

# Egress Elements

- Explain how the Fire Safety Concept Tree applies to the course
- Explain the purpose of the means of egress
- Distinguish between the three elements of the means of egress

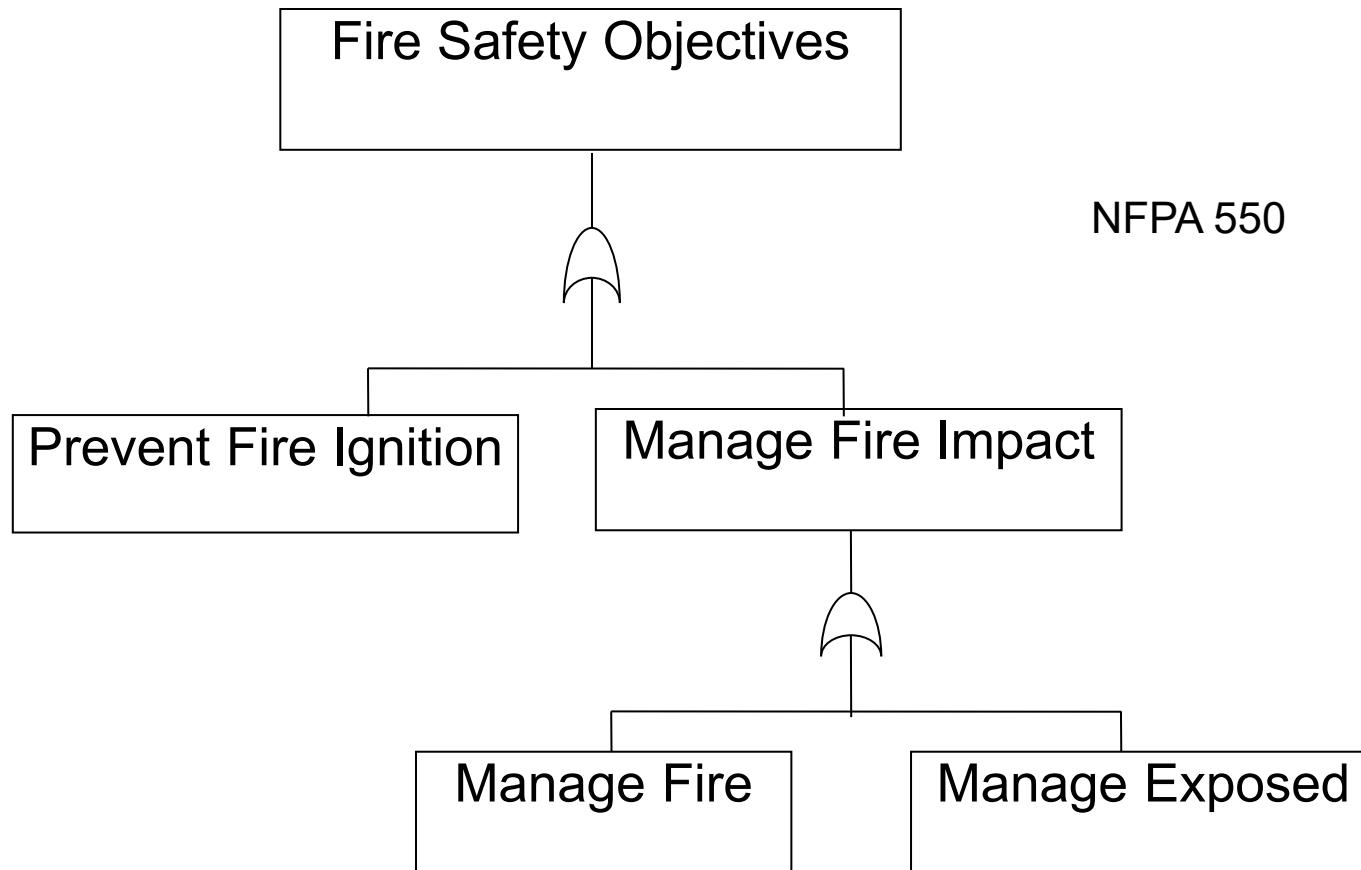


# Historic Fire

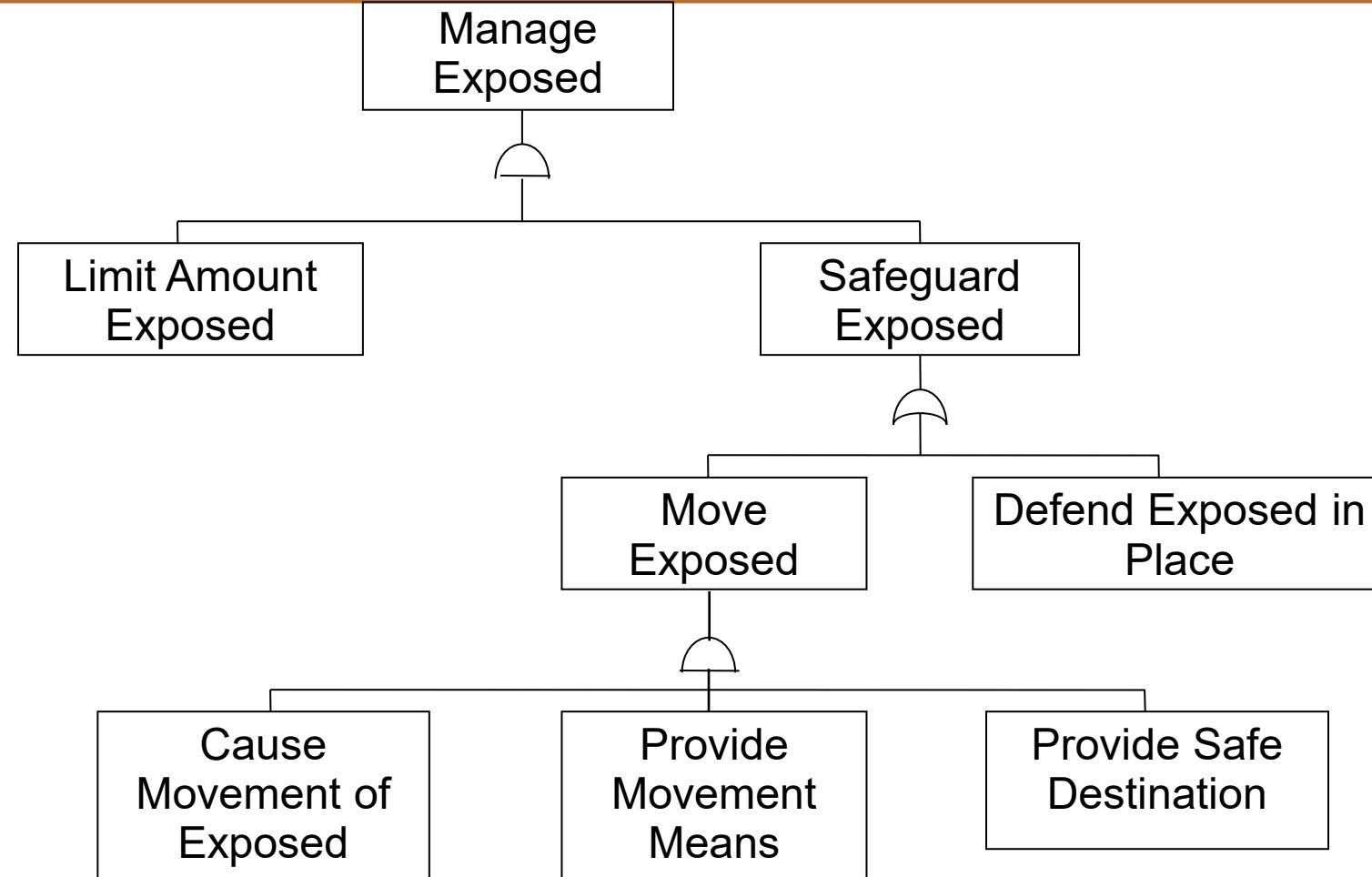
- Happy Land Social Club



# Fire Safety Concepts Tree

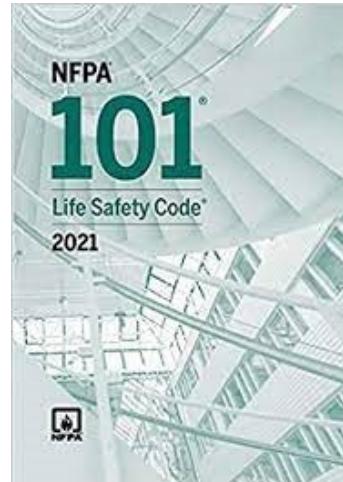


# Fire Safety Concepts Tree



# Codes

- Minimum requirements
  - Can exceed
- Not a limit on what can be done
- Based on consensus
  - Best practices



# Egress Elements

- Exit
  - Meaning
  - Examples



# Egress Elements

- Exit Access
  - The portion of a means of egress that leads to an exit.
- Exit
  - The portion of a means of egress that is separated from all other spaces of the building or structure by construction, location, or equipment as required to provide a protected way of travel to the exit discharge.
- Exit Discharge
  - The portion of a means of egress between the termination of an exit and a public way.

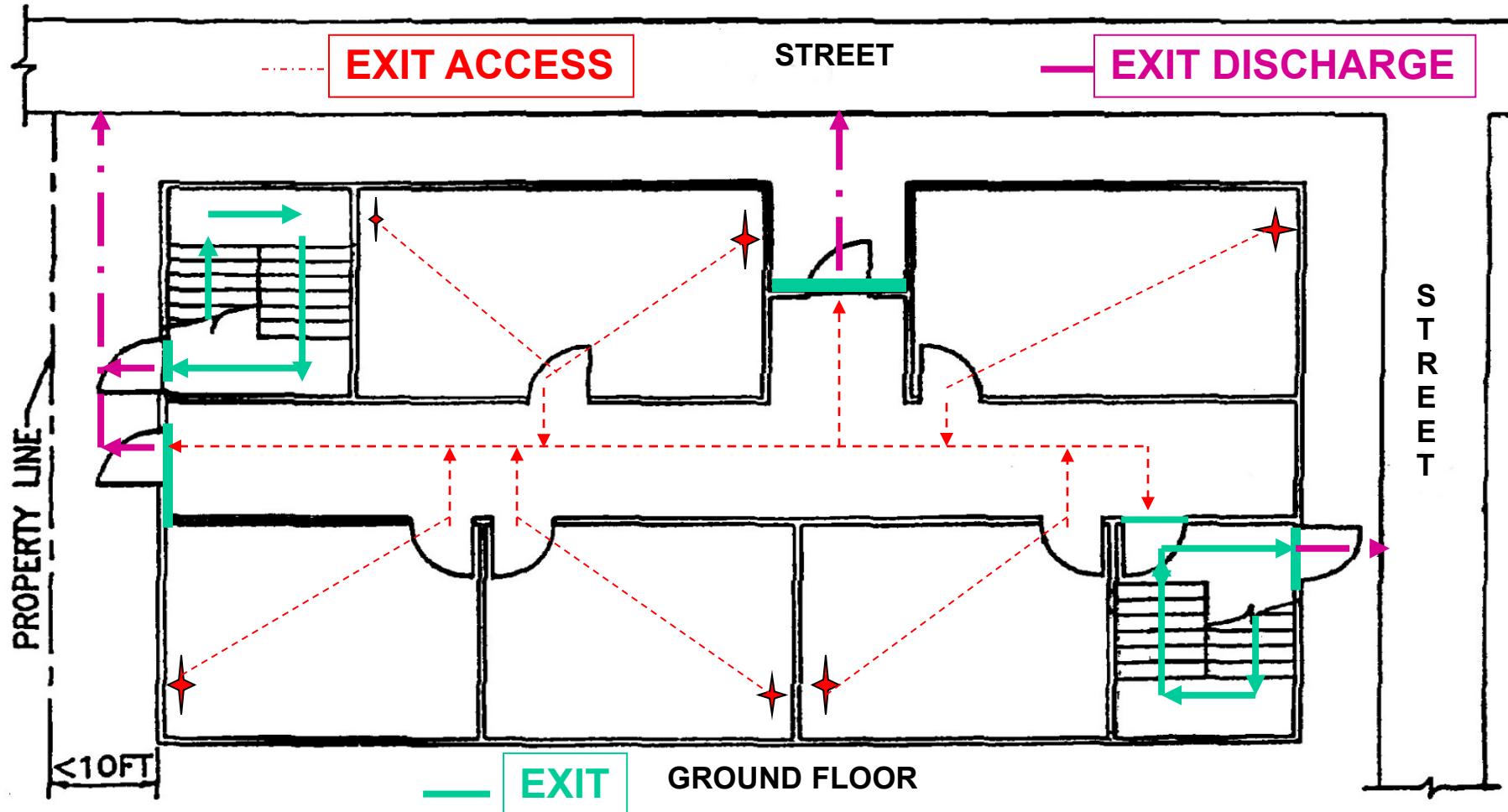


# Egress Elements

- Public Way
  - A street, alley, or other similar parcel of land essentially open to the outside air deeded, dedicated, or otherwise permanently appropriated to the public for public use and having a clear width and height of not less than 10 ft.
  - The code intends a situation where occupants egressing from a building ultimately reach a point where they can move away from the building unimpeded and no longer need the protection of the Code.



# Egress Elements







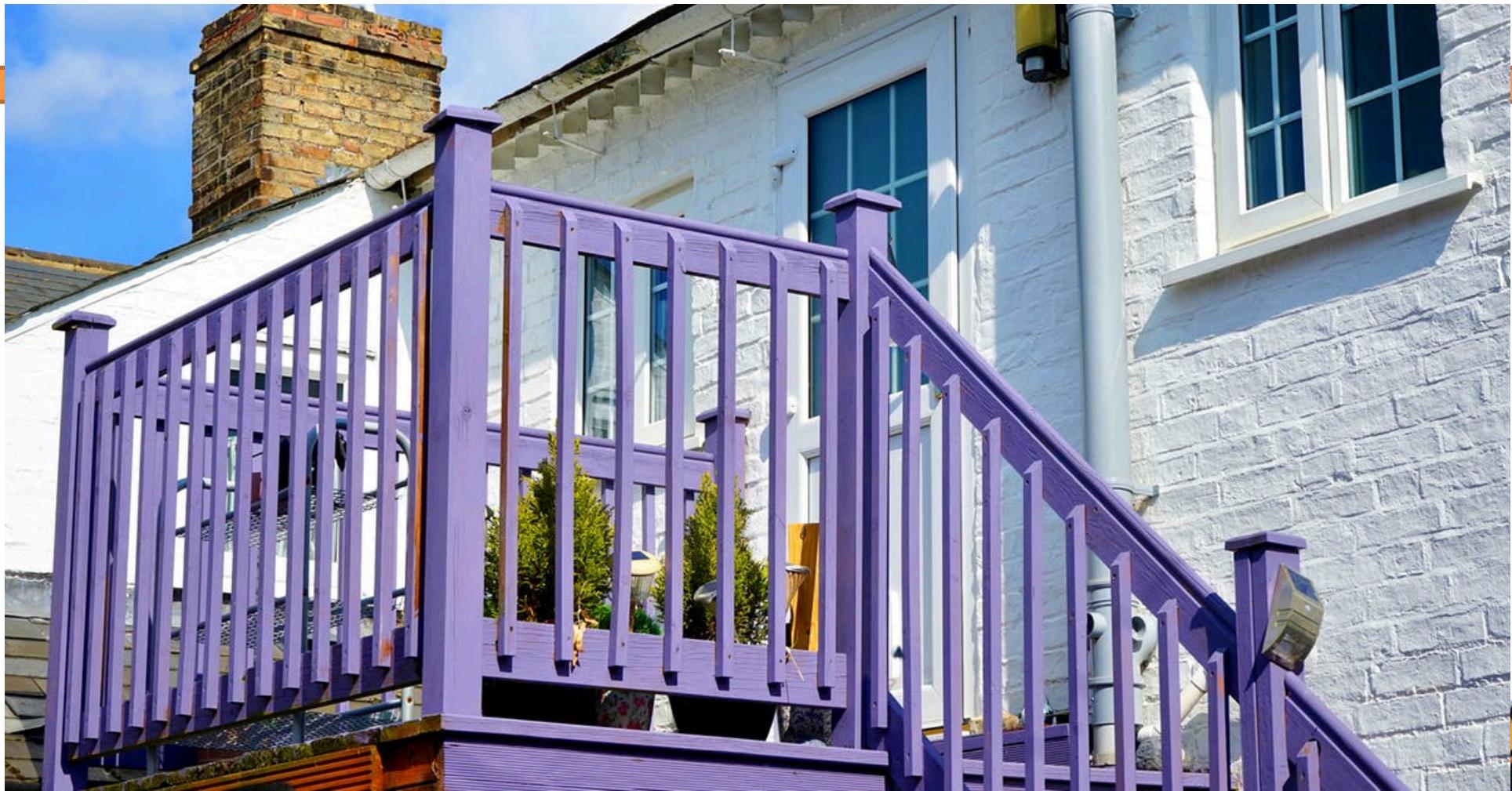










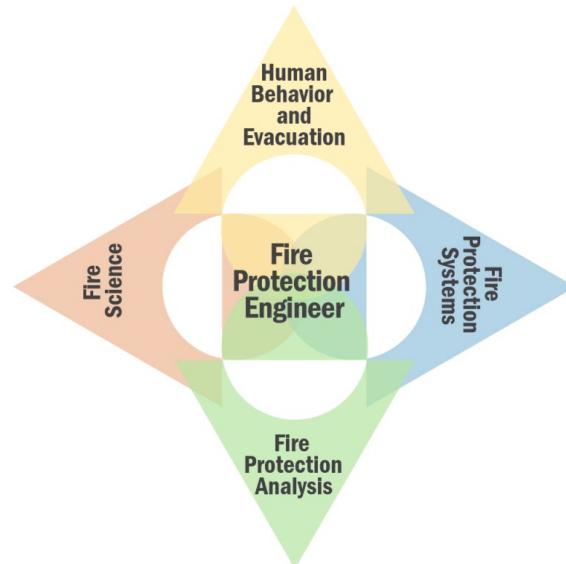






# Professional Requirements

- PE Exam
  - 85 total questions
  - 11-17 questions on egress and occupant movement
  - [https://ncees.org/wp-content/uploads/PE-Fire-Oct-2020\\_CBT\\_with-standards.pdf](https://ncees.org/wp-content/uploads/PE-Fire-Oct-2020_CBT_with-standards.pdf)
- CSP Exam
  - Part of Domain 4
  - SFPE core competencies



# Intent

- Identify hazards
  - No building is 100 % compliant
  - Understand impact of deficiency
  - Different than identifying code requirements



# Means of Egress

- Identify minimum required widths
- Determine the clear width
- Explain the rules for the means of egress



# Historic Fire

- Cocoanut Grove



# Means of Egress

- Chapter 7 of NFPA101
  - Chapter 10 of IBC
  - Fundamental to life safety



# Means of Egress Requirements

- Level
  - Not more than  $\frac{1}{4}$  in
  - More than  $\frac{1}{2}$  in change in level
- Clearance
  - 7 ft 6 in
  - 6 ft 8 in
- Slip resistant
- No obstructions



# Decreasing Hazard

- From corridor to a room
- From one room to another room
- Through kitchens
- Through mechanical rooms
- Rated enclosure to unprotected space
- Enclosed stair to lobby
- Stairs directly to outside



# Minimums

## Doors and Corridors

- Access: 36 in
- Doors:
  - Clear width
  - 28 in
  - 32 in
- Cannot decrease in direction of travel

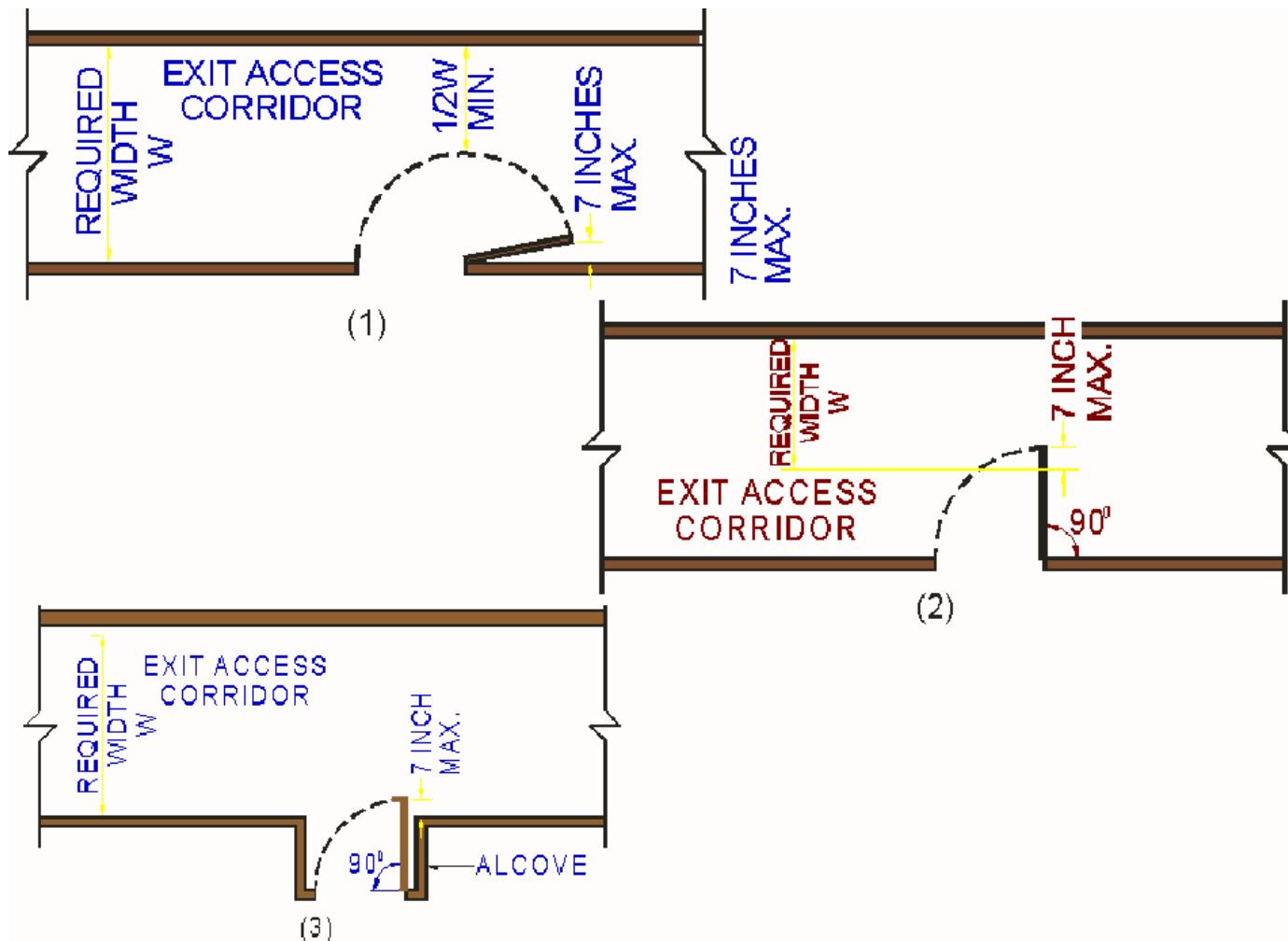
## Stairs

- 44 in
  - Exception 36 in
- 56 in
- Cannot decrease in direction of travel



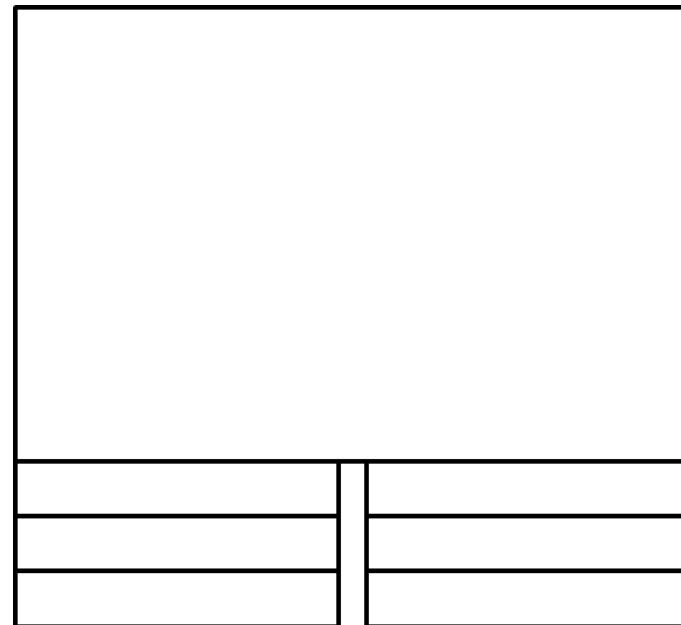
# Clear Width

- Doors
- Stairs
- Corridors



# Landings

- No decrease in width
- Length equal to width of stairs
  - 48 in
- At doors



# Exits

- Calculate the number of exits required
- Explain how the exit should not be used



# Historic Fire

- Rhythm Nightclub



# Number of Exits

- Based on the number of people
  - Not dependent on type of occupancy
- Assume single exit could be blocked
  - 50 %



# Horizontal Exit



# Exit Usage

- Fire protection systems only

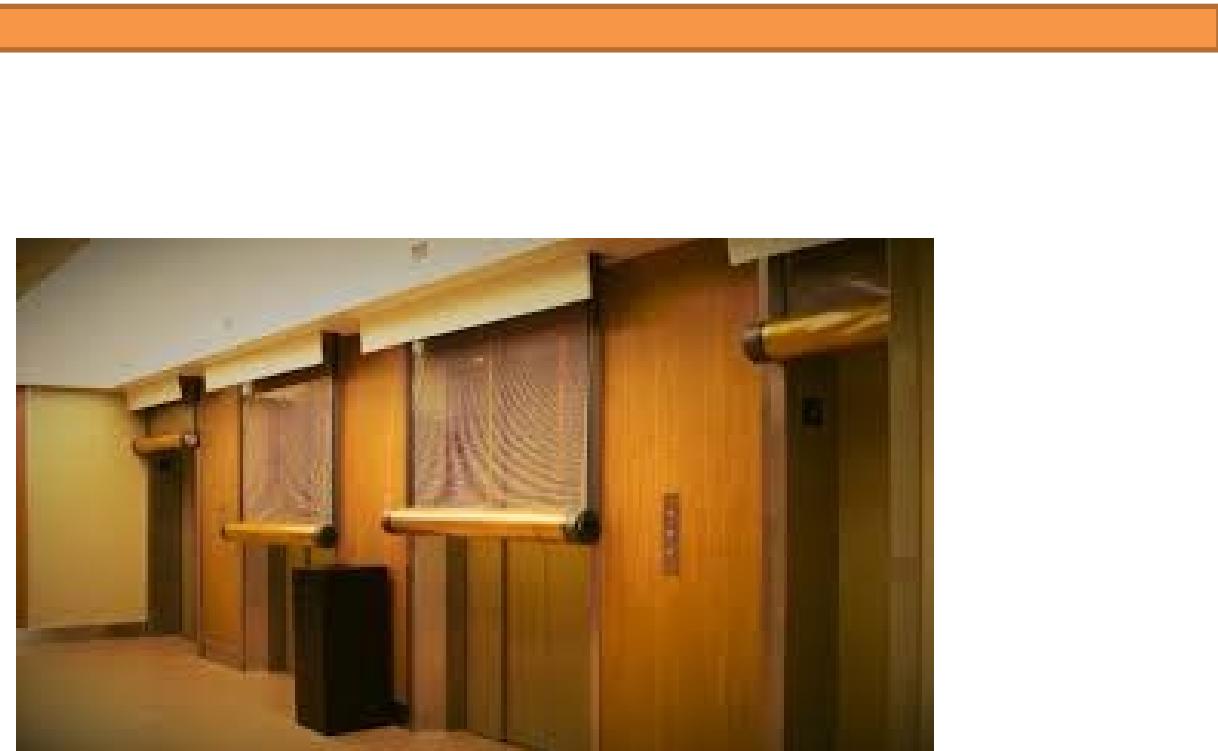




# Maintenance of Exits



# Enclosures





# Doors and Corridors

- Calculate the minimum size of doors and corridors
- Identify the features of doors and corridors



# Historic Fire

- Hartford Hospital



# Minimum Widths

- NFPA rules
- IBC rules



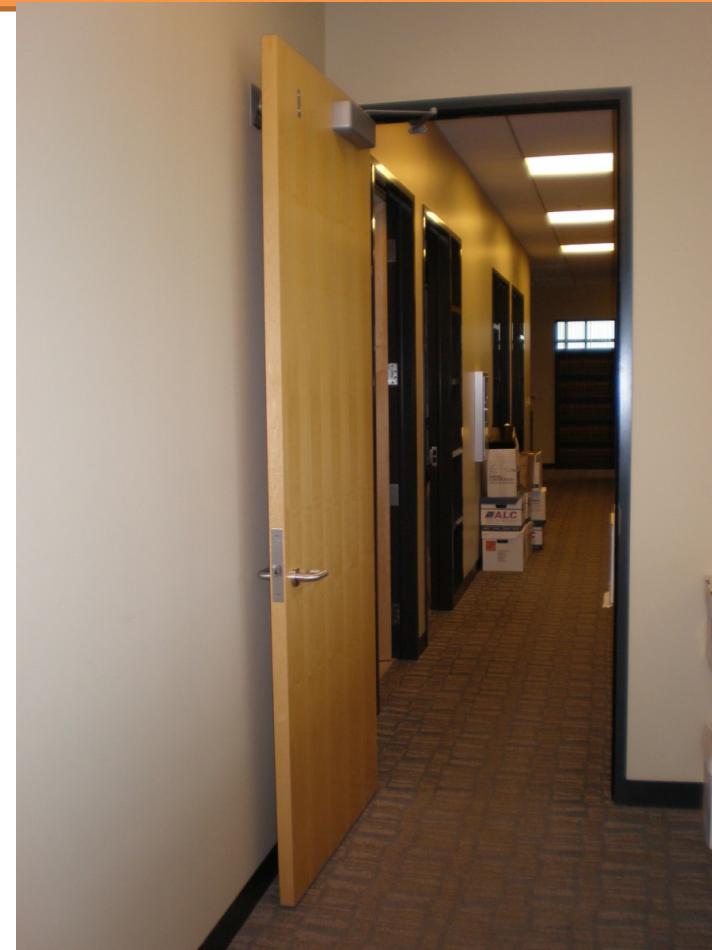
# Doors

- Direction
- Hardware
- Locks
  - Delays
- Forces
- Labels



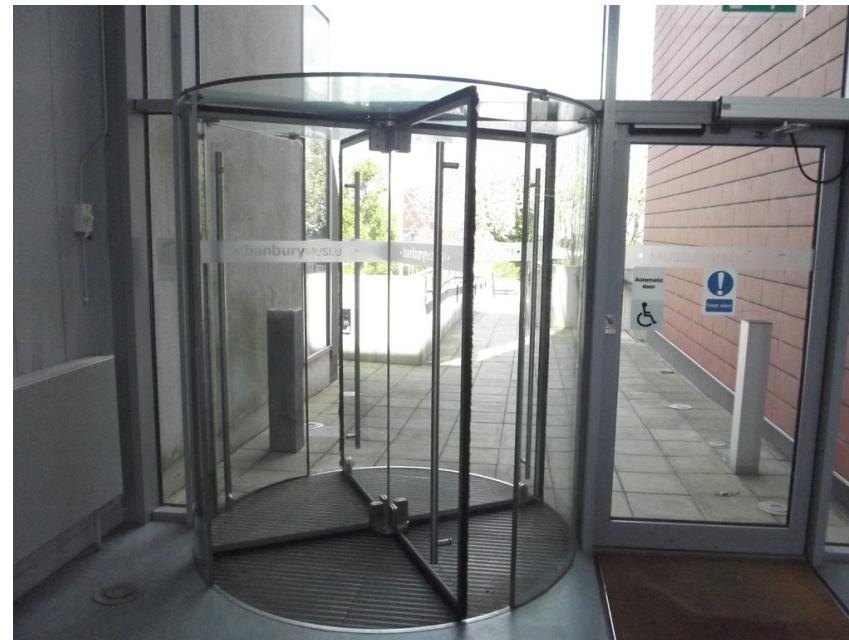
# Doors

- Automatic-closing
- Self-closing
- Level
  - Width of leaf on either side
- Egress side
- Ingress side



# Revolving Doors

- Typically not include in means of egress
- Must have regular doors adjacent
- Doors must break-away in direction of travel
- Rules on speeds



# Doors

- Single action
  - No special knowledge
  - No special tools
- Lock side based on security



# Other Components

- Identify other elements that can be part of the means of egress
- Determine when other components are appropriate to use



# Historic Fire

- Cook County Administration Building



# Others

- Areas of Refuge
  - Area to wait
    - Separated
  - Connected to means of egress
    - 48 in stair
    - 2 way communication
  - Accessible
  - Size
    - A 30 in x 48 in wheelchair space per 200 occupants
- Smoke Proof Enclosure
  - Outside building
  - Protected shaft



# Others



- $\geq 44$  (30) in clear width
- $\leq 1$  in 12 (8) slope
- $\leq 30$  in (12 ft) rise per run
- Landings
  - Top and bottom
  - Length  $\geq 60$  in if accessible,  $\geq 48$  in otherwise
- Other provisions similar to stairs



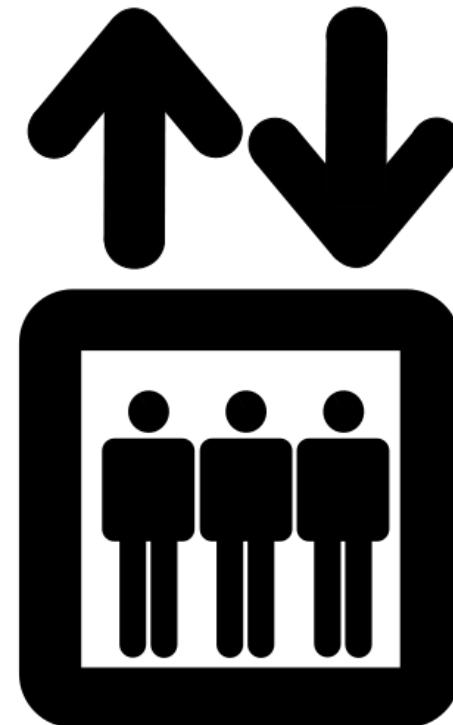
# Others

- Second means of egress
- $\leq 90$  persons
- 100 % capacity independent
- Training
  - No general public
- $\geq 8$  persons capacity
- Lobby
  - A 30 in x 48 in wheelchair space per 50 occupants
  - $3 \text{ ft}^2$  for  $\geq 50$  % occupant load
- Separated and two-way communication



# Others

- Before Phase I
- Stair replacement?
- Shaft with stair
- Signage
- FFCP
  - 2 way communication
- Building must have
  - Voice alarm
  - Sprinklers



# Others



- 60 persons capacity
- $\leq 25\%$  of capacity except in industrial
- Must be allowed by occupancy chapter
  - Not allowed for most
  - Training required



# Others

- Allowed in spaces with occupant loads < 4
  - Unoccupied roofs
  - Second option from storage elevators and boiler rooms
  - Towers and elevated platforms around machinery
- Dimensions
  - $17 \text{ in} \leq \text{Clear width} \leq 24 \text{ in}$
  - $6 \text{ ft } 8 \text{ in}$  headroom
  - $50^\circ \leq \text{Clear width} \leq 68^\circ$
  - Riser height  $\leq 9.5 \text{ in}$
  - Tread depth  $\geq 9.5 \text{ in}$ 
    - $\geq 5.67 \text{ in}$  not overlapped
    - Lateral separation  $\leq 2 \text{ in}$



# Others



# Ladders

- Access to unoccupied spaces
- Second means of egress from storage elevators or boiler rooms with occupant loads < 4 persons
- Towers and elevated platforms around machinery with occupant loads < 4 persons
- $> 75^\circ$
- Lowest rung  $\leq 12$  in of surface



# Supplementary Escape Devices



# Stairs

- Calculate the minimum size of stairs
- Identify the features of stairs



# Historic Fire

- Grenfell Tower



# Stairs are Simple

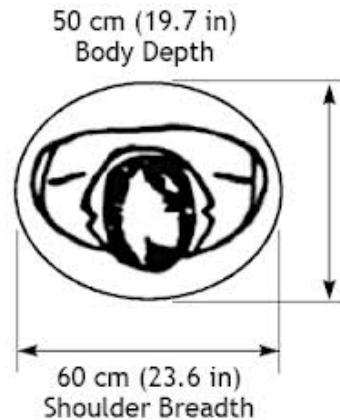
<https://themindcircle.com/30-epic-stair-design-fails/>



# Stair Widths

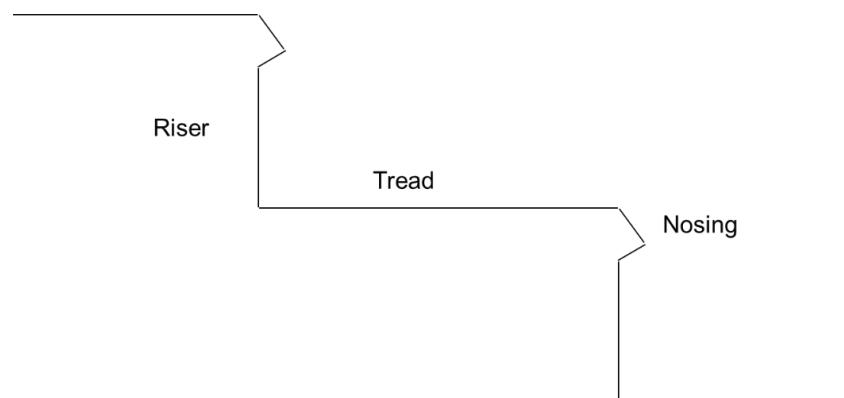
- Exit lanes
  - Not used by NFPA101 or IBC
- Width calculations
  - NFPA
  - IBC

$$C = 146.7 + \left( \frac{Wn - 44}{0.218} \right)$$



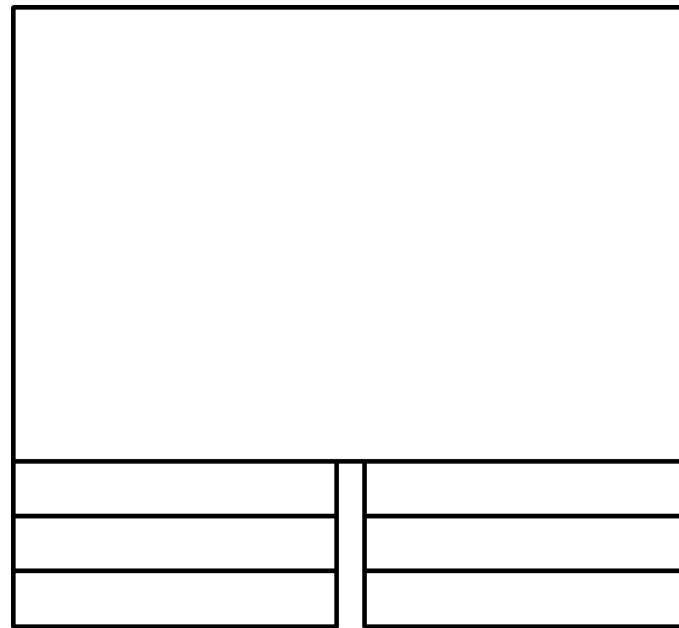
# Stairs

- Size
- Usage
- Slip resistant
- Marked
- Changes in size
  - 3/16 in
  - 3/8 in

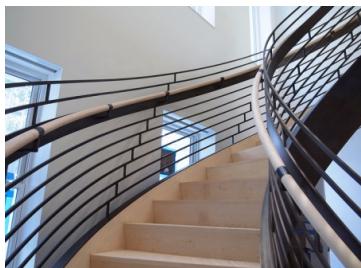


# Stair Terminology

- Flight
- Landing
- Dog-leg
  - Sinistral
  - Dextral
- Straight
- Curved
- Spiral



# Curved and Spiral Stairs



# Handrails and Guards

- Shape
- Location



# Outside Stairs

- Account for fear of heights
  - $\geq 36$  ft
  - Opaque  $\geq 48$  in
- Separated from interior
- Minimize water accumulation
- $\geq 50$  % open on one side



# Occupant Loads

- Select the appropriate number of people per exit
- Determine the capacity of areas with merging flows



# Historic Fire

- Dusseldorf Airport



# Assigning Exits

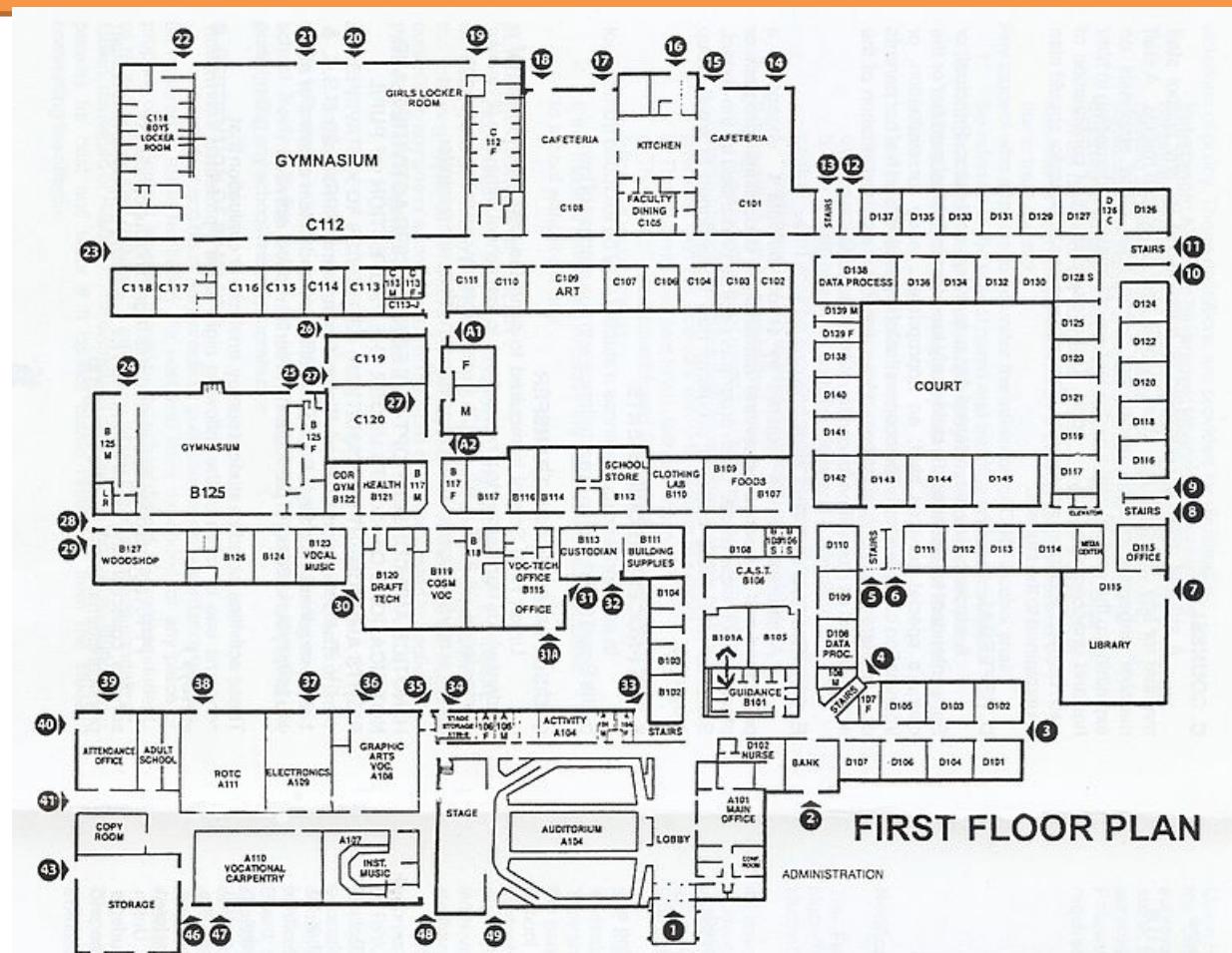
Department store: 20,000

Skating rink: 5,000

Restaurant: 11,000



# Simultaneous Occupancy



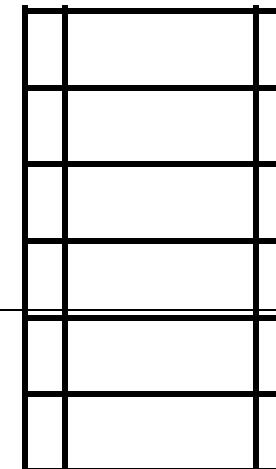
# Evacuation Elevators

- 25 % population + 2 % wheelchairs

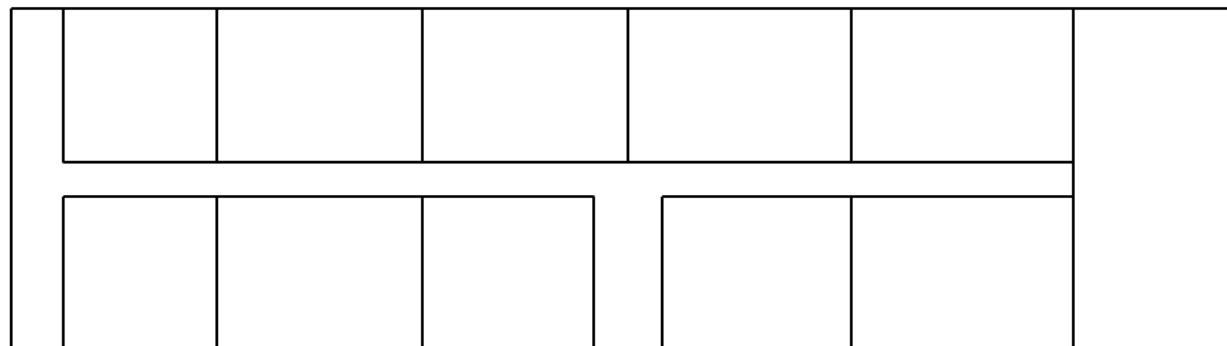


# Merging Flows

- Corridors
- Stairs



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# Balconies and Mezzanines



# Occupant Loads

- Select the appropriate choice between gross and net area
- Calculate the occupant load



# Historic Fire

- Ghost Ship



# Occupant Load Factors

- Gross
- Net
- Mixed use



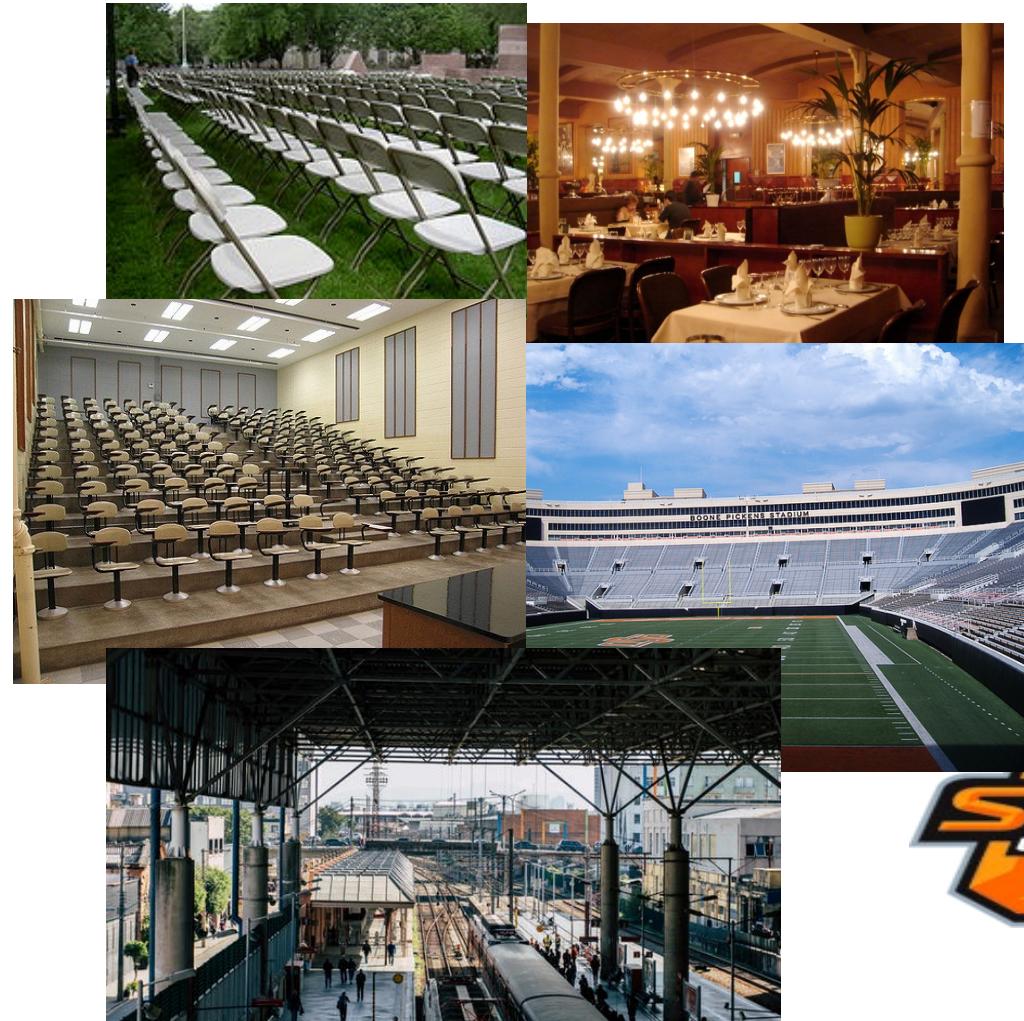
# Occupant Load Factors

- Minimum design value
  - Are more people acceptable?
- Origin of load factors
- Meaning of words
  - Based on use
- Rounding rules



# Seating Arrangements

- Concentrated
- Less concentrated
- Fixed
- Bench
- Waiting spaces



# Malls

- Load factor varies with size of mall



# Exits

- Determine the remoteness of exits
- Calculate the capacity of exits



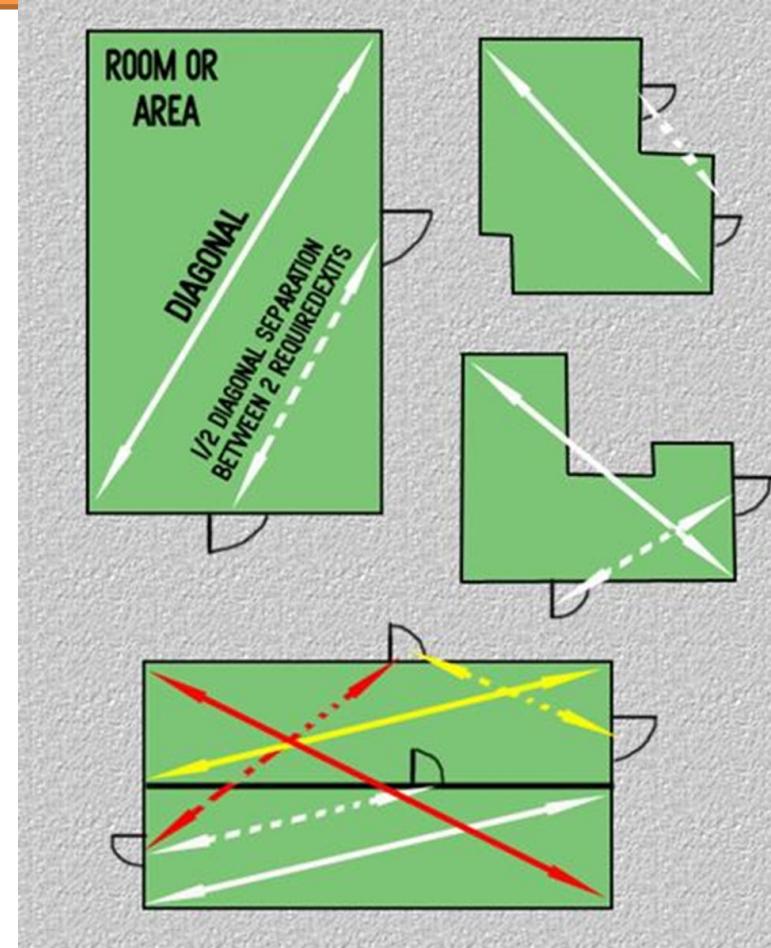
# Historic Fire

- Katie Jane Memorial Home



# Remote

- Rules for two exits
  - Additional exits as far apart as is practical
- Sprinkler trade-off
- No familiarity requirements



# Requirements

- Openings from normally occupied spaces
- Rating depends on building height
  - 1 hr for 3 stories or less
  - 2 hr for 4 stories or more



# Discharge

- Remote
- All outside
  - 50 % in some instances
- Barrier



# Capacity

- Typically for existing buildings
  - Change of use
  - Reconstruction on floor
- Look for limiting component
  - More to consider than just the first component
- Rounding



# Distances

- Determine where distance calculations are required
- Calculate distances
- Explain the limits on dead end corridors and common path of travel



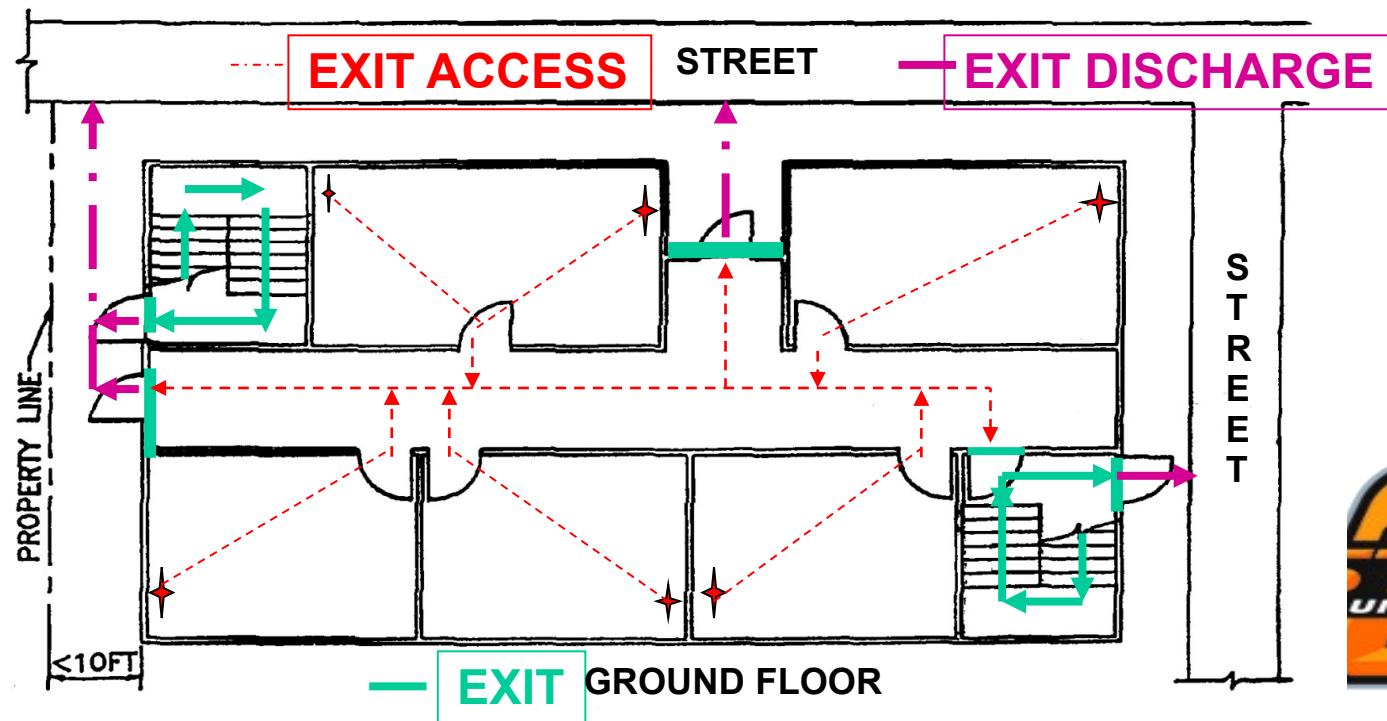
# Historic Fire

- Iroquois Theater



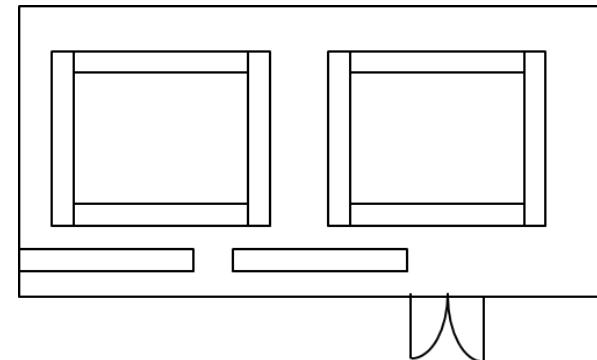
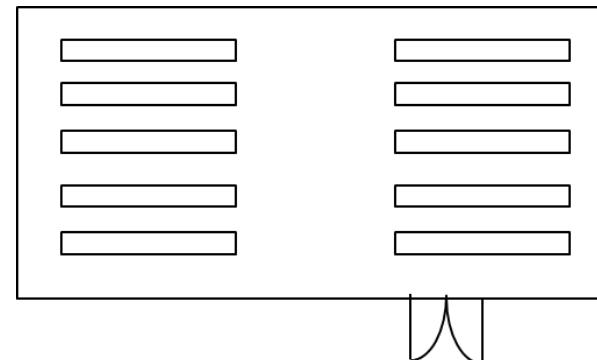
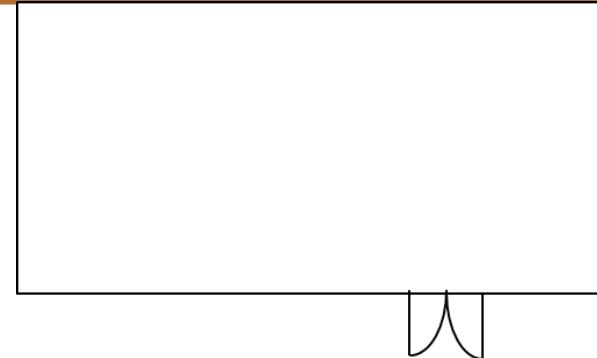
# Travel Distance

- When to measure
- Two paths



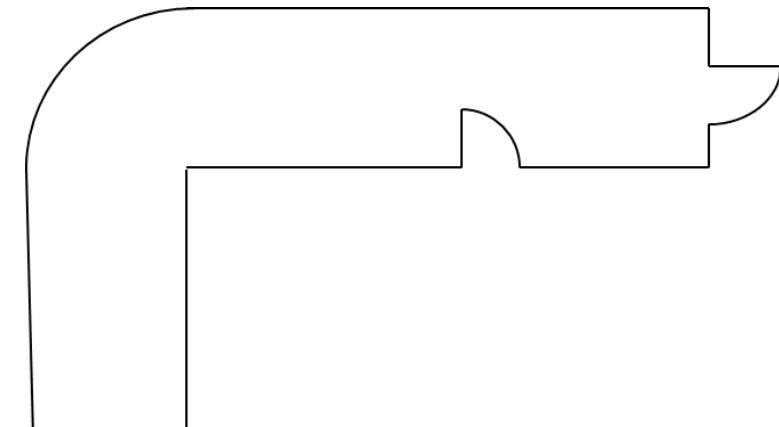
# Rooms

- How to measure



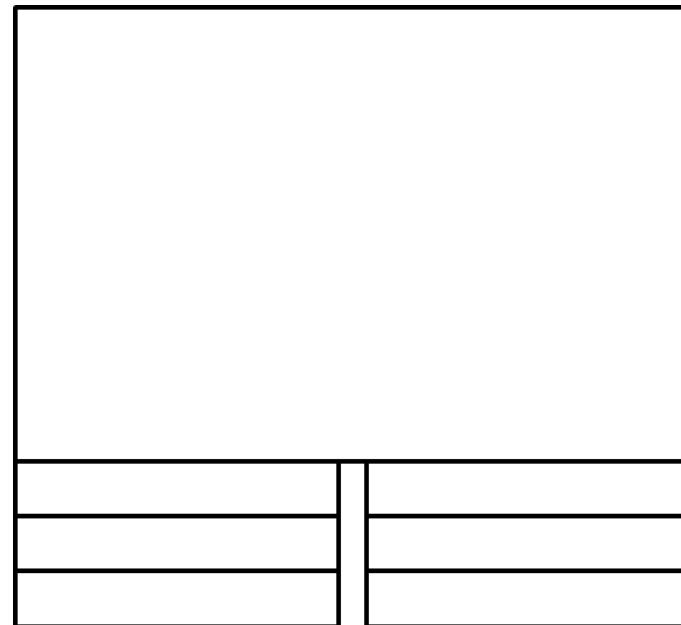
# Corridors

- Natural path
- Minimum 12 in clearance around curves/obstructions
- To exit
  - Door



# Stairs

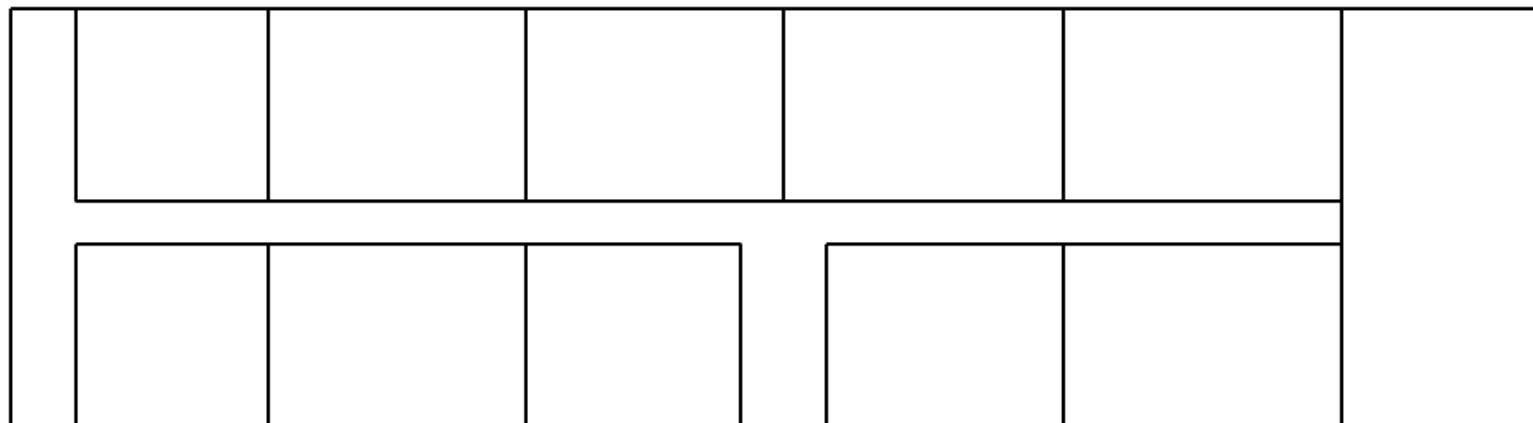
- On treads
- On landing



# Areas of Concern

- Dead End Corridors
- Common Path of Travel

Exit



Exit

