PLANNING FOR FIRE SAFETY DURING THE CONSTRUCTION PHASE - A RISK MANAGEMENT PERSPECTIVE

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INTRODUCTION

Fire safety and risk management during the construction phase for building projects is an issue that has traditionally been treated in relatively simplistic terms in the Australian building construction industry. This is despite the presence of local and global evidence that construction phase fires do in fact occur and can have significant and serious consequences particularly in partially occupied buildings.

Buildings classifications of all types, during construction, renovation or demolition activities, are susceptible to fire just the same way buildings that are occupied with all the required fire systems in place. However, the fire risks are different. Ignition sources unique to construction activities can increase the likelihood of fires starting. Similarly the concentration of combustible materials, incomplete compartmentation and passive barriers, and non-commissioned fire protection systems may allow fire to spread unimpeded. The presence of multiple independent trade groups on site makes the fire and work place safety management a complicated task susceptible occasional breaches.

The objective of this paper is to stimulate discussion on the issue of fire safety during the construction phase and more specifically in buildings where building occupation and construction activities occur simultaneously on the same site. The paper provides examples of actual projects where Interim Fire Safety Management Plans (IFSMP) have been implemented to address specific building activities and mitigate fire risks during staged construction programs in occupied buildings. Suitable methodologies and processes employed to identify, evaluate and treat fire risks appropriate to the construction phase of building projects are also further highlighted in this paper.

REVIEW OF CURRENT PRACTICES AND GUIDELINES

The Building Code of Australia[1] has mandatory requirements for fire protection of construction sites which are relatively limited. More specifically Part E1, Clause E1.9 of the BCA stipulates the minimum requirements for fire precautions during construction. There are no specific guidelines or regulations that are uniformly adopted across the states and building regulatory boundaries within Australia that mandate the planning for fire safety during construction and moreover where construction activities and building occupation occur concurrently within the same building site.

In other international jurisdictions the building and fire codes, such as those promulgated by the National Fire Protection Association (NFPA) and the International Code Council (ICC), typically contain detailed lists of the protection measures that are to be followed during construction. However, these codes tend to focus more on the "what," and offer less attention to the "who," "how" and "when" of risk mitigation and implementation.

There are a number of international codes, guidance documents and ordinances that do provide guidance on fire safety management for construction sites. While such documents can be adopted for general guidance by building practitioners in Australia, the process remains voluntary. In researching

this field, a number of codes and guidelines that attempt to outline appropriate practices for safeguarding construction sites were identified and they are listed below (in no particular order). These include, but not limited to, the following:

CFPA-E No 21;2009 'Fire protection on Construction Sites (The Confederation of fire Protection Associations in Europe)

The CFPA-E[2] (European Guideline) is predominantly a prescriptive document outlining the preventative measures required for fire protection on construction sites. While it can be applied as a relatively simplistic recipe for fire protection on construction sites, it offers very little in the way of risk based methodologies to aid in the process of identification and treatment of fire risks.

The Construction (Design & Management) Regulations 2007 (CDM 2007)

The CDMR 2007[3] came into force in Great Britain on 6 April 2007 and also provides prescriptive measures for fire prevention on construction sites. However, the document takes the next step and includes a risk assessment approach which is relatively straight forward and can be carried out by the responsible person or nominated consultant.

There are five steps noted in the CDM 2007 document in carrying out a fire risk assessment:

1. Identify hazards: consider how a fire could start and what could burn;
2. People at risk: employees, contractors, visitors and anyone who is vulnerable, e.g. disabled;
3. Evaluation and action: consider the hazards and people identified in 1 and 2 and act to remove and reduce risk to protect people and premises;
4. Record, plan and train: keep a record of the risks and action taken. Make a clear plan for fire safety and ensure that people understand what they need to do in the event of a fire; and
5. Review: your assessment regularly and check it takes account of any changes on site.

NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations;

The NFPA 241[4] standard is an expansive document and has been drafted to apply to structures in the course of construction, alteration, or demolition, including underground locations. It outlines general requirements applying to construction and demolition activities and details specific requirements in a prescriptive manner.

Fire Safety in Construction (Health & Safety Executive UK) HSG168 Second Edition 2010;

HSG168[5] aims to assist all those involved in construction to identify the main causes of accidents and ill health and explain how to eliminate the hazards and control the risks. It is not a compulsory document under the local legislative jurisdictions of the UK. The purpose of the HSG168 document is to help stakeholders understand the action they can take on construction sites to manage fire risks. It contains many prescriptive protection measures to address fire risks in construction sites but in addition follows the following basic risk approach which is similar to that defined in AS/NZS 4360:2004 - Risk management.

1. Recognised the risks in their workplaces;
2. Considered who will be affected;
3. Assessed the extent of the risks;
4. Come to an informed decision on the necessary action to reduce them; and
5. Ensured that the actions decided are implemented.

Australian standard "AS/NZS 4360:2004 - Risk Management"

Superseded by ISO 31000:2009, AS/NZS 4360:2004[6] is a document which can be adopted for guidance on how to systematically conduct a risk assessment and develop a management plan for treating and mitigating the risks identified as a consequence of the assessment. Figure 0-1 depicts the risk management process presented in AS/NZS 4360:2004.

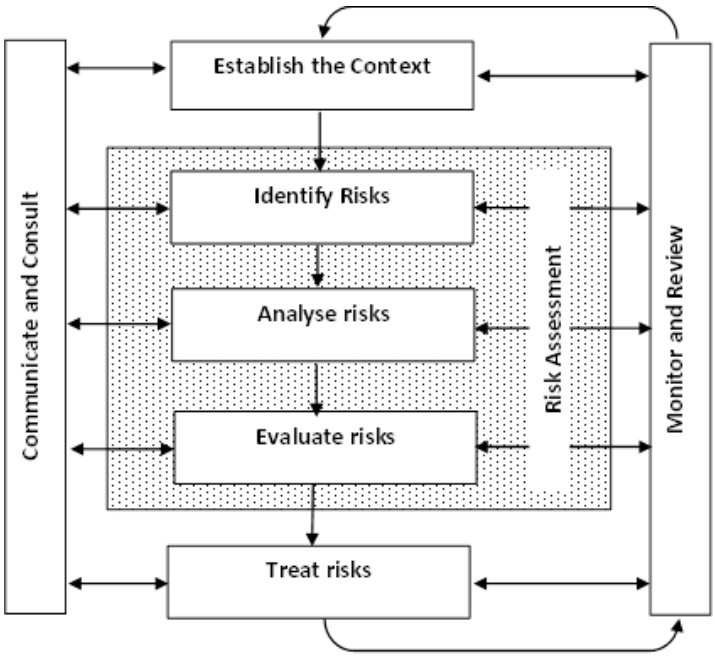

Figure 0-1 – Risk management process AS/NZS 4360:2004

The process stages can be summarised as listed below:

1. Establish the context for managing risks, including criteria for evaluating them.
2. Identify risks and how they can arise.
3. Analyse how often risks are likely to occur and the consequences they would have.
4. Evaluate each risk's likelihood and potential consequences against your evaluation criteria.
5. Treat unacceptable risks to reduce the chance that they will happen or the consequences they would have if they did.

In the development of an Interim Fire Safety Management Plan (IFSMP) for an occupied building undergoing construction activities, the process may be modified as discussed further in the following subsections of this paper.

Construction Global Minimum Requirements (Lend Lease)

This is an industry example developed by Lend Lease for their own Global Minimum Requirements[7] (GMR's) which provide the framework in ensuring that in all countries in which the company has a presence (including some third world countries), they follow the same "platform" in which they operate their construction sites. The Construction GMR's (consisting of eight GMRs) detail the processes and standards specific to Lend Lease construction activities which include fire precautions and management. The GMR's are prescriptive in nature and have been developed to ensure that effective arrangements are in place to minimise the risk of, and manage the consequences of, all potential fire and emergency situations in order to protect life, property and business continuity during construction. The main salient points in GMR 7 – 'Fire and Emergency' include the following:

- Fire Prevention Measures
- Fire Detection and Alarm Systems
- Means of Escape
- Fire Fighting Equipment
- Emergency Planning and Evacuation Procedures

WHAT ARE THE RISKS?

AS/NZS 4360 defines risk as, "the chance of something happening that will have an impact upon objectives". Risk may have a positive or negative effect, and is measured in terms of consequences and likelihood. Some of the notable key objectives in terms of fire risk mitigation for structures include protection of life safety of building occupants and fire services personnel, protection of key asset, business continuity, business reputation and sovereign reputation all of which are also keenly understood by insurers.

Fire safety risk engineers work in the design of new buildings and the refurbishment of existing buildings where the analysis of conditions within new and existing buildings most often forms the extent of the scope of services provided. In some instances, fire safety and risk engineers also provide construction-period services in relation to construction or installation of fire safety strategies throughout the construction phase.

It is the experience of the authors of this paper that fire safety risk engineers in Australia are not often engaged to undertake a more rigorous risk assessment of the fire risks during construction activities. Consideration to comply with the mandatory minimal fire precautions is typically undertaken by suitably qualified fire protection engineers during periods of construction. However, since the fire hazards, mitigating factors and credible fire scenarios will vary during construction operations especially in occupied buildings the more appropriate process of risk assessment is clearly warranted.

When fires do occur, proper consideration of passive and active fire protection features can minimize the extent of damage and loss that will occur. Such losses can simply include the owner's exposure to financial losses incurred due to delays caused by fires during construction activities, a concern that is often outside the scope of most regulatory requirements that apply to buildings under construction.

According to NFPA Fire Analysis and Research Division [8] the leading causes of fires in buildings during construction activities are incendiary or suspicious (39.5%); open flame, embers or torches (20.8%); and heating equipment (9.7%). Similarly for demolition activities the leading causes of fires are open flame, embers or torches (51.7%), and incendiary or suspicious (35.9%). Notably the property loss per fire incident resulting from fires in buildings during construction is higher than most structure fire losses.

A local example in Melbourne was the Myer Department store fire (Oct 2008) that occurred as a direct result of construction activities according to the Metropolitan Fire Brigade (MFB) Post Incident Summary Report (08 04192B) [9]. Cutting/welding in combination with the accumulation of combustible debris on Level 3 fuelled the fire. At the time of the fire (after trading hours) the basement and ground floor levels were operating as a retail department store and the upper levels were undergoing varying stages of refurbishment work. The authors of this paper draw no conclusions regarding the presence and/or implementation of fire safety management plans however note the fire occurred as a result of construction activities on a site shared by an operating retail department store.

Another local example is where a fire broke out in February 2005 within the 24 storey building located at 60 Market Street Melbourne which was undergoing refurbishment works at the time. The fire was deemed to be suspicious according to the Post Incident Summary Report prepared by the MFB. According to the MFB report (CSC 05 00184) [10] the hydrant main located in the fire stair was dry. Again the authors of this paper draw no conclusions regarding the presence and/or implementation of fire safety management plans however note the fire occurred as a result of construction activities.

In the context of risk, both of the fires discussed above had non-severe consequences as there were no fatalities or injuries.

The practises and guidelines listed above address many of these common causes in an attempt to prevent or minimize fire damage during construction, alteration and demolition operations. In isolation the above statistics have a dominant bearing on life safety of construction workers and attending fire services personnel. However, the risks may be significantly higher where a building is occupied in conjunction with construction activities as the Shanghai apartment fire in 2010 demonstrated.

A fire in 2010 destroyed a 28-story high-rise apartment building in the city of Shanghai, China, killing at least 58 people and injuring more than 70 others. The apartment tower was undergoing construction activities while still occupied by apartment residents. The source of the fire was confirmed to be as a direct result of welding works associated with construction activities. The local regulatory requirements are unknown to the authors of this paper with regard to construction activities, however, the consequences clearly demonstrate that the risks associated with construction activities in occupied buildings can have a profound impact on the building objectives.

HOW TO DEVELOP AN INTERIM FIRE SAFETY MANAGEMENT PLAN

A fire safety management plan is a means of mitigation of risks. Hence, it is a "risk management plan". Risk can be defined as the potential for realisation of unwanted adverse consequences to human life, health, property and environment. Risk is defined as the product of a hazard (such as damage costs) and the probability that this hazard occurs. In other words:

The first two values must be known or at least estimated in order to define risk. Likelihood may be expressed as a rate or a probability. For example the risk of an aircraft accident (hazard) can be expressed as one accident per million flights (likelihood).

Risk can be expressed in many ways, so long as it combines a hazard with likelihood. One can use the methods of science, engineering, and math in order to define risks.

Each building site is unique with respect to its geometry, use, fuel content, ignition sources and most importantly to its occupants. These different parameters result in different levels and types and hazards for each building. The fire safety systems and management measures prescribed for a building are the means of mitigating the hazards that exist in the building. Qualitative and quantitative risk assessments prove to be a highly powerful tool in identifying types and magnitudes of hazards specific to different classifications of buildings. Through risk assessments it becomes possible to identify the most appropriate fire safety systems and management measures. Building codes and regulations provide the benchmark with respect to fire safety in buildings. The hazards within a building are mitigated to a level acceptable to the society when the fire safety systems are designed in accordance with the codes.

In the event when the construction process takes place in an already occupied building, i.e. a shopping centre refurbishment, the risk may increase significantly for the parts of the building that are already occupied and operational and hence, further mitigation will be essential. Unless the risk impact is assessed and even quantified the mitigation measures may not be overall effective. Risks are future problems that can be avoided or mitigated, rather than current ones that must be immediately addressed. As discussed previously the mitigation measure can be collected and presented in an Interim Fire Safety Management Plan.

The primary objective of an Interim Fire Safety Management Plan is to improve occupant life safety in relation to fires that may occur during the construction phase of an already occupied building. Casualties, and to a certain extent property losses, are always aimed to be minimised. In doing this, the issue is approached from the following perspectives:

1. Prevent/minimise ignitions - reduce ignition frequency/probability
2. Ensure immediate and safe occupant evacuation and limit the damage caused by fires – minimise consequences
3. Provide immediate intervention services – mitigate immediate hazards

Overall, whether it is the protection of life or protection of property the process adopted is a form of risk management, which is the process of combining a risk assessment with decisions on how to address that risk. Risk management is part of a larger decision process that considers the technical and social aspects of the risk situation. Risk assessments are performed primarily for the purpose of providing information and insight to those who make decisions about how that risk should be managed. Judgment and values enter into risk assessment in the context of what techniques one should use to objectively describe and evaluate risk. Judgment and values also enter into risk management in the context of what is the most effective and socially acceptable solution.

The combined risk assessment and risk management process can be described as a six step process. The first three steps are associated with risk assessment and the last three with risk management.

1. Formulate problem in a broad context - Do this by answering questions like: What is the problem? Who must manage the problem? Who are the stakeholders? Also, establish relationships among the problems and rely on stakeholders for problem identification and characterization.
2. Perform the risk analysis - Evaluate the risk in order to determine the hazard, the likelihood of the hazard occurring, and any uncertainties in the estimate
3. Define the options - Determine what can be done about the risk issue and the ways that it could be done. Determine potential consequences, costs, and benefits.
4. Make sound decisions - Determine the best solutions and how they could be implemented in ways that are feasible, cost effective, and socially acceptable.
5. Implement decisions - Find out what actions are needed to implement and deal with any objections or reassessments.
6. Evaluate actions taken - Determine what is an acceptable and effective means of evaluating the effectiveness or appropriateness of the risk management actions.

As previously noted Australian Standard "AS/NZS 4360:2004 - Risk management" is a document which can be adopted for guidance on how to systematically conduct a risk assessment and develop a management plan for treating and mitigating the risks identified as a consequence of the assessment. Figure 0-1 depicts the risk management process presented in AS/NZS 4360:2004.

An Interim Fire Safety Management Plan (IFSMP) can be developed on the principles of this process and may be modified as shown in Figure 0-2.

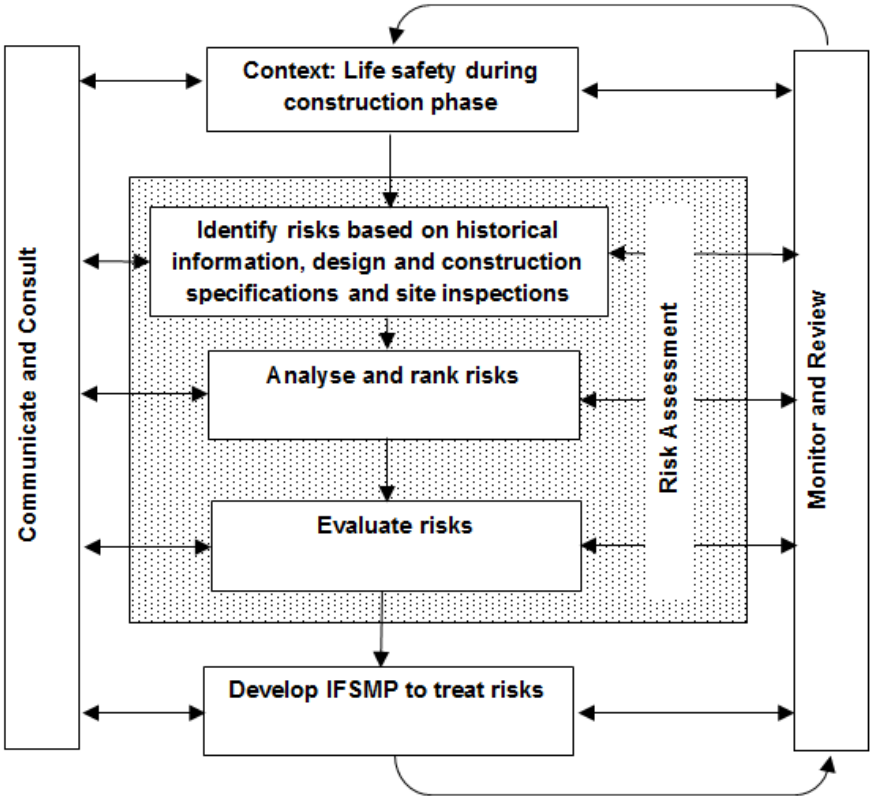

Figure 0-2 – Modified risk management process AS/NZS 4360:2004

Communicate and Consult

Communication and consultation with external and internal stakeholders should take place during all stages. Communication and consultation should address issues relating to:

- the risk itself;
- its causes;
- its consequences (if known); and
- the measures being taken to treat it.

At the start and during the assessment stage risks and corresponding consequences are discussed and identified. At the treatment and monitoring stage the proposed and/or adopted measures are discussed and reviewed. The stages of the process are explained in the following sections.

Establishing the Context

The first step in the risk management process is establishing the context and deciding precisely what it is that the risk management program expected to achieve. The key questions are listed below.

a. What are the objectives of the management process?

A primary objective of risk management is to identify and to manage (take preventive steps) to handle the uncertainties that attend an organization or event or process or entity. Uncertainty may be defined as "unmeasurable risk".

From the perspective of interim fire risk management the primary objective will be to protect life safety (both public and fire brigade). Other objectives may focus on:

- protection of existing property;
- consequential cost of a fire;
- business continuation;
- social responsibility, and
- preservation of good public relations.

b. What are the parameters to be taken into account when managing risk?

The parameters for evaluating, categorizing, and prioritizing risks include:

- Risk likelihood (i.e., probability of risk occurrence)
- Risk consequence (i.e., impact and severity of risk occurrence)
- Thresholds to trigger management activities

c. What is the scope and the risk criteria?

Risk criteria is defined as the nature and types of causes and consequences that can occur and how they will be measured. The criteria also include how likelihood will be defined and the timeframe(s) of the likelihood and/or consequence(s).

It is critical that how the level of risk is to be determined; the level at which risk becomes acceptable or tolerable; and whether combinations of multiple risks should be taken into account and, if so, how and which combinations should be considered.

Risk Assessment

There are three stages attributed to the assessment of risk:

a. Identification of Risks

In relation to risk the sources of risk; areas of impacts and the events and their causes and their potential consequences must be identified The aim is to generate a comprehensive list of risks based on those events that might impact on the achievement of objectives including:

- create,
- enhance,
- prevent,
- degrade,
- accelerate, or
- delay

Comprehensive identification is critical, because a risk that is not identified at this stage will not be included in further analysis. Identification should include risks whether or not their source is controllable or evident. All significant causes and consequences should be considered.

Risk identification tools and techniques that are suited to the objectives and capabilities, and to the risks faced must be adopted. Relevant and up-to-date information is important in identifying risks.

b. Analysis of risks

Risk analysis involves developing an understanding of the risk. Risk analysis provides an input to risk evaluation and to decisions on whether risks need to be treated, and on the most appropriate risk treatment strategies and methods. It involves consideration of the causes and sources of risk; their positive and negative consequences; and the likelihood that those consequences can occur.

The way in which consequences and likelihood are expressed and the way in which they are combined to determine a level of risk should reflect the type of risk; the information available; and the purpose for which the risk assessment output is to be used.

Risk analysis can be undertaken with varying degrees of detail, depending on the risk; the purpose of the analysis; and the information, data and resources available. The analysis can be qualitative; semi-quantitative or quantitative; or a combination of these, depending on the circumstances.

INTERIM FIRE SAFETY MANAGEMENT PLANS – A CASE STUDY SUMMARY OF WORKED EXAMPLES

More often detailed construction programs for building projects are developed that include staged construction works packages and in many instances partial occupation of buildings over prolonged construction periods. The regular shut-down and isolation of fire safety systems to

accommodate staged construction programs remains commonplace in the Australian building construction industry. Furthermore, the emergence of alternative solutions and the use of unconventional building materials can introduce new fire risks to building projects that have previously not been considered.

Two (2) notable examples of staged construction programs where Scientific Fire Services Pty Limited where engaged to develop IFSMP's are listed below. In both cases the extensive building construction programs were undertaken at the same time the buildings remained operational and open to the general public for retail trading. The application of the above described risk based process was adopted as part of the development of the IFSMP's.

Charlestown Square Shopping (Newcastle 2010)
The project involved the expansion of the existing retail shopping centre by some 40,000m^2. During the construction program there were 37 separate construction zones/stages over the construction period of some four (4) years which all occurred alongside the existing operational retail centre. A brief summary of the development of the IFSMP is provided below.

The fire safety philosophy adopted to reduce risks associated with the construction staging of the Charlestown Square Shopping Centre upgrade works followed basic risk management processes. This process was initiated by the building construction team (Lend Lease) and subsequently supported by the NSW Fire Brigades. The relevant stakeholders included:

The builder:	Lend Lease
Fire Engineers	Scientific Fire Services Pty Limited
Principle Certifying Authority	McKenzie Group Consulting (NSW)
Fire services	NSW Fire Brigades
Centre Operations Management	GPT

The following process was developed based on the general methodologies defined in AS/NZS 4360:2004.

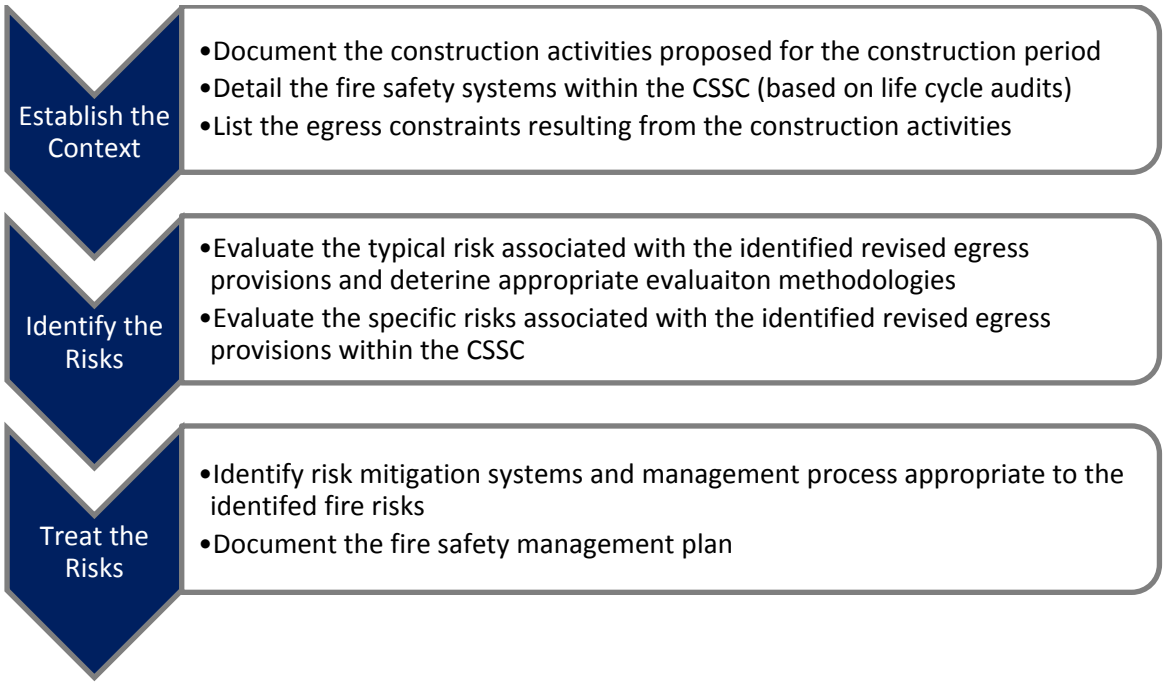

Figure 0-3 – Modified risk management process for Charlestown Square

Establish the Context

Prior to any works commencing, Lend Lease prepared a Stage Construction Impact Statement document (SCIS) which briefly described the proposed works and indicated the area of the centre to be affected by these works. This was simply an internal review by Lend Lease and identified any areas impacted within the retail centre. Site inspections by Lend Lease construction managers formed the basic part of this process.

The SCIS document identified aspects of the works that would have an impact on the egress provisions of the centre and/or individual retail tenancies. The focus of the SCIS were issues such as:

- Temporary deletion of exits
- Change of exit locations
- Reduced egress path dimensions
- Alternative egress routes.
- Hoarding works associated with egress provisions

Identify the risks

The following steps were proposed and agreed upon in order to effectively identify the risks:

Step 1. On completion the SCIS document was submitted to the Building Certifier and an inspection of the area organised.

Step 2. The Building Certifier provided advice as to whether the impact was considered detrimental from a BCA perspective.

Step 3. Where no detrimental impacts were identified by the Building Certifier the works proceeded as per the documented works program. The building owner was responsible for informing centre management and the individual tenants of the proposed works.

Step 4. Where it was deemed that there is a detrimental effect the following parties were notified:

- Lend Lease
- Building owner
- Fire safety engineer (Scientific Fire Services).

Step 5. The fire safety engineer determined the appropriate methodology to be applied based on an evaluation of the documentation and risk assessment of the proposed works.

Step 7. Where the proposal was not accepted by the project fire safety engineer works could not proceed until an approved solution is agreed to by Lend Lease, the Certifier and Scientific Fire Services Pty Limited.

Treat the risks

The fire safety risk report undertaken as a result of the above listed process clearly identified all the measures that were required to be implemented within the centre to ensure an adequate level of life safety for the retail occupants. The report was submitted to Lend Lease and the Building Certifier.

Lend Lease notified the building owner and centre management and the affected tenancies of the measures to be adopted during the construction works.

Lend Lease implemented all the required measures detailed in the fire safety risk report ensuring that all relevant operational manuals of centre management and affected tenancies were modified as necessary, to reflect the required procedures during the temporary construction works.

At the completion of the works, Lend Lease ensured that the operational manuals in use in the centre and retail stores were also revised to reflect the new permanent conditions applicable.

Lend Lease undertook the works as per the agreed sign-off from the Building Certifier and Scientific Fire Services Pty Limited and at the times determined by the building owner.

The documentation appropriate to each risk analysis process was maintained within Lend Lease's site office and were furnished to all relevant stakeholders subject to request.

Pacific Place Mall (Hong Kong 2010)
The Pacific Place Mall (PP Mall) revitalisation project (Hong Kong) involved the refurbishment of an existing land mark retail centre in Hong Kong. There were four (4) significant retail zones that underwent significant refurbishment works including the introduction of new voids and interconnecting lift shafts in a fully operational retail shopping centre. The PP Mall project accommodated construction works after hours, retail trading during trading hours coupled with significant time periods where suppression and smoke hazard management systems were isolated.

The purpose of the IFSMP document developed for the PPMall was to provide a set of fire safety management plans specifically drafted to manage and mitigate fire hazards and risks associated with the renovations/construction works for the contemporisation project.

The construction phasing and sequencing of the construction works introduced non-typical activities within the functioning retail shopping centre. These included the activities associated with the physical construction of the project coupled with the suspension of fire safety systems throughout various stages of the contemporisation works. This is simply described in the following illustration.

The introduction of the IFSMP for the contemporisation works program was designed to enhance the level of fire safety during this 3 year construction period. The fire risks associated with the construction works within a fully functioning retail centre required careful examination and treatment through risk minimisation strategies. This was the key objective of the IFSMP.

A detailed review of the three (3) year construction program provided by the builder (Gammon) was undertaken to understand and evaluate the construction risks that were imposed on the PPMall site. This included the development of a detailed program identifying the time and duration of suspension of key fire systems within the operational retail centre retail.

Coupled with the construction program and identified construction fire risks, a detailed evaluation of the hazards and risks associated with the operating retail centre was undertaken. A statistical summary of fire ignition frequencies, fire spread impact, fire occurrence by time of day and consequence of fires during times where key fire systems were suspended was undertaken.

A management program was developed in the form of an IFSMP applied for the duration of the construction program. All key stakeholders were involved in the process and clear responsibilities were assigned and understood by all parties. Key preventative measures and management requirements were documented for the following circumstances:

Shopping Centre (non-construction zones) – Trading Hours
Shopping Centre (non-construction zones) – Non-Trading Hours

Construction Zone(s) - Trading Hours
Construction Zone(s) - Non-Trading Hours
Introduced displays and decorative features (Promotions and Christmas trading)

Detailed daily handover procedures were introduced and the construction zones and retail operations were subjected to comprehensive auditing and recording procedures which were complied with throughout the PP Mall Contemporisation construction program.

The objective of the IFSMP as a risk management tool was successfully implemented and enforced over the construction period. The philosophy adopted to manage the risks associated with the construction phase of the PP Mall Contemporisation followed the basic risk management processes defined in AS/NZS 4360:2004.

Forte, Docklands (Melbourne 2012)
Designed, developed and constructed by Lend Lease, Forte, Australia's first timber high-rise apartment building and the tallest in the world currently under construction in Melbourne's Docklands precinct offered a unique construction method and new construction material previously untried in Australia on this scale. As part of the submission process to the building and fire services authorities in Melbourne, the unique nature of the construction methodology and the construction materials was highlighted by the MFB as representing a risk warranting consideration during construction.

The predominant construction material for the Forte apartment building project is Cross Laminated Timber (CLT) panels. CLT panels are produced from mechanically dried timber boards which are stacked together at right angles and glued over the entirety of their surface. The use of timber as the construction material for almost every building element of the Forte project (load bearing and non-load bearing; horizontal and vertical, internal and external) introduced a truly unique potential fire risk.

As previously noted in this paper, Global Minimum Requirements (GRM's) set out the standard minimum requirements for construction activities on Lend Lease building sites. The GMR's in affect are considered to be risk management plans. A fire safety management plan was further developed in collaboration with the project team with reliance on the existing management plans contained within the GMR's. A review of international documents highlighting recent experience such as the London Assembly Planning and Housing Committee review "Fire safety in London - Fire risks in London's tall and timber framed buildings" of December 2010 were also relied upon. Areas on consideration (based on Lend Lease's existing GMR's) were:

Logistics – Site security
Housekeeping
Electrical temporary supply
Lighting
Fire prevention measures
Fire fighting equipment
Construction Methodology
Egress and Access
Hydrant Extinguisher and Booster location
Site plan evacuation and vehicle access
Traffic management

CONCLUSIONS

Building codes, having been generally drafted for the 'built' environment, are documents of compliance and conformance and offer little in the way of fire risk management during construction. While there are some interim life safety management requirements in a number of countries such as USA and UK, in Australia it is mostly a self-imposed responsibility generally managed by the builder. There are a number of generic guidelines and standards that offer methodologies for risk management that can be adopted and applied for the purposes of developing an IFSMP. The application of such generic documents requires a detailed knowledge of the building project and an understanding of the

specific systems, building materials and fire risks associated with the construction activities. An ongoing review of the construction activities and site conditions is crucial to the success of an IFSMP.

The authors of this paper have witnessed the evolution of IFSMP over the past decade and they are of the opinion that a fresh look at fire safety during the construction phase of a building project is warranted.

ACKNOWLEDGMENTS

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