BRIME

Bridge Management in Europe

Funding: European (4th RTD Framework Programme)
Duration: Jan 1998 - Dec 1999
Status: Complete with results

Background & policy context:

Europe has a large capital investment in the road network including bridges, which are the most vulnerable element. As bridges age, deterioration caused by heavy traffic and an aggressive environment becomes increasingly significant, resulting in a higher frequency of repairs and possibly a reduced load carrying capacity.

Deterioration is exacerbated because many modern structures are more prone to chemical degradation than their forerunners. The effects of alkali silica reaction, chloride ingress and carbonation exacerbated by low cover and poor quality materials are causing progressive deterioration of the bridge stock.

The direct cost of the engineering work necessary to maintain a satisfactory road network is high. However, indirect costs due to the resulting traffic congestion and disruption can be much higher and cause a severe economic penalty particularly on the increasing number of roads where traffic flows are reaching saturation.

Objectives:

The overall objective of the project will be to develop a framework for the management of bridges on the European road network and identify the inputs required to implement such a system. This project will look at the various modules required to enable the bridge stock to be managed, review the current state-of-the-art and produce an outline framework for management of the bridge stock.

Methodology:

The task will be achieved by examining the various inputs required for a bridge management system, covering the, condition, load carrying capacity, and the rate of deterioration.

In addition, the mechanisms by which decisions are reached will be examined by:

- the most appropriate action for a sub-standard or deteriorated structure i.e. whether it should be repaired, strengthened or replaced;
- mechanisms for prioritising bridges in terms of their need for repair, rehabilitation or improvement.

To achieve the aim, the project will involve:

- classification of the condition of a structure;
- assessing the load carrying capacity of existing bridges, including the use of risk based methods;
- modelling of deteriorated structures and effect of deterioration on load carrying capacity;
- modelling of deterioration rates;
- deciding whether a sub-standard or deteriorated structure should be repaired, strengthened or replaced;
- prioritising bridges in terms of their need or repair, rehabilitation or improvement;
- review of systems for bridge management and development of a framework for a bridge.
management system.

Related Projects:
- PARIS: Performance analysis of road infrastructure
- PAV-ECO: Economic evaluation of pavement maintenance & life cycle cost at project and network level
- WAVE: Weighing-in-motion of axles and vehicles for Europe

Parent Programmes:
FP4-TRANSPORT - Specific research, technological development and demonstration programme in the field of transport, 1994-1998

Institute type: Public institution

Institute name: European Commission; Directorate-General for Energy and Transport (DG TREN; formerly DG VII)
Funding type: Public (EU)

Partners:
Transport Research Laboratory (UK); Centro de Estudios y Experimentacion de Obras Publicas (E); Bundesanstalt für Straßenwesen (D); Laboratoire Central des Ponts et Chaussées (F); Norwegian Public Roads Administration (NO); Slovenian National Building and Civil Engineering Institute (SI).

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Key Results:
As part of the project, a questionnaire was sent to the BRIME participating countries (France, Germany, Norway, Slovenia, Spain, UK) to obtain general information on the national bridge stock, the condition of the bridges, and their main forms of deterioration. The sources of bridge deterioration could be divided into three groups:
- deterioration or defects arising from faults in design and construction,
- defects arising during construction, and
- deterioration from external influences.

A simple model has been developed for categorising damaged locations in concrete structures. The model is based on a visual assessment of the damaged area as well as on test results, both on site and in the laboratory. It uses the neural network hybrid model and can assess the type of repair work required on structures with a large number of deteriorated areas.

The structural assessment module, developed for the BRIME project, has given information on the load carrying capacity of bridges. It has consequently reconstructed the load carrying capacity history of a specific bridge, as well as of the overall bridge network.

The project has developed a method that considers all costs involved in the designing, constructing, inspecting, maintaining, repairing, strengthening and demolishing a bridge as well as the associated road user costs, in order to choose between bridge repair alternatives.

It has also shown how it is possible to combine results from the main bridge management activities, such as inspections, assessment, testing, maintenance, prioritisation and replacement, to produce a framework for a computerised bridge management system.

Policy implications
The work undertaken in the BRIME project has provided a framework for a Bridge Management System which would enable the bridge stock on the European Highway Network to be managed efficiently and effectively. The Bridge Management System addresses all activities throughout the life of a bridge, from design and construction to replacement, and is aimed at ensuring its safety and functionality. The implementation of this framework would require a detailed inventory of the bridge stock and the development and application of reliable inspection, assessment and maintenance procedures.

In the future, despite the expected improvements in the information processing system, engineering judgement will still probably be necessary to take decisions in terms of priority and maintenance options. Given this scenario, computerised management of bridges will be mainly used for data storage and retrieval and to inform the decisions made by engineers.

Expected developments will include further applications of the use of artificial intelligence methods for various aspects of bridge management. In the future, the Bridge Management System must become a part of a wider European asset management system (the overall highway network management system) which will be able to ensure to the society the maximum benefit from its investment in the highway infrastructure.

Documents:
* brimerep.pdf (Final report)

**STRIA Roadmaps:** Infrastructure
**Transport mode:** Road transport
**Transport policies:** Decarbonisation, Societal/Economic issues
**Geo-spatial type:** Other