



# Fire Safety Design Principles for Malls

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Safety Design in Buildings

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UNITED  
BY OUR  
DIFFERENCE



# Learning Objectives



Key Design  
Challenge

Understanding  
Mall Design  
Principles

Understanding  
Common  
Misinterpretations



# Alexander Castellanos



- University of Maryland, B.S. Fire Protection Engineering
  - 2004 – 2008, RJA New York
  - 2008 – 2010, Buro Happold London
  - 2010 – 2012, Buro Happold New York
  - 2012 – Present, WSP in the Middle East
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- Experience in design of high profile, high occupancy buildings
  - Fire, Smoke, and egress modelling
  - Liaison with Approving Authorities

# Key Design Challenges



High Occupant  
Loads



Means of Egress  
System Design

# High Occupancy Challenges



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



# Human Behaviour in Mall Buildings



**Alertness** – Awake but potentially distracted

**Familiarity** – Likely to return to their entrance point

**Alone or Group** – Following the crowd

**Ownership** – Staying committed to a task i.e. in process of buying

**Leadership** – Being responsible for others

# Means of Egress Challenges



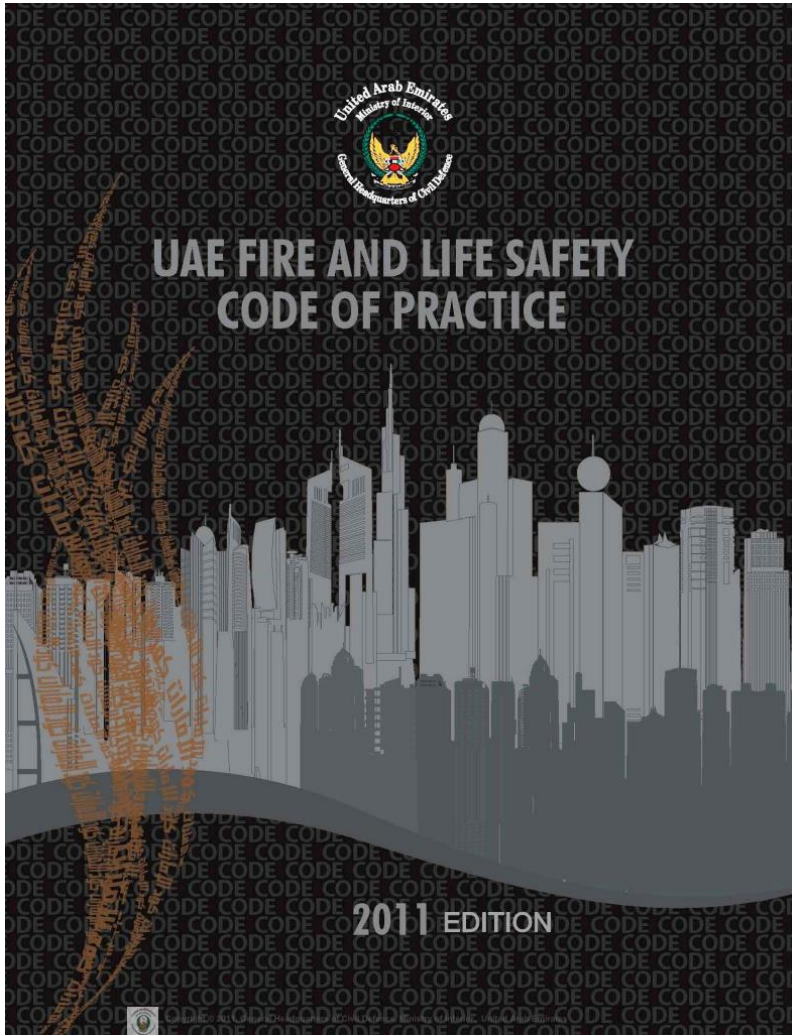
**Occupant Loads** – Mall specific

**Exit Width** – Cater for large occupant loads

**Travel Distance** – Large volume, long distances, “mega malls”

**Exit Discharge** – Following the crowd

# Design Logic For New Malls



UAE Fire Code  
Compliance For:

Fire Fighting Access  
and Provisions

Compartmentation

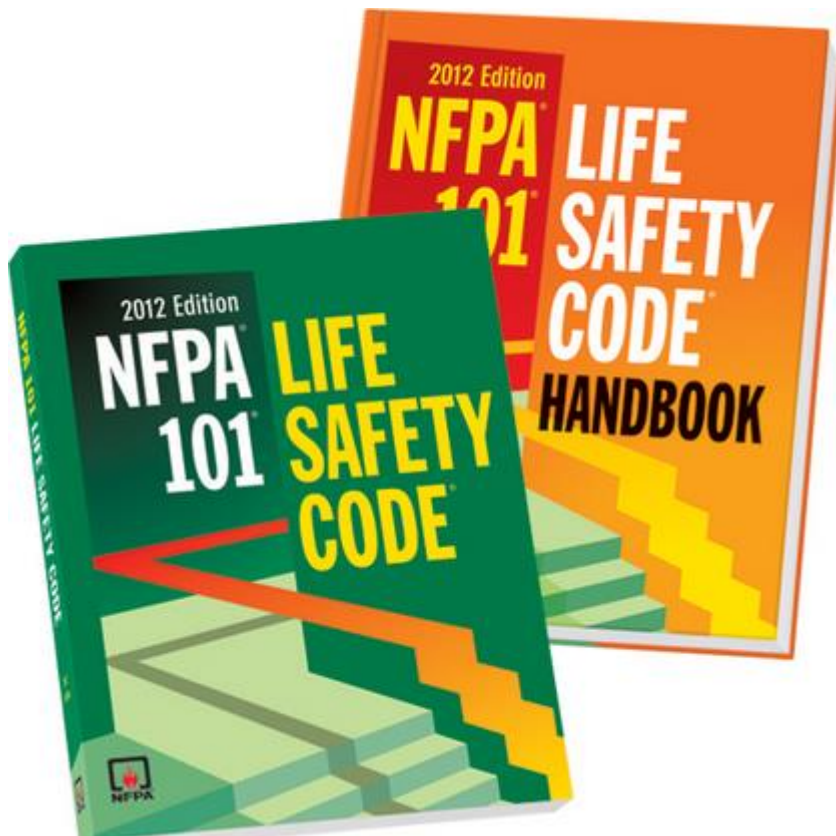
Special suppression  
requirements

Basic Smoke Control  
Requirements

Supplemented by NFPA 101/5000



# Advantages Built Into NFPA 101



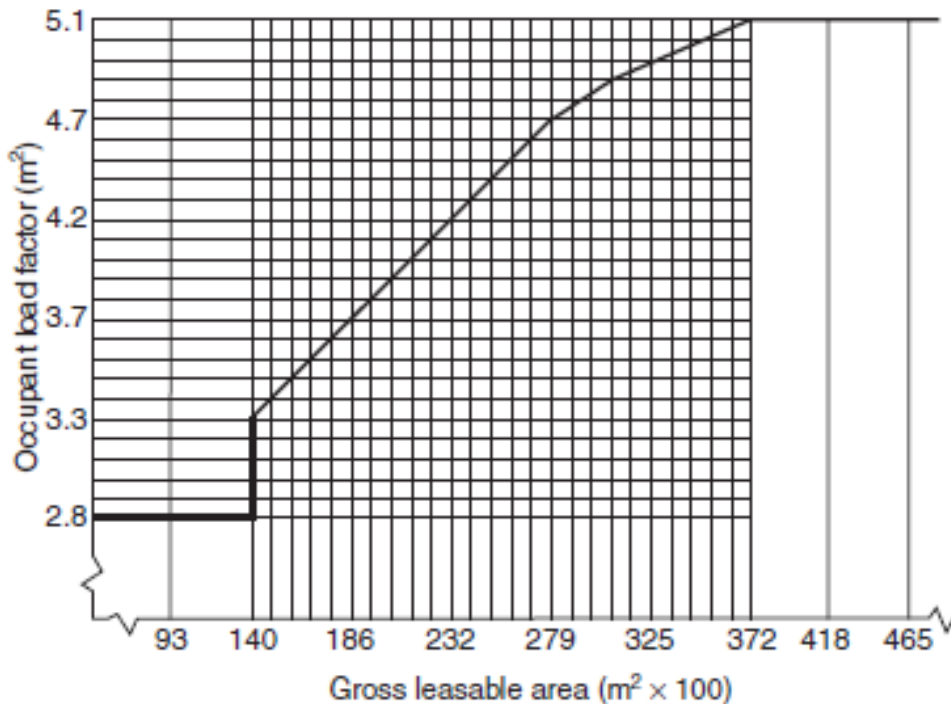
Based on Mall  
Precedents and  
Research From  
Large Malls

Occupant Load

Means of Egress

Large Connecting  
Volumes

# Mall Occupant Load Assessments



## Mall Exit Assessment

- Total GLA (Determines Factor)
- Non GLA Calculated Separate
- Assess Individual Levels

## Individual Unit Egress Assessment

- Assembly - 1.4m<sup>2</sup>/person
- Retail (Ground) - 2.8 m<sup>2</sup>/person
- Retail (Upper Levels) - 5.6m<sup>2</sup>/person
- Storage - 27.9m<sup>2</sup>/person (UAE Fire Code)

# Unit Travel Distance



76m Internal Travel Distance

# Mall Travel Distance



60m Mall Travel Distance

Based on Smoke Control Provisions

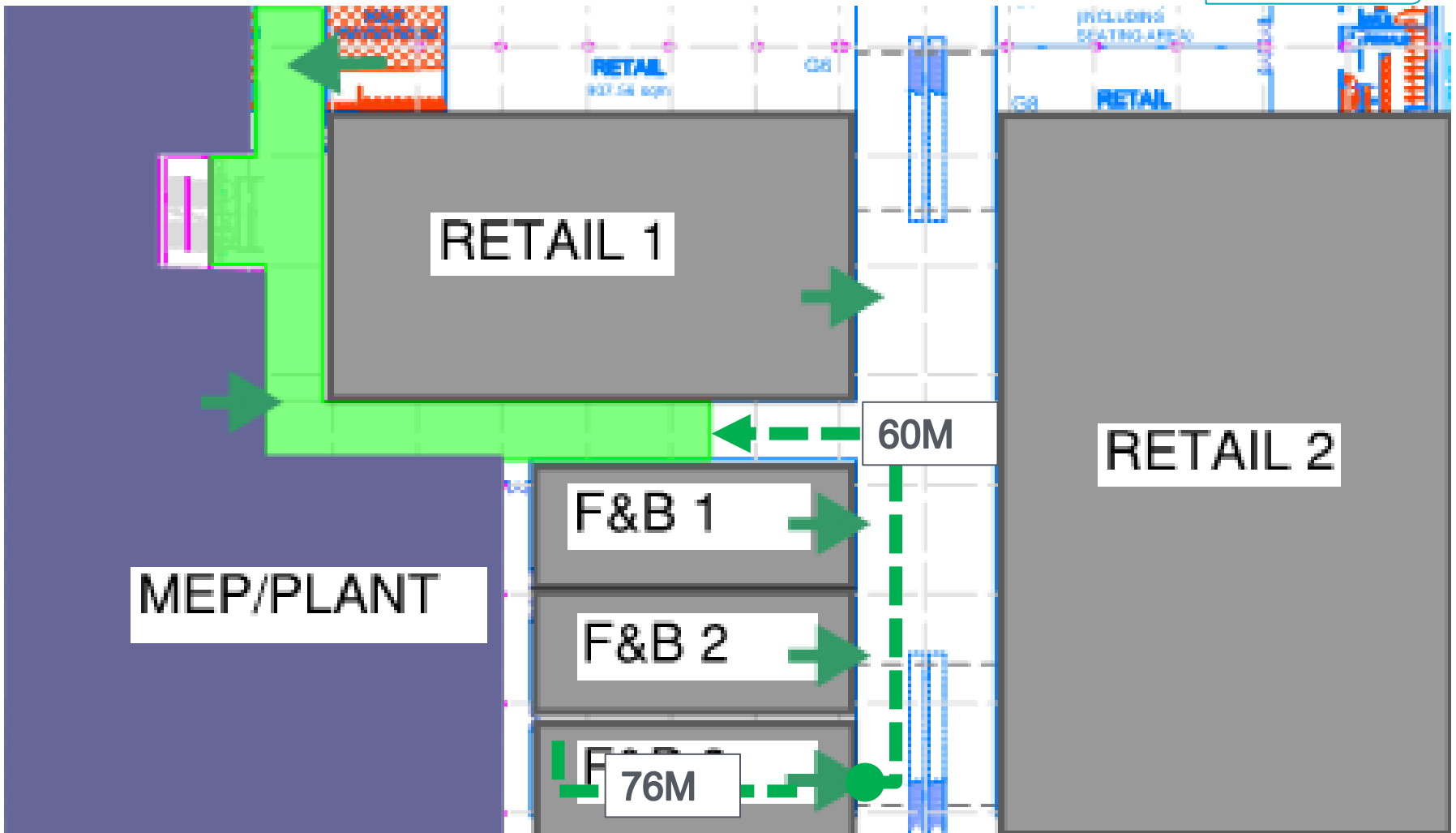
# Mall Exit Passageways



Flexibility on Exit Passageways

Openings and Services Permitted

# Mall Design Basics - Summary



# Smoke Management - Mall



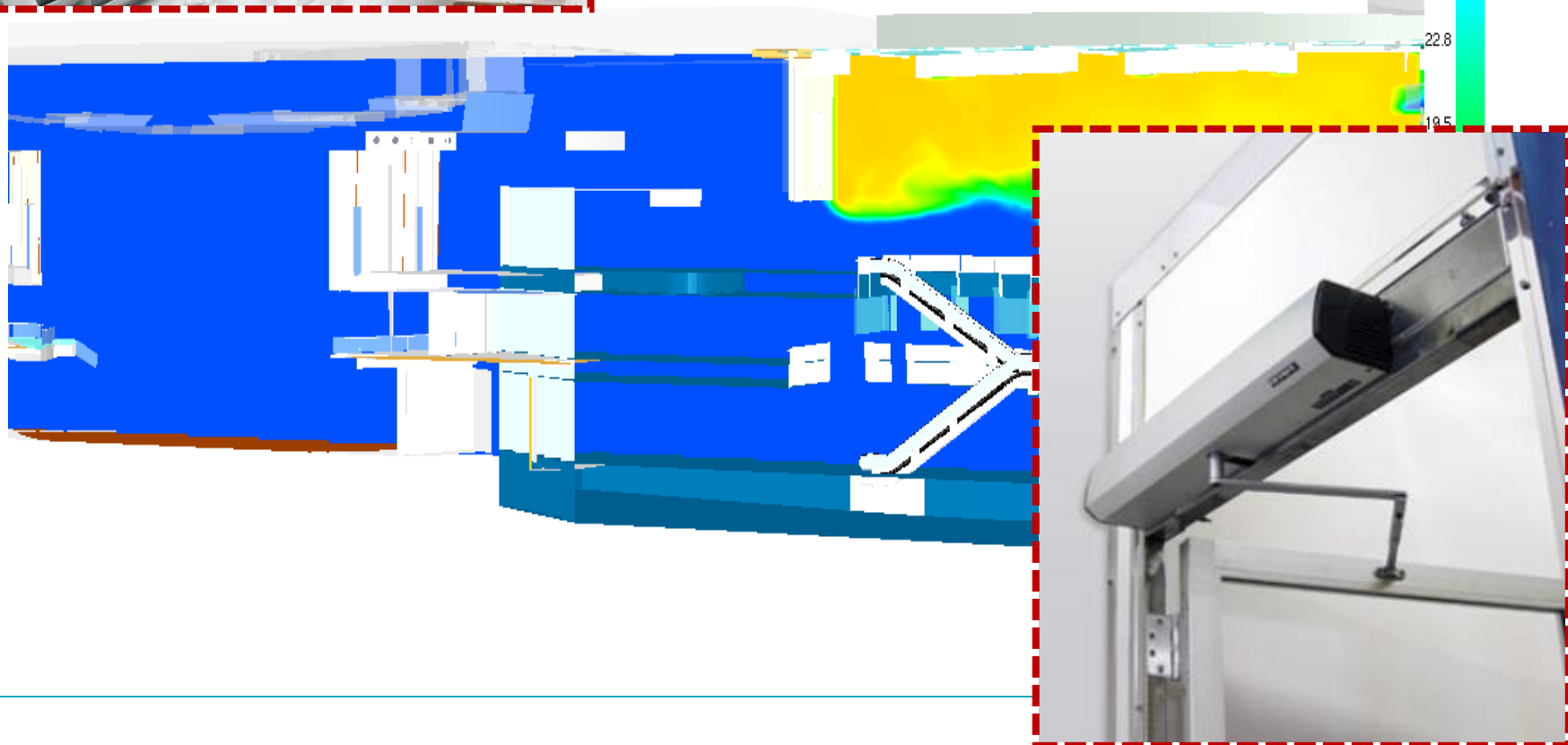
NFPA – Chapter 30 – MALL  
CONNECTING MORE THAN 2 LEVELS

UFC – Chapter 10 – MALL  
CONNECTING MORE THAN 2 LEVELS

GENERAL LOCAL PRACTICE –  
MINIMUM 6 AIR CHANGES



# Smoke Management - Mall



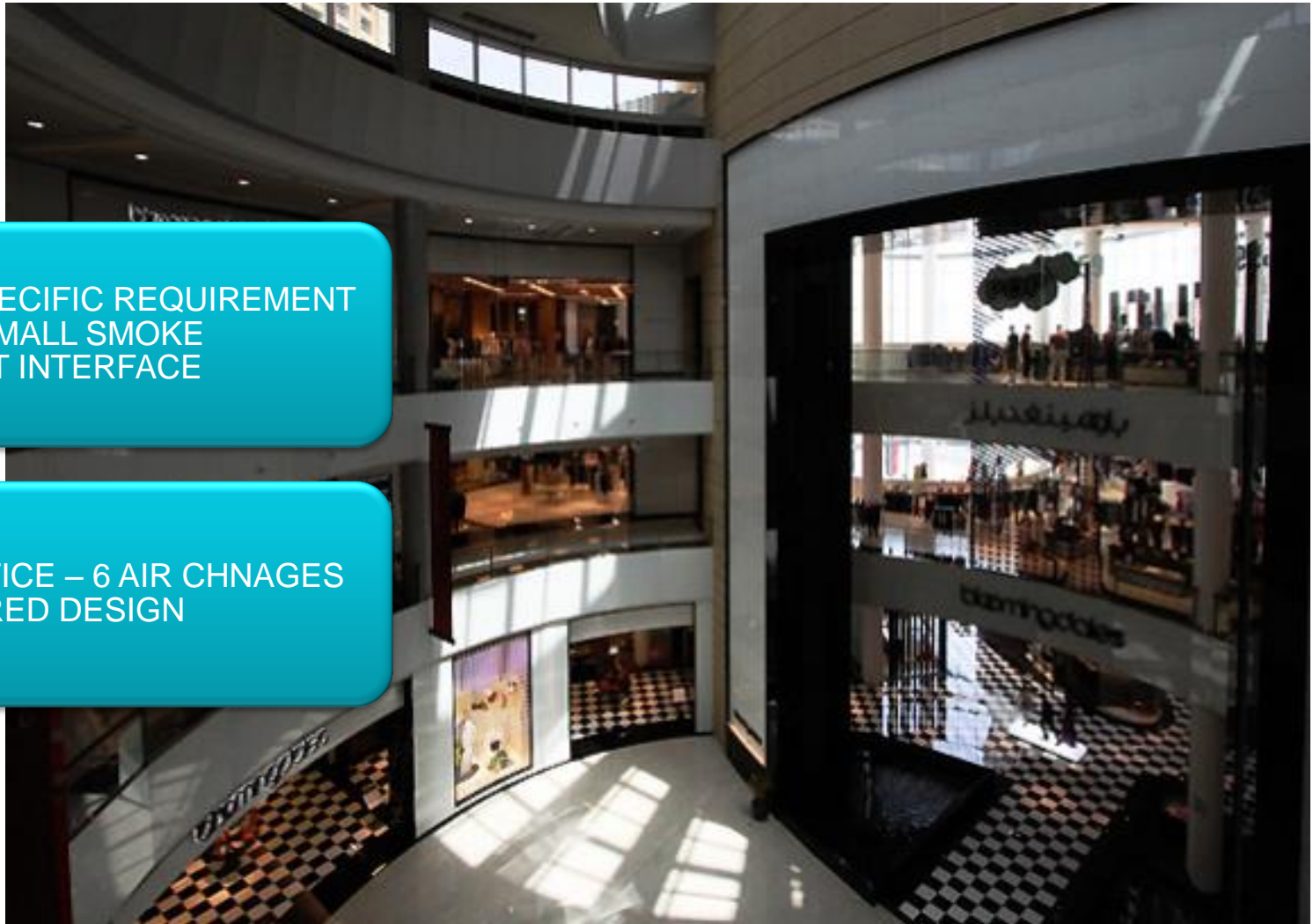


# Smoke Management – Anchor Units



NFPA – NO SPECIFIC REQUIREMENT  
– RESULT OF MALL SMOKE  
MANAGEMENT INTERFACE

LOCAL PRACTICE – 6 AIR CHANGES  
OR ENGINEERED DESIGN



# Mall Expansion



Determine  
Applicable  
Code

Assess Impact  
on existing  
adjacent  
structures

Treat as new  
build where  
feasible

# Mall Expansion



Determine  
Applicable  
Code

Assess Impact  
on existing  
adjacent  
structures

Use existing  
approved  
strategy where  
necessary

# Mall Expansion



# Mall Refurbishment



Determine Original Strategy and Code

Assess Impact on existing adjacent structures

Use existing approved strategy where necessary, and achieve new code where practical

Coordinate interface with other engineering