Application Note

Transmission & Distribution Power Cable Monitoring

SENSORTRAN
Optical Conclusions

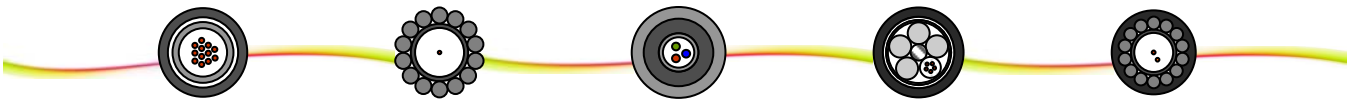
Maximizing the current-carrying capacity within thermal limits is a principle concern in the design, installation, operation, and maintenance of a reliable and efficient power transmission and distribution system. Current methods of load optimization base ampacity estimates on models of ambient thermal conditions and can result in underutilization of circuit capacity or over stressing of the power cables.

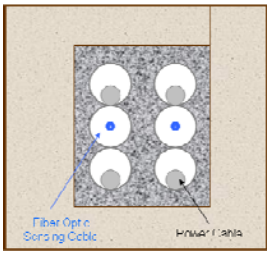
Fiber optic-based Distributed Temperature Sensing (DTS) technology has proven to be an effective tool for real-time thermal monitoring and load optimization. DTS systems are able to monitor multiple power circuits to capture and record dense temperature measurements over time. Overheating beyond a cable's maximum operating temperature will significantly reduce its life and can result in complete loss of the circuit. By combining actual thermal data from the DTS with a real-time load input, SensorTran's ampacity software provides enhanced capabilities for the effective operational management of power circuits.

Even with controlled backfills, the thermal impact of the environment varies along the length of the cable, throughout the life of cable, and with changing seasonal weather conditions. In order to accommodate these thermal fluctuations, models incorporate significant safety margins which serve to reduce the recommended load capacity. By monitoring the cable in real-time, guesswork related to the thermal environment is eliminated, allowing operators to use actual temperature measurements to adjust loads – thus maximizing available capacity without exceeding the thermal limit. At the same time, the risk of circuit damage due to overheating is reduced – avoiding outages (cable loss) and extending cable life.

Using DTS technology to monitor transmission and distribution power systems reduces costs by increasing the usable capacity of the circuits, avoiding cable damage, and extending cable life by maintaining optimal loading.

Better Decisions from Better Data	
• Small hotspot identification	• Lifetime asset protection and monitoring of aging circuits
• Load optimization through real-time thermal monitoring	• Verification of mathematical models
• Access to all usable capacity without exceeding thermal limits	• Early identification of joint deterioration



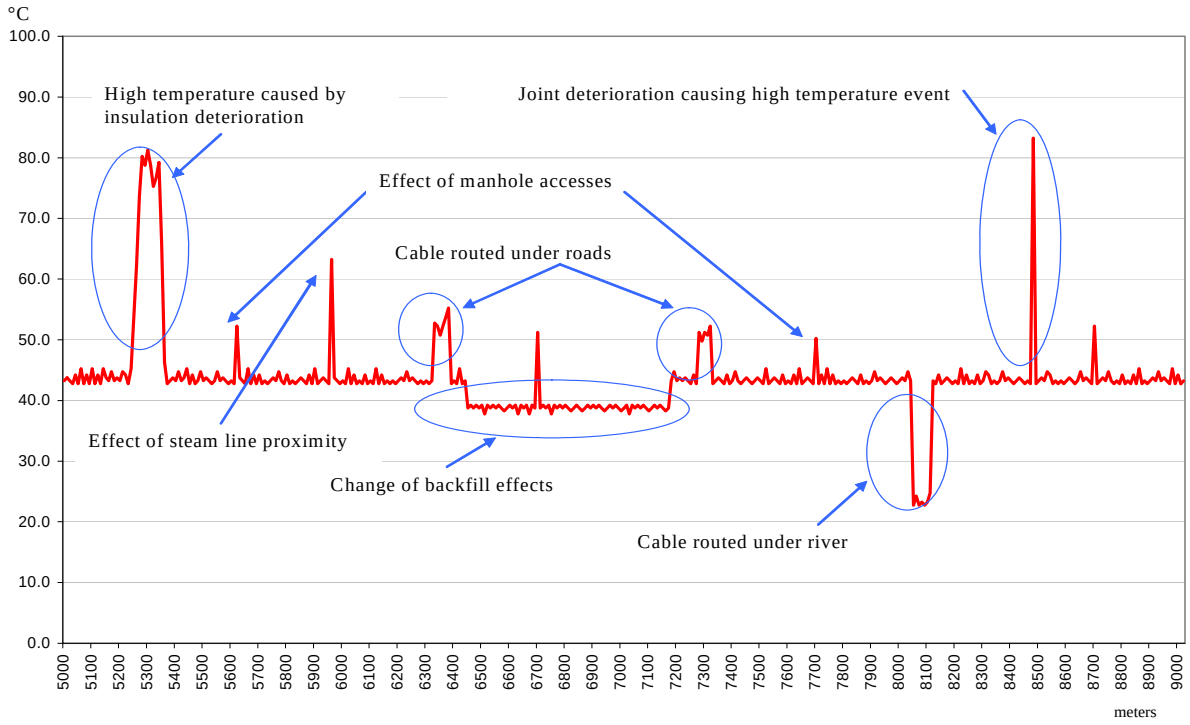


Optical fiber which is already integrated within the power cable itself can be easily utilized for monitoring. Where this is not the case, optical fiber can be retrospectively secured to the outside of the cable (typically within a stainless steel protective tube), or even retrofitted into a duct bank.

SensorTran has hands-on experience deploying monitoring solutions to direct buried, duct, and tunnel cable installations.

The optical fiber can be configured in either single-ended or double-ended configuration. Double-ended configuration is where both ends of the fiber are connected to the DTS system to form a “loop”. This has the additional advantage that in the unlikely event of a fiber-break, the power cable can still be totally monitored by the system.

The example below shows a simple temperature trace along a single power distribution cable, clearly displaying events and features.



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Contact

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