New Zealand Fire Service

Design Review Unit

Audit

by

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New Zealand Fire Service
Design Review Unit
Audit

Executive Summary

This audit was largely conducted by reviewing documents supplied by the New Zealand Fire Service Design Review Unit (DRU) covering 26 building consent applications. The work of the DRU, the methodology used by their fire engineers and issues they see as affecting their ability to carry out their task effectively were discussed with DRU staff.

The DRU appears to competently assess and advise on building consent applications as required by law and regulations. However, the quality of the submissions the DRU review is generally poor. The DRU does not appear to be able to enforce a suitable standard for such submissions. This appears to be the role of the Building Consent Authorities (BCAs).

The DRU appears to work within a difficult legal and regulatory environment that may limit some aspects of their effectiveness. It is suggested this situation may be improved in several ways:

- by clarification (and perhaps simplification) of the criteria used to assess whether building consent applications should be submitted to the DRU for review (NZ Building Act)
- improved advice on interpretation of the criteria (Department of Building and Housing)
- simplification of the Acceptable Solutions so that they do not require what appear to be fire engineering calculations (Department of Building and Housing)

The role of BCAs in assessing building consent applications is critical and improvement in the process of handling applications could lead to less duplication of effort and improved effectiveness of the DRU. This requires improved assessment of applications by BCAs requiring them to:

- ensure that only applications that fit the criteria for DRU advice are forwarded to the DRU
- forward to the DRU only applications containing all of the necessary information
- ensure that the DRU receive feedback on the action taken in response to their advice
- involve the DRU in assessing the response of a Fire Engineer to the DRU advice

The DRU could, by leadership and example, encourage better standards of fire engineering design and documentation. This requires the support and cooperation of BCAs. There is certainly a strong case for an improved standard of Fire Engineering Reports. The DRU could also encourage better standards by being more supportive of performance based fire engineering design by:

- showing less reliance on the Acceptable Solutions
- suggesting sources of data, suitable analysis methods, etc
- providing generally available advice on the criteria used in assessments
- providing generally available advice on suitable design data and methods

Many of the cases reviewed featured questionable statements asserting “adequacy” based on dubious “expert judgement”. Suitable advice from the DRU might help to eliminate assertions of adequacy and expert judgement where there is little or no documented basis for the claim.

Finally, the DRU and NZFS should endeavour to become less wedded to the Acceptable Solutions and become more comfortable with, and better able to judge the adequacy of, performance based Fire Engineering design of building fire safety systems. The adoption of a risk-informed approach to the assessment and design of fire safety in buildings would be a useful step in this direction.

Audit Evaluation Sheet May 2006

		Percentage of reports				
Engineering Reports		Poor	Incomplete	Acceptable	Good	Very Good
Formal fire engineering design process	*Identified*	70	30			
	Followed	90	10			
Acceptance criteria	*Specified*	70	20	10		
	Comprehensive	100				
Engineering methods used	*Appropriate*	50	40	10		
	Technically correct					
Conclusions	*Clear*	70	20	10		
	Substantiated	70	20	10		
		Each line adds up to 100%				

	Percentage of reports				
Design Review Unit Memos	Poor	Incomplete	Acceptable	Good	Very Good
Legal Background specified			20	80	
Well presented format			10	90	
Technically accurate			20	80	
Information actionable			100		
	Each line adds up to 100%				

In filling in the top table I have assumed that Engineering Reports refers to those submitted **to** the DRU.
I had difficulty in evaluating many because they were not recognisable as "engineering reports". Many were largely based on Acceptable Solutions and opinion.

The DRU memos mainly contained standard clauses but were very oriented towards Acceptable Solutions.

Introduction

The New Zealand Building Act 2004 places a requirement upon Building Consent Authorities (BCAs) to send a copy of certain applications for building consent to the New Zealand Fire Service (NZFS) for comment. NZFS has set up a Design Review Unit (DRU) to provide such comment.

When a BCA receives an application it is assessed to see whether it is necessary to send a copy to the DRU. Those requiring DRU comment are then sent to the DRU while in parallel they are also assessed by the BCA.

The applications for building consent that must be sent to the DRU are those that utilize performance based fire engineering design (effectively do not completely comply the Acceptable Solutions) or that require a NZFS approved evacuation scheme. Section 47 of the Building Act states that:

> The New Zealand Fire Service Commission may… provide the BCA concerned with a memorandum that sets out advice on the following matters:
>
> (a) provisions for means of escape from fire
>
> (b) the needs of persons who are authorised by law to enter the building to undertake fire-fighting

Section 47 also states that the NZFS (DRU) must not set out advice that provides for the building to meet performance criteria that exceed the requirements of the building code and that if it does not provide advice within ten days the BCA may proceed to determine the application without NZFS advice.

The DRU has developed a set of standard clauses that can be incorporated in the DRU report to the BCA. These standard clauses are attached as Appendix A. The DRU has also developed a checklist that is used to standardise the checking process undertaken by the DRU. This is included as Appendix B.

This audit has been conducted by reviewing the documents supplied to the DRU by the BCA and the subsequent report to the BCA by the DRU for a total of 26 building consents (cases) picked at random by the author from a list of over 600 cases understood to have been processed by the DRU.

This report first covers the method used in conducting the audit and then provides observations and discussion on the supplied documentation and the DRU responses. The author does not claim to be expert in all of the details of the NZ Building Act or in the content and use of the Acceptable Solutions and consequently cannot claim to have identified all of the deficiencies in the information submitted to the BCAs or in the advice supplied by the DRU to the BCA. Nevertheless an attempt has been made to identify such deficiencies.

I would like to thank the DRU staff for their help with this review. They were very efficient and helpful in supplying the material necessary for this review and in meetings and discussions.

Method

This audit was undertaken principally by reviewing the documents contained in the files of 26 cases supplied by the DRU. This information generally included the documents received by the DRU from the BCA, the memorandum from the DRU to the BCA and internal DRU documents such as the completed checklist (Appendix B).

The first step in reviewing each case was to become familiar with the documents supplied by the BCA. These included the documents supplied to the BCA by the person or body submitting the building application and any documentation generated by the BCA itself.

The second step was then to become familiar with the response of the DRU including any relevant internal documentation.

The final step was to reconcile the DRU response with the application documentation.

The audit also included a visit to the DRU involving discussions with the unit as a whole and one-on-one discussions with several members of the DRU staff. The latter discussions were principally on specific cases reviewed by the staff member. This facilitated an understanding of the work of the DRU and the approach of the unit overall and of individual members of the unit to the process of review and provision of advice. This included discussion of issues seen by DRU staff as affecting their ability to carry out their task efficiently and effectively.

As a result of the discussions with DRU staff the author also received a list of issues of concern to DRU staff in relation to the building consent approval process. This has been used to inform some of the observations and conclusions in this report but not all of the issues raised have been mentioned or considered in this report.

Observations and Discussion

Much of what was observed in reviewing the sample files was quite repetitive. Consequently this review will not deal with each in detail. Instead, some overall comments will be made and a number of issues discussed.

The DRU checklist (Appendix B) indicates that the process undertaken by the DRU is a well thought out and standardised process. The checklist appears to be very comprehensive and is clearly set out.

The DRU standard clauses (Appendix A) are also clear and quite comprehensive. They appear to cover much of the advice issued as a result of the 26 reviewed cases. Many of them point out clear deficiencies in the submitted report (it is difficult to call many of them a Fire Engineering Report, see below), for example clauses 1.3, 1.5, 1.7, 2.5, 2.6 and 2.8. At least one (clause 1.1) and perhaps more seem to advocate provisions that may be in excess of the performance requirements of the building code, although the intent of the clause is admirable. Some appear rather judgemental and severe and at the very least could be appear more helpful while still making the point intended (1.6, 2.1, 2.2, 2.3, 2.4, 2.7 and 2.8).

The process of review of building applications undertaken by the DRU inherently involves some duplication of the review that should be undertaken by the BCA. This presumably comes about because of the time limitations imposed on both processes. It appears that the BCA provides the building application documentation to the DRU prior to any significant assessment of the application it (the BCA) may make, except to determine whether there is a need to ask for DRU advice.

This means that in some cases faults are found in the application by the DRU that would probably (and should) be obvious to a competent BCA. Thus, inherently, the DRU's time is being wasted.

The building applications forwarded to the DRU are meant to only be those that involve performance based design. In practice many of the cases appeared to involve either no departure from the acceptable solutions or rather trivial departures from them. It is also apparent that there is

some difficulty with the definition of building applications that are to be sent to the DRU for advice. There appears to be some complexity and confusion that results from a rather unclear definition and from various sources of advice on what should be passed to the DRU. For example, in Building Controls Update Number 9 (Design Review Unit Update 1) [http://www.dbh.govt.nz/bcupdate-article-9] under the heading "What buildings will be reviewed?" the list of questions does not appear to match the criteria listed in the preceding paragraph. It appears that some clarification would be helpful as would improved education of designers and BCAs.

To some extent the confusion also appears to come about because of the somewhat complex nature of some of the Acceptable Solutions. In general deemed-to-satisfy requirements of building codes (for example the Building Code of Australia) require no calculation on the part of the building designer. The New Zealand Acceptable Solutions incorporate some sections that require some calculation and possibly even some judgement on the part of the designer as to the input values to be used in some calculations. It appears that sometimes BCAs view such calculations as signalling a performance based fire engineering design and perhaps unnecessarily involve the DRU.

It is also worth noting that with such calculations required in using the Acceptable Solutions inevitably some designers carry out these calculations incorrectly or use input values that are judged by others to be incorrect. Simplification of the Acceptable Solutions may help in both aspects.

Many of the documents supplied to the BCA and subsequently to the DRU do not claim to cover the whole of the fire safety system design for the building. (Many claim to only cover provision for means of escape, while some claim to cover means of escape plus the needs of persons who are authorised by law to enter the building to undertake fire fighting.). Others claim to only apply to part of a building without any apparent knowledge of (and certainly no submitted documentation of) the fire safety system design for the whole building. So it is either assumed that the part being designed has no bearing on the remainder of the building (which is extremely unlikely and in any case substantiation would be required) or that the design of the remainder of the building fire safety system is sufficiently robust that it will not be affected by changes to part of the building (also extremely unlikely and requiring substantiation). In my opinion, documentation covering the entire building should normally be supplied to the BCA and DRU in support of any building consent application.

In my opinion, as a matter of principle, any design that claims to be an Acceptable Solution should be entirely in accordance with the Acceptable Solutions. Any departure of any aspect of the design should, prima facie, require justification of the whole design by way of a complete fire engineering analysis and report. Small departures that it is claimed do not warrant such an approach should specifically state the logical basis for the claim.

It is necessary to state at this point that **no report provided in the cases reviewed** by the author constitute, in my judgement, an adequate Fire Engineering Report (FER). There may be some debate as to what exactly is required in an adequate FER but in my opinion the content suggested in Section 1.11 of the International Fire Engineering Guidelines (Edition 2005) provides reasonable guidance in this regard.

In general in the documents reviewed there was little indication that the author(s) of the report had:

- thought through the operation of the building on a day-to-day basis
- adequately assessed the potential hazards represented by fire in the building
- understood the behaviour and involvement of the building occupants in initiating and dealing with fires in the building
- adequately assessed the range of fires that could occur in the building (and thus the range of design fires that needed to be addressed in the design of the building fire safety system)

- adequately addressed many other aspects of the fire safety system design

Many of the reports supplied in support of building consent applications contained no engineering analysis at all, even when it could have reasonably been expected. Instead may based claims and statements of adequacy on "expert judgement" with no logical or factual basis for that opinion apparent or stated. In my opinion this is quite unsatisfactory. Many reports also incorporated a large amount of computer printout that added greatly to the bulk of the report but little to the value. In many cases it was difficult or impossible to ascertain details of the situation modelled or the implications of the results. Computer or other modelling should be fully explained and justified, all of the input data tabulated and all of the relevant output explained and evaluated.

Many reports attempt to simply substitute a clause from another standard or set of regulations (often from another country) in place of an Acceptable Solutions clause that produces an inconvenient result. This should be viewed as creating an Alternative Solution and thus should require technical justification. Such substitutions can be quite unsatisfactory and should not be accepted simply through asserting their existence in an irrelevant standard or code.

In my opinion, many of the building consent applications forwarded to the DRU should not have been forwarded because a competent BCA should have recognised that the documentation was inadequate. The BCA should have required suitable documentation before forwarding the case to the DRU for their advice.

It was noticeable in reviewing the DRU advice to the BCAs that almost all of it stated that the design differed from the Acceptable Solution and suggested that the BCA require the designer to comply with (or perhaps use) the Acceptable Solution or justify the departure from the acceptable solution. This effectively becomes a message to the BCAs and the designers that only the Acceptable Solutions will do, and that Alternative Solutions will always be questioned. This automatically acts as a disincentive to the use of Alternative Solutions. It also assumes that the Acceptable Solutions are always correct and always the best option. In my opinion neither of these assumptions is always correct.

If it is desired that Alternative Solutions be encouraged (albeit done well, justified and properly documented) then some consideration should be given to ways of offering advice that is supportive, rather than simply indicating a preference for Acceptable Solutions. For example, the DRU could suggest sources of information or data or could suggest methodologies or computer programs that would, in their judgement, be suitable for use in the circumstances. This would be supportive of the engineering design process and would help to lead designers towards better practices rather than just leading them back to the Acceptable Solutions.

It appears from the cases reviewed that the DRU often suggests to the BCA that additional information and/or justification is required before building consent approval is granted. It appears that the DRU usually (perhaps always) does not receive feedback that the BCA has accepted the DRU's advice and made the request or that the request has been responded to satisfactorily. This is unsatisfactory in several ways. It is unsatisfactory for the DRU personnel (and the Unit itself) who deserve feedback so that they know whether their efforts are worthwhile or are simply falling into a black hole. It is also unsatisfactory in terms of the design of the process. If it is worthwhile involving the DRU at all, then they should be involved in bringing the process to a successful conclusion. Thus it would be preferable that cases requiring clarification or additional information be resubmitted to the DRU for them to confirm that the additional information and/or justification are satisfactory.

The DRU is staffed by qualified Fire Engineers because they are required to assess performance based fire engineering designs. An aspect of what appears to be the current policy and practice of

the DRU mentioned above, an apparent preference for and reliance on Acceptable Solutions, leads to the suggestion that this is not really as satisfactory use of Fire Engineers. If what is required is application and enforcement of the Acceptable Solutions then Fire Engineers are not necessary (as is implied by the fact that designs based only on Acceptable Solutions are not required to be forwarded to the DRU). All that is needed are competent BCAs. The employment of Fire Engineers in the DRU is taken as an indication that the NZFS does not wish to remain wedded solely to the Acceptable Solutions. This could be achieved by adoption of a risk-informed approach to fire safety assessment and design. This might involve the development in the DRU and the NZFS of a better appreciation of the effectiveness of fire safety system components and sub-systems in reducing the frequency and/or consequences of fires in buildings.

In reviewing the 26 cases it appears that the DRU diligently and competently assesses each building consent application they receive and supplies suitable advice to the BCA. The standard of assessment seemed to be quite uniform within the policies and procedures of the DRU. Many of the cases reviewed appear to hardly require the involvement of the DRU and could have been adequately assessed by a competent BCA. As mentioned above, many of them should have been rejected by the BCA prior to submission to the DRU and sent back to the designers until adequate documentation was supplied.

Conclusion and Recommendations

Based on the review of cases mentioned above, discussions with DRU personnel and on issues otherwise raised by DRU personnel it appears that the DRU competently assesses and issues advice on building consent applications as required by law and regulations. In my opinion the quality of the submissions the DRU are asked to review and issue advice on is generally poor. The DRU does not appear to be in a position where it can enforce a suitable standard for such submissions, this appears to be more appropriately the role of the BCAs.

It appears the DRU works within a difficult legal and regulatory environment and that may limit some aspects of their effectiveness. This situation may be improved in several ways:

- by clarification (and perhaps simplification) of the criteria used to assess whether building consent applications should be submitted to the DRU for review (NZ Building Act)
- improved advice on interpretation of the criteria (Department of Building and Housing)
- simplification of the Acceptable Solutions so that they do not require what appear to be fire engineering calculations (Department of Building and Housing)

These improvements would help BCAs to more readily and reliably distinguish cases requiring review by the DRU from those that do not.

The role of BCAs in assessing building consent applications is critical and improvement in the process of handling of applications could lead to less duplication of effort and improved effectiveness of the DRU. This would require improved assessment of applications by BCAs and would require them to ensure that:

- only applications that fit the criteria for DRU advice are forwarded to the DRU
- only applications of a suitable standard and containing all of the necessary information are forwarded to the DRU
- the DRU receive feedback on the action taken in response to their advice
- that the DRU be involved in assessing whether the response from a Fire Engineer to DRU advice is satisfactory (rather than being left in limbo as appears to usually be the case at present)

In my opinion the DRU could, by leadership and example, encourage better standards of fire engineering design and documentation of designs. This would require the support and cooperation

of BCAs. In my opinion there is certainly a strong case for an improved standard of Fire Engineering Reports.

In addition the DRU could encourage better standards by being more supportive of performance based fire engineering design by:

- showing less reliance on the Acceptable Solutions (designs should not be assessed as inadequate simply because they differ from the Acceptable Solutions)
- suggesting sources of data, suitable analysis methods, etc when it assesses design and/or documentation to be inadequate
- providing generally available advice on the criteria used in their assessment of designs and documentation
- providing generally available advice on data and methods they view as being suitable for use in fire engineering design that requires their assessment

(It has come to my attention in undertaking this review that the NZFS has prepared a draft Code of Practice on Fire Safety Features for Fire Service Operations for Buildings. While not necessarily suggesting documents as formal as Codes of Practice or endorsing the content of this particular document, documents similar to this providing a NZFS perspective on issues could be very beneficial and help to provide the leadership mentioned above. It should also be noted that this document, at 76 pages, is rather longer than any of the fire engineering reports in the reviewed cases.)

A feature of many of the cases reviewed was questionable statements asserting "adequacy" based on equally questionable "expert judgement". Suitable advice from the DRU might help to eliminate assertions of adequacy and expert judgement where there is little or no basis for the claim in the documentation provided by the designer.

Finally, the DRU and NZFS should endeavour to become less wedded to the Acceptable Solutions and become more comfortable with, and better able to judge the adequacy of, performance based Fire Engineering design of building fire safety systems. The adoption of a risk-informed approach to the assessment and design of fire safety in buildings would be a useful step in this direction.

Appendix A

The DRU has developed standard clauses that can be used in the memorandum conveying their advice to the BCA. These standard clauses are set out below:

> This memorandum is provided based on the information shown above. Note that the memorandum provides advice on the following matters:
>
> 1. Provision of the means of escape from fire.
> 2. The needs of persons who are authorised by law to enter the building to undertake fire fighting.
>
> Advice provided by the NZFS must not exceed the performance requirements of the building code. Note however that the memorandum may also include information on matters relating to the Fire Service Act and the Fire Safety and Evacuation of Buildings Regulations. This additional advice is provided for information purposes only.
>
> **New Zealand Fire Service Advice**
>
> The consent documentation indicates that this is a new building. Under s.17 of the Building Act 2004, the NZFS considers this building should comply with all clauses of the Building Code, and has assessed the design accordingly.
>
> The fire report uses the acceptable solutions as a basis for design. The NZFS has also referred to the acceptable solutions when providing advice contained in this memo.
>
> **1. MEANS OF ESCAPE**
>
> 1.1. The fire report states that smoke detection in the apartments will be local alerting within the apartment of origin and non-latching. While the NZFS supports this approach, it is concerned that continued unwanted alarms will adversely affect the fire safety behaviour of the apartment occupant's. The NZFS considers the building owner has a duty of care to ensure that the systems installed in the building are fit for purpose.
>
> **The NZFS recommends that the applicant investigates methods of reducing the incidence and consequence of unwanted smoke detector activation within the apartments. The NZFS suggests selecting detectors that are resistant to unwanted activations caused by cooking fumes and steam, providing a wall mounted hush button in an easily accessible location close to the kitchen area, and installing a high quality kitchen extract system, preferably one that vents to the outside.**
>
> 1.2. This firecell contains an intermediate floor. The NZFS notes that the definition of escape height in the acceptable solution includes the height of the intermediate floor. Given that the firecell is FHC 4, under C/AS1 Table 4.1 an escape height of <4 m means that fire safety precautions F30, 6, 18c are required.
>
> **The NZFS recommends that the BCA requires the applicant to provide an automatic sprinkler system for this building as required by C/AS1 Table 4.1/1.**
>
> 1.3. The NZFS notes that no occupancy load has been provided in the fire report. This is fundamental information that should be included in any fire engineering design. It is

required for example to assess the adequacy of the means of escape, and to identify the level of risk inherent in any alternative solutions presented as part of the fire engineering analysis.

The NZFS recommends that the BCA requires fire engineering designs to provide all the basic information, including occupancy load, necessary to adequately assess the merits of the design.

1.4. Paragraph 6.9.3 of C/AS1 requires safe path stairs leading from basement levels and which continue to floors above the level of the final exit, to have the lower levels fire separated from the final exit level. The plans show that the safe path stairway is open from the basement levels through to the top floor of the building, with the final exit being on the ground floor level.

The NZFS recommends that the BCA requires the safe path stairs to be fire separated between the basement levels and the final exit level on the ground floor in accordance with the acceptable solution.

1.5. The fire report states that a stairway pressurisation system will be provided. The fire report sets out performance requirements for the pressurisation system. However no mechanical drawings or specifications have been provided, so the NZFS is unable to comment on whether the requirements of the fire report have been adequately transferred to the main consent documentation.

The NZFS recommends that the BCA satisfies itself that the building consent drawings and specifications accurately reflect the requirements of the fire report with regard to the stairway pressurisation system.

1.6. The fire report uses the BRANZFIRE zone model as part of the ASET/RSET egress analysis. The NZFS notes that the floor area of this warehouse significantly exceeds the validated compartment sizes published in BRANZFIRE 2004 – Compilation of Verification Data (November 2004). The warehouse floor area is also well beyond the 500 m^2 suggested by the author of BRANZFIRE as a reasonable size limit.

The NZFS recommends that the BCA requires the applicant to provide documentation demonstrating that the BRANZFIRE zone model can be applied to compartments the size of this building.

1.7. The Building Act 2004 requires plans and specifications accompanying the consent application to be final and complete. The plans and specifications provided in this consent application do not contain all the information necessary to carry out the proposed building work in accordance with the recommendations of the fire report.

The NZFS recommends that the BCA requires the applicant to include the following information in the consent documentation:

a. Details of proposed surface finishes, including evidence that the specified product(s) will not exceed the maximum spread of flame and smoke development indices as specified in the fire report.

b. Fire rated construction details, showing how the assembly is to achieve the fire resistance rating specified in the fire report.

c. The location of proposed emergency lighting shown clearly on the drawings.

d. The location of proposed exit signage shown clearly on the drawings.

[1] 'BRANZFIRE Fire Room Size Limitations', correspondence between Colleen Wade, BRANZ, and the NZFS Engineering Unit, 23 May, 2005

[1] Buchanan Andrews H., *Structural Design for Fire Safety,* John Wiley & Sons Ltd, Chichester, England, 2001, pp.102 to 104.

2. FIREFIGHTING NEEDS

2.1. The fire report states that a Type 18 fire hydrant system will not be provided on the basis that the hose run distance does not exceed 75 m. No further information on this matter is contained in the consent documentation.

The NZFS recommends that the BCA requires the applicant to demonstrate that the fire hydrant system is not required. The Fire Service vehicular attendance point should be clearly marked on the plans, along with the hose run distance as laid on the ground to the furthest point on any floor, showing that the hose run distance does not exceed 75 m.

2.2. The fire report contains a tenability analysis as part of the egress calculations for the car park levels. This analysis does not address the specific needs of firefighters to carry out rescue operations and control the spread of fire as required by Clause C3.3.9 of the building code. Basement car parks with limited ventilation present a significant safety risk to Fire Service personnel who are required to enter in this environment.

The Fire Service recommends that the BCA requests further analysis demonstrating that tenable conditions are maintained for firefighters conducting interior operations in the car park firecell.

2.3. The consent issue drawings indicate that this building is an unprotected steel portal frame structure. The fire report states that the building is FHC 4, meaning that a severe fire can be expected. The NZFS therefore considers that structural collapse of the steel portal frame and roof members should be anticipated relatively early in the fire, along with the potential subsequent collapse of the concrete tilt slab panel exterior walls. The fire report has not addressed the requirements of clause C3.3.9 of the building code, which requires that the fire safety systems installed in the building shall facilitate the specific needs of Fire Service personnel to carry out rescue operations and control the spread of fire.

The NZFS recommends that the BCA requires the applicant to provide an analysis demonstrating that Fire Service personnel will not be placed at undue risk if required to carry out rescue operations and control the spread of fire in this building. The NZFS considers that in a large open space building with a FHC 4 fire load, this mandatory performance requirement of the building code is best served through the installation of a sprinkler system.

2.4. The Eurocode formula has been used to calculate the required S-ratings for the control of fire spread to other property. This time equivalent formula has been empirically derived using design fires for small rooms (maximum size 23m x 5.5m x 2.7m high)1. As such it may not be applicable to larger rooms with high ceiling heights. In addition, the Eurocode formula does not have well documented derivations which describe its limitations[1]. The NZFS therefore considers that in the absence of further supporting information, it is inappropriate to apply this design method to this building.

The NZFS recommends that the BCA requires the applicant to provide documentation justifying the use of time equivalency to determine fire severity for a building of this size. If such information cannot be provided, the NZFS recommends that a sprinkler system be installed to ensure boundary protection is maintained, as anticipated by C/AS1 5.6.11 Comment 3.

2.5. The fire report states that the external cladding must comply with C/AS1 Table 7.5 for peak heat release rate and total energy released.

The NZFS recommends that the BCA requires the applicant to provide evidence that the proposed cladding product(s) will not exceed the maximum peak heat release rate and total energy released as contained in C/AS1 Table 7.5.

2.6. The fire report states that plastic sheeting will be used to provide effective fire venting to 15% of the roof area. The NZFS notes that the fire performance of plastic roof sheets varies considerably, and may not always provide effective venting. Some plastic sheets contain a fibreglass reinforcing mat that will not readily melt out to provide an effective path for the smoke and fire gases to exit the building.

The NZFS recommends that the BCA requires the applicant to specify the type of plastic sheet to be used, and supply documentation showing that the product will provide effective roof venting in the event of a fire. If this is not possible, the applicant must either provide a proprietary roof vent system specifically designed for fire venting, or install a sprinkler system in order to comply with the requirements of the acceptable solution.

2.7. The fire report states that concrete tilt slab panels will provide the required fire resistance rating to control external fire spread to the boundary. This requires the tilt slab panels to remain intact for the duration of the fire. The NZFS notes that the tilt slab panels are connected to the building's steel portal structural framing. No information has been provided showing how to prevent the tilt slab panels from being pulled inwards as the unprotected steel portal frame collapses due to fire exposure.

The NZFS recommends that the BCA requires the applicant to provide information regarding the connection details between the concrete tilt slab panels and the steel portal frame to demonstrate that structural collapse of the steel portal frame during the fire will not affect the stability of the tilt slab panels.

2.8. The fire report states that concrete tilt slab panels will provide the required fire resistance rating to control external fire spread to the boundary. No details of the sealant located between the tilt slabs showing how it achieves this fire resistance rating requirement have been provided.

The NZFS recommends that the BCA requires the applicant to provide details of the fire resistance rating of the sealant used between the concrete tilt slabs panels.

3. FIRE SERVICE ACT (INFORMATION ONLY)

3.1. No information has been provided on the available firefighting water supply. An inadequate water supply may prevent the NZFS from controlling a fire, and potentially result in the complete loss of the building. NZS PAS 4509:2003 *New Zealand Fire Service*

Fire Fighting Water Supplies Code of Practice provides methodologies for calculating the required firefighting water supply for a building.

The NZFS recommends that the applicant provide information on the required and available water supplies for the site. This information should also include the locations, pressures and flow rates of the underground fire hydrants from which the required water supply can be obtained.

4. EVACUATION SCHEME (INFORMATION ONLY)

4.1. The NZFS believes that this building will require an evacuation scheme under the Fire Safety and Evacuation of Buildings Regulations 1992. The Building Act 2004 s.35(e) requires the territorial authority, when issuing a project information memorandum, to inform the owner of the building or proposed building if it considers that an evacuation scheme is likely to be required. The territorial authority is therefore requested to pass this information on to the applicant.

4.2. Where buildings require an evacuation scheme the National Commander, in accordance with Regulation 10(2) of the Fire Safety and Evacuation of Buildings Regulations, will require a building owner to install and maintain fire extinguishers in accordance with NZS 4503.

4.3. Further information on the requirements of an evacuation scheme can be found at www.fire.org.nz.

DISCLAIMER

The fire safety report states that property protection has not been addressed in this design (other than as required by the Building Code). This may impact on the insurability of the completed building, and may affect the ability of the NZFS to successfully extinguish a fire and thus reduce property loss.

This memo is provided in accordance with section 47 of the Building Act 2004 and as such does not constitute a peer review of all fire safety systems in the design.

Appendix B

Design Review Unit – Tier 1 Review Checklist

Note: Sections 1 – 7 to be completed on Day 1

1. Job Details

Job number		Priority	
Job name			
NZFS Fire engineer			
Date in		Day 8 date	
Date out		Approved (Yes/No)	

2. Charge Out Details

Hours booked	Name	Date	Hours
Engineer			
Review 1			
Review 2			
Manager			
		Total hours	
		Hours invoiced	
		Efficiency	

3. Designer Details

Fire engineer	
Qualifications	
Company	
Architect	

4. Project Details

New Building	Alterations and Additions	Alterations	Change of Use (Sleeping)	Change of Use (Non-sleeping)

5. Building Details

No. of floors		Max. escape height					
Footprint (m^2)		No. of occupants					
Special hazards		Building FHC	1	2	3	4	

Water classification	W1	W2	W3	W4	W5	W6	W7	W8

Sprinklers	None		NZS 4541		NZS 4515		
	Appendix D		Non-compliant		Other:		
Classified use	Housing		Community res.		Community non-res.		
	Commercial		Industrial		Out building		

6. Consent Documentation

Information	Yes	No	N/A	Information	Yes	No	N/A
Consent application form				Elevations (each face)			
Fire report				Sections			
Specifications				Mechanical services			
Site plan				Electrical services			
Floor plans (all levels)				Door schedule			
Fire safety drawings				Window schedule			
Fire safety drawings location:		Fire report			Architectural plans		

7. DRU Considerations

Reason for DRU Memo:
If alteration, identify extent of work in relation to size/value of building:

	Yes	No
Does design refer to the acceptable solutions?		
Is the building fully sprinklered?		
Do the drawings referenced in the fire report match those of the building consent?		
Are the hours assigned to this job correct?[1]		
Is there sufficient information to carry out an assessment of the design?[2]		

Note1: If hours are not correct, reassign priority with Administration Manager
Note 2: If more information is required, memo must be sent by Day 3

8. Preliminary Notes

9. Fire Safety Precautions
(C/AS1 Table 4.1)

Firecell	Description						PG	FHC	OL	EH
	F									
C/AS1										
Provided										
Notes										

Firecell	Description						PG	FHC	OL	EH
	F									
C/AS1										
Provided										
Notes										

Firecell	Description						PG	FHC	OL	EH
	F									
C/AS1										
Provided										
Notes										

C/AS1 deletion	Alternative solution	Justification provided	Adequate	
			Yes	No

10. Escape Routes (C/AS1 Part3)	Adequate			
	Yes	No	N/A	Reference
Number (refer C/AS1 Table 3.1)				
Separation (min. 8 metres clear separation)				
Height (min. 2100 mm)				
Width (refer C/AS1 Table 3.2)				
Length (refer C/AS1 Table 3.3)				
Length increase for FSPs (refer C/AS1 Table 3.3)				
Door opening direction (max. 10-EW; 20-OP against flow)				
Fixed seating				
Escape via adjacent firecell				
Escape via adjacent building				
Escape via intermediate floor				
External escape route				
Single means of escape				
Escape from basement level/s				
Vertical safe path				
Intermediate floor (length 1.5 times actual)				
Crowd large purpose group				
Sleeping purpose group				
Revolving or sliding automatic doors				
Windows used for escape				

11. Requirements for Firecells (C/AS1 Part 4)	Adequate			
	Yes	No	N/A	Reference
Floor area limits (unsprinklered buildings)				
15% roof ventilation for unlimited floor area (single floors)				
Multiple firecells (determine FSPs for whole building)				
Early childhood centre				
Mezzanine floor escape height for determining FSPs				
F rating reduced for sprinklers **not required under Table 4.1**				

12. Fire Resistance Ratings (C/AS1 Part 5)	Adequate			
	Yes	No	N/A	Reference
F ratings applied to firecells as per C/AS1 Table 4.1				
S ratings applied to all external walls without 100% U.O.				
S ratings calculated correctly (C/AS1 5.5.2 and Table 5.1)				
A_f includes intermediate floor area				
Concessions for single firecells with multiple PGs				
Firecells with FHC 4				
Higher FRR applied to both sides of firecell separation				
FRR applied to primary elements supporting fire separation				
FRR applied to both sides of external wall (C/AS1 5.7.6)				
Specific minimum FRR requirements (C/AS1 5.7.9)				
Glazing in fire separations				
Primary element stability				

13. Control of Internal Fire and Smoke Spread (C/AS1 Part 6)	Adequate			
	Yes	No	N/A	Reference
Fire separation between firecells rated F0				
Purpose groups CS and CL				
Purpose group CM				
Purpose groups CO, CS and CL				
Purpose groups SC and SD				
SC and SD group sleeping areas				
SC and SD suites				
Operating theatres, delivery & recovery suites, intensive care				
Purpose group SA				
SA group sleeping areas				
SA suites				
Purpose groups SR and SH				
Exitways (purpose group IE)				
Ventilation in enclosed exitways for SC, SD, SR and SA				
Smoke control for vertical safe paths exceeding 25 m				
Support activities (purpose group IA)				
Enclosed solid waste storage areas				
Car parking				
Purpose group ID (intermittent activity – medium fireload)				
Plant, boiler and incinerator rooms				
Each floor a separate firecell (exemption C/AS1 6.14.1)				

Firecell construction details				
Long corridor subdivision (40 m for OP & PP, 80 m for SP)				
Intermediate floors				
Basement floors				
Subfloor spaces				
Protected shafts				
Concealed spaces				
Unsprinklered firecell roof/ceiling space area restrictions				
Closures in fire and smoke separations				
Lift landing doors				
Interior surface finishes				
Foamed plastic building materials				
Exitway pressurisation				
Smoke control for intermediate floors				
Limited area intermediate floors				
Limited area atriums				
Smoke detection interface with smoke control system				
Smoke control in air-handling systems				
Emergency power for smoke control systems				

14. Control of External Fire Spread (C/AS1 Part 7)	Adequate			
	Yes	No	N/A	Reference
Horizontal fire spread to other property				
Horizontal fire spread to adjacent sleeping PG buildings				
Horizontal fire spread to external safe paths				
Separate legal titles				
Calculation method (dependant on building/boundary angle)				
Wing walls and return walls				
Sprinkler concessions for Methods 2 and 3				
Horizontal fire spread from roofs and floors				
Horizontal fire spread from open sided buildings				
Vertical fire spread from roofs				
Vertical fire spread in same building (if unsprinklered)				
Roof car parking and storage				
Specific requirements for FRRs of external walls				
Exterior surface finishes				

15. Fire Fighting (C/AS1 Part 8 and NZBC C3.3.9)	Adequate			
	Yes	No	N/A	Reference
Fire Service Vehicular Access				
Special provisions for SC and SD purpose groups				
Fire Service access to building				
Fire hydrant system				
Fire sprinkler system				
Fire alarm panel				
Fire systems centre				
Fire Service lift control				
Voice communication system				
First aid firefighting				

16. Performance Based Design	Adequate			
	Yes	No	N/A	Reference
ASET input variables				
RSET input variables				
Computer fire model suitable for application				
Computer fire model used within validation limits				
Computer fire model input variables				
Computer evacuation model suitable for application				
Computer evacuation model used within validation limits				
Computer evacuation model input variables				
Eurocode method for S rating calculations				
NZS 4203 Load Combination 7 post fire structural loading				
Use of non-fire rated doors in fire separations				
Tilt slab construction (release mechanisms/gap sealant)				

Appendix C to this report has been removed to protect the identities of the projects reviewed, the fire engineering organisations involved in the designs and the DRU reviewers.