



Multi Mapping in Condition Assessment of three City Bridges

**Aleksander
WAWRUSIEWICZ**
Ph. D.
Białystok Technical
University
Białystok, Poland
alekwawr@pb.bialystok.pl



Aleksander Wawrusiewicz, born 1957, received his civil engineering degree from the Warsaw Technical University. In 1992 received his Ph.D. degree from Białystok Technical University, where he is working till today. Author of many evaluations of structures, mainly bridges as well as publications about diagnostics of concrete structures.

Summary

The conception of the unified presentation of reinforced concrete bridges tests results realized implementing varying diagnostic methods is presented in the paper. The Multi Mapping procedure comprises maps charting for the investigated surfaces incorporating corrosive state of reinforcement, concrete strength, the range of carbonation, the thickness of concrete cover, the contents of chlorides, the permeability of concrete cover etc. Maps created on the same base are more precisely outlining existing deterioration factors. The overlapping of these maps will enable to specify the areas requiring special diagnostic control, or estimation of complex hazards of structure durability. The case study presented in the paper shows results of Multi Mapping investigations done on three similar concrete bridges, located in the same city and on the same river.

Keywords: diagnostic, concrete bridges, Multi Mapping.

1. Introduction

All concrete bridges independent from their size should have secured exploitation reliability. The ageing concrete infrastructure demands increasing maintenance expenditure. Sensible management in solving of maintenance problems require new and complex diagnostic assistance, like Multi Mapping approach. The exemplary practical application of Multi Mapping method is related to three city bridges in Białystok. Investigations were carried out on the whole concrete structure of the bridges, in the paper are compared results collected on the slab spans of the bridges.

2. Saint Joan Street Bridge

2.1 Structure describing



Fig. 1: Typical view of the bridges

All bridges were built in the some time: between 1960 and 1962, they have near the some total length between 14.7 and 17.0 m. All are performed as reinforced concrete single span frames with cantilevers, like Saint Joan Street Bridge (*Fig. 1*). The structural parts of that bridge are in various technical condition. Concrete and reinforcement corrosion are influencing together structure durability. Due to Multi Mapping analysis the identification of destruction hazards and their causes was performed.

2.2 Corrosion state of reinforcement and its possible causes

Maps illustrating hazard d_E resulting from reinforcement corrosion, hazard d_{Cl} of occurrence of the critical contents of chlorides, hazard d_c caused by carbonation of reinforcement cover and the map showing the local concrete strength f in evaluated bridge slab are presented in Fig. 2-7.

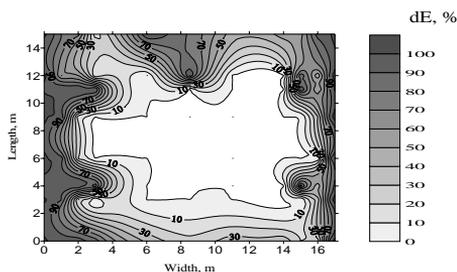


Fig. 2: Hazard d_E resulting from reinforcement corrosion

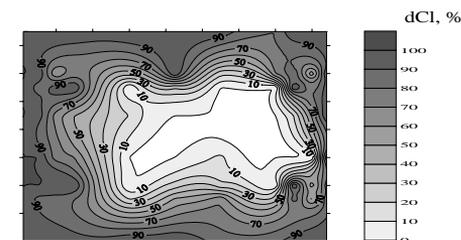


Fig. 3: Hazard d_{Cl} of large occurrence of chloride critical value

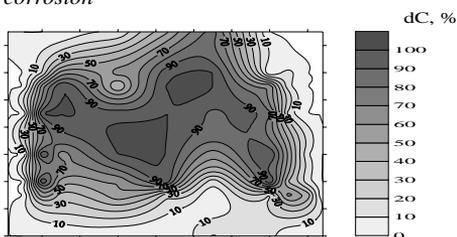


Fig. 4: Hazard d_c of carbonation of reinforcement cover

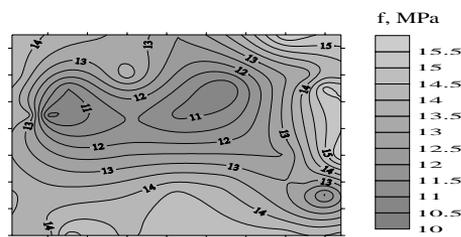


Fig. 5: Local concrete strength

2.3 Determination of destruction causes

The result of evaluation of hazard $d_{E(Cl)}$ of reinforcement corrosion caused by chloride activity d_{Cl} and the hazard $d_{E(C)}$ of reinforcement corrosion caused by carbonation is shown on Fig. 6 and 7.

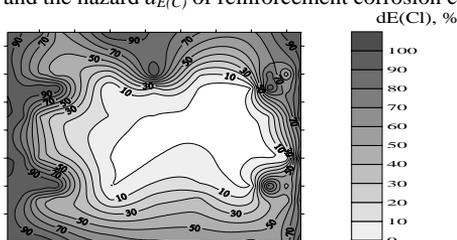


Fig. 6: Hazard $d_{E(Cl)}$ of reinforcement corrosion in result of chloride action

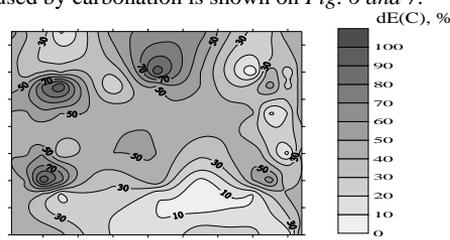


Fig. 7: Hazard $d_{E(C)}$ of reinforcement corrosion in result of carbonation

3. References

- [1] WAWRUSIEWICZ A., "Multi Mapping Procedure in Forensic Engineering", *Structural Engineering International, Journal of the IABSE*, Vol. 17, No. 2/2007, pp. 172-177.