

## THSG POLICY ON PUBLIC TRANSPORT

### SUMMARY

Public transport is important for health because of safety, benefits to climate change, air quality and physical activity as an alternative to the private car. Transit has a role addressing inequalities by providing mobility for those without access to a car or unable to walk or cycle a given journey. The work of Mogridge has shown that transit is also of key importance to reducing congestion, having a greater benefit than road improvement (for reasons explained in our policy on road charging and congestion).

Equitable sustainable transport requires the fluid interaction of the walk-bike-bus/subway modes. Pleasurable, safe, direct walking routes for trips from 0-2 km are essential to encourage car-free living without reducing quality of life and access to social, urban and other benefits. Similarly, both standalone and public transport ingress trips should be well served by private bicycles, public bikeshare, cycle taxis and cargo bicycles (2-10 km), which encourage walking to shop, for example, but don't require users to then carry heavy loads on their return journey.

Public transport may serve as a standalone mode for some journeys, but is primarily a strategic component of a sustainable and socially just transport system covering distances over 5 km. Transit must provide assistance for carers with children, the sick or other vulnerable users. Key components of this new vision include:

1. Dense, high-quality networks of walking and cycling facilities around public transport hubs, stations and stops.
2. A "cycle-inclusive" strategy as cycles provide the missing link between walking and public transport. As a minimum we need
  - safe and secure cycle parking at key transport hubs
  - cycle maintenance and repair and cycle rentals at major stations and other intermediate points;
  - bike racks on buses and cycle vans on trains;
  - public bikeshare, with full fare integration, designed to connect residential, commercial and public transport hubs, offering a variety of cycles for adults and children
  - informational and educational programs to motivate and teach people how to use these services most effectively;
  - smart phone applications to map and highlight intermodal routes.
  - special attention to tourism that highlights the cultural and environmental benefits of sustainable intermodal transport, encouraging recreational use of the system and taking care to connect non-work-related destinations in ways that make them particularly accessible and friendly to diverse families;

3. As many women have been sexually harassed on public transport we need
  - gender parity in staffing the system
  - protocols for dealing with sexual assault and harassment,
  - generation of lively and secure streetscapes around public transport stops and hubs, as close to 24 hours as possible
  - permission to stop as near as possible to destinations particularly at night,
  - and other similar initiatives;
4. Cycle-carrying public transport is important since the combination of these modes offers a system comparable to the car in its flexibility.
5. Public transport needs to be comprehensive, operating at all times on a mixture of radial, orbital and circular routes and as demand response, accessible to all places of residence, work, business, recreation and public recourse.
6. Access with full cycling facilities should be available within cycling distance. Access to a frequent rapid transit system (rail, tram, BRT or limited stop bus) should be available within walking distance. Access to a less frequent but still regular bus service should be close enough to be accessible to those whose frailty or disabilities might make it difficult to walk to the station. For those too encumbered with heavy luggage, or too impaired with mobility or visual impairments, access should be available at the door to a wheelchair-accessible service. For those who need help getting to the door or care in transit there should be an ambulance service able to carry stretchers.
7. Demand-responsive services should provide door to door services as needed and should also fill gaps in the network for which scheduled services can't be justified.
8. Account-based fare payment accommodating integrated zonal fares, ticketing and ride subsidies is necessary to support mobility. Different transport modes should work together not in competition. We describe a way that the service could be operated in an integrated network, whilst recognising that variations from this are possible and may be more suitable in local settings.
9. Local services should feed into regional services which in turn should feed into an international high-speed rail system. Sleeper services are important in extending the distance over which trains are competitive with aviation.
10. Those living in rural areas have the same mobility needs as those in urban areas. Their journeys are longer as the distances between settlements and destinations is greater. Although the needs are the same in rural areas, the best way to meet them may be different.
11. Railways are an important contributor to mobility and we discuss ways to develop the rail system.
12. Motorways/ autobahns/ interstates/ etc. are a major component of transport infrastructure which must be adapted for use in a changed transport system. We

suggest ways to add a public transport component to them. WHY IS PUBLIC TRANSPORT IMPORTANT FOR HEALTH?

1. Using transit is safer than the private car.
2. A substantial shift from the private car to public transport is necessary to reduce the impact of motor traffic on climate change, on air quality, on noise pollution and on local communities.
3. Those who use public transport tend to undertake more physical activity in the course of doing so. Hence, those who commute by public transport have a mortality rate (adjusted for age, sex and occupation) intermediate between the lower rates of those who commute on foot or cycle and the higher rates of those who commute by car.
4. For those without access to a car, public transport is necessary to be mobile. Research in a number of countries and regions (China, UK, USA, Latin America) has shown the importance of access to public transport for reducing health inequalities.
5. Cycle-carrying public transport makes the combination of the cycle and public transport an effective alternative to the car, thus increasing the amount of cycling (with consequent benefits for health) and reducing car use (with consequent reductions in the adverse effects of motor traffic).
6. Research some years ago in South Yorkshire, England and more recently in Saskatchewan, Canada has shown that the direct savings to public funds from reducing public transport subsidies are outweighed by additional costs on other areas of public expenditure. These were purely financial studies and if wider benefits had been considered in a full cost/benefit study the benefits would have been even greater.

WHY IS IT IMPORTANT THAT PUBLIC TRANSPORT NETWORKS ARE COMPREHENSIVE AND CAN THEY BE?

Public transport needs to be comprehensive in serving all areas at all times for people of all abilities. Transit needs to be accessible to people with all kinds of impairment or with encumbrances such as heavy luggage. Transit should be direct to the maximum practical extent possible, offering orbital as well as radial connections. Transit policies should address the complex journeys of those who need to fit work, childcare and shopping into their journeys rather than just go to and from work.

Service routes, frequencies and span together should be designed to enable mobility. If it is not comprehensive those without access to a car will be unable to make some journeys while those with a car will be encouraged to use it for all their journeys not just those which the system fails to cater for. If you are going out for the evening you do not go by bus if there isn't a bus back. If transit doesn't reach your

destination you are likely to drive the whole journey not take transit for part of the journey.

If fixed rail and bus routes are designed and operated to meet significant demand, gaps can be filled with demand-responsive services.

#### WHAT ARE THE CRITERIA OF A COMPREHENSIVE SERVICE?

- Regular services should be available at all appropriate times at a stop within a short distance of every place of residence, place of work or education, place of business, place of recreation or other place of public recourse.
- Frequent services should be available at all appropriate times at a stop within walking distance of every such place.
- High quality fast regular services (such as trains or coaches) equipped for use by cyclists should be available at all appropriate times at a stop within cycling distance of every such place.
- Demand responsive services should pick passengers up at their door and set them down either at their destination or at an interchange to scheduled services if the passengers are unable to make their way to a stop, due to impairments, hazards or encumbrances such as heavy luggage.
- Special demand responsive services, possibly offered by ambulance services, should be available for passengers who need help getting to their door, who need to be conveyed on stretchers or who need care in transit.
- Security measures are needed, recognising that many people (especially women) are afraid of being alone at stops or of being the victim of violence or other abuse during the journey.
- Effective solutions are needed for the complex journeys made by those with childcare needs. These could include the provision of childcare at public transport interchanges, the adjustment of connections at bus stops close to childcare establishments, or demand responsive feeder services.

In urban areas, the meaning of "regular" would usually be at least every half hour, and the meaning of "frequent" would usually be at least every fifteen minutes. These intervals could be doubled in rural areas, doubled again in remote areas and quadrupled in the depths of the night. The meaning of "close" would usually be within 200 yards, the meaning of "within walking distance" would usually be within a mile, and the meaning of "within cycling distance" would normally be within 5 miles. These distances could be somewhat greater in rural areas and cycling distance may be significantly greater in remote areas.

"All appropriate times" for residences would be at all times, for businesses and recreational facilities all times when they are open and for workplaces all times when people may be arriving or leaving.

#### HOW CAN THIS BE PROVIDED?

A comprehensive system can be organized in many ways – being prescriptive would not be sensible. The following is one possible model that would work in much of the world but may need modification in the more sparsely populated areas

- An international high-speed railway network, including sleeper services, would link cities and regions around the world. Sleeper services are important because they considerably increase the distance over which trains are competitive with air travel.
- Regular “regional express” rail services, including a cycle van, would operate on the rail system, increasing the frequency on many services and restoring local passenger services to lines from which they have been withdrawn. Regional express stations would have cycle hire and cycle storage facilities. For routes where rail provision is not feasible high-quality cycle-carrying rail-link bus services would operate. There would be a station within cycling distance of most places, with demand-responsive services where scheduled services cannot be justified. The network would be orbital as well as radial, although if the rail system is mainly radial the orbital routes may need to be provided by rail-link buses. Operators of this network should view the train/cycle combination as a major potential source of business and revenue and should aim to promote it and make high quality provision for it.
- A rapid transit system, consisting of frequent stopping trains, trams and bus-rapid-transit (BRT) would operate serving stations within walking distance of their surroundings. Major stations would offer transfer opportunities with regional express services and local route feeder services. Where BRT cannot be justified, limited stop buses would operate. The network would be orbital as well as radial. Where scheduled services are not justified, demand-responsive services would fill the gaps.
- A local bus network would operate regular services bus stops close to all neighborhoods, shops, and places of employment, healthcare and community activities. These could be scheduled services, semi-scheduled services (operating only on request), or semi-fixed routes (varying the route according to requests). Demand-responsive services would fill in gaps. There would be a mixture of orbital radial and circular services There would be good connections between routes and also between the bus network and the rapid transit system.
- A demand-responsive transport system including shared taxis, community transport and variable-route buses would be arranged to fill in the gaps in the above networks and also to provide transport to the door for those who are unable to make their own way to a bus stop due to impairments (such as mobility-impairments, encumbrances (such as heavy luggage) or hazards (when walking or standing at a stop might be dangerous in a particular area at a particular time).
- This whole system would operate as an interconnected system with through-ticketing and zonal fares.

- Taxis would be commissioned to operate as part of the demand-responsive transport system by the operational controllers of that system where they would be the most efficient way of meeting the need, but they would often be commissioned on a shared basis or on a basis of serving only as a feeder to scheduled services. It is likely that the fare charged to the passenger as part of the zonal fare system would be less than the system would have to pay the taxi operator. , but in any public transport system there is cross-subsidy between different parts of the system. Passengers who want to only ride alone on a taxi or to cover a walkable trip to a transit stop would be unsubsidised and the trip would therefore be more expensive.
- The ambulance service would operate a service for people who require help getting to the door, need to be carried on stretchers or who need care in transit. In return, the public transport network would enable as many patients as possible to connect via transit to health care appointments.
- Public transport operators should make better provision for shopping and for luggage, recognising that they are in competition with the car boot.

There will clearly be variations on this model.

In Europe, bus operators should be aware of the fact that bus usage is higher in cities with rail-based public transport systems. The rail system should be viewed not as a competitor but rather as the part of the public transport system at the cutting edge of competition with the car. However, this is not the case in all parts of the world. In some parts of the world the system (apart from the high-speed inter-regional services) could be entirely bus-based without a local rail component.

Cable cars and fast ferries may be included in the system in some areas.

The different tiers of regional, rapid transit and bus networks could be combined in some rural areas. Sometimes, instead of an express service and a stopping service, a more frequent express service making wayside stops on a rotating or demand-responsive basis may be preferable.

#### IS THIS VIABLE IN RURAL AREAS?

The transport needs of most rural areas are no different from those of urban areas – There is the same population but more dispersed, so the journeys are longer because the gaps between settlements is greater. However longer journeys may mean higher costs

Failing to extend the comprehensive system to include such areas would be to accept rural inequality for those without cars, to leave unchallenged a large proportion of the climate change of car use and to fail to address the impact on city traffic of vehicles bringing people in from rural areas. Rural settlements, the areas around them and places of public recourse within rural areas (such as tourist destinations) must be part of the comprehensive public transport system. Some sparsely populated areas consisting mostly of individual farms likely will generate mostly individual rides. Public transport in such areas is likely to be entirely

demand-responsive and essentially a taxi or volunteer service. Use of private cars may be more efficient. Where such areas abut more settled areas, park and ride facilities should be provided.

In very sparsely populated areas, such as Alaska and Antarctica, public transport is likely to be provided by aviation.

## HOW SHOULD WE CATER FOR IMPAIRMENTS AND ENCUMBRANCES?

In our first policy on disability we recognised three levels of public transport impairment.

Level 1 consists of people who can make their own way to the bus stop but cannot use a bus which has not been rendered accessible for their particular disability (e.g. a wheelchair user who cannot use a bus which is not wheelchair-accessible). For people at this level what they need is for the general public transport system to be accessible.

Level 2 consists of people who can make their own way to their front door and can use an accessible bus or an ambulette but cannot make their way to the bus stop. For people at this level the use of accessible vehicles or ambulettes within the demand-responsive system meets their needs.

Level 3 consists of people who need help getting to their own front door, need care in transit or need to be conveyed on a stretcher. For people at this level the public transport system needs to include ambulances within its range of demand-responsive services, possibly by an arrangement with the ambulance service (for which the quid pro quo could be a public transport system which accommodates a wider range of patient transport needs for those travelling to or between health care facilities).

We have always recognised that meeting these needs is not just a special provision for disabled people but a provision that should be integral to the provision of public transport and that benefits everybody. Hence, we have always referred to “disabilities and encumbrances.” Somebody pushing a pram may have the same problems as a wheelchair-user and therefore have a level 1 encumbrance. Somebody with luggage too heavy to carry to the bus stop will have a level 2 encumbrance.

In a later modification we divided level 2 into level 2A and level 2B to recognise that some people need a level 2 service not because of mobility or sensory impairments but because of cognitive or intellectual impairments which prevent them finding their own way around. Such individuals might be at level 1, or even be unimpaired, when accompanied by a companion. Their needs can be met by providing free travel for a companion or by providing a companion.

This is actually only one of a number of examples of situations in which the level of disability can be reduced by providing free travel for a companion or by providing a companion. For example, some people who would need an ambulance to provide care in transit if travelling alone might be able to use an ambulette if accompanied by somebody familiar with their needs and able to offer the care.

## INTERMODAL PUBLIC TRANSPORT

From both a theoretical and practical perspective, sustainable transport with equity requires the fluid interaction of the walk-bike-bus/subway ecology of modes, and their respective users. Pleasurable, safe, direct walking routes for trips from 0-2 km are essential to encourage car-free living without reducing quality of life and access to social, urban and other benefits. Similarly, both standalone and public transport ingress trips should be well served by private bicycles, public bikeshare, cycle taxis and cargo bicycles (2-10 km), which encourage walking to shop, for example, but don't require users to then carry heavy loads on their return journey.

From this perspective, public transport may serve as a standalone mode for some journeys, but is primarily a strategic component of a sustainable and socially just transport system, covering distances over 5 km and trips requiring more assistance, particularly those of carers with children, the sick or other vulnerable users. In practice, this requires evolving from a *multimodal* transport system, in which diverse modes are present but not well connected, toward an *intermodal* system, which allows users to flow seamlessly from one sustainable mode to the next. Key components of this new vision for public transport include:

1. Dense, high-quality networks of walking and cycling facilities around public transport hubs, stations and stops. By "quality" we refer to levels of service or walkability based on direct routes; safe and secure walking conditions, minimizing conflicts with motor vehicles; preventing falls, providing bathrooms and attractive streetscapes, with good lighting, forestation and green spaces; with well-connected intersections that give priority to pedestrians and cyclists; and a coherence within the system that prioritizes connections and avoids the barrier effect generated by highways, some bridges, rivers or other features.
2. A "cycle-inclusive" strategy is key to this vision, as cycles provide the missing link between walking and public transport, covering longer distances more comfortably and economically, making mobility at night or through less well served locations feasible, and reducing long waits at lonely bus stops or feeder points. This requires both routes and physical infrastructure, as described in the previous section, and measures that respond to the diversity of users, travel purposes, needs and abilities within the general population. At minimum these should include:
  - safe and secure cycle parking at key transport hubs, cycle maintenance and repair and cycle rentals at major stations and other intermediate points;

- bike racks on buses (a cheap, safe measure, which requires minimal operational changes, now common throughout North America);
- public bikeshare, with full fare integration, designed to connect residential, commercial and public transport hubs, offering a variety of cycles for adults and children — tricycles, bicycles, tandems, cargo bikes, with some electro-assisted versions, ample carrying capacity for grocery bags, child-seats, step-through bikes — facilitated by full fare integration with local and regional travel services;
- informational and educational programs to motivate and teach people how to use these services most effectively;
- security measures with a gender focus that include parity hiring of women and men among frontline staff, protocols for handling cases of sexual and other forms of harassment and bullying, generation of lively and secure streetscapes around public transport stops and hubs (using Transport Oriented Demand and similar strategies) for as close to 24 hours a day as possible, permission to stop as near as possible to destinations particularly at night, and other similar initiatives;
- special attention to tourism that highlights the cultural and environmental benefits of sustainable intermodal transport, encouraging recreational use of the system and taking care to connect non-work-related destinations in ways that make them particularly accessible and friendly to diverse families;
- smart phone and equivalent applications that map and highlight intermodal routes, providing information on health, time, environmental and other benefits of using them, as well as specific to destinations.

## RAILWAYS

Railways have an important part to play in the public transport system. They are also central to freight transport. Railway development is therefore important. In this document we will concentrate on their passenger role, and we will deal with their freight role in a different document. The two roles do however interact because of competition for track capacity and because of the underused potential of mixed trains.

A high-speed international rail system is necessary as a healthier alternative to aviation. We discuss in our policy document on Infrastructure how a network covering Africa, Asia, Europe, North America and Latin America could be created with links across the Straits of Gibraltar and the Bering Straits. It is feasible to extend it to Australia by linking a string of Indonesian islands but it is uncertain whether this would be cost-beneficial.

Sleeper services extend the distance over which trains are competitive with aviation since people can sleep during their journey instead of at their destination. At 200mph (readily achievable by current high-speed trains) a ten-hour sleeper train journey (two leisurely meals and eight hours sleep) is possible on journeys of 2,000 miles. At 300 mph (potentially achievable by future development of conventional high-speed trains) this increases to 3,000 miles. At 450mph (potentially achievable by mag lev if the technical problems of operating mag lev trains over long distances can be solved) this increases to 4,500 miles. A judgment needs to be made as to the potential of the mag lev and of the hyperloop to form the basis of an international system, as it would be sensible for all high-speed rail investment, other than short extensions of existing systems, to be based on the technology which is ultimately going to be the international system. There has been some optimism about the hyperloop over recent years but it is now fading, whilst mag lev trains operate successfully over short and medium distances but the technical problems of operating them over long distances remain an issue.

Local services should be reintroduced on almost all railways. The main exceptions are a few freight routes where the potential passenger function is so limited that upgrading to passenger standard would not be justified. This reintroduction of local services includes the reopening, at least as a tram stop, of almost all stations that have been closed, if the line on which they were situated remains. The main exceptions are stations which have been replaced by alternatives or where the original purpose of the station no longer exists. Where communities, workplaces, business developments or places of significant public recourse adjoin the track, new stations or tram stops should be opened. Often the most appropriate way to serve these new stations, and to increase the frequency of existing services, will be by a new tram/train stopping service, because that will have less impact on track capacity as it can decelerate and accelerate more quickly, it is easier to provide passing loops and additional platform faces, and it can be diverted onto adjacent roads or streets at pinch points or where grade-separated junctions need to be established. However, there are alternatives. Where track capacity is not an issue it may be simpler just to provide a heavy-rail stopping service. Where there is already a heavy-rail stopping service of sufficient frequency and very few new stations are needed it may be easier to add them to the existing service rather than provide a new service. On heavily-used fast routes, rotating wayside stops may be better than an additional service. On some freight routes, passenger coaches added to freight trains may be better than a new passenger service; now that freight trains tend to be faster and safer than they used to be, the need for a rigid separation of passenger and freight trains is diminished. On some lines, freight tends to be timetabled at night with passenger services taking priority in the day, so adding passenger coaches to freight trains is a good way to expand the overnight service. On many lines, such as the long transcontinental lines of North America, the through services from China to Europe, and much of the rail system of Latin America, freight is much more frequent than passenger services and adding passenger coaches to freight trains would be a simple way to expand the passenger service, albeit that some freight trains may be too slow for long-distance journeys.

There should be serious consideration given to reopening a reserved track public transport service along the corridor of each railway that has been closed. This will not always be justified and may sometimes be achieved by a bus, coach or tram service along a parallel road. However, reopening of the railway will be appropriate in many cases. Regulatory obstacles should be diminished and distortions in methods of prioritising funds should be corrected. The details of the problem will vary from country to country. Our UK proposals are given as an example.

#### FUNDING AND REGULATORY OBSTACLES TO RAIL DEVELOPMENT – THE UK AS AN EXAMPLE.

1. Highways authorities should have the power to establish a street tramway on any road on which public vehicular rights exist, instead of needing specific statutory authority. This will not only facilitate the expansion of light rail systems but the construction of such tramways for the use of tram/trains will help address issues of rail capacity at junctions and other bottlenecks.
2. There should be greater knowledge of the potential for very light rail to diminish the cost of moving pipes and cables beneath the road. There should also be consideration of the potential for rail/greenways (high speed miniature railways parallel to cycle paths). See our policy statement on Infrastructure.
3. There should be a statutory power for public transport authorities to authorise the construction of heavy rail or light rail infrastructure or busways along any disused railway formation. Provided certain conditions can be met, neither Transport & Works Act procedures nor planning permission should be needed. These conditions should be that it does not interfere with the use of the formation for walking and cycling, preserves any highway rights or private rights of access that have used the formation, makes compensation for any displaced commercial or agricultural use, makes a wayleave payment to the owner of the land on a fixed scale, does not affect any established residential use of the land (or alternatively makes arrangements acceptable to both the owner and the occupier), meets proper noise standards for residential properties bordering the track and arranges protection for wildlife, tree cover and habitat. (In making this recommendation we have no wish to add our voice to any general pressures for relaxation of planning controls nor to oppose the empowerment of local communities in development control but we believe that the special circumstances of a type of development essential to climate change and public health, requiring linear developments passing through several communities and capable of being obstructed at any one point, are exceptional and that the conditions we propose are rigorous and protective of legitimate concerns).
4. There should be a power to franchise and subsidise expanded services on heritage railways. Regulatory obstacles to such railways connecting to and operating over the national rail network should be reduced.
5. The current assessment system for new rail services has significantly underestimated the usage of most railways and stations that have been opened so it is probably systematically underestimating the potential of other proposals and should be revised.

6. One reason for such underestimation is the failure of current systems to make proper allowances for network benefits. If there is no rail service to a community, it is wrong to assume people will drive to a railhead – many will drive to their destination instead. This problem also affects bus services which tend to be assessed journey by journey rather than as a service – the almost empty last bus may well have given people the confidence to rely on and catch the bus before, and may be the reason that earlier bus was full.
7. The contribution a comprehensive public transport system makes to reducing congestion should be identified and a commensurate funding stream established, based on road charges. At the same time, it should be recognised that building or widening roads usually has only a temporary effect on congestion (see our policy statement on Congestion and Road Charging) so benefits of reduced congestion should be excluded from the cost/benefit assessment of new or improved roads.
8. Other flaws in Treasury methodologies include
  - They value the time of cyclists less than the time of motorists but the rationale for that (that cyclists have chosen a slower mode) is outdated in most cities.
  - They place too low a value on the negative effects of community severance and poor air quality. Community severance costs at least 1.6% of GDP.
  - They assume that many of the external benefits (including health and environmental benefits) will not contribute funding, but in many cases a mechanism of benefit-capture could be framed.
  - They disbelieve very high cost/benefit ratios, which leads to failure to fund some cycling schemes that have very high cost/benefits.
  - There is a strong tendency to favour individual large schemes over packages of smaller schemes creating widespread network benefits. This is unfortunate since network improvements in alternatives to the car are more likely to improve congestion than individual schemes.
  - Schemes tend to be considered in isolation, in dedicated funding packages devoted to particular types of spend, which makes it difficult to consider the transport system as a whole. For example, the proposal for a Woodhead Rolling Motorway would deliver a vehicle-carrying rail service as a direct alternative to an expensive and damaging road scheme and would also deliver major improvements in rail services in and between Greater Manchester and South Yorkshire, but these two sets of benefits lie in different funding packages and it is very hard to find a way to add them together.
9. In view of its successful adoption in Europe, the British perception of the tram/train as an untried technology requiring extensive evaluation and careful consideration should be abandoned. Happily, things are beginning to change but, in many areas, this is happening far too slowly.
10. Whilst the railway safety system is fundamentally important and the reason the railway is so safe, it must be recognised that if it becomes excessively bureaucratic and obsessively averse to even insignificant risks it will damage transport safety by limiting the development of the safest part of the system)

and will even damage rail safety itself by distracting attention from things that are important.

## PUBLIC TRANSPORT ON MOTORWAYS

A huge proportion of transport investment over the last three quarters of a century has gone into the construction of what in the UK is called the motorway system, in the US the interstate system and in Germany the autobahn system.

This infrastructure must be adapted to be used in the transport system of the future.

For public transport we believe that motorway bus services have an immediate place in the network.

High frequency mid-distance bus services stopping typically about once every 8km and high frequency long-distance coach services stopping typically about once every 20km should operate on almost all motorways and should serve on a rotational basis local stations situated typically every 1km or so along urban motorways (less in more sparsely populated areas). These stations would normally consist of a reserved area into which buses and coaches could pull off clear of the passing traffic and an adjacent waiting room. Some would be at motorway junctions with the general road system; some would be interchanges with railways or local bus services; others would be at road or foot bridges close to the community they serve.

In the future, alternatives to this could be monorails above the motorway or autonomous shared guided vehicles.

## PASSENGER AVIATION

We envisage that most passenger aviation will be replaced by the high-speed train and by the wider business use of cyberspace. Ultimately, we envisage the role of aviation as being limited to flights across ocean and polar ice caps, flights to islands too far from the mainland to be linked to it by bridge, tunnel or high-speed ferry and local flights in very remote areas like Alaska and Antarctica.

To the extent that aviation has a continuing role it should be linked to the general network and be seen as a part of it.

July 2022