NYC Buildings Department
280 Broadway, New York, NY 10007

Rick D. Chandler, P.E., Commissioner

BUILDINGS BULLETIN 2017-014

Technical

Supersedes: None

Issuer: Gus Sirakis, P.E.
Assistant Commissioner for Technical Affairs and Code Development

Issuance Date: October 25, 2017

Purpose: This document establishes the minimum criteria for a fire engineering analysis with respect to section BC 705.12

Related Code Section(s):	AC 28-104.7.11	BC 703.5	BC 705.8	BC Table 705.8
	BC 705.12	BC 705.12.1	BC 705.12.1.1	BC 705.12.2
	BC Table 1406.2.1.2			

Subject(s): Cantilevered Buildings; Fire Engineering Studies; Fire Engineering Analysis; Fire Modeling

This bulletin clarifies code requirements and establishes the minimum submittal requirements for fire engineering studies in regards to cantilevered buildings.

I. Introduction

Per BC 705.12, where a portion of a building is cantilevered over an adjacent building or tax lot by a horizontal distance greater than 1 foot (305 mm), the cantilevered portions shall be protected with a construction or engineering approach that conforms to a fire engineering analysis acceptable to the commissioner. Per BC 705.12.2, a separate approval from the Fire Department that the proposed cantilever complies with the provisions of the New York City Fire Code with respect to access to buildings and roofs is required.

II. Submittal Procedure

Where a fire engineering analysis is required, such analysis and supporting documentation shall be submitted to the Borough office by way of a Construction Code Determination (CCD1) form to confirm that the analysis and supporting documents comply with this bulletin and the requirements of BC 705.12. The applicant shall request for an "Interpretation or Clarification" in Section 5, Description of Request. All supporting documentation shall be signed and sealed by a registered design professional from the issuing party as applicable. In addition to the Fire Department approval with respect to building and rooftop access, FDNY may require a separate submission to verify compliance with the NYC Fire Code.

III. Analysis

Per BC 705.12.1, an analysis shall demonstrate that the cantilevered portions and surrounding building elements will withstand the anticipated effects of a design fire in accordance with generally accepted fire engineering principles. For such analyses, the Department accepts a Computational Fluid Dynamics (CFD) computer model and finite element modeling. However, other calculation methods for determining radiant

heat flux and temperatures based on basic engineering principles may be accepted where deemed appropriate by the Department.

IV. Fire Modeling Methodology

a. Modeling Conditions. The fire engineering analysis shall be based on accurate building conditions. The Department requires the fire engineering report to include a written description of the existing adjacent building underneath the cantilever, as well as the cantilevered building. The descriptions of both buildings should include all relevant fire protection and life safety features of the buildings, including, but not limited to the buildings' use, fire-resistance ratings of exterior walls and horizontal assemblies, and detailed information about active fire protection systems. The description for the cantilevered building shall include detailed information about the cantilever such as where the cantilevered portions begin, projected distance over the lot line and percentages of permitted openings in exterior walls.

b. Fuel Load Density and Heat Release Rate. The model shall incorporate a fire fuel load density (in kW/m2, MJ/m2, or BTU/s/ft2), and heat release rate per unit area (in kW/m2, MJ/m2 or BTU/s/ft2) based on the existing building's occupancy taken from generally accepted fire engineering guidance documents or where warranted based on site conditions, a larger fire hazard shall be used. For cantilevers over a combustible roof, a minimum heat release rate per unit area of 500kW/m2 shall be applied.

For cantilevers over non-combustible roofs, values for fuel load density and heat release rate shall be obtained from various references as provided below:

- NFPA 557;
- SFPE Handbook of Fire Protection Engineering;
- NFPA 92, Annex B;
- CIBSE Guide E; or
- an equivalent document providing fire engineering guidance

c. Simulation Duration. The fire engineering analysis shall indicate the duration of the fire simulation. The Department requires, at a minimum, a 30 minute simulation be performed and may request longer durations if deemed necessary.

d. Ventilation Conditions. When preparing the fire engineering analysis, it shall be assumed that optimal ventilation is provided to fuel the fire within the existing structure. Additionally, it shall be assumed that a minimum number of existing exterior openings have failed to simulate maximum heat production. The windows facing or located directly below the cantilevered portion shall be among the exterior openings assumed broken.

e. Ambient Exterior Temperature. The fire engineering analysis shall use an ambient temperature condition of a summer design as per ASHRAE/Smoke Control Handbook.

f. Exterior Enclosure Conditions. The analysis should account for the type of materials used for the façade and window assembly, such as type of glass (glass curtain wall, glass windows, plane float glass, tempered glass, double glazed glass, etc.) and the exterior wall coverings of the façade.

g. Design Fire Scenario. Per BC Section 705.12.1.1, with respect to the existing building or other controlling fire hazard, the design fire scenario shall include a scenario to burn-out, where any active fire suppression systems do not operate, and that the fire department does not intervene. The applicant must determine the most critical design fire scenario based upon various roof levels, potential fuel sources, and proximity to the cantilever. The following considerations shall apply to combustible and noncombustible roofs underneath the cantilever:

1. Combustible roofs shall model a fully-involved rooftop fire with a heat release rate of no less than 500 kW/m2 applied over all roof surfaces.

2. Noncombustible roofs modelling shall assume the more conservative design fire scenario of either a fire on the upper most floor of the adjacent building below the cantilever or a rooftop fire. For a

design fire scenario on the upper most floor, all interior vertical compartmentation, including at the entrances to the stairways, shall be assumed to have been removed. For design fire on the rooftop, the design fire scenario shall utilize the greatest fuel source, i.e. near rooftop equipment, water towers, cooling towers, photovoltaic systems or any other miscellaneous combustible roof structures.

i. Factor of Safety. The applicant must include a factor of safety in the analysis to compensate for difficult to analyze conditions such as wind conditions or other contributing factors. The Department deems 20% as a minimum acceptable factor of safety to be added to the baseline heat release rate per unit area. Such increased rate with the added factor of safety shall be used to analyze the design fire scenario, except the Department may request a higher factor of safety if deemed necessary.

3. The fire engineering analysis shall include a rooftop plan depicting current conditions or photograph of the existing building's roof to verify the placement of the design fire scenario location.

   Where the controlling fire is not a rooftop fire, the analysis shall provide plans adequate to verify the location of the design fire scenario location.

h. Performance Objectives.

1. Structural Elements and Horizontal Assemblies. Per BC 705.12, in no case shall the protection for structural elements and horizontal assemblies be less than required for the construction class of the building. The fire engineering analysis shall demonstrate that all cantilevered portions of the building shall withstand the anticipated effects of a design fire. For most materials and assemblies, ASTM E 119 is the standard performance-based test method used to determine a fire-resistance rating for building construction and materials, and shall serve as the failure criteria for the analysis. The fire engineering analysis shall include a time temperature curve depicting the modeled adiabatic surface temperatures for the entire simulation and the failure criterion used. Where the adiabatic temperatures modeled exceed the temperature failure criterion, calculations shall be provided demonstrating the structural systems are stable when analyzed to the integrity load combinations for extraordinary events[1]. These calculations shall be verified by a Structural Engineer to ensure that structures are capable of withstanding the effects. However, the Department may also require such calculations to include the evaluation of structural assemblies if deemed necessary.

2. Exterior Walls. Per BC 705.12, in no case shall the fire-resistance rating of exterior walls be less than required for a lot line condition. The fire engineering analysis shall demonstrate that all cantilevered portions of the building will withstand the anticipated effects of a design fire. For most materials and assemblies, ASTM E 119 is the standard performance based test method used to determine a fire resistance rating for building construction and materials, and shall serve as the failure criteria for the analysis. The fire engineering analysis shall include a time temperature curve depicting the modeled adiabatic surface temperatures for the entire simulation and the failure criterion used. Where exterior walls are loadbearing, such walls shall satisfy the requirements listed above for structural elements.

   i. ***Fire Separation Distance****.* The fire separation distance shall be measured perpendicularly from the face of the exterior wall to any neighboring building or tax lot line, whichever is closer. The fire separation distance shall be measured individually from all exterior walls cantilevered over a tax lot line.

   ii. ***Wall Covering Failure Criterion****.* If the exterior wall coverings include combustible materials, the maximum tolerable level of incident radiant heat flux that does not cause sustained flaming of the assembly shall be used as prescribed in BC Table 1406.2.1.2.

3. Permitted Openings. Per BC 705.12, in no case shall the amount of openings be greater than permitted for a lot line condition pursuant to BC 705.8. For additional clarification on how to apply BC 705.8, refer to Buildings Bulletin 2015-017.

[1] For guidance see ASCE 7-16 Section 2.5.2

i. ***Fire Separation Distance***. The fire separation distance shall be measured perpendicularly from the face of the exterior wall to any neighboring building or tax lot line, whichever is closer. The applicant shall demonstrate compliance with BC 705.8 and Buildings Bulletin 2015-017 by measuring the fire separation distance individually from all exterior walls that cantilever over a tax lot line.

ii. ***Glazing/Window Assembly Failure Criteria***. Per BC Section 703.5, fire-resistant-rated glazing is required to be tested in accordance with ASTM E 119 or UL 263. Where fire-resistance-rated glazing is not utilized, glass cracking is deemed a failure by the Department.

The fire engineering analysis shall include the failure criteria in which the window framing material would separate from the façade, burn or melt. Furthermore, the fire engineering analysis shall include information regarding the window sealant and gaskets. The heat flux value used in the analysis shall accurately represent the window assembly, but in no case exceed 16kW/m2. Where the applicant can provide fire testing that is specific to the proposed window assembly, the Department may allow a greater heat flux value. Where such information is not yet available, the analysis must establish the minimum criteria of such window assembly.

i. Temperature Measurement Devices. The CFD model, or equivalent modeling program, shall include temperature measuring devices in various locations on the proposed structure's façade, beneath the cantilever, and along structural supports and members to adequately determine the adiabatic surface temperatures during the simulation.

V. Fire Modeling Results and Recommendations

The fire engineering analysis shall provide a summary of the results from a nationally recognized and validated CFD fire modeling program, or an equivalent calculation methodology. Acceptable results are those that indicate the structural supports and members, projecting assemblies, and exterior façade and openings withstand the anticipated effects of a design fire. Prior to acceptance by the Department, the fire engineering analysis shall include a statement that the structure passes the design fire simulation, and is in accordance with BC Section 705.12.

a. Peer Review. In accordance with AC 28-104.7.11, the Department requires that a peer review be performed to support the fire engineering analysis required by BC 705.12. The peer review shall be performed by an independent, qualified registered design professional to determine compliance with basic engineering principles, the Building Code, other applicable laws and rules of the Department, and this Buildings Bulletin. The peer reviewer shall have relevant experience, as deemed acceptable to the Department, performing fire-engineering analyses. The peer reviewer shall submit a signed and sealed letter stating that the fire engineering analysis is acceptable and in compliance with basic engineering principles, the Building Code, other applicable laws and rules of the Department, and this Buildings Bulletin.

VI. Required Items for a Complete Submittal

a. Fire Engineering Analysis: Roof Plan. The fire engineering analysis shall include a detailed roof plan of the adjacent existing building, elevation drawings, building sections, soffit details of cantilevered portions and a site plan of the proposed building as well as the adjacent building under the cantilever. All rooftop features such as equipment, bulkheads, openings and other elements shall be indicated and all relevant information provided, including heights of such features.

b. Fire Engineering Analysis: Window Assembly. The fire engineering analysis shall include window assembly details and specifications to substantiate the failure criteria listed above in section IV(h)(3)(ii).