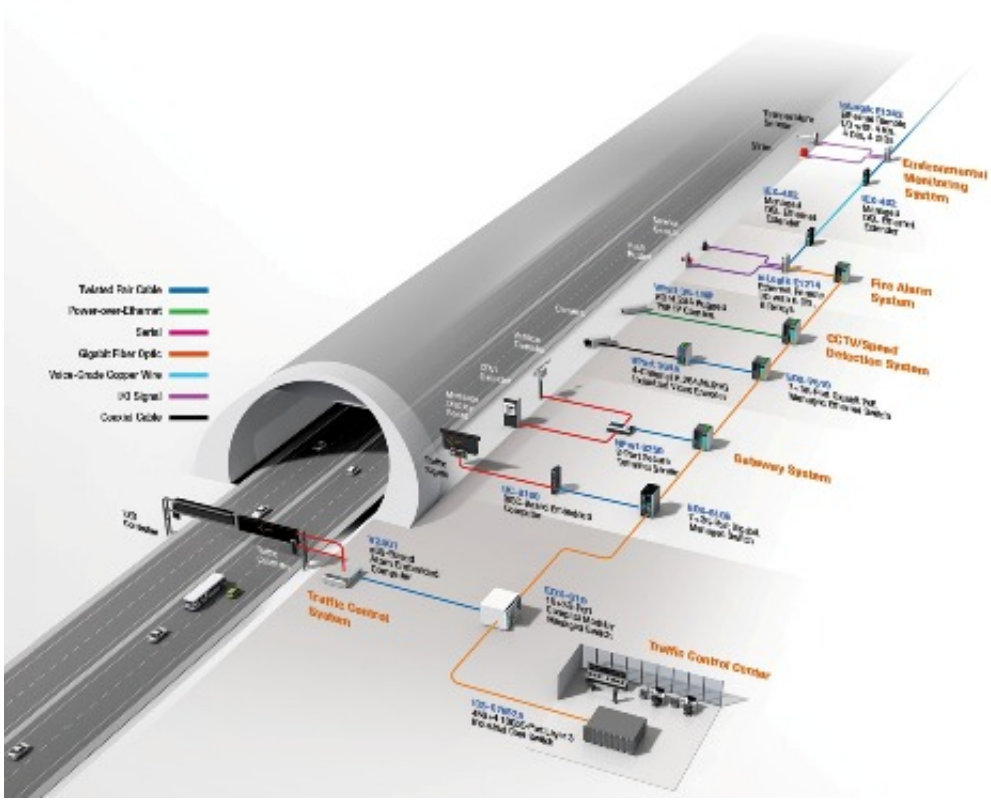
# Tunnels

## Intelligent transportation solutions for tunnels require an integrated and completely reliable solution.




## Introduction

Intelligent transportation solutions for tunnels require an integrated and completely reliable solution. Tunnels not only require management of vehicle traffic, but also control of multiple infrastructure systems. For very long tunnels, this means an integrated system that can control ventilation, road and signage lighting, fire detection and alarms, redundant power systems, air quality measurements, water drainage systems, and emergency communications such as emergency telephones.

To meet tunnel safety requirements, an operator needs to both monitor and control traffic. The operator must be able to detect tunnel incidents immediately to minimize risk and to determine if vehicles must be prevented from entering danger zones, or to clear traffic from the tunnel as quickly as possible.

## Network Requirements

### High Resiliency and Responsiveness

Since tunnel safety is top priority, an operator needs rugged network switches that can provide resiliency and redundancy, such as those using Turbo Ring redundancy with less than 20 ms recovery from faults. In addition, control centers need all tunnel sensor data to be delivered with a minimum delay so that action can be taken as soon as adverse tunnel conditions arise.

### Centralized Traffic Gate Control

Depending on the length of the tunnel, gateways need to be deployed at tunnel entrances and predefined locations inside the tunnel. The gateway controllers need access to robust serial-to-Ethernet devices to provide connectivity to the tunnel control center to automatically or manually lower and raise traffic access gates for both safety and incident management.

### Live Traffic Video Monitoring

Continuous monitoring of traffic within a tunnel requires visual information from CCTV cameras placed along the tunnel interior, and at the entrance and exit. Traffic density, accidents, and speeders need to be monitored and controlled to prevent safety issues from arising. The cameras employed need to be rugged, and sensitive to the darker conditions of the tunnel interior. Eventually, intelligent HD IP video and management become a necessity for low-light tunnel applications with image enhancement and bandwidth optimization technologies.

### Highly Reliable Alarm System

The atmosphere inside a tunnel must be continuously monitored, not only to raise alarms when needed, but also to control the tunnel?s automatic ventilation system. In addition, although tunnel fires may be rare, when they do occur it should be possible to detect them immediately so that vehicles and passengers can be evacuated from the tunnel as quickly as possible. The devices used need reliable and uninterrupted access to the tunnel?s data communication system and a separate I/O control functionality should be provided to operate the devices remotely.

## Moxa Solutions

- Unique, reliable, and flexible Turbo Ring / Turbo Chain Ethernet redundancy technologies with under 20 ms recovery time

- Flexible, stable, and ready-to-run computing platforms for multi-level open data transmission and easy third-party device integration

- Smarter and more efficient tunnel surveillance with IVA functionality for loitering and alert zone detection

- Daisy-chained I/O with active reporting

- Rugged design that can survive and operate in harsh, -40 to 75?C conditions

