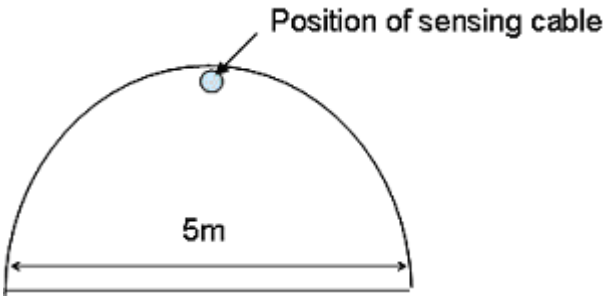
Case Study

Sensornet Linear Heat Detection System for Xuanwu Tunnel

In March 2005 Sensornet and Bandweaver (Sensornet's partner company based in China) jointly installed and commissioned the Sentinel Linear Heat Detection system in the Xuanwu Lake tunnel in Nanjing for the Nanjing construction company. The Xuanwu Lake tunnel is the only under lake tunnel constructed in China and is a key traffic route for the city of Nanjing and the safety considerations for such a high-profile busy route are critical. With the Sentinel Linear Heat Detection system they were able to obtain temperature data at all points along the tunnel every 10 seconds with a temperature resolution of +/-0.1°C. This means that in the event of a fire, the tunnel operators are able to exactly pinpoint the location of the fire within seconds and react accordingly.

1.0 Installation

The tunnel is 5m in diameter and is 2km in length, the sensing cable was installed on the crown of the tunnel. This is the standard position for the Sentinel sensing cable and because heat rises, this is likely to be the hottest point in the event of a fire.



The sensing cable was attached using fixtures with a design life of 30 years and so maintenance costs for the sensing cable are anticipated as being minimal. The sensing cable was installed using a hydraulic elevation truck and a 4 man team. It took 4 days with the installation taking place between the hours of 1am and 4am in the morning (the tunnel was closed to traffic during this period to facilitate the installation).

In addition to the road tunnel section (which was 1600m in length) the sensing cable was also installed in a side tunnel which contained power supply cables for the tunnel. The sensing cable was attached to one of the feeder cables.

In the event of a power load or cable hot spot – the Sentinel Linear Heat Detection system will be able to quickly locate and alert the operator to take appropriate action. The quality of the cable installation was checked using the OTDR tool on the DTS which provides a rigorous analysis of any defects or poor connections along the length of the entire cable. Using this technique, it was ascertained that the cable installation was of a high quality and so the cable was connectorised and terminated in the instrumentation centre.

1.0 Control Room

The Sentinel DTS was housed in a rack mounted enclosure in the instrumentation centre of Nanjing construction group. This instrumentation centre was house in an adjacent room to the control centre.

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The safety of such an important traffic route through Nanjing is the critical for Nanjing Construction Group and so they have utilised a variety of sensing systems (smoke sensors, radiation sensors, CCTV…) and also the necessary communications architecture so that the fire safety/prevention measures (ventilation fans, sprinkler systems…) can automatically take the necessary action. Nanjing construction group's control room is the nerve centre for monitoring the tunnel.

1.0 Commissioning of Sentinel Linear Heat Detection System

For this project, Nanjing construction group wanted to evaluate how the Linear Heat Detection system reacted so a much smaller fire (<1MW vs the 5MW usually used to simulated a car fire). In order to simulated a small fire – a basin test was used whereby diesel was placed in a 50cm diameter basin and ignited. The first test was performed in the absence of ventilation fans.

Using the Sentinel visualisation software. The results for this test can be shown in various formats:

1.0 Temperature profile (distance vs. temperature)

In this case you can clearly see the heat peak at 860m. The peak has detected a temperature differential of 12°C.

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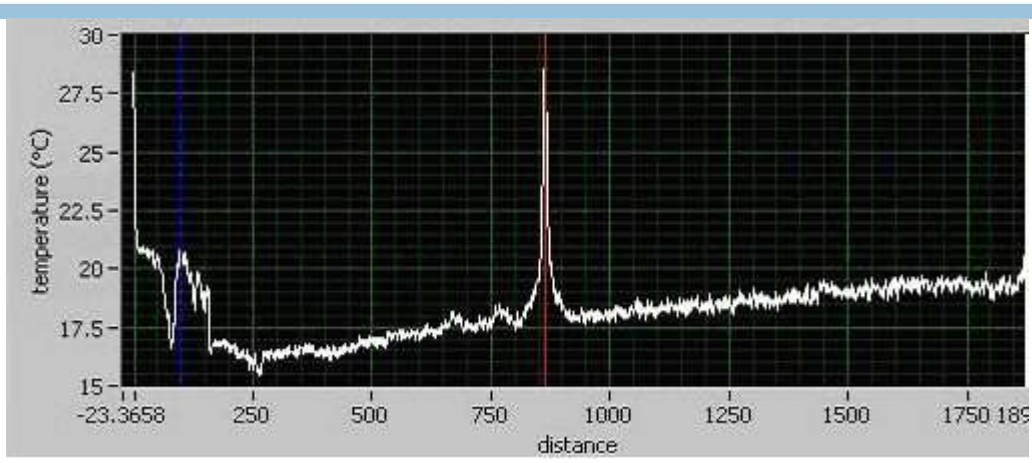
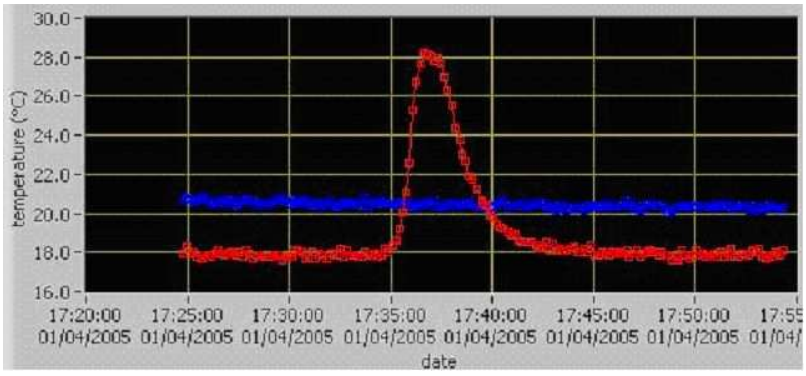


In order to see how this peak developed over time – it is also helpful to view the temperature vs time plot.

1.0 Temperature at 860m vs. Time

Each measurement point corresponds to a 10 second measurement and as can be seen it took 80 seconds for the fire to reach the maximum temperature.



At this point the ventilation fans in the system were automatically triggered by the alarms and the strong winds generated by the fans dissipated the heat over a large area.

1.0 2-Dimensional thermal map of heat source

This heat source can also be seen in a thermal map of the tunnel – which can also be generated by the Sentinel visualisation software.

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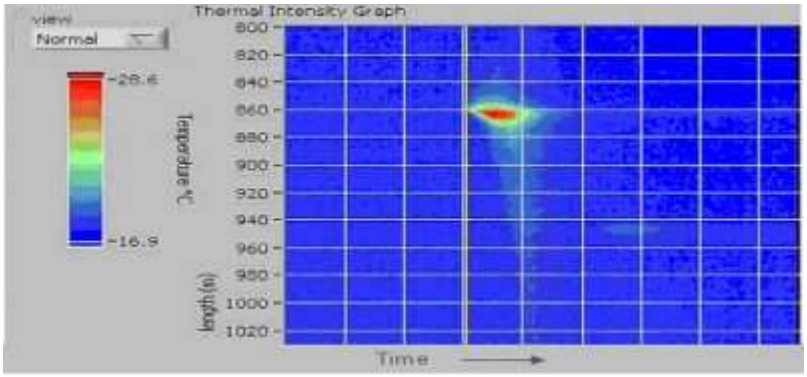
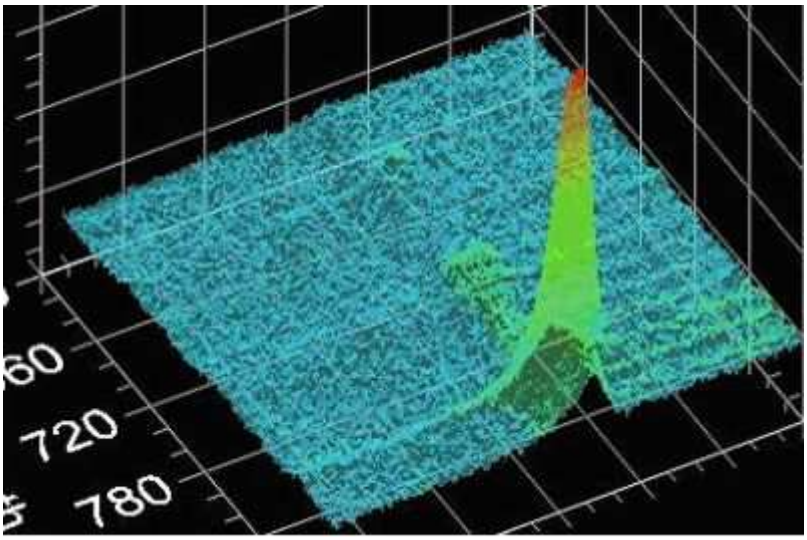


1.0 3-Dimensional thermal map of heat source

This thermal map can also be viewed in a three dimensional graph.



Both of these thermal map views can be effective tools in quickly detecting temperature events or in analysing large amounts of historical data to customise intelligent alarm criteria.

For more information on the Sensornet linear heat detection system - please contact your local Sensornet representative.