

Book review

CONCRETE BRIDGE STRENGTHENING AND REPAIR

Iain L. Kennedy Reid. Thomas Telford Limited, London, 2009.
ISBN 978-0-7277-3603-1, £40.00, 128 pp.

Kennedy Reid's book, recently published by Thomas Telford, consists of a compilation of 20 case studies relating to the maintenance of the Midland Links by Atkins Highways & Transportation on behalf of the Highways Agency. The book is a very useful collection of individual problems and their treatments, many of which have been described in various reports and conferences over the years. The book is a companion to *Steel Bridge Strengthening* by the same author (Kennedy Reid *et al.*, 2001).

The Midland Links connecting the M5 and M6 motorways near Birmingham in the UK carry about 140 000 vehicles per day, 30% of which are heavy goods vehicles. Over 20 km of this section of the UK motorway system was built on elevated viaducts to avoid conflict with existing road, railways, canals and other industrial development. The viaduct system consists of some 1200 reinforced concrete spans.

The structure was opened to traffic in 1972, but began to experience problems within 4 years, due initially to the failure of the buried joints used, which were not able to cope with the unexpectedly heavy traffic. Many of the subsequent problems related to the application of de-icing salts, exacerbated by the leaking joints which allowed the chlorides to contaminate the crossbeams and bridge substructures causing widespread corrosion. Other defects also became evident as more detailed inspections were carried out. These included insufficient reinforcement, voids in the concrete, settlement of supports, low cement content, shrinkage of the concrete, and the use of reactive aggregates leading to alkali-silica reaction.

Each of the case studies in the book is clearly laid out in terms of a summary and diagnosis of problem, the specific objectives of intervention, the various options considered and the solution adopted. Emphasis is appropriately placed on the correct diagnosis of the root problem and the need to eliminate this problem rather than simply relieving the symptoms of it. The implementation of each solution is also described, along with a description of other issues such as safety, site access, management of substandard structures pending and during intervention, and the overriding need to minimise traffic disruption as much as possible.

The case studies cover a range of problems and the often innovative solutions adopted, both as interim measures and for long-term rehabilitation. They include situations in which engineering intervention was avoided by using advanced analysis, detailed investigations and laboratory testing to justify departures from standards. Some of the projects utilised innovative solutions such as cathodic protection, shock transmission devices, etc., to enable structures to continue in service. In others, major reconstruction was required including extensive concrete repair, complete replacement of cross-heads and piers, and strengthening of columns for impact resistance. The level of detail provided for some of the case studies is low, particularly in relation to the analysis and testing work that was carried out as part of the selection and implementation of the solutions adopted. References in which this information is available would have been a useful addition for those readers who would like more technical detail.

As some of the rehabilitation work was carried out a number of years ago, it would have been very useful if some comments were made on the performance of the various repair systems, providing information on long-term serviceability and durability.

The book provides useful insights into the problem of concrete deterioration in bridges, based on 20 years of experience in dealing with the Midland Links. Bringing these case studies together within a single publication provides bridge engineers with a very useful reference on how to deal not just with the technical problems of deterioration but also the associated issues such as site access, traffic management and structural safety. The book forms a useful companion document to the various concrete repair guides available on this subject (BRE, 2005; Pearson and Patel, 2002). With this book, Kennedy Reid has provided bridge maintenance engineers, managers and owners with a very useful addition to their library.

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REFERENCES

- BRE (British Research Establishment) (2005) *Concrete Durability and Repair Pack*. BRE Publications, Bracknell.
- Kennedy Reid IL, Milne DM and Craig RE (2001) *Steel Bridge Strengthening*. Thomas Telford, London.
- Pearson S and Patel RG (2002) *Repair of Concrete in Highway Bridges: A Practical Guide*. TRL, Wokingham.