Photoluminescent Signage in Road and Railway Tunnels

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Abstract: Aluminium Photoluminescent Safety Signs for Tunnels (In accordance with European Council Directive 2004/54/EC)
In enclosed environments like road and rail tunnels, accidents often result in tragic consequences, particularly if the incident is fire related. This risk may be increased significantly if there is a lack of consistent, continuous safety information giving details of escape routes, fire safety equipment, emergency phones, safe areas etc. In the event of an incident or accident, the first ten to fifteen minutes are crucial when it comes to people's safety and damage limitation.
Photoluminescent safety signs for tunnels provide an effective means of reducing risks by communicating clear, unambiguous instructions and by providing guidance.
Photoluminescent safety signs for tunnels are manufactured on an aluminium base which guarantees high performance in extreme conditions.
Keywords: tunnel, photoluminescent safety signs, auto-evacuation

Introduction

In the 80's, photoluminescent materials started to be used in different applications such as underground nuclear power plant facilities, offshore platforms, civil aviation, passenger vessels, etc…

Afterwards, other industries found interest in the photoluminescent intrinsic characteristics and their benefits in improving the conspicuity of evacuation routes and overall safety: high-rise office buildings, roadway and railway tunnels, and more recently residential high-rise buildings in the UK (2023).

What are photoluminescent (phosphorescent) safety signs and why should they be photoluminescent (phosphorescent)?

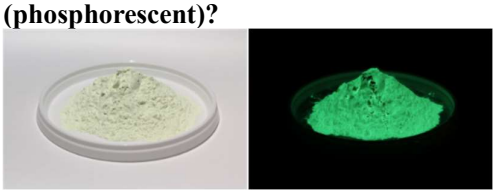

Figure 1 Photoluminescent pigments

Photoluminescent (phosphorescent) safety signs are signs that have a resin covering with photoluminescent pigments in its composition (rare earth).
The purpose of a photoluminescent sign is to effectively convey the message for which it was manufactured, i.e., to show escape routes (exits, exit doors, stairwells, etc.). It also identifies fire alarm equipment, fire-fighting equipment, emergency equipment, as well as hazardous areas and respective dangers, mandatory and prohibited actions, guaranteeing total understanding, even in blackout situations.

Tunnel Application

Requirements for Tunnels in the Trans-European Road Network

Tunnel accidents in the early 2000's, from which the violent accident in Gotthard tunnel in June 2001 was notable, have shown that self-rescuing is what has the highest probability of saving lives in such events. With this goal in mind, the installation of clear and self-explanatory signs in sufficient numbers is an important measure that can be implemented at a relatively low-cost to help identifying the location of fire-fighting and safety equipment as well as to help evacuees find their emergency exits in tunnels.
To prevent accidents in tunnels and their repercussions, the European Parliament and Council have approved the European Directive 2004/54/EC of 29th of April which defines the minimum safety requirements for tunnels in the Trans-European Road Network. One of the crucial requirements introduced by the 2004/54/EC European Directive was the installation of directional exit signs indicating the distance to the closest emergency exits in intervals of 25m in both directions of the tunnel.

This requirement has also been implemented in other geographies such as in the USA where it was integrated in NFPA 502 Standard for Road Tunnels, Bridges, and Other Limited Access Highways.

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Figure 2 Example of F52bis sign for distance

In enclosed environments like road and rail tunnels, accidents often result in tragic consequences, particularly if the incident is fire related. This risk may be increased significantly if there is a lack of consistent, continuous safety information giving details of escape routes, fire safety equipment, emergency phones, safe areas etc. In the event of an incident or accident, the first ten to fifteen minutes are crucial when it comes to people's safety and damage limitation.
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Figure 3 Example of F52b sign for exit

Technical Characteristics

Minimum luminance properties tested in accordance with Annex A of NBN ISO 16069.
Minimum luminance required in installed position in accordance with NBN ISO 16069.

Conclusion

Photoluminescent signage efficiency in tunnels has been proved: our experience show that most part of the countries around the world have approved this technology and are using it.
Benefits:
● Improve safety
●Promote fast evacuation in emergency situations or if no natural lighting.
● Promote and facilitate the engagement of fire brigades: access and safety way guidance system.
● Sustainable Development approach: charge by natural light, low maintenance, long life, easy replacement and recycling.

REFERENCES

Directive 2004/54/EC Minimum safety requirements for tunnels in the Trans-European Road Network
NBN ISO 16069: 2020 Graphical symbols safety signs Safety Way Guidance Systems (SWGS)
NFPA 502 Standard for Road Tunnels, Bridges, and Other Limited Access Highways.