

2024 WASBO Spring Conference

Module 2: Life Safety and Building Codes
MAY 17, 2024



AGENDA

Objective

Building Codes for Schools

Use and Occupancy Classification

Type of Construction

Fire and Smoke Protection Features

Fire Protection Systems

Means of Egress

Questions / Answer



OUR TEAM



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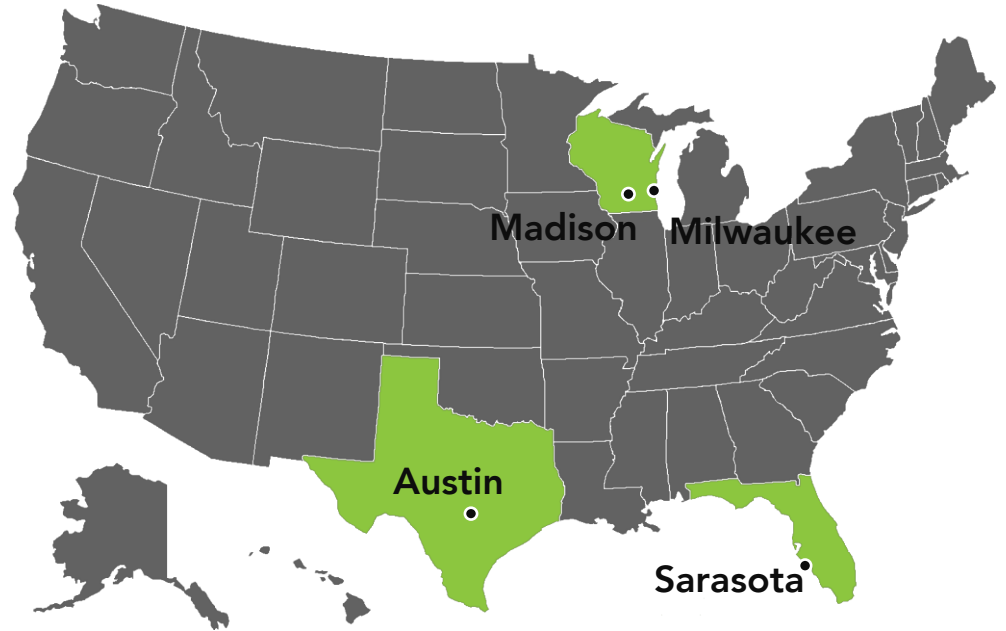
FIRM BACKGROUND

Plunkett Raysich Architects, LLP (**PRA**)

Currently over **90 employees** with a studio specializing in education facilities and other markets

Design of **educational facilities** throughout Wisconsin

At PRA, we don't merely design buildings, we create spaces for people that **inspire people**

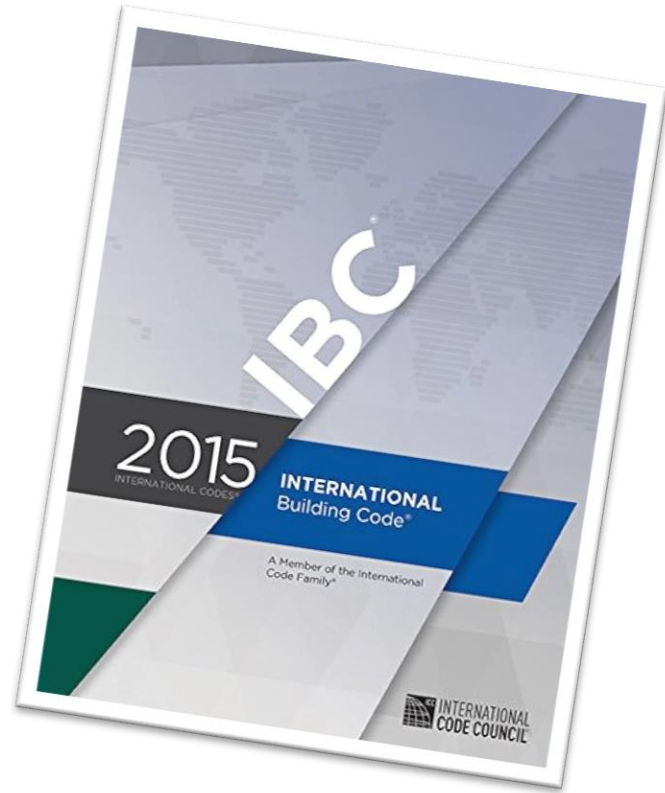


OBJECTIVE

Life Safety and Building Codes are going to mean FIRE and Life Safety

You should understand basics of the code so that you can get involved in the design process and understand how the direction of the design has been **developed based on the code.**

These codes specify just how fire and life safety systems should be designed, installed, tested and maintained.



BUILDING CODES FOR SCHOOLS

International Code Council (ICC)

International Code Council (ICC) develops new code every 3 years
(Codes can differ and change by State)

- **Wisconsin** – 2015 IBC / 2015 IEBC *(does not adopt every 3 years)*
- **Illinois** – 2021 IBC / 2021 IEBC *
- **Minnesota** – 2020 Minnesota State Building Code *(this code references 2018 IBC)*
- **Iowa** – 2015 IBC / 2015 IEBC *
- **Missouri** – 2018 IBC / 2015 IEBC *

The state delegates code enforcement to local authorities.



BUILDING CODES FOR SCHOOLS

Current Building Code for Schools – Three Codes to Study

- 1 International Building Code (IBC)**

The Wisconsin Commercial Building Code has adopted IBC which was developed by the International Code Council (ICC). It covers construction and renovation issues. Wisconsin has also adopted many specific modifications to the IBC referred to as Administrative Code SPS.
- 2 NFPA 101 – Life Safety Code (Chapters 14 & 15)**

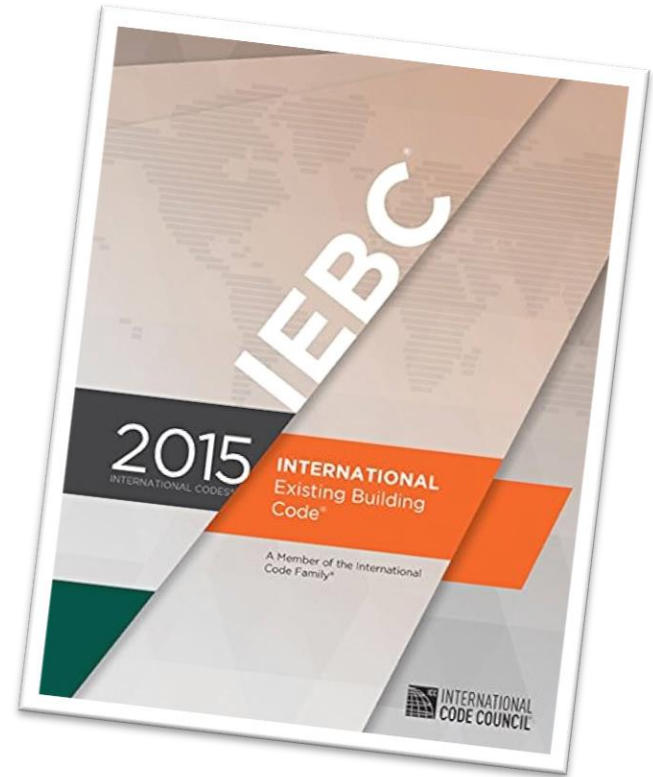
A commonly used code is the Life Safety Code published by the National Fire Prevention Association (NFPA). It is designated NFPA 101, and it covers things such as the width of exits, emergency lighting, exit signs, and alarms.
- 3 NFPA 1 / IFC (Emergency Action Plan)**

There are two codes that jurisdictions can choose between. The ICC publishes the International Fire Code (IFC). NFPA has developed NFPA 1, also known as the Uniform Fire Code.

BUILDING CODES FOR SCHOOLS

International Existing Building Code

- **The IEBC (International Existing Building Code)** is for existing building construction. *Example: IEBC will handle Repairs, Alterations, Additions, Change of Occupancy, etc.*
- Applicable anytime a **modification to an existing building** is made
- Defines what is “repair” and what is an “alteration”
- **Three levels of Alterations** identified



BUILDING CODES FOR SCHOOLS

International Existing Building Code

Alteration Levels

Repairs

Level 1

Removal and replacement or covering of existing materials, elements, equipment or fixtures using new materials serving a similar purpose.

Level 2

Alterations including the reconfiguration of any space, addition or elimination of any window or door or the reconfiguration or extension of any system.

Level 3

Applies when alterations exceed 50% of the aggregate area of the building.



BUILDING CODES FOR SCHOOLS

International Existing Building Code

Case Study

Jerstad-Agerholm (Racine Unified SD)

Goal: Modernize learning environments, enhance safety, and improve indoor environment.

Existing: 164,600 SF

Renovation: 131,000 SF

Addition: 30,000 SF

Scope triggered by Level 3 Alteration

- Fire walls
- Fire alarm, emergency lighting
- Accessibility
- Sprinklers added building wide



USE AND OCCUPANCY CLASSIFICATIONS

Typical K12 Facilities

Group E: Educational

Group B: Business

Group A-3: Assembly

- Community or Exhibition Halls
- Gymnasiums (without seating)
- Indoor Swimming Pools (without seating)
- Lecture Halls
- Libraries

Group A-4: Assembly

- Arenas (with seating)
- Indoor Swimming Pools (without seating)
- Tennis Courts (with seating)

Group A-5: Assembly

- Bleachers
- Grandstands
- Stadiums

USE AND OCCUPANCY CLASSIFICATION

Classrooms / Vocational Rooms

Assembly with seats

Shall be determined by number of seats

Example: Gym (Assembly occupancy) – can show bleachers to determine number of occupants

Assembly without seats

Concentrated – chairs not fixed – 7 net SF / occupant

Unconcentrated – tables and chairs – 15 net SF / occupant

Example: Cafeteria (Assembly occupancy) – can use the maximum floor area allowance per occupant to determine number of occupants

Educational

Classroom – 20 net SF / occupant

Shops / Vocational Room – 50 net SF / occupant

Example: Classroom (Educational occupancy) – can use the maximum floor area allowance per occupant to determine number of occupants



TYPE OF CONSTRUCTION

Materiality and Design

One of the first steps to designing a building is determining the type of construction.

There are 5 types of construction:

- **Type I** (all non-combustible)
- **Type II** (all non-combustible)
- **Type III** (ext. non-combustible, int. any material allowed)
- **Type IV** (ext. non-combustible, int. heavy timber)
- **Type V** (any material allowed)

Determines **allowable building height**, **number of stories**, and **allowable area**.

TABLE 601 FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

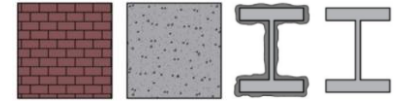
BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV HT	TYPE V	
	A	B	A	B	A	B		A	B
Primary structural frame ^f (see Section 202)	3 ^a	2 ^a	1	0	1	0	HT	1	0
Bearing walls Exterior ^{e, f} Interior	3 3 ^a	2 2 ^a	1 1	0 0	2 1	2 0	2 1/HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior ^d	0	0	0	0	0	0	See Section 602.4.8	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1 ^{1/2} ^b	1 ^{b,c}	1 ^{b,c}	0 ^c	1 ^{b,c}	0	HT	1 ^{b,c}	0

TYPE OF CONSTRUCTION

Materiality and Design

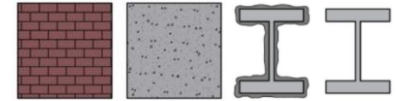
Type I - Fire-Resistive

Most stringent
Concrete or steel



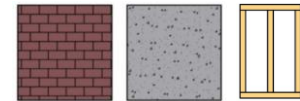
Type II - Non-combustible

Common
Like Type I, but requires lower fire resistance ratings
Concrete or steel



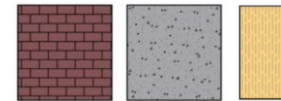
Type III - Ordinary

Exterior walls built out of non-combustible materials (masonry or concrete)
Floors, roof, etc. can be of any material permitted (ex. wood)



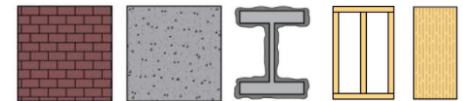
Type IV - Heavy Timber

Exterior walls built out of non-combustible materials (masonry or concrete)
Interior materials made of solid or laminated wood (natural fire resistance)



Type V - Wood Framed

Most combustible
Common for single family homes
Exterior and interior materials can be of any material permitted (ex. wood)



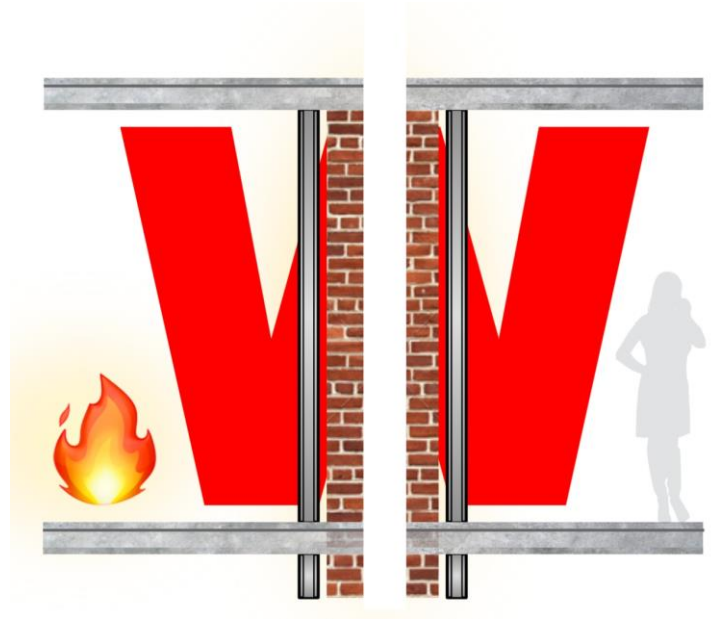
FIRE AND SMOKE PROTECTION FEATURES

Fire Resistant Rated Construction

Fire Wall

A wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with structural system to allow collapse on either side

- Party walls
- Create separate buildings
- Class of construction separation



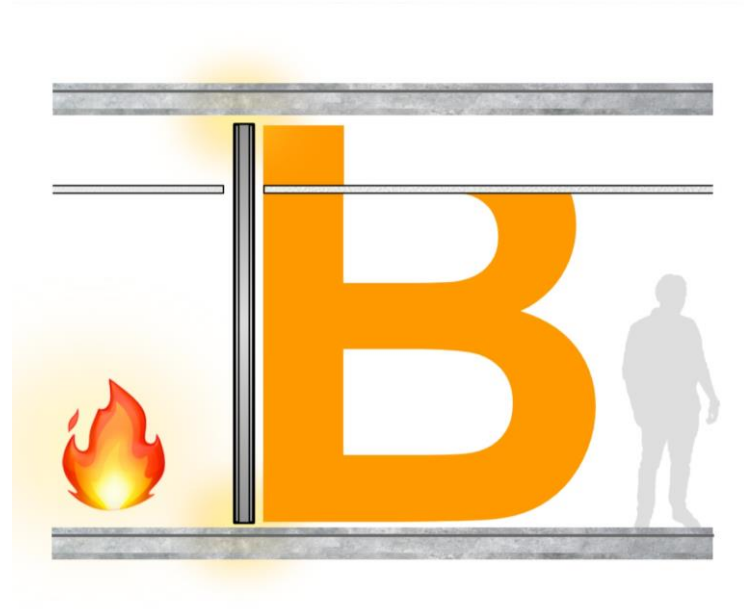
FIRE AND SMOKE PROTECTION FEATURES

Fire Resistant Rated Construction

Fire Barrier

A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained

- Define fire area
- Separate uses
- Exit enclosure and passageway
- Horizontal exit



FIRE AND SMOKE PROTECTION FEATURES

Fire Resistant Rated Construction

Case Study

Brown Deer High School

Building types need to be consistent

Existing Combustible
Construction Modified by
Renovation



FIRE AND SMOKE PROTECTION FEATURES

Fire Resistant Rated Construction

Fire Partition

A vertical assembly of materials designed to restrict the spread of fire in which openings are protected

- Corridors
- Elevator lobby



FIRE AND SMOKE PROTECTION FEATURES

Fire Resistant Rated Construction

Fire-Rated Glass

Most commonly is installed in corridors, lobbies, stairwells and other areas of a building that might become an escape route during a fire



FIRE AND SMOKE PROTECTION FEATURES

Fire Compartmentalization

Allowable Areas (example Education)

- Type IIB non-sprinkled 14,500 SF
- Type IIB sprinkled 58,000 SF (single-story building)
- Type IIB sprinkled 43,500 SF (multi-story building)

This is the process of **dividing a building into smaller units** using fire-resistant construction materials. Fire-rated windows, sheet rock, doors and other materials act as physical barriers that can keep a fire in a restricted space and prevent it from spreading too quickly.

One important material in compartmentalization is fire-rated glass, which can be found in doors, sidelights, transoms, or windows.

Read more: http://asumag.com/security/life_safety/university_safe_passage_2/

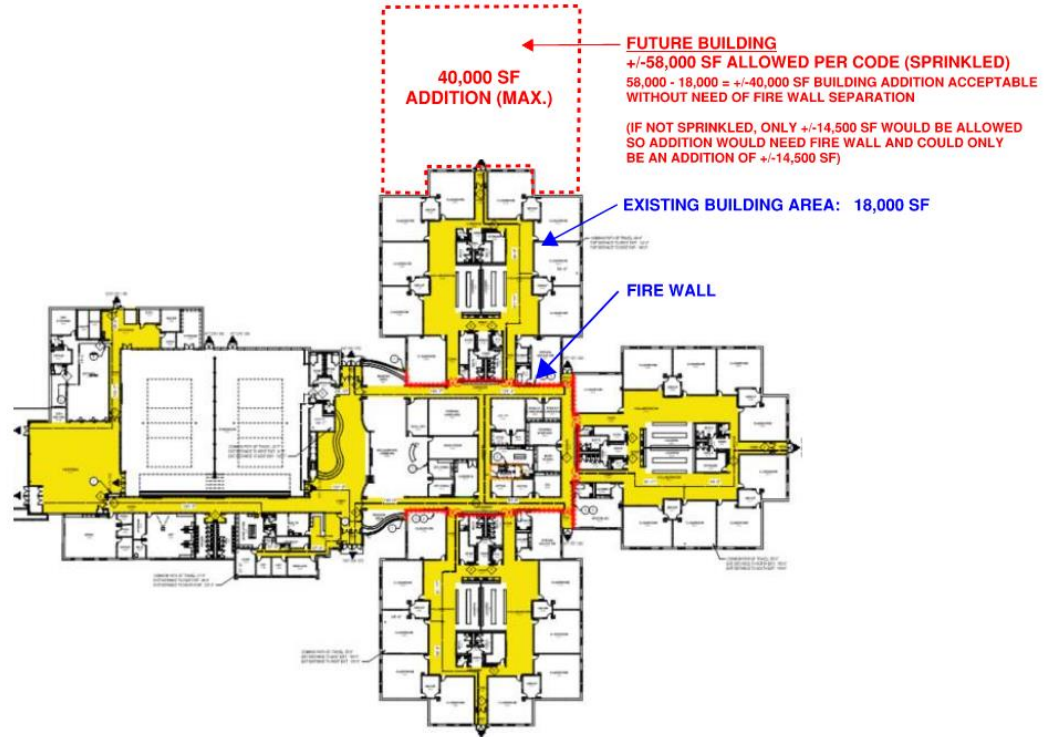
FIRE AND SMOKE PROTECTION FEATURES

Fire Separations

Case Study Reedsburg Intermediate School

Allowable Area

- Type IIB non-sprinkled 14,500 SF
- Type IIB sprinkled 58,000 SF



FIRE PROTECTION SYSTEMS

Fire Alarms

- Current code requires an addressable system
- Fire alarm system to be maintained and checked regularly.
- Smoke detection tied into alarm system
- Always take school fire drills seriously and evacuate the school when the alarm sounds.
- Hold fire drills on a regular basis. Have the initial fire drill for the school year in early September.
- Ensure that school employees know how to evacuate their work areas and perform their fire drill duties in an emergency.
- Be familiar with the location of the nearest fire alarm and extinguisher.
- Learn how to operate fire extinguishers. Your fire department is available to provide instructions and demonstrations.



FIRE PROTECTION SYSTEMS

Automatic Sprinkler Systems

Group E

An automatic sprinkler system shall be provided throughout all fire areas greater than 14,500 SF



FIRE PROTECTION SYSTEMS

Sprinklered vs. Non-sprinklered

Case Study

Jerstad-Agerholm (Racine Unified SD)

User Impacts:

- Nothing stored within 24" of ceiling
- No combustibles stored in vestibules, hallways, or mechanical rooms
- Artwork, paper, etc. limited to 20% of wall areas
- Insurance premiums likely higher
- Cost of fire damper and smoke detector testing

Design & Construction impacts:

- All corridors required to be 1-hour rated, existing walls would need to extend up to underside of deck, all penetrations would need to be fire caulked
- All doors, frames, and glass required to be 1-hour rated, all classroom doors would need closers (therefore would need ADA power operators)
- Limits allowable area of addition
- Etc.



FIRE PROTECTION SYSTEMS

Fire Inspections

Fire inspectors should perform **routine inspections**

Fire drills are usually witnessed by fire operations staff

Component testing is performed by qualified contractors hired by the School District



MEANS OF EGRESS

Egress Components

- **2 exit routes** required for 49 or more occupants
- Spaces serving 50 or more have **panic exit hardware**
- **Egress** minimum width is 32" clear
- **Minimum corridor** width is 6'-0"
- **Dead end Corridors** no more than 20 feet (non-sprinkled), 50 feet (sprinkled)
- **Common path of travel** is 75'-0"
- **Travel distance** not to exceed 200 feet (non-sprinkled), 250 feet (sprinkled building)



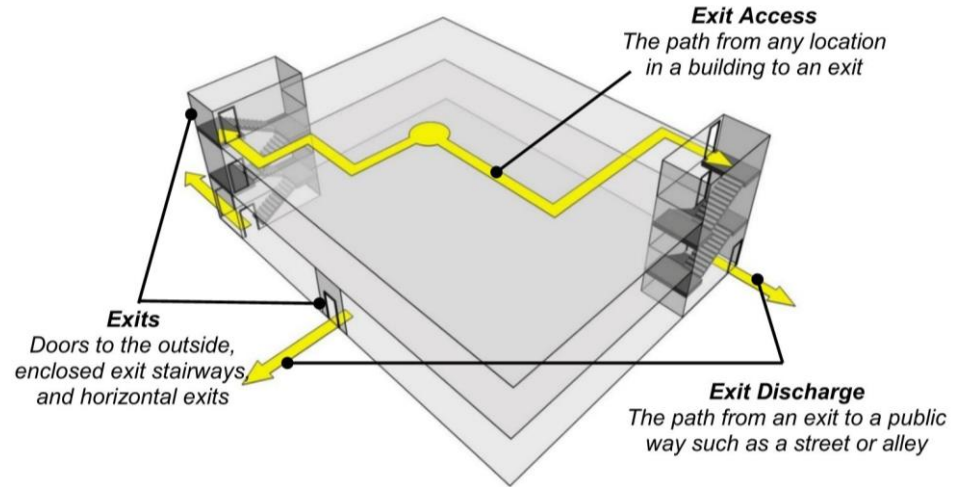
MEANS OF EGRESS

Exit Access, Exit, and Exit Discharge

Intent is to **protect occupants in a fire** event while compartmentalizing fire and smoke damage.

Prior to Wisconsin's adoption of IBC in 2002, schools were typically unlimited area if constructed of noncombustible materials. Also did not require corridor ratings and enclosed stairwells. In addition, classroom air was typically transferred to the occupied space of corridors for central return air handler.

Without sprinklers to extinguish with the source of smoke, ratings are required at all corridors and stairs to protect occupants egressing. With sprinklers, those rating requirements are typically omitted.

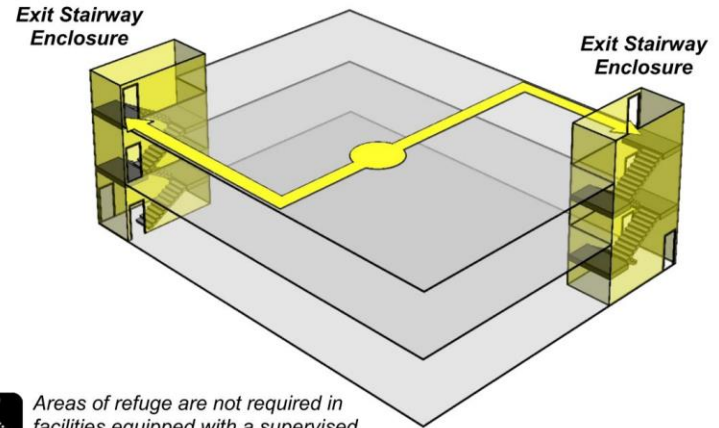


MEANS OF EGRESS

Vertical Enclosures

- **Elevators** shut down when Fire Alarms activate to prevent delivering users to danger
- **Stairwells** are only way out
- Smoke rises
- **Without sprinklers**, all stairwells require ratings
- **With sprinklers**, can omit rating requirements (if both floors have exits to grade)
- Even with sprinklers, 50% of stairwells must be enclosed and rated
- **Areas of Refuge**
- Minimum width depends on occupancy (typ. 44")

On floors above or below the level of exit discharge, accessible means of egress typically lead to exit stairways.



Areas of refuge are not required in facilities equipped with a supervised automated sprinkler system.

MEANS OF EGRESS

Exit Lights

Incandescent egress lighting and institutional “steel can” exit signs have been the norm in school facilities for decades

New technology can improve the appearance of student residence halls while reducing maintenance and energy costs

New light source technology, improved design and built-in diagnostics

Replacement of incandescent light sources with light-emitting diodes (LEDs)



MEANS OF EGRESS

Emergency Action Plan

The **facility's emergency plan** should describe how the egress systems are to be used for various emergencies. Occupants need to be familiar with all the building's exits, especially those not used on a daily basis. Their comfort level can be increased by holding periodic emergency drills, both announced for training purposes and unannounced for determining whether or not more practice is needed.



RESOURCES

Facilities Net

<https://www.facilitiesnet.com/default.aspx>

School Planning & Management

<https://webspm.com/Home.aspx>

American School & University

<https://asumag.com>



questions and **answers**

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