

A worldwide acknowledged expertise



More than 100 km of infrastructures monitored by our systems after 12 years of existence

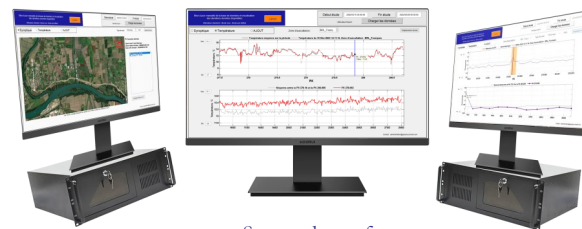
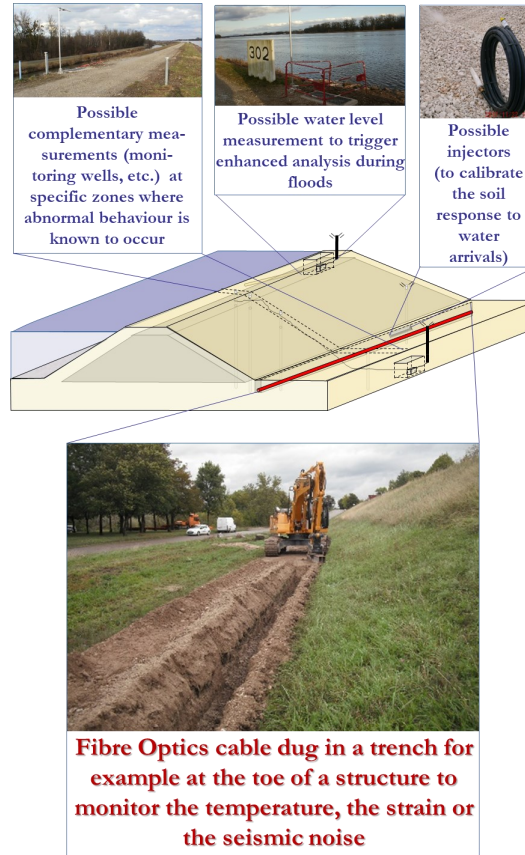


Contact

geophyConsult – 159, quai des Allobroges – 73 000 Chambéry – France—FO_monitoring@geophyconsult.com—
+33 6 52 97 74 33 ou +33 6 95 38 85 09



Typical installation



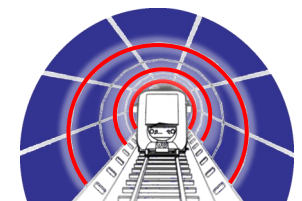
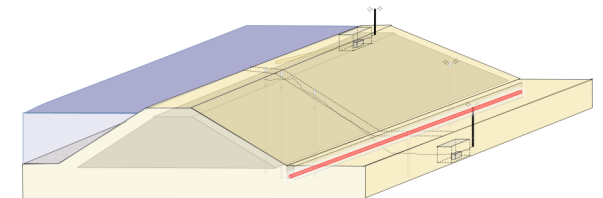
Screen-shots of geophyConsult FO analysis suite



geophyConsult



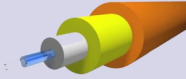
« State-of-the-art technologies for the safety and the monitoring of infrastructures »



« Fibre Optics monitoring of infrastructures »

Fibre Optics monitoring

Fibre Optics (FO) are known to be excellent telecom cables. This means that when a laser beam is set up at one of their ends, it reaches the other extremity almost instantly (at light velocity), with very low loss, even over long distances.



A beam however cannot help interacting with the silicate atoms it goes through. Light must therefore be reflected somehow, even though in an extremely low proportion.

These light reflexions are linked to the temperature and the lengthening or the shortening of the fibre all along the optical path. Thus, by comparing the characteristics of the emitted signal with that of the successively received reflected signals, one can use a fibre optics as a succession of thermometers and strainmeters able to permanently measure the temperature and the lengthening or the shortening of the fibre along its way : the first received echo comes from the vicinity of the extremity in which the beam has been injected, while the second echo comes from a little further, etc. until the last echo, coming from the other extremity of the fibre.

With state-of-the-art instruments, one can expect, every 10 minutes, precisions of the order of 0.1 °C every meter in temperature and 2×10^{-6} every meter in strain, which corresponds to elongations or shortenings of 2 µm over 1 m.

The fibres can be either embedded into the foundation of the infrastructure or within it, or glued to its surface, depending on the application. It can be used to monitor dikes, levees, dams, tunnels, bridges, roads, pipelines, high tensions masts, buildings, etc.



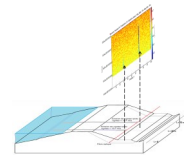
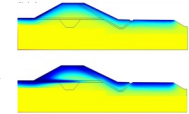
This type of **distributed sensor** is **not sensitive to electromagnetic noise or radiations**. Besides, it is **very stable over time** (as telecom fibre optics installed almost 50 years ago are still operational). To finish, it is **very competitive for extended monitoring zones** (from a few hundreds of meters to a few tens of kilometres).



Fibre optics monitoring of infrastructures

A monitoring system is worth installing only provided (i) it targets a well defined and relevant risk scenario ; (ii) the chosen technology has been proven competitive both in terms of investment and operating costs. This is when designing a FO monitoring system, it is necessary to:

- ✓ define a robust risk scenario (generally provided by the owner),
- ✓ build a numerical model of the infrastructure, so as to quantify the expected anomalies and define relevant thresholds above which the measured parameters become relevant risk indicators,
- ✓ show, by simulation, that the FO system is actually capable of detecting the expected anomalies in real operating conditions (for instance when the networks on which the infrastructure is based fall down, or when the monitored data are perturbed by extreme weather events),
- ✓ show, via a detailed study, that the investment and operating costs of the FO system are lower than those of all its competitors.



The installation of a FO monitoring system requires then a works management team that has an acknowledged ability to supervise installations in civil engineering projects, so as to ensure that (i) the FO installation will never delay civil works ; (ii) all the site data necessary for the future FO analysis are actually going to be acquired onsite.



Finally, the operation of a FO monitoring system requires:



- ✓ a good knowledge of FO technologies and geosciences, so that it can be warranted that criteria enabling to clearly distinguish between the targeted anomalies and possible instrumental artefacts or possible site effects are actually going to be defined during the « *learning phase* » of the monitoring system,
- ✓ a solid experience in databases, as the monitored data are to be integrated into wider databases, possibly including complementary data necessary for the FO analysis,
- ✓ real-time data-processing, so that automatic alerts or alarms can be emitted if anomalies are detected,
- ✓ internet security management, as monitoring systems are most of the time connected to the internet,
- ✓ the ability to manage specific FO technologies like the « *Heat Pulse method* » or predictive models like AJOUT, (©EDF), which are commonly used to detect targeted anomalies in raw data.

geophyConsult manages all these pre-requisites. Besides, it has developed a user-friendly software suite including modules adapted to all the traditional steps of the operation of FO monitoring systems : data pre-processing, data validations, data integration into larger databases, 3D visualisation and interpretation with GIS-compatible inputs and outputs, etc. The suite can be either installed onsite or accessed via a user-friendly Windows® web interface.

