

## Editorial



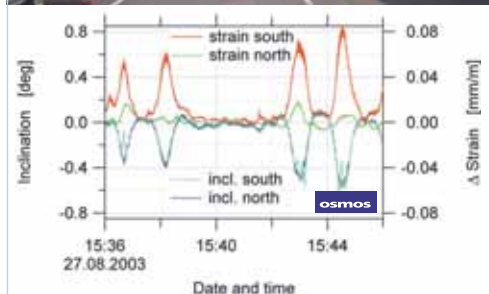
### MOMA joins OSMOS

Bernard Hodac, CEO of the OSMOS Group

The OSMOS Affiliates network welcomes a new member. MOMA, a French company specialized in solution engineering recently joined our fast growing group of affiliates. MOMA focuses mainly on process optimization and modelization for industrial and civil engineering applications.

Simultaneously to the expansion of our international network, existing OSMOS partners continue to win prestigious monitoring projects, like Manhattan Bridge in New York City.

As in the past editions, we are highlighting a new product on page 4. The revolutionary bi-axial optical caterpillar is going to change the way landslides and underground structures are monitored.



Reversible deformation and tilt of the bridge as a subway passes over it.



First in situ measurement and launch of the system.



Monitoring station connected to the OSMOS database server.

## Manhattan Bridge



**U**rbitran, our new partner in New York City, installed OSMOS monitoring on the Manhattan Bridge in August, 2003, in collaboration with the DOT (Department of Transport).

Extensometers and tiltmeters are monitoring the effectiveness of repair work being carried out to reinforce the structure of this hundred-year-old bridge. Any additional work required will be assessed in detail and adapted to the actual structure. The repairs in progress on the bridge, which links Manhattan to Brooklyn, are not yet finished with the result that Urbitran will be able to demonstrate the "before repair-and-after repair" behaviour of the bridge.

OSMOS monitoring was installed in a record 2 days without disturbing traffic and has already enabled a behaviour profile of the bridge to be established as both road traffic and a subway train pass over it.

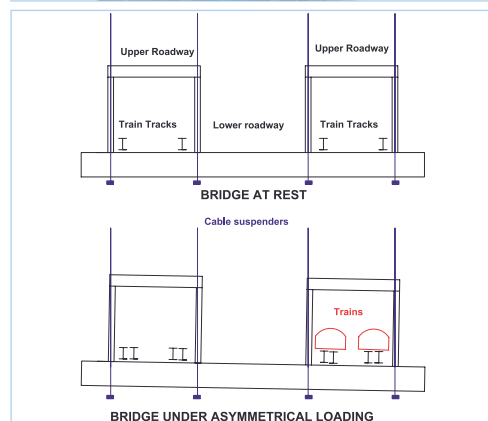


Optical extensometer under a vertical suspension cable.



Optical extensometer (Detail).

## Front page news



The monitoring will remain in place long-term in order to monitor the «new lease of life» that the bridge has just been given.



# The 2002 floods

## One year hence

### Mulden bridge



A TÜV technician installs an optical strand.

**A** year ago, last August, torrential rain caused unprecedented floods in Eastern Germany. Tens of thousands of people were affected by this catastrophe. Many engineering structures were also badly damaged.

Humanitarian and technical aid poured in from all over the world. TÜV-OSMOS got involved by suggesting to the Saxony and Thuringia Department of Highways that the bridges most damaged by the floods be monitored. The bridges at Falkenau on the Flöha and at Wurzen on the Mulden were immediately placed under TÜV-OSMOS surveillance monitoring.



### Bridge over the Flöha



Emergency bridge shoring and optical strand in protective housing (see arrow).

In the case of the bridge over the Flöha depicted to the left, an entire piling was severely damaged by the pressure of the exceptional amounts of water when the flood was at its peak.

Parts of the deck of the Mulden bridge depicted above revealed a worrisome buckling as a result of the action of the current.

The monitoring of these two bridges by TÜV-OSMOS allowed them to continue to be used in complete safety during the crisis period such that emergency repairs could be installed until water levels returned to normal.

Final repairs to both bridges have now been carried out. The bridge on the Mulden continues to be monitored, however, by TÜV-OSMOS.



# Railway bridge at EMDEN



At almost fifty years old, the bridge is exhibiting certain signs of ageing and some areas of cracking which are causing the operator concern. TÜV-OSMOS has put the bridge under preventive monitoring: three optical strands, one 10 m and two 5 m long have been installed. They are connected to the monitoring station and will enable what is considered normal behaviour under the action of day-to-day loading to be quickly determined and preventive alarm thresholds to be established.

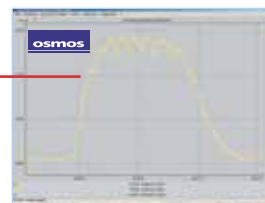
The operator will thus have the advantage of being aware well in advance of any possible repairs that need to be carried out. With this monitoring, TÜV-OSMOS enables the relevant bridge security measures to be taken, and, at the same time, provides an immediate postponement of impending large-scale repairs.



Optical strand of 10 m length installed on a curve section.



Static and dynamic behaviour compared with freight trains recorded automatically.



Close-up of the dynamic trace produced by a freight train. The number of wagons and even the passage of each wheel are clearly seen.

**The railway bridge at Emden is a structure that curves over a urban road. It is the only crossing point for all the freight trains leaving the Port of Emden.**



# Early detection of sinkholes in railway tunnels : OSMOS sinkhole watcher

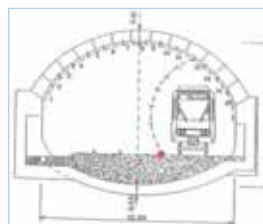
## Test on an actual site in the Paris Subway



The length of an optical strand should be greater than the Z of the tunnel in order to determine its behaviour as a beam on between two elastic bearing points.

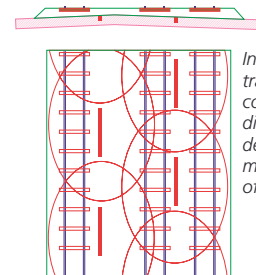
As part of longstanding collaboration with the Paris Public Transport Authority, RATP, OSMOS developed an early warning system for sinkholes, geological phenomena known for their sudden appearance and lack of early warning signs. OSMOS presented RATP with a solution and tested it on an actual site between the RER rapid transit stations Luxembourg and Châtelet.

The OSMOS solution: Long-base optical strands mounted beside the cross ties in the tunnel, alongside the tracks. The principle is as follows: With the movement of trains, a railway tunnel behaves like a beam on a sliding bearing point. The loading case represented by a passing train is clearly identified by the optical strand. Overloading beyond that considered normal is, without doubt, an early warning sign of a possible sinkhole. In other words, the «train» + «impending sinkhole» loading case displayed on OSMOS monitors is indeed considerably bigger than the standard «train» loading case. Only the dynamic performance of OSMOS optical strands guarantees this revolutionary system unequalled reliability.

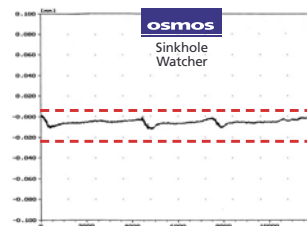


Position of sinkhole detector. View from Châtelet towards Luxembourg.

OSMOS has also developed an adaptation of this system for highway tunnels and sewerworks.



Installed alongside train tracks, each optical stand covers an area affected by different sinkholes depending on the mechanical properties of the substrat.



Reaction of the balast-bearing substrat system to 3 successive Rapid Transit Trains.



## Kléber Car Park

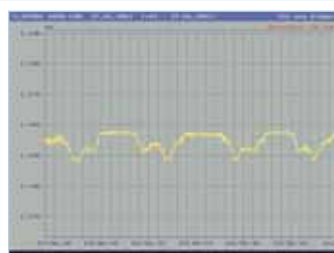
### OSMOS confirms repair solution



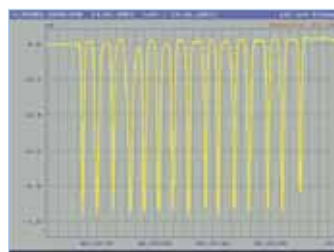
Kléber Business Center in Paris.

The Kléber garage, near to the Trocadéro in Paris's 16th arrondissement is an underground car park that is showing pronounced cracking of certain slabs.

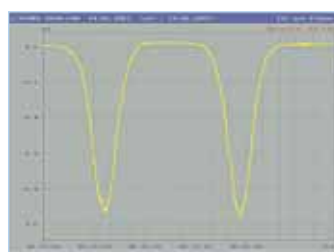
A contractor has been engaged to coat all of the slabs with a special protective layer. The product to be used is guaranteed provided that the cracks are less than 1 mm wide.



< Successive expansion-contraction cracks as vehicles repeatedly pass over slabs.



< Up-and-down movement at slab joints as vehicles repeatedly pass over.



< Total rebound of the slab under flexion.



Test vehicle.

Before undertaking the job, the contractor decided to consult OSMOS. Two days of tests have been organised with a 1,5-tonne test vehicle; An optical extensometer on each crack and an optical sensor under each slab monitor the deflection dynamically.

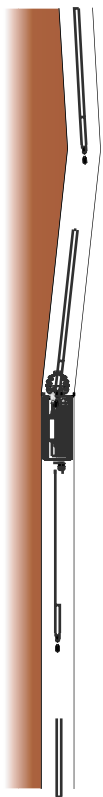
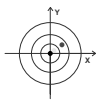
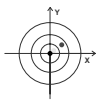
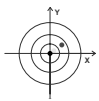
Result: the 1-mm threshold is not exceeded at any point. The operator may therefore apply the coating on all the slabs.

Extensometer in sleeping mode will soon be installed in order to carry out selective tests periodically.





7°



The caterpillar's resolution is on the order of  $0.003^\circ$  or  $5 \cdot 10^{-5}$  rad. With a shaft of 1 m in length, a variation of up to  $\pm 12.5$  cm is obtained with a theoretical resolution of  $25 \mu\text{m}$ .

The system can, of course, be installed horizontally or even in the form of an arc of a circle along cross sections of a tunnel as a permanent monitoring alternative to periodic convergence measurements.

