CAL POLY

Fire Protection Engineering

Fire & Life Safety Analysis

Grant M. Brown Engineering Building

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Mentors

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Institution

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Applicable Codes and Standards

Used During Construction

- ▶ Building Standards Administrative Code – 2001 Edition
- ▶ California Building Code – CBC 2001 Edition
- ▶ California Plumbing Code – CPC 2001 Edition
- ▶ California Mechanical Code – CMC 2001 Edition
- ▶ California Fire Code – CFC 2001 Edition
- ▶ California Electrical Code – CEC 2001 Edition
- ▶ Energy Efficiency Standards – 2001 Edition
- ▶ National Electrical Code – NEC 2001 Edition
- ▶ NFPA 13: Automatic Sprinkler Systems – 1996 Edition
- ▶ NFPA 72: National Fire Alarm Code – 1999 Edition

Current Codes and Standards Applied for Analysis

Used For Analysis

- ▶ California Building Code – CBC 2010 Edition
- ▶ California Plumbing Code – CPC 2010 Edition
- ▶ California Mechanical Code – CMC 2010 Edition
- ▶ California Fire Code – CFC 2010 Edition
- ▶ California Electrical Code – CEC 2010 Edition
- ▶ International Building Code (IBC) – 2012 Edition
- ▶ NFPA Fire Protection Handbook – 20th Edition
- ▶ NFPA 13: Automatic Sprinkler Systems – 2013 Edition
- ▶ NFPA 72: National Fire Alarm Code – 2010 Edition
- ▶ NFPA 101: Life Safety Code (LSC) – 2012 Edition
- ▶ SFPE Handbook of Fire Protection Engineering – 4th Edition

Building Overview

First Floor

Actual Floor Area

26,531 SF

Building 'A' – 19,348 SF

Building 'B' – 5,869 SF

Building 'C' – 1,314 SF

Occupancy Classification

Business Occupancy

- NFPA 101 LSC 2012

Business Group B

- CBC 2010 Section 304.1

Type of Construction

Type II-B

Sprinkler Design

Light Hazard

Ordinary Hazard Group 1

Second Floor

Actual Floor Area

Building 'A' Only – 11,827 SF

Occupancy Classification

Business Occupancy

- NFPA 101 LSC 2012

Business Group B

- CBC 2010 Section 304.1

Type of Construction

Type II-B

Sprinkler Design

Light Hazard

Ordinary Hazard Group 1

41-A Grant M. Brown Engineering Building

Building Construction

Building Construction → *Allowable Increases*

Type II-B, Business Occupancy
CBC 2010 and IBC 2012

- ▶ **Section 504.2**

The value listed in Table 503 can be increased by 20 feet above the listed building height. The number of stories is also allowed to be increased by 1.

- ▶ **Section 506.2**

The allowable building area increase due to street frontage.

- ▶ **Section 506.3**

Defines the allowable building area increase due to automatic sprinkler system installation.

Building Construction → Allowable Increases

Type II-B, Business Occupancy

	Actual	Allowable	Adjusted (Sprinklered)	Passes
Building Height	45'	55'	75'	Yes
Area	19,348 SF	23,000 SF	86,250 SF	Yes
# of Stories	2	4	5	Yes

Frontage Increase

$$I_f = [F/P - 0.25]W/30$$

I_f = Area increase due to frontage

F = Building perimeter that fronts on a public way or open space having 20 feet open minimum width (feet).

P = Perimeter of entire building (feet).

W = Width of public way or open space (feet) accordance w/ Sec. 506.2.1.

$$I_f = [1 - .25]30/30$$

$$I_f = 0.75$$

Area Modifications

$$A_a = \{ A_t + [A_t \times I_f] + [A_t \times I_s] \}$$

A_a = Allowable building area per story (SF).

A_t = Tabular building area per story in accordance with Table 503 (23,000 SF).

I_f = Area increase factor due to frontage as calculated in accordance with Section 506.2.

I_s = Area increase factor due to sprinkler protection as calculated in accordance with Section 506.3.

$$A_a = A_t + (A_t \times 0.75) + (A_t \times 2)$$

$$A_a = A_t (1 + 0.75 + 2)$$

$$A_a = 3.75A_t$$

$$A_a = 86,250 \text{ SF}$$

Building Construction → Heights & Areas

Type II-B, Business Occupancy

IBC 2012 – Table 503

**TABLE 503
ALLOWABLE BUILDING HEIGHTS AND AREAS¹**

Building height limitations shown in feet above grade plane. Story limitations shown as stories above grade plane.
Building area limitations shown in square feet, as determined by the definition of "Area, building," per story

GROUP		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
	HEIGHT(feet)	UL	160	65	55	65	55	65	50	40
		STORIES(S) AREA (A)								
A-1	S	UL	5	3	2	3	2	3	2	1
	A	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
A-2	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-3	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-4	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-5	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	S	UL	11	5	3	5	3	5	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
Adjusted B	S	UL	12	6	4	6	4	6	4	3
	A	UL	UL	140,625	86,250	106,875	71,250	135,000	67,500	33,750
	Height	UL	180	85	75	85	75	85	70	60

This table shows that the building even meets the most minimum standard after being adjusted for an automatic sprinkler system.

Building Construction → Fire-Resistance

Type II-B, Business Occupancy

IBC 2012 – Section 601, Table 601

TABLE 601 FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A ^d	B	A ^d	B	HT	A ^d	B
Primary structural frame ^g (see Section 202)	3 ^a	2 ^a	1	0	1	0	HT	1	0
Bearing walls									
Exterior ^{f, g}	3	2	1	0	2	2	2	1	0
Interior	3 ^a	2 ^a	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior									
Nonbearing walls and partitions	0	0	0	0	0	0	See Section 602.4.6	0	0
Interior ^e									
Floor construction and associated secondary member (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1½ ^b	1 ^{b,c}	1 ^{b,c}	0 ^c	1 ^{b,c}	0	HT	1 ^{b,c}	0

For this building, there are no fire-resistance rating requirements for a Type II-B construction.

Building Construction → Rated Conditions

1-Hour Fire-Rated Corridor is provided in accordance with the LSC

7.1.3.1 Exit Access Corridors. Corridors used as exit access and serving an area having an occupant load exceeding 30 shall be separated from other parts of the building by walls having not less than a 1-hour fire resistance rating in accordance with Section 8.3

20-Minute Fire-Rated Door Openings

45-Minute Window Openings

1-Hour Fire-Rated Floor/Ceilings

Prescriptive Egress Analysis

Prescriptive Egress Analysis (First Floor – Exits)

Prescriptive Egress Analysis *First Floor*

Calculated Occupant Load

Building 1 st Floor	Usage	Gross Floor Area	OLF	Occupant Load
<i>Building A</i>	Offices	1,870 SF	100	19
	Laboratories	12,833 SF	50	257
	Conference Rm.	296 SF	15	20
	Storage (S-1)	1,133 SF	300	4
	Storage (S-2)	394 SF	300	2
	Bathrooms	614 SF	0	0
	Walkways	2,208 SF	0	0
<i>Building B</i>	Laboratories	5,741 SF	50	115
	Storage (S-2)	128 SF	300	1
<i>Building C</i>	Laboratories	1,314 SF	50	27
		Total: 26,531 SF		Total: 445 People

Prescriptive Egress Analysis *First Floor*

Calculated Exit Capacity

Exit	Width (inches)	Capacity Factor (in/person)	Capacity (persons)	Notes
East Main Lobby Doors	72	.2	360	2 doors @ 36 in
West Main Lobby Doors	72	.2	360	2 doors @ 36 in
Room-Double Doors	144	.2	720	4 doors @ 36 in
Room-Single Doors	36	.2	180	1 doors @ 36 in
Total:			1620 People	
Total People Required from OLF Calculations:			445 People	Passes: YES

Prescriptive Egress Analysis (Second Floor – Exits)

- Vertical Exits Exterior
- Vertical Exits Interior
- Vertical Exits (Not Part of Egress Plan)
- Building Exit

Prescriptive Egress Analysis *Second Floor*

Calculated Occupant Load

Building 2nd Floor	Usage	Gross Floor Area	OLF	Occupant Load
<i>Building A</i>	Offices	2,771 SF	100	28
	Laboratories	4,599 SF	50	92
	Conference Rm.	280 SF	15	19
	Storage (S-1)	306 SF	300	2
	Storage (S-2)	81 SF	300	1
	Bathrooms	353 SF	0	0
	Walkways	2253 SF	0	0
		Total: 10,643		Total: 142 People

Prescriptive Egress Analysis Second Floor

Calculated Exit Capacity

Exit	Width (inches)	Capacity Factor (in/person)	Capacity (persons)
East Stairs	48	.3	165
West Stairs	48	.3	165
Total:			330 People
Total People Required from OLF Calculations:			142 People Passes: YES

Water-Based Fire Suppression System

Water Supply

Static Pressure:	85 PSI	<u>Less 10%</u> 76.5 PSI
Residual Pressure:	65 PSI	58.5 PSI
Flow:	1045 GPM	940.5 GPM

Tested By: **Cal Poly**

Witnessed By: **Bruce Bjornson, Hoffman & Associates**

Hydrant Tested: **Hydrant #29**

Flow Hydrant: **Hydrant #30**

Test Date: **January 31st, 2002**

Manual Hydraulic Calculations

Location: 2nd Floor NE Side
(Most remote area in reference to the riser)

Remote Area: 1,560 SF

Laboratory Areas, Storage & Mechanical Spaces

Ordinary Hazard Group 1

Density: **0.15 GPM/SQ. FT.**

Max. Area Per Sprinkler: **130 SQ. FT.**

Design Area of Discharge: **1500 SQ. FT.**

Hose Stream Allowance for OH 1: **250 GPM**

Water Supply Duration: **60-90 minutes**

Viking Micromatic Model M Upright

Temp. Rating: **155° F**

Finish Head/Escut.: **Brass/ ---**

Number of Sprinklers: **12**

Orifice: **½ Inch**

K Factor: **5.6**

Type: **Standard Sprinkler Upright (SSU)**

Results showed **264.5 GPM @ 59.79 PSI** at the base of the riser. Compared to the city water supply this amount is adequate to cover the required demands.

With hose stream added in (**+250 GPM**) the total came to **514.5 GPM**, well under the **1045 GPM @ 65 PSI Static** and **85 PSI Residual** provided by the city's water supply.

Water Supply Curve

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Fire Protection Engineering

Fire Detection, Alarm, & Communication System

This building is equipped with a manual fire alarm system with elevator recall, fire sprinkler monitoring, and duct detector monitoring.

According to NFPA 72, 2010 Edition “The purpose of fire alarm and signaling systems shall be primarily to provide notification of alarm, supervisory, and trouble conditions; to alert the occupants; to summon aid; and to control emergency control functions.”

Device	Model
Fire Alarm Control Panel (FACP)	Notifier NFS2-640
Smoke Detectors	Notifier FSP-751
Heat Detectors	Notifier FST-751
Duct Detectors	Notifier FSD-751P
Manual Pull Station	Notifier NBG-12LX
Horn/Strobe Notification Devices	System Sensor P241575 & S241575 System Sensor P1224MC & S1224MC

NFS2-640

FSP-751T with B710LP base

FST-751

The NBG-12LX
Addressable Manual Pull Station

Visual

Audio/Visual

Fire Detection, Alarm, & Communication System

This building was also equipped with a Mass Notification System.

Blue Alert M.N.S. has been found to meet and maintain the standards found in the NFPA 72, 2010 Edition under chapter 24 for emergency communication systems.

Code Blue InterAct 4100 Speakerphone

Performance Criteria

Section 5.2.2 of NFPA 101 specifies a performance criterion concluding that, “Any occupant who is not intimate with ignition shall not be exposed to instantaneous or cumulative untenable conditions.” (NFPA 101 Section 5.2.2*).

Tenability Requirements

Tenability Limits

Performance Criteria	Tenability Limit	Source
Temperature	60°C	SFPE Handbook 3 rd Edition 2-129 Table 2-6.19
Visibility	4 Meters	SFPE Handbook 3 rd Edition Table 2-4.2 for Familiar Occupants
Radiant Heat Flux	2.5 kWm ⁻² or 375°C	SFPE Handbook 3 rd Edition 2-129 Table 2-6.19

Performance Based Design

Computer Based Fire Modeling

PyroSim

- Advanced fire modeling graphical user interface.
 - Used in bulk geometry design and simple parameters
 - Produces an exportable FDS input file

Pathfinder

- Pathfinder is an emergency egress simulator that includes an integrated user interface and animated 3D results.

Fire Dynamics Simulator (FDS)

- Simulation for low speed flows that has an emphasis on smoke and heat transport from fires.

Smokeview (SMV)

- Visualization program used to display the output of FDS simulations

Performance Based Design

NFPA 101 Section 5.5.3.1* Design Fire Scenario 1.

Design Fire Scenario 1 shall be described as follows:

- (1) It is an occupancy-specific fire representative of a typical fire for the occupancy.
- (2) It explicitly accounts for the following:

Occupant activities

Number and location of occupants

Room size

Contents and furnishings

Fuel properties and ignition sources

Ventilation conditions

Identification of the first item ignited and its location

Performance Based Design

Scenario #1:

Sofa fire in the corridor in the main hallway.

Fuel Load: Polyurethane foam from the sofa's cushions

F32 SOFA (Fig. 3-1.52) from SFPE Hb. 3rd Edition for Upholstered Furniture Items Tested by NIST

Figure 3-1.52. Several upholstered furniture items tested by NIST.

Scenario #1 – Sofa Fire in Corridor

PyroSim Model

Scenario #1 – Sofa Fire in Corridor

FDS Model – 0 Seconds

Tenability Limits: $< 60^{\circ}\text{C}$
 $> 4 \text{ M}$ Visibility

Scenario #1 – Sofa Fire in Corridor

FDS Model – Sprinkler Activated @ 59 Seconds

Scenario #1 – Sofa Fire in Corridor

Viking Micromatic Model M Upright

Temp. Rating:	155° F/68°C
Finish Head/Escut.:	Brass/ ---
Number of Sprinklers:	12
Orifice:	½ Inch
K Factor:	5.6
Type:	Standard Sprinkler Upright (SSU)

Tenability Limit: > 4 M Visibility

FDS Model – 120 Seconds

Tenability Limit: > 4 M Visibility

Scenario #1 – Sofa Fire in Corridor

FDS Model – 180 Seconds

Tenability Limit: > 4 M Visibility

FDS Model – 240 Seconds

Tenability Limit:

> 4 M Visibility

Tenability of > 4m is Reached @ 240 Seconds

31.5

31.5

FDS Model – 60 Seconds

Tenability Limits: $< 60^{\circ}\text{C}$

Scenario #1 – Sofa Fire in Corridor

FDS Model – 120 Seconds

Tenability Limits: $< 60^{\circ}\text{C}$

Scenario #1 – Sofa Fire in Corridor

FDS Model – 180 Seconds

Tenability Limits: $< 60^{\circ}\text{C}$

Scenario #1 – Sofa Fire in Corridor

FDS Model – 240 Seconds

Tenability Limits: $< 60^{\circ}\text{C}$

Scenario #1 – Sofa Fire in Corridor

FDS Model – 300 Seconds

Tenability Limits: $< 60^{\circ}\text{C}$

Tenability of $< 60^{\circ}\text{C}$ is Not Reached

Scenario #1 – Sofa Fire in Corridor

Scenario 1 Graphs

Sprinkler Temperature

Scenario #1 – Sofa Fire in Corridor

HRR vs Time

Scenario #1 – Sofa Fire in Corridor

Pathfinder – 0 Seconds

Exited: 0/587

Occupants Exited: 0/587

Exited: 517/587

Pathfinder – 60 Seconds

Occupants Exited: 517/587

60.0

Exited: 587/587

Pathfinder – 81.5 Seconds
Simulation Ends

Occupants Exited: 587/587

Scenario #1 – Sofa Fire in Corridor

RSET = 191.5 Seconds

ASET = 240 Seconds

The Available Safe Egress Time exceeds the Required Safe Egress Time with a margin of 48.5 seconds. This building passes the performance based design criteria for maintaining tenability of the occupants during the complete egress of the building.

Performance Based Design

- ▶ **5.5.3.2* Design Fire Scenario 2.** Design Fire Scenario 2 shall be described as follows:
- ▶ (1) It is an ultrafast-developing fire, in the primary means of egress, with interior doors open at the start of the fire.
- ▶ (2) It addresses the concern regarding a reduction in the number of available means of egress.

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

Performance Based Design

Scenario #2:

Cabinet fire in the corridor in the main hallway under the stairs.

Fuel Load: Stored Paper

Storage Units

(Fig. 3-1.15 SFPE HB 4th Ed)

Figure 3-1.13. Storage units.

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

PyroSim Model

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

FDS Model – 0 Seconds

Tenability Limits: $< 60^{\circ}\text{C}$
> 4 M Visibility

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

FDS Model – 60 Seconds

Tenability Limit: > 4 M Visibility

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

FDS Model – 120 Seconds

Tenability Limit: > 4 M Visibility

FDS Model – 180 Seconds

Tenability Limit: > 4 M Visibility

Tenability of > 4m is reached at a height of 6ft above floor level.

FDS Model – 210 Seconds

Tenability Limit: > 4 M Visibility

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

FDS Model – 240 Seconds

Tenability Limit: > 4 M Visibility

30.0

27.0

24.0

21.0

18.0

15.0

12.0

9.00

6.00

4.00

0.00

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

FDS Model – 60 Seconds

Tenability Limits: $< 60^{\circ}\text{C}$

115

106

96.0

86.5

77.0

67.5

60.2

48.5

39.0

29.5

20.0

20.0

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

115
106
96.0
86.5
77.0
67.5
60.2
48.5
39.0
29.5
20.0

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

115
106
96.0
86.5
77.0
67.5
60.2
48.5
39.0
29.5
20.0

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

FDS Model – 240 Seconds

Tenability Limits: $< 60^{\circ}\text{C}$

115

106

96.0

86.5

77.0

67.5

60.2

48.5

39.0

29.5

20.0

20.0

-55.954.953.952.951.950.949.948.947.946.945.944.943.942.941.940.939.938.937.936.935.934.933.932.931.930.929.928.927.926.925.924.923.922.921.920.919.918.917.916.915.914.913.912.911.910.909.908.907.906.905.904.903.902.901.900.899.898.897.896.895.894.893.892.891.890.889.888.887.886.885.884.883.882.881.880.879.878.877.876.875.874.873.872.871.870.869.868.867.866.865.864.863.862.861.860.859.858.857.856.855.854.853.852.851.850.849.848.847.846.845.844.843.842.841.840.839.838.837.836.835.834.833.832.831.830.829.828.827.826.825.824.823.822.821.820.819.818.817.816.815.814.813.812.811.810.809.808.807.806.805.804.803.802.801.800.799.798.797.796.795.794.793.792.791.790.789.788.787.786.785.784.783.782.781.780.779.778.777.776.775.774.773.772.771.770.769.768.767.766.765.764.763.762.761.760.759.758.757.756.755.754.753.752.751.750.749.748.747.746.745.744.743.742.741.740.739.738.737.736.735.734.733.732.731.730.729.728.727.726.725.724.723.722.721.720.719.718.717.716.715.714.713.712.711.710.709.708.707.706.705.704.703.702.701.700.699.698.697.696.695.694.693.692.691.690.689.688.687.686.685.684.683.682.681.680.679.678.677.676.675.674.673.672.671.670.669.668.667.666.665.664.663.662.661.660.659.658.657.656.655.654.653.652.651.650.649.648.647.646.645.644.643.642.641.640.639.638.637.636.635.634.633.632.631.630.629.628.627.626.625.624.623.622.621.620.619.618.617.616.615.614.613.612.611.610.609.608.607.606.605.604.603.602.601.600.599.598.597.596.595.594.593.592.591.590.589.588.587.586.585.584.583.582.581.580.579.578.577.576.575.574.573.572.571.570.569.568.567.566.565.564.563.562.561.560.559.558.557.556.555.554.553.552.551.550.549.548.547.546.545.544.543.542.541.540.539.538.537.536.535.534.533.532.531.530.529.528.527.526.525.524.523.522.521.520.519.518.517.516.515.514.513.512.511.510.509.508.507.506.505.504.503.502.501.500.499.498.497.496.495.494.493.492.491.490.489.488.487.486.485.484.483.482.481.480.479.478.477.476.475.474.473.472.471.470.469.468.467.466.465.464.463.462.461.460.459.458.457.456.455.454.453.452.451.450.449.448.447.446.445.444.443.442.441.440.439.438.437.436.435.434.433.432.431.430.429.428.427.426.425.424.423.422.421.420.419.418.417.416.415.414.413.412.411.410.409.408.407.406.405.404.403.402.401.400.399.398.397.396.395.394.393.392.391.390.389.388.387.386.385.384.383.382.381.380.379.378.377.376.375.374.373.372.371.370.369.368.367.366.365.364.363.362.361.360.359.358.357.356.355.354.353.352.351.350.349.348.347.346.345.344.343.342.341.340.339.338.337.336.335.334.333.332.331.330.329.328.327.326.325.324.323.322.321.320.319.318.317.316.315.314.313.312.311.310.309.308.307.306.305.304.303.302.301.300.299.298.297.296.295.294.293.292.291.290.289.288.287.286.285.284.283.282.281.280.279.278.277.276.275.274.273.272.271.270.269.268.267.266.265.264.263.262.261.260.259.258.257.256.255.254.253.252.251.250.249.248.247.246.245.244.243.242.241.240.239.238.237.236.235.234.233.232.231.230.229.228.227.226.225.224.223.222.221.220.219.218.217.216.215.214.213.212.211.210.209.208.207.206.205.204.203.202.201.200.199.198.197.196.195.194.193.192.191.190.189.188.187.186.185.184.183.182.181.180.179.178.177.176.175.174.173.172.171.170.169.168.167.166.165.164.163.162.161.160.159.158.157.156.155.154.153.152.151.150.149.148.147.146.145.144.143.142.141.140.139.138.137.136.135.134.133.132.131.130.129.128.127.126.125.124.123.122.121.120.119.118.117.116.115.114.113.112.111.110.109.108.107.106.105.104.103.102.101.100.99.98.97.96.95.94.93.92.91.90.89.88.87.86.85.84.83.82.81.80.79.78.77.76.75.74.73.72.71.70.69.68.67.66.65.64.63.62.61.60.59.58.57.56.55.54.53.52.51.50.49.48.47.46.45.44.43.42.41.40.39.38.37.36.35.34.33.32.31.30.29.28.27.26.25.24.23.22.21.20.19.18.17.16.15.14.13.12.11.10.9.8.7.6.5.4.3.2.1.0.0

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

FDS Model – 300 Seconds

Tenability Limits: $< 60^{\circ}\text{C}$

Tenability of $< 60^{\circ}\text{C}$ is reached at a height of 6ft above floor level.

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

FDS Model – 231.3 Seconds

Sprinkler Activates

Frame: 771
Time: 231.3

Scenario #2 – Cabinet Fire in Corridor Under The Stairs

Scenario 2 Graphs

Sprinkler Temperature

HRR vs Time

Pathfinder – 0 Seconds

Exited: 0/587

Occupants Exited: 0/587

Exited: 496/587

Pathfinder – 60 Seconds

- Door Closes, East Exit is Untenable To Use

Occupants Exited: 496/587

Exited: 587/587

Pathfinder – 141.3 Seconds
Simulation Ends

Occupants Exited: 587/587

Scenario #2 – Cabinet Fire Under the Stairs

RSET = 252.3 Seconds

ASET = 180 Seconds

The Available Safe Egress Time does not exceed the Required Safe Egress Time. This building fails the performance based design criteria for maintaining tenability of the occupants during the complete egress of the building.

Conclusion

The performance based analysis shows that the tenability criteria has not been met for scenario 2. The building became untenable before a full evacuation could take place. The available safe egress time (ASET) was significantly less than the required safe egress time (RSET). Therefore the system in place does not provide a level of safety required to protect all of the occupants in various fire scenarios during the egress of the building's occupants.

Recommendations

- ▶ A clear area under the east side stairs needs to be maintained in order to prevent the loss of a main path of egress due to ignition of flammable objects under the stairs whether by accident or arson.
- ▶ Staff and students should be trained on the building's fire evacuation plan at the beginning of each quarter.
- ▶ Consideration of installing a sprinkler on the underside of the stairs in order to prevent fires like scenario 2 from jeopardizing the use of a main path of egress.
- ▶ Scheduled Inspection, Testing, and Maintenance (ITM)
- ▶ Keep the main path of egress clear of obstructions.

The End

Questions?

Thank You

CALPOLY