Transport Visions

Vehicles and Infrastructure

The fourth of eight reports from the Transport Visions Network

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Preface

Futurology - *the study or prediction of the future of mankind.*

1. At the beginning of the 21st Century, the UK transport profession in all its guises is very active. A Transport White Paper in 1998[1] set a new agenda to address the burgeoning levels of travel demand and motorised traffic. In the face of short-term workloads and objectives it is tempting to put to one side the potentially distracting business of transport futurology. After all, has not the time for debate and imaginative forward thinking now passed with the publication of the White Paper and 'Transport 2010'[2] which outlines the Government's £180 billion spending plan for transport? Is it not now time to begin 'bedding in' the new policies and practices that will serve us for the next decade or two? The answer is no. While action is urgently needed to address present-day problems, debate is also necessary to avoid complacency about the future and the transport challenges it will bring. Hence forward thinking remains crucial.

2. Reports documenting attempts to set out transport visions are not new and examples are plentiful. In the run up to the new millennium, many people contemplated the future of transportation and numerous documents were published presenting predictions and visions. In the UK, the RAC Foundation[3] convened an advisory group in 1992 to assess the relationship between cars and the environment and to identify research priorities. Then in 1997 the Engineering Council[4] set up working groups to examine challenges and solutions for the UK's future transport needs. They started with a simple vision of 'access for all' and 'transport without costs' and identified what was required to realise the vision, including a timetable for action. Within the Department of Trade and Industry's (DTI) Foresight Programme of 1999 a task force examined the implications for transport of four different 'environmental' futures for the period 2010-2040. The task force produced recommendations for policy and research that were designed to be robust against each of the futures.

3. The Institute for Transport Studies at the University of Leeds[5] attempted to provide a vision for the future of transport in Britain for the next thirty years by interviewing transport stakeholders about what might happen and how it could be achieved. The Europe 2020 group[6] considered the future of transport and communications in Europe. They looked at the impacts on population, lifestyles, economy, environment, regional development, urban and rural form, goods transport, passenger transport and communications of three different scenarios relating to economic growth and environmental futures.

4. David Banister[7] presented a 'Eurovision' for sustainable urban development and transport in 2020 developed by specifying environmental, regional development and efficiency targets, tracing two paths towards the targets and back-casting to determine actions required to achieve them. William Garrison and Jerry Ward[8] offered their visions of transportation systems that will better serve the future needs of the United States. They include better ways of managing congestion, new types of vehicles, new possibilities for cities designed to meet the varied needs of their inhabitants and different ways of moving people and freight over long distances.

5. What, then, is the justification for yet another transport visions report or indeed a series of reports? There are three principal justifications. Firstly, the world is an ever-changing place and attempts at transport visions must be regularly revisited and revised in light of the developments we experience in society, such as the emergence of mobile communications. Also the uncertainty of the future means that no single vision can claim to be accurate. The only certainty is that transport and travel patterns will always be dynamic. Visions from a variety of perspectives enable a more informed consideration of the future.

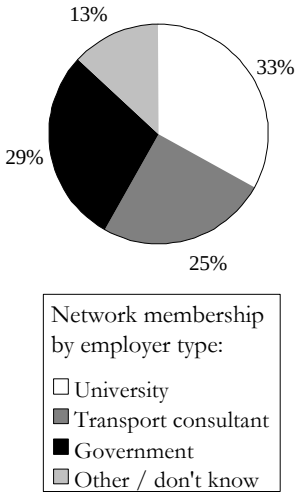
6. Secondly, we are at a propitious point in time in the UK. The present and pending acuteness of car dependence, traffic congestion and their associated effects has pushed transport high on the public and political agenda. Longstanding solutions to problems are no longer appropriate (at least by themselves) and politicians and other key decision-makers are prepared to listen to new and possibly radical propositions. The time is ripe for the imaginative thinking and innovation that can be derived from transport futurology.



7. Thirdly, almost without exception, all previous vision documents have been the product of senior professionals. Listed in the acknowledgements of such reports are the likes of Professors, Chief Executives, Chairmen and Directors. Conspicuous by its absence is the explicit acknowledgement of young professionals. All the reports in this series have been produced exclusively by young professionals - men and women aged 35 or under. Being 'young' does not give any special insight into the future. However, with young professionals comes the prospect of new ideas and perspectives that can potentially challenge existing mindsets. Furthermore, the young professionals of today will be the decision makers of tomorrow with a responsibility for delivering effective solutions. It is hoped that the act of engaging young professionals in a transport visions debate will in itself be of value to the individuals concerned by assisting in their professional development

and the forging of new professional relationships with important future influence.

8. This report and others in the series are a product of the Transport Visions Network. The Network was conceived by Drs Glenn Lyons, Kiron Chatterjee and Greg Marsden of the Transportation Research Group (TRG) at the University of Southampton. The TRG has been responsible for securing funds for co-ordinating and reporting on the Network. Funding has been kindly provided by the Engineering and Physical Sciences Research Council, the Rees Jeffreys Road Fund and the Department of Transport, Local Government and the Regions. The Network was established at the end of 1999 and formally began its operations in February 2000 with the aim of addressing and reporting on eight transport Themes during a 36 month period. Membership of the Network has been open to anyone aged 35 or under. The membership predominantly consists of transport professionals who have a range of background disciplines and experience. Membership has totalled around 250 people with local authorities, transport consultancies and universities all well represented alongside other organisations.



9. The reader will find that the discussion is focussed on visions for the United Kingdom, reflecting the fact that the Network's founders are UK based, as are the majority of its members. Nevertheless, Network membership also has representation from a number of other countries including: Australia; Austria; Brazil; Belgium; Canada; Chile; Czech Republic; Denmark; Finland; Former Yugoslav Republic of Macedonia; France; Germany; Greece; Hong Kong; India; Indonesia; Italy; Japan; Malaysia; Mauritius; Netherlands; New Zealand; Norway; Pakistan; Portugal; Republic of Ireland; Romania; Russia; Singapore; South Africa; South Korea; Spain; Sweden; Switzerland; Taiwan; Turkey; and the United States of America. We feel that our visions could apply in many respects to other 'developed' nations and possibly also to less 'developed' nations.

10. So, what do we hope the value and impact of our reports will be? Pragmatists might be anxious to determine whether or not the reports can shed any light on solving today's problems. Others might expect that our reports should abandon convention and offer truly provocative and far-fetched forays into a distant future. Perhaps we have been able to reconcile both of these aspirations. Our principal goal is to challenge existing mindsets and to reinforce the importance of forward thinking in transport research, policy and practice. We hope to reach a wide variety of audiences and provoke fresh ideas and perspectives. If we have been successful then our

reports should help to influence current policy debate. We hope they will also inspire a stream of adventurous research proposals.

Introduction

To the reader in a hurry -

This report details the Network's views regarding the future of vehicles and infrastructure in the UK. A brief review of historic trends precedes a discussion of transport modes in widespread use today and the potential role of new modes. The importance of infrastructure and its financing is presented before the role of Government is discussed. The discussion sets the scene for six future visions of vehicles and infrastructure. Each vision stems from a different standpoint concerning societal values and portrays a variety of perspectives from future citizens on the transport system developments that could emerge.



11. The Transport Visions Network is exploring the future of transport in the 21st Century. The first report in this series, *Society and Lifestyles*[9], considered a myriad of issues and trends that are shaping or have the potential to shape the way we live in the future and our travel needs. It presented six different scenarios for the future. In the second report, *Transportation Requirements*[10], the Network set out twelve guiding principles for the design of future transport systems. These are listed at the end of this Section. The third report in this series, *Land Use Planning*[11], considered the role of land use planning in shaping transport. Visions were developed for four different aspects of land use planning.

12. This report examines some possible ideas for vehicles and infrastructure that could apply to the UK surface transport network in the future. The discussion is supported by a broad coverage of reference material on past experience, contemporary concepts and future aspirations. The report does not restrict itself to a consideration of solutions that might reduce the problems that we face today. Rather, it aims to present a range of futures, which may or may not be appealing to transport professionals and considers how or why they might come about.

Vehicles and Lifestyles

Here in my car
I feel safest of all
I can lock all my doors
It's the only way to live
In cars

Lyrics from the song 'Cars' by Gary Numan[12]

13. It has been suggested that we have a love affair with the car[13]. To many people the car offers a safe and comfortable means of travel that allows them independence to pursue their lifestyles. Indeed, the car has offered flexibility in reaching a range of destinations not possible within the same timescales through public transport systems. In terms of total travel (measured in passenger kilometres) the car has not only acted as a substitute for travel by public transport but has facilitated, and over time perhaps necessitated, more motorised journeys and more journeys over longer distances[14].

14. However, we should critically evaluate the idea that the vehicle is the controlling factor. History has shown that there have been expansions in growth of other vehicle modes (e.g. coach, rail and air). If it is the lifestyle afforded by the vehicles we have available that we love rather than the vehicles themselves, then new modes could bring new choices and, in turn, new transport challenges. After all, it is not inconceivable that, at some point in the future, car use may decline as new modes of travel or means of access become popular within society.

15. Demand forecasts have traditionally determined infrastructure provision but there is a growing acceptance of the need to influence demand and not just meet it. "*The mobile office (i.e. reduced importance of workplace location) will gradually liberate us from the 8am/4pm commute. Travelling and commuting will increase but it will be spread over more hours than it is now and we will use the available infrastructure much more efficiently than we do now.*"

16. This report has been assembled from the contributions of a wide range of individuals from the Transport Visions Network, through structured e-mail debate and a workshop held in Summer 2001. The suggestions put forward do not necessarily reflect a consensus of opinion. Quotations appearing in the text of the report without any attribution (as above) are statements made by Network members during either email or workshop discussion. The Network's deliberations were influenced by its previously formulated 'Transportation Requirements'- a set of guiding principles for future visions and developments in transport. For reference, these are set out below:

Transportation Requirements

1. There should be an equitable distribution of access to a range of key real and virtual destinations that support people's quality of life.

2. The absolute level of resource use for transport activities should be controlled and the resource efficiency of mobility should be maximised.

3. Users should pay the full internal and external costs of transport and these should be made transparent. Where appropriate, transport uses or users providing external benefits should be subsidised.

4. In the provision and operation of transport systems the adverse effects on the environment should be minimised according to agreed principles and targets.

5. There should be discrimination and prioritisation between different types of trips and activities.

6. Transport should not exacerbate the adverse effects of lifestyle on health and safety and should aim to reduce these effects wherever possible.

7. Electronic and other non-mobile means of communication should be considered as transport options and treated accordingly in policy and practice.

8. Land use efficiency should be maximised and net land take by the transport system minimised.

9. The reliability of the transport system and its operation should be regarded as a fundamental system management goal.

10. Transport should not exacerbate problems of social participation and should aim to reduce these problems wherever possible.

11. Stakeholders should play an integral role in the entire life cycle of problem identification, solution formulation, implementation and evaluation.

12. Transport users should be enabled and encouraged to make fully informed choices.

Report Methodology

17. The period of e-mail discussion began with an open call to Network members for ideas: *"Motorised roller skates to flying cars - what new mobility concepts do you envisage in the next 50 to 100 years?"* Thereafter Network members were presented with a more structured approach. Short fact sheets accompanied by questions and issues to consider were used to prompt discussion under the following headings:

- The role of vehicles in transportation
- The role of new vehicle concepts
- Possibilities, politics, costs and impacts
- Driving forces for change

18. During this period of email debate, there was discussion of the prospects for the introduction of new types of vehicles and infrastructure. Emphasis was placed upon the problems and benefits of present day options, as well as the prospects for adaptation and improvement of these options. Discussion relating to the nature of today's vehicles and infrastructure is presented in Section 1 of the report. This is taken forward in the subsequent section of the report with a consideration of the future prospects for new developments in vehicles and infrastructure.

19. At the workshop many of the issues discussed in the e-mail debate were revisited and developed as the problems associated with present day vehicles and infrastructure were considered and solutions proposed. Workshop discussion was framed by a recognition that changes in vehicles and infrastructure could not take place in isolation. They would be driven and shaped by political, technological, economic, social, environmental, legal and cultural change.

20. The workshop therefore focussed upon developing ideas for vehicles and infrastructure to address the needs of a range of possible future contexts. This process involved the development of six visions. Each vision originated from a different outline scenario of the future (encompassing differing aspects of the changes listed in paragraph 19). It was the Network's role to consider how vehicles and infrastructure would exist and operate in these situations. The resulting visions are conveyed through the viewpoints of future citizens and are presented in Sections 3-8 of the report.

1 Today's Vehicles and Infrastructure

Introduction- Historical Perspective

21. The existence of settlements in ancient civilisation, as today, required sufficient supplies of food and water. For this reason, many settlements developed by the coast or alongside major rivers. Water-borne transport benefited from wind and river currents and was faster than land based transport. Indeed, even when the wheel was invented, a lack of suitable road infrastructure limited its use. Garrison and Ward[15] point out that most transportation between settlements was not over 3 mph up until 1800. The same could be said for transport within large settlements such as cities where "*proximity had to substitute for mobility*"

22. It took the development of new forms of transportation to change the daily constraints on people's lives and, therefore the patterns of our cities and their spatial structure. Horse drawn street cars were followed by the trolley bus, which more than doubled the average speed of urban travel from 3 mph (walking) to 7 mph. The car made an even more significant step-change with urban speeds about 3 times faster than the trolley bus[16]. Faster modes of transport led to rapid expansion of urban areas with jobs and other opportunities able to be reached from greater distances. However, it is worth acknowledging that due to the popularity of the car and the limitations of infrastructure provision, the average speed of car traffic in central London is now below 10 mph[17].

23. The development of the UK railway network, as described by Simmons and Biddle[18] provides an interesting case study in understanding how transportation system decisions have important long-term implications. Wooden colliery tramways had been in use in central Europe since the middle ages although the first recorded system in the UK was not until 1603 at Wollaton, near Nottingham. In 1825 George Stephenson (1781-1848) built the first public railway to utilise steam locomotives, the Stockton and Darlington Railway, to the same rail gauge as that for horse drawn colliery trams at 4 foot 8 inches. He subsequently added a further half-inch for the Liverpool to Manchester Railway, probably to ease clearance between wheel and rail, creating standard gauge track.

24. Isambard Kingdom Brunel (1806-1859) opted to use a broad track gauge of 7ft (later expanded to 7ft 0.25 inches[19]) on the Bristol to London line to enable higher speed operation (through use of larger-diameter wheels) with greater stability than that afforded by

the 4ft 8.5in gauge railways. However, where Brunel's broad track gauge met standard gauge at places such as Gloucester, track chaos ensued as passengers and goods had to be transhipped from one train to another. As a result of these problems in 1845 a Royal Commission was appointed to study the problem of incompatible rail gauges. The Commission decided that, although Brunel's broad track gauge did indeed offer significant advantages in terms of speed, stability, safety and carrying capacity, so much track had already been laid to the 4ft 8.5in gauge that it was too late to change.

25. Every mode of transport is constrained by the availability and quality of the infrastructure it uses. Examples of unstandardised infrastructure are still to be found and are still emerging. For example, the UK remains at odds with its neighbours in driving on the left-hand side of the road. Similarly, different local authorities in the UK have invested in different information and communications technology (ICT) products and systems for transport. Infrastructure is an expensive and on-going financial commitment to service. The benefits of expanding existing infrastructure or providing new infrastructure must be set against the need to maintain the existing networks to a high standard. Present day performance related problems on the UK rail network and the London Underground could be attributed to a large degree to poorly maintained networks.

26. Developments in rail, again described by Simmons and Biddle[20], offer a precedent for how we might expect new forms of propulsion to become established in the future. Around 1800, Richard Trevithick (1771-1833) developed steam engines capable of pulling significant loads, as ably demonstrated by his Pen-y-Darren tramroad locomotive of 1804, which could have been used on rails. However, Trevithick's 1804 locomotive broke the tramroad's cast-iron rails (George Stephenson specified wrought iron rails for the Stockton and Darlington Railway for precisely this reason) and Trevithick was unable to attract sufficient financial backing for further locomotive construction. He subsequently returned to building stationary steam engines for use in mines and elsewhere.

27. It took the special geographic and financial constraints and entrepreneurial conditions surrounding the Stockton and Darlington Railway for steam locomotive technology to be finally deployed on a public railway, even though steam locomotives such as Hedley's 'Puffing Billy' and Murray's 'Salamanca' had been in use on private industrial railways since as early as 1812. It required the further impetus of the Rainhill Trials of 1829 for steam locomotives to evolve into the modern multi-tubular boiler design pioneered by the winner of that competition, Stephenson's 'Rocket'.

Today's Modes

28. During its discussion the Network considered the diverse range of surface transport modes currently available. Table 1 illustrates the spatial range of some of today's transport modes. Each mode provides a different level of service for a given range. Walking across a city might be feasible, but perhaps less convenient than catching a bus. Driving 200 yards to the shops is possible but less healthy (and can take longer) than walking. A number of other less widely established or commonplace modes exist. For example, monorail systems have been in operation in the USA, Japan, and Malaysia for a number of years[21]. However, they only operate in niche high density markets.

Mode	Average journey length in miles 1997/99
Walk	0.6
Bicycle	2.4
Motorcycle	9.6
Car - driver	8.5
Car - passenger	8.7
Taxi/minicab	4.4
Bus - in London	3.5
Bus - Other local	4.4
Bus - Non-local	61.5
LT underground	8.0
Surface rail	33.7

Table 1: Average journey length in the UK by main mode 1997/99[22]

29. UK transport policy actively promotes walking[23], cycling[24] and collective forms of transport[25] to reduce congestion and environmental impacts. However, the continued rise in car ownership and use seems to indicate that collective transport can only compete with the car over certain fixed routes. Walking only competes with the car over a one to two mile journey and cycling, even though it has a larger range than walking, is subject to a number of difficulties including safety, route, topology and weather. This may explain the dominance of the car, as it offers a flexibility of range at such high levels of service that it is difficult to match by other modes. However, this success has bred the problems of congestion, pollution, traffic accidents, community severance and other environmental and social impacts that we face today and solutions are needed to address all of these problems.

Walking

30. The environment in which the pedestrian operates is crucial to increasing the viability of walking as a transport mode. Data from Transport Statistics Great Britain shows that, on average, we only walk 186 miles a year, 21% less than we did 10 years ago[26]. However, it is not clear how much of this reduction is due to a less

than adequate range of amenities and services accessible by foot and how much is due to a reduced desire to walk in the face of the quick and convenient option of the car.

31. In spite of this uncertainty the Network believes that quality infrastructure can make walking attractive "*If you go into a big supermarket or an out of town shopping area, you have covered walkways. You don't see people riding bikes in shopping centres. If you've got a big shopping centre, say Lakeside Thurrock, once you are inside people are walking around. No-one complains about having to walk.*"

32. Improving walking facilities will not solve all our transport problems, but it should form an important part of any solution that is developed. Further understanding of the quality of local service and activity provision that is required to increase access by foot should be addressed. Clearly the consumer of the 21st century values choice highly. It may not be enough to have an array of local shops unless the quality, variety and price of the products matches that available at other locations easily accessible by motorised transport.

Two Wheel Options

33. Recently in the UK there has been an increase in the use of microscooters (see Figure 1), which operate on journey ranges somewhere between walking and cycling. Microscooters are faster than walking and unlike cycling they require very limited storage facilities when the destination is reached. The microscooter can also compete with motorised transport in areas of high density, which are prone to congestion such as cities and towns. However, it remains to be seen if the microscooter will represent a fad or fashion craze or be considered as a genuine transport option.



Figure 1: Microscooter[27]

34. Another two wheeled phenomenon that has recently received public attention is the Segway Human Transporter (see Figure 2), invented by American engineer Dean Kamen[28]. The vehicle has gyroscopes to keep it upright and a sensitive steering mechanism that starts the scooter moving when its rider leans forward. The machine has a top speed of 19kmph and one charge of its battery holds enough power for a 24-km trip. Even before launch, the contraption has its first customers. The US Postal Service, General

Electric and the US National Parks have reportedly agreed to buy many heavy-duty models for $8,000 each. A great deal of media hype has surrounded this invention with great claims being made for its utility. However, it remains to be seen if the invention will have any serious role as a future transport mode.

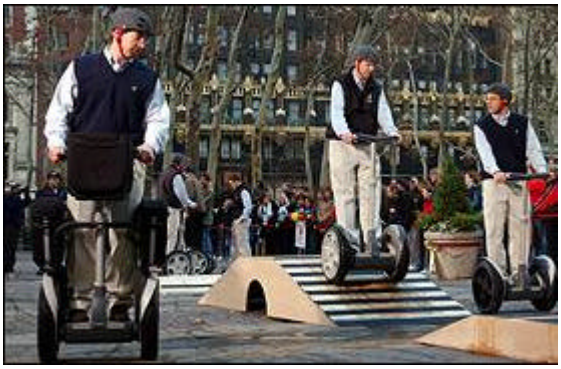


Figure 2: The Segway Human Transporter[29]

35. Network members felt that, as a mode, the powered two wheeler offered the potential to compete with the car over a greater variety of trips. "*At a rough guess, I would imagine our existing urban road infrastructure could support 10 times the current travel demand if reserved only for bicycles. Electric assisted bikes are on the market In the future these could become increasingly popular*". Current disincentives to powered two wheelers include weather, luggage capacity, safety, and transportation of small children. However, these barriers may be overcome. New motorcycle designs, such as the BMW C1 (see Figure 3), may address weather and luggage problems[30]. Safety concerns relate to the degree of risk of being involved in an accident and, in turn, to the severity of the accident. Use of two-wheelers does not necessarily equate to higher accident risk, as cities with high cycle usage such as York[31] have demonstrated.



Figure 3: The BMW C1[32]

Mixed Mode Infrastructure

36. To what extent should different modes be segregated from each other by the transport infrastructure? Dedicated roadspace for buses, trams and light rail can enable them to bypass congested traffic and enjoy faster and more reliable journey times. On the other hand inter-operability can be important. In the Karlsruhe light rail system, the vehicles can travel seamlessly from inter city rail network to street-level urban tramway[33]. A similar shared running approach will see the Tyne and Wear Metro extended over heavy rail tracks from Pelaw (Gateshead) to Sunderland in spring 2002[34].

37. Dedicated cycle lanes are often pursued as a means to offer a more favourable transport network for cyclists. It is argued that they improve the safety of cyclists by reducing the risk of collision with faster mechanised vehicles. They may also enable cyclists to bypass congestion on general roadspace.

38. However, there was a feeling among Network members that segregation might not be the only viable way forward. In some cases it will not be possible within physical constraints to set aside road or pavement space for buses, light rail and cyclists. For the latter in particular an alternative regime may be able to improve road safety. It was proposed that homogenisation of speeds be sought for mixed use infrastructure. In effect this would extend the principle of 20mph speed limits already introduced in some urban areas. It would seek to impose average journey speeds throughout the day in urban areas comparable to those that are currently experienced during peak periods when congestion rather than speed limits is the form of traffic regulation. The 'system' prevails in many parts of the world where cars, bicycles, rickshaws and buses compete for the same roadspace. Speeds in urban areas are often regulated by congestion in the peak periods. Not only could this be effective in improving road safety, but by encouraging mixed mode use of infrastructure as an alternative to segregation it might also help in changing attitudes towards and levels of use of walking and cycling in urban areas.

39. There is debate about the environmental impacts of lowering the speed limit in some urban areas. Research at TRL[35] has shown that lower speeds can lead to significant increases in vehicle emissions. However, whilst this may be true of the vehicle fleet today, new hybrid engine driven vehicles are now available and fuel cell vehicles (discussed in Section 2) will be available in the future, which should mitigate these problems.

Car Sharing

40. The Network has on a number of previous occasions highlighted the potential benefits of car sharing in improving the efficiency of our transport system at little or no extra cost in terms of vehicles and infrastructure. "*Several of the recent emails have been about*

improving the fuel efficiency of vehicles. 5% here, 5% there. It's all good news, but its scarcely relevant if the car has only one person it - i.e. 20% efficient. You can increase a vehicle's efficiency by 100% by simply getting two people in it rather than one." Improvements in ICT offer the prospect of making the process of matching lifts with people increasingly simple and efficient[36].

41. One high-profile example of a successful lift share project is at the Boots company site in Beeston, Nottingham[37]. Staff are guaranteed a lift home by taxi if they have a problem with their arranged lift although it is understood that this option is rarely exercised. There is also a boom in the lift share market for event based transport, for example, arranging lifts to away football matches. Clearly there is a role for Government in promoting the advantages of car sharing by providing infrastructure management, which benefits high occupancy vehicles (HOV) such as the HOV lane in Leeds[38] or in California[39] where HOV accounts for over 900 lane miles.

42. Lessons from the fuel crisis[40] of September 2000 in the UK showed that although people felt able to lift share on a short term basis they found it difficult to do so on a longer term basis. However, this may be a state-of-mind rather than a major stumbling block to scheme deployment. Providing the right incentives and creating markets for the right support systems that enable people to car share will be important. Many people conduct a number of activities on their way home that could prevent lift sharing (e.g. shopping). Some of these tasks could be conducted by other means such as the Internet.

Long Distance Modes

43. The train has enabled us to make some journeys that would not be possible by car over a similar time horizon. Improvements in the rail links between Edinburgh, Glasgow, Manchester, Birmingham and London could significantly reduce the journey times between these cities. However, the West Coast Main Line[41] Upgrade has shown that it may actually be more cost-effective to adopt the approach of building a new high speed line to enable 300 kmph trains than attempting to run 225 kmph trains on the existing mixed use railway. The improved accessibility of the West Midlands, the North West and Scotland may promote additional economic growth and regional development.

44. The question in the UK at the moment is who will pay for new infrastructure to take the railways into the modern high speed era. The French[42] and German[43] Railways have shown that new high-speed railways can be built with sufficient Government financial support. The recent financial collapse of the privatised Railtrack[44] (which proved unable to adequately maintain and renew its existing

network) followed substantial increases in the costs of projects such as the West Coast Main Line Upgrade[45].

45. A further step change in high speed rail travel is in progress through the utilisation of superconducting magnetic levitation technology (Maglev). Vehicles are run by repulsive and attractive forces of superconducting magnets, there are no wheels or contact with the track and speeds of 500 kmph have been reached. Research and development of the Maglev started in Japan in 1962 (proponents of the technology are now also to be found in Europe and North America). Following many successful test runs, a manned test run at the Yamanashi Maglev Test Line achieved 500 kmph in 1997[46].

46. The long distance coach industry has about the same market share as rail for journeys between 75 and 350 miles[47]. It should be acknowledged that many other countries offer a much greater range of choice and service quality (e.g. first class, sleepers) in their national coach networks. There may be more that can be done in the UK to support the coach industry and promote and exploit its role as a collective mode for long distance travel. The M4 bus lane is an example of how infrastructure priority can be applied to enhance the viability of long distance collective modes. It is possible that such measures could start the re-invention of the motorway with high capacity road trains or even LRT routes taking advantage of highway infrastructure.

47. The bus, train and coach all offer benefits to the traveller that are not available to the car driver. They allow passengers the freedom to conduct a range of activities whilst travelling (e.g. eat, sleep, read, work). However, collective transport operators may not enjoy this advantage indefinitely. Intelligent cars are being developed that adapt the controls, seats and mirror positions to suit the driver and can even control the time/distance gap between the driver and the vehicle in front[48]. The car also offers a personal environment that does not have to be shared with other travellers.

48. Societal values have a clear role to play in determining whether there will be a future for widespread collective passenger transport. On the positive side, Light Rapid Transit and Metro systems are seeing increased use, with patrons drawn from a wide range of socio-economic backgrounds. This illustrates that perceived service quality and peer acceptance can play an important role in delivering change.

49. Overcrowding on railways and long-term growth prospects, particularly on South East commuter routes, require new solutions to enhance capacity if we are to continue to promote rail as a sustainable alternative to the car. Double-decker trains, such as

those operated around the Canadian city of Toronto[49], and on the French LGV high speed rail lines[50] offer one possibility. However, there are considerable technical and financial obstacles to achieving this.

50. Between 1949 and 1971 two double deck trains, designed by Oliver Bulleid, operated commuter services on the crowded Charing Cross and Cannon Street to Dartford and Gravesend routes[51]. In order to fit the UK loading gauge the trains were extremely cramped inside with restricted headroom and standing space and were not deemed to be an operational success.

51. In order to run suitably dimensioned double deck trains, the UK loading gauge would therefore have to be increased (at least in terms of height), but raising overbridges or lowering track through tunnels is a costly process. However, because there is no single uniform UK loading gauge it is easier to increase the loading gauge on some lines than others. Hence Stagecoach, owners of the South West Trains franchise, is conducting feasibility studies into double deck train operation, but only on selected lines from Waterloo to Guildford, Basingstoke, Chessington, Hampton Court and Kingston-upon-Thames[52].

52. The new Channel Tunnel Rail link [53](St Pancras to the Channel Tunnel) will be able to accommodate continental style double deck trains such as TGV Duplex[54], as would the proposed Central Railway project[55] which aims to build a £6bn privately-funded, primarily freight railway between Liverpool Docks, Manchester, Sheffield, East Midlands (possibly Heathrow) and the Channel Tunnel capable of accommodating double stack container trains.

53. The implementation of European Union Rail Interoperability Directives 96/48[56] (High Speed Lines) and 01/16[57] (Conventional Lines) may eventually require large sections of the UK railway network (including tunnels, station platforms, signals and overbridges) to be completely rebuilt or repositioned to an, as yet, unspecified European standard loading gauge. Such a task would dwarf even the deliberated conversion of Brunel's Broad Gauge railway to standard track gauge in the 1860's and 70's.

2 Tomorrow's Vehicles and Infrastructure

The Future Context

54. The 1997 National Road Traffic Forecasts suggest that traffic volumes might grow by between 36% and 84% by 2031[58]. Growth in travel demand is being fuelled by the improved economic conditions of all sectors of society and the resulting increase in activity demand. The idea of meeting this increase in demand through increased road capacity supply ('predict and provide') was dismissed as unworkable in the early 1990s[59]. It became widely recognised that investment in new transport infrastructure often facilitates faster journey speeds, allowing longer distances to be covered in a given travel time. Over time, adaptation to this new capability encourages new location decisions, which may encourage people to travel longer distances. In these conditions mobility can reach unsustainable levels with adverse impacts upon the environment, the economy and society.

55. The philosophy of 'predict and provide' has, to some extent, been replaced by an approach of 'travel demand management', which seeks to accommodate growth by encouraging a more sustainable use of modes. This approach is broadly endorsed by the Network and reflected in its Transportation Requirements[60].

56. 'Travel demand management' does not necessarily imply that total transport supply should be restricted to constrain demand[61]. Indeed, it is difficult to foresee measures that could be taken to curtail demand that would be deemed socially or politically acceptable. The Network has argued that economic and social considerations must necessitate the stimulation of demand in some circumstances, for example, in order to provide adequate links to allow growth in all UK regions[62]. Instead of seeking to curtail demand, it might be hoped that at some point in the future, perhaps in the next 100 years, a limit will be reached whereby everyone who wants to can travel, as much as they desire or need to, using the available modes.

57. However, the Government cannot afford to wait passively for the prospect of total demand satisfaction to be realised. As the main sponsor of most national infrastructure developments it has to determine the physical network over which managed growth occurs. In managing growth, the Network would encourage a reliability based approach and not a speed enhancement approach for travel within the UK. "*We should not seek to reduce (minimise) journey*

times since this will only encourage longer or more journeys. Instead, we should focus on making the journey itself less stressful, more enjoyable, healthier and safer and more reliable in terms of journey time. Improved journey time reliability will be possible through prudent use of banked capacity." In effect the hard shoulder of the motorway is an existing example of banked capacity. It represents spare capacity (equivalent to an extra lane) that can be called upon for use when vehicles break down, accidents occur, or roadworks take place, in order to minimise disruption.

58. The discussion thus far has concentrated on traditional travel modes. The Network has advocated that virtual mobility should be considered on a par with corporeal mobility. "*It's probably over-tempting to point to virtual mobility as a replacement for travel etc... but the various IT developments are certain to have a BIG effect on what travelling we actually do and how we perceive it.*" Clearly, new communications technology has the potential to offer virtual substitutes for some of the activities conducted today (e.g. Internet banking) but it also has the potential to develop new activities (e.g. virtual private auctions) that create travel. Had the telephone been invented at a time of significant congestion then one might have been tempted to see it as a solution that prevented the need to travel. The reality has been quite different. Garrison and Ward offer a simple conceptual plan (see Figure 4) of the developmental processes involved in any transportation improvement:

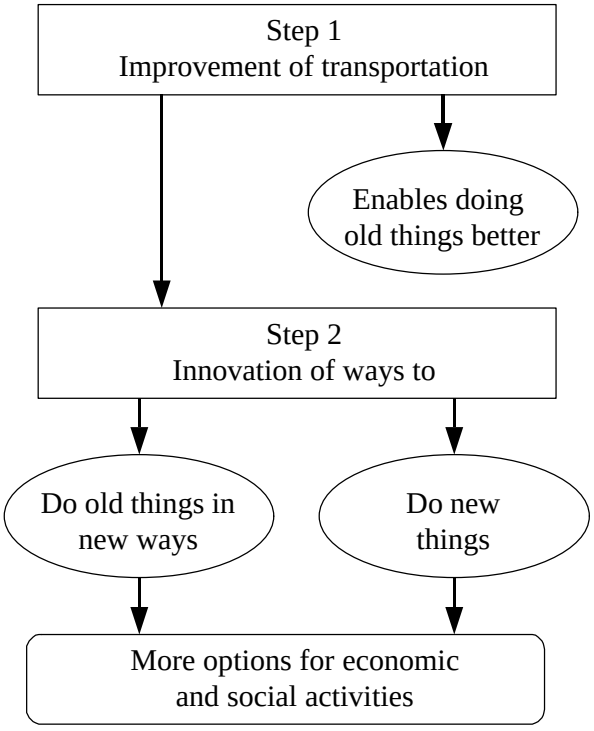


Figure 4: Two steps to increasing social and economic options[63]

59. One of the major concerns recognised by the Network about current vehicle dependence is the contribution that vehicles make to noise pollution, local air quality and the production of climate changing gases. However, a number of new technology options are available which promise to continue to reduce the environmental cost of every vehicle kilometre travelled.

Fuel Cell Technology

60. Perhaps the most widely known and anticipated transport development in this area is the fuel cell. This is a catalytic device that converts the energy stored in a fuel directly into electrical energy without combustion. This occurs through the use of an electrolyte, which allows the passage of ions, but acts as a barrier to the chemical reactants[64].

61. The draft Government strategy, 'Powering Future Vehicles'[65] reflects the widening and increased attention that politicians are paying to fuel cell technology as the strategy was developed across four departments: DTLR, DTI, DEFRA (Department of Environment, Food and Rural Affairs) and Her Majesty's Treasury. The strategy attempts to assess the responsibilities Government holds to facilitate the smooth and early development, introduction and take-up of successive new vehicle technologies and fuels, whilst recognising that no one can foresee or dictate the way ahead.

62. The DTI has supported research and development on fuel cell technology since 1992 through its Advanced Fuel Cells Programme, a sub programme within the New and Renewable Energy Programme[66]. As a result of such work the Government recognises that although fuel cell cars are unlikely to reach the mass market until 2010-2015, fuel cell buses and urban delivery vehicles will arrive earlier, together with increasing use of small fuel cells to power the auxiliary systems in existing vehicles[67].

63. Indeed, it is anticipated that 27 Mercedes-Benz Citaro[68] zero emission hydrogen fuel cell buses (see Figure 5) will go on trial across major European cities (Amsterdam, Barcelona, Hamburg, London, Luxembourg, Oporto, Reykjavik, Stockholm and Stuttgart) in 2002/3. Transport for London and First Group aim to have three such vehicles in operation in London by early 2003. BP Amoco, one of the partners in the project, will supply fuel for the vehicles which will take up to 70 passengers. They will have an operating range of 200-250 km and a maximum speed of about 50 mph. Current estimates put the cost per bus at £780,000[69].

64. In addition to fuel cell development, considerable effort is being made to improve the environmental performance of the conventionally fuelled car. Lotus have produced a concept car, the Lotus Extreme[70], which is capable of delivering 110 miles per gallon (mpg), a four-fold improvement on the current fleet fuel

consumption average. If current trends continue, it seems unlikely that exhaust emissions will be a major issue by the second quarter of this century. However, the potential for diminishing environmental pollution does not mean that the wider environmental impacts of car use will be mitigated. The problems of land take and community severance, caused by the provision of infrastructure to meet the demand of increasing numbers of vehicles, look set to increase.



Figure 5: Mercedes-Benz Citaro urban fuel cell bus[71]

65. There is a need to be aware of the indirect environmental impacts of vehicles operating on transport infrastructure. Electric vehicles may produce no emissions at the point of use, but the issue of emissions at the point of electricity generation remains. Similarly, whilst vehicles can produce environmental impacts through their use, the manufacturing process involved in producing such vehicles can also entail environmental impacts.

66. Lotus, in partnership with a group of other automotive companies, have also been involved with the International Ecotechnology Research Centre and the Centre for Logistics and Transportation at Cranfield University, in a research project that has the ultimate aim of 'designing and taking to prototype stage a commercially viable environmental car'[72]. The project is funded by the DTI's Foresight Vehicle programme[73]. This vehicle (see Figure 6), known as the ASCC (Aerostable Carbon Car) is projected to deliver 120mpg - using a small conventional petrol engine. The fuel savings come through the use of a new, ultra lightweight carbon compound for the body of the car, coupled with a new patented styling to ensure the vehicle isn't simply blown from the road[74].



Figure 6: Computer simulated image of the ASCC[75]

Narrow Cars

67. The Network discussed the potential for a hybrid vehicle combining the features of a motorcycle and car. The concept of a single occupant width car (see Figure 7) was considered. Clearly a critical mass of narrow vehicles could significantly increase the capacity of our urban networks by enabling more lanes to be accommodated across the available roadwidth. Prior to such infrastructure reorganisation, these narrow cars could operate within current conditions, allowing penetration into the market over time. This could be assisted by a reduction in road tax similar to that currently given to vehicles with smaller engine sizes. The benefits of lower fuel consumption that such vehicles would inevitably bring would also yield economic advantages. As economic growth continues, it may be that such vehicles become fashion items - much like small mobile phones have become 'must have' items.

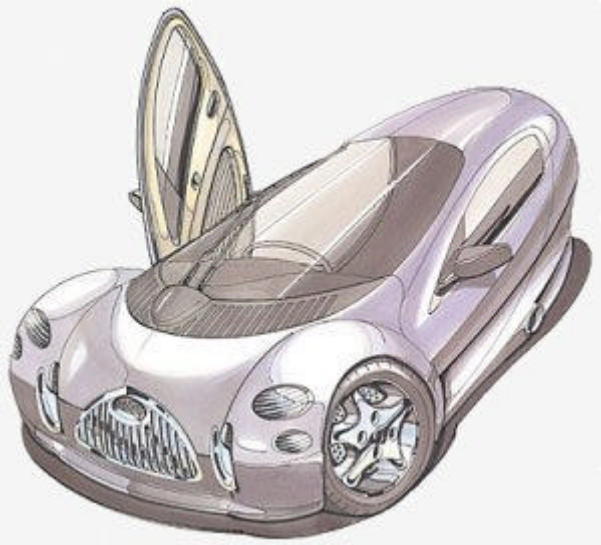


Figure 7: Merlin concept electric vehicle[76]

68. The promotion of smaller cars to minimise land-take for parking and to reduce vehicle queues during congestion was also proposed. However, it was felt that while such measures might make a contribution to solving transport problems, they would not form a major part of any solution. One of the main stumbling blocks to this approach is that people make vehicle purchases based on personal requirements. Clearly, smaller vehicles are more restrictive than bigger vehicles in this respect. It was suggested that this is one of the benefits of City Car Share Clubs[77] where a variety of vehicles are available to the user, which can be chosen to fit the purpose of the trip. In future this could mean the use of the people carrier for the family outing or the narrow car for the single occupant business trip.

69. Network members cautioned that narrow cars would contribute to even higher levels of car ownership and requirements for more rather than less space for parking as a result. Indeed, there was concern that promotion of single occupant vehicles could discourage car sharing, which in itself might prove a more effective and energy efficient option.

Automated Vehicles

70. Increasingly, driving tasks are supported by intelligent automated assistance. This seems set to continue as electronic support systems replace the current mechanical systems used in cars. Semi-automatic gear boxes, intelligent speed adaptation, ABS traction control, adaptive cruise control and automated parking aids are all becoming standard features in top of the range models. An extension to driver support, considered for some time by many to be the way forward for the future, is a fully automated driving system.

71. Such a system has been successfully developed and demonstrated in the United States of America under the US Government sponsored automated highway program (see Figure 8), where platoons of vehicles were operated in a fully automated way on dedicated lanes. However, the program was discontinued shortly after the demonstration in San Diego in 1997 primarily due to the significant costs of the system and concerns about whether a viable consumer market existed or would exist in the near future (the next ten years) for such a system. However, the program did serve to stimulate research activity. In Europe the CHAFFEUR project has been exploring the potential application of such technology in the movement of freight by developing an electronic link between Heavy Goods Vehicles to enable 'truck platooning' to take place[78].



Figure 8: First full road demonstration of the automated highway program, California, USA (Picture courtesy of California PATH)[79]

72. Network members found it difficult to see how a Government could bring a system such as dedicated automated highway lanes

into existence. Government has a clear role to play in legislation for and approval of new technology, but this system relies on car buyers seeing a personal benefit to justify the extra investment that they would have to make for such a capability. However, the benefits of automated control might, for example, be marketed on the grounds of increased safety and convenience to drivers - particularly if congestion increases and the attractiveness of driving itself declines. The acceptance of automated systems by users (i.e. trusting big brother) is also seen as critical issue. Should such systems become available over time at an acceptable price then Government will have a role to play in facilitating the benefits of the system. Ensuring that any systems brought onto the market can interact with each other would be an important first step.

73. Safety issues are often seen as a barrier to progression towards automated vehicles. Indeed, it was argued within the Network that semi-automated vehicles could be less safe than human drivers as humans might, having relaxed their attention to the driving task, find it difficult to react when they have to take over from the system. However, accidents are predominantly a result of human error rather than mechanical failure[80] and the potential for a fully automated system to reduce accidents may continue the drive towards automation. The case remains to be proven that automated vehicles can be safer, both for other drivers and for pedestrians and cyclists. However, if similar advances in technology can be achieved over the next 20 years to those that have been achieved over the last 20 years, it is not inconceivable that automated driving systems will become reality.



Figure 9: Cycab automated low speed vehicle in St Germain en Laye[81]

74. Automated vehicles already operate in many other countries. For example, an automated bus service runs at Schipol airport [82]. This service operates on a fixed route, although this can be 're-programmed'. Similarly, a pan-European project, Cybernetic Technologies for the Car in the City (CyberCars[83]), is underway drawing together key European technology providers working in automated control with the aim of developing small automated vehicles capable of operating in low speed city environments (see Figure 9). One path to technological development could be through trial use in campus and business sites before deployment on public highways takes place. Demonstrating the capabilities of the technology at low speeds and in a range of different environments will provide an important step towards transferring the technology and principles to a wider operating environment.

Dual Modes

75. The Network acknowledged that a number of commercial companies were developing vehicles capable of operating in a range of environments which combine the flexibility of the car with the efficiency gains promised by automated driving systems. A sample system proposed by Rapid Urban Flexible (RUF) in Denmark (see Figure 10) consists of developing new cars capable of running on a fixed track (of triangular cross section) as well as operating as individual driven units. When running on the track, vehicles can be operated at very short headways and can run on electricity. The concept (although not the technology) is not dissimilar to the automated highway.

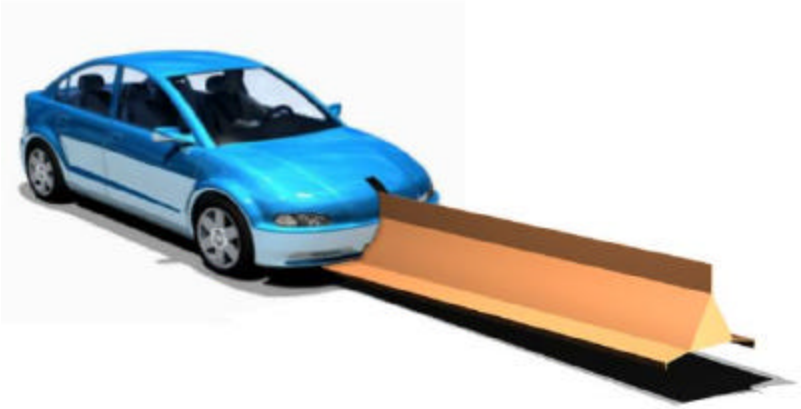


Figure 10: RUF dual mode transport system[84]

76. It is widely accepted that such systems offer the potential to deliver infrastructure capacity improvements and therefore these systems may have a place in transport networks of the future. However, one of the main issues with such systems is achieving a critical mass of vehicles capable of using such modified road infrastructure to justify setting aside existing capacity for the purpose. This is an argument that is well rehearsed in relation to the

introduction of bus lanes. The Network also questioned whether we should be promoting an increase in vehicle capacity rather than an increase in human occupant capacity. High occupancy vehicle (HOV) lanes could come into operation at much lower costs and could achieve greater capacity gains than would be expected through automated lanes.

Shared Use Vehicle

77. Parallel to the work of technology providers, vehicle manufacturers are also developing innovative future vehicle concepts. The Citroen Osmose (see Figure 11) is a concept shared use vehicle. Osmose drivers can advertise their destination and indicate whether they are willing to pick up pedestrians heading in the same direction. Travellers can either flag down a passing Osmose or book a journey in advance using WAP phone technology. Osmose can carry up to five adults and, as a hybrid, runs in zero emissions mode in town, where it ensures pedestrian safety with external airbags. The glass roof panel enables small interior solar panels to provide power for the fresh air ventilation system in the vehicle[85].

78. The Osmose is constructed from transparent materials similar to those used in the iMac computer (see Figure 12). Design innovation is an important driving force in developing appealing future transport solutions. Conversely, design can also act as a barrier to developing new solutions, according to market research into the factors affecting new car buyer's decisions to buy a particular vehicle type. Unconventional designs, at least before they are considered fashionable, can act as a purchasing barrier. When respondents compared the ASCC (see paragraph 66) with a conventional car on the market, the appearance of the ASCC reduced the overall value of the vehicle to the consumer. However, these negative considerations were offset by the car's fuel efficiency (120mpg) in the eyes of most respondents. Consumer acceptance of solutions to transport problems should not be underestimated as a consideration[86].



Figure 11: Citroen Osmose concept shared vehicle[87]

79. It was suggested within the Network that automated taxi vehicles capable of operating in an urban environment would reduce the need for parking spaces and could therefore promote more dense land use. As traffic flow into major trip attraction centres is tidal in nature (with significant inbound flows during morning peak periods and corresponding outbound flows at night), such a system offers the opportunity to connect to high capacity collective transport services, providing a flexible alternative to the car.



Figure 12: The iMac computer by Apple Macintosh[88]

Personal Rapid Transit

80. Personal Rapid Transit (PRT) systems (see Figure 13) were discussed at some length by the Network. The systems consist of automated carriages running on fixed infrastructure. Advances in materials technology mean that the cost per km of assembling such systems has significantly reduced and, although such infrastructure might be seen as a source of visual intrusion, it is possible to address this problem. Infrastructure exists for power lines, communications, lighting and traffic signs on our roads. Such infrastructure could be mounted on the support structure for the PRT carriages. Such systems can also be integrated into building design with stops inside or at the front of a building at first floor level as evidenced by the Seattle Center Monorail[89] and the Dockland Light Railway station at Canary Wharf[90].



Figure 13: Personal rapid transit scheme[91]

81. In the UK, the ULTra PRT (Urban Light Transport Personal Rapid Transit) system[92] may be installed at Cardiff Bay in Wales. In January 2002 system trials began on a test circuit of just under 1km, on which three vehicles could be tested on ground level and elevated tracks. If the tests were successful, funding would be sought for a £45 million project to link the city centre, civic centre and Cardiff Bay starting in 2004[93]. To date, such PRT systems have operated on identified corridors and have not spread across cities to deliver the alternative to car ownership and usage that proponents of such systems suggest they could offer. For selected corridors, PRT may be able to compete with other systems for capacity and value for money, but questions remain regarding the business case for operating such systems on a citywide basis.

Flying Options

82. One futuristic option that is seen in many science fiction films is the use of air space in the urban area to meet our future mobility needs. The Network considered whether jet packs and flying cars were indeed the preserve of science fiction writers or whether they might offer a useful alternative to the way we travel today.

83. Jet packs (see Figure 14) were discussed as a suitable option for truly personalised travel with limited congestion implications. However, it seems unlikely that jet packs will be developed which will not require unacceptable levels of energy consumption. The safety issues associated with unregulated flying at low levels also make the mind boggle.



Figure 14: Personal helicopter[94]

84. Flying cars (see Figure 15) have also been proposed by a number of inventors and speculative enterprises. The energy requirements needed to effect vertical take off and landing, combined with the need for a management control system to regulate such vehicles, would make their introduction a very long-term option, at least with regard to the mass market.



Figure 15: Vertical take off and landing SkyCar[95]

Infrastructure Development

85. The Network acknowledged that the process of changing infrastructure in the UK is slow. The Channel Tunnel Rail Link[96], and the Jubilee Line underground extension[97] are both examples of projects that have been extremely expensive and time consuming to bring to fruition. The Birmingham Northern Relief Road[98] has taken twenty years from design to construction. The upgrades to the West Coast Main Line railway infrastructure[99] are significantly over budget and behind schedule and the decision to proceed with the development of Heathrow Terminal 5[100] has only just been made following one of the longest public inquiries yet seen. The Government is proposing new measures to speed up the planning process and a 'raft' of suitable procurement (contact) procedures are being developed[101]. Nevertheless, infrastructure development is often an uncertain, difficult and most certainly a political process.

86. The UK has a well developed network of roads with over 3400km of motorways and 391,000km of road in total. £3.8 billion per year is spent on roads of which approximately 75% is on maintenance, lighting and road safety measures with the remaining balance spent on improvements and new construction. The UK rail network consists of 16,652km of track of which 1,610km is open for freight only. £3.2 billion is spent every year on rail infrastructure. £321 million is spent on rolling stock[102]. The proposed Public Private Partnership for the London Underground aims to remove the maintenance backlog of £1.2 billion and increase system capacity by reducing breakdowns and improving the use of systems operation technology. The investment makes no provision for the physical expansion of the system[103].

87. The UK Government's Ten Year Plan for transport[104] identifies a number of investment schemes to alleviate congestion points on the road network, to fund some new rail infrastructure in London and on major regional routes and to fund up to 20 Light Rapid Transit schemes. The financial commitment required to fund maintenance of existing infrastructure means it is unlikely that large amounts of new infrastructure will be developed (even discounting the considerable environmental reasons for not doing so). The

prospect of an entirely new infrastructure system operating on a nationwide basis was, therefore, considered by the Network to be unfeasible even in the medium term.

88. Whilst the Network felt it was difficult to see new forms of nationwide infrastructure, it is possible that new or state-of-the-art infrastructure may fill niche markets. For example, Personal Rapid Transit systems fall into this category. However, although such systems are employing state-of-the-art technology, they are not new in concept. The Network felt that future transport modes would mostly be comprised of "*hybrids of what we have already*".

Travelling by Tube

89. Despite the widespread view that wholly new infrastructure systems were unlikely to come to fruition the Network did try to consider all available options. For improving freight deliveries and even potentially for human transit, the concept of evacuated tube technology was discussed whereby goods can be moved at high speed around a network of near frictionless tubes (see Figure 16 below). If significant savings to business could be made then the market conditions might exist for this type of system to develop.

90. Of course, pneumatic tube technology is not new and has been employed extensively in the past as the following information based on an historical account by J.D.Hayhurst illustrates[105]. In the first half of the 19th century the introduction of the electric telegraph greatly enhanced the speed of communication, but benefits could be lost if a message took a long time to get from the telegraph office to the intended recipient. To avoid this delay, in 1853, a 220 yard long pneumatic tube was installed connecting the London Stock Exchange in Threadneedle Street with the Central Station of the Electric Telegraph Company in Lothbury. There were similar installations in Berlin in 1865 between the Central Telegraph Office and the Stock Exchange, and in 1866 in Paris out of the Place de la Bourse.

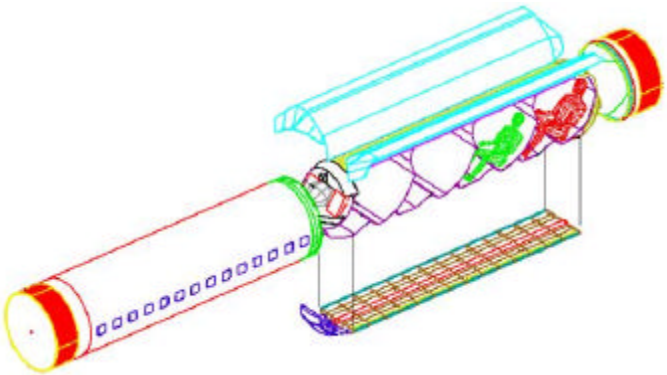


Figure 16: Evacuated tube transport[106]

91. Other cities followed and tube systems were opened for the transport of telegrams and letters. The transport of letters in bulk required large diameter tubes such as exist today in Hamburg and as once existed in a number of American cities. Today, the pneumatic post survives only in Paris and Italy. Pneumatic tubes are still widely used for the transport inside many cities of the world of small batches of telegrams, express letters and air mail letters. These tubes are generally of a diameter of about 3 inches and the messages are carried in cylinders which are propelled along the tube by an air pressure differential from the back to the front, attaining speeds of around 40 kmph.

92. Where the modern day proponents of the system can claim to be innovative is in the increased size of goods (including people) which they aim to transport and in their estimate that such a system would be able to operate at speeds between 320 kmph and 6400 kmph. However, the expense of installing such a system, were the technology to be proven, would require high value payload goods to make worthwhile efficiency gains for transport within the UK. The concept is being promoted most vigorously in the USA where distances for the majority of freight transfer are much longer than in the UK. It is unlikely that such a system would be developed commercially through traditional market forces in the UK. Successful development would be likely to depend upon an international level of implementation via the European Union.

Virtual Options

93. The Network advocated in its second report[107] 'Transportation Requirements' that virtual mobility be treated as a mode of transport in its own right. From this perspective, we can foresee the development of a new infrastructure over which to reach and conduct activities. However, it is felt that at the moment, the use of ICT is in its formative stages alongside the comparative infancy of the technology itself. "*Ultimately the success (?) of the car has been dependent on the creation of a new infrastructure network and as such it has taken several decades for the car to become a fully mature mode. The new mode on the horizon is perhaps electronic communication although the quality of the vehicles (i.e. applications such as video conferencing) and the infrastructure (bandwidth instead of roadwidth) is still some way from maturity*".

94. ICT in its current format is often dismissed as a poor substitute for actual travel. However, parallels can be drawn between the development of the Internet and the development of the car. "*I imagine that 100 years ago if Henry Ford had shown transport professionals a concept vehicle - the Mondeo - and explained that it could reach speeds of over 100 mph and could travel for over 300 miles with a tank of fuel, (not to mention the interior facilities) - the professionals would have been united in their belief that here indeed was the ultimate vehicle for the future. The truly new mode (if there is to be one) is the Internet. It takes mobility to its limit - the*

spatial range is tending towards infinity and easily covers the planet earth - and information is capable of being moved at the speed of light. Internet vehicles of today have yet to mature from the Model T into the Mondeo".

95. The Internet does not offer the same opportunities that physical travel provides to interact with people and environments, but it does enable many activities to be conducted for which travel was previously necessary. It may, therefore, reduce the market place for high speed alternatives to existing transport modes. However, a note of caution must be sounded against the panacea for all woes in whatever guise it takes "*Once the new mode does overcome these issues it will have solved and created transport problems of its own on a scale that may overshadow the effects of the car today*."

Managing What We Have

96. "*I want to travel further and faster and so do most people. Isn't it the last part that's the real problem?*" Currently, some parts of the UK transport system have a problem of capacity at peak periods and not of overall capacity. The unreliability of travel has, to a large extent, been caused by too many people using some parts of the road and rail systems at the same time. This is due partly to working practices and partly to inefficient pricing in transport. Solutions to the inefficiency of pricing in transport have been discussed for many years. Road user charging is a widely supported solution. However, this is also a highly political issue. In the UK, road user charging is only proposed for certain cities (the first being London) and sensitive rural areas with a potential roll out to the inter-urban trunk road network. It was suggested that the problems of diversion to alternative routes and relocation to cities not facing such charges would need to be overcome by the development of a universal road user charging scheme.

97. Whilst the inefficiencies in the present pricing system have been identified[108], it is clear that developing an appropriate means of identifying congestion and environmental costs across the country in a dynamic manner to ensure efficient pricing is not an easy task. It would have to be packaged in a manner understandable to the general public and which was felt to be fairer than fuel taxes. Although difficult, achieving these goals is not impossible.

98. One alternative or perhaps complementary addition to developing nationwide road user charging is the concept of 'slot booking' for travel on the road network. Slot booking is not a new concept in the UK and has been deployed with considerable success by the budget airline industry and to a lesser extent in the rail industry through options such as Apex tickets[109]. Simply, the earlier in advance you book your slot for travel, the cheaper it is. People who want to travel on an already fully booked network would be

charged a premium to reflect the extra delays that their trip would cause. Alternatively, they could wait 20 minutes for a cheaper slot.

99. The Network believed that aligning the decision about when and how to travel with the cost of that particular journey would make users more aware of the consequences of their travel decisions. It may also offer a route to developing greater reliability on the road network. A guaranteed maximum journey time could be provided for parts of the road network for those people that book early. Compensation could be paid out, when required, funded by the premiums paid by those who turn up late. The advancement of ICT could certainly help in the delivery of such a service, although the complexity of delivering this should not be underestimated. Reliability could also be addressed by the development of strategic spare capacity (see paragraph 57).

100. There seems greater potential for enhancing the capacity of inter-urban highways through intelligent highway management because there are fewer conflicts of movement (junctions) to be managed than in an urban area. However, the desirability of increasing the capacity of the inter-urban road network in isolation from the city networks is questionable as many trips will start and end with an urban leg. Novel solutions may have to be developed to manage this 'urban funnel' so that the advantages of improved motorway travel do not lead to reduced urban levels of service.

Role of Government

101. The Government is the key sponsor of major infrastructure investment in the UK. It has to juggle varying financial resources with changing political agendas and local democratic opposition when drawing up investment plans. Whilst the current Government has set out a strategic ten year plan[110] for investment in transport and five year local transport investment plans[111], the recent crises in the rail[112] and air[113] industries have shown the inherent problems in providing a stable background for investment.

102. Some Network members considered that political and local democratic opposition to change were key barriers to the uptake of future innovative transport solutions. It is difficult for the Government to apply a 'long-term' approach to policy when it has a maximum term of office of five years. It would be a bold Government indeed that introduced new infrastructure that would yield absolutely no results during that period. It is perhaps such political concerns that leave us in a cycle of incremental improvement (or incremental deterioration) of existing legacy systems. Even though the problems associated with the privatisation of the UK rail network demonstrate that solutions are not guaranteed by the private sector it was suggested that "*we should continue to court the private sector when it comes to developing solutions - many*

"advances" in transportation have come from private sector innovation and experimentation."

Conclusions

103. One conclusion that can be drawn from all of the discussion on infrastructure is that as so much of our investment in transport is in maintaining the existing assets, large scale change is unlikely to occur over a period of 20 to 30 years. This does not mean that no change will occur or that this change will not be worthwhile. However, it seems much more likely that the potential changes in business and working practices over the next 20 to 30 years as a result of efficiency drives and the increasing maturity of ICT will cause greater changes in travel demand and traffic patterns than investment in infrastructure could deliver alone. Transport professionals should work hand in hand with UK business to maximise investment in transport to deliver these efficiency gains in the most cost-effective and sustainable manner.

104. Every year in the UK £560M is spent by households on the purchase of cars, of which £195M is spent on new cars. This is only a small part of the £41,300M spent on purchasing, maintaining and running cars and motorcycles by businesses and households. This dwarfs the public expenditure on road infrastructure (£3,073M) and rail infrastructure (£3,182M). Expenditure on road vehicles has increased by 46% since 1989/90 compared to a decline in expenditure on road infrastructure and rail rolling stock (although expenditure on rail infrastructure has increased)[114].

105. Given this economic context it appears that supporting technological improvements in vehicles is the best way to effect change. The vehicle fleet is constantly renewing itself and will be able to take on new technologies in a relatively short time frame. It should also be noted that not all vehicles have to be equipped with a new system for the operating regime on a road to be governed by those that are (e.g. speed-limited vehicles[115]).

106. Even if this perspective on delivering technological improvements has some advantages, the Network stressed its preference for solutions that lower energy consumption and ultimately reduce the number of vehicle kilometres that need to be travelled to maintain mobility at a sustainable level.

Visions for the Future

107. Set against the backdrop of our preceding deliberations regarding present and future possibilities, the report now goes on to present six different visions for the future of vehicles and infrastructure. The visions were developed from a set of outline scenarios, each of which takes a different slant on the values and priorities that will be predominant in the future:

- **Control Culture**- Safety and security are dominant values
- **Community Future**- Concern for community and the collective good are dominant values
- **The Handshake**- Physical interaction remains central to human economic activity
- **Leisure World**- Increasingly flexible lifestyles render the accommodation of the leisure needs of society an increasingly important concern.
- **After You**- Excessive demand for resources results in the prioritisation of certain activities
- **Design For All**- Social inclusion is a key concern and is achieved by attempting to respond to the needs of all sections of society

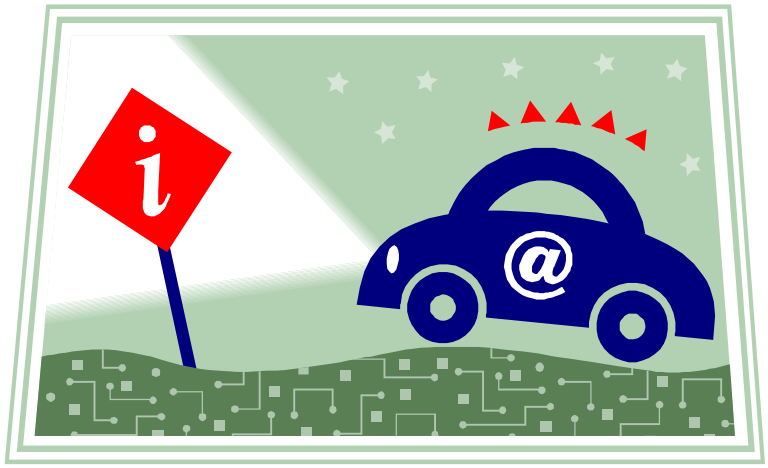
108. The scenarios were not developed beyond the information provided above. The intention was that these scenarios would provide an overall context within which visions of the future of vehicles and infrastructure could be developed. The choice of scenarios was made after the period of Network email discussion and attempted to encapsulate some of the thinking expressed by Network members on the underlying trends likely to influence future vehicle and infrastructure developments. These scenarios then provided the starting points from which the future visions were developed at the workshop of Network members. (It was felt that these six scenarios would better reflect Network views specifically on the future of vehicles and infrastructure than a reversion to the more general 'society and lifestyles' scenarios developed in the Network's first report[116]).

3 A Vision: Control Culture

Vision Summary

In the control culture, safety and security are the predominant concerns for society. As a result, most citizens are willing to accept a degree of curtailment of their individual freedom in order to ensure these concerns are met. The vehicles and infrastructure in the control culture reflect these dominant values as safety and security in travel have been increased by the gradual accumulation of control mechanisms. Increasingly control has been passed from the individual to 'big brother' systems of vehicle control. This is largely in response to fears about crime, accidents and liability for the consequences of such incidents and the implications in terms of insurance costs. Vehicles and their drivers are constantly monitored when travelling and their adherence to the laws of the road is remotely enforced. For example, speed limits are automatically relayed to the vehicles and applied independently of the driver's control.

Most citizens in the control culture appreciate the reduced level of responsibility they now have concerning the driving task as automation and interaction mechanisms between vehicles and remote systems of control enable many driving decisions to be taken remotely, bypassing potential human error. The simplicity and convenience of travel in the control culture is generally perceived as a benefit that outweighs concerns over civil liberty and the amount of information that the authorities possess not only about the vehicle but also about the driver.



The Origins of Control

109. **Rab Davies, Historian of Transport and Society** - "My services have been in demand increasingly since the 2020s. This was when policymakers really began to realise how valuable it could be for future policy formulation to look to the past to understand how society has evolved, what its tolerances and responses to change are and to unearth precedents for future innovations in terms of public acceptance and efficacy. My latest piece of work has involved reflecting on the origins of the control culture in transport, which the Government is now looking to further expand.

110. 'Control culture' has always sounded rather draconian and unattractive to me and yet in so many ways it is beneficial and not restrictive. It is not something that has suddenly come upon us either. I suppose in some ways there has been a gradual accumulation of control mechanisms over decades or even centuries. An early and striking example for me was in the early 1900s when Government introduced a requirement for all cars to have number plates - there was a public outcry (at least amongst the few car owners) that this was an infringement of their privacy and civil liberties. A few decades later of course and hardly a soul would view this as more than a source of amusement - it was no longer seen as anything resembling control culture, merely an inevitable part of everyday life.

111. For a large part of the 20th century it was common practice for people to have the ownership of their vehicle centrally registered and, on an annual basis, pay a fixed level of tax for their vehicle to use the pubic highways. Vehicles were given MOT (Ministry of Transport) tests effectively enforcing minimum acceptable standards on a vehicle's safety. Early in the 21st century the UK saw a proliferation of speed cameras and CCTV camera networks.

112. In subsequent decades the control culture has grown in its capacity, scope and sophistication, thanks in no small way to technological advances. But before I briefly summarise where we are today in 2040, I would like to reflect on what the catalysts have been for us encouraging and accepting such a high degree of control into our society and our patterns of movement.

113. In the early part of the 21st Century car users were under particular strain. Busy lifestyles resulted in the majority of car journeys involving drivers who were stressed and under time pressure to arrive at their destinations. The potential for dangerous driving was readily apparent, made worse by the sheer number of vehicles on our roads. Ironically this situation was compounded by the in-vehicle comfort within which drivers would languish - air conditioning, armchair seating, soothing entertainment systems and communications devices. Such comfort merely accentuated a false

sense of personal control and safety. The world outside the windscreen appeared little more than a driving game in an amusement arcade, whereby if a crash occurred one would suffer no injury, but merely be prompted to insert a coin to begin another game.

114. While low by the standards of the time, the number of UK road traffic accidents was causing concern. Not only were motorists putting themselves and other people increasingly at risk, but also they could not afford financially to have an accident. Motor insurance costs were coming close to turning ownership of a car back into a luxury rather than the perceived necessity it had become. Prices were becoming prohibitively high, to the extent that any speeding offence or accident claim would inflate individual insurance premiums beyond many people's means to pay.

115. Motor insurance costs were also influenced by increasing car crime which had been rising unabated for many years with lawbreakers continually and rapidly able to catch up with each new security innovation. The situation was further exacerbated by joy-riding in stolen cars causing numerous accidents. In this climate many people were electing to drive illegally without insurance.

116. There was a growing sense that even though, on the face of it, people were in control of their cars, the reality was that they were rapidly losing self-control or losing the ability to be in control. People were growing anxious about the situation they were in and were receptive to or even asking for more remote/automated control to be introduced. They wanted systems that would outsmart the car thieves and ensure they avoided getting fines whether for speeding, driving under the influence of alcohol or dangerous driving in general. They wanted to reduce the stress in their lives, particularly in their everyday journeys and they wanted to ensure they would not be responsible for others becoming road accident fatality statistics.

117. Perhaps a more subconscious concern was that brought about by the advances in healthcare in recent decades that have substantially extended typical life spans. Putting it bluntly, with the prospect of being able to live a longer life, people have got more to lose by getting themselves killed in a traffic accident. As a result of this widespread public mood, civil liberty groups, who had for many years been seen by some as the fly in the ointment of progress, no longer found favour in any corridors of power. The way was paved for the politicians and technologists to expand the control culture for mobility, both to satiate the mood of the electorate and also to extend opportunities, through greater control, to better manage

transport networks and deliver a better quality of service to network customers.

118. So, for the last 20 years leading to 2040, we have seen the fruits of such labours. As individuals we are now all electronically tagged with small implants that not only communicate and verify who we are to other devices in vehicles, at roadsides etc., but which also allow our exact position at any time to be identified. Vast, centrally controlled databases hold detailed profiles of each of us in terms of our fitness to drive, past offences, entitlement to travel using particular modes at particular times and in particular places and the extent to which we travel over time. This provides a high degree of accountability and facilitates measures and systems that can enhance collective personal security.

119. Road vehicles themselves are increasingly monitored and controlled, in much the same way as aircraft have been for some decades. There are now two forms of control in this regard. Individually automated vehicles are able to function partially or fully automated- a vehicle's in built system can guide it through traffic and make the necessary adjustments to its path and behaviour. The term used here is the 'intelligent vehicle'. Alternatively or in addition, vehicles can be guided through the transport network and through traffic by the delivery of external commands to the vehicle, to which it responds automatically. The term used here is the 'obedient vehicle'. In both systems, like the pre-travel monitoring of the driver, the vehicle is checked and not granted access to the network until it is deemed to be both suitable for and able to complete the journey ahead.

120. My own view, having considered the historic perspective, is that the control culture, particularly where the private car is concerned, has been a positive step forward. However, perhaps it remains a treatment, rather than a cure to the way in which we choose to exercise our mobility. Much of the need for control arises from our dependence on vast hoards of privately owned vehicles. I can't help but wonder whether the Government should now be seriously looking to find the cure and this may reside (perhaps with the further assistance of the control culture) with greater use of various forms of collective transport."

Travelling in a Control Culture

121. **Gina Ambrosini, Estate Agent**- "I'm reminded of a rather amusing anecdote of a German driver early in the 21st Century who was making a journey by car and following the navigation instructions provided by his computerised in-car route guidance system. The computerised map thought there was a bridge across a river, and guided the driver towards it. Even though there was no bridge and in spite of bystanders hooting, signalling and waving

madly at him as he approached, he carried on regardless straight into the river! He had essentially disengaged his brain from the driving task and simply done what he was told by the technology. Of course that is not a fair reflection of the type of automated control we have today. The purpose of control systems is not to take away the driving task entirely from the human. Instead they allow the human driver to be in control, but at the same time they enforce certain limits and minimum acceptable standards and can override human control when necessary to avoid collisions.

122. Let me explain how these systems work by describing a recent and rather eventful journey I made with my husband during our holiday to have lunch at a country pub. At first there was the usual routine of getting into and starting the car - the thumb print-activated lock ensures only myself and other specified individuals can gain access to my vehicle. Inside the car a voice recognition system is used to confirm who is in the car - this is an add-on belt-and-braces device I paid to have installed in addition to the use of the personal ID-chips both my husband and I have implanted which can be recognised by the car's computer.

123. We set off on our journey and in the residential streets through which we must first pass, the in-car computer enforced the maximum 40 kmph speed limit and activated the onboard headway checking device to enable the braking override to kick in should I get too close to the vehicle in front or should a vehicle pull out suddenly into my line of travel. Once we joined the main road, beyond the residential area, our vehicle was logged by the local area control system and I was able to switch to automated cruise/convoy control, enabling me to relax my attention in terms of the manual control of the vehicle. As we passed Dresmonton Primary School the car automatically slowed down to the maximum speed of 30 kmph applied in zones associated with schools. I welcome this form of automatically enforced speed control. As a young driver I was one of those guilty of liberally interpreting the speed limits - i.e. if the posted limit said 60 kmph I thought it was OK to do 70 kmph. I can tell you that as law enforcement increased, in particular with regard to anti-social driving (speeding became an unacceptable option like 'drinking' had in the 1980's) I had more than my fair share of run-ins with the police. Anyway, beyond the school we were then on the open road, heading out into the country and with no local area control system here I resumed full control of the vehicle.

124. We arrived at the pub and enjoyed a hearty meal and a couple of drinks. On returning to our car the speech recognition system was able to identify that the alcohol I had consumed had put me over the limit for driving. Of course this was not a problem as my

husband and I swapped seats and the in-car systems adjusted all the controls to his settings so he could drive us home. When we were about half-way back we were caught in a thunder storm. The on-board computer picked up the conditions on the tyre-road interface and automatically reduced our maximum speed and increased the minimum headway to any vehicle in front.

125. It was then that we were beset with bad luck. It is not yet compulsory for pets to be tagged and the unfortunate cat which ran out in front of our car was one such animal. The vehicle's detectors did not pick it up and we hit it and, in combination with the wet road surface, the car skidded and hit a tree. Within minutes a local police officer was at the scene having automatically received a transmission from the car identifying our location and notification of a road traffic accident. We logged details of the incident into the officer's electronic notebook, which in turn were automatically transferred to the national database and to our insurance company. So there was no inconvenience as such in the aftermath of the accident other than the fact that the excess on the costs of repairing the car rendered our trip to the pub a little more expensive than we had bargained for!".

4 A Vision: Community Future

Vision Summary

In the community future, society operates according to the dominant values of community and the collective good. As a result, most citizens are willing to forego a degree of personal choice and individual freedom to ensure that these values are upheld. This state of affairs is clearly reflected in the ways in which vehicles and infrastructure operate. It was recognised that increasing car dependence was causing mobility to reach unsustainable levels with highly detrimental consequences for the environment, the economy and society. To rectify this situation it was accepted that drastic measures were necessary to cause a step change in the provision and quality of collective transport. An unprecedented level of Government investment combined with the revenues from a universal mobility tax were then ploughed into a high quality, high density and high frequency public transport network called the Silver Shuttle Service (SSS).

After a difficult transition period, particularly in rural areas, the SSS proved a popular alternative to the car by delivering the door-to-door convenience and in-vehicle service quality of personal transport without the responsibility of ownership and maintenance. Discrete charging mechanisms were a further aid to take up and citizens responded positively to the communal nature of travel. The SSS facilitated the gradual removal of the car from the range of mobility options. As a result, reduction in the requirement for infrastructure capacity has led to the conversion of much former residential road space into community greens and open spaces.



A New Systems Approach to Transport

126. Published in *Mobility Today*, 13 July, 2023 "The future's bright, the future's silver -Its almost exactly 25 years since a White Paper on transport was published - its aims were commendable and substantial investment in public transport has followed in the intervening period. However, the integrated transport policy failed to take account of the influence of car ownership on the nation's choice of how to travel. Over recent years we have seen a prolonged stalemate that has failed to arrest the decline in the quality of the mobility experience. Car ownership has remained high with owners doggedly continuing to use their cars and squeeze into the reduced roadspace that has been left following major reallocation of roadspace and enhancements to public transport networks. Meanwhile local public transport has been heavily under-utilised and has continued to draw on the public purse to sustain its existence. The result has been an inefficient mess with both the person in the street and the Government getting poor value for money in terms of mobility.

127. In the last three years an old argument has undergone a major rethink and, as they say in the fashion world, 'black (or in this case silver) is the new white'. At the turn of the century leading figures were arguing that it was the fixed cost of motoring that made it impossible for public transport to compete with the car on a per trip basis. It was considered that the way forward was to reduce the fixed cost of motoring and to increase the variable costs. Unfortunately the biggest fixed cost (which cannot be reduced) has always been the vehicle purchase. As a result little has changed in terms of the motorists' perceptions of cost for many years. However, this has now been turned on its head.

128. The Government has today unveiled an unprecedented new transport policy coupled with a trillion (million, million) pound 15 year investment plan. The vision is called the Silver Shuttle Service (SSS) and will transform the operation of our transport system in the UK. The plan allows public transport to mimic the fixed and variable cost formula of the car. Every citizen will be charged an annual (fixed cost) mobility tax. It is speculated that this might be in the order of £2000 per year. There will then be a (small) pence per mile charge for travelling using the SSS high quality community mobility service. The substantial revenue stream from the mobility tax will form the basis for funding SSS, which will involve a huge (a figure of over 2 million has been mentioned) national fleet of vehicles and a range of vehicle types. In essence, SSS will provide a high density, high frequency public transport network. The range of vehicle types will offer choice to the traveller on a 'horses for courses' basis. Silver Shuttle taxis will offer the greatest flexibility with the range running right across to Silver Shuttle coaches, trains and even planes.

129. The Government has been clever in the way it has delivered its announcement of the policy. A thirty-minute video created by Dreamworks Studios in Ealing has been made available on the Internet portraying to the public what the future will look like under its vision. The effect of the video is breathtaking - it leaves one with a sense of excited optimism and impatience for the vision to be realised rather than fuelling public outrage at the draconian steps the Government proposes to take. In the video there is an almost chilling realisation that the car as we know it today is on the brink of extinction. But in its wake comes a sense of continued personal mobility and freedom delivered by a centrally provided service. Central provision means fewer vehicles on our roads, leading to pleasant, more reliable journeys and a more efficient and environmentally sustainable use of energy resources.

130. The video confronts both what the new service itself will look like as well as what it will mean for the environment and society in which we live. Initially the service will make use of existing transport infrastructure with investment focused on the vehicle fleet. However, over time the increasingly central provision and control of our transport system will offer a favourable environment for innovations in terms of interoperability of our vehicles and infrastructure. For example, the video shows some of the larger capacity SSS vehicles moving seamlessly from road to rail infrastructure. On parts of the road network the vehicles run on an embedded electrified rail that both provides for a form of propulsion and the facilitation of driverless vehicles. Through greater control of the lateral movement of vehicles it also enables a larger number of lanes to be fitted into the roadspace. Although the physical lane widths of the road network must still cater for larger freight vehicles, these rail-based lanes can be superimposed at narrower spacing allowing, in effect, an additional stop-off/pick-up lane to be introduced.

131. The vehicles themselves are visually appealing. Not only do they not possess the box-like public-service look of public transport vehicles at the end of the 20th Century, but they are not all identical. They possess a curved aerodynamic design and have many different looking body shells much in the same way as mobile phones at the beginning of this Century had snap on covers of different designs to allow their owners to be expressive and fashionable. Their interiors make ingenious use of new materials technology such that, whilst looking plush and being comfortable, they can be easily powerwashed to maintain a 'good as new' look. Flat screen multimedia panels are in every vehicle providing information, entertainment and marketing. Some of the larger vehicles are partitioned into quiet areas with 'teleworking' facilities and social areas where conversation is encouraged.

132. Perhaps what is most astonishing about the video is how it is able to communicate how wasteful car ownership and use have been - notably the vast tracts of community living space that they occupy when parked for the majority of the day. With SSS, parking itself becomes an almost redundant feature of our transport systems and neighbourhoods. Instead we will enjoy many more open, green spaces in our cities and see children playing in the street once again. Families can transform their own homes, converting garages into living space and driveways into lawns. Businesses will have the prospect of premises that are not overwhelmed by huge expanses of tarmac. Perhaps the most aspirational aspect of the SSS vision is that it will expect to nurture a greater sense of community as people once again mingle shoulder to shoulder while they travel around as part of their daily lives. This is expected to offer a relief to the stressful, detached lives many of us have been exposed to over many years due in no small measure to the impact of the car on the way we live.

133. The policy is far from economic madness either. We are reminded that towards the end of the last century, at today's prices, business and households were spending 70 billion pounds a year purchasing, maintaining and running cars. The Government believes that not only will its new vision be economically sustainable, but it expects it to substantially strengthen the UK economy and our global competitiveness. Motor manufacturers will be able to turn their businesses from car production to the delivery of the huge fleets of vehicles required for SSS. Huge employment opportunities will be created with the need for SSS fleet drivers.

134. In a recent issue of Mobility Today we looked back at an old Government policy document describing the role of the bus called 'From Workhorse to Thoroughbred'. Perhaps a little unfairly our own article was labelled 'From Workhorse to Knackers Yard?'. We now feel a surge of new optimism both from the hope that the SSS vision inspires and from the fact that a UK Government has been bold enough to pursue such a step-change in the functioning of our society. It is taking a huge risk of alienating itself from the electorate, but harbours the prospect of equally huge support if it can see through the policy and keep the public on its side."

Overcoming Resistance to Change

135. **Julia Perlew, IT Specialist** - "Its amazing how easy it is to defend the life you know and put up arguments against change. Back in the 2020s I was one of the most vociferous opponents of the Government's SSS policy. I was convinced it was a huge threat to my personal lifestyle, would leave me out of pocket, would be unable to deliver my expectations for getting around and in short would leave the country in a bigger mess than ever. This year marks the tenth anniversary of SSS's launch and, though it has seen more

than its fair share of teething problems, the reality does now bear an uncanny resemblance to the portrayal in that Government video.

136. I specialise in the maintenance of virtual conferencing facilities in companies around the UK, so I travel a lot. Consequently, in the early days of my career I was entirely dependent on my company car. Now I travel more than ever and SSS meets all my needs. A mini shuttle usually passes by my house every five to ten minutes. Catching them is pretty much like hailing a cab in the old days. The notion of bus stops is really a thing of the past now - they pick up and drop off on request. My local SSS hub is only a twelve minute journey away. From there I pick up a Silver Shuttle train (they've just increased the frequency of these from three to four an hour). I will often then pick up a Silver Shuttle taxi at the other end and pay the small extra premium so I can be taken directly to the company I need to visit. I say 'pay' but of course now it is all electronic. The Universal Communication And Transactions (UCAT) device, which most people now carry, makes things so easy. I guess, using the old terminology, it's a smart card, phone, Internet console and global positioning satellite (GPS) system all rolled into one. You simply walk on and off the SSS vehicles and payments are automatically charged to your account. The UCAT device allows me to easily issue a request for an SSS vehicle to pick me up on occasions when I'm on a less densely served part of the network.

137. The drivers are always really friendly on the vehicles, which was something I'd never expected. In fact it's not even just the drivers who are different from those grey old days of bus travel. People generally seem more open and it just seems natural now to strike up conversations with strangers when you're travelling - that is if I've not decided (and I occasionally do) to pay for a platinum service vehicle which is a door-to-door SSS option that provides a solitary travel environment which allows one to work or relax. Talking of drivers, I heard on the news last week that the first fleets of the new driverless SSS vehicles are being rolled out in some urban areas."

How it Used to Be

138. **Zak Hastings, Sixth Form Student** - "I find it funny when the older generation start talking about the days when they had cars. I guess I can understand how they had a fascination with showing off how cool or rich they were by having all these different sorts of cars. Sounds like an expensive way to make a fashion statement though. They say that they needed to have them back then to get around though I can't quite understand why - after all they had the SSS type vehicles to use didn't they? Mind you, they do tell me that when SSS was called public transport it wasn't anything like what we have today.

139. Owning a car sounds too much like stress to me - I wouldn't like to have to maintain a machine like that and then have to leave it outside where anyone could pinch it or damage it. They didn't seem very bright back then if you ask me - fancy putting down road surfaces everywhere and giving up community greens and open spaces where you can meet friends so that people can store their 'fashion statements' when they're not using them. Apart from that, how could anyone travel anywhere if there were so many of these stupid cars?"

Ministerial Reflection

140. **Angela Mulholland-J-Jones, Cabinet Minister** - "I suppose I'm the last in a dying breed of politicians who lived through the latter stages of governance that worked on the basis of cautious, incremental change. Of course, the SSS which now sits within my portfolio has been a glowing success in the new big, bold approach in Government. That's not to say things will always work out as well with this approach, but the UK is currently riding on a wave of success. Perhaps we hold a distinct advantage over our European neighbours by being an island. I'm not sure France or Germany would have achieved what we have because of the ever growing levels of trans-border travel within Europe. UK Plc is now the focus of everyone's attention. We have shown the world a new way forward for transport and there are over a dozen countries that are in talks with us and with UK vehicle manufacturers with an interest in establishing their own versions of SSS.

141. Of course, it was not all plain sailing in the early years. The transition from a car culture in which personal mobility reigned unfettered to a community based approach to transport was pretty difficult. In retrospect, we needed to develop a more considered implementation process, particularly in relation to rural areas. Although the SSS approach could meet the service levels and demands of high density urban environments, it struggled to meet the needs of less densely populated and remote areas. Rural depopulation was certainly not anticipated on the scale that it occurred, but in the long run it has helped to deliver the urban renaissance we have talked about for decades. It is just a shame that it was achieved at such a cost.

142. On the positive side, the SSS has helped break down social barriers. People now seem to treat travel in much the same way as they did shopping malls, cinemas and so on at the turn of the century - public places in which people of all backgrounds and different socio-economic status are content to mingle together. Because of the discrete charging mechanisms now used for travel, we are easily able to subsidise those who would otherwise be unable to afford sufficient mobility without them needing to stand out as receiving such treatment when they board vehicles.

143. Our latest idea through the highly automated process of monitoring people's travel that SSS has afforded is that we might look at ways to introduce more sophisticated pricing structures to dampen the extent to which people exercise their opportunity for mobility. At present we already give people annual rebates on their mobility tax if they travel very little. We hope to be able to give people further fiscal incentives to make a conscious effort to travel less."

5 A Vision: The Handshake

Vision Summary

In the handshake, physical interaction will remain central to human activity and not be replaced to any significant degree by virtual interaction. People will meet together in person to conduct business and other activities and will travel over increasing distances to do so. Inter-urban transport networks will be expanded to cater for more travellers. For example the M25 motorway will operate on two levels. The bottom deck will be for the exclusive use of lorries and collective forms of transport such as coaches and buses. The upper deck will exclusively accommodate drive free personal vehicles. Infrastructure will be extensively developed at interchange points to enable meetings and other activities to take place.

An example of such developments is the Crayford COnference and Interchange Location (COIL) which incorporates both conference facilities and transport links. The COIL benefits from its location adjacent to the M25 which allows easy access to both drive free vehicles and collective transport. Upon arrival at the vehicle park, an airway service of transparent cable cars takes passengers to the interchange terminal (for transfer on to central London). The COIL's proximity to the River Thames means it can also operate a catamaran service to central London, which is particularly popular with leisure travellers. The excellent quality of the conference facilities at the COIL has led to a high proportion of its business users opting to hold their meetings at the COIL rather than travelling into central London.



The Multi-Modal Swap Shop

144. **Stephanie Linke, Operations Manager for Crayford COIL (COnference and Interchange Location)** "Thank you very much ladies and gentlemen. I am honoured to receive the 2051 Connecting People Award on behalf of TransHub's Crayford team. We fought off strong competition from the COILs at East Birmingham and Cardiff Dockside I'd like to thank those who have made it possible. First I would like to thank the Highways Agency and SwiftStream for their co-operation in making the Crayford COIL such a success. The Highways Agency has made sure that the M25 has been able to cope with an expanding number of vehicles and passengers. The conversion of the bottom deck - the old road - for use by coaches and lorries reduced congestion around the COIL without reducing the numbers of passengers and goods that we can serve. Then the new upper deck for exclusive use by Drive Free vehicles has been a big hit with our business customers. Twice as many Drive Free vehicles can be accommodated on the same road lane as self drive vehicles.

145. SwiftStream's catamaran service from Crayford to central London has also played a big part in attracting customers for us. Its services run every ten minutes now and the service is equally popular with business people and visitors from the continent who have arrived via the Channel Tunnel.

146. So what have we done ourselves to make Crayford work? Everyone told us that parking would be our downfall and it has been the biggest challenge. We have limited land space here. What's helped has been the fact that many of the Drive Free vehicles are hired by their users and not owned by them. They can therefore be turned around quickly when they arrive here for a new user leaving Crayford. That means there are fewer vehicles to stack. We will soon improve things further when we complete the latest parking carousel. It's designed specifically for the Drive Free vehicles. We can fit in three times as many of these in the same space as conventional cars as the automatic shuffler sorts the vehicles out and packs them efficiently.

147. I must thank our TransHub team here for designing and managing the excellent conference and interchange facilities that we have. I hope you have all taken a ride on the Airway shuttle from the vehicle park to the SwiftStream terminal. For those of you that don't know about the Airway shuttle, it's the cable-car style system with the transparent bubble pods - you get great views of the Thames as you descend towards it. At first most of our business users came here to transfer on to central London, but now 40% hold their business activities here. I like to think that's down to the quality of the conference and meeting facilities that we operate.

148. We can't rest on our laurels - well TransHub won't let me. We have got further targets to increase business use and to increase use of the COIL outside business hours. This weekend's Internet Revival Extravaganza is an example of the sort of thing we're looking to do. I might even find out myself what all the fuss was about with the Internet all those year ago. The Highways Agency also requires us to continue to reduce the average time taken to interchange from the M25 to the SwiftStream. They're concerned that if we don't manage this there will be calls to open the A2 lanes into central London to general traffic rather than just to public transport as at present. Finally, I would like us to remember the Dutch who built the forerunners of COILs, the Transferiums, just before the end of the 20th century and were real pioneers in this field. Further to this award we are pleased to announce that new COILS in Belfast and Manchester Trafford will be opened next year."

The Infrastructure Innovator

149. **Rita Hossein, M25 Strategic Manager, Highways Agency**
"I remember when I first started out in this profession that there were naï ve expectations that we could make do with the transport capacity that we had. Everyone thought that we would communicate digitally and would not need to travel so much in the future. It never worked out that way. I suppose people just naturally want to interact in person and technology will never be able to deliver the complete substitute.

150. With the M25 we tried squeezing as much capacity as we could out of the original lower level lanes and added extra lanes when and where we could. With the decision by Government to take the heat out of our urban centres and promote interchange points at urban peripheries - the so-called multi-modal swap shops or COILS as they're now known - we needed to rethink our motorway infrastructure. First we set aside some of the motorway lanes for coach and lorry use only. The coach services that were established by private operators to serve the COILs enabled more people to be carried by the M25 than before when there were mixed traffic lanes. Then came the decision to invest in the largest transport infrastructure project of all time - the M25 upper deck, making the M25 the first double decker motorway in the UK. The Drive Free vehicles had been found to work very well in operation in China so we opted to only allow the upper deck to be used by them. This helped alleviate safety concerns. They are also very energy efficient powered through the electrical system in the road carriageway. The design of the decking and support structures using transparent polycarbonates helped sway those who thought the upper deck would be unsightly. Given the success of the M25 double deck a national roll-out programme on other major motorways is likely to follow.

User Perspectives

151. It's nice that our part has not been forgotten in making the COILs work. Miss Linke made fulsome praise of our part when TransHub received the Connecting People Award. People often take for granted the transport connection between interchanges."

152. **Geoff Cheeseman, Business Executive** "Every minute is vital for a businessman like myself. So now I always choose to use my Ford Freedom on the drive free motorways. Once I've linked to the system I get on with business until arriving at the COIL. I prefer it when we have meetings at the COILs themselves - it saves time getting into town. When I meet our London partners I can't be doing with wasting valuable minutes on one of those SwiftStreams, swift death more like, having to sit next to all those people who don't appreciate that I need to get on with my business calls. At the Crayford COIL they've got some decent meeting facilities - TransHub understand the modern executive. I enjoy having a cup of coffee and listening to the news while being whisked from my car to the congress rooms in an Airway Pod. That's if I'm not interrupted by tourists gawping at the view. The congress rooms are designed tastefully and they do a decent steak in the courtyard restaurant. Using the Ford Freedom means I can also have a few glasses of Chateau Mouton Rothschild.

153. I've been invited today to a ceremony they're having at Crayford. Its won some award for connecting people or something. They've invited me as a frequent visitor. At first I thought 'You must be joking' but it's a good opportunity to do some networking - I can't waste opportunities to meet influential players. That's where the real deals are done.

154. **Paul Spotter, Internet Enthusiast** "I like to go to most of the get togethers of the Internet Appreciation Society. Next weekend the Reading branch will hire a coach and take the motorway to Crayford for the annual Internet Revival Extravaganza - this year they're looking back at desktop computers. It's not actually in Crayford by the way - it's at the COIL. Call me a luddite but I'm not too keen on the motorways these days. They're very dull - stuck going steadily at 55 miles per hour in the coach lane surrounded by other coaches. Before, you never knew what might happen- roadworks with those long lines of orange cones, pile ups when the slightest accident occurred, demonstrations by convoys of lorries. It's all so predictable nowadays. There's not even much to look at by the roadside since they've removed the variable message signs. Apparently the driver gets transmitted virtual reality messages onto the dashboard display that look like road signs.

155. I suppose we've got the travel entertainment consoles where we can do quizzes and competitions. I also enjoy just chatting to the

other enthusiasts on the way. It means the event starts as soon I get outside the front door. We can talk about our memories of the early days of network computing. There will be lots of other coaches from other branches. I guess some enthusiasts will have got themselves a drive free vehicle and will be travelling above us on the higher deck."

6 A Vision: Leisure World

Vision Summary

In leisure world, a very large proportion of people will conduct work and business remotely and often in the home. This will be facilitated by a combination of technological change and societal pressure. By contrast, leisure travel will continue to rise and solutions to activity-based congestion will become the most pressing transport issue. As a result, activity centres invest heavily in providing effective transport links to their sites. This equates to the introduction of high quality collective transport with on-board facilities, which enable the leisure experience to begin on the journey to the attraction. For example, 'stadia express' services enable sports fans to travel to matches on buses equipped with video and internet facilities to allow them to keep up to date about their teams. Similarly, train and coach services to leisure attractions will include on-board children's play areas. This cultural trend will permeate down to local levels as swimming pools provide attractive cycle paths to enable local residents to enjoy a pleasant journey to the amenity.

Tourism in leisure world becomes the most powerful industry in the UK. This creates pressure upon many of the nation's heritage attractions that requires a new approach to access to alleviate environmental impacts. One approach, pioneered in the Lake District, known as heritage rings, proves particularly successful in facilitating sustainable access. Tourist traffic is directed to satellite 'park and ride' centres on the edges of the rings where collective transport then takes visitors to the heritage centre. Then visitors are free to travel around on bicycles or electric vehicles rather like golf carts. Trends in international tourism prove equally significant as the vogue for travel as a leisure experience in its own right leads to substantial growth in luxury sea travel. Global tourism is also influenced by the prominence of virtual alternatives to travel. Technological developments enable total immersion so that virtual international holidays can be experienced from home.



Turning the Tables of Responsibility

156. **Ron Jackson, Retired Solicitor**- "*A triumph for the little man: Fans beat Premiership Giants in High Court Ruling on activity centre liability*. I still look back with pride on what we achieved and the long term implications for society. Of course, none of it would have been possible without the universal introduction of congestion charging in our towns and cities. Soon after implementation the measure gave a much-needed boost to the replacement of those boring needs-based journeys to work and on business with virtual alternatives. The availability of the carrot of virtual access through universal Internet provision had achieved positive results, but it needed a big stick to achieve significant change. With the emphasis of the charging policy on congestion rather than road use, people soon resented the fact that it was the need to access their workplace at peak times that was costing them money.

157. When the trade unions defeated the employers in the landmark judgement on liability for workplace-related congestion charges the situation changed pretty quickly. Employers became liable to pay the congestion charges of their employees if viable collective transport options (not liable to congestion charging) were not provided either by public transport or in its absence by the employers themselves. This really provided the impetus for a step change in teleworking and teleconferencing as employers found that investment in the provision and maintenance of increasingly effective and cheap technology often made more sense than providing the means for workers to get to the office. In addition, companies found they could save money on the office facilities and associated running costs and thereby improve efficiency and profitability.

158. It was against this background that I started my crusade. With less work travel in the week, weekends had become the real money spinning days for congestion charges. I resented the fact that I was paying through the nose for the lack of planning foresight and integration with public transport services shown by my football club when building their new stadium. Many of my fellow supporters agreed that it was not fair that we should be paying for the consequences of the failings of decision makers. If employers were now liable for the costs of their employers accessing work, why not make clubs liable in the same way to their supporters, or indeed any activity centre, which generates substantial travel, to their patrons?

159. Of course, there had been moves towards an acceptance of responsibility by some activity centres and in the slow evolution of planning policy. The example of Heathrow airport was discussed at court, where the management of this major transport hub recognised its duty to cater for surface access, primarily for economic reasons, and provided services like the Heathrow

Express. Similarly, much evidence was given about the planning restrictions placed on many sports stadium developments, which had resulted in innovative and successful collective transport solutions.

160. Dwelling on the positive potential of activity centred transport certainly worked in our favour in court. In giving his ruling the judge argued that activity centre liability would ensure that the piecemeal and haphazard nature of transport provision to leisure activities was at an end. All over the country people could now look forward to improved access standards rather than looking enviously at their neighbouring town and grumbling at their own inadequacies".

The Leisure Experience

161. **Hayley Gibbs, Author**- "Ever since my husband Mike's firm redesignated his job status to 'teleworker' six months ago, we have both been working at home, which is great for the kids who now see much more of us both. This can lead to 'cabin fever' though and by the weekend we are ready to get out and about and have some fun. We used to jump in the car and go away for weekends, but the stress of travelling took the edge off the experience. On the Friday night after a long day at work we would struggle to find our destination with restless kids on the back seat. On the Sunday we would face a frustrating motorway journey home. It was no surprise to me when the statistics were released showing that the peak motorway congestion time had become Sunday evenings.

162. The kids love the new theme/leisure parks that have opened in recent years. We never would have fancied facing hours on the motorway trying to get in. The fact that they have all been built close to rail stations and provide their own coaches certainly makes it the easy option and the fact that they do not provide any car parking space at the parks means that coaches are not held up in traffic. The only driving that people seem to do is to the public transport interchanges (people who live in high density urban communities have no need to drive to access leisure activities). It all makes for a stress free and hands free (particularly important with four kids!) journey. In fact, to call it a journey at all seems somewhat out of date. Getting there has become part of the leisure experience. Like it used to be in my great grandmother's day when they went on day trips to the seaside.

163. You will not find many weekend trains that don't have a kids' carriage, complete with ball pit/sand pit and staffed by theme/leisure park employees. Then, when you get on the coaches, all the things that used to delay your enjoyment when you get there are dealt with. All the information on where the activities and facilities are within the complex is provided and you get your virtual

Internet tour. If you haven't paid, got your tickets and booked your meals in advance, then you can also do that en route. Given the regularity with which we visit these places, we have opted for leisure travel smartcards where everything is paid for on the card account, another bill to pay at the end of the month!

164. It is not just about visiting the large leisure activity centres though. Everyday leisure during the week is now much more accessible and enjoyable. Local leisure facilities at a community level have developed greatly in recent years. It's getting to the stage that every residential area has its own swimming pool. Partly this is a response to the fallout from the liability court judgement, which meant that every activity centre had to take responsibility for access needs, i.e. every local authority has a duty to provide a cycle path that gives you fulfilment and pleasure getting to the swimming pool. The trip must become an activity experience. So what we now seem to have is a blend of very local leisure facilities and activities accessible by foot and bike and larger activity centres accessible by high quality public transport. Anything falling between these two categories has tended to struggle, unless like the supermarkets they have diversified into virtual services (i.e. Internet shopping)".

Events Oriented Society

165. **Steve Andrews, Sports and Entertainment Stadium Manager**- "People like myself have become high profile figures in recent times as the nation seems to be insatiable in its demand to participate in these activities. Quality demands in the wake of the liability judgement seem to parallel quantity demands. A major boost to the step change in transport provision to sports and entertainment venues also came from watching the success of international examples, beginning with the Sydney Olympics in 2000 and reaching its peak in the 2006 Football World Cup in Germany. What bothered the Nation and consequently the Government was that even though England could compete in the sporting arena, winning the World Cup in 2006 and 2010, it seemed to be completely unable to attract major sporting events to its shores. National pride was at stake over the issue and a key stumbling block was seen to be transport provision.

166. The successful bid to host the 2018 World Cup provided the stimulus for a new level of vehicle and infrastructure provision in the major English cities. This led in turn to multi-centred roll out of high quality public transport services in our towns and cities as the new prestige services became highly desired. My own local community benefited from this as our stadium was used for several world cup matches. With the local team firmly established in the premier league and backed by an array of local corporate sponsors we have been able to ensure the long term viability of the Stadia Express public transport services. As well as providing access to the

stadium, the leisure and retail companies who dominate our sponsorship provide customer access to their centres through the service. The advertising and brand identity spin-offs are beneficial for all parties".

167. **Imran Saleem, Office Manager**- "As a fan I always use the Stadia Express service to get to the ground. En route I can watch highlights of last week's game and look at the online match programme. After the match I can have a drink or two without the responsibility of driving home. As I support my country as well as my local team I am pleased that the system also operates on a national level on the trains. The four National Stadia in London, Manchester, Birmingham and Newcastle have all invested in supporter trains with all the onboard facilities you would expect at a local level for those longer trips to international matches and the occasional cup final.

168. Of course, it is not all about football. My friends and I follow a number of sports and most of the stadia are multi sports venues and provide a similar level of service for all. Music is another passion of mine and mass non-sporting entertainment activities are also catered for in the same way, you can warm up for a concert by your favourite band by watching a video of a recent concert en route. The stadia can cater for pretty much anything, especially now they don't waste space on car parking".

Tourism- Heritage and the Environment

169. **May Wilkinson, Retired Doctor**- "Having lived in Windermere all my life I have seen a few changes. In the years immediately before I retired the Government finally recognised that providing 'access for all' to our most precious rural environments was having serious detrimental impacts on those environments in terms of degrading their quality and spoiling their potential to be enjoyed by those visiting them. What needed to change was how people accessed these places.

170. Heritage rings have been a great success in allowing local communities to function while excluding unwanted tourist traffic. Satellite pick up sites by local heritage centre vehicles are located at rail stations and near motorway junctions and have served to disperse traffic. Number plate based road user charging targeting non-local traffic has reinforced this approach. Of course, it is cheaper to enter the heritage ring if you have used collective transport to reach the pick up site. The buses then bring the tourists to the fringes of the heritage rings. En route the tourists begin their heritage experience by watching videos of the sights and sounds they can look forward to viewing. Together with several friends I have enjoyed adding a touch of local knowledge to the commentaries.

171. At the edge of the heritage ring people are given access to bicycles and to a fleet of personalised environmentally friendly vehicles, like golf carts, for visiting more dispersed attractions. The vehicles are fitted with automated driving so that you can programme in your destinations and relax, knowing that you will get there and back. I think from memory that the idea stemmed from Switzerland, a town called Zermatt[117]. All this means that those of us living inside the heritage ring are not constantly disturbed by noisy traffic and safety concerns. The experience of the heritage area is also enhanced for the visitor as they are no longer cocooned inside cars and can appreciate their surroundings in peace and quiet".

Tourism- Virtual

172. **Richard Dawes, Civil Servant**-"I have become hooked on the whole total recall concept, which has been all over the media recently. If bosses can get us all sitting at home using the Internet and virtual reality to do our jobs, it seems only fair that the technology is being developed to help us make use of computers for relaxation or virtual leisure. I first tried it with a Canadian skiing holiday. I didn't fancy the long haul flight but still wanted to experience what friends had told was a wholly different experience to the European skiing scene. So I went with a couple of friends to a nearby hotel, which caters for such group experience holidays. I was amazed by how genuinely real an experience it was. You really do get immersed in it, sometimes for hours at a time. So the chance to break out of the intensity of the experience and enjoy a few drinks in the bar was most welcome.

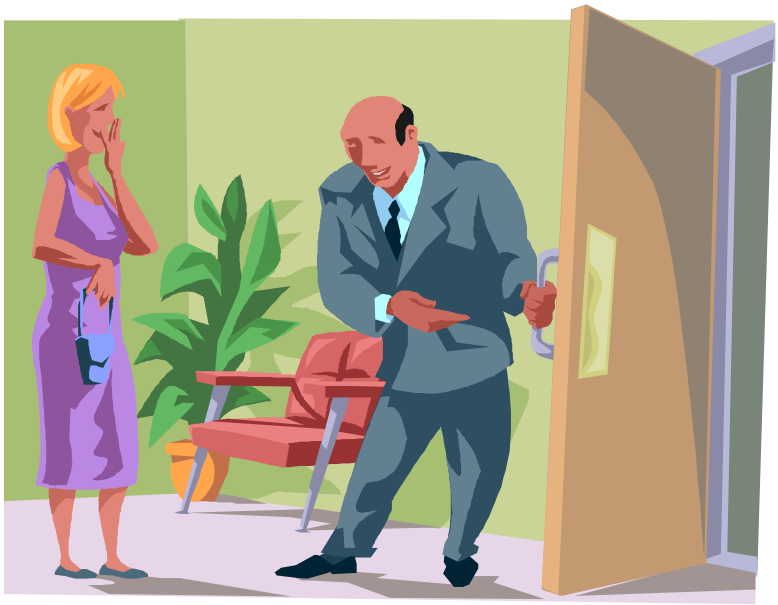
173. I hear that they are starting to open public auditoriums. The Minister for Social Inclusion said it was a way of giving access to all to a wide array of leisure experiences. The whole craze has certainly been a talking point in my local, especially as the technology is allowing for an ever increasing proportion of the globe to be covered. We often try and trump each other in terms of who can go to the most unusual or exciting destination. The experts say that if it takes off in a big way there could be a big effect on air travel, which could possibly help alleviate some of the problems associated with huge numbers of tourists in beauty spots and historic environments around the world. A problem which has, of course, become increasingly acute in recent years as economic, political and social liberalisation in China has led to mass international tourism on an unprecedented scale".

7 A Vision: After You

Vision Summary

In after you, society faces up to excessive demand upon resources and infrastructure by giving priorities to certain users and uses of it. This is reflected in the management of transport network capacity. For example, there are LOCAL lanes, which are only used by bicycles, motorcycles, minibuses and pencil cars (single occupant width vehicles). Roads in residential areas and city centres are designated as LOCAL lanes and this has helped to reduce accidents. One lane of main roads is also usually designated as a LOCAL lane as well.

Whereas previously everyone could choose when and how to travel even if this resulted in inefficient usage of networks, now usage is allocated according to agreed priorities. Between the hours of 10am and 4pm commercial and freight traffic, including driverless vehicles, have priority. Outside those hours other users can access this infrastructure. Users can ensure access to the transport network by booking their travel slot in advance. The reliability of the transport network is enhanced by technological developments and flexible infrastructure. For example, if there is a traffic incident, switchover lanes enable the direction traffic moves on the roads to be changed to alleviate congestion or enhance safety. Users are informed of such developments via head-up-display technology in their vehicles, negating the need for any physical change to road signing.



Whose Slot is it Anyway?

174. **Justin Thyme**, **Freight Forwarder**- "It's hectic first thing when we have to prepare everything for our deliveries which start from 10am. In this region the commercial (COM) lanes are available to us from 10am to 4pm. I have to make sure all the goods are ready, allocate them to vehicles and make sure we have all the slots we need on the network. If my forecasts are off the mark then I have to buy or sell slots and that becomes expensive. After that our fleet of dumb vans do the job. We got the dumb vans a couple of months ago. They're driverless vehicles that use the guided sections of the COM lanes. Our customers then unload the vans themselves. When one of our routes is not fully guided we have to use a driver. A few customers are still insisting that there is a driver even when the route is entirely guided. That's usually when they haven't got the on-line dispatch system installed to deal with the delivery efficiently.

175. Yesterday one of our dumb vans was sent out to one of these companies that has insisted on a driver being sent as well. It was dropping off some parts to a manufacturing company at the West Way industrial park. Whilst the van was being unloaded our driver felt unwell and decided that he could not continue. He went back and started the van off and thought he'd got it going on the guided COM lane but he hadn't done it properly. It got stuck at the Turnpike Junction and, oh dear, what a mess followed. Apart from the LOCAL lanes (lanes reserved for use by bicycles, motorcycles, minibuses and pencil cars), the West Way was out of operation for the start of the evening rush hour. I'm concerned that we could get in trouble about this, although SlotWays are dealing with the repercussions at the moment.

176. I don't know why all our customers don't use the GoodTrack on-line dispatch system. When we installed it we found it revolutionised our operations. GoodTrack continually monitors the status of every single delivery item that we deal with. Each item has a tracking identity number with full details of the item's characteristics such as its origin, destination, fragility and temperature. GoodTrack knows exactly where each item is at any time. Each item is identified to a vessel (transport or otherwise) which has its Geographical Information Systems (GIS) co-ordinates monitored in real time.

177. The information is available to the customer through their connection to the GoodTrack customer database. It means that they have total certainty about the timing of new deliveries and can better manage their stock so that they have little need to keep large quantities of stock on site. Nowadays retailers and manufacturing companies don't bother with all that warehousing space they used to have.

178. For our customers who use the GoodTrack system the loading and unloading operation is very simple. The dumb vans arrive at the delivery port and items to be unloaded at that location are shuffled to the unloading tray and taken away by the customer's staff. The items continue to be tracked in the customer's premises. For loading items into our dumb vans the customers have to tag items for tracking, which is straight forward when they have the GoodTrack customer scanning unit. We are giving incentives to our last few customers without GoodTrack to use the system by offering them free installation of the scanning units and software. If they don't take it on we might have to refuse to serve them as the city authorities here will soon require our transport operations to be fully automated so as to avoid further accidents like the one I mentioned earlier."

The Benefits of Pencil Cars

179. **Paul Smith**, **Office Worker**- "It's just not acceptable. Months in advance I've booked my daily slot home from work at 5:30pm. Apparently there was some cock up with one of those dumb vans - they live up to their name. It got stuck at the Turnpike Junction and they had to close the West Way. I had already set off when I heard about it through the SlotWays console. They advised me to pull over at the Windmill Centre and wait until it cleared. I ended up checking out a fashion show before finally one hour and forty minutes later I was informed that I'd got a new slot. I spent £150 on a shirt and shoes and all I'll get back from SlotWays is £55 and a week's worth of free slots.

180. It's typical really. The delivery people get priority during the middle of the day with all those lanes transferred over as COM lanes and they still end up messing us commuters around. We only get use of the COM lanes after 4pm. I think they should allow us to use the LOCAL lanes. The mini-buses, bicycles and single width pencil cars don't need all that space. At least I suppose at weekends we can use the COM lanes all day. The delivery companies can't complain about that since they get all that time during the week. A lot of people are out and about at the weekend and without the COM lanes it would be terrible.

181. All this has got me thinking about getting one of those pencil cars. They look like they might get crushed by other traffic with them being so narrow, but I guess there's little risk of that in the LOCAL lanes. I don't really need the extra seats and space of my current car for getting to work, so I could get on happily with the single seat. I think the idea for them came from that children's book where the mice had cars shaped like pencils. Anyway, there's much less congestion in the LOCAL lanes and slots are much cheaper. I wouldn't need to book them so far in advance.

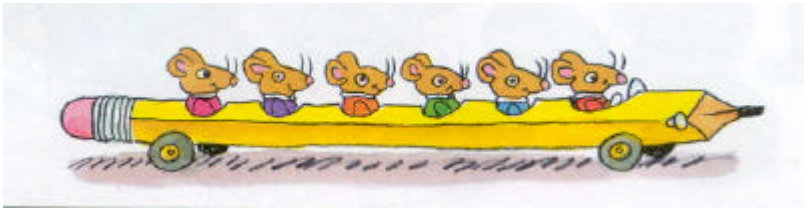


Figure 17: Illustration of a pencil car[118]

182. My neighbour has bought a pencil car. She decided it suited her day-to-day needs - the bulk of trips that she makes - so now she just hires a more suitable car for family outings. The increased availability and reduced cost of hire cars has meant that this is easy to do.

183. My daughter gets to school by bicycle so she wasn't affected by the dumb van incident at all. She uses the West Way for a short section but the LOCAL lanes were still open. Traffic wasn't able to get round West Way and go past her school as traffic outside schools was banned some years ago. It means there's more traffic on the main roads but it's much safer for the kids and I don't worry so much about my daughter cycling or scootering to school. They've also banned cars from the whole city centre now. Buses can get through the entry gate. I think they have remote controls on the buses to open them.

System Management

184. **Wendy Stevens**, **SlotWays Manager** -"The whole thing was a public relations disaster. To be fair to us, I think we dealt with it fairly promptly and these teething problems are increasingly rare. Those with slots booked who had not set off were told the situation on entering their vehicles or hopefully knew about it through the various information channels. While some people were inconvenienced, these glitches will soon be ironed out.

185. Thankfully we managed to keep the LOCAL lanes going along the WestWay. One report suggested that the whole event was set up to sell more pencil cars. It wouldn't have been so bad if it happened on the East Way where we've got switchover lanes. The head-up-display (HUD)[119] technology has worked for this exactly as promised. Physically switching the direction of lanes according to demand was never easy to achieve so HUD has been a real boon. On approach to the switchover lanes the system transmits a message to vehicles, displaying a sign on the windscreen indicating which directions are in operation. Then lane markings are displayed all along the East Way. It was good that the vehicle manufacturers followed the agreement some year ago to install HUD compatible operating systems in their vehicles".

8 A Vision: Design For All

Vision Summary

In design for all, an increasingly diverse and aging population will mean that meeting all the very different mobility needs of the population is a major challenge. The principal vehicle solution which emerges for personal transport is the Plug and Play Vehicle (PPV). This is a modular open architecture vehicle in which users develop their own vehicle design based around the core propulsion technology. For example, they add their own carrying capacity, which because of the modular nature of the vehicle can be changed at will (i.e. from single occupant commute trip to family outing). All internal features (i.e. Internet access, sound system etc) can be selected and plugged in by the user.

The standard PPV has been followed on the mass market by the Intelligent Diagnostic Vehicle (IDV) which provides personal mobility which transcends traditional barriers of mobility impairment. The IDV diagnoses the degree of manual control which it is safe for the user to have and applies automation to other driving tasks. Alternatively, the IDV can operate as an entirely automated vehicle enabling the user to both enjoy personalised, private travel whilst being able to work, rest or play. In design for all, technology is applied to provide holistic solutions. Therefore those who enjoy communal transport are served by fully automated public transport, staffed not by a driver but a customer information officer. Similarly, walkers and cyclists enjoy greater safety as the IDVs and PPVs detect other infrastructure users through sensor equipment.



The Plug and Play Vehicle

186. **Alex Norman, Motor Franchise Holder**-"Having worked in the motor trade all my life I know what a volatile business it is. It is driven by customer demand and if you are not in touch with your market you go under. Over the last decade or so the sector has realised that it's all about meeting individual needs. Some motor manufacturers tried designing a multitude of different vehicles for different users, but it became economic madness as economies of scale were lost. This 'design for all' culture demanded instead a simple framework upon which users could add their own modifications. The result is the PPV or 'plug and play vehicle'. This was essentially a modular open architecture vehicle. They have saturated the market for about five years as they are seen as providing the ultimate solution to individual mobility needs.

187. The vehicle is designed wholly around user needs. The design space begins with what a user needs to sit comfortably to operate a vehicle rather than with a conventional car space model. The space required for the operating engineering technology is massively reduced from the vehicles of the early decades of the century so that it has far less of a bearing on vehicle design. Then you just add on what you want in terms of carrying capacity e.g. single or multi occupancy or anything in between. The modules can be removed/added with ease before your journey begins. As for all the internal features, the universal standardisation of module interfaces means you can do exactly what it says in the adverts 'simply plug in what you want and play'. Old-fashioned single purpose vehicles are now only made for the collectors market. They are holding a vintage rally next weekend, involving historic Mondeos and Vectras, I believe there are even going to be some of those 4x4 jeeps".

Flexibility for Varying Needs

188. **Darren Rose, Personnel Manager**- "Having a PPV has certainly made accommodating the lifestyle needs of my family far simpler than when we had a people carrier. For a start all the internal features are what I want, I chose them from a multitude of options. When I first got it I didn't think I needed Internet access for four passenger modules, but then when we had our two kids we changed our minds and simply plugged it in. It is all such a contrast from the old days when to put in a sun roof cost a fortune and took ages, leaving you with the hassle of using a hire car and clearing your things from your vehicle.

189. The adaptability of the PPV is great. When I am just going to work in the city I use the bare minimum in terms of capacity, it makes those citycars of the past look pretty inefficient and cumbersome. Then when we are taking the kids to their grandparents and heading on to the supermarket we add on the people carrier modules. Sometimes I will head out with one purpose, like work, and then realise I need to take some colleagues

to a meeting or do some shopping. Fortunately, most large companies keep a supply of modules, otherwise you can nip out to any nearby garage and hire the module(s) you want.

190. My wife Paula's parents have just bought a PPV as well. They were one of those rare breeds who couldn't shake from their attachment to the traditional car. The turning point was when Paula's mother knew that her medical condition required her to use a wheelchair. The hassle of using a car became too much. Of course, with a PPV you can set the specifications to accommodate any mobility impairments so she doesn't have the problem of getting in and out of the wheelchair".

The Intelligent Diagnostic Vehicle

191. **Rebecca Wild, President of Senior Voice**- "A standard PPV is fine if you are young and fit. However, if you are what used to be known as a 'senior citizen' you have needs that require more sophisticated technological support. Of course, with people in this age group now constituting the most powerful political and economic voice in the country it was not difficult to get our demands heard and acted upon. We forced through the 'personal mobility for all' law, which meant Government and the manufacturers had to provide equal access opportunities to personal motorised mobility for all adults, irrespective of age, disability and/ or other considerations. The result is the IDV or 'Intelligent Diagnostic Vehicle'.

192. The IDV allows you to retain your access to independent motorised mobility. It is equipped with an array of sensor and diagnostic equipment to assess your fitness to drive, before and during your journey. The IDV gradually shuts off manual controls and automates as your human abilities degenerate. The IDV is effectively an all round health scanner, which assesses your reactions and sensory perceptions. What probably was not anticipated was how it would be used to assess the medical condition of all drivers, regardless of age and disability. My cousin has epilepsy, which always prevented him from using personal transport in the past. Now he can drive his IDV and if he is ever in danger of becoming ill whilst driving, the automation takes over. If the IDV deems it necessary it will take him to the nearest hospital or doctor's surgery".

Meeting Lifestyle Needs

193. **Susan Porter, Sales Executive**- "For some people, like my mother it has reached the stage where her IDV is effectively a fully automated vehicle. But still having access to her own private means of transport has helped to preserve her quality of life. Her mother had to use schemes like dial-a-ride in her old age, which meant she had to rely on others to achieve a door-to-door level of service. This way she keeps her independence. For me it is often a lifestyle

choice to go fully automated for a journey. This way you can do the kind of activities you might do on public transport like read a book, work on a computer or watch TV whilst being able to retain your independence, comfort, personal space and door-to-door level of service.

194. The stress I underwent when driving, particularly to and from business meetings, was incredible, but it was only when I got a PPV with IDV facilities that I really appreciated the levels that my stress/blood pressure had reached, it continually measures these things in assessing your fitness to drive. I seemed to be constantly charging around the country to meet clients. I would be frantically trying to find the destination on the map whilst negotiating alien traffic environments. Of course, I would lose valuable preparation time in underestimating how long it would take to get there. Now if I am going to a business meeting I always go automated and add on the office module. It frees up all the travelling time for preparation work and takes the hassle out of finding the destinations, taking me door-to-door.

195. Then at the end of the day on the journey home I can sit back, relax and even have a drink. No one with a PPV with IDV facilities gets prosecuted for drink driving anymore as automation kicks in if you are over the limit. Similarly, speeding is not a problem anymore, as your PPV overrides your desire to break speed limits. If there is a lot of traffic and it takes a long time it doesn't bother me too much. I have all I need to relax in my IDV and your monitor will show you that the vast majority of other road users are doing the same thing. Congestion is no longer seen as a cost in all circumstances, particularly as you can do so many activities in your PPV".

Fully Automated Public Transport

196. **Sanjeev Sharma, Retired Bus Driver**- "One of the benefits of the new attitude to transport provision that pervades society is that it offers options for everyone. It recognises that some people prefer collective transport and the interaction with the community that it offers. It particularly meets the needs of older people in society like myself who don't want to get involved with all the new technology or even own a vehicle. Of course, all the buses and trains are automated, but you do not lose the human interaction. For security, safety and customer information and reassurance purposes all vehicles are manned. In fact in many ways it is like a return to the days of the bus conductor except that the person is free to talk to you.

197. Of course, the problem is still congestion. It's all very well for PPV users to talk about how that's less of a problem for them since they can work on the move, but it is taking longer than ever to get anywhere, and where the infrastructure is shared between private

and public vehicles we get hugely held up. Someone told me that they used to complain about congestion back in the 1990s but it was nothing to what we get today. Believe me, it's no wonder people are so keen on automatic drive and office modules because they spend so long commuting".

Smart Walking and Cycling

198. **Jasmine Ling, University Student**- "The good thing about the culture of individual mobility in which we now live is that everyone's choices are catered for. As a university student studying sports science I am keenly aware of the importance of physical exercise and wherever possible I walk or cycle. Technology can be used to improve any journey, however local or complex. It started with a headphones based audio system that directed you to your destination and warned you of any dangers en route and most cyclists and walkers used them. A less intrusive option, which I prefer to use, is to consult my watch, I don't think you can buy one now that doesn't have a built in GPS locating system. Nowadays you really just need standard sensors in your clothing and on your bike to communicate to the PPVs and warn them of your presence.

199. What really excites me at the moment are the developments in technologically assisted walking and running that are anticipated in the not too distant future. Training shoes are being adapted to include motive power with the expected potential to enable speeds equivalent to the rollerblade or scooter. This is perhaps in reaction to the success of such modes in enabling quick movement in large complexes like airports and hypermarkets. There is even talk of developing 'space boots' so you can bound two or three metres at a time, but I think that is a bit too fanciful".

Conclusion

200. This report has examined how vehicles and infrastructure might be used to develop our transport systems of the future. In doing so, it has attempted to highlight the balance between maintaining existing systems and making the best use of technological advances to develop new vehicles and new systems. Historical precedents suggest that as new modes emerge to meet the shortcomings of existing systems, people, businesses and lifestyles adapt to the benefits of the new mode and new problems emerge. Travel is an important commodity and a multi billion pound industry. As such, companies are looking for opportunities to adapt to consumer needs in order to maintain and increase their market share, as evidenced by the volume and cost of car and airline advertising campaigns.

201. Six visions of how new vehicles and infrastructure might develop to meet current and future transport needs have been developed in this report. The visions do not set out detailed technological and design aspects of vehicle and infrastructure systems, but provide a picture of how different systems might integrate to meet the needs of society. All Network reports acknowledge that a variety of alternative futures may exist and each of these futures will influence the solutions we require in different ways. Table 2 offers a purely illustrative assessment of the compatibility of the visions with the Network's Transportation Requirements (see page 11).

202. Table 2 does not attempt to provide a rigorous and definitive assessment of the compatibility between the visions and the Network's Transportation Requirements. To judge the visions purely in terms of their compatibility with the Transportation Requirements would be unhelpfully simplistic. However, the analysis does highlight some of the principal strengths and weaknesses of the visions, at least in terms of their relationships to the Network's guiding principles for future transport developments.

203. The *control culture* vision exists within a context where safe, reliable and secure mobility are high priorities. It is therefore unsurprising that the Transportation Requirements associated with these factors proved compatible with the vision. The principal weaknesses of the vision are associated with social participation and with the resource efficiency of mobility. It would have to be questioned whether the socially excluded and other vulnerable members of society may be disadvantaged by the way in which the

control technology is used and enforced. The vision is focussed upon personal transport with no clear role for collective transport options expressed. Indeed, this fact is conceded by our esteemed transport historian.

	Control Culture	Community Future	The Handshake	Leisure World	After You	Design For All
1. Accessibility	-	👈	👈	👍	👈	👍
2. Mobility	👎	👍	👈	👍	👍	👈
3. Costs	-	👍	-	👍	👍	👎
4. Environment	-	👍	👈	👍	👍	-
5. Trip Type	-	-	-	-	👍	-
6. Health and Safety	👍	-	-	-	👍	👍
7. Electronic Communication	-	-	👎	👍	-	-
8. Land Use	-	👍	👍	-	-	-
9. Reliability	👍	-	👍	👍	👍	👎
10. Social Participation	👎	👈	-	-	-	👍
11. Stakeholder Involvement	-	👎	-	👍	👎	👍
12. Information	-	-	-	-	👍	-

👍 Compatibility between vision and Transportation Requirement

👎 Incompatibility between vision and Transportation Requirement

👈 Elements of compatibility and incompatibility between vision and Transportation Requirement

\- Compatibility between vision and Transportation Requirement cannot be determined

Table 2: The compatibility of the Visions with the Network's Transportation Requirements

204. The future of vehicles and infrastructure in the *community future* vision proves compatible with a range of Transportation Requirements. The emphasis on collective transport corresponds with the Network's desire for resource efficient mobility. The SSS system is also predicated on the transparent expression and full appreciation of the internal and external costs of transport options. The reduced role for the car also has clear benefits in terms of land use and the environment. It is perhaps ironic that the greatest weakness of this community vision relates to stakeholder involvement. Inherent to this vision is a top down imposition of a new transport regime and system. There is a clear implication that consultation in the form of stakeholder involvement has not been prominent. Perhaps inevitably, such a marked change in the nature of the transport system introduces transitional problems, which may disadvantage certain elements of the population more than others. It is for this reason that the community future does not prove wholly compatible with the Network's aims for equitable accessibility and social participation.

205. *The handshake* vision is based on the need to facilitate physical communication between people and to achieve this in an efficient manner. The intelligent use of interchange facilities in the vision supports the Transportation Requirement for mobility that is efficient in its use of resources. The innovative development and use of transport infrastructure in this vision is consistent both with the Network's Transportation Requirement to see improved reliability as a fundamental transport system management goal and with its aim to maximise land use efficiency and minimise net land take by the transport system. However, the vision is diametrically opposed to the Network's aims for electronic communication to be considered as a transport option.

206. *Leisure world* offers a future vision that is compatible with a large number of the Network's Transportation Requirements. The key impetus for the changes in the transport system in this vision came from the involvement of a stakeholders. The emphasis on collective transport solutions to the problems associated with leisure travel is commensurate with the Transportation Requirements relating to accessibility, mobility, reliability and social participation. The combination of utilising the potential of electronic communication to substitute for physical travel and applying charging mechanisms to better reflect the costs (including environmental costs) which mobility incurs also reflects the aims of the Network's Transportation Requirements.

207. The *after you* vision is predicated on a recognition of the need to fulfil the Network's Transportation Requirement for prioritisation and discrimination between different types of trips and activities. The system is seen to operate to improve reliability by utilising the potential of technology to enable fully informed choices to be taken based upon a recognition of the costs of different transport options. The infrastructure segregation between different modes in this vision also supports the Network's aims with regard to the environment, health and safety and efficient land use. Incompatibility with the Transportation Requirements centres upon stakeholder involvement, as like the *community future*, *after you* is a top-down vision with regulations imposed from above.

208. The vision of the future of vehicles and infrastructure generated in *design for all* is one in which equitable accessibility and stakeholder involvement are the central tenets. The equity of access to vehicles and infrastructure provided by the technological and cultural developments that take place within this vision facilitates social participation and enhances health and safety. The principal failings of this vision relate to reliability and costs. The spectre of increasing congestion, alleviated principally by the vehicle occupant's ability to conduct alternative activities whilst travelling, does not bode well

for the reliability of the transport system. Similarly, if a proportion of the travelling public is taking little notice of congestion it is unlikely that people are very aware of the costs that their transport decisions are incurring and they certainly are not paying for them. The picture of resource efficient mobility in design for all is mixed. The PPVs and IDVs suggest a future of unfettered personal transport, but fully automated public transport and developments to enhance walking and cycling suggest a more sustainable path is available.

209. The visions attempt to present the reader with a range of alternative solutions that make different use of perceived technological advances. The solutions may not only apply within the context of the scenario for which they were developed. A mixture of solutions from the different visions may be appropriate. However, underpinning all of these solutions are a number of important factors that the Network feels will strongly influence future vehicle and infrastructure development.

210. Technology offers the opportunity to increase the flow capacity that any system of infrastructure can provide. However, greater capacity gains will be delivered if technology is harnessed to develop systems that increase the number of people per hour that we move rather than the number of vehicles per hour. Measures such as dedicated lanes and intelligent charging can facilitate this. Similarly, greater support for car sharing and innovative forms of shared vehicle ownership could help achieve such aims. The improvements in throughput in people per hour achieved through these measures may also deliver vastly enhanced energy efficiency per kilometre moved. A new car today with two occupants will be more energy efficient than a car built in 2010 with one occupant even if targets for improving vehicle efficiency are met.

211. The Network supports the need for increased reliability. New high-speed networks should not be the sole focus of our transport policy. The economic benefits of reduced journey times are not disputed, but the need for reliability of journey times seems to be increasingly important to enable efficient business practices to flourish. Reliability also serves to reduce energy consumption and toxic exhaust emissions. The environmental credentials of high-speed networks are less clear.

212. The Network did not see any new transport modes emerging in the near future. There does not appear to be sufficient demand, which is not catered for in an acceptable way by existing modes, for investment in new systems to be justified. However, the Network sounds a note of caution that should the management of the modes we have today fail to improve, such conditions could be created.

Flying cars and jet packs seem set to continue in the minds of inventors and fiction writers for now. It seems unlikely that the energy requirements of such systems could fit into any conceivable sustainable transport policy. Rather, the Network saw our infrastructure and vehicles consisting of new hybrids of what we already have.

213. However, the Network continues to acknowledge that ICT is an important and as yet underdeveloped infrastructure with important transport implications. ICT is in its infancy and perhaps has suffered from too much being expected too soon from the systems of today. An analogy has been drawn between ICT and the car. The Internet system we have today is equivalent to the car of the early 20th century. ICT systems of 50 years hence will potentially offer extraordinary communications opportunities that promise to change the way we do things. Although this may offer us the opportunity to do the things we do today differently, it will undoubtedly allow us to undertake more or different activities, which could create new transport problems.

214. The Network also stressed the difficulties in delivering radically new infrastructures given the huge financial commitment that maintaining our current infrastructure already requires. In this regard, the millions of pounds which private consumers already invest in cars and bicycles offers a more attractive and flexible alternative to allow new technology to diffuse into our transport networks. The use of vehicles as the main method for delivering new technology also allows incremental change to filter through, whereas infrastructure improvements require long-term commitments to particular systems, which often present a significant legacy of problems in the future.

215. This outlook should not be taken as marginalizing the role of Government in delivering improved transport. Government and transport professionals have key roles in trying to bring forward solutions that offer the most sustainable future. Government will also need to continue to engage business in developing solutions. Future solutions should include collective transport. The conclusion from the visions was that a future could exist in which collective transport offers a level of service parallel to that of the private car. It remains possible that private car use will decline at some point over the next century.

216. The problem of the UK road network is not principally a lack of capacity, but of an uneven distribution of demand for capacity. Expanding capacity does not address the unevenness and inefficiencies of this demand. Changes in business practices to embrace flexible working (including working hours and location)

could potentially have a more significant impact on the efficiency of our transport networks than any amount of ICT or vehicle technology. The reductions in delays experienced over school holiday periods suggest that significant improvements could be achieved. However, there could be significant social implications from moves in this direction that give good reason to question this approach. Furthermore, changes to business practices could worsen our transport problems through increasing dependence on just-in-time deliveries, facilitated through improved computer stock control.

217. The Network believes that there is still a considerable role for expanded public transport provision, particularly where high quality local and national corridor services are developed to offer intermediate trip stage options. Indeed, in some visions, automated taxi services replace the need for private cars altogether - although this would necessitate a change in mentality as well as a step-change in technology to be delivered.

218. In summary, we are likely to see significant change in the nature of vehicles using our infrastructure in the future. Radically new infrastructure networks are less likely to be developed. New hybrids of the systems in operation today may form the basis of our systems for the coming decades. This should be supported by a more intelligent infrastructure for information provision, trip management and charging. However, the type of solutions that flourish will be highly dependent on the values of society and the market conditions created by Government.

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References

[1] DETR (1998). A New Deal for Transport- Better for Everyone, Transport White Paper. TSO, London. Available (as at 09/01/02): http://www.dtlr.gov.uk/itwp/paper/index.htm

[2] DETR (2000) *Transport 2010- The Ten Year Plan*, TSO, London. Available (as at 09/01/02): http://www.dtlr.gov.uk/trans2010/plan/index.htm

[3] The RAC Foundation (1992). *Cars and the Environment. A View to the Year 2020*. London.

[4] The Engineering Council (1997). *A vision for transport 2020*. Thomas Telford, London.

[5] Tight, M., Bristow, A., Page, M. and Milne, D. (2000). *Transport - a Vision for the Future*, Landor, London.

[6] Masser, I., Sviden, O. and Wegener, M. (1992). *The geography of Europe's futures*. Belhaven, London.

[7] Banister, D. (2000) Sustainable urban development and transport- a Eurovision for 2020. *Transport Reviews*, Vol 20, No 1, pp113-30.

[8] Garrison, W. and Ward, J. (2000). *Tomorrow's Transportation: Changing Cities, Economies, and Lives*. Artech House, Boston.

[9] Lyons, G., Chatterjee, K., Marsden, G. and Beecroft, M. (2000) *Society and Lifestyles. Number One in a series of Eight Reports form the Transport Visions Network*. Landor, London. Available (as at 09/01/02): http://www.trg.soton.ac.uk/research/TVNetwork/reports/report1.htm

[10] Lyons, G., Marsden, G., Beecroft, M. and Chatterjee, K., (2001) *Transportation Requirement. Number Two in a series of Eight Reports from the Transport Visions Network*. Landor, London. Available (as at 09/01/02): http://www.trg.soton.ac.uk/research/TVNetwork/reports/report2.htm

[11] Chatterjee, K., Beecroft, M., Lyons, G. and Marsden, G. (2001) *Land Use Planning. Number Three in a series of Eight Reports from the Transport Visions Network*. Landor, London. Available (as at 09/01/02): http://www.trg.soton.ac.uk/research/TVNetwork/reports/report3.htm

[12] Numan, G. (1979). Cars (Single from the album The Pleasure Principle'). See Unofficial Gary Numan Fan Website. Available (as at 09/01/02): http://www.kill-by-numbers.net/numan/lyrics/C.html#2

[13] Wright, C. and Egan, J. (2000) De-marketing the car. *Transport Policy* Vol 7 pp287-294.

[14] Wootton, J. and Marsden, G. (2001) The Local Transport Plan Submissions: A Review. Report for the RAC Foundation Public Policy

Committee, February. Available (as at 09/01/02): http://www.trg.soton.ac.uk/news-features/ltp/ltp_submissions.PDF

[15] See Reference 8.

[16] See Reference 8.

[17] Transport for London (2000). *Transport Statistics for London 2000*. Transport for London, London. Available (as at 09/01/02): http://www.transportforlondon.gov.uk/PDFfiles/statsone.pdf

[18] Simmons, J and Biddle, B (1997) The Oxford Companion to British Railway History, Oxford University Press, Oxford.

[19] Waters, L (1999) *The Great Western Broad Gauge*. Ian Allen, Surrey.

[20] See Reference 18.

[21] The Monorail Society website. Available (as at 09/01/02): http://www.monorails.org/

[22] National Statistics (2000). *Transport Statistics Bulletin. National Travel Survey: 1997/99 Update*. TSO, London. Available (as at 09/01/02): http://www.transtat.dtlr.gov.uk/tables/2000/nts/nts00.pdf

[23] DETR (1996). *Developing a Strategy for Walking*. TSO, London. Available (as at 09/01/02): http://www.local-transport.dtlr.gov.uk/walk/walk.htm#index

DETR (2000). *Encouraging walking: advice to local authorities*. TSO, London. Available (as at 09/01/02): http://www.local-transport.dtlr.gov.uk/walking/pdf/stepout.pdf

DETR (2000) *Guidance on Full Local Transport Plans*. TSO, London. Available (as at 09/01/02): http://www.local-transport.dtlr.gov.uk/fulltp/index.htm

[24] DETR (1996). *National Cycling Strategy*. TSO, London. Available (as at 09/01/02): http://www.dtlr.gov.uk/itwp/ncs/ncs.htm

DETR (2000) *Guidance on Full Local Transport Plans*. TSO, London. Available (as at 09/01/02): http://www.local-transport.dtlr.gov.uk/fulltp/index.htm

[25] DETR (1999). *From Workhorse to Thoroughbred: A Better Role for Bus Travel*. TSO, London. Available (as at 09/01/02): http://www.dtlr.gov.uk/itwp/brbus/index.htm

DETR (2000) *Guidance on Full Local Transport Plans*. TSO, London. Available (as at 09/01/02): http://www.local-transport.dtlr.gov.uk/fulltp/index.htm

[26] DTLR (2001) *Transport Statistics Great Britain 2001 Edition*. TSO, London. Available (as at 09/01/02): http://www.transtat.dtlr.gov.uk/tables/tsgb01/text/tsgbcont.htm

[27] Evolutions Limited website. Available (as at 09/01/02): http://www.evolutionsltd.com/scooter.htm

[28] BBC News website. Available (as at 09/01/02): http://news.bbc.co.uk/hi/english/sci/tech/newsid_1689000/1689106.stm

[29] See Reference 28.

[30] BMW website. Available (as at 14/11/01): http://www.bmw-c1.com/c1/english/index.htm

[31] Harrison, J. (2001). Planning for more cycling: the York experience bucks the trend. *World Transport Policy & Practice*, Vol 7, No 3, (Autumn 2001), pp21-27. Available (as at 09/01/02): http://www.ecoplan.org/library/wt7-3.pdf

[32] See Reference 30.

[33] Rackliff, T (2000), Integrating Suburban Rail Systems with Urban Tramways: The Potential for the Karlsruhe Model in the UK. Universities Transport Studies Group 2000, Liverpool.

[34] Tyne and Wear Metro Website. Available (as at 09/01/02): http://www.tyneandwearmetro.co.uk/metro.htm

[35] Cloke,J., Boulter, P., Davies, G., Hickman, A., McCrae, I. & Nelson, P. (1999). *Traffic Management and Air Quality Research Programme*. TRL Ltd, Crowthorne.

[36] Liftshare website. Available (as at 09/01/02): http://www.liftshare.com

[37] Nottingham Travel Wise Centre website. Available (as at 09/01/02): http://utc.nottscc.gov.uk/boots1.htm

[38] Leeds City Council website. Available (as at 09/01/02): http://www.leeds.gov.uk/lcc/highways/various/twop_inf.html

[39] Legislative Analyst's Office, California website. Available (as at 09/01/02): http://www.lao.ca.gov/010700_hov/010700_hov_lanes.html

[40] Lyons, G. & Chatterjee, K. (Forthcoming 2002) 'Travel Behaviour of Car Users During the UK Fuel Crisis and Insights into Car Dependence'. In Lyons, G. and Chatterjee, K. (eds.) *Transport Lessons from the Fuel Tax Protests of 2000*. Ashgate, Aldershot.

[41] Railtrack West Coast Route Modernisation website. Available (as at 09/01/02): http://www.wcrm.co.uk/

[42] TGVweb website. Available (as at 09/01/02): http://mercurio.iet.unipi.it/tgv/tgvindex.html

[43] InterCityExpress website. Available (as at 09/01/02): http://mercurio.iet.unipi.it/ice/

[44] DTLR (2001). Railtrack placed in administration. DTLR Press Release, 7/10/01. Available (as at 09/01/02): http://www.press.dtlr.gov.uk/0110/0416.htm

[45] See Reference 41.

[46] Japan Atlas Advanced Technology website. Available (as at 09/01/02): http://www.jinjapan.org/atlas/technology/tec04.html

[47] See Reference 2.

[48] Richardson, M. (1999) Adaptive Cruise Control: A Product Whose Time has Come. Presentation at 9th Annual ITS America Conference. Washington D.C. USA. ITS America. See also: Richardson, M., Searcy, R., Haney, P. and Burnham, K. (1999). Adaptive Cruise Control Systems: A Case Study. *Proc. of the 6th World Congress on ITS*, Toronto, Canada, 1999. CD-ROM.

[49] Transit Toronto website. Available (as at 14/11/01): http://transit.toronto.on.ca/gotransit/bilevels.htm

[50] See Reference 42.

[51] The Bulleid Double Decker Society website. Available (as at 09/01/02): http://members.tripod.com/~dart75/bdds.htm

[52] South West Trains website. Available (as at 09/01/02): http://www.swtrains.co.uk/aboutus/franchise.asp

[53] Channel Tunnel Rail Link website. Available (as at 09/01/02): http://www.ctrl.co.uk/

[54] TGVweb website. Available (as at 09/01/02): http://mercurio.iet.unipi.it/tgv/duplex.html

[55] Central Railway website. Available (as at 09/01/02): http://www.central-railway.co.uk/inprogress/home.shtml

[56] EU website. Available (as at 09/01/02): http://europa.eu.int/eur-lex/en/lif/dat/1996/en_396L0048.html

[57] EU website. Available (as at 09/01/02): http://europa.eu.int/eur-lex/en/lif/dat/2001/en_301L0016.html

[58] DETR. (1997). *National Road Traffic Forecasts (Great Britain) 1997*. TSO, London. Available (as at 09/01/02): http://www.roads.dtlr.gov.uk/roadnetwork/nrpd/heta2/nrtf97/index.htm

[59] Banister, C., Turner, J. & Richardson, T. (2000). *Unravelling the Transport Web*. Landor, London.

[60] See Reference 10.

[61] See Reference 59.

[62] See Reference 11.

[63] See Reference 8.

[64] Energy Saving Trust Powershift website. Available (as at 09/01/02): http://www.est-powershift.org.uk/ps_fuel_cells.html

[65] DTLR, DTI, DEFRA, HM Treasury (2001). Powering Future Vehicles. Draft Government Strategy. TSO, London. Available (as at 09/01/02):

http://www.roads.dtlr.gov.uk/vehicle/environment/futurepower/index.htm

[66] DTI New and Renewable Energy Programme website. Available (as at 09/01/02): http://www.dti.gov.uk/renewable/

[67] See Reference 65.

[68] Mercedes-Benz website. Available (as at 09/01/02): http://www.mercedes-benz.com/e/ecars/omnibus/journal/news_fuel_cell_bus.htm

[69] Buses (2001). 'First Group to operate three German-built fuel cell buses in London from early 2003' & 'The wire-less electric bus solution'. *Buses*, (May 2001). Ian Allan Publishing, London.

[70] PistonHeads website. Available (as at 14/11/01): http://www.pistonheads.com/lotus/extreme.htm

[71] See Reference 68.

[72] MIL Motoring Research (1993), E-Auto Conjoint Study. Report for the International Ecotechnology Research Centre.

[73] DTI Foresight Vehicle Programme website. Available (as at 09/01/02): http://www.foresightvehicle.org.uk/

[74] Abley, J. (2000). Measuring Consumer Utility for the Aerostable Carbon Car. Project Report. Cranfield University.

[75] See Reference 74.

[76] Corbin Motors website. Available (as at 14/11/01): http://www.corbinmotors.com/gallery.htm

[77] Community Car Share Network website. Available (as at 09/01/02): http://www.carshareclubs.org.uk/index.htm

[78] European Union Community Research and Development Information website. Available (as at 09/01/02): http://www.cordis.lu/telematics/tap_transport/research/projects/chauffeur.html

[79] Picture courtesy of California PATH.

[80] DTLR, Scottish Executive, National Assembly for Wales (2000). *Road Accident Statistics 2000*. TSO, London. Available (as at 09/01/02): http://www.transtat.dtlr.gov.uk/tables/2001/ragb/pdf/ragb01_1.pdf

[81] French National Institute for Research in Computer Science and Automatic Control (INRIA) website. Available (as at 09/01/02): http://www-lara.inria.fr/cycaba/

[82] The Source for Intelligent Vehicles News website. Available (as at 09/01/02): http://www.ivsource.net/buses.htm

[83] CyberCars project website. Available (as at 09/01/02): http://www.cybercars.org/

[84] Rapid Urban Flexible website. Available (as at 09/01/02): http://www.ruf.dk/

[85] Car Design New website. Available (as at 09/01/02): http://www.cardesignnews.com/events/paris2000/features/citroen-c5/

[86] See Reference 74.

[87] Citroen website. Available (as at 14/11/01): http://www.citroen.com/us/bleu/concept/concept_osmose.htm

[88] imac2day website. Available (as at 09/01/02): http://www.imac2day.com/

[89] Seattle Center Monorail website. Available (as at 09/01/02): http://www.seattlemonorail.com/

[90] The Canary Wharf Group PLC website. Available (as at 09/01/02): http://www.canarywharf.com/mainFrm1.asp

[91] Advanced Transport Group, University of Bristol website. Available (as at 09/01/02): http://atg.fen.bris.ac.uk/ultra.html

[92] See Reference 91.

[93] BBC News Website. Available (as at 17/01/02): http://news.bbc.co.uk/hi/english/uk/wales/newsid_1765000/1765120.stm

[94] BBC News website. Available (as at 09/01/02): http://news.bbc.co.uk/hi/english/sci/tech/newsid_893000/893200.stm

[95] Moller International website. Available (as at 09/01/02): http://www.moller.com/skycar

[96] See Reference 53.

[97] Railway Technology website. Available (as at 09/01/02): http://www.railway-technology.com/projects/jubilee/

[98] Birmingham Northern Relief Road website. Available (as at 09/01/02): http://www.bnrr.co.uk/news_1.htm

[99] See Reference 41.

[100] The Planning Inspectorate website. Available (as at 09/01/02): http://www.planning-inspectorate.gov.uk/pi_journal/thorpe_art2.htm

See also BAA website. Available (as at 09/01/01): http://www.baa.co.uk/main/airports/heathrow/about_heathrow_frame.html

[101] DTLR (2001). *Planning Green Paper. Planning: Delivering a Fundamental Change*. TSO, London. Available (as at 09/01/02): http://www.planning.dtlr.gov.uk/consult/greenpap/index.htm

[102] See Reference 26.

[103] DETR (1999). *London Underground Statement by The Rt Hon John Prescott, MP, Deputy Prime Minister*. TSO, London. Available (as at 09/01/02) at: http://www.local-transport.dtlr.gov.uk/joinedup/index.htm

[104] See Reference 2.

[105] Hayhurst, J (1974). *The Pneumatic Post of Paris*. The France & Colonies Philatelic Society of Great Britain. Available (as at 09/01/02): http://www.cix.co.uk/~mhayhurst/jdhayhurst/pneumatic/book1.html

[106] Evacuated Tube Transport Technologies website. Available (as at 09/01/02): http://www.et3.com/

[107] See Reference 10.

[108] Sansom, T., Nash, C., Mackie, P., Shires, J. and Watkiss, P. (2001) Surface Transport Costs and Charges Great Britain 1998. Final Report for the Department of the Environment, Transport and the Regions. Institute of Transport Studies, Leeds and AEA Technology.

[109] National Rail website. Available (as at 09/01/02): http://www.nationalrail.co.uk/info/tickets/tickets.htm

[110] See Reference 2.

[111] DETR (2000) *Guidance on Full Local Transport Plans*. TSO, London. Available (as at 09/01/02): http://www.local-transport.dtlr.gov.uk/fulltp/index.htm

[112] BBC News website. Available (as at 09/01/02): http://news.bbc.co.uk/vote2001/hi/english/main_issues/sections/facts/newsid_1202000/1202815.stm

[113] BBC News website. Available (as at 09/01/02): http://news.bbc.co.uk/hi/english/business/newsid_1578000/1578795.stm

[114] See Reference 26.

[115] Comte, S. 'The effect of automatic speed control on driver behavioural adaptation', Conference paper at 9th International Conference, Road Safety in Europe, Bergisch Gladbach, Germany, 1998. See also VTT Building and Transport website. Available (as at 09/01/02): http://www.vtt.fi/rte/projects/yki6/master/pre32b.pdf

[116] See Reference 9.

[117] Ski Zermatt website. Available (as at 09/01/02): http://www.ski-zermatt.com/zermatt.html

[118] Scarry, R. (1999). *Busy Numbers*. Egmont Children's Books, London.

[119] Chevrolet Europe website. Available (as at 09/01/02): http://www.chevroleteurope.com/english/model_lineup/corvette/comfort/en_xx_head_up.htm