SENTINEL DTS PROVIDES AN EFFICIENT VENTILATION CONTROL AND LINEAR HEAT DETECTION SYSTEM FOR POWER CABLES

In conjunction with Olex Australia – Sensornet monitored a 132 kV cable within a tunnel installation using the Sentinel DTS. The objective was to provide information on the temperature distribution of the cable along the tunnel, and on the behaviour of the cables when subjected to daily load cycles. The DTS effectively illustrated temperature variation during a full load cycle and provided integral information on the effectiveness of the tunnel ventilation system.

CLIENT REQUIREMENTS

Olex Australia required monitoring of a 132kV cable within a tunnel installation using distributed temperature sensing (DTS). The purpose of the DTS monitoring was to provide information on the temperature distribution of the cable along the tunnel, and on the behaviour of the cables when subjected to normal daily loads.

THE MONITORING GAP

Achieving maximum return from the asset means optimizing the amount of electricity throughout the network. The key period of interest for monitoring the cable is during the peak loading hours – as it is the period at which the price of electricity is at the highest. Sentinel-DTS offers an unparalleled monitoring system for the operator to effectively optimise the amount of power in the cables, while working within rating limits to maximise the network lifetime.

THE SENSORNET SOLUTION

The DTS was set up inside the control room within the substation. The sensor cable ran thought a switch room into the tunnel area (which was 750m in length).

The power cables were mounted on the side of the tunnel in the trefoil configuration and the fibre was installed inside the power cable (in the shielding layer) during cable manufacturing (see diagram on reverse page). Installing the fibre inside the power cable places it closer to the conducting core and provides a more accurate measure of the core temperature.

The distributed temperature nature of the Sentinel DTS enables the user to obtain a measurement point every 1m along the length of the cable. The different temperature zones along the length of the installation are seen clearly (see diagram on reverse page) in one of the temperature traces obtained by the Sentinel DTS.

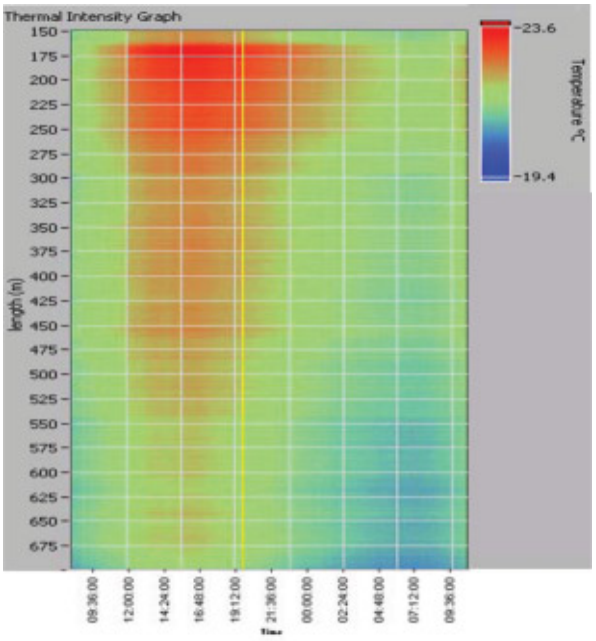
SUBSTANTIAL BENEFITS

Sensornet thermal mapping is the most efficient way to qualitatively analyse large amounts of data. Below is an example of a visualisation view throughout a 24 hour period. The screenshot shows length along the tunnel along the vertical axis, and the time during a 24 hour period along the horizontal axis. The colour of the data points is proportional to the temperature – with red representing the hottest zones (in this case 23.6°C and blue the coldest at 19.4°C).

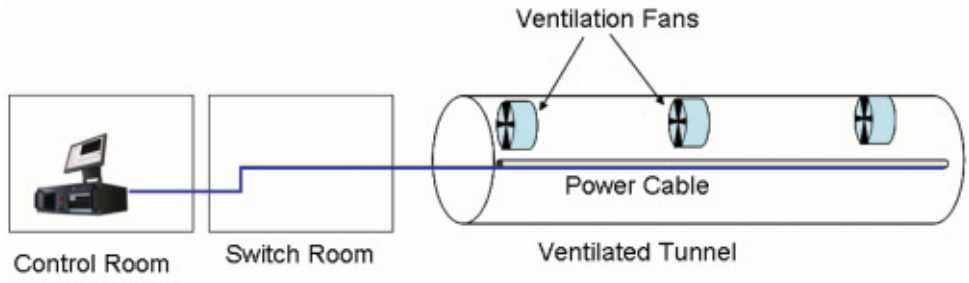
MEASURABLE PERFORMANCE

The DTS effectively illustrated temperature variation during a full load cycle (i.e. a 24 hour period) and provided integral information on the effectiveness of the tunnel ventilation system.

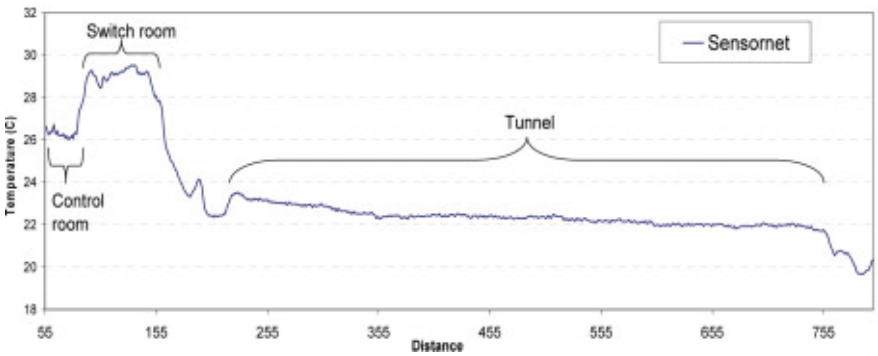
The thermal map shows there is a distinct temperature cycle throughout the 24 hours corresponding with the load cycle, with the hottest temperature along the length of the cable corresponding to about 16:00 in the afternoon. A hotspot can also be seen in the tunnel in the section between 150m and 250m along the length of the tunnel. The absolute temperatures are still low with relation to the cables thermal rating (90°C) – as the actual loading on the cables was quite light – but this hotter zone indicates that the ventilation at this point is not as effective as it could be and that at higher current loading levels this area is a potential trouble spot and should be monitored carefully.



Thermal profile of installation



Tunnel cable system layout



Temperature profile of installation

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