

TRANSPORTATION



GERMA, or how to manage the risks in complex civil engineering projects

The 4-year GERMA project was managed by Artelia and involved four engineering companies, a construction firm and three research laboratories. The aim was to develop methods and tools and put forward recommendations to help analyse and treat risks of all kinds occurring in complex civil engineering projects on any type of structure. Accredited by the Advancity research cluster, GERMA was partly subsidised by the French National Research Agency. The results were presented at a meeting held on 16 June 2011. A methodological guide was published by Syntec-Ingénierie, the French professional engineering federation.



Jean Bergounioux
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In 2011 we set up a Research and Innovation Committee in Artelia's Urban Development and Transportation sector, which I was appointed to chair. Its aim is to stimulate, coordinate and promote the research and innovation activities carried out by our teams, located far apart geographically and with very different backgrounds prior to the creation of Artelia. By structuring our research topics and our technological monitoring, we are able to identify our objectives more clearly. In liaison with the group's Research and Innovation Committee, our sector committee helps to ensure that experience in managing in-house or collaborative research is shared more effectively. In 2012, we can already measure the beneficial effects of rationalising our research efforts.

In the area of land transportation, Artelia's research efforts concentrated mainly on dynamic regulation, traffic flow modelling and complex urban structures. Major research projects on river and maritime transportation and the associated infrastructure have been described earlier in this report.

For **road and motorway transportation**, Artelia is developing data acquisition systems (virtual sensors), and processing methods and tools adapted to traffic management with a view to ensuring dynamic regulation.

As part of a project to create a dedicated bus lane along a particularly busy 34 km section of an urban motorway in the Paris region, Artelia designed innovative methods for **handling the extreme complexity** created by the confined environment, the many feeder roads and interchanges and the large number of stakeholders involved.

Artelia also developed a **flow model** for simulating loading/unloading operations involving numerous exceptional convoys on a large, complex work site with no logistics base.

To ensure smoother, faster **pedestrian movement in a major station**, Artelia developed an innovative approach as part of a prototype project. This enables to take into consideration more effectively, at various times during peak periods, the behavior of different types of passengers (in terms of time taken to get to the station, speed of boarding and alighting from trains, routes taken depending on natural bottlenecks, etc.), the comfort criteria (depending in particular on passenger density), and the safety requirements (time taken to clear platforms, etc).

In the field of **complex urban structures**, Artelia invented the ODIL concept, a roofing structure with no expansion joints. Another development was a method for designing grassed roadway structures requiring little maintenance for car parks at stadium-type facilities, used about 30 times a year.

Other areas of research involved simulating the electricity requirements for a tramway network or for new payment methods.



Nastaran Vivan
Director
Infrastructure

Artelia is very often called on to design complex urban structures, and meeting our clients' requirements involves constant innovation. As an example, Artelia developed the ODIL concept (a roofing structure with no expansion joints) for a prototype application for the 1,600 m covered section on the A6b motorway at the southern exit of Paris. In order to use as few expansion joints as possible, which normally need to be positioned every 20 to 30 m, an innovative approach was developed using composite steel-concrete design calculation methods. This approach helps to transfer and absorb the forces induced by the blockage of the deck on the tunnel walls.

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