



Fire Engineering Consultants

**Appeal Against Conditions attached to
Fire Safety Certificate (FSC 1606/18)**

Appeal Ref: ABP-301398-18

Project **Construction of proposed new
college building over six storeys.
Central Quad, DIT Campus,
Grangegorman, Co. Dublin**

Local Authority **Dublin City Council**

Date **29 August 2018**

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1.0 INTRODUCTION

This case concerns the appeal of four conditions attached to the Fire Safety Certificate for the proposed Central Quad building at the DIT campus, Grangegorman. A Fire Safety Certificate was granted by Dublin City Council for the building on 6 March 2018 with seven conditions attached. These were:

Condition 1

A life safety sprinkler system complying with BS EN 12845 shall be installed throughout the building (other than hazard areas having an alternative fire suppression system).

Reason:

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017 and to limit the size of a fire, control fire spread, provided additional time to evacuate, limit fire damage and be beneficial in terms of operational continuity.

Condition 2

The smoke control strategy and design shall be independently assessed for efficacy and compliance with Part B (Fire Safety) of the Second Schedule to the Building Regulations by specialist consultants who shall confirm or modify the design. Once installed, they shall further verify the system before the building is used or occupied.

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017.

Condition 3

Smoke ventilations shall be provided to the lower ground/basement area in accordance with section 27.2 of BS 9999:2017. Smoke vents shall be site at high level and should be distributed around the building perimeter to maximise the effectiveness of cross ventilation. The clear cross sectional area of all smoke vents, allowing for frames and louvres, shall not be less than 2.5% of the basement storey served. Smoke vents from basements shall be permanently open and unobstructed. As an alternative to outlet vents as described above, a system of mechanical extraction may be provided, the ventilation system shall meet the criteria set out in section 27.2.3 of BS 9999: 2017.

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017

Condition 4

Lockers shall not be provided in the circulation spaces.

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017

Condition 5

Lecture Theatres shall comply with the relevant provisions of Annex D of BS 9999: 2017.

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017

Condition 6

The ring road shall comply with Table 20 of BS 9999:2017.

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017

Condition 7

Except as modified by the above condition, the additional information received on 12/11/2015, 03/10/2017, 01/02/2018 and 27/02/2018 from Michael Slattery Associates shall be incorporated in the development.

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017

The appellant is appealing conditions 1, 2, 3 and 4.

2.0 INFORMATION REVIEWED

The following information was reviewed in the assessment of this case:

- Additional information submission from MSA to DCC dated 12 November 2015
- Additional information submission from MSA to DCC dated 29 September 2017
- Additional information submission from MSA to DCC dated 29 January 2018
- Additional information submission from MSA to DCC dated 21 February 2018
- Fire Safety Certificate grant with submissions issued by DCC dated 6 March 2018
- Submission from MSA to DCC on condition 3 dated 15 March 2018
- DCC Fire officers memorandum on the MSA proposal for dealing with condition 3 dated 28 March 2018
- Appeal submission by Michael Slattery Associates (MSA) dated 5 April 2018
- Dublin City Council Fire Officers report dated 3 May 2018
- MSA response to DCC Appeal submission dated 12 June 2018
- DCC fire officer response to MSA submission dated 6 July 2018

3.0 DISCUSSION

3.1 Condition 1

Condition 1

A life safety sprinkler system complying with BS EN 12845 shall be installed throughout the building (other than hazard areas having an alternative fire suppression system).

Reason:

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017 and to limit the size of a fire, control fire spread, provided additional time to evacuate, limit fire damage and be beneficial in terms of operational continuity.

3.1.1 BCA's Reasons for Condition

The BCA have provided a long list of technical reasons as to why they consider full sprinkler protection is required in the building. They state that life safety sprinklers will:

1. Limit the fire size
2. Control the spread of fire
3. Provide additional time for occupants to evacuate the building
4. Reduce fatalities and injuries in the event of fire
5. Limit fire damage
6. Assist operational fire fighters by controlling the fire size
7. Reduce the possibility of flashover
8. Reduce the possibility of backdraught
9. Be beneficial in terms of operational continuity.

Other reasons stated include:

- A fire strategy solely reliant on passive measures is susceptible to reliability failure and the provision of sprinklers would help to alleviate this.
- DFB have a policy of conditioning sprinklers in residential care homes.
- The guidance in Technical Guidance Document B is outdated and it is expected that forthcoming revision will require sprinklers in a building such as the central quad.
- Unsprinklered transient fire loads in the atrium space could compromise the smoke venting system.
- The building is designed to BS 9999: 2017 which permits much larger compartment sizes than permitted under Technical Guidance B.
- BS 9999: 2017 would require sprinklers for an atrium building such as this.
- An alternative design should provided a standard of fire safety equivalent to Technical Guidance Document B.
- Since 2007, sprinkler systems in all new school buildings have been mandatory in Scotland and Wales.

3.1.2 Appellants Case for Appeal

In appealing the condition for sprinklers in the building the appellant has stated the following arguments:

1. The design is based on BS 9999 and therefore, reference to Technical Guidance B by the BCA is not relevant. They state that the BCA actually requested that BS 9999: 2017 was used as the basis of design.
2. TGD B is only suitable for small to medium projects and is not appropriate for large complex buildings. BS 9999 provides a more flexible approach to a very large building such as the central quad.
3. The passive fire safety measures in the building will be scrutinized by MSA during the construction phase of the development and will be issuing a Certificate of Compliance on completion as part of their BCAR responsibilities and that there is no reason why the passive fire protection in the central quad would be anything other than reliable.
4. DFB's policy of conditioning of sprinklers in residential care homes is not relevant to the central quad due to the lack of a sleeping risk.
5. Fire fighting access to the building is adequate in the absence of sprinklers with the provision of 3 fire fighting shafts.
6. It is not envisaged that any future change to TGD B will require sprinklers in buildings such as the Central Quad which are less than 30m in height.
7. There will be no transient fire loads in the building and apart from some break out spaces and locker areas, all circulation spaces will be sterile.
8. BS 9999: 2017 is the most appropriate guidance for the building as such compartment floors are not required. As the atrium does not breach compartmentation then the guidance in Annex B and C of BS 9999 does not apply.
9. They contend that DFB's statement that BS 9999 requires sprinklers in an atrium building such as this is incorrect, as this only applies where an atrium breaches compartment floors and there are none in the Central Quad building.
10. The fire strategy is in excess of minimum code guidance in that
 - a. There will be a category L1M fire detection and alarm system with a voice alarm system.
 - b. Open connections will be enclosed at all levels to create a smoke reservoir.
 - c. A natural smoke clearance system will be provided.
 - d. The use of the atrium base will be controlled or completely sterile.
11. It is not within the remit of DFB to condition sprinklers for property protection or business continuity.

3.1.3 Consideration

In considering the requirement for sprinklers the following issues are key:

1. What is the correct basis of compliance – TGD B or BS 9999?
2. Is the building less than 30m in height?
3. Are compartment floors required?

4. Does the guidance in BS 9999 for atria apply?
5. Is the issue of open spatial planning adequately addressed?

Basis of Compliance

Both the BCA and the appellant agree that the guidance in TGD B is outdated, having not been properly revised in over 20 years. Furthermore, as pointed out by the appellant, the Department of Environment and Local Government have endorsed the use of BS 9999 as an acceptable basis of achieving compliance with the functional requirements of the Building Regulations. BS 9999 is also now routinely accepted by fire authorities throughout the country as an acceptable basis of design. In my view, therefore, the use of BS 9999 in this case is correct.

Building Height

Section 30.2.2 of BS 9999 recommends that buildings > 30m in height should be sprinklered. However, the height of the top storey above the adjacent ground level at the Central Quad is approximately 21.1m. Sprinklers are not required therefore, to comply with BS 9999 due to the height of the building.

Compartment Floors

Section 31.3.2 (b) of BS 9999 recommends compartment floors in buildings of risk profile B where - "every floor above ground floor level, or separated part of the building, has a storey with a floor at a height more than 30m above ground level."

As noted above, the height to the top storey of the Central Quad is less than 30m therefore, compartment floors are not required.

Atrium Guidance

Section 31.3.1.1 of BS 9999 states

"Where a building contains an atrium, the recommendations of Annex B should be followed where the atrium affects compartmentation between storeys, except for connections between levels in a dwelling."

Furthermore, although not the basis of compliance, it is noted that section 3.2.7.7 of TGD B also states;

" Detailed guidance on all issues relating to the incorporation of atria in buildings is given in BS 5588 Part 7 Code of Practice for the incorporation of atria in buildings. However, it should be noted that for the purposes of TGD B, the standard is relevant only where the atrium breaches compartmentation".

It is noted that Annex B and C of BS 9999 superseded the guidance in BS 5588 Part 7.

It is clear therefore that as the Central Quad does not have compartment floors, that the atrium does not breach compartmentation and that the guidance in Annex B of BS 9999 does not apply.

Open Spatial Planning

Whilst the atrium does not breach compartmentation, escape from the rooms on the upper levels are in towards and within 4.5m of the void edge which does not comply with fire code guidance. However, as part of the Fire Safety Certificate application the appellant has carried out a fire engineering analysis using Computational Fluid Dynamics to demonstrate that tenable conditions are maintained on the balconies on

the upper levels in the event of a fire. Having reviewed the technical note in the FSC compliance report I am satisfied that this has been adequately demonstrated.

Summary

It is clear from the above that the building is less than 30m in height and the atrium does not breach compartmentation. External fire spread has been assessed with an enclosing rectangle the full height of the compartment without sprinklers. CFD analysis has also shown that tenable conditions are maintained on the balconies opening onto the atrium in the event of a fire. In my opinion therefore, the condition for sprinklers throughout the building is not warranted and should be removed.

3.2 Condition 2

Condition 2

The smoke control strategy and design shall be independently assessed for efficacy and compliance with Part B (Fire Safety) of the Second Schedule to the Building Regulations by specialist consultants who shall confirm or modify the design. Once installed, they shall further verify the system before the building is used or occupied.

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017.

3.2.1 BCA's Reasons for Condition

The BCA give a number of reasons for this condition primarily:-

1. The complexity of the building
2. The varied uses of the rooms
3. The large population
4. The number of interconnecting floors
5. The lack of compartmentation between floors
6. The reliance on smoke curtains to protect escapes routes; and
7. The limited number of fire scenarios considered

3.2.2 Appellants Response

In appealing the condition the appellant has stated the following arguments:

1. The smoke venting system has been assessed using the FDS computational fluid dynamics program which is widely recognised and has considered the worst case scenario of a fire on the ground floor.
2. When compared to a non-atrium code compliant building where means of escape from rooms would be into corridors which would have low ceilings and no smoke ventilation, conditions in the Quad Building would be much better.
3. The large open volume space created by the atrium results in a smoke reservoir which delays the rate of smoke logging in the building.
4. Tenability limits for temperature and visibility were maintained throughout the full duration of the simulation.

3.2.3 Consideration

The NIST FDS programme is internationally recognised as a robust computational fluid dynamics code and is widely used in smoke ventilation design and analysis. The use of FDS in the case is therefore, appropriate.

The large volume space created by the atrium in the Quad building, whilst allowing smoke to spread through the building is in fact an inherent fire safety feature. The larger the volume of the space, the longer it will take to fill with smoke and therefore extend the time available for occupants to escape.

When a fire occurs in an open space, such as beneath a high roof in an atrium, it will produce hot gases due to combustion. As these gases rise they will entrain large quantities of cool air. This entrainment, or mixing, is induced by the upward movement of the hot gases, which are replaced by cold air drawn into the fire column from below.

As the smoke plume rises, it increases in volume as more air is entrained into it which results in an increase in volume. Furthermore, the air entrained will cool the smoke the further it rises.

In an atrium, smoke will continue to rise until it forms a layer in the roof structure. The amount of smoke produced is directly related to both the size of the fire and the height through which it rises in order to reach the layer.

In a very tall atrium such as the Central Quad, the amount of air entrained into the rising smoke plume will be large and mean that a smoke clear layer would only be possible to maintain for the bridges on the lower levels. As smoke will build down to a level at which a clear layer can be maintained, balconies on the upper levels will be within the smoke layer. Therefore, conditions within the smoke layer need to be considered.

The appellant has sought to provide sufficient smoke venting to sufficiently delay the rate of smoke logging and to ensure that the visibility through the smoke is greater than 10m and the temperature within the smoke layer does not exceed 60°C. The tenability criteria comply with the guidance contained in PD 7974-6: Application of Fire Safety Engineering Principles to the Design of Buildings. The analysis showed that both tenability criteria were not exceeded.

The BCA also express a concern that changes to the atrium design could adversely affect the performance of the smoke venting system. Unless the fire strategy design changed dramatically then the performance of the smoke venting is unlikely to be affected. The key factor in this building is the sheer volume of the atrium space and its height. Any fire on the atrium base will grow slowly and the large amount of air entrainment due to the height of rise will result in relatively cool smoke which is not a significant risk to occupants. Should there be significant changes however, these would be subject to a revised fire safety certificate application

In addition to the design, the building will be subject to the Building Control Amendment Regulations and the design team and contractors will be required to confirm that the system has been installed and commissioned as per the Fire Safety Certificate.

In my opinion therefore, the condition should be removed and replaced with another condition requiring the CFD modelling for the atrium smoke venting system to be revised as necessary if a revised Fire Safety Certificate is required due to changes in the atrium design.

3.3 Condition 3

Condition 3

Smoke ventilations shall be provided to the lower ground/basement area in accordance with section 27.2 of BS 9999:2017. Smoke vents shall be site at high level and should be distributed around the building perimeter to maximise the effectiveness of cross ventilation. The clear cross sectional area of all smoke vents, allowing for frames and louvres, shall not be less than 2.5% of the basement storey served. Smoke vents from basements shall be permanently open and unobstructed. As an alternative to outlet vents as described above, a system of mechanical extraction may be provided, the ventilation system shall meet the criteria set out in section 27.2.3 of BS 9999: 2017.

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017

3.3.1 BCA's Reasons for Condition

The BCA give a number of reasons for this condition primarily:-

1. The proposal to ventilate rooms into adjacent ventilated spaces does not comply with the guidance in BS 9999 or TGD B.
2. The proposed ventilation does not meet the distribution requirements recommended by BS 9999.
3. A number of the smoke outlets proposed are situation close to escape routes at ground level.
4. Basements present fire fighters with particular problems and as such it is vital that all access routes used by fire fighters are kept as clear as possible.

3.3.2 Appellants Response

In appealing the condition the appellant has stated the following arguments:

1. The basement level contains limited fire load and is subdivided into small fire compartments < 130m².
2. The guidance in BS 9999 is intended to deal with much larger and deeper basement, and as such it would be unreasonable to apply the full recommendations of the guidance in this case.

The appellant is also now proposing enhancements to the original design which include:

1. Additional natural ventilation openings will be provided on the ground floor slab which results in a total area of 118m². This is equivalent to 2.8% of the net floor area of the lower ground.
2. The new proposal is a mixture of pavement lights for some rooms, and opening doors in other rooms into ventilated spaces. These spaces are ventilated by the atrium voids above.

3. The rooms on the lower ground floor are enclosed in 60 minutes fire resisting construction and contain relatively low fire loads. Kitchens will be provided with suppression systems.

3.3.3 Consideration

The BCA are correct in that basement present fire fighters with particular problems. If a fire occurs on a storey on an upper floor of a building access for fire fighters is easier due to;

1. They are attacking the fire from below and fire generally spreads upwards and
2. A large fire will cause glazing to fail which depressurises the fire compartment and reduces smoke spread into the protected stairs.

In a basement however, there are no windows through which smoke and hot gases can vent. As a result therefore, as the fire grows and the smoke gets hotter, the buoyancy pressures also increase and can force the smoke into the stairs which fire fighters are trying to descend. The stairs effectively become chimneys.

To address this Building Regulations guidance seeks to depressurise the basement space to create a positive air flow from the stairs into the basement. This is done by providing openable vents equivalent to 2.5% of the area of the basement.

The proposed strategy provides for openable knock out panels for a number of the rooms however, this accounts for just 34.8m² of the total 118m² provided. The remaining ventilation is provided in the form of openings in the ground floor slab into the atrium voids above i.e. the atrium voids have been extended down to the lower ground floor.

When one considers what the functional requirement of the Building Regulations is in relation to basement smoke venting, this is considered a reasonable approach. The open voids above the corridors means that these corridors would never completely fill with smoke as it would simply flow into the space above. In contrast a fully compliant design would require fire fighter manual operation and would therefore, not begin venting smoke until they arrive. The condition should therefore, be reworded to reflect the enhanced proposals submitted as part of this appeal.

3.4 Condition 4

Condition 4

Lockers shall not be provided in the circulation spaces.

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017

3.4.1 BCA's Reasons for Condition

The BCA give a number of reasons for this condition primarily:-

1. The complexity of the building
2. The varied uses of the rooms
3. The large population
4. The number of interconnecting floors
5. The reliance on smoke curtains to protect escapes routes

6. Circulation spaces should contain as minimum a fire load as possible so as to limit the possibility of a fire.

3.4.2 Appellants Response

In appealing the condition the appellant has stated the following arguments:

- The lockers will be of non-combustible metal construction with sloping tops to prevent storage on top.
- A fire in a locker is unlikely to spread to adjacent lockers.
- The locker areas will be well dispersed and limited in area (largest locker area is 3m²).
- In the event of a locker fire, occupants have an alternative means of escape.
- The building is provided with an L1M fire detection and voice alarm system
- There is a smoke venting system in the atrium
- BS 7974 recommends that the peak heat release rate from a metal wardrobe would be 270kW. On this basis it was not considered necessary to model this small fire size.

3.4.3 Consideration

As discussed above the circulations spaces in the Central Quad are a large undivided volume. The CFD modelling carried out showed that a relatively large fire from a room facing onto the atrium at ground floor would not result in untenable conditions on the balconies.

A fire in a metal locker is unlikely to spread, particularly in a building provided with L1M fire detection and alarm. This would therefore, be a very small fire in a very large volume space. The amount of smoke produced would be significantly less than for a fire in a room adjacent to the atrium. On this basis therefore, in my opinion the condition is unwarranted and should be removed.

4.0 RECOMMENDATIONS

The Building Control Authority should be directed to

Condition 1

The BCA should be directed to remove this condition.

Condition 2

This condition should be reworded as follows

"In the event of design changes to the building requiring a revised Fire Safety Certificate the smoke control strategy and design shall be reassessed if necessary to ensure that tenable conditions are still maintained on the atrium balconies."

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017.

Condition 3

This condition should be reworded as follows

"A total of 118m² of openable ventilation should be provided to the lower ground floor, of which 82m² may be via permanently open voids linking the circulation corridors to the ground floor above. The remaining openable vents may be via knock out pavement lights to external and be dispersed so that each room between gridlines 5-8 are provided with ventilation."

Reason

To ensure compliance with Part B of the Second Schedule to the Building Regulations, 1997 to 2017

Condition 4

The BCA should be directed to remove this condition.

Signed.....
Martin Davidson
B.Eng MSc (Fire Eng) CEng MIEI

Date: 29th August 2018