

CFR

Congreso Internacional Fuego y Rescate



Modern Buildings

Fires in the Built Environment

Valdivia, Chile
January 2010

CFBT-US

Not just what and how, but why!





One who knows the enemy and knows himself will not be in danger in a hundred battles.

One who does not know the enemy but knows himself will sometimes win, sometimes lose.

One who does not know the enemy and does not know himself will be in danger in every battle.

The Art of War
Sun Tzu

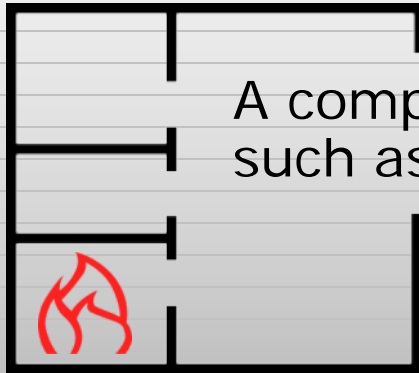
Learning Outcomes

- ▶ Recognize factors that influence compartment fire development.
- ▶ Explain how changes in the built environment have influenced fire development and potential for extreme fire behavior.

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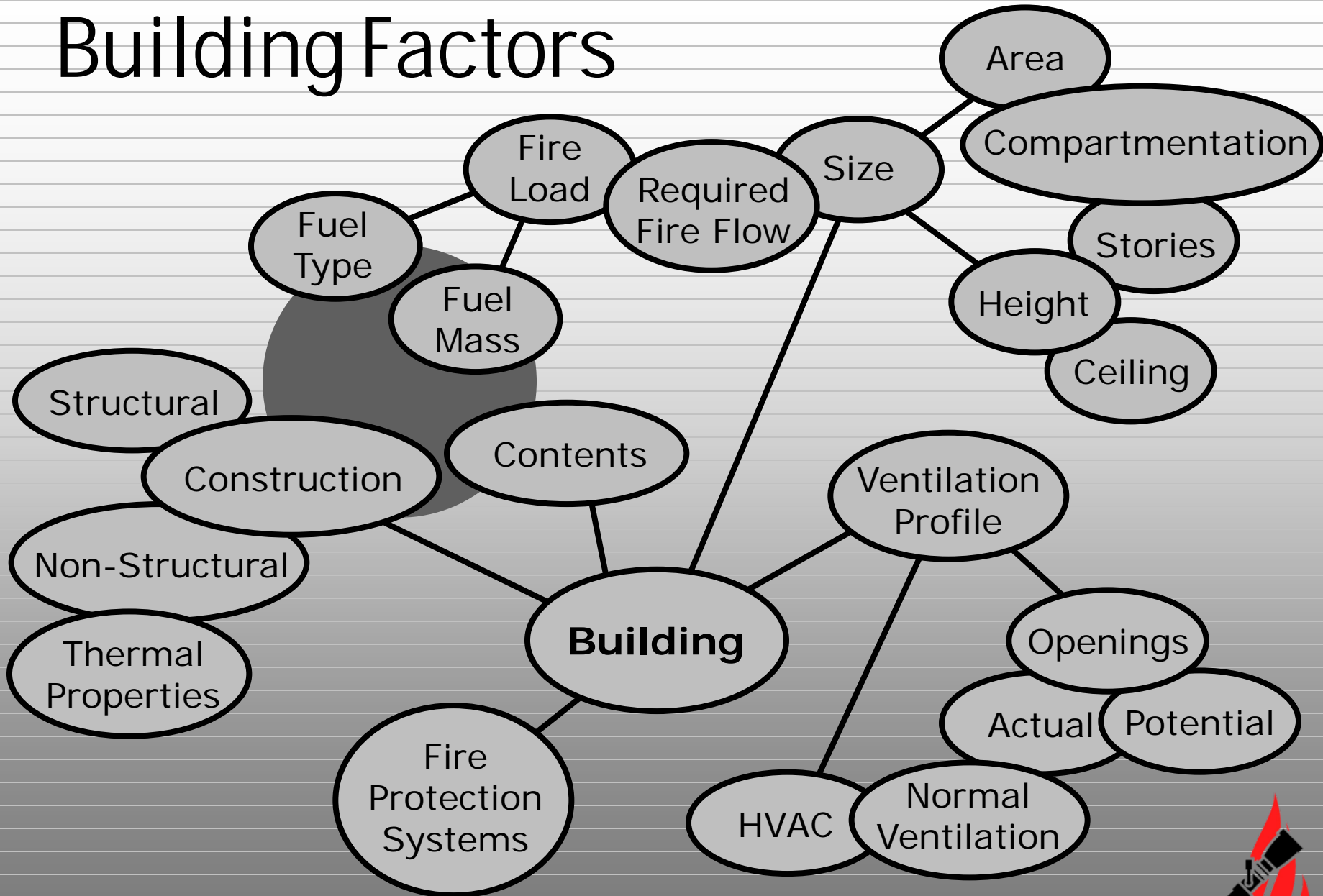
Compartment Fire



A compartment is an enclosure such as a room within a building.

The term compartment fire is generally used to refer to fires inside buildings (even though multiple compartments may be involved).

Building Factors

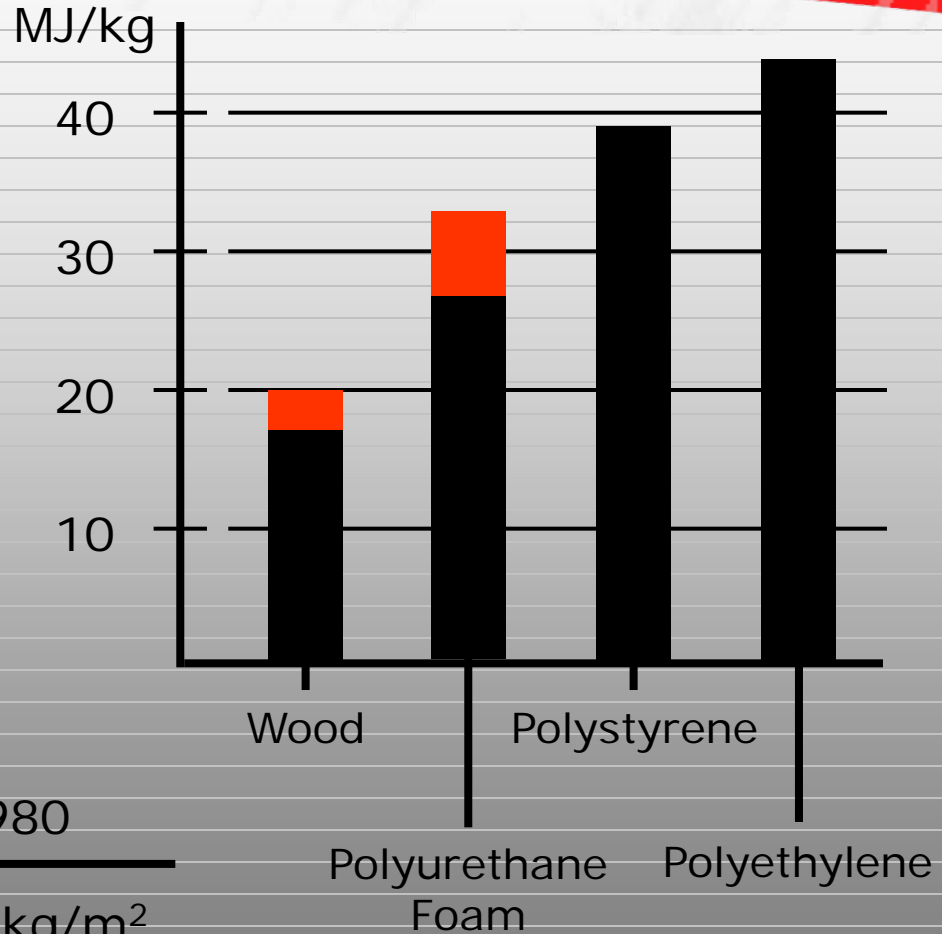


The Built Environment

- ▶ Fire Load (structural and contents)
- ▶ Size and compartmentation
- ▶ Ventilation profile
- ▶ Thermal properties of the compartment

Fire Load

The mass and burning characteristics of the fuel encountered in compartment fires has changed over time.



Fuel Load

1942

1980

Low	9.9 kg/m ²	29.3 kg/m ²
High	64.4 kg/m ²	125.5 kg/m ²

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Visualization

Flashover of an average size family room will occur with a HRR of 1000 kW.

Wood and Polyurethane Chair
28.3 kg (62.4 lbs)
 ± 2100 kW Peak HRR



Remember the example of HRR used in the preceding lesson? The couch in this family room is likely to have a Peak HRR of ± 3100 kW.

Size & Compartmentation

- ▶ Fire develops more quickly in a small compartment.
- ▶ Highly compartmented buildings may slow fire spread.
- ▶ Large compartments contain more air and may have a substantial fuel load.



Ventilation Profile



Existing and Potential Openings

- ▶ *Normal building ventilation and compartmentation*
- ▶ *Ventilation openings created by exiting civilian occupants*
- ▶ *Tactical action taken by firefighters*
- ▶ *Unplanned ventilation*



All changes to the ventilation profile may influence fire behavior!

Thermal Properties



- ▶ Effective insulation prevents heat loss
- ▶ Normally this is a good thing.
- ▶ What effect does this have on fire development?

Brick Wall _____
December 3, 1999
Asphalt Impregnated Cork _____
Worcester MA
Styrofoam _____
Foam Glass _____



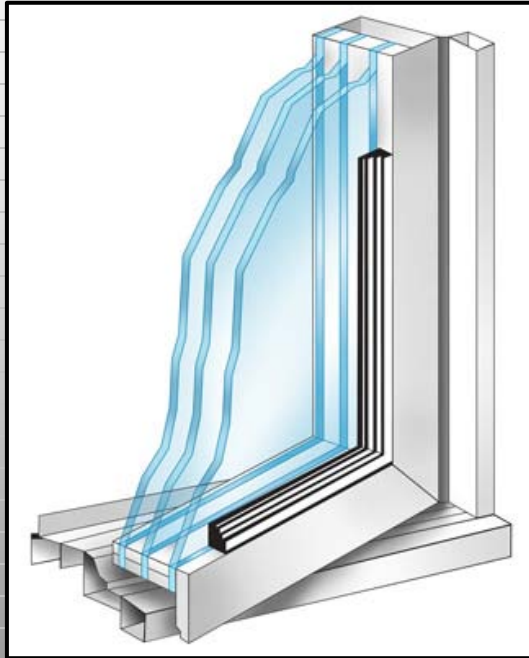
Important Changes



- ▶ Changes in Fuel & Fuel Load
- ▶ Energy Efficient Design & Construction
- ▶ Architectural Design
- ▶ Engineered (Lightweight) Structural Systems

International Variations?

Energy Efficient Construction



- ▶ Insulation
- ▶ Multi-Pane Windows
- ▶ Air Handling Systems
(*Heat, Ventilation, Air Conditioning*)

Architectural Design



Legacy



Contemporary

Engineered Structural Systems

- ▶ Engineered Wood Products
- ▶ Hybrid (Wood & Steel) Construction



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