DEPARTMENT OF FIRE PROTECTION ENGINEERING

Jacobs

BWI Airport | Team 6
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Problem Definition

A performance-based fire protection and evacuation strategy for the BWI Airport AB Connector must be developed to ensure safe occupant evacuation without disrupting airport operations. This must address fire hazards, security, and code compliance.

Performance Criteria & Design Calculations

Temperature Control:

- Keep below 100°C outside fire compartment to prevent heat hazards

Smoke Management:

- Maintain a minimum of 1.8 meters above walking surface for visibility

Radiant Heat Flux:

- No greater than 2.5 kW/m² to prevent secondary ignition

Heat Release Estimation

$$Q = m'' \Delta H_{c,eff}(1-e^{-k\beta D})A_f = 402 \text{ kW}$$

Q = Heat release rate of the pool fire (kW)
m'' = Mass burning rate per area (kg/m²-sec)
$\Delta H_{c,eff}$ = Effective heat of combustion (kJ/kg)
A_f = Surface area of the pool fire (m²)
$k\beta$ = Empirical constant (m⁻¹)
D = Diameter of the pool fire (m)

Final Design

The AB connector will be split into zoned areas for horizontal evacuation. Partition assemblies will separate the zoned areas, protecting occupants within each zone. Occupants in the zone of fire origin will egress to an adjacent zone, guided by the zoned public address system and trained airport staff. The compartmentalization of the airport aims to contain the fire and minimize impact on the non-affected areas of the concourse.
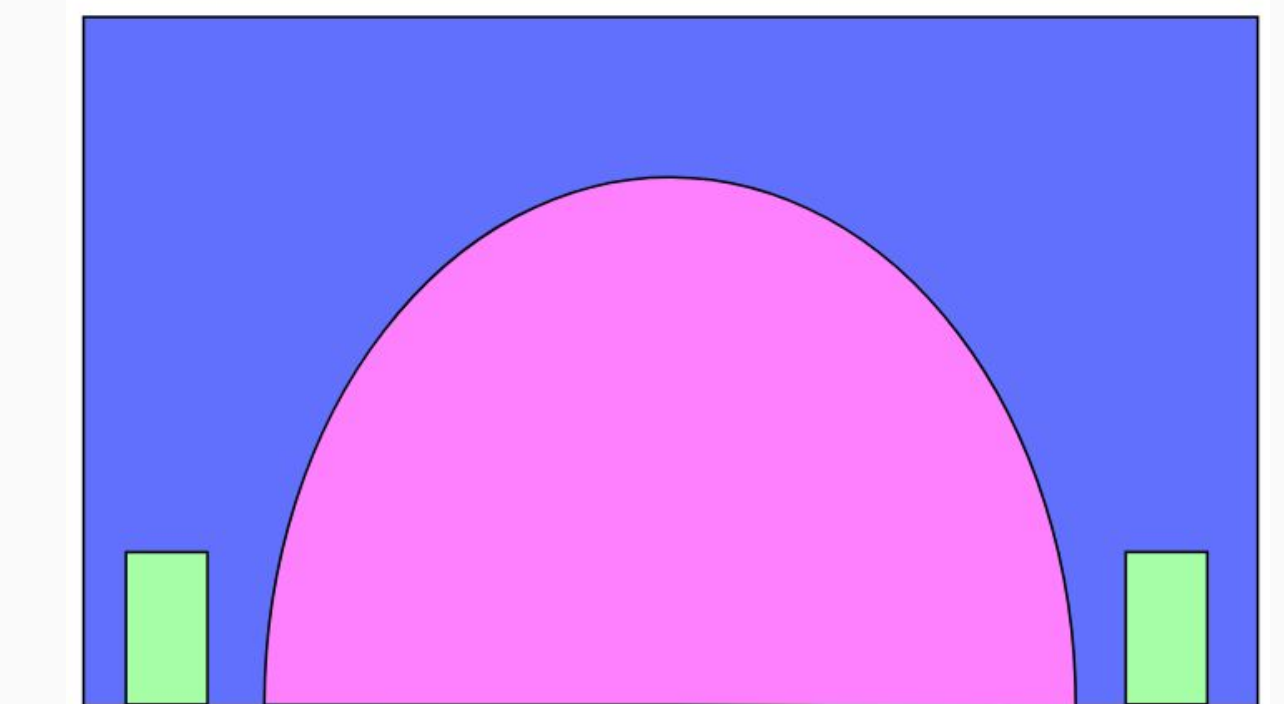
■ 2-hour rated fire rated arch built into the airport

■ 2-hour rated fire curtain, stored in arch during typical operations to facilitate occupant movement

■ 1.5-hour rated fire doors, on electric door holders during typical operation
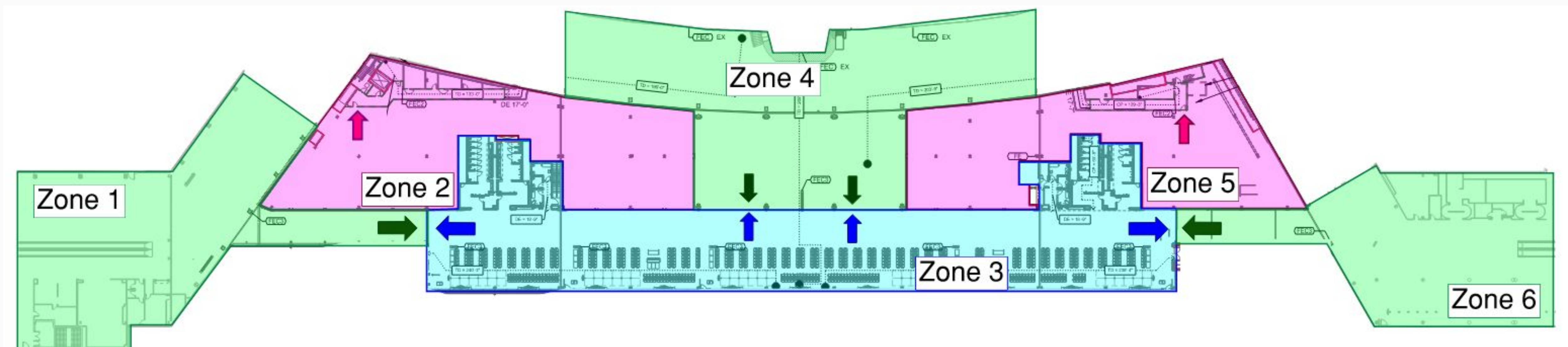
Fire Scenario ⚠

An electrical fire (20–30 kW) breaks out in the duty-free shop display and spreads to ignite ethanol-based perfumes (60–95% ethanol), resulting in a high-intensity fire. The likelihood of ignition is low, but the potential consequences are catastrophic, making it one of the most severe fire scenarios considered in the design.

Test Results

Pathfinder is an egress modeling software, used to evaluate the evacuation time of each zone model.

PyroSim is a modeling software used to simulate the growth and spread of fires, powered by Fire Dynamics Simulator (FDS)