

FireLaser Fiber Optic Linear Heat Detection (LHD) Used to Protect World's Largest 4-Lane Tunnel



Pilot Dario Costa broke world record of longest tunnel flight by plane, 2.26km in 44 seconds through two tunnels on the KMO – [click to view the full video here.](#)

The Scenario

The Northern Marmara Highway (KMO) has the widest four-lane tunnels in the world and the latest state of the art systems for road transportation. Connecting Asian and European continents, KMO is 435 kilometers long and includes 8 tunnels, 30 viaducts, 143 bridges, 96 underpasses, 73 overpasses, and 600 culverts.

Equipped with smart transportation systems technology to ensure the safety of highway users, KMO has:

- 2360 cameras,
- 93 variable message signs,
- 165 variable traffic signs,
- 77 traffic counting sensors,
- 23 meteorology stations
- Scada tunnel / highway security system located along the highway route.

The goal is for these systems to provide uninterrupted, comfortable and high standards of highway traffic service through rapid responses to incidents that occur in the KMO. There is 365/24/7 monitoring service which is carried out both at the main control center and two sub-control centers.



Figure 1 Section of KMO tunnel

Client Requirements

As with the other elements of the highway management, security and fire safety systems, the customer was looking to deploy state of the art technologies with a proven and reliable track record. The client required a fire detection system with the following functionality:

- Provides continuous coverage for the full length of the tunnels
- Rapid detection time using smart alarm technology
- Redundancy: System continues detecting even in the event that the cable is cut
- Full integration with other systems both fire detection and tunnel facilities



Figure 2 - Photo inside the control room

What Did We Do?

Overview

BTS Yangin worked with the customer, consultants and contractors to aid in designing and installing the tunnels Linear Heat Detection system based on the FireLaser fiber optic LHD by Bandweaver. This was a multiphase project with 8 tunnels across the length of the highway (5 tunnels on the Asian side and 3 on the European side).



Figure 3- Plan view of the KMO highway

The FireLaser systems were installed in 3 separate phases with a total of 13 FireLaser LHD systems installed over the entire length and 76km of detection cable:

- Phase 1: 5 FireLaser systems
- Phase 2: 6 FireLaser systems
- Phase 3: 2 FireLaser systems

The FireLaser LHD systems were used in conjunction with the FireFiber AT detection cable which was installed at the roof of the tunnel in 2 locations. Typically, for a tunnel width up to 10m a single cable can be deployed. As the largest tunnel had a width of 16m 2 cable were deployed at the midpoint of each of the 2 highway lanes.

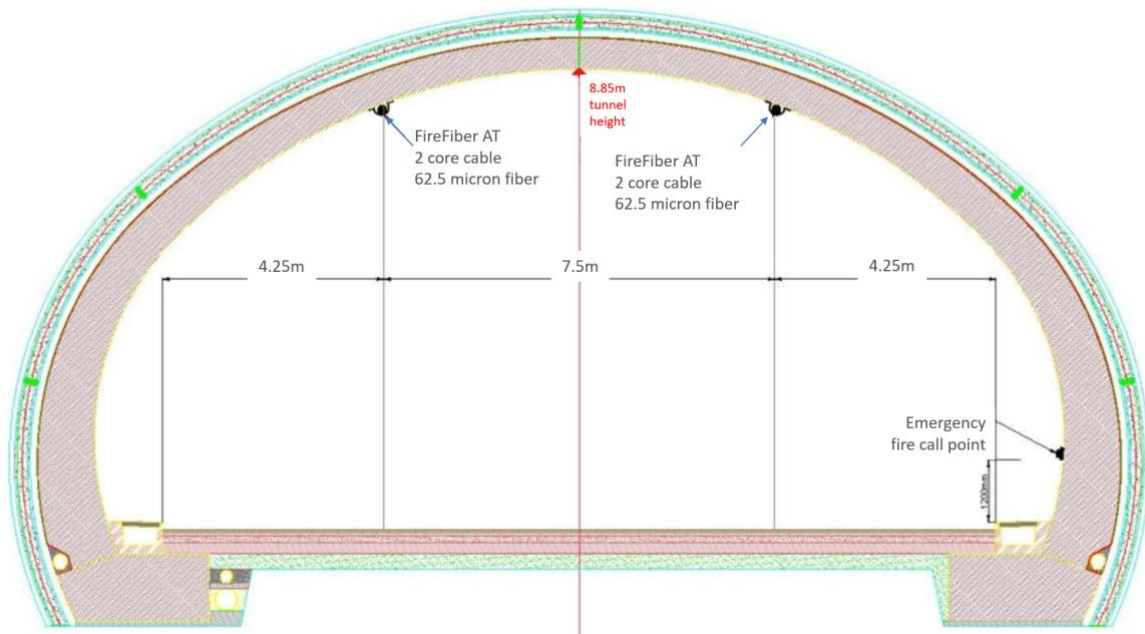


Figure 4 - Tunnel cross section and location of FireFiber AT cable



Figure 5 - Photo of FireFiber AT locations in tunnel

System Configuration

The customer required dual integration of the system with 2 key functions:

1. Integration with Fire Detection system
In the event of a fire the FireLaser LHD needs to send a signal as rapidly as possible to the Fire Alarm Control Panel (FACP). As per the EN54-22 requirements the FireLaser LHD is connected to the FACP via electrical relay contacts. The FireFiber AT detection cable is configured into the required number of zones using the FireLaser software. Each zone is connected to a zone on the FACP
2. Integration with SCADA/Tunnel Management System (TMS): In addition to the fire detection zones, the FireLaser can provide additional information to the SCADA/TMS in order to activate other elements of the system (fans, lighting...). Because the FireLaser provides the precise location of the fire and the actual temperature at all points along the cable, this additional information can prove critical

Below is an overview of the system set up for the KMO tunnel:

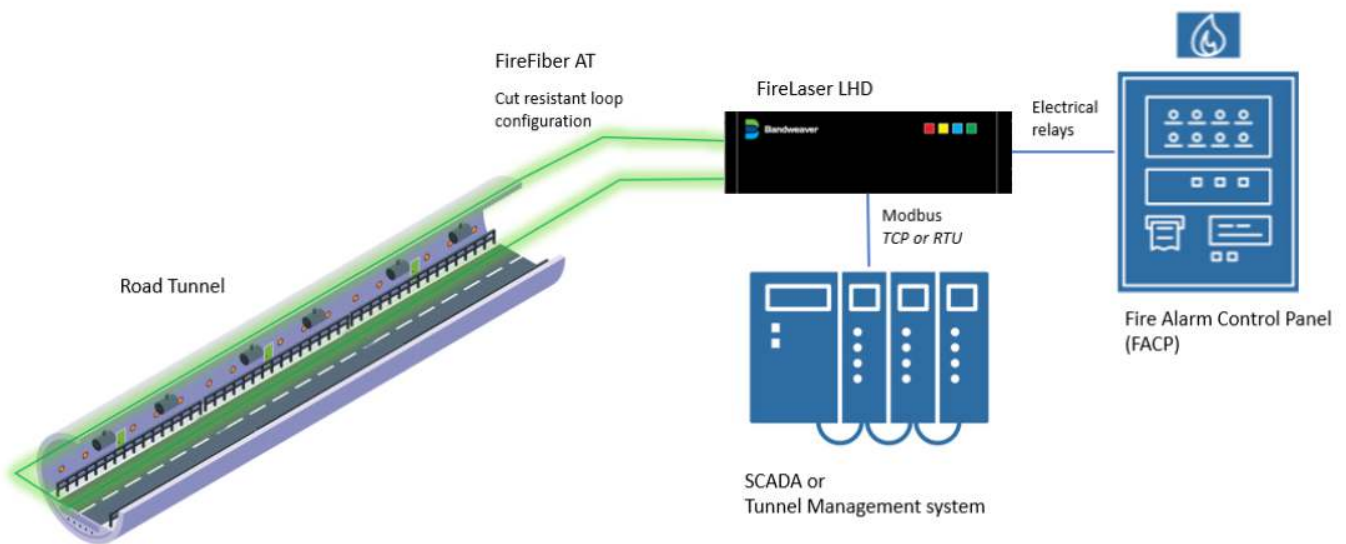


Figure 6 - System integration of FireLaser LHD

System Commissioning

For the KMO tunnel, the system was configured using a fire pan test in order to configure the alarms. The FireLaser LHD has smart alarms and by using the smart alarms the system can detect fires even at an early stage. The FireLaser LHD is the fastest system available on the market and provides updates at a rate of every 5 seconds at distances up to 10km (that is 10,000 heat detector locations!). Typically, the standard smart alarms configured in a tunnel situation would be as follows:

- **Maximum temperature 58°C:** In the event the temperature at any point exceeds 58 °C then the system will alarm. This can be adjusted higher or lower depending on the specific ambient environment.
- **Rate of rise 10°C/minute:** Often the fire can be detected much earlier using a rate of rise alarm. For example, with a rate of rise of 10°C per minute and an ambient temperature of 15°C then the system can detect when the fire has only reached 25°C. Giving extra valuable time to take action to save lives and prevent damage. Again, rate of rise can be configured according to the specific environment.

- **Deviation of 10°C:** In addition to rate of rise you can set the system to alarm if a specific point within a zone deviates by 10°C from the average (or whatever value you configure). This can be extremely useful for slow developing fires where the rate of rise will not trigger.

For this commissioning test, the FireLaser detected the fire within 30 seconds of lighting the fire. Below is a photo taken from the commissioning test ([click here to view the video](#)).



Figure 7 - Lighting the fire pan

The photo below shows a screen shot of the tunnel management system highlighting the system alarm triggered by the FireLaser LHD system 30 seconds after lighting the pan fire



Figure 8 - Tunnel Management Software displaying alarm



Benefits To The Client

The Bandweaver FireLaser LHD is the fastest available system available on the market today. Some of the key following benefits and advantages to the end user include.

- **Early detection of even a small fire:** Bandweaver LHD systems are approved to operate with a measurement time of 5 seconds which is considerably quicker than the alternatives. With the smart alarms (including rate or rise and deviation alarms), the system can detect fires at a very early level without risk of false alarms. This is evidenced by the fact that the FireLaser can pass the fire pan test to the strict requirements of NEN 25235-17.
- **Complete Coverage:** The distributed nature of the fiber optic system provides measurements every 1m along the length of the cable providing complete and continuous coverage with no blind spots or gaps in the protection.
- **Reliable and robust system:** The system was configured in a loop configuration which means that there is a level of redundancy even if the cable is damaged. Also, it is not affected by any dust, particulates or moisture in the air. For example, the electrically based system is affected adversely by moisture.
- **Low Cost of Ownership:** Fiber optic cables are completely passive and have no moving parts, they are non-corrosive and immune to electromagnetic interference and typically have lifetimes of more than 30 years and so carry a very low cost of ownership and no maintenance

About Bandweaver Technologies

With an installed base of over 60,000km and 8,000 systems installed worldwide, Bandweaver's vision is to be the first choice for integrated distributed fiber optic sensing solutions across the globe. Since 2002, Bandweaver has been committed to delivering reliable, innovative, client-centric and value-added products and services, via a dedicated and talented team of people.

Bandweaver manufactures and distributes advanced fiber optic monitoring sensors and integrated technologies, enabling customers to monitor, secure and keep personnel and critical assets safe. Bandweaver provides solutions for Security, Fire, Power and Pipelines.

For further information please contact our global team at info@bandweaver.com

About BTS Yangin

BTS Yangin is the exclusive business partner of Bandweaver Ltd in Turkey. BTS Yangin offers FireLaser DTS fiber optic sensor technologies and the associated specific system design, system installation services, and technical support and long-term maintenance packages. BTS Yangin has extensive experience both inside and outside Turkey with more than 750,000 m of fiber optic sensor cables and more than 200 DTS Units.

For more information, please contact us. info@btsyangin.com.tr



