IPENZ ENGINEERS NEW ZEALAND

Practice Note 22

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Guidelines for Documenting Fire Safety Designs

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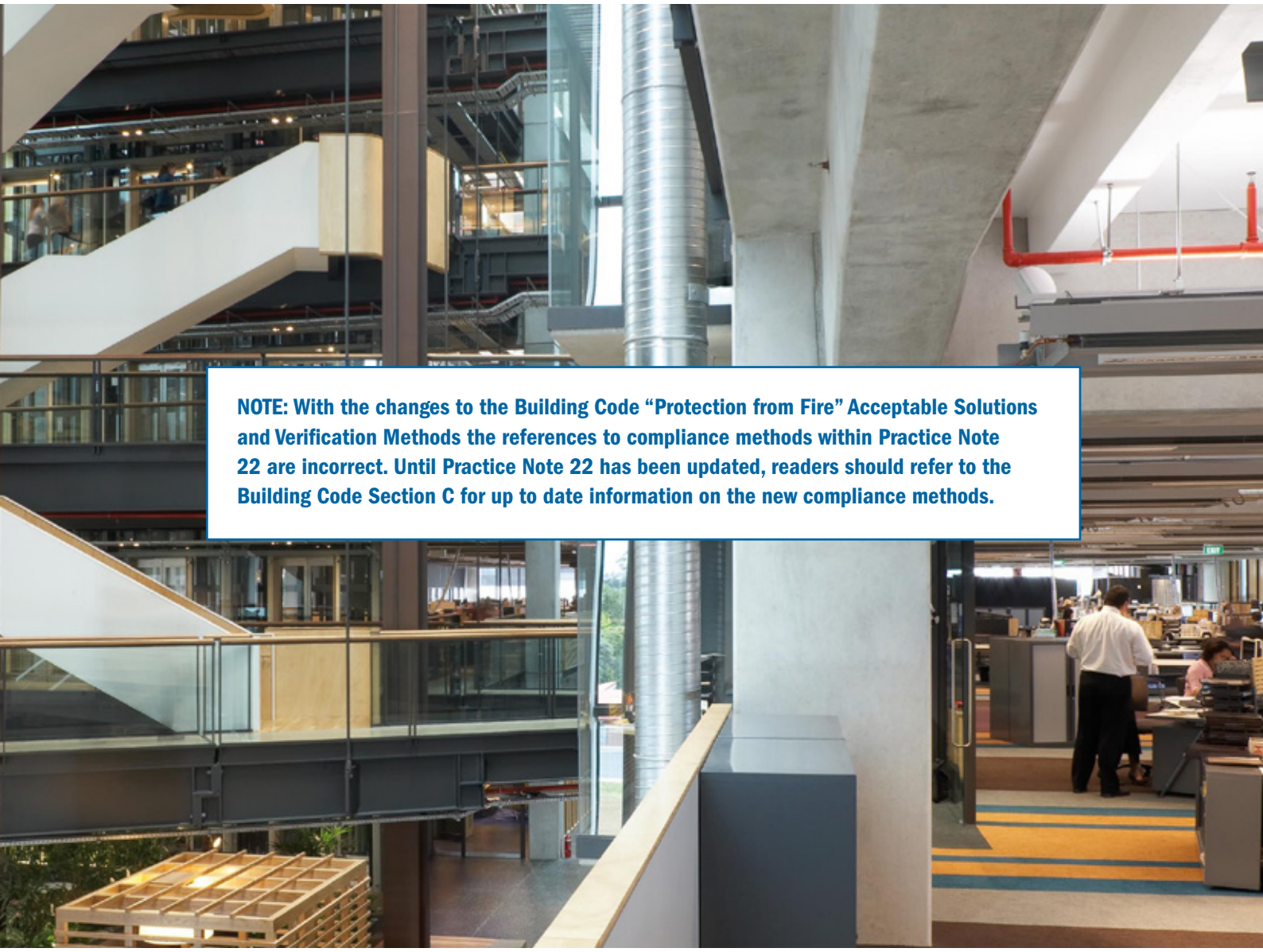

NOTE: With the changes to the Building Code "Protection from Fire" Acceptable Solutions and Verification Methods the references to compliance methods within Practice Note 22 are incorrect. Until Practice Note 22 has been updated, readers should refer to the Building Code Section C for up to date information on the new compliance methods.

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NEW ZEALAND FIRE SERVICE

Department of Building and Housing
Te Tari Kaupapa Whare

1. Foreword

This document is published as Practice Note 22 by the Institution of Professional Engineers New Zealand.

This Practice Note is also published by the Department of Building and Housing as guidance under section 175 of the Building Act 2004. It is not a substitute for professional or legal advice, and should not be relied on as establishing compliance with the **building code**. It is not an **"acceptable solution"** in terms of the Building Act, and may be updated from time to time.

NOTE: With the changes to the Building Code "Protection from Fire" Acceptable Solutions and Verification Methods the references to compliance methods within Practice Note 22 are incorrect. Until Practice Note 22 has been updated, readers should refer to the Building Code Section C for up to date information on the new compliance methods.

Contents

2. Introduction

One of the significant concerns with fire design practice in New Zealand has been poor fire design documentation. This has led to uncertainty about how to incorporate fire design into **plans and specifications**, and how the designs have been justified. This problem was identified by the Fire Engineering Task Force in 2007 and noted in the "Hot Topics" report on its findings and recommendations.

Fire safety design must be properly communicated and incorporated into a building's final **design documentation**. The documentation must describe and justify the fire safety design to enable a **building consent** to be issued.

Design documentation submitted for consent must describe the building's **intended use** and provide the detail from which the **building work** can be completed. It must also justify, if necessary, the fire design's adequacy and advise proposals, if any, for checking on-site construction. Finally, if **specified systems** are involved the **design documentation** must nominate the necessary ongoing maintenance and inspection requirements to keep those systems functional after the **building work** has been completed.

This Practice Note provides guidelines for **fire designers**, other design professionals, **Building Consent Authorities (BCAs)** and the New Zealand Fire Service. It is important to note that the New Zealand fire engineering profession and the Department of Building and Housing (DBH) regard these guidelines as the minimum level of documentation necessary.

The Practice Note outlines the documentation required to adequately describe a building project's fire engineering design solution, and how to record it for **building consent**. It also describes the type and extent of information required to record fire design requirements, how to communicate these to other members of the design team and the type and extent of information required to support applications for **building consent**.
In addition, this Practice Note specifies the information (summarised in the table on pages 11 to 18) that:

- A **BCA** could reasonably require with a **building consent** application
- Is expected to be provided by good designers.

Besides the aspects mentioned above, this Practice Note describes how **fire designers** should clearly communicate with other design professionals about features and systems that impact on fire safety. This will enable the **fire designer's** design intent to be accurately incorporated into the finished building.

This Practice Note provides guidance about the form of **design documentation**. There is considerable emphasis on graphical communication, rather than traditional text-based reports. It also lists expectations of the designers and their responsibilities for producing **plans and specifications** for construction.

The Practice Note does not offer guidance in relation to the fire safety solution's specific content, nor does it put forward advice about the design methodology or content of the calculations and justification that produced the solution. The scope and responsibilities for the parties who prepare various parts of **design documentation** is covered elsewhere, for example in the CIC *Design Documentation Guidelines*.

All fire safety design stakeholders are encouraged to insist on these guidelines being incorporated into the **fire designers'** and building design team's daily practice. This will improve the quality of fire **design documentation**. Regular reviews and updates of this Practice Note are proposed. The input and assistance given by many **fire designers** and others to develop this Practice Note is acknowledged. This Practice Note has been developed with input from various workshops held around the country, attended by designers, representatives from **BCAs**, the Fire Service and the DBH.

3. Purpose of this Practice Note

This Practice Note:

- Provides guidance to **fire designers** by describing how design information should be recorded and communicated to the other design professionals
- Provides guidance on documenting the evidence which verifies that the fire design has been properly carried out and is accurately reflected in the construction documents; this justification is principally for the benefit of regulatory authorities
- Provides guidance to **BCAs** about where and how the final detail of the fire safety design should be documented and describes the information to be submitted with a **building consent** application
- Encourages a consistent level of documentation from **fire designers** regardless of the design methodology they use.

Although this Practice Note applies to designs that follow a prescriptive approach (using an **acceptable solution**) and to those using **specific fire engineering design**, the level of verification detail the designs require may differ. The Practice Note applies to new work and alterations to existing buildings.

This Practice Note does not describe the design process. It complements the *IPENZ Fire Engineering Taskforce Report*, the Construction Industry Council (CIC) *Design Documentation Guidelines*, the Society of Fire Protection Engineers *(SFPE) Engineering Guide to Performance Based Fire Protection* and the *International Fire Engineering Guidelines*, which address various aspects of fire engineering design. The latter two documents each describe a process for carrying out **specific fire engineering design** to meet general performance based objectives, although they do not detail exactly what should be included in **design documentation**. The SFPE *Code Officials Guide to Performance Based Design Review* also provides guidance on reviewing **specific fire engineering designs** and the documentation that should be produced.

Good-quality **design documentation** makes it easier for **BCAs** to process **building consent** applications. Applicants also benefit by having their applications processed in a smooth and timely manner.

Recommendations in this Practice Note are for typical minimum requirements for **building consent** approval. However they can also apply to documentation prepared when a building owner or occupier has objectives exceeding minimum **building code** requirements (e.g. for property protection). When a building owner or occupier has objectives exceeding the minimum **building code** requirements for fire safety (eg. property protection) the **design documentation** will record and reflect the client's brief. In most cases, documentation which is more comprehensive than the minimum recommendations provides a clearer understanding of the design intent and therefore provides a more reliable basis for future alterations to the building.

Design documentation also provides a record of the built environment, which is useful when building alterations are being planned. Access to the building's original design details – including the methodologies used, assumptions made, and the design limitations – is very important for assessing the impact of proposed changes.

Appendix A gives the definitions of the terms that appear in **bold** in this document. Relevant sections of the Building Act 2004 (Building Act) are given in Appendix B.

4. Documentation Guidelines – Outline

This section outlines the content and preferred format for fire engineering **design documentation**.

The **fire designer's** documentation is provided for at least two purposes:

- The design process – during the design process the documentation identifies what must be included in construction documentation (supplied for example by architects, engineers or the building owner) to meet the fire safety design requirements
- **Building consent** approval – the documents provide the justification that the fire safety design complies with the **building code**.

ITEM	DESCRIPTION	DESIGN DOCUMENTATION
A	Building description and use	**Intended use** (5.1) Fire Engineering brief report **Plans and specifications** (5.2) Verification of **Building code compliance** (5.3)
B	Fire engineering design philosophy	
C	Means of escape	
D	Fire safety systems	
E	Control of internal spread of fire and smoke	
F	Control of external spread of fire	
G	Fire Service access and fire fighting facilities	
H	Construction inspection	Owner's inspections (5.4)
I	Compliance schedule	Ongoing inspections and maintenance requirements (5.5)
J	Miscellaneous information	Other information (5.6)

Table 1: Fire Designers' Documentation

Items A to G in Table 1 above are broadly aligned with the following categorisation of fire safety subsystems from the *International Fire Engineering Guidelines*: Fire Initiation, Development and Control; Smoke Development, Spread and Control; Fire Spread, Impact and Control; Fire Detection, Warning and Suppression; Occupant Evacuation and Control; Fire Service Intervention.

Items H to J relate to **building code** compliance. Items H and I are the written proposals for the owner's inspection while **building work** is carried out, and the procedures for inspecting and maintaining **specified systems** after the **building work's** completion. Where the **building consent** applicant undertakes inspections throughout the work, advice on those inspections also needs to be included in the documentation.

Item J covers miscellaneous information such as information on the **fire designer's** qualifications.

Table 2 **(Fire Designers' Documentation)** uses items A to J from Table 1 above to outline the content of the **fire designers'** documentation and describes the form the **design documentation** needs to take. The table is divided into two parts as follows.

The information in the left hand column is produced by the **fire designer** and needs to be presented as shown in the table: it describes and justifies the fire design. It records the fire engineering solution and includes information for the direct use of the other design team members. It is used to demonstrate compliance with the **building code** and is not used by the building trades for construction.

The information is categorised into three main format types:

i. Narrative – this is described in text; it is usually descriptive in nature and may include tabular information.

ii. Plans and sketches – this is described using figures, graphs, sketches or mark-ups. These documents, when forming part of the **design documentation**, need to be given titles and/or numbers that uniquely identify each document as part of the fire engineering **design documentation**.

iii. Verification and calculations – this documentation is usually numerical, although sometimes qualitative. It may contain background descriptive text relating to application, method, assumptions and limitations. Calculations include hand calculations, spreadsheet output, and computer input/output and marked-up tables for compliance verification. Fire modelling analysis and/or calculations need to clearly identify assumptions and limitations (hence validity), input values, acceptance criteria, output values and conclusions. Verification includes justifying the use of alternative solutions.

Every fire design is different, so not all items will be relevant to every job. For example, **design documentation** for fire designs that use **specific fire engineering design** need to include the design justification (i.e. the basis for the design along with specific assumptions, limitations) whereas a design using C/AS1 will only need a narrative explaining how the **acceptable solution** has been used. It is likely that separate sketches or drawings will not be needed for every item in the table – one set of sketches is likely to cover several items.

The information in the right hand column of Table 2 **(Fire Designers' Documentation)** identifies the design disciplines responsible for producing the **plans and specifications** which detail the fire design for building consent approval. These are also used for construction purposes. Apart from items A and B, the **plans and specifications** are usually produced by disciplines other than the **fire designer**. Examples of these **plans and specifications** could be details of fire rated walls, which are included in the architectural documents, or a particular smoke control system which is included in the building services engineer's specifications. The **plans and specifications** must completely and accurately describe and detail, as appropriate, all the fire protection measures required by the fire design.

When the **fire designer** produces documentation for the appropriate discipline to incorporate into their **building consent**/construction documents, the **fire designer** and other disciplines share responsibility for correct interpretation and accurate representation in the other disciplines' documents. Primary responsibility for co-ordinating the design correctly rests with the consultants for the other design disciplines. However, it is expected that the **building consent** documents (e.g. drawings, wall, door and window schedules, and surface finish schedules) will be referred back to the **fire designer** who will undertake a secondary review of the documents for compliance with the fire engineering design.

When the **fire designer** and other disciplines are satisfied the design shown in the **building consent** documents complies with the fire engineering design, a "design co-ordination statement" is to be provided to the **BCA**. This statement accompanies the documents submitted for **building consent** approval. The design statement advises that the fire safety design requirements have been co-ordinated with and accurately transferred to the drawings, specifications and documents prepared by these other disciplines. A fire safety designer will usually provide the statement, but it may be appropriate for this to be provided by a design manager or another party eg. for non-complex **building work**. It is expected that this statement will apply to the **plans and specifications** lodged for **building consent** and therefore the associated review occurs concurrently with the **BCA's** consent document processing. The extent to which a **BCA** relies on design co-ordination statements is entirely at their discretion. They may undertake additional reviews for auditing purposes or if they feel there is evidence of insufficient design co-ordination carried out by the designers.

The following provides an example of a suitable design co-ordination statement.

"The drawings, specifications and other documents produced by the various designers as listed on the attached document schedules have been reviewed within the context of the fire safety design to determine that the fire safety design's intent for compliance with the **building code** is correctly shown on these documents. This review does not relieve the other designers of their responsibilities for correctly interpreting the fire design or from ensuring the fire safety requirements in their documents are correct and complete.

This design co-ordination statement is provided specifically for **building code** compliance only. It is based on the statements received from the various designers as attached."

NOTE ON THE FIRE DESIGNER'S ROLE IN COORDINATING THE FIRE SAFETY DESIGN WITH OTHER DISCIPLINES

The aim of confirming to the **BCA** the design co-ordination has taken place is to provide quality assurance to the co-ordination process. This ensures **fire designers** refer to the **building consent**/ construction documents and communicate with the other designers when preparing their fire designs, and ensures the other designers on the project do the same. The result will ensure the final design is properly co-ordinated.

Fire designers are not expected to carry out detailed co-ordination or accept liability beyond that considered reasonable to discharge the duty of care that exists when fire design requirements are described in performance terms for other consultants to integrate into their documents.

As **fire designers** know their fire designs better than any other party, they are best placed to decide which aspects need to be well co-ordinated with others, and who should be involved in this. Therefore it is logical for **fire designers** to confirm the design co-ordination has been carried out. This confirmation can also be provided by others. Nevertheless, providing a design co-ordination statement does not diminish other disciplines' responsibility from understanding, correctly interpreting and incorporating fire safety design requirements into their documents. Design managers may find it helpful to prepare a scoping brief that outlines the extent of review that each designer is expected to carry out.

USING THE TABLE

Legend

✓ = Documentation to be provided by the **fire designer** for all projects.

(✓) = Additional information to be provided by the **fire designer** in this format where the design is not clearly detailed in the format indicated by the ticked boxes.

FIRE ENGINEERING DESIGN DOCUMENTATION

FIRE DESIGNER'S DOCUMENTATION COMMUNICATING AND VERIFYING THE FIRE SAFETY DESIGN	NARRATIVE	DRAWINGS AND SKETCHES	VERIFICATION AND CALCULATIONS	DISCIPLINE RESPONSIBLE FOR PRODUCING **PLANS AND SPECIFICATIONS** FOR **BUILDING CONSENT** AND CONSTRUCTION
A. Building description and building use				
Bulk and location; size and geometry; use, area				Fire designer
Provide a brief description of the building size, shape, location, geometry and **intended uses** to highlight any special features that affect the fire safety design. Describe any staging of construction or completion or occupation, or proposals for future stages which impact on fire safety design.	✓	✓	(✓)	
Occupant load assessment				Fire designer
Show how the design occupancy has been derived.	✓		✓	
Occupancy type and occupant characteristics				Fire designer
Provide a brief description of the building occupancy to highlight any special aspects that affect the fire safety design.	✓	(✓)		
Fire hazards (as needed) and fire load				Fire designer
Provide a brief description of the design fire load and any special hazards that affect the fire safety design.	✓		(✓)	
Design fires and fire scenarios and/or fire hazard category				Fire designer
Provide information on the fire hazard category (for C/AS1 designs) or fire scenarios for specific designs.	✓	(✓)	✓	
Site water supply				Fire designer
Provide a brief description of the water supply available to the site for fire fighting and sprinklers	✓			

	NARRATIVE	DRAWINGS AND SKETCHES	VERIFICATION AND CALCULATIONS	DISCIPLINE RESPONSIBLE FOR PRODUCING **PLANS AND SPECIFICATIONS** FOR **BUILDING CONSENT** AND CONSTRUCTION
B. Design philosophy				
Design intent and methodology; compliance basis.				**Fire designer**
State the scope of the fire engineering design – e.g. is it only for **building code** compliance or does the owner have additional objectives such as property protection or business continuity that have been included? List all the documents prepared by the **fire designer** that form part of the overall fire safety documentation package (e.g. sketches, drawings, specifications, analyses, separate reports). List or reference documents prepared by others that are relied on to describe the fire safety design for the proposed works (e.g. architectural drawings, survey plans, design brief, description of **building use**, information supplied by others). Describe whether the design follows C/AS1 entirely, contains some departures or specific calculations, or is a completely performance based fire engineering design. Provide a description of the fire design and means of escape methodology (e.g. building wide evacuation, sequential or staged), with any assumptions and limitations, and acceptance criteria for quantitative methods.	✓			
Legal environment for regulatory compliance.				**Fire designer**
List the sections of the Building Act, **building code** or other legislation covered by this design e.g. Hazardous Substances and New Organisms, Fire Safety and Evacuation of Buildings Regulations. State whether the design is required to be sent to the Fire Service Design Review Unit.	✓			
Include the record of outcome of key discussions with Fire Service				**Fire designer**
This may include sketches, diagrams and correspondence with the Fire Service.	✓	(✓)		

	NARRATIVE	DRAWINGS AND SKETCHES	VERIFICATION AND CALCULATIONS	DISCIPLINE RESPONSIBLE FOR PRODUCING **PLANS AND SPECIFICATIONS** FOR **BUILDING CONSENT** AND CONSTRUCTION
C. Means of escape				
Number and location of escape routes				Architect
Show on drawings or sketches the positions and direction of internal escape routes to places of safety and final exits. Identify extent of protected escape routes e.g. protected paths and/or safe paths. Show the locations of safe places and final exits including any external escape routes.	(✓)	✓	✓	
Escape route width, capacity, travel distance or time				Architect
Identify the location and width of escape routes. Provide calculations of the escape route flow capacities, travel distances and/or travel times to justify the location and width of escape routes.	(✓)	✓	✓	
Extent of fire protection of escape routes				Architect
Identify the means of protecting the escape routes e.g. by fire rated construction or by separation distance. Include any management restrictions on escape route activities, e.g. fire load, access and security.	✓	✓		
Visibility in escape routes/exit signage				Electrical Engineer
Describe the extent of measures to provide adequate visibility and way finding. Show on sketches/drawings the indicative locations of signage and other way finding provisions. This could also include reference to another consultant's documentation.	✓	✓		

	NARRATIVE	DRAWINGS AND SKETCHES	VERIFICATION AND CALCULATIONS	DISCIPLINE RESPONSIBLE FOR PRODUCING **PLANS AND SPECIFICATIONS** FOR **BUILDING CONSENT** AND CONSTRUCTION
D. Fire safety systems				
Active fire protection systems (fire alarm, emergency warning and intercommunication system, detection and suppression systems)				Fire Protection Engineer
Identify required installation standards, specifically noting any departures from full compliance with the relevant standard. Identify key issues, including specific suppression, detection and alerting systems and/or performance requirements. Describe the evacuation alerting protocols. Describe interfacing requirements with other systems, including cause and effect information where relevant. Coverage shown on sketches if not otherwise obvious. A sketch for the location of primary fire safety equipment like sprinkler valve house, panels, Brigade inlets, fire control rooms etc must be provided	✓	(✓)	(✓)	
Smoke control systems				Mechanical Engineer/ Electrical Engineer/ Architect
Identify overall requirements. Identify required installation and commissioning standards, specifically noting any departures from full compliance with the relevant standard. Describe interfacing requirements with other systems (e.g. supply and return air systems, automatic doors and windows). Identify extract and inlet points, extract rates and make-up air considerations (airflow areas and operation) on sketches	✓	✓	✓	
Fire hose reels, extinguishers, first aid fire fighting				Fire Protection Engineer/ Architect
List type, size and locations in specification/summary etc Identify installation standards, specifically noting any departures from full compliance.	✓	(✓)	(✓)	

	NARRATIVE	DRAWINGS AND SKETCHES	VERIFICATION AND CALCULATIONS	DISCIPLINE RESPONSIBLE FOR PRODUCING **PLANS AND SPECIFICATIONS** FOR **BUILDING CONSENT** AND CONSTRUCTION
E. Internal spread of fire and smoke				
Fire resistance ratings, compartmentation/separation				Architect and Structural Engineer
Identify the locations and required fire resistance ratings for each fire cell. Show these on plans, sections and elevations. Specify fire resistance ratings for structural elements and locations	✓	✓	✓	
Smoke compartmentation/separations				Architect
Identify the locations of smoke separations. Show these on plans, sections and elevations. Identify the size and locations of smoke baffles.	✓	✓		
Penetrations (building services)				All Building Services Engineers
Identify the generic fire and smoke stopping requirements. Identify any special requirements for type and location of fire and smoke control dampers. Identify any special inspection and construction monitoring requirements. Prescribe the extent of installation certification required.	✓			
Internal surface finish limitations				Architect and Building Services Engineer
Show any specific locations not covered by general specification on sketches	✓		(✓)	
Doors, access panels and other closures in smoke and fire separations				Architect
Identify required fire ratings and installation standards, specifically noting any departures from full compliance with the relevant standard.	✓	✓		
Fire load limitations				Fire designer
Show on drawings the locations where the type or quantity of fire load is restricted. Describe the associated control and management procedures.	✓	✓	✓	

	NARRATIVE	DRAWINGS AND SKETCHES	VERIFICATION AND CALCULATIONS	DISCIPLINE RESPONSIBLE FOR PRODUCING **PLANS AND SPECIFICATIONS** FOR **BUILDING CONSENT** AND CONSTRUCTION
F. External spread of fire				
Fire separations: fire resistance rating and location				Architect and Structural Engineer
Identify external walls requiring a fire resistance rating and required proportion or areas – show these on sketches.	(✓)	✓	✓	
Fire compartmentation (if different for control of external fire spread)				Architect and Structural Engineer
Identify internal walls and floors requiring a fire resistance rating		✓	✓	
Site plan showing property and notional boundaries				Architect, Surveyor
Provide site plan showing property and notional boundaries, location of building and distances to all relevant boundaries		✓		
Control of external vertical fire spread (elevations)				Architect
Show on drawings the size, location and fire resistance rating of spandrels, aprons or other features.	(✓)	✓	(✓)	
External surface finish limitations				Architect
Show on sketches any specific locations not covered by the general specification.	✓	(✓)	(✓)	

	NARRATIVE	DRAWINGS AND SKETCHES	VERIFICATION AND CALCULATIONS	DISCIPLINE RESPONSIBLE FOR PRODUCING **PLANS AND SPECIFICATIONS** FOR **BUILDING CONSENT** AND CONSTRUCTION
G. Fire Service access and fire fighting facilities				
Fire Service vehicle access and attendance point (This may not be necessary for minor alterations to existing buildings).				Architect, Civil, Fire Protection
Identify on sketches and/or site plans the signed agreement and signed fire fighting facilities checklist for New Zealand Fire Service vehicle attendance points/indicator panels, Fire Sprinkler Inlet and Fire Hydrant Inlet locations. Include Fire Fighting Facilities Checklist where appropriate.	✓	✓		
Facilities in and around the building for Fire Service use				Architect, Fire Protection
Identify locations of fire control rooms, emergency warning information systems, panels, sprinkler valve rooms, entry points, final exits, etc.	(✓)	✓		
Hydrant outlets and hose coverage				Architect, Fire Protection
Describe or show locations on sketches/drawings. Provide typical clearance requirements.		(✓)	(✓)	
H. Construction monitoring				
For special maintenance or operational requirements (e.g. for improved reliability); special control systems and/or interfaces				Building owner/ project manager *
List any specific aspects of the fire safety design or fire safety related **specified systems** that need particular inspection or commissioning during the construction monitoring phase. These items should also be listed for inclusion in the building Operation and Maintenance documents.	✓	(✓)		

	NARRATIVE	DRAWINGS AND SKETCHES	VERIFICATION AND CALCULATIONS	DISCIPLINE RESPONSIBLE FOR PRODUCING **PLANS AND SPECIFICATIONS** FOR **BUILDING CONSENT** AND CONSTRUCTION
I. Compliance Schedule				
For all fire safety related specified systems				Building owner/ project manager *
Identify all fire safety related **specified systems** that need to be listed on the **Compliance Schedule**, with indicative maintenance/management/operational requirements for each system.	✓	(✓)		
J. Miscellaneous Information				
Information for the BCA for **building code** compliance				**Fire designer**/ design manager
Describe the qualifications, areas of knowledge and practice and provide statement of competency as recommended in IPENZ Fire Engineering Taskforce Report for the **fire designer** taking responsibility for the design. (This information is unlikely to be needed for each project if the **BCA** already has this information on file). Provide confirmation that co-ordination of fire safety requirements has occurred between the fire design and the drawings, specifications and documents produced by other design disciplines.	✓			

Table 2: Fire Engineering Design Documentation

* **NOTE:** The **fire designer** provides information to people such as the Building Owner/Project Manager to include in the draft Compliance Schedule.

5. Documenting Fire Designs

This section provides further information about the detail expected when documenting fire designs.

Fire engineering **design documentation**, like all other engineering design documentation is principally about communicating information – about the project, the design, the solution and verification of compliance with design objectives.

Whether using C/AS1 or putting forward a **specific fire engineering design**, the **design documentation** needs to be specific to the **building work** proposed. It needs to include adequate **plans and specifications**, establish compliance with the **building code**, advise the owner's proposed inspections during construction, if any, and spell out **compliance schedule** requirements for any **specified systems**.

The main difference between a design based on C/AS1 and a **specific fire engineering design** lies in the **building code** compliance verification i.e. in establishing how the fire design complies with the **building code**. Fire engineering **design documentation** is most commonly prepared to demonstrate regulatory compliance. However, this is frequently not the documentation's only purpose. When a building owner or occupier's brief has objectives exceeding minimum **building code** requirements (e.g. property protection) the **design documentation** will also record and reflect these specific aspects. This Practice Note should also be used for fire **design documentation** prepared for purposes other than regulatory compliance.

This section describes the six parts of **design documentation**:

5.1 THE INTENDED USE OF THE BUILDING

The application needs to outline the full details of **intended uses** within the building. When alterations are planned, this gives an indication of whether there might be a "change of use".

5.2 PLANS AND SPECIFICATIONS

Details of the **building work** proposals are provided in the **plans and specifications**. They must be specific to the particular **building work**, and provide enough detail for the **building work** to be constructed and maintained directly from them. If they reference information from other sources, the sources need to be identified; it must be clear how the references will be used in relation to the **building work**.

Most of the documentation the **fire designer** produces focuses specifically on fire performance and is insufficient in itself to be used for construction. However, it often provides a useful adjunct to documents other consultants prepare. For example, the fire engineering design may require fire rated walls at certain locations, but the walls' specification and construction details will be covered in the architectural documents. Another example could be when fire engineering design requires a particular fire detection system to be provided, but the specification for this is prepared by the fire protection systems engineer.

The **plans and specifications** may include details of particular products which will be used during the **building work**. The detail may include the actual product to be used, the manufacturer and model number, and any other details needed to uniquely identify the product. However this is seldom possible if contractors and suppliers are not known at the time of consent application (e.g. for a project following common construction industry practice which arranges construction contracts in parallel with or subsequent to applications for **building consent**). When contractors and suppliers are not known at the time of consent application, or in cases where more than one specific product could be used, the product's required performance must be specified e.g. a fire damper's required fire resistance rating.

Where building elements need maintenance to meet the **building code's** durability requirements, these also need to be outlined in the **design documentation** (this applies particularly to **specified systems**, but can apply to other building elements as well). The **design documentation** must include what needs to be maintained, how it is maintained, how often it is maintained and by whom. It is also helpful to copy all the maintenance requirements that appear in the **plans and specifications** and put them together in one place for easy reference.

The **fire designer** cannot consider matters in isolation. The designer's responsibilities include familiarity with the overall **building work** proposals and for co-ordinating the process through which fire designs are appropriately incorporated into the **plans and specifications**.

Information provided by the **fire designer** which is directly related to construction should include any procedures proposed for construction monitoring. It should also include any details which need to be included on the **compliance schedule** of fire safety related **specified systems**.

5.3 DOCUMENTS VERIFYING BUILDING CODE COMPLIANCE

This information needs to establish that the fire design complies with the **building code**. More detail is required for **specific fire engineering designs** than for designs using C/AS1.

If the **BCA** is relying on producer statements from the **fire designer** (or an independent regulatory reviewer if one is used), those statements need to be included.

5.3.1 ACCEPTABLE SOLUTION C/AS1

When the fire design uses C/AS1, the information submitted needs to describe how the **acceptable solution** has been used. There is no need to justify the **acceptable solution's** provisions but the documentation requirements in section 4 still apply.

5.3.2 SPECIFIC FIRE ENGINEERING DESIGN

Verification documents showing that a **specific fire engineering design** complies with the **building code** will usually include justification, calculations and conclusions. This is likely to include a mix of written reporting and numerical calculations, which may include computer printout. The information needs to be coherent and able to be understood by a competent, appropriately qualified person.

5.3.3 JUSTIFICATION, CALCULATIONS AND CONCLUSIONS

The engineering basis for the design (methodology and analytical approach) must be outlined and justified, along with the reasoning behind the design criteria, the fire and occupant scenarios chosen and all associated assumptions and limitations. This may include:

- The occupancy and maximum number of occupants
- Maximum size of spaces
- Description of combustible loadings, hazards and risk
- Limitations on fire load or material surface finishes
- Threshold values for the point at which the design no longer meets acceptance criteria.

If computer models are used, then full details of the programme (e.g. name, version number, date) need to be provided. If the models are based on technical literature, identifying the literature and its source should be sufficient unless the literature is not readily available. In these cases, the literature needs to be included with the application. The justification for choosing the model, including its sensitivity to key parameters, must also be included. Verification documents need to include explanations of choices for input values for analyses, and sufficient detail in the outputs to show how and why conclusions were drawn. Extensive computer outputs, for instance, will often be included in Appendices or as separate hard or soft copy referenced from the main documentation.

If the design relies on a waiver of any of the **building code** performance requirements, the designer needs to outline the waiver sought and the reasons for this.

All the calculations (inputs, workings and outputs) required must be included to show the design has been properly carried out in accordance with the design methodology showing that the **building work** will meet the **building code's** performance criteria. Where sensitivity analyses are used to show the adequacy of the design and the model used, details of these need to be included.

The conclusions drawn from the design methodology and calculations need to be clearly stated.

5.4 PROPOSED PROCEDURES FOR MONITORING THE BUILDING WORK DURING CONSTRUCTION

There is increasing awareness of the importance of involving **fire designers** during the construction phase to co-ordinate the systems providing the overall fire safety solution.

To be consistent with the Building Act requirements, the **design documentation** should enable the building owner and **BCA** to identify those aspects of the fire safety systems that require specific monitoring, testing and commissioning during the construction phase. In particular, the requirements for interface checking and co-ordination between the parts of the overall fire safety system need to be clearly identified.

The **building consent** applicant must explain in their application how they, their **fire designer** or the **BCA** will monitor the **building work** as construction progresses. This includes how they will verify the building's fire protection systems are working properly (through commissioning and acceptance testing). Requirements for construction monitoring will normally be developed with the **fire designer's** input.

Information about the proposed observations of the **building work** must specify:

- Who will carry out the observations
- When they will be carried out (and how often, if more than once)
- What needs to be observed
- The method of measurement or acceptance (if it is not otherwise clear from the **plans and specifications**)
- What confirmation or certification, if any, will be provided for the monitoring.

If special qualifications are needed to carry out the monitoring work, information about the competence of those performing the checks needs to be submitted with the **building consent** application.

NOTE ON THE FIRE DESIGNER'S ROLE IN MONITORING THE BUILDING WORK

It is generally considered advisable for the **fire designer** to be involved in the inspection process. The level of the **fire designer's** involvement will depend on the complexity of the **fire design solution**. The **fire designer** understands the **fire design** better than anyone, and is therefore in the best position to ensure the design is implemented correctly in accordance with the **plans and specifications**. Having the **fire designer** on site can also help to promptly resolve any issues that may arise and advise on any necessary variations to the **building consent**.

If the **building consent** applicant intends to provide producer statements for aspects of the construction process, this needs to be noted in the application. The **BCA** can then advise the applicant before work starts if it is willing to rely on those producer statements to show work complies with the **building code**. Providing details of any planned on-site construction monitoring and producer statements enables the **BCA** to decide what inspections it needs to carry out during the course of the **building work** so it can issue a **Code Compliance Certificate**.

Examples of on-site construction monitoring by the **building consent** applicant are:

A) OBSERVATIONS WHILE THE WORK IS IN PROGRESS

Checking the work at various key stages increases confidence that the **plans and specifications** are being correctly followed. Observations need to take place before critical work is covered up, as well as from time to time and, most importantly, on completion. This checks that work done by others (e.g. penetrations through firewalls for building services) has not adversely affected the fire design's integrity.

B) COMMISSIONING AND ACCEPTANCE TESTING

Commissioning and acceptance testing is required for many fire protection systems. The **design documentation** needs to outline the commissioning and acceptance testing required to verify that the systems comply with the **building code**. In some cases, the testing required may be from recognised Standards, while in others it may be unique to the design proposals.

NZS 4512 for fire detection and alarm systems and NZS 4541 for fire sprinkler systems are recognised Standards that contain inspection requirements for commissioning and acceptance testing. Both of these Standards require the inspections to be performed by appropriately qualified third party certifiers.

5.5 COMPLIANCE SCHEDULE REQUIREMENTS

The Building Act requires that any building with a specified system has a **Compliance Schedule** (see Appendix B for a list of **specified systems**). Generally these are systems whose failure to operate correctly could affect the building users' health or safety. **Compliance Schedules** spell out the performance standards for the **specified systems** and the building owners' obligations for inspecting and maintaining any **specified systems** to ensure they continue to operate as designed.

If the fire design includes, or impacts on, a specified system, the specified system needs to be identified in the **design documentation**, along with the proposed procedures for inspection and routine maintenance to ensure it remains in good working order. The documentation needs to describe not only what is to be inspected or maintained and how, but also the frequency of the inspections and who should carry them out. The requirements need to be specific to the building's **specified systems** and avoid referencing information from other publications, such as Standards, unless the information is directly relevant.

As the **Compliance Schedule** is required to list all **specified systems** as defined by the Building Act not just those associated with fire safety, a **fire designer** provides input into the **Compliance Schedule** but is unlikely to compile the entire schedule. It is recommended that the building owner arranges for preparation of as-built documents at the end of construction, to record any decisions or changes to the design that occur during construction.

All fire designs, including those using C/AS1, are conditional on the design parameters (as set out in 5.3: Verification of **building code** compliance) remaining constant or within acceptable limits. This means the **Compliance Schedule** requires these parameters be checked regularly throughout the life of the building.

The activities of the building's users can affect the performance of **specified systems** relating to fire design; these need to be monitored by the **Compliance Schedule**. Examples include placing combustible material in escape routes, holding open smoke stop or fire doors, or cutting openings in fire separations.

The **BCA** will consider the **building consent** applicant's proposals for inspecting and maintaining any **specified systems**. If it agrees they are appropriate, the **BCA** will include them on the **Compliance Schedule** issued to the building owner when the **building work** is complete, along with the **Code Compliance Certificate**.

If any design parameters change after the **building work** is complete and the **Code Compliance Certificate** has been issued (such as the use, occupant density or fire risk), the building's fire protection may no longer be sufficient to ensure the building's users are safe. Such changes could mean a change of use under section 115 of the Building Act. The owner will require written notice that the territorial authority is satisfied the building in its new use will comply, to a level as nearly as is reasonably practicable, with the provisions of the **building code** relating to the means of escape from fire, protection of other property and fire rating performance. The territorial authority may refuse to give this notice and require alterations to the building as a result of the change of use. Such alterations will require a new **building consent** application including proposed changes to the **Compliance Schedule's** requirements.

Further information on **Compliance Schedules** and the building warrant of fitness regime can be found in the *Compliance Schedule Handbook* on the Department of Building and Housing's website at: www.dbh.govt.nz/publications-about-the-building-act-2004

5.6 OTHER INFORMATION

The Building Act specifies that an application for **building consent** must contain any other information the **BCA** reasonably requires to process the **building consent** application (see section 45(1)(c)), and, when the **building work** is complete to issue the **Code Compliance Certificate** (see section 94). This includes any information not already discussed in 5.1 to 5.5 that may be needed to:

- Detail and justify the fire design to fulfil the Building Act and **building code** requirements
- Confirm the adequacy of construction when the **building work** is complete.

This could include information relating to:

a) The **fire designer's** and other relevant parties' knowledge and experience

Providing information on the **fire designer's** qualifications, areas of competency, knowledge and practice as recommended in the IPENZ Fire Engineering Taskforce Report may help support an application for **building consent**, particularly for design solutions which rely on **specific fire engineering design**.

If the **building consent** applicant arranges tasks which involve other parties, such as regulatory reviews or construction monitoring, then information on the other parties' qualifications, areas of competency, knowledge and practice is expected to be included.

NOTE: In the future, **building consent** applications and regulatory approval of complex designs may be subject to requirements for designers to use a quality system. The qualifications of the designers may be one way of demonstrating a higher likelihood that the design and construction will comply with the **building code**.

b) Confirming the adequacy of any construction review performed by the **building consent** applicant or delegated party when the building work has been completed

The **building consent** applicant must confirm that on-site construction monitoring as outlined in the **building consent** has been carried out, and the work was in accordance with the **plans and specifications**. Depending on what was agreed with the **BCA** at the **building consent** application stage, this confirmation may take the form of producer statements or other documentation such as site reports.

6. Complying with the building code

This section describes the design approaches that can be adopted to verify a fire design application complies with the **building code** and to obtain **building consent** approval.

The **building code** is performance-based, which means it sets out performance standards for completed building work. The **building code** does not prescribe the **building work** required to achieve the necessary performance. Accordingly building owners can choose the way in which they prepare building designs.

Fire designs can follow the prescriptive **acceptable solution** C/AS1, or be a **specific fire engineering design**, using a methodology agreed with the **BCA**.

6.1 ACCEPTABLE SOLUTION C/AS1

C/AS1 is a generic, simple, conservative, prescriptive solution intended to be applied to a wide range of buildings. It offers one non-mandatory way to comply with Clauses C1 to C4 of the **building code**.

A fire design that correctly uses C/AS1 must be accepted by a **BCA** as complying with the **building code**. The **building consent** applicant, or the **fire designer**, must provide enough information to enable the **BCA** to verify that the design complies with C/AS1. However they do not need to justify the design approach, provide calculations (other than those required to demonstrate compliance with C/AS1) or explain the conclusions they have reached.

The content of the documents supplied to the **BCA** will depend on the nature of the **building work**. Typically a written report is unlikely to contain sufficient detail unless it is accompanied by drawings, sketches and other supporting documentation described in this Practice Note.
No special qualifications are currently required to design the fire safety aspects of a building. However it is recommended that designs using C/AS1 should be prepared by people who are suitably experienced in fire safety design. This is likely to be a person who either:

- Has formal qualifications and demonstrated competence in fire engineering design
- Is familiar with the **acceptable solution** and has used it over an extended period of time under the direction of someone competent in fire design.

6.2 SPECIFIC FIRE ENGINEERING DESIGN

Even a minor departure from C/AS1 is regarded as a **specific fire engineering design**. The solutions in many parts of C/AS1 do not have formally published verification or justification. This complicates the process of quantifying the impact of even minor deviations from the **acceptable solution**, to determine how the adjustments may affect the overall fire safety solution. In some cases, justifying the variation might be straightforward. Where the change affects more than one fire safety subsystem's performance, demonstrating the suitability of the variation is likely to require more detailed justification.

A **specific fire engineering design** may consider the actual use and characteristics of a particular building in a way that varies from the **acceptable solution**. Therefore the fire safety features may be designed specifically for use in that building. Factors such as occupant characteristics, hazards and risks may be used to develop fire and occupant scenarios for fire design. These are then evaluated using engineering methods and models to determine fire protection measures required to comply with the **building code's** performance requirements.

Specific fire engineering design can be complex. The **fire designer** may need to apply their professional judgement to assess the engineering methods used, evaluate inputs and draw accurate conclusions from the outputs.

If a **building consent** applicant puts forward a **specific fire engineering design**, the documentation needs to provide:

- Justification of the design approach
- The basis of the calculations and
- The conclusions reached (see 5.3: Verification of **building code** compliance).

However, every **specific fire engineering design** is different. More detailed information will be required if the departure from C/AS1 is not minor, or if a completely different design approach is proposed. The applicant needs to provide sufficient information in the form of verification and calculations to satisfy the **BCA** on reasonable grounds that the proposed design complies with the **building code**.

7. Other Building Act considerations

7.1 ALTERATIONS TO, CHANGING THE USE OF, AND SUB-DIVIDING EXISTING BUILDINGS

Where a building is altered, sub-divided or the use changes the building may need to be upgraded to comply with the current **building code**.

Where an existing building is being altered, the applicant must satisfy the **BCA** that after the alteration, the building will comply as nearly as reasonably practicable with the provisions of the **building code** relating to means of escape from fire (see section 112 of the Building Act 2004). Similarly, before changing a building's use, the owner must obtain written notice from the territorial authority that the building, in its new use, will comply as nearly as reasonably practicable with the provisions relating to means of escape from fire, protection of other property and fire rating performance (see section 115 of the Building Act 2004).

If applying for a subdivision that affects a building or part of a building, an owner must satisfy the territorial authority on reasonable grounds that the building, will comply as nearly as reasonably practicable with the provisions relating to means of escape from fire and protection of other property (see Building Act section 116A).

The **design documentation** submitted for a sub division or **building consent** for alterations and/or a change of use needs to detail and justify how the design will meet the Building Act and **building code** requirements.

7.2 VARIATIONS TO A BUILDING CONSENT

If there are any proposed changes to a **building consent**, the **BCA** needs to be given the details and justifications so they can consider and approve the change. Depending on the nature of the proposed change, getting the **BCA's** approval can range from a simple phone call to a formal application for an amendment to the **building consent**. The important point is that in all cases, the **BCA's** approval is needed before any work is carried out that differs from what was originally approved.

For more information, see the Department of Building and Housing's guidance document on **building consent** amendments at: www.dbh.govt.nz/publications-about-the-building-act-2004

7.3 APPLICATION TO WAIVE COMPLIANCE WITH A REQUIREMENT OF THE BUILDING CODE

If **building work** cannot, for a particular reason, comply with a **building code** requirement a **BCA**, which is a territorial authority, can waive the requirement to comply if it considers this is reasonable in the circumstances. The building owner must provide evidence to justify why the work does not need to meet the requirement, including any mitigating factors that may be relevant.

8. References

1. *Design Documentation Guidelines – Fire Engineering/ Fire Protection*; Construction Industry Council, New Zealand, 2004 (www.nzcic.co.nz)
2. IPENZ Fire Engineering Advisory Taskforce Report and Recommendations, Institution of Professional Engineers New Zealand, Wellington, New Zealand, August 2007.
3. *SFPE Engineering Guide to Performance-Based Fire Protection*, 2nd edition, Society of Fire Protection Engineers, Quincy, MA, USA, 2007.
4. *International Fire Engineering Guidelines*, Australian Building Codes Board (ABCB), Australia, March 2005.
5. *Code Officials Guide to Performance Based Design Review*, Society of Fire Protection Engineers, Quincy, MA, USA, 2007.

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1. Bennetts, I.D., Poh, K.W. and Thomas, I.R., A Framework for Fire Engineering Design, AJSE 2000, Vol 3, Nos 1 & 2.
2. Caldwell, C.A., Buchanan, A.H. and Fleischmann, C.M., *Documentation for Performance Based Fire Engineering Design*, Journal of Fire Protection engineering, 10(2), 1999.
3. *Code of Practice for Fire Safety Design, Certification & Peer Review to Determine Compliance with the Building Code of Australia*, 2nd edition, Society of Fire Safety and Engineers Australia, May 2006.
4. Custer, R.L. and Meacham, B.J., *Introduction to Performance-Based Fire Safety*, Society of Fire Protection Engineers, 1997.
5. ISO/DIS 23932 *Fire Safety Engineering – General Principles*, International Organisation for Standardisation, 2007
6. *BS 7974:2001 Application of Fire Safety Engineering Principles to the Design of Buildings – Code of Practice*, British Standards Institute, London, United Kingdom, 2001 and suite of supporting Published Documents PD 7974 Part 0 to Part 7.
7. *CIBSE Guide E: Fire Engineering*, The Chartered Institution of Building Services Engineers, London, UK, 2003.
8. Further information on **Compliance Schedules** and the building warrant of fitness regime can be found in the *Compliance Schedule Handbook* on the Department of Building and Housing's website at: www.dbh.govt.nz/publications-about-the-building-act-2004

10. Appendix A: Definitions

Acceptable solution
As defined in the Building Act 2004

Building code
As defined in the Building Act 2004

Building consent
As defined in the Building Act 2004

Building Consent Authority (BCA)
As defined in the Building Act 2004

Building work
As defined in the Building Act 2004

Code Compliance Certificate
As defined in the Building Act 2004

Compliance Schedule
As defined in the Building Act 2004

Design documentation
Information required to be submitted with the **building consent** application detailing the **building work** proposals and justifying their adequacy. If the owner is performing observations during construction, the **design documentation** must include the proposals for confirming adequacy of these observations. **Design documentation** has six parts involving **"plans and specifications"** as defined in section 7 of the Building Act and certain other information. This other information is required by section 45(1) (c) of the Building Act and that reasonably required by the **BCA** at **Code Compliance Certificate** stage. The **design documentation's** six parts and how they relate to the Building Act are as follows:

5.1 The **intended use** of the building
(see item (c)(i) of the Building Act's definition of **"plans and specifications"**)

5.2 **Plans and specifications**
(see item (a) of the Building Act's definition of "**plans and specifications**")

5.3 Verification of **building code** compliance
(this is the "other documents" of item (a) of Building Act's definition of **"plans and specifications"**)

5.4 The **building consent** applicant's proposed procedures for inspection during construction
(see item (b) of the Building Act's definition of **"plans and specifications"**)

5.5 **Compliance schedule** requirements
(see item (c)(ii) and (c)(iii) of the Building Act's definition of "**plans and specifications**")

5.6 Other information
(see sections 45(1)(c) and 94(1) of the Building Act)

Fire designer

The person responsible for the design of the fire safety components of the **building work** proposals, regardless of whether C/AS1 or a **specific fire engineering design** is used. The **fire designer** may specifically authorise another person to carry out duties associated with the fire design on their behalf, for example performing certain observations on site.

Plans and specifications

As defined in the Building Act 2004 (see Appendix B)

Specific fire engineering design

The term used in this document to describe fire engineering design that considers the actual use and characteristics of a particular building. It usually uses quantitative engineering methods and models to determine fire protection measures required to comply with the design's performance requirements.

Specific fire engineering design might be used because:

- C/AS1 may not cover the proposed fire design
- The building may incorporate unusual design features
- New materials and methods may have become available.
- Specifically engineered solutions might provide a better means of compliance.

Unlike a design which meets the C/AS1 requirements and is therefore deemed to comply with the **building code**, the **BCA** decides whether or not a **specific fire engineering design** is accepted as **building code** compliant.

Specified systems

These are systems defined in the Building Act 2004.

11. Appendix B: Legislation

The following extracts from sections of the Building Act 2004 are relevant to producing fire engineering **design documentation**. For the full sections please see the Building Act.

SECTION 7 (INTERPRETATION) (EXTRACT)

Plans and specifications –

(a) Means the drawings, specifications, and other documents according to which a building is proposed to be constructed, altered, demolished, or removed; and

(b) Includes the proposed procedures for inspection during the construction, alteration, demolition, or removal of a building; and

(c) In the case of the construction or alteration of a building, also includes—

(i) the **intended use** of the building; and

(ii) the **specified systems** that the applicant for **building consent** considers will be required to be included in a **compliance schedule** required under section 100; and

(iii) the proposed procedures for inspection and routine maintenance for the purposes of the **compliance schedule** for those **specified systems**

SECTION 45 (HOW TO APPLY FOR BUILDING CONSENT) (EXTRACT)

(1) An application for a **building consent** must –

(a) be in the prescribed form; and

(b) be accompanied by **plans and specifications** that are –

(i) required by regulations made under section 402; or

(ii) if the regulations do not so require, required by a **Building Consent Authority**; and

(c) contain or be accompanied by any other information that the **Building Consent Authority** reasonably requires; and

(d) be accompanied by the charge fixed by the **Building Consent Authority**; and

(e) in the case of an application for a **building consent** that relates to restricted **building work**, state the name of each licensed building practitioner who, as far as the applicant is aware at the time the application is made, will be involved in carrying out or supervising the restricted **building work** that is the subject of the application.

12. Appendix C: List of specified systems

SPECIFIED SYSTEM	DESCRIPTION
1	Automatic systems for fire suppression
2	Automatic or manual emergency warning systems for fire or other dangers
3	Electromagnetic or automatic doors or windows
4	Emergency lighting systems
5	Escape route pressurisation systems
6	Riser mains for use by fire services
7	Automatic back-flow preventers connected to a potable water supply
8	Lifts, escalators, travelators, or other systems for moving people or goods within buildings
9	Mechanical ventilation or air conditioning systems
10	Building maintenance units providing access to exterior and interior walls of buildings
11	Laboratory fume cupboards
12	Audio loops or other assistive listening systems
13	Smoke control systems
14	Emergency power systems for, or signs relating to, a system or feature specified in any of SS1 to SS13 above
15	Other fire safety systems or features (features for communicating information intended to facilitate evacuation, final exits, fire separations, signs)
16	Cable cars

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