



Stadium and Arena Egress

Best Practice Photoluminescent Solution





Best Practice Photoluminescent Solution

System design and product performance specification of photoluminescent markings for use in stadia and arenas.

Reduce everyday **slips & falls** with better step edge contrast

Increase **safety & security** preparedness with failsafe emergency lighting

Provide **aisle lighting** & wayfinding for low light or dark events

Improve orientation & wayfinding for the **visually impaired**

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M Dimond

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Technical Help: EcogloVenues@ecoglo.com

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Ecoglo International produces high performance, highly durable photoluminescent products for step edges, handrails, path marking and signage.

These products can be used for three purposes:

1. everyday reduction of slips and falls through the provision of step edge contrast
2. aisle lighting and wayfinding for low light or dark events
3. emergency lighting, being either standalone or to enhance electrical emergency lighting

Ecoglo products can be used in a variety of locations.

Recommended locations and products are:

Location	Product
Bowl area	Contrast strips, handrail strips, row markers, signage
Scissor ramps	Guidance strips, discs, signage
Access stairs	Contrast strips, handrail strips,
Corporate suites	Step nosings
Parking structures	Contrast strips, signage

General product codes are provided in Appendix 2. Specific product codes and specifications recommended for different jurisdictions can be found at www.EcogloVenues.com.

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High Durability

Product used in stadia and arenas must have high durability due to the demands of high foot traffic. To provide the necessary durability the Ecoglo manufacturing process involves heat curing to integrally bond the active ingredients into an aluminium substrate. The products have passed tests by accredited agencies for durability, UV resistance, weather resistance, stain resistance, abrasion resistance, ease of cleaning, flammability, toxicity and radioactivity.

High Performance Photoluminescence

Ecoglo products contain photoluminescent pigment phosphors that absorb light energy and re-emit this as a bright glow. Following testing of over 100 pigments on the market, a custom pigment was designed to achieve the greatest luminosity possible. Ecoglo products are tested in accordance with UL1994¹ by an independent laboratory to prove their high visibility.




Ecoglo products are activated by either natural or artificial light and will glow for many hours following activation. The duration of visibility indoors will depend upon the charging source and the length of time of exposure to this light source (see Appendix 1). Outdoors, the natural light will fully charge Ecoglo photoluminescent material, even on the most overcast day. When fully charged outdoors, Ecoglo products have luminance that will last all through the night.

High Performance Slip Resistance

Ecoglo anti-slip components are produced using hard wearing silicon carbide and the same heat curing process as the photoluminescent components. They can be used indoors or outdoors as they are UV and weather resistant. They have passed UL410 Standard for Slip Resistance for Floor Surface Material and have high performance classifications as shown in Appendix 4.

1. UL 1994 Standard for Luminous Egress Path Marking Systems.

Photoluminescent markings can be used to provide step edge contrast to:

-  prevent slips and falls
-  improve accessibility for patrons with impaired vision
-  aid in wayfinding in low light or dark environments

Steps should allow for fast, orderly and safe movement of patrons in both emergency and non emergency situations. Poor visibility is a leading cause of slips and falls on steps. The costs to facilities in claims for slips and falls can be an excessive avoidable expense.

Glare in the environment, visual reflectance and specular properties of a stair tread can contribute to daytime visibility difficulties. Photoluminescent systems can provide step edge contrast that overcomes these issues and ensures good contrast in light, dark and dim conditions.

Step edge contrast is important for all patrons but particularly important for those with impaired vision.

Functional Requirements

In order to prevent slips and falls the step edge strips are slip resistant, provide visual contrast to define the edge and are highly durable to ensure that they are not worn out by high foot traffic, rendering them ineffective.

Contrast meets appropriate Light Reflectance Value (LRV) difference or Luminance Contrast Value for the particular jurisdiction(see Appendix 3).

When the products are being used to meet accessibility codes the width of the strip will be determined by the code requirement in the particular jurisdiction.

Slip resistance meets the appropriate slip resistance test for the region (see Appendix 4).

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Design Philosophy

The philosophy of the design is to make step edges visible using Ecoglo's high durability photoluminescent markers. Ecoglo photoluminescent markings have two components, a photoluminescent strip and an anti-slip strip. These two components create internal visual contrast thus ensuring the step edge contrast is independent of the tread surface (Fig. 2.1). This internal contrast also ensures that visibility is good even under conditions of glare and visual reflectance.

Step edge contrast should be on the tread of a stair, not the riser, because when either ascending or descending stairs the tread provides the visual information required to negotiate stairs safely (Fig 2.2).

Ecoglo photoluminescent products are aluminium based and are manufactured using a patented heat curing process to ensure high durability to cope with the demands of high foot traffic.

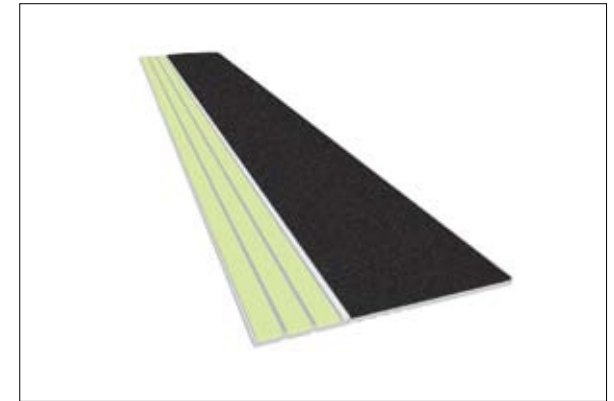


Fig. 2.1 Showing internal visual contrast

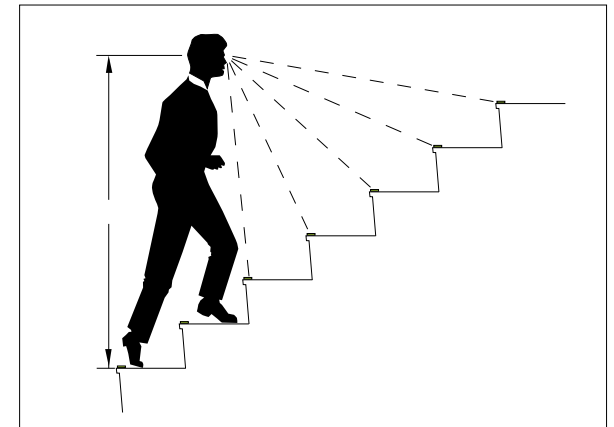


Fig. 2.2 Showing vision when ascending stairs

System Design

The horizontal leading edge of all steps should be marked including the landing step at the top of any flight of steps (Fig 2.3).

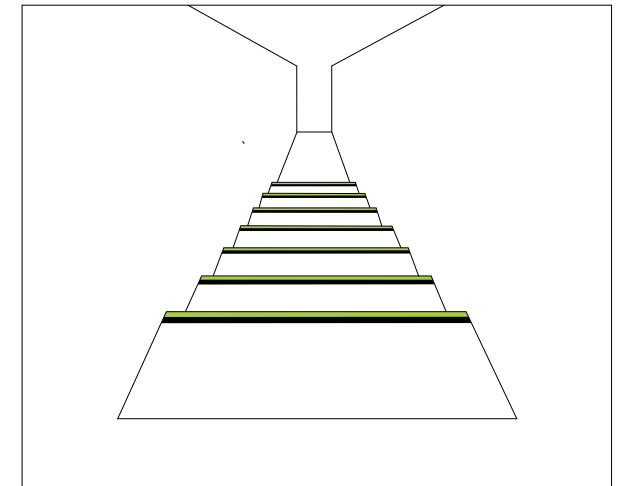




Fig. 2.3 Showing step markings

Photoluminescent markings can be used to:

-  provide aisle lighting for low light or dark events
-  provide high visibility signage for direction and row marking

Modern day stadia and arenas are often required to be multipurpose, for example they may be used for a sporting event requiring high light levels or a concert requiring low light levels. Although concert performers may wish to keep the lighting very low, stadium managers must provide safe access to concession stands and bathrooms. Late comers must also be provided for. Consideration must therefore be given to aisle lighting and signage that allows for these conflicting demands. Photoluminescent systems will provide sufficient visibility for patrons under low light conditions while at the same time they will not create a visual distraction for performers.

Functional Requirements

The functional requirement of an aisle lighting system is that aisle features are clearly visible under all light conditions. The aisle features are defined to be steps, aisle landings, ramps, handrails and row markers.

High visibility signage providing directions and labelling (eg bathrooms, accessibility routes, fire hydrants) can also be advantageous.

Design Philosophy

The philosophy of the design is to make aisle elements visible using Ecoglo photoluminescent markers so that accessing seats is both easy and safe. Directional and facility signage aids in the ease of patron movement around the facility.

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System Design

The recommended photoluminescent markings are as follows:

1. Aisle Steps

The horizontal leading edge of all steps are marked. (Fig 2.4 page 10)

2. Aisle Landings

The perimeters are marked either on the floor within 100mm of the wall or on the wall within 100mm of the floor. (Fig 2.4 page10)

3. Ramps

The perimeters are marked either on the floor within 100mm of the perimeter or on the wall within 100mm of the floor.

4. Handrails

The top surface of all handrails is marked with a strip. The strip extends along the entire length of the handrail to within 100mm of the ends. Where a handrail bends or turns corners there is a gap of no more than 100mm. (Fig 2.4 page 10)

5. Row Markers

The rows are labelled with photoluminescent row markers to identify the row and the range of seats accessed from the aisle. These can be either attached to the seats or installed on the floor. (Fig 2.4 page 10)

6. Signage

Wherever directional decisions need to be made photoluminescent signs showing an arrow and/or running man are used (Fig 2.4 page 10). Photoluminescent labelling of facilities such as bathrooms, accessibility routes, fire hydrants etc can also be advantageous.

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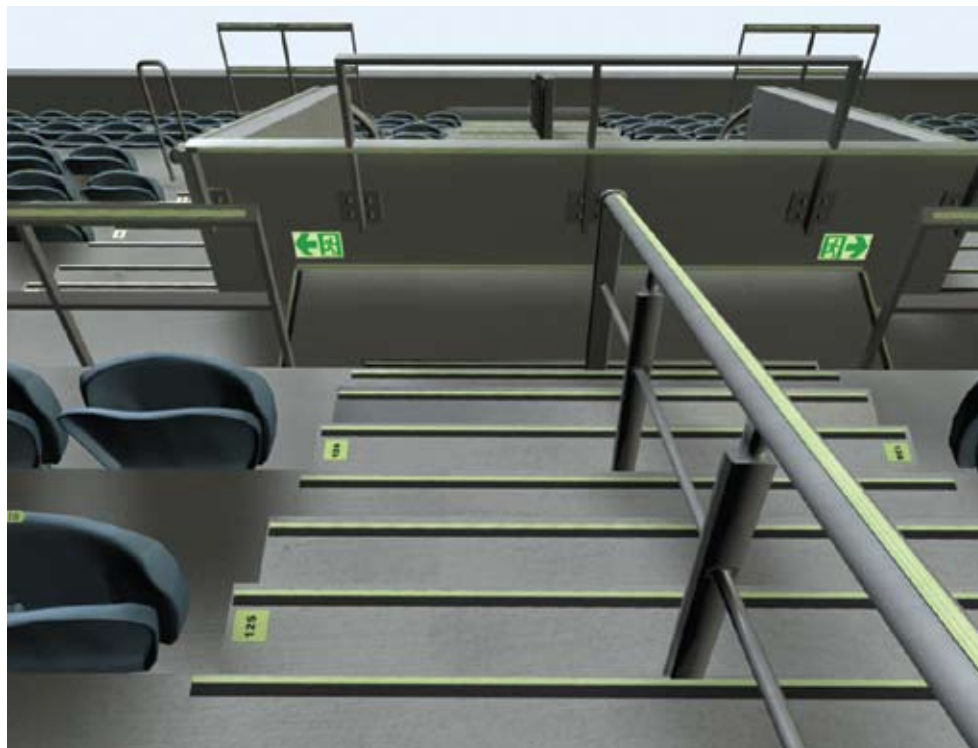




Fig. 2.4 Showing step and handrail markings, aisle labelling and directional signage.

Photoluminescent markings can be used to:

-  provide an emergency lighting system
-  enhance existing emergency lighting systems

Emergency lighting systems must be highly reliable and operate as soon as there is failure of the main lighting system. Traditional back up battery or generator systems can suffer from partial or total failure to operate, delays in start-up times, limited operating durations, installation difficulties and maintenance issues. Photoluminescent systems can overcome these shortcomings due to their immediate start up and the fact that they are failsafe. For this reason even where traditional emergency systems are in place a photoluminescent system will greatly improve safety.²

Functional Requirements

The functional requirement of a photoluminescent emergency lighting system is that 'specified features' in escape routes are visible from 10 metres. These specified features are defined to be stairs and landings, corridors and ramps, handrails, direction indicators, building elements that may act as obstructions, escape doors, and entries to a safe place. Photoluminescent products can also be used for emergency egress signage.

2. National Research Council of Canada, field study, 2007 authors stated that "Photoluminescent way-finding systems appear as a cost-effective addition to, or even a potential replacement for, traditional emergency lighting". G. Proulx, N. Bénichou, J.K. Hum and K.N. Restivo.

Part Two System Design - Emergency Lighting

Ecoglo products are tested in accordance with UL1994³ by an independent laboratory to ensure that they are visible from 10 metres, by a person with normal vision. This criterion is based on the New Zealand Building Code,⁴ which is the most stringent international code available, therefore providing for safest outcome. The independent testing also verifies that the products are visible from 10 metres when emitting a luminance output of 5 mcd/m². The minimum design level for visibility of Ecoglo emergency products was therefore set at 5 mcd/m².

Exit signage can be provided to meet UL 924⁵ or designed to meet local requirements.

Electrical light can be used to charge photoluminescent products. Fluorescent light charging for 5 minutes at 150 lux ensures that the luminance output is above the design level of 5 mcd for 150 minutes after the main lighting has been turned off (See Appendix 1). A longer duration of visibility can be achieved by charging for a longer duration and/or charging with a brighter source. See www.EcogloVenues.com for further visibility tables.

Natural light is the most efficient source of UV and will fully charge Ecoglo photoluminescent material, even on the most overcast day. When fully charged Ecoglo products installed outdoors have luminance output above the design level of 5mcd/m² for 12-15 hours depending on the climatic conditions.

Step edge contrast meets appropriate Light Reflectance Value (LRV) difference or Luminance Contrast Value of the particular region (see Appendix 3).

Slip resistance meets the appropriate slip resistance test for the region (see Appendix 4).

3. UL 1994 Standard for Luminous Egress Path Marking Systems.
4. New Zealand Building Code Clause F6 Visibility in Escape Routes has a 10m (32.8 ft) requirement. In comparison the International Building Code Chapter 10 Means of Egress has a 25ft (7.62m) requirement.
5. UL 924 Standard for Emergency Lighting and Power Equipment

Design Philosophy

The philosophy of the design is to make building elements visible using Ecoglo photoluminescent markers in areas where safe movement can be guided by simple path markings and emergency egress instructions. Examples of areas utilising photoluminescent markers include stairways, corridors, ramps and landings.

When movement requires complex decision-making or where there is no clear path visibility should be provided by other lighting systems. Examples of areas that may require other lighting systems include open concourses.

System Design For Emergency Lighting

The marking of the specified building features in escape routes has been modelled on the design criteria of the International Building Code.⁶

Building features in an escape route shall have photoluminescent markings as follows:

1. Steps in Aisles & Stairways

The horizontal leading edge of all steps should be marked including the landing step at the top of any flight of steps. (Fig 2.5)

2. Handrails

The top surface of all handrails is marked with a strip. The strip extends along the entire length of the handrail to within 100mm of the ends. Where a handrail bends or turns corners there is a gap of no more than 100mm. (Fig 2.5)

3. Stairway Landings

The perimeters are marked either on the floor within 100mm of the wall or on the wall within 100mm of the floor. (Fig 2.6)

6. International Building Code Section 1024, Exit Path Markings

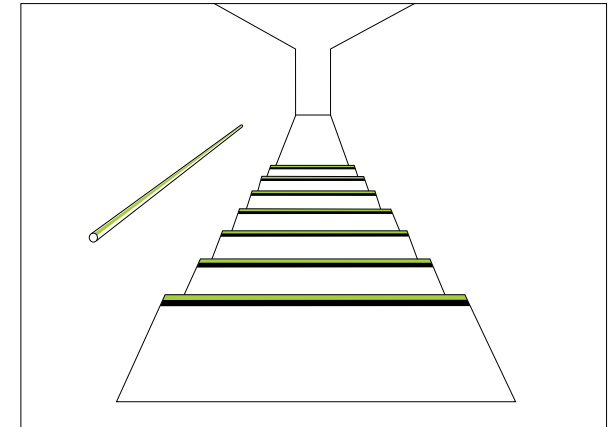


Fig. 2.5 Step and handrail markings

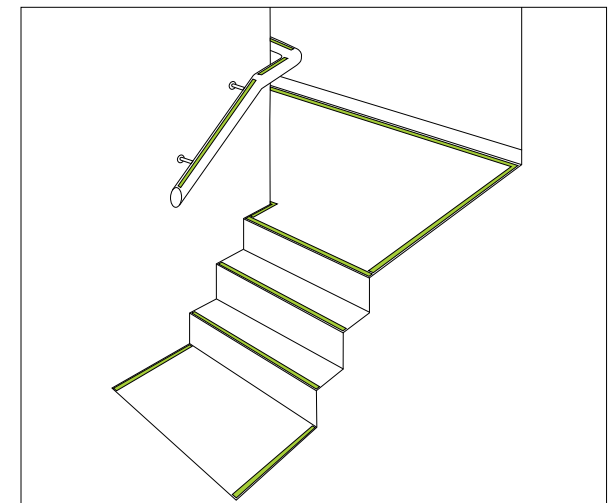


Fig. 2.6 Both steps and landings must be marked

4. Corridors

The perimeters are marked either on the floor within 100mm of the perimeter or on the wall within 100mm of the floor. Markings continue across the floor of all doors that do not form part of the escape route. If the perimeter markings are on the wall they continue across the surface of any door that does not form part of the escape route. (Fig 2.7)

5. Ramps

Ramps of less than 3 metres wide are marked on the perimeters only. If a ramp is between 3 metres and 6 metres in width, the centre of the ramp should also be marked with one 68mm diameter disk every 3 metres along the ramp. If a ramp is wider than 6 metres, create evenly spaced lines of photoluminescent discs with a maximum space between each line of 3 metres. (Fig 2.8)

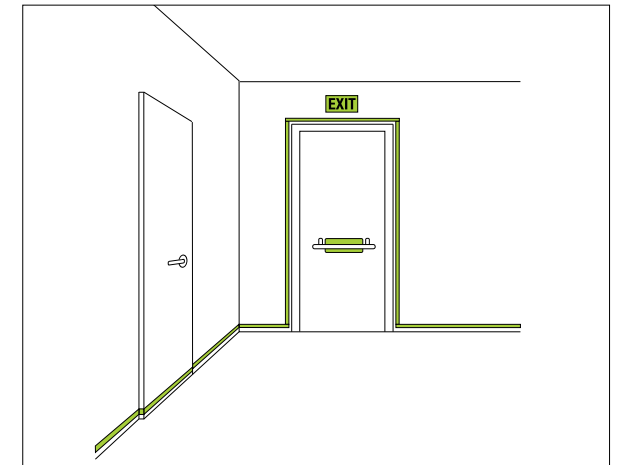


Fig. 2.7 Markings continue across non-escape doors

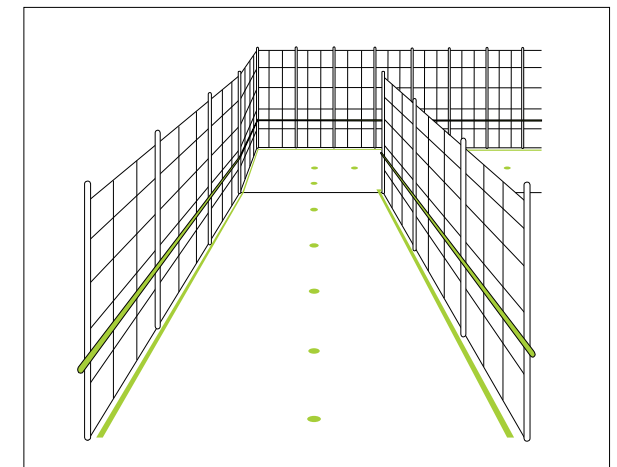


Fig. 2.8 Ramp with photoluminescent discs, handrails & floor markings

6. Open Spaces

Where there is an obstacle free path through an open space, the perimeter of that path is marked. Concourses generally have multiple paths from vomitories intersecting therefore a clear path may not exist and other emergency lighting must be used in areas such as this.

7. Obstacles

Obstacles at or below 2 metres in height and projecting more than 100mm into an escape route are identified with hazard markings. (Fig 2.9)

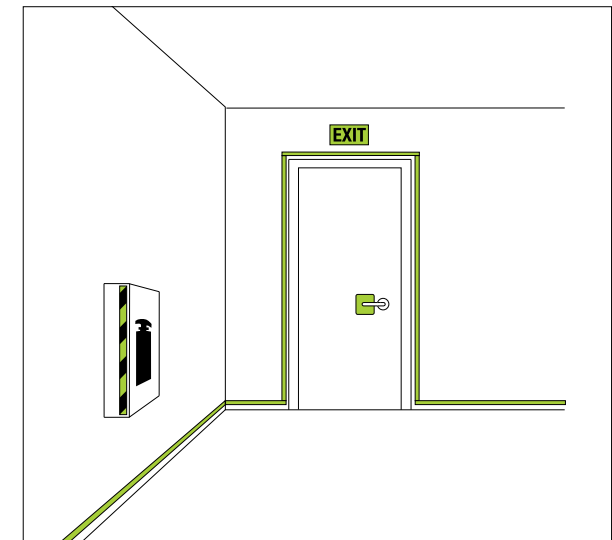


Fig. 2.9 Obstacles at or below 2 metres are marked with a photoluminescent hazard marker

8. Escape Doors and Entries to a Safe Place

Door frames have a solid continuous stripe. Door handles and panic bars have markings installed behind, immediately adjacent to, or on the hardware (Fig 2.10).

9. Signage

Directional signage at least 100mm x 100mm is installed not more than 500mm above the finished floor to clearly indicate direction changes (Fig 2.11). Emergency Exit signage is designed to meet the requirements of the particular jurisdiction.

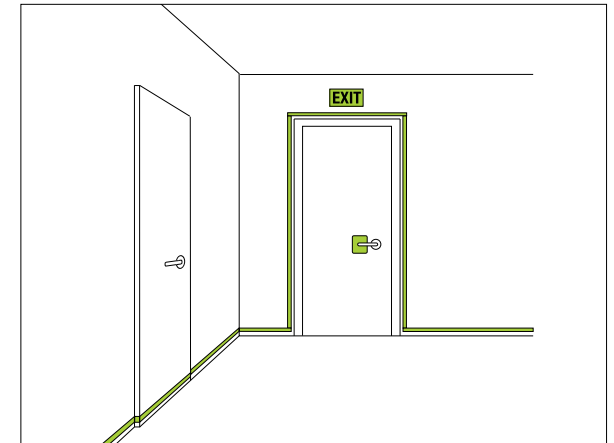


Fig. 2.10 Door showing photoluminescent marking around the frame

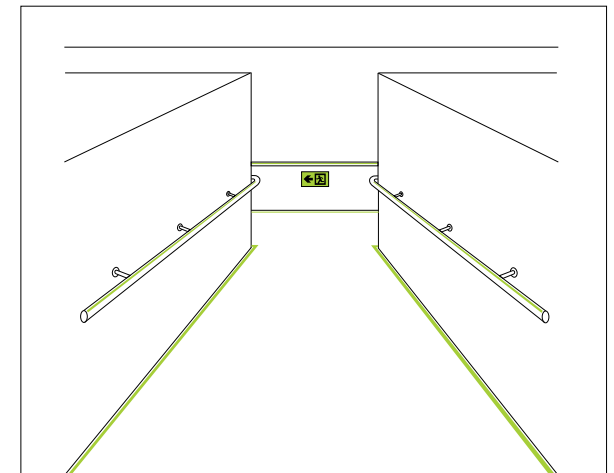


Fig. 2.11 Ramp showing photoluminescent marking and directional signage

A periodic evaluation of the photoluminescent markings should be undertaken to ensure that:

1. All products are still configured as at installation and there is no material damage to any of these products.
2. All products are clean from general dust build up and any other specific obscuring deposits.
3. All products are clearly visible and have not been covered up by floor coverings or other materials.
4. All products mark a clear path and have not been obstructed by physical hazards such as machinery, partitions or other equipment.
5. All light required to charge the product is operating as designed at installation.
6. All products used for emergency systems continue to provide clear escape path marking and there has been no change to the configuration of the building which renders the escape path unusable.

Safety and Durability Tests

Independent testing of Ecoglo photoluminescent products in accordance with ASTM G155-2004⁷ has determined that there is no material degradation of luminance output due to exposure to weathering by ultra violet light.

The Ecoglo system has also met the following New York City RS6-1A tests for safety and durability:

- 5.0 Flame Spread
- 4.0 Radioactivity
- 3.0 Toxicity
- 2.0 Washability
- 6.0 UV degradation

Ecoglo maintains an ISO 9001:2008 Quality Assurance system to ensure products are manufactured to specification.

7. ASTM G 155-2004 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non Metallic Materials

Example of Visibility Duration

(Ecoglo S10 material following fluorescent charging of 150 Lux)

Charging Time	Duration of Visibility*
5 minutes	150 minutes
10 minutes	240 minutes
20 minutes	360 minutes
30 minutes	420 minutes
60 minutes	450 minutes

*Visibility defined as a luminance level above 5 mcd/m²

NB: Longer visible duration can be achieved by using a brighter charging source, a longer charging duration or a higher specification Ecoglo Product.

Product Selection

See www.EcogloVenues.com for the recommended products for your region.
Or email: EcogloVenues@ecoglo.com

Area	Suitable Products
Steps - Bowl area	E3-071, E3-051, E2-071, E2-051, E7-071, E7-051
Steps - Corporate suites	F4-171, F4-161, F8-171, F8-161, F11-171, F11-161
Steps - Other areas	E3-071, E3-051, E2-071, E2-051, E7-071, E7-051
Handrails	H3-001, H5-001
Stair/Aisle Landings	G3-001, G6-001
Corridors / Ramps	G3-001, G6-001
Obstacles	OB82025
Escape Doors	G3-001, G6-001
Directional Signage	RM1010 & AR1010
Row Markers	SQ88x88, RE38x162, DS68
Discs	DS68-S10
Egress Signage	AR1010H, AR1010D, RM1010
Emergency Exit Signage	RMR420225-24m, RML420225-24m RMR220120-12m, RML220120-12m RM225225-24m, RM120120-12m EX420225-24m, EX220120-12m

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Light Reflectance Values

Material	Reflectance Value
Black Non Slip	5%
Grey Non Slip	19%
Yellow Non Slip	45%
Photoluminescent	69%

Internal Contrast by LRV Difference

All regions except Australia (LRV difference between non slip material and photoluminescent material)

Product	LRV Difference
E3071 & E2071 (Black non slip)	64%
E3061 & E2061 (Grey non slip)	50%
E3051 & E2051 (Yellow non slip)	24%

Internal Contrast by Luminance Contrast Value

Australia only (LRV ratio calculation)

Product	Luminance Contrast Value
E3071 & E2071 (Black non slip)	81%
E3061 & E2061 (Grey non slip)	55%
E3051 & E2051 (Yellow non slip)	22%

Slip Resistance Test

Region	Test	Ecoglo Rating
USA, Canada, Mexico	UL410 Standard for Slip Resistance for Floor Surface Material	Pass
United Kingdom	BS7976 Pendulum Test	Wet 7, Dry 7
Europe	DIN51130 Ramp Test	R12
Australia, New Zealand	AS/NZ4586	V, F, R12



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