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Whole life cost analysis in concrete bridge tender evaluation

C. Arya and P. R. Vassie

Proceedings of the Institution of Civil Engineers—Bridge Engineering, **157**, No. 1, March, 9–18

In the UK large sums of money are spent annually on the repair and maintenance of structures. To avoid this problem in future construction, many government and private agencies responsible for asset management have recommended that designers should develop schemes that seek to minimise whole life costs, namely construction plus maintenance costs, rather than just initial construction costs. Currently there is no standard procedure for evaluating tenders in terms of whole life costs and therefore no way of checking that this recommendation is being fully implemented. This paper describes a straightforward model that can be used to assess the whole life costs of concrete bridges exploiting alternative durability options and shows how this model could be incorporated in the tendering process.

Assessment testing Mizen Head Footbridge, Ireland

K. D. Ruane and A. Healy

Proceedings of the Institution of Civil Engineers—Bridge Engineering, **157**, No. 3, September, 117–122

Mizen Head Footbridge in County Cork, Ireland, is a reinforced concrete through-arch structure spanning 50 m. The structure is 95 years old and exhibits typical reinforced concrete defects of spalled concrete, cracking and staining from reinforcement corrosion. An inspection, geometrical survey and a series of material tests were carried out as part of an assessment of the bridge. Petrographic examination of samples removed from the structure gave confidence in the quality of the concrete in the structure. Determination of carbonation and chloride levels in the concrete identified future repair strategies for the structure.

Development of Eirspan: Ireland's bridge management system

L. Duffy

Proceedings of the Institution of Civil Engineers—Bridge Engineering, **157**, No. 3, September, 139–146

The road network in Ireland comprises national primary and national secondary roads, and non-national regional roads and local roads. Since 1994 the responsibility for the management and maintenance of the national roads has rested with the National Roads Authority (NRA). In 2001 the Eirspan bridge management system was introduced to coordinate and integrate activities such as inspections, repairs and rehabilitation work to ensure optimal management of the national road structure stock. This paper summarises the reasons for the introduction of the system and gives a review of the distinct activities included in Eirspan. It describes how bridge components are condition rated within principal inspections and outlines how, after the completion of the inventory gathering and first principal inspections, repair works are priority ranked. Future developments within Eirspan are also discussed. Eirspan helps engineers within the NRA to prioritise maintenance needs and maximise the use of available funding. It has proved to be an invaluable tool in helping to maintain the function and safety of bridges throughout the national road network in Ireland.

Comparison of slab-bridge safety assessment strategies

D. Imhof and C. R. Middleton

Proceedings of the Institution of Civil Engineers—Bridge Engineering, **157**, No. 3, September, 147–155

When assessing the safety of existing structures it is often not economic to use the design codes, which may be rather conservative in nature. In this paper, safety is measured in terms of the factor of safety, defined as the ratio of available strength to total load effect. The paper examines the sensitivity of the safety factor of two example concrete slab bridges to: (1) the method of structural analysis and failure criterion; (2) the inclusion of updated strength information; and (3) the application of site-specific loading. It is shown that in certain cases plastic analysis methods can predict the ultimate load capacity more accurately than conventional elastic analysis. Methods are suggested for calculating the material strength values based on test results so as to better reflect the true in situ strength of the bridge. Finally, the use of a bridge-specific load model is suggested which may lead to an increase of the factor of safety.

Strengthening rail bridge wingwalls for containment barriers

S. K. Clubley and M. E. J. Morey

Proceedings of the Institution of Civil Engineers—Bridge Engineering, **157**, No. 3, September, 163–170

Windsor Branch Railway Bridge carries the busy M4 motorway over a mainline railway and two public footpaths. The route forms the main link from London to South Wales and the south west of England. Constructed in the early 1960s, the bridge consists of five simply supported skewed spans each comprising precast, prestressed concrete beams. The deck is divided longitudinally into two halves by a covered central reserve light-well. A risk assessment identified the bridge as requiring high containment barriers to protect the railway line below. Unfortunately, it was not possible to install these barriers without additional structural strengthening. This paper discusses the use of ground anchors to restrain the wingwalls and capping beams against the collision loads imparted on the structure by the high containment barriers.

Performance of repairs to concrete bridges

G. P. Tilly

Proceedings of the Institution of Civil Engineers—Bridge Engineering, **157**, No. 3, September, 171–174

This paper provides an overview of the performance of repairs made to concrete bridges in the field and subjected to the actions of traffic and weathering. Data have been obtained from some 70 case histories having repair lives of up to 33 years on bridges aged from 1908 to the 1990s. It was found that only 45% of the repairs were reported as being wholly successful when last inspected. Perceived causes of failures are considered and ways of making more durable repairs are outlined.

Controlling holes in the highway

I. Stanley

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 1, February, 8

The Queen's announcement last November that a new Traffic Management Bill will give local authorities more control over utilities is a promise that engineers and motorists would dearly like fulfilled. Ian Stanley of the Campaign Against Road Disruption reports.

Integer Hong Kong Pavilion: showcasing sustainable construction

R. Slade

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 1, February, 19–25

Last month a new sustainable energy centre opened in Beijing. It was formerly the Integer Hong Kong Pavilion, a unique British-inspired industry showcase for sustainable high-rise construction that attracted over 100 000 visitors during 2001 and 2002.The pavilion combines a multi-media exhibition and two demonstration apartments known as 'flats of the future'. It also demonstrates many examples of sustainable, low-waste construction techniques in its own design and construction—not least its re-usability.

Professional engineers' needs for managerial skills and expertise

S. Wearne

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 1, February, 44–48

This paper reviews the results of a questionnaire sent to a sample of chartered engineers resident in the UK in 2002 to survey what 'managerial' skills and expertise they need in their jobs. The data obtained show that most engineers' careers demand a variety of managerial skills and expertise, particularly in two groups of topics: leadership; and the management of projects. These demands vary with age and level of responsibility but some of these managerial skills and knowledge are required early in engineers' careers.

Managing the restoration of destroyed public services

S. Wearne

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 2, May, 54

Following a seminar on recent experiences in attempting to restore severely damaged public services and infrastructure, the ICE is planning a new guide. Stephen Wearne of UMIST's project management division reports.

Choosing the right contract: a probabilistic model

V. Stovin, S. Eccles and M. O'Reilly

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 2, May, 86–90

The inherent risks of civil engineering projects mean the choice of contract can have a significant impact on cost and duration. In the absence of any quantitative comparisons, the decision tends to be based on qualitative criteria or personal preference—which may not result in the best solution either for the client or contractor. Help is now at hand in the form of a spreadsheet-based, probabilistic model which uses a Monte Carlo simulation to plot the possible range of costs and durations associated with each type of contract. This paper shows how the model can be applied to a small tunneling project, making a comparison between fixed-priced and cost plus-fixed-fee arrangements. The results are quite striking, showing the substantial potential cost savings offered by the cost-plus route in this case.

New road-salt additive cuts winter maintenance costs

K. Atkinson

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 2, May, 55

A low-cost additive for road deicing salt has been shown to reduce its corrosive effect by over 80%. Ken Atkinson, former head of highway maintenance at the GLC and now consultant to Safecote, reports.

New transport noise barrier developed in France

P. Jolly

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 2, May, 59

A new transport noise barrier developed in France is claimed to be up to 50% more effective than anything else on the market. Philip Jolly of the French Technology Press Bureau reports on the award-winning design.

Full circle for UK canals: restoring the South Pennine Ring

K. Paylor, M. Marshall and C. Wearne

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 3, August, 116–125

Britain's emergence as the world's leading industrial power in the nineteenth century was highly dependent on its extensive new canal network created by the founders of the UK civil engineering profession. Reopening the network—much of which has been closed for over half a century—is now seen as a valuable catalyst to regenerating Britain's former industrial cities. However, the task presents today's civil engineers with almost as many challenges as the original construction. The £58 million project to reopen the final sections of the trans-Pennine Rochdale and Huddersfield Canals—and thus restore the South Pennine Ring waterway—is a classic example of the flexible and innovative approaches needed to thread new life into today's decayed and congested urban environments.

Voluntary engineering—charity begins at home

M. Doughty

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 6, November, 4–6

Professional engineers are often asked to provide free advice but it is less easy to say no when the client is a charity or community group with little or no funding. There is also much evidence to suggest that providing *pro bono* advice to local communities is actually good for business in terms of networking opportunities with other volunteer professionals, increased employee satisfaction and improved public perception. This papers describes the work of ProHelp, an initiative by the Business in the Community charity to help engineers and other professionals provide coordinated and effective support to local community projects in the UK.

Rebuilding communities after disasters: the role of volunteer engineers

R. Hodgson

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 6, November, 16–26

A major natural disaster breaks down a community's capacity to cope with everyday life through destruction of physical infrastructure, while wars and civil disturbances achieve a similar result through destruction of social fabric. This paper reports on personal experiences of volunteer engineers working with RedR–Engineers for Disaster Relief, and examines ways in which well-planned relief and rehabilitation interventions can restore and enhance community cohesion and coping mechanisms. The result should be a mitigation of future hazards to which the community may be subjected.

Emergency water for a refugee camp: a volunteer's perspective

R. Lorenz

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 6, November, 27–31

This paper is a personal account by a volunteer engineer supplied to Oxfam by RedR–Engineers for Disaster Relief, to provide emergency water supplies within a refugee camp in Macedonia. Originally planned for 5000 people, the camp grew to over 50 000 people within just a few weeks, requiring a rapid escalation in supply infrastructure despite limited availability of materials and expertise. In addition to being able to design a technically simple yet effective and flexible infrastructure system, the paper highlights the fundamental importance of interpersonal skills when working in crisis situations.

How community volunteers can help make disaster response sustainable

J. Ross-Jordan

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 6, November, 32–36

Technology-based disaster response projects are only appropriate of they are built within the social, economic and institutional capacities of a disaster-hit community. Mobilising, training and monitoring community volunteers is the key, helping to ensure that aid-funded projects such as water wells and latrines do not fall into disrepair and disuse. Using case studies of water and sanitation projects carried out by UK charity Tearfund in post-civil war Sierra Leone, this paper shows how quick fixes can be converted into sustainable, long-term solutions when they are conceived, built and maintained by local volunteers.

Sustainable poverty alleviation—changing role for engineers

D. Singleton and N. Hahn

Proceedings of the Institution of Civil Engineers—Civil Engineering, **157**, No. 6, November, 37–42

A significant proportion of volunteer engineers are involved with poverty alleviation in the developing world. Such work invariably involves a contribution from professional engineers, whether voluntary or otherwise. However, there is an increasing danger of using good engineering to support poor policy. The role of engineers is important, but they must work in collaboration with other professionals if long-lasting solutions are to be achieved. As illustrated by the case studies in this paper, sustained alleviation of poverty through implementation of infrastructure solutions requires careful attention to underlying social, economic and political influences.

Making London a walkable city

G. Tanner

Proceedings of the Institution of Civil Engineers—Engineering Sustainability, **157**, No. 2, June, 67–68

The level of walking in London has fallen steadily over the past 50 years but this decline has accelerated over the last decade with a 13% fall in walking trips. To try to reverse this trend, Transport for London (TfL) has published the Walking Plan for London, developed to assist all organizations involved in taking the Plan forward. The Plan supports the revitalisation of public spaces and the creation of a high-quality urban environment that enriches Londoners' experience and appreciation of walking as a valued and enjoyable activity.

Community-partnered contracts in developing countries

M. S. Khan and A. S. Baldwin

Proceedings of the Institution of Civil Engineers—Engineering Sustainability, **157**, No. 4, December, 193–201

There is a growing recognition in developing countries of community-based infrastructure procurement and its potential to achieve sustainable development. The advantages of such an approach are that it encourages participative negotiation of activities and speedier implementation, the use of local resources, skills and appropriate technology, and entrepreneurship within communities. These wider socio-economic impacts arising from community-partnered micro-projects can lead to more sustainable infrastructure through meeting local stakeholders' needs, community empowerment and capacity building. This paper describes the development and use of performance indicators for community-contracted urban infrastructure provision in low-income communities in India, Pakistan and Sri Lanka. In particular, these indicators refer to the dimensions of time and cost; some key performance yardsticks are also proposed. The urban infrastructure and services referred to in these cases are the facilities needed for water and sanitation provision, access roads, street lighting and solid waste management. In general, it was found that costs for community-contracted micro-projects were normally very close to being on target. The quality of infrastructure and service provision also tended to be superior to that envisioned by local government engineers. However, project duration generally exceeded the target but was still comparable to conventional contracts. The overall performance of the community-partnered micro-projects was found to be comparable or better than the conventional micro-contracts; in addition, the performance of these projects in terms of socio-economic elements was likely to far exceed that of the conventional micro-projects.

The Buchanan report: 40 years on

P. Hall

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 1, February, 7–14

The 1963 Buchanan report made significant contributions to the theory and methodology of planning that are of continuing significance, albeit generally unrecognised. Most important was the concept of absolute environmental standards, basic to Buchanan's entire approach, which led him to fundamental and repeated conflict with the economists' notion that all standards had an economic price capable of tradeoff. It came to a head in the contemporary criticisms of the Buchanan report by Michael Beesley and Christopher Foster, never resolved in debates at the time, and was repeated in the deliberations of the Roskill Commission on the Third London Airport, when Buchanan's 1971 minority report rejected both the cost-benefit approach of the other commissioners and its conclusion that the new airport should be located at Cublington in the Aylesbury Vale. It continues today in the debates about the environment, where environmentalists take an absolute position and economists a relative one.

Urban mobility worldwide—how does it look today?

D. Bayliss

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 1, February, 15–25

When Traffic in Towns was published in 1963, the UK motor-vehicle fleet was probably as large a proportion of the world fleet as it has ever been or has been since. While motorisation had proceeded apace in North America in the 1930s, it had not really taken off elsewhere. The UK was one of the first countries outside the US to see a rapid burgeoning in motor-vehicle ownership after the Second World War, with the number of cars growing by 280% and road traffic by 190% between 1938 and 1963. In 1963, the UK road-vehicle fleet comprised almost 7% of the world total. Today it is a little over 4%. It is not surprising, therefore, that we saw the urban traffic-congestion problem as something that was characteristically British. Today, urban traffic-congestion from motor vehicles is to be found in many countries and, severe as our problems can be, it is in cities such as Bangkok, Mexico City, Cairo and Delhi where the largest incidences of urban traffic-congestion are to be found. This paper looks at urban travel in different parts of the world to see how the problems of actual and incipient mass-motorisation considered in Traffic in Towns are manifesting themselves. It leans heavily on the work done in compiling the report Mobility 2001: World Mobility at the End of the Twentieth Century and its Sustainability for the World Business Council for Sustainable Development, produced by a team from the Massachusetts Institute of Technology (to which the author was the senior transport consultant) and Charles River Associates, but the arguments and conclusions here are the responsibility of the author alone.

More or less traffic in towns

M. Buchanan

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 1, February, 27–41

This paper reviews some of the key assumptions and analyses of Traffic in Towns (1963), and finds significant new dimensions to the problems. In particular, towns have changed substantially as a result of the motor vehicle, opposition has undermined road programmes, and threatening new dimensions have been added to the 1963 diagnosis of environmental issues. Though there have been numerous localised environmental improvements, there has also been a steady erosion of environmental standards on many roads and streets. Restraints on the use of cars have been increasingly applied, and road pricing is now available to local authorities. Road user pricing

will not, however, solve all the problems. Moreover, willingness to apply restraints on private vehicle use is likely to be limited to travel markets for which public transport can provide a reasonable alternative to the car. Trains, buses and trams can deliver such alternatives only for long-distance travel and for trips to town centres and other major trip attractors. They could do this much better than is the case today, and therefore further traffic reductions are possible. However, for the bulk of the traffic on the UK's roads, origins and destinations are dispersed, and therefore public transport and rail freight are not good alternatives to the motor vehicle. New forms of transport, capable of outperforming the fast vehicle on the fast road, are therefore needed, and two of particular interest are at advanced stages of development. The major choice to be faced today is concerned with the dispersed (intra-suburban) travel markets. It lies between, on the one hand, improving the road network to cater for the demands for which public transport as we know it is not a realistic alternative and, on the other hand, developing new forms of public and freight transport.

An investigation of lane utilisation on Turkish highways

B. Gunay

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 1, February, 43–49

This paper, being the first report on 'lane utilisation on Turkish highways', explores some of the unconventional characteristics of multilane traffic flows. As in many developing countries, the discipline of lane-based driving in Turkey is fairly weak. Possible reasons for this problem are different driving attitudes, poor road surface, poorly maintained lane markings, and the nonexistence of studs on lane lines. The possible consequences of the problem, thus, could be loss of safety, difficult traffic management, inapplicability of conventional lane-based models, etc. Findings revealed that lateral positions of vehicles within the lane were more disorderly when compared with developed countries, where a normal distribution can be used. Regarding the distribution of vehicles over the lanes, the results in general were significantly different from the existing diagrams of some European highways. The proportion of traffic exhibited totally opposite trends for the median and shoulder lanes in Turkey, especially with wider shoulders. Whereas using the shoulder provided some extra capacity, along with some disadvantages, highways with no shoulders discharged less traffic than their counterparts from the developed world. Therefore, the present paper is thought to be the first step of the research into the problem of untidiness.

Are new rail lines right for Britain?

N. G. Harris

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 2, May, 83–87

A great deal of investment is currently going into the railway industry across Europe, including into new lines. The British Channel Tunnel Rail Link is under construction, and a number of other high-speed lines in Britain have been discussed. This paper considers whether high-speed lines are the best solution in the British context. It challenges those involved in decisionmaking to determine more clearly the reasons for such high-speed lines, where capacity increases are often more important than achieving end-to-end journey time reductions. A number of other strategies for railway investment are also discussed, with the paper concluding that (after operational improvements), a targeted investment in bottlenecks in the existing system may be the most cost-effective solution in general. However, this response is made more difficult by the performance regime on Britain's privatised railway.

Transport costs and urban development

H. B. Wenban-Smith

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 2, May, 89–97

This article offers a selective introduction to two recent books on spatial economics. It focuses in particular on the light that they shed on the role in urban development of transport costs (section 3), rents (section 4) and governance (section 5). Thus, lower transport costs are found to favour fewer, larger settlements rather than small, dispersed settlements, as is sometimes assumed. Rents, often overlooked or considered to be of secondary importance in other treatments, here prove to play a key role in the spatial allocation of activity. By reflecting the costs and benefits attaching to particular locations, they are shown to provide an important market signal as well as a potential policy instrument through taxation. Finally, it is suggested that although infrastructure provision and the role of government policy is rather skated over by the authors of these books, the insights provided by their analysis should be helpful in developing better policies for the future.

Travel time constraints in transport policy

D. Metz

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 2, May, 99–105

Average travel time per person has remained constant at about an hour a day for at least the past 30 years, over which period average distance travelled has increased by over 50%. The average number of trips per person has also held steady, at 1000 per year. It follows that the growth in travel has taken the form of longer journeys at higher average speeds. Most of the intended investment in the UK Government's Ten Year Transport Plan has the effect of increasing average speed. This will increase distances travelled within constant average travel time, will result in increased environmental detriments, and is not likely to have a perceptible impact on congestion. Congestion charging could reduce distances travelled, but raises an issue of equity. Some approaches are discussed that could increase transport system efficiency without increasing average speed.

Planning for the Leeds Supertram

R. Pickup

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 2, May, 107–115

This paper sets out to show how the Leeds Supertram scheme was conceived as part of the Leeds Transport Strategy and the various procedures and criteria which are necessary if such a scheme is to be brought to fruition. It highlights the issues which emerged and the approach to gaining powers and funding. It demonstrates the good partnership working between the

promoters, West Yorkshire PTE and Leeds City Council, and that the scheme has been robust enough to weather all the changes during the last decade and remain the cornerstone of transport ambitions in Leeds. Unfortunately, given recent press speculation that the Government is placing lower priority on major urban transport schemes, the future of the scheme may still not be secure despite the encouragement given following the publication of the Government's Ten Year Transport Plan in 2000.

Evaluation of a national congestion charging system

G. Copley and J. Dodgson

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 2, May, 117–123

In work undertaken for the Commission for Integrated Transport, the authors have demonstrated that a national road user charging system could be developed that would make more efficient use of road space. The system could, in principle, charge motorists on a distance basis for every part of the road system, with charges varying by time of day and level of congestion, avoiding the issue of diversion of traffic onto unsuitable roads that would arise if charges only applied to the motorway system. This 'peak-pricing' mirrors the way we pay for other utilities such as telephone and electricity. The system could be 'revenue-neutral' such that the funds raised through the charges are balanced by reductions in vehicle excise duty and/or fuel tax. Alternatively, subject to Treasury agreement, variants could hypothecate some of the funding to transport improvements. The system could bring benefits to a large number of low-mileage drivers and rural residents who depend on their cars but impose little on others because they tend to drive in non-congested conditions. It would encourage drivers in congested conditions to reconsider whether their journey is necessary, whether it could be made by another mode or at a less congested time of day. The paper describes the findings from the research work, highlighting the technical, political and practical issues, and providing further insights into the impacts of such a scheme.

Applying commercial advertising skills in transport planning

P. J. Wiltshire

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 2, May, 125–132

The motor car has become more than a means of transport. Despite the high cost and dire road safety problems, the car has become a totem in our social grouping and a metaphor for our lifestyle aspirations. This did not happen by accident. It is the consequence of some 90 years of soft-selling and highly sophisticated marketing. This paper explores the techniques that the advertising profession uses, and touches upon their application in marketing sustainable transport modes.

Strategic environmental assessment directive and local transport planning

C. Ferrary

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 2, May, 133–139

This paper sets out what strategic environmental assessment is, and what the purposes of it are in the context of local transport plans. It outlines what should be in a strategic environmental assessment environmental report, and specifically discusses the strategic environmental assessment process in relation to local transport plans. The paper also offers advice on complying with the requirements of the Directive, in particular focusing on those tasks that local authorities and others have found difficult to date. Finally it recommends some steps to achieving 'strategic environmental assessment without tears'.

A philosophy for a performance specification for road foundations

C. D. F. Rogers, P. R. Fleming and M. W. Frost

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 3, August, 143–151

The road foundation layers perform several functions both during construction and when the road is in service, for example load-spreading, temporary haul routes, and a base for the overlying construction layers. The critical loading condition is usually directing trafficking where the applied stresses are greatest. The capping and sub-base layers during construction require adequate stiffness and strength to resist these stresses. The current UK specification for road foundations is based on a recipe approach, and, unless permission is granted to use an analytical design, the pavement foundation designs are based entirely on the California Bearing Ratio (CBR) to characterise the subgrade, capping and sub-base materials. Here CBR is used as an index of both material strength and stiffness, although it measures neither directly. Such an approach is potentially inefficient and does not readily facilitate the use of new and marginal materials or alternative design procedures. Recent technical advances in laboratory and in situ testing of pavement foundation materials now allow the performance parameters of stiffness, strength and resistance to permanent deformation to be measured both for design and during construction. This in turn enables a performance-based specification for road foundation layers to be introduced to provide some assurance of the as-constructed quality, and by permitting the use of secondary or recycled aggregates, to contribute to the parallel goal of sustainable construction. This paper sets out an idealised philosophy for a performance-based specification for road foundations, examines the individual elements of the specification in relation to current knowledge and makes recommendations for a phased introduction alongside CBR-based methods.

Accelerated pavement testing in highway engineering

S. F. Brown

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 3, August, 173–180

Full-scale accelerated testing of pavements has become a powerful technique for assisting with understanding pavement deterioration under realistic conditions and measuring pavement response to moving wheel loads. It forms an essential bridge between laboratory work and theory and the site situation. In the USA there has been a major investment in such facilities in recent years following a careful assessment of the potential cost–benefit ratios. Extensive experience in South Africa suggests a ratio of about 1 : 10, and this would be the likely situation in the UK if further investment were made. A description is given of the

leading test tracks and testing machines, focusing mainly on US developments but with reference to experience in the EU and elsewhere. Equipment that is laboratory-based, such as that at the Transport Research Laboratory in the UK, and facilities that may be moved to various sites are reviewed. It is concluded that a mobile facility that uses the best of modern technology blended with proven experience from elsewhere would be most appropriate to support the UK highway industry in the future.

Traffic operations at on-street parking facilities

S. Yousif and Purnawan

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 3, August, 189–194

This study reports on the findings based on observations from sites with parallel and angle parking layouts. The main parameters under consideration were the manoeuvre time for parking or unparking and the gap acceptance to merge into the traffic stream when leaving a parking stall. The results showed that the design of on-street parking layouts strongly affects drivers' parking and unparking behaviour. Alternative suggestions to the design of parking stalls were made depending on local conditions.

Vision 2030: transport visions for strategic highways

R. Eastman, J. C. Miles and J. Wilkinson

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 4, November, 203–210

This paper reports work done three years ago for the Highways Agency in England to stimulate long-term thinking about how to develop and operate the strategic highway network in the UK. The effects of road traffic are becoming a critical problem throughout the world, and without some radical solutions the situation is forecast to get worse. Problems such as traffic congestion, global warming and how to achieve sustainability are politically sensitive yet require positive action. Innovative thinking is needed now to develop solutions and actions that are good for the long term. The Highways Agency in its role as network operator is responsible for managing, maintaining and improving the strategic road network in England—over 8000 km of motorways and trunk roads. In a bid to look beyond the usual 5–10 year planning cycle, the Highways Agency commissioned the Vision 2030 Project. Visioning techniques and innovative thinking were used to develop several possible scenarios and propositions for the long-term future of inter-urban transport. These transport visions have influenced the Highways Agency in developing suitable action plans to achieve the desired levels of service for users of the strategic road network, against a changing and challenging background.

Injuries and fatalities in Turkish road traffic accidents

M. Gökdağ, M. D. Kaya, A. Atalay and A. S. Haşiloğlu

Proceedings of the Institution of Civil Engineers—Transport, **157**, No. 4, November, 231–237

This study aims to describe quantitatively the injuries and fatalities from high rates of serious road traffic accidents (RTAs) in Turkey, to identify any trends during the period 1980–2000, to compare the results with those of developed countries and to evaluate the information available on possible causes with a view to identifying the most useful direction for future research. Data were obtained from the Turkish police, State Institute of Statistics, health sources and, for international comparison, from the published literature. Estimates of trends were made using linear regression. The results revealed that during the period 1980–2000, the rates of RTAs per 100 000 population and per 100 000 motor vehicles increased. Deaths in each RTA increased in the short period (1980–1987) and declined during the period 1987–2000. RTA injuries during the period 1980–2000 increased steadily. Between 1980 and 2000 the severity rate (the ratio of fatalities per 1000 RTAs) decreased threefold in Turkey. Turkey's rates were compared to a number of selected countries. Further investigation requiring close collaboration between police and health authorities is therefore essential.