

alert solutions



**GeoBeads[®] sensor systems
for geotechnical monitoring
&
Early Warning Systems**

FORMOSE

Seolane, Barcelonnette

26 June 2013

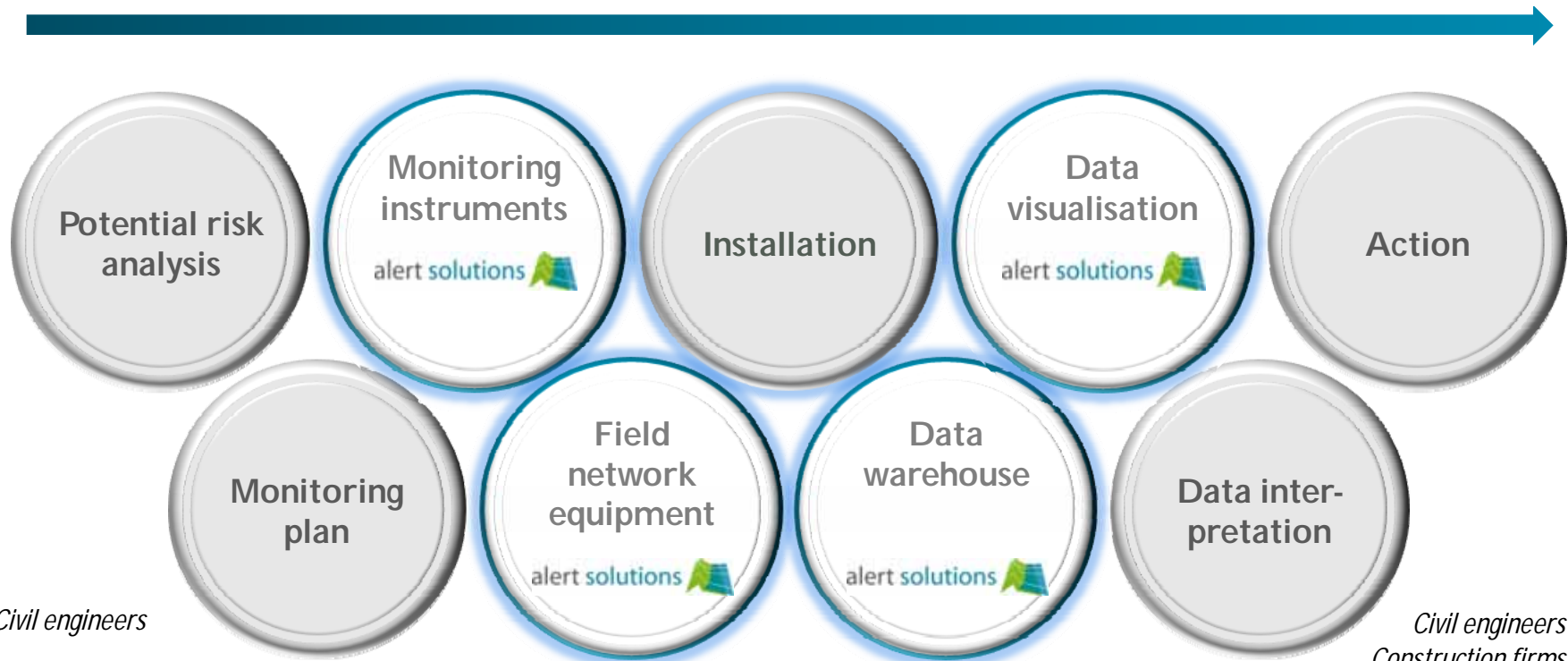
Alert Solutions - Company Focus

- Deliver a technology platform that creates sensor networks for real-time monitoring
- Ability to turn any object into an intelligent connected device, no matter where in the world
- Serve geo-technology and civil engineering disciplines
- Specific focus on flood control, slope stability and construction works



Alert Solutions at the core of smart monitoring

Monitoring business process



Civil engineers

Civil engineers
Construction firms



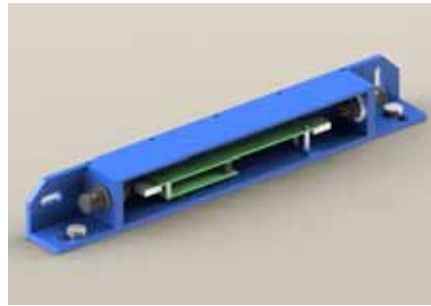
Product examples (hardware)

Sensor devices

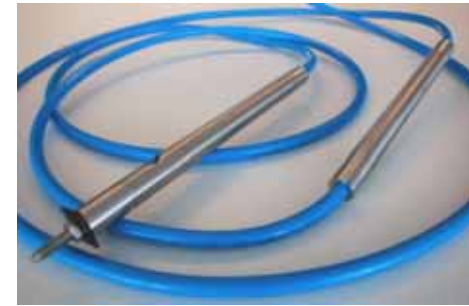
Multi-sensor/piezometer



Precision tilt sensor Beam level



GeoBeads® multi-level array



Network devices

Network controller



3rd party sensor interface



Network hub



Third party product integration

Sensor devices

Inclinometer array



Automatic settlement



Soil moisture



Data feeds

Meteo

River levels

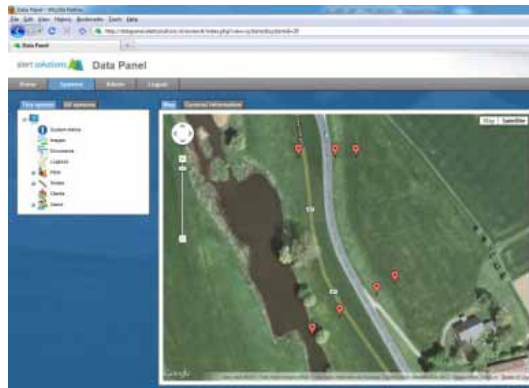
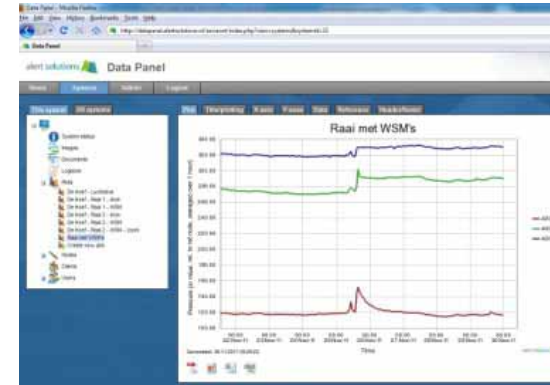
Traffic density

Software suite (online data access)

Online data panel

Real-time dashboard

Data forward and download

A screenshot of a web browser displaying a data panel. The main feature is a grid of numerical data points. The grid has 4 columns and 4 rows. The values are: Row 1: 100.85, 100.89, 100.89, 100.86; Row 2: 0.01, 0.04, 0.05, 0.02; Row 3: 23.36, 23.30, 23.22, 23.39; Row 4: 81.41, 82.93, 89.91, 87.79. The grid is surrounded by a blue border and a sidebar on the left with a tree view of data sources.

Completed 60+ projects in three markets

■ Flood control

- *Levees, dikes, dams, embankments*



- 25 sites instrumented
- 4 countries
- Customers include:
 - 8x NL water boards
 - NL Ministry of Infrastructure
 - Several leading civil engineering firms and research institutes

■ Slope stability

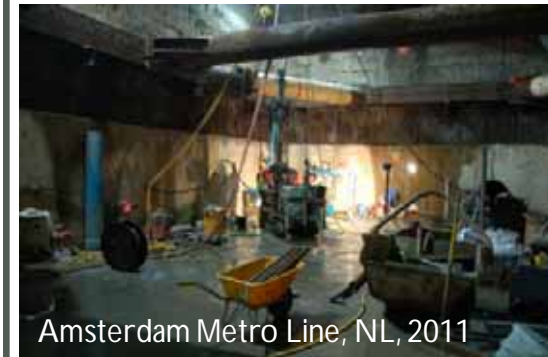
- *Mountain slopes, river valleys, coastal cliffs*



- 3 sites in France
- Slope stability is a major worldwide issue
- Proposals for China and Thailand running

■ Construction works

- *Building pits, tunnels, railway and highway embankments*



- >30 projects served
- Risk reduction in complex construction
- Customers include:
 - City of Amsterdam
 - City of Rotterdam
 - NL water boards
 - Major NL construction companies

Sensor data from Super Sauze landslide

GeoBeads Multi-Parameter Data – Super Sauze – Top of Landslide Site – May through July 2010

Meteorology

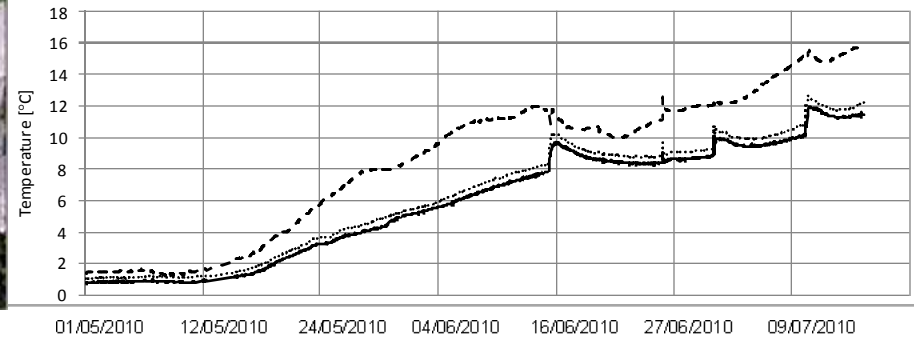
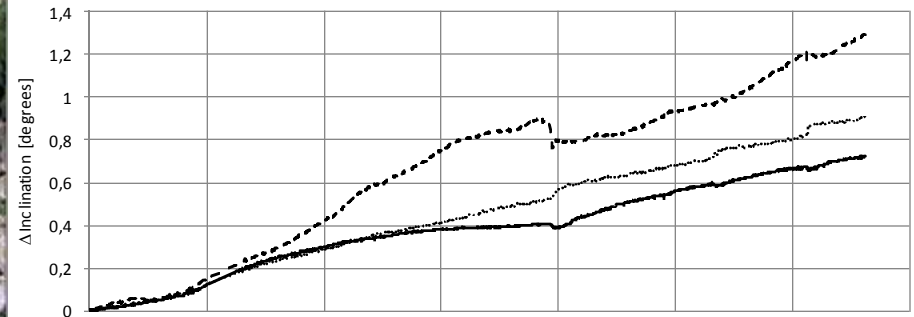
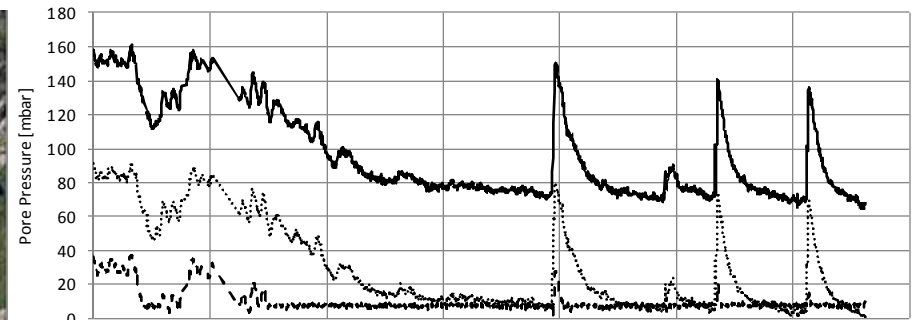
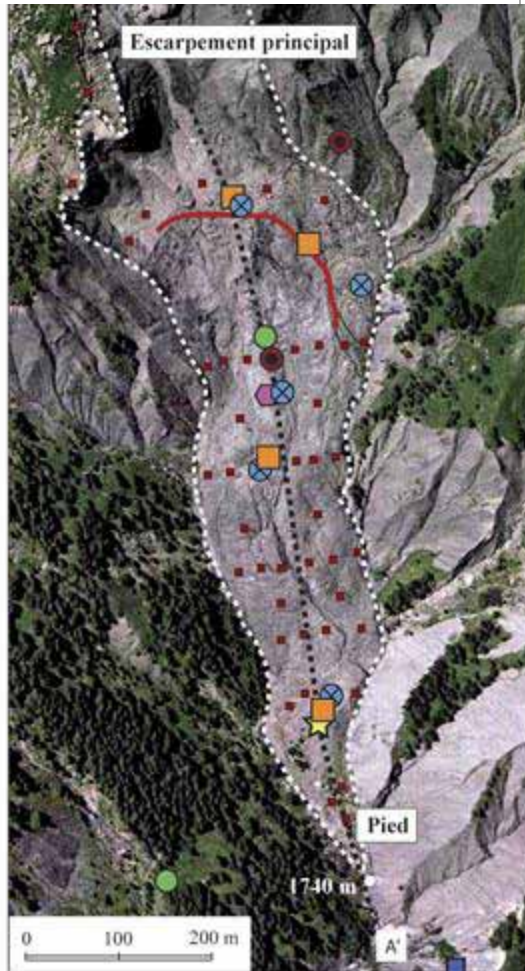
- Meteo station & snow depth

Hydrology & hydrodynamics

- Pore water pressure
- Hydrology & inclinometry (Geobeads)
- Temperature (DTS)

Kinematics

- Seismometer (June/July 2009)
- Extensometer
- GPS
- Topo benchmark
- Hut with VHR optical camera



GeoBeads® for flood control

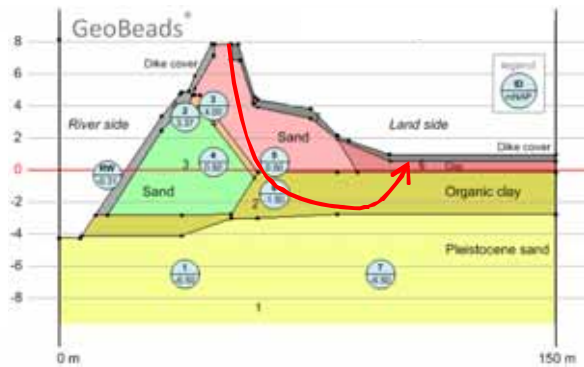
(Province of Utrecht, The Netherlands)

Client: Dutch ministry of Transportation, Water Authority
Object: Levee along a major freight shipping waterway
Project period: September 2012 and running

"With the GeoBeads® system users gain instant and continuous insight in the levee stability. This is vital input for early warning. It also supplies engineers with the information to optimize the strengthening regime, with large potential savings."

Mr. G. Loots, TNO

Design of smart sensor network



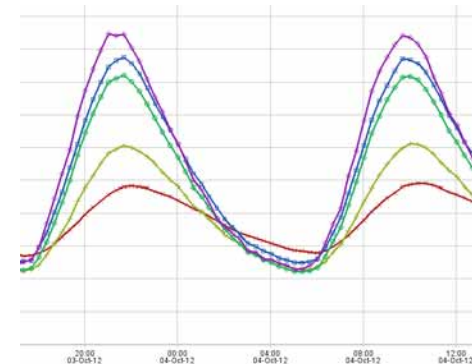
- This levee is at risk of macro instability (low shear strength of levee under heightened loading conditions) and has shown substantial water seepage

Installation of GeoBeads®



- GeoBeads® sensors are installed in all relevant ground layers for continuous monitoring of pore water pressure, temperature and tilt

Online data availability



- Client is offered live and continuous insight into the measurements and the results of stability calculations

GeoBeads® for construction control

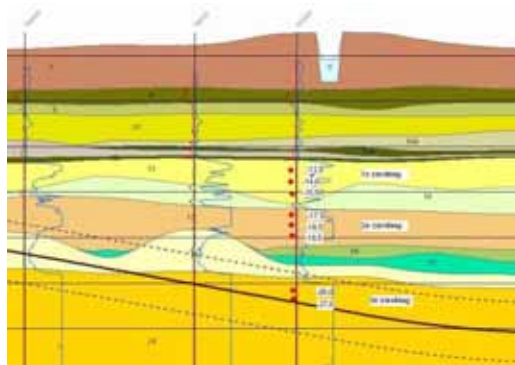
(City of Amsterdam, The Netherlands)

Client: Civil Service North-South metro line Amsterdam
Object: Direct vicinity of major tunnel boring works
Project period: June 2011 – March 2012

” The GeoBeads® system gave us real-time insight into the groundwater pressure effects caused by the tunnel boring process. It gave us the opportunity to validate our construction design and control the risk of instabilities in the direct vicinity”

Mr. R. de Nijs, Witteveen+Bos

Design of smart system



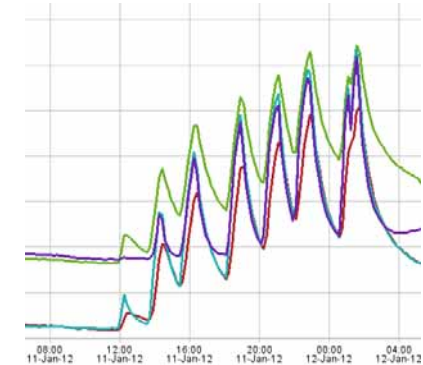
- The foundations of buildings and bridges rest on the top two sand layers. Nearby construction activity (tunnel boring) can potentially cause instability

Installation of GeoBeads



- Alert Solutions installed GeoBeads® for monitoring of pore water pressure in the sand layers near the tunnel boring machine trajectory

Online data availability



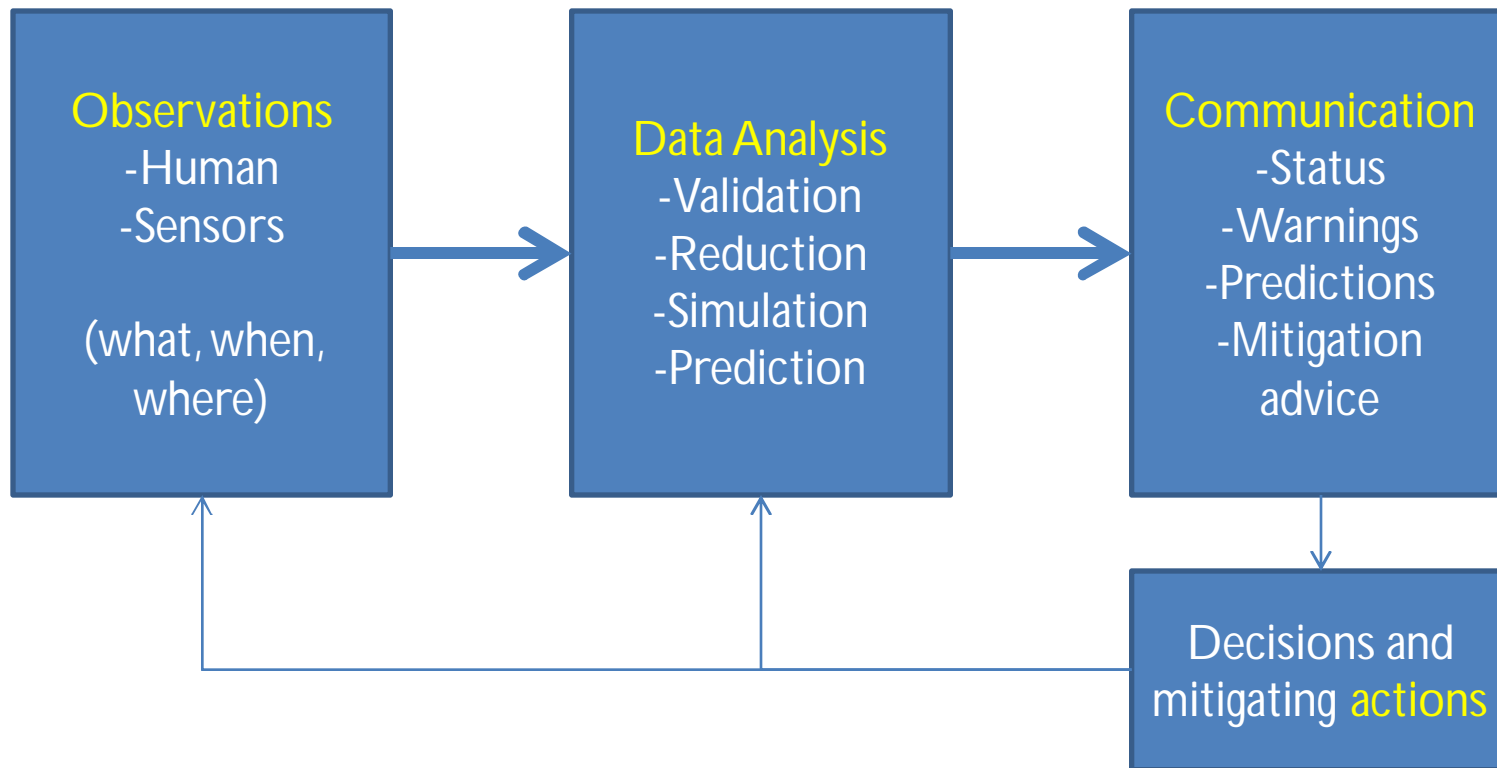
- Client gained real-time data access and was able to control construction activities in relation to ground water pressure build-up

Early warning systems in practice

- What should an early warning system do?
 - Inform people
 - About upcoming hazards
 - In time
 - To prevent or reduce damage

Early warning systems in practice

- Key ingredients of an early warning system



Early Warning Systems - Communication

- Intuitive for anyone
 - Decision makers, stakeholders, general public
 - Zero learning time in crisis situation
- Reduce information to what is necessary, but still complete
- Information may include
 - What's happening, where and when
 - Ongoing development of the situation (trends)
 - Expected / predicted turn of events
 - Time left before disaster event
 - Potential impact (damages)
 - Suggested mitigating actions and their expected results
 - Time involved to take action
 - Actual result of taken actions

HAVE EARLY WARNING SYSTEMS ENJOYED WIDESPREAD ADOPTION?

Examples of recent EWS developments

- IBM (USA)
 - Global center of excellence for water management based in Amsterdam The Netherlands
- Siemens (Germany)
 - Flood prevention and water quantity management center based in The Hague, The Netherlands
- AGT International (Switzerland)
 - Center of Excellence for Water based in The Hague, The Netherlands

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