

# CASE STUDY TO EVALUATE THE EFFECTS OF BUILDING CODE VIOLATIONS ON A FATALITY FIRE

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- ⌘ On a warm summer weekend night near midnight
- ⌘ A fire is noted, 911 called
- ⌘ Bystanders make efforts to alert the occupants
- ⌘ The Fire Department arrives from blocks away and are stunned by the following sight on arrival.....

# Events



- & The engines roll in 2 minutes
- & The engines arrive in 5 minutes
- & The building is largely involved and threatening other structures on arrival
- & They know there are trapped people

## The Tragedy





# Common Apartment Layout



Central Corridor



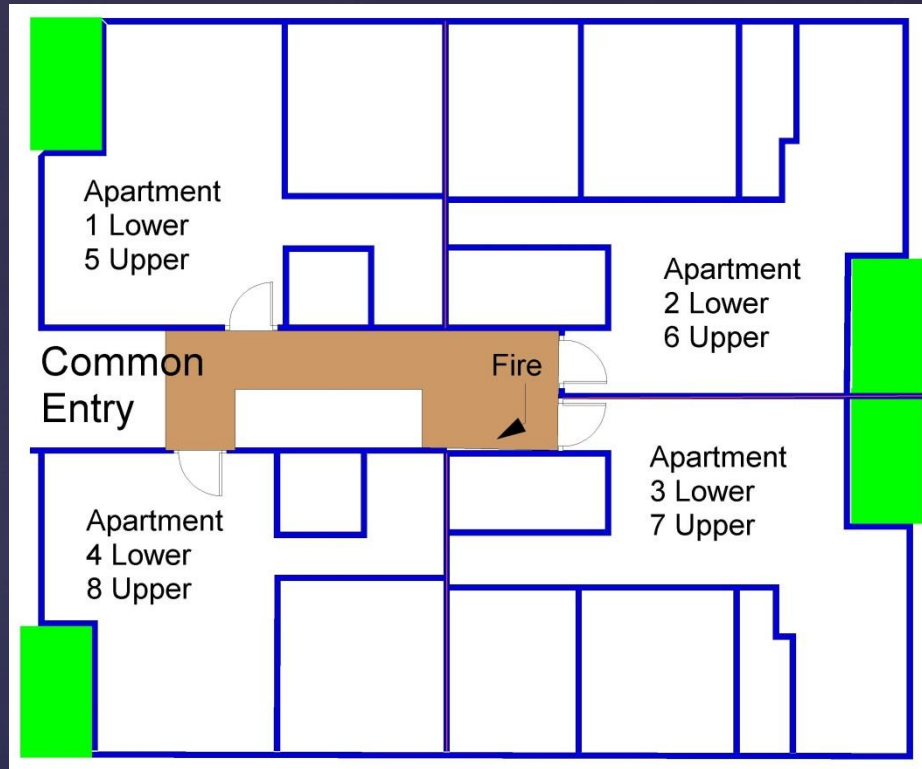


The initial fire occurs  
hidden from view

- ⌘ 1977 Construction
- ⌘ 5 structures all plans approved
- ⌘ Main entry to apartments in central corridor
- ⌘ T1-11 siding exterior
  - ⌘ Building exterior
  - ⌘ Central corridor
- ⌘ Plywood ceiling
- ⌘ Carpet in central corridor

# Building Construction





# Floor Plan

- ⌘ The family in unit #6 was not aware of the fire
- ⌘ Adults heard commotion outside the complex
- ⌘ To investigate they opened the main entry door
- ⌘ They were overwhelmed by hot gases
- ⌘ They were not able to approach the door to close it
- ⌘ They exited out the rear slider
- ⌘ Two kids egress through 2<sup>nd</sup> story bedroom windows

## Events in #6

- ⌘ The living room rapidly fills with smoke
- ⌘ The occupants attempt to egress by the balcony
- ⌘ Two are lost in the smoke and do not egress

## Events #6 - continued

- ‡ Once the fire is put out
- ‡ The subject apartment is largely destroyed
- ‡ The adjacent apartment is 50% destroyed
- ‡ Three fatalities were found

## The Scene



& 5 Buildings

& Matching plans

& Permitted at the same time

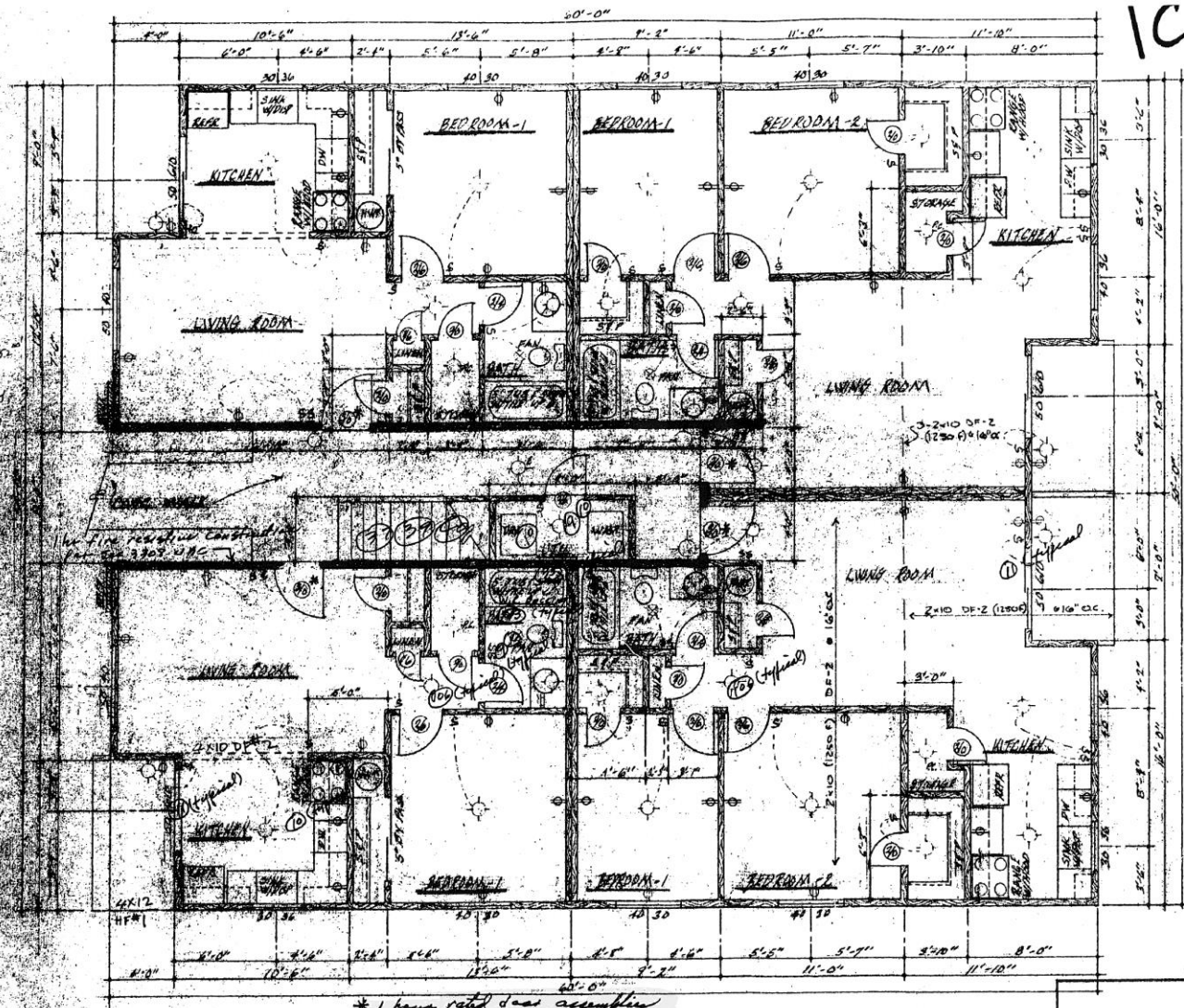
& Used to reconstruct subject  
structure

# Exemplar Structures

- ⌘ Evidence of AC smoke detector and power supply
- ⌘ Building construction
- ⌘ Evidence of ignitable liquids
- ⌘ Terrain level at structure perimeter
- ⌘ Electrical supply
- ⌘ Main entry door construction and hardware
- ⌘ Window size and location
- ⌘ Balcony location and height above terrain

# The Investigation

IC 7481



Area = 552  
 100 sq ft

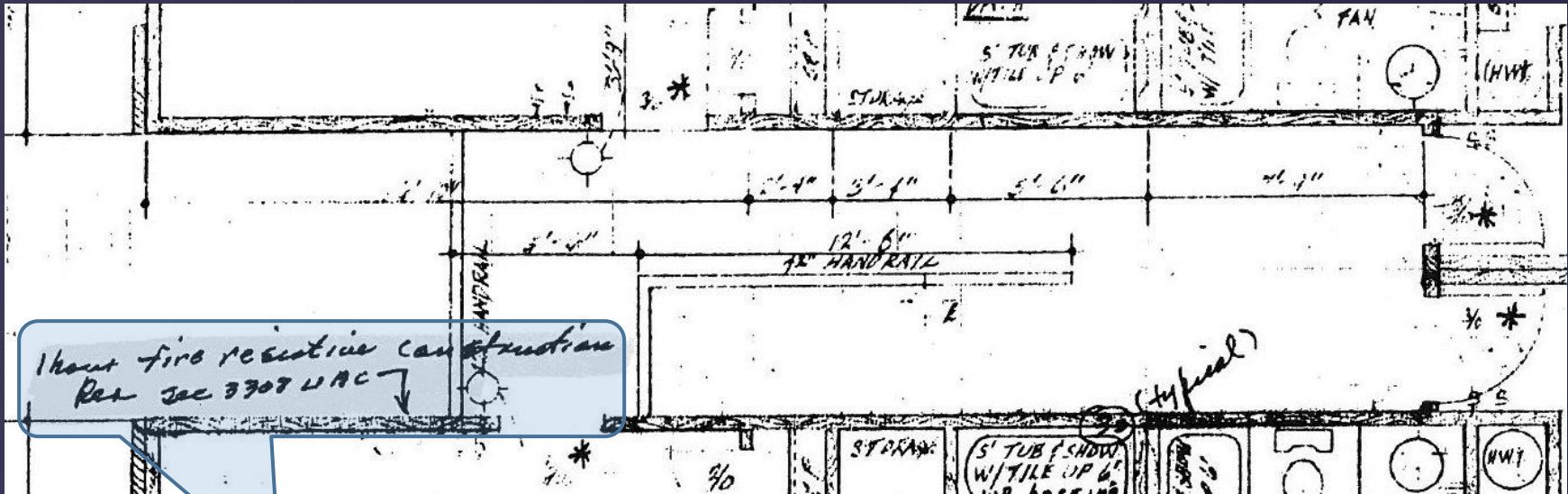
See Fire Department Construction Part 3303 U.M.C.

\* 1 hour rated door assembly  
 Area = 128 (21' - 0" x 6') = 552  
 enclosed - 3  
 Staircase enclosure  
 (2) 12' x 72' (36' x 36')

FIRST FLOOR PLAN  
 SCALE: 1/4" = 1'-0"

SCALE: 1/4" = 1'-0"	APPROVED BY:	DRAWN BY: LJV
DATE:		REVISED:
<b>FIRST FLOOR PLAN</b>		
PLAN NO. 77-001-A-B		DRAWING NUMBER 3 of 4

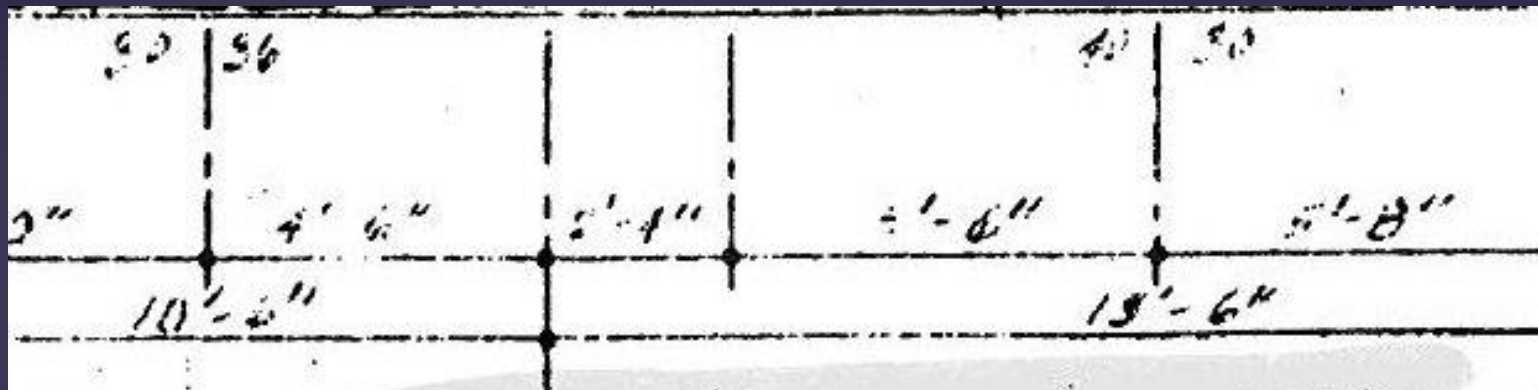




- & 1 hour fire resistive construction
- & Sec 3308 UBC
- & \* at each entry door

# Building Plans





\* 1 hour rated door assemblies

$$\text{area} = (21)(28) - \text{door} = 592$$

FCM  
5

door: 51  
 door: 27  
 occ load = 3

# Building Plans



Door Plate

- ‡ 1977 Construction
- ‡ 1973 and 1976 UBC evaluations
- ‡ Sec. 4306 – self closing
- ‡ Sec 3308 – one hour and self closing

# Code Review

- ⌘ Building occupancy – 28 (14 per floor)
- ⌘ 1973 code required second exit when more than 10 are on a floor
- ⌘ All main entry doors opened into covered entry

# Occupancy and Egress



- ⌘ A continuous and unobstructed means of egress to public way
- ⌘ Balconies require a stairway as built

# Exits - defined

⌘ T1-11 Siding

⌘ Class III flame spread rating

⌘ Enclosed interior exit pathway

⌘ All doors opened into the corridor

⌘ Class II flame spread limitation

# Central Corridor

- ⌘ Corridor exceeds flame spread limit
- ⌘ Doors not one hour
- ⌘ Doors had no closing hardware
- ⌘ Two exits required, only one for 2<sup>nd</sup> floor units
- ⌘ Corridor slightly longer than 20'

# Building Code Violations

- ⌘ Building code violations don't cause deaths
- ⌘ How do you demonstrate that door closures would have made a difference?
- ⌘ How do you demonstrate that excessive flame spread played a role?

## Building the Case



- ⌘ This was common construction
- ⌘ It was approved by the building department
- ⌘ It was inspected by the fire department
- ⌘ It was an incendiary fire, how can the building be responsible
- ⌘ They could easily jump 10' down from the balconies
- ⌘ Fire doors were installed, the occupants opened the door

## Defense Points

⌘ 1996 Aloha Oregon fire ( 8 fatalities)

⌘ 3 level apartment

⌘ The occupants unaware of the fire

⌘ Opened the door and could not close it

⌘ The fire trapped the victims in the 3<sup>rd</sup> floor apartment

# Historical Reference

& FDS 4.07

& June 2009

& Geometry - Chief Architect

& Material Properties of T1-11 and  
carpet-

& MDE Cone Calorimeter

# FDS Modeling

- ⌘ 4.07 was used
- ⌘ 5.0 had been released
  - ⌘ Coding
  - ⌘ Material
  - ⌘ Familiarity
- ⌘ Plaintiff used 4.07, Defense used 5.0
- ⌘ Models were very similar

# Model Specifics



- ⌘ Domain was extended upward and beyond the walls
- ⌘ Wind was applied to two domain boundaries
- ⌘ 291,600 cells
- ⌘ 0.1m cell size (4")
- ⌘ Model time 1500 seconds (25 minutes)
- ⌘ 12 hour CPU time

## Model Specifics 2

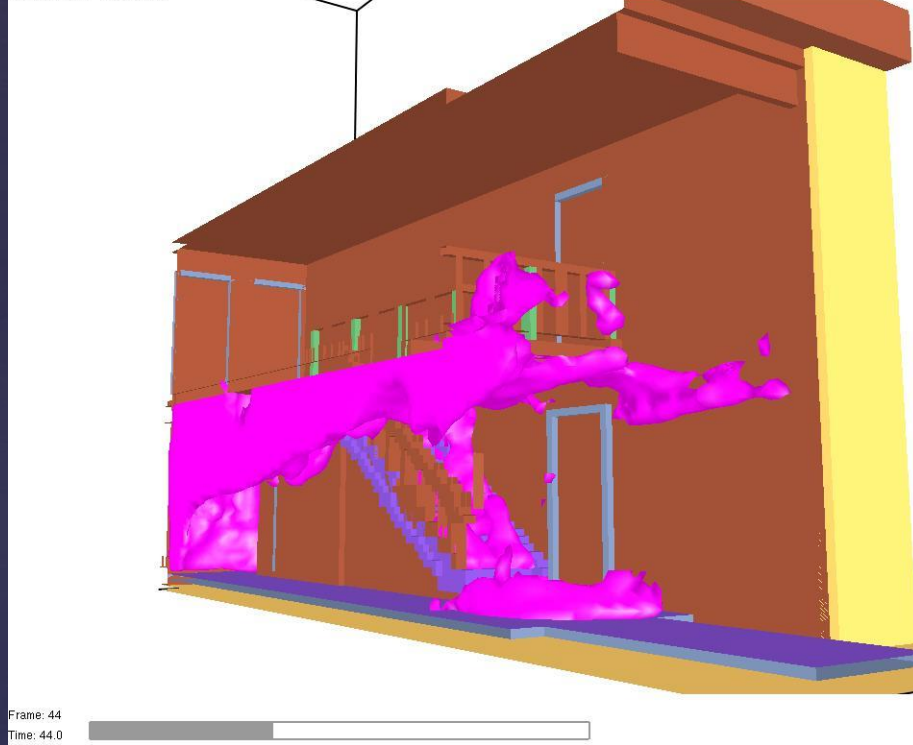
- ⌘ T1-11 Plywood
- ⌘ Commercial carpet
- ⌘ Gypsum sheetrock
  
- ⌘ MDE Cone Calorimeter
  - ⌘ Heat Release
  - ⌘ Ignition temperature
  - ⌘ Critical Radiant Flux

# Material Properties

- ⌘ The wood walls and ceiling turned a small fire into an untenable environment
- ⌘ Non-combustible wall, ceiling and floor was tenable with prescribed initial fires as large 500 kW
- ⌘ The pressure on the door was not so great that a door closure would not have functioned at least partially

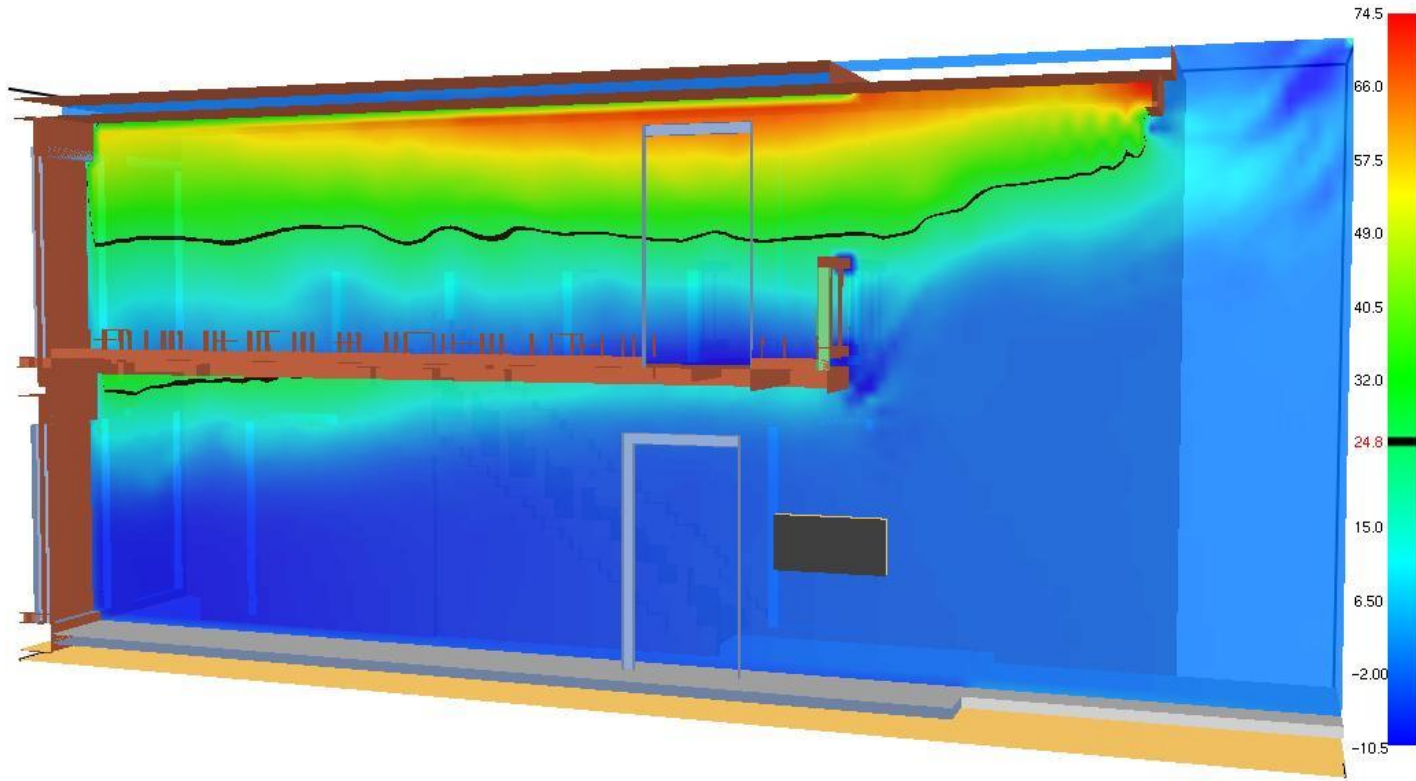
# FDS Model Summary

Smokeview 5.6 - Oct 29 2010



# Untenable Environment





Frame: 24

Time: 240.0



# Door Pressure vs. Closing

& Depose the experts

& Code references

& Display the Fire Models

# Preparing for Mediation

&Mediation

&Confidential Settlement

&The two damaged buildings  
rebuilt with fire sprinklers

# Resolution

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Questions?