FIRE AND LIFE SAFETY ANALYSIS OF THE PROVIDENCE PAVILION MEDFORD, OREGON

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June, 2013
Providence Pavilion

- Introduction
- Construction
- Fire & Life Safety Features
- Prescriptive Evaluation
- Egress Performance (RSET)
- Fire Scenarios (ASET)
- Summary and Recommendations
### TABLE 503

Allowable Building Heights and Areas

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.

<table>
<thead>
<tr>
<th>GROUP</th>
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**I-2/I-3, II**

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<th>GROUP</th>
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Providence – slide 4
Construction Type and
Fire Resistance Requirements

**Primary Frame:** Steel wide-flange columns-girders-beams-joists, with spray-applied fire resistive material = 3 hr

**Bearing Walls:** none.

**Nonbearing Exterior Walls:** Brick veneer, 5/8” gyp bd. sheathing, insulated steel studs, 5/8” gyp bd. = 2 hr

**Nonbearing Interior Walls:** 5/8” gyp bd. both sides, sound insulated steel studs = 1 hr

**Stairways & Horizontal Exits:** double ¾” gyp bd. both sides, sound insulated steel studs = 2 hr

**Floor/Roof:** Composite metal decking, lightweight concrete with welded wire fabric reinforcement = 2hr

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

<table>
<thead>
<tr>
<th>BUILDING ELEMENT</th>
<th>TYPE I</th>
<th>TYPE II</th>
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<td>B</td>
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<td>Primary structural frame&lt;sup&gt;e&lt;/sup&gt; (see Section 202)</td>
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<td>Floor construction and secondary members (see Section 202)</td>
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<td>1&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>Roof construction and secondary members (see Section 202)</td>
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[1 hr.]
Ground Floor

Cancer Treatment Center
22,553 sq.ft.
226 occupants

Exit capacity = 900
Light Hazard sprinklered
Ground Floor

Original west wall of hospital shown-
Ground Floor

Original west wall of hospital shown-

Second floor overhang shown-
Second Floor

Short Stay Unit (SSU)
Day surgery

22 beds
15,440 sq.ft.
155 occupants
Exit cap. = 194 (stairs),
650 (horizontal exits)

30 sq.ft./patient required
on other side of horiz.
exit (I-2 occupancy)

Light Hazard sprinklered
Third Floor

Clinical Care
Physicians’ Offices
Business Group B
occupancy

12,418 sq.ft.
125 occupants
Exit capacity = 194
Light Hazard sprinklered
Fourth Floor

Clinical Care
Physicians’ Offices
Hospital Administration
Business Group B
occupancy

12,418 sq.ft.
125 occupants
Exit capacity = 194
Light Hazard sprinklered
Penthouse and Roof

HVAC Equipment for all floors

Ordinary Hazard sprinklered
Fire & Life Safety Features

- Fully sprinklered
- Class I standpipes in stairways
- Complete coverage—fully addressable manual and automatic fire alarm system
- Public Address system, continuously attended, with fire evacuation plan and staff training
Fire Flow Graph

Medford Water System:

Static = 104 psi
Residual = 98 psi, with 1400 GPM flowing

System demand = 278.1 GPM @ 82 psi (Mech. Penthouse)
Prescriptive Evaluation

- Occupancy classification
- Construction type
- Height, number of stories, area
- Structural fire protection
- Smoke compartmentalization
- Egress capacity
- Exit arrangement
- Travel distance to exits
- Dead-end corridors
- Interior finish classification
- Separation from hazards
- Protection of openings
- Accessibility
- Fire alarm system coverage
- Fire sprinkler type and coverage
NFPA 101, Performance-Based Design
Section 5.5 – Design Fire Scenarios

1. Type of fire most likely to occur: Short Stay Waiting

2. Maximum effects of smoke and toxic products in primary means of egress: Short Stay

3. Fire starts in normally unoccupied room and migrates into a highly occupied room: Third Floor Clinical
RSET-
Second Floor

155 occupants
Exit capacity = 194
+horizontal for gurneys

Family Waiting:
Notification = 10s
Reaction = 10s
Pre-movement = 30s
Egress travel = 25s
RSET = 94s

SSU:
Notification = 5s
Reaction = 5s
Pre-movement = 30s
Egress travel = 41s
(patient on gurney)-82ft, 2 ft/sec
RSET = 81s
(one horiz. exit blocked)
RSET -
Third Floor

125 occupants
Exit capacity = 194

[65 actual occupants, OB/GYN practice]

Notification = 195s (first sprinkler activation)
Reaction = 5s
Pre-movement = 15s
Egress travel = 109s
(Pathfinder simulation, SFPE mode)
RSET = 324s (~5 min)

(Fourth floor similar)
Fire Scenario No. 1 - SSU Waiting Area
Fire Scenario
No. 1 – Family Waiting

- F21 upholstered chair from Fig. 3.1.102, SFPE Hbk., 2000kW
- Medium fire growth rate
- Smoke detector activates very quickly
- First sprinkler activates at 290s (fire HRR at maximum)
- Tenability limit reached at 170s (visibility <10m)
Upholstered Chair HRR

Figure 11. Effect of specimen padding and fabric on rate of heat release

- Calorimeter test data
- FDS heat release rate output

First sprinkler discharge 296s
Fire Scenario No. 1 – FDS/Smokeview Smoke Visibility Slice

- CO and radiant heat flux not a factor
- 10m = tenable limit for visibility
- 170s = ASET
- 75s = RSET
- 94s = RSET (alternate route)

Visibility slice at head height, 170s after ignition. Waiting room visibility <10m
Fire Scenario No. 2 – SSU Trash/Disposables Carts
Fire Scenario
No. 2 – SSU
Trash/Disposables Carts

- Plastic bags with trash (two), total HRR = 350kW
- Fast fire growth
- Very fast detector activation
- 62s for first sprinkler to activate
- Tenability limit reached at 170s (visibility <4m)
HRR of Two Plastic Bags of Trash and Medical Disposables

Calorimeter test data

FDS heat release rate output

First sprinkler discharge 62s
Fire Scenario No. 2 – FDS/Smokeview Smoke Visibility Slice

- CO and radiant heat flux not a factor
- 4m = tenable limit for visibility
- 170s = ASET
- 81s = RSET
Fire Scenario No. 3 - Clinical Offices

- HRR of 600kW; stacked paper, same HRR per unit area as Cook County Admin Building storage room fire
- Fast fire growth rate
- Smoldering to incipient
- 195s to first sprinkler activation, 250s to second
- Tenability limits reached at 285s
HRR of Stored Office Supplies

First sprinkler activation

Second sprinkler activation
Fire Scenario No. 3 – FDS/Smokeview
Smoke Visibility Slice

- CO and radiant heat flux not a factor
- 10m = tenable limit
- 285s = ASET
- 324s = RSET
- Difference = 40s
- Two floors evacuating
- Queuing at doors due to high occupancy
- Distance across waiting room = 12m
Summary and Recommendations

- Fire & Life Safety systems comply with prescriptive requirements

- Systems pass performance-based design challenges with minor concern for maximum occupancy scenarios

- Staff training and vigilance are important

- Inspection, testing, and maintenance are important

- Review periodically for changes in usage, furnishings, occupancy

Providence Health & Services – Oregon
Jon R. Jurgens & Associates, Architects - Portland