Barrier Management

PL Markings
Learning Objectives

By the end of this session, you should be able to answer the following questions:

• What are photoluminescent markings (PL)?
• Why are PL markings essential to barrier management?
• What codes govern PL marking?
• How are PL markings installed?
• What are the pros and cons to different types of PL marking products?
History of uses:

- Marine Industry
- Off Shore Oil Drilling
- Transportation
- Building Industry
What Led to PL in Buildings?

_Disasters Change Building Codes_

- MGM Grand Hotel Fire – Nov 21, 1980
  - Add Fire Barriers Smoke and Fire Containment
- One Meridian Plaza Fire – Feb 23, 1991
  - Add Floor ID Signage
- World Trade Center – Feb 26, 1993 Bombing
  - Add PL Markings
    - Increase Speed of Occupant Evacuation
    - Increase Speed First Responder Access
Assessment of Photoluminescent Material Used Within Stairwell During Office Evacuation

Source: National Research Council of Canada
April 1999 & June 2007
Stairwell C – Full Electrical Lighting – No PL Markings
Stairwell A – Reduced Lighting @ 57 Lux – PL markings added
Stairwell G – Reduced Lighting @ 74 Lux – PL markings added
Stairwell E – No Electrical Lighting – PL markings only
Benefit of PL in Buildings

- World Trade Center – 9/11 Disaster

**Final report of the Federal Building & Fire Safety Investigation**

**NIST NCSTAR 1-7**

**Occupant Behavior:**
- 17,000 Survivors
- 1,200 Interviews
- 6 Focus Groups

**Top Three Aids During Evacuation:**
1) Coworkers
2) First Responders
3) PL Markings in Stairwells and Corridors
Types of Luminescence

• Self-luminescent – Radioactive Tritium
  • EXIT signs inside buildings

• **Photoluminescent (PL)** – Charged by an external light source
  • Phosphors derived from non-radioactive rare earth mineral crystals that absorb and store energy from ambient light conditions
  • Stored light is gradually released, producing a highly visible surface illumination
  • Exposure to light sources recharges and repeats the process
Building Codes

- 2009 | 2012 | 2015 | 2018  
  International Building Code (IBC)

- 2009 | 2012 | 2015 | 2018  
  International Fire Code (IFC)

- National Fire Protection Association (NFPA) – 101 and 5000

- State of California Building Code

- State of Connecticut

- New York City Building Code

- General Services Administration (GSA)
2018 IBC & IFC
Sections 1025 & 1023.9

Applicable Occupancy Groups:

• Group A Assembly; gathering together of persons for civic, social, religious, recreation, casinos, arenas, theaters
• Group B Business; Offices, banks, education above 12th grade, laboratories, post offices
• Group E Educational; through 12th grade
• Group I-1 Institutional; Hospitals, Nursing Homes, Health Care in general
• Group M Mercantile; Department stores, retail stores, wholesale stores
• Group R-1 Residential subset; where occupants are primarily transient in nature including boarding houses, hotels, and motels.

IBC Section 202
High-rise buildings: occupied floors over 75 ft in height
Outline the requirements for various components within the stairway

- Steps
- Landings
- Handrails
- Passageway Perimeter
- Obstacles
- Doors
Typical Egress Stairwell

Final Exit

(Basement)
Typical Egress Stairwell
1025.2 Markings within exit components

1025.2.1 Steps & 1025.2.2 Landings

- PL applied to the horizontal leading edge of each step and landings
- Extend full length of step
- Leading edge of stripe shall be placed a maximum of ½" from leading edge of each step
- Stripe shall overlap the leading edge of step by not more than ½" down the vertical face (though not recommended)
1025.2.1 Steps & 1025.2.2 Landings

Stair Nosing Components

Aluminum extrusion base, Flexible epoxy with abrasive grit, PL strip
1025.2.1 Steps & 1025.2.2 Landings

★ Stair Nosing Options

• Cast-in - New Construction/Precast
  • Single component base or two-component base
  • Solid or ribbed abrasive

• Retrofit - Used on existing stairs
  • Solid or ribbed abrasive
  • Swept back or 90 degree
1025.2.1 Steps & 1025.2.2 Landings

**Stair Nosings Should Be Slip Resistant**

- UL 1994 requires slip resistant testing in accordance with UL 410

- Tested by James Machine for Static Coefficient of Friction (SCOF)

- SCOF of .5 or greater is considered slip resistant
Tape Failures
1025.2 Markings within exit components

1025.2.3 Handrails

- PL placed on top surface for entire length, including extensions and newel post caps
- 4" max gap at bends and turns
- End caps for aluminum strips standard
- PL tape is suitable but less durable than aluminum
1025.2 Markings within exit components

1025.2.4 Perimeter demarcation lines

- Stair landings and other floor areas within exit enclosures
- Solid and continuous outline of egress path
- Floor mount – 4" max from wall (metal recommended)
- Wall mount – 4" max from floor (tape recommended)
- Exception – Not required on sides of steps (risers)
1025.2.4 Perimeter demarcation lines

Doors at non-exit levels

1025.2.4.1  
Floor-mounted demarcation lines  
shall continue across the floor in front of any door within exit path, except final exit

1025.2.4.2  
Wall-mounted demarcation lines  
shall continue across the face of any door or transition to the floor and extend across the floor in front of any door within exit path, except final exit
Demarcation

1025.2.4.3 Transition

• Where a wall-mounted demarcation line transitions to a floor-mounted line, or vice versa, the wall-mounted line shall drop vertically to the floor to meet a complementary extension of the floor-mounted line, thus forming a continuous marking.
1025.2 Markings within exit components

1025.2.5 Obstacles

• Required for obstacles at or below 6'6" in height and projecting more than 4" into the egress path

• Marked with pattern of alternating equal bands of luminescent material and black

• Alternating bands min. of 1" and no more than 2" thick, angled at 45 degrees

• Markings shall not conceal any required information or indicators

• Obstruction tape is available
1025.2 Markings within exit components

1025.2.6 Doors within exit path

- Emergency Exit Symbol Signage
- Door hardware markings
- Door frame markings
1025.2 Markings within exit components

1025.2.6 Doors within exit path
1025.2.6.2 Door Hardware Markings

• Min 16 sq. in.
• PUSH TO OPEN for rotating cross bar and recessed push bar (panic bar)
• 4”x4” blank or running man for handle
• Installed with construction adhesive or fasteners
1025.2.6.1 Emergency Exit Symbol

- Mount centered on the door
- Install 18" from floor to top of sign or lower
- Intermediate and Final Exit options
Other Commonly Used Signage

• Not required by IBC, but required by some local code (NYC)
• Directional Signage
• Not an Exit
1023 Interior Exit Stairways and Ramps

1023.9 Stairway Identification Signs

Must Designate the Following:

- Identification of stair or ramp
- Availability of roof access
- Floor-level (in visual characters, raised characters and compliant braille)
- Terminus of top and bottom of interior exit stairway and ramp
- Story of & direction to exit discharge

Placement of the Sign:

- 5 feet above the floor level
- Adjacent to door leading from enclosure
- Visible when door is open or closed
- Minimum size 18" tall by 12" wide
Placement and dimensions of markings shall be consistent and uniform throughout the same enclosure.

1025.3 Uniformity
1025.4 Self-luminous and photoluminescent

Test Standards

Materials shall comply with either of the following standards:

1. UL 1994.
2. ASTM E 2072, except that the charging source shall be 1 footcandle (11 lux) of fluorescent illumination for 60 minutes, and the minimum luminance shall be 30 millicandelas per square meter at 10 minutes and 5 millicandelas per square meter after 90 minutes.
Stairwell A – Reduced Lighting @ 57 Lux – PL markings added
Exit enclosures where photoluminescent markings are installed shall be provided with not less than 1 footcandle (11 lux) of illumination for not less than 60 minutes prior to periods when the building is occupied and continuously during the building occupancy.
Today we have answered:

• What are photoluminescent markings (PL)?
• Why are PL markings essential to barrier management?
• What codes govern PL marking?
• How are PL markings installed?
• What are the pros and cons to different types of PL marking products?
Thank you for your time and attention!

This concludes the American Institute of Architects Continuing Education Program
Questions?

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Barrier Management

Fire Protective Rolling Steel Doors

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NPD