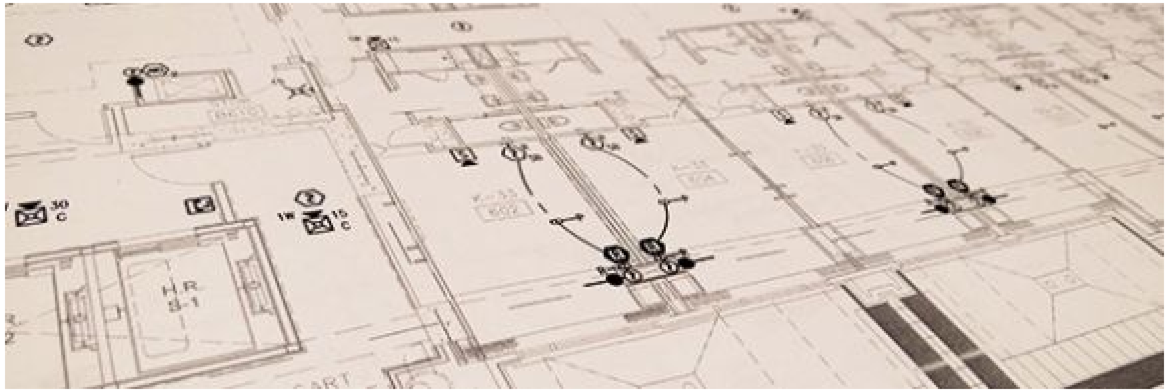

Advanced Plan Review

October 24, 2018

David F. Kokot, P.E.

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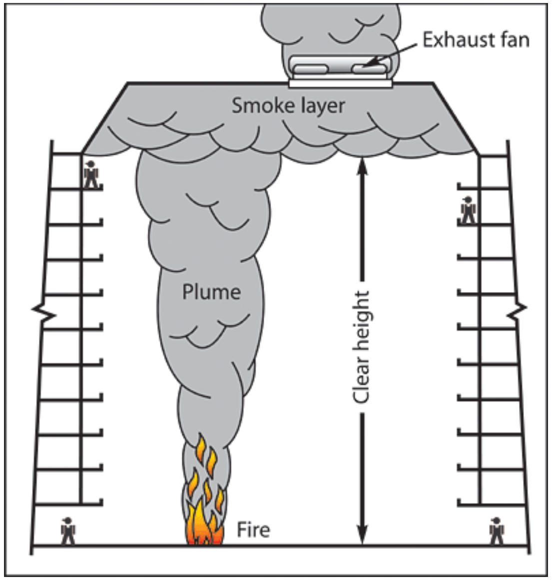
DATE: 10/23/18	
TITLE:	DWG NO. REV

Agenda

1. Background of Advanced Plan Review
2. Building Exits/Occupant Load
3. Fire Pumps
4. Standpipes
5. Fire Suppression Systems
6. Smoke Control
7. Alternative materials and methods
8. Reviewing an engineering analysis
9. What to look out for
10. Practical Practice



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Background of Advanced Plan Review

Advanced plan review consists of a higher level of technical expertise to evaluate plans developed by competent professionals that show how a building, site or system will be constructed in accordance with the applicable codes for the authority having jurisdiction.

Advanced reviews can include review of reports, alternative methods, water supply systems, mixed use facilities, and larger scale projects, to name a few.

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Background of Plan Review

The intent of plan review is to determine if the design submitted meets the minimum requirements of the codes in effect at the time of submission.

It does not mean that the reviewer has to correct the plans for the design professional.

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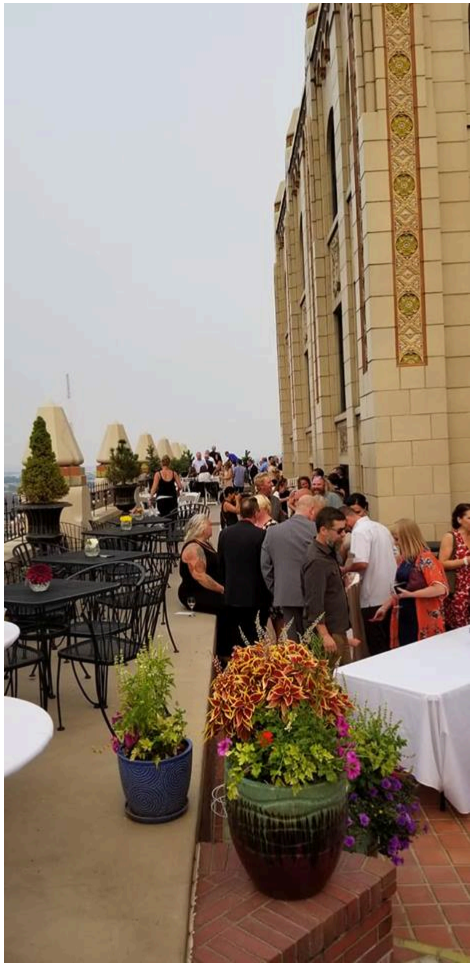
Building Exits and Occupant Loading



The requirements for building access and occupant loading are from Chapter 10 of the Building Code. That chapter is repeated in the IFC.

If it is in the Building Code – why would we be involved?

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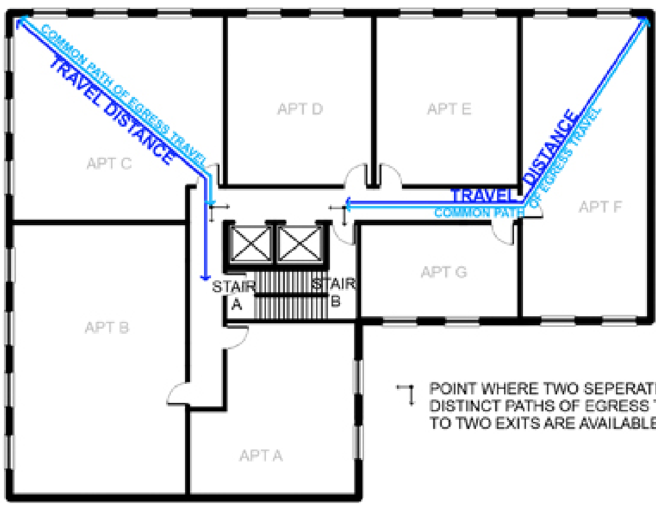
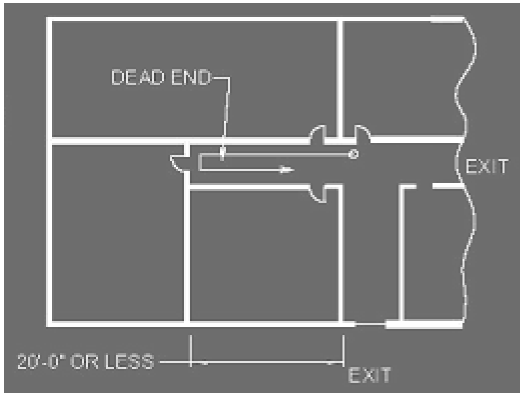
Building Exits

Although the review of building exits is primarily under the Building Code, it is important that the Fire Code Plan review also look at it. Paths of egress are also paths of ingress for responders. Adequate exit width, distance, and capacity are necessary for a building to not only meet the code, but to provide adequate life safety.



POINT WHERE TWO SEPERATE AND DISTINCT PATHS OF EGRESS TRAVEL TO TWO EXITS ARE AVAILABLE



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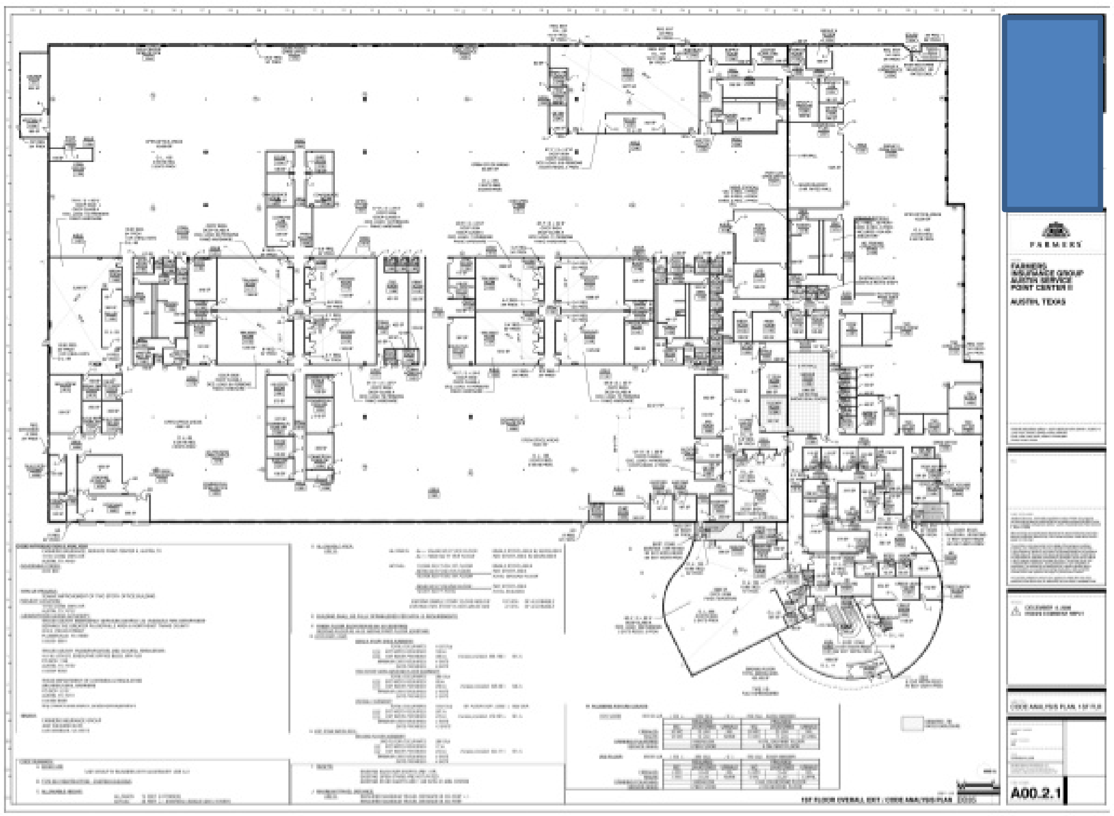
Building Exits

An exit analysis normally accompanies the building permit plans. This analysis can show the designed occupancies, occupant loads, as well as capacities of the exits (not unlike a traffic analysis).



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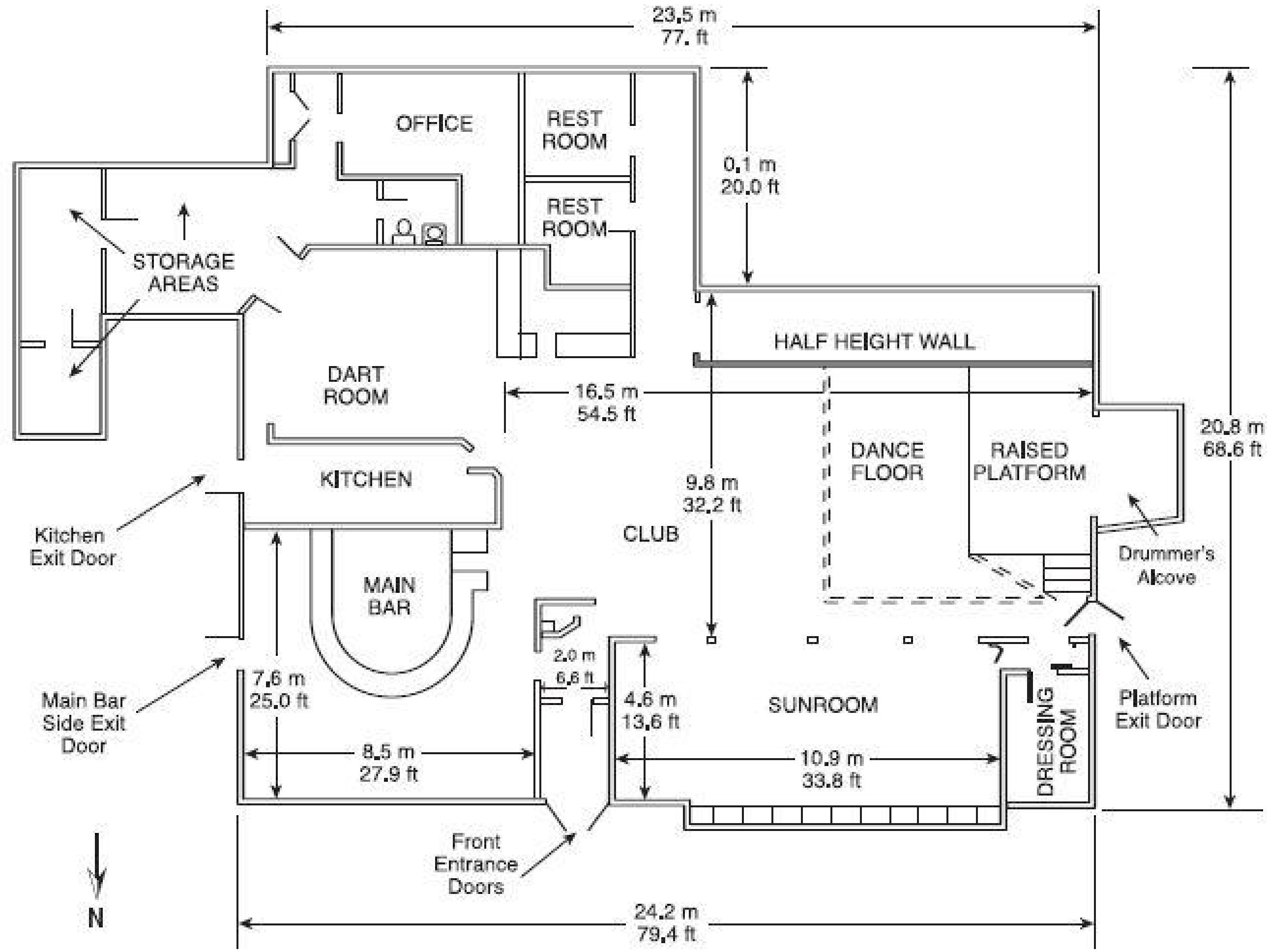

Why is an egress review important?

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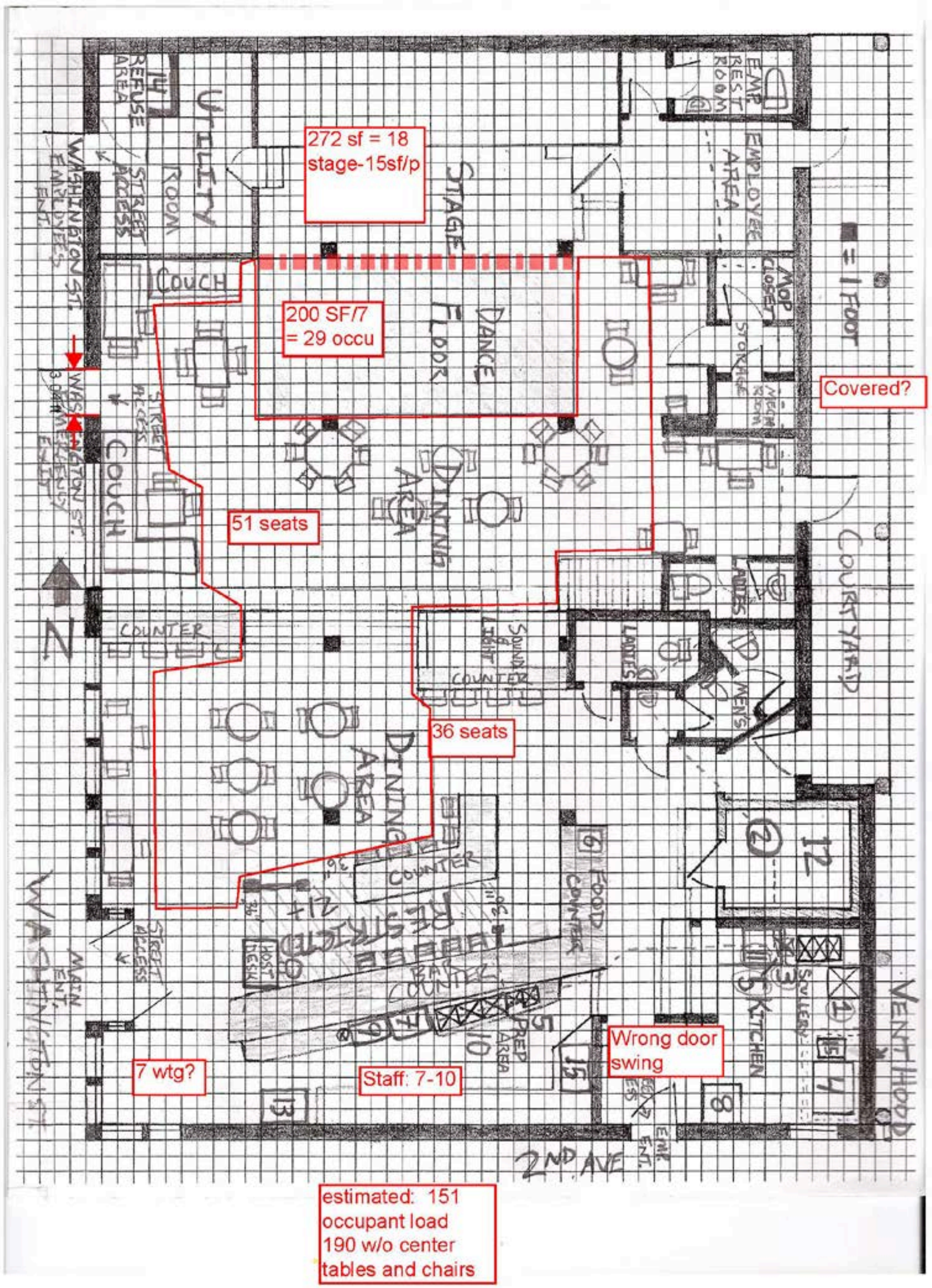

Why should we focus on occupant load?

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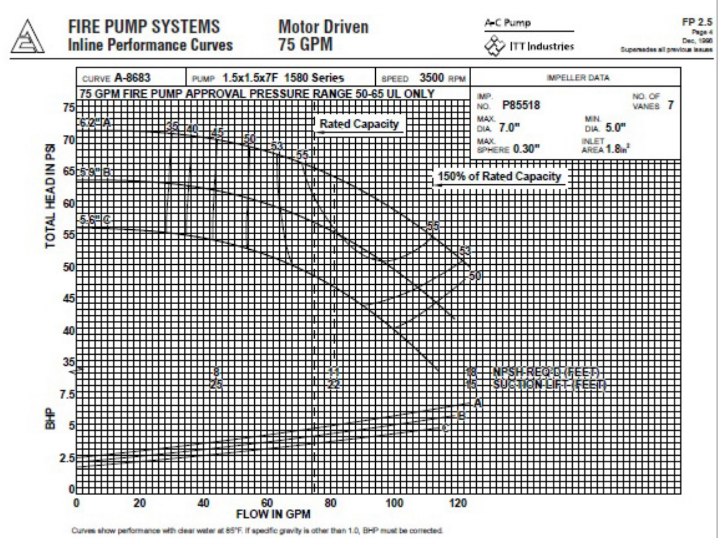
Fire Pumps

A fire pump is a part of a fire sprinkler system's water supply and powered by electric, diesel or steam. The pump intake is either connected to the public underground water supply piping, or a static water source. The pump provides water flow at a higher pressure to the sprinkler system risers and hose standpipes.

Fire Pumps Review

Review of the design:

1. Verify the fire water-supply information
2. Verify the required flow
3. Verify the required pressure
4. Verify the pressure boost required
5. Verify that pump selected is between 100% and 150% of rated flow. Preferably between 115% and 135%.
6. Does the pump provide sufficient boost at the flow demand?



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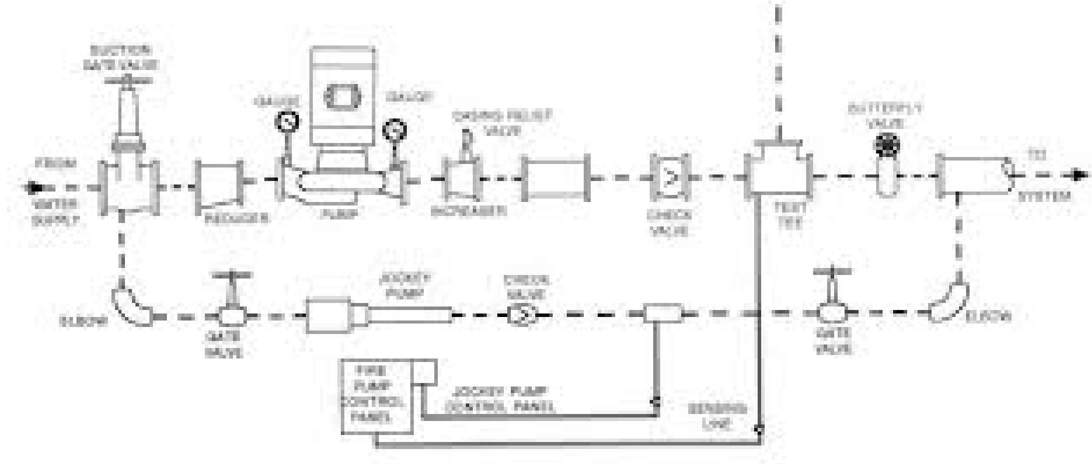
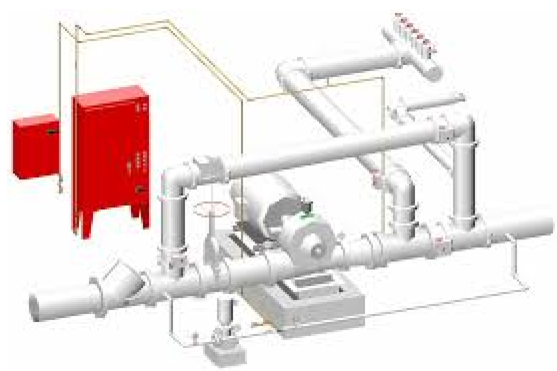
Fire Pumps





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Standpipes

Standpipe systems are permanent piping systems, and associated equipment, that transports water from a reliable water source to designated areas of a building where hoses can be deployed for fire- fighting.

Standpipes

What to review for standpipes:

1. Class I, Class II, or Class III
2. Wet or dry
3. Accessibility
4. FDC and supply hydrant location
5. Location of standpipe outlets
6. Design flow calculation at outlet(s)
7. Design pressure calculation at outlet(s)
8. Height of standpipe – How much can your apparatus pump?

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Standpipes

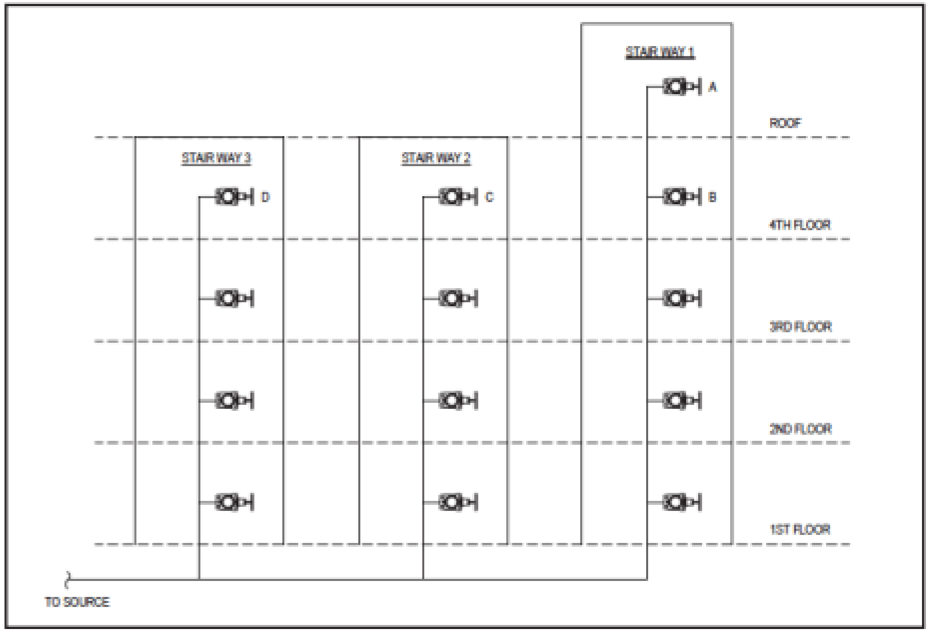

Figure 5. Outlet flow requirements.

Standpipe layout – depends on size and height of building

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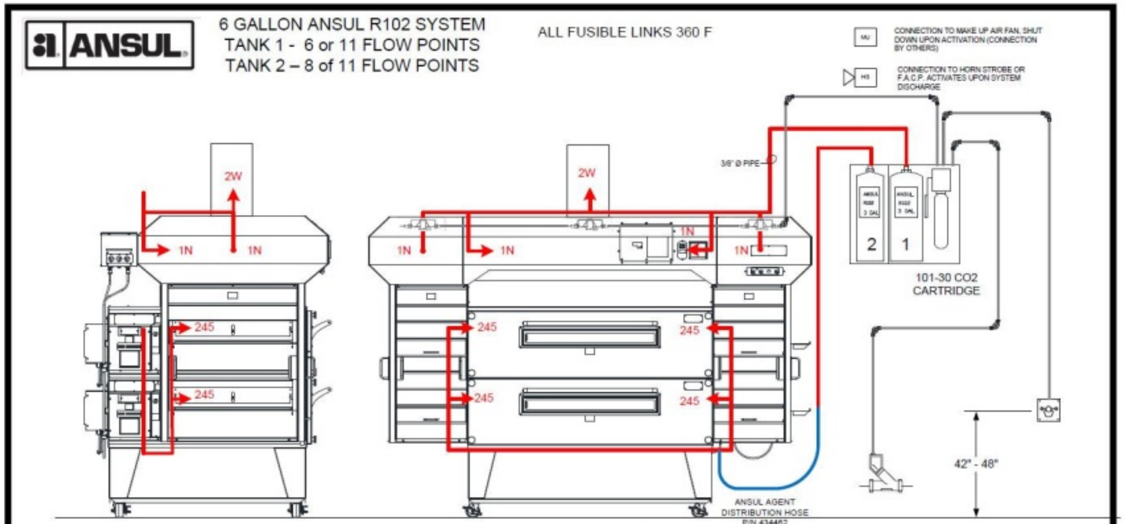
Fire Suppression

These type of systems use a suppression medium other than water. This includes inert gases, foam, chemical, and other gases. These systems require an engineered design to obtain the proper level of suppression for time, containment, concentration, and environmental effects.

Fire Suppression



DOUBLE DECKER CHAIN BROILER

SIDE VIEW

FRONT VIEW

GAS SHUT OFF VALVE TO BE INSTALLED BY CUSTOMERS PLUMBER

REMOTE PULL STATION

SHALL BE INSTALLED 42" - 48" ABOVE THE FINISHED FLOOR AND A DISTANCE OF AT LEAST 10FT FROM THE HAZARD BUT NOT MORE THAN 20FT. IT SHALL BE INSTALLED IN THE PATH OF EXIT AND REQUIRE A MAXIMUM FORCE OF 40 LBS AND A MAXIMUM MOVEMENT OF 14" FOR ACTUATION

PRE-ENGINEERED SYSTEM SHOP DRAWING ONLY – NOT TO SCALE

Requirements	Supply Line	Duct Branch Line	Plenum Branch Line	Appliance Branch Line
Pipe Size	3/8 in.	3/8 in.	3/8 in.	3/8 in.
Maximum Length	40 ft (12.2 m)	8 ft (2.4 m)	4 ft (1.2 m)	12 ft (3.7 m)
Maximum Rise	6 ft (1.8 m)	4 ft (1.2 m)	2 ft (0.6 m)	2 ft (0.6 m)
Maximum 90° Elbows	9	4	4	6
Maximum Tees	1	2	2	4
Maximum Flow Numbers	11*	4	2	4

SIZE	FSCM NO	DWG	REV
		KITCHEN FIRE SYSTEM	
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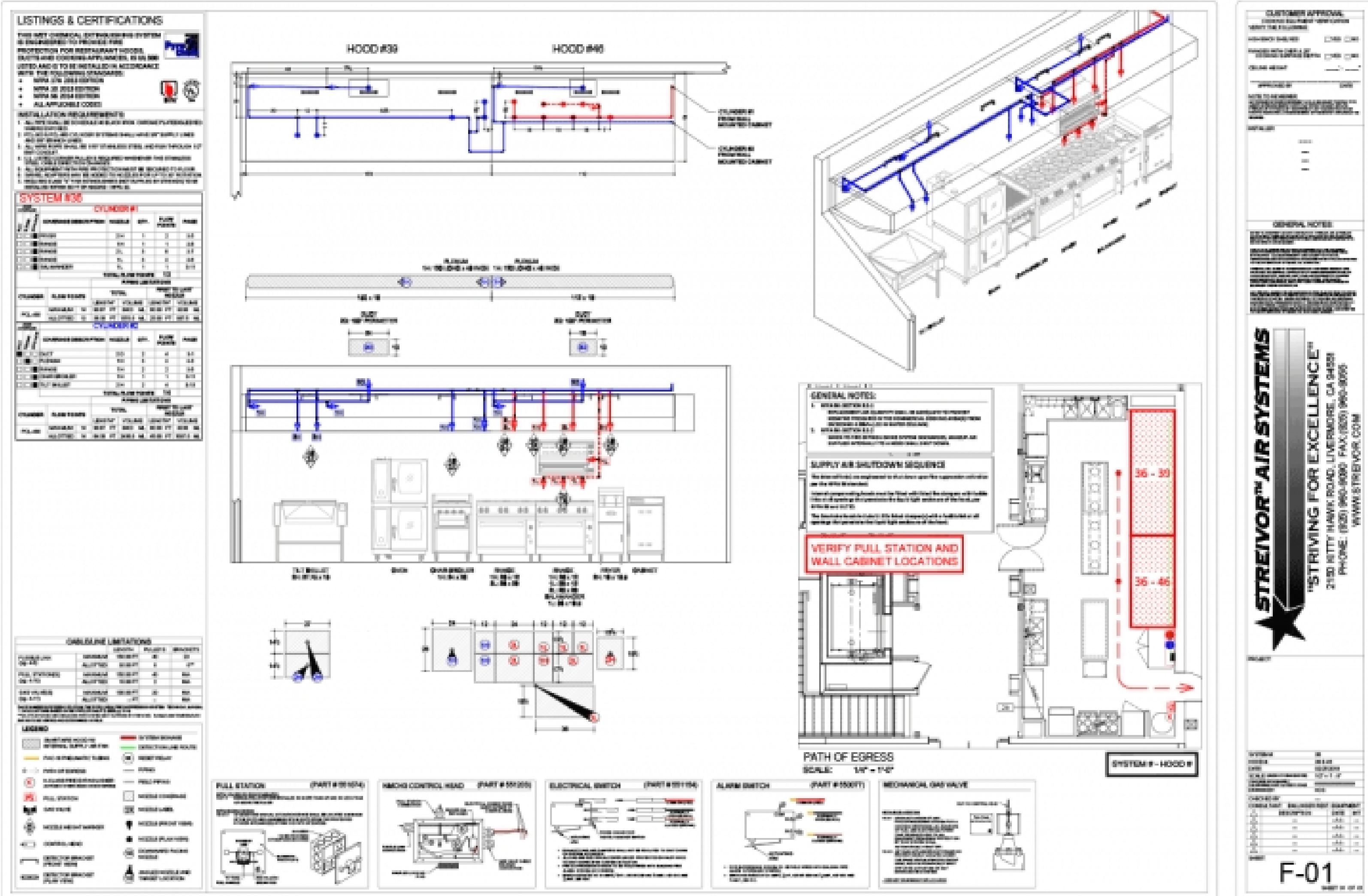
Fire Suppression



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Smoke Control

The principal of redirecting hazardous **smoke** and fumes in the instance of a building fire.

Designing and installing the smoke control system correctly and efficiently can be difficult; identifying the most appropriate system-type and configuration can also be confusing. Coordination is challenging because it is a multi-disciplinary affair. Proper plan review for these systems requires a good knowledge of engineering and smoke behavior.

Engaging a fire protection engineer to perform computer fire/smoke modeling can seem like overkill to an architect, although it is necessary for the interconnectedness of modern buildings. Architects and owners do not want bigger fans or more equipment than what is absolutely necessary.

Smoke Control

Smoke control can be passive or active.

Passive – Smoke doors, smoke curtains, vents

Active – Pressurization, exhaust, airflow

Smoke Control

Basis of Design

The most important part of smoke modeling, besides accurately simulating the smoke exhaust and supply, is defining the design fire scenarios. The design fire quantifies the ‘load’ that will be placed on the smoke control system. Fire test and growth data is available and should be used to justify the design fire.

The size and characteristics of it need to reflect the potential combustible loads within the space. For example, if a small, upholstered chair is used as the design fire for a large atrium space where there may be seasonal Christmas trees or cars on display, then the smoke control system will be undersized.

Plan review needs to understand and verify that the basis of the design is appropriate.

The design also needs to address the potentially different fire scenarios.

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Smoke Control

IFC Section 909 mandates a smoke control rational analysis accompany the project construction documents. The rational analysis is required to justify the smoke control systems to be employed, the method of operations, and the system equipment.

The analysis must also cover the following topics:

- stack effect;
- temperature effect on fire;
- wind effect;
- HVAC systems;
- climate; and
- duration of operation;
- smoke control interaction (more than one system in building).

Plan review needs to verify that these factors have been incorporated into the analysis and modeling.

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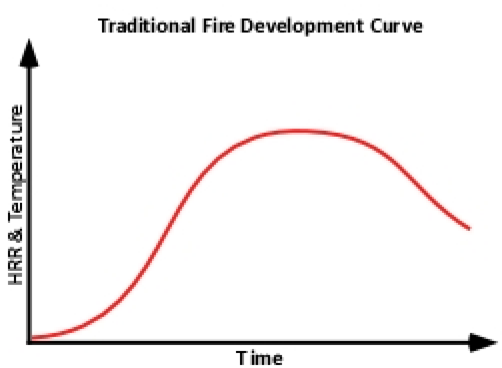
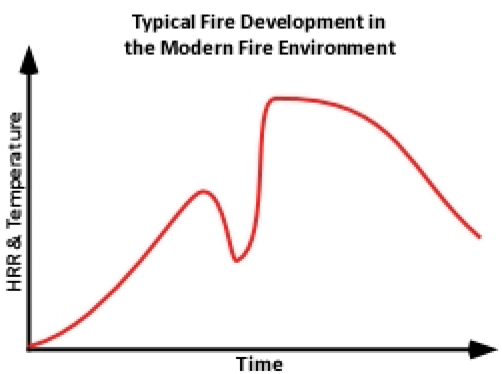
Smoke Control

Computer modeling software is normally used to simulate a fire scenario. It usually includes some nice graphics and a report of the fire growth and smoke generation over a period of time.

Review the inputs to the model (which should be provided) and be sure that they are appropriate for the different scenarios that you are expecting.

For example, if the design fire is products that will have a steady growth curve, it does not make sense to use a fast/hot fire growth curve. In addition, does the curve simulate actual conditions?

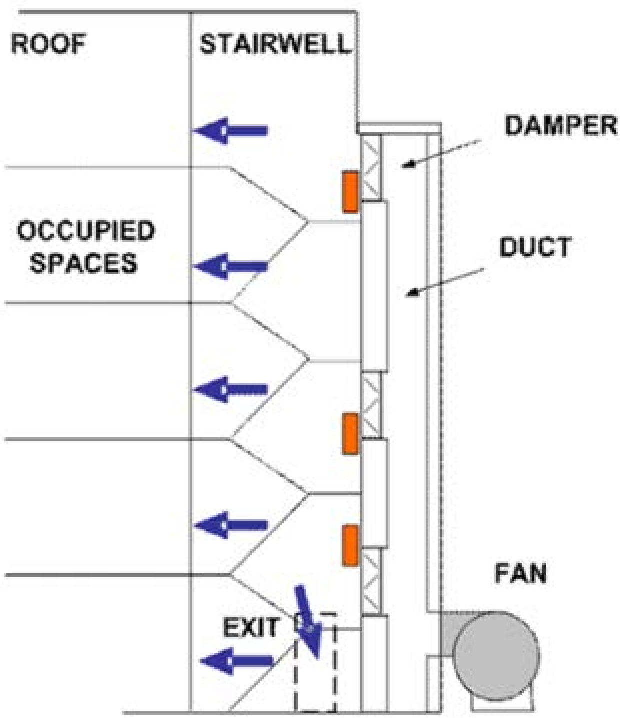


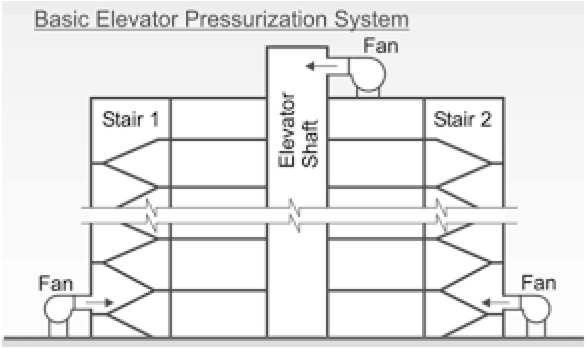


Smoke Control

Shaft Pressurization

One of the most common smoke control systems is used to pressurize elevator and stairway shafts. These systems are designed to move air into the shaft to create a "positive pressure" to keep smoke from entering the building. The requirements for these systems is in IFC 909.20 and 909.21.





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Smoke Control

909.20.4.4 Stairway or Ramp Shaft Air Movement System

The stairway or ramp shaft shall be provided with a dampered relief opening and supplied with sufficient air to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) in the shaft relative to the vestibule with all doors closed.

909.20.5 Stairway and Ramp Pressurization Alternative

Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the vestibule is not required, provided each interior exit stairway or ramp is pressurized to not less than 0.10 inch of water (25 Pa) and not more than 0.35 inches of water (87 Pa) in the shaft relative to the building measured with all interior exit stairway and ramp doors closed under maximum anticipated conditions of stack effect and wind effect.

Smoke Control

909.21.1 Pressurization Requirements

Elevator hoistways shall be pressurized to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) and a maximum positive pressure of 0.25 inch of water (67 Pa) with respect to adjacent occupied space on all floors. This pressure shall be measured at the midpoint of each hoistway door, with all elevator cars at the floor of recall and all hoistway doors on the floor of recall open and all other hoistway doors closed. The pressure differentials shall be measured between the hoistway and the adjacent elevator landing. The opening and closing of hoistway doors at each level must be demonstrated during this test. The supply air intake shall be from an outside, uncontaminated source located a minimum distance of 20 feet (6096 mm) from any air exhaust system or outlet.

Exceptions:

1. On floors containing only Group R occupancies, the pressure differential is permitted to be measured between the hoistway and a dwelling unit or sleeping unit.

2. Where an elevator opens into a lobby enclosed in accordance with Section 3007.6 or 3008.6, the pressure differential is permitted to be measured between the hoistway and the space immediately outside the door(s) from the floor to the enclosed lobby. 3. The pressure differential is permitted to be measured relative to the outdoor atmosphere on floors other than the following: 3.1. The fire floor. 3.2. The two floors immediately below the fire floor. 3.3. The floor immediately above the fire floor. 4. The minimum positive pressure of 0.10 inch of water (25 Pa) and a maximum positive pressure of 0.25 inch of water (67 Pa) with respect to occupied floors are not required at the floor of recall with the doors open.

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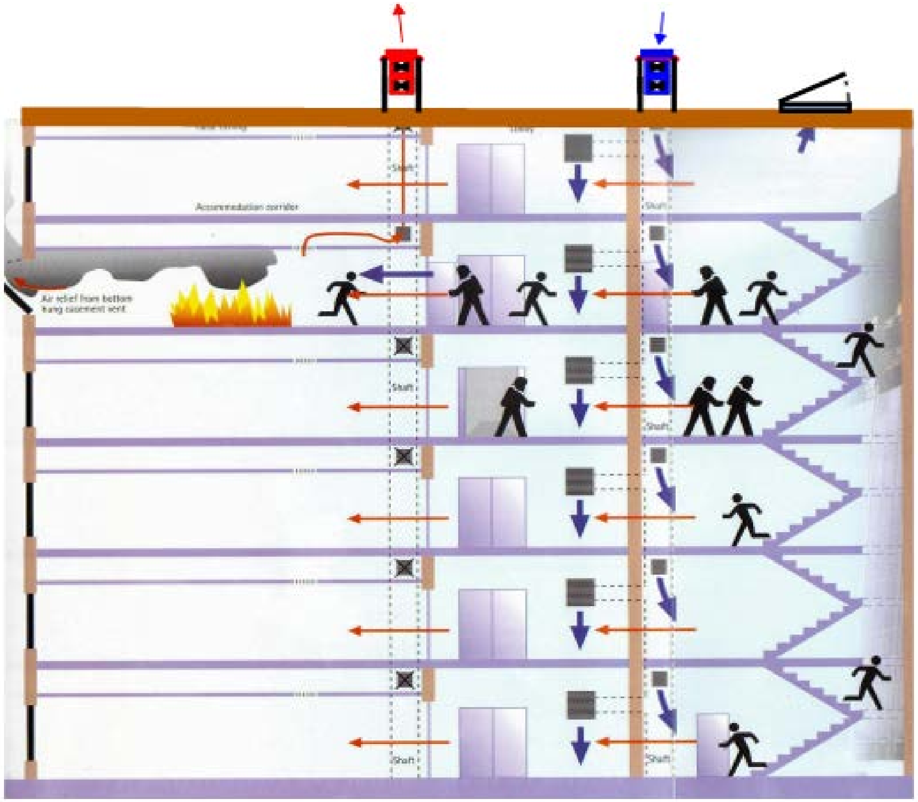
Smoke Control

Plan review needs to verify that the calculations or modeling will meet the requirements of the code and have properly addressed the variables that the system could encounter.



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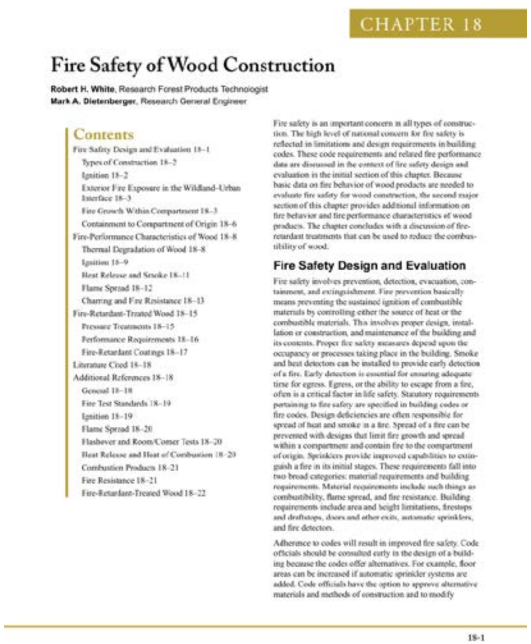
Alternative Materials and Methods

Alternative materials and methods are included in the Fire Code to allow for a performance-based type of design in lieu of a prescriptive code path. These proposals are required to provide an engineering analysis to justify their proposed alternative compliance.



CHAPTER 18

Fire Safety of Wood Construction

Robert H. White, Research Forest Products Technologist
Mark A. Dietenberger, Research General Engineer

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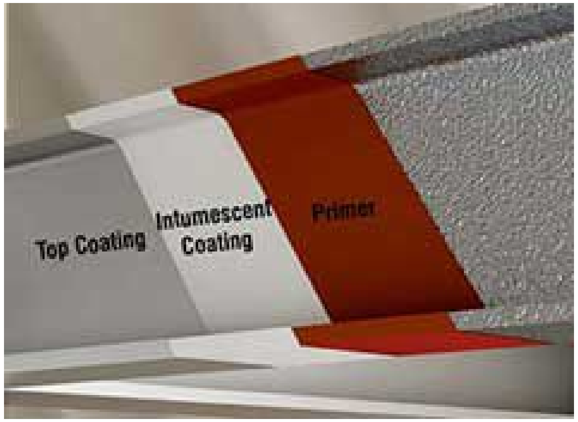
Fire safety is an important concern in all types of construction. The high level of national concern for fire safety is reflected in limitations and design requirements in building codes. These code requirements and related fire performance data are discussed in the context of fire safety design and evaluation in the initial section of this chapter. Because basic data on fire behavior of wood products are needed to evaluate fire safety for wood construction, the second major section of this chapter provides additional information on fire behavior and fire performance characteristics of wood products. The chapter concludes with a discussion of fire-retardant treatments that can be used to reduce the combustibility of wood.

Fire Safety Design and Evaluation

Fire safety involves prevention, detection, evacuation, containment, and extinguishment. Fire prevention basically means preventing the sustained ignition of combustible materials by controlling either the source of heat or the combustible materials. This involves proper design, installation or construction, and maintenance of the building and its contents. Proper fire safety measures depend upon the occupancy or processes taking place in the building. Smoke and heat detectors can be installed to provide early detection of a fire. Early detection is essential for ensuring adequate time for egress. Egress, or the ability to escape from a fire, often is a critical factor in life safety. Statutory requirements pertaining to fire safety are specified in building codes or fire codes. Design deficiencies are often responsible for spread of heat and smoke in a fire. Spread of a fire can be prevented with designs that limit fire growth and spread within a compartment and contain fire to the compartment of origin. Sprinklers provide improved capabilities to extinguish a fire in its initial stages. These requirements fall into two broad categories: material requirements and building requirements. Material requirements include such things as combustibility, flame spread, and fire resistance. Building requirements include area and height limitations, firestops and draftstops, doors and other exits, automatic sprinklers, and fire detectors.

Adherence to codes will result in improved fire safety. Code officials should be consulted early in the design of a building because the codes offer alternatives. For example, floor areas can be increased if automatic sprinkler systems are added. Code officials have the option to approve alternative materials and methods of construction and to modify



Alternative Materials and Methods

104.9 Alternative Materials and Methods

The provisions of this code are not intended to prevent the installation of any material or to prohibit any method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. The *fire code official* is authorized to approve an alternative material or method of construction where the *fire code official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability and safety. Where the alternative material, design or method of construction is not approved, the *fire code official* shall respond in writing, stating the reasons why the alternative was not approved.

104.9.1 Research Reports

Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved* sources.

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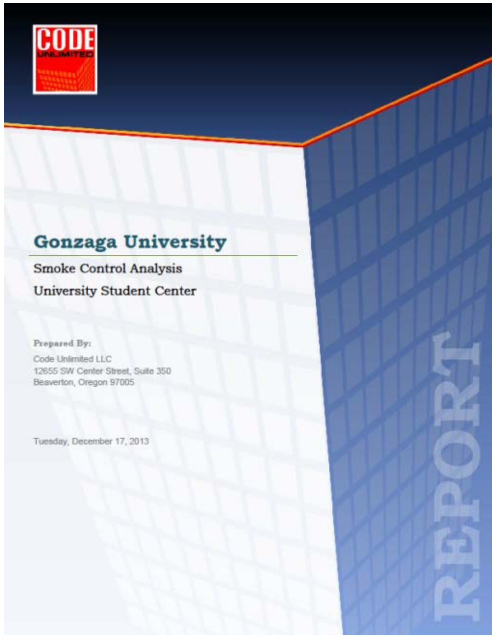
Reviewing an Engineering Analysis

An engineering analysis is normally undertaken as a method to justify or provide an equivalency to the prescriptive codes. In other terms, an engineering analysis can be a performance design.

There are several situations in which an engineering analysis may be required to be reviewed:

- Alternative Materials and Method
- Smoke control Rational Analysis
- Cannabis Facility/Extraction



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Reviewing an Engineering Analysis

In conducting a review of an engineering analysis, the Plan Reviewer will need to fully understand the scope and be capable of doing the review. If that is not the case, then a 3rd party reviewer should be considered.

Keep in mind that when an alternative material or method analysis is conducted, the resulting approval by the AHJ assumes partial responsibility for the design.

It has been stated that as long as a Licensed Architect or Engineer has signed a plan, then that is an indication that all parts of the code have been met. That is not necessarily true.

What to look out for

1. Is the engineer conducting the analysis capable of doing the analysis?
2. Are the assumptions appropriate for the analysis?
3. Are all of the required components included in the analysis?
4. Has adequate supporting information (such as calculations) been provided to conduct a proper review?
5. Are the findings verifiable?
6. Does the report compromise life safety?

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Practical Practice

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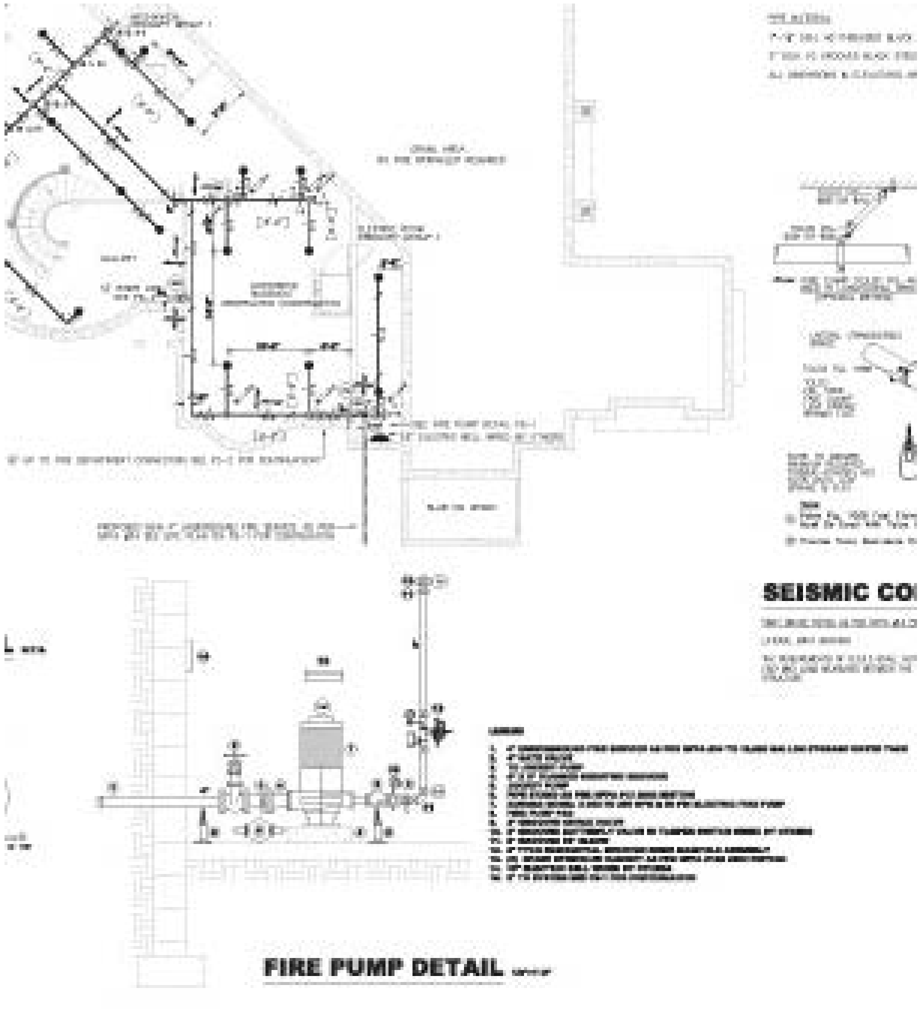

Fire pump

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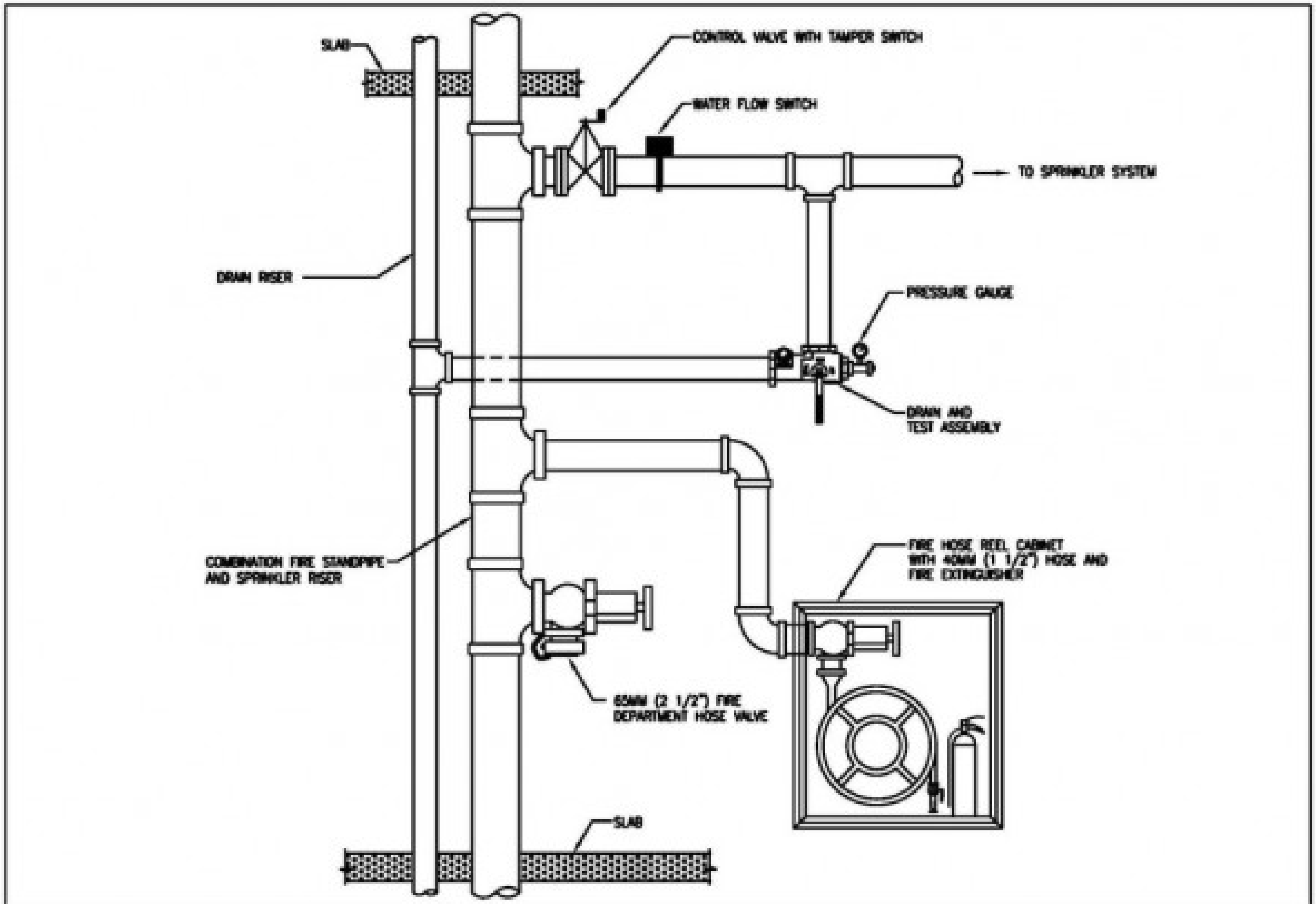
ZONE	REV	DESCRIPTION	DATE	APPROVED



STANDPIPE AND SPRINKLER RISER WITH VALVE ASSEMBLY

X

Standpipe

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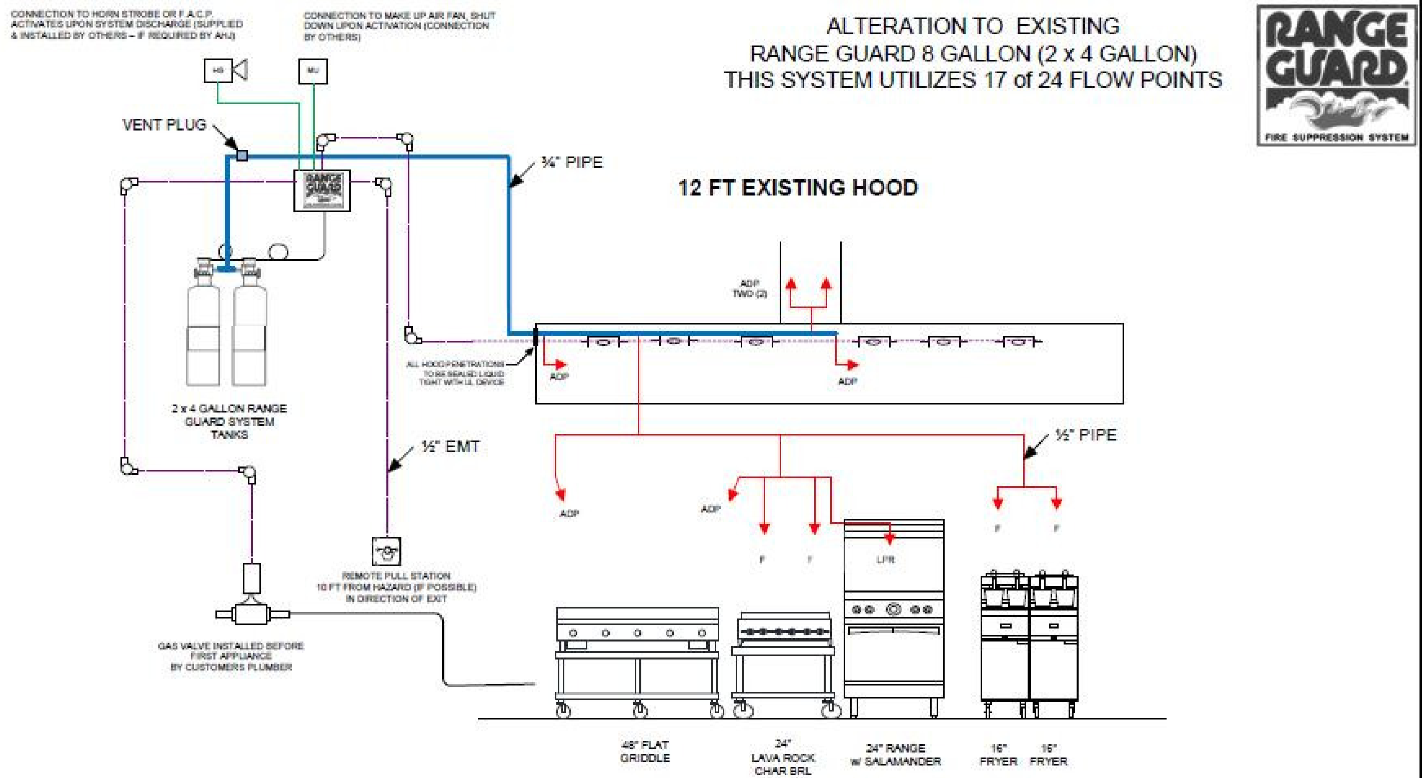

NOZZLE SPECIFICATIONS			
Model Number	Flow Points	QTY	POINTS
ADP	1	9	9
F	2	4	8
LPR	1	1	1
GRW	1	0	0
R	1	0	0
DM	3	0	0
			18

PRE-ENGINEERED SYSTEM SHOP DRAWING ONLY – NOT TO SCALE

SIZE	FSCM NO	DWG	REV
		KITCHEN FIRE SYSTEM	
SCALE N/A		SHEET 1 OF 2	

Fire suppression

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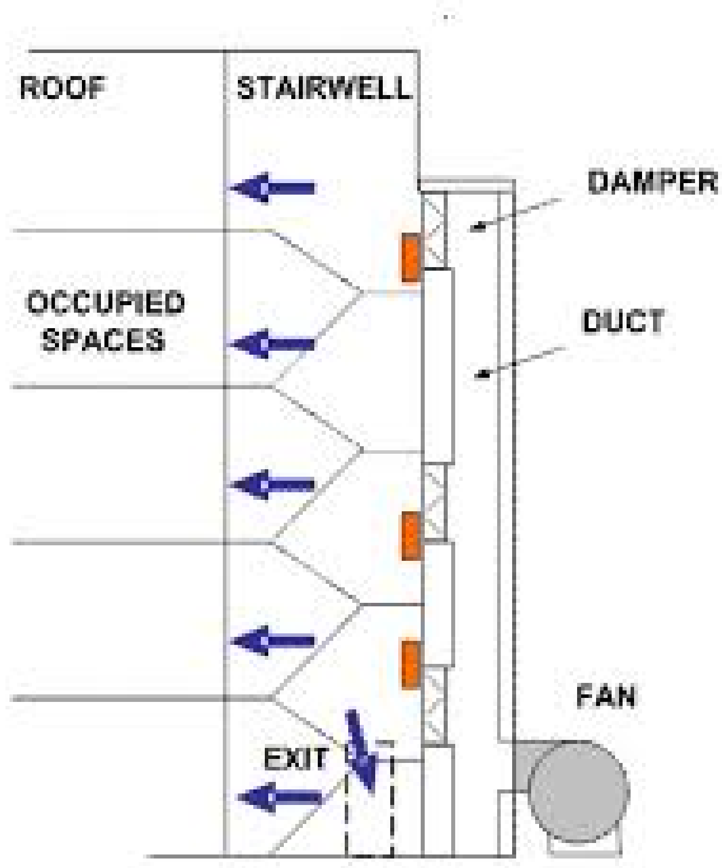
REVIEWED BY: DFK
SCALE: None
DATE: 10/23/18

WASHINGTON STATE FIRE MARSHALS

TITLE:
DWG NO.
REV

REVDATE:102318
183577
KOKOT



Stair pressurization

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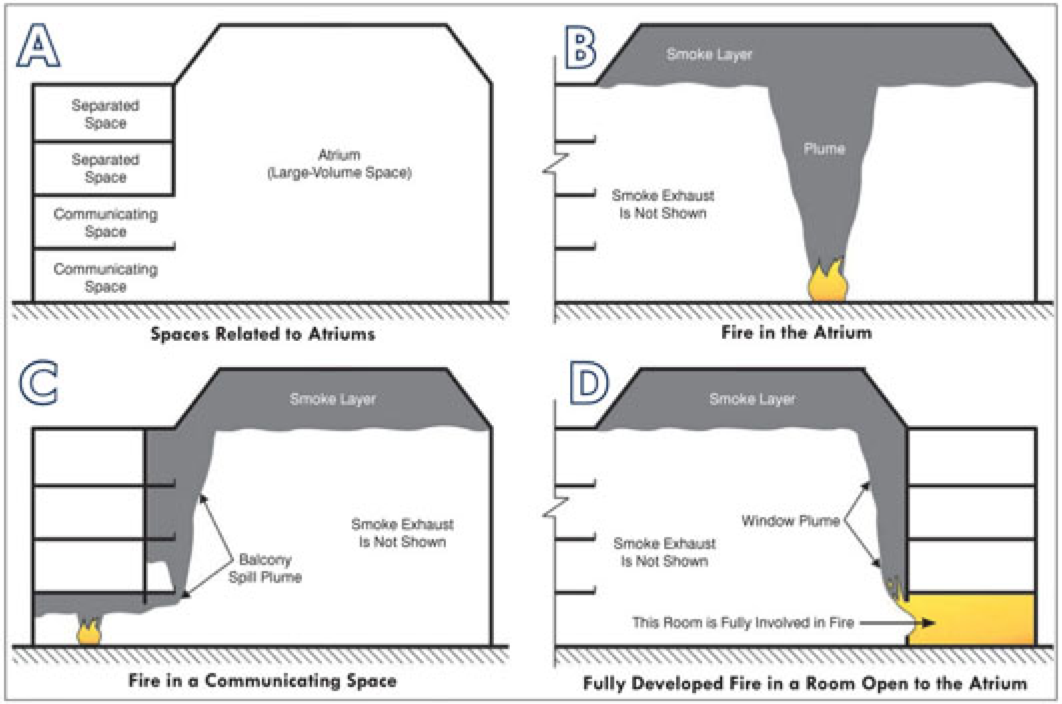

Figure 1: Fire locations for atrium smoke control analysis.

Smoke control report

1. Should the report include different fire scenarios?
2. Has fire growth been accounted for?
3. Is there an analysis for egress time?

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Final Thoughts

Consistency is critical to successful plan review

As easy as this sounds, it can be challenging as no two projects are exactly the same and the Code is not specific enough for all buildings.

No matter your opinion, the Code needs to be followed

To step away from the basic code requirements is what a slippery slope refers to.

Questions?

D C B A

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8 7 6 5 4 3 2 1

ZONE	REV	DESCRIPTION	DATE	APPROVED

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