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S. K. Fullalove, *Editor*

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Air link: building London's elevated light-rail extension

A. Alder, J. Best, A. Sharpe and J. Cronje
Proceedings of the Institution of Civil Engineers, Civil Engineering, **161**, No. 2, May, 87–95, doi: 10.1680/cien.2008.161.2.87

The Docklands Light Railway in London has been extended to London City Airport, providing an essential public transport connection between the airport and the London Underground rail network. This paper describes the design and construction of the challenging 4.4 km, twin-track extension—two-thirds of which had to be built above congested urban space on a viaduct—and its four new stations. The viaduct typically consists of post-tensioned concrete segments with span lengths of up to 37 m, with three longer spans being built using the balanced-cantilever method.

Lessons from historical bridge failures

D. Collings
Proceedings of the Institution of Civil Engineers, Civil Engineering, special issue, **161**, No. 6, November, 20–27, doi: 10.1680/cien.2008.161.20

This paper presents reviews of the histories of seven large bridges that failed or required repair due to a weakness in design either during construction or shortly after being brought into service. All seven failures played a significant role in developing the civil engineering profession's knowledge of structural action and materials behaviour. The author builds upon the important historical research work of others to show that these case histories still hold lessons for the profession today. In particular, they all had some precedent, which at the time went largely unnoticed, indicating that such failures may be controlled or foreseen.

Lessons learned from the bridge collapse in Palau

C. Burgoyne and R. Scantlebury
Proceedings of the Institution of Civil Engineers, Civil Engineering, special issue, **161**, No. 6, November, 28–34, doi: 10.1680/cien.2008.161.28

The collapse of a record-breaking 240 m span prestressed-concrete bridge in the Pacific island nation of Palau occurred

without warning in 1996. The parties involved were subject to a confidentiality agreement, so no definitive statement has been made as to the cause of the collapse. This paper reports on a study carried out using information in the public domain. It concludes that a repair carried out six weeks before the collapse was not to blame, but did expose weaknesses in the original design. It is recommended that the construction industry should not shelter behind confidentiality clauses but, like the aircraft industry, publish its mistakes so lessons can be learned.

Extended finite-element analysis of fractures in concrete

X.-J. Fang, F. Jin, and Q.-D. Yang
Proceedings of the Institution of Civil Engineers, Engineering and Computational Mechanics, **161**, No. 4, December, 187–197, doi: 10.1680/eacm.2008.161.4.187

In this paper an extended finite-element method (X-FEM) that is fully compatible with standard FE program has been formulated based on a virtual node technique. A cohesive crack model that is appropriate for concrete fracture under mixed-mode loading has been integrated into the formulation. The proposed method was implemented into a commercial FE program as a user subroutine, and two benchmark experimental tests were successfully modelled. The numerical robustness and predictive power of the proposed method have been demonstrated by its excellent predictions on arbitrary crack evolution and the associated load–displacement curves. Detailed numerical investigation of the crack wake shielding effects on the fracture loading curves showed that: (a) crack wake shear shielding has little effect on the peak fracture load and its immediate neighbouring softening phase; (b) the initial shear cohesive stiffness has a significant influence on the descending slope of the softening part of the load–CMSD curve; and (c) the shear cohesive strength appears to make the softening phase more

Bridge distress caused by approach embankment settlement

C. A. Jones, D. I. Stewart and C. J. Danilewicz
Proceedings of the Institution of Civil Engineers, Geotechnical Engineering, **161**, No. 2, April, 63–74, doi: 10.1680/geng.2008.161.2.63

Surtees Bridge, which carries the A66(T) over the River Tees near Thornaby-on-Tees in the UK, has been showing signs of distress that predate its opening in 1981. Subsequent investigations have shown that the bridge distress is related to unexpectedly large settlement of the eastern approach embankment. Recent ground

investigations prompted by a proposed widening of the river crossing have produced many new data on the alluvial deposits underlying the site, and explain why embankment settlement was so much larger than originally anticipated. Comparison of the geotechnical parameters obtained from the original and more recent ground investigations suggests that the original investigation significantly underestimated the thickness of an alluvial clay layer underlying the site, and that its coefficient of consolidation was overestimated. Settlement analyses using geotechnical data from the original ground investigations predict moderate embankment settlements occurring principally during construction. Settlement analyses based on all the available data predict far larger embankment settlements occurring over extended time periods. The latter analyses predict an embankment settlement similar to that observed and of sufficient magnitude to cause the observed lateral displacement of the bridge due to lateral loading of its piled foundation.

Bridge-building in Malawi: a student expedition

H. Kirk

Proceedings of the Institution of Civil Engineers, Municipal Engineer, **161**, No. 3, September, 191–198, doi:10.1680/muen.2008.161.3.191

A group of students from Imperial College London spent two years working on the design and construction of a footbridge for a remote village in northern Malawi. This exciting project allowed the students to develop engineering and organisational skills while working on a structure that would bring real benefit to an impoverished community. The team faced considerable challenges throughout, both in terms of the low-technology construction and in learning to deal with logistical, social and cultural issues. This paper discusses the need for the bridge, a range of issues raised by the construction process and the outcomes of the project. It also offers some recommendations to those taking part in similar projects in the future, based on the team's experiences in Malawi.

Effect of the Froude number on assessment of the bridge afflux

G. Seckin, D. W. Knight, S. Atabay, and N. Seckin

Proceedings of the Institution of Civil Engineers, Water management, **161**, No. 2, April, 97–104, doi: 10.1680/muen.2008.161.2.97

This paper presents the findings of laboratory model testing

of arch and straight-deck bridge constrictions, in a symmetrical compound channel flume having different roughness conditions. Four different types of bridge models, namely a single-opening, semicircular arch bridge, a multiple-opening, semicircular arch bridge, a single opening, elliptic arch bridge, and a straight-deck bridge with and without piers, were used in the testing programme. The validity of the Biery and Delleur method developed for the single cross-sectional-shaped arch bridge constrictions was examined for a compound channel case. The effect of different definitions of the Froude number on the application of the Biery and Delleur method was also investigated. The results showed that the Biery and Delleur method agreed reasonably well with the University of Birmingham data presented in the current study, provided that the Froude number was defined in the same way as originally envisaged. Significant errors may result, however, from using this method with definitions of the Froude number that are more appropriate to compound channels.

Improving bridge afflux prediction for overbank flows

G. Seckin, D. W. Knight, S. Atabay and N. Seckin

Proceedings of the Institution of Civil Engineers, Water management, **161**, No. 5, October, 253–260, doi:10.1680/wama.2008.161.5.253

Tests were carried out to investigate bridge afflux phenomena for bridge constrictions in a compound channel flume. The flume had different roughness configurations in the main channel and floodplains. All tests were undertaken for the condition of no eccentricity and no entrance rounding. The normal crossing ($f \frac{1}{4} 08$) and two different skew angles ($f \frac{1}{4} 308$ and 458) were tested for different arch and flat soffit type bridge models. For each set of experiments, the Froude number for normal depth, afflux ratio and blockage ratio (area of bridge below water level to total flow area) were obtained based on an analogical method developed previously. These quantities were analysed to obtain a simple practical afflux equation. This afflux equation was also applied to field data collected by the US Geological Survey and the results were compared with those obtained using the more complex methods such as HEC-2, WSPRO and USBPR.