Please hold questions until the end, thank you!
Acknowledgement & Gratitude

WCHS Faculty and Staff
Dan Quatier (Project manager)

Cal Poly
Dr. Mowrer & Dr. Pascual
Location
8200 SW Pfaffle Street
Tigard, Oregon 97223

Close to home!
History, Scope and Schedule

• Originally Built around 1957 General Motors (Training facility)
• City Bible Church (2003-2013)
• WCHS Purchased 2013
• Opened in January some ongoing construction (gymnasium)
• Tenant(s)
  • WCH occupy during day
  • College/night classes
  • CBC holds service on weekends
Iso View

WESTSIDE CHRISTIAN HIGH SCHOOL ADDITIONS AND REMODEL

VIEW LOOKING NORTHEAST
Areas of addition
Applicable Codes

2010 Oregon Structural Specialty Code (OSSC)
Oregon Adoption of International Building Code (IBC)

2010 Oregon Fire Code (OFC)
Oregon Adoption of International Fire Code

NFPA Standards (13,72,25)
Building Overview

Summary
• Single Story
• Type ‘E’ occupancy
• Noncombustible construction
• Automatic Fire Sprinkler System Throughout

Use and Occupancy
• General classrooms, cafeteria/commons, office and administration.

Construction Type/ Height and Area Limitation (Table 503; OSSC)
• II-B
• Existing area 35,965 sq.ft.
• Allowable modification area up to 68,875 sq.ft. (60,679 actual)
Fire Resistive Rating

- Based on type II B, the primary elements of the bldg. are not required to carry a resistive rating.

<table>
<thead>
<tr>
<th>BUILDING ELEMENT</th>
<th>TYPE I</th>
<th>TYPE II</th>
<th>TYPE III</th>
<th>TYPE IV</th>
<th>TYPE V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>A(^d)</td>
<td>B</td>
<td>HT</td>
</tr>
<tr>
<td>Primary structural frame(^g) (see Section 202)</td>
<td>3(^a)</td>
<td>2(^a)</td>
<td>1</td>
<td>0</td>
<td>HT</td>
</tr>
<tr>
<td>Bearing walls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exterior(^f, g)</td>
<td>2</td>
<td>2(^a)</td>
<td>1</td>
<td>0</td>
<td>2(^2)</td>
</tr>
<tr>
<td>Interior</td>
<td>3(^a)</td>
<td>2(^a)</td>
<td>1</td>
<td>0</td>
<td>2(^2)</td>
</tr>
<tr>
<td>Nonbearing walls and partitions</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Exterior</td>
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<td></td>
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<tr>
<td>Interior</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Nonbearing walls and partitions</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Interior</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor construction and secondary members (see Section 202)</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>HT</td>
</tr>
<tr>
<td>Roof construction and secondary members (see Section 202)</td>
<td>1(^1/2)</td>
<td>1(^b, c)</td>
<td>1(^b, c)</td>
<td>0(^c)</td>
<td>1(^b, c)</td>
</tr>
</tbody>
</table>
Fire Resistive Rating

Similarly..

Fire resistance rating for exterior walls is 0 based on a fire separation distance greater than 30ft. (Recall aerial view shows no adjacent bldgs.)

<table>
<thead>
<tr>
<th>FIRE SEPARATION DISTANCE = X (feet)</th>
<th>TYPE OF CONSTRUCTION</th>
<th>OCCUPANCY GROUP H</th>
<th>OCCUPANCY GROUP F-1, M, S-1</th>
<th>OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U</th>
</tr>
</thead>
<tbody>
<tr>
<td>X &lt; 5</td>
<td>All</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5 ≤ X &lt; 10</td>
<td>IA</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>2</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>10 ≤ X &lt; 30</td>
<td>IA, IB</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>IIB, VB</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>X ≥ 30</td>
<td>All</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Fire resistance rating of corridors is 0 based on Group ‘E’ and being Full sprinkled

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>OCCUPANT LOAD SERVED BY CORRIDOR</th>
<th>REQUIRED FIRE-RESISTANCE RATING (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-1, H-2, H-3</td>
<td>All</td>
<td>Without sprinkler system: Not Permitted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With sprinkler system: 1</td>
</tr>
<tr>
<td>H-4, H-5</td>
<td>Greater than 30</td>
<td>Without sprinkler system: Not Permitted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With sprinkler system: 1</td>
</tr>
<tr>
<td>A, B, E, F, M, S, U</td>
<td>Greater than 30</td>
<td>Without sprinkler system: Not Permitted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With sprinkler system: 0</td>
</tr>
<tr>
<td>R</td>
<td>Greater than 10</td>
<td>Without sprinkler system: Not Permitted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With sprinkler system: 0.5</td>
</tr>
<tr>
<td>I-2, I-4</td>
<td>All</td>
<td>Without sprinkler system: Not Permitted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With sprinkler system: 0</td>
</tr>
<tr>
<td>I-1, I-3</td>
<td>All</td>
<td>Without sprinkler system: Not Permitted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With sprinkler system: 1</td>
</tr>
</tbody>
</table>
Exits

- Direct to outside, single story, no stairways or elevators
- Roll up gates.
- No dead ends (exceed 20ft)
- Number of exits comply with OSCC. Occupant load >1,000 = 4 exit min.
Travel Distance

Greatest travel distance determined to be 188ft
“Accessory to primary area” — Assumes rendered unoccupied when adjacent space full.
### Occupant Load

- Occupant Load Factor; Max allowable sq.ft. per occupant (OSSC Table 1004.1.2)
- Excludes:
  - Areas considered to be “accessory use” to primary adjacent room.
  - Corridors & Passage way for which occupants will travel

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Room types</th>
<th>Area (sq.ft.)</th>
<th>OLF</th>
<th>Occupants</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-2</td>
<td>Commons</td>
<td>5,850</td>
<td>7</td>
<td>836</td>
</tr>
<tr>
<td>A-3</td>
<td>Auditorium, stage, weight</td>
<td>4,606</td>
<td>7</td>
<td>450</td>
</tr>
<tr>
<td>A-4</td>
<td>Gymnasium</td>
<td>10,307</td>
<td>7</td>
<td>1,472</td>
</tr>
<tr>
<td>ACC</td>
<td>Alcove, Locker, Toilet, storage</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>B</td>
<td>Admin, office, workroom</td>
<td>6,134</td>
<td>100</td>
<td>102</td>
</tr>
<tr>
<td>E</td>
<td>Art, Classroom, library, music, physics, science</td>
<td>16,259</td>
<td>20</td>
<td>700</td>
</tr>
<tr>
<td>F</td>
<td>Kitchen</td>
<td>625</td>
<td>200</td>
<td>3</td>
</tr>
<tr>
<td>S-2</td>
<td>Storage</td>
<td>738</td>
<td>300</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>43,156</strong></td>
<td></td>
<td><strong>3,565</strong></td>
</tr>
</tbody>
</table>
Exit Capacity

- Capacity factor of 0.2 inch/occupant;

Table 7.3.3.1 Capacity Factors

<table>
<thead>
<tr>
<th>Area</th>
<th>Stairways (width/person)</th>
<th>Level Components and Ramps (width/person)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in.</td>
<td>mm</td>
</tr>
<tr>
<td>Board and care</td>
<td>0.4</td>
<td>10</td>
</tr>
<tr>
<td>Health care, sprinklered</td>
<td>0.3</td>
<td>7.6</td>
</tr>
<tr>
<td>Health care, nonsprinklered</td>
<td>0.6</td>
<td>15</td>
</tr>
<tr>
<td>High hazard contents</td>
<td>0.7</td>
<td>18</td>
</tr>
<tr>
<td>All others</td>
<td>0.3</td>
<td>7.6</td>
</tr>
</tbody>
</table>

- Assumes 33” clear width for 3ft doors, and 66” for 6ft doors.

- Most exterior doors are double doors and the exit capacities = 330

<table>
<thead>
<tr>
<th>Exit</th>
<th>Width (FT)</th>
<th>Width Clear</th>
<th>Width (in)</th>
<th>Capacity Factor</th>
<th>Capacity</th>
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<tbody>
<tr>
<td>100A</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>100B</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>101A</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>101B</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>101C</td>
<td>17</td>
<td>17</td>
<td>204</td>
<td>0.2</td>
<td>1020</td>
</tr>
<tr>
<td>102A</td>
<td>14</td>
<td>14</td>
<td>168</td>
<td>0.2</td>
<td>840</td>
</tr>
<tr>
<td>102B</td>
<td>14</td>
<td>14</td>
<td>168</td>
<td>0.2</td>
<td>840</td>
</tr>
<tr>
<td>110A</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>127A</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>131A</td>
<td>3</td>
<td>2.5</td>
<td>30</td>
<td>0.2</td>
<td>150</td>
</tr>
<tr>
<td>133A</td>
<td>3</td>
<td>2.75</td>
<td>33</td>
<td>0.2</td>
<td>165</td>
</tr>
<tr>
<td>143A</td>
<td>3</td>
<td>2.75</td>
<td>33</td>
<td>0.2</td>
<td>165</td>
</tr>
<tr>
<td>143B</td>
<td>7</td>
<td>7</td>
<td>84</td>
<td>0.2</td>
<td>420</td>
</tr>
<tr>
<td>143C</td>
<td>7</td>
<td>7</td>
<td>84</td>
<td>0.2</td>
<td>420</td>
</tr>
<tr>
<td>150A</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>150B</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>152A</td>
<td>14.5</td>
<td>14.5</td>
<td>174</td>
<td>0.2</td>
<td>870</td>
</tr>
<tr>
<td>154A</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
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<tr>
<td>160A</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
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<tr>
<td>160B</td>
<td>15.33</td>
<td>15.33</td>
<td>183.96</td>
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<td>920</td>
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<td>166A</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>166B</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>166C</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>166D</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>166E</td>
<td>6</td>
<td>5.5</td>
<td>66</td>
<td>0.2</td>
<td>330</td>
</tr>
<tr>
<td>166F</td>
<td>3</td>
<td>2.75</td>
<td>33</td>
<td>0.2</td>
<td>165</td>
</tr>
<tr>
<td>164A</td>
<td>3</td>
<td>2.75</td>
<td>33</td>
<td>0.2</td>
<td>165</td>
</tr>
</tbody>
</table>
Exit Capacity

- Gates segment Bldg. into (3) areas
Green = Calculated Occupant load
Purple = Exit capacity

Area#1-Exit Capacity

Discovered in CD/plans
1. Occupant load (1,474) > Exit capacity (1,463)
2. South exit funnels/corrals

Informed Contractor
- Proposed (2) solution
  1. Auto Gate open in fire
  2. Add door

Resolved
- Addition at North entrance
Area#2-Exit Capacity

Discovered in CD/plans
- Occupant load 1,716 > Exit capacity (1,650)

Informed Contractor
- Proposed (2) solution
  1. Auto Gate
  2. Add exterior door

Resolved
- Reduced Occupant load sign posted (per AHJ)
Area#3-Exit Capacity

Adequate exit capacity
Fire Alarm System

• Compliant with NFPA 72 (2010)
• Major components
  • Controls
    • FACP-Mechanical Room
    • Remote Annunciator-Main entrance
  • Initiation devices
    • (1) Manual Pull station @ office/reception
    • Tampers & flow @ BOR
    • Smoke detectors @ Mech. & Elect Rooms
    • Duct detectors
    • No beam or heat
  • Notification
    • Speaker/strobes interconnect with paging system allows for voice evacuation/live messages
• Monitored
  • Connected to central monitoring
8.2 System Protection Area Limitations

8.2.1 The maximum floor area on any one floor to be protected by sprinklers supplied by any one sprinkler system riser or combined system riser shall be as follows:

(1) Light hazard — 52,000 ft² (4831 m²)
(2) Ordinary hazard — 52,000 ft² (4831 m²)
(3)* Extra hazard — Hydraulically calculated — 40,000 ft² (3716 m²)

Automatic Sprinkler Systems Handbook 2013
Hazard and Supply

- Hazard Occupancies
  - Light Hazard (Majority)
    - Classrooms and offices
  - Ordinary Group I
    - Mechanical/Electrical Rooms, storage
  - Ordinary Group II
    - Stage, Library
- Water supply
  - Static=78psi
  - Residual @ 20psi = 3,947GPM

TUALATIN VALLEY WATER DISTRICT
FIRE HYDRANT FLOW TEST REPORT

Location: PFaffen ST & 82ND AVE
Test made by: HERB & JAMES
Witness: 
Time: 12:45

Discharge coefficient: 0.54816
Inside dia. of outlet = 4.5 inches
Pitot reading = 33 psi  Pitot 2 = 0 psi
Observed flow rate = 1901.6 gpm

Flow method: HOSE MONSTER

Static pressure: 78 psi  Residual pressure: 63 psi

Flow at 20psi residual pressure (calculated): 3947 gpm

Location map: To be attached to test report and to show which hydrants were used to monitor residual pressure and flow.

Hydrant Information:

Tualatin ID Year Make Notes
Flow hydrant: 1S1W36C6H50 1995 US PIPE see map for location
Read hydrant: 1S1W36C6H50 2001 WATEROUS see map for location
Demand

• Demand
  • (3) areas calculated
    • Gymnasium-311 GPM @69psi (most demanding)
    • Fitness area/Commons-247 GPM @63.2
    • Science & Library-266 GPM @58.4

Demands Includes Hose allowance of 100GPM
Fire Suppression-Demand

- Gymnasium Hydraulic calculation
  - Grid system
  - Heads
    - Reliable J112 SSU; k=11.2; QR
    - Extended Coverage 20x20=400ft^2
    - Light and Ordinary
  - Criteria
    - Design density = .10gpm/1500 sq.ft.
    - Area reduction not allowed (EC)
  - Calculation
    - Gridded system
    - Heads actual spacing @ 18.33’ X 20’ =366sq.ft
    - 5 heads flowing Design density = .10gpm/1500
Prescriptive Summary

All systems and building components in conformance with standards set forth OSSC/IBC, and IFC.
Performance Design
Areas/scenario considerations

• Gymnasium
  • Under construction
  • Equipment storage outside compartment
  • Bleacher type unknown
• Classroom or storage fire adjacent to main corridor.
  • No large fuel loads identified
• Auditorium/Commons area
  • Deemed to be highest risk
  • Large occupant load
  • Respectable size storage/fuel load within compartment
  • Potential for loss of exit
Performance Design

The design fire I have selected combines both design scenario #2 & #3 as described in the Life Safety Code (NFPA 101).

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.

5.5.3.3* Design Fire Scenario 3. Design Fire Scenario 3 shall be described as follows:

(1) It is a fire that starts in a normally unoccupied room, potentially endangering a large number of occupants in a large room or other area.
(2) It addresses the concern regarding a fire starting in a normally unoccupied room and migrating into the space that potentially holds the greatest number of occupants in the building.
Performance Design Scenario

- During church service
- Fully Occupied (429 occupants)
- Adjacent storage room fire
- Loss of exit
Performance Design Scenario
ASET vs. RSET

Used to compare and validate the results for the performance approach.

Available Safe Egress Time-

*Time from ignition until tenability limit is reached*

Required Safe Egress Time-

*Time from ignition until evacuation of occupants is complete*
ASET vs. RSET

Signature time development period for occupants during a Fire Event.

Values assigned to each time step to be discussed.
Tenability

-“Measure of environmental conditions for which an occupant can endure.”

In a building fire, the main hazards to the occupants:

- **Temperature/Exposure to heat**
  - Life threatening in (3) ways:
    1. Heat stroke,
    2. Skin pain and/or burns
    3. Respiratory tract burns

- **Toxic gasses (asphyxiate)**
  - Main cause of incapacitation in fire

- **Smoke Obscurity**
  - Not directly life threatening.
  - Reduce walking speed intern increasing the exposure time.
Tenability & Limits

- No single set of values.
- Up to engineer to use sound judgment
- Threshold levels established per SFPE HB.
Tenability & Limits

- Temperature < 60°C (140°F)
- CO < 1,500 PPM
- Visibility > 10m (30ft)

- All measurements at 2m AFF
- Temp. > 60 C for more than 15 min cause heat stroke
- CO exposure of 1,500 ppm can result in incapacitation within 30 minutes
Performance Design Scenario

Fire Dynamic Simulator (FDS)
Performance Design Scenario

Fuel Load

Observed onsite

Test data-SFPE HB

Figure 3-1.19. HRR of metal-frame, upholstered stacking chairs.
Performance Design Scenario

Fire growth (Alpha) Calculated to be 0.08

<table>
<thead>
<tr>
<th>Category</th>
<th>HRR (KJ/s³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow</td>
<td>0.0029</td>
</tr>
<tr>
<td>Medium</td>
<td>0.012</td>
</tr>
<tr>
<td>Fast</td>
<td>0.047</td>
</tr>
<tr>
<td>Ultra-fast</td>
<td>0.188</td>
</tr>
</tbody>
</table>

HRR plot from FDS Model

FDS Input- Byproduct (NFPA HB)

- Product-Polyurethane
- CO Yield (kg/kg)-0.04
- Soot Yield (kg/kg)-0.2
Timeline

- Detection = 30 seconds (Human detection-Smoke Visual-FDS Model)
- Notifications = 20 Seconds (NFPA H.B. study); Sprinkler Head Release (@50 sec)
- Pre-movement = 10 Seconds (NFPA Study)
- Travel Time= 152 Seconds (Pathfinder Model)
- Total Required Safe Egress Time = 212 Seconds
Detection (30 seconds)

Human Detection
Notification#1 (20 Seconds)

- NFPA HB study
  - Group environments/public places, individuals are reluctant to act
  - Results reflected delayed reactions time of 20 sec (vs 5sec for individuals)

*NFPA HB-Human Behavior; 4-11*

The study reported that reaction to smoke was apparently delayed by the presence of other persons, with the median being 5 seconds for single subjects but **20 seconds** in both the group conditions. These results undoubtedly reflect constraints that people accept regarding their behavior in public places. The performance of naive subjects in the passive-confederate situation was reported as follows:
Notification#2 (20 Seconds)

Sprinkler Activation @ 50 sec from ignition (=30s detect + 20s notify)

Note: There may be an additional delay for flow switch (retard)
Pre-movement (10 Seconds)

- No good data (NFPA HB Table 4.2.1) includes department stores, Hotels, Mid-rise, high rise.
- Most times based on:
  - Post fire questionnaires (time seem longer) D
  - rills (no immediate threat).
- NFPA HB overview of the Station Nightclub
  - Fire reported actual pre-movement time of 6 seconds, I have assigned 10 seconds.

**NFPA HB-Human Behavior; 4-31**

The investigation report provided the following analysis relative to the occupants egress behavior as follows:

The first patrons recognized the fire danger about 24 seconds after ignition of the foam; the bulk of the crowd began to evacuate shortly after that, around the time the band stopped playing (30 seconds).

To validate this assumption, participated in 1st fire drill April 2014....
Pre-movement – Fire Drill 04/10/14

Time (0 sec)
Alarm sounds Ears covered

Time (9 sec)
Still conversing

Time (10 sec)
Everyone Committed
Travel Time (152 Seconds)

- South Door rendered un usable.
- Assumes exits behind stage are being utilized.
- Seats modeled as obstructions (not fixed seating)

*Pathfinder model*
Observations (could impact travel time)

1. Locks permitted provided readily visible sign stating “DOOR TO REMAIN UNLOCKED WHEN BUILDING IS OCCUPIED” (OSSC 1008.1.9.3)

2. Landing @ door =44” at direction of travel (OSSC 1008.1.6)

“The road to nowhere”
Tenability/Conditions Modeled

@ 212 Seconds; 2m AFF

(Recall) Defined thresholds
Temperature

@ 212 Seconds; 2m AFF

30°C < 60°C
CO Concentration

@ 212 Seconds; 2m AFF

260ppm < 1,500ppm
Visibility

@ (ONLY) 100 Seconds; 2m AFF

Blue is Bad (Low visibility)
Red is Good (High visibility)
Visibility

@ (ONLY) 140 Seconds; 2m AFF

Blue is Bad (Low visibility)
Red is Good (High visibility)
Visibility

@ 212 Seconds; 2m AFF

Visibility=1m
Results

ASET vs. RSET
Results

Prescriptive method
- Fire alarm
- Fire sprinkler
- Egress

Performance Design Scenario
- Temperature
- CO concentration
- Visibility
Recommendation

1. Remove abandoned exit sign at East side of stage
2. Install unlockable door (perhaps with panic bar) at West end of stage. *Posting of a sign unlikely to be enforced.*
3. Reduce stacking height of chairs when/where feasible
4. Keep storage door closed (especially during service)
5. Evaluation vs Design. If designing based on performance incorporate a safety factor