Bandweaver

APPLICATION NOTE

CAR PARKS – LINEAR HEAT DETECTION USING FIBER OPTIC SENSING TECHNOLOGY

Bandweaver's FireLaser distributed temperature sensing (DTS) technology has a successful track record in providing fire safety and detection solutions as a linear heat detection system used within industrial facilities and large indoor spaces. Due to the specific need for a solution involving a low maintenance, low cost of ownership, high reliability, and effective fire detection, FireLaser DTS technology is very well suited to car park applications.

INTRODUCTION

Car park fire safety is a unique situation for fire detection, as there are potentially large areas with exposure to people and a high density of fuel loading. Given that the conditions of the cars entering the car park is unknown, the risk can be difficult to quantify. Some statistics around car fires include:

- 71% of car fires caused by vehicle defects; defects in wiring and batteries was the largest
- Arson/deliberate fires is a major concern with >50% deliberate*
- 38% of car park fires result in flashover to other vehicles

The risk as well as difficult to predict are increasing with a number of factors contributing:

- Bigger cars, resulting in higher chance of flashover
  - Smaller space between cars
  - Fuel tank capacity increased
- Higher % of diesel (forms burning pools)
- Higher % of plastic in cars – burns quicker and plastic fuel tanks fail faster
- Car park structure more flammable components (e.g. piping plastic)
- Electric cars – unknown long-term reliability – batteries highly flammable

With regards to traditional fire detection, smoke detectors are highly susceptible to false alarms due to vehicle emissions. Points heat detectors are used extensively, however if the seat of the fire does not happen to be immediately under a point type sensor, the fire can no longer be detected with certainty, mainly due to detector spacing. The FireLaser fire detection system does not have any such "gaps", since the radiation heat given off by the fire is applied over the continuous length of sensing cable and is recorded and displayed accordingly.

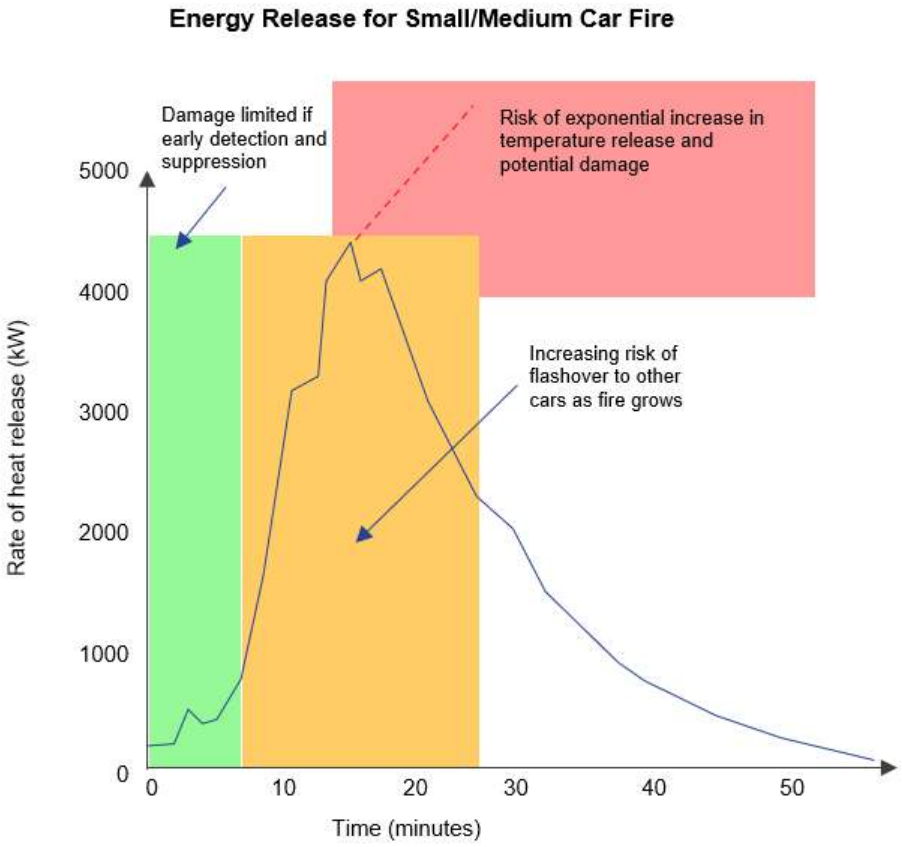


Figure 1 - Progression of fire from car fire

It is therefore critical in these situations for the system to detect early on to minimize damage and prevent flashover. If action is taken early fire can be contained to a single location. However, if allowed to spread then there can be significant damage to infrastructure and risk to personnel.

SMART ALARMS & FULL COVERAGE

Two of the key advantages of fiber optic linear heat detection (LHD) systems are based on the smart alarming functionality and the distributed nature of the measurements. With fiber optic LHD systems based on DTS, three different types of alarms are configurable.

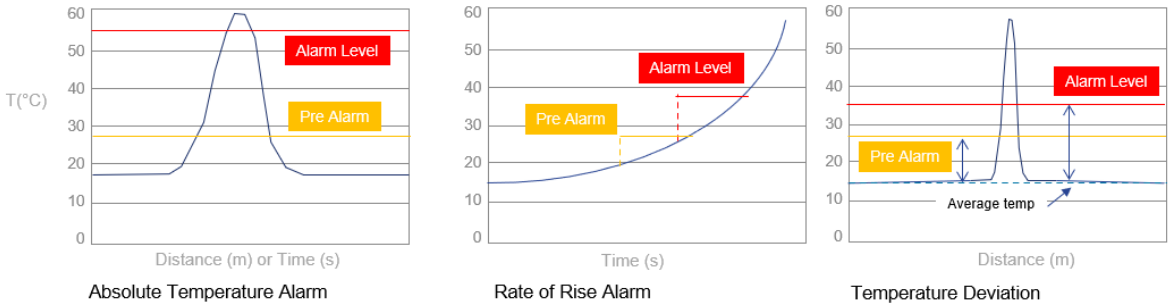
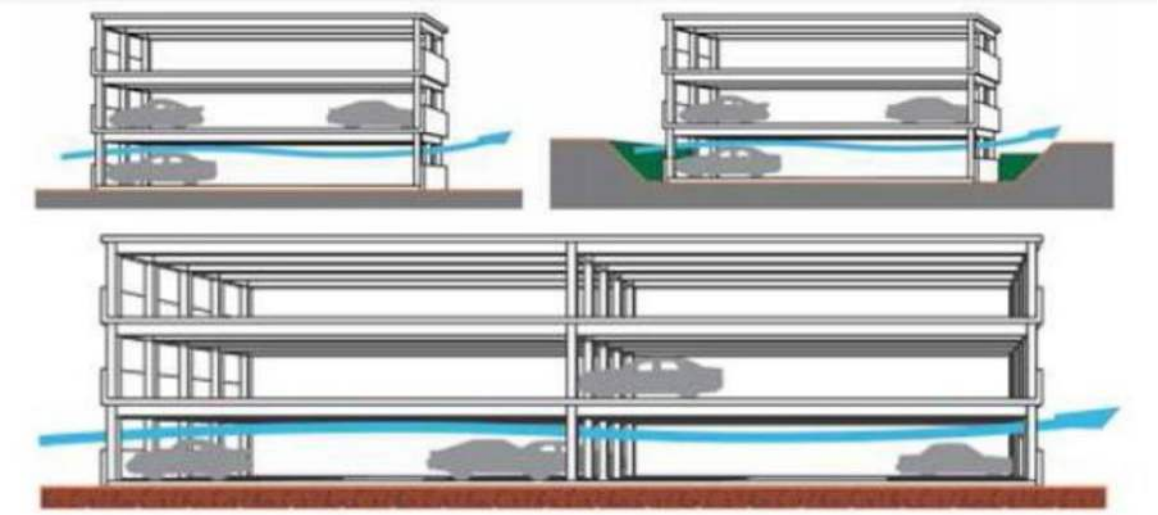


Figure 2 - Smart alarming with fiber optic linear heat detection systems

With regards to the distributed nature of the measurement, with LHD systems the system provides a full temperature profile with points every 0.5m along the length of the system. In traditional detection systems, if the seat of the fire does not happen to be immediately under a point type sensor, the fire can no longer be detected with certainty, mainly due to detector spacing. The FireLaser fire detection system does not have any such "gaps", since the radiation heat given off by the fire is applied over the continuous length of sensing cable and is recorded and displayed accordingly.



Natural Ventilation flows in car parks

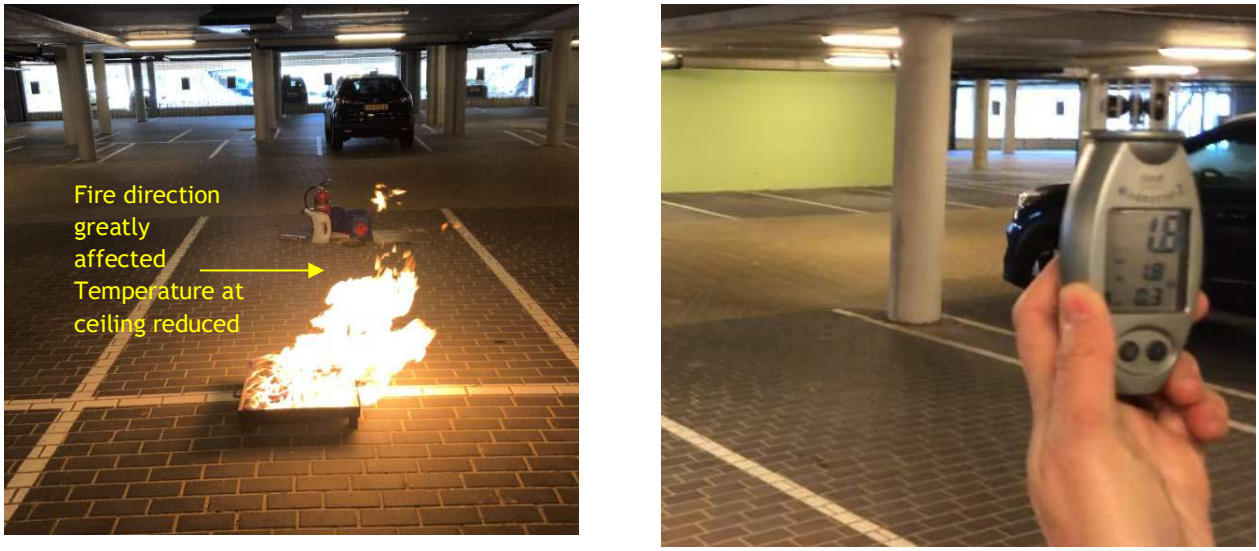


Figure 3 - Effect of wind on fire on car park fire pan test

As can be seen above there can be considerable natural air ventilation in car parks which can substantially change the dynamics of the heat distribution. With points sensors this can be missed, and it is difficult to plan where to place the sensors. With fiber optic linear heat detection, you have full coverage of the facility and with smart alarms you can detect at a lower temperature).

System Integration

The fire detection system which incorporates a FireLaser DTS system recognizes a fire and automatically actuates the relevant, preprogrammed protective measures (alarm signals, ventilation control, fire suppression etc.). The fire alarm system needs to provide information on the exact location of the fire and key data on fire development to bring the necessary rescue or fire-fighting measures into action systematically.

The Bandweaver FireLaser DTS linear heat detection system has a centrally located sensor control unit, which can determine the temperature at any position along the length of connected sensor cable. The sensor cable is fed through the assets to be protected, which may include ceiling and floor void spaces, switch rooms etc. The cable is divided in software into multiple fire detection zones, where each zone can have its own unique characteristic alarm thresholds assigned to it, so the system is extremely flexible in this regard.

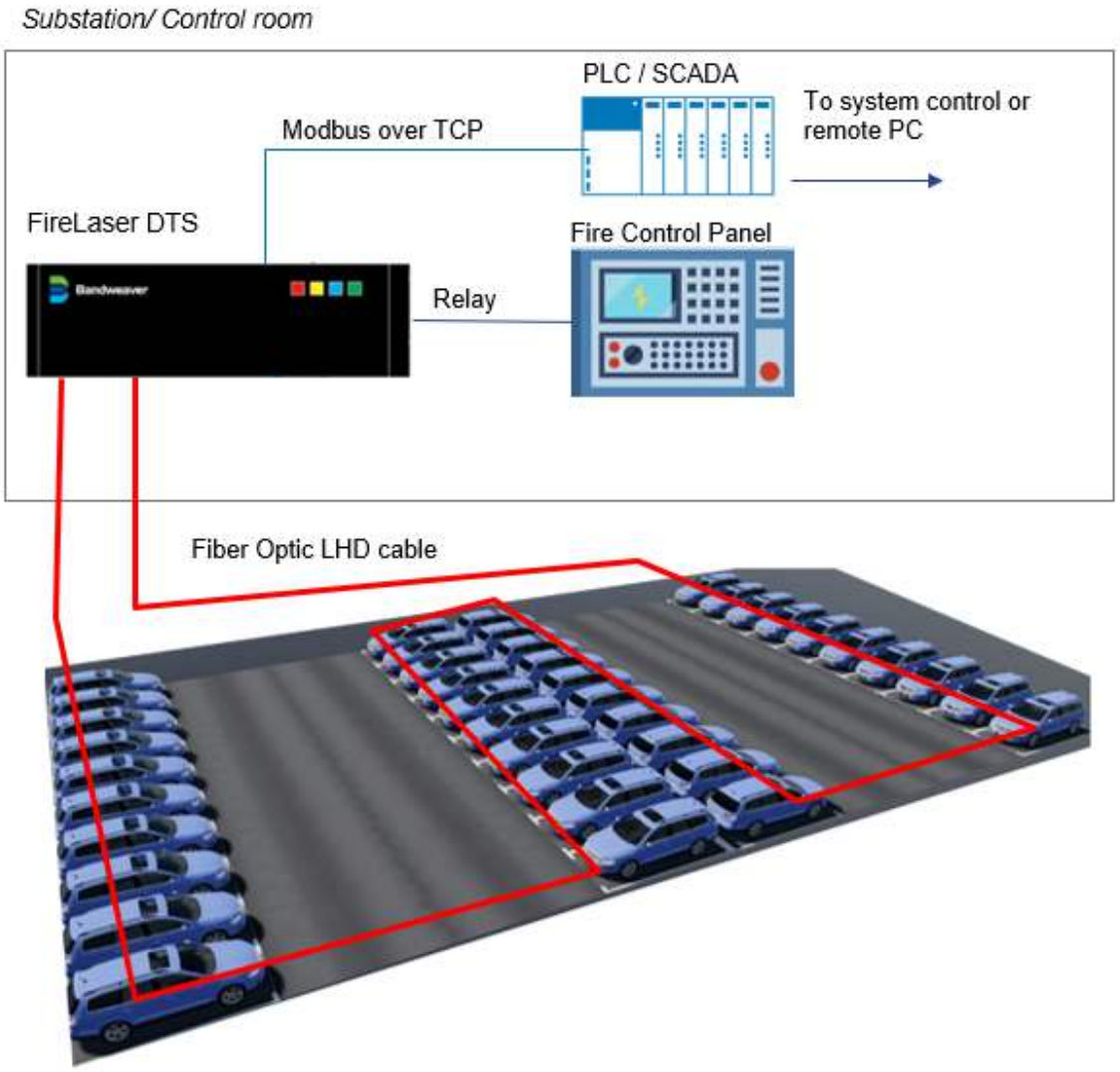


Figure 4 - Example of System Architecture

SMART ZONE CONFIGURATION

The FireLaser LHD system gives the unique capability to configure the smart alarms in conjunction with smart zones. This enables each zone to have its own specific configuration according to the specific environmental conditions or integration with other elements of the system. Examples where you may want different zone configurations include, emergency exits, ventilation zones, fire suppression.

The following table gives an example of how the smart zones integrate with the rest of the system. Because the fiber optic LHD system gives you the precise location and temperature of each event you can decide how the system will respond. In some cases, an entire zone may communicate through a relay switch (e.g. direct contact to the fire panel) and activate the fire suppression for that zone. Or in other cases the actual data can be transmitted via Modbus (or other protocol) to the system where it can decide which actions to take. The diagram below details how this may work with integration of the other sub systems.

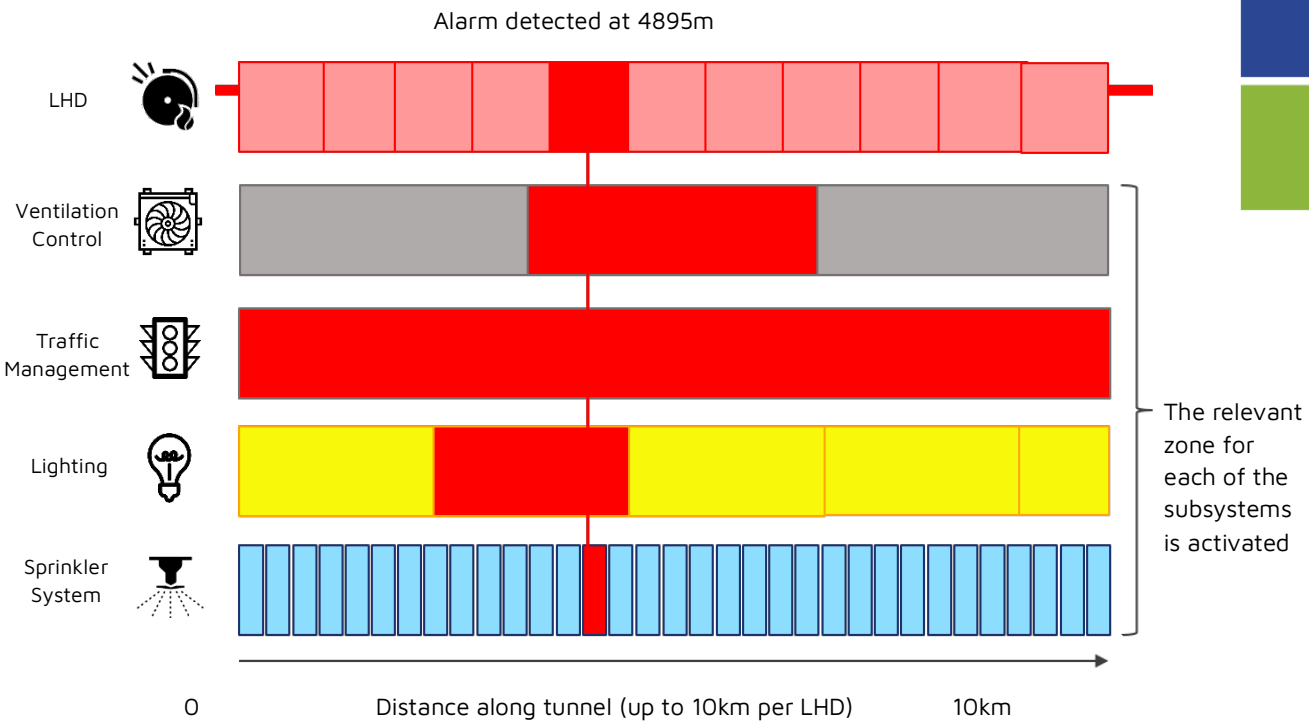


Figure 5 - Example of smart zone configuration

SENSING CABLE

The sensing cable is a completely passive element and is based on standard fiber optic telecommunications fiber. For the fire industry the standard fiber configuration has been using a 62.5/125 fiber optic due to its superior performance at distances up to 10km.

Because the sensing cable is made from fiber optic and is completely passive, it has the following benefits:

- **Continuous coverage:** No discrete sensors but continuous spatial measurements. The FireLaser provides measurement points every 50cm
- **Immune to electromagnetic interference:** Can be used in areas of high electromagnetic activity without fear of affecting or being affected by other electrical equipment
- **Corrosion and vibration resistant:** As the sensing element has no moving parts and immune to corrosion, the cable has an extremely long lifetime and can be in excess of 30 years

The FireFiber range of cables are designed to give maximum protection to the fiber optic while maintaining a thermal conduction which can enable the system to react very quickly. It is also very lightweight and flexible, making it easy to install.

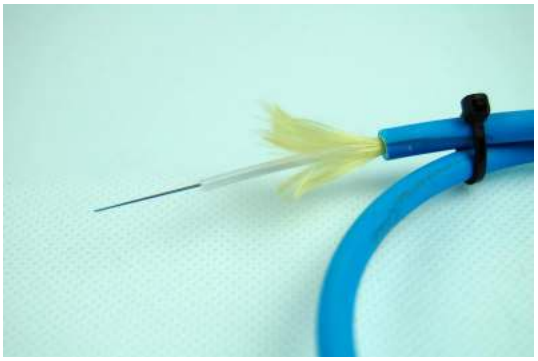


Figure 6- Examples of FireFiber cables

CABLE INSTALLATION AND POSITIONING

Depending on the layout of the car park the cable route is between 4-8m apart between runs. It should also typically be run at least 2m from the walls.

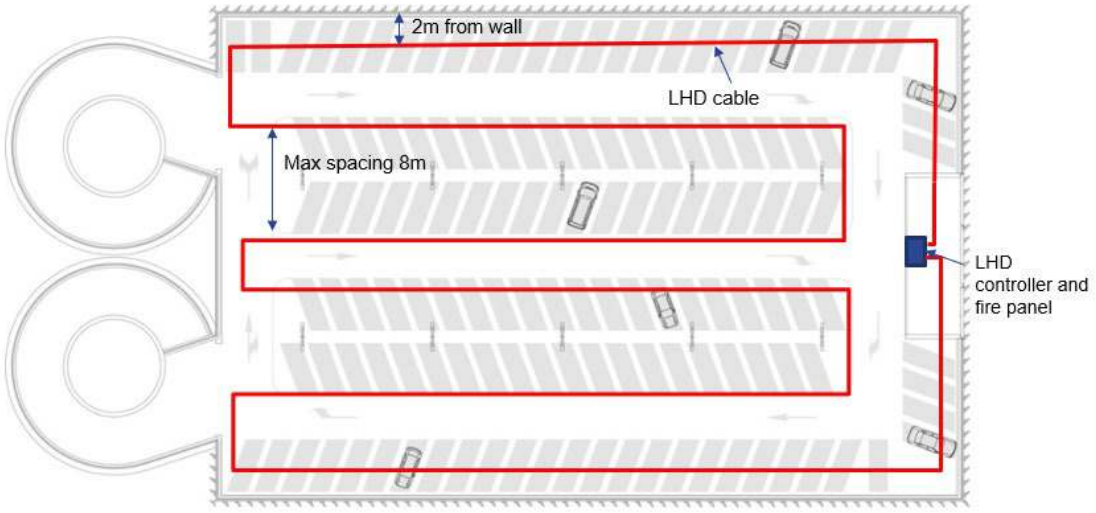


Figure 7 - Example of cable route in car park

The sensing cable is typically suspended from the ceiling by use of various fixing methods. The minimum level of protection is achieved by locating the sensing cable at the ceiling, its position defined by the structure of the ceiling, but generally under a flat ceiling, the sensor cable can be located in the center of the ceiling, at a distance of 15-50mm from the ceiling surface.

A suitable cable fixing method should be adopted, using the recommended cable fixing distances, generally 1.5m apart. This type of application is a so called "room protection" (see approvals) application, where the sensor cable is located at a distance away from the main fire risk.

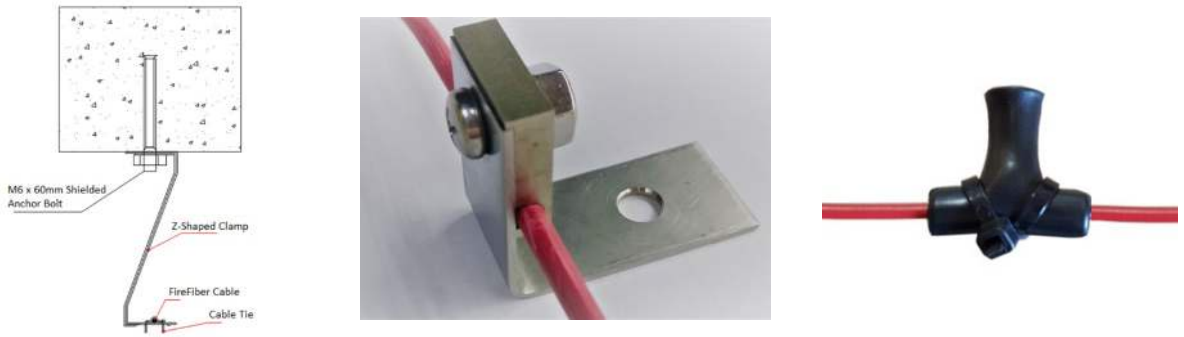


Figure 8 - Examples of cable fixtures

The location of the FireLaser controllers for an application is typically near the fire control panel. The FireLaser LHD comes with it's own LCD screen and so can independently display the alarm events and also outputs to the fire alarm control panel.

SYSTEM REDUNDANCY

Depending on the customer requirements, different levels of redundancy can be required. But essentially there are two key types of redundancy:

- **Cable Redundancy:** In the event of a cut to the cable, the system can continue to function (although a system alarm will be generated so that action for repair, analysis can be taken)
- **Controller Redundancy:** In the event of a failure to one of the fiber optic LHD controllers, the system will continue to function

For car parks it is unusual to have more than a single controller and so the redundancy is based around cable redundancy. The diagram below outlines the principle.

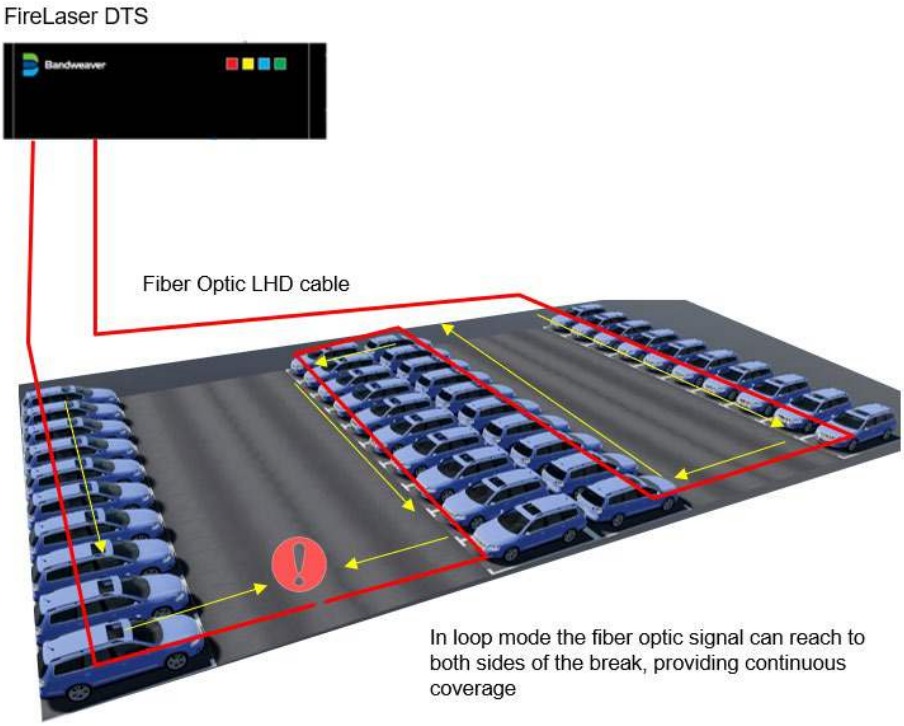


Figure 9 - Loop redundancy example

ABOUT BANDWEAVER TECHNOLOGIES

Bandweaver has been providing advanced fiber optic monitoring sensors and integrated technologies since 2002. With an installed base of over 60,000km and 8,000 systems installed, our knowledge regarding the application of distributed temperature sensing technology and linear heat detection within the fire industry is second to none. We focus on the safe integration of FireLaser DTS technologies into clients' proprietary systems and Bandweaver and our partners provide exceptional systems design support, product support during installation and provide long term maintenance packages.

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