The Fundamentals of Smoke Control

Methods, Requirements and Regional Perception of its Performance

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COURSE DESCRIPTION

Smoke control is a widely misunderstood concept within the design of buildings. Often smoke control and post fire clearance is seen as the same thing.

This presentation explores the requirements of smoke control and outlines where they are required, and to dispel the myth that smoke control systems solve all problems.

Presenter

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- Principal Consultant at WSP | Parsons Brinckerhoff
- Fire strategy development
- Authority and client liaison

Learning Objectives

1. *Understand the difference between smoke control and smoke purging*

2. *Understand where smoke control might be required, and for what purpose*

3. *Dispel the misconception that smoke control can solve all problems*

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).

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AGENDA

→ **What is smoke?**

→ **Codes and standards**

→ **Difference between life safety and property protection**

→ **Component of a larger system**

→ **Why is smoke control used across the region**

→ **Terminology**

→ **Performance requirements**

→ **Examples of smoke control and smoke extract systems**

→ **Documentation and controls**
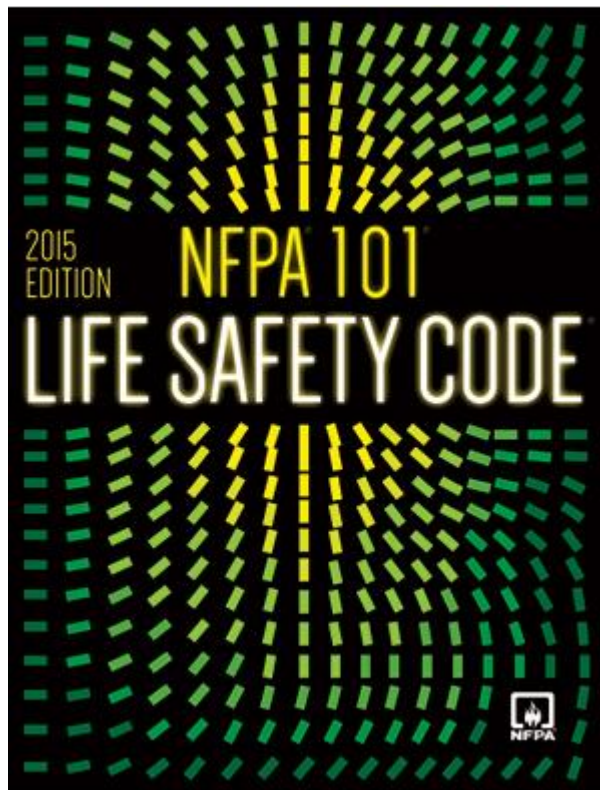
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WHAT IS THE ISSUE WITH SMOKE?

→ 212,500 fires – 322 deaths

- 41% overcome by smoke/ gases
- 20% due to burns
- 20% due to combination of burns/ gases
- 19% other

→ Extensive property damage

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International Code

Local Authority Requirements

LIFE SAFETY OR PROPERTY PROTECTION

People

Property (Insurance)

HOLISTIC ENGINEERING ANALYSIS

Local Authority Requirements

Applicable Codes/ Standards for the Project under Consideration

International Best Practice
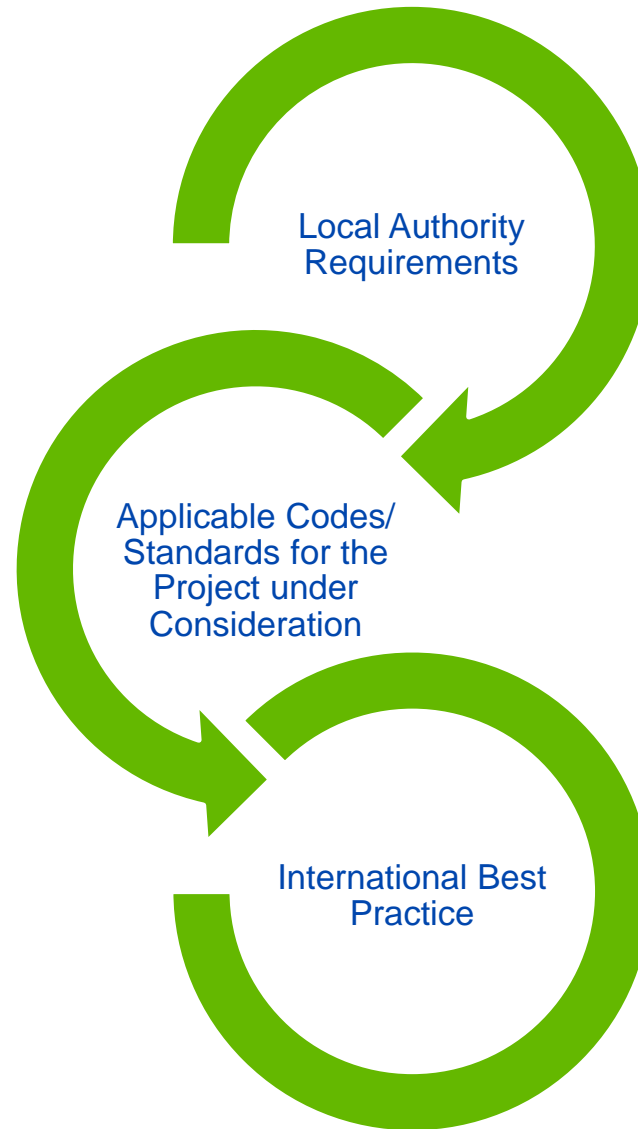
COMPONENT OF A LARGER PACKAGE

Means of Warning and Escape

- Suitable and sufficient for the intended use?
- Sized to accommodate expected occupant load
- Early warning
- Self evacuation

Internal Fire Spread

- Interior finish classifications
- Fire sprinklers
- Compartmentation

External Fire Spread

- Cladding material
- Proximity to adjoining buildings

Structural Fire Resistance

- Suitable structural fire resistance

Fire Department Access

- Time to arrive
- Suitable fire fighting provisions
- Maintained
- Adequate water supply and equipment

WHY IS SMOKE CONTROL USED?

Codes and Standards

→ **Dynamic occupancy**

→ **Little overall control of fire loading within the space**

→ **Large occupant load**

→ **Extensive smoke spread due to vertical openings**

→ **Mitigate certain risks based upon location**

→ **As part of an overall design approach – not a bolt on.**

Regional Requirements

→ **Mitigate poor construction**

→ **Assist evacuation of occupants**

→ **Remove smoke post fire**

→ **Assist fire fighting**

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WHERE IS SMOKE CONTROL REQUIRED?

→ **Underground buildings**

→ **Enclosed train stations**

→ **Road and rail tunnels**

→ **Atria within buildings**

→ **Mall pedestrian way**

TERMS

→ **Performance criteria**
- What is the system intended to do?

→ **Tenable conditions**
- Maintaining conditions to allow occupants to evacuate
- Fire fighting activities

→ **Smoke layer interface**
- The location horizontally between tenable and untenable conditions

→ **Smoke clearance**
- No performance criteria
- System designed to clear smoke post fire

TERMS (2)

→ **Smoke control**

- Detailed performance criteria
- Maintain tenable conditions for minimum 20 minutes or 1.5 time the calculated egress time

→ **Design fire size**

- The fire size modelled, based upon engineering analysis

→ **Atrium**

- A space of 3 or more stories in height un-compartmented from the remained of the building

→ **Back layering**

- Smoke movement counter to direction of ventilation

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TENABLE CONDITIONS (SMOKE CONTROL)

SMOKE CONTROL

→ Hand calculations
→ Specialist software packages

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SMOKE CONTROL DESIGN OBJECTIVES (NFPA 72)

→ Contain smoke to zone of origin
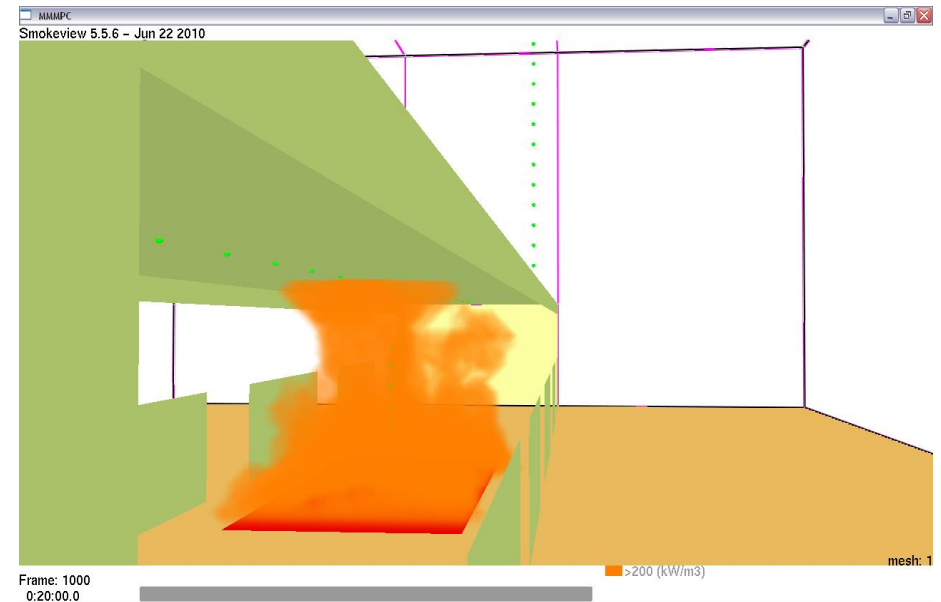→ Maintain tenable conditions
→ Maintain smoke layer interface

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UNDERGROUND BUILDINGS

→ Break out of smoke/ fire

→ Large occupant loads

→ Limited control of contents

→ What is being achieved

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ENCLOSED TRAIN STATION

→ Platform evacuation time

→ Tenable conditions on concourse level

→ Concourse is a place of relative safety

→ Demographics of transit systems

→ Fire spread – train to station/ station to train?

TUNNELS

→ Prevent back layering

→ Egress time

→ Fire fighting access

→ Engineering Analysis part of
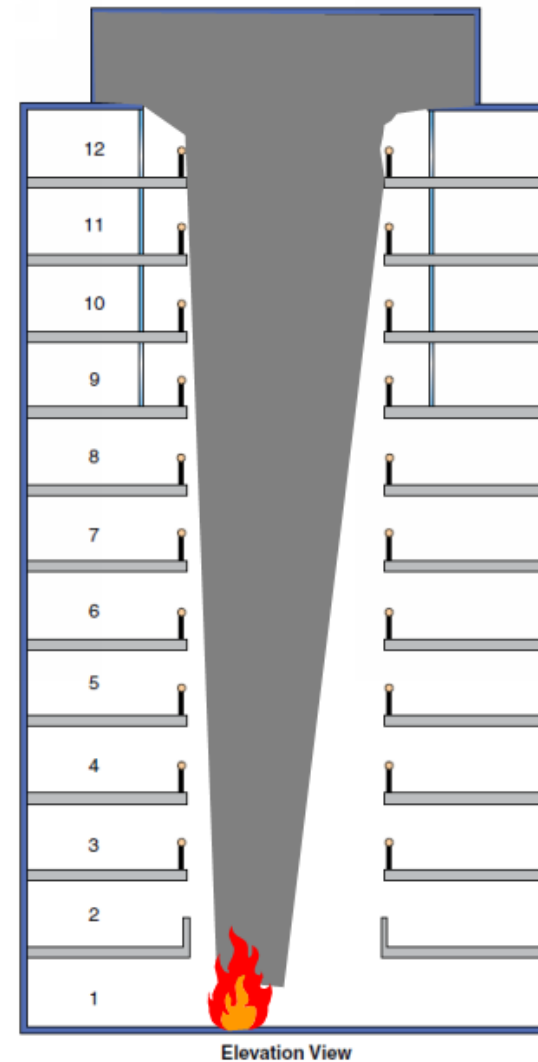 '*holistic multidisciplinary
 engineering analysis*' (NFPA 502)
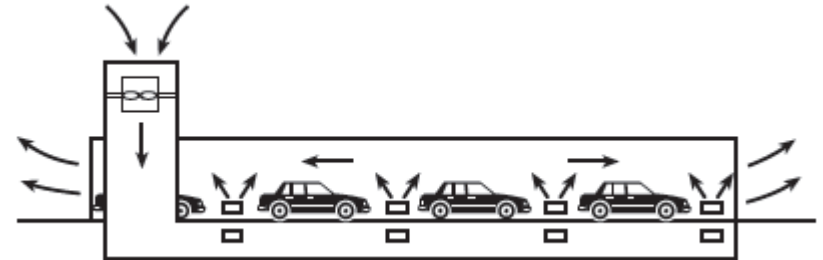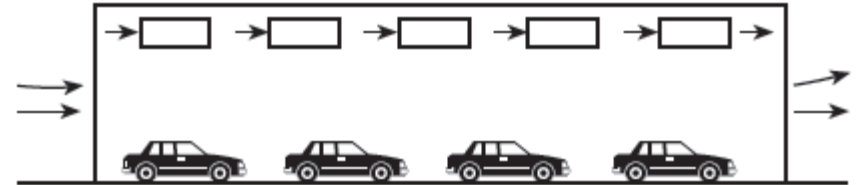
MALLS AND ATRIA

→ Tenable conditions
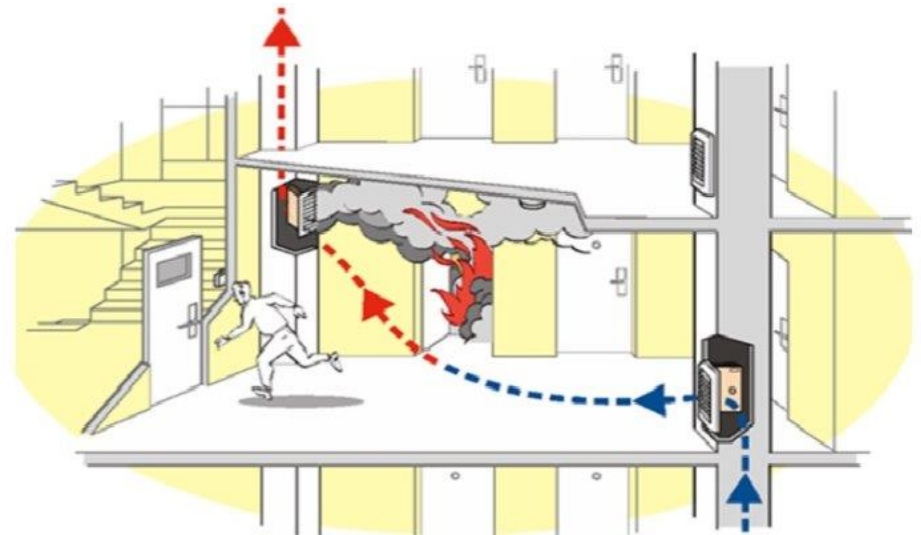
→ Enclosed upper levels

→ NFPA 92

Elevation View

CAR PARK VENTILATION

✓ Assisting fire fighters to clear smoke during and post fire

✗ Provide smoke free access for fire fighting

✗ Protect means of egress

CORRIDOR SMOKE EXTRACT

→ High level extract

→ Low level makeup air

→ 6 ACH system

SMOKE CONTROL DESIGN DOCUMENTATION

→ System purpose

→ System design objectives

→ Design approach

→ Design assumptions (building height, ambient conditions, reliance on other fire protection systems, leakage, etc.)

→ Location of smoke zone(s)

→ Design pressure differences

→ Building use limitations that arise out of the system design

→ Design calculations

→ Fan and duct specifications

→ Damper specifications

→ Detailed inlet or exhaust inlets site information

→ Detailed method of activation

→ Smoke control system operation logic

→ System commissioning procedures

CONTROLS

→ Automation

→ Local controls

→ Fire fighters controls

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SUMMARY

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→ Why is smoke control used across the region

→ Terminology

→ Performance requirements

→ Examples of smoke control and smoke extract systems

→ Documentation and controls

QUESTIONS

Thank you

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