Learning from the damage history of bridges: a case study

Learning from the Damage History of Bridges – A Case Study

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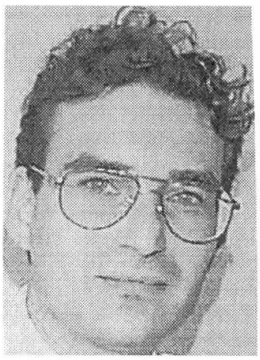

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Summary

The Swedish Road Administration has, at the present, a relatively intact and well-organised bridge archive system. Most of the former bridge inspections performed on the public road network after the nationalisation of the Swedish roads in 1944, are documented and stored in different archives throughout the country. The information from these inspections has been fed into a Microsoft Access database called BEA (Bridge Element Analysis), with the purpose to explore the possibility to determine the damage occurrence, damage growth and the real service life for bridge structural members.

In this case study it is examined, if certain information and factors like geographical location, traffic, and weather data at the time of casting, affect the service life of bridge structural members thus the service life of bridges. Based on the information stored in the BEA database, the service life of bridge structural members in certain service life conditions may be estimated. For example, the real service life of bridge members as a function of the outside airs temperature at the time of the concrete casting. The information stored in the database may also be used in the development of a damage growth model based on the assessed condition at the time of inspection.

Keywords: Bridges, Service Life, Bridge Structural Member, Bridge Management, Database, Estimated Service Life, Damage Type, Damage Cause.

1. Introduction

It is generally expected that during their service life, bridges can fulfil certain demands such as traffic safety, continuous traffic flow and a designed load bearing capacity. Regular and systematic inspection of the existing bridge stock should be performed in order to verify that such demands are met at all times.

2. Relational database

The Windows - ACCESS database, BEA (Bridge Element Analysis), specially developed for the needs and requirements imposed by this research project, deliberately uses the same codes, definitions and terms as used by the Swedish National Road Administration. The BEA database is described in detail under chapter four in the Licentiate Thesis "Konstbyggnaders reella livslängd". The database BEA has great development possibilities. New objects can be created without difficulties. The performance can be improved if that becomes a priority, for

example, through division of the database or better query design. Many queries have developed during the investigation. This is mainly due to the many questions of issues and reports that have occurred throughout the project.

3. Damage picture in the investigation

3747 bridge inspection remarks on the 353 investigated bridges have brought forward 2980 damage remarks where type- and cause of damage were stated and 767 remarks where the structural members were considered flawless at the time of inspection. Even if the results are not significant for the entire country, they are giving a clear indication of the general condition of the bridges in certain parts of Sweden.

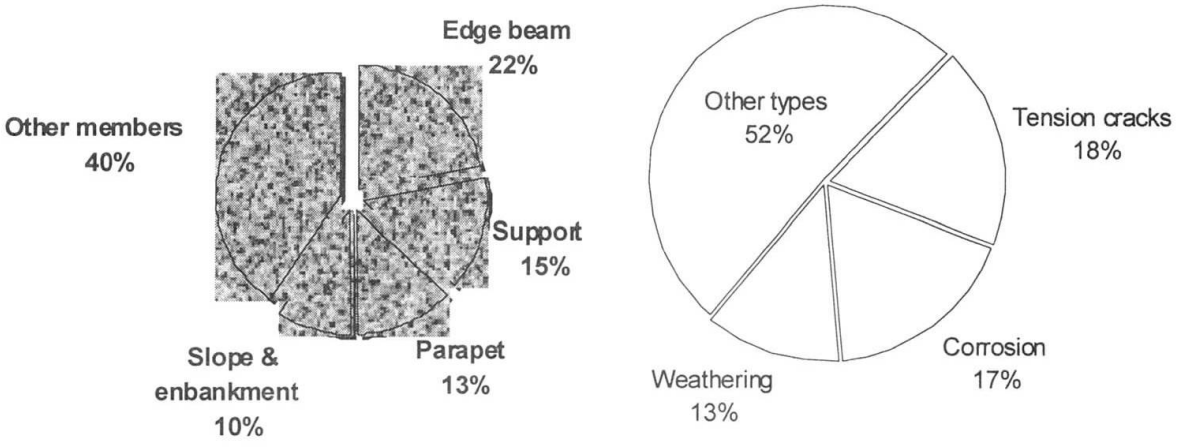

Fig. 5 *Percentage distribution of the damage types remarks on the bridges' different structural members, all condition classes.*

4. Conclusion and final comments

Obviously, BEA database can be used to achieve important information about the service life of bridges and their structural members. The historical information from former bridge inspections can be used to determine the growth of damages in time, certain service environment and bridge generation. The database can be used to examine, if information and data like geographical location traffic and weather data at casting, may influence damage growth and therefore effect on the service life of bridge structural members and also the service life of bridges. For the 353 bridges in the study, 22% of all inspection remarks are related to the structural member "Edge beam". The Swedish design and construction method of edge beams has to be improved as regarding durability. Based on the information in the database BEA, the service life of bridge structural members may even be estimated with a modified factor method, not presented in this paper. The information in the BEA database is very useful but not, however, representative for the whole country. The database should be completed with more bridges situated in different parts of Sweden.

It is also important to note that the heart of any management system, the database, is highly dependent upon the information put into them. The quality, and not neccesarily the quantity of information is essential when it comes to predicting damage growth.