Chapter 10
Means of Egress

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Means of Egress – Administrative MSFC 1001.1
• New buildings:
  – Sections 1003-1030 apply
• Existing buildings:
  – Sections 1001, 1002, 1030, & 1104 apply
• Means of egress deemed to comply with Chapter 10 (if properly installed & maintained):
  – Minnesota Residential Code
  – Minnesota Building Code
**Means of Egress – Overview**

- Most of the changes from 2006 to 2012 IFC involved a re-format of requirements
- Some new locking provisions were added**
- Reduction of egress width for sprinkler-protected buildings now also requires voice evacuation system**

**Occupant Load Calculations**

MSFC 1004

<table>
<thead>
<tr>
<th>Use</th>
<th>Stairways (in. per person)</th>
<th>Level components and ramps (in. per person)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 MSFC</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>2007 MSFC (with sprinkler protection)</td>
<td>0.2</td>
<td>0.15</td>
</tr>
<tr>
<td>2015 MSFC</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>2015 MSFC (with sprinkler protection)</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>2015 MSFC (with sprinklers &amp; voice alarm)</td>
<td>0.2</td>
<td>0.15</td>
</tr>
<tr>
<td>2015 MSFC – Group H &amp; I-2</td>
<td>0.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>
You Make the Call

• Determine the occupant load
• Assess the adequacy of egress:
  – Number of exits
  – Width
  – Arrangement
  – Panic hardware?

Locking Arrangements

MSFC 1008.1.9.3

Locking Arrangements – MSFC 1008.1.9.3*

• Locks and latches can prevent door operation (9 conditions):
  – Detention or restraint
  – Groups A, B, F & S occupancies (main door key-locking exception)
  – Pair of doors – inactive leaf
  – Dwelling / sleeping unit doors
  – Fire-rated door hardware*
Locking Arrangements*

- Locks and latches can prevent door operation:
  - Delayed egress door locks*
  - Special locking arrangements*
  - Electromagnetically locked doors* (**)
  - Special detention arrangements*  

Special Locking Arrangements*

- Allowed for Group I-1, I-2, R-3 or R-4 where clinical needs require locking
- Requires:
  - Full sprinkler system (NFPA 13)
  - Detection system – can be either smoke or heat
  - Doors to unlock upon activation of sprinkler or alarm system

Special Locking Arrangements*

- Requires:
  - Doors to unlock upon loss of power to lock
  - Capable of being unlocked from fire command, nursing station, or other approved location
  - Only one arrangement allowed before entering an exit
Special Locking Arrangements*

• Requires:
  – Staff to have ability to operate the lock (keys, codes, etc.)
  – Emergency lighting at the door
  – 24 hour supervision within the locked area
  – Locks to fail in the open position
  – Minimum of two smoke compartments per floor (exception for R-3)

Special Locking Arrangements

Magnetic Locks

Key Card Reader

Delayed Egress Door Locks*

• Allowed for occupancies other than Group A and Group H
• Requires:
  – Full sprinkler system (NFPA 13) or smoke detection system
  – Doors to unlock upon activation of sprinkler or alarm system
**Delayed Egress Door Locks**

- Requires:
  - Doors to unlock upon loss of power to lock
  - Capable of being unlocked from fire command center
  - Initiation of irreversible process to release the door (15 second delay permitted)

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**Delayed Egress Door Locks**

- Requires:
  - Signage on door
  - Emergency lighting at the door
  - Maintenance and testing required

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**Delayed Egress Door Locks**

- Mag-lock
- Emergency Illumination
- Control panel: audible alarm, bypass, and manual reset
Special Egress Door Locks

- Emergency Illumination
- Separate power supply
- Some hardware kits include locking device, timed release, audible alarm, bypass and reset all in one assembly

Special Detention Arrangements*

- Allowed for rooms (other than cells)
- Requires:
  - Sprinkler system for room or area being secured
  - Smoke detection system between room or area and exit door
  - Doors to unlock upon activation of sprinkler or alarm system

Special Detention Arrangements *

- Requires:
  - Doors to release upon loss of power to lock
  - Capable of being unlocked from manual switch
  - Doors to swing in direction of egress (swing out)
Special Detention Arrangements (Detainment Rooms)

Exit Signs

MSFC 1011

Floor Level EXIT Signs – MSFC 1011.2

- Required for Group R-1 occupancies
- Bottom: 10-12” above the floor
- Mounted to door or wall
- On latch side of frame
- Within 4” of frame
You Make the Call

• Does this work for floor level EXIT signs?

Escape Windows

MSFC 1029

Escape Windows – MSFC 1029

• Required for Group R occupancies:
  – Basements & each basement bedroom
  – Sleeping rooms below the 4th story
• Exceptions for:
  – Sprinkler-protected buildings
  – Sleeping rooms entering fire-rated corridor with two remote exits
  – High-rise buildings
  – Atriums
Escape Windows – MSFC 1029

- Additional exceptions for:
  - Room has door direct to public way, yard, or court
  - Basements less than 200 sq. ft. without habitable space or only for mechanical equipment
  - Basement bedrooms:
    - Constructed prior to 8/1/2008 (Effective date of statewide building code)

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Escape Windows – MSFC 1029

- Additional exceptions for:
  - Basement bedrooms:
    - Constructed prior to 8/1/2008
    - Undergoing alteration / repair
    - Basement and all of the means of egress are sprinkler-protected (to exit discharge)

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Escape Windows – MSFC 1029.6.1

- For licensed day care or foster care:
  - Minimum dimensions:
    - 20” in clear width
    - 20” in clear height
    - 4.5 sq. ft. (648 sq. in.) of clear opening
  - Maximum of 48” from floor to sill height
Maintenance of Means of Egress
MSFC 1030

Reliability – MSFC 1030.2
• Exit features to be maintained free of obstructions to full instant use
• Security devices affecting egress need approval of fire code official
• Requires maintenance of special locking arrangements

Maintenance – Special Locking (MSFC 1030.2.2)
• Monthly operability test
• Annual operability test of fire alarm and sprinkler interconnects
• Annual operability test of failsafe release functions
• Conducted by knowledgeable person
• Deficiencies corrected without delay
ICC 300 Added to Fire Code

- ICC 300 addresses Bleachers, Folding and Telescopic Seating, and Grandstands
- ICC 300 was added to the state fire code
- ICC 300 is referenced in Chapter 10 (Section 1028.1.1)

Construction Requirements for Existing Buildings

Chapter 11

Format of Chapter 11* / **

- Section 1101 – General
- Section 1102 – Definition
- Section 1103 – Fire Safety Requirements for Existing Buildings
- Section 1104 – Means of Egress
- Section 1105 – Outdoor Operations
- Section 1106 – Separation of Occupancies & Hazardous Areas*
Chapter 11 Format **

• Most everything is shown as “new” language
• Uses tables to simplify interpretation and application
• Almost everything is shown in “positive” language (no exceptions)

“Positive Language” vs. Exceptions

• Exit signs shall be provided where two or more exits are required from a room, area, or story.
• Exit and exit access doorways shall be marked with an approved exit sign readily visible from any direction of egress travel.
  – Exception: Exit signs are not required in rooms or areas that require only one exit or exit access.

Section 1101 – General **

• Scope (1101.1): Buildings constructed prior to the adoption of this code
• Intent (1101.2): To provide a:
  – Minimum degree of fire and life safety
  – To persons occupying existing buildings
  – By providing minimum construction requirements
**Existing – General* (MSFC 1101)**

- Compliance option (1101.5): Existing buildings comply if they meet:
  - International Residential Code (if applicable)
  - NFPA 101 (Life Safety Code)
- Previous codes (1101.6): Considered to comply if:
  - Meets previous fire or building code
  - Does not constitute a distinct hazard to life

**Section 1103 – Fire Safety Requirements (Format)**

- 1103.1 – Required construction
- 1103.2 – Emergency responder radio coverage (moved to appendix chapter)
- 1103.3 – Elevator operation
- 1103.4 – Vertical opening protection
- 1103.5 – Sprinkler systems

- 1103.6 – Standpipes
- 1103.7 – Fire alarm systems
- 1103.8 – Smoke alarms
- 1103.9 – Commercial cooking protection
Vertical Opening Protection

MSFC 1103.4 and Table 1103.4

Why Do We Care About Vertical Openings?

• Convective heat release is predominant method of heat travel (60-75%)
• Convective heat spread is primarily upwards
• Smoke and heat travels vertically
• Unprotected vertical openings have been identified as a contributing factor in many large life loss fires

Examples of Vertical Openings

• Stairways
• Elevator hoistways
• Service and utility shafts / chutes
• Building expansion seismic joints
• Other openings
Common Vertical Openings

Section 1103.4 – Vertical Opening Protection*

- Interior vertical shafts to be:
  - Enclosed
  - Otherwise protected
  - Per Table 1103.4 (same as 2007 MSFC Table 704.1)
  - Allows two stories to be open in most occupancies

Table 1103.4

<table>
<thead>
<tr>
<th>OCCUPANCY CLASSIFICATION</th>
<th>CONDITIONS</th>
<th>PROTECTION REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>Vertical openings connecting two or more stories</td>
<td>1-hour protection</td>
</tr>
<tr>
<td>All, other than Group I</td>
<td>Vertical openings connecting two stories</td>
<td>No protection required</td>
</tr>
<tr>
<td>All, other than Group I</td>
<td>Vertical openings connecting three to five stories</td>
<td>1-hour protection or automatic sprinklers throughout</td>
</tr>
<tr>
<td>All, other than Group I</td>
<td>Vertical openings connecting more than five stories</td>
<td>1-hour protection</td>
</tr>
<tr>
<td>All</td>
<td>Mezzanines open to the floor below</td>
<td>No protection required</td>
</tr>
<tr>
<td>All, other than Group I</td>
<td>Atriums and covered mall buildings</td>
<td>1-hour protection or automatic sprinklers throughout</td>
</tr>
<tr>
<td>All, other than Groups B and M</td>
<td>Escalator openings connecting four or less stories in a sprinklered building</td>
<td>1-hour protection or automatic sprinklers throughout</td>
</tr>
<tr>
<td>Group B and M</td>
<td>Escalator openings in a sprinklered building protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13</td>
<td>No protection required</td>
</tr>
<tr>
<td>Group B and M</td>
<td>Escalator openings in a sprinklered building not protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13</td>
<td>No protection required</td>
</tr>
</tbody>
</table>
Section 1103.4 – Vertical Openings*

• Can have 2 stories open in most occupancies

Section 1103.4 – Vertical Openings*

• Over two stories, must be protected by:
  – Construction (one-hour minimum)
  – Sprinklers throughout (up to five stories)

Vertical Opening Protection*

• Six (6) or more stories:
  – One-hour fire resistive construction (regardless of sprinkler protection)
Floor Openings & Shafts
MSFC 704.1

Open Stairs – 3 or more Stories
• Should be a “red flag” to inspectors

Correcting Vertical Openings
Code Intent – Have a Protected Shaft

Would This be Acceptable?

Elevator Shafts
Rubbish and Linen Chutes

Escalator Enclosures – MSFC Table 1103.4
• Draft curtain and closely spaced sprinklers allowed for escalator openings:
  – 4 or fewer stories (all occupancies)
  – Unlimited number of stories (Groups B & M occupancies)

Atriums – MSFC Table 1103.4
• Options:
  – One-hour fire protection
  – Sprinkler entire building
What is an Atrium?

• Essentially it is an exception to allow unprotected vertical opening(s) that exceed the number of stories allowed to be open by the codes
• In new construction the building code has additional requirements:
  – Primarily smoke control system
  – Some egress limitations

You Make the Call

• Can a two-story building have an atrium?
Atrium Smoke Control System

You Make the Call

• Would you accept this?

Existing Sprinkler Requirements*
(MSFC 1103.5)

• Pyroxylin plastics manufacture, storage, or handling (more than 100 lbs.)
• Group I-2 occupancies**
• Basements exceeding 2,500 sq. ft.:
  – Group A (dining, drinking, bowling)
  – Group E
  – Group I
  – Group R-1 & R-2 (sleeping rooms)
Standpipes** - MSFC 1103.6

- Standpipes required:
  - Occupied floors more than 50 ft. above or below level of FD access
  - Existing helistops / heliports when 30 ft. above level of FD access
  - Allows manual standpipes when approved by the AHJ

Fire Alarm Systems* - MSFC 1103.7

- Required in existing Group A, E, I, R-1, and R-2 occupancies
- Format:
  - General – when required
  - Initiation – what activates it
  - Notification – what it does when activated

Smoke Alarms* - MSFC 1103.8

- Required for existing Group I-1 and R occupancies
- Refers to Table 1103.8:
  - Existing with no smoke alarms
  - Existing (after 8/1/1989) – hardwired
  - Existing (before 8/1/1989) – can be battery-powered
  - Replacement – must meet applicable sections above
Table 1103.8*

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Location</th>
<th>Power Supply</th>
<th>Interconnection Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing buildings, unless stated other than in this code...</td>
<td>1. In hallways outside sleeping rooms.</td>
<td>1. In hallways outside sleeping rooms.</td>
<td>If constructed on or after 8/1/1989, smoke alarms are required to be hard-wired (120 volt). If constructed before 8/1/1989, smoke alarms can be battery-powered. No interconnection is required for battery-powered alarms.</td>
</tr>
<tr>
<td>Existing buildings, unless stated other than in this code...</td>
<td>2. In sleeping rooms.</td>
<td>2. In sleeping rooms.</td>
<td>Smoke alarms are required to be hard-wired (120 volt). No interconnection is required.</td>
</tr>
<tr>
<td>Existing buildings, unless stated other than in this code...</td>
<td>3. On each level of the building and in basements.</td>
<td>3. On each level of the building and in basements.</td>
<td>Smoke alarms are required to be hard-wired (120 volt). No interconnection is required.</td>
</tr>
<tr>
<td>Existing buildings, unless stated other than in this code...</td>
<td>4. On ceiling or wall (less than 12 inches below ceiling).</td>
<td>4. On ceiling or wall (less than 12 inches below ceiling).</td>
<td>Smoke alarms are required to be hard-wired (120 volt). No interconnection is required.</td>
</tr>
<tr>
<td>Existing buildings, unless stated other than in this code...</td>
<td>5. On center of ceiling above stairways.</td>
<td>5. On center of ceiling above stairways.</td>
<td>Smoke alarms are required to be hard-wired (120 volt). No interconnection is required.</td>
</tr>
</tbody>
</table>

Commercial Cooking Protection* - MSFC 1103.9

- Approved automatic fire extinguishing system required
- When cooking produces grease-laden vapors

Section 1104 – Means of Egress (Format)

- 1104.1 – General
- 1104.2 – Elevators, escalators, moving walks
- 1104.3 – Exit signs
- 1104.4 – Power source for Exit signs (back-up power)
- 1104.5 – Illumination required (includes emergency lighting)
Section 1104 – Means of Egress (Format)

- 1104.6 – Guards
- 1104.7 – Doors
- 1104.8 – Opening force for doors
- 1104.9 – Revolving doors
- 1104.10 – Stair dimensions (includes replacement stairs)
- 1104.11 – Winders

Section 1104 – Means of Egress (Format)

- 1104.12 – Circular stairs
- 1104.13 – Stair handrails
- 1104.14 – Ramps
- 1104.15 – Width of ramps
- 1104.16 – Fire escape stairs
- 1104.17 – Corridors
- 1104.18 – Travel distance

Section 1104 – Means of Egress (Format)

- 1104.19 – Common path of egress travel
- 1104.20 – Stairway discharge ID
- 1104.21 – Aisle widths
- 1104.22 – Stairway floor number signs
- 1104.23 – Number of means of egress or exits
- 1104.24 – Escape windows
MSFC 1104.1 – Egress (General)

- 1104.1.1 – Number of occupants per Section 1004
- 1104.1.2 – Minimum egress width per Section 1005.1
- 1104.1.3 – Ceiling height of 78 inches in corridors
- 1104.1.4 – Special exiting provisions for Pre-school, K, 1, & 2

Elevators / Escalators as Exits

- Elevators & escalators can be used as an egress component
- When previously approved

Stair Dimension – MSFC 1104.10

- Allows existing stairs:
  - 8.25” maximum rise
  - 9” minimum run
- Minimum width:
  - 36” or
  - As needed for occupants
- Existing stairs can be rebuilt
Winders – MSFC 1104.11

- Minimum tread depth of 6 inches
- Minimum of 9 inches measured 12 inches from narrow edge

Circular Stairs – MSFC 1104.12

- Allowed to continue when:
  - Minimum tread depth of 10 inches

Handrails – MSFC 1104.13

- Required on one side of stairs
- Additional handrail required if distance to a handrail exceeds 44 inches
- Aisle stairs with center handrail not required to have additional ones
- Mounting height: 30-42 inches
Handrails

Only required on one side if stair is 44 inches wide or less

Height: 30-42"

Ramps - MSFC 1104.14 & 1104.15

• Ramps in means of egress to be less than 1:10 slope
• Other ramps (non-egress areas) to be less than 1:8 slope
• Minimum width:
  – Not less than needed for the occupants served
  – 30 inches minimum

Fire Escape Stairs – MSFC 1104.16

• Allowed in existing buildings
• Can serve up to 50% of required egress capacity
• ¾-hour opening protection within 10 feet
Fire Escape Stairs

Fire Escape Stair Dimensions

<table>
<thead>
<tr>
<th>Feature</th>
<th>Serving More Than 10 Occupants</th>
<th>Serving 10 or Fewer Occupants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Width</td>
<td>22 inches</td>
<td>18 inches</td>
</tr>
<tr>
<td>Maximum Height of Risers</td>
<td>9 inches</td>
<td>12 inches</td>
</tr>
<tr>
<td>Minimum Tread Depth</td>
<td>9 inches</td>
<td>6 inches</td>
</tr>
</tbody>
</table>

Corridors – MSFC 1104.17

- Corridors to be one-hour fire-rated or sprinkler-protected:
  - Most occupancies – greater than 30 occupants
  - Groups I & R – greater than 10 occupants
- Allows wood lath and plaster in good condition or 1/2” gypsum wallboard in lieu of one-hour fire-rated construction
### Corridor Construction Options* - MSFC 1104.17.1
- Allowed for churches, schools, and business occupancies
- Must meet one of three conditions:
  - One-hour fire separated (some exceptions for lath & plaster, wire glass, solid doors)
  - Building sprinkler-protected throughout
  - Smoke detection throughout egress system connected to central station

### Corridor Openings – MSFC 1104.17.2
- Doors to be:
  - 20 minute fire-rated
  - Solid wood at least 1 ¾” thick
  - Allows certain other doors if frame will not accommodate above
  - Self-closing or auto-closing

- Other openings to be:
  - Wire glass in steel frames
  - Transoms, louvers, and other openings to be auto-closing or covered with ¾” gypsum wallboard on room side
  - Patient room doors in I-2 and corridors of I-3 need not be fire-rated where smoke barriers are provided
Corridor Width – MSFC 1104.17.3

• Minimum width:
  – Not less than needed for the occupants served
  – 36 inches minimum
  – Allows 24 inch minimum for spaces providing access to electrical, mechanical, or plumbing systems

Other Egress – Table 1104.17.4

• Table 1104.17.4 contains:
  – Common path of travel limits
  – Dead-end corridor limits
  – Maximum travel distance

Dead-End Corridors
Minnesota State Fire Marshal Division 2015 Minnesota State Fire Code Update Class

Aisle Accessway vs. Aisle - Section 1104.21

- Aisle Access Way Defined: That portion of an exit access that leads to an aisle
- Aisle Defined: That portion of an exit access that connects an aisle access way to an exit access doorway, corridor or exit

Aisle Accessway vs. Aisle - Section 1104.21

- Aisle
- Aisle Access Way

Aisle Width – MSFC 1104.21

- Minimum width for the occupant load served
- Refers to Table 1104.21 for minimum widths
- Different values for aisles that are level vs. aisles that are stairs
**Aisle Width – MSFC 1104.21**

- Aisle Accessways:
  - Minimum of 24 inches when serving less than 50 people
  - Minimum of 30 inches when serving 50 or more people

**Number of Means of Egress or Exits – MSFC 1104.23**

- Two means of egress doors or exits from rooms or areas are required:
  - 50 occupants – Groups A, B, E, F, M, S, & U Occupancies
  - 10 occupants – Groups H, I, & R Occupancies
  - 16 occupants – Group R dormitories (with some conditions)

**Section 1104.23 – Number of Means of Egress or Exits**

- Three means of egress or exit doors are required when over 500 occupants
- Four means of egress or exit doors are required when over 1,000 occupants
- Two means of egress or exit doors are required for Group E science laboratories over 1,000 sq. ft. in size*
**Section 1104.24 – Escape Windows**

- Escape windows required in sleeping rooms of Group R and I-1 occupancies:
  - Below the 4th story and basements
  - Not required if two separate means of escape or door direct to exterior
  - Not required if building is sprinklered
  - Not required for hotels built before 4/11/1983

**Section 1104.24 – Escape Window Dimensions**

- Allowed to reduce to 4.5 sq. ft. (648 sq. inches)
- Minimum opening size of 20 inches
- Sill height not to exceed 48 inches from floor
- Specific criteria for escape window wells and windows under decks / porches

**Section 1105 – Outdoor Operations**

- Deals with tire storage yards:
  - 150 ft. maximum from FD access road to end of pile
  - FD access roads located per 3405.4 and 3405.5 for pile clearances and fire breaks
Section 1106 – Separations (Format)*

- 1106.1 – General
- 1106.2 – Occupancy separations
- 1106.3 – Incidental use areas

Incidental Use vs. Accessory Occupancies

- Accessory Occupancies (MSBC 508.2):
  - Same or lower hazard
  - Less than 10% of area
- Incidental Use (MSBC 509):
  - Higher hazard, minor use
  - Sprinkler or separate (or both)

Section 1106.2 – Occupancy Separations*

- Separations are required in buildings containing Groups I & R occupancies.
- Separations:
  - Group I: Per the building code
  - Group R: 1-hour (several exceptions)
    - Wood lath & plaster or ½” gypsum or sprinklers in lieu of 1-hour separations
Incidental Area Separations – MSFC 1106.3*

- Usually need 1 hour fire separation or sprinklered
  - Shops
  - Laboratories with hazardous materials
  - Storage or laundry rooms > 100 sq. ft.
  - Boiler rooms & central heating plants > 400K BTU

Incidental Area Separations – MSFC 1106.3*

- Existing wood lath & plaster in good condition allowed
- Doors
  - Fire rated, steel insulated or solid wood core
  - In sprinklered I & R occupancies, doors to be self-closing or auto-closing
- No separation in certain conditions

Questions