


Greater Bristol Strategic Transport Study

Final Report

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Executive Summary

Background to the Study

The Greater Bristol Strategic Transport Study (GBSTS), undertaken by the consultant team led by Atkins, developed a series of transport strategies for the Greater Bristol sub-region covering the period to 2031, with intermediate years of 2011, 2016 and 2021. This report outlines the development and appraisal of the transport strategies.

GBSTS has its origins in the London to South West and South Wales Multi-Modal Study (SWARMMS) which explored the needs to 2016 of the main east-west transport corridors between London/South East and the South West. Within SWARMMS, insufficient time was available to deal in detail with the complex issues of the Greater Bristol sub-region. GBSTS followed on from SWARMMS, with the objective of fulfilling this requirement, building and drawing on the work undertaken by SWARMMS, but not constrained by it.

The principal partners for the study included:

- ◆ Department for Transport/Government Office for the South West;
- ◆ South West Regional Development Agency;
- ◆ Highways Agency;
- ◆ Bath & North East Somerset Council;
- ◆ Bristol City Council;
- ◆ North Somerset Council; and
- ◆ South Gloucestershire Council.

The study has been guided by a Key Stakeholder Advisory Group (KSAG) drawn from representative organisations with an interest in transport planning and operations in the study area. In addition to the study partners listed above, the KSAG included:

- ◆ South West Regional Assembly;
- ◆ Business West;
- ◆ Joint Strategic Planning and Transportation Unit;
- ◆ Strategic Rail Authority (until June 2005); and
- ◆ Sustainability South West.

In brief specified that GBSTS should:

- ◆ develop a series of integrated multi-modal transport strategies over time (detailed strategies for 2011 and 2016 and broader, high level, strategies for 2021 and 2031) for the study area identifying, analysing and appraising solutions on the national strategic transport networks, on the local strategic transport networks and at the interface between them, so as to improve strategic transport movements into, out of and through the study area;

- ◆ develop transport strategies that support existing economic activity, continue sustainable development and assist economic regeneration of urban areas and the wider process of urban renewal within the study area; and
- ◆ reduce the impact of transport on the environment.

Furthermore, in developing and appraising the strategies, the study was required to 'make focused and realistic recommendations on transport policy and infrastructure provision across all modes and networks, focusing on the period to 2016 and taking full account of potential funding and deliverability constraints'. Hence, the strategies that are developed need to be both affordable and implementable.

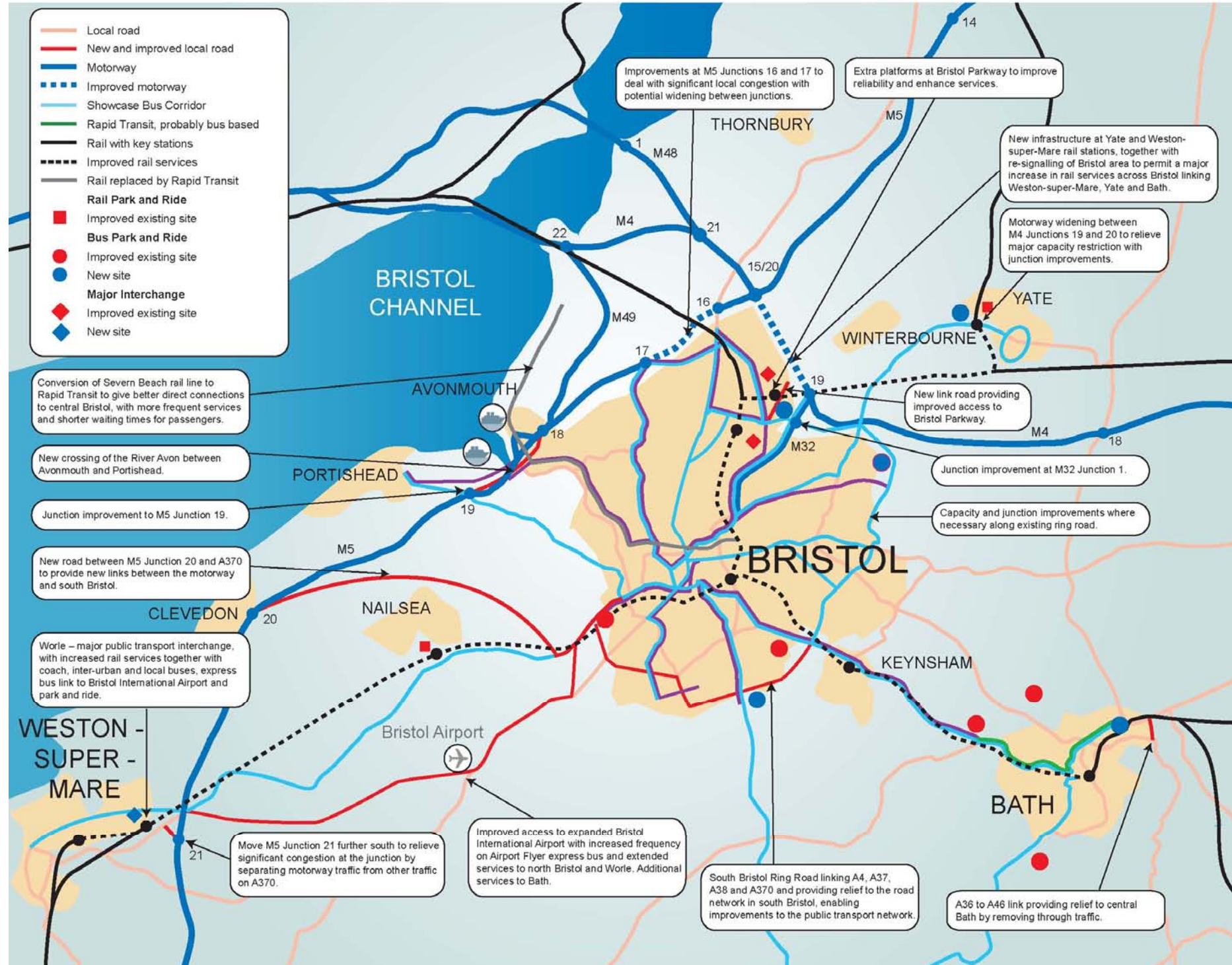
Growth in the Demand for Travel

The development of the GBSTS transport strategy up to 2031 was based on significantly increased demand for travel, of which a key factor was the projected growth in population and employment within the Greater Bristol area, with the associated rise in freight movements. Working with the West of England Partnership, GBSTS prepared travel forecasts for 2031 based on 138,000 extra dwellings in the study area, equivalent to population growth of 245,000 from the existing 990,000. For employment, the forecast increase was 95,000 jobs in addition to the current workforce of about 500,000.

The additional dwellings were split between 78,000 on brownfield sites in existing built-up areas and 60,000 on greenfield sites formed by extensions to the principal urban areas, particularly Bristol and Weston-super-Mare. Further travel would be generated by growth in activity at BIA with air passenger numbers rising from the current 4 mppa to 12 mppa by 2031 with an associated increase in employee levels.

The growth in travel demand resulting from the increased population and employment would be significant. However, the growth is constrained by the limited capacity on the transport system which results in the suppression of some journeys. Nevertheless, even with some suppression, the additional demand creates severe problems for the operation of the transport network. By 2031, the study forecast a 34% rise in the number of vehicle trips on the road system in the morning peak but the limited capacity results in a 35% drop in average speeds from 44 km/hour to 28 km/hour and an increase in delay of 230%, indicating a large-scale growth in congestion. The rise in traffic occurs particularly on the motorway network, with a further 3000 passenger car units in the peak between 2003 and 2031 across the M5 Avonmouth Bridge and between Junctions 19 and 20 of the M4. Bus operators experience the impact of increased congestion on the road network with bus speeds dropping between 20% and 40%. Consequently the car mode share rises from 88.8% in 2003 to 90.8% in 2031. The decline in bus use is offset to a limited extent by an increase in rail patronage, although the restricted coverage and capacity on the rail system constrains the growth in passenger levels with a significant rise in crowding on trains.

Transport Strategy



Across the Study Area

- Significant improvements in bus services through extended bus priority measures, bus lanes, etc with faster and more reliable services, higher frequencies, more cross-city services and better, fully accessible vehicles.
- Expanded network of Rapid Transit services providing faster journey times using dedicated sections of road where possible and 'state of the art' vehicles.
 - Ashton Vale - Emersons Green
 - Hengrove - North Fringe
 - Whitchurch - Portishead
 - Bath - Cribbs Causeway
- Newer trains on local services with additional capacity. Better integration with local bus services. Increased parking capacity at key stations. Improved cycle facilities at stations.
- Extended network of interurban bus services with a wider variety of potential destinations.
- Expansion of Park and Ride network.
- Range of complementary measures to encourage the use of alternative modes, including improved pedestrian facilities, increased cycling facilities and better design of new residential and commercial developments.
- Extensive introduction of workplace and school travel plans and car sharing to strongly encourage alternatives to the car.
- More efficient use of the motorway network to reduce incidents and provide better driver information through improved communications and Variable Message Signs. Investigate introduction of High Occupancy Vehicle lanes on motorways.
- Increased parking charges within city centres, especially for long stays and linked to park and ride improvements.
- Development of workplace parking changes and cordon user charging and introduction of area-wide road user charges.

The series of transport measures designed to cater for and accommodate the projected growth in demand for travel are outlined below and summarised on the attached diagram. The measures are considered in the following sequence which reflects the strategy development and appraisal process:

- ◆ encouraging the use of alternative modes;
- ◆ management of travel demand;
- ◆ public transport improvements; and
- ◆ highway measures.

Measures to Encourage the Use of Other Modes

Before embarking on measures that are potentially costly in resources or finance, in developing the transport strategy it was important to explore measures which are designed to influence the decision to make a journey to a particular destination or to encourage the use of alternative modes.

The transport strategy has been prepared against a background of significant developments in population and employment. The design and implementation of the new developments should be planned so as to reduce the total volume of travel and encourage the use of alternative modes to the car. Such policies should include the concentration of developments within transport corridors easily served by public transport; the creation of a mix of developments so that more activities are easily reached by walking or cycling; and an increase in the density of development such that there is a choice of facilities within a reasonable distance. Furthermore, the design of developments (especially major residential schemes), should pay particular attention to their operation in the most sustainable way.

Although detailed schemes to enhance walking and cycling are outside the scope of a strategic study like GBSTS, there are nevertheless benefits to be achieved from providing attractive schemes and facilities to encourage greater levels of these activities. At the same time, other policies, such as demand management or 'Smarter Choices' will encourage the use of alternative modes in general and hence will stimulate walking and cycling, if the supplementary measures are in place.

The expansion of initiatives under the heading of 'Smarter Choices' can have a positive impact on the overall volume of travel and the level of car use. Some of the policies contained in 'Smarter Choices' are within the responsibility of the public sector including workplace travel plans, school travel plans, car sharing schemes and car clubs. The unitary authorities within the Greater Bristol area already actively pursue these measures, and it is vital that renewed and enhanced efforts are made to expand their coverage. This will require a continuous application of resources to maintain the impetus and continue the level of benefits. The impact of 'Smarter Choices' would be strengthened and supported by other policy measures such as demand management which would provide further encouragement for the use of alternative modes. It is estimated that a comprehensive policy of 'Smarter Choices' combined with other complementary measures could reduce person trips in the study area by car by around 10%. Other elements of 'Smarter Choices' could include teleworking, tele-conferencing and home shopping; while these features would contribute to the use of alternative modes, much of the initiative behind them would come from market forces,

with the savings and benefits obtained by the private sector. Hence, because they are generally outside the control or influence of local authorities, their promotion is not included in the GBSTS transport strategy.

It will be important to develop the full potential of the range of approaches to encourage alternative modes before embarking on major infrastructure developments. However, there needs to be awareness that continued promotion of the measures is necessary if the full impact is to be achieved and maintained and therefore resources must continue to be allocated to 'Smarter Choices' in the future.

Demand Management

Within the transport strategy, it is important to include measures designed to control or manage the level of demand for travel by car across the study area. A number of measures to manage demand are available for implementation now and concentrate on varying the availability and cost of parking. The policies need to be adjusted and refined in order to reflect the growth in car traffic, by increasing charges, controlling the number and availability of spaces, raising enforcement, introducing controlled parking zones, exploring ways of controlling parking at Cribbs Causeway and introducing stringent parking standards. The expansion and variation of parking policy measures also need to take into account the potential impact on economic activity, especially within city and neighbourhood centres, in order to ensure that the prosperity of the centres is maintained.

The range of additional policy instruments to manage traffic demand includes workplace parking charges. Although there are potential limitations to the impact that such measures may have, it remains a possible tool for introduction in areas outside the scope of existing parking policy, e.g. the North Fringe, and hence should be examined further. The introduction of workplace parking charges would strengthen the operation of workplace travel plans.

However, the most effective additional form of demand management is likely to be some type of road user charging. The study has identified a number of potential charging mechanisms, including bridge tolls, cordon charging, motorway tolls, supplementary licences, congestion charging and distanced-based charging. In the longer-term, the study believes that the most effective form of demand management would be an area-wide charge. However, it is unlikely that such an approach would be feasible until later in the study's horizon and hence it is important to explore charging systems that provide the opportunity for more immediate implementation. A cordon-based charge would be the most appropriate technique and the initiative by unitary authorities within the Transport Innovation Fund should be taken forward as quickly as possible.

The study does not believe that the introduction of tolls on the motorway network would produce overall benefits with the likelihood that such a system would encourage the diversion of traffic onto the uncharged local roads, generally unsuitable for the traffic volumes, and with only a small change in the overall level of traffic across the study area. For many of these journeys, there is a lack of an attractive public transport alternative. Hence, an area-wide road user charging system would be the most suitable long-term approach. We have examined alternative forms for the area-wide road user charging scheme and believe that the most appropriate is one in which the charge varies with the

level of congestion. As highlighted earlier, the benefits from charging are greater where the congestion is more severe. By varying the charge in line with the level of congestion, it is therefore possible to optimise the level of benefits. It is estimated that, with such a variable charge in 2031, it would be possible to reduce total vehicle delay across the study area by 20% and increase vehicle speeds by 9% for a lower average charge (14p/mile) than with a simple distance based charge of 50p/mile on all roads in the study area.

Public Transport Improvements

The study has examined a wide range of potential improvements to the public transport system in order to cater for the general growth in the demand for travel across Greater Bristol. The particular components of the public transport measures within the transport strategy range from improvements to the local bus services through to an expansion of the rail network.

Improvements to **urban bus services** would be a main focus in the strategy for enhancing the public transport system in the short to medium term. The Showcase bus corridors which form the Greater Bristol Bus Network are the subject of a Major Scheme Bid within the Local Transport Plan process and include a package of measures with junction improvements providing priorities for buses, new bus lanes, improved bus shelters, real-time passenger information and new low-floor buses. It is important that the Greater Bristol Bus Network is introduced as soon as practical.

Extensions to the **park and ride system** would involve expansion at the existing sites in Bristol and Bath to increase the capacity and improve the facilities. New sites are also identified in the strategy at Emersons Green, Hambrook, Whitchurch, Nibley and Lambridge.

The detailed consideration of **inter-urban bus services** is outside the main scope of GBSTS. Nevertheless, it is possible to identify new connections that would be necessary following the new population and employment developments across the study area. In addition, extensions to the highway network will provide the opportunity to offer service improvements such as journey time cuts and reliability gains on existing routes or through a re-routing of services. The network of services will need to be reviewed in association with the priority measures in the Greater Bristol Bus Network together with the introduction of rapid transit routes and improvements to rail services.

Extensions to the **coach services** in the strategy would be a combination of enhanced operations through the use of priority measures within the Greater Bristol Bus Network together with potential new stopping locations outside city centres at the new Worle Parkway Interchange, Lambridge Park and Ride and in north Bristol at Parkway/UWE/Hambrook.

A particular growth area of future travel is **BIA** and public transport access to the airport must be enhanced to accommodate the growth in both air passengers and workers at the airport. The strategy identifies the current Flyer service as the foundation for future expansion, with increased frequency on the existing route together with expansion to serve north Bristol (Parkway) and Worle Interchange (for both Weston-super-Mare and the wider South West region). To cater particularly for the airport workers, a demand-responsive or shared taxi operation would be the most appropriate means of serving the widespread destinations.

The strategy identifies a number of **public transport interchanges** which should be developed outside town or city centres to serve local developments, including Worle Parkway (with multi-modal activity), UWE (serving the North Fringe), Yate and Filton Abbey Wood rail stations.

A major area of new development for the public transport system involves the network of **rapid transit** lines which would build on the priority measures within the Greater Bristol Bus Network to produce a system with further priorities including segregation from general traffic wherever possible. The lines would be designed to serve many of the new residential and employment developments, with the initial plans comprising:

- ◆ Ashton Vale – Emersons Green;
- ◆ Hengrove – North Fringe/Cribbs Causeway;
- ◆ Bath – Cribbs Causeway; and
- ◆ Whitchurch – Avonmouth/Portishead.

An early element of the rapid transit network would operate in Bath between Lambridge and Newbridge as part of the Major Scheme Bid which is being prepared within the JLTP process.

Further work is required to identify the type of vehicle used to operate the service but modern, low-floor, articulated buses are likely to be the most appropriate, flexible and cost effective vehicles to satisfy the requirements of the service. Further work is also necessary to specify the precise routes, taking into account the desire for significant levels of segregated operation.

The **rail** network within Greater Bristol represents a potential resource capable of wider and more intensive use although there are limitations brought about by the number and location of existing rail lines. The restricted penetration of the rail network into the city centres of Bristol, Bath and Weston-super-Mare and the poor links to the North Fringe contribute to low levels of current rail use, with just 2% of journeys in the morning peak period.

A range of measures has been identified to improve and expand the rail network, taking into account the availability of resources within the industry:

- ◆ improved rolling stock providing increased capacity and speed enhancements on the local rail services;
 - ◆ additional facilities at Bristol Parkway with initially three and ultimately four platforms to increase capacity and improve reliability;
 - ◆ expanded facilities at Worle station to create a major interchange location, including platform lengthening and an expansion of services;
 - ◆ new turn-back facilities to enable more trains to operate to/from Weston-super-Mare and Yate; and
 - ◆ increased services across Bristol linking Weston-super-Mare, Yate and Bath Spa – in view of the restrictions in turning trains at Bath Spa, it may be necessary to extend the local services to Westbury to provide better connections between the west Wiltshire towns of Trowbridge and Bradford-on-Avon and the employment centres of Bath and Bristol.
-

Although some of the improvements could be introduced in the short-medium term, the full extent of service increases would be dependent on the re-signalling of the Bristol area which is likely to be completed by 2018.

Highway Measures

The approach adopted within the study for the development of the transport strategy concentrated on examining and promoting alternatives to the private car before considering improvements to the highway network. This was designed to ensure that highway measures are only considered after all other possibilities have been explored. Within the highway improvements themselves, the emphasis was placed on making best use of the existing infrastructure before examining the need for schemes which increase highway capacity.

The examination of highway improvements was undertaken against the background of significant growth in the demand for travel in line with a 25% rise in population and 20% growth in employment by 2031. The identification of enhancements to highway capacity took direct account of the location, scale and timing of these developments; in some cases, additional highway infrastructure is necessary to connect new developments into the existing network.

The emphasis in identifying measures to make best use of the highway network in the study area concentrated on the existing infrastructure and capacity on the motorway and major trunk roads, although many of the measures are also suitable for the local network:

- ◆ **planned maintenance** should continue to be programmed to minimise disruption by avoiding periods of peak daily and seasonal flows, including the main summer holiday periods;
- ◆ wider measures to **reduce incidents** through better driving training, increased enforcement, stricter penalties and greater use of advanced warning signs;
- ◆ continued development of **incident management** by speeding up detection, evidence collection and documentation, incident clear-up and the initiation of diversionary routes; and
- ◆ wider application of **signing, surveillance and automated systems** including active traffic management techniques.

The assessment of capacity enhancements across the study area's highway network considered a number of potential new schemes and appraised the full range of impacts before developing a preferred package of improvements. The identification of schemes concentrated on those which would have a direct impact on the strategic highway movements across the study area. The schemes within the strategy would not be the only highway measures which would generate potential enhancements; local measures, outside the scope of GBSTS, could also have merits but would need to be progressed separately by the local authorities. Hence, the schemes identified in the strategy are concentrated on the strategic highway network in the area.

The principal schemes which the study recommended should be taken forward included:

- ◆ South Bristol Ring Road between A4 and A38

South Bristol experiences severe congestion on the constrained highway network in the area together with restricted accessibility to other parts of the study area, particularly the new employment areas of the North Fringe. Accessibility would be enhanced by extension of the Avon Ring Road with an indicative alignment from the junction with the A4 at Hicks Gate, following a new alignment south-west of Whitchurch to the A37, then running south of Hengrove before heading north to junction at Hartcliffe Way and Hengrove Way and finally, following an on-line alignment through Withywood before skirting Highridge Common to the A38. The scheme produces significant benefits through reduced delays across south Bristol, creating major new connections between south Bristol and the major employment areas. The scheme shows a strong economic performance with NPV of £950 million and BCR of 16.
- ◆ A38 – A370 Link

Extension of the South Bristol Ring Road from A38 through to the A370, with the study's preferred alignment following the path of the earlier Red route. The scheme provides relief to the congestion on the B3130 through Barrow Gurney and produces a strong economic performance with NPV of £70 million and BCR of over 8.
- ◆ Links between south Bristol and M5

Current congestion levels on the highway network on the approaches to south Bristol from the south west would be exacerbated by planned future developments in housing and employment together with growth at BIA. The study identified alternative schemes to improve the connections to south Bristol and from the M5 motorway and the South West. The northern route would link M5 Junction 20 to the A370 near Long Ashton along an alignment to the north of the B3130 and would include bypasses for Nailsea, Tickenham and Wraxhall. The southern route would link M5 Junction 21 at Weston-super-Mare with BIA and northwards to the A370 with a bypass of Barrow Gurney. Outline alignments for the schemes have been identified for the purposes of the appraisal but considerable detailed work is necessary in order to identify potential environmental and other constraints. Both alternatives have strong transport economic case with a NPV of £270 million and a BCR of over 5 for the Junction 21 route and a NPV of £160 million and BCR of 3 for the Junction 20 option.
- ◆ Improvements to M5 Junction 21

Current conflict at this junction, between traffic wishing to access the M5 and through movements on the A370 between Weston-super-Mare and Congresbury/south Bristol, will worsen with future growth in traffic. The most effective approach identified by the study is to separate the two movements by constructing a replacement junction to the south of the current Junction 20 which would be accessed by a new link to the A370 in Weston-super-Mare. The existing Junction 20 would be closed for access to the M5 and would therefore be restricted to A370 traffic alone. The scheme produces a strong economic performance with a NPV of £150 million and a BCR of 3.
- ◆ M4 Widening between Junctions 19 and 20

The need to increase the capacity from three to four lanes in each direction on this section of the motorway was highlighted by forecast traffic flows consistently exceeding 85% of current capacity. Considerable journey time savings are achieved producing a NPV of £350 million. Due to an increase in distances travelled and a rise in vehicle operating costs, there is a growth in government indirect tax revenue which produces a negative BCR (-5). Despite this anomaly, the overall scheme performance is strong.

- ◆ M5 Junctions 16 and 17 and M32 Junction 1
Problems at Junction 16 are created by a combination of high traffic levels to/from Aztec West and the North Fringe, conflicts between through traffic on the A38 and motorway access/egress and the proximity of Junction 16 with Almondsbury Interchange. Junction 17 serves the Cribbs Causeway regional shopping centre as well as other local destinations and experiences significant congestion, particularly on Saturdays. High traffic volumes through M32 Junction 1 create peak period congestion difficulties, exacerbated by the proximity to M4 Junction 19. Schemes to improve the operation of these junctions have been identified including the enhancement of the on and off slip roads and changes to the local road network and produce benefits to traffic movements. A more detailed assessment of operation of the junction is required, which is outside the scope of the study, before a full appraisal of the scheme can be completed.
- ◆ Second Avon Crossing
M5 between Junction 18 and 19 is one of the few crossings of the River Avon and is a critical section of the region's strategic road network. Incidents on this section have a widespread impact across the region and traffic levels are influenced by high levels of local traffic including movements to, from and between the two port areas on opposite banks of the river. The proposed second crossing would relieve the motorway and its junctions and improve access to Portishead and Avonmouth. The study has identified a potential low level crossing including an opening bridge or barrage which, in addition to carrying normal traffic, would also include a rapid transit link to Portishead. Because the scheme runs parallel to existing infrastructure, the journey time savings are low with a NPV of £30 million and BCR of 1.6 although this excludes the benefits from rapid transit and the improved resilience of the highway network.
- ◆ A36 to A46 Link Road
The link road was recommended for further development by the earlier Bristol Bath to South Coast study. Located to the east of Bath, it produces significant benefits within Bath, through reduced congestion in the city on the A4 and A36, and traffic relief in the west Wiltshire towns of Trowbridge and Bradford-on-Avon. The overall economic performance is strong with a NPV of £700 million and BCR of 27 but there are significant environmental impacts which will need to be considered in the further development of the scheme.
- ◆ Winterbourne and Stoke Gifford Bypasses
The scheme provides substantial relief to roads in the North Fringe including A38 and B4057 Winterbourne Road. The majority of the benefits occur south of the M4 and the northern section does not significantly add to the benefits and hence should not be progressed unless there are changes to developments in the area. The Stoke Gifford bypass and southern section of the scheme produces a NPV of £260 million and BCR of 8 and hence should be progressed further.

A number of additional schemes for highway capacity improvement were examined but were not included in the GBSTS strategy.

- ◆ M4 to A4174 Link Road
The potential alignment for the scheme would involve close inter-relationship with M4 Junction 19 and a number of alternative designs were examined with the most effective being the construction of a new M4 junction (18A) with access limited to motorway traffic to/from the east and closure of the east-facing slip roads at the existing Junction 18.
-

Such a scheme in isolation recorded a NPV of £270 million and BCR of 12 but the generation of additional traffic on the M4 to the east of the new junction would create the need to add an additional lane on the M4 through to Junction 18 and hence the scheme was not recommended by the study.

- ◆ **A4 Salford Bypass**

The scheme would relieve the congestion from traffic passing through the village but would involve high construction costs due to the terrain through which it would pass. Hence, the scheme's economic performance, with a NPV of £17 million and BCR of 1.2, does not justify its inclusion in the strategy; although it produces some local relief, the strategic benefits are limited.

- ◆ **A37 Whitchurch Bypass and Callington Road Link**

These two schemes were identified as providing local relief to the highway network rather than having a strategic impact and hence were not included in the strategy although they produced a reasonable economic performance. Some of the benefits from the Whitchurch bypass would be achieved by the wider South Bristol Ring Road.

- ◆ **Clutton and Temple Cloud Bypass**

The construction of bypasses for the two neighbouring villages on the A37 would provide local relief but would not have a strategic impact.

- ◆ **Banwell, Churchill and Sandford Bypasses**

The three adjacent communities on the A371, A368 and A38 experience local congestion which is exacerbated by the restricted capacity through the village centres. The study examined the impact of a series of bypasses to provide relief to the villages and identified that, because the use of bypasses would increase the length of journeys, the net impact of the schemes was diminished such that the overall NPV was -£2 million with a BCR of 0.96. The scheme was therefore considered to have local rather than strategic merits and was not included in the GBSTS strategy.

- ◆ **M49/Sevenside Intermediate Junction**

Projected increases in employment within the Sevenside area are not sufficient to justify the potential highway improvements which include a new junction on the M49 and construction of a Spine Road through the main development area. While there are potential travel time savings for traffic to/from Sevenside, the volume of traffic is small and the benefits do not justify the high scheme costs.

Freight Aspects

Although the movement of freight was not identified as a major feature of the GBSTS, measures designed to relieve particular congestion locations will also generally benefit goods traffic whether on the road or rail network. Other measures with a specific freight interest have been identified within the study, although a detailed appraisal has not been undertaken:

- ◆ review of the consolidation trial for goods deliveries to Broadmead area, with potential expansion in terms of types of goods covered and the extent of the area served;
- ◆ increased publicity for freight routes within and through the area and the facilities available to HGV drivers; and

- ◆ accommodation of potential expansion in rail freight opportunities from Royal Portbury and Avonmouth Docks.

Appraisal of the Strategy

The contents of the GBSTS strategy and their impacts have been appraised under the key headings of environment, safety, economy, accessibility and integration. The detailed appraisals are summarised in the Appraisal Summary Table for the strategy shown in the attached table which highlights the key features in the appraisal of the strategy.

The Next Steps

The recommendations from the study outlined in this report will be presented to the partner group comprising officers from the organisations listed earlier. Having reviewed the outcomes from the study, the officers will develop recommendations on which schemes and measures should be taken forward by their organisations, identifying a potential timetable for implementation.

The Secretary of State for Transport and elected members of the unitary authorities will then consider which schemes and measures should be taken forward. Once decisions have been made, further work will be undertaken on the schemes and measures to enable them to be entered into the appropriate programmes of the Department for Transport, the Highways Agency and the unitary authorities. The schemes and measures will then be subject to the normal statutory planning processes.

One of the key aspects will be the potential sources of funding for individual schemes. These will depend upon the characteristics of the scheme, but will include Local Transport Plan, Regional Funding Allocation, Highways Agency and Network Rail budgets together with potential contributions from local developers and possible revenues from road user charging and other demand management measures. The development and appraisal of the schemes will need to make particular reference to the requirement of the appropriate funding processes.

The Secretary of State for Transport has asked the South West region to advise him on its priorities for transport investment in the next ten years or so. The recommendations from GBSTS will assist the region to understand the benefits of the schemes and measures, in terms of supporting future prosperity in Greater Bristol by investing in transport, compared with other areas in the South West. The advice to the Secretary of State will be based on evidence from GBSTS.

The study has been progressed in an open and consultative manner and the possible options have been discussed publicly. Many of the proposals are at a very early stage in the planning process and, if the recommendations are accepted, considerable further work will be required to prepare and consult on detailed designs for the schemes, including specific route alignments.

Appraisal Summary Table for GBSTS Strategy

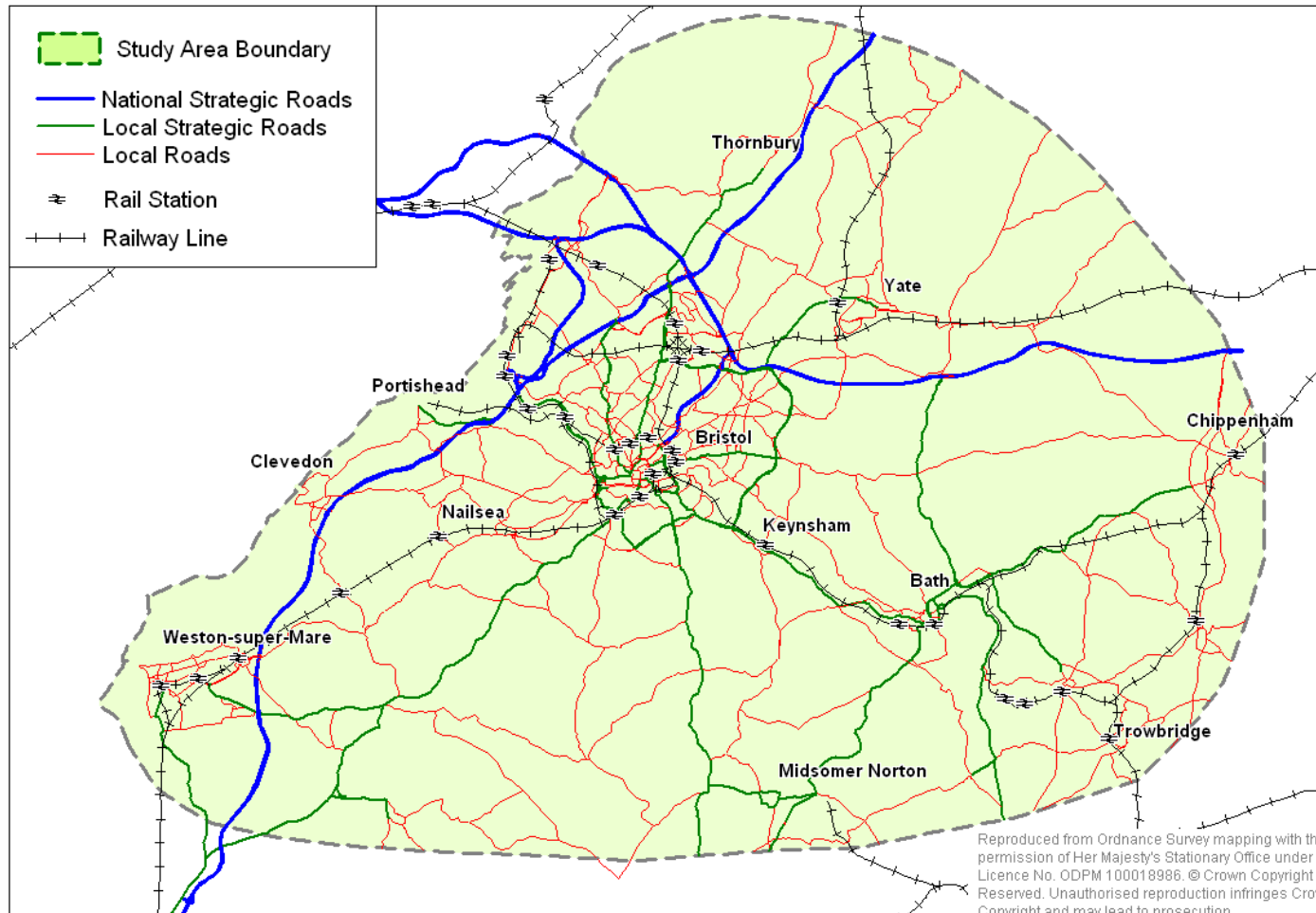
GBSTS Strategy		Problems: congested road network with lack of high quality public transport options		Present Value of Costs to Public Accounts £1,103M
OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE ASSESSMENT	ASSESSMENT
Environment	Noise	Small net decrease in the number of people annoyed by noise (based on perceptible changes in noise levels). Increase in noise levels along new highway links on strategic road network. Decreases in noise spread across the study area network. The appraisal excludes the potential impacts attributable to the use of low noise surfacing and noise barriers in new schemes which would further reduce levels of noise pollution.	Number of zones experiencing noise impact: - Increase in population annoyed – 28 zones - No change in population annoyed – 82 zones - Decrease in population annoyed – 77 zones	Net decrease in estimated population annoyed of 16,800.
	Local Air Quality	Reduction in emission levels of NO _x and PM ₁₀ between 2003 and 2031 through increasing use of cleaner, more efficient engines and improved fuels. Further moderate improvements achieved in 2031 by the strategy for both NO _x (2%) and PM ₁₀ (4%) compared with Do Minimum. Within the local Air Quality Management Areas, there are reductions in emissions compared with 2031 Do Minimum. For NO _x reductions are 3% (Avonmouth), 7% (Bristol) and 8% (Bath) and for PM ₁₀ a 4% drop in Bath and no change in Avonmouth and Bristol. The appraisal excludes impacts attributable to possible supporting measures such as roadside emissions testing, low emission zones and the further development of low emissions technologies.	- Total annual emissions (tonnes) – NO _x : - Base (2003) – 13033 - Do Minimum (2031) – 7150 - Strategy (2031) – 6980 Total annual emissions (tonnes) – PM ₁₀ : - Base (2003) – 416 - Do Minimum (2031) – 196 - Strategy (2031) – 188	Changes in: NO _x : -170 tonnes pa (-2.4% change) PM ₁₀ : -8 tonnes pa (-4.1% change)
	Greenhouse Gases	A moderate (5%) reduction in CO ₂ emissions in 2031 making a contribution towards meeting the UK Government's obligations under the Kyoto agreement on tackling climate change. Due to growth in development between 2003 and 2031, the level of CO ₂ emissions increases by 33% between 2003 and 2031 Do Minimum.	Total annual emissions (tonnes) – CO ₂ : - Base (2003) – 2027705 - Do Minimum (2031) – 2694531 - Strategy (2031) – 2559328	Changes in: CO ₂ : -135203 tonnes pa (-5.0% change)
	Landscape	Impacts of specific strategy measures on individual landscape designations: - South Bristol Ring Road – potential impacts at western and eastern ends of the route; - Airport Link Road – potentially significant impacts on landscape in the Wrington area - M5 Junction 17 – possible impact on local landscape designations to west of existing junction; and - A36 – A46 Link Road – potentially significant impact on AONB. Remedial measures may need to be included within the design as schemes are developed.	N/A	Potentially large adverse impact
	Townscape	Impacts of specific strategy measures on individual townscape designations: - South Bristol Ring Road – parts of the urban sections of the route (Bishop Ave, Hawkfield Rd, Hengrove Way, Cater Rd Link, King George's Rd, Highridge Grn) could have potential townscape impacts; and - Stoke Gifford Bypass – potential local impacts. Remedial measures may need to be included within the design as schemes are developed.	N/A	Potentially moderate adverse impact
	Heritage of Historic Resources	Impacts of specific strategy measures on individual heritage designations: - South Bristol Ring Road – runs through Avon Conservation Area in Highridge and Withywood area; - Airport Link Road – runs very close to Scheduled Ancient Monuments at Nye, Redhill and Felton; - Nailsea Bypass – passes close to, but does not directly impact on, a Scheduled Ancient Monument at Wraxall and listed garden at Tyntesfield; - Widening of A370 – lies close to a Scheduled Ancient Monument and runs through a narrow band of Avon Conservation Area; - Improvements to M32 Junction 1 – could potentially impact on Avon Conservation Area to the north-east of the junction; and - A36 – A46 Link Road – runs close to Avon Conservation Area. Remedial measures may need to be included within the design as schemes are developed.	N/A	Potentially moderate adverse impact
	Biodiversity	Impacts of specific strategy measures on individual biodiversity designations: - South Bristol Ring Road – runs close to small ancient woodland at eastern end; - Airport Link Road – skirts SSSI between Nye and Congresbury, crosses Local Nature Reserve along disused rail line between Congresbury and Winscombe, runs through ancient woodlands north of Wrington; - Nailsea Bypass – skirts northern boundary of SSSI across Tickenham Moor; - Second Avon Crossing – runs close to important bird area when it crosses River Avon; - Improvements to M5 Junctions 16 & 17 – close proximity to areas of ancient woodland; and - A36 – A46 Link Road – passes close to small SSSI. Remedial measures may need to be included within the design as schemes are developed.	N/A	Potentially moderate adverse impact
	Water Environment	Impacts of specific strategy measures on individual water environment designations: - South Bristol Ring Road – runs close to a number of landfill sites at western end; - Airport Link Road – crosses fluvial flood plain between Nye and Congresbury, crosses the flood plain of River Yeo to the south of Wrington, crosses Source Protection Zones near to	N/A	Potentially moderate adverse impact

GBSTS Strategy		Problems: congested road network with lack of high quality public transport options		Present Value of Costs to Public Accounts £1,103M
OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE ASSESSMENT	ASSESSMENT
		BIA and runs close to landfill sites north of BIA; - Nailsea Bypass – runs through flood plain between Tickenham and Nailsea; - Second Avon Crossing – runs within tidal flood plain of River Avon and at southern end near to landfill sites; - Widening of A370 – runs close to landfill sites; - Widening of M4 between Junctions 19 and 20 – lies close to landfill sites and crosses Bradley Brook; - Stoke Gifford Bypass – crosses small streams; - Improvements to M5 Junctions 16 & 17 – close proximity to landfill site near Junction 17; and - A36 – A46 Link Road – crosses River Avon. Remedial measures may need to be included within the design as schemes are developed.		
	Physical Fitness	Promotion of walking and cycling measures and reduced car use through transfer to public transport would increase physical activity and fitness.	N/A	Moderate beneficial impact
	Journey Ambience	Various measures potentially reduce stress for drivers (through improved journey reliability, e.g. Variable Message signs, reduced congestion) and public transport passengers (improved journey times, real-time passenger information).	N/A	Moderate beneficial impact
Safety	Accidents	Transfer of traffic onto new higher standard roads reduces overall accident levels.	Annual weekday casualty levels: 2003 – 398 KSI 2031 (Do Minimum) – 365 2031 (Strategy) - 329	PVB £681M
	Security	Improved public transport security through better facilities at stops, real-time passenger information.	N/A	Moderate beneficial impact
Economy	Public Accounts	Significant public sector expenditure, particularly on public transport and highway schemes.	Central Government PVC: £703M, Local Government PVC: £399M	PVC £1,103M
	Transport Economic Efficiency: Business Users and Transport Providers	Large travel time savings, especially for freight, with smaller vehicle operating cost savings. Significant time savings for public transport operators.	Users PVB: £13,743M, Transport Providers PVB: £4,414M, Other PVB: £0M	PVB: £18,158M
	Transport Economic Efficiency: Consumers	Large travel time savings for users, with smaller operating cost savings.	Users PVB: £15,603M	PVB: £15,603
	Reliability	Additional highway capacity will reduce congestion and improve reliability. Extended use of Variable Message Signs will improve reliability on the motorway network.	Proportion of vehicle-kms below capacity: Base – 91% Do Minimum – 69% Strategy – 86%	Moderate beneficial impact
	Wider Economic Impacts	Current and future population have improved accessibility to work particularly in south Bristol.		Moderate beneficial impact
Accessibility	Option Values	Significant increase in level of public transport provision through bus, rapid transit park and ride and rail improvements.	Increase in public transport capacity between Do Minimum and Strategy: Rail – 20% Bus and rapid transit – 102% Park and Ride – 109%	Large beneficial impact
	Severance	Individual highway schemes will increase local severance although detailed scheme design should include mitigation measures to maintain current links.	N/A	Slight adverse impact
	Access to Transport	Improved accessibility to main city/town centres. North Fringe and BIA for both public transport and highways.	Extra population within 60 mins – public transport Bristol city centre – 515,000 Bath city centre – 56,000 Weston-super-Mare – 53,000 North Fringe – 61,000 BIA – 62,000 Extra population within 30 mins – highways Bristol city centre – 623,000 Bath city centre – 21,000 Weston-super-Mare – 60,000 North Fringe – 210,000 BIA – 533,000	Large beneficial impact
	Accessibility for the Disabled	Introduction of new vehicles on bus, rapid transit and rail services with low floor access and designated areas for disabled.	N/A	Moderate beneficial impact
Integration	Transport Interchange	Improved interchange through developments including expansion of interchanges (at Worle, Bristol Parkway and UWE.), enhanced network of rapid transit and rail services, increased provision of park and ride. Improved real-time information for passengers.	N/A	Moderate beneficial impact
	Land-Use Policy	Spatial development forecasts have been key input to strategy development process. Close liaison with West of England Partnership in preparation of Sub-Regional Spatial Strategy.	N/A	Moderate beneficial impact
	Other Government Policies	Strategy assists other Government policies (e.g. sustainability and social inclusion) through improvements to public transport services and changes in mode split.	N/A	Moderate beneficial impact

1. Introduction

- 1.1 This report describes the recommendations of the Greater Bristol Strategic Transport Study (GBSTS) which have been prepared by the consultant team led by Atkins. In developing the transport strategy for the area shown in Figure 1.1, the study has examined a wide range of potential measures and the individual components are considered separately in the different sections of the report.
- 1.2 GBSTS has its origins in the London to South West and South Wales Multi-Modal Study (SWARMMS) which was completed in May 2002. SWARMMS examined the strategic needs, up to 2016, of the main east-west strategic transport corridors for the South West region based on the M4 and M5 motorways, the A30, A303, A38 trunk roads, the Great Western, Waterloo to Exeter and the Berks and Hants rail lines. The large scale of this multi-modal study (MMS), together with its corridor based approach, meant that insufficient time was available to deal in detail, outside these main corridors, with the complex area-wide issues at play in Greater Bristol. GBSTS therefore follows on from SWARMMS, building and drawing on work undertaken by the MMS but not constrained by it.
- 1.3 The principal partners for the study included:
- ◆ Department for Transport (DfT)/Government Office for the South West (GOSW);
 - ◆ South West Regional Development Agency (SWRDA);
 - ◆ Highways Agency (HA);
 - ◆ Bath & North East Somerset Council (B&NES);
 - ◆ Bristol City Council (BCC);
 - ◆ North Somerset Council (NSC); and
 - ◆ South Gloucestershire Council (SGC).
- 1.4 The study has been guided by a Key Stakeholder Advisory Group (KSAG) drawn from representative organisations with an interest in transport planning and operations in the study area. In addition to the study partners listed above, the KSAG included:
- ◆ South West Regional Assembly (SWRA);
 - ◆ Business West;
 - ◆ Joint Strategic Planning and Transportation Unit (JSPTU);
 - ◆ Strategic Rail Authority (SRA) (until June 2005); and
 - ◆ Sustainability South West.

Figure 1.1 – The Study Area



OBJECTIVES OF THE STUDY

- 1.5 The brief for the study identified a series of objectives designed to direct the study's development:
- ◆ to investigate the potential for transferring to local transport means, trips that start or end within the study area and use national strategic routes;
 - ◆ having identified the potential for change, to look into the more detailed needs of the national and local strategic networks to deal with the residual problems on these routes; and
 - ◆ to support, validate and inform development of the Regional Transport Strategy and future development scenarios reflecting the Principal Urban Area (PUA) status as defined by Regional Planning Guidance (RPG10).
- 1.6 In developing the strategies designed to satisfy these objectives, the brief specified that the study should:
- ◆ develop a series of integrated multi-modal transport strategies over time (detailed strategies for 2011 and 2016 and broader, high level, strategies for 2021 and 2031) for the study area identifying, analysing and appraising solutions on the national strategic transport networks, on the local strategic transport networks and at the interface between them, so as to improve strategic transport movements into, out of and through the study area;
 - ◆ develop transport strategies that support existing economic activity, continue sustainable development and assist economic regeneration of urban areas and the wider process of urban renewal within the study area; and
 - ◆ reduce the impact of transport on the environment.
- 1.7 Furthermore, in developing and appraising the strategies, the study is required to 'make focused and realistic recommendations on transport policy and infrastructure provision across all modes and networks, focusing on the period to 2016 and taking full account of potential funding and deliverability constraints'. Hence, the strategies that are developed need to be both affordable and implementable.
- 1.8 There is a clear link between the demand for travel across the study area and the changes in the distribution of population and employment. The projections for spatial development have been developed, in parallel with the work of GBSTS, by the West of England Partnership (WoEP) as part of the Sub-Regional Spatial Strategy (SRSS).
- 1.9 These projections by the WoEP have been based on the features enshrined in its vision for the sub-region – that, by 2026, it will have:
- ◆ one of Europe's fastest growing and most prosperous sub-regions which has closed the gap between disadvantaged and other communities – driven by major developments in employment and government backed infrastructure improvements in south Bristol and North Somerset;
 - ◆ a buoyant economy competing internationally, based on investment by innovative, knowledge-based businesses and a high level of graduate and vocational skills;

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- ◆ a rising quality of life for all, achieved by the promotion of healthy lifestyles, access to better quality healthcare, an upturn in the supply of affordable housing of all types and the development of sustainable communities;
 - ◆ easier local, national and international travel, thanks to transport solutions that link communities to employment opportunities and local services, control and reduce congestion and improve strategic connections by road, rail and through Bristol International Airport and seaport;
 - ◆ cultural attractions that are the envy of competitor city regions across Europe, making the West of England the place of choice for talented, creative workers and affluent visitors;
 - ◆ success secured in ways that are energy efficient, protect air quality, minimise and manage waste and protect and enhance the natural and built environment;
 - ◆ built upon the benefits of its distinctive mix of urban and rural areas; and
 - ◆ real influence with regional and national government, by demonstrating vision and leadership and delivering these achievements.

1.10 The vision for the sub-region is reflected in the series of key objectives for the WoEP in developing its spatial strategy to benefit the area and the regional and national economies, and to maintain and improve the quality of life of the area's residents, by:

- ◆ as a priority, promoting urban renaissance, especially in Bristol, Bath and Weston-super-Mare, to make them better places in which to live, work, visit and invest, to create balanced communities, and to maximise the success of their future growth and development;
- ◆ regenerating areas of disadvantage, particularly in Bristol and Weston-super-Mare;
- ◆ promoting and enhancing prospects for sustainable development and investment in south Bristol and Weston-super-Mare;
- ◆ ensuring that the Green Belt continues to perform its fundamental roles in the area, while reviewing its extent in certain areas to meet the sub-region's requirements for sustainable development;
- ◆ overcoming existing deficits in physical and social infrastructure in the West of England, and providing infrastructure to create balanced new communities, as part of the sub-region's successful economic expansion;
- ◆ delivering a step change in the quality of public transport and traffic management within the Bristol urban area, Bath and Weston-super-Mare, and between the cities, smaller towns and rural areas across the sub-region;
- ◆ improving strategic communications to areas outside the West of England, by sea, air, rail and road;
- ◆ protecting and enhancing key environmental assets, especially those of national or international importance, and retaining, enhancing and restoring the diversity of wildlife and the landscape in the sub-region;
- ◆ improving efficiency in the use of resources, with waste production minimised and waste managed in a sustainable way;
- ◆ contributing towards achieving a carbon-neutral economy in the sub-region, with reduced household, transport and commercial energy consumption, reduced

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- environmental pollution, increased renewable energy generation, and positive adaptations to climate change and rising sea levels;
- ◆ encouraging the provision of green infrastructure throughout the sub-region, through environmental initiatives within the urban areas, maximising the potential of the Forest of Avon, and measures to encourage the appropriate use and management of the Green Belt and rural areas for amenity; and
 - ◆ enhancing positive relationships between urban and rural areas for their mutual benefit.
- 1.11 Furthermore, the WoEP has identified a series of additional objectives relating to the individual components of the SRSS. As far as transport is concerned, the objective identifies that an essential part of the 2026 Vision for the West of England is achieving a transport system that is capable of accommodating the proposed level of growth. This includes reducing dependence on the car, delivering a step-change in public transport provision that is reliable, safe, affordable and accessible, and investing in traffic management solutions and the road network.
- 1.12 The requirements outlined above have therefore formed an important role in the development of the transport strategies prepared by the study and outlined in this report.
- 1.13 The requirement that the study should be implementable has a particular repercussion on the inclusion of specific demand management measures, particularly forms of area-wide congestion or road user charging. As explained in Chapter 4, the study identified that the introduction of area-wide congestion charging would have a potentially significant impact on the level of travel on the highway network and, at the same time, would influence the relative shares of public transport and private car within the overall travel across the study area. However, to be cost effective, area-wide congestion charging across the study area would need to be part of a national scheme, and hence it would have to be an important element of national transport policy. In view of the technological, practical, financial and political hurdles that would need to be cleared before a national scheme could be implemented, and the length of time necessary to achieve implementation, it was felt to be impractical to develop a single transport strategy that relied on area-wide charging as a cornerstone for the strategy. As a consequence, two alternative strategies were developed – excluding and including area-wide charging.

THE STRATEGY DEVELOPMENT PROCESS

- 1.14 The process used in the development of the transport strategies followed a hierarchical approach designed to identify measures which seek to make best use of existing infrastructure before considering the impact of, potentially costly, new infrastructure.
- 1.15 At the outset, a wide range of potential measures was identified and each was considered in relation to its appropriateness to the problems in the study area, taking into account the objectives and timescale of the study, the characteristics of the area and the availability of resources. The range of potential measures was extensive and included:

1. Land-Use Measures

- ◆ location of new developments within transport corridors and near to transport nodes;
- ◆ creating a development mix with housing close to places of work, schools, shops and leisure facilities;
- ◆ higher development densities, especially residential and employment;
- ◆ setting maximum parking standards in development plans;
- ◆ promotion of company and school travel plans;
- ◆ flexible or staggered working hours; and
- ◆ increased use of teleworking, teleshopping and teleconferencing.

2. Infrastructure Measures

- ◆ new road construction;
- ◆ new off-street car parks;
- ◆ rail infrastructure provision – upgrades to existing infrastructure, reopening of closed rail lines and provision of new stations, etc;
- ◆ introduction of new light rail or rapid transit operations;
- ◆ introduction of new guided bus operations;
- ◆ new or expanded park and ride sites;
- ◆ new or improved terminals and interchanges;
- ◆ new or extended cycle routes, cycle lanes and priorities;
- ◆ new cycle parking facilities – secure cycle parking, lockers or supervised facilities;
- ◆ introduction of pedestrian crossing facilities;
- ◆ new or extended pedestrian areas;
- ◆ new lorry parks;
- ◆ new trans-shipment facilities; and
- ◆ encouragement of other modes for freight, e.g. by water and pipeline.

3. Management Measures

- ◆ conventional traffic management measures;
- ◆ new or extended Urban Traffic Control (UTC) systems;
- ◆ introduction of Intelligent Transport Systems (ITS) – motorway access control (ramp metering), Automatic Incident Detection (AID), image processing of CCTV records, selective vehicle priority, queue management techniques;
- ◆ accident remedial measures;
- ◆ traffic restraint measures – segregation (road closures, banned turns, etc) and integration measures (traffic calming techniques);
- ◆ other physical restrictions on car use e.g. pedestrian areas, traffic calming, bus lanes;
- ◆ regulatory restrictions on car use e.g. permits and number plate restrictions;

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- ◆ parking controls – supply of spaces, restricting duration or opening hours, regulating use through permits or charging;
 - ◆ encouragement of car sharing or pooling;
 - ◆ introduction of bus priority measures e.g. bus lanes, bus-gates or bus only sections, selective detection at signals;
 - ◆ high occupancy vehicle lanes – to extend the use of bus lanes to selected other vehicles;
 - ◆ new (inter-urban) bus services – to provide direct public transport links;
 - ◆ enhanced public transport service levels – increased route density or frequency, new demand-responsive bus services and a wide spectrum of paratransit measures;
 - ◆ bus service management measures to improve the reliability of services and reduce operating costs;
 - ◆ Quality Bus Partnerships and Quality Contracts – between local authorities and bus operators to enhance bus services to achieve higher quality services; and
 - ◆ introduction of lorry routes and bans to reduce environmental intrusion and improve safety.

4. Information Provision

- ◆ enhanced conventional direction signing;
- ◆ introduction of variable message signs, especially on the motorway network;
- ◆ expansion or real-time driver information systems and route guidance;
- ◆ introduction of parking guidance and information systems
- ◆ public awareness campaigns directed particularly at car users to increase awareness of the effects of their travel behaviour and to highlight alternatives;
- ◆ improved timetable and other public transport service information;
- ◆ extended real-time passenger information;
- ◆ public transport operation information systems including bus location;
- ◆ static direction signs for cyclists and pedestrians;
- ◆ static direction signs for freight traffic; and
- ◆ fleet management systems for freight vehicles for 'Just in Time' delivery schedules.

5. Pricing Measures

- ◆ variations in parking charges;
- ◆ introduction of workplace parking – charge on all private non-residential parking at the workplace;
- ◆ introduction of urban and inter-urban road user charging schemes;
- ◆ changes in fare levels;
- ◆ variations in fares structures – alternatives to conventional graduated fares including lower off-peak fares, travelcards and season tickets; and
- ◆ variations in concessionary fares schemes to provide lower fares or free travel to identifiable categories of passenger with special needs.

- 1.16 The identification of the potential range of measures provided the starting point for the preparation of transport strategies.
- 1.17 Once a 'long list' of potential measures had been identified, analysed and assessed, a series of packages was developed, reflecting different themes for the content of transport strategies:
- ◆ public transport improvements;
 - ◆ public transport improvements with demand management measures; and
 - ◆ highway measures.
- 1.18 Within each theme, a range of alternative components were examined to establish their relative impacts in resolving problems and issues on the transport system and satisfying the objectives of the study. The analysis of the performance of the individual themes provided a background for the preparation of strategies combining the key features of each theme in an overall package of measures.
- 1.19 The development of the measures considered for inclusion in the strategies examined the alternatives within a hierarchy which considered the following sequence:
- ◆ making best (or better) use of existing transport infrastructure;
 - ◆ encouragement of alternative modes;
 - ◆ demand management measures including parking and charging-based techniques;
 - ◆ improvements to the public transport system; and
 - ◆ enhancements to the highway network.

WHAT HAPPENS NEXT

- 1.20 The recommendations from the study will be presented to the partner group, identified earlier in this chapter. The Secretary of State for Transport and elected members of the unitary authorities will then consider which schemes and measures should be taken forward. Once decisions have been made by the appropriate bodies and authorities, further work will be undertaken on the schemes and measures to enable them to be entered into the appropriate programmes of the Department for Transport, the Highways Agency and the unitary authorities. This will take into account the procedures within the Regional Funding Allocation process and the preparation of the Joint Local Transport Plan by the four unitary authorities covering the period 2006/07 to 2010/11. The schemes and measures will be subject to the normal statutory planning processes.
- 1.21 The Secretary of State for Transport has asked the South West region to advise him on its priorities for transport investment in the next ten years or so. The recommendations from GBSTS will assist the region to understand the benefits of the schemes and measures, in terms of supporting future prosperity in Greater Bristol by investing in transport, compared with other areas in the South West. The advice to the Secretary of State will be based on evidence from GBSTS.

- 1.22 Some of the GBSTS recommendations outlined in this report may cause anxiety amongst residents and businesses which hear that they may be affected by the schemes and measures. However, it should be highlighted that no decisions have yet been taken about whether the strategy, or any of the measures within it, should go ahead.
- 1.23 The study has been progressed in an open and consultative manner and the possible options have been discussed publicly. Many of the proposals are at a very early stage in the planning process and, if the recommendations are accepted, considerable further work will be required to prepare and consult on detailed designs for the schemes, including specific route alignments.
- 1.24 At this stage, there are no provisions for compensation to be paid to those who consider that they may be affected by any of the recommendations. However, if the recommendations are taken forward, then statutory blight provisions in the Town and Country Planning Act 1990 will apply. These set out the circumstances in which those residential owner-occupiers and owners of small businesses, who are directly affected, can require the promoting authority to acquire their property. Any queries on this issue can be addressed to The Government Office for the South West, 2 Rivergate, Temple Quay, Bristol BS1 6EH. However, it is recommended that anyone who feels that they are affected by blight as a result of these recommendations should seek independent advice.

CONSULTATION DURING THE STUDY

- 1.25 Consultation has played an important role throughout the study, with concentrated activities at three main points in the study process:
- ◆ to establish the views on current problems and issues for the transport system in the study area;
 - ◆ to understand attitudes towards different measures being considered in the development of transport strategies, under the themes of:
 - better public transport,
 - better public transport and controlling demand
 - better roads
 - ◆ to obtain feedback on the contents of the emerging strategy.
- 1.26 The consultation process involved different groups who were engaged in a variety of ways:
- ◆ a Wider Reference Group formed by members of organisations with a direct interest in the planning and operation of the transport system in the study area; and
 - ◆ members of the general public who live and/or work in the study area.
- 1.27 A variety of techniques were adopted to engage with the different groups, including:
- ◆ preparation of an explanatory leaflet describing the relevant issues for each of the three stages;
 - ◆ inclusion in the leaflet of a questionnaire designed to gain views on specific aspects;

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- ◆ liaison with the local media (television, radio and newspapers) in order to publicise the consultation process;
 - ◆ development of a website to provide a further source of information about the study, with regular updates, and the provision of a message board for members of the public and organisations to record their views; and
 - ◆ organisation of events to which members of the Wider Reference Group were invited during which discussions were arranged on the contents of the specific focus for the consultation.
- 1.28 The results from the consultation on problems and issues provided an important input into the assessment of the transport system in the study area and the development of transport strategies to cater for the problems and issues.

1.29 The responses from the consultation process do not, of course, represent a statistical sample of views; they are the opinions expressed by stakeholders and members of the public responding to the consultation questionnaire and, hence, are to a large extent self-selecting. Nevertheless, the responses provide an indication of the range of views on a number of transport issues. Considerable effort was made to ensure that the leaflet was available as widely as possible, with publicity in the local press and media to announce it. The overall response to the consultation was reasonable, bearing in mind that GBSTS was one of a number of consultation events within the area in recent times. In addition, in the consultation the emphasis was on problems and issues rather than specific measures; it is recognised that greater response is achieved when seeking views on the implementation of measures, rather than perceived problems and issues.

1.30 The main conclusions from this stage of the consultation are outlined below.

Travel Issues

1.31 It was widely recognised, by both stakeholders and survey respondents, that the biggest problem facing Bristol and the surrounding area is that of congestion. As many as 93% of respondents agreed that this was a major problem. Further questions revealed that it is felt that the major towns and cities in the study area suffer worst (77% of those surveyed had experienced severe congestion in Bristol city centre).

1.32 It was also felt that the growth in the surrounding towns, particularly Weston-super-Mare and Portishead, without an increase in public transport provision, is making access worse – especially to the motorway network. Many stakeholders (especially transport operators) commented on this and stated that the delays create many problems for them. Interestingly though, despite many comments about it, only 28% of respondents had experienced delays in Portishead.

1.33 Access to Bristol Airport is also a concern with many people stating that the surrounding villages and lanes are used as ‘rat runs’. Only 41% of respondents agreed that access to the airport is easy by car.

1.34 The other major concern for the public is the local public transport services, which are generally viewed as poor.

Road

- 1.35 Apart from congestion, as mentioned above, the main concerns on the road network covered three areas; access to the network, accident management and the general condition of the roads.
- 1.36 Access to the road network was key to many stakeholders, especially bus and coach operators. Several locations were highlighted as being of particular concern, especially during the summer when much of the strategic road network in the region becomes congested. These include:
- ◆ crossing the M5 at Junction 21 (A370) – this is the main link to the motorway from Weston-super-Mare;
 - ◆ M32 into and out of Bristol;
 - ◆ A4 towards Bath;
 - ◆ Inner Ring Road east of Bristol city centre; and
 - ◆ A38 north and south of Bristol (especially in the summer) – this acts as an overspill when the M5 becomes congested.
- 1.37 There was also concern about the lack of east-west routes across the study area, which results in many people travelling via the centre of Bristol. The major contributor to this is felt to be the absence of a southern and south-eastern ring road for Bristol.
- 1.38 All stakeholders noted that accidents often result in a complete standstill on the road network – especially if they occur on the motorway network. Concern was raised that there are no effective diversion routes or other alternatives available.
- 1.39 Finally, although it is outside the scope of GBSTS, people are concerned about the condition of the roads, for example bad surfacing. Just over a fifth (22%) of survey respondents highlighted that they had experienced poor road conditions, with central Bristol being cited as the worst location.

Rail

- 1.40 The main comments on rail services, both for stakeholders and the public, were related to the vehicles. Only 36% of survey respondents agreed that “rail vehicles are comfortable”. A further 83% felt that “rail services are inconvenient and infrequent”; whilst concern was raised amongst the stakeholders that the vehicles are not good enough to attract people to use them.

“Pacers are worse than many third world trains – they’re dirty, noisy and have an awful ride quality”.

- 1.41 This was followed by ticketing and ticket prices. Amongst the public, over two-thirds of respondents (69%) felt that fares are too expensive whereas the stakeholders felt that the introduction of integrated ticketing and travelcards in the area would help increase ridership.
- 1.42 Several stakeholders were concerned at the standard of the stations and the facilities provided. It was felt that many of the local stations are especially poor and this

results in making the trains a less attractive journey option. The major stations, especially Bristol Temple Meads and Bath Spa, also came in for criticism regarding access. It is felt that Bath station has poor access to road vehicles whilst Bristol Temple Meads gives a poor first impression as a gateway to the city and that the links to the city centre are poor.

- 1.43 Finally, many survey respondents called for various routes and stations to be reopened. The majority of these commented that the Portishead branch, which is largely still in use by freight traffic, should be re-opened for passenger services to relieve the daily congestion faced by people who live in this growing town for which the only form of public transport provision is the bus.

Local Public Transport

Bus

- 1.44 The stakeholders' major concern was the lack of progress on the delivery of bus priority measures, as it is felt that these will go a long way to helping to improve reliability of services. There were also concerns over the current operating times which were deemed not suitable for a modern society and many people cannot easily use buses for their work trip.
- 1.45 Only 9% of survey respondents agreed with the statement "buses are frequent and convenient". In addition, 61% felt that fares were too high and only 15% felt that buses are comfortable. Concern was also raised at the level of information provision. Comments like this are typical of many received concerning buses.

"Buses are very expensive, uncomfortable and frequently late."

Park and Ride

- 1.46 Stakeholders were concerned about the costs and opening hours. Whilst the public were not specifically asked about park and ride, 61% stated that they would be willing to use park and ride as an alternative to the car. At the same time, views were expressed about the impact of park and ride sites on the environment, especially when introduced on green-field sites in the Green Belt, and the possible effect on local bus patronage where passengers switch from local services to park and ride.

LRT

- 1.47 Survey respondents voiced support for a rail based transit system. The stakeholder group agreed that, whilst it meets many of the area's needs, it could be expensive. Several stakeholders suggested that guided bus could be investigated as a cheaper alternative that would meet many of the facilities of a rail based system.

Walking and Cycling

- 1.48 The attention of the study was directed at strategic issues and hence there was not undue emphasis on the detailed or local impacts. Nevertheless, while it was not possible for the study to identify detailed walking and cycling issues, it was felt important to understand and record problems and issues associated with these modes. More people choose to walk rather than use public transport for all journey

types except commuting and just under half of respondents (46%) agreed that it is easy to walk around their local area. It was interesting, however, to note that few comments were received regarding improvements to facilities. One exception was the need to improve pedestrian links between Bristol Temple Meads and the city centre.

- 1.49 More suggestions were received for cycling improvements, which can mainly be divided between a lack of suitable and secure cycle storage facilities, inadequate cycle lanes and difficulties travelling on trains with cycles. Several respondents questioned why some cycle lanes only last for 50 metres or so before ending. If facilities were improved however, a higher percentage of people (54%) would prefer to walk than cycle (47%).

Other Issues

- 1.50 All stakeholders agreed that transport plays a significant role in a successful local economy and is vital to reducing social exclusion. It was noted how important it is that transport policies are linked with other regional plans, such as the Environment Strategy, to ensure the success of any plans.
- 1.51 Many stakeholders felt that road charging would be difficult to bring in (one stakeholder said it would be 'political suicide'), although the concept of workplace charging was felt to be more acceptable. The role that attractive transport links plays to those companies looking to invest in a region was highlighted, and that a careful balance is required to ensure that the area does not become uncompetitive.

CONTENTS OF THE REPORT

- 1.52 This report contains a summary of the main contents of the transport strategies, considering the measures under the principal headings in turn:
- ◆ the contents and location of the future spatial developments and associated population and employment forecasts are described in Chapter 2;
 - ◆ elements of the transport strategies designed to encourage the use of alternative modes through the introduction of "smarter choices", together with important features to be included in the design of new developments are summarised in Chapter 3;
 - ◆ Chapter 4 considers the range of potential demand management measures with the relative scale of their impacts;
 - ◆ Chapter 5 concentrates on the range of enhancements to the public transport system within the transport strategies;
 - ◆ the improvements to the strategic highway network are examined in Chapter 6, concentrating firstly on ways of making best use of the existing highway network before turning to the provision of additional capacity across the network;
 - ◆ while many of the measures within the transport strategies will have an impact on all movements on the transport system, Chapter 7 concentrates on those measures designed specifically to deal with freight;
 - ◆ Chapter 8 outlines the appraisal of the transport strategies including an assessment of the wider economic impacts of the measures; and

- ◆ Chapter 9 summarises the range of potential sources of funding for the measures included in the transport strategies together with the next steps in the further development of the strategies.
- 1.53 Further details of the appraisal of the strategies are included in Appendices to the report:
- ◆ Appendix A contains the set of summary appraisal tables for GBSTS strategies;
 - ◆ Appendix B includes maps and diagrams which summarise key site specific impacts of the strategies; and
 - ◆ Appendix C lists the abbreviations used within the report.

OTHER REPORTS PREPARED DURING THE STUDY

- 1.54 The objective of this Final Report is to summarise and highlight the key aspects within the development of the transport strategies during the study. Details of the work undertaken during the study are included in the technical reports which have been prepared on specific aspects. The contents of the associated reports are summarised below.

Inception Report	Prepared at the outset of the study containing an outline of the process to be followed and a review of the available documents and reports of relevance to the study;
Review of Existing Problems and Issues	An assessment of existing data sources and relevant reports to identify the location and magnitude of current problems and issues across the transport system, together with the views expressed during the first consultation stage;
Review of Appraisal Methods Report	A description of the approach adopted in the appraisal of transport strategies developed within the study, together with key assumptions used in the calculation of the principal indicators;
Data Collection and Transport Surveys Report	A summary of the statistics assembled in the development of the study including the main transport modes (road, rail, bus, park and ride, etc) and incorporating the findings of surveys undertaken during the study;
Model Validation Report	A description of the development of the multi-modal transport model (Greater Bristol Model) prepared specifically for the study and its validation against observed travel patterns;
Forecasting Review Report	An examination of the range of alternative sources available for forecasts of travel behaviour across the study area, including a summary of the main assumptions about future levels of growth;

Forecasting of Spatial Planning Options Report	An outline of the steps followed to prepare projections for the growth in population, employment places, dwellings, etc for the study area to 2031 and the anticipated location of new development sites;
Model Forecasting Report	A description of the process by which the projections for the future growth in population, employment, etc has been translated into forecasts of travel demand levels and the resulting volume and patterns of demand on the different modes;
Future Problem Identification Report	An analysis of the outputs from the Greater Bristol Model relating to the impact of the alternative spatial development scenarios on the Do Minimum transport network, highlighting the location and severity of the future problems across the different transport modes;
Transport Model User Manual	A summary of the different components of the Greater Bristol Model developed during the study and the key features of its operation including input data requirements and principal outputs;
Model Results Report	A description of the main results for the wide range of tests undertaken using the Greater Bristol Model during the development of the transport strategies, including a summary of the major outputs for each of the different transport modes;
Strategy Development Report	A detailed description of the process adopted for the development of the transport strategies for the study area to 2031, examining the contents of the strategies for each transport mode in turn and the detailed features of the individual measures in the strategies;
Appraisal Report	A summary of the appraisal of the overall strategy from the viewpoint of impacts within the main headings of environment, safety, economics, accessibility and integration, together with a detailed appraisal of specific schemes identified for implementation in the short/medium term;
Wider Economic Benefits Report	A description of the likely impacts of the measures in the transport strategies on the economic performance of the study area, identifying the likely effects on the economic regeneration of the area and the potential for relieving current and future areas of deprivation; and

**Consultation and
Participation Report**

An examination of the methods used at three key points during the study to establish the views of key stakeholders and the general public on:

- ◆ the current problems and issues for transport in the study area;
- ◆ the relative impacts of the main themes to be included in the transport strategy; and
- ◆ the contents of the emerging transport strategy from the study.

2. Spatial Development Forecasts

INTRODUCTION

- 2.1 As indicated in the previous chapter, there are close links between changes in the location of population and employment across the study area, and the requirements of the associated developments to the transport system. In addition, the content of the transport system, and changes to it, can play an important role in influencing the form, scale and timing of the population and employment changes. Hence, there is the potential for iterations between changes to the transport system and population/employment developments in order to achieve a balance between the two elements.
- 2.2 However, the consideration of such interaction was outside the scope of GBSTS. From the outset of the study, the attention was directed at the preparation of transport strategies designed to serve a single spatial development forecast prepared by the WoEP. Nevertheless, the preparation of the spatial development forecasts was not undertaken by the WoEP in isolation from transport issues. To assist the WoEP in the identification of the spatial development to form the basis of the transport strategy development, the study provided analysis of the transport impacts of a range of alternative spatial development scenarios. The components of this work are described within the remainder of this chapter. In addition, specific attention was directed at the potential future growth at two significant developments in the study area: Bristol International Airport (BIA) and Bristol Port and these are also described separately.
- 2.3 The modelled changes in population and employment across the study area by 2031 have a corresponding impact on the level and distribution of travel demand across the study area. The main aspects of the changes in demand, their effect on the operation of the transport system in 2031 without any improvements to it, and the creation of problems and issues are described in the final sections of the chapter.

INITIAL ALTERNATIVE SPATIAL SCENARIOS

- 2.4 In parallel with the work of the study in preparing transport strategies to 2031, the WoEP has been developing the future spatial distribution for the Greater Bristol sub-region within its work on the SRSS for the SWRA.
- 2.5 Initially, as part of GBSTS, a series of five spatial scenarios was prepared with officers of the unitary authorities and the Joint Strategic Planning and Transportation Unit (JSPTU), with each scenario representing an alternative distribution of the growth in population and employment across the study area. For one of the spatial scenarios (A), the overall growth was equivalent to RPG10 levels, while for the four other scenarios (B to E) a higher growth level of RPG10 + 25% was used. Each of the scenarios adopted different assumptions for the distribution of the extra population and employment developments across the study area:
- ◆ Scenario A – extensions to existing Principal Urban Areas of Bristol, Bath and Weston-super-Mare;

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- ◆ Scenario B – extensions to existing Principal Urban Areas;
 - ◆ Scenario C – growth concentrated to the north and east of Bristol;
 - ◆ Scenario D – growth concentrated to the south and west of Bristol; and
 - ◆ Scenario E – growth along current principal transport corridors.
- 2.6 With the higher growth scenarios (B to E), the increase in the number of dwellings represented by the RPG10 + 25% level was estimated at 138,000 or equivalent to population growth of 245,000 from the current 990,000 in the study area. For employment, the forecast increase was 95,000 from the current workforce of 500,000 across the study area.
- 2.7 The 138,000 additional dwellings were distributed between brownfield and greenfield development sites; it was estimated that 65,000 dwellings would be located on brownfield sites within the existing built-up areas, leaving 73,000 dwellings to be distributed on the greenfield sites identified for each scenario.
- 2.8 None of the scenarios was designed to be a distribution of developments that was expected to be implemented; they represented an extreme range of different assumptions whose impact on the transport system could then be estimated and assessed. From the transport analysis, it was possible to assess the effects that each scenario would have on the performance of the transport system and the types of measures that would be required in order to resolve some of the resulting transport problems. This analysis formed an input into the selection by the WoEP of a baseline spatial distribution (termed Scenario F) which has formed the basis for the preparation and assessment of the study's transport strategy described in the remainder of this document. Scenario F does not always reflect the WoEP's 'First Detailed Proposals' for the Regional Spatial Strategy, which are also understood to be subject to reconsideration in the light of this study.

SPATIAL SCENARIO USED FOR THE DEVELOPMENT OF THE STUDY'S PREFERRED TRANSPORT STRATEGY

- 2.9 There is a strong linkage between the modelled distribution of additional population and employment across the study area and the design of the future transport strategy emerging from the study. It is therefore important to highlight some of the main features of Spatial Scenario F developed for the study by the WoEP.
- 2.10 Firstly, compared with the preceding scenarios (A to E), with Scenario F there was a change in the assumption about the level of growth on brownfield sites within the existing urban areas and on greenfield sites outside these areas. The same overall growth level of 138,000 extra dwellings by 2031 represented the total increase. However, with Scenario F, there was a change in the assumed split between greenfield and brownfield sites, with a greater proportion (78,000) being positioned on brownfield sites in existing built-up areas. The remaining 60,000 dwellings located on greenfield sites represented an 11% reduction compared with earlier spatial scenarios.
- 2.11 The locations of the additional modelled housing developments on greenfield sites are shown in Figure 2.1. The main sites, including the overall dwelling growth level

and the approximate timing of the development, are shown below. As may be seen, many of the developments extend over a long timescale through to 2031.

- ◆ Ashton Vale – 15,000 (2011-2031);
- ◆ Emersons Green/Pucklechurch – 10,000 (2016-2031);
- ◆ Whitchurch – 10,000 (2021-2031);
- ◆ Locking – 7,000 (2021 - 2031);
- ◆ Harry Stoke – 4,500 (2011-2031);
- ◆ Portishead – 3,200 (2011-2031);
- ◆ Keynsham – 3,000 (2016-2031); and
- ◆ Cribbs Causeway – 2,500 (2011-2031).

2.12 From the summary above, it is evident that the majority of the modelled development is located to the south of Bristol with the major sites at Ashton Vale and, in the longer term, Whitchurch. These sites are also programmed for completion later in the study timetable. The location of these developments and their timing contribute to the contents of the transport strategy outlined in the following sections and in the proposed timetable for the introduction of some of the measures.

2.13 As with the new dwellings, the location of employment developments reflects the split between brownfield and greenfield locations as shown in Figure 2.2. Many of the modelled additional employment places are allocated to sites within the existing PUAs, particularly in the centres of Bristol, Bath and Weston-super-Mare and in the North Fringe of Bristol. However, in line with the new dwellings within the spatial development scenario, employment growth is located in the major new development areas identified above, with the following forecasts for growth by 2031 at these sites:

- ◆ Ashton Vale 6,500;
- ◆ Emersons Green/Pucklechurch 10,000;
- ◆ Whitchurch/Hicks Gate 6,000;
- ◆ Locking 1,750;
- ◆ Harry Stoke 4,000;
- ◆ Portishead 4,000;
- ◆ Keynsham 1,500; and
- ◆ Cribbs Causeway 5,400.

2.14 In addition, there is specific employment growth at BIA which is considered separately below.

2.15 The positioning of both new dwellings and employment within the same development increases the potential for self-containment on the sites, with residents living and working within the same broad location. Whilst this is an attractive aspiration, and developing sites with a combination of both homes and workplaces will encourage self-containment, it is not, of course, possible to guarantee such an eventuality. This is particularly true in the medium to long term, when residents of the area may tend to seek new employment outside the development while still maintaining their residence there.

Figure 2.1 – Location of Potential New Developments (Dwellings) in 2031 as modelled in GBSTS Scenario F

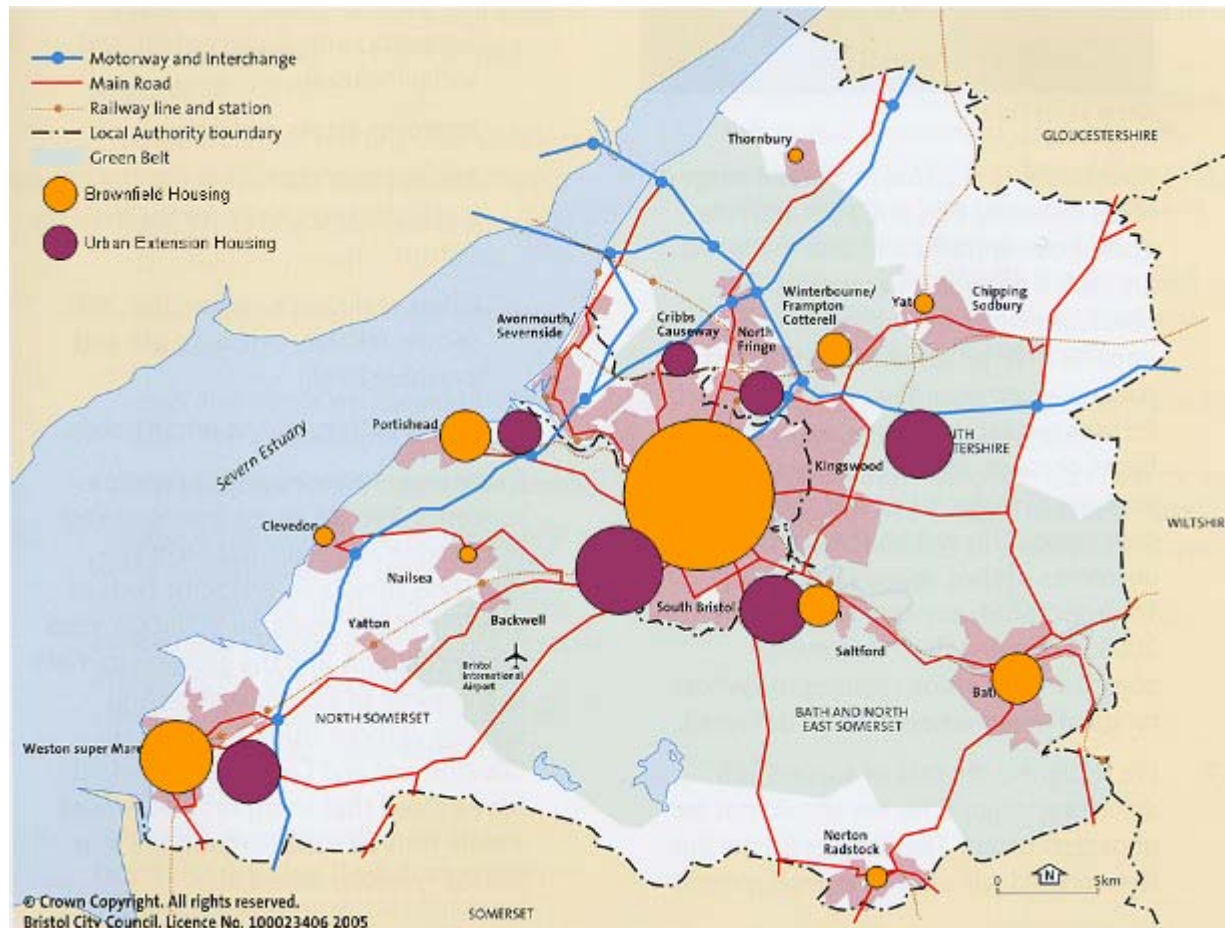
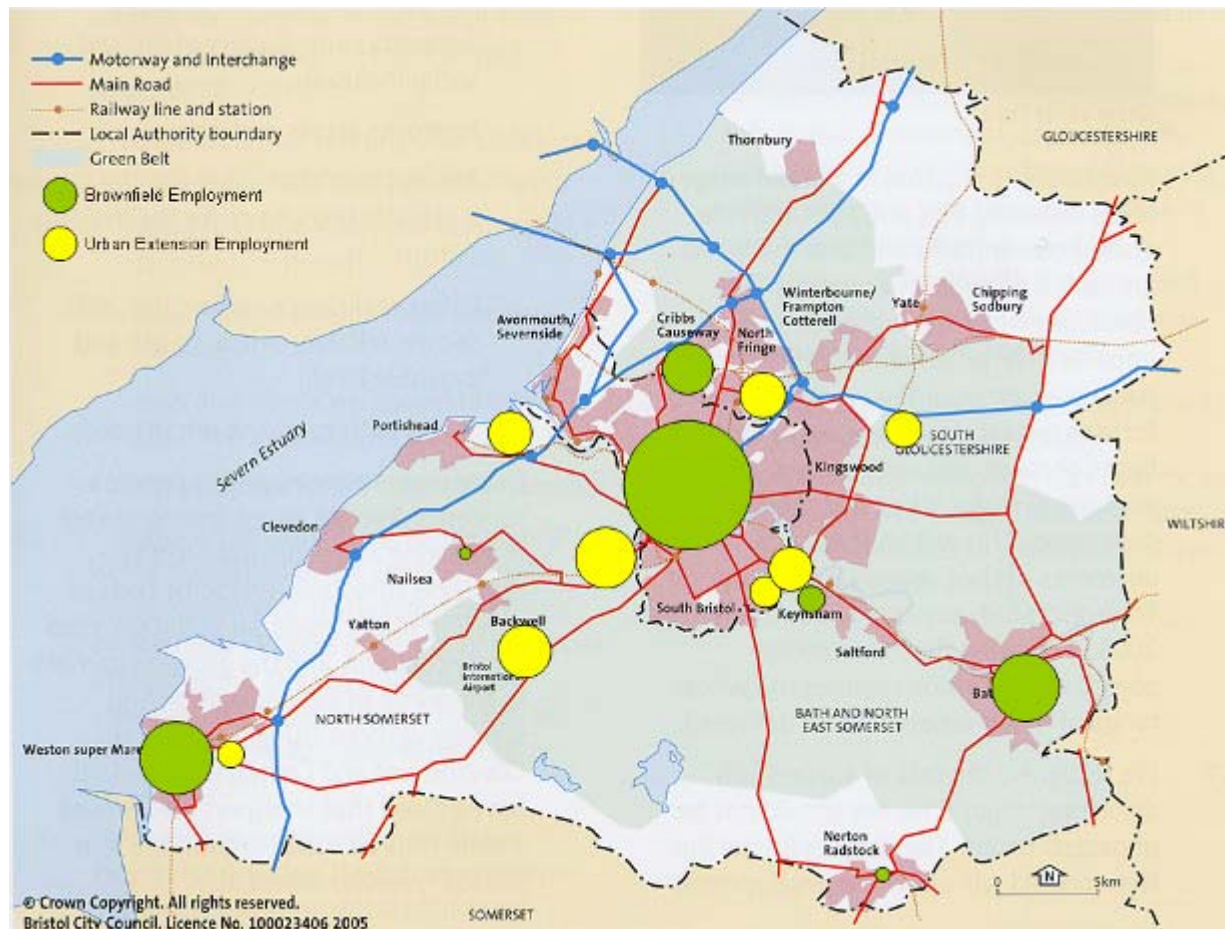
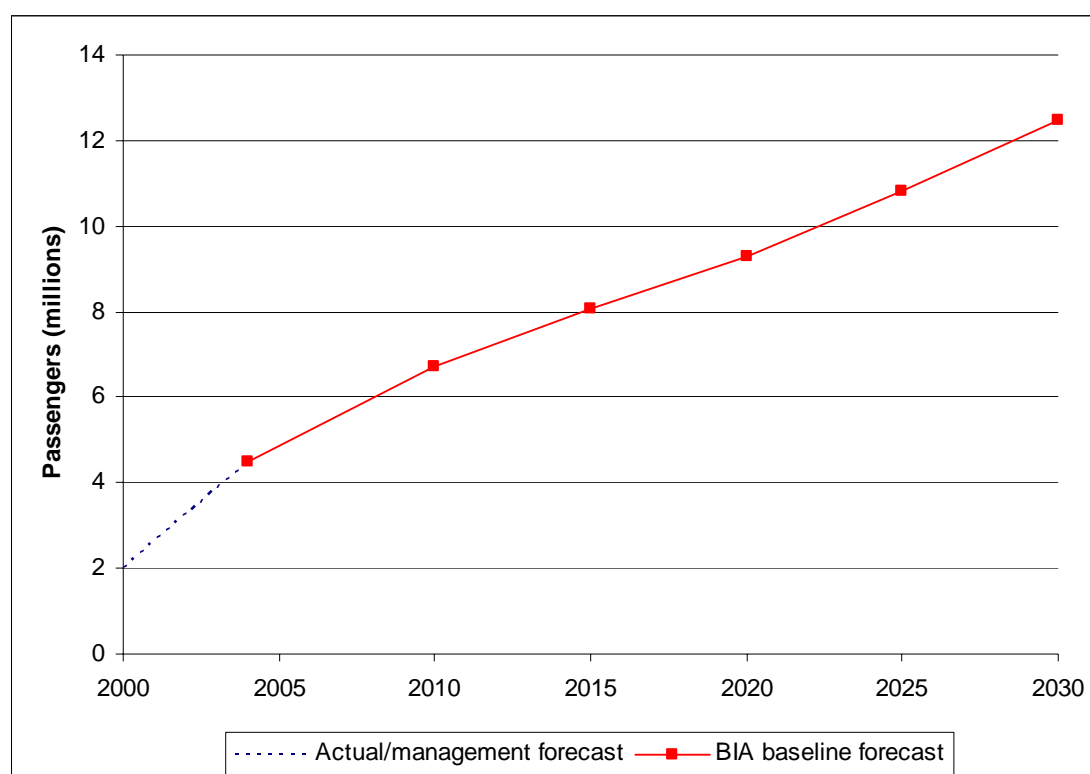


Figure 2.2 – Location of Potential New Developments (Employment) in 2031 as modelled in GBSTS Scenario F



DEVELOPMENT OF BRISTOL INTERNATIONAL AIRPORT (BIA)

- 2.16 In December 2003, the Government published its White Paper on 'The Future of Air Transport' that set the framework for development of airport capacity in the UK to 2030 and included the provision for growth at BIA from the current 4 million passengers per annum (mppa) to 12 mppa by that date. In parallel with GBSTS, the airport has produced a master plan which lays out the specific proposals for airport development up to 2015, and indicative plans up to 2030. The master plan includes the surface access initiatives planned by the airport to serve the predicted demand. In addition to the growth in passengers, employee levels would grow from an average in 2003 of 1950 (with 2350 in peak summer months) to 6700 (and 8100 in peak months) in 2030.
- 2.17 The projections of activity levels at BIA and the impacts on demand for surface access to the airport in the future were assessed by GBSTS with attention paid to the particular characteristics of BIA and the volume and timing of surface access journeys to and from the airport. The objective of the analysis was to estimate the volume of arriving and departing travel volumes in average peak and off peak hours for the base year (2003) and each of the forecast years (2011, 2016, 2021 and 2031). In addition to the travel volumes, the spatial distribution of trips was also investigated.
- 2.18 BIA's own traffic forecasts for air passenger volumes formed the basis of the projections. The forecasts are similar to those prepared by the DfT for the White Paper but take greater account of the airport's own aspirations for growth and the historical performance of other similar developing airports. Figure 2.3 summarises the growth profile through the study period. Note that passenger levels represent the combination of passenger arrivals and departures.
- 2.19 Existing airport passenger number forecasts were used to assess future surface access travel volumes with current and future usage profiles applied as appropriate. In addition, current staff numbers, shift patterns and predicted growth rates were used to estimate this element of the complete airport travel flows.
- 2.20 Forecasts of passenger numbers for a typical month were derived from the annual data via a time series analysis of historic trends. Daily flows were derived from an analysis of traffic count data recorded on the airport approach road. The conversion of daily forecasts into peak and off peak hours made use of the airport's timetable of air traffic movements for a typical week, along with profiles of passenger arrivals and departures. This analysis was conducted separately for domestic/scheduled/charter traffic, and used a BIA supplied notional timetable for the situation with annual passenger levels of 9 mppa (around 2020) which was then extrapolated to represent the situation with 12 mppa.

Figure 2.3 – BIA Passenger Growth Forecasts

- 2.21 The number of staff employed at the airport was estimated by using the relationship between staff numbers and total annual passenger levels. Adjustments were made for levels of seasonal work that occur at BIA. Around 95 percent of airport staff are employed on shift work and hence there are staff trip movements throughout the day rather than merely at the traditional highway peak times. The proportion of staff arriving and departing in peak and off peak hours was taken from work undertaken by BIA.
- 2.22 Vehicle movements were forecast from the estimated passenger and staff numbers using assumptions for mode split, car occupancy and the volume of 'drop off' vehicles (taxi and kiss and ride). Analysis undertaken by BIA indicated that 4.5 percent of current passengers use public transport to access the airport. Based on BIA's own target for public transport mode share, this was estimated to grow by five percent each year and would result in a public transport mode share of 16.0 percent by 2030.

BRISTOL PORT

- 2.23 The overall Bristol Port operation comprises two ports: Avonmouth (opened in 1877) and Royal Portbury Dock (RPD) (opened in 1979). The two ports were owned by Bristol City Council until 1991 when they were sold to First Corporate Shipping Limited trading as Bristol Port Company (BPC).

- 2.24 The entire dock estate is 2,419 acres, of which 45% is useable for port operations. Portbury is the larger of the two ports and has received greater investment since privatisation. The port can handle vessels up to 130,000 dead weight tonne (dwt) and deals primarily with dry bulk goods, oil (aviation fuel), forest products and motor vehicles. Avonmouth can handle vessels up to 35-39,000 dwt. Cargo handled at Avonmouth covers a wide range of commodities including petroleum, fresh produce, gas, cement, scrap metals, containers, sand and gravel, grain, steel products and forestry products.
- 2.25 Since the purchase of the port by BPC in 1991 traffic has increased, making it the third fastest growing port in the UK over the last decade. The greatest increases have been in coal and vehicles while other cargoes have shown more modest growth.
- 2.26 The Bristol Bulk Handling Terminal opened in 1993 and can handle products such as coal and petroleum, coke, grain derivatives, fertilisers and aggregates. Coal is Bristol's largest cargo and is mainly forwarded by rail to three inland power stations. UK coal imports have been rising steadily and are expected to fluctuate in the range 3-6 million tonnes over the next few years. Although carbon taxes are likely to cause a decline, the efficiency of Bristol Port could mean that it handles an increasing proportion of UK coal imports.
- 2.27 Most of the vehicle imports are from the Far East and South Africa. Vehicles are stored in the port and, when requested, are customised in pre-delivery buildings before being delivered direct to the customer. This has considerable implications for land requirements. National vehicle import growth of 7% p.a., an increasing market share of imports and the recent investment in the rail link at RPD suggest that prospects for future growth are good, although the refusal of planning permission for expansion on the Sheepway Farm site could constrain activity within RPD. However, this could encourage increased interaction with Avonmouth.
- 2.28 The construction of a new deep water container facility at Avonmouth is currently being considered although the proposal is at a very early stage. The proposal would increase the Port's capacity from 150,000 to 850,000 container movements a year, with most containers being transported to/from the port by road although a proportion (perhaps 25%) could be attracted to rail with the good existing connections to both RPD and Avonmouth.

IMPACT OF SPATIAL SCENARIO F ON THE TRANSPORT SYSTEM

- 2.29 Spatial Scenario F has formed the basis for model testing using the Greater Bristol Model, a strategic multi-modal transport model developed specifically for GBSTS and representing an average hour in the morning peak (0700-1000) and inter-peak (1000-1600) periods. The model was based on an average hour because the incidence of relatively long-distance trips means that the peak hour occurs at various times in different parts of the study area. The model has been built and validated using 2003 base year data.
- 2.30 The land use changes represented by Spatial Scenario F create additional demand for travel in the period between 2003 and 2031. A Do Minimum transport scenario

has been defined to examine the effects on the transport system if no new transport measures are put in place. The Do Minimum is identical to the 2003 base year scenario, with the exception that it includes committed Highways Agency schemes to implement climbing lanes on the M4 and M5 motorways (which have now been completed or are under construction).

- 2.31 The forecasting of future travel demand levels following from the growth in population and employment is described in the Model Forecasting Report. The process involved the disaggregation of travel demand by journey purpose and car availability category, with the application of appropriate trip rates to each category.
- 2.32 The Future Problems Identification Report contains a detailed analysis of the impact on the transport system of the growth in travel demand, associated with Spatial Scenario F. Key elements of the analysis are examined below.
- 2.33 Table 2.1 shows the total trips by mode for an average hour in the morning peak period. In the Do Minimum case, there is an 18% increase in the total number of trips by motorised modes between 2003 and 2031, with a 21% increase in car trips. The level of bus usage drops because of the increased congestion on the road network which produces a worsening of bus journey times and hence a reduction in competitiveness.

Table 2.1 – Person Trips by Mode (average hour in morning peak period)

Mode	2003	2031 Scenario F Do Minimum	% Difference
Car	154700	187300	21%
Bus	13600	11700	-14%
Rail	4400	5550	26%
Park-and-Ride	1550	1750	14%
Total Trips	174300	206300	18%

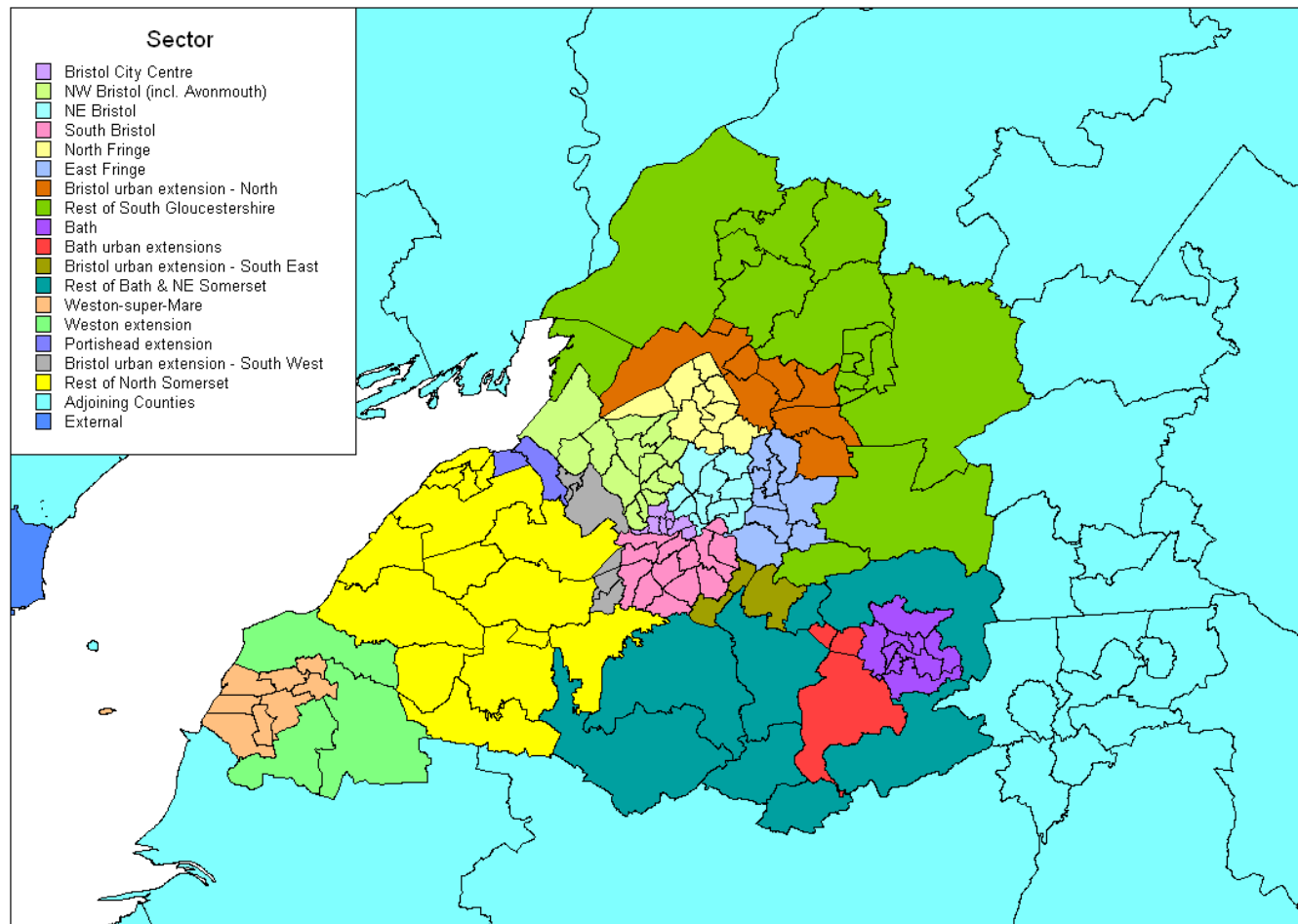
- 2.34 Table 2.2 shows changes in demand in terms of the origins and destinations for person trips for different parts of the study area. To simplify this, a series of sectors has been defined; these are shown in Figure 2.4.
- 2.35 Table 2.2 shows that the growth in trips is distributed unevenly around the study area, with the largest increases in morning peak trip origins located in areas of increased housing development, including:
- ◆ Bristol city centre;
 - ◆ the North Fringe;
 - ◆ extensions to the Bristol urban area in the south-east (including Whitchurch and Hicks Gate), south-west (including Ashton Vale), and north-east (including Emersons Green and Pucklechurch);
 - ◆ extension to Portishead; and

- ◆ Weston-super-Mare – within the existing urban area as well as in the urban extensions.

**Table 2.2 – Trips Origins and Destinations by Sector
(average hour in morning peak period)**

Sector	Trip Origins			Trip Destinations		
	2003	2031 Do Min	% Diff	2003	2031 Do Min	% Diff
Bristol City Centre	8050	12750	58%	18000	19800	10%
NW Bristol (incl. Avonmouth)	15500	15500	0%	13900	14500	4%
NE Bristol	12650	14250	13%	12150	12400	2%
South Bristol	16650	15850	-5%	14450	14200	-2%
North Fringe	6600	11650	77%	11650	13800	18%
East Fringe	10900	11900	9%	8550	9250	9%
Bristol urban extension – north and north-east	4350	5700	31%	2600	3550	36%
Rest of South Gloucestershire	7650	7600	-1%	5650	5700	1%
Bath	14950	15550	4%	17450	18800	8%
Bath urban extensions	200	200	-4%	150	100	-13%
Bristol urban extension – South East	1500	3450	133%	2450	3950	61%
Rest of Bath & NE Somerset	3700	3450	-7%	2000	1950	-4%
Weston-super-Mare	9750	11850	22%	9450	11500	22%
Weston-super-Mare extension	1600	2900	79%	1000	1500	53%
Portishead extension	450	800	81%	700	1200	72%
Bristol urban extension – South West	850	3300	296%	1400	2500	77%
Rest of North Somerset	9500	11150	17%	6450	7950	23%
Hinterland	41350	48900	18%	37900	52450	38%
Rest of UK	8200	9600	17%	8400	11200	34%
Total Trips	174300	206300	18%	174300	206300	18%

Figure 2.4 – GBSTS Sector System



- 2.36 The largest increases in morning peak destinations are correlated to areas of increased employment development, including:
- ◆ extensions to the Bristol urban area in the south-east (including Whitchurch and Hicks Gate), south-west (including Ashton Vale), and north-east (including Emersons Green and Pucklechurch);
 - ◆ extension to Portishead; and
 - ◆ Weston-super-Mare, within the existing urban area and urban extensions.
- 2.37 Table 2.3 compares the mode share in 2003 with that in 2031 under Spatial Scenario F. The results indicate an increase in the car mode share, due in part to increasing car ownership. The reduction in bus mode share is due to a number of factors including increasing car ownership and increased congestion on the road network, which makes bus travel less attractive by lengthening journey times and reducing reliability.

Table 2.3 – Mode Share (morning peak period)

Mode	2003	2031 Scenario F Do Minimum
Car	88.8%	90.8%
Bus	7.8%	5.7%
Rail	2.5%	2.7%
Park-and-Ride	0.9%	0.9%

- 2.38 Table 2.4 shows the impact of Spatial Scenario F on the highway network in the Do Minimum situation in the morning peak period. Over the period between 2003 and 2031, the model indicates a 34% increase in vehicle trips and a 44% increase in vehicle-kilometres. This gives rise to large increases in delay, with the total vehicle delay more than tripling and the time lost per vehicle-kilometre increasing from 34 seconds to 80 seconds. The proportion of vehicle-kilometres on relatively uncongested links falls from 91% to 69%, while the proportion on links at or above capacity increases from 6% to 17%.
- 2.39 The impact of Spatial Scenario F on the highway network in the Do Minimum is shown in more detail in Figures 2.5 and 2.6. Figure 2.5 shows that, in the Do Minimum situation, highway flows increase substantially on almost all roads in the Greater Bristol area in the average morning peak hour. On the M5 motorway, there is an increase in flow of around 2000 pcus per hour in each direction between J21 at Weston-super-Mare and J19 at Portishead. On the M5 Avonmouth Bridge, the increase is higher, at around 3000 pcus¹ per hour. On the M4 motorway east of the Almondsbury Interchange, there is an increase of almost 3000 pcus per hour in the eastbound direction and 1000 pcus per hour westbound. The A4174 Avon Ring Road is also put under more pressure, with flow increases in excess of 1000 pcus per hour on some sections.

¹ pcu = passenger car unit, a standard unit used in traffic modelling whereby larger vehicles such as heavy goods vehicles are converted into the equivalent number of car units.

Table 2.4 – Key Highway Network Statistics (average hour in morning peak period)

	2003	2031 Do Minimum	% Difference
Vehicle Trips ('000)	154	207	+34%
Vehicle Kilometres ('000)	2,000	2,880	+44%
Vehicle Hours ('000)	45	101	+123%
Average Vehicle Speed (km/hr)	44.2	28.5	-35%
Mean Journey Length km (per vehicle)	13.0	13.9	+8%
Total Vehicle Delay ('000 Hours)	19	64	+233%
Time Lost per Vehicle-Km (seconds/veh km)	34.5	79.6	+131%
Vehicle-Hours of Delay per Network Km (veh hrs/km)	6.8	22.7	+233%
Proportion of Vehicle Kms on Links at Different Levels of Capacity Utilisation			
Below capacity	91%	69%	
Approaching capacity	4%	14%	
At capacity	3%	8%	
Significantly over capacity	3%	9%	

2.40 Figure 2.6 shows highway links which are approaching or above their capacity (defined as links with flows in excess of 85% of the link capacity in the average morning peak hour). Links marked in red are already above this capacity threshold in 2003, while those marked in blue are pushed above the threshold as a result of additional traffic on the network in 2031. There is therefore a general worsening of conditions, with particular areas of increased congestion as follows:

- ◆ on the motorway network, in particular on the M5 northbound and the M4 eastbound;
- ◆ on the approaches to motorway junctions, particularly where areas of new development adjoin the motorway network, i.e. at Portishead, Cribbs Causeway, Harry Stoke and Weston-super-Mare;
- ◆ within the principal urban areas of Bristol, Bath and Weston-super-Mare; and
- ◆ on the periphery of the principal urban areas, particularly around areas of new development such as Ashton Vale and Weston-super-Mare.

Figure 2.5 – Difference in Highway Flows between 2003 and 2031 Do Minimum (average morning peak hour)

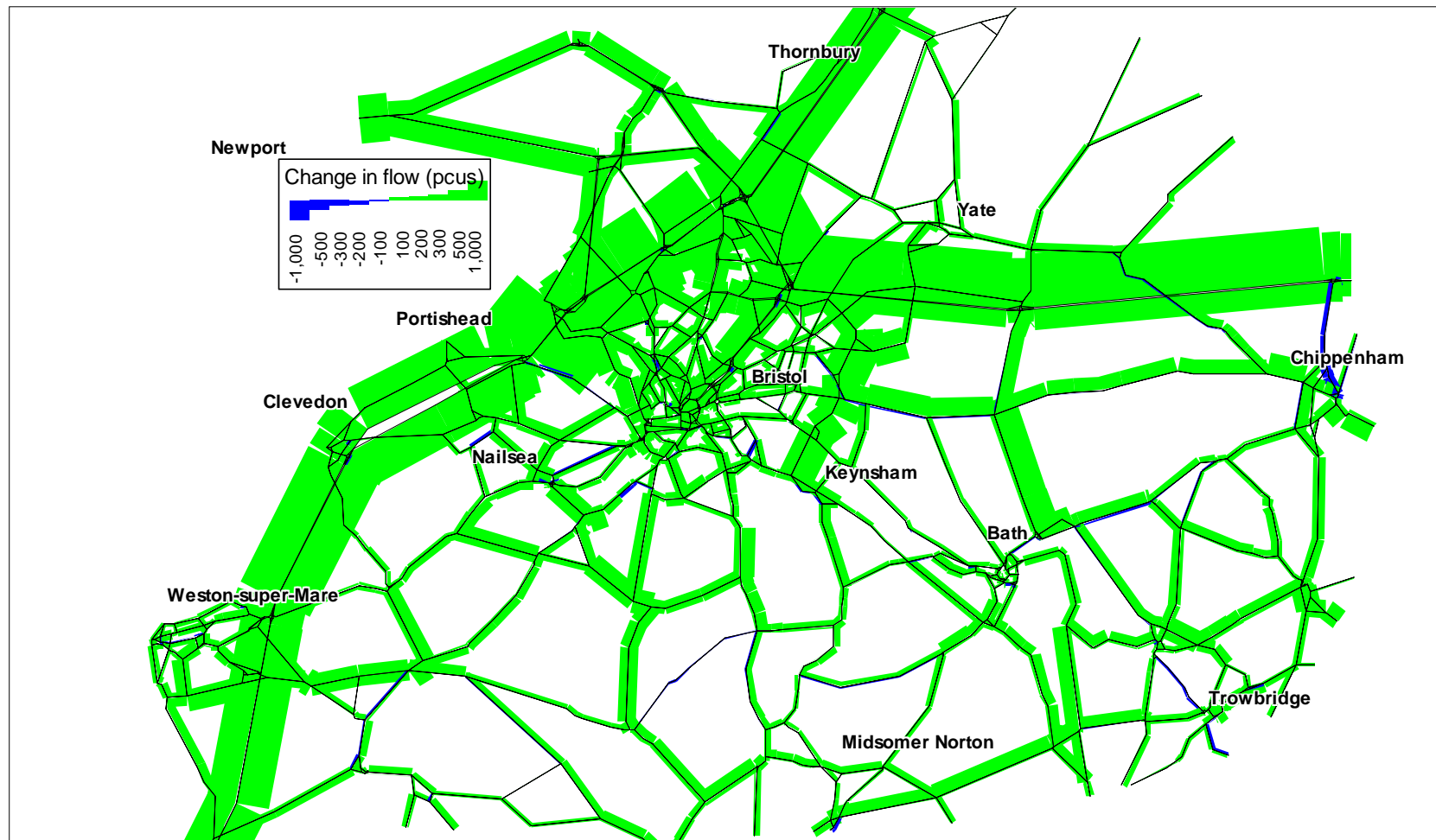
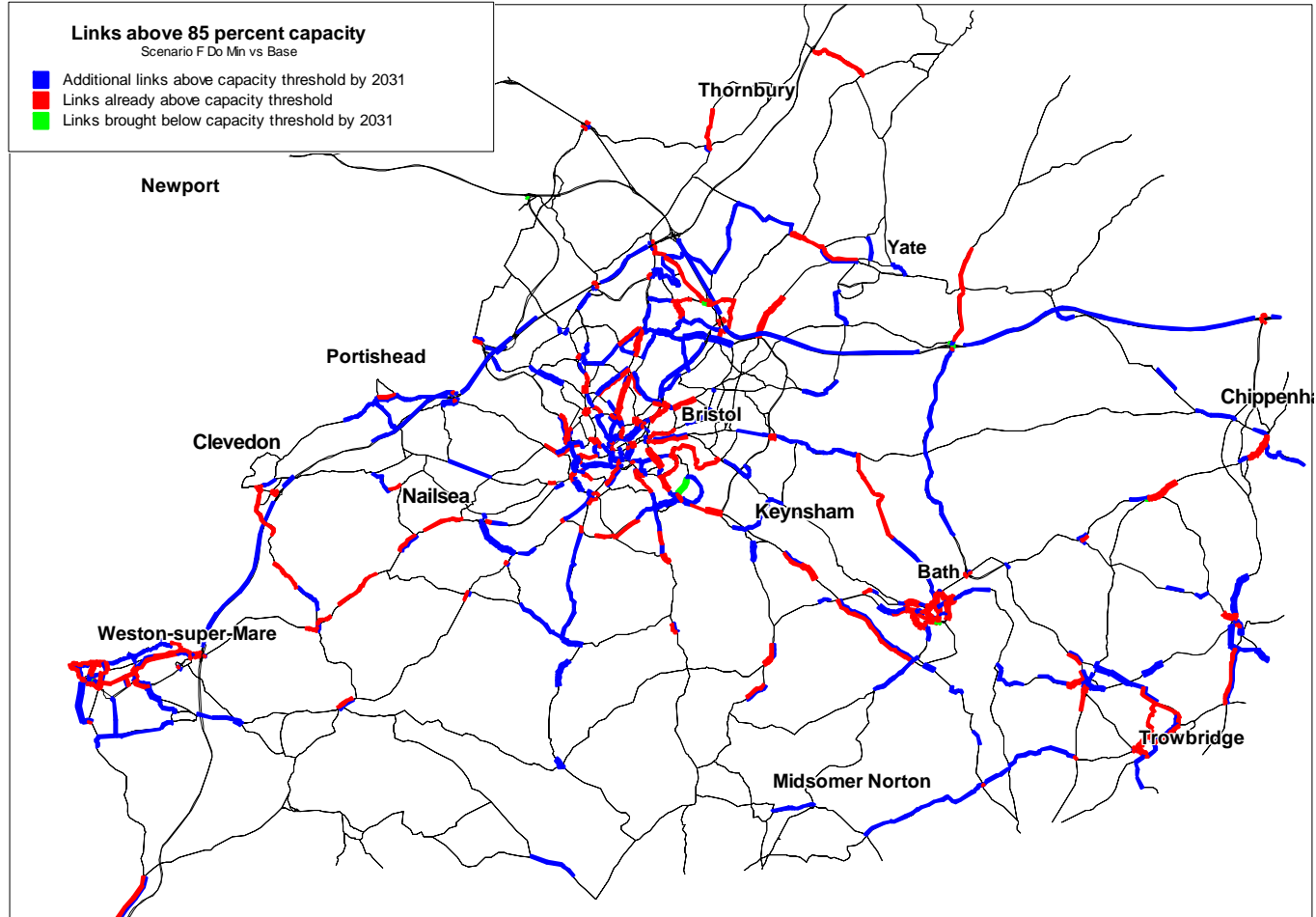


Figure 2.6 – Difference in Highway Capacity Utilisation between 2003 and 2031 Do Minimum (average morning peak hour)

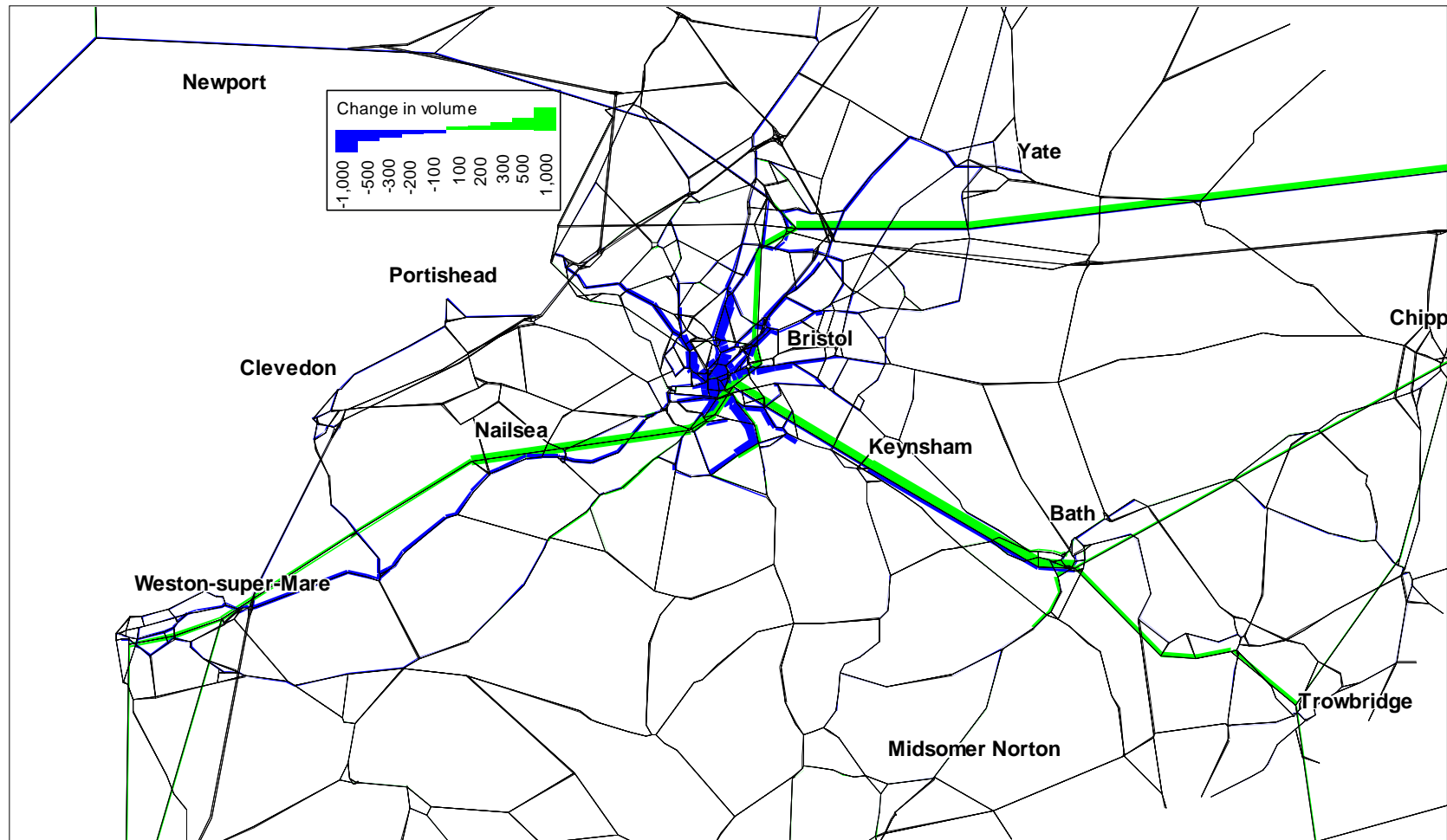


- 2.41 The changes exacerbate major problems of congestion on the strategic highway network already identified in 2003, including those at:
- ◆ M32 Junction 1 and on the northern section of the A4174 Avon Ring Road;
 - ◆ M5 Junction 21
 - ◆ M5 Junction 19;
 - ◆ M5 Junction 17;
 - ◆ M5 Junction 16; and
 - ◆ M4 between Junction 19 and 20.
- 2.42 Without improvements in capacity, a number of the developments included in Spatial Scenario F create particular difficulties on the highway network in the immediate vicinity of the development, especially at key junctions.
- 2.43 Table 2.5 shows the impact of Spatial Scenario F on the public transport network. In line with the changes in bus patronage described above, there is a reduction in both bus passenger-kilometres and passenger-hours. On the rail network, however, a 6% increase in passenger-kilometres adds to pressure on the system, and the level of overcrowding more than trebles from 2003 levels. The level of overcrowding on the rail network is reflected by increases in the in-vehicle travel time, based on the degree of overcrowding. The size of the perceived crowding penalty was derived from the SRA Passenger Demand Forecasting Handbook. These trends are also illustrated in Figure 2.7, which shows changes in passenger flow on public transport routes. Increases in flow, primarily on the rail network, are shown in green while decreases are shown in blue.

Table 2.5 – Public Transport Network Statistics (average hour in morning peak period)

	2003 Base	2031 Do Minimum	% Difference
<i>Passenger Kilometres ('000)</i>			
Bus	104	81	-22%
Rail	601	639	+6%
<i>Passenger Hours, including walking and waiting time</i>			
Bus	12500	11900	-5%
Rail	32900	35600	+8%
Rail Crowded Time (Passenger hours)	300	970	+227%

Figure 2.7 – Difference in Public Transport Flows between 2003 and 2031 Do Minimum (average morning peak hour)



- 2.44 Thus, if no transport measures were to be put in place, Spatial Scenario F would have the following impacts on the transport system in the Greater Bristol area:
- ◆ increase the overall level of congestion on the road network, lengthening journey times and reducing journey time reliability;
 - ◆ put additional pressure on the motorways and other strategic links, with the impacts exacerbated by developments close to motorway junctions;
 - ◆ add to existing congestion problems at particular “hot spots” including: M32 Junction 1 and adjoining sections of the A4174; the M4 between Junctions 19 and 20; the M5 between Junction 15 (Almondsbury interchange) and Junction 19; and the M5 at Junction 21;
 - ◆ reduce the attractiveness of bus services through increased congestion in urban areas, thereby strengthening the dominance of the car for travel in Greater Bristol; and
 - ◆ increase pressure on already overcrowded rail services.
- 2.45 These changes, especially the increase in car use and associated worsening of congestion, would have a considerable impact on the environment of the Greater Bristol area. The environmental effects would include a 33% increase in CO₂ emissions and increased levels of traffic noise. However, improvements in vehicle efficiency between 2003 and 2031 are forecast to lead to a substantial reduction in emissions of local pollutants such as NO_x (-45%) and PM₁₀ (-52%) despite the increase in traffic volumes.

SUMMARY

- 2.46 The development of the GBSTS transport strategy up to 2031 was based on the increased demand for travel, of which a key factor was the projected growth in population and employment within the Greater Bristol area, with the associated rise in freight movements. Working with the WoEP, GBSTS prepared travel forecasts for 2031 based on 138,000 extra dwellings in the study area, equivalent to population growth of 245,000 from the existing 990,000. For employment, the forecast increase was 95,000 jobs in addition to the current workforce of 500,000.
- 2.47 The additional dwellings were split between 78,000 on brownfield sites in existing built-up areas and 60,000 on greenfield sites formed by extensions to the principal urban areas, particularly Bristol and Weston-super-Mare. Further travel would be generated by growth in activity at BIA with air passenger numbers rising from the current 4 mppa to 12 mppa by 2031 with an associated increase in employee levels.
- 2.48 The growth in travel demand resulting from the increased population and employment would be significant. However, the growth is constrained by the limited capacity on the transport system which results in the suppression of some journeys. Nevertheless, even with some suppression, the additional demand creates severe problems for the operation of the transport network. There is a forecast 34% rise in the number of vehicle trips on the road system in the morning peak but the limited capacity results in a 35% drop in speeds from 44 km/hour and an increase in delay of

230%, indicating a large scale growth in congestion. Growth in traffic occurs particularly on the motorway network, with an extra 3000 pcus between 2003 and 2031 across the M5 Avonmouth Bridge and between M4 Junctions 19 and 20. Bus operators experience the impact of increased congestion on the road network with bus speeds dropping between 20% and 40%. Consequently the car mode share rises from 88.8% in 2003 to 90.8% in 2031. The decline in bus use is offset to a limited extent by an increase in rail patronage, although the restricted capacity on the rail system constrains the growth in passenger levels with a significant rise in crowding on trains.

3. Measures to Encourage the Use of Alternative Modes

- 3.1 The first group of measures within the study's transport strategy is designed to encourage the use of alternative modes or to influence the need to make a journey and the choice of destination. These are examined under the headings of:
- ◆ walking;
 - ◆ cycling;
 - ◆ 'smarter choices'; and
 - ◆ land use/development factors.
- 3.2 With each of these measures, there is the opportunity of making a significant change in the characteristics of journeys, by encouraging either an avoidance of travel, a change in destination (e.g. to more local facilities), a reduction in the frequency of travel or a switch in the mode used. However, there must also be awareness that, for the measures to be fully successful, they need to form part of a package which considers alternatives for the complete journey, for example, providing facilities at both the origin and destination ends of the journey. Furthermore, not all of the travelling public may be able to take advantage of the measures; for example, the disabled, elderly or unfit might be unable to take advantage of improvements to pedestrian and cycling facilities. In addition, there may be further issues, e.g. personal security, which have an impact on the take-up and success of initiatives within this heading. Finally, where the measures are successful in achieving a significant change in travel behaviour, thereby reducing the volume of car travel, there is the potential impact of generated or induced traffic which is encouraged by the newly increased availability of spare highway capacity.
- 3.3 Despite these potential effects, if introduced with care and skill the measures outlined below have the capability of influencing and altering travel behaviour.

WALKING

- 3.4 There is considerable scope for walking to provide an alternative to the car for short trips and (with high quality connections to, and between, public transport services) it can be a significant part of longer distance journeys. Walking schemes offer the opportunity to provide better access to local services, and also to enhance health, reduce congestion and improve air quality. Improvements to street environments can create vibrant and prosperous urban areas, and contribute to crime reduction.
- 3.5 Walking to work in the Greater Bristol area is already higher than average at 12%, rising to over 15% in the main urban areas, compared to the English average (10.0%) and the Metropolitan County average (9.8%). Schemes such as the Hillside First School Walking Bus in Weston-super-Mare have shown that it is possible to convert a situation where two-thirds of pupils are being driven to school into one where two-thirds regularly walk.

-
- 3.6 Walking is ideally suited to journeys of up to 2km, and integration with public transport can make this a wider catchment area, opening up employment and recreational opportunities across all four unitary authority areas. The use of planning policies and Section 106 agreements can help to achieve improved pedestrian and cycling facilities and enhanced patterns of development which encourage walking and cycling.
- 3.7 The pedestrian environment has a direct impact on the ease and attractiveness of walking activities, and infrastructure should be high quality and accessible to all. Better design and maintenance of public spaces, the removal of obstructive street furniture and the provision of high quality signing and lighting can create public spaces that are conducive to walking. With the likelihood that there will be extensive levels of new developments across the study area in the period to 2031, it will be vital that the urban design of the developments encourages pedestrian activity and facilitates walking access to the main facilities.
- 3.8 The aims of the unitary authorities' Rights of Way Improvement Plan are to help promote walking throughout the Greater Bristol area, providing safe and attractive sustainable transport and recreational opportunities in each unitary authority area. Within the preparation of accessibility analysis for the Joint Local Transport Plan (JLTP), the current pedestrian links and opportunities are highlighted.
- 3.9 Due to the strategic nature of GBSTS, the transport strategy does not contain specific measures to promote increased walking, although a number of the strategy components (e.g. 'Smarter Choices' and demand management measures) are likely to encourage more walking. The study would, however, support measures designed to promote a higher proportion of trips being made by pedestrians and, where specific transport measures are proposed (e.g. public transport enhancements, highway schemes), the needs of the pedestrian should be incorporated actively in the design.

CYCLING

- 3.10 The Greater Bristol area, and Bristol in particular, has achieved considerable success in stimulating greater levels of cycling in recent years; Bristol recorded one of the highest increases in cycling in the UK from 1991 to 2001.
- 3.11 There is considerable scope for cycling to provide an alternative to the car for short trips. It is a healthy, emission-free and fairly cheap mode of transport which can provide access to local facilities and services, as well as links to the public transport network, especially rail. Furthermore, making the key trip attractors accessible to non-motorised modes is vital in creating an inclusive society. Cycling has an important role to play in progressing towards each of the shared priorities, e.g. improving accessibility for the 21% of households in the Greater Bristol area which do not have access to a car.
- 3.12 Given the skilful targeting of resources, the Greater Bristol area has great potential to achieve considerably higher levels of cycling. The key strengths of the area are the existing infrastructure, the recent successes in increasing cycling, and the considerable amount of cycle-planning expertise both at the local authority level and with organisations such as Sustrans and Life Cycle. The introduction of the National

Cycle Network with long-distance trunk cycle routes has been important in raising the awareness of cycle routes. The key challenges will be the need to target new measures in carefully selected areas, ensure that residential and destination cycle parking are comprehensively available, and to strike the right balance between infrastructure and the 'Smarter Choices' (described later in this section). In the design of the new housing and employment developments to be implemented by 2031, it will be important to integrate the cycle facilities within the urban environment, with cycle paths incorporated within other transport infrastructure as appropriate. It will be important that cycle measures are included from the outset and due allowance is made in the design so that the cycle measures are fully integrated and not treated as an afterthought.

- 3.13 Cycle parking is arguably the most important of all cycle facilities. Without adequate secure cycle parking at both ends of the journey, people are more reluctant to cycle. Trip end cycle parking facilities should be encouraged at all major trip attractors (workplaces, shops, leisure activities, etc). Medium and long stay public cycle parking in town centres is particularly important (but often overlooked). Most important of all is the provision of residential cycle parking; all new residential developments should include resident (and, where possible, visitor) cycle parking facilities.
- 3.14 Design of cycle facilities should be based on the latest and most appropriate technical advice such as cycle-friendly infrastructure, local transport notes and traffic advisory leaflets. It should also reflect the hierarchy of measures as described in recently published Government guidance with traffic and speed reductions coming before re-allocation of road space and dedicated cycle facilities. Cycle audits should be carried out for all significant transport and development infrastructure proposals.
- 3.15 When cycling is combined with public transport for longer trips, journey times can compete with those achieved by car. Traditionally, heavy rail is the mode which best complements cycling. Catchment areas for cycle trips around train stations are likely to be in the order of 3kms to 5kms. Heavy rail offers good opportunities for both cycle parking (at stations) and cycle carriage (although current provision varies considerably between train operators). Bus travel does not offer the same opportunities as rail for integration with cycling. However, cycle parking should be provided at bus stations, especially if served by longer distance or limited stop bus or coach services.
- 3.16 The effectiveness and value for money of 'soft' measures has only been realised in recent years. Examples of such measures include cycle maps (which have been shown to be effective in increasing the number of cycle trips), personalised travel planning techniques and cycle training.
- 3.17 As with walking measures described above, the strategic nature of GBSTS means that specific cycling measures are not included in the strategy. Nevertheless, the study supports the introduction by the unitary authorities of the range of potential measures outlined above, particularly those designed to encourage greater use of public transport. At the same time, all new transport infrastructure should be designed to facilitate and stimulate increased cycling.

‘SMARTER CHOICES’

- 3.18 ‘Smarter Choices’ (also known as ‘soft measures’) are initiatives that seek to provide better information and opportunities to help people reduce their car use while improving the alternatives provided. Taken together, the various measures, if introduced effectively and comprehensively, have the opportunity of making a significant impact on the mode split of travel in the GBSTS area.
- 3.19 The Government has conducted a programme of research² designed to establish the current position with UK experience in the implementation and operation of the ‘Smarter Choices’ measures. The research has been reviewed to highlight the potential impacts for the study area of the individual measures in terms of the level of trip-making and the changes to mode choice, together with the likely costs of implementing the measures. The most effective measures are included in the transport strategy and are described in turn below. However, there are two further general aspects that need to be taken into account when assessing the overall effects on travel behaviour if the measures were to be implemented:
- ◆ the distinction between short term and long term effects of the measures on travel behaviour; and
 - ◆ whether the benefits of changes in travel behaviour, in terms of reduced private car use, created by the measures is eroded by new, induced traffic which takes up some of the newly released capacity.
- 3.20 In some cases, the local authorities within the Greater Bristol area have already been pursuing some of the ‘Smarter Choices’ policies. Where this is the case, account has been made of the traffic reductions that potentially have already occurred, and the appraisal results reflect the additional benefit that could be accrued over and above that already achieved. Correspondingly, the costs of pursuing the ‘Smarter Choices’ policies are additional to any expenditure that is already taking place.
- 3.21 In the appraisal of potential measures, the attention was directed at the ‘Smarter Choices’ as a whole. The appraisal did not explore the impact of individual measures on their own.

Workplace Travel Plans

- 3.22 Workplace travel plans (WTPs) are packages of measures put in place by an employer to try and encourage more sustainable travel amongst its employees. WTPs are aimed primarily at addressing the commuting habits of employees, although many also incorporate measures directed at travel during the course of work, including business and delivery travel, and also travel by patients, shoppers, tourists, or other visitors to the employer’s site.
- 3.23 In parallel with the introduction of workplace travel plans, there are potential benefits from the application of residential travel plans. These plans promote more sustainable travel, particularly for larger new residential developments. While the residential travel plans could assist in achieving some of the benefits identified later in this chapter under the ‘Land Use’ heading, they have so far concentrated on new developments. In the future, there might be the potential to extend the measures

² ‘Smarter Choices – Changing the Way we Travel’ Cairns et al, Department for Transport (2004).

retrospectively to existing developments. However, the introduction is likely to be limited to sizeable developments and hence the impact might not be extended across the whole study area.

- 3.24 Currently around 13% of employees in the Bristol area are targeted by WTPs while the 'Smarter Choices' report indicates that, if sufficient resources are allocated to the promotion of measures, the figure could grow to 78%. For forecasting purposes, it is assumed that this increase will take place linearly from 13% in the base year to 78% by 2021, after which time it will remain unchanged. Overall, this would produce a reduction of 9.7% in the number of peak car trips to Bristol city centre in 2021, with car trips to destinations outside Bristol city centre falling by 7.6%.
- 3.25 Based on the costs of promoting WTPs in Bristol and elsewhere, it is estimated that travel plans will cost £4.30 per head in their first year, falling linearly to £2 per head by their third year. The £2 per head will need to continue to be incurred for as long as the plans are retained in order to maintain the impact of the measure. On this basis, the annual cost in 2021 would reach £800,000 and, thereafter, the additional on-going annual cost of WTPs to the local authorities would be around £770,000 per year.

School Travel Plans

- 3.26 School travel plans (STPs) include a range of potential components:
- ◆ consultation with the school or college as well as the local community;
 - ◆ education and information measures;
 - ◆ road safety training;
 - ◆ changes within the school;
 - ◆ initiatives such as 'walking buses' and 'cycle trains';
 - ◆ measures to encourage bus use;
 - ◆ traffic calming;
 - ◆ cycle lanes; and
 - ◆ safe crossings.
- 3.27 Within the South West region, around 15% of schools already have a STP while the DfT's 'Smarter Choices' research indicates that there is unlikely to be an upper limit to the application of travel plans to schools and colleges. Thus, it is assumed that measures could be introduced such that the remaining 85% of schools in the South West have developed a school travel plan by 2021. The reduction in car trips for schools with travel plans is estimated to be the mid-point of the range of impacts identified by the research. This represents a reduction of 12% in the number of car trips to schools, resulting in a drop of 0.5% in the total number of peak car trips to Bristol city centre in 2021, and a 0.4% fall to destinations outside Bristol city centre.
- 3.28 The annual cost per head to the local authority of a school travel plan is likely to be substantial at around £3.50 to £4.00 per head. This includes the costs of the range of measures outlined above. Maintaining the benefits of the plan, with an ever-changing student population, means that this cost would be incurred every year – thus, the annual cost is estimated to reach £575,000 by 2021.

Tele-working

- 3.29 Tele-working is the term used to describe the situation where employers encourage employees to adopt a range of remote working practices including working at home or in a location closer to home than their main workplace, for some or all of the time. The impact of tele-working on traffic flows may not be straightforward and will be dependent upon its form and scale. For example, the impact will be affected by whether the tele-working is undertaken on a full-time or part-time basis and whether, in the latter case, it is spread evenly throughout the week. If the majority of tele-working occurs on, say, Fridays, the demand for highway capacity will remain high throughout the rest of the week. In addition, if tele-working encourages people to live remotely from their workplace, the total mileage travelled might actually increase.
- 3.30 'Smarter Choices' research identifies that around 8% of the working population is engaged in tele-working for some of the time. In addition, the future potential for tele-working is placed at 22.6%. For peak trips to Bristol city centre, the reduction in car trips could represent 3.7% of journeys in 2021 and 2.9% to other destinations.
- 3.31 Tele-working can save companies money through reduced requirements for office space, parking etc. Its growth is likely, therefore, to come about through market forces and thus there are no public sector costs that need to be considered.

Tele-conferencing

- 3.32 Tele-conferencing can be defined as the use of telecommunications to facilitate contacts that might otherwise have involved business travel.
- 3.33 Research quoted in the 'Smarter Choices' report indicates that tele-conferencing is relevant to around 26% of employees who are company car drivers, in managerial occupations, who work from home or who travel on behalf of work. For peak trips to the study area, the impact of tele-conferencing is likely to be small; by 2021, the reduction in car trips to Bristol city centre could be less than 0.1% and around 0.25% to other destinations. Off-peak reductions are slightly greater, reflecting the potential for tele-conferencing to replace journeys made in the course of work.
- 3.34 It is assumed that tele-conferencing offers a commercial benefit to companies such that its growth will take place without further public sector intervention. The cost to local authorities is, therefore, assumed to be zero.

Car Sharing

- 3.35 Car sharing schemes aim to encourage individuals to share private vehicles for particular journeys. Formal schemes can be employer-led, and are thus assumed to form part of WTPs, or they can be promoted independently by private or public bodies. There are two aspects to the level of take-up for a particular scheme:
- ◆ the number of people encouraged to join the scheme; and
 - ◆ the frequency with which they are in a position to share a vehicle for a particular journey.

- 3.36 The overall impact of car sharing is likely to be relatively low. For peak trips to Bristol city centre, the reduction in car trips could represent 0.8% of journeys in 2021 and 0.6% to other destinations.
- 3.37 The costs of running and promoting car share schemes are not insignificant with South Gloucestershire currently paying around £2,000 per annum for the software licence with £10,000 for promotion and operation. In May 2005, this equated to £20 per match per annum although it is not clear how these costs would change with the expanded coverage of the scheme across the Greater Bristol area.

Car Clubs

- 3.38 Under the scheme, car club members pay an annual membership fee to an operator who then provides a range of vehicles in their neighbourhood for the use of members. To be effective, the combined costs of membership and use are intended to be cheaper than personal car ownership.
- 3.39 Car clubs are already established in the Bristol area and are likely to continue to grow. However, the impact on overall vehicle mileage is unclear, with the impact on peak demand likely to be small with the main application being for leisure trips, particularly those involving group travel for medium to long distances, especially at weekends. Thus, although there are many benefits to be accrued from the expansion of car clubs, they have not been assessed in detail within GBSTS.

Home Shopping

- 3.40 Although home shopping is a growing phenomenon, in many cases its use does not replace a car journey; the items are purchased for convenience and regular journeys are still made to shopping centres to purchase other items.
- 3.41 The main area where home shopping could reduce car journeys is in grocery shopping, which accounts for around 40% of all shopping trips. The proportion of grocery shopping represented by internet or telephone shopping currently stands at around 5% and 'Smarter Choices' estimates that this could rise to 15% by 2021. The forecast impact of increased home shopping on car traffic in the peak period would be small – around 0.1% by 2021 – though in the inter-peak the reduction would be around 0.75%.
- 3.42 The promotion of home shopping would be likely to come from the private sector and thus no public sector costs need to be estimated.

Public Transport Information and Marketing

- 3.43 One of the perceived difficulties of existing drivers in using public transport is the absence or shortage of readily available information on services. While this is sometimes an excuse rather than a true reason, there is still a need for both enhanced availability and improved design of public transport information. The network of Showcase Bus Corridors, described in Chapter 5, includes the expansion of real-time passenger information at stops which will provide a significant benefit to passengers.

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- 3.44 However, the provision of information needs to be widened and improved, not only at stops but also with a wider availability. This should involve, for example, identifying a number of key centres and preparing plans showing the range of services, routes and destinations available from the stops in the area. To provide further convenience to potential passengers, local maps showing the street plan in the vicinity of the stop and key facilities should be added. Such information could also be added to the Internet.
- 3.45 A key feature of the passenger information is that it must be maintained so that the public can have confidence in its accuracy and reliability. Sufficient resources therefore need to be devoted to the maintenance of the information sources.
- 3.46 There is evidence that the impact of improvements to public transport can be enhanced through effective marketing. In Bristol, following the introduction of the first Showcase bus corridor, it was found that the public transport mode share of groups targeted by marketing increased by 4% while that of the control group only increased by 2%.
- 3.47 However, while the benefits of enhanced levels of public transport marketing are accepted, it is not possible to estimate the level of traffic reduction that may be achieved from a general adoption of this policy. Furthermore, the impacts of the marketing would tend to be short-lived and hence would not have a major long term effect unless the marketing is maintained and updated regularly.

Travel Awareness

- 3.48 As with public transport marketing schemes, travel awareness campaigns are closely linked with other enhancements to the transport system. Similarly, it is not possible to predict the traffic reductions that may be expected from introducing the travel awareness initiatives and thus this measure has not been included in the core GBSTS strategy.

Personalised Travel Plans

- 3.49 Personalised travel plans provide information directly to individuals or households enabling them to make alternative travel choices and reduce car use. As they encourage changes in travel behaviour for trips to work and school, and promote measures such as car sharing, home shopping and tele-working, to consider personalised travel plans in addition to the other 'Smarter Choices' measures would risk significant 'double counting'. For this reason, specific consideration of personalised travel plans has not been included within the GBSTS strategy.

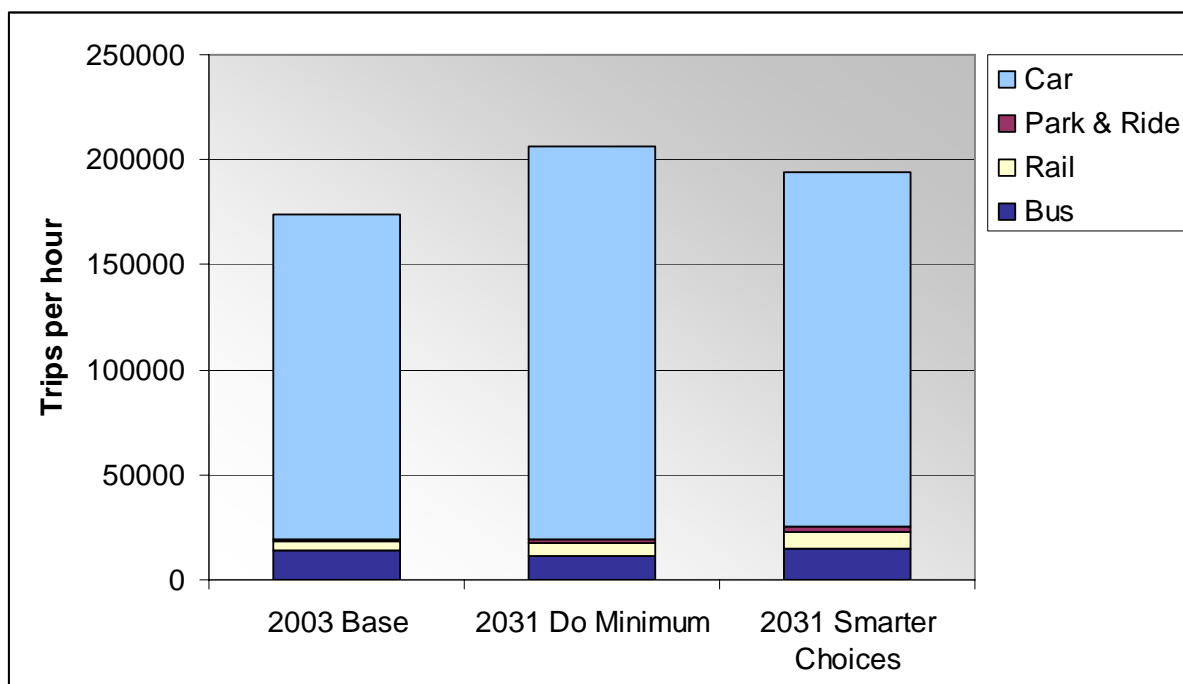
Overall Impact of 'Smarter Choices' on Car Trip Making

- 3.50 The preceding analysis has examined the impact of individual measures designed to encourage changes in travel behaviour. Although the impacts of most of the measures can be added together to provide a prediction of the combined impact, research has shown that, for example, when both WTPs and car sharing policies are pursued, only around 80% of the aggregated benefits can be achieved. On this basis, the effect of implementing the full range of measures outlined above would be a reduction of around 10% in the number of peak period journeys by car across the study area. Using the research in 'Smarter Choices', a proportion of the reduction in

car trips is converted into public transport journeys and is allocated to the public transport network as appropriate; on average, about one-third of the reduced car trips transfer to public transport, although this will vary depending upon the quality of public transport services. For the remainder, the trip is either suppressed and removed from the highway network or adjusted through increased car occupancy. In the assessment of the full transport strategy, the impact of the ‘Smarter Choices’ is examined as a sensitivity test to identify whether the introduction of the ‘Smarter Choices’ avoids the need for other measures.

- 3.51 Figure 3.1 summarises the change in mode split in 2031 as a result of the introduction of ‘Smarter Choices’. Thus, there would be a 9.7% fall in the level of **person** trips by car, reducing the car mode share from 91% to 87%. The increase in public transport use is spread across the three sub-modes with comparable increases in bus (31%), rail (36%) and park and ride (42%).

Figure 3.1 – Impact of ‘Smarter Choices’ on Person Trip Rates and Mode Shares



- 3.52 To achieve this level of impact will require significant and constant investment and resources. Furthermore, as identified at the start of this chapter, without parallel schemes (e.g. demand management) to control the level of traffic induced by the capacity released through the ‘Smarter Choices’ measures, there is the danger that the overall impact would be less than predicted, based on the review of available research.

- 3.53 As the highway network statistics in Table 3.1 suggest, ‘Smarter Choices’ have a potentially large impact on highway congestion. Compared with the Do Minimum, highway trips are reduced by 8%, and total vehicle delay reduced by 32%. Nevertheless, even with ‘Smarter Choices’ in place, the total vehicle delay in 2031 is more than double that in 2003. This highlights that, while ‘Smarter Choices’ may

reduce the need for improvements to the highway network, other solutions are needed in addition to the 'Smarter Choices'.

Table 3.1 – Impact of 'Smarter Choices' on Highway Network Statistics

	2003 Base	2031 Do Minimum	2031 with 'Smarter Choices'	% Change – 2031 'Smarter Choices' compared with 2003 Base	% Change 2031 with 'Smarter Choices' compared with Do Minimum
Vehicle Trips	154200	207000	191100	24.0%	-7.7%
Vehicle Kilometres	1998000	2899000	2665000	33.4%	-8.1%
Vehicle Hours	45200	102600	78600	73.8%	-23.4%
Average Vehicle Speed	44	28	34	-23.3%	20.0%
Mean Journey Length km (per vehicle)	13.0	14.0	13.9	7.6%	-0.4%
Total Vehicle Delay (Hours)	19100	65200	44300	131.5%	-32.1%
Time Lost per Vehicle-Km (seconds/veh km)	34.5	81.0	59.8	73.6%	-26.1%
Vehicle-Hours of Delay per Network Km (veh hrs/km)	6.8	23.2	15.7	131.5%	-32.1%

Impact of 'Smarter Choices' on Public Transport Trip Making

- 3.54 The public transport network statistics in Table 3.2 illustrate the impact on the public transport network of mode switching due to the implementation of 'Smarter Choices'. With no capacity enhancements, it is unlikely that the public transport network would be able to cope with such a widespread increase in demand. On the rail network, the level of crowding increases threefold compared with the Do Minimum. This equates to around 10 times the level of crowding experienced by passengers in 2003. Thus, it is vital that the implementation of 'Smarter Choices' is in association with other improvements to the transport system. In particular, increased public transport capacity is required to cater for the additional public transport demand generated by the 'Smarter Choices'.

Table 3.2 – Impact of ‘Smarter Choices’ on Public Transport Network Statistics

	2003 Base	2031 Do Minimum	2031 with ‘Smarter Choices’	% Change – 2031 with ‘Smarter Choices’ compared with 2003 Base	% Change – 2031 with ‘Smarter Choices’ compared with Do Minimum
Passenger Kilometres by Public Transport Sub-Mode					
Bus	104000	80000	117000	13%	46%
Rail	601000	637000	755000	26%	18%
Crowded Time (Passenger Hours)					
Rail	300	1000	3700	930%	209%

LAND USE ISSUES

- 3.55 The relationship between land use patterns and the transport system is well-appreciated. People need to travel between places in order to undertake their desired activities and thus the pattern and scale of development influences the pattern and scale of travel. Conversely, changes in accessibility brought about by adjustments to the transport system influence the uses made of available land and the locations where activities are undertaken.
- 3.56 Land use changes have had a significant impact on facilitating and encouraging the increase in the demand for car travel over the last 25 years. During this time, there has been some implicit travel demand management in the denser urban areas through rationing by congestion. This has had the impact of producing a major switch in population patterns away from congested urban areas where cars are costly to keep and run, and into suburban or rural areas where cars are easier to park and traffic speeds are higher. Research on national travel patterns over time has highlighted that people ‘appear to have a need to travel to find resources and to socialise. Individuals have, on average, spent 55-65 minutes a day travelling since records were first kept’³. So, the impact of improving the highway network has been to encourage people to travel further within the given available time and hence workplace and home have tended to become more remote. In the same way, the impact of increasing congestion, especially in the outer suburbs, would be to encourage a movement back into central areas.
- 3.57 Urban road improvements and the level of congestion have certainly not been the sole cause of population decentralisation, but they have acted as major contributory factors. There is already evidence of some recent changes in these trends: increasing road congestion has encouraged significant growth in rail movements within the study area although absolute rail demand levels are low.

³ Intelligent Infrastructure Futures Project Overview, Office of Science and Technology, Department of Trade and Industry, (Jan 2006).

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- 3.58 The construction and improvement of the strategic road network has resulted in the generation of a series of developments within the GBSTS area. These developments represent a wide range of different land uses: residential, retailing, industrial, warehousing, etc. However, in many cases, the transport system has not kept pace with the traffic generated by the new developments, with the resulting increase in the level of congestion within the local road network. This is especially true in the North Fringe. This stems from a time when there was little integration between land use and transport planning policies. Many of the new developments were located in or adjacent to the Green Belt, creating additional pressures on the Green Belt with consequent environmental problems. Furthermore, the growth of the out-of-town developments, principally at Cribbs Causeway, was at the expense of the traditional urban centres which therefore experienced a significant decline with resulting economic problems. Finally, the out-of-town centres were designed with car access in mind and hence the centres frequently experienced low levels of public transport service thereby increasing the social exclusion for those without access to private transport.
- 3.59 The choice made by households about where to live is based on a complex number of factors including the size of the household, its age composition, number of workers, available schools, cost of housing, etc. However, once the family has found the house that they can afford, in an area where they wish to live, they are generally reluctant to relocate when one of the household members seeks alternative employment. Changes in the general employment market in recent years have strengthened the effect because of:
- ◆ an increased number of temporary and short-term contracts;
 - ◆ a greater likelihood that both partners in a household are in employment and hence it becomes less likely that the household will move home when one partner changes jobs; and
 - ◆ the perception that jobs are less secure and hence people are unwilling to move house to be nearer to a job that they may wish, or need, to change in the foreseeable future.
- 3.60 The diminished desire to move home is exacerbated by the costs involved in house sale and purchase, especially with the increase in property prices and the extra costs due to Stamp Duty.
- 3.61 The overall impact of such effects is that, due to the reluctance to change the home location, when seeking new employment the potential catchment area is drawn based on the available transport system – the road network and public transport services. As the highway network has been extended and improved in the past, so the employment catchment area has widened and the level and length of commuting has increased. Although congestion may have dampened the impact slightly, often the reaction has been to change the time of travel (especially to a time before the morning peak and after the evening peak periods) in order to avoid the main congestion. Hence, there must be an awareness of the implications of the location and form of new land use developments on the transport systems when the details of the spatial developments are being confirmed.
- 3.62 The starting point for the development of transport strategies within the study was the spatial development forecasts prepared by the WoEP. Our primary task was to design a transport system which best served the given land use pattern in Scenario
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F. However, within the linkage between land use and transport, the form and density of any development can have a significant impact on the associated volume of travel.

3.63 Land use policies which may encourage both a reduction in the total volume of travel and a decreased use of the car include:

- ◆ concentrating developments within transport corridors and near to public transport nodes;
- ◆ mixing development so that homes are closer to schools, workplaces, shops and leisure facilities; and
- ◆ increasing the density of development so that more facilities can be reached within a given distance.

3.64 One argument against policies of this kind is that they tend to concentrate development where land is in shortest supply and where it is most costly to provide transport improvements. That aside, the policies ought, in principle, to reduce the need for travel. The three key questions are:

- ◆ would they actually result in less travel?
- ◆ how quickly could they have an effect?
- ◆ how much effect could they have?

3.65 Rather than inducing less travel, policies of concentration simply provide people with more choice within any given travel budget and, as a result, the effects are quite muted. Thus, on their own, land use policies might not have a large effect, but if they could be supported by other traffic restraint policies e.g. workplace travel plans, public transport improvements, the effects could be more significant. Moreover, in established areas where the need for regeneration is not strong, the pace of redevelopment is likely to be slow, thereby limiting what these policies can achieve within reasonable time frames. That is not to say that these policies are not worth pursuing; they are probably a step in the right direction, but, on their own, they will not lead to large reductions in traffic in short or medium timescales.

3.66 In summary, there are four points of particular note about land use policies:

- ◆ policies which, in principle, reduce the need for travel by mixing development and which focus the demand for travel on the public transport system are worthy of support;
- ◆ however, even though land use policies may reduce the need for travel by car, on their own, they would not be sufficient to reduce travel by car significantly – some other measure would be required to encourage or coerce people to use the facilities nearest to them;
- ◆ moreover, development in established areas is renewed at a relatively slow rate and therefore the effects of land use policies can take a long time to feed through into reduced car travel; and
- ◆ even if planning policies which reduce car travel are adopted, and people reduce their car travel voluntarily, and the rate of re-development is high, it is still necessary for the policies to be enforced for their effects to be felt – the desire for more jobs or housing often compromises the strict application of land use policies.

- 3.67 There is a strong need for increased quality in the general design of new developments, including the provision and incorporation of transport measures. Recent research undertaken by the Commission for Architecture and the Built Environment into private housing projects undertaken in the north of England over the past three years identified that 94% of the projects failed to provide the necessary design quality, including the provision and design of transport facilities. These results confirmed the conclusions from an earlier examination of developments in the south of England. Hence, there is strong evidence that more attention and efforts need to be taken in the design of the new developments proposed for the study area in the future.
- 3.68 One of the primary reasons that strategic roads fill up with new traffic so quickly after being built or widened is because new developments spring up close to them and it is often difficult for the planning and highway authorities to resist these development pressures. Clearly, a policy of restricting certain kinds of development (e.g. offices) at interchanges would avoid much localised congestion, both on the trunk road itself and on the connecting roads, although, of course, there are other kinds of development (e.g. warehousing and distribution centres) which are better located near to a motorway than elsewhere.
- 3.69 In terms of employment locations, there is a large number of competing sites in the study area, with the result that the planning system has great difficulty in influencing the overall pattern of development. The planning system is, generally, more effective in controlling residential and retail developments than other forms of development. However, in the case of residential development, the planning system cannot control the destination of trips from residents – i.e. their place of work.
- 3.70 The current position is one in which existing investment in the motorway network has resulted in strong pressures for development of traffic intensive facilities close to entry/exit points. These pressures remain, despite growing levels of motorway congestion.
- 3.71 It is recognised that certain kinds of development are acceptable, or even desirable, in proximity to motorway junctions. For example, warehousing and distribution in these locations can be argued to reduce heavy good vehicle mileage on less suitable roads. The problems arise where proposed developments are intensive in employment or retail terms, and hence are likely to be major traffic generators.
- 3.72 There may also be a need for a strengthening of policies. In particular, it may be argued that proponents of employment or retail developments close to motorways should have to provide evidence that modal shares for public transport, walking and cycling would be significant. Given that current Government policy identifies town centres as the preferred location for major employment and retail development, forecast non-car modal shares could be required to be of the same order of magnitude as is generally achieved for town centres. For most motorway junction sites, such non-car mode shares would not be achievable. In such cases, even if a suitable alternative town centre location is unavailable, logic, from the point of view of the management of the road system, suggests that the application should be refused.

SUMMARY

- 3.73 Before embarking on measures that are potentially costly in resources or finance, in developing the transport strategy it is important to explore measures which are designed to influence the decision to make a journey or to encourage the use of alternative modes.
- 3.74 The transport strategy has been prepared against a background of significant developments in population and employment. The design and implementation of the new developments should be planned so as to reduce the total volume of travel and encourage the use of alternative modes to the car. Such policies should include the concentration of developments within transport corridors easily served by public transport; the creation of a mix of developments so that more activities are easily reached by walking or cycling; and an increase in the density of development such that there is a choice of facilities within a specified distance. Furthermore, the design of developments (especially major residential schemes), should pay particular attention to their operation in the most sustainable way.
- 3.75 Although detailed schemes to enhance walking and cycling are outside the scope of a strategic study like GBSTS, there are nevertheless benefits to be achieved from providing attractive schemes and facilities to encourage greater levels of these activities. At the same time, other policies, such as demand management or 'Smarter Choices' will encourage the use of alternative modes and hence will stimulate walking and cycling, if the supplementary measures are in place.
- 3.76 The expansion of initiatives under the heading of 'Smarter Choices' can have a positive impact on the overall volume of travel and the level of car use. Some of the policies contained in 'Smarter Choices' are within the responsibility of the public sector including workplace travel plans, school travel plans, car sharing and car clubs. The unitary authorities within the Greater Bristol area already actively pursue these measures, and it is vital that renewed and enhanced efforts are made to expand their coverage. This will require a continuous application of resources to maintain the impetus and continue the level of benefits. The impact of 'Smarter Choices' would be strengthened and supported by other policy measures such as demand management which would provide further encouragement for the use of alternative modes. It is estimated that a comprehensive policy of 'Smarter Choices' combined with other complementary measures could reduce person trips by car by around 10%. Other elements of 'Smarter Choices' could include tele-working, tele-conferencing and home shopping; while these features would contribute to the use of alternative modes, much of the initiative behind them would come from market forces and the savings and benefits obtained by the private sector. Hence, because they are generally outside the control or influence of local authorities, their promotion is not included in the GBSTS transport strategy.
- 3.77 It will be important to develop the full potential of the range of approaches to encourage alternative modes before embarking on major infrastructure developments. However, there needs to be awareness that continued promotion of the measures is necessary if the full impact is to be achieved and maintained.

4. Demand Management Measures

INTRODUCTION

- 4.1 Chapter 2 highlighted the growth in the demand for travel by 2031, linked to the general increase in travel demand and the specific impacts of individual developments. It would not be feasible, or desirable, to satisfy the full extent of projected car usage by the provision of additional capacity on the highway network. Hence, within the transport strategy, it is important to explore ways of effectively controlling the growth in demand for travel by car while at the same time providing more attractive public transport alternatives before considering extensions to highway capacity. Such measures to control car demand would also act to support the policies, outlined in Chapter 3, to encourage the use of alternative modes. Within this chapter, we describe the impact of measures designed to manage the demand for private car use before examining public transport improvements in Chapter 5 and highway measures in Chapter 6.
- 4.2 There is a wide range of potential measures that can play an important role in influencing and controlling the volume of travel across the GBSTS study area, and the proportion of that travel that is undertaken by the private car. While many of the measures can be undertaken immediately (and many are already being employed by some or all of the unitary authorities as part of their current transport policies), many additional potential measures are not yet available. In some cases, the measures would require new legislation and may not be implemented for several years, perhaps towards the end of the GBSTS horizon of 2031.
- 4.3 In examining the available measures and their potential impacts, it is therefore important to distinguish between policies that can be implemented immediately and those that will require considerable development time and resources. In the latter case, it would not be prudent to develop an overall transport strategy that is critically dependent upon measures that have such a high risk associated with them. This is particularly true of various forms of road user charging which would require a combination of additional legislation, new technology and the resolution of significant technical and policy issues before they could be implemented, and may be more appropriate as part of a national scheme. As a result, the transport strategy has two elements within the heading of demand management measures: firstly, using conventional demand management tools and secondly including more innovative, charging-based policies and techniques.
- 4.4 Within the development of the transport strategy, there is therefore a distinction between the policies that are available at different stages in the timescale for the study:
- ◆ short term – parking controls and other existing policy instruments;
 - ◆ medium term – introduction of workplace parking charges and local vehicle charging measures; and
 - ◆ long term – application of wider regional or national charging measures.
- 4.5 Within this structure, the use of parking controls is considered before moving to various forms of charging for the use of different parts of the highway network.

PARKING CONTROLS

- 4.6 There are several forms in which parking controls may have an impact on the use of the private car, each of which is currently implemented in various ways by the four unitary authorities in the GBSTS study area:
- ◆ increased or improved enforcement of existing parking controls;
 - ◆ varying the cost of parking – this could include changes to the general charge level, the structure of charges or the area covered by the charging system, although the latter may also require increased resources for enforcement;
 - ◆ controls on the number of spaces available, including a reduction in the absolute number of spaces, controlled levels of growth or restrictions in parking availability at specific times of day or for certain types of vehicle or driver;
 - ◆ limits to the availability of spaces for specific categories of user, e.g. the introduction of controlled parking zones or the allocation of parking places to specific users, e.g. the disabled or drivers of vehicles with a high vehicle occupancy; and
 - ◆ parking standards – controls on the maximum number of spaces provided in new developments.
- 4.7 Most of the measures identified above can be introduced or amended within a relatively short period of time and hence would have an early impact on demand. The exception is with parking standards which, although existing standards might be adjusted quickly to control the maximum permitted number of spaces, the speed with which they might reduce traffic levels would be dependent upon the rate at which new developments are completed. Hence, the policy will be effective in only a limited number of locations and over a lengthy period.
- 4.8 Parking controls are usually introduced and applied in major centres of activity such as town or city centres or local suburban centres. However, there is no reason, in principle, why the controls could not be introduced over wider areas, although the costs of enforcement would increase and resources would be spread over a wider area. Within the GBSTS study area, there is the additional constraint that parking at the main out-of-town shopping centre at Cribbs Causeway, which has about 10,000 spaces, is outside the control of the unitary authority and hence there is limited opportunity to use parking controls to influence the use of the private car at this site. Given the importance of Cribbs Causeway to traffic movements in the study area (especially in the north of the area and on the motorway network), this represents a restriction in the ability of the unitary authority to control traffic levels on the highway network in the area.
- 4.9 With increased parking controls, it is likely that there would be some induced traffic both in the controlled area and immediately outside it (where congestion is reduced as a result of parking restraint). Hence, other traffic restraint measures would also be required to supplement the effects of parking controls if they are to be fully effective. In addition, controls which limit the availability of parking spaces are likely to increase the volume of circulating traffic in search of spaces. The introduction of workplace travel plans or workplace parking charges could also require additional on-street controls (e.g. controlled parking zones) and enforcement, potentially over a wide area. This would therefore lead to the need for the development of a comprehensive area-wide parking plan.

- 4.10 An additional important factor with the introduction of parking controls is that they are an important potential source of revenue for the unitary authorities which in turn provides a means of redressing some of the adverse effects of traffic restraint, through investment in beneficial complementary transport projects, especially improvements to public transport.
- 4.11 Table 4.1 shows the results of testing parking restraint using the Greater Bristol Model, indicating that increased parking restraint would have a modest impact on delays across the study area in 2031, but could generate significant revenues.

Table 4.1 – Impact of Parking Controls

Measure	Reducing Parking Capacity	Doubling Public Parking Charges in City Centres
<i>Change compared with Background Transport Strategy</i>		
Car Trips	-0.2%	-1.0%
Total Vehicle Kilometres	+0.0%	-0.4%
Average Journey Length	+0.1%	+0.4%
Total Vehicle Delay	-0.4%	-2.6%
Average Vehicle Speed	+0.2%	+1.1%
Estimated Annual Gross Revenue (in 2003 prices)	n/a	£30 million

- 4.12 Although increased parking charges and extensions to the coverage of parking controls could produce additional revenue for use in complementary measures, the variations in charges will need to take into account factors other than those related specifically to controls in private car usage. In particular, the levels of charges in town or city centres could have a significant impact on the level of retail activity and hence the economic prosperity of the area. Hence, any increases in parking charges would need to reflect this, perhaps by limiting the increases in charges during off-peak periods or for short stays so as to restrict the impact on shopping activities which are a major influence on the commercial prosperity of the area. Furthermore, not all parking revenue accrues to the public sector; there are significant volumes of parking capacity within the private sector. Revenue from these spaces is therefore not available for reinvestment in complementary measures.
- 4.13 In order to control traffic levels using parking policy instruments, the strategy should therefore include:
- ◆ increasing parking charges at rates above the level of inflation, with particular attention to long stay rates charged to commuters, rather than short term charges for shoppers;
 - ◆ controls on the number and availability of parking spaces;
 - ◆ increased enforcement;
 - ◆ introduction of controlled parking zones on the periphery of the central areas and in locations where there is significant on-street employment-related parking;

- ◆ exploration of ways of controlling traffic levels at Cribbs Causeway; and
- ◆ introduction of more stringent parking standards at new developments, coupled with Travel Plans and 'Smarter Choices' described in Chapter 3.

WORKPLACE PARKING CHARGES

- 4.14 The 2000 Transport Act provided local authorities with the powers to introduce workplace parking charges, by which employers incur charges based on the availability of parking spaces provided for staff.
- 4.15 With no practical experience in the UK of implementing workplace parking charges, it is difficult to assess fully the effectiveness of the measures. In the first instance, the workplace charge would be incurred by the employer. Its effectiveness as a mechanism for reducing traffic is likely to be dependent upon the extent to which employers pass on charges to the users of the parking spaces, i.e. their employees, who are making the decision about which mode to use for the journey to and from work. There is the strong possibility that employers would not pass the charge onto the employee. Even if there was an obligation on the employer to pass the charge onto the employee, salary levels could be increased to compensate, if the employer was concerned about potential problems of staff retention. Hence, the impact on reducing traffic levels would be muted.
- 4.16 The introduction of the charge would, however, encourage employers to reduce the number of parking spaces on the site and, in parallel, provide an impetus for an active workplace travel plan to influence the travel behaviour of employees. Thus, the workplace charging scheme could be seen as a complement to travel plans, described in Chapter 3.
- 4.17 To be **fully** effective, the introduction of workplace charges would need to be combined with measures that:
- ◆ oblige employers to pass the charges onto the users of the parking spaces;
 - ◆ control the level of induced traffic; and
 - ◆ manage the volume of longer distance traffic that re-routes through the area in which parking is controlled.
- 4.18 Table 4.2 shows the results of testing workplace parking charges in the North Fringe area in 2031. The test assumes that employers pass the charges on to the users of the parking spaces, but takes into account the potential for induced traffic and the effects of the re-routeing of longer distance traffic. The results show that the workplace charge would have a greater impact on congestion and generate more revenue than increasing city centre parking charges because, by including private non-residential spaces, it involves more parking activity.
- 4.19 It should be highlighted that an obligation for the employer to pass on the charge would require a change to the existing legislation. Even if legislation were introduced, it is doubtful if the obligation to pass on the charge would be fully effective; employers could simply compensate employees through a higher salary (in order to attract or retain staff) and hence there would be little deterrence. Thus the impact on congestion shown in Table 4.2 indicates the upper end of what could be achieved.

Table 4.2 – Impact of Workplace Parking Charges

Measure	Workplace Parking Charge (£5 per day)
Change compared with Background Transport Strategy	
Car Trips	-0.5
Total Vehicle Kilometres	-0.1
Average Journey Length	+0.3
Total Vehicle Delay	-0.8
Average Vehicle Speed	+0.3
Estimated Annual Gross Revenue (in 2003 prices)	£10 million

- 4.20 The potential imposition of workplace charging could result in either fewer parking spaces in new developments or the release of land currently used for parking in existing developments. However, the magnitude of the latter effect is likely to be limited because the packages of land would be small and it could take a long time to work through into changes in traffic levels.
- 4.21 Furthermore, where there is a predominance of office-based employment in leased accommodation, there would be a need to ensure that the workplace charging extends over the wider area, otherwise at the end of the lease, the employers may relocate out of the area covered by the workplace charge.
- 4.22 While we do not therefore see workplace charging as a major long term element of the transport strategy for the whole GBSTS area, there will be benefits from a local scheme in locations which are not otherwise subject to significant controls on car use (e.g. the North Fringe). Advantage should therefore be taken within the scope of the newly-created Transport Innovation Fund (TIF) to further develop this scheme. At the same time, with the operation of workplace travel plans in the area, the two measures will enforce each other.

ROAD USER CHARGING

- 4.23 Charging for use of the road network by private vehicles could take a number of forms. All such schemes would create benefits and disbenefits for different users of the transport system in terms of changes in journey times, vehicle operating costs and the level of charges paid. In line with the 2000 Transport Act, receipts from any charging scheme would need to be hypothecated to fund other transport initiatives in the area, which should then create further benefits to transport users.
- 4.24 For a road user charging scheme to be worthy of implementation, it should:
- ◆ be good value for money, taking account of environmental and safety impacts, economic benefits and disbenefits, and the costs of implementation, operation and enforcement;

-
- ◆ be acceptable in terms of the distribution and equity of its impacts, particularly in terms of its effects on social exclusion; and
 - ◆ be financially viable, practical and broadly acceptable to the public.
- 4.25 Ideally, the charges should be set so as to yield the maximum net benefits to society as a whole. In principle, to achieve this, charges would need to vary by area, by road type, by vehicle type, by time of day or by the level of congestion. However, there will be limits to the variations that would be practical to implement and acceptable in practice if they are to be fully understood by the public. To be effective in influencing behaviour, the driver would need to know the likely charge before setting out. If there are too many potential reasons for variations to the charge, the lack of transparency could influence the successful operation of the scheme.
- 4.26 Benefits from the introduction of charging measures accrue to continuing road users as a result of reduced congestion, which arises because of the lower traffic levels in the road network. Disbenefits to the current road users arise in a number of ways, if, as a result of the charge, they decide to change their existing journeys to a less preferred alternative, including a change of mode, a change of destination or the suppression of the trip. People who change mode will experience a loss because the trip by the new mode will be less desirable or convenient in some sense than the current car trip, otherwise they would have used the new mode initially. Similarly, travel to the new destination will be less desirable or convenient than travel to the original one. If they are deterred from travelling at all, car drivers will clearly experience a loss of benefit in some form through their inability to undertake the desired activity at the destination.
- 4.27 If congestion is sufficiently high, the benefits arising from reduced congestion and faster travel times on the road system will outweigh the penalties experienced by those who are deterred from travelling as they wish. Thus, charging in areas where congestion is high will often yield a positive net travel time benefit, but charging in areas where congestion is lower may not actually yield a net travel time benefit.
- 4.28 There may also be some potentially undesirable side-effects, such as extra traffic and development pressures on roads which, without the charging system, would be relatively uncongested and therefore would potentially attract lower than average charges. In principle, the charging structure could be set up so that people pay for the costs they impose on society, whether in the form of congestion, accidents or environmental impacts.

Urban Congestion Charging

- 4.29 Charging for the use of the road network in urban areas by private vehicles could take a number of forms:
- ◆ charges for using a single link (e.g. a bridge toll) or one of a series of links forming a cordon around an area, with charging levels possibly varying by direction, time of day, type of vehicle, etc;
 - ◆ payment for a supplementary licence – either a charge to enter an area (an entry permit) or to travel within an area (an area licence);
 - ◆ congestion metering – a charge which reflects the congestion caused by each driver, varying according to traffic conditions;

- ◆ time-based charging – a charge which is proportional to the time spent travelling within the charged area; and
 - ◆ distanced-based charging – a charge directly linked to the distance travelled within the charged area.
- 4.30 With point-based or cordon charging, drivers would be charged for entering an area (for example inside Bristol Inner Ring Road), and a number of pay stations could be required to cover such an area adequately. Through the use of electronic payment and monitoring systems, the need for pay stations can be minimised. Supplementary licences charge for access but, once a payment has been made, the amount of travel is unlimited. The Mayor's scheme for central London is a form of supplementary licence.
- 4.31 The schemes that have been considered in the past for Bristol and Bath city centres are a form of cordon charge with drivers paying each time they cross the cordon. There is merit in such schemes, although attention needs to be paid to the location of the cordon so that it is sufficiently large to influence the behaviour of a number of drivers; a small cordon would have little impact on overall traffic levels, although it could represent a means of testing the technology and payment systems as well as a source of revenue for investment in other transport improvements and a way of introducing the principle of charging. A large cordon, on the other hand (for example along the broad alignment of the Avon Ring Road), would mean that a large number of journeys are made wholly within the cordon and hence would not be intercepted by the charging system. A number of alternative alignments for a cordon charge have been examined by the study including an intermediate cordon midway between the Inner and Avon Ring Roads.
- 4.32 Further work is necessary to examine the full range of impacts of individual cordon alignments. A bid for funding under the Transport Innovation Fund for the further development of a cordon charging scheme for Bristol City Centre has been submitted recently to the Department for Transport and such a scheme is supported as an important initiative in the short/medium term.
- 4.33 Distance-based charging can now be achieved, in principle, through the use of GPS-based systems which are being developed for use in many parts of the world although a number of technical, administrative and political issues need to be resolved before a full system can be implemented. In the earlier section on parking controls, it was explained how the removal of traffic can cause secondary effects such as induced traffic and the re-routing of traffic previously travelling around the controlled area. Congestion metering has the advantage that it can be used to control the amount of new traffic that would be induced when congestion in an area is reduced.

Inter-Urban or Motorway Charging

- 4.34 Motorway charging could be applied in order to fund improvements to the motorway system or to reduce demand on the motorways, particularly at peak times.
- 4.35 Studies of this mechanism have shown that the most likely reaction of drivers to a charge for use of motorways is to divert to the uncharged roads, and changes in overall demand are likely to be small by comparison. While this achieves the objective of reducing congestion on the charged roads, congestion, accidents and

environmental nuisance would all increase on the parallel uncharged roads. The propensity of drivers to divert away from motorways is dependent on the availability of other routes, on the comparative levels of congestion on charged and uncharged roads and on the size of the charge. For example, in the GBSTS study area, it would be feasible to introduce tolls on the M5 Avonmouth Bridge. As the alternative routes are fairly limited, the demand for the motorway is likely to be relatively inelastic to increases in the toll. However, if the construction of a parallel Avon Crossing was also included in the strategy, the demand for using the motorway would be more elastic because there would be more opportunities for traffic to divert from the motorway onto local roads, particularly onto the second Avon Crossing. Hence, the two crossings would need to be included in the charging system.

- 4.36 Charging is also an important instrument in avoiding the benefits of transport investments being diluted by the impact of induced traffic. By including charges on the new links, e.g. a second Avon Crossing, it would be possible to control the level of induced traffic and hence 'lock in' the benefits of journey time savings from the new investment so that they are not eroded by increased traffic levels and hence lower speeds and less journey time savings.
- 4.37 If tolls were located on the entry to the motorway and hence the charge on drivers was not dependent on the distance travelled, this would tend to reduce the use of the motorway by those people only travelling for a short section on the motorway. For example, as a fairly large proportion of the traffic crossing the M5 Avonmouth Bridge is of this kind, entry tolls could be an effective means of managing demand on such sections of the motorway.
- 4.38 In contrast to urban congestion charging, it is rare for motorway charging to be economically beneficial. This is because the disbenefits caused by traffic diverting from the motorway onto other roads will generally outweigh the benefits from reduced congestion on the motorway. For this not to be true, motorway congestion would have to be very severe and the uncharged roads relatively uncongested, and these conditions are rare and certainly not found within the study area. So, while motorway charging can provide revenues, it does not generally yield economic benefits.

Area-Wide Congestion Charging

- 4.39 The impacts of urban congestion charging schemes, especially those confined to central areas (such as the Mayor's scheme for London and the schemes considered in the past for Bristol), will dissipate quite rapidly outside the charged area. The impacts of this kind of scheme on strategic traffic, e.g. on the M4 and M5, may therefore be quite limited. As explained in the previous section, applying charges to traffic using the motorways alone could cause significant diversion of traffic onto the uncharged non-motorway roads, which would be undesirable because of additional environmental nuisance, accidents and congestion. In other words, motorway charges on their own would simply move traffic and the related problems from the motorways to the non-motorway roads.
- 4.40 In order to reduce traffic on the motorways without causing major diversions to the local road network, congestion charging could be extended to cover all roads. This area-wide approach would provide a means of reducing congestion and controlling traffic levels across the network as a whole, thereby minimising the likelihood of additional traffic being induced due to reduced congestion. Furthermore, the

introduction of area-wide charging in parallel with other transport measures, e.g. parking controls or workplace travel plans, will tend to reinforce the other measures by controlling the level of induced traffic.

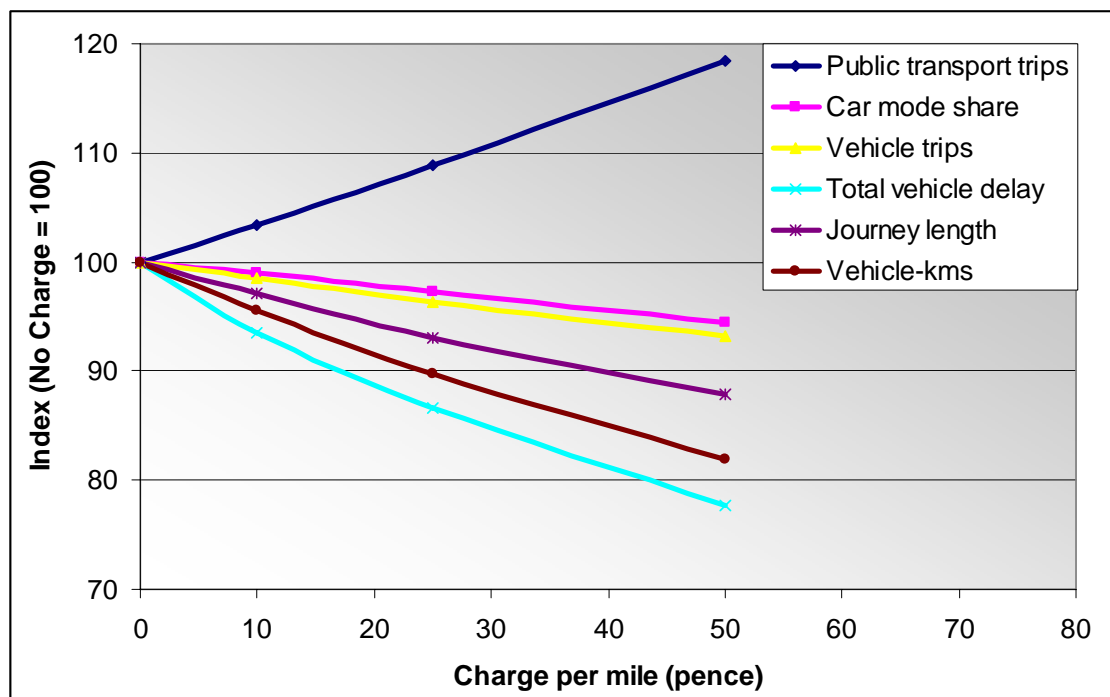
- 4.41 The revenue from an area-wide system, net of the costs, is expected to be very considerable. For the economy of the charged area to benefit, the net revenues should be spent in the charged area. As noted above, it is important that the revenues are spent wisely, so that the expenditure or investment of the revenues itself brings further benefits.
- 4.42 The DfT is currently investigating the possible implementation of a national road pricing scheme which would cover all roads. Its work has been focusing on:
- ◆ developing a scheme that is not too complex or costly to run;
 - ◆ establishing the technological options for a reliable and cost effective system of recording distance, place and time of travel; and
 - ◆ establishing safeguards to protect privacy of individuals and to ensure that an appropriate price is charged for each journey in a way that the motorist can see and understand.
- 4.43 Such aspects raise a range of issues and in order to ensure that full consideration is given to all the issues and allowing sufficient time for debate, legislation, preparation and implementation, the Government's view is that such a national approach would not be feasible until after 2021. However, within the current bids for funding under the Transport Innovation Fund, there is the potential for schemes promoted by local authorities which have some of the characteristics of the possible national scheme to be introduced within a shorter timescale.
- 4.44 There had been a separate scheme to introduce distance-based HGV charging, which was due to be implemented in 2008, and hence could pilot some of the techniques and help to inform the debate on a future wider scheme extended to all traffic. However, the Government announced that the plans for the HGV scheme have been shelved and will now be considered as part of the wider national road pricing proposals, and hence could not be implemented before 2021.
- 4.45 Within GBSTS, alternative forms of area-wide charging have been assessed:
- ◆ distance-based charge applied at a standard rate on all roads in the study area; or
 - ◆ variable charge linked to the level of congestion on individual roads.
- 4.46 With the distance-based charge, a wide range of different charge levels were examined ranging from 10p/mile to £1.25/mile, applied to all roads in the study area.
- 4.47 The area-wide distance-based charge was applied across the whole study area and, as would be expected, the impact increases at higher charge levels (see Figure 4.1), although the additional effect of an incremental increase in the charge reduces very slightly at higher charge levels. In addition, for simplicity, the tests assumed that the same charge would be applied to all vehicle types. In practice, a differential charge might be introduced, e.g. for HGVs. As noted above, until recently the Government had plans to introduce an initial distance-based charging scheme for goods vehicles which had the broad support of the UK freight industry which felt that the charge

would have the impact of equalising operating costs, especially with foreign based vehicles which currently have lower operating costs. Operators of goods vehicles perceived significant benefits from the introduction of area-wide road user charging, with the impacts of significant improvements in journey time reliability, a key aspect of freight operations.

4.48 At the 25p – 50p per mile level, the charge has a very significant impact, resulting in:

- ◆ 5%/10% reduction in car trips (at 25p/50p respectively);
- ◆ 13%/22% reduction in total vehicle delay;
- ◆ 7%/12% reduction in average journey length;
- ◆ 23%/51% increase in bus passenger km; and
- ◆ 10%/20% increase in rail passenger km, leading to an increase in rail crowding of 33%/73%.

Figure 4.1 – Impact of Distance-Based Area-Wide Charging



4.49 For the congestion-related charge, the research undertaken by the DfT within its Road Pricing Feasibility Study was adapted to provide relationships between the level of congestion (defined by the volume to capacity ratio – V/C) and the level of charge. These relationships are presented in Figures 4.2 and 4.3 which highlight the variations in charge due to the level of congestion for different types of road, distinguishing between urban and rural areas.

Figure 4.2 – Urban Area Charge by Road Type and V/C Ratio

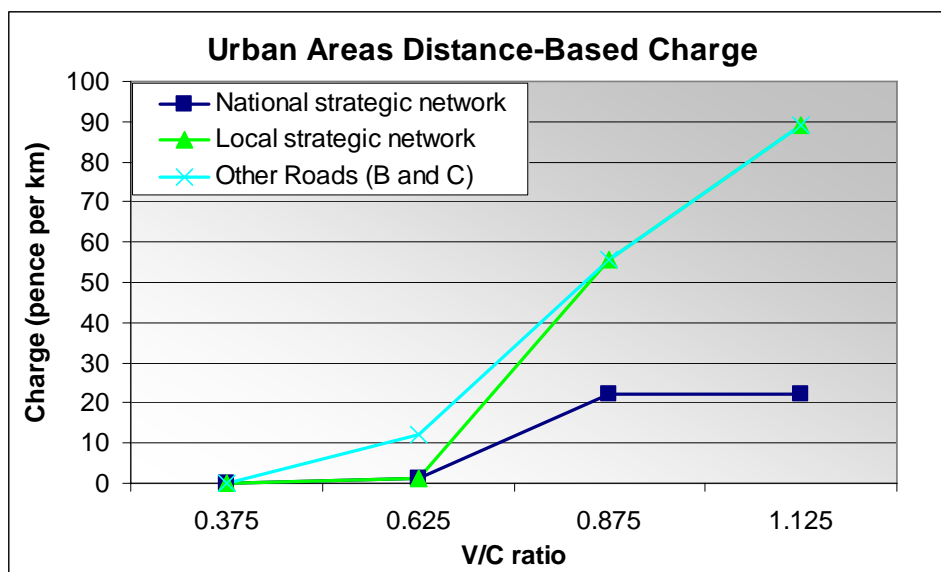
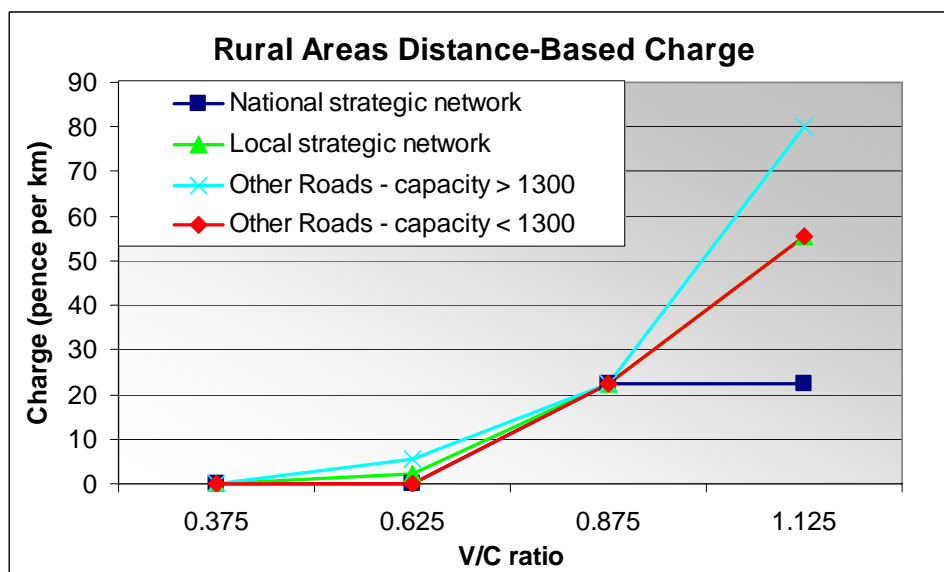


Figure 4.3 – Rural Area Charge by Road Type and V/C Ratio



4.50 If the variable congestion-related charge system was introduced, based on the relationships between charge and capacity utilisation in the curves in Figures 4.2 and 4.3 then across the study area in 2031 the average amount paid by drivers would be 14p/mile.

4.51 Figure 4.4 shows the change in morning peak hour traffic levels on the strategic road network with the variable charge producing flow reductions on most roads within the study area. The exceptions are on the M48 Severn Crossing (where traffic re-routes from the M4 Severn Crossing), on the M49 and on a few rural roads.

4.52 Figure 4.5 shows links brought below the 85% capacity threshold by the variable charging scheme. These are shown in green, while links still above 85% capacity in

spite of the congestion-related charge are shown in red. This demonstrates that the variable charge relieves capacity problems on motorway links, including the M32, as well as within the urban areas. The only motorway link remaining above the threshold is M4 J20-19, which previous GBSTS work has identified as being under **considerable stress** in 2031.

Figure 4.4 – Difference in Flow between Variable Charge Test and Do Minimum

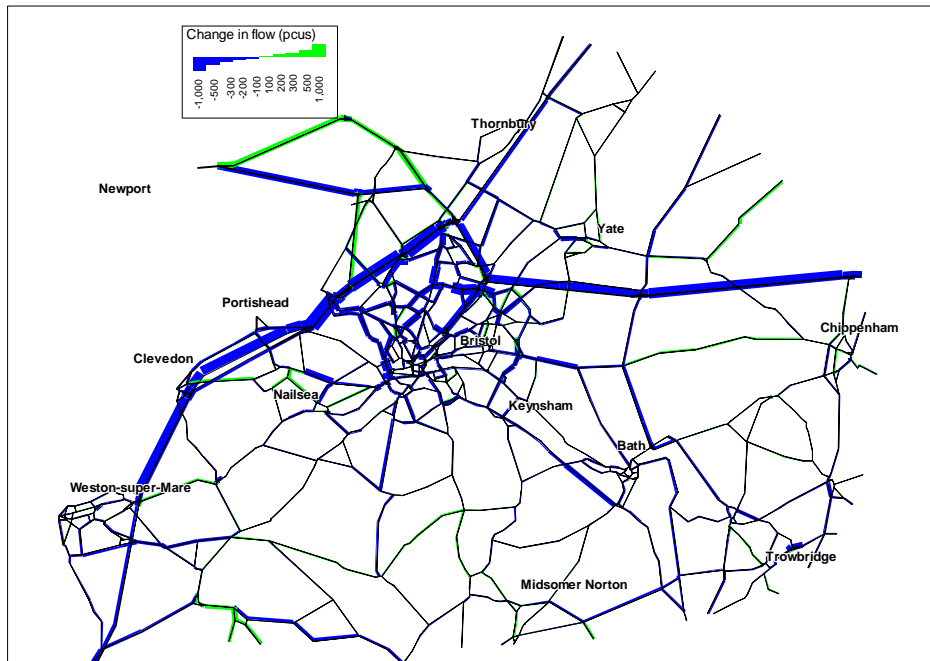
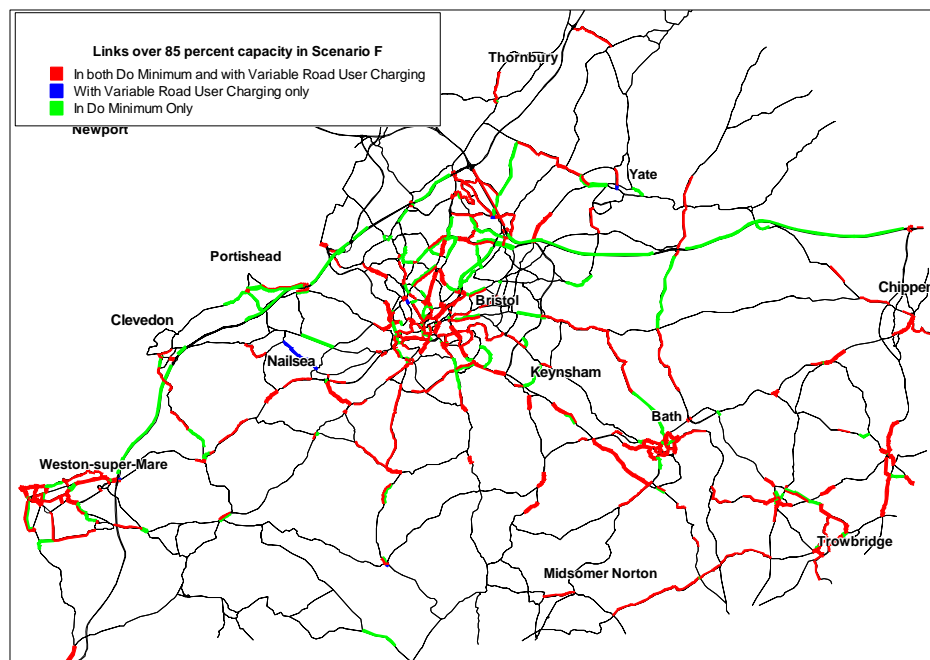
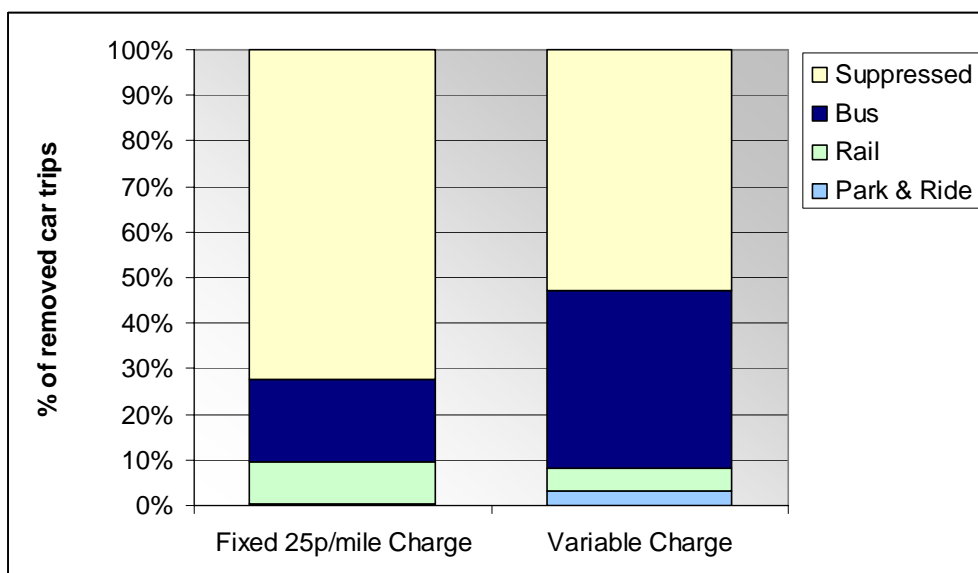


Figure 4.5 – Difference in Capacity Utilisation between Variable Charge Test and Do Minimum

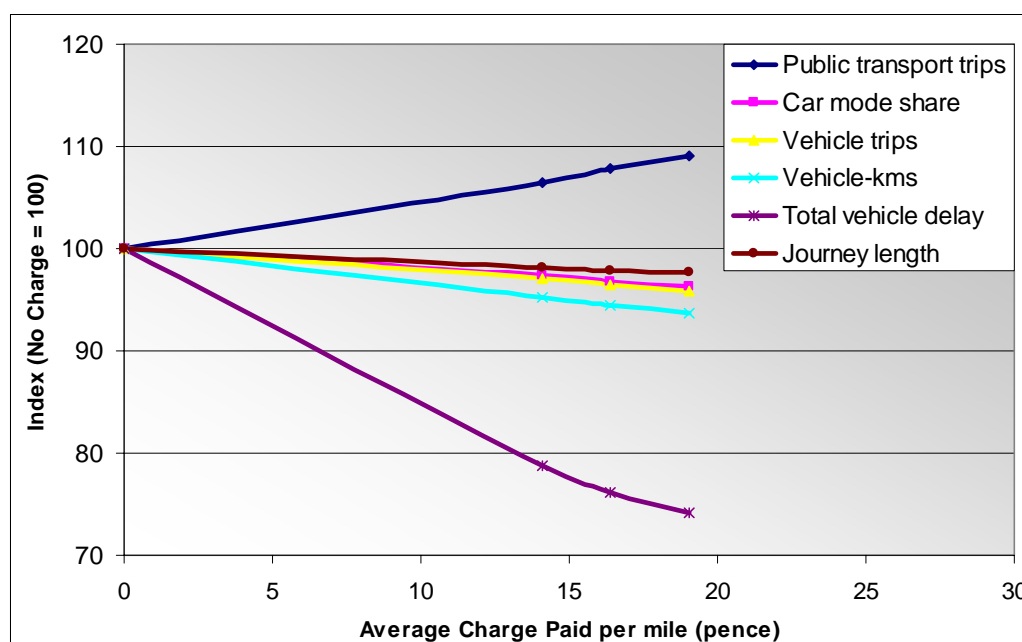


4.53 Comparing an overall distance-based charge of 25p/mile and the variable (congestion-related) charge, the overall number of car trips removed from the network in the 2031 morning peak would be similar – at around 4% of the total. As shown in Figure 4.6, with the variable charge around half of the car trips removed from the highway network are suppressed, i.e. the trips are no longer made by motorised modes in the morning peak time period. The variable charge is targeted at congested roads, which are mainly in urban areas and relatively well served by bus. Consequently, a much higher proportion of the removed trips (almost 40%) switch to bus, and there is markedly less trip suppression. The fixed 25p/mile charge has a greater impact on trip suppression with almost three-quarters of the removed trips being suppressed. The charge has most impact on longer distance trips, and therefore, in this test, a higher proportion of trips switch to rail.

Figure 4.6 – What Happens to the Removed Car Trips?



4.54 The study explored the impact of raising the scale of the variable congestion-based charge, with tests examining the impact of raising the charges by 25% and 50% above the initial levels implied by Figures 4.2 and 4.3. The impact on key indicators of the higher charges is shown in Figure 4.7.

Figure 4.7 – Impact of Variations to the Congestion-Based Charge

4.55 Since the charge is linked directly to the level of congestion, raising the charging scale by 25% and 50% results in the removal of additional traffic from the road network, reducing congestion and therefore the increase in the average amount paid by the motorist is less than the increase in the charge level. For example:

- ◆ with the charge level raised by 25%, the average charge actually paid rises by just 16% (from 14p/mile to 16p/mile)
- ◆ with the 50% increase in charging levels, the average charge actually paid grows by 35% (from 14p/mile to 19p/mile).

4.56 Hence, as might be expected, there are diminishing returns (in terms of revenue) from increases in the scale of charge with the variable charging system. Furthermore, there is a diminishing impact on congestion levels, as indicated by the slight flattening of the total vehicle delay curve shown in Figure 4.7.

4.57 Table 4.3 summarises the results of testing several forms of road user charging. The location of the intermediate cordon is shown in Figure 4.8. The results show that, although urban congestion charging (either cordon- or distance-based) can have some impact on delays, area wide measures are much more effective. The most efficient option would be a flexible charge of the kind the DfT is investigating (i.e. with the level varying by road type and the level of congestion), which would target the areas of highest congestion. As shown earlier, by introducing charging on the most congested areas of the network, the greatest economic benefits are obtained. This charging structure, which gives an average charge of 14p/mile, delivers almost as much congestion relief as a fixed charge of 50p/mile, reducing delays by over 20% and increasing average speed by 9%. The differential impact of the two types of charge on total vehicle delay across the road network is illustrated by Figure 4.9, which shows that the variable congestion based charge reduces delays significantly at much lower levels of charge than a purely distance based scheme.

Figure 4.8 – Potential Location of Bristol Intermediate Cordon

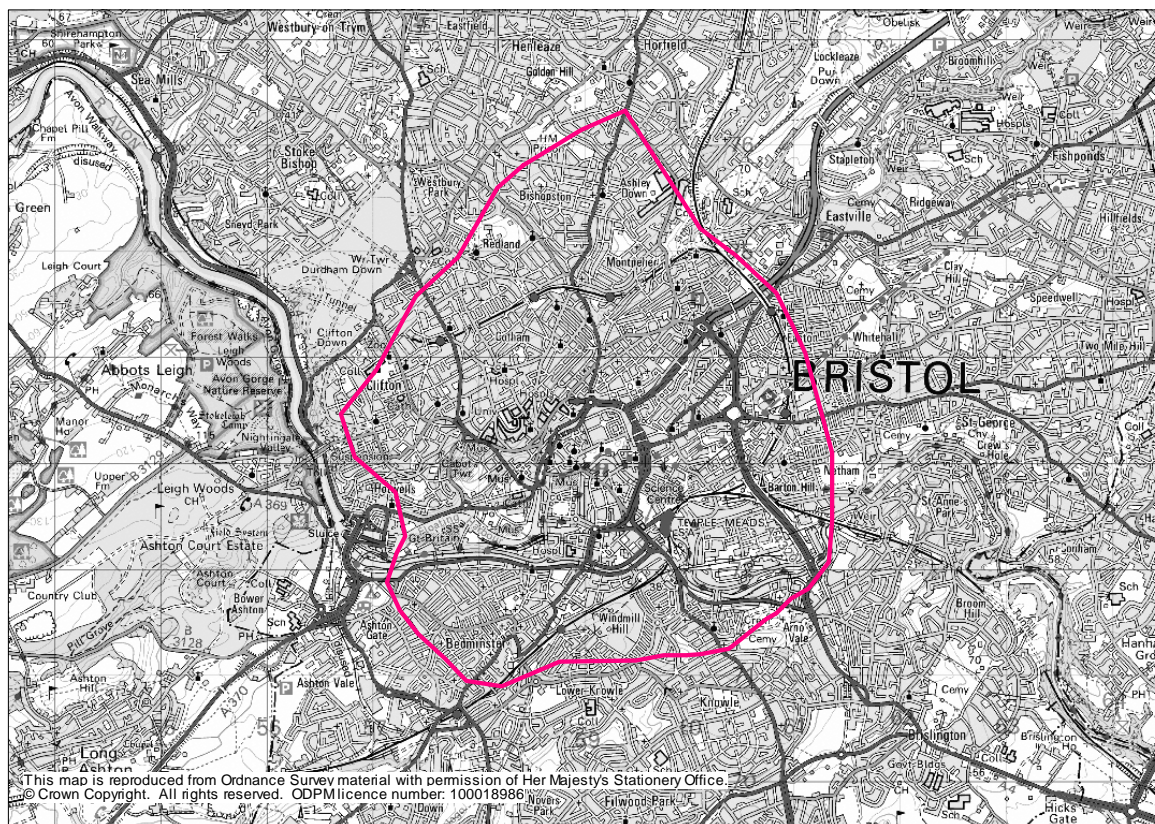
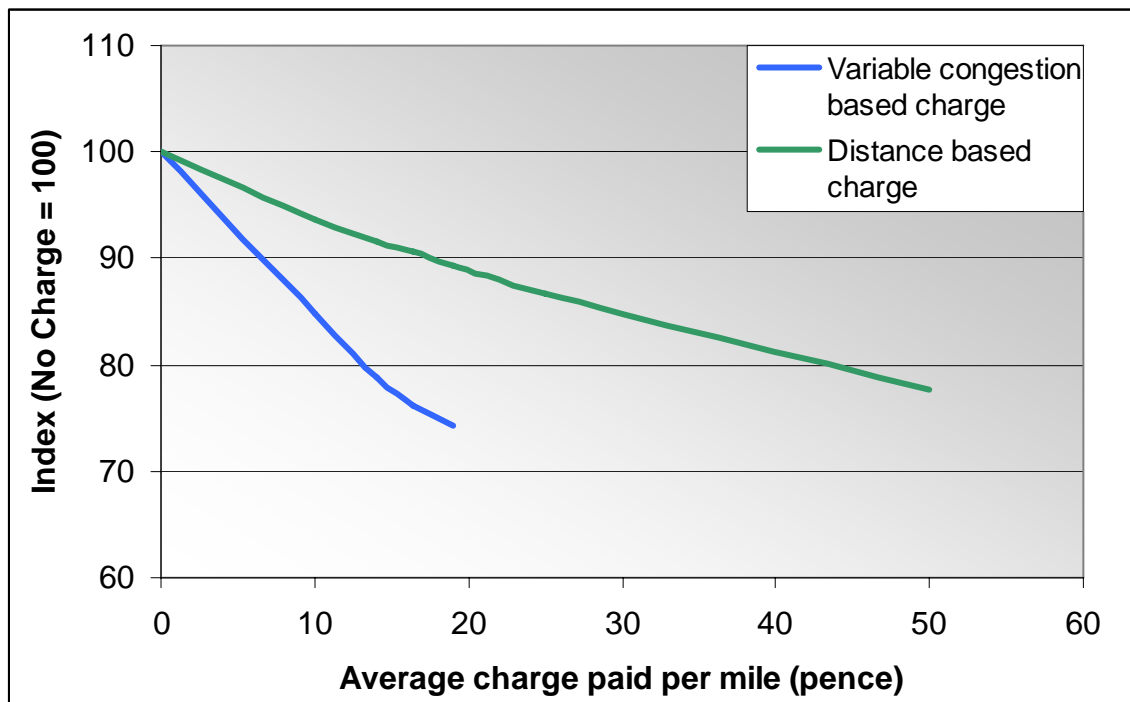


Table 4.3 – Impact of Road User Charging

Measure	Bristol Intermediate Cordon (£5 charge)	Urban Area Charge (25p/mile)	Area-wide charge (25p/mile)	Area-wide charge (50p/mile)	Area-wide variable charge*
Change compared with Background Transport Strategy					
Car Trips	-2.4%	-2.1%	-5.4%	-10.0%	-4.6%
Total Vehicle Kilometres	-1.0%	-1.9%	-10.3%	-18.1%	-5.0%
Average Journey Length	+0.7%	-0.5%	-6.9%	-12.2%	-1.9%
Total Vehicle Delay	-2.5%	-3.7%	-13.4%	-22.3%	-21.2%
Average Vehicle Speed	+0.9%	+1.0%	+1.1%	+1.4%	+9.4%
Estimated Annual Gross Revenue (in 2003 prices)	£170million	£250million	£1050million	£2080million	£580million

Figure 4.9 – Impact of Different Types and Levels of Charge on Total Vehicle Delay

- 4.58 Table 4.3 shows that road user charging could generate substantial revenues, which could be used to fund other transport schemes. The table shows the gross revenues for each type of scheme, i.e. before infrastructure and operating costs are taken into account. Local schemes (cordon or urban area charges) could generate around £200 million per annum, while area-wide schemes would generate even more. The revenue reflects the charges paid by the motorist, and hence the highest revenues are derived from an area-wide distance based charge of 50p/mile. It should be noted, however, that the figures quoted assume the same charge would be levied in the inter-peak period as in the morning peak period; in practice the off-peak charges, and hence the revenue, would be lower.

POTENTIAL IMPLEMENTATION PROGRAMME

- 4.59 The preceding analysis has identified a range of potential demand management measures. However, due to a range of factors, it would not be possible to introduce many of the measures immediately, even though there might be merit in doing so. Hence, a potential programme has been developed with which the different elements can be introduced in a phased manner.
- 4.60 A potential implementation programme for demand management measures could therefore include:
- ◆ in the short term:
 - range of parking measures,
 - exploration of cordon charging in Central Bristol on the alignment of the Inner Ring Road (or further out) with a daily charge of, say, £2 rising eventually to £5,

-
- exploration of workplace parking charges in key areas, e.g. North Fringe, where there are significant levels of private non-residential parking;
 - ◆ in the medium term
 - continuation of parking measures,
 - introduction of the Intermediate Bristol cordon charge with gradual increases in the level of charge,
 - introduction of the workplace parking charging scheme in the North Fringe and potential extension to other areas,
 - introduction of additional cordons (central Bath and Outer Bristol – perhaps on the alignment of the Avon Ring Road); and
 - ◆ in the long term
 - continuation of parking measures,
 - comprehensive congestion charging, with the system extending across the complete highway network in the study area and perhaps representing part of a national scheme – such a scheme would replace the cordon charging schemes, although workplace parking charging could be retained, although with adjustments to the charge levels.
- 4.61 The Greater Bristol unitary authorities have recently received pump priming funding to develop a congestion charging scheme within the DfT's Transport Innovation Fund. This will enable a detailed appraisal to be undertaken into the impacts of implementing potential schemes within the Greater Bristol area. Over time, the manner in which some of the policy measures are implemented could change, for example starting with a simple cordon charging approach before moving ultimately to a satellite-based technique.
- 4.62 In the examination of highway measures in Chapter 6, consideration is given to the potential for encouraging the use of alternative fuels. In this respect, the congestion charging system could encourage this by varying the charge according to the type of fuel used in a vehicle.
- 4.63 As indicated in the introduction to this chapter, any satellite-based area-wide road user charging scheme would have to be linked to the timescale and implementation programme for the national scheme. In view of the resulting risks, it would not be prudent for the study's area-wide congestion charging measures to be a central part of a single transport strategy. Consequently, two separate strategies have been prepared and appraised; the central strategy excludes area-wide road user charging, while this forms a key part of the second strategy. As a result, the revenue generated by the congestion charging is not available in the central strategy to fund transport measures. The appraisal of strategies and their components in Chapter 8, therefore distinguishes between the two strategies; with and without area-wide road user charging.

SUMMARY

- 4.64 Within the transport strategy, it is important to include measures designed to control or manage the level of demand for travel by car across the study area. A number of measures to manage demand are available for implementation now and concentrate on varying the availability and cost of parking. The policies need to be adjusted and refined in order to reflect the growth in car traffic, by increasing charges, controlling

the number and availability of spaces, raising enforcement, introducing controlled parking zones, exploring ways of controlling parking at Cribbs Causeway and introducing stringent parking standards. The expansion and variation of parking policy measures also need to take into account the potential impact on economic activity, especially within city and neighbourhood centres, in order to ensure that the prosperity of the centres is maintained.

- 4.65 The range of additional policy instruments to manage traffic demand includes workplace parking charges. Although there are potential limitations to the impact that such measures may have, it remains a possible tool for introduction in areas outside the scope of existing parking policy, e.g. the North Fringe, and hence should be examined further. The introduction of workplace parking charges would strengthen the operation of workplace travel plans.
- 4.66 However, the most effective additional form of demand management is likely to be some type of road user charging. The study has identified a number of potential charging mechanisms, including bridge tolls, cordon charging, motorway tolls, supplementary licences, congestion charging and distanced-based charging. In the longer-term, the study believes that the most effective form of demand management would be an area-wide charge. However, it is unlikely that such an approach would be feasible until later in the study's horizon and hence it is important to explore charging systems that provide the opportunity for more immediate implementation. A cordon-based charge would be the most appropriate technique and the initiative by unitary authorities within the Transport Innovation Fund should be taken forward as quickly as possible.
- 4.67 The study does not believe that the introduction of tolls on the motorway network would produce overall benefits with the likelihood that such a system would encourage the diversion of traffic onto the uncharged local roads, generally unsuitable for the traffic volumes, and with only a small change in the overall level of traffic across the study area. For many of these journeys, there is a lack of an attractive public transport alternative. Hence, an area-wide road user charging system would be the most suitable long-term approach. We have examined alternative forms for the area-wide road user charging scheme and believe that the most appropriate is one in which the charge varies with the level of congestion. As highlighted earlier, the benefits from charging are greater where the congestion is more severe. By varying the charge in line with the level of congestion, it is therefore possible to optimise the level of benefits. It is estimated that, with such a variable charge in 2031, it would be possible to reduce total vehicle delay across the study area by 20% and increase vehicle speeds by 9% for a lower average charge (14p/mile) than with a simple distance based charge of 50p/mile on all roads in the study area.

5. Public Transport Measures

INTRODUCTION

- 5.1 Public transport represents a key element of the GBSTS transport strategy for the sub-region. There are a number of challenges to be resolved in the current public transport network which will experience further pressure in the future with the prospect of significant growth in the demand for travel within the timescale of the GBSTS study. The current public transport system contains a number of limitations including:
- ◆ an acute shortage of capacity on the rail network, especially through the principal rail stations in the study area;
 - ◆ conflicts between different routes and types of rail traffic, e.g. between local and long distance passenger operations and between passenger and freight services;
 - ◆ the locations of stations, some of which no longer reflect current passenger travel patterns;
 - ◆ the condition of the rail assets (including rolling stock) on local passenger services and the need to replace them in an environment of a shortage of funding and resources in the rail industry;
 - ◆ the impact of congestion on bus services, creating increased journey times and worsening reliability;
 - ◆ the continuing growth in fare levels in contrast with reduced private vehicle operating costs, in real terms;
 - ◆ the shortage of bus priority measures to counter the effects of the increased congestion;
 - ◆ unreliability of public transport operations due to mechanical failures, staff shortages, etc;
 - ◆ the poor quality of some vehicles across the bus fleet; and
 - ◆ the need for better integration between bus and rail services, including ticketing arrangements.
- 5.2 The analysis summarised in Chapter 2 highlighted that, in the future, with the increased population and employment growth across the study area, if no improvements are made to the transport system, then the additional congestion will create significant problems for the operation of bus services with consequent reductions in the level of bus demand. The rail services are not affected by the increased congestion on the road network and, despite significant increases in car ownership across the study area, there are likely to be some increases in rail patronage.
- 5.3 In order to provide an attractive and competitive public transport system, it is necessary to consider a range of measures, each directed at specific aspects of the travel market, including:
- ◆ urban bus services;

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- ◆ park and ride;
 - ◆ inter-urban bus services;
 - ◆ coach services;
 - ◆ access to Bristol International Airport;
 - ◆ public transport interchanges;
 - ◆ rapid transit; and
 - ◆ rail infrastructure and services.

5.4 Each of these different aspects is considered separately below.

URBAN BUS SERVICES

5.5 In the short to medium term, enhancements to the urban bus networks represent the most effective means of improving public transport services in the study area.

5.6 The Joint Local Transport Plan has identified a series of Showcase bus corridors which are designed to build on the success of the first scheme (introduced by Bristol City Council along route 76/77 between Henbury and Hartcliffe) in increasing the level of public transport demand along the corridors. The first Showcase route achieved a net 12% increase in patronage through a package of measures including junction improvements, new bus lanes, improved bus shelters, real time passenger information and new low-floor buses which together produced improved reliability and faster journey times. Bristol City Council is in the process of extending the Showcase concept to the A420 corridor in the east of the city. Similar initiatives have been introduced by the other unitary authorities in the area in the form of Quality Bus Partnerships involving the bus operators. The study strongly supports the JLTP Major Scheme Bid for the Greater Bristol Bus Network which contains ten Showcase bus corridors (see Figure 5.1). These expand the principles of the first scheme to the new corridors which extend across the study area.

5.7 As the series of Showcase corridors develops from the initial routes to the network of corridors, there is the opportunity in the future to expand the concept to provide further improvements, including:

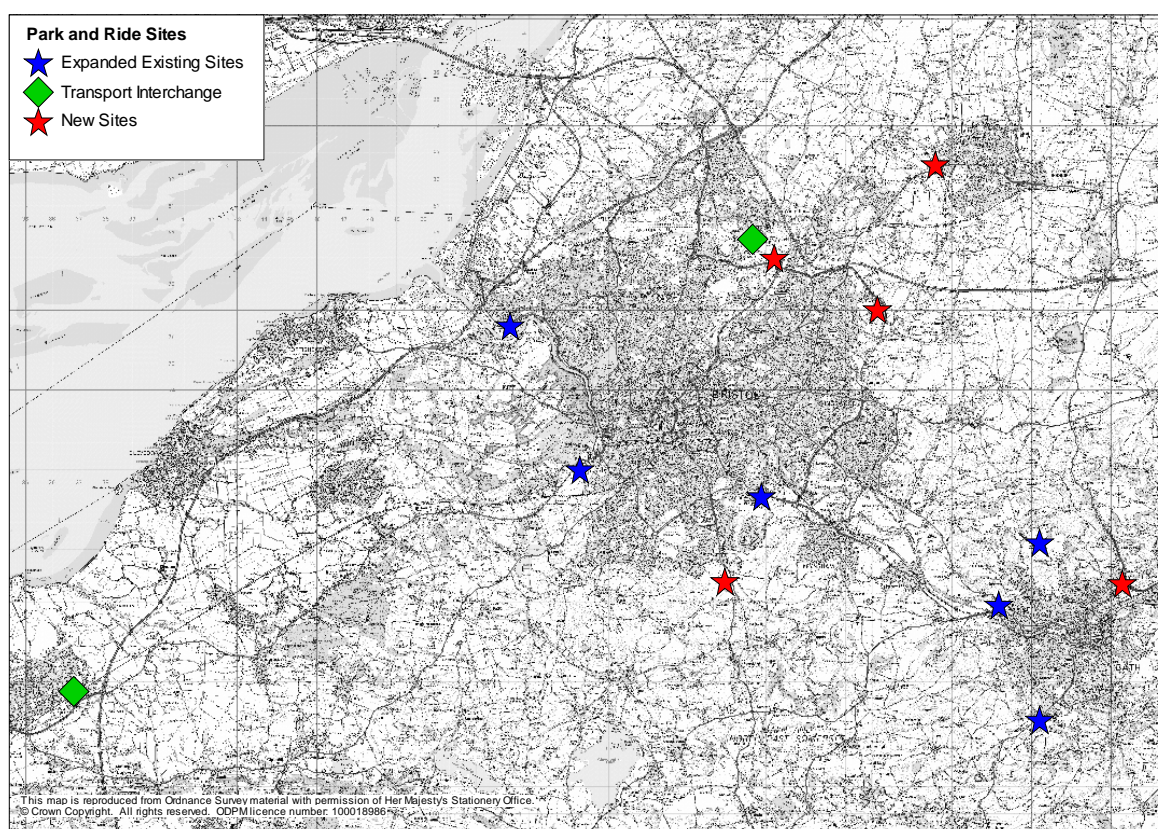
- ◆ the re-routing of services to take advantage of the enhanced priority measures;
- ◆ more cross-city services to take advantage of the improved reliability to reduce the need for passengers to interchange;
- ◆ wider use of Travelcards, by more active promotion and aggressive marketing, in order to ease inter-modal interchange, speed up boarding times, etc and produce enhanced brand loyalty for public transport;
- ◆ as outlined in Chapter 3, enhanced passenger information on the availability of public transport services;
- ◆ a more extensive network of orbital bus services providing links to North Fringe and other non-central destinations, including improved interchanges outlined below;
- ◆ increased feeder bus operations, especially in areas not served by rapid transit (see below), and in association with the introduction of area-wide road user charging (see Chapter 4);

- ◆ an extension of the Showcase corridors into the new areas of development, including Ashton Vale, Whitchurch and Emersons Green;
- ◆ more extensive bus priority measures to form 'Red Routes' or clearways with no on-street parking;
- ◆ increased enforcement of parking and other traffic measures along the Showcase corridors, perhaps through the use of surveillance cameras (on-bus or at the roadside); and
- ◆ in the longer term, the possible conversion of some of the Showcase corridors into rapid transit routes (described below), with new vehicles, increased frequencies, some sections of segregated operation and further reductions in journey times.

PARK AND RIDE

- 5.8 With three formal bus-based park and ride sites in Bristol (Long Ashton, Brislington and Portway) and three in Bath (Lansdown, Newbridge and Odd Down), (see Figure 5.2) together with well-used car parks at many of the rail stations in the study area, park and ride represents a popular form of access. There is the opportunity to expand the system by:
- ◆ increasing the capacity at existing park and ride sites;
 - ◆ enhancing the operation of sites, with extended hours, improved facilities (including security issues) and ticketing arrangements, etc;
 - ◆ creating new park and ride sites; and
 - ◆ expanding capacity at selected rail station car parks.
- 5.9 At times, some of the existing park and ride sites experience capacity problems and hence there is a need to expand the capacity, especially at the Brislington, Lansdown, Newbridge and Odd Down sites.
- 5.10 Carefully selected additional park and ride sites (shown in Figure 5.2) could also be added to the current capacity. In considering potential sites, it is important to identify the role of the site, its impact on the environment, its effect on the neighbouring road network and the extent to which it diverts demand from existing public transport services.
- 5.11 The introduction of a park and ride site is designed to attract existing motorists, who currently drive into the town or city centre, onto public transport for the final part of the journey which would normally be on the congested sections of the road network. Within Greater Bristol, the public transport component of the park and ride journey would normally be by bus, using one of the dedicated services, although there is some park and ride activity at key rail stations.

Figure 5.2 – Existing and Potential Park and Ride Sites



- 5.12 Where existing motorists have a bus service available for their whole journey, they currently prefer not to use the service for a variety of possible reasons, including frequency, journey time, convenience, etc. The objective of improvements is to make the public transport element of the Park and Ride journey sufficiently attractive (by bus priority measures, frequent operations, suitable hours of operation, etc) in order to outweigh some of the perceived benefits of the direct car journey. An important factor is the overall charge for the park and ride activity compared with the parking charge in the central area (taking into account the availability of parking spaces) and the prevailing bus fares. Hence, the success of park and ride is associated with the complementary policies of parking charges, availability of spaces (including restrictions designed to deter commuter use) and other measures such as bus fares and congestion charges aimed at deterring car use. In the operation of park and ride sites there is therefore a continuing need to monitor the balance in relative costs between park and ride and alternative direct journeys by car.
- 5.13 With the introduction of park and ride, there is sometimes the danger that existing bus passengers are encouraged by the enhanced public transport journey to switch from a current direct bus journey onto park and ride. This would therefore:
- ◆ increase the level of car activity in the vicinity of the park and ride site; and
 - ◆ potentially impair the viability of the existing bus services by the switching of passengers.

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- 5.14 The magnitude of these potential effects will vary between park and ride sites and it may be necessary to introduce remedial measures, such as:
- ◆ provision of improved feeder bus services to the park and ride site from neighbouring communities, with enhanced frequencies at the key commuting times;
 - ◆ introduction of ticketing arrangements to encourage through ticketing between local bus and park and ride services; and
 - ◆ potentially, provide revenue support for local bus services linking to the park and ride site.
- 5.15 The new park and ride sites identified by the study include:
- ◆ Lambridge to the east of Bath, adjacent to the A4 London Road – this scheme is currently being progressed by Bath and North East Somerset Council for early implementation and is included in the Bath Package Major Scheme Bid within the Joint Local Transport Plan process;
 - ◆ Nibley to the west of Yate – to be introduced in the short term to aid links between Yate and central Bristol;
 - ◆ Emersons Green – adjacent to the Avon Ring Road, the site would serve motorists from the Emersons Green developments as well as those approaching the Bristol area from Pucklechurch and other communities to the north-east;
 - ◆ Whitchurch – in the longer term, and in association with the development of residential and employment sites in the vicinity, the park and ride site would cater for traffic currently using the A37 from the numerous communities along its route, extending into northern parts of Somerset; and
 - ◆ Hambrook – adjacent to M4 Junction 19 and M32 Junction 1.
- 5.16 The park and ride schemes would tend to concentrate on traditional activities with a high frequency, fast and direct link into the central urban areas. However, in some locations, there may be the potential for expanded activities, for example by the provision of stops on the inter-urban bus or national coach network which would be attractive to passengers who do not wish to travel into the town/city centres to catch the bus/coach, e.g. at Lambridge for the Bath to London service.
- 5.17 There has been much discussion about the possible introduction of a park and ride site at Hambrook, adjacent to M4 Junction 19 and M32 Junction 1. Such a site would provide an alternative for traffic from the motorway wishing to gain access to Bristol city centre with the potential for a high speed bus connection along the M32, taking advantage of proposed bus priority measures along the route. The proposed capacity for the site is large at some 2,500 spaces and it will therefore be vital to ensure that the highway network in the area, and especially M4 Junction 19 and M32 Junction 1, is able to accommodate the movements created by the traffic using the site.
- 5.18 The study has explored the potential operating designs for the site and has identified that there would be significant practical difficulties in any design that placed additional stress on M32 Junction 1 from either commuter traffic wishing to access/egress the site or the operation of the park and ride bus services. Hence, the view is that access to the site should be from the west rather than the east, with possible connectivity with the construction of the Stoke Gifford bypass described in

Chapter 6 and the detailed design of the Harry Stoke development. The bus link could be routed so as to take advantage of priority measures associated with the proposed rapid transit route between the North Fringe and central Bristol via the M32 and UWE, described later in this chapter.

- 5.19 Bristol City Council has explored alternative locations for a park and ride site along the M32 corridor. The most attractive alternative site is to the east of the M32, north of the Coldharbour Lane overbridge. Such a site has the merit of avoiding the access and egress issues at M32 Junction 1, but care would need to be taken with its own access and egress and the impact on the M32 and B4058 Frenchay Park Road. The park and ride bus operation from this site could take advantage of the proposed priority measures (described below) for the rapid transit route through UWE and Bradley Stoke, including the potential new restricted junction between Coldharbour Lane and the M32 for public transport. Further work is therefore necessary on this alternative park and ride site.
- 5.20 In the past, Bristol City Council has explored the potential for a Park and Ride site at Bedminster Down adjacent to the A38. In view of other aspects of the GBSTS transport strategy, this site is not included within the long term strategy because:
- ◆ the construction of the South Bristol Ring Road would provide an improved link between the A38 and A370 corridors and hence between the A38 and the Long Ashton Park and Ride site;
 - ◆ within the strategy, Long Ashton Park and Ride site would be served by the proposed rapid transit route which would offer a direct, frequent and fast link to central Bristol;
 - ◆ journey times for buses between Bedminster Down and central Bristol are likely to be little different from those by car, given the limited scope for bus priority measures; and
 - ◆ the level of demand for park and ride at the Bedminster Down site may not justify such a high frequency bus link as at Long Ashton and hence the attractiveness of the site would be diminished.
- 5.21 Although in the long term there may not be justification for Park and Ride facilities at Bedminster, there could well be a short-term need for park and ride facilities on the A38 corridor, covering the period until the South Bristol Ring Road provides links between the A38 corridor and an expanded Long Ashton site.
- 5.22 As described below under the rail measures and interchange, there is the potential for increased public transport activity at Worle rail station with the creation of a major multi-modal interchange including significant park and ride facilities. Other stations are experiencing pressure on car park facilities, including Bristol Parkway and Nailsea and Backwell and hence expansion of the capacity will be necessary in order to meet the expected future demands.

INTER-URBAN BUS SERVICES

- 5.23 The current network of inter-urban bus services (e.g. between Bristol and Weston-super-Mare) provides reasonable coverage across the study area, although perhaps not at the frequency of service and with journey times that would be attractive to existing car drivers. The network of Showcase bus corridors in Figure 5.1 extends

beyond the urban areas and hence will provide the opportunity for the inter-urban services to take advantage of the priority measures to gain journey time and reliability benefits, perhaps through a change to routeing. In addition, some of the enhancements to the highway network, e.g. the South Bristol Ring Road, and second Avon crossing, will offer the opportunity for further service improvements, journey time savings, reliability gains and frequency increases, in the medium term.

- 5.24 The specification of detailed changes to the inter-urban bus services is outside the scope of a strategic study. Nevertheless, in terms of the network of inter-urban services, there will be a need to review the connections in the light of new population and employment developments to ensure that there are opportunities to access the new developments by public transport. At the same time, it will be necessary to review the access to the North Fringe from different parts of the study area, including Weston-super-Mare, Bath and Yate, particularly where demand management and other measures are likely to encourage greater use of public transport.
- 5.25 The rapid transit routes, described below, would offer significant enhancements to public transport services to several of the new development areas. However, where new developments are not linked to the rapid transport network, it will be important to provide a network of local and inter-urban bus connections from the developments to key destinations.

COACH SERVICES

- 5.26 The coach services from and through the region are limited to regular links between Bristol and Bath to London and airports in the South East and more occasional services along the M5 corridor which also access Bristol. There is the opportunity to increase the level of coach usage by providing increased locations from which to access coach services in the area:
- ◆ expansion of operations at Worle Parkway rail station with the creation of significant facilities for interchange between rail, coach, airport bus, local bus and park and ride;
 - ◆ if Hambrook park and ride is constructed (see above), there may be an opportunity to provide access to coach services for residents of north Bristol and South Gloucestershire without the need to travel into central Bristol (the site could also be used by coaches between South Wales and the South East) – attention would need to be paid to the impact of the coach movements on the adjacent junctions and also the local impact of pick-up and drop-off traffic;
 - ◆ alternatively the expanded bus interchange at the University of the West of England could possibly satisfy the role of a connection in north Bristol;
 - ◆ although it is less accessible from the motorway network, an alternative interchange point would be at Bristol Parkway station; and
 - ◆ similar, although smaller, facilities at Lambridge park and ride site may also be useful for coach services between Bath and the South East.
- 5.27 It is outside the scope of the study to specify detailed changes to the network of coach services although improved connections with the rest of the public transport network in the area will provide the opportunity for expansion to the current services.

ACCESS TO BRISTOL INTERNATIONAL AIRPORT

- 5.28 As described in Chapter 2, air passenger demand through Bristol International Airport (BIA) has experienced significant growth in recent years from 2 million passengers per annum in 2001 to 4.6 million in 2004. The forecast in the Airports White Paper was that this would grow to 12 million by 2026. In parallel with the growth in passengers, there would also be a corresponding increase in employees at the airport from 2,500 in 2004 to around 6,500 in 2026.
- 5.29 Current public transport access to the airport is concentrated on the Airport Flyer, a limited stop coach service linking Bristol Bus Station and Bristol Temple Meads rail station to the airport, at a frequency of three buses per hour. A local bus service between Weston-super-Mare and central Bristol also serves the airport at an hourly frequency during the day. The nearest rail services are about three miles away at Nailsea and Backwell although there are no connections to the airport from this station. BIA is therefore relatively isolated in public transport terms with few other generators of travel in the neighbourhood of the airport. As a result, the airport has to be fairly self-sufficient in relation to public transport provision.
- 5.30 Table 5.1 shows demand forecast by the GBM for the Airport Flyer buses in 2031. This indicates that the service from Bristol would have a reasonable level of demand, particularly towards the airport in the morning peak period. Depending on the exact pattern of demand, this would require a headway of perhaps 5-6 minutes. To speed up passenger boarding and alighting, new vehicles with low floor entry/exit and spacious interior design could be introduced on the Flyer service. While the demand to and from Worle Parkway is lower, it would justify a dedicated service with two or three departures per hour.

Table 5.1 – Demand for Airport Flyer Buses (morning peak period in 2031)

Route	Passengers per hour	
	Arriving at BIA	Leaving BIA
Bristol and Bristol Parkway	313	169
Worle Parkway	29	33

- 5.31 If associated highway infrastructure is available it would be possible for rapid transit services (described below) to be extended from Ashton Vale to BIA. However, we do not necessarily recommend the extension of rapid transit, because:
- ◆ it is anticipated that the demand to BIA would only be sufficient for a proportion of rapid transit departures to be extended to the airport;
 - ◆ it would be important to retain the limited stop Flyer service, which would provide a better quality of service for through passengers from Bristol Temple Meads and Bristol Parkway;
 - ◆ the rapid transit service would need to operate outside normal hours in order to serve the particular operating schedules of the airport;
 - ◆ a shared use rapid transit service may be crowded with commuters and shoppers, causing difficulties for airport passengers with luggage; and

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- ◆ rapid transit would make additional stops, for example through Ashton Vale and at Long Ashton Park and Ride, compared with the express operation of the Flyer.
- 5.32 Current public transport access by employees to BIA is very low – perhaps around 3% of employees use the Flyer – and, with an increased level of shift working, this is unlikely to change dramatically with improved Flyer operations. Currently, employees use some of the early Flyer departures to the airport from central Bristol but even with increased numbers of employees and a continuation of the free travel for employees, they are unlikely to influence Flyer demand levels to the extent that the level of service would need to be increased. It would be more appropriate to use demand-responsive public transport modes (e.g. shared taxis) to cater for the variety of travel times and origins/destinations likely to be exhibited by airport employees.
- 5.33 The following range of public transport services could therefore act as the basis for serving the passenger and employee demand for travel to and from the BIA:
- ◆ increased frequency for the current Airport Flyer service from Bristol city centre to a frequency of at least six buses per hour rising to ten buses per hour in the long term;
 - ◆ the period of operation of the Flyer should be extended to match early morning and late evening flights;
 - ◆ extension of the Airport Flyer service (half of the expanded service, i.e. starting from three buses per hour) north to Bristol Parkway station via the M32, the UWE interchange and using priority measures described below for rapid transit, thereby providing an improved link to the airport for residents of north Bristol and South Gloucestershire and also offering connections to rail services from South Wales, Gloucestershire and Swindon;
 - ◆ to speed up passenger boarding and alighting, use of new vehicles with low floor entry/exit and spacious interior design;
 - ◆ new limited stop service between Worle Parkway station and BIA with a frequency of three buses per hour – as outlined in the following section, Worle Parkway could play a significant role as an interchange hub for rail, coach, local bus and park and ride operations;
 - ◆ initially air passengers to/from Bath would probably find it more convenient to transfer onto the Airport Flyer at Temple Meads station, but when the South Bristol Ring Road is completed, this could provide a more suitable route for a direct bus services linking Bath and Keynsham with BIA, perhaps at a frequency of two buses per hour; and
 - ◆ to cater for the extended travel times of employees following the expansion of the airport and the move to a 7 days a week and 24 hours a day operation together with the diffuse travel patterns demand responsive or shared taxi services would be the most effective means of catering for this type of demand with services to Weston-super-Mare and south Bristol (and potentially other locations such as Bath, Clevedon, Portishead, Kingswood, etc) that could also be used by air passengers.

PUBLIC TRANSPORT INTERCHANGES

- 5.34 Within the study area, there are a number of established interchange points or transport nodes where transfer occurs between public transport modes, e.g. the principal rail stations at Bristol Temple Meads, Bristol Parkway, Bath Spa and Weston-super-Mare together with bus stations in Bristol, Bath, etc, as well as between on-street stops in the city centres. In addition, some of the smaller rail stations including Yate and Filton Abbey Wood experience reasonable levels of interchange. In recent years, there has been increased bus interchange activity at the University of the West of England site at Coldharbour Lane and at Cribbs Causeway.
- 5.35 With geographically dispersed levels of demand, it is difficult to design commercially viable public transport services that can provide the direct links desired by passengers. It is therefore inevitable that passengers will need to transfer in order to complete their journey and, if the overall public transport service is to be attractive, it becomes increasingly important for strong interchanges to be provided between modes and services.
- 5.36 The existing interchange points will continue to play a crucial role and extra facilities will therefore be required in order to strengthen the position, supplemented by facilities to encourage walking and cycling access to them. However, it will also be important to develop and promote new interchange locations in parallel with improvements to services. There are four main locations for potential improvements to interchanges:
- ◆ **Worle**

There is scope for Worle to become a full multi-modal parkway station combining rail, local bus, coach and airport links together with park and ride and cycle facilities. The proximity to the M5, together with proposed improvements at M5 Junction 21, provide the opportunity for National Express coach services to use the location as a coachway with onward connections into Weston-super-Mare and BIA. Distances from the M5 to both these locations means that it is not viable to divert regular coach services to serve them and hence they currently experience poor coach links. With the potential for increased rail services and with new developments planned for the Locking area, the provision of new bus links from the northern and eastern areas of Weston-super-Mare to Worle station would represent a more attractive connection.
 - ◆ **University of the West of England (UWE)**

At the UWE site at Coldharbour Lane there is the opportunity to create a major bus interchange point serving the wider North Fringe area. The location already carries a significant level of interchange activity and this would be increased with enhanced facilities and services. The attractiveness of the site would be further increased with the provision of a direct bus-only link between the M32 and Coldharbour Lane to enhance potential bus connections to the south including the proposed rapid transit lines described below.

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- ◆ Yate
With the potential in the future for increased rail services to Yate (see below) there is the opportunity to increase the level of passenger activity through the station, with improved bus connections together with cycle and similar facilities.
 - ◆ Filton Abbey Wood
With the potential in the future for increased rail services to Yate which would also serve Filton Abbey Wood (see below), improved bus connections to the station together with cycle and similar facilities would provide the opportunity to increase the level of passenger activity through the station.
- 5.37 In addition to the interchange points based on rail stations, coach interchanges could be promoted at the Hambrook park and ride site adjacent to M4 Junction 19 and also, although to a lesser extent, at the proposed Lambridge park and ride site in east Bath. In each case, these interchange points would avoid the need for passengers to travel into the centre of Bristol or Bath and hence would make the coach journey more attractive. In SWARMMS, there was a proposal to develop a coachway at Cribbs Causeway but the traffic congestion in the area of Cribbs Causeway would suggest that the alternative site at Hambrook might be more attractive for this role.

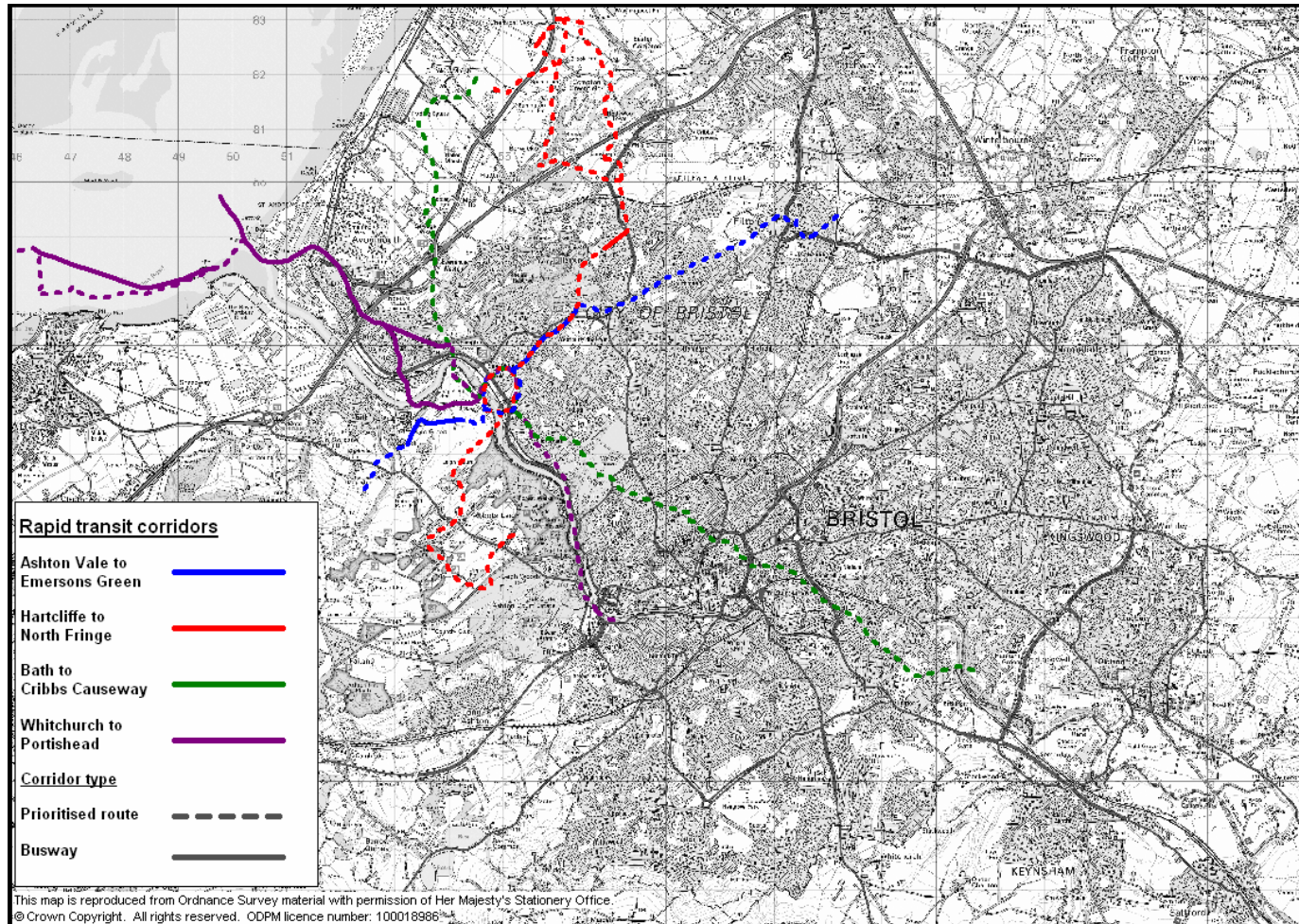
RAPID TRANSIT

Definition of the Potential Lines

- 5.38 There has been considerable attention in recent years to the introduction of rapid transit in the form of a light rail system in the study area. Line One of the earlier light rail system contained a link from north Bristol to Bristol Temple Meads and Bristol city centre using an alignment which for much of its length would run parallel to the rail line between Bristol Temple Meads and Filton Abbey Wood. Recently, the development of Line One to Bristol Parkway has been suspended and the scheme is not currently being pursued by the local authorities, although the alignment continues to be safeguarded by South Gloucestershire and Bristol City Councils. As far as the GBSTS study is concerned, there are three major new factors that could influence the content of a rapid transit system in the study area:
- ◆ the identification of new development sites which will create significant growth in demand for travel;
 - ◆ the major plans for the introduction of a network of Showcase bus corridors shown in Figure 5.1 which will produce significant improvements in the operation of bus services; and
 - ◆ plans for the expansion of local cross-Bristol rail services (described below).
- 5.39 The study has explored the potential for a rapid transit system that:
- ◆ serves the major new development areas of Ashton Vale, Whitchurch and Emersons Green/Pucklechurch providing a high-quality, high-speed, public transport link between these locations and central Bristol;
 - ◆ offers new and improved links between south Bristol, central Bristol and the North Fringe;
 - ◆ provides new public transport links to Portishead;

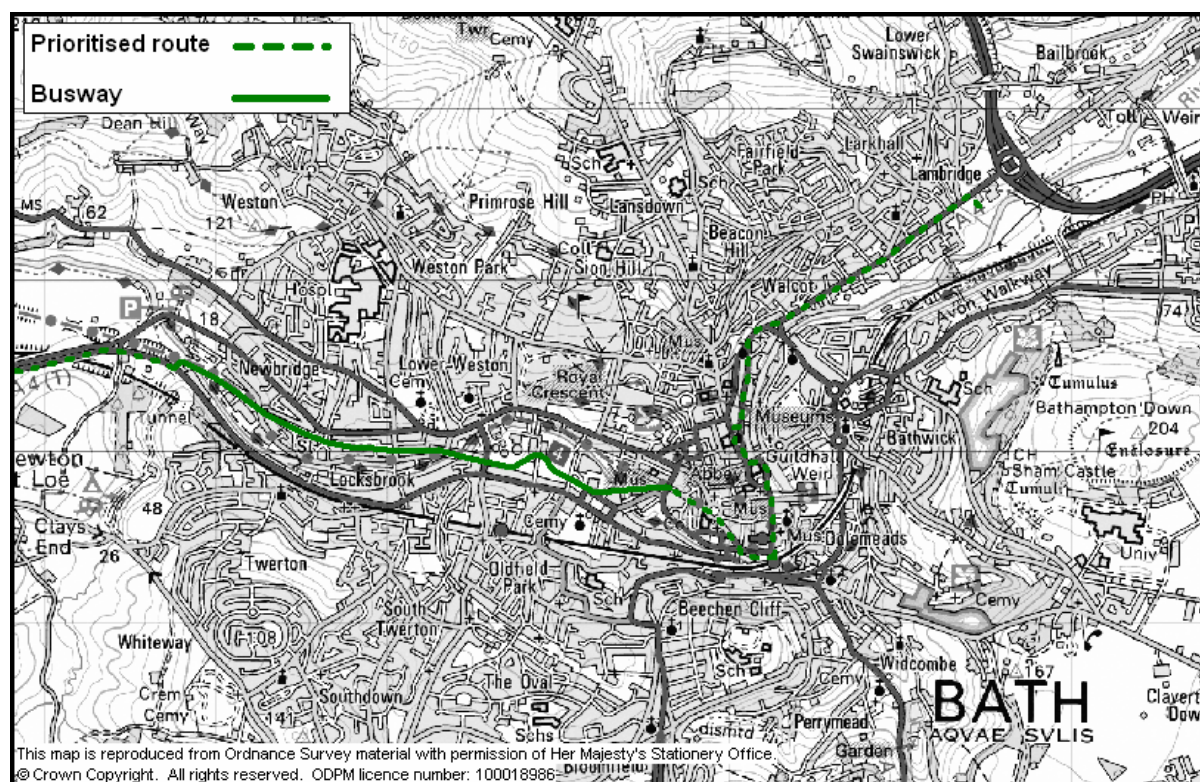
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- ◆ where possible, has high degrees of segregation from other road traffic;
 - ◆ creates new cross-Bristol linkages; and
 - ◆ builds on the network of Showcase bus corridors by maximising the use of infrastructure already put in place with the Showcase corridors including priority lanes, shelters and real-time passenger information.
- 5.40 The study has completed an assessment of a system involving four cross-Bristol rapid transit routes shown in Figure 5.3, although the precise details of the routes would be the subject of review and revision as the scheme is developed:
- ◆ Ashton Vale – Emersons Green;
 - ◆ Hengrove – North Fringe/Cribbs Causeway;
 - ◆ Bath – Cribbs Causeway; and
 - ◆ Whitchurch – Avonmouth/Portishead (using the potential second Avon Crossing).
- 5.41 An example of the form that the rapid transit operation might follow is demonstrated by the public transport measures included in the Bath Package which is currently being developed as a Major Scheme Bid within the Joint Local Transport Plan process. The rapid transit component of the Bath Package has been developed by B&NES in association with the bus operator First Group and local developers and contains one cross-city line (see Figure 5.4) formed by:
- ◆ a mainly segregated alignment between Newbridge and central Bath, linking an expanded park and ride site at Newbridge, adjacent to the A4 to the west of Bath, with the city centre using a former rail alignment and a segregated route through the proposed Western Riverside development and then on-street running through mainly bus priority areas; and
 - ◆ an on-street alignment between the proposed Lambridge park and ride site on A4 London Road to the east of Bath and the city centre.
- 5.42 The proposals include the use of modern, spacious, low floor, articulated vehicles, currently being developed by the operator. The mixture of on-street operation and segregated running provides an example of the type of operation envisaged for the rapid transit system across the rest of Greater Bristol.
- 5.43 Considering each of the four lines of the Greater Bristol rapid transit network in turn, some of the key features are:
- ◆ Ashton Vale to Emersons Green:
 - at the southern end of the route, it would serve the current park and ride site at Long Ashton and the potential new development at Ashton Vale;
 - it is assumed that a dedicated alignment through the new development at Ashton Vale would be incorporated into its design;
 - if associated highway infrastructure is available, it would be possible for some of the services to be extended from Ashton Vale to BIA, although as indicated in paragraph 5.31, the Airport Flyer and rapid transit may not be compatible for joint working;

Figure 5.3 – Potential Bristol Rapid Transit Lines



Note: The schemes in this diagram are conceptual and defined for appraisal purposes.

Figure 5.4 – Bath Rapid Transit Network



Note: The schemes in this diagram are conceptual and defined for appraisal purposes.

- the alignment crosses the River Avon on the disused railway bridge;
 - a segregated alignment through the floating harbour along the alignment of the existing rail line – in places the alignment may not be wide enough for two-way operation for the whole length and hence it may need to be single direction with passing places;
 - in designing the route within the central area, a feature will be the identification of common sections for all rapid transit routes to enable easy interchange between lines;
 - along the M32, the design would aim to achieve some form of segregation;
 - the position of the northern terminal will depend upon the scale and location of development in the Emersons Green/Pucklechurch area;
 - the precise alignment of the route would also be based on the location of the developments;
 - if the focus of new development is to the east of Emersons Green, towards Pucklechurch, then a route through Mangotsfield would be appropriate with on-line priority measures;
 - with developments to the north, a routing using the HOV lanes on the A4174 Avon Ring Road and the M32 would be more appropriate.
- ◆ Hengrove to North Fringe and Cribbs Causeway:
- the southern section of the route would start within Hengrove Park, follow a new route across Hartcliffe Campus and then operate within the existing

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- highway with local priority measures and taking advantage of reduced traffic flows on the A37 associated with the South Bristol Ring Road;
 - the route through the central area would enable interchange with other rapid transit routes at the same stop;
 - north of the central area the route would follow the M32 with a segregated alignment/priority measures;
 - at Coldharbour Lane, a new bus/transit only junction would be created to provide direct access, with new on/off access ramps between the M32 and Coldharbour Lane;
 - the route would service an expanded bus interchange at UWE providing links to a wide range of feeder services linking to the North Fringe and other destinations;
 - the route would then serve Bristol Parkway station and the core of the Bradley Stoke development;
 - finally, the route would run through Aztec West and the potential bus gate linking to Cribbs Causeway; and
 - the level of service on the route would need to be monitored – there is the potential for some short working of the service to intermediate points e.g. UWE, Bradley Stoke and Aztec West, with only a proportion of departures completing the full route.
- ◆ Bath – Cribbs Causeway:
- within Bath, the alignment would follow the planned rapid transit line in the Bath Package, i.e. from Lambridge via the city centre to Newbridge, using the segregated sections to the west of the centre through Western Riverside;
 - west of Bath the route would follow the A4 serving Saltford and Keynsham, with appropriate priority measures along the route;
 - west of the Hicks Gate, the proposed South Bristol Ring Road provides relief to the A4 and enables increased priority measures to be introduced;
 - if the local highway scheme to introduce the Callington Road link is completed, this would provide further relief to the A4 and would therefore facilitate additional priority measures for rapid transit;
 - after running through central Bristol, the alignment would follow Park Street and Whiteladies Road – with joint running with the Whitchurch to Avonmouth/Portishead rapid transit route (described below) there would be the opportunity to introduce more extensive priority measures;
 - the gradient on Park Street may limit the type of vehicles able to operate the route – at 9% it is on the limit of conventional metal wheeled light rail vehicles;
 - the route would take advantage of priority measures on the approaches to the Clifton Downs up Whiteladies Road and Blackboy Hill and across the Downs;
 - the feasibility of diverting the service into Westbury-on-Trym would need to be explored to establish the potential for priority measures and the impact on operating speeds for the rapid transit; and
 - north of Westbury-on-Trym, the route would take advantage of the dual carriageway A4018 to gain further priority measures on the approach to Cribbs Causeway.

- ◆ Whitchurch – Avonmouth/Portishead:
 - at the southern end of the route, the rapid transit service would serve major new residential developments at Whitchurch together with the proposed park and ride site adjacent to the A37;
 - the construction of the proposed South Bristol Ring Road would provide relief to the A37 and hence enable increased priority measures to be introduced along the corridor to benefit the operation of the rapid transit route;
 - within Hengrove the route would take advantage of sections of dual carriageway in order to achieve increased priority levels;
 - across central Bristol, the route would serve common sections with the Bath to Cribbs Causeway route, increasing the potential for interchange and strengthening the opportunity for priority measures to benefit both routes;
 - as with the Bath to Cribbs Causeway route, the Whitchurch – Avonmouth/Portishead route would operate on Park Street and Whiteladies Road, with potential priority measures along these roads, although, as noted above, there may be impacts on the type of vehicle that could operate the service due to the gradient on Park Street;
 - at Clifton Down station, the proposed route takes over the section of the Severn Beach rail line between Clifton Down and Avonmouth, creating a more direct service between this area and central Bristol while at the same time significantly increasing the frequency of public transport services – the impact on rail services is examined in the next section;
 - the segregated alignment through the Clifton Down tunnel and the northern sections through Sea Mills and Shirehampton will decrease journey times with the potential for creating additional stops;
 - if it proves to be impractical to use the Severn Beach rail line between Clifton Down and Avonmouth, an alternative alignment from the Centre would be along Anchor Road, Hotwell Road and Portway – although the route would be slower and longer, it would enable the rail line to be retained although there may be some abstraction of passengers by rapid transit due to its better penetration of central Bristol and the opportunity for additional stops within Sea Mills and Shirehampton;
 - to the north of Shirehampton, the route would divide with one section continuing to Avonmouth with potential extensions beyond Avonmouth rail station and with the second section using the proposed new Avon crossing road scheme to provide a direct link to Portishead;
 - the Avon crossing would connect to the A4 and the existing highway network close to the current Portway park and ride site and hence the rapid transit service would serve the site;
 - there are alternative routes between Royal Portbury Dock and Portishead – along the former rail alignment or along The Portbury Hundred, Bristol Road and Portishead High Street;
 - on serving Portishead the route would penetrate through the centre of the town to provide access across the town.

5.44 The initial alignments have been designed to build on Showcase bus corridors with enhanced priority measures and hence to operate within the existing highway. The exceptions are the following possible segregated sections:

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- ◆ the Severn Beach rail line which is part of the Whitchurch to Avonmouth/Portishead link;
 - ◆ along the former rail alignment between Royal Portbury Dock and Portishead;
 - ◆ the old Harbourside rail line for the Ashton Vale line;
 - ◆ the proposed new public transport connection between the M32 and Coldharbour Lane, providing access to UWE and Bristol Parkway station; and
 - ◆ use of a former rail line and a segregated route through the proposed Western Riverside development in Bath.
- 5.45 Although some sections of the rapid transit network could operate on a segregated alignment with no impact on other vehicles, for much of its length there would be direct contact with other traffic. This would result in a range of effects which would need to be incorporated in the detailed design of the scheme:
- ◆ the measures would be designed to build on the priority measures and other improvements contained in the Showcase bus scheme of the Greater Bristol Bus Network summarised in Figure 5.1;
 - ◆ re-allocation of road space from private vehicles to rapid transit, through the introduction of separate lanes for use by rapid transit – this could reduce capacity and hence increase private vehicle journey times along rapid transit corridors;
 - ◆ priority for rapid transit through junctions – by increasing the amount of green-time allocated to rapid transit vehicles, there would be reduced capacity for other traffic through the junctions, especially for traffic crossing the rapid transit route;
 - ◆ in parallel with the increased priority measures along the rapid transit route, there would be need to control other traffic use, especially the volume of on-street parking and the access for delivery vehicles;
 - ◆ the rapid transit vehicles could be longer than current standard buses and hence the infrastructure at stops may need to be amended, with more extensive passenger waiting facilities and the relocation of other street furniture in the immediate vicinity of the stops; and
 - ◆ while there would be an aspiration to provide as much priority as possible for rapid transit, this will be constrained by the characteristics of infrastructure along the route, especially in the heavily built-up areas on the approaches to town and city centres.
- 5.46 With the introduction of the major network of rapid transit routes, attention will need to be paid to the financial and administrative structure of the system's operation. Although the local bus operator is involved actively in the development of the smaller Bath rapid transit system, it is by no means clear whether there would be competition from bus operators for the rest of the proposed rapid transit network. To the extent that any competition from bus operators would abstract passengers from rapid transit, it would therefore diminish the viability of the new system.
- 5.47 Such a situation is not new: the introduction of rail-based light rail systems in the UK has encountered competition from bus operators, particularly in the early stages of operation e.g. South Yorkshire Supertram. Hence, institutional arrangements need to be established concerning the operation of rapid transit and its relationship with other public transport operators in the area. A number of alternative models are
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available; however, the detailed consideration of these is outside the scope of the present study.

Bus/Rapid Transit/Light Rapid Transit Costs

5.48 There is a variety of alternative forms of public transport systems which include varying degrees of segregation:

- ◆ conventional bus with limited segregation:
 - traditional bus or new vehicle design,
 - limited segregation within existing highway e.g. high occupancy vehicle lanes, bus lanes, Red Routes, access to pedestrian areas,
- ◆ conventional bus with maximum segregation:
 - traditional bus or new vehicle design,
 - extensive segregation including outside the existing highway e.g. contra-flow bus lanes, bus-only sections, bus gates, e.g. Edinburgh ‘Greenways’, Showcase routes,
- ◆ guided bus with limited segregation:
 - buses using specially built bus lanes at key locations with raised kerbs or forms of guidance (e.g. Leeds ‘Superbus’, Crawley ‘Fastway’),
- ◆ guided bus with maximum segregation:
 - bus running on own alignment for most of the route using dedicated raised kerb bus lanes or segregated busways e.g. Edinburgh, proposals for Cambridgeshire,
- ◆ light rail:
 - lightweight vehicles operating at lower speeds from trains using rubber or metal wheeled vehicles.

5.49 There are a number of new technologies, many of which are relatively untried within the UK operating environment. These include:

- ◆ varying forms of guidance (optical or wire guidance);
- ◆ different types of propulsion (e.g. electric bus, hydrogen, etc); and
- ◆ personal rapid transit.

5.50 The development of the rapid transit elements of the GBSTS proposals have been based, at this stage, on a system using guided bus with levels of segregation where practical. In the further development of the schemes, it will be appropriate to consider other technologies, perhaps new ones as yet untried within the UK environment, before selecting the preferred approach. In the selection process, attention should be given to the changing availability and cost of technologies (especially for guidance and propulsion systems), the costs of alternative fuels and their availability, the relative impacts on the environment through the levels of different emissions and variations in the risks associated with alternative systems.

5.51 Following a number of cost increases in recently planned and implemented urban transit schemes, the costs of all such proposals have received a heightened level of scrutiny. In particular, the publication of the recent Commission for Integrated

Transport (CfIT) report 'Affordable Mass Transit' (2005) has highlighted the need to consider alternatives to standard 'steel wheel on steel rail' trams.

- 5.52 An important element within the comparison is the variation in capacities of systems applying alternative formats. The CfIT report summarises the maximum corridor capacity (in terms of passengers per hour per direction) of different systems as shown in Table 5.2. Although, by specifying the maximum capacity, the comparison includes the impact of variations in both the maximum frequency and the size of vehicle, it provides an indication of the relative performance of different approaches.

Table 5.2 – Comparison of Corridor Capacity (by Direction)

Technology	Maximum System Capacity
Standard bus	2,500 – 4,000
Busway	4,000 – 6,000
Guided bus	4,000 – 6,000
Tram/light rail	12,000 – 18,000
Heavy rail	10,000 – 30,000

- 5.53 Within GBSTS, available cost data has been used for the dual purposes of selecting the nature of the rapid transit proposed in the strategy, and for estimating the cost of the proposals. To allow comparisons between systems within the UK and the rest of Europe, a cost per double track kilometre has been used with consideration given to the nature of the system built. This comparison excluded forecast costs for systems that had not yet been built and any outlying values as a result of local circumstances (e.g. a significant length of tunnelling). The costs quoted (in Table 5.3, Table 5.4 and Table 5.5) have all been adjusted to a 2005 base year.

Table 5.3 – European LRT Construction Cost Rates (£ Millions)

City	Cost per km (double track)	Notes
Berlin	7.09	Track only
Bonn (Auerberg)	8.39	Track with new street design
Bremen (line 4)	5.63	Track with new street design
Bremen (Line 6)	9.91	Track and separated track with difficult bridge
Duisberg	4.61	Track (only rails and wires)
Nantes	10.26	Complete system cost – on former rail track
Nantes	21.00	Complete system cost – new build rate
Paris (T1)	11.80	Complete system cost – new build rate
Paris (T2)	7.13	Complete system cost – on former rail track
Strasbourg (line A)	17.24	Complete system with 10% tunnel and new street design
Manchester phase 1	6.57	Mainly former rail track
Sheffield Supertram	11.13	
Midland Metro	8.06	
Croydon Tramlink	8.27	
Manchester phase 2	22.47	
Nottingham Transit	13.36	
Lyon	13.78	

Source: 'Bus or Light Rail: Making the Right Choice (April 2000) & NAO 'Improving Public Transport in England through Light Rail' (April 2004)

Table 5.4 – Guided Bus Construction Cost Rates (£ Millions)

City	Cost per km (double track)	Notes
Adelaide	3.53	
Ipswich	2.71	
Leeds (Scott Hall Rd)	4.84	
Paris	2.60	Part of a busway

Source: 'Bus or Light Rail: Making the Right Choice (April 2000)

Table 5.5 – Busway Construction Cost Rates (£ Millions)

City	Cost per km (double track)	Notes
Ottawa	6.96	
Paris	5.83	Includes a section of Guided Light Transit
Pittsburgh (east)	12.84	
Pittsburgh (south)	5.75	
Quito	3.26	

Source: 'Bus or Light Rail: Making the Right Choice (April 2000)

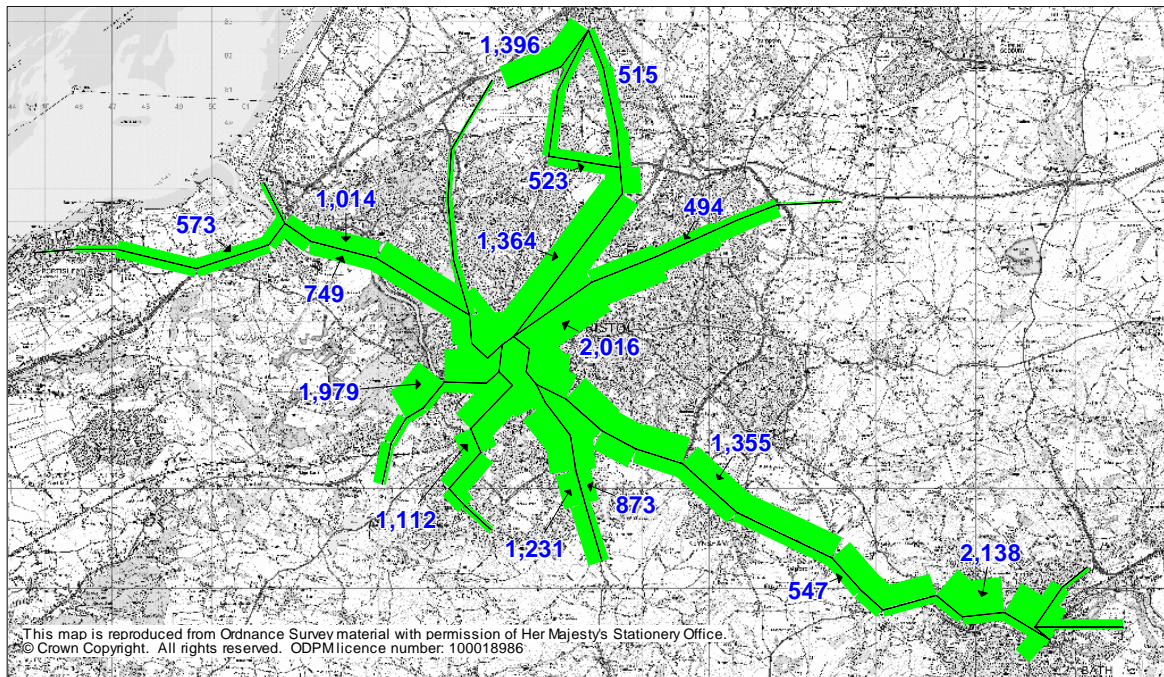
5.54 Clearly, even with some outlying examples removed, as shown in Table 5.6 there remains a great variation in the costs of implementing rapid transit systems. However, the examples indicate that guided bus systems are generally the lowest cost option, rising through busways – with their greater level of segregation – to full LRT systems.

Table 5.6 – Summary of LRT/Guided Bus/Busway Cost Rates (£ Millions)

	Min	Max	Mean	Median
LRT	4.61	22.47	10.98	9.91
Guided bus	2.60	4.84	3.42	3.12
Busway	3.26	12.84	6.93	5.83

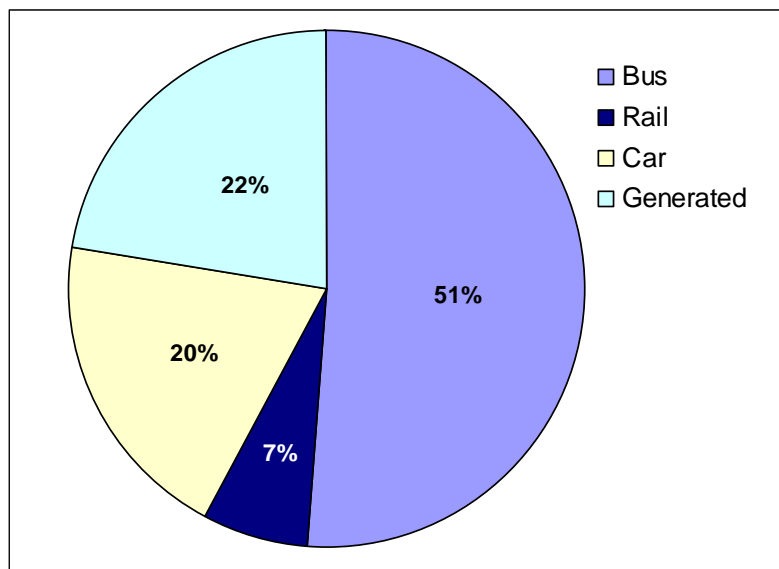
5.55 The proposed Greater Bristol rapid transit system described above was tested using the GBM using service frequencies of up to 12 departures per hour. The test assumed all other elements of the GBSTS strategy to be in place, and indicated a high level of demand for rapid transit, with a total of up to 20,000 trips per hour on the system in the morning peak period in 2031. In addition, there was an increase of around 2000 in trips by park and ride, with passengers taking advantage of the improved services by rapid transit from Long Ashton, Brislington, Whitchurch, Emersons Green, Avonmouth, Hambrook and Bristol Parkway park and ride sites. The forecast flows on the system are shown in Figure 5.5.

Figure 5.5 – Passenger Flows on the Rapid Transit System (average morning peak hour)



5.56 Figure 5.6 shows where the demand for rapid transit has come from, indicating that half the rapid transit passengers would otherwise travel by bus, while 20% have transferred from car.

Figure 5.6 – Original Mode of Rapid Transit Passengers



5.57 Table 5.7 shows comparative journey times for bus, rail (where appropriate) and rapid transit. The times given are for the whole journey and include:

- ◆ time spent travelling on the public transport service;

- ◆ time spent walking to the station or stop;
- ◆ time spent waiting (assumed to be half the combined service headway of available services); and
- ◆ an interchange penalty to reflect the inconvenience of having to change service.

5.58 Note that in practice, journeys could be shorter if passengers know the timetable and only arrive when a service is due, but these figures give a good indication of the level of service offered.

Table 5.7 – Comparative Journey Times in Morning Peak Period (minutes)

Journey	Bus	Rail	Rapid Transit
Hengrove to Bristol city centre	47	n/a	32
Newbridge P&R to Bath centre	38	n/a	24
Portishead to Bristol city centre	151	n/a	49
Avonmouth to Bristol city centre	73	86*	57
Stoke Gifford to Bristol city centre	53	37	34
Keynsham to Bristol city centre	n/a	45	43

* Do Minimum journey time via Severn Beach line.

- 5.59 Table 5.7 shows that the rapid transit system delivers considerable time savings on routes currently served by bus, such as Hengrove to Bristol city centre and Newbridge to Bath city centre. Rapid transit would deliver a step change in the level of public transport service from Portishead, reducing the total journey time to a third of that offered by the infrequent bus service. Note that the journey times that could be achieved with the Portishead rail line are considered in the section below on rail.
- 5.60 Journey time savings are modest for routes already served by rail, for example Stoke Gifford (near Bristol Parkway station) to Bristol city centre and Keynsham to Bristol city centre, although the rapid transit would offer a new travel option and would improve accessibility to destinations outside the city centre. It should be noted that the rail travel times shown for these routes assume the introduction of new cross-Bristol rail services (see section on rail below). For trips from Avonmouth, Table 5.7 shows that the more frequent and direct rapid transit service offers a better level of service than the Severn Beach rail line.
- 5.61 Some key performance statistics are given in Table 5.8. These indicate the impact that the introduction of rapid transit could have on the transport system as a whole. The rapid transit system would reduce the number of car trips across the Greater Bristol area by 2% thereby reducing the car mode share from 80% to 76%. There would be a 4% reduction in total highway delay, which compares favourably with

most road schemes considered as part of the study. Rapid transit would also relieve pressure on the rail network, reducing crowding levels by around a third. In general, the rapid transit system would abstract demand from other public transport services although there would be an overall increase in public transport demand. In the detailed development of the rapid transit network, potential revisions to bus services would need to be identified.

Table 5.8 – Impact of the Rapid Transit System (morning peak period)

Measure	Impact
Vehicle Trips	2% reduction
Vehicle Kilometres	1% reduction
Car Mode Share	Reduced from 80% to 76%
Total Vehicle Delay on Highway network (Hours)	4% reduction
Average Vehicle Speed (Highway)	2% increase
Rail Crowding	32% reduction

5.62 Table 5.9 gives a summary of the economic performance of the rapid transit system. The overall economic performance of the scheme is very strong. The user benefits generated considerably outweigh the scheme costs, resulting in an NPV and BCR of £2300 million and 5.3 respectively.

Table 5.9 – Economic Performance of the Rapid Transit System

	Rapid Transit System
Capital Cost (2005,Q1 prices) £mill, inc Optimism Bias	£166
Annual Operating Cost (2005,Q1 prices)	£12
PVC (£ mill, 2002 prices & values)	£540
PVB (£ mill, 2002 prices & values)	£2,900
NPV (£ mill, 2002 prices & values)	£2,300
BCR	5.3

5.63 The majority of the benefits are related to time savings. These are experienced both by:

- ◆ those travellers directly benefiting from the more convenient, frequent and direct services provided by the rapid transit network; and
- ◆ those making use of the highway network and therefore benefiting from the congestion relief resulting from the attraction of trips to rapid transit from highway.

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- 5.64 Travel time savings for public transport users are spread over the area covered by the rapid transit network, but particularly focused on trips to and from Bristol and Bath city centres from south Bristol and the development areas of Ashton Vale, Whitchurch, Hicks Gate and Portishead. The largest highway benefits are accrued in those areas experiencing the highest congestion levels, such as within the Bristol and Bath urban areas.
- 5.65 The additional trips drawn to rapid transit also cause a substantial increase in rapid transit revenue, although the associated reductions in parking, bus, rail and park and ride revenue act to offset this to some extent.
- 5.66 An additional consequence of the switch in trips from highway to public transport is the reduction in indirect tax paid (primarily due to a reduction in fuel duty paid and the lack of tax on public transport fares). This adds to the net cost of the scheme to the government.
- 5.67 The study has identified strong demand patterns for the rapid transit lines included in the study's transport strategy. However, further work is required to take the measures forward. As demonstrated in the description of each individual alignment, there are a number of detailed issues that will need to be resolved. Included in this is the type of vehicle to be used as the basis for the rapid transit operation. Initially, the work has been based on the premise of a bus-based operation, using high quality vehicles currently being developed which are capable of operating along segregated alignments as well as within existing traffic.
- 5.68 The earlier analysis has identified the relative characteristics and costs of rubber-tired and metal-wheeled rapid transit operations. However there is not a single type of system within each heading; rather there is a continuum with a wide range of alternative systems in terms of the characteristics of the vehicle (e.g. capacity, speed, reliability, performance, attractiveness, fuel efficiency, perception, etc) which would need to be taken into account in the detailed assessment.
- 5.69 Key factors will be the passenger capacity and quality of the vehicles. Although it is by no means a requirement, there would be merit in using a single type of vehicle for all four lines. This would produce benefits in the design, economics of scale in vehicle purchase, maintenance and operation, etc. The quality of the vehicles will be vital to establish a clear identity for the system. The vehicles should present a strong image designed to encourage existing car drivers to consider switching to public transport. Hence, the image should be as distinctive as possible, and a clear change from current public transport services in the area.
- 5.70 Many of the proposed rapid transit lines would serve new developments and, in many cases, the scale of the development in terms of population and workplaces has yet to be defined. Some initial assessments on the performance of the rapid transit routes have highlighted that, if the highest levels of density are achieved in the new developments, the volume of passenger demand would not easily or comfortably be satisfied by a bus-based rapid transit system. The frequency requirements to cater for the demand would require a frequency of service which is not compatible with a reliable operation. Hence, once clarity is obtained on the characteristics of the new developments, then a more precise specification for the vehicles to be used on the associated rapid transit system can be completed.
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RAIL

- 5.71 The rail network within the Greater Bristol area represents a potential resource capable of wider and more intensive use, although there are significant limitations as to the extent to which its usage can be increased. The most obvious limitations lie in the number and location of the existing rail lines which provide only partial coverage of the area at a level which is much less than many other conurbations of a similar size. At the same time, the rail lines provide insufficient penetration of the current main passenger objectives, for example central Bristol and the North Fringe. These factors contribute to the current relatively low levels of rail use in the Greater Bristol area, with just 2% of peak journeys being made by rail, compared with 89% by car, although in some corridors (e.g. Bath and Weston-super-Mare to Bristol), rail has a more significant, although still minor, role. In the face of such levels of usage, the scope for rail improvements to make a significant impact on car use must therefore be limited; a doubling of rail demand through diversion from car would only produce a 2% drop in the car mode share.
- 5.72 With the present state of the rail industry, there are limited resources available for major enhancements to the rail network. The Network Rail Discretionary Fund, announced in 2005, comprises £200 million of government funding over the period to 2008/9 matched by a corresponding amount of Network Rail's own funds. It represents a mechanism by which funding is available for minor schemes costing less than £5 million. The construction of a third platform at Bristol Parkway has been authorised out of the NRDF and takes advantage of defunct Royal Mail infrastructure at the station. The third platform represents an opportunity for increased cross-Bristol links.
- 5.73 The objectives of GBSTS include the need to take into account the affordability and potential to implement measures and hence this represents a constraint on the types of measures that can realistically be pursued, especially in the short term. The Route Utilisation Strategy and the Greater Western franchise indicate the direction in which the development of the railway is likely to take in the short to medium term.
- 5.74 In the medium term, although unlikely to be completed until 2018, the scheduled resignalling of the Bristol area provides a further opportunity to increase the flexibility and capacity of the infrastructure with the potential to significantly increase the rail throughput across the area. While the completion of the re-signalling provides the opportunity for improvements to rail operations in the Bristol area, it should not be seen as a limiting factor – there is the potential to introduce measures in advance of the signalling scheme.
- 5.75 The combination of increased congestion on the road network and measures designed to encourage the use of public transport (i.e. 'Smarter Choices' described in Chapter 3) would produce significant increases in rail demand on the three main rail corridors compared with current levels, even without improvements to public transport. The passenger growth between 2003 and 2031 on the Bath line would be 50%; it would be 220% between Bristol and Weston-super-Mare and 140% between Bristol and Bristol Parkway. Even with these levels of growth on rail, the impact on car traffic growth is small. For example, even with the large growth in rail trips between Bristol and Weston-super-Mare, with around 1100 extra rail passengers, this represents just 4% of car traffic on the road network between the two places.

- 5.76 However, measures need to be introduced to meet the potential demand for rail to ensure that there is sufficient capacity on the rail network to accommodate the additional demand. The danger might be that, in the absence of sufficient capacity, the train operating company seeks to match supply and demand by raising real fare levels.
- 5.77 In addition to the measures outlined above, there are additional schemes which could be scheduled throughout the GBSTS study period and would contribute to a further extension of rail services in the GBSTS area.

Rolling Stock and Train Capacity

- 5.78 The transport strategy includes a number of measures designed to encourage car drivers to use other modes of transport. With the parallel growth in development in the sub-region including significant increases in population and employment, there will be pressure for additional capacity for the rolling stock used in the area. This pressure will be increased if other measures such as Smarter Choices and demand management are introduced and have the anticipated impact of influencing mode choice and hence increasing rail patronage levels.
- 5.79 The Route Utilisation Strategy (RUS) and the Greater Western refranchise specification have both highlighted the need to improve the quality of rolling stock used for local services with the proposed cascade of Thames Turbo stock onto the network; this will increase rail capacity by at least a third without lengthening trains.
- 5.80 The RUS suggested a rolling stock cascade which would see the trains currently used on local services around Bristol and Cardiff replaced by trains with a higher capacity. Class 143 and 150 trains would be replaced by Class 165 trains cascaded from the former Thames Trains operation, with an increase in seating capacity from 104 and 141 respectively to 170 seats per 2 car train (188 if the existing first class provision is replaced with standard class). The Class 165 trains also have a 90 miles/hour maximum speed as opposed to 75 miles/hour for the existing trains.
- 5.81 The growth in demand over time will further increase the need to raise capacity on the local stopping services by lengthening these new trains from two to four cars which can be achieved without the need to increase platform lengths.

Worle

- 5.82 As outlined above, there is potential in the expansion of the current station at Worle to play a greater role as a multi-modal interchange, providing a focus for local and regional rail services, local and regional bus services, airport buses, coach services and park and ride. The potential rail infrastructure improvements would involve lengthening platforms to accommodate Cross Country services; this lengthening could be implemented before signalling enhancements. The initial expansion of services may be limited in the short to medium term by the availability of paths, but the planned resignalling of the Bristol area in the medium term (around 2018) should permit the further expansion of services to Worle. The level of additional capacity, which the Bristol area re-signalling will generate, will not be known until the design of the work has been undertaken by Network Rail. This, together with other demands for capacity from cross country and mainline services, means that it is difficult to

assess the capacity available for local Bristol services and hence the need for further capacity improvements, for example the introduction of additional passing loops.

- 5.83 More intermediate improvements can be achieved to the operation of rail services through Worle Junction by introducing double tracks to replace the single lead junction. This can be undertaken as part of scheduled maintenance at the junction.

Yate

- 5.84 The opportunity for the extension of cross-Bristol services to Yate is precluded by the absence of turnback facilities there. The planned new platform at Bristol Parkway will increase capacity, but the provision of additional facilities at Yate would enable a significant increase in cross-Bristol services between Yate and Weston-super-Mare or Bath. The turnback facilities would enable the rolling stock unit to be parked clear of the two running lines. It is likely that the capacity of the signalling system will be an initial constraint but once the re-signalling is completed and the Yate turnback facilities are undertaken, a significant increase in services would be possible. Yate would also be the location for increased interchange, between local bus services and rail.

Weston-super-Mare

- 5.85 The single track section between Worle Junction and Weston-super-Mare station represents a constraint in the operation of rail services to Weston-super-Mare. Although the improvements at Worle and the associated increase in services would represent an increase in the overall rail services to Weston-super-Mare as a whole, the desire for increased cross-Bristol services between Bristol Parkway/Yate, Bath and Weston-super-Mare will put further pressure on the single track section. While it was a SWARMMS recommendation to reinstate the double track over this section, most of the benefits can be achieved by the improvement of turnback facilities at Weston-super-Mare at a much lower cost. The expansion of operations at Worle diminishes the need to provide the double track connections for the whole length between Worle junction and Weston-super-Mare. However, as highlighted above in relation to Worle station, there would be merit in removing the constraint of the single lead junction at Worle by introducing a double-track section of sufficient length to accommodate local services.

Increased Cross-Bristol Services

- 5.86 Much of the infrastructure improvements outlined above have been designed to increase the capacity and flexibility of rail operations across Bristol and to aid the expansion of services. Although the full expansion of services is likely to be dependent upon the completion of the re-signalling in the Bristol area to achieve the maximum benefits, it will nevertheless be possible to achieve noticeable improvements to services in advance of the resignalling. The increased links would represent a significant improvement to local services. The services would include links between Weston-super-Mare and Yate and between Bath Spa and Yate. There may be constraints in the capability of turning trains at Bath Spa, with a desire to avoid impacts on the operation of mainline services between Swindon and Bristol Temple Meads through Bath Spa. It may therefore be necessary to extend the cross-Bristol services beyond Bath Spa to Westbury which, although increasing the

cost of the additional services, would significantly improve connections between the west Wiltshire towns of Trowbridge, Bradford-on-Avon with the main employment centres of Bath and Bristol.

Severn Beach line

- 5.87 The Severn Beach line currently operates at an hourly interval service for much of the day and this level of service (combined with the circuitous nature of the route to Bristol Temple Meads) produces low passenger loadings along the route. There are currently 15 trains per day in each direction between Avonmouth and Bristol Temple Meads on Mondays to Saturdays, with no trains on Sundays. In the peak periods, the service is extended from Avonmouth to Severn Beach; in the off-peak this link is replaced by a connecting bus service. The estimated annual patronage level of 340,000 represents an average flow of about 40 passengers per hour although there are heavy loadings on individual trains in the morning peak towards Bristol and in the evening peak from Bristol.
- 5.88 The study has explored the feasibility of converting the line in the longer term to rapid transit with, at the same time, a possible extension to Portishead as part of a second Avon Crossing. The proposed replacement rapid transit services would offer an improved frequency of up to 10 services an hour. Within the Bristol area, the poor accessibility of the rail line to the central area would be corrected with rapid transit by the introduction of on-street operations between Clifton Down and central Bristol along Whiteladies Road, Park Street and The Centre to give a significantly enhanced link from the corridor as well as improved frequency. Additional stops in Sea Mills and Shirehampton would provide improved penetration in these areas.
- 5.89 However, while the rapid transit scheme provided benefits, there are other factors, apart from enhancement to the public transport service, to be taken into account in the conversion of the Severn Beach line to rapid transit operation. In particular, the Severn Beach line has been identified within the Government's Community Rail initiative as the potential recipient of measures designed to encourage greater rail patronage. Furthermore, the line currently serves as a relief line for the main line passenger operation on Filton Bank and the freight operation from Avonmouth to Bristol Parkway Junction. There is likely to be a need to maintain this emergency provision and to continue the freight operation. However, it is likely that the, and whether it would be deemed to outweigh potential passenger benefits, needs to be explored with the appropriate authorities. As explained in the section on the rapid transit proposals, if it proves to be difficult to release the rail alignment for rapid transit, there is an alternative route for the rapid transit line from Bristol Centre via Anchor Road, Hotwell Road and Portway to Avonmouth.

Bristol Parkway

- 5.90 Network Rail is progressing a scheme to increase the capacity at Bristol Parkway station through the construction of a third platform. In the longer term, the increased operation of passenger and freight services through the station, including the mix of local, regional and national passenger services will place further pressure on the capacity. Hence, towards the end of the horizon for the study, it may become necessary to increase capacity through an additional fourth platform. The station would increase its role as an interchange point with the increased number of rail

services, including not only transfers between rail services (local, regional and main line), but also between local bus and rail and between rail and the extended Flyer service to BIA.

TESTING RAIL OPTIONS WITH GREATER BRISTOL MODEL

5.91 The GBM was used to test the following rail options:

- ◆ additional cross-Bristol rail services on the following routes:
 - Weston-super-Mare – Bristol Temple Meads – Bristol Parkway – Yate (semi-fast);
 - Weston-super-Mare – Bristol Temple Meads – Bristol Parkway (all stations) ;
 - Bath – Bristol Temple Meads – Bristol Parkway – Yate (all stations except Stapleton Road and Lawrence Hill); and
 - Bath – Bristol Temple Meads – Filton – Bristol Parkway (fast); and
- ◆ Portishead rail line.

Cross Bristol Rail Services

5.92 Introducing the new services leads to an increase in rail trips of 1950 per hour in the morning peak period. Furthermore, there are an additional 350 park-and-ride trips per hour making use of the improved rail service. This leads to a 10% increase in both rail passenger-kilometres and passenger-hours. The increase in rail demand due to the new services is shown in Figure 5.7. As indicated above, in order to achieve the increased volume of services, it will be necessary to provide enhanced turnback facilities and will also require additional capacity to be provided by the re-signalling of the Bristol area. Even with the increased capacity, there will be competition from mainline, regional and freight services as well as the aspirations for the local services. The content of the re-signalling scheme has yet to be specified and it will therefore be crucial that sufficient support and promotion is given for the merits of enhanced local services.

5.93 Figure 5.8 shows, the source of the additional rail demand, indicating that around a third of the passengers have transferred from other modes of public transport, a third has transferred from car and a third comprises completely new (generated) trips.

Figure 5.7 – Difference in Passenger Flow as a Result of Cross Bristol Rail Services

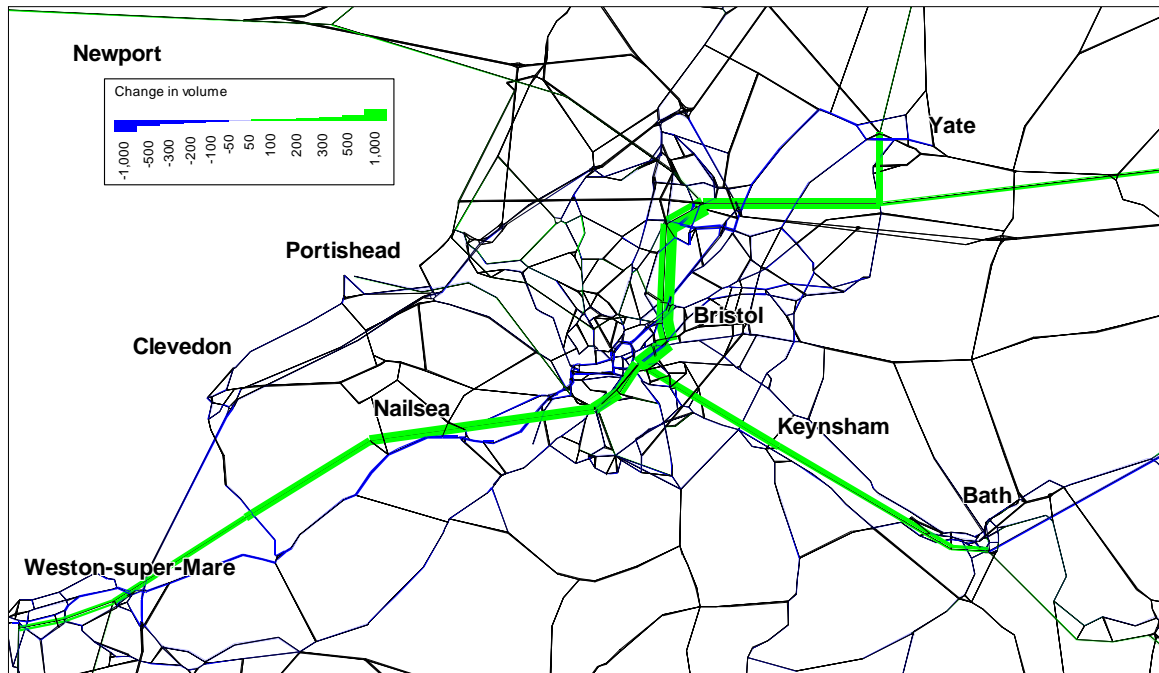
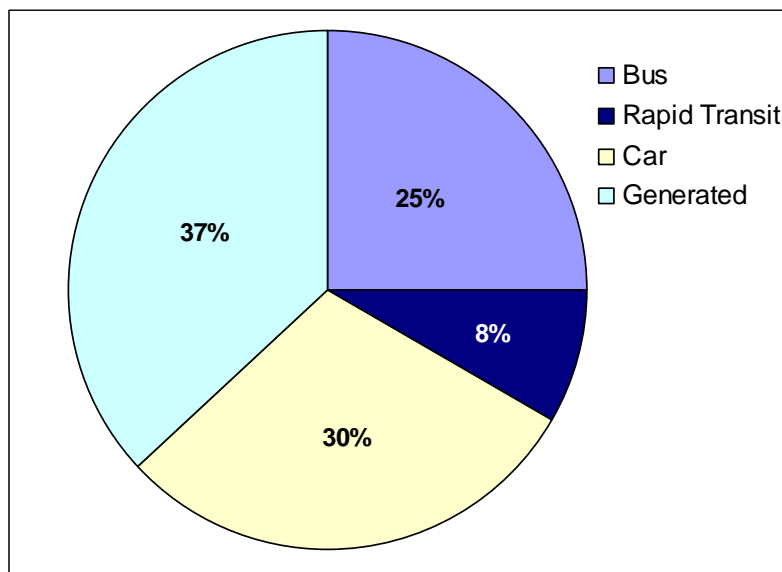


Figure 5.8 – Origin of Additional Rail Passengers



5.94 Table 5.10 shows the impact of the cross-Bristol rail services on rail journey times. As described in the section on rapid transit above, the journey times quoted include time spent travelling on the rail service, walking time, waiting time and an interchange penalty.

5.95 The results show that the new services offer considerable journey time savings on the routes covered, particularly to and from Yate. It should be noted, however, that the figures assume a wait time of half the service headway. In practice, journey times would be shorter as it is likely that passengers would know the timetable and

only arrive at the station when a train is due. This applies particularly to the infrequent Yate services.

Table 5.10 – Effect of Cross Bristol Rail Services on Journey Times

Journey	No cross-Bristol services	With cross-Bristol services	% reduction in Journey Time
Weston-super-Mare to Bristol city centre	73	62	15%
Weston-super-Mare to Yate	249	105	58%
Weston-super-Mare to Filton	87	69	21%
Bath to Filton	61	54	11%
Bristol to Yate	214	67	69%

5.96 Some key statistics are given in Table 5.11. These indicate the impact the introduction of the cross Bristol rail services could have on the transport system as a whole.

Table 5.11 – Impact of Cross Bristol Rail Services

Measure	Impact
Vehicle Trips	0.3% reduction
Vehicle Kilometres	0.5% reduction
Car Mode Share	reduced from 81% to 80%
Total Vehicle Delay on Highway network (Hours)	2% reduction
Average Vehicle Speed (Highway)	1% increase
Rail Demand	25% increase
Rail Crowding*	2% reduction

* Crowding is reflected by increases in the in-vehicle time to reflect passengers' perceived dislike of travelling in crowded conditions. The size of the impact grows as the level of crowding increases (measured by relationship between seated capacity and passenger loadings).

5.97 The additional capacity provided on the rail network is largely taken up by new trips, formed by a combination of diversion from other modes and newly generated journeys. As a result, there is only a modest reduction of 2% in rail crowded time. However, the scheme provides some crowding relief for the bus and rail networks between Nailsea and Weston-super-Mare. On the highway network, there is a reduction of 2% in total vehicle delay across the study area as a result of car trips switching to rail.

5.98 Although there is a considerable increase in rail demand (25%), the impact on the overall car mode share is modest, indicating that, while rail improvements can

contribute positively to reducing congestion on the road network, other measures are needed in addition, e.g. Smarter Choices, demand management, new highway infrastructure etc.

- 5.99 The overall economic performance of the scheme is strong. The user benefits generated considerably outweigh the scheme costs, resulting in an NPV and BCR of £760 million and 3.2 respectively.
- 5.100 The majority of the benefits are related to time savings. These are experienced both by:
- ◆ those travellers directly benefiting from the reduced rail journey times resulting from the more frequent and direct services provided by the scheme (examples include trips to and from the Yate and Weston-super-Mare areas); and
 - ◆ those making use of the highway network and therefore benefiting from the congestion relief resulting from the attraction of trips to rail from highway. The largest benefits are accrued in those areas experiencing the highest congestion levels, such as within the Bath urban area.
- 5.101 The additional trips drawn to rail also cause a substantial increase in rail revenue, although the associated reductions in parking, bus and Park and Ride revenue act to offset this to some extent.
- 5.102 A further consequence of the switch in trips from highway to public transport is the reduction in indirect tax paid (primarily due to a reduction in fuel duty paid and the lack of tax on public transport fares). This adds to the net cost of the scheme to the government.

Portishead Rail Line

- 5.103 The Portishead rail line was tested using the GBM at a service frequency of two trains per hour with intermediate stops at Portbury, Pill, Ham Green, Ashton Gate, Parson Street and Bedminster.
- 5.104 Introducing the Portishead line resulted in an increase in rail demand of 550 passengers per hour (or about 6%). Of these, around 200 transferred from car, causing a modest reduction of 0.3% in total vehicle delay.
- 5.105 The total journey time from Portishead to Bristol city centre (including time spent travelling on the rail service, walking time, waiting time and an interchange penalty) was 93 minutes – a considerable improvement on the level of service offered by bus (151 minutes). However, the rapid transit service described in the previous section gave a journey time of 49 minutes for the same point-to-point journey. This is due to a number of factors:
- ◆ more frequent service by rapid transit (at least 5 per hour, compared with 2 per hour for the train service);
 - ◆ better penetration of the rapid transit route into central areas of Bristol, reducing walking time, and allowing convenient interchange with other routes in the rapid transit network; and

- ◆ the location of the proposed rail station on the edge of Portishead would be much less accessible than the rapid transit stops, which could easily serve central areas of Portishead.

5.106 While the economic assessment of the Portishead rail line was relatively positive, with an NPV of £160 million and BCR of 2.3, the rapid transit scheme would offer a better quality of service and better value for money. The costs of the two schemes are set out in Table 5.12 below. The rapid transit capital cost is of the same order as the capital cost of converting the Portishead line. The greater difference is found in the operating costs, with those for rapid transit estimated at around a third of what would be required to run the Portishead rail line.

Table 5.12 – Cost Comparison – Portishead Rail Line vs Rapid Transit

Cost (£M, 2005 Prices)	Rail	Rapid Transit
Capital Cost	29	25
Operating Cost (per annum)	5.2	1.9

5.107 Other rail schemes have been assessed including the potential for re-opening passenger rail services to Thornbury and from Avonmouth to Bristol Parkway on the current freight route. For each of these options, the forecast level of demand is very low and hence the schemes have not been progressed. Similarly, the potential for re-opening a station at Charfield, north of Yate was examined. The low levels of demand, together with the impact of the additional stop on the journey times of existing passengers, resulted in poor performance for the scheme.

POTENTIAL IMPLEMENTATION PROGRAMME

5.108 An implementation programme for the public transport schemes has been developed, based on a wide range of criteria, including the timing of new developments, timetable for scheme design and appraisal, availability of resources, implementation of associated measures, etc:

- ◆ in the short term:
 - Greater Bristol Bus Network;
 - Bath Package including new park-and-ride site at Lambridge, extensions to sites at Odd Down, Lansdown and Newbridge and rapid transit route between Newbridge and Lambridge via central Bath;
 - improvements to inter-urban buses including an extension of Airport Flyer services;
 - improved interchange facilities at UWE;
 - Bristol Parkway third platform;
 - new rolling stock for local rail services;
- ◆ in the medium term:
 - Worle public transport interchange
 - rapid transit on three routes: Ashton Vale to Emersons Green; Hengrove to North Fringe/Cribbs Causeway; Bath to Cribbs Causeway;

- extensions to park and ride sites at Brislington, Long Ashton and Bristol Parkway and to the station car park at Nailsea;
- new park and ride sites at Emersons Green, Hambrook and Nibley; and
- ◆ in the long term:
 - Bristol Parkway fourth platform;
 - new cross-Bristol rail services;
 - rapid transit from Whitchurch to Avonmouth and Portishead;
 - extensions to park and ride sites at Avonmouth and Nibley,
 - new park and ride site at Whitchurch;

IMPACT OF EXTENSIVE PUBLIC TRANSPORT MEASURES IN ISOLATION

5.109 It had been suggested to the study team that the introduction of significantly enhanced public transport services would, on their own, produce a sufficient impact on travel across the study area to the extent that other measures, particularly increases in highway capacity through new road construction, would play a much decreased role in the transport strategy. To test this approach, a more extensive set of public transport improvements was tested to examine their impact. These measures included:

- ◆ in-vehicle times on the bus network reduced by 15%;
- ◆ bus frequencies increased by 25% with a corresponding reduction in waiting times;
- ◆ interchange penalties reduced by 25%;
- ◆ fares reduced by 10% in real terms;
- ◆ high-speed, limited stop, inter-urban bus services linking major centres (e.g. Weston-super-Mare, Bath, North Fringe, BIA) with average speeds of over 30 miles/hour;
- ◆ significant **additions** to the current rail network:
 - Weston-super-Mare to Bristol Parkway (extra 2 tph),
 - Weston-super-Mare to Yate and Thornbury (extra 1tph),
 - Bath to Bristol Parkway (extra 2 tph),
 - Bath to Yate and Thornbury (extra 1 tph),
 - Portishead Line (3 tph),
 - Severn Beach Line (extra 2 tph)
- ◆ rapid transit network with average speeds of 20 miles/hour; and
- ◆ extensive park and ride network.

5.110 Table 5.13 shows the key impacts of the enhanced public transport package on its own in the morning peak period, which includes a doubling in the number of public transport trips and a 250% increase in park and ride trips, compared to the Do Minimum scenario. The rail capacity improvements bring the level of rail crowding down by two-thirds to 2003 levels.

Table 5.13 – Key Impacts of Public Transport Package (morning peak period)

	2003 Base	2031 Do Minimum	2031 PT Package	PT Package vs Do Minimum	PT Package vs Base
Public Transport Trips	18000	17000	35000	+ 102%	+ 93%
Park and Ride Trips	1550	1770	6220	+ 252%	+ 301%
Rail Crowding (passenger hours)	300	970	310	- 69%	+ 3%
Highway Vehicle Trips ('000)	154	207	197	- 5%	+ 28%
Vehicle Kilometres ('000)	2,000	2,880	2,790	- 3%	+ 40%
Car Mode Share	89%	91%	81%	- 2%	- 8%
Total Vehicle Delay on Highway Network ('000 Hours)	19	64	54	-16%	180%
Average Vehicle Speed (km/hr)	44	29	31	9%	-29%

5.111 Although the significantly enhanced public transport system encouraged large levels of diversion onto the public transport services, the overall effect on the highway network was muted. The total number of vehicle trips on the highway network falls by 5% in 2031 and still represents a 28% growth from current (2003) levels. Furthermore, journey lengths on the highway network have increased, with the total vehicle-kms falling by just 3% which represents a 40% growth from current levels.

5.112 These effects demonstrate that, even though the public transport improvements stimulate extra usage of the system, the diversion from car to public transport encourages induced or generated traffic through the released highway capacity. At the same time, there would be an increased proportion of goods vehicles on the road network since these trips would not be affected by the public transport improvements. Such vehicles would also have a higher average trip length.

5.113 Hence, the public transport improvements would need to be combined with other policies to control the level of highway traffic, especially a means of limiting the level of induced traffic, e.g. demand management. Even so, the level of highway demand would be greater than current levels, leading to the need to expand the capacity of the highway network.

SUMMARY

5.114 The study has examined a wide range of potential improvements to the public transport system in order to cater for the general growth in the demand for travel

across Greater Bristol. The particular components of the public transport measures within the transport strategy range from improvements to the local bus services through to an expansion of the rail network.

- 5.115 Improvements to **urban bus services** would be a main focus in the strategy for enhancing the public transport system in the short to medium term. The Showcase bus corridors which form the Greater Bristol Bus Network JLTP Major Scheme Bid include a package of measures with junction improvements providing priorities for buses, new bus lanes, improved bus shelters, real-time passenger information and new low-floor buses.
- 5.116 Extensions to the **park and ride system** would involve expansion at the existing sites in Bristol and Bath to increase the capacity and improve the facilities. New sites are also identified in the strategy at Emersons Green, Hambrook, Whitchurch, Nibley and Lambridge.
- 5.117 The detailed consideration of **inter-urban bus services** is outside the main scope of GBSTS. Nevertheless, it is possible to identify new connections that would be necessary following the new population and employment developments across the study area. In addition, extensions to the highway network will provide the opportunity to offer service improvements such as journey time cuts and reliability gains. The network of services will need to be reviewed in association with the priority measures in the Greater Bristol Bus Network together with the introduction of rapid transit and improvements to rail services.
- 5.118 Extensions to the **coach services** in the strategy would be a combination of enhanced operations through the use of priority measures within the Greater Bristol Bus Network together with potential new stopping locations out of city centres at the new Worle Parkway Interchange, Lambridge Park and Ride and in north Bristol at Parkway/UWE/Hambrook.
- 5.119 A particular growth area of future travel is **BIA** and public transport access to the airport must be enhanced to accommodate the growth in air passengers and workers at the airport. The strategy identifies the current Flyer service as the foundation for future expansion, with increased frequency on the existing route together with expansion to serve north Bristol (Parkway) and Worle Interchange. To cater particularly for the airport workers, a demand-responsive or shared taxi operation would be the most appropriate means of serving the widespread destinations.
- 5.120 The strategy identifies a number of **public transport interchanges** which should be developed out of town or city centres to serve local developments, including Worle Parkway (with multi-modal activity), UWE (serving the North Fringe), Yate and Filton Abbey Wood rail stations.
- 5.121 A major area of new development for the public transport involves the network of **rapid transit** lines which would build on the priority measures within the Greater Bristol Bus Network to produce a system with further priorities including segregation from general traffic wherever possible. The lines would be designed to serve many of the new residential and employment developments, with the initial plans comprising:

- ◆ Ashton Vale – Emersons Green;
- ◆ Hengrove – North Fringe/Cribbs Causeway;
- ◆ Bath – Cribbs Causeway; and
- ◆ Whitchurch – Avonmouth/Portishead.

5.122 An early element of the rapid transit network would operate in Bath between Lambridge and Newbridge as part of the Major Scheme Bid which is being prepared within the JLTP process.

5.123 Further work is required to identify the type of vehicle to be used to operate the service but modern, low-floor, articulated buses are likely to be the most appropriate, flexible and cost effective vehicles to satisfy the requirements of the service. Further work is also necessary to specify the precise routes, taking into account the desire for significant levels of segregated operation.

5.124 The **rail** network within Greater Bristol represents a potential resource capable of wider and more intensive use although there are limitations through the number and location of existing rail lines. The restricted penetration into the city centres of Bristol, Bath and Weston-super-Mare and the poor links to the North Fringe contribute to low levels of current rail use, with just 2% of journeys in the morning peak period.

5.125 A range of measures has been identified to improve and expand the rail network, taking into account the availability of resources within the industry:

- ◆ improved rolling stock providing increased capacity and speed enhancements on the local rail services;
- ◆ additional platforms at Bristol Parkway to provide initially three and ultimately four platforms;
- ◆ expanded facilities at Worle station to create a major interchange location, including platform lengthening and an expansion of services;
- ◆ new turn-back facilities to enable more trains to operate to/from Weston-super-Mare and Yate; and
- ◆ increased services across Bristol linking Weston-super-Mare, Yate and Bath Spa – in view of the restrictions in turning trains at Bath Spa, it may be necessary to extend the local services to Westbury to provide better connections between the West Wiltshire towns of Trowbridge and Bradford-on-Avon and the employment centres of Bath and Bristol.

5.126 Although some of the improvements could be introduced in the short-medium term, the full extent of service increases would be dependent on the re-signalling of the Bristol area which is likely to be completed by 2018.

