. It is the opinion of most of the interviewees that if the total change in costs for all buildings were examined, the net economic effects may be negligible. This implies that any improvements on the overall fire safety of the community would be reason enough to commence efforts for reform of the classification system.

The project group believes once it is determined that a move to a risk assessment classification system would be beneficial; the next step would be to develop a standard assessment methodology. This would require the cooperation of many of the key building and fire safety organizations along with the ABCB. Suggestions from the interviewed professionals include using a risk assessment matrix or checklist, Venn diagrams, computational modelling, and a probability and consequence analysis. All of these suggestions have good qualities and could be used as a basis for the standard methodology. The project team members think the important thing is to create a uniform, nation wide method of determining risk so that consistency between professionals' assessments can be guaranteed. A standard methodology would only go so far if there was a lack of proper education concerning

the use of the new classification system. Thus, research should also be done into the possibility of having a national education and accreditation program for all practitioners of the new BCA. This proposed reform process might seem like a daunting task. However, if the opinions described in this report can be considered a representative of all professionals concerned, then there should be support and enthusiasm for a reform effort from various members of the fire safety and building communities.

The project group has also discovered the possibility of various opportunities for students and faculty of Worcester Polytechnic Institute. It may be possible to send project groups of WPI graduate and post-graduate students to Australia to work on the various levels of the BCA classification system reform project. It may also be useful for the Australian organizations, which are involved in the reform project, to create consortiums with the WPI community. Australian organizations may benefit from working with WPI because of the expertise and ability of the university in the field of fire safety engineering. It may also be beneficial to seek help from an international group, which is not aware of some of the biases attached to the controversial issue of building classification reform.

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Appendix A:
Information regarding the Australasian Fire Authorities Council

Appendix A:

History of the AFAC:

In May of 1993 the Australian Association of Rural Fire Authorities and the Australian Assembly of Fire Authorities held a joint meeting in Maroochydore, Queensland. The two voted to merge to established the Australian Fire Authorities Council (AFAC) to provide a strong union between the Australian fire and emergency services and land management agencies. The Council, which was formed on July 1 of the same year, focused on the exchange of strategic information and the development of national positions on issues of strategic importance.

AFAC promotes the interests of the member agencies in the public arena. Through the development of a competency based learning and development system, the council tries to foster the professional advancement of member services. There are currently at members are twenty three full members of AFAC as well as eight associate members:

Full Members:

- Australian Capital Territory Emergency Service Bureau
- AirServices Australia
- Bushfires Council of Northern Territory
- Country Fire Authority, Victoria
- Country Fire Authority
- Department of Conservation and Land Management, WA
- Department of Environment, Heritage and Aboriginal Affairs, SA
- Department of Primary Industry, Queensland
- Fire and Emergency Services Authority of Western Australia
- Forestry Tasmania
- Metropolitan Fire and Emergency Services Board, Melbourne
- New South Wales Fire Brigades
- National Parks and Wildlife Service, New South Wales
- New South Wales Rural Fire Service
- Parks and Wildlife Service Tasmania
- Queensland Fire and Rescue Authority
- Queensland National Parks and Wildlife Services
- South Australia Metropolitan Fire Services
- State Forest of New South Wales

- Tasmania Fire Service

Associate Members:

- Army Fire Service
- Australian Capital Territory Bush Fore Council
- Australian Capital Territory Fire Brigade
- Brisbane City Council
- Bureau of Meteorology
- CSIRO Forestry and Forest Products
- Emergency Management Australia
- Hong Kong Fire Service Department.

In recognition of the Australasian component of the Council, the AFAC members endorsed a proposal to alter the name to the 'Australasian Fire Authorities Council' in May of 1996.

Vision

The Australasian Fire Authorities Council's vision is for a community protected from the adverse effects of fire and other emergencies.

Mission

The mission of the Australasian Fire Authorities Council is to create a safer environment by:

- promoting community fire prevention and education
- enhancing the operational performance and accountability of fire and emergency service agencies
- promoting change within the fire industry in a planned and controlled way
- coordinating education and training policies and strategies to provide a learning environment for members' employees
- influencing national fire policy, product and performance standards, and fire management practices
- obtaining and sharing knowledge on issues affecting members, and facilitating discussions and debate on those issues
- facilitating research and development in areas of common interest to members
- effectively representing its member in Australasian and international forums.

AFAC Membership Benefits

In addition to maintaining an interactive website for its members, AFAC produces a quarterly journal. The Australasian Fire Authorities Council (AFAC) Journal is the vehicle through which AFAC publishes major reports, research findings and information of national or international significance. Staff members of AFAC member agencies and of the AFAC secretariat have provided the articles for the Journal.

AFAC sponsors several conferences and courses for its members to attend. These include the annual AFAC conference, the Executive Planning Course, AFAC Executive Development Program, National Incident Controller Course, and the Executive Fire Officer Program. AFAC also provides the framework for Competency Based Training, a Catalogue of Learning Manuals, an Australian Inter-service Incident Management Systems, Fire Emergency Response Training, as well as ordering capabilities for AFAC materials.

AFAC Strategic Groups

AFAC is managed by the Secretariat. This small staff of full time employees manages the day to day aspects of the Council. It is responsible for all financial matters as well as overseeing all events sponsored by AFAC and its strategic groups. Each of these five separate strategic groups has a specific purpose.

Strategic Information Management Group

The is the Strategic Information Management Group which is tasked with ensuring the provision of relevant, accurate and reliable information to AFAC members in support of sound strategic decision making. While part of the focus of the activities of this group is on the collection and analysis of operational data through the use of tools such as AIRS, a primary focus is the data collection and analysis used

to support existing and future corporate initiatives. The group will also shortly undertake the development of an appropriate comparative performance measure and benchmarking initiative. Although each strategy group has it own goals, the complementary nature of their work requires that a close relationship be maintained between the Strategic Information Management and Business Management Strategy Groups.

The Operational Services Strategy Group

The Operational Services Strategy Group is a forum tasked wit h reviewing operational management issues of national importance, and developing effective strategies to address those issues. Accordingly, the Strategy Group will be engaged in, but not limited to, activities relating to:

- enhancement of service delivery (e.g. operational techniques, communications, community relations etc);
- better matching of resources to needs;
- improved operational preparedness;
- development and implementation of new methods; and
- application of new and/or enhanced technology and equipment.

The Community Safety Strategy Group

The Community Safety Strategy Group has been established to advise AFAC on matters that relate to cost-effective methods of increasing the community's actual and perceived level of safety and protection of life and property from exposure to fire and emergency incidents. In the broadest sense the Strategy Group will be involved in identifying and analyzing exposures and developing and promoting policies and systems for treating each exposure. Accordingly, the Strategy Group will be engaged in, but not limited to, activities relating to:

- fire safety;
- fire prevention; and
- community education.

The Business Management Strategy Group

The Business Management Strategy Group is a forum in which business management activities of national relevance can be addressed in a coordinated manner. The Strategy Group identifies areas of overlap, duplication and interdependence in business management activities between member agencies, and considers means through which the collective effort can be optimized. This may include the examination and possible implementation of contemporary business practices that are considered to be of a 'best practice' or equivalent standard.

The Strategy Group addresses matters of business management that are related to, but not limited to:

- development of a Business System and Best Practice Model ;
- funding;
- taxation issues (including consideration of GST implications);
- business planning ;
- cash/debt management ;
- business delivery models;
- group buying;
- benchmarking of corporate functions;
- outsourcing;
- asset management; and
- inventory management.

The Volunteer and Employee Management Strategy Group

The Volunteer and Employee Management Strategy Group is a forum in which human resource management activities of national relevance can be addressed in a coordinated manner. The Strategy Group identifies areas of overlap, duplication and interdependence in volunteer and employee management activities between member agencies, and considers means through which the collective effort can be optimized. The Strategy Group addresses matters of volunteer and employee management that are related to, but not limited to:

- voluntarism;
- employee relations;
- learning and development;
- occupational health and safety; and
- human resource management policy and systems.

Appendix B

Building Fire Assessment Checksheet

Appendix B

Building Fire Risk Assessment Checksheet:

The following appendix contains the complete risk assessment checksheet created by J. W. Boyes. J. W. Boyes designed this ranking system for the University of Canterbury's School of Engineering. The checksheet follows a step by step method that ultimately ends up with a number being assigned to the building examined. This final number could be used to place buildings in categories of a risk assessment classification system or a sub-classification system. This checksheet could be used as the standard risk assessment methodology that would be required in order to adopt the recommended reform to the current BCA building classification system.

This appendix also contains an example of a building that was assessed using the Boyes Checksheet. The building is described and the checksheet is filled out according to the evacuator's interpretation of the building's description. The final risk ranking number is shown at the end of the appendix.

J. W. Boyes' Building Fire Risk Assessment Checksheet was taken directly out of his thesis paper, *Risk Ranking of Buildings for Life Safety* (1997).

Building Fire Assessment Checksheet

Admin Details

Date _____ **Risk Score** _____

Fire Station _____

Building Name _____

Address _____

Fire Severity, Y

	Growth			
Ignition	Low	Medium	Fast	U. Fast
Low	1	2	3	4
Medium	2	3	4	5
High	3	4	5	6
			Score Used	

Occupants

Number of Occupants

No. Occupants	Category	Score
0 to 2	Low	4
3 to 5	Medium	6
6 to 20	High	8
over 20	Extreme	10
	Score Used	

a

Aged, Immobile, Children

	Score
Yes	4
No	0
Score Used	

b

Sleeping Occupants

	Score
Yes	4
No	0
Score Used	

c

Building

No. Stories

No. Stories	Category	Score
1	Low	0
2 to 4	Medium	3
over 5	High	5
	Score Used	

d

Exit Only

	Score
Yes	0
No	2
Score Used	

e

Confusing Exits?

	Score	
Yes	2	
No	0	
Score Used		f

Sufficient Exits?

	Score	
Yes	0	
No	2	
Score Used		g

Fire and Smoke Spread

Concealed Spaces?

	Score	
Yes	2	
No	0	
Score Used		h

Open Shafts?

	Score	
Yes	2	
No	0	
Score Used		i

Holes or Penetrations?

	Score	
Yes	2	
No	0	
Score Used		j

Hazardous Substances

Present?

	Score	
Yes	3	
No	0	
Score Used		k

Management Practices

Obstructions in Exitways?

	Score	
Yes	1	
No	0	
Score Used		l

Wedges Under Doors?

	Score	
Yes	4	
No	0	
Score Used		m

Evacuation Procedure?

	Score	
Yes	-2	
No	0	
Score Used		n

Trial Evacuations?

	Score	
Yes	-1	
No	0	
Score Used		o

Staff Training?

	Score	
Yes	-1	
No	0	
Score Used		p

Protection

Sprinklers?

	Score	
Yes	-6	
No	0	
Score Used		q

Smoke Alarms?

	Score	
Yes	-4	
No	0	
Score Used		r

Heat Detectors?

	Score	
Yes	-2	
No	0	
Score Used		s

Manual Call Points?

	Score	
Yes	-2	
No	0	
Score Used		t

Brigade Connection?

	Score	
Yes	-2	
No	0	
Score Used		u

Probable Fire Severity, Y = _____

Total Consequence Score, Z = a + b + c + d + e + f + g + h + i + j + k + l + m + o + p + q + r + s + t + u = _____

Risk, X = Y x Z = _____ x _____ = _____

Example

An example of the application of the model is presented here to illustrate its use.

Consider a building which is a 3 story office block.

There are heaters and computers in the offices and loose papers, foam stuffed furniture, curtains etc. also.

The building contains 40 people, none of which sleep in the offices.

There are no aged or disabled occupants and no children.

The exits are of good quality however there are boxes and other office equipment stacked in some of the exitways.

There are no concealed spaces, holes or penetrations or shafts which smoke would be likely to travel through.

There are no hazardous substances stored.

There is an evacuation plan but almost all of the staff has no idea it exists, nor have they had any training in evacuation of that building.

The protection system consists of sprinklers, manual call points and a brigade connection.

There are no wedges under the smoke stop doors.

The checksheet and risk for this example is shown as follows.

Building Fire Assessment Checksheet

Admin Details

Date 25/2/97 **Risk Score** 16

Fire Station Sockburn

Building Name Bareback & Co. Ltd.

Address Christchurch, NZ

Fire Severity, Y

	Growth			
Ignition	Low	Medium	Fast	U. Fast
Low	1	2	3	4
Medium	2	3	4	5
High	3	4	5	6
			Score Used	4

Occupants

Number of Occupants

No. Occupants	Category	Score	
0 to 2	Low	4	
3 to 5	Medium	6	
6 to 20	High	8	
over 20	Extreme	10	
	Score Used		10 a

Aged, Immobile, Children

	Score	
Yes	4	
No	0	
Score Used		0 b

Sleeping Occupants

	Score	
Yes	4	
No	0	
Score Used		0 c

Building

No. Stories

No. Stories	Category	Score	
1	Low	0	
2 to 4	Medium	3	
over 5	High	5	
	Score Used		3 d

Exit Only

	Score	
Yes	0	
No	2	
Score Used		0 e

Confusing Exits?

	Score	
Yes	2	
No	0	
Score Used	0	f

Sufficient Exits?

	Score	
Yes	0	
No	2	
Score Used	0	g

Fire and Smoke Spread

Concealed Spaces?

	Score	
Yes	2	
No	0	
Score Used	0	h

Open Shafts?

	Score	
Yes	2	
No	0	
Score Used	0	i

Holes or Penetrations?

	Score	
Yes	2	
No	0	
Score Used	0	j

Hazardous Substances

Present?

	Score	
Yes	3	
No	0	
Score Used	0	k

Management Practices

Obstructions in Exitways?

	Score	
Yes	1	
No	0	
Score Used	1	l

Wedges Under Doors?

	Score	
Yes	4	
No	0	
Score Used	0	m

Evacuation Procedure?

	Score	
Yes	-2	
No	0	
Score Used	0	n

Trial Evacuations?

	Score	
Yes	-1	
No	0	
Score Used	0	o

Staff Training?

	Score	
Yes	-1	
No	0	
Score Used	0	p

Protection

Sprinklers?

	Score	
Yes	-6	
No	0	
Score Used	-6	q

Smoke Alarms?

	Score	
Yes	-4	
No	0	
Score Used	0	r

Heat Detectors?

	Score	
Yes	-2	
No	0	
Score Used	0	s

Manual Call Points?

	Score	
Yes	-2	
No	0	
Score Used	-2	t

Brigade Connection?

	Score	
Yes	-2	
No	0	
Score Used	-2	u

Probable Fire Severity, Y = 4

Total Consequence Score, Z = a + b + c + d + e + f + g + h + i + j + k + l + m + o + p + q + r + s + t + u = 4

Risk, X = Y x Z = 4 x 4 = 16

Appendix C:
Interview Questionnaire

Appendix C:

Interview Questionnaire

This is the questionnaire used in the forty interviews conducted with professionals in the building and fire safety community.

- What positions have you held in the field of fire safety?
- Are you familiar with the building classification systems as stated in the BCA?
- Are you familiar with those classification systems for other building and fire codes, either international or foreign?
- Is the use of building classification a vital process in your work?
- In what ways, if any, do people in your profession deal with the classification of buildings and the BCA building classification system?
- Do you believe that the current system of BCA building classification is a sufficient system for placing all building types in its proper category?
- Do you believe that the current building categories are explicitly defined and that there are enough categories in the current system?
- Do you feel that there is a need for a more explicit building classification system?
- Do you feel that the current classification system is easy to use?
- Would you be willing to sacrifice simplicity for a more descriptive and thorough classification system?
- What are some of the specific problems that you have run into or that you can determine through your involvement with use of the BCA classification system?

- Why do you believe that these problems are present within the current system?
- In your opinion do you believe that there is a need to reform the current BCA building classification system?
- What do you feel could be done to change or reform the current classification system in order to reduce the problems?
- Do you feel that a move to a risk assessment form of building classification may be a good solution to the problem?
- In what ways would a reform to the current system aid in the proper classification of all building types?
- In what way would a reform of the building classification system impact the overall fire safety of the community?
- In what way would reform affect members of the fire safety community including professionals in your field?
- What might be some of the economic effects of a reform of the current classification system?

Appendix D:
Opinion Matrices and Percentage Graphics

Appendix D:

Opinion Matrices and Percentage Graphics

This section contains a visual representation of the data analysis conducted throughout this report. First are the matrices, which examine the reasons given by the interviewees to justify a reform of the current classification system of the Building Code of Australia (BCA) as well as the specific changes that were suggested. The first matrix, the Reason Matrix, covers the reason in support of reform. It also examines the advantages of the current system as stated by the professionals interviewed. The second matrix, the Suggestions Matrix, analyzes the specific reforms to the classification system given by the interviewees. In both cases, the name of each interviewee is found in the left column of the matrix.

In the Reasons Matrix, the numbers across the top row of the matrix refer to the numbers found in the Reasons Matrix Explanation. The numbers located in the top row of the Suggestions Matrix refer to the numbers found in the Suggestions Matrix Explanation. To find which professionals interviewed discussed which ideas regarding reform, simply look in the row belonging to that particular interviewee. If an "X" appears in a column, the interviewee discussed the idea referred to at the top of the column with the authors.

The Percentage Graphics located in this section are visual representation of the percentages of interviewees that stated specific reform suggestions. These charts represent the percentages of the group of professionals interviewed and not the views of the entire building and fire safety communities.

Reason Matrix Explanation

Supporting Reform

1 antiquated (does not account for technology developed since UBR)
2 common buildings do not fit/problems with multi-class buildings
3 too general/subjective (unclear boundaries)
4 neglects the wide range of risk in some classes
5 limits/restricts performance code
6 allows varied interpretations that cause conflict
7 does not adequately address buildings that change use
8 neglects the ability level of the occupants
9 reduce overall cost of construction
10 based on property protection not life safety
11 lacks federal require uniform level of expertise to apply code

Opposing Reform

12 easy to use in general sense
13 requires revision of entire BCA
14 too much definition will over complicate & cause regulatory problems
15 numbers of incidents show there is little room for improvement
16 risk assessment method might be too subjective
17 problem is with people who are applying the code

Interviewee	Reasons Justifying Reform											Reasons Opposing Reform					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Trevor Perkins (MFB)				X			X					X					
Mark Swiney (MFB)		X										X					
Stephen Kip (BCC)	X	X			X			X				X					
Jarrod Edwards (WorkCover)		X	X					X				X					
Gary Martin (MFB)				X													
Paul England (Warrington)			X									X			X		
Scott Young (Warrington)						X						X	X	X			
Ray Joppich (DHS)			X													X	
Roger Bobbera (DHS)			X														
Rod Sinclair (Crown Casino)							X										X
Dave Nicholson (MFB)																	
Sam Aloi (NDY)			X														
Bruce Thomas (Bruce Thomas)					X				X								
Neil Bibby (CFA)				X													
Ian Bennetts (VUT)			X							X							
Peter Johnson (Ove Arup)	X	X		X													
Robert Marsicovetre (MFB)												X					
Bob Barber (Mel. Olympic Parks)			X														
Philip Chun (Philip Chun)	X					X			X			X					
Christine Iliaskos (MFB)		X	X														
Trinh Lew (MFB)			X	X								X					
Mick Coombes (MFB)												X					
Wayne Bretherton (BGSM)	X				X			X									
Mark Boswell (BGSM)			X						X			X					
Ray Lacey (Lincolne Scott)	X		X			X		X									
Andrew Gibson (Gardner Group)														X			
Jane Blackmore (CSIRO)	X	X							X				X				
John Koloadin (Tyco)			X														
Stephen Grubits (Grubits)			X														
Stephen Durnford (DUAP)			X		X								X				
Alan Host (DUAP)							X										
Jon Lynch (DUAP)		X															
Stephen Wise (Grubits ACT)		X					X				X						
Kevin Comerford (ACTFB)		X				X					X						
Kel Hannon (ACTFB)																	
Steve Barker (ACTFB)																	
Steve Hudson (ABCB)			X										X	X			
John Barwick (DOD)																	
Richard Custer (FCRC)																	
John Clampett (BRANZ)		X		X		X									X		
Total # of Interviewees with this opinion	6	10	15	6	4	5	4	4	4	1	2	11	4	3	2	1	1

Specific Suggestion for Reform:

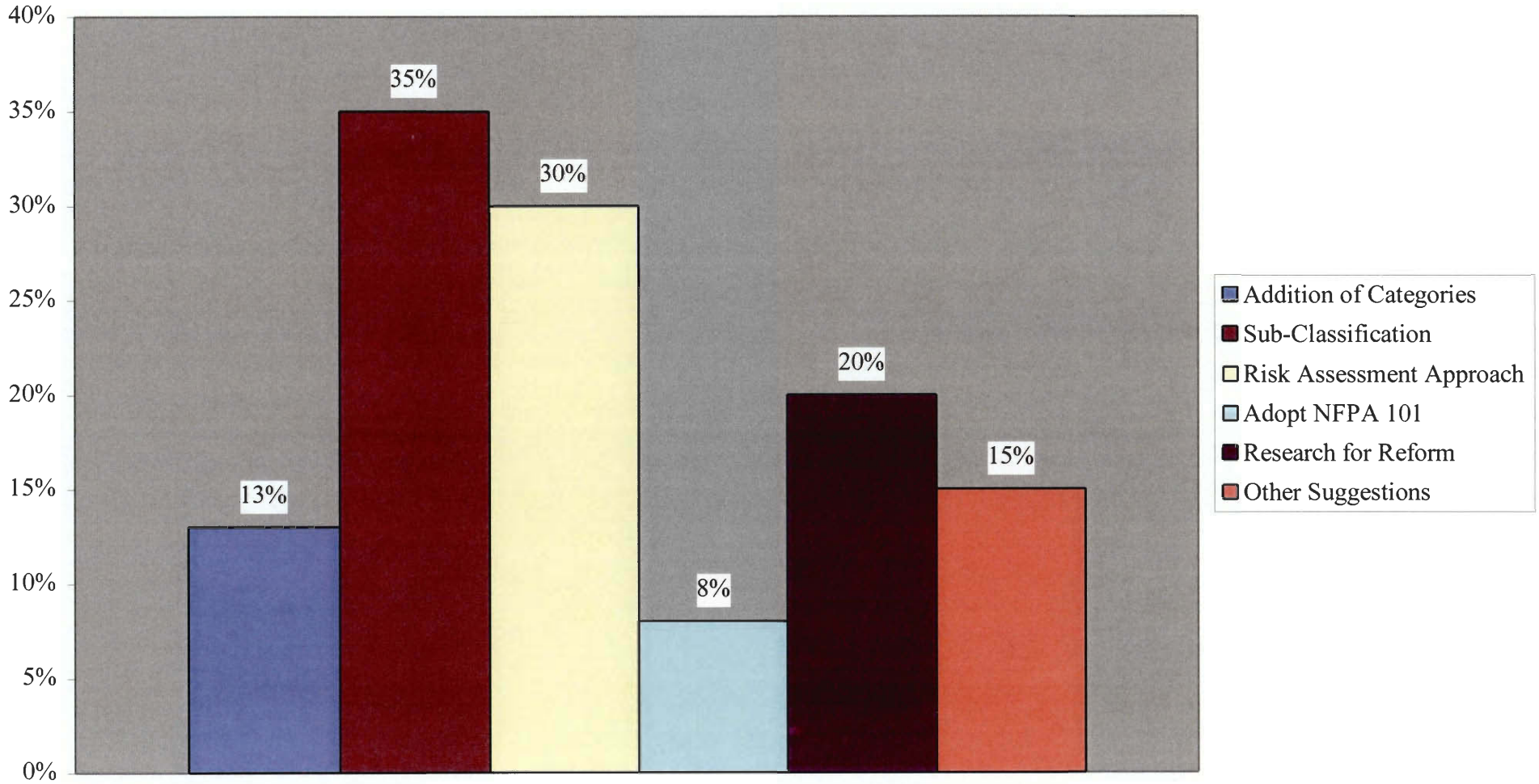
1. Addition of Categories
2. Sub-classification
3. Assessment Approach
4. Adopt some form of NFPA 101
5. Research for Reform

Other. Other Suggestions

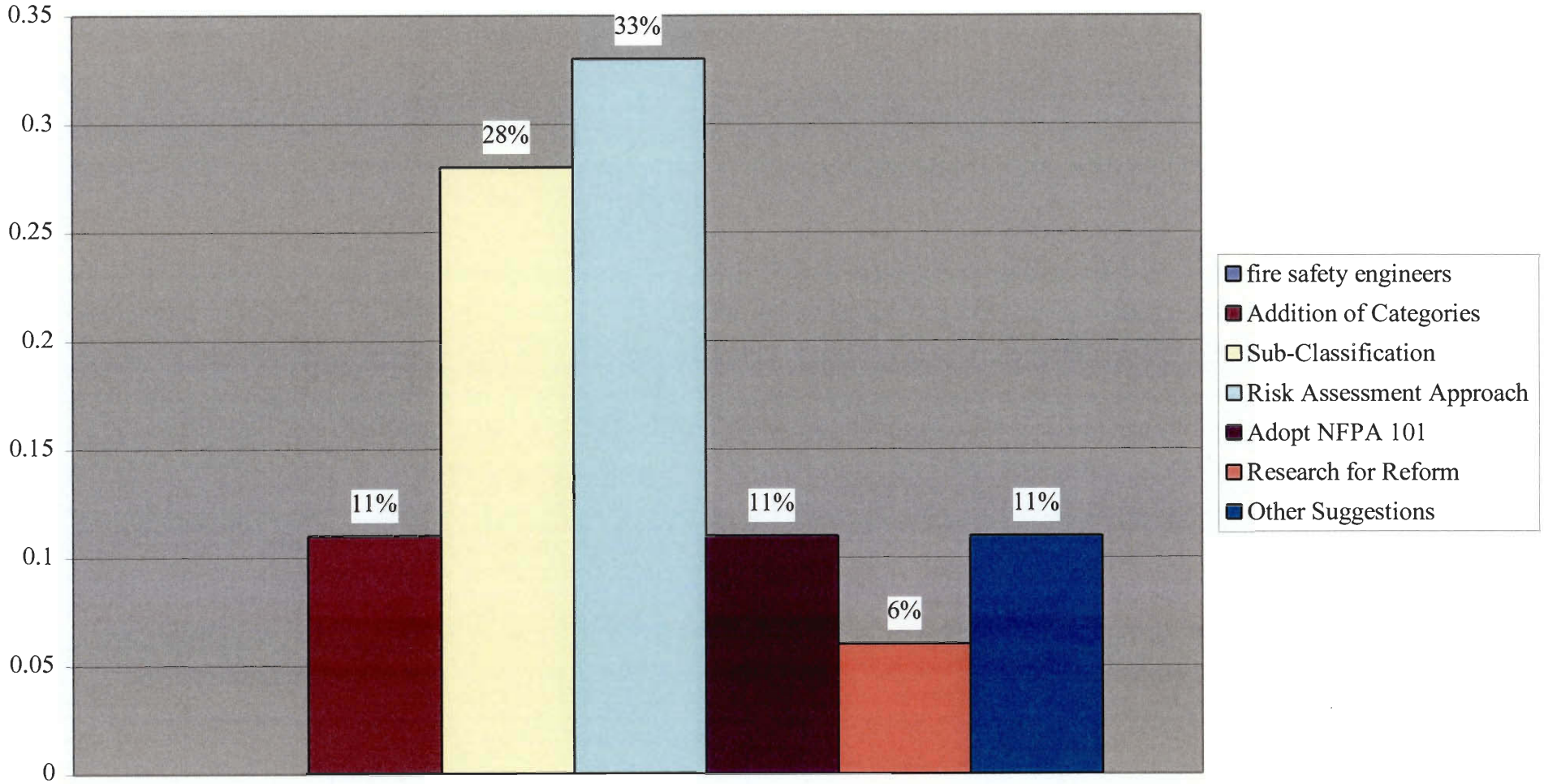
Interviewees	Suggested Reforms					
	1	2	3	4	5	Other
Trevor Perkins (MFB)		X				
Mark Swiney (MFB)	X	X				
Stephen Kip (BCC)			X			
Jarrod Edwards (WorkCover)	X		X			
Gary Martin (MFB)				X		
Paul England (Warrington)	X					
Scott Young (Warrington)				X		
Ray Joppich (DHS)		X				
Roger Bobbera (DHS)			X			
Rod Sinclair (Crown Casino)						X
Dave Nicholson (MFB)		X				X
Sam Aloi (NDY)			X			
Bruce Thomas (Bruce Thomas)			X			
Neil Bibby (CFA)			X			
Ian Bennetts (VUT)			X			
Peter Johnson (Ove Arup)			X		X	
Robert Marsicovetre (MFB)	X	X				
Bob Barber (Mel. Olympic Parks)						X
Philip Chun (Philip Chun)		X				
Christine Iliaskos (MFB)		X	X			
Trinh Lew (MFB)		X				
Mick Coombes (MFB)					X	
Wayne Bretherton (BGSM)			X			
Mark Boswell (BGSM)					X	
Ray Lacey (Lincolne Scott)			X			
Andrew Gibson (Gardner Group)						X
Jane Blackmore (CSIRO)						X
John Koloadin (Tyco)					X	
Stephen Grubits (Grubits)		X				
Stephen Durnford (DUAP)					X	
Alan Host (DUAP)		X				
Jon Lynch (DUAP)					X	
Stephen Wise (Grubits ACT)		X				X
Kevin Comerford (ACTFB)	X	X				
Kel Hannon (ACTFB)		X				
Steve Barker (ACTFB)		X				
Steve Hudson (ABCB)					X	
John Barwick (DOD)					X	
Richard Custer (FCRC)				X		
John Clampett (BRANZ)			X			
Total # of Interviewees with this opinion	**5**	**14**	**12**	**3**	**8**	**6**

Percentage Graphics

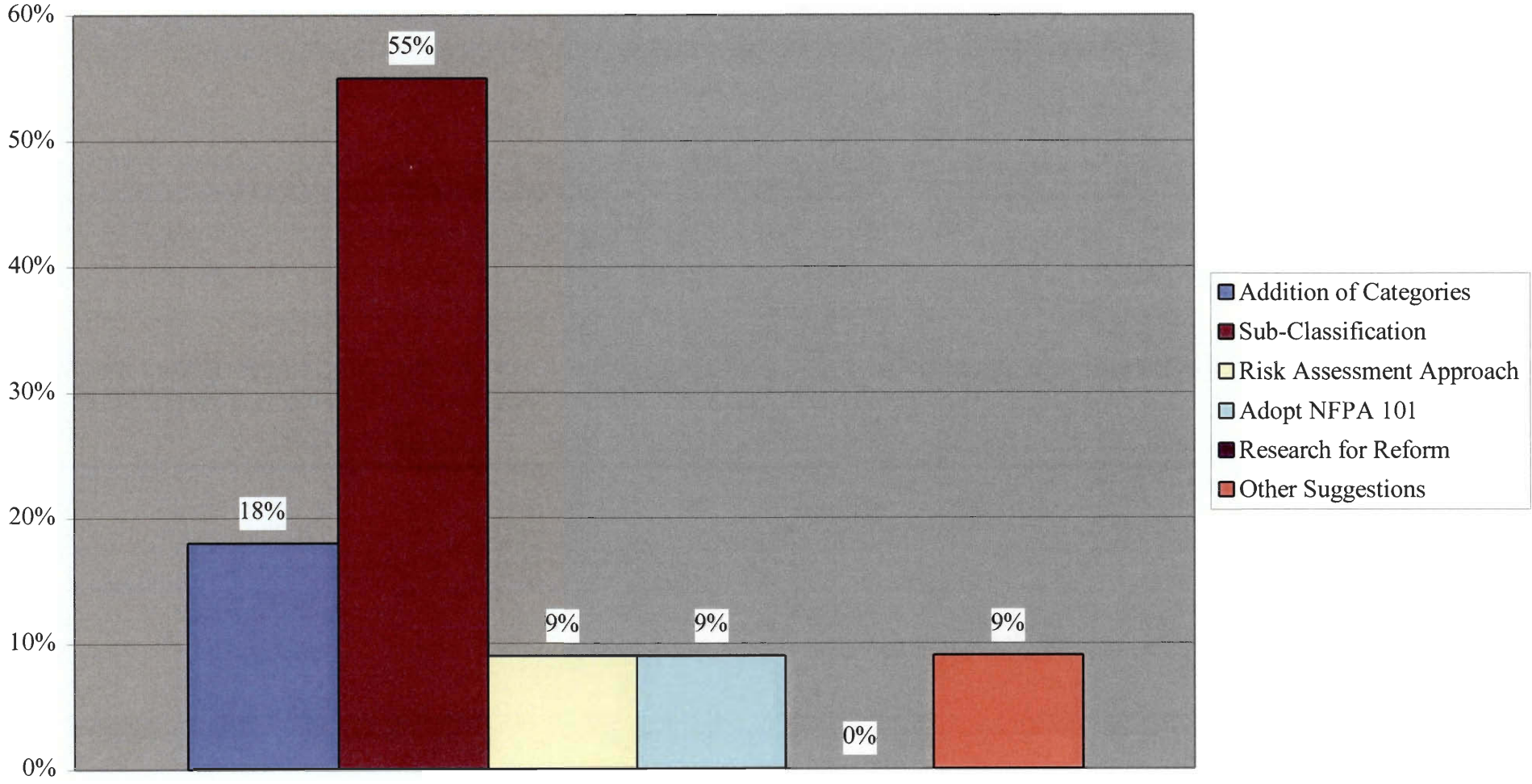
Overall Breakdown of Suggested Reform



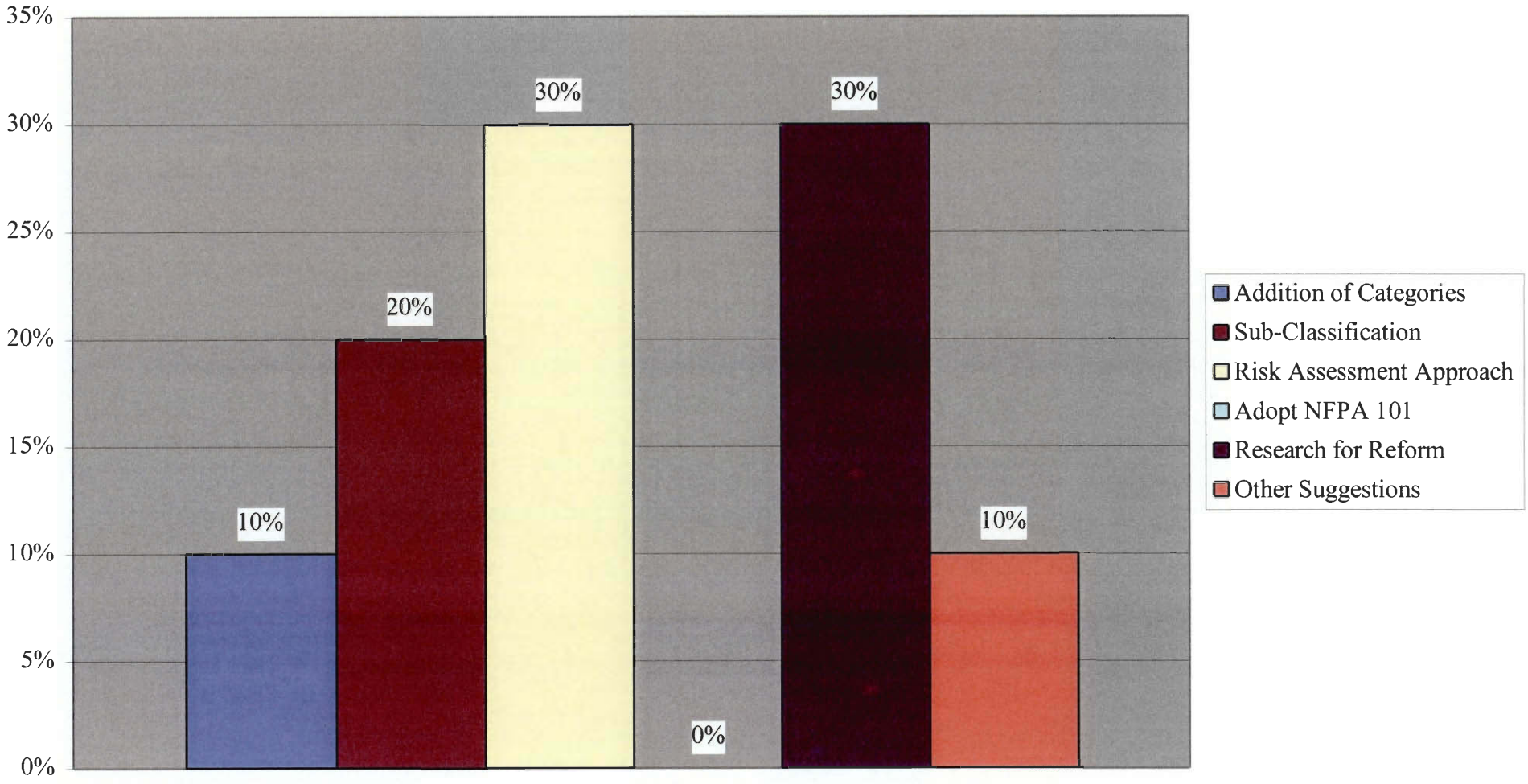
Fire Safety Engineer Breakdown of Suggested Reform



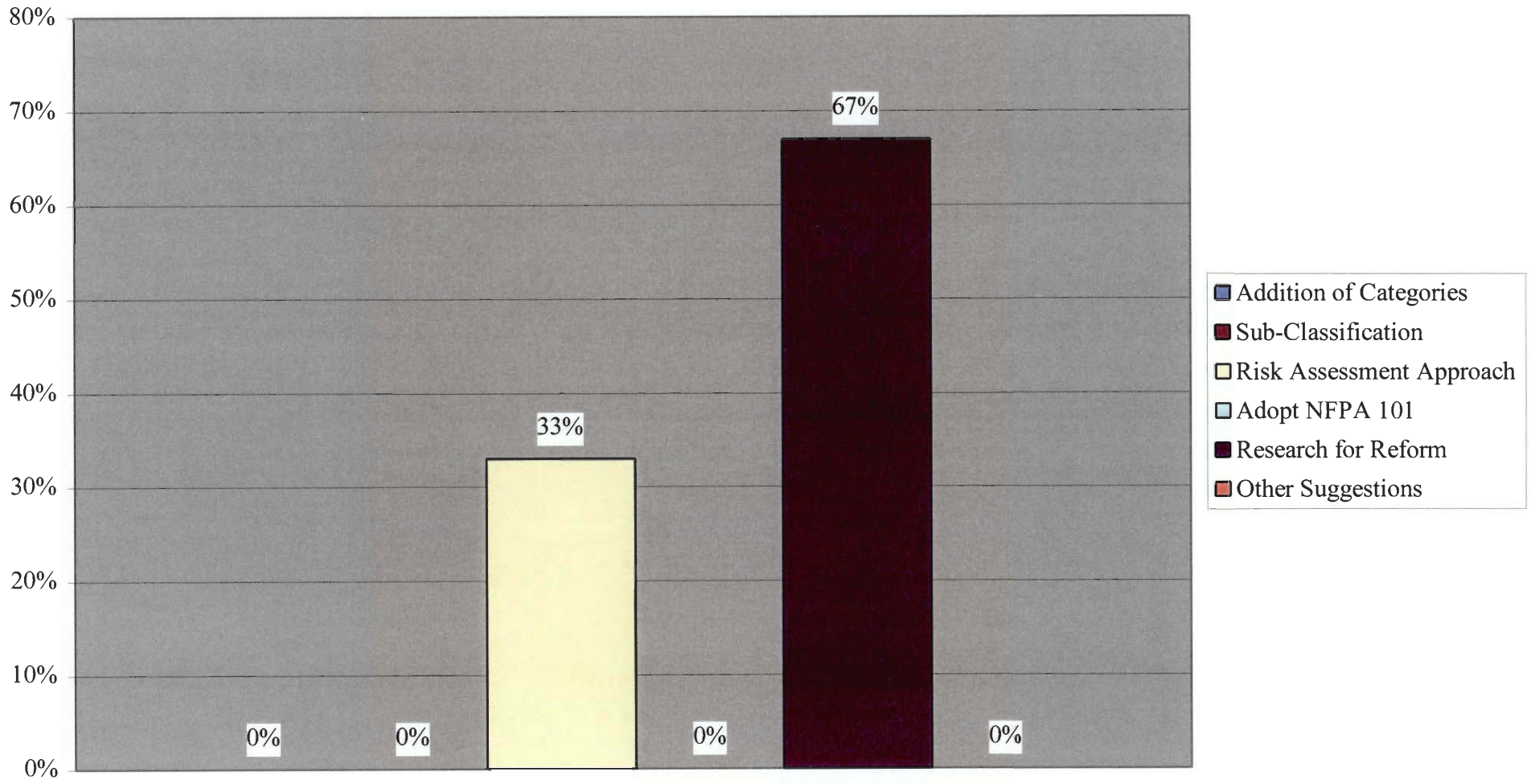
Fire Service Agencey Official Breakdown of Suggested Reform



Building Surveyor Breakdown of Suggested Reform



Regulatory Official Breakdown of Suggested Reform



Appendix E:
Interview Summaries

Interview Summaries

Interview 1
Trevor Perkins (CMND)
MFB Major Hazard Facility Unit

Perkins feels that the current BCA do not address the full usage of a building especially when considering factories and warehouses. The current BCA is based on floor area and style of construction rather than hazard or use. Perkins feels the BCA is appropriate for generic easy classifications but maintains that the BCA fails to properly consider the process by which a building is made. It also fails in assessing the final use that the building is intended for. He sights the example of and alcohol manufacturer storing raw alcohol as well as a processing plant under the classification of a factory that does not require sprinklers. He feels that the low flash point of the raw alcohol coupled with the processing plant would classify this building as needing sprinklers under a better classification system.

Perkins also sights the presence of protected works (school, hospitals, etc.) next to factories as being often overlooked. He feels that super hardware stores are another line of buildings that wrongly fall into categories requiring little or no fire protection systems and more often than not no sprinklers. In conclusion Perkins feels that more sub-classification of the BCA would help to account for those buildings that fall through the cracks. He feels that the additional sub categories should be based on risk rather than a deem to satisfy system that the current BCA uses in its classification system. Perkins feels that any inconvenience and expense caused by these sub-categories would be outweighed by the amount of life and property that would eventually be saved in the long run.

Interview 2
Mark Swiney
Senior Station Officer MFB

After having done brief research into some risk assessment methods of building classifications Swiney finds that the main problem with the BCA is with buildings falling through the cracks of each category. He feels the classification system is not that great when it comes to these special cases but for general use he feels that it is easy to use as well as understand. He feels that most of the buildings that the MFB finds falling through the cracks would be the older buildings that did not require smoke detectors or sprinklers. He feels that another type of building which often falls through the cracks are nursing homes and backpackers' hostels. They pose a serious risk to human life but are not required to have sprinkler systems. Swiney feel that there needs to be a more explicit classification system to fit in these odd buildings. He suggests perhaps an addendum where each of these buildings is looked at specifically and classified in terms of risk. He also feels that sub-categorizing the current BCA classifications might be a plausible approach to account for these exceptions.

Interview 3
Stephen Kip
Building Manager
Building Control Commission

Kip feels that there are not enough categories in the BCA classification system and that the existing categories are defined around building characteristics rather than human characteristics. This greatly limits their effectiveness in the result of a fire. The categories have been left much the same as they were 30 years ago and the building industry has evolved leaving the classification system behind. Some of the categories are based on old styles of buildings while excluding new types of construction for example sports complexes and mega malls. Kip feels that the new performance based portions of the BCA are limited by the old prescriptive classification system. The amount of worked required for a performance-based classification is enormous and no one group has the resources to develop it.

Kip feels the current classification system is very easy to use but should only be used for general terms and buildings. He feels that any reforms made to the current system would only serve to increase the overall fire safety. Although any reforms made should be based on the risk profile of the potential occupants and the community rather than of the buildings physical characteristics. The problems with implementing a new performance or risk assessed classification system would be its inability to stand on its own. By benchmarking against the current BCA you carry with it all of its shortcomings and stand the chance of raising even more questions. Overall Kip feels that a mix between performance and prescriptive would suit the community and the building industry the best by keeping the old and adding the new no one is left to far behind.

Interview 4
Jarrod Edwards
WorkCover Safety
Major Hazard Unit

Edwards sees the classification system as being clearly defined but on to high a level. This allows the construction industry to often stretch the boundaries of a classification type. He feels that if the classification system were perhaps subdivided it might eliminate the problem of some building falling on the fence of two different types requiring each building surveyor to pick a classification. The existing BCA is easy to use in a broad sense because it leaves decisions up to the designer and contractor but Edwards would be willing to give up some of the simplicity for better explanation and definition.

Edwards feels that the BCA needs to move towards risk assessment to provide adequate safety but warns that this would further complicate exact classification. He suggests instead perhaps the addition of more categories to the existing system. If a risk assessment approach is adopted Edwards feels it needs to be based on peoples' abilities as well as the ability of each building and its safety measures to ignore either would not be safe. Another suggestion would be a more qualitative risk assessment with comparison to tables perhaps. This would be beneficial to larger projects but would probably not work on smaller construction. The problem now is that people are using the BCA performance based sections to slip through the cracks of the prescriptive and not install the necessary fire safety. Edwards feels that any change could only help the overall fire safety of the community and that it would give leeway in classifying buildings. This would allow the construction industry to rely less on the designer although the MFB would have to work harder and become more educated.

Interview 5
Gary Martin
Dangerous Goods
MFB

Martin feels that the linear system employed by the current BCA classification system is too rigid a system for the changing environment of the building and fire safety industries. He feels that the classification system was designed to simplify things that should not be simplified. Martin would gladly give up the simplicity of the current classification system for an increase in flexibility when classifying buildings. He feels the BCA tries to package some special buildings into neat categories when it is impossible. In doing so the BCA cannot deal with the risk associated with some special building such as laboratories or dangerous goods warehouses. Martin feels the BCA needs to move to a classification system that is more like NFPA 101 where categories are based on risks and life safety rather than buildings physical characteristics and its original intent. Reforms in the classification system he feels would ensure the integrity of buildings as well as improve the overall fire safety of the community as well as the MFB personnel. He is fine with the prescriptive classification method but feels that something is needed to compliment it. Maybe a system of subcategories based on risk levels. This classification system he feels will save money because of better overall design.

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IQP/MQP SCANNING PROJECT

Interview 7
Scott Young
Senior Consultant
Warrington Fire Research Pty. Ltd.

In Young's opinion the greatest shortcoming of the current BCA classification system is the ambiguity that exist is some of its definitions. This ambiguity is the cause of some inconsistencies in the application of the classification system by different building surveyors. While the buildings classifications as they stand are easy to use Young would gladly forfeit some of the simplicity for some specificity. He feels this would reduce the number of buildings that fell on the fence between two classes thus relying on the subjective opinion of a building surveyor. Young is wary of over defining the classes and feels that such definitions would only serve to complicate the building and fire safety industries. He feels that an alternative solution would be to restructure the classification system to one more similar to the NFPA 101 life safety code. He warns that a prescriptive performance mix is best and that the inclusion of risk assessment would only serve to further complicate the issues at hand. Young feels that any reform of the current BCA would not have much of an effect on fire safety but would rather cut the costs associated with unnecessary fire safety measures be installed. He feels that reforms would also serve in making a building surveyor task clearer. There would be less subjective decisions being made which allows for more consistent classification.

Interview 8
Ray Joppich
Manger Fire Risk Management Study
Department of Human Services

Joppich believes that the categories within the BCA classification system are not clearly defined. It is this lack of definition that has led to confusion between building surveyors about classifying certain types of buildings. Particularly with respect to age care housing and the definition of disabled. Joppich feels too much is left to chance in the current system and has informed us that DHS has written its own classification and performance system against which all health and welfare buildings are judged. The Capital Development Guidelines are a set of performance-based documents written by the DHS for fire safety upgrades in DHS facilities. Joppich believes the best way to reform the current BCA system would be to implement a ranking system within each classification category. Maybe a group of sub categories based on risk. Joppich acknowledges that this would take a fair bit of work to develop, and that unless a clear checklist is formulated such a system would leave many subjective decisions to building surveyors. Another problem, he feels, is with maintaining accurate risk assessment s of each building. The inherent risk and use of a building is always changing and therefore buildings would have to be revisited on a regular basis, perhaps every 3-5 years. Joppich feels the biggest problem with any reforms made is the communication to industry about such reforms. Reforms in the past have not been well publicized leading to confusion among building surveyors, building owners, and government officials. Joppich feels that communication and education among regulatory bodies needs to improve. As for the impact on fire safety Joppich can only see a positive effect on the community safety and awareness although he does feel that such reforms would increase the cost of servicing buildings under the new classification system.

Interview 9
Roger Bobbera
Project Manager
Department of Human Services

Bobbera believes that the current BCA classification is not sufficient for the classification of all buildings. He feels that a move needs to be made to a more performance oriented classification system. A clearer definition of each of the categories needs to be given as well as definitions of words like disabled, or physical assistance. Benchmarks for such words need to be formulated to properly classify buildings otherwise everything become too subjective. Bobbera feels that most building surveyors are not well educated at this time about the performance-based sections of the BCA. As a result the implementation of a performance based classification system would have to run parallel to some sort of education for building surveyors on how to implement such a system. Bobbera also believes that a firm checklist must be formulated and that such a checklist would be a scoring list with different weight given to various safety factors in a building. An expansion of the performance side of the classification system Bobbera feels would obviously mean an increase in the cost of maintenance. If not enough is done to inspect such systems the performance-based system, Bobbera feels, would be no better than the current system of classification.

Interview 10
Rod Sinclair
Manager Fire and Safety Systems
Crown Casino Melbourne

It is Sinclair's opinion that the BCA classification system works reasonably well and that the problems lies with the building surveyors who do not have the knowledge base to deal with the performance sections of the BCA. Sinclair feels the largest problem other than education is with a change in intent of a building. When one tenant moves out and another moves in Sinclair feels that a lot of problems arise in the re-classification of a building. He feels that there needs to be some gray area in the classification system and in the BCA because otherwise things are oversimplified and buildings will begin to fail. The BCA, Sinclair feels, needs to allow for more innovation in design. Sinclair feels, at this point, the best way to reform the BCA would be to educate the masses on how it should be properly applied to increase the fire safety of the community. Sinclair is of the opinion that buildings should be constructed to protect the people in the community rather than the buildings themselves.

Interview 11
Dave Nicholson (CMND)
Structural Fire Safety

Nicholson knows that some sort of structure is vital t o keep it all in line and also knows that most people feel comfortable with the current system. Nicholson also realize that the current system of building classification has a number of short falls when it comes to borderline buildings. Nicholson feels that people are trying to manipulate the system with categories that allow building to sit on the fence. Nicholson feels that extra categories are not necessary but rather better definitions of the existing categories. The existing system is pretty simple and the last thing that needs to be done is to complicate it. This will only add to the number of problems and loopholes with classifying borderline buildings. Another problem with the current system is its archaic nature. There are many types of buildings that were not considered when the classification system was written thirty years ago and not much reform has occurred to account for these types of buildings. (prisons, laboratories, hardware warehouses, etc.)

Nicholson feels the most important thing to keep in the foreground of any reforms is that they are made relative to the building use rather than the building structure. Nicholson feels that any reform that will be made could only have a positive effect on the fire safety of the community otherwise it wouldn't be worth the money associated with the change. Nicholson agrees that there would be an increase on the financial burden of building owners and operators but is also of the opinion that it costs more to have a fire than to protect against one.

Interview 12
Sam Aloi
Associate
Norman, Disney, and Young

Aloi believes that the BCA classification system is a good starting point that is easy to follow but feels that buildings need to be categorized by occupancy and building behavior. Aloi sees the need for better definition among the existing categories in the BCA. He feels that many of the classification have ambiguous definitions and that aged care is the biggest concern in reforming the BCA as it stands. Any reform, Aloi believes, can only improve the fire safety of the community. Aloi knows that reform is necessary but is worried about the education of the community about such changes. He agrees that there will be an increase in maintenance cost as a result of some reforms but feels the increase in fire safety is worth the cost. Aloi believes that for most large firms any reforms would just mean business as usual and they will adjust. It is the smaller firms that Aloi feels will suffer. Most, he feels, will not have the resources or the knowledge base to handle keeping up with any reforms made.

Interview 13
Bruce Thomas
Bruce Thomas and Associates

Thomas feels that the entire deem to satisfy building style is the ball and chain that is holding back the performance based system in Australia. He feels that the current classification system doesn't work and is not worth redefining. He is of the belief that the entire system should just be let go and phased out of the building industry. Thomas sees the problem more with the attitude of the industry more than anything else . The architects and other stakeholders in the industry are so stuck in a deem to satisfy mentality that any change will be hard. The biggest problem Thomas foresees is with a mixing of the old deem to satisfy and the new performance based systems. He feels that not many people validate their assessment of a building when they mix each system and that they purposely work their way around both systems to take advantage of the loopholes. Thomas also sees risk assessment as a possible means of building classification but warns that the process is very labor intensive and may not be worth the cost associated with it on smaller projects. Thomas also warns that any change on a building's original purpose would also be hard to account for in a risk assessment form of building classification. Another roadblock would be setting a number to benchmark assessments by. What number is considered an allowable risk to take when a person's life is at stake? If a risk assessment method were employed Thomas feels that buildings would be more economically efficient while having little if any effect on the overall fire safety.

Interview 14
Neil Bibby
Director Community Safety
Country Fire Authority

Bibby believes that by sticking with current system of building classification and only fixing it up you are only glossing over the larger problems. Classifications, Bibby feels, need to be based on what the risk is not what the building is called. To many people want to just fix up the current system because it is familiar to them but this will only cover up the larger problems associated with the current classification system and the building that it is producing. Bibby feels the best way to go is to fix up the current system for the short term while developing a risk assessment format of building classifications for the future. A system where a building is evaluated and given a risk number and then based on that number the requirements of the building are determined. There will still be a deem to satisfy solution but there needs to be a way to assess the risk. In order to implement a risk assessment method the education of building surveyors is key. Bibby feels there needs to be a core curriculum which all building surveyors must learn before they become qualified and can begin practicing. Eventually, Bibby feels, such an education will phase out the old school building surveyor who refuses to use anything but the old classification system. Bibby feels that a risk assessment system will be far more complicated but maintains that the system will still ensure fire safety better than the current classification methods used. Bibby sees retenament as the largest obstacle for a risk assessment classification system. Therefore it is important that reclassification is done based on risk in the future not on what type of building you own. It is impossible to eliminate all misclassification but Bibby believes that by instituting a risk assessment method of classification the mistakes made will be smaller and have less effect on the overall fire safety of a building. A risk assessment classification system, Bibby believes, will provide better fire safety at a cheaper cost.

Interview 15
Dr. Ian Bennetts
Victoria University of Technology

Dr. Bennetts feels that while the classification is fundamentally sound there are some areas that need improvement. Even after recognizing these shortcomings Bennetts is still reluctant to dramatically change the current system. The biggest problems Bennetts sees with the current classification system occurs with the classification of factories and warehouses. Bennetts sees ambiguity in the code where it tries to deal with factories that store products on sight, with large isolated buildings and with the overall way in which factories and warehouses are classified. He sees the need to classify buildings based on fire load and materials preset rather than on the type of a specific building as they are based now. He sees the current system geared more towards the protection of property rather than towards the overall fire safety of the community. Buildings are based on height, type, and area rather than on what real risks they pose to the surrounding community. Bennetts feels the only way that the classification system will ever be dramatically changed is by a series of fires, which cause huge environmental damage to the community in which they occur. Bennetts feels that a risk assessment method of classification would be the best way to go but sees a problem with policing the system over a period of time. Risk levels are always changing in a building's environment and it is impossible to keep up with all of them. He feels that a risk assessment method would mean that industry would have to spend a lot of money on re-assessments every time they changed something on their buildings. Although it would take some considerable time and money Bennetts does not see a problem in the re-education of the public and of professionals towards a risk assessed classification system. Large companies, he argues, are already employing such methods so it wouldn't be much a problem to industry either.

Interview 16
Peter Johnson
Ove Arup and Partners

Johnson feels that the BCA classification system does a reasonable good job at placing all building into one class or another and that each category is reasonably well defined. His worry however is that the classes are based on an archaic system which hasn't changed much over the years. As a result while you might be able to fit a building into a specific category it doesn't necessarily mean that is where the building truly belongs. Johnson sees a problem with the current classification system but warns that there must be solid reasoning behind any changes made otherwise you might be trading in for a system which is perhaps less effective. Johnson feels that one of the main issues that needs to be addressed is the fact that the BCA calls out for the same provisions to be placed on buildings with a wide range of potential hazard levels. Johnson suggests a qualitative analysis system of building classifications would be an alternative to the current system. One were there was a standard way of looking at each building from a fundamental standpoint. This is not a new concept and Johnson warns that it might be just as ambiguous as the current system of classification. Johnson feels the major benefits of a qualitative analysis system would be an increase in flexibility of design and a more cost effective construction industry. Johnson feels the key to ensuring the success of any new system will be the education process that follows its acceptance as law.

Interview 17
Robert Marsicovetre
Building Surveyor MFB

Marsicovetre feels that the current system of building classification within the BCA is insufficient in placing all building into a clearly defined category. He feels that if the current system is left relatively unchanged there needs to be an addition of at least a few new categories and sub-classifications within the current categories. This he feels will eliminate most of the buildings that fall through the cracks of the current system and are either misclassified by mistake or because they do not fall within any of the current categories. Marsicovetre feels the current system is very straightforward and easy to use but is too restrictive on building surveyors and building designers. He feels that while a risk assessment method of building classification has some merit it would eventually become just as restrictive as the current methods. Marsicovetre feels that as a whole the cost of building would go down with a risk assessed classification system but there are always building that will increase in cost as a result of the system. Marsicovetre feels that the need for re-education of professionals would be minimal because most people would either re-educate themselves or fade away with the old system over time.

Interview 18
Bob Barber
Building Services Coordinator
Melbourne and Olympic Parks

As Barber is involved only with the building management side of the Melbourne and Olympic Parks he has dealt primarily with the classification system as it applies to maintaining his building and making sure he is in compliance with codes and regulations. From his vantage point Barber feels the problems of the classification systems have arisen with the Melbourne Fire Brigade decreasing role. Barber would like to see abutted buildings in Melbourne brought up to the standards set forth in the code. As a result of this not being required the Melbourne and Olympic Parks have one building that is fully sprinklered while they have another with no sprinklers and few smoke alarms. He feels that the classification system is a bit ambiguous and that because building surveyors are in charge of classification everything is based on self-determination and money rather than life safety as the Brigade had once run things. Barber feels that things have gone to far in the building industry and that a balance needs to occur between the Brigade and self-determination or the safety of the community will suffer. Barber feels most of the problems with the industry and with the classification system go back to saving money and coming in under budget. Barber feels that the Standards need to become law and that any reforms made would certainly have an economic impact. Some, he feels, would save money while other buildings would be forced to spend more money. Either way Barber feels a reform could only increase the fire safety of the community.

Interview 19
Phillip Chun
Director
Phillip Chun and Associates

Chun feels that the largest problem with the BCA classification system is that the system itself was written back in the forties and has only been adapted slightly over the years after each major disaster. As a result Chun feels the BCA has been left with a classification system that over the years has changed little while the world around it has grown in leaps and bounds. Society has been changing and as a result so have the potential uses of a building, this Chun feels is something the BCA fails to take into account. Chun feels that while the current classification system is relatively easy to use it lacks the ability to classify all buildings properly and adequately. Chun would gladly give up the simplicity of the current classification system for a more explicit one. He feels that with the use of a performance code also needs to come a classification system that applies to such a code. Chun feels the biggest roadblock to any reform or to the current system is the changing interpretation of each classification from state to state throughout Australia. Chun feels that there needs to be more continuity among the building surveyors in each state if a new system is to succeed. Chun feels that a risk assessment classification system is the best way to go. He feels that only two or three main categories are required each with ten sub-classifications for each based on a risk assessment matrix. Ultimately Chun feels that a classification system means nothing and only serves the purpose of making regulation easier. The most important factors in design are safety and amenities and Chun feels that a classification system rarely plays into design with respect to these two main issues. Chun admits that a risk assessed classification system would be prone to errors in judgment but feels that if everyone is competent that it will improve the overall fire safety of the community. Chun feels that costs will be cut and that a new system will result in tailor made buildings. He sees the need for a monitoring or ethics board is a new system is to succeed and feels that professionalism can only be relied on to a certain point when it comes to safe design.

Interview 20
Christine Iliaskos
Engineer Structural Fire Safety
MFB

Iliaskos feels the weakest feature of the classification system is its lack of depth. She feels that the classifications are too broad and not adequately defined. This uncertainty is most prevalent in the classification of multiple use buildings. Iliaskos feels that added definition would go far in solving the problems with the classification system. She feels that buildings should be classified by content, hazard, and use rather than by structure as they are in the classification system as it stands. She feels that the present system is too subjective and that building surveyors are taking advantage of this aspect. Any new system must be clearly defined if it is going to be more beneficial than the system currently in place. Iliaskos feels that a risk assessment approach to classification is a possibility but warns that policing such a system might be impossible. Unless owners inform the authorities of a change in potential risk things will never be re-evaluated. The contents and people in a building are always changing which makes maintenance of a risk assessment system a key factor in its success. If a risk assessment approach is taken for future building classification Iliaskos sees an increase in fire safety as a result of more purpose-oriented designs in buildings. Whatever reform is undertaken education will be a key in determining the systems success. Iliaskos feels that education needs to come from the regulators; too much is being subjectively understood and better definitions will help solve some of the ambiguity in classification.

Interview 21
Trinh Lew
Engineer Fire Safety Department
MFB

Lew feels that the BCA in its current form is not a very fluid document. She feels that there is some difficulty in sifting through the requirements and that this discontinuity affects the classification system at times. She sees the lack of definition as a major problem in the system but realizes that no matter how well defined each category is there will always be buildings that fall outside of the system. Trinh feels the classification system gives generalized definitions which work, but only if your building does not have any odd features. The classification system becomes more difficult to use with the addition of each new feature to a building. Trinh feels that the BCA is flawed when it deals with buildings of different risks in the same manor because they happen to fall into the same class. She feels that perhaps a matrix system of classification would work best one that allows for a variation of risk within each category based on a system of sub-classifications. Trinh feels that any reform undertaken will have some effect on the fire safety profession but not as much as the change to performance did in 1996. The cost of buildings she estimates will decrease for new construction while the cost of refurbishing may increase.

Interview 22
Mick Coombes
Building Surveyor
MFB

Coombes feels that problems will always arise within any system but in his experience it is hard to pinpoint one or two major issues with the current classification system as it stands. Coombes feels that there will always be shortcomings of any system and that any attempt made could only hope to solve some of the existing problems. He feels that any problems that arise get bogged down in disputes over definition and in the working of the system. Coombes feels that there will never be a system with no fence-sitters and that the more sub-categories you have the more opportunity for fence-sitters you present. Any reform Coombes feels needs to be done from an independent point of view otherwise you are just trading one flawed system for another with a slightly different slant on things. Coombes also feels that the classification system and the code in general should be reviewed to make it more applicable with the performance side of regulations.

Interview 23
Wayne Bretherton
BGSM Consulting Building Surveyors
Associate

Bretherton feels that the problems with the classification system arise from its history. He feels that the classification system was developed and written long ago when the building industry and the fire safety of the community were very different than they are today. The classification has since been passed from document to document being adopted with little if any change. As a result the current system is based primarily on conditions that are not prevalent in society any longer. The entire philosophy on buildings and their uses has changed and the classification system has stayed the same. This Bretherton feels is at the root of all of its problems. The system, he feels, is too rigid. It does not allow for the use of performance design with prescriptive codes to be very productive. He feels that any system that is to be implemented in the future should not be too complex. He also feels that occupant profiles should be factored in to the classification system. Deem to satisfy needs to stay relatively easy to use but there is a need for a better classification system to accompany the performance portion of the code. At the present time performance designed buildings do not properly fit into the classification system. Bretherton feels the BCA needs to become more user friendly with more charts, tables, and graphs. It needs more explanation of what each requirement is and exactly why number where chosen for various requirements. Whatever becomes of the BCA and its classification system Bretherton feels that education will continue to play a major role in the fire safety industry. There needs to be a certain level of qualification that is expected throughout Australia, not from state to state as is the case currently. There needs to be a uniform education and this will hopefully help with the different interpretations being used in each state and by each professional.

Interview 24
Mark Boswell
BGSM Consulting Building Surveyors
Director

Boswell feels that current system of building classification is not sufficient and that more subcategories are necessary to adequately place most buildings into a proper category. He feels that it will always be hard to pigeon hole every building but that more categories would certainly help the problem of buildings that just don't seem to fit properly into any of the current classes. Boswell is hesitant to reform the current classification system and feels that any reform undertaken needs to be proceeded by a research component that would highlight the need for reform and identify exactly what is wrong. Boswell feels that deem to satisfy will always be the benchmark and that any move away from it will leave many of the older building surveyors behind.

Interview 25
Ray Lacey
Lincolne Scott
Director

Lacey feels that the classification system in the current BCA is not sufficient in placing all buildings into a category and that at times it is inappropriate. He feels that the BCA classification system can be traced back to the London fire and that it is driven mostly by insurance concerns. Lacey feels the classification system is easy enough to use but questions whether or not it is scientifically correct. Lacey sees the change to a new system of building classification as a Herculean task and warns that there are certain issues that should not be overlooked. At the heart of the classification system is its use and application. Lacey feels that any new system must keep in mind who its users are and that it should be simple in nature. The science should come in developing the code not in reading and applying it. Lacey sees the use of a matrix or network of Venn diagrams as a possibility for communicating a new classification system. He feels that the BCA needs to look at the role human behavior plays in classifying buildings. He feels they are presently solely preoccupied with the bricks and mortar of things; people's behavior plays a major role in overall fire safety. Lacey feels that the government needs to research the BCA thoroughly and then make a definite stand on things. This will get rid of a lot of the ambiguity. If there are set standards, that are clearly defined, then everything else should fall into place. Lacey does not see a major economic impact on the community as long as the reforms made do not require people to change their behavior.

Interview 26
Andrew Gibson
Gardner Group: Building Surveyors and Consultants
Director

In Gibson's opinion it is very difficult to be broad but still cover all possibilities. You can only hope to be broadly sufficient no matter what the approach is to classifying buildings. Gibson does not see any problem with the definitions set forth in the BCA and feels that if they are nailed down specifically that it will remove all ability for professionals to come up with more cost effective designs. Gibson feels that the Building Appeals Board is sufficient to deal with any buildings that do not quite fit into the current system. The building and fire safety industry needs room to move; the world is not black and white so why should the classification system be? Gibson feels that the worst thing that could happen would be a classification system that ties down the industry. No matter how many categories you have not everything will ever fit in. Gibson feels that deciding where to draw the line will be the hardest part of reforming the current classification system.

Interview 27
Jane Blackmore
CSIRO - Sydney

Blackmore feels that there are obvious problems with the current classifications system. She feels the general groupings are on the right track but that more sub-classification is necessary. She feels that the current system is not appropriate for the range of buildings that are present in today's industry. Blackmore feels that the current system is easy to use overall but that occasionally there are buildings that do not fit into a classification. Also she finds some problems with the classification of multiple use buildings. Blackmore feels that a deem to satisfy classification system will never cover all buildings and that a reform needs to be made. Blackmore feels that the best possible move for the system would be to put the classification system onto a menu driven electronic system. This form of classification, Blackmore feels will lead to tailor made buildings that will at times will become more costly but will ultimately ensure maximum fire and community safety as well as property protection. Blackmore feels that the prescriptive system has its place and that it will probably stick around in a parallel system with a computer version. Blackmore feels that a computerized system of building classification, while it might impose on the jobs of some building surveyors and regulators, will ultimately assist in the timely process of approvals for occupancy permits. Blackmore also feels that a system of risk-assessed classifications would be fundamentally flawed. She feels that the risk assessment should be in the design of a building not in its classification.

Interview 28
John Koloadin
Tyco
Building Regulation Consultant

Koloadin feels the classification system in the BCA can never cover every building. It can only attempt to classify the majority of buildings. He feels the classification system is easy to use and feels that the current system deals with most of the fence-sitters that are present in today's building industry. Koloadin feels that there is a need for a review of the code every 2-3 years to determine whether or not the classifications within the BCA are pertinent to the current status of industry. If a change is necessary Koloadin feels that the BCA must find a balance between simplicity and definition. A system that is too broad or too narrow will result in an increase in management costs as well as a complication in the codes overall application.

Interview 29
Stephen Grubits
Stephen Grubits and Associates
Managing Director

Grubits feels the current classification system does not adequately fit all buildings into one of the categories. Grubits feels that the classification system is easy to use but that there are boundary issues with some of the different categories. Grubits feels that boundary issues will always exist but that many of the issues will be solved if a new classification system was based on occupancy as well as on use. Grubits feels that a two-tiered approach to the classification of buildings would prove most beneficial with the second tier being based on factors other than use. Any new system needs to be a middle of the road approach merging the performance with the deem to satisfy. This will allow for the formation of more tailor made solution to each buildings classification and ultimately its construction and maintenance. Grubits feels that solutions given by the classification system and the new BCA will be safer and more cost effective than the current system. Any reform, Grubits feels, needs to be driven by the regulators otherwise a new system would be just as ambiguous and subjective as the current system.

Interview 30
Stephen Durnford
Dept. of Urban Affairs and Planning
Assistant Director

Durnford feels that the ABCB needs to step back and take a look at the fundamental principles behind the classification system and then start from there with the development of a new or revised system. Durnford feels the current system is too rigid and that it needs flexibility to allow for all circumstances to be addressed. He feels there are many buildings that are alike but still do not fit neatly into the current classes. Durnford also sees a need for the BCA to articulate exactly what the purpose of the classification system is and the criteria associated with each individual class. Durnford feels that it is impossible to capture every potential scenario in a prescriptive manner. Durnford feels that any new classification system needs to provide for flexibility and uniform application and interpretation. Another major issue, which Durnford feels needs to be addressed, is the education of professionals. Durnford sees a need for continuity among professionals otherwise the same problems will arise with a new system that are present with the current one in terms of interpretation and understanding of the principles behind the issue of classification.

Interview 31
Allen Host
Dept. of Urban Affairs and Planning
Team Leader

Host feels that the classification system as it stands does not neatly place all buildings into the existing 10 categories. Host feels that more flexibility needs to be built into the classification system. Host also feels that the BCA needs to more clearly define each category, the criteria each category is based on, and what the system is trying to achieve as a whole. This is to ensure that the BCA isn't requiring more than is needed and it is a mechanism relied upon to identify when an existing building needs to be reassessed to ensure it provides for an acceptable level of heath, safety, and amenity. He feels that classification is principally about appropriate application of regulations. That is, change of use of a building which involves a change of classification. Host feels that the performance portion of the code also presents some constraints on this matter. If the use of a building changes over its life Host poses the question of whether or not the original performance design is still valid with respect to the new class as a change may not necessarily require a change in classification. Host feels that the current system could be better defined. Host sees the addition of a matrix system as a possible solution to some of the issues. He feels that if some of the subjectivity is removed a lot of the problems will be removed as well.

Interview 32
Jon Lynch
Dept. of Urban Affairs and Planning
Building Codes Officer

Lynch feels that current classification does a reasonably good job in classifying most buildings but runs into problems with some multiple use buildings and other buildings that do not properly fit into the system. Lynch feels that the system covers the buildings that existed at the time the classification system was written but also realizes that there are always new buildings popping up that won't fit into the system. The current system takes a conservative approach by requiring the highest fire resistance requirements to a class of buildings that covers a range of uses (e.g. Class 7) can range from storage on concrete railway sleepers to the storage of goods that are a high fire hazard. This conservative approach gives future owners certainty and flexibility in that it allows for a range of different uses without a change in class. Lynch also feels that the conservative approach of the existing system adds to the simplicity of the system. Lynch warns that education about a new system will be key and that any system that is proposed should be examined against the existing system. It would be even worse to trade in the current system for one that requires more of the people using it than it is worth.

Interview 33
Stephen Wise
Stephen Grubits and Associates ACT
Managing Director

Wise feels that the system as it stands is quite good for normal build ings but falters when considering buildings with multiple uses or any type of hazards. Wise feels that more clearly defined system is necessary and that the problem of change in occupancy and use needs to be addressed. Wise feels that a group of sub-classifications would be good and maybe a list of buildings that fall into each category could be added in either the BCA or the Guide to the BCA. Wise sees the greatest problem with the BCA coming from the accreditation of those professionals applying it. Wise feels that some sort of national system needs to be developed so that everyone in the country is working at the same level of expertise and applying the code in the same way. The government needs to set a minimum standard for being allowed to practice, and it needs to be country wide not state by state. Wise sees a table format much like the sprinkler code as a possibility and feels the BCA needs more explanation about it purpose and its origins. Wise feels the BCA needs to be looked at as a system not as single parts. He feels that the system is interdependent and that failing to realize this will produce another fundamentally flawed code.

Interview 34
Kevin Comerford
ACT Fire Brigade
Director of Fire Safety

Comerford feels that the current syst em works well for general buildings but has problems with multiple classifications and other difficult buildings. He feels that the BCA should be more of a fluid document perhaps telling you exactly what you need to look at. As it stands it is very easy to look past certain requirements or equivalencies that can either save someone money or if overlooked cost someone money and life safety. Comerford feels that code needs to be streamlined to read easier. He feel that it is impossible to classify all buildings into 10 classes and feels that some classes and sub-classes should be added when streamlining the current system. He also feels that the code needs to be written in plain English so that there aren't major disputes in translating and applying the code. Comerford also identifies uniform qualification of professionals across the country as a major issue. He feels that if a new system is to succeed that a level of accreditation of fire engineering professionals needs to be established by the government.

Interview 35
Kel Hannon and Frank Barker
ACT Fire Brigade

Both Hannon and Barker feel that the current BCA not flow as a complete working document. They feel that as a result some of the concessions and requirements of the BCA are being left out of designs. They suggest a flowchart should be implemented, one that describes the order in which the BCA should be read and applied from start to finish. They feel that this flowchart, or perhaps a checklist, will ensure that most of the concessions and requirement that are left out will be included in future designs. Frank believes that a system of sub-classifications is necessary; one which is based on use and intended use. If these factors change the building will then need to be re-assessed. A list of overall requirements is another option. The classification system would then be a key that would list which of the requirements applied to each class of building. Hannon and Barker believe that more clear cut the process becomes the less subjective and ambiguous the decisions of professionals will become.

Interview 36
Steve Hudson
Australian Building Codes Board
Project Manager

Hudson sees the need for reform of the classification system and of the BCA itself. He feels that before such reforms can be made thorough research must be conducted on all aspects of BCA, such as emerging and current issues not just the classification system. He feels that any new system needs to be concise, easy to use, and provide adequate safety for the community. He recognizes the problems with buildings that fall outside of the current classification system but points out that the BCA intention is to classify most buildings on similar risk levels based on use, hazard and occupancy. It was meant to broadly classify buildings. He feels the current system is easy to use and that the broad nature of the classes sometimes plays into its success rather than its downfalls. He sees the need for some further definition of classes but warns that by over sub categorizing each class you may introduce in even more buildings that will not fall properly into each sub category creating subjectivity. He believes that there needs to be some explanation of the purpose of the BCA and its classification system and that perhaps a guideline describing exactly where the lines are between classes may assist and be appropriate. Any classification system must find the balance between the life safety of the community and the cost that will be imposed on the industry using the code so that an acceptable minimum standard is achieved. Hudson feels that sub-classification in theory is a good idea. However, he stated that the boundaries between definitions and the associated administrative/assessment provisions should be clearly stated and this is an area where there may be more subjective issues given that the extent of sub-classification may vary and therefore must be suitably balanced in the technical provisions. Whatever system comes out of a review by the ABCB will be the start for the rest of the BCA as the classification of a building is used as a tool for design/assessment/approval processes. The more specific and well defined the classification system is the easier the BCA becomes to interpret and apply. Hudson warns, however, that too extended a system could run into problems down the line with its own maintenance.

Interview 37
John Barwick
Department of Defense
Chief Fire Safety Officer

Barwick feels that the classification system as its stands is pretty sufficient in dealing with all building and that it is relatively easy to use. He feels that in reviewing the system one thing that needs to be examined is the performance codes effect on maintenance requirements. He feels that the performance designs used are relying more and more on the maintenance of both passive and active fire suppression systems. As a result more attention needs to be directed towards writing a code that requires more regular inspection to make sure that proper maintenance procedures are being followed. The Department of Defense uses the BCA as a starting point for all of its buildings but then take it a step further adding additional systems to ensure property protection. Barwick feels that not enough steps are taken by the classification system to ensure property protection.

Interview 38
Richard Custer
Fire Code Reform Center
Technical Director

Custer feels that the current classification system within the BCA is not explicit enough to properly place all buildings within each of its categories. He feels that there needs to be more categories which should be better defined. He feels that current classification system is easy to use but would gladly give up some of the simplicity for some more clearly defined categories. He feels that NFPA 101 would be a good starting point for an Australian code and that from here the ABCB can adapt the code to best serve the needs of the country. He feels that if the code had more categories and better definition it would be easier to make performance solutions and designs. Smaller groups he feels will also tell more about the population and overall use of the building. Custer feels that there will be an impact on fire safety professionals but that it will be fairly small. There would be a learning curve but Custer feels that it would not be that difficult to deal with. It would have more of an effect on the cost of construction than anything else. Some buildings could save money while others that are under designed would be required to spend extra money to comply.

Interview 39
John Clampett
Building Research Association of New Zealand
Director of Fire Safety Division

John Clampett feels that although the building classification system in the BCA is not entirely perfect, it does accomplish its goal properly. He feels that for the most part there will be anomaly in any system of categorizing buildings. He felt that mixed occupancy buildings would always be hard to classify. The prescriptive system can be improved by incorporating the recent knowledge of different hazard levels and occupant behaviors in Clampett's view. He believes that in the short term some of the problems with the classification system can be resolved by a "band-aid approach". Accomplished by simply placing the building types where problems are apparent, such as aged care facilities, into more appropriate classes, existing if possible or, if not, one that is newly created. In his several years of working in the fire safety fields, Clampett has noticed some problems with the classification system. He believes the buildings under class 9B, public assembly buildings can vary greatly in risk level and therefore should differ in requirements. These buildings currently have the same classification and therefore the same requirements. Clampett also stated that some change should be made to the class 1 requirements, since most deaths due to fire occur in these residential type buildings.

Clampett views a new deem-to-satisfy classification system based on risk assessment analysis as a realistic solution, allowing the buildings to be more accurately categorized while maintaining a prescriptive benchmark. He felt this would eliminate some issues that arise from varying interpretations of the same system of classification. In the long term, Clampett would like the classification system to move toward a categorization based solely on risk assessment like is currently done when building with the performance-based code; but feels that a deem-to satisfy benchmark should always remain in place. He stated that to move to a risk assessment system would require a major mind shift of the code users and an increase in education. Clampett did not feel that changing the classification system would have any real impact on the fire safety of the community. He said, "Australia's numbers are low in comparison with other countries, it would be hard to quantify any significant improvement brought about by a change in the classification system."