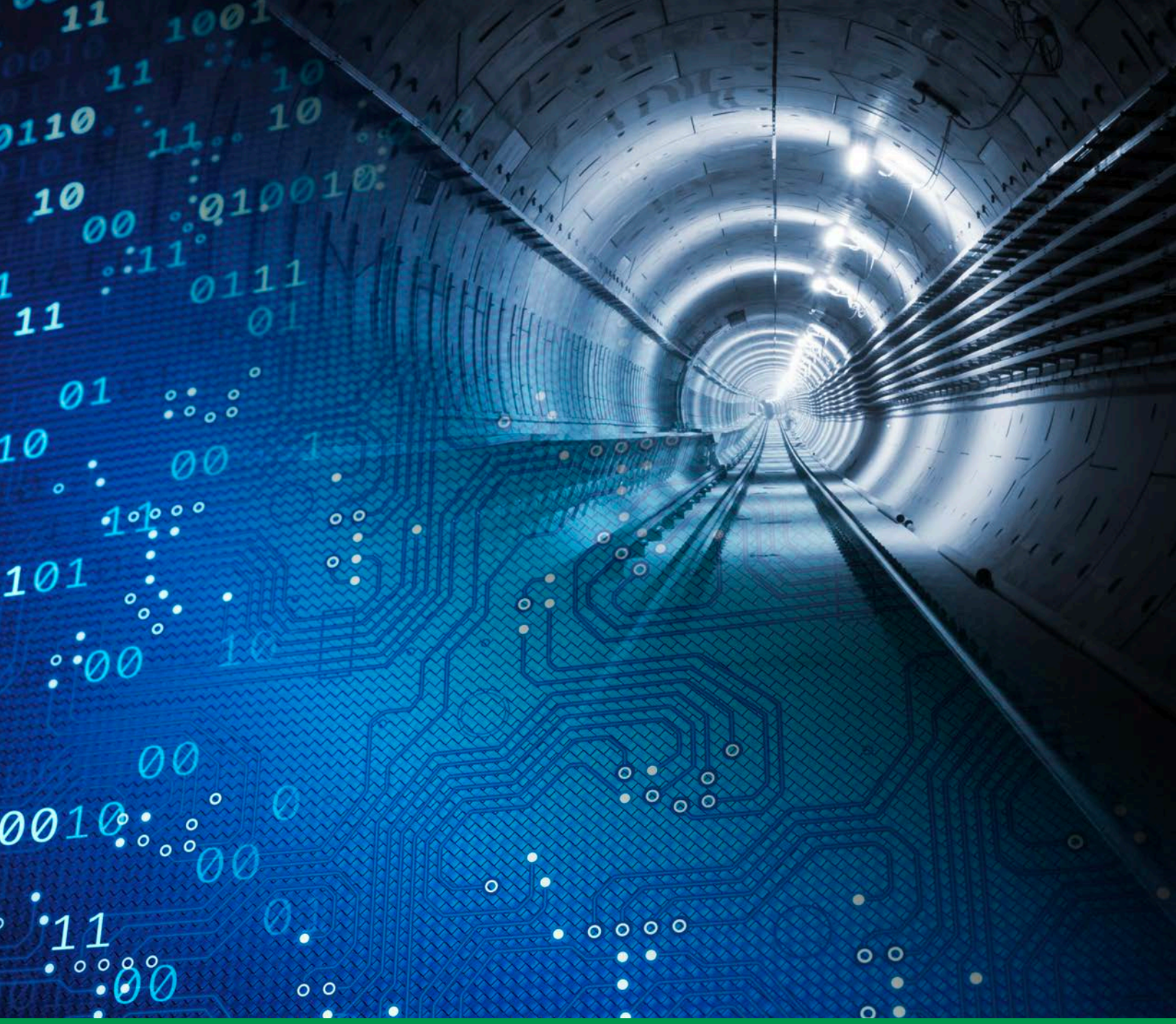


clearNET™ Wireless Mesh Network

for Subway Station and Tunnel Applications

clear-vu lighting

clearNET™ Wireless Mesh Network

Safety • Security • Efficiency

clearNET provides a communication channel to monitor and control transit system assets and environments

- Monitor health of lighting systems for effective and efficient maintenance and asset management.
- Control the level of illumination specific to each activity within the subway station – passenger safety and energy efficiency.
- Provide a modular and expandable power and data communication infrastructure for non-lighting mechatronic system sensors and actuators – temperature, smoke, hazardous materials.

clearNET is programmable to monitor and control to meet the lighting requirements of each subway station location

Entryways

Control Areas

Stairways and Passageways

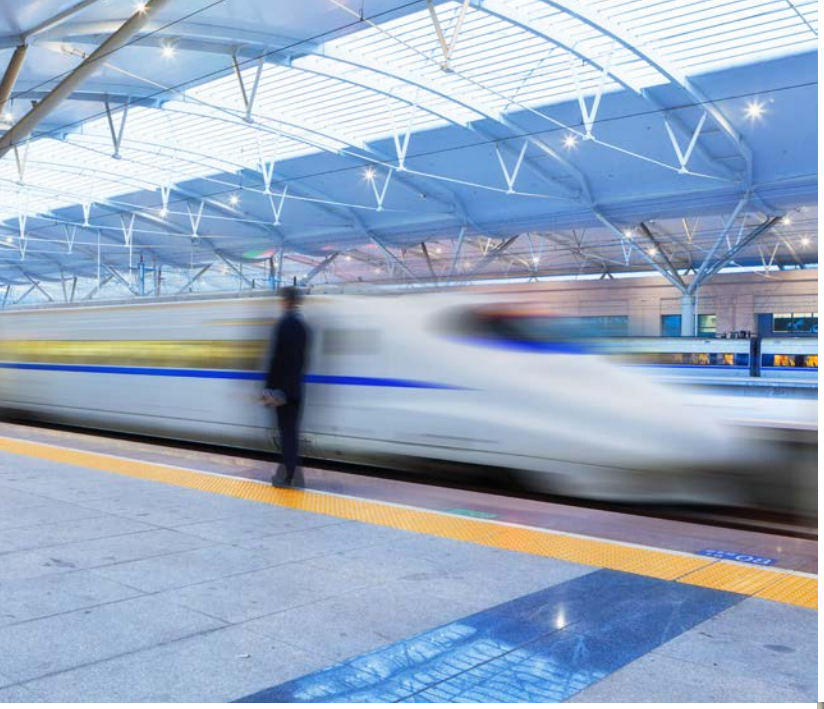
Platforms

Tunnels

International Transportation Systems

Utilize IOT

Major transportation systems utilize IOT to monitor and control the performance of their logistical, safety, energy and maintenance functions with effectiveness and efficiency never-before imagined. clearNET facilitates IOT benefits within subway station environments. Focused on facility infrastructure maintenance and asset management, clearNET dramatically reduces associated operational costs.

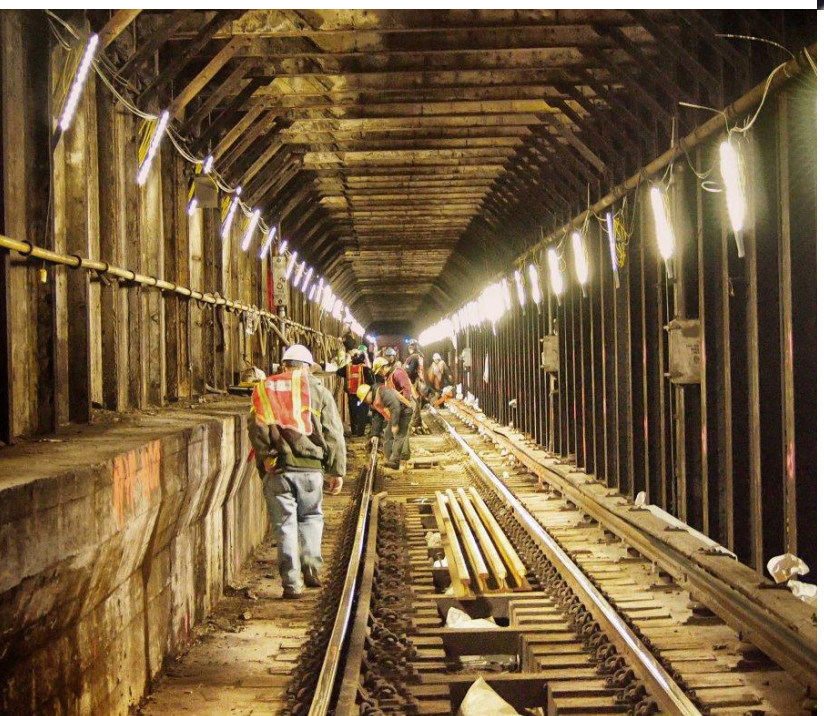


SNCF FRENCH NATIONAL RAILWAY

The SNCF French National Railway transports over two billion passengers annually. The SNCF is reducing maintenance costs, down-time, safety hazards and improving the reliability of it tracks, trains and signals through its recent adoption of IOT. Tens of thousands of sensors are collecting and transmitting data that is empowering the maintenance system with proactive strategies that improve reliability, safety and security.

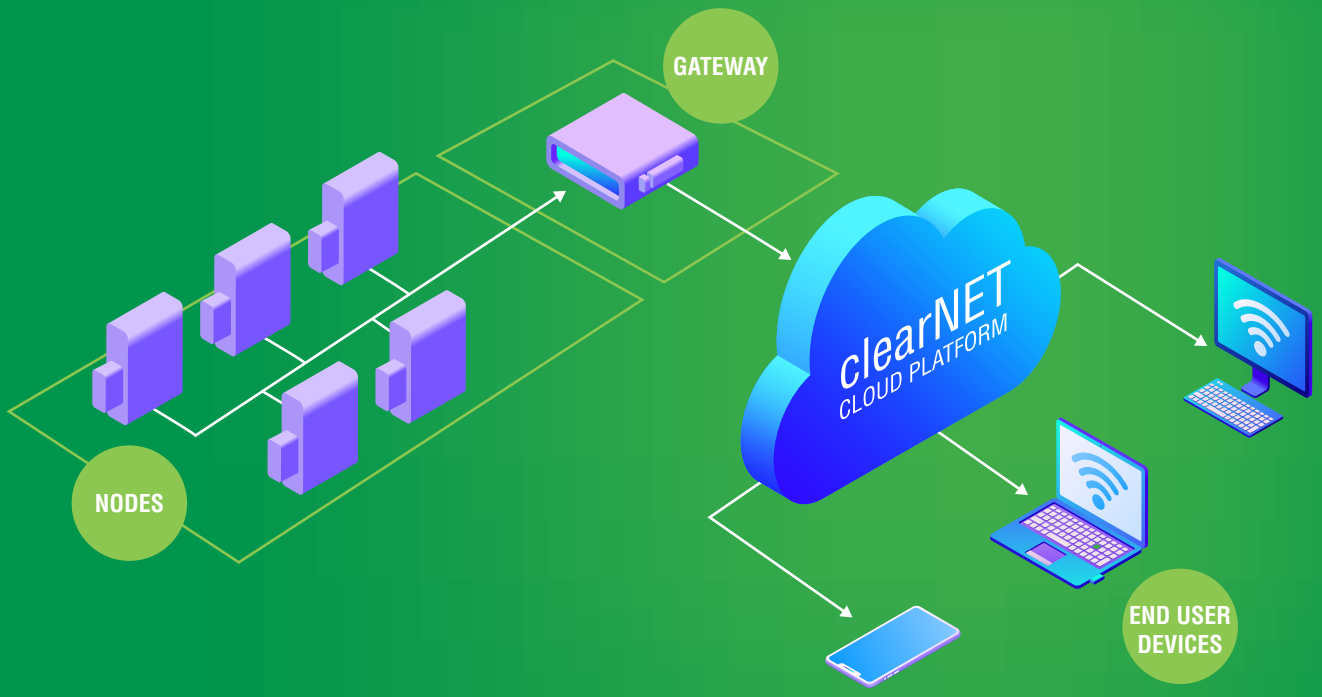
LONDON UNDERGROUND

The London Underground, one of the world's oldest public transportation systems, uses a central control center to monitor and aggregate sensor data collected via network-enable sensors from across the tube system. The ability to monitor equipment performance and automate maintenance functions improves customer satisfaction and decreases costs.



NYCT

The New York City MTA is utilizing clearNET to increase the reliability and reduce the maintenance costs of its subway tunnel emergency lighting systems. The tunnel lighting fixtures will be outfitted with nodes that will monitor the health of the lighting elements, power drivers and emergency power back-up system.



How clearNET Works

Controlling and monitoring subway platform and tunnel lighting fixtures, and battery backup systems through clearNET comprises 3 interrelated components:

1. NODES

Nodes control light levels and monitor driver status and battery health.

Each node includes:

- a wireless chipset to transmit and receive network data between nodes and gateways;
- firmware and protocol optimized for communication in transit/tunnel applications; and
- a special antenna designed for signal propagation in non-cooperative environments

Nodes also provide a power source and wireless network infrastructure for non-lighting mechatronic system sensors and actuators for temperature, smoke, and hazardous materials.

2. GATEWAY

The nodes communicate with the gateway via a mesh network. The gateway includes a chipset, processor, and memory to store the accumulated data sent by the nodes. The gateway can be configured to connect to the clearNET cloud platform through a WIFI or hardwired connection.

3. END USER DEVICES

End user devices (desktops, laptops, tablets, mobile phones) interrogate the gateway either directly or through the cloud and compile the data in a web-based graphical user interface (GUI) for analysis. End users can monitor lighting equipment status, or send instructions to the gateway to modify the output level of the lighting fixtures based on real-time requirements.

Subway Tunnel Mesh Network Challenges

clearNET meets the physical obstruction, frequency, max node load and harsh environment challenges of subway tunnels.

CHALLENGE 1:
Physical Obstructions, Frequency, and EMI

The subway tunnel presents many challenges to message routing – curves, concrete and steel obstructions, high voltage DC third rail generating electromagnetic interference, fast-moving trains, 2.4GHz computer-based-train-control systems (CBTC), etc. The most common industrial and commercial mesh network systems that have been applied to mass transit systems operate at 2.4GHz frequency. This presents two challenges: 2.4GHz frequency does not perform well in curved tunnels with obstructions and potential interference between multiple 2.4GHz systems (example: temperature sensors and CBTC).

The clearNET Solution:

clearNET utilizes 900MHz, controlled flood routing nodes. Each node of this type of system acts as both a transmitter and a receiver. Each node attempts to forward every message to all other nodes except the source node. This assures shortest paths and reliable message delivery. Additionally, the sub-1GHz frequency reflects off the irregularities, curves and obstacles of the tunnel, achieves a far-reaching range, and is not affected by other potential wireless systems operating at 2.4GHz.

CHALLENGE 2:
Max Node Load

Subway tunnels typically have long linear runs without the capability to run additional/new data cables. In some cases, hundreds or thousands of nodes would be located between gateways at tunnel entrances.

The clearNET Solution:

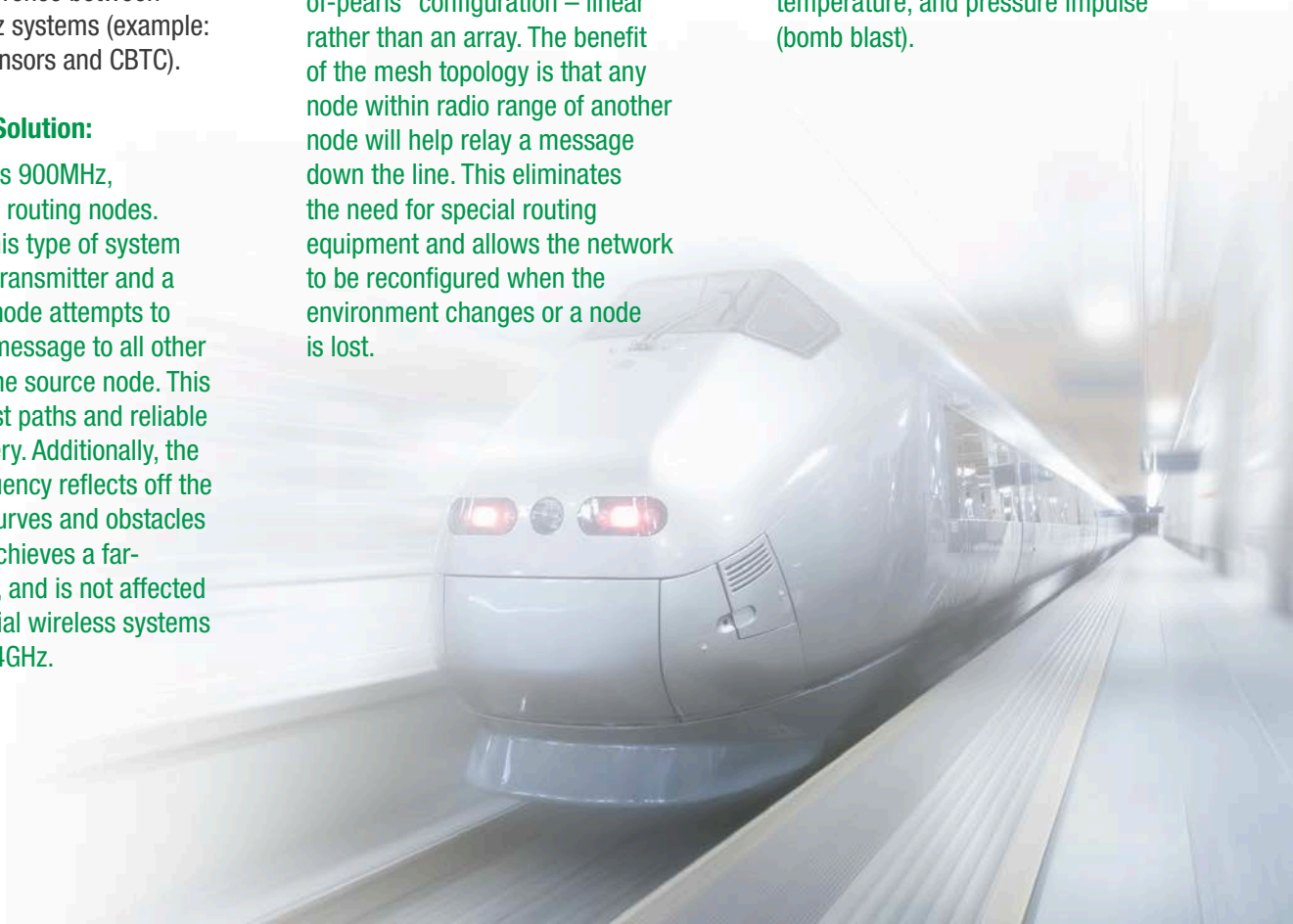
Clear-vu Lighting's network hardware and software is capable of single node hops up to 3,000 feet in the tunnel and up to 1,500 nodes on a gateway, enabling run lengths over 1.5 miles between gateways in real world applications. The "hop" between fixtures utilizes a "string-of-pearls" configuration – linear rather than an array. The benefit of the mesh topology is that any node within radio range of another node will help relay a message down the line. This eliminates the need for special routing equipment and allows the network to be reconfigured when the environment changes or a node is lost.

CHALLENGE 3:
Harsh Environment

Two components of the mesh network – nodes and gateways – reside in harsh environments and must be impervious to physical and environmental abuse.

The clearNET Solution:

Clear-vu Lighting nodes (including node interface with lighting fixtures) and gateways are housed in IP66 rated, polycarbonate housings that are mounted and secured with tamperproof fasteners. Since the nodes reside in the tunnels they comply with NYCT's Specification 16ES for other environmental considerations such as steel dust, salt fog, vibration, temperature, and pressure impulse (bomb blast).



INCORPORATING IOT INTO SUBWAY STATION DESIGN

Established Experience

IOT is widely accepted as a means of achieving the primary mission of all mass transit systems – to transport people safely and comfortably without bankrupting the economy or destroying the ecosystem. Although select architectural firms, engineering firms, contractors and manufacturers have established reputations in most transportation applications, communication through a tunnel environment continues to be the weak link.

Clear-Vu Lighting has introduced clearNET, a solution to the subway tunnel mesh network challenge. Additionally, Clear-Vu Lighting offers its services to assist in the design integration, specification, field testing, installation, commissioning and field training of its innovative IOT mesh network for subway tunnel lighting systems.

CLEAR-VU LIGHTING SUPPORT

Design and Specification Integration

Field Testing

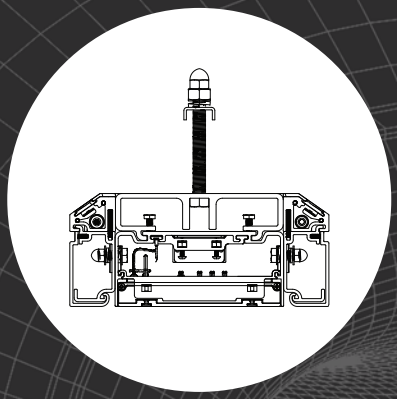
Installation

Field Training

Commissioning

Area Lighting, Maintenance Lighting and Emergency Lighting Systems for Subway Stations

Clear-Vu Lighting offers subway and tunnel lighting systems that integrate both hardwired and mesh network control and monitor systems.



Low-Profile Linear Lighting and Raceway for Area and Emergency Lighting

The Metro Platform System provides area and emergency lighting for subway station entryways, control areas, stairwell, passages and platforms. Available with single or multiple raceway – integral and/or independent. clearNET compatible for monitoring of electronic components and battery back-up systems. Also compatible for controlled light levels.

Metro Guide Light – Emergency Lighting and Battery Back-up

An energy efficient LED pathlight for subway tunnel lighting designed to produce uniform wide lighting distributions.

- Surpasses NFPA 130 lighting level standards
- The luminaire features an integrated 4-hour emergency battery back-up system

Metro Track Light – Emergency and Maintenance Lighting

The first LED tunnel lighting system designed for two modes of operation – NFPA compliant emergency pathway lighting and OSHA compliant maintenance lighting. Produces uniform wide pathway and up-lighting distributions with high efficacy.

- Surpasses NFPA 130 lighting level standards with < 3:1 max to min ratio and up to 2 foot candle min
- Operating mode (emergency/maintenanc) can be set and scheduled through clearNET platform or manually at fixture location.
- The luminaire can optionally be configured with up to 4-hour integral emergency battery back-up system

1150 Motor Parkway
Central Islip, NY 11722
516.941.3737
lighting@clear-vu.com
www.clearvulighting.com