DEPARTMENT OF FIRE PROTECTION ENGINEERING

FPE 3 Security Fire Protection Egress Express

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Problem Definition

Project Scope:

This project evaluates the fire protection design for the UMD Hillel New Center for Jewish Life, focusing on sprinkler, fire alarm, and security systems to ensure life safety and code compliance. A performance-based design (PBD) approach is applied to key areas, using fire scenarios and egress analysis to justify alternative strategies. PBD analysis includes modified opening requirements and delayed egress doors, while maintaining safe occupant evacuation.

Goals:	Ensure occupant safety during evacuation	Minimize fire damage to the building and its contents
Objectives:	Maintain tenable conditions for safe evacuation	Prevent fire from spreading outside compartment of origin
Criteria:	Carbon monoxide concentration < 100 ppm near occupants	Maintain upper layer gas temperature < 800˚F (427˚C)
	Visibility > 7 ft in areas outside of radius of 10 ft from fire location	Heat flux on surrounding walls and surfaces < 20 (kW/m^2)

Design Calculations & Analysis

Building Description:

The building is a new two-story construction with a vertical opening containing a stairway connecting both levels.

Occupant Description:

The building is primarily occupied by UMD students, with a total design occupant load of 1,736, concentrated in assembly spaces, but distributed throughout. Occupants are generally awake, mobile, and familiar with the building. Conservative assumptions for pre-movement time and walking speed are used.

Methods of Evaluation:

Proposed design changes are evaluated using performance-based methods, primarily through Fire Dynamics Simulator/PyroSim fire modeling and Pathfinder egress simulations, supported by hand calculations for tenability and ASET vs. RSET. The analysis ensures that all alternatives meet or exceed life safety and property protection criteria.

Design Fires:

The two design fire scenarios developed, evaluate proposed communicating space fire protection and building security features. Both represent moderate-risk, for occupant safety and system performance.

Design Fire 1:

Examines a fast growing chair fire in the first floor lobby affecting egress paths.

Design Fire 2:

Examines a sofa fire on the second floor impairing stair access and detection time.

Trial Designs:

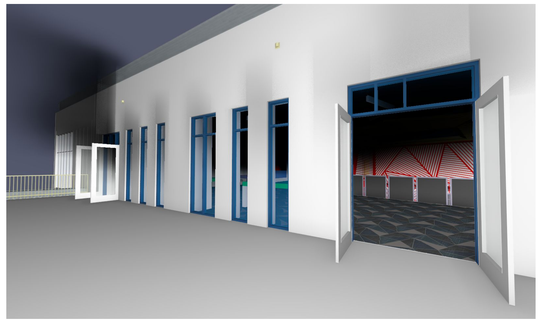
Proposed additional fire protection strategies for the vertical opening include:

- Photoelectric smoke/CO detectors
- Automatic retractable smoke curtain/blinds
- Automatic natural ventilation by terrace doors

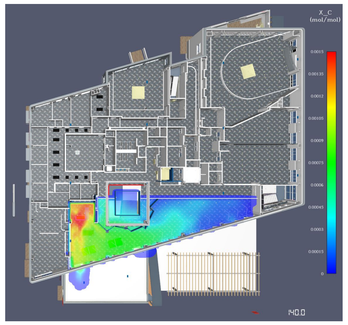
These systems aim to improve early detection, control fire growth, and maintain tenable conditions for egress while balancing cost, code compliance, and architectural considerations.

Fire and Egress Modeling Results

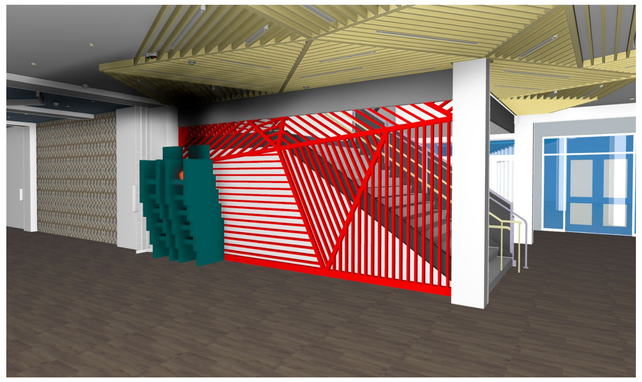
Design Fire Scenario 2: Couch fire, near the terrace exits, in the second level Student Lounge is blocked from view on three sides.



Terrace doors open during Design Fire Scenario 2.

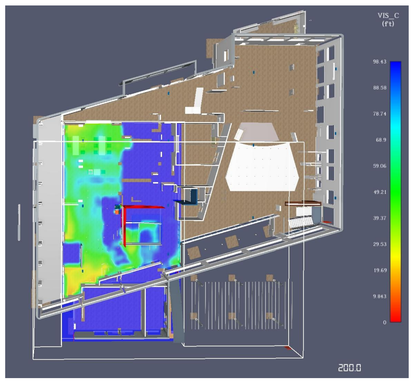


Soot volume fraction on level 2.



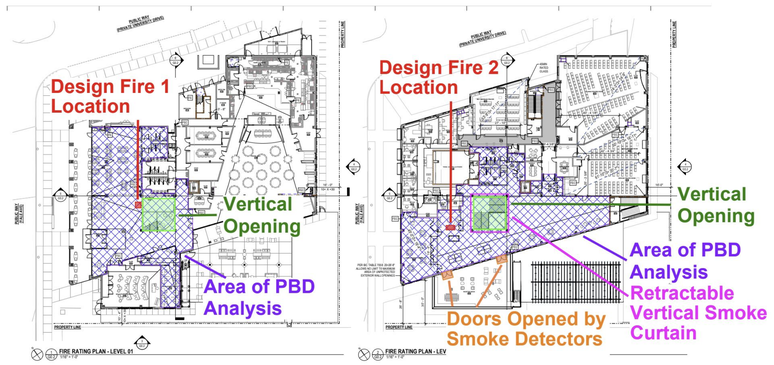
Design Fire Scenario 1: Fire on chairs stacked next to the unenclosed stairway in first floor lobby.

Smoke curtain descending during Design Fire Scenario 1.



Soot visibility on Level 1.

Final Designs



Level 1 (left) & Level 2 (right) floor plans.

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