Leak Detection - Application Note

FIBER OPTIC LEAK DETECTION OF BURIED PIPELINES IN FOUNDATIONS

THE SUREST WAY TO DETECT THE PRECISE LOCATION OF ANY LEAK OF BURIED PIPELINES IN BUILDING FOUNDATIONS AND PROVIDE IN REAL TIME TOTAL INTEGRITY THROUGHOUT YOUR STRUCTURE.

ROCTEST has developed an innovative system based on fiber optic technology to detect leaking pipelines that are buried in foundations of industrial sites such as nuclear power plants, fertilizer production plants and hydro power stations.

Uncontrolled flow of water or other liquids in the terrain can cause internal erosion of the foundations, which in turn tends to structural failure and ultimately building collapse. Analysis of the temperature distribution along the buried pipelines enables the identification of the exact zone of leakage in the building foundation and immediate action can be taken to prevent major structural failures. The distributed temperature-sensors (DTS), based on Raman optical fiber, allows the monitoring and localization of liquid spills with high spatial and temperature resolutions.

ROCTEST offers a wide range of acquisition units able to satisfy all technical requirements.

References

- QAFCO Project - Leak Detection - Water Pipelines - Qatar
- Paradip South Jetty Pipeline leak detection - India, 2015
- Leak Detection - Third party intrusion - Switzerland, 2013
- Leak detection - 140 km mining pipeline - Chile, 2013
- 9 km crude oil pipeline leak detection - Italy, 2011
- Deformation/strain 50 m buried oil pipeline - France, 2011
- Pipeline strain monitoring - Russian Federation, 2010
- Alameda Siphon water pipeline - USA, 2010
- LNG pipeline leak detection - UK, 2010
- Under river gas pipeline - strain - Switzerland, 2011
- Buried pipelines earthquake—movement - USA, 2010
- Third party intrusion detection simulation - Germany, 2009
- Water pipeline leak detection - Korea LNG transfer hose monitoring - France, 2009
- Pipeline distributed strain monitoring - Italy, 2009
- Seawater pipeline leakage detection - Qatar, 2009-2012
- Grain Terminal LNG pipeline leak detection - UK, 2008
- Pipeline leak detection for LNG plant - USA, 2008
- 20 km Pipeline Monitoring - Canada, 2008
FIBER OPTIC LEAK DETECTION OF BURIED PIPELINES IN FOUNDATIONS

SYSTEM SPECIFICATIONS
- Localization of leaks with better than 1m accuracy
- over distances of 30km and more
- Precise temperature mapping with high resolution & accuracy
- Autonomous and continuous monitoring 24/7
- Rugged and durable cable construction for direct embedding in soil or concrete
- Easy and quick to install, use and maintain
- Can be combined with distributed strain sensors for soil stability monitoring
- Immune to electromagnetic fields
- corrosion and rodent resistant
- Remote monitoring and alerting

ROCTEST SERVICES
- Monitoring system design and supply of all components
- Installation and commissioning of the system
- Training
- Data analysis and interpretation

INTERNAL EROSION
Uncontrolled leakage through foundation terrain can induce the movement of soil particles. This phenomenon, known as internal erosion has been identified as one of the most important causes of subsidence and structural failure.

Detecting internal erosion is difficult at an early stage, so DTS is increasingly recommended by designers as an essential monitoring solution for management of structural integrity.

FIBER OPTIC LEAKAGE DETECTION
SMARTEC leak detection and localization system is extremely sensitive and able to detect small and micro leaks. With regular updates provided by the system provides, you will be notified where the leak is occurring.
Leaks can be pinpointed to within 1m with this technology. This rapid location minimizes response time, and any potential excavation expense.

This technology is a permanent monitoring solution and continuously monitors at all points along the pipe.

BENEFITS
- Improved safety of infrastructure and for personnel
- Leaks will be detected quickly thus minimizing risk to structural integrity.
- The optic signals used for the leak detection are extremely low power and incapable of igniting flammable gases making it suitable for use in hazardous zones.
- The sensing element is a passive fiber optic cable with a design life of over 30 years with minimum maintenance costs.
- Small and micro leaks can be detected, allowing action to be taken early.
- Additional sensors can be used to monitor the structural integrity of the pipeline, alerting the operator to any movement in the pipeline.
- System is fully automated lowering operating costs with less risk of human error. It can interface with existing SCADA and industrial control system using standard protocols (OPC, Modbus, electrical relays).

DTS system over 10’000 m of buried pipelines carrying sea water to process plant in Qatar.
The installation is quick, easy and durable, as the optical fibers are protected by a stainless steel armored reinforced cable. Customized monitoring software is offered enabling the client to see the position of the sensor in the structure, as well as the exact location of an event when alarms or warnings occur.

**FLUID DETECTION**

The system is based on temperature measurements using distributed fibre optic sensing technology and can be used to detect both liquid and gaseous leaks.

In the effect of liquid leakage (e.g. oil, water) where the temperature change is less pronounced, the key is in the sensitivity of the system which can detect changes as small as 0.01°C.

The cables are designed to be installed on the pipeline surface or in its vicinity. The Distributed Temperature (DiTemp) measurement instruments can measure sensors with a length of up to 2 x 45 km (upstream and downstream).

Software packages are available for detecting leakages of fluids pipelines, to display and publish the measurement results in a user-friendly interface, and to generate warnings when abnormal conditions are detected.

GIS maps can be used to highlight precise locations of events.

**SYSTEM COMPONENTS**

SMARTEC pipeline monitoring systems are based on a combination of sensing cables, measurement instruments and data processing software. Different cables are available for temperature sensing (normal and high temperatures), strain sensing and combined Strain, and temperature sensing.

The Distributed Data Management and Analysis Software DiView is an integral and fully compatible part of SMARTEC distributed monitoring systems. In particular, it is designed for data storing, processing, representation and analysis, as well as for the control of single or multiple reading units. DiView is also used to store and manage data in a centralized interface.
Roctest is the leading developer, manufacturer and supplier of innovative sensing technologies based on vibrating wire and fiber optic sensors for geotechnical and structural instrumentation.

We are featuring a complete line of conventional sensor-based solutions ranging from the ultra-robust traditional vibrating wire technology to state-of-the-art fiber-optic technology used for the measurement and monitoring of geotechnical projects and structural health monitoring (SHM) of critical assets such as: dams, tunnels, mines, buildings, bridges, nuclear power plants and many other structures too numerous to list.

Roctest offers a wide range of pressuremeters, rock dilatometers, laboratory and in-situ testing equipment for soil and rock.

Available Application Notes

- FO Leak Detection for Dams and Dikes
- Dam & Dike Instrumentation and Safety Monitoring
- Tunnel Instrumentation & Structural Health Monitoring
- Bridge Instrumentation & Structural Health Monitoring
- Building Instrumentation & Structural Health Monitoring
- Historical Monument Instrumentation
- Geotechnical and Structural Monitoring
- Nuclear Power Plant Instrumentation
- FO Movement Detection in Tunnels
- FO Leak Detection for Chemical Plants
- FO Leak Detection for Pipelines
- Storage Facility Instrumentation
- Cliff Instrumentation