Bandweaver

Case Study

Bandweaver's Linear Heat Detection (LHD) System Turin Metro Monitoring

The Scenario

Since commencing operations in 2006, the Turin Metro has established itself as Italy's pioneering fully automated metro system and a benchmark for state-of-the-art urban mobility. It delivers driverless service, short headways, and energy-optimised performance with a fleet of Siemens-delivered VAL 208 trains designed to carry a maximum of 440 passengers. The trains operate at a top speed of 80 km/h on a 750 V DC supply and employ rubber wheels to achieve high acceleration with minimal vibration, with each wheel equipped with traction and electrical braking systems.

In underground metro systems, trains constitute a significant fire risk due to thermal stresses in braking systems during deceleration, mechanical wear from frequent stop-start operations, and the presence of high-voltage traction power supplies. These hazards are particularly relevant for Siemens VAL 208 trains, which employ IGBT-based traction converters and brushless DC motors. While these technologies deliver high efficiency and reliable performance, their high voltage switching and associated thermal loads under heavy operating conditions increase the potential for fire incidents, requiring careful monitoring.

Traditional point-based smoke or heat detectors in metro stations are not suitable for this type of fire monitoring, as they cannot provide complete coverage near the tracks, where fire risks are elevated due to braking systems, traction equipment, and frequent train movements. In late 2024, the Turin Metro end user identified the need to replace legacy third-party LHD systems that had been in service for over a decade. The project scope included evaluating alternative LHD solutions, reviewing system specifications, and deploying a reliable replacement to ensure continuous fire monitoring and uninterrupted operational continuity.

Client Requirements

The Turin Metro operator needed to replace its ageing third-party LHD systems with a modern, high-performance fire detection solution. A total of 40 units were scheduled for phased replacement across the network.

The key operational risks included:

- Overheating of braking systems during frequent stop–start movements.
- Mechanical stress from constant deceleration and acceleration.
- High-voltage power supplies located at track level.

Each underground platform has two parallel trackways carrying trains in opposite directions, with monitored lengths of 100–150 metres per track. To ensure clear and accurate alarm management, the operator required the inbound and outbound trackways to be monitored as independent zones, enabling rapid pinpointing of potential fire risks.
Crucially, because trains dwell in stations for only 25–30 seconds, the system needed to detect abnormal heat or fire conditions before the train departed. This meant the LHD had to feature a fast rate-of-rise fire detection capability, capable of identifying temperature anomalies within seconds.

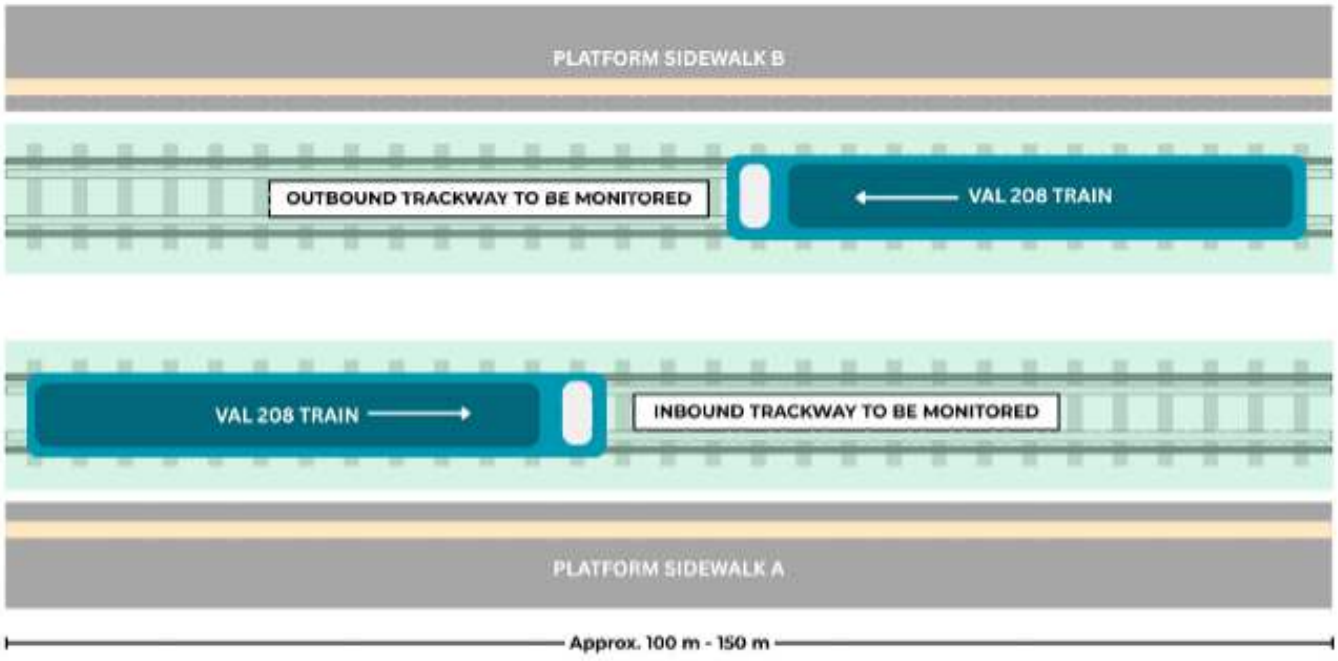

Figure 1 – Trackway to be monitored

Additional requirements included:

- Continuous, real-time temperature monitoring along the full trackway length.
- Integration with SCADA and PLC systems, using Modbus TCP/IP for live data transfer.
- Delivery of detailed alarm information, including type, location, and severity.
- Full integration into the network-wide SCADA platform, acting as the central hub for monitoring and response.

What Did We Do?

Bandweaver worked in partnership with R.A.E.T. S.r.l., its authorised distributor in Italy, and SPS Automation Torino, the appointed system integrator. The project required a fire detection solution that could prove it was able to detect heat anomalies within the 25–30 second train dwell time.

The chosen system was Bandweaver's FireLaser Distributed Temperature Sensing (DTS) unit, combined with the FireFiber AT armoured sensing cable. One FireLaser was installed per station, with each system divided into two zones – one for the inbound trackway and one for the outbound trackway. This allowed operators to pinpoint risks in real time for trains arriving in either direction.

The FireLaser was fully integrated into the metro's SCADA system, delivering:

- Continuous temperature readings across the full length of the platform trackway.
- Smart alarm outputs, including both rate-of-rise detection and maximum temperature thresholds.
- Seamless communication with existing PLC systems via Modbus TCP/IP.

Figure 2 - FireLaser Installation

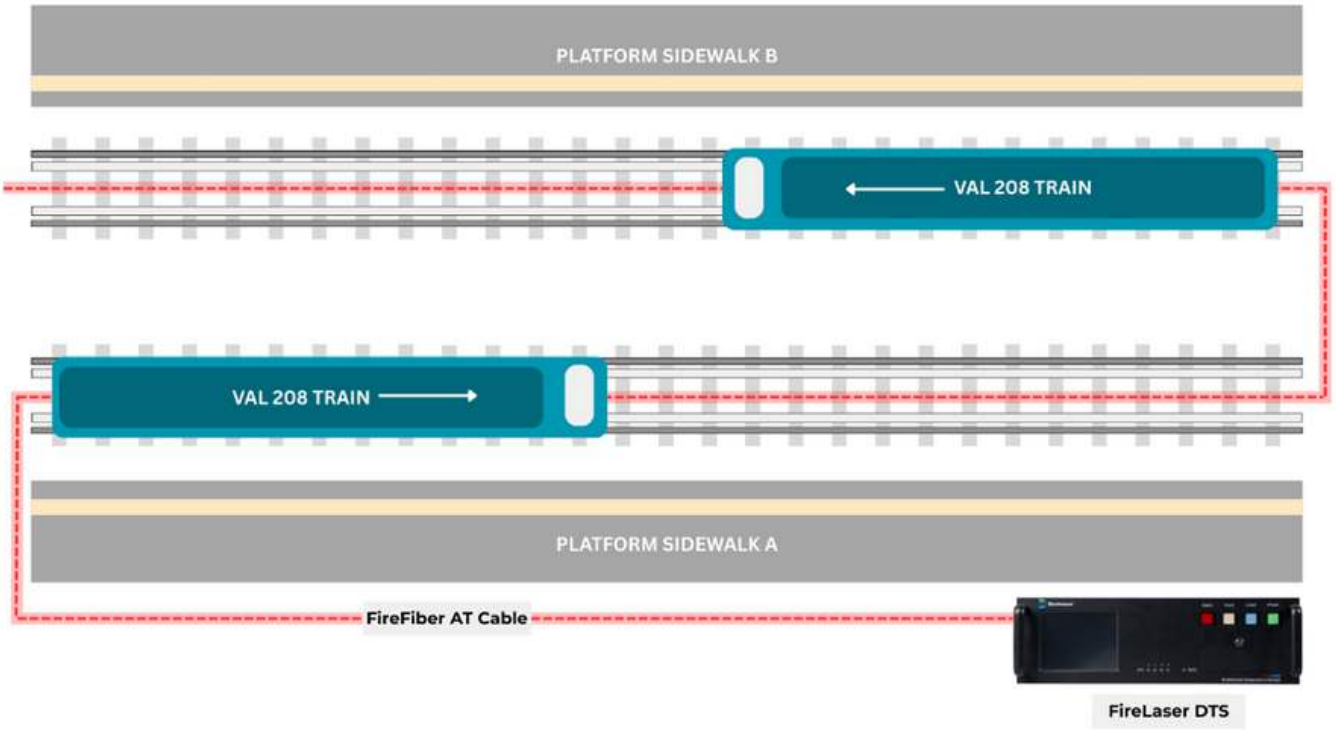

Figure 3 – FireFiber AT Cable Layout (shown as dashed lines)

Figure 4 – Turin Metro Platform Trackways

The monitored platform trackway area was divided into two main fire detection zones: one for the inbound trackway and one for the outbound trackway, enabling the FireLaser to monitor trains arriving in both directions.

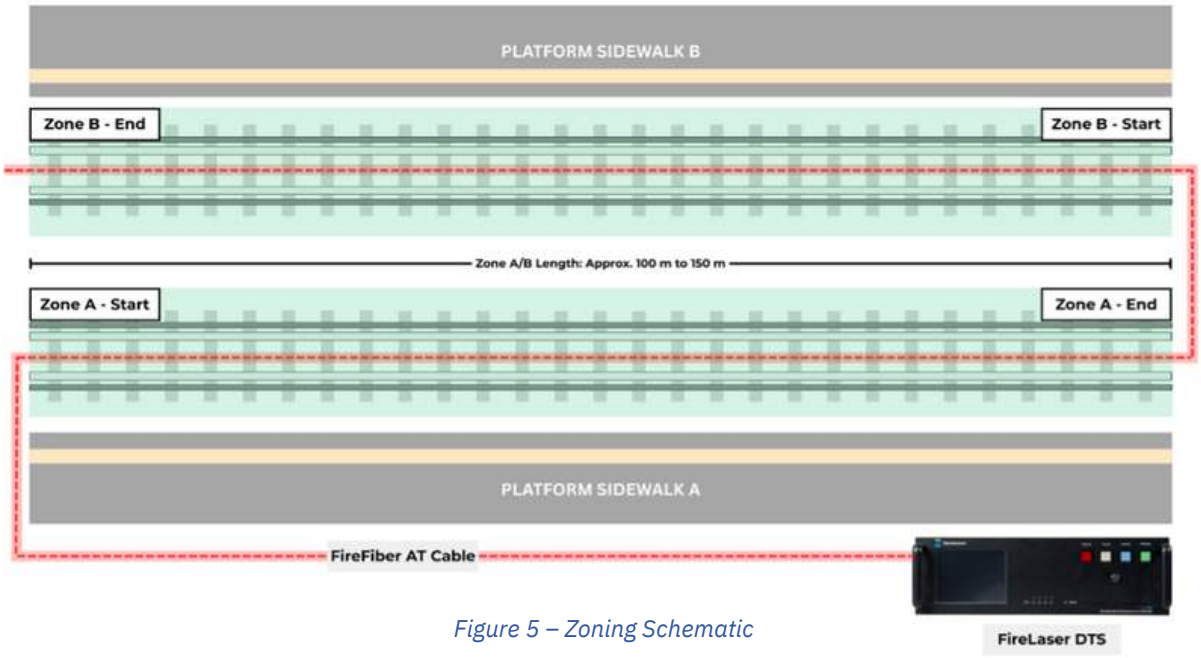

Figure 5 – Zoning Schematic

Two distinct alarm types and thresholds were programmed into the FireLaser system:

- Rate-of-rise threshold: 9 °C
- Maximum temperature threshold: 55 °C

The rate-of-rise threshold was configured to trigger the fire alarm rapidly, allowing the system to detect sudden temperature increases along the train path as trains approach or depart the platform. The scanning interval was fully customisable and was set to 5 seconds for this deployment, ensuring timely detection during the short dwell periods of trains.

The maximum temperature threshold was set to provide conventional fire-room protection, activating the alarm if the ambient temperature exceeded the defined limit.

To validate performance, night-time fire simulations were conducted using heated covers positioned along the platforms. The system was configured with a 5-second scan interval, enabling it to respond rapidly to abnormal temperature rises. During testing, the FireLaser consistently triggered alarms in under 25 seconds, outperforming competing LHD solutions. As a result, R.A.E.T. and Bandweaver were awarded the contract to deliver the full 40-unit replacement programme for the Turin Metro.

Benefits To the Client

The end user aimed to protect their critical facility from fire risks associated with the rooftop photovoltaic array. The Bandweaver LHD system met this requirement effectively, successfully detecting an overheating condition near the PV inverter caused by an improperly inserted connector. Some of the other key 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 of rise and deviation alarms), the system can detect fires at a very early level without risk of false alarms.
- **Complete Coverage:** The distributed nature of the fiber optic system provides measurements every 1 m 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 90,000km and 9,000 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.

With quality and excellence as fundamental elements of Bandweaver's portfolio, the business is continuously developing its range of technologies, including Distributed Temperature Sensors (DTS), Distributed Acoustic Sensors (DAS) and integrated smart intelligent software solutions. Bandweaver provides solutions for multiple industries.

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

About R.A.E.T S.r.l.

R.A.E.T. S.r.l. is a renowned Italian engineering firm based in Pontassieve (Florence), established in 1981. Specializing in automation systems and transportation safety, the company delivers advanced solutions for industrial automation, tunnel security, fire detection, and roadway/rail infrastructure. Their expertise spans linear heat-sensitive cable systems and real-time video analytics, tailored for demanding environments such as metro systems and galleries
europages.co.uk
With decades of experience serving critical infrastructure projects, R.A.E.T. consistently demonstrates technical innovation, reliability, and a commitment to enhancing safety across complex transit environments.
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