TUNNEL GUIDANCE

Inductively Powered On Road LED Markers

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International Commission on Illumination ("CIE") and European Union ("EU") provide clear standards or guidelines for lighting in road tunnels. Regulations require active emergency lighting in all road tunnels over 500m and there are special provisions for guidance to allow tunnel users to evacuate the tunnel on foot.

The Regulation also indicate that Horizontal signing delineation should be at the road side edge, at emergency exit door marker lights as well as overhead illuminated lane and variable message signage.

Many Tunnel Authorities are specifying the use of inductively-powered lighting solution as the solutions significantly outperform hard-wired systems on the whole of life cost test.
<table>
<thead>
<tr>
<th>WORLD MARKET</th>
<th>Total Number of Tunnels</th>
<th>%</th>
<th>Total Length in meter</th>
<th>%</th>
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<tbody>
<tr>
<td>World</td>
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<td>6,046,701</td>
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<td>1,699,123</td>
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<td>Norway</td>
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<td>13.3</td>
<td>595,655</td>
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<td>486,311</td>
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<td>1,066</td>
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</table>
Issue

There are two main traffic safety problems in tunnels: guidance and emergencies. Driver visibility in tunnels is limited and normal reflective guidance, especially in emergencies, is insufficient. Temporary lane changes and tube closures can create dangerous traffic situations, and emergency situations require high attention from drivers. Fire, smoke and chemical spills are the most hazardous emergency situations in tunnels. Impaired vision and disorientation can cause disastrous conditions for drivers and passengers trying to flee to safety.
Tunnel Application Benefits

ON ROAD LED marker’s unique features:

• Improves driver guidance.
• Maintains lane separation both inside and on tunnel approaches.
• Enforces lane discipline.
• Improves guidance in emergencies.
• Emergency teams can rely on guidance in smoke conditions and are able to localize fire sources faster.
LED Road Marker

Product Description:
- Flush mounted
- Inductively powered
- Waterproof, no corrosion
- Light units are uniquely addressable
- High impact UV stable poly carbonate housing
- Scratch resistant coating
- Self-cleaning design
- Built to perform in extreme conditions and temperatures

Product Option:

Light Direction
- Bi-Directional
  16 high intensity LED’s (8 front & 8 back).
- Uni-Directional
  8 high intensity LEDs (facing one direction)
- iiiLEVEL+
  16 high intensity LEDs (facing one direction).

LED colours
White, yellow, red, green, blue and RGB.

Functions
Intelligent On, Off, dimming, flashing, sequencing, LED colour switching, uniquely addressable and fully programmable.

Passive
- On
- Flashing (permanent pre-programmable)
SmartStud

**Product description:**
- Surface mounted
- Inductively powered
- Waterproof, no corrosion
- Light units are uniquely addressable
- High impact UV stable poly carbonate housing
- Scratch resistant coating
- Self-cleaning design
- Built to perform in extreme conditions and temperatures

**Product option:**

**Light Direction**
- Bi-Directional
  20 high intensity LED’s (10 front & 10 back).
- Uni-Directional
  10 high intensity LEDs (facing one direction).

**LED colours**
White, yellow, red, green, blue and RGB.

**Functions**
Intelligent On, Off, dimming, flashing, sequencing, LED colour switching, uniquely addressable and fully programmable.

**Passive**
- On
- Flashing (permanent pre-programmable)
**Nodex/ Nodex Flex**

*Inductive Power Coupler*

**Product Description:**
- Power transfer device: Inductively couples power to devices (light/sensor)
- Replaces the use of a Node
- Allows most flexibility available in demanding installation situations
- Installation orientation: any angle or flexible (around obstacles)
- Up to 5m distance between cable installation and light possible
- Eliminates the need for saw cutting of cable
- Allows cable to be in existing ducting
- Waterproof, no corrosion

**Product Option:**
- Nodex: Standard power transfer extension between power cable and device: installation in a fixed angle
- Nodex flex: Bendable, flexible extension (up to 5m)
**Product Description:**
- Inductively powered
- Waterproof, no corrosion
- Light units are uniquely addressable
- Built to perform in extreme conditions and temperatures
- Vertical LED light with adjustable light direction

**Product Option:**

*LED colours*
- Green

*Functions*
Intelligent On, Off, dimming, flashing, sequencing, LED colour switching, uniquely addressable and fully programmable.

*Passive*
- On
- Flashing (permanent pre-programmable)
**Inductive Power**

The Inductive System is very simple to use and install, with minimum components. The Inductive Power system comprises of four distinct hardware components: Power supply, LED light unit, Node at each device/light/sensor location and single run cable.

**Power Supply**

Intelligent control or manual control. Switching and dimming capabilities. Fully programmable light sequencing. Capable of powering 2000m of cable and 200 LED’s.

- 220v/240v
- 24 V
- Solar

**LED Light Unit**

Within each light or sensor there is a receiver that manages the power input as well as the communication instructions.

**Node**

A Node is required at each device (light/sensor) location. Each device requires a node between the cable to inductively couple power. The Node dimension varies depending on the power demand required.

**Cable**

The inductive power system uses a two core, plain annealed copper wire (PACW) conductors, cross-linked polyethylene (XLPE) insulated, unsheathed flat figure 8 cable.
The Inductive or wireless power system is used to illuminate lights. Inductive Power requires no physical wire connection between power source and light.

Underlying technical advantages created through inductive power are no wired connections and no corrosion, therefore the units have a far longer life expectancy. Additionally, the system does not incorporate sparks or electrocution danger, making it much safer to use than traditional wiring systems.

Light units are faster to install and the system is easier to maintain than traditional approaches.

Inductive Power system can be powered by both mains and solar panels and can run up to 2km with 200 light units from a single source. Instructions can be sent via cable and then wirelessly to each light, controlling its output as well as receiving data from each unit. Each light unit has the capability for independent diagnostic control, including such things as a report of the light unit performance, temperature, movement and moisture.

This can turn lights into detectional tools for alerting customers of specified events or environmental changes. Inductive Power solution enhances the investment into LED lighting and represents a breakthrough in safety as well as reducing the total cost of ownership of lighting systems.
Benefits

- Low life-time cost and longer life expectancy: On Road LED lights have substantially fewer replacement cycles than wired or solar markers; light units are fully sealed, therefore there is no water ingress or corrosion.

- Fast and easy installation

- Easy maintenance

- Proven technology for more than 15 years

- Built to perform in high volume traffic areas and extreme temperatures.

- Our systems are reducing the amount of costly accidents for economies around the world.

- Increased light luminance compared to current reflectors or solar markers especially in: wet weather conditions, dusk and sunrise, fog conditions, daylight and night-time.

- Intelligent system allows individually controllable lights to receive and send information wirelessly via inductive power allowing dimming, flashing, sequencing and colour changes of lights.
Inductive Power

Simple
Easy installation and maintenance.

Durable
Completely sealed lights.

Wireless Comms
Individual controllable lights.

Safer
No exposed wires, electrocution danger, sparks.

Wireless Control
Wireless controllers control the lights individually.

Independent
Independently powers all light units.

Wireless
iiiPOWER is based on Inductive Power Transfer (IPT).

Long Range
Powering 2,000m of cable off one power supply. A wired system is less than 800m.
Elbtunnel in Hamburg is an iconic engineering accomplishment and one of the most famous road tunnels in the world.

Inductively powered **ON ROAD LED** markers were a part of the upgrade programme due to tunnel authority insisting on the latest and optimum technology available.

Smartstud® used **ON ROAD LED** markers and intelligent SSGEN2 Power supplies to increase tunnel safety through traffic delineation and supporting exit and emergency signage.
Distributors at

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