



Evacuation Philosophies for High Occupancy Buildings

Presented by
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Course Description

Stadia, malls, museums, arenas, and other assembly and high occupancies require Fire and Life Safety considerations above and beyond code. The evacuation of these buildings is key, and this presentation will highlight the design and operational elements that should be accounted for in order to achieve a safe evacuation during emergencies

Presenter

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- Royal Berkshire Fire & Rescue Service 1978 – 2006
- Station Commander Langley & Slough Fire Stations
- Fire Safety Inspecting Officer West Berkshire
- Kingfell Consulting London 2006
- 2007 Graduated University of Central Lancashire Fire Engineering
- 2007 Managed Locke Carey business's in Dubai & Abu Dhabi
- 2010 Buro Happold worked on large mixed use / high rise developments throughout the ME and Azerbaijan region.
- 2012 JBA Consulting Engineers Macau worked on large casino projects in Coati Strip
- 2014 WSP Doha as Associate Fire & Life Safety
- Specialties: NFPA/Qatar/UAE/KSA Code Consulting, Fire Safety Strategies, Smoke Control Design

Learning Objectives

1. Understand factors that influence evacuation design for high occupancy buildings
2. Understanding of human behavioral science
3. Familiar with key aspects of a fire strategy for a high occupancy buildings
4. Understand the key role fire safety management plays in the evacuation of high occupancy buildings

The purpose of this presentation is to convey technical knowledge to the conference participants.

The presentation also contains slides with text that summarises the content of the presentation and the main learning objectives.

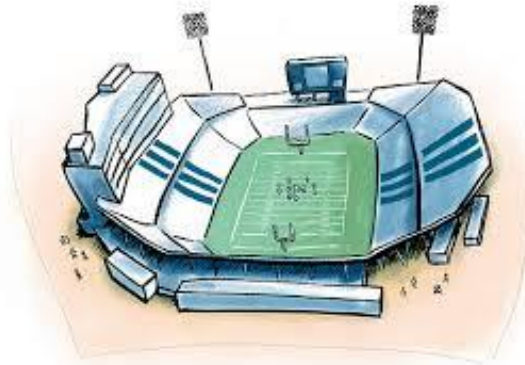
These may be used to update CPD records for relevant organisations including the Chartered Institute of Building (CIOB).

Presentation Summary

The objective of this presentation is to outline the issues that need to be considered when addressing fire safety for a high occupancy building. The presentation will cover the following:

- Types of high occupancies
- Challenges faced when dealing with high occupancies
- Human behavioral science and case studies
- Design of the egress provisions and the technologies available
- Evacuation philosophies and the role of the fire alarm system
- Fire safety management

High Occupancy Buildings



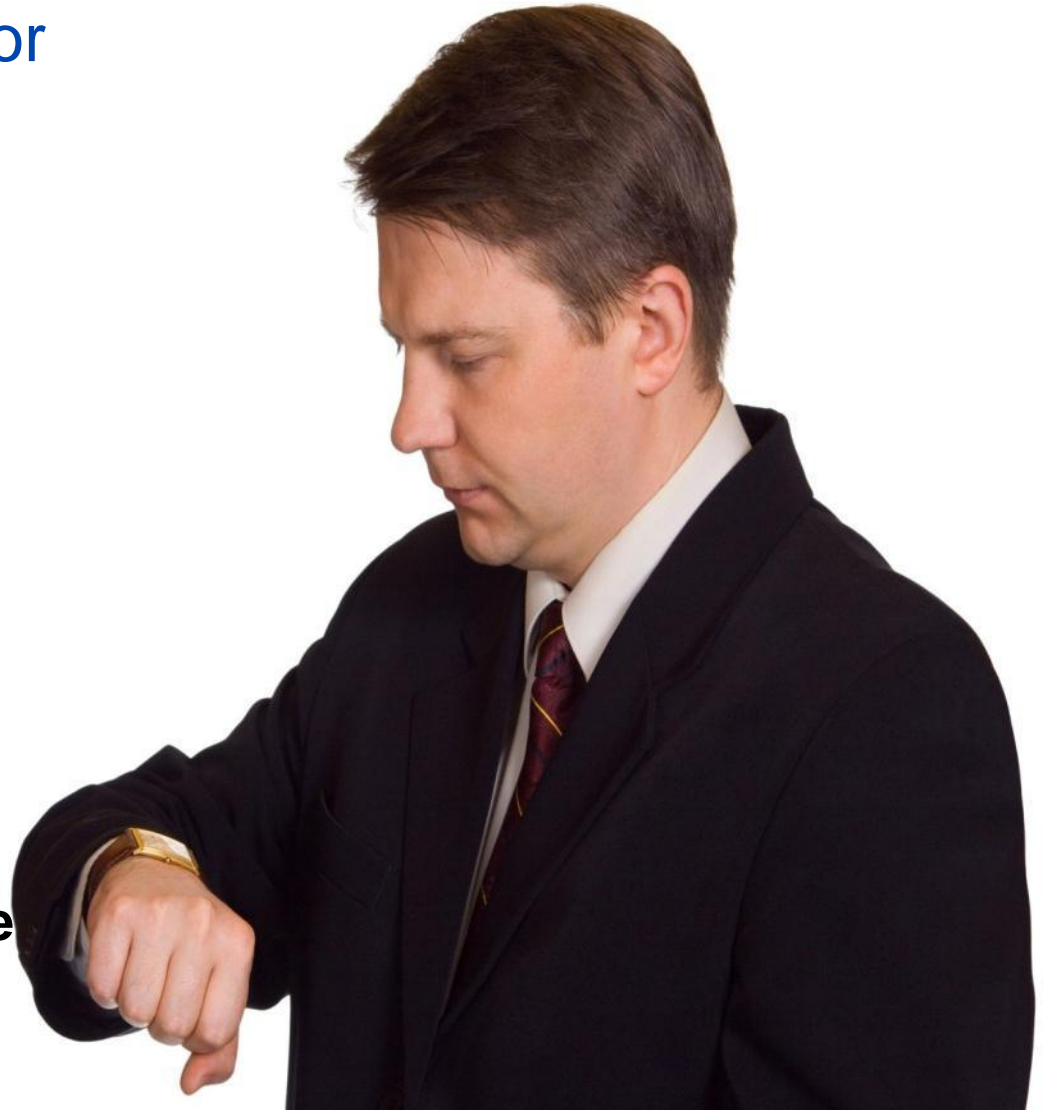
Challenges

- People
- Lots of people
- Awake but unfamiliar with surroundings
- Potential lack of alertness
- Reliant on good management (worldwide issue)



Influences on Human Behavior

- **Population and density**
- **Individuals alone or in groups**
- **Familiarity with building**
- **Distribution and activities**
- **Alertness**
- **Physical/cognitive abilities**
- **Role/responsibilities**
- **Location Commitment to task**
- **Gender/Culture/Age**
- **Prior fire/evacuation experience**
- **Smoke and toxic gases**
- **Temperature/Visibility**



Human Behavior in High Occupancy Buildings

Alertness – Awake but potentially distracted

Familiarity – Returning to Main entrance/exit

Grouping – Following the crowd

Ownership – Staying committed to a task/objective

Leadership – Being responsible for others

'Panic' in Fire Situations

The word 'panic' is frequently used in media accounts and statements of survivors of emergency evacuations and fires, but what does it really mean, is it a phenomenon that actually occurs?

Despite evidence that panic is a very rare occurrence in fires, the idea of panic and the term continues to be used by the public as well as fire experts.

Large numbers of deaths in catastrophic events are often attributed to panic, just as is the action of a parent going back inside a burning house to save his child

Experts conclude that occupants who state that they panicked in a fire is usually a judgment made in retrospect, which does not consider the perspective of the person at the time of the event

All human behaviour in fire can be rationalized when the event is seen through the subject's perspective

Case Studies

Gothenburg Discotheque Fire, Sweden, October 29, 1998

Fire was discovered in one of the two stairwells of the two-story building. The upstairs dance hall was approved to hold 150 patrons, but there were between 340 and 400 people. When patrons rushed toward the only available exit, crushing and congestion occurred. When one of the DJs warned the crowd of the fire, many of those in the hall ignored the warning and continued to dance.

Station Nightclub Fire, USA, February 21, 2003

- Evacuees describe aggressive behaviour, either their own or others, but do not mention cases of irrational or illogical responses**
- Occupants demonstrate two characteristics:**
 - Hope to escape through dwindling resources
 - Aggressive concern about own safety

Design of Egress Provisions

- **Determine appropriate Occupant Load Factor**
- **Identify Main Entrance/Exit**
- **Determine minimum number of exits**
- **Determine required minimum exit widths**
- **Ensure exits are arranged to provide adequate separation**
- **Avoid converging exits at the discharge points**
- **Provide appropriate signage/lighting to ensure exits are marked and visible**
- **Ensure egress components are appropriately designed (stairs, ramps, doors, handrails)**
- **Avoid obstructions (security barriers, columns)**
- **Ensure a adequately sized assembly area is provided outside and away from the exits**
- **Local code requires design to be based upon full simultaneous evacuation**

Technologies – Egress Modelling

Commonality between egress modelling and pedestrian movement/comfort modeling

- **Avoid bottlenecks (provide multiple egress routes)**
- **Coordinate with general circulation**
- **Avoid crush conditions**

Evacuation Philosophies



- **Full simultaneous (total) evacuation**
- **Zoned evacuation – One zone evacuated**
- **Staged evacuation – Zones evacuation in sequence**
- **Defend-in-place (typically used in residential)**
- **Relocation (typically used in prisons and hospitals)**

Fire Alarm Systems

→ Components:

- Detection Devices – Smoke/heat detectors, flow switches, manual call points
- Notification Devices – Voice alarm, audible and visual alarms
- Monitoring – Fire alarm panels

→ Cause and effect matrix i.e. actuation of detector (cause) results in actuation of alarm (effect)

- Single knock
- Double knock
- Investigation periods

→ Voice alarm – Proven benefits for high occupancy buildings

→ Positive alarm sequencing

- Acknowledgement within 15 seconds
- Investigation period of 180 seconds
- Alarm activated if alarm is not acknowledged or system is not reset

Fire Safety Management

→ Information

- Fire Safety Manual including policies and procedures
- Accessible at all times
- Containing plans and a list of hazardous materials
- Location and provisions for those with mobility impairment

→ Education and Training

- Fire safety awareness training for all
- Training in evacuation procedures for all operational staff

→ Records

- Frequency of training or drills
- Who is trained or drilled

→ External Crowd Management

- Assembly points
- Interaction between Fire Department access and assembly points
- Liaison with attending Fire Department

ANY QUESTIONS?

