TRLnews

80th Anniversary Edition

THE ECONOMIC FUNDAMENTALS
PROFESSOR STEPHEN GLAISTER

TRANSPORT SYSTEMS INTEGRATION
PROFESSOR BRIAN COLLINS

THE CHALLENGE OF URBAN TRANSPORT
PROFESSOR TONY MAY

ITS IN 2050
PROFESSOR ERIC SAMPSON

MOTOR & INFORMATION AGE COLLIDE
PROFESSOR GLENN LYONS

Looking to the future

TRL is now 80 years old! Our core business is the creation of transport knowledge and understanding, which is then applied to finding practical solutions to a wide range of transport problems around the world.

Typical of our approach is in the formation of the Fellowship of the Transport Research Foundation, TRL's parent body. Leading professionals are elected to the Fellowship for their distinction and world standing in transport-related research. The aim of the Fellowship is to promote knowledge and the development of ideas and strategy in the field of transport, and can provide strategic guidance for the self-funded research that TRL undertakes through the TRL Academy.

The unique link between both research and application is essential to enabling TRL to provide a significant body of knowledge, to win business and in turn to contribute to many crucial advances within transport, helping to improve the efficient and safe movement of people and goods.

In this celebratory edition of TRL News, rather than look back at the many and varied contributions we have made to all aspects of transport, we want to look forward to the challenges that will be faced in the future. We have therefore invited a number of the Fellows of the Transport Research Foundation to take a forward look at transport over the next 40 years or so. Here they reflect on the issues and challenges that we will have to address.

The economic fundamentals: wealth, population, price, capacity and quality

Forecasting is unavoidable but difficult. So the least we should do is to hang on to economic, social and demographic fundamentals.

The first of these is population. Ageing and likely growth in numbers in many locations are as near certain as anything. The implications are not given enough attention. Then there is prosperity. Taking one decade with another, real standards of living have always increased. At a long-term average rate of 2 percent per annum, real living standards double every thirty five years! Demand for movement will grow and expectations of travel comfort and convenience will increase in line with consumers' experience in all walks of life.

But there is a cloud that will overshadow our capital-hungry transport industry for decades. In 2007 the cost of servicing the national debt was £25 billion a year. Even assuming the government achieves a return to economic growth so that it can eliminate the current spending deficit by 2017, the annual cost will have risen in the meantime to £70 billion. Public capital is going to be in very short supply.

The shortages of land and capital make it highly unlikely that the future will bring enough new physical road capacity. It is fortunate that we use the capacity we have inefficiently. It is taken for granted that one has to regulate the flow of trains carefully to maximise throughput. Yet we generally leave our strategic roads to look after themselves. The success of the first Managed Motorway schemes has already demonstrated a principle that can and will be extended on a larger geographical scale at reasonably low cost with both safety and reliability benefits. And much more will be done to clear up incidents quickly.

But we will still be left with insufficient road capacity. There is one but only one way to deal with this: some form of road user charging. More intelligent, variable pricing will produce a more efficient pattern of usage and it will produce additional revenues to fund additional capacity. So far we have failed to persuade the UK public, with the honourable exception of Central London. There are at least four new arguments: the relevant technology reducing in cost and proven in the field; it is in use all over the world and the public acknowledge the benefits; the progressive de-carbonising of the vehicle fleet implies that the traditional system of "charging" will have to be replaced; the shortage of public capital for roads, especially if investment plans for high speed and conventional railways are realised, will drive government to create new income streams to service additional private lending. The necessary reform of the governance of the Highways Agency is bound to happen in any case, in line with the recommendations of the Cook Review. It is an anomaly for this massive infrastructure business to be run by a government department, with all the short-termism and inefficiency that implies. The speed and nature of the reform - government-owned company; long term concession; public trust; or privatised utility (all with a degree of independent, public interest oversight) - remain to be seen.

Meanwhile, funding for local roads and local transport is horribly confused. Incentives are obscure. Accountability is opaque or non-existent. The highly-centralised local government finance system means that local communities cannot chose to pay for what they want. It is not at all clear how devolution to Local Enterprise partnerships and Local Transport Bodies is going to work. Significant responsibilities are at risk of neglect: for instance the regional-scale infrastructures and local roads maintenance. Repeated failures of public service will be unpopular (especially poor road surfaces) and rationalisation and reform will surely follow.

Britain's railways have financial and political problems. Technical innovations have made the passenger safer and more comfortable. There has been one fundamental innovation: moving-block signalling. This should eventually reduce signalling costs and increase capacity. Generally speaking, increasing rail capacity through new construction is not financially viable. So the first thing to do, as with the roads, is to make best use of the existing physical capacity.

It is hard to run more trains without compromising service reliability. Modern signalling systems are not sufficient. The McNulty Review pointed out that the average utilisation of the railway is actually quite low (as it is on the roads) and he correctly recommended greater use of variable prices to manage the peaks in demand (again, as for the roads). Politicians have been unwilling to countenance either a revised structure for rail fares or an increase in the average level. Consequently the rail industry is producing plans for physical expansion which can only be paid for by rapidly escalating near-public debt.

The prospects for very high speed rail are poor for Britain. The appraisals for HS2 show that it would require yet more increases in public debt and that the benefits cannot justify the costs. Capacity and other objectives can be obtained more cheaply. In Britain the distances are too short, the land and construction costs too high and the competing rail and road systems too effective for very high speed rail on the Continental model to work. The HS2 project has survived so far as a political initiative, not a transport planning one.

The appetite for safety increases. Whilst it is hard to see what more could be done at reasonable cost in the case of aviation and rail this is not the case on the roads. Road vehicles have improved enormously and there are more innovations imminent, many of them electronic aids to prevent or mitigate driver error. Moves are afoot to reduce the exposure to risk of newly-qualified drivers and drivers as a whole are becoming more compliant with speed limits.

So the inadequate design of the roadside environment is left exposed. It is now relatively cheap to survey roads and to identify hazards. Removing them offers spectacularly good value for money. It is something of a scandal that this has not already happened.

The electronic revolution has transformed charging, though adoption for public transport has been slow. It is an anomaly that so much financial support is given to the operator rather than direct to the target individuals. HM Treasury has been concerned about this for some time and change will surely come.

People have been predicting that the advent of better electronic communication will reduce the need for travel. But the research is inconclusive and it has not happened yet. Historically, innovation in communication has been associated with more, not less travel. And it is the benefits of bringing people close together that continue to support the high commercial rentals in the centres of cities, and make possible the arts and other leisure activities.

The revolution in communications and geographic positioning is beginning to be exploited by motor insurance companies to enable them to match individual risk to premium. This is a welcome improvement in fairness. Crucially, people can be offered a reward for changing their behaviour, because behaviour is being measured. That will have an important benefit for the risk to all road users.

This will undoubtedly be just one of many innovations offering new services. But one has to wonder whether some of them will work for the general public benefit. The dangers of texting and using hand-held mobile phones whilst driving illustrate. It is going to be a struggle for sensible and enforceable regulations to keep up.

The imperative to reduce carbon dioxide emissions from road transport has begun to have a real impact, most clearly seen in the automotive manufacturing industry's successful response to tightening regulations. A viable trajectory towards 2050 is becoming clearer. Whilst government policy has promoted the development of a mass market in pure electric vehicles the realities are against this. The fundamental difficulty remains the cost and inferior energy:mass characteristics of batteries. Progress for the mass market will be in the adoption of hybrid technologies, light-weighting and further improving the efficiency of conventional internal combustion engines.

But as the fashion for concern about greenhouse gas emissions begins to fade (though the concern itself remains) it is likely that it will be replaced by growing concern about the alleged health damages due to transport-generated air pollutants. For many of these technology has already provided a solution. But others, such as particulates from brakes, tyres and badly maintained engines, remain a worry.

We will have more, travel-hungry people and less public capital with which to build the means to serve them. Fortunately the electronic revolution offers the means to extract more quantity, better quality and improved safety from what we already have. Private capital is eager to invest in our infrastructure: electronics also provides the way to generate the income streams necessary to remunerate the necessary capital.

Professor Stephen Glaister CBE

Stephen is Director of the RAC Foundation and Emeritus Professor of Transport and Infrastructure at Imperial College London. Currently he is also a member of the expert advisory panel of the Office of Rail Regulation.

He has been a member of the analytical challenge panel at HS2 Ltd and was partnership director at Tube Lines. For eight years prior to this he sat on the board of Transport for London.

He has also been: a non-executive director of London Regional Transport; a specialist advisor to the Transport Select Committee in Parliament; an advisor to the 2006 Eddington Transport Study; an advisor to the Commission for Integrated Transport; and a member of the steering group for the Department for Transport's 2004 National Road Pricing Feasibility Study.

TRANSPORT SYSTEMS INTEGRATION – A GOAL FOR THE FUTURE OR A CHIMERA

The possibility that the UK should develop an integrated transport strategy has been discussed for many decades. What does developing such a strategy imply? Firstly, it would seem that achieving such a strategy would meet some purpose. Possible purposes could include: economic efficiency in either buying transport infrastructure or in operating services; minimising environmental impacts by effective use of natural ecosystems; better experiences for people in planning and carrying out their journeys or facilitating social and economic progress. Secondly, the successful governance of such an integrated strategy implies a mechanism to sustain consensus as to levels of priority and achievement for each or all of the purposes, by all the major stakeholders over a considerable period of time, decades for most transport modes. Thirdly, the need to encompass technical and business innovation implies that the strategy needs to be revisited and revised periodically or as a result of external events. All these implications are self-evidently interconnected and interdependent, so attempting to optimise a strategy for any one of them, which is very tempting as a simplification of the issues, runs a significant risk of running into conflicts from other neglected domains. Examples might include: financial and land use efficiency having unacceptable environmental consequences; multimodal journey effectiveness through harmonisation of schedules having negative consequences on profitability; and asset exploitation for operators.

Recent attempts in the UK to develop an integrated strategy across modes at a national level have foundered on a neglect of some or most of these implications when addressing any given need or purpose. This was not always the case. The British Transport Commission (BTC) under the Transport Act set up by the post war Attlee government in 1947 had the remit and powers at least in principle to develop a national transport strategy.

'Its general duty under the Transport Act 1947 was to provide "an efficient, adequate, economical and properly integrated system of public inland transport and port facilities within Great Britain for passengers and goods", excluding transport by air'

However, it failed to achieve integrated ticketing, an integrated transport plan, efficient and economic operation of the railways and a reduction in operating costs. It is clear that the purposes of an integrated transport strategy were not clearly articulated and that the BTC did not actually have the necessary powers or influence for long enough (it lasted only 15 years) to achieve much useful and long lasting integration. In the intervening years to the present a number of bodies have been created to consider an integrated transport strategy, in particular the Integrated Transport Commission in 1999. Whilst they influenced policy thinking and social debate, following privatisation, the four main modes of transport, Road, Rail, Air and Sea have been and are treated in silos by government at all scales, by industry, by the markets (finance and investment), by tertiary education and by regulators.

The barriers to integration for the future are therefore very high and well established. So why should we in the future expect achieving an integrated transport strategy to be a goal worthy of investment? What are the indicators that suggest that now is the time to consider or reconsider such an approach?

Firstly, a number of countries and cities facing similar issues to the UK as a nation and cities in the UK are now publishing integrated transport strategies. Secondly, the exploitation of modern Information and Communication Technologies (ICT) makes it much easier technologically and viable economically to deliver Intelligent Transport Systems (ITS). Thirdly, in a densely populated country such as the UK and in cities everywhere, the use of the scarce asset of land for transport purposes becomes a critical decision, and in particular, evidence for which mode delivers best use of the land asset, a vital output of analysis, especially when the land might be used for non-transport purposes as well. Fourthly, the availability of affordable transport to almost every member of the nation has caused an explosion in commercial and private demand, together with a cultural attitude that a high level of quality of journeys is to be expected in a developed society (it is asserted that the UK has unacceptable congestion on roads, overcrowding on railways and insufficient flights from airports that are operating at capacity). Fifthly, global trade is now endemic, and global supply chains optimised across modes to deliver 'at the right time' logistic services that support almost all utility, manufacturing and retail commercial activities. Unless these 'integrated services' can be maintained and grown as the demand from 7bn people grows to anything between 10 to 16bn people depending upon which demographic forecast you trust, significant economic and social damage will ensue.

These five factors combined should persuade a government that consideration should be given to reviewing the need for an integrated transport strategy. But transport is just one part of national infrastructure, the other components being Energy, ICT, Water and Waste, with the first two of these having a major impact on any given transport strategy, integrated or not. So any integrated transport strategy has to be combined with strategies for these other two infrastructure sectors; neither show signs of addressing these issues, essentially for the same historic reasons. The privatisation of the electricity industry and oil industry as separate energy utilities in the 1980s made it nearly impossible for a national strategy on energy, and hence transport, to be realised. Indeed a seminal paper now released to the Thatcher Archive (Ridley 1977 http://fc95d419f4478b3b6e5f3f71d0fe2b653c4f00f32175760e96e7.r87.cf1.rackcdn.com/FABEA1F4BFA64CB398DFA20D8B8B6C98.pdf) states that the Conservative Party strategy for privatisation of the utilities would make a national strategy for energy and transport virtually impossible. This was considered at the time a price worth paying for economic and market efficiency. But a number of other purposes of an integrated transport strategy and indeed energy strategy were made very difficult or impossible to realise as a result. Hence, it becomes clear that purposes such as those outlined at the beginning of this article should now be re-examined as to their relative weight compared with economic and market factors, to see if some form of integrated thinking and doing would provide a better outcome for all stakeholders.

Academic study groups, policy think-tanks and government departments could convene around this issue in an a-political manner to develop policy options, investment and financial models, and governance frameworks that could generate better methods for achieving the basket of purposes that transport services and systems attempt to meet.

The 'do nothing' option is to continue to muddle through with transport systems being treated in modal silos possibly resulting in the growth of an economic and social gap between the UK and other nations and cities. The sensible (even common sense) option is to start governing and designing transport and energy systems as one large strategic component of a developed society's infrastructure, even if the implementation and operation is carried out as now with a transport or energy component being dominant in any given instance.

The first 'do nothing' option will treat an integrated transport system as a concept never to be achieved with the benefits not realised, a chimera; the second option will treat it as a goal for the future to be moved towards coherently and systematically, realising the advantages and learnings as progress occurs.

The critical question in a democracy is who chooses which approach to take and then maintains it over many decades. As for most things, politics is central to the debate and the decisions, but the evidence for the choices comes from the work of a wide range of academics and professionals. Provision of that evidence is now an urgent requirement if the UK is to maintain itself as a developed nation.

Professor Brian Collins CB FREng FRSA

Brian took up the role of Professor of Engineering Policy at University College London in August 2011 and is Head of a new Department at UCL, Science, Engineering, Technology and Public Policy.

Prior to his appointment at UCL he was the Chief Scientific Adviser (CSA) for the UK Department for Transport from October 2006; CSA for the Department for Business, Enterprise and Regulatory Reform (BERR) from May 2008; and CSA for the Department for Business, Innovation and Skills (BIS) from March 2009. In his time within BERR UK energy policy was within his remit. He was Professor of Information Systems at Cranfield University from August 2003 until July 2011.

He was a member of the Council of Science and Technology working party that published in 2009 the report 'A National Infrastructure for the 21st Century' under the leadership of Sir Mark Walport, now GCSA.

Until March 2012, Brian was Chair of the Engineering and Interdependency Expert Group for Infrastructure UK, then led by Lord James Sassoon, Commercial Secretary in Her Majesty's Treasury.

He has a visiting Professorship at Wollongong University, New South Wales, Australia and holds Honorary Doctorates from Kingston University and City University London.

PHOTO COURTESY OF GIZ DEUTSCHE GESELLSCHAFT FÜR INTERNATIONALE ZUSAMMENARBEIT (GIZ) GMBH

THE CHALLENGE OF URBAN TRANSPORT

A growing problem

The year 2010 was a milestone in the inexorable growth of global population. For the first time, more people were living in urban areas than in the countryside. By 2050 it is predicted that global population will be approaching 10bn, with almost 70% living in towns and cities. There will by then be as many urban dwellers as there are people in the world today.

However, urban growth rates differ markedly across the world. Many Latin American and Asian cities are predicted to grow by 50% in the first quarter of this century, while some African cities are expected to more than double in size. Meanwhile population in most developed cities will stagnate or, as in the case of Japan, decline. These growing populations in developing cities will aspire to greater mobility and, to this end, greater car ownership. Motorisation rates are expected to double in Eastern Europe, Latin America and Africa, and treble in Asia over the same period. Where capacity permits, traffic levels could well see a three-fold increase over the same period, and as much as five-fold in Asia.

This has alarming consequences. Cities in developing countries already have more serious congestion, pollution and accident problems than developed cities, and these will continue to grow. For example, fatalities per capita are expected to be two to four times those in developed cities by 2020, despite much lower levels of motorisation. Perhaps the greatest threat is that of global warming. Globally, greenhouse gases from transport are expected to increase by 120% between 2000 and 2050, with most of this increase from developing country cities.

Given these challenges, developed cities need to adopt a policy of sharp carbon reduction, while developing cities require a leap-frog policy, in which they avoid repeating the mistakes of the developed world, but instead jump straight to low carbon policies. Such policies require a strategy which combines measures which avoid the need to travel, shift to more sustainable modes and improve the carbon efficiency of these modes.

A wider range of solutions

Fortunately, there is now a much wider range of measures in these three categories. Of the 50 types of policy measure included in the urban transport knowledgebase, KonSULT (www.konsult.leeds.ac.uk), only around half were available 40 years ago, and many have emerged in the last decade. These include bus rapid transit, cybercars, car clubs, shared bicycles, personalised journey planning and financial incentives to travel less.

Traditionally these new solutions have been generated by professionals and industry, but the last few years have witnessed a number of initiatives promoted by innovative individuals through the social media. These include real time information generated through crowd sourcing, car clubs using members' own vehicles, and novel uses of telecommunications to reduce travel. It seems likely that these initiatives will continue to increase rapidly through what one entrepreneur refers to as "Peers Incorporated".

This raises two significant challenges for urban transport planners. Firstly they need to understand the potential of these new policy measures, yet empirical evidence and objective advice on them remain limited. Secondly, they may have a decreasing influence on travel patterns as individual initiatives increasingly determine travel behaviour.

An ill-prepared public sector

Ten years ago, the European Conference of Ministers of Transport (ECMT) concluded that developed cities were already aware of the type of strategy which they should be adopting, but that pursuing such strategies was "easier said than done", largely as a result of the following weaknesses in decision-making:

- Weak partnership between national and local government
- Failure to involve stakeholders and the public
- Lack of vision and failure to specify clear objectives
- Inappropriate indicators and targets
- Inadequate use of the available measures, and failure to package them effectively
- Failure to integrate transport with land use, environmental and economic policies
- Biased and uncertain funding
- Failure to monitor and evaluate the strategy as implemented

The development of guidance

The European Commission has argued that, since European cities account for 60% of Europe's population and 85% of its economic power, urban transport was too important to be left to local government alone. It has developed guidance for cities on ways to overcome these weaknesses in preparing Sustainable Urban Mobility Plans (SUMPs). It is expected later this year to make a further announcement linking funding to the preparation of such Plans.

Its guidance makes particular reference to practice in the UK, which has 40 years' experience of central government requirements for Transport Policies and Programmes and Local Transport Plans. Unfortunately successive UK governments have all felt the need to change the rules for preparing such Plans, often aggravating the weaknesses listed above. The third round of Local Transport Plans came closest to satisfying these requirements. Central government provided guidance and support, while local authorities, working with their own stakeholders, had the flexibility to set their own objectives and targets and both tiers contributed to monitoring of performance. Local authorities had a wide range of policy instruments available to them, albeit with continuing constraints on their ability to manage public transport services and to control car use. Moreover, they were able to integrate their transport policies effectively with those for land use, the environment and regional development. Only in the area of financial support were there continuing weaknesses, with distinctions between capital and revenue funding which often made it difficult to finance the most cost-effective solutions.

Sadly, the present government's emphasis on localism and cost-cutting has eroded most of these strengths of the UK system. Guidance is no longer provided, the government has withdrawn its contributions to monitoring, cuts in staffing have made it harder to plan effectively, regional plans have been abolished and land use planning seriously weakened. Meanwhile, at a time of substantial cuts in finance, it has paradoxically become even more difficult to finance the low cost alternatives to capital projects on which plans should be focusing. It would be hard to argue that current UK practice offers an effective model for cities elsewhere in Europe.

How can cities do better?

We can expect that the main advances in urban transport policy will continue to come from innovative cities which are prepared to take the political risk to try out new ideas. The main challenge is to transfer their experience to the less innovative majority. Ideally, as the ECMT advocated, this should be facilitated by national governments. A review of 26 European countries' preparedness for SUMPs indicates the scale of this challenge, even in a developed continent with limited growth. In half the countries, governments provided no guidance on urban transport, in a similar number, skills at the local level were judged limited or non-existent, while in some two thirds, national governments did not provide the political, financial and legislative support necessary for effective local planning. It appears, therefore, that urban transport cannot be left to the vagaries of national government either.

Fortunately there is now an increasing level of support from international bodies. Such support can come from the development of decision-support tools, encouragement of policy learning and, above all, from the stimulation of the policy networks which are fundamental to the encouragement of policy transfer. Within Europe the SUMP guidance provides links to 25 existing decision-support tools. A new European project, CH4LLENGE, will develop these decision-support tools further and cascade experience in their use from four western cities to five eastern cities and subsequently to a further 30 follower cities. Meanwhile the ELTIS portal has become a repository for case studies on innovatory transport polices, while the CIVITAS programme has assisted over 200 cities in 31countries to exchange experience and help one another to enhance their planning processes and transport systems.

While these initiatives are welcome, activities in the developing world are perhaps more impressive. The GIZ Sustainable Urban Transport Project has developed a Sourcebook which now contains 31decision support modules, and has been the basis for over 80 training courses in Asia, Latin America and, to a lesser extent, Africa. They have since initiated the Sustainable Low Carbon Transport (SLoCaT) partnership to provide support to cities, and the Bridging the Gap initiative, in which TRL is a full partner, designed to disseminate good practice and to encourage south to south policy learning.

These initiatives, perhaps offer the greatest hope that developed cities will be able to achieve a sharp reduction in carbon emissions, and developing cities a leap-frog policy. They merit continued support from interested professionals. But above all, they need a renewed commitment from national governments to take urban transport seriously and to provide continuing financial backing for the underpinning decision-support tools and policy networks.

Professor Tony May OBE FREng

Tony is Emeritus Professor of Transport Engineering at the University of Leeds. Since his appointment at Leeds in 1977, he has served as Director of the Institute for Transport Studies, Dean of the Faculty of Engineering and Pro-Vice Chancellor for Research. Between 1985 and 2001 he maintained a link between research, teaching and consultancy as Director of Transport Policy for MVA Ltd.

Prior to 1977 he spent ten years with the Greater London Council, where he was responsible for policy on highways, traffic management and land use planning. He was elected as a Fellow of the Royal Academy of Engineering in 1995, and awarded the OBE for services to transport engineering in 2004. He retired from the University of Leeds in 2009, but is still active in research, consultancy and professional development. He is currently President of the World Conference on Transport Research Society

ITS in 2050

I'm going to start my 2050 exercise by looking back 37 years to 1976 and some of the technologies we had then. Portable computers were on sale and the ARPANET had just started. The IBM PC and mobile telephones didn't appear until 1982, the World Wide Web launched in 1989, the handheld digital camera was 1993 and a usable GPS service 1994. We were aware of Moore's Law but nobody predicted the increases in functionality coupled with reductions in size, power consumption and cost that have taken place in all these areas as well as the introduction of completely new products. So what can we learn from past trends and innovations – "Always expect the unexpected".

I believe 2050 will see major changes in 4 key areas: vehicle design, vehicle usage, management of transport infrastructure, and mobility/accessibility. Change will sometimes be driven by a technology breakthrough – for example a new battery technology offering 50% more capacity weight-for-weight would undoubtedly impact the take-up of electric vehicles. Conversely a new policy can drive the need for new technology – the Moon Landing goal drove a size and weight reduction programme that led to printed circuits and microprocessors; navigation at sea drove the development of the GPS system. In almost every case the barrier to change will be raising user acceptability to counter entrenched habits, not the technology.

Vehicle design

By 2050 vehicles are likely to be powered by fuel cells as well as all-electric or hybrid systems and advanced petrol or diesel combustion. The relative mix of these will depend on two factors: the global price of oil and the UK's clean energy generation which I believe will be mainly nuclear. My vote goes more to electric than fuel cells; both require new distribution networks and difficult though it is the recharging network is easier and cheaper to install and make leak-resistant than a liquid hydrogen network.

Vehicles are unlikely to be smaller as users seem to like driving lorries disguised as cars but will certainly be much lighter and just as strong as a result of extensive use of aluminium, carbon fibre and polymers in their construction. They will have continuous internet linkage for information and entertainment; lateral & longitudinal sensors with driver over-ride if stability is threatened or speed limits exceeded. They will be "Connected" with a continuous vehicle–infrastructure information exchange for safety and network management as well as reporting, not just the condition of the road but also the condition of the vehicle.

Despite customer unease about the 'spy in the cab' I expect insurance companies to require all 2050 vehicles to be equipped with some sort of in-vehicle black box that is the basis for "Pay as you Drive" insurance but which also uses the same data elements for satellite-based position fixing and navigation, e-call, a road user charging unit, a parking guide etc.

Vehicle usage and management of transport infrastructure

These topics are already closely related and by 2050 I believe they will overlap considerably. Here's why. Our roads are getting increasingly intelligent in the sense that we collect information from them on usage and have well developed techniques to maximise the throughput from a single link or a network. But unlike rail, sea or air, road managers don't know where the vehicles are going or exactly where they started their journeys. There are only two ways to make significant improvements in our traffic management – become better at spotting the development of a pattern that we recognise and can act on; or preferably gain knowledge of where the customers want to go.

If you operate a ship, airplane or train you can't just "turn up and go" – you need access to the network and a path through it. So the question is – how much longer can we accept "turn up and go" for roads? I believe that by 2050 we will have crossed this critical point as well as another one. As vehicles become more fuel efficient, through powertrain developments or by increasing electrification or both, the Treasury income from Fuel Duty will have steadily fallen until a point is reached where the transport tax system has to change by transferring to a road use charge regime. This will probably be delivered as a link between "turn up and go" and payment for access; for example just turn up = £x/Km whereas notifying the system in advance to book a slot = £y/Km.

However, there is a more far-reaching point about vehicle usage and network management. Put at its simplest, for a number of years we have been making the roads and the vehicles using them smarter but the weakest link in this chain is the driver – someone who is almost unpredictable in demand and behaviour, and is frequently capricious, unsafe and unresponsive to requests, advice or information. We already apply mild constraints to drivers' freedom of decision – freedom to mess up the system – using techniques such as ramp metering, traffic calming and intelligent speed adaptation.

Some driving functions are already automated: intelligent cruise control, assisted parking, lane departure warning and traction control and electronic stability systems show that computers and sensors can control a vehicle better than most drivers. We are approaching a similar point to aviation, where airplane controls are so complex that the pilot's movements are interpreted as a command to achieve something and the on-board systems work out how to do it. There is already a lobby arguing for safety reasons to take more control away from the driver and reduce the driver's ability to get in the way of a better outcome. It is the ultimate gain from the Connected Vehicle thinking.

I am sure that by 2050 access to some parts of the trunk network or routes in major cities will only be permitted if the vehicle is equipped with Vehicle-Infrastructure linking so that road managers have more information about their users/customers and are able to manage traffic flows, with potential vehicle–vehicle collisions detected and an accident avoided by overriding the driver. This is likely to gain only reluctant acceptance by leisure drivers, even though the alternative is increased congestion, but be welcomed by the freight and logistics industry. I do not expect to see fully autonomous vehicles, even by 2050.

Mobility/accessibility

Cities are growing. Approximately four in five people in the UK now live in urban areas. Globally just over 50% of the population live in cities, but developing countries are rapidly shifting from rural towards more urban societies. Urban areas are currently responsible for as much as 70% of greenhouse gas emissions and consume around three quarters of the world's resources. And in many locations, urban populations are ageing, placing different demands on existing infrastructure systems.

In urban areas with a good supply and choice of public transport we are seeing a pressure to change the purchasing model in much the same way as mobile telecoms providers had to create pay-as-you-go for customers who did not have or want a bank account. By 2050 we will not automatically own a car and thus use the same vehicle for all types of trip, however appropriate or inappropriate: we will purchase 'mobility' from a range of suppliers offering transport that is closely matched to the immediate requirement.

I expect 2050 to bring us genuinely seamless journeys and through ticketing based on the widespread use of a "Personal Journey Tutor" – a service that alerts you while on the train from the airport to the city centre to say that there has been flooding on the metro so instead of getting to your meeting as expected you should take bus N from a stop outside XXX. Similarly, a message to your car warning "there is massive congestion ahead but which you could avoid by leaving at Intersection N then going to the Park-and-Ride to continue by train; do you want a parking space reserved?"

So in summary I see four strong trends: a different technology-based motoring tax regime; linked vehicles and infrastructure managed as one system because it will be the only way to cope with travel demand, especially in cities; extensive availability of not just reliable real-time information on services but "Personal Journey Tutors" to advise on best available choices; and a different transport services supply model where we purchase 'mobility' and do not necessarily own our own personal vehicle.

Professor Eric Sampson CBE

Eric is a Visiting Professor at Newcastle University and City University London. He is the President of the International ITS Benefits and Evaluation and Costs Group[IBEC]. He was elected Chairman of ITS-UK in May 2007 and was appointed CBE in the Queen's Birthday Honours List 2007. He worked in the UK public sector for for 39 years, retiring in November 2006. At the Department for Transport he worked in the Marine, Highways, Rail and Safety Directorates, as well as The Coastguard Agency.

He was a founder member of the international study group that led to the formation of ERTICO – "ITS-Europe" – in 1992 and has been a member of the ERTICO Supervisory Board and then its Chairman. Eric still has a strong interest in developing academic–industrial collaboration and the contribution of science and technology to transport policy-making.

THE MOTOR AGE AND THE INFORMATION AGE COLLIDE

Opening our minds

It's hard to be visionary. It's easy to be too far-fetched in looking to the future. It's even easier to lack imagination. "Computers in the future may weigh no more than one and a half tons" – so goes the popularised version of the quote from Popular Mechanics in 1949. Will generations of the future consider today's prophecies with similar amusement?

In this article I reflect on the coming together of the motor age and information age. I consider the interplay between them and whether we might be looking to a world beyond the 'regime of automobility' in 2050. Critically, we need to recognise that the technologies affecting transport and travel reach well beyond the preserve of those of the motor industry and the field of Intelligent Transport Systems. The real power of emerging technologies of the information age will be through how they shape social and business practices which then indirectly affect travel patterns. For example, the development of assistive technologies may massively affect where and how older people lead their lives and the lives of those around them – with major implications for where, when and how much people will travel. The move, if it happens, of 3D printing from niche novelty to the mainstream could redefine how goods are produced and transform global supply chains and freight travel. Tempted to dismiss this? Think about those one and half tonne computers if so.

The frogboiler

So the story goes, a frog placed in a pan of hot water will jump straight out, immediately realising the danger; a frog in a pan of cold water will remain as the water is gradually warmed up to boiling point. It adjusts to the gradual change, unaware of the cumulative change of its environment. I suggest we are experiencing the frogboiler. Year by year, major advances in the information age occur around us. We absorb them into our lifestyles and soon take them for granted. We similarly adjust to changing social norms and to pricing signals. Only by consciously looking back over a span of time can we appreciate how much the world might have changed. 20 years ago Google did not exist. 10 year ago the iPhone and FaceBook did not exist; 5 years ago the Kindle and iPad did not exist. I heard on the radio recently that 400 bookshops in the UK closed last year in the face of e-book sales. UK online grocery sales have increased by 900% from 2000 to 2010. According to the National Travel Survey the average number of trips per person per year has dropped by 10% in that time – including a reduction in car trips. In the same period the number of full car licence holders aged 17-20 has dropped by 15%. According to the Health Survey for England, there has been a 23% change in obesity levels (up not down). The world is changing. We are relying more and more on information and communications technologies – concurrently with the possibility of being less and less dependent on motorised travel. Perhaps we must now look to walking and cycling to come to the rescue in terms of public health.

Relationships between technologies and travel

Attempting to understand how technologies are affecting travel is not rocket science. It's much more complex than that. There are a number of ways in which technologies can impact on travel demand both in terms of its overall level and its manifestation across modes, routes and times. The following is a summary of technology-travel relationships:

- Substitution of technology use for travel (decrease in travel)
- Stimulation of more travel because of technology use
- Technology use supplements travel (increasing access and participation thus substituting for an increase in travel)
- Technology use redistributes travel in time and space (even if total amount of travel is unaltered)
- Technology use enriches travel (our travel time use affects the value of that time)
- Operational efficiency improvements in transport system use through advances in and use of technology
- Indirect longer-term impacts upon travel encouraged by use of technology

In John Prescott's 10 Year Plan for transport, the Government stated that "the likely effects of increasing Internet use on transport and work patterns are still uncertain, but potentially profound, and will need to be monitored closely". From where I've been standing there hasn't been much 'close monitoring' going on over the last decade, let alone there being nearly enough research to try and understand the effects of technology on travel. This said, even had we attempted to do more, we would have faced and continue to face something of a 'wicked problem'. The relationships are changing over time. The technologies are changing over time. There can be lags between cause and effect. The different relationships are interacting with each other. How on earth do we make empirical sense of all this to identify the net effect on travel? Perhaps it's not possible. What I would venture to suggest overall is that the information age has been oiling the wheels of the motor age in the face of our continued dependence on motorised mobility and accommodation of congestion. And inside the frogboiler, our communications cultures at work and play have been evolving.

Possible, desirable or necessary?

It is becoming possible to do many things in ways differently to how we have done them in the past. We can have 'meetings' without needing to bring people physically together. Our shopping can be done online in the comfort of our living rooms. We can 'speed up' long train journeys by watching films on our iPads – or do our grocery shopping on the train. Knowledge workers can more flexibly determine where and when they work in the absence of reliance on fixed office facilities. We can tap into a collective intelligence emerging through the Internet to address our lifestyle questions and concerns. We can engage in co-operative behaviour with others through mobile communications and social networking services.

However, just because we can doesn't mean we do. Commentators, quite rightly, are quick to caution technological evangelism. We are reminded that there are anthropological and social reasons why certain practices, encounters and rituals are important to how individuals and societies function. There are reasons why we welcome direct encounters with others as part of our building and maintenance of relationships and social capital. There seems to be an enduring constant to overall amounts of travel societies engage in around the world – around an hour per person per day. Thus whether or not the art of the possible is always desirable is brought into question. However, what we consider acceptable or desirable can evolve as we seek to fulfil higher level goals in our lives. I believe as individuals and as a society we have significant capabilities to adapt. We are able to reconfigure how we do things to achieve the same end goals in life such as food and shelter, social encounter, status and self-worth.

It may well be that how we choose to take advantage of the information age is driven as much by necessity as by desire. There is a dogged determination in some quarters to preserve the motor age – we look to electric cars, new energy sources, autonomous vehicles, intelligent highways and the like in a belief that the world as we know it should continue. A world in which economic prosperity is linked to traffic levels. However, the profligate society in which the motor age flourished may be in its twilight years. In the potentially resource-constrained world of the future, motorised mobility may become a more precious commodity. It may be constrained either through energy supply and storage limitations or by political will and pricing in the face of climate change challenges. In this context, we may embrace much more readily (and with ingenuity and innovation) the alternatives of the information age alongside the non-motorised modes of walking and cycling.

Looking to the future

Of one thing I'm certain. I don't know what the future will look like. I do, however, believe that we should shape it rather than trying to predict it. I would be inclined to invest in telecommunications infrastructure and not transport infrastructure (beyond maintenance). My gut instinct is that the motor age will move into the shadow of the information age. This won't mean the extinction of the motor car but the regime of automobility will be behind us – at least in Western Europe. Motorised travel will have to 'fit in' rather than be pandered to as we move into the as yet unimaginable territories of what the information has yet to offer. As we absorb complex choreographies of physical travel and virtual encounters through wireless mobile technologies we might imagine a new regime of multi-mobilities.

Professor Glenn Lyons

Glenn is Associate Dean and Professor of Transport and Society at UWE Bristol. He aims to improve and promote understanding of the inherent links between lifestyles and personal travel in the context of continuing social and technological change.

Alongside Glenn's research he has an active involvement within the wider transport profession. From 2000-2003 he was the Director of the Transport Visions Network which brought together some 250 young professionals from universities, public authorities and consultancies. He was the 2002/2003 Chairman of the Transport Planning Society, an organisation that promotes and supports the continuing professional development of transport planners. Concluding in 2005, Glenn chaired Bristol City Council's Best Value Review of Integrated Transport. From 2007-2010 he was Chairman of the Universities Transport Study Group in the UK. He has been a member of the Chartered Institution of Highways and Transportation's Transport Policy Board and from 2008-2012 was a Trustee of London Transport Museum Limited.

"Our world is changing, adapting and evolving at an ever increasing pace, and the same is true at TRL, where we never stand still. The latest change is the appointment of our new Chief Executive, Rob Wallis, who is taking over at a very important time for the development of TRL. Rob has 30 years of professional and business services leadership experience, working across private, public and non-profit sectors in the UK and internationally. A major focus has been delivering solutions into the transport, logistics, supply chain and automotive sector, which means that he is very well-placed to take TRL forward. On his appointment, Rob Wallis said: "Innovative transport solutions are increasingly crucial to governments, economies and businesses around the world. As TRL's new CEO, I am delighted to be joining a team that has an 80-year heritage and reputation in researching, developing and implementing innovative transport solutions with clients internationally."

TRL's work contributes to practical transport improvements through an understanding of a wide and diverse evidence base. In turn, the benefits provided by an efficient multi-modal transport system are very large adding greatly to societies' wealth and prosperity. Our infrastructure is providing access to a greater range of facilities and services and our expectations of what transport enables us to do, both at a commercial and a personal level, are ever increasing. There are changes in demographies and lifestyle which influence, and are influenced by, mobility and the opportunities it affords.

The economic climate has of course had some impact on travel behaviour, but as the economy begins to grow again the underlying trends will tend to reassert themselves. Globalisation and population growth add to these effects. There are implications for all who work in transport research, as the problems become more international, and the solutions both more cross-boundary and more interdisciplinary.

Even in times of economic uncertainty, transport continues to deliver opportunities for increases in mobility and benefits to economic growth, and the way we work and live. However, set against these benefits are the high costs of developing, operating and maintaining our transport system, coupled with the large social and financial costs associated with transport externalities such as road accidents and environmental impact. These are complex issues which are often deeply interactive. An improvement in one area can often lead to a negative effect in another. It is often no longer possible to deal with a particular transport issue in isolation and a much broader assessment of many, often conflicting issues is needed when searching for the most appropriate solution.

As has been seen in these articles, we live in an age when technology is developing at an astonishing rate, and the benefits from technology and systems advances in relation to transport in particular are potentially very large. Technology is also of course delivering the possibility of real-time information gathering on a large scale, encompassing a wide range of individual activities across the travelling population that together constitute a large source of data, much of which is highly relevant for transport, safety and infrastructure. Understanding, analysis and evidence inform better development of policy options facilitated by such technology advances and innovation. These activities go with the present evidence base to help get more out of existing transport systems, to help integrate movement between them, to help integrate them with other infrastructure components, such as energy, and to point the way to what is needed from the infrastructure systems of the future.

These are challenging times for us all, but they also offer great opportunities and potentially great benefits from properly targeted research. Getting things right depends on understanding; we need knowledge - how to achieve, when to achieve, what options there are, or could be, for policy and operations and how to choose between them to get the best outcome. Providing that knowledge, and how to apply it, offers the prospect of an exciting future and one that TRL is proud to be a part of."

Professor
Neil Paulley FCIHT
Director, TRL Academy

Creating the future of transport

TRL HEAD OFFICE
Crowthorne House
Nine Mile Ride Wokingham
Berkshire RG40 3GA
United Kingdom
Tel: +44 (0)1344 773131

MEDIA ENQUIRIES
Tel: +44 (0)1344 770141/770514
Email: mediaenquiries@trl.co.uk

TRL LIBRARY
Tel: +44 (0)1344 770203
Email: info@trl.co.uk

GENERAL ENQUIRIES
Tel: +44 (0)1344 773131
Email: enquiries@trl.co.uk

TRL BIRMINGHAM
Tel: +44 (0)121 222 5497/5498

TRL SCOTLAND
Edinburgh
Tel: +44 (0)131 455 4613

TRL WALES
Cardiff
Tel: +44 (0)29 2066 0117

TRL ABU DHABI
Tel: +971 2444 6010

TRL QATAR
Tel: +974 4491 4471

For further information email: **enquiries@trl.co.uk** or **visit www.trl.co.uk** Compiled by TRL's Communications Team