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Autor: Pickett, Alan / Das, Parag
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Future Trends in Design and Maintenance of Structures

Alan PICKETT
Divisional Director
Highways Agency
London, UK

Alan Pickett, is responsible for the civil engineering standards by which roads and bridges are designed, built and maintained in the UK

Parag DAS
Project Director Bridge
Highways Agency
London, UK

Parag Das, is a chartered civil engineer with many years experience in developing bridge design and management procedures

Summary

Whilst globally governments are coming to terms with the need for sustainable development, this still has to translate and cascade through to practical policies and actions. When it does, it will impact and manifest in the design and management of structures. This is just beginning in the UK and this paper addresses some of the issues that are beginning to emerge and impact on bridge design and management. The paper looks particularly at the development by the UK, Highways Agency of a structures database around with sustainable maintenance strategies for the bridge stock can be developed.

Keywords: Sustainability, bridge management, design codes, structures database.

1. Introduction

The Kyoto Protocol of 1997 has led to the acceptance by most of the world's developed countries to a commitment of a 5.2% reduction in CO₂ emissions by 2010. This real target brought a new urgency to the debate about the major sustainable development challenges that confront construction. They include global issues such as resource depletion, protecting bio-diversity and climate change. The processes and potential impacts are not yet well understood but as knowledge advances the implications for design and management of existing and future buildings, infrastructure and communities will need to be addressed. This paper addresses some of the issues that will need to be addressed in the design and management of bridges. It particularly looks at the development in the UK of the Highways Agency's Structures Management Information System (SMIS), which will support the development of a sustainable management strategy for the Highways Agency's 15,000 structures including bridges.

2. What is "Sustainability"?

The UK Government's vision of sustainable development is based on four broad objectives.

- Maintenance of high and stable levels of economic growth and development.
- Social progress which recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.

The objectives need to be translated through policies and practically applied to the built environment, including bridges. It will mean some changes to current thinking.

3. Bridge Design

Bridge design codes and standards have traditionally concerned themselves with safety and economy, embracing all aspects of techniques and materials. The every widening spectrum and increasing rate of change threatens to outstrip their usefulness and in future they may need to concern themselves only with the fundamental requirements, which will include sustainability as well as safety and economy. Engineers will use their skills and wealth of information becoming available to meet them. However, much more research and information on sustainability issues is needed.

Bridge owners and designers do not have the information or rationale to make optimum decisions. New techniques and developments to whole life costing and design life will be needed as well as radical changes in conceptual thinking. For future, sustainable, bridge design we can expect to see wider but more basic performance requirements, embracing sustainable issues coupled with component specific design lives to reflect future functional uncertainty and sustainable considerations.

4. Bridge Stock Management

Sustainable management should ensure that future generations will not face a costly and burdensome legacy from our activities of today. Such burdens can be environmental pollution, depletion of natural resources, as well as economical and logistical burdens.

There is a lot to do before it can be claimed that bridges are managed in a sustainable way. In the UK a structures database containing key information providing a high level review of the performance of network structures is seen as a fundamental building block and starting point, around which sustainable maintenance strategies for the bridge stock can be developed. Current performance indicators being developed seek to avoid future logistical and funding problems, but the system is being developed so that it can accommodate any change in values arising from issues of sustainability.

5. Conclusion

Engineers are just beginning to come to terms with sustainability and what this may mean for bridge design and management. The paper describes some of the issues that engineers may have to contend with and which may overturn conventional thinking. The paper also describes part of the development of the Highways Agency's future bridge management methodology aimed at addressing future sustainability needs. Many issues remain to be decided.