Worthing Area Strategy Development Plan
South Coast Corridor Multi-Modal Study
Prepared for
Government Office for the South East
August 2002

Halcrow Group Limited

In association with:

- Accent
- Chris Blandford Associates
- DTZ Pieda
- Baxter Eadie Ltd
- Sustainable Futures
- Camargue – PR media Consultants
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South Coast Corridor Multi Modal Study
Worthing Area Strategy Development Plan

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed

Contents

1 Introduction

1 Introduction

1.1 ***Background to the Strategy Development Plan***

1.1.1 The South Coast Corridor Multi Modal study (SoCoMMS) is being undertaken on behalf of the Government Office for the South East (GOSE). The study has developed a transport strategy for the South Coast between Southampton and Thanet. This in turn will be an important element of the Regional Transport Strategy being developed by the South East Regional Assembly.

1.1.2 The development of the transport strategy has made use of a strategic transport model, which has been specifically developed for SoCoMMS. The model represents an average hour between 0700 and 1900 and includes highway and rail network definitions. Travel forecasts have been developed for 2016 and 2030 and a range of transport measures have been tested, either in isolation or in combination.

1.1.3 The transport strategy that has emerged includes a range of interventions:

- local initiatives (public and private sector);
- local public transport improvements;
- strategic public transport improvements;
- targeted road improvements;
- freight initiatives;
- safety and mobility initiatives; and
- balance - demand management.

1.1.4 In order to provide further detail on the elements of the strategy, a series of Strategy Development Plans are being prepared. These include:

- South Hampshire;
- Chichester;
- Arundel;
- Worthing;

- Brighton and Hove;
- East of Lewes;
- Bexhill-Hastings; and
- Public transport.
-

1.1.5 The purpose of the strategy development plans is to investigate the performance of multi-modal measures at the local level. The plans will provide a feedback to the strategy development process by confirming the inclusion of key measures. The plans will provide greater detail on the measures and their appraisal. Where appropriate, an Appraisal Summary Table (AST) will be developed.

1.2 ***The Worthing Strategy Development Plan***

1.2.1 This Strategy Development Plan covers the area around Worthing. The key issues to be considered as part of this strategy development plan are:

- to assess the potential for other modes
- to review potential for longer term improvements on the A27
- assess relationship between developments and highway performance
- provide initial appraisal

1.2.2 Prior to SoCoMMS, the Worthing-Lancing Integrated Transport study carried out a review of transport issues in the Worthing-Lancing area. The study provided a series of recommended schemes in the short term to assist transport in the area. These were presented to the Regional Assembly and ministers who accepted the findings of the study. SoCoMMS is taking a longer-term view of transport in the area. The strategy development plan reviews alternative concepts for Worthing-Lancing and as such it provides an advice note on long term interventions.

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2 Current Travel Conditions

2 Current Travel Conditions

2.1 ***Introduction***

2.1.1 This section of the report outlines the current travel conditions within the Worthing-Lancing area. This analysis draws on data collected from a wide range of sources from the local authorities, transport operators and other survey information.

2.2 ***Current Problems and Issues-***

2.2.1 The Worthing-Lancing Integrated Transport Study was undertaken on behalf of the DTLR. The study investigated the problems and issues affecting the A27 through Worthing and Lancing. The study included a review of key transport data which are identified in this section. These have been supplemented by data collated during the SoCoMMS study.

2.2.2 Worthing Borough lies along the Sussex coast between Chichester and Brighton. It accommodates a larger than average service sector and has a population of some 100 000 people. It also attracts over 1.5 million visitors per year. Adur district covers the area of Shoreham and Lancing and has a population of 58,000. Census data collected in 1991 indicated that 32% and 30% of households in Worthing and Adur respectively had 0 cars. These are among the lowest car ownership levels in West Sussex.

2.2.3 **Journey to Work** - The Worthing- Lancing study identified information on journey to work trip patterns from the 1991 Census. This data shows that a high degree of interaction exists between Worthing, Arun and Adur, and also the neighbouring districts in Central Sussex (including Crawley and Horsham) and East Sussex (including Brighton and Hove, and Eastbourne). A number of key features of the journey to work data were:

- 29% of Worthing's working residents travel beyond the Borough for the purposes of work, equivalent to around 10,000 trips on the typical working day. This comprises around 11% who travel to the neighbouring districts of Arun and Adur, with 7% travelling to Brighton and Hove, 6% to Central Sussex, and 3% to London;
- 31% of Worthing's workforce travels into the Borough from beyond for work purposes, again equivalent to around 10,000 trips a day. Trips to

Worthing for work purposes are of a more 'local' nature than work trips from the area. Thus, the 31% travelling from beyond Worthing comprises 21% from Arun and Adur, 5% from Brighton and Hove, and 3% from Central Sussex; and

- In Adur 39% of the workforce is drawn from areas beyond the district, with 15% (2880) travelling from Brighton and Hove and 21% (2240) from Worthing. In Arun around 15% of the total work force travel from areas beyond to work in the District, mainly from Chichester (1720, 4%) and Worthing (2150, 5%).

2.2.4 Information has been collated as part of SoCoMMS from a database of commuting information held by the DfT. This shows that commuting characteristics in Adur and Worthing are broadly similar. There are currently higher proportions of cycle journeys than bus and rail combined. This reflects the level terrain of the area and the availability of cycle networks. However, over 70% of commuting journeys are made by car or motorcycle.

	% of trips	
Mode	**Adur**	**Worthing**
Walk	13%	14%
Bicycle	7%	8%
Bus	4%	3%
Rail	3%	3%
Car/ motorcycle	73%	72%

Table 2.1: Percentage of trips to work by mode (Source DfT)

2.2.5 **School Trips** - The Worthing-Lancing study noted that the use of private cars for school travel has continued to increase for many years, and is a matter of local and national concern. Nationally between 1986 and 1996 the percentage of school children under 16 years of age who walked to school has reduced from 60% to 50%, while at the same time those travelling by private car rose from 16% to 29%.

2.2.6 A travel survey was undertaken at the Boundstone School (located in North Lancing) to investigate the potential for reducing the number of pupils who travel to school by car. The proportion of pupils travelling to the school by different modes was reported in the Local Transport Plan, as shown in Table 2.2.

Table 2.2 – Mode Share for School Travel

	Walk	Car	Bus	Cycle	Rail	Taxi
Boundstone School	63%	34%	1%	1%	0.5%	0.5%

2.2.7 Compared to the national average, car travel is similar, walking is significantly higher, but the number travelling by public transport is significantly lower. Whilst a relatively high proportion of pupils walk to Boundstone School there are significant number who are driven to school with very low use of bus or bicycle. There are a number of factors which can influence these mode choices, and hence explain the significant increase in pupils being driven to school:

- With the increasing traffic flows on the A27, and within the urban areas of Worthing and Lancing, parents perceive the roads to be too dangerous to walk or cycle;
- Parents are concerned with their child's personal security, especially in the Winter months when it is often dark during travel times;
- In cases where both parents/single parents work it becomes difficult to find the time to accompany children on foot. Many parents therefore choose to combine their work trip with taking their children to school;
- In many instances public transport is not always available, or viable in that it may take too long or is too costly; and
- Parents have a wider choice of both places to live and to send their children to schools, and hence in many cases travel distances increase.

2.2.8 **Highway Trip Purposes** - Roadside interview data from 1990 was used to examine journey purposes on the A27, the A24 and the A259. Table 2.3 presents observed journey purposes by time period.

2.2.9 Across the 3 sites, home based work trips generally account for 50-60% of car driver trips during the AM and PM peaks, falling to between 15% and 20% during the inter-peak. Likewise employer's business trips account for between 10% and 20% of trips in the peak periods, and rises to 30-45% during the inter-peak. The level of home based education trips is generally less than 3%.

Table 2.3 – Level of Trip Making By Journey Purpose

Purpose	AM Peak	Inter peak	PM Peak
A27:			
Home Based Work	61%	19%	58%
Home Based Education	3%	1%	1%
Other Home Based	13%	27%	24%
Employer's Business	19%	46%	11%
Non Home Based	4%	8%	6%
A24:			
Home Based Work	47%	16%	59%
Home Based Education	2%	1%	0%
Other Home Based	24%	40%	23%
Employer's Business	24%	38%	11%
Non Home Based	3%	5%	7%
A259:			
Home Based Work	60%	14%	43%
Home Based Education	4%	0%	2%
Other Home Based	15%	39%	34%
Employer's Business	14%	32%	8%
Non Home Based	7%	14%	13%

2.2.10 On the A27, 60% of car driver trips made during the AM peak are home-base work (HBW) trips, with 3% home based education.

2.2.11 **Network Standard** To the west of Worthing, the A27 is a two-lane dual carriageway with at-grade junctions and continues at this standard to the outskirts of Worthing. This improved section of road, together with the grade separated intersection at Patching generally functions well.

A27 through Worthing and Lancing

2.2.12 Through the northern fringes of Worthing, the A27 has a single carriageway, part

of which also carries traffic on the A24 route to London. Through Sompting Abbotts and North Lancing there is a mixture of single and narrow two-lane dual carriageways.

2.2.13 Through Worthing, the poor alignment and the two roundabouts with the A24 reduces the capacity of the A27 route. This combination of reduced standards, at-grade junctions and shared use of the corridor gives rise to congestion, environmental problems and rat running on adjacent routes.

2.2.14 To accommodate the additional A24 traffic, the section of A27 between the two roundabouts has three narrow lanes, with the middle lane used for traffic approaching each roundabout. However, observations indicate that motorists do not use these lanes effectively, and measures should be considered to encourage drivers to use both of the lanes.

2.2.15 The A27 through Lancing has two narrow lanes in each direction, but has signal controlled junctions that limit the capacity of the route.

A27, East of Lancing

2.2.16 Between Lancing and Lewes the A27 is a purpose built, grade-separated dual two-lane carriageway. This includes the Brighton and Hove bypass, which has grade-separated junctions but has steep gradients as it crosses the South Downs. At its western end, between Shoreham and Portslade, the bypass tunnels through the downs (where pedestrians, pedal-cyclists, horse-drawn vehicles and motorcycles of less than 50 cc are banned).

2.2.17 **Traffic levels** - and recent trends in growth for the Worthing area were obtained from the Annual Traffic Monitoring Report for West Sussex[1]. This reviews traffic characteristics over a number of screenlines including a Worthing Cordon, which comprises:

- the A259 between Worthing and Lancing;
- A27 in Sompting;
- A24 north of the A280;
- A27 west of the A280;

[1] West Sussex County Council – '*Traffic in West Sussex 1998*'

- A280 North of Angmering; and
- A259 in Ferring.

2.2.18 Across this cordon as a whole, total daily 2-way traffic flows increased between 1992 and 1998 from about 125,000 vehicles to around 141,000 vehicles (13%). Over the same period, total peak hour 2-way traffic flows across the cordon have increased by a similar percentage in the AM and by 9% in the PM peak.

2.2.19 On the A27 itself the observed daily traffic growth between 1992 and 1998 was 14% near Sompting towards the eastern limit of the study area, and 19% to the west by its junction with the A280, Clapham, equivalent to annual rates of growth rates of approximately 2% and 3% respectively.

2.2.20 Analysis of the hourly traffic flows on the A27 over the period 1997 to 2000 suggests that the growth has been greater during the off-peak than during the peak periods. This fact could be used to support an argument that the A27 congestion is acting as a restraint on peak period growth. But there is less scope for an increase in peak period travel – an employee can only travel to one job in the peak period whereas there is less restriction on the potential growth in off-peak travel. Further investigation showed that the morning peak hour growth (between 8.00 and 9.00) is almost non-existent, but this if offset by growth in the previous hour (7.00-8.00) suggesting that the worst of the congestion is encouraging a small transfer to other travel times as drivers seek to ease their journeys.

2.2.21 The all-day growth for A27 (14% near Sompting, 19% at Clapham) is lower than the equivalent on other County trunk roads (25%) over the same 1992-1998 period, but higher than on other County primary roads (12%) and higher than across other County Cordons (13%).

2.2.22 On the A27 the daily 2-way traffic flows increase from west to east. Along Arundel Road between the western boundary of the borough and Offington Roundabout there were approximately 22,500 vehicles per day (vpd) in 1999. Offington Roundabout and Grove Lodge Roundabout are connected by a short section of the A24(T) Warren Road, which caters for both long distance and local trips on the A27 and A24 and carries in the region of 40,000 vpd. East of the Grove Lodge Roundabout the A27 to Sompting Way section carries 38,500 vpd, and the increase in volume continues to Grinstead Lane and the Sussex Pad junctions with between 41,000 and 43,000 vpd.

2.2.23 The A24 Findon Road running north of the A27 and the A24 Broadwater Street West to the south of the A27 carry two way flows of approximately 27,000 vpd and 28,000 vpd AADT respectively. The A259 Brighton Road to the east of Worthing Town Centre carries in the region of 22,000 vpd, with the A259 Goring Road to the west carrying 24,500 vpd. Continuing west the A259 Littlehampton Road, carries on average 33,000 vpd AADT. The A2032 section on the Littlehampton Road in West Worthing has a two way AADT of between 20,000 and 24,000 vpd.

2.2.24 Junction turning flows were collected by Mott MacDonald, on behalf of the HA, at a number of locations along the A27. Traffic count data show that the AM peak generally occurs between 08.00 and 09.00, and the PM peak between 17.00 and 18.00. At some locations, and in particular Grove Lodge Roundabout, flows between 16.00 and 17.00 can be as high as and even exceed the flow levels in the peaks.

2.2.25 **Through Traffic -** A registration plate survey undertaken for the purposes of the Worthing- Lancing study indicate that over 30% of the morning peak traffic travelling eastbound at the western borough boundary continues on the A27 and travels beyond the Sussex Pad junction. This increases to 38% during the inter-peak and evening peak periods. The survey results show that most of the southbound traffic on the A24 north of Findon is destined for the urban areas of Worthing and Lancing, with no more than 10% observed at either the western borough boundary or the Sussex Pad. The data shows that for most of the day (apart from the evening peak) the 'long distance' movements on the A27 account for between half and two-thirds of the A27 movements using Warren Road.

2.2.26 The data show that these A27 movements account for about half of the total Warren Road volume. It therefore follows that long-distance A27 traffic comprises about one quarter, or slightly more than one quarter, of the Warren Road traffic throughout most of the day. This proportion is highest in the evening peak.

2.2.27 Origin and destination information collected in 1990 is quoted by the Worthing-Lancing study. Data were obtained on the A27 in North Lancing and the A24 north of Findon for the purposes of developing the Worthing Improvement Traffic Model. This information has been used here to identify the key traffic movements related to the study area. On the A27 in North Lancing, approximately 45% of trips are to and from the Brighton and Hove area. About

60% of those have their origins or destinations in Worthing or Lancing. (40% Worthing and 20% Lancing). Shoreham generates in the region of 23% of the traffic using the A27, 25% of which are Worthing and Lancing related. Chichester and Bognor Regis each contribute less than 5% of the A27 traffic.

2.2.28 These surveys also indicated that in the region of 65% of the traffic on the A24 is to and from Worthing. This high percentage is not surprising as other nearby towns are often served directly by parallel routes for north-south traffic, for example the A23 to Brighton, A283 to Shoreham, A284 for Arundel and Littlehampton. With regards to trip ends to the north, the area comprising Petworth, Storrington, Chiltington, and Pulborough generates over 20% of the A24 traffic, with Horsham, Crawley, Henfield and Steyning areas accounting for approximately 15%, 10%, 5% and 5% respectively.

2.2.29 **Freight -** Road freight traffic accounts for approximately 6% of the total traffic flow currently recorded on the A27 trunk road. There are a large number of heavy goods vehicles (HGV) in the east Worthing and Lancing area using residential roads to reach industrial estates. There is also a vehicle testing centre in South Lancing which generates HGV movements. On Busticle Lane/Western Avenue, which serve mainly residential areas but also provide good access to several trading estates and the HGV vehicle testing centre, there are 290 HGVs over a 12 hour period (over 8% of the traffic flow). This compares with less than 2% HGVs on Grinstead Lane and 3% on Boundstone Lane.

2.2.30 **Rail-** The western Coastway route passes through the Worthing- Lancing area. There are a number of stations including from west to east:

- Goring by Sea;
- Durrington by Sea;
- West Worthing;
- Worthing;
- East Worthing; and
- Lancing.

2.2.31 Services at these stations are provided by South Central and include.

- the longer distance coastway services operating between London, Hove, Worthing, Southampton and Bournemouth (does not call at the smaller stations);
- services from London to Littlehampton;
- a local coastway service between Brighton and Portsmouth;
- local services between Seaford, Brighton and Littlehampton/ West Worthing;

2.2.32 The number of trains calling at each station per hour is shown in Table 2.4. This shows that the area has a good frequency of trains with at least 3 to 4 trains per hour calling at each station per direction. Worthing is the key station in the area in terms of service provision. Typically there are between over 5 trains per hour, in each direction, calling at the station during the week.

Station	Am peak (0800-0900)	Interpeak (1000-1600)	PM peak (1700-1800)	Evenings	Saturdays	Sundays
Lancing	5/4	4/4	5/6	3/3	4/4	2/2
East Worthing	3/4	3/3	3/3	3/2	3/3	2/2
Worthing	6/5	7/7	7/9	4/4	7/7	5/5
West Worthing	5/4	5/3	5/5	3/3	5/3	3/3
Durrington	4/4	3/3	4/5	3/3	3/3	3/3
Goring	4/4	3/3	4/5	3/3	3/3	3/3

Table 2.4: Number of Trains departing per Hour each direction (east/west)

2.2.33 As part of the London Area Transport Survey (LATS), a number of stations in the south east have been surveyed. The data collection has included entry counts to the stations. Station counts have been obtained for the first tranches of stations that were surveyed. The length of the count varied between stations with smaller stations being counted for the peak periods only while larger stations were surveyed for 12 or 16 hours. Table 2.5 provides the entry counts for those stations for which data have been provided by the SRA (Strategic Rail Authority). The data shows that Worthing has twice as many boarders as Lancing and East Worthing between 0700 and 1900.

Station	Total (0700-1900)
Lancing	930
East Worthing	850
Worthing	1970
West Worthing	400
Goring	640

Table 2.5: Station Entry Counts, South Coast Stations, LATS Surveys 2001

2.3 ***Bus***

2.3.1 Bus timetable data has been assembled from local bus guides published by the operators and local authorities, and from the Great Britain Bus Timetable (version to June 2001). **Table 2.6** shows the key inter-urban bus routes serving the Worthing area. The main service to Worthing is route 700 which links the coastal towns. The service operates every 30 minutes. Other hourly services operate to Horsham, Midhurst and Arundel.

Route	Operator	Mon-Friday	Saturday	Sunday
1 Worthing- Petworth- Midhurst	Coastline Buses	Hourly	Hourly	1 every 2 hours
2 Worthing – Horsham	Coastline Buses	Hourly	Hourly	1 every 2 hours
2 Worthing- Shoreham- Brighton- Rottingdean	Brighton & Hove	Irregular evening service	Irregular evening service	No service
12 Worthing – Angmering – Littlehampton	Coastline Buses	1 journey per day	No service	No service
15 Worthing – Findon- Arundel- Chichester	Compass Travel	1 journey Wednesdays	No service	No service
69 Worthing – Arundel- Pulborough- Alford	Buses Rural	1 journey Tuesdays/ Thursdays	No service	No service
102 Worthing – Littlehampton- Arundel- Amberley	Coastline Buses	3 journeys per Tuesday/ Thursday	No service	4 journeys
106 Worthing – Lancing- Cowfold	Coastline Buses	1 journey per day	No service	No service
700 Portsmouth- Chichester- Worthing – Brighton	Coastline Buses	Every 30 minutes	Every 30 minutes	Hourly
702 Arundel- Worthing – Brighton	Coastline Buses	Every 30 minutes	Every 30 minutes	No Service

Table 2.6 : Key Inter-urban Bus Services to Worthing *(Source- 2002 National Bus Timetable and Local Authority/Operator timetables)*

2.3.2 In addition, there are a number of local bus services operating within the Worthing area (see Table 2.7). These link the town centre to the suburban areas such as East Worthing, Sompting, Goring, Durrington.

Route	Operator	Mon-Friday	Saturday	Sunday
3/ 3A Worthing – West Worthing – Durrington	Coastline	Every 30 minutes	Every 30 minutes	Hourly
4/ 4A Worthing – Durrington	Coastline	Every 30 minutes	Every 30 minutes	Hourly
5/5A Broadwater- Worthing – Lancing- Shoreham- Portslade	Coastline	Every 30 minutes	Every 30 minutes	No service
6 Worthing – High Salvington	Coastline	Hourly	Hourly	Two-Hourly
7/7A Worthing – Lancing- Sompting- Worthing	Coastline	Every 30 minutes	Every 30 minutes	Hourly
8 South Fering- Worthing – East Worthing	Coastline	Hourly	Hourly	Hourly
9 Littlehampton – Worthing- East Worthing	Coastline	Hourly	Hourly	Two-Hourly
10 Worthing – Durrington	Coastline	Every 30 minutes	Every 30 minutes	Two-Hourly

Table 2.7 : Key Urban Bus Services in Worthing *(Source- 2002 National Bus Timetable and Local Authority/Operator timetables)*

2.3.3 National Express coast service 315 operates along the south coast via Worthing from Eastbourne/ Brighton along the coast to Southampton and Cornwall (2 per day). There is also a National Express service from Chichester and Worthing to London (route 27). There is one service each way per day.

2.4 ***Road Safety***

2.4.1 The highway authorities have provided details of road crashes that resulted in personal injury for the whole of the SoCoMMS area during a three-year period. As part of earlier analyses, the severity of the injuries sustained and the combination of vehicles and pedestrians involved were transferred to an Excel workbook. The crash locations were recorded as OS grid references, supplemented in most, but not all, instances by a description of the location.

2.4.2 The national accident rates in 1999 (from table 4.16 of Transport Statistics Great Britain: 2000 edition) are:

- Motorway 11 accidents per 100 million vehicle-kilometres
- All A roads 50 accidents per 100 million vehicle-kilometres

2.4.3 Analysis of the local data shows that the A27 through Worthing has an observed accident rate that is greater than the national average.

2.4.4 The analysis then examined the proportion of crashes for each section of route where someone was killed or seriously injured (KSI), and where a pedestrian, pedal-cyclist or motorcyclist was involved. The same national statistics as used above shows that the proportion of crashes in which someone is killed or seriously injured are:

- Motorway 13.3%
- All A roads 16.2%

2.4.5 In this case, the severity of injuries in crashes exceeds the national average on the A27 to the west of Worthing. The analysis shows that there are particular problems in terms of accidents to pedal cyclists.

2.4.6 **Accident clusters-** To identify accident "black spots", where a large number of crashes occurred on a short length of road, locations were determined where either of the following criteria was met.

- 10 adjacent crashes occurred in the three year period at a frequency in excess of 15 crashes/km (approximately twice the average for the whole route); or
- 10 crashes occurred in the three-year period at a single location.

- Accident "black spots" were identified on the A27 through Worthing (83 crashes, of which 35 occurred at 4 junctions) and through Lancing (37 crashes of which 22 occurred at three junctions).

2.5 ***Key issues from consultation***

2.5.1 As part of the SoCoMMS study a series of workshops were held along the corridor. These sought to identify problems and issues with the transport system in the area. These are outlined in separate reports.

2.5.2 Within the Worthing area, workshop with key stakeholders sought to identify those transport elements which were working well and those where there problems. The elements that were working well included:

- A259 dual carriageway section
- Rail services to London
- Coastal bus services
- Urban bus services
- Local walking and cycle strategies

2.5.3 The current problems were identified as:

- Congestion in Worthing
- Congestion at Arundel
- The links between the A27 and A259
- Traffic Speeds and safety
- The quality of the rail infrastructure, and the lack of investment
- Rail Safety
- Fragmentation of the rail services
- Level crossings (delays to road users, cyclists and pedestrians)
- Cost of travel by public transport
- Poor North – South service by bus
- Poor integration between bus and train
- Cycle provision on trains
- Few links for cyclists
- Environmental problems caused by cars

3 Transport Model Development

3 Transport Model Development

3.1 ***Introduction***

3.1.1 A hierarchy of transport models have been used to assess the impact of transport schemes in the South Coast Corridor. These include a strategic model which has been developed using EMME/2 software to represent travel networks across the south east from Southampton to Thanet. In addition, use has been made of local morning peak SATURN models such as the Worthing- Lancing ITS model.

3.2 ***The SoCoMMS Strategic Model***

3.2.1 A strategic transport model has been developed for the SoCoMMS study with the aim of testing a range of schemes, policy measures, and strategies within the study area. The model is multi-modal in nature in that it has representations of the highway, rail and interurban bus/coach networks. The model operates within the EMME/2 software.

3.2.2 The SoCoMMS model has been developed from a range of existing sources. The highway model has been developed from SERTM (South East Regional Traffic Model), ORBIT (a multi-modal study investigating orbital movements around London) and local models developed for other multi-modal studies (e.g. the Access to Hastings study and M27 Integrated Transport Study). The rail element of the model has been developed from data obtained from the DTLR (Department of Transport, Local Government and the Regions). The network databases have been developed in a Geographic Information System (GIS). The model covers an area from the south coast to London and the river Thames (northern boundary) and Wiltshire / Dorset (western boundary) The model operates for an average hour between 0700 and 1900.

3.3 ***The Worthing Model***

3.3.1 The SATURN assignment model developed for the Worthing-Lancing study was made available to the SoCoMMS study team. The model was derived from highway models that had previously been developed to test schemes on the A27, the A259 and within East Worthing. The SATURN model includes a simulation area within which, junctions are modelled in detail (in terms of saturation flows, and traffic signal timings). The network includes all A class and B class routes with a number of C class routes. The model is validated against 1999 traffic data within the simulation area. The model operates for the morning peak period (0800-0900).

4 Future Travel Conditions

4 Future Travel Conditions

4.1 ***Introduction***

4.1.1 This chapter outlines the future travel conditions within the Worthing area. This starts from a review of development and planning policy. This is followed by a discussion of trip forecasts for 2016.

4.2 ***Structure Plan Policy***

4.2.1 The West Sussex Structure Plan was adopted in 1993 and covers the period to 2006. The Deposit Draft Structure Plan was published in 1996, extending the policy period to 2011. After an initial round of consultation with the District and Borough Councils, the county council has published a Consultation Document (The Choices Ahead – May 2000). The document sets out a range of options, promoting new development to be built on previously developed land as a first preference and suggests that 17,700 dwellings could be accommodated in this way between 1996 and 2011. Additionally, it sets out the options for greenfield development as follows:

- Solely by extensions to the main towns and possibly major expansion around Crawley, providing approximately 2,000-3,000 dwellings.
- Partly by extensions to the main towns and partly by new or expanded villages, providing approximately 2,000-3,000 dwellings.
- Partly by extensions to the main towns and partly by new market towns, providing approximately 10,000 dwellings.

4.2.2 There is the possibility of concentrating significant growth around Crawley, although it is only one of a number of ways in which growth could be accommodated. It would involve using land within Horsham and / or mid Sussex Districts

4.3 ***West Sussex Local Transport Plan***

4.3.1 In the Local Transport Plan six objectives are outlined for Transport Planning in West Sussex. These are:

Choice – to widen travel choice and promote the most sustainable transport modes by:

- obtaining a high standard of service in bus passenger transport and increase patronage through enhanced services;
- to maximise the use of rail for passengers and freight;
- making cycling more appealing and safer in order to increase the use of this mode;
- making walking more appealing and safer in order to increase the use of this mode;
- informing and influencing people about sustainable travel through the Travel/Wise programme; and
- promoting the introduction of Company Travel Plans.

Safety – to improve road safety and personal safety for the travelling public by:

- reducing road casualties;
- reducing the fear of crime in all aspects of transport;
- reducing and controlling vehicle speeds; and
- promoting road user safety.

Integration – to integrate transport and the various providers of services in order to maximise the efficiency of our transport systems by:

- working with public transport providers to improve integration within and between transport types, and to improve our public transport interchanges and information; and
- ensuring new development is designed and located to minimise the need to travel, and is accessible by sustainable travel modes.

Economic performance– to assist in the promotion of an efficient economy and the achievement of sustainable economic growth by:

- maintaining the road network to a high standard and addressing key gaps and weaknesses;
- working with business to ensure sustainable freight distribution and the viability of our town centres;
- improving sustainable access to Gatwick Airport and road access to Shoreham Harbour;
- maximising opportunities in relation to e-commerce, modern technology in local service and information provision and other new ways of working;
- encouraging and promoting local tourism and leisure opportunities in a sustainable manner.

The Environment - to reduce traffic growth, pollution and congestion in order to protect and enhance the built and natural environment by:

- reducing the growth in unsustainable travel;
- improving air quality and promoting Local Agenda 21 initiatives;
- reducing environmental impacts of undertaking all aspects of transport provision and maintenance;
- managing and improving our strategic road network to maintain efficiency and effectiveness and to encourage heavy goods vehicles and longer distance traffic to use it; and
- managing the remaining network in accordance with identified hierarchies giving due regard to the mobility impaired, pedestrians, cyclists, buses, taxis, freight, motorcyclists and car users.

Accessibility – to promote access to services and facilities for all by:

- ensuring proper provision for the mobility impaired;

- ensuring those without the use of a car (in both rural and urban areas) have access to local services or appropriate public or community transport; and
- helping all parts of our society to share in the benefits arising from improved communications and information technology.

4.3.2 In order to deliver the above objectives West Sussex County Council has a number of strategies that are fundamental to the delivery of these objectives. These are based on

- A Network Management Strategy which seeks to maintain and enhance West Sussex strategic road and rail networks;
- A Road Safety Strategy
- Economic and Freight Strategy
- An Integrated Parking Strategy

4.4 ***2016 Land Use Assumptions- Strategic Model***

4.4.1 Throughout the development of the SoCoMMS Reference Case we have, as far as possible, attempted to maintain consistency with the other multi-modal studies which are proceeding simultaneously. In so doing, we have used the latest TEMPRO projections as control totals at the County level for those counties in the study area which fall into the South East Region. These County totals were prepared by HETA for use in the SERAS Reference Case and have been used to maintain consistency with SERAS, despite the reservations of some of the County Authorities about these totals.

4.4.2 However, the notable difference between the SoCoMMS methodology used and that used for SERAS is the manner in which the district distributions for population, workforce, households and employment have been derived[2]. We felt that narrower study area of SoCoMMS necessitated more of a policy-related focus at the level of the individual districts, as it was thought that variations between

[2] The SERAS Planning Reference Case derived district distributions by dividing the TEMPRO county trend-based totals by the TEMPRO county policy based totals to achieve a factor. This factor was then applied to each of the TEMPRO trend based totals at the district level so as to derive a policy based total for each of the districts.

Districts within the Counties are likely to have an impact on the study outcomes. Thus, in order to determine distributions across the Counties, reference has been made to the relevant County Structure Plans which set out housing allocations for each of the districts. We have also consulted the County authorities to obtain their views on the distribution of these figures between the respective districts in their area.

4.4.3 Consultation with the Counties on the district distribution of the TEMPRO totals was undertaken in two phases. In the first instance letters were sent out following the land use planning workshop, requesting the population and employment figures which underpin the respective Structure Plan dwelling allocations to 2016 (where relevant). Housing and employment land monitoring reports were also requested.

4.4.4 In most cases, the levels of response from the Counties to this first round of consultation was good, although two broad issues emerged:

- In general, the Structure Plan time horizons were to 2011 rather than to 2016; and
- The County baseline figures and the projected growth figures were not always compatible with the TEMPRO County totals.

4.4.5 Although there was some level of variation between the levels of information supplied by the Counties, the approach adopted for each County was similar. For the assembly of the household, population and employment datasets, this broadly consisted of the following:

4.4.6 For **household growth**, based on the housing and employment land monitoring reports, an estimate of the completions to 1998 was obtained. This was fed into the baseline information and allowed us to calculate outstanding commitments (levels of housing growth) for the remainder of the Structure Plan period. Where the Structure Plan time horizon was to 2011, it was assumed that the distribution of dwelling growth implicit in the Structure Plan would continue to 2016 unless the County indicated otherwise. This permitted us to arrive at an estimate as to the distribution of future household growth between the districts in each county. This distribution was applied to the TEMPRO county level growth figure. When added to the TEMPRO 1998 base year figures, this yielded a distribution for 2016.

4.4.7 For **population growth**, where the county provided population growth figures, a similar approach to that described above was adopted, applying the County distribution to the TEMPRO County control total. Where the county did not provide population data, a similar distribution to that applied to household growth was applied to the TEMPRO population growth figure with the distribution for 2016 calculated as described above. For **workforce** totals a workforce/population factor was derived from the TEMPRO trend based forecasts for 2016 for each district, and then applied to the SoCCoMS population figures to arrive at a figure for 2016.

4.4.8 DTZ Pieda undertook to produce the **employment change** forecasts. TEMPRO 2016 county employment forecasts were used as control totals. A shift share method was adopted, taking into account land use policy considerations in order to determine the distribution of jobs at district level within each county. The first step was to calculate the shift in relative importance of employment within each district, assessing the distribution of the county total in the last 5 years, and to project that shift in the future to year 2016 assuming this shift happens at constant rate. These trend-based projections were then adjusted to take into account specific land use hypotheses that affect individual sites or areas within the districts. An adjustment factor was therefore applied to fine-tune the trend-based projections to knowledge of what is expected "on the ground" over the time period considered. Information on land use policy was substantiated by local forecasts of employment endorsed by the county councils themselves and / or by qualitative judgements from Structure Plans officers or forecasting officers in the County Councils.

4.4.9 Based on the above methodology, an interim draft distribution was derived for household, population and employment growth for each of the Counties to 2016. These figures were re-issued for comment by the Counties in mid-September. Where appropriate, the distributions have been adjusted to reflect further comments received. It is assumed that these figures are now generally in line with the County Authorities' views on the distribution of future growth for the purposes of this study.

4.4.10 Following consultation with the study area and area of influence local authorities, a set of planning data have been derived for each district. These are shown in **Table 4.1**.

	HOUSEHOLD		POPULATION		EMPLOYMENT		WORKFORCE	
District	**1998**	**2016**	**1998**	**2016**	**1998**	**2016**	**1998**	**2016**
Adur	25,089	27,473	57,450	57,530	20,368	20,895	27,187	27,614
Arun	62,892	75,145	137,911	155,104	49,760	55,846	61,688	71,348
Chichester	46,297	57,706	105,353	120,055	59,350	71,801	48,071	58,827
Crawley	39,506	46,211	95,280	102,832	68,740	76,139	49,864	55,529
Horsham	50,663	64,171	119,880	137,796	57,235	69,265	61,679	73,032
Mid Sussex	52,740	66,426	125,219	143,456	58,707	65,690	66,102	78,901
Worthing	44,416	49,438	97,697	102,276	48,245	53,632	45,300	48,070
WEST SUSSEX	**321,603**	**386,570**	**738,790**	**819,130**	**362,405**	**413,267**	**359,891**	**413,321**

Table 4.1: Demographic Data- 2016 SoCoMMS Reference Case

4.4.11 There is an additional refinement in allocating growth levels to individual zones. The SoCoMMS team have undertaken a review of development plans and environmental constraints to assess the future distribution of development within a district. On this basis, growth in the SoCoMMS model is allocated away from environmentally sensitive areas.

4.5 ***Travel Forecasts for 2016 Do-minimum- Network Assumptions***

4.5.1 In developing a strategy for the south coast, account has been taken of those transport initiatives that are currently under construction, currently committed and those measures likely to be in place by 2016. Within the study area, these include:

- **Trunk Roads Schemes**
- A27 - Polegate bypass- D2 standard
- **Major Rail Improvements**
- Completion of CTRL from Ashford to St Pancras – currently under construction (this will need to take into account changes to service patterns on the existing network)
- Virgin Cross- Country service improvements
- Completion of Thameslink 2000 and associated timetable changes
- **Franchise Proposals-**

- Measures arising from franchise proposals put forward by South Central, South West Trains and Connex South Eastern
- **Local Transport Plans**- Through the Local Transport Plan process, a number of initiatives have been accepted for funding in the December 2000 statement. These include:
- Crawley Fastway (guided bus scheme in the Gatwick Area)
- East Kent Access – A256 upgrade to dual carriageway
- South Hampshire Rapid Transit (including provision of light rail between Portsmouth and Fareham and bus improvements between Portsmouth and Waterlooville-Horndean Bus Improvements
- A280 Angmering Bypass
- **Other Schemes**
- East Kent Access Phase 2
- A259 Bognor Regis Relief Road.
- M20 junction 10a

4.5.2 In addition, there are a number of schemes in the Area of Influence being pursued, which influence the South Coast corridor. These include:

- **Trunk Roads Schemes**
- M2 widening to D4 standard between Cobham and junction 4
- A2- Bean – Cobham Widening Phase 1 (Bean-Tolgate) -D4 standard
- A2 – Bean – Cobham Widening Phase 2 (Tolgate- Cobham) – D4 standard
- A21 - Lamberhurst bypass (S of Maidstone) – D2 standard
- A249 - Iwade – Queenborough Improvement (Kent) – D2 standard
- M25 - J12-J15 Widening (Surrey) –D5/D6 standard
- A2/A282 – Dartford Improvement (M25) – D4 standard
- A23 - Coulsdon Inner Relief Road (S London)- D2 standard
- **Schemes from Multi Modal Studies and Road Based Studies**

- A21 Tonbridge to Pembury Improvements
- A3 Hindhead Common Tunnel
- Service improvements Wadhurst to Tonbridge
- **Other Schemes**
- A24 Horsham – Capel Improvement

4.6 ***Worthing-Lancing ITS Elements***

4.6.1 Prior to the start of the SoCoMMS study, the Worthing-Lancing study identified a series of short term elements which are recognised in the SoCoMMS strategy:

- Improvements at the two key A27 roundabouts by the addition of traffic signal controls, and provision of traffic signals at a third junction;
- Use the signal improvements to provide for pedestrians and cyclists;
- Traffic calming and environmental management measures on alternative routes;
- New bus service routes and service frequency enhancements on existing routes, together with passenger facility enhancements and provision of real time information;
- Off-peak and weekend bus service enhancements;
- Provision of taxibus facilities at Worthing and Lancing;
- Rail infrastructure improvements (station enhancements, better provision of rail information, improved passenger security measures);
- Improvements to station accessibility, especially for bus users, cyclists and pedestrians,
- Complementary measures to address travel behaviour and encourage a modal shift (green travel plans, improved travel information, education programmes)

4.6.2 These improvements have been reflected in the 2016 traffic forecasts.

4.7 ***Future Travel Conditions- Local Model***

4.7.1 The local model has been used to assess the impact of traffic growth in the local area. 2016 trip matrices were obtained from WS Atkins as these took into account recent work examining development sites in East Worthing. The analysis has been undertaken to examine:

- Total vehicle hours on the network;
- Total vehicle kilometres;
- Average speed;
- Total volume of queuing traffic;
- Flows across a north-south screenline (through West Worthing and Salvington);
- Flows crossing the railway line; and
- Journey times along the A27.

4.7.2 Table 4.2 shows the network summary statistics for the area. This shows that there is a growth in the trip matrix within the Worthing-Lancing area of 28%. This produces a forecast increase in vehicle kilometres of 34%. The additional increase is due in part to traffic rat-running to avoid congestion on the main routes. The total travel time in the model increases by 64% between 1999 and 2016 with a significant increase in queuing.

	Base Year	**2016 Do-minimum**	**% change**
Vehicle Hours (pcu-hr/hr)	3807	6256	64%
Vehicle Kilometres (pcu-km/hr)	157302	210147	34%
Average Speed (Km/h)	41.3	33.6	-19%
Total queues	187	1423	661%
Trip Matrix	37210	47755	28%

Table 4.2: Comparison of Network Summary Statistics 1999 and 2016 Do-minimum

4.7.3 Table 4.3 shows the morning peak hour traffic flows across the railway screenline (in pcu/hrs). The table shows two-way flows. This indicates that the total traffic across the screenline grows by 29%. Much of the growth is at the eastern end of the study area through East Worthing and Lancing.

	Base	2016 Do-minimum	% change
A259 Goring Street	2199	2827	29%
Shaftesbury Avenue	1096	1460	33%
A2031 South Street	1054	1441	37%
South Farm Rd	1201	1929	61%
A24 Broadwater Road	3084	3187	3%
B2223 Ham Road	1363	1462	7%
Western Rd	1531	1581	3%
A2025 Grinstead Lane	610	1258	106%
A283 Old Shoreham Road	782	1486	90%
	12920	16631	29%

Table 4.3: Traffic flows across Railway Screenline

4.7.4 Table 4.4 shows the morning peak hour traffic flows across the north-south screenline (in pcu/hrs). The table shows two-way flows. This indicates that the total traffic across the screenline grows by 38%. Much of the growth is on the parallel routes to the A27. There is little growth on the A27 itself.

	Base	2016 Do-minimum	% change
A27 Arundel Road	2019	2053	2%
Salvington Road	338	897	165%
A2032 Littlehampton Rd	1643	2355	43%
Terringes Avenue	1196	2146	79%
A259 Goring Rd	2253	2854	27%
	7449	10305	38%

Table 4.4: Traffic flows across North-south Screenline

4.8 ***Summary***

4.8.1 The 2016 do-minimum tests indicate that if there are no additional transport interventions in the Worthing-Lancing area, then traffic levels and the associated congestion will worsen. Additional traffic will use alternative routes to the main corridors. This will lead to a worsening of the human environment, in terms of air quality and traffic noise, as well as increasing safety problems. The increase in congestion will impact upon local accessibility within the Worthing area, as well as sub-regional accessibility on the trunk road. This could have wider economic impacts.

4.8.2 Beyond 2016 the traffic levels are forecast to grow even further. The strategic model indicates that flows on the A27 could increase by up to a further 10% over the 2016 traffic level. In addition, traffic flows on the A259 corridor are forecast to grow by up to 15% between 2016 and 2030. This will add even further strain on environmental and safety problems in the area.

4.8.3 Thus do-nothing above the measures identified in Worthing-Lancing study is not sufficient.

5 Assessment of Options for Worthing

5 Assessment of Options For Worthing

5.1 ***Introduction***

5.1.1 The Worthing- Lancing Integrated transport study investigated the potential for short-term improvements to assist the area. These were reflected in the do-minimum. The work shows that by 2016, and certainly by 2030 further measures will be required in the Worthing- Lancing area.

5.1.2 A series of 'concept' tests were undertaken to advise delivery agents of the implications of the measures. There needs to be further work through detailed design and assessment work before finalising the nature of improvements. No detailed alignments have been developed at this stage.

5.2 ***Previous Schemes***

5.2.1 During the 1980's the Department of Transport undertook studies investigating the potential for improvements at Worthing, Sompting and Lancing. These indicated the need for traffic and environmental improvements. A bypass was proposed which intruded into the downlands around Lancing and Sompting with a part on-line/ bypass in Worthing. This was identified as a protected route from development.

5.2.2 In November 1992 the Department of Transport published detailed proposals in the form of Draft Orders, under the Highways Act, for construction of the improvements. These 'Published' proposals were as the Preferred Route but included twin bored tunnels of 580 metres in length under Lancing Ring and a 'cut and cover' tunnel under the built up area of Worthing. The scheme included a grade-separated junction at the eastern end to enable connections to the existing A27 route and Shoreham Airport.

5.2.3 An Environmental Statement which compared the Published scheme with two alternatives accompanied the Draft Orders. These included a downland route around Worthing as well as the on-line improvements.

5.2.4 The scheme went to Public Inquiry in 1994 following which the Department abandoned the previous proposals. The issues centred on the environmental implications of the bypasses, particularly in terms of their impact on the physical environment.

5.2.5 Following the inquiry, in 1998 the DETR announced the proposals to carry out the Worthing- Lancing Integrated Study and SoCoMMS.

5.2.6 A review of the current local plans indicates support for improvements on the A27. The Worthing Borough Local Plan Review notes:

> *'The Borough Council has welcomed the proposed studies, but in view of the pressing nature of the problems on the A27, seeks that the work related to Worthing be carried out as a high and urgent priority, in order that early acceptable solutions to the congestion and pollution can be identified and funded with a minimum of delay'*

5.3 ***Options Reviewed***

5.3.1 This strategy development plan has sought to investigate the impact of a range of concepts. These have been undertaken using both the strategic and the local traffic models. Within the strategic model the tests have investigated:

- The impact of highway measures;
- The impact of public transport improvements;
- The impact of demand management.

5.3.2 Within the local highway model, tests have been undertaken to review alternative highway options including:

- An off-line bypass;
- An on-line improvement;
- A long tunnel under Worthing and Lancing;
- Short sections of tunnel linking the existing dual carriageway sections;
- Impact of traffic reduction (through soft measures, demand management).

5.4 ***Description of Concepts***

5.4.1 Five concepts in addition to the Do-Minimum have been assessed. These options are outlined below. These tests were undertaken assuming indicative alignments. And have not been based on detailed examination of potential routes at this stage.

5.4.2 Do-Minimum – outlined in chapter 4.

5.4.3 Concept 1 Online Implementation of a Dual Carriageway – This Option assumes dualling the A27 with 2 lanes in both directions between A27 Arundel Road / Ivydore Avenue and the A27/ Sompting Way, west of Sompting Road.

5.4.4 Concept 2 Tunnel – This concept assumes that a full length tunnel connects the the A27 at Cote with the junction of A27 (T) Old Shoreham Road/ Mash Barn Lane. The design of the tunnel ends was assumed to be cut and cover with 2 lanes in both directions.

5.4.5 Concept 3 - Short sections of tunnel–This concept assumes an on-line improvement linking the existing dual carriageway with short sections of tunnel, 2 lanes in each direction. A link was assumed between the A27 and the A24 at Warren Road. A sensitivity test has been undertaken without the link to the A24.

5.4.6 Concept 4 Worthing By-pass – A northern bypass was assumed within the downland area to the north of Worthing and Lancing. The by-pass was assumed to be 2 lanes in both directions with the connection of the by-pass and the A24 would be an at-grade roundabout.

5.4.7 Concept 5- Traffic Reduction Test (Soft measures and demand management)- A further test was undertaken to assess the impact of traffic reduction strategies on flows and travel times along the A27 corridor. In order to test this, the 2016 trip matrices with developments were factored down by 15% respectively. These were considered to represent a highly optimistic view of the successful implementation of soft measures and modal competition including pricing measures to restrain traffic and development controls to substantially restrict parking in new developments.

5.4.8 In the morning peak, roadside interview data shows that 60% of trips are home based work journeys, 24% goods vehicles, 3% employers business trips and 13% home based other journeys. To achieve a 15% reduction overall would require at least:

- A 20% reduction in home based work trips,
- A 15% reduction in home based other trips; and
- A 5% reduction in employers business trips.

5.4.9 In the morning peak this equates to a reduction in the trip matrix of 7000 trips, which would be made in comparison with the do-minimum (equivalent to 100 double deck buses).

5.4.10 It is further noted that this 15% reduction would have to be against a wide pattern of traffic movements made within the Worthing area. This affects the range of measures that can successfully be applied in order to achieve traffic reductions 'Soft measures' will be more successful in affecting shorter distance trips than the longer distance movements. The range of movements includes:

- Local trips within the Worthing area;
- Trips to/from Worthing from neighbouring areas (particularly to Brighton and Hove) and northwards towards Gatwick and London; and
- Through trips on the A27.

5.5 ***Traffic Impacts of the Concepts tests***

5.5.1 Table 5.1 compares the network summary statistics for each of the tests. The percentage change from the 2016 do-minimum is shown in Table 5.2. The table shows that each of the option reduces the growth in vehicle hours compared to the base. With the traffic reduction option, vehicle hours grow by 17% for a 9% growth in the trip matrix,. This can be compared with a 43% increase in vehicle hours with the Concept 3 option and a 28% increase in trips. None of the options produce an average speed across the network, which is equivalent to the base speed. In terms of network speeds in the Worthing-Lancing area, the single tunnel provides the fastest speed. The Traffic reduction test and the concept 3 option provide similar traffic speeds.

Table 5.1; Network Summary Statistics- Worthing- Lancing area

	PCU Hours	PCU Kms	Av Speed	Queues	Matrix
Base	3807	157302	41.3	187	37210
Do Minimum	6256	210147	33.6	1423	47755
Short Tunnels	5439	209288	38.5	1332	47755
1 Tunnel	5286	213239	40.3	916	47755
Bypass	5762	212585	36.9	1448	47755
Traffic Reduction Option	4437	173646	39.1	427	40592

Table 5.2; Percentage Change Network Summary Statistics from Base

	PCU Hours	PCU Kms	Av Speed	Queues	Matrix
Do-minimum	64%	34%	-19%	661%	28%
Short Tunnels	43%	33%	-7%	612%	28%
1 Tunnel	39%	36%	-2%	390%	28%
Bypass	51%	35%	-11%	674%	28%
Traffic Reduction Option	17%	10%	-5%	128%	9%

5.5.2 The impact on traffic flows on the railway screenline is shown on Table 5.3. This shows that the infrastructure schemes have the largest reductions on South Farm Road and Goring Street.

	Base	Do Minimum	Short Tunnels	1 Tunnel	Bypass	Traffic Reduction option
A259 Goring Street	2199	2827	2667	2657	2780	2433
Shaftesbury Avenue	1096	1460	1412	1391	1366	1156
A2031 South Street	1054	1441	1040	1371	1175	1084
South Farm Rd	1201	1929	1898	1707	1792	1619
A24 Broadwater Road	3084	3187	3324	3274	3209	2775
B2223 Ham Road	1363	1462	1551	1560	1554	1364
Western Rd	1531	1581	1571	1505	1633	1332
A2025 Grinstead Lane	610	1258	1344	1445	1508	1188
A283 Old Shoreham Road	782	1486	1344	1273	1317	1180
	12920	16631	16151	16183	16334	14131
% change from Base Year						
	Base	**Do Minimum**	**Short Tunnels**	**1 Tunnel**	**Bypass**	**Traffic Reduction option**
A259 Goring Street	2199	29%	21%	21%	26%	11%
Shaftesbury Avenue	1096	33%	29%	27%	25%	5%
A2031 South Street	1054	37%	-1%	30%	11%	3%
South Farm Rd	1201	61%	58%	42%	49%	35%
A24 Broadwater Road	3084	3%	8%	6%	4%	-10%
B2223 Ham Road	1363	7%	14%	14%	14%	0%
Western Rd	1531	3%	3%	-2%	7%	-13%
A2025 Grinstead Lane	610	106%	120%	137%	147%	95%
A283 Old Shoreham Road	782	90%	72%	63%	68%	51%
	12920	29%	25%	25%	26%	9%

Table 5.3: Traffic Flow comparison on Railway Screenline

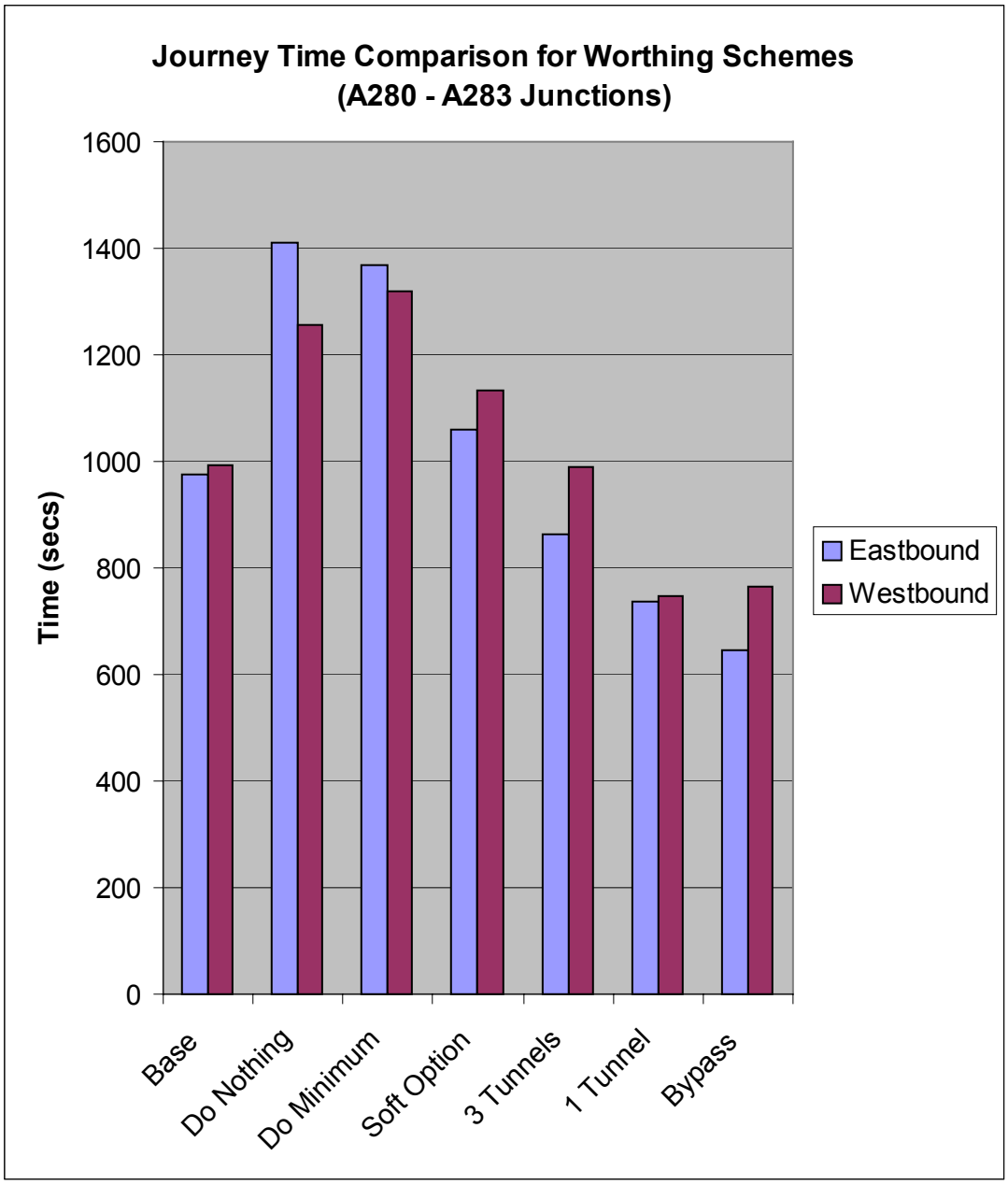
5.5.3 The impact on traffic flows on the north-south screenline is shown on Table 5.4. This shows that traffic levels on the existing Arundel Road would be reduced below today's levels.

	Base	Do Minimum	Short Tunnels	1 Tunnel	Bypass	Traffic Reduction option
A27 Arundel Road	2019	2053	596	1372	1581	2159
Salvington Road	338	897	387	506	356	547
A2032 Littlehampton Rd	1643	2355	2047	2042	2022	1940
Terringes Avenue	1196	2146	1672	1814	1680	1626
A259 Goring Rd	2253	2854	2605	2520	2597	2341
Tunnel/Bypass	0	0	3104	2603	2523	0
Total	7449	10305	10411	10857	10759	8613
	Base	**Do Minimum**	**Short Tunnels**	**1 Tunnel**	**Bypass**	**Traffic Reduction option**
A27 Arundel Road	2019	2%	-70%	-32%	-22%	7%
Salvington Road	338	165%	14%	50%	5%	62%
A2032 Littlehampton Rd	1643	43%	25%	24%	23%	18%
Terringes Avenue	1196	79%	40%	52%	40%	36%
A259 Goring Rd	2253	27%	16%	12%	15%	4%
Total	7449	38%	40%	46%	44%	16%

Table 5.4: Traffic Flow comparison on the north-south Screenline

5.5.4 Figure 5.1 shows the impact of the options on the travel times on the A27 between the A280 and A283 junctions. The figure shows that with a single tunnel or off-line bypass the travel times are reduced to a level below today's. In the case of the soft option, the times are still greater than current travel times. The figure shows that without transport interventions, travel times on the A27 are forecast to be increased by 40% in the eastbound direction.

Figure 5.1:


Journey Time Comparison for Worthing Schemes
(A280 - A283 Junctions)
Time (secs)
1600
1400
1200
1000
800
600
400
200
0
Base
Do Nothing
Do Minimum
Soft Option
3 Tunnels
1 Tunnel
Bypass
Eastbound
Westbound

5.6 ***Tests within the Wider Strategic Model***

5.6.1 The local SATURN model has the ability to examine peak period conditions within the Worthing- Lancing area. The SoCoMMS strategic model can examine issues over the region. As such, the model is able to examine traffic impacts of a range of measures on the South East traffic network up to the M25 motorway.

5.6.2 A number of tests were undertaken to assess the impact of alternative interventions. These ranged from scheme specific issues through to area-wide interventions. The tests of interest to the Worthing Plan include:

- Worthing on-line improvements;
- Worthing tunnel improvements;
- Combination of measures at Worthing, Arundel and Chichester;
- Impact of rail improvements;
- Tolls on motorways;
- Tolls on trunk roads; and
- A GPS toll approach.

5.6.3 **Do-minimum-** The strategic model indicated that traffic flows across the day would increase by 21% on Arundel Road (note that the morning peak local model produced an increase of 2%).

5.6.4 **Improvements to Rail services-** A series of tests were undertaken within the strategic model to assess the impact on traffic flows of improvements to the rail services. These tests investigated reductions in fares, improvements in station access, increased rail frequencies and faster journey times. The test showed that such rail improvements would have limited impact on traffic flows. Traffic flows on Arundel Road were reduced by less than 1%.

5.6.5 **Impact of tolls on motorways and trunk roads-** A demand management test was undertaken to assess the impact on tolls on motorways and trunk roads. The test showed that with a 6p/km charge traffic flows on the A27 Arundel Road could be reduced by 43%. However, there is a significant transfer of traffic onto alternative routes (such as the A259 and the A272) such that any benefits on the

trunk roads would be offset by safety, congestion and environmental problems on the alternative routes.

5.6.6 **Tolling of all links**- a test was undertaken to assess the impact if the entire south east road network were tolled. The test assumed a charge of 4p/km for all roads. The test showed that traffic flows on Arundel Road could be reduced by 11% compared to the do-minimum.

5.6.7 **Impact of GPS Charging-** A further test was undertaken to assess the impact of GPS charge. This assumed that only locations of congestion would be charged. Within the model, any link in the network with a v/c ratio greater than 0.5 in the average hour was assumed to have a charge applied to it. The test was found to reduce traffic flows on the A27 by 9%.

5.6.8 **Impact of Arundel Bypass**- The model was used to assess the impact of the Arundel bypass on traffic flows in Worthing. The model indicated that traffic flows on the Arundel road would be increased by 5% and Sompting Way by 2%. Thus the completion of the Arundel bypass had a small impact on flows on the A27. Much of this additional traffic has diverted from the A259 and A272.

5.6.9 **Impact of Worthing on-line improvements**- This test assumed that the single carriageway sections of the A27 were upgraded to dual 2-lane carriageway. No other changes were made within the SoCoMMS area. The model showed that there was an 8% reduction in vehicle hours in the West Sussex portion of the core area. Traffic was attracted to the A27 corridor from the A259 and A272 providing relief on these corridors (note that the A272 is outside the area of the local model). The improvement was found to increase traffic speeds on the A27 between the Worthing and the A23 by 40%.

5.6.10 Traffic flows were increased on Arundel Road by 90%. Assuming such an improvement were at-grade this would have a serious impact on the human environment in terms of noise and air quality.

5.6.11 **Impact of a tunnel at Worthing**- This test assumed that a tunnel improvement was provided such that a dual carriageway A27 was provided from east to west at Worthing. No other changes were made within the SoCoMMS area. The model showed that there was an 8% reduction in vehicle hours in the West Sussex portion of the core area. Traffic was attracted to the A27 corridor from the A259 and A272 providing relief on these corridors (note that the A272 is outside the

area of the local model). The improvement was found to increase traffic speeds on the A27 between the Worthing and the A23 by 40%. Traffic on Arundel Road was found to be reduced by 44%.

5.6.12 **Impact of the Strategy**- The SoCoMMS strategy includes a combination of measures based on public transport, soft options, highway improvements and demand management. Within the strategy it has been assumed that the short sections of tunnel are included. The results indicate a transfer of traffic from the A259 and A272 onto the improved A27. Traffic flows on the existing Arundel Road are reduced by 43%. Traffic flows on Warren Road are reduced by 21%.

5.7 ***Summary***

5.7.1 A series of traffic tests have been undertaken for 2016. The Soft Options test demonstrates a reduction in traffic levels with journeys being suppressed rather than transfering to other modes. However, whilst travel times on the A27 trunk road would be worse than current conditions. Thus consideration should be given to additional highway improvements. Beyond 2016, further growth in traffic levels is forecast which will increase congestion.

5.7.2 It is therefore recommended that the tunnel options be considered in greater detail with a view to incorporate them into the strategy. The next chapter provides an initial appraisal of the options. The Highways Agency should develop and consider options in the area and conduct further public consultation on the way forward.

6 Appraisal

6 Appraisal

6.1 ***Introduction***

6.1.1 The previous chapter outlined the traffic impacts of alternative options. This chapter outlines an appraisal of the various options that have been reviewed. The focus has been on the economic appraisal of the schemes and their impact on the environment.

6.2 ***Economic Impacts***

6.2.1 In order to assess the value for money of the major infrastructure projects, an economic analysis was undertaken of the single tunnel and an option of short sections of tunnel. A set of indicative costs were estimated for the purposes of this assessment. This broadly assumed the length of tunnel and applied a cost rate. The costs identified were (assumed to include land costs):

- Single tunnel – 2 lane full bore = £400m
- Short sections of tunnel option - 2 lane full bore = £275m

6.2.2 It is noted that the high cost of these schemes reflects the desire to provide infrastructure which is less damaging to the environment. The costs reflect a balance between the need to provide an improvement and a premium on the environment.

6.2.3 The TUBA program was used to assess the economic impact of the scheme. Table 5.5 provides a summary of the tests. These indicate that the schemes have positive cost benefit ratios. The table shows that while these schemes are very expensive, they do provide value for money. This is due to the wider benefits they are giving in influencing congestion across the sub-region. The scheme is providing wider economic benefits.

Scheme	**Scheme Cost £**	**Net Present Value**	**Benefit Cost Ratio**
Single tunnel	400m	172m	1.781
Short tunnels	275m	205m	2.347

Table 5.5 Economic Assessment

6.3 ***Environmental Impact***

6.3.1 **Human Environment**- An initial assessment has been undertaken of the impact on the human environment. If these schemes are taken forward to detailed design it is recommended that additional work is undertaken.

6.3.2 The impact of the on-line improvements would produce the largest negative impact on the human environment. With substantial increase in flow on the A27 (assuming at-grade with no tunnel) there would be local increases in noise and air quality. There would be reductions on the A259 and A272 but these would not be sufficient to offset the worsening on the A27.

6.3.3 With tunnel options the strategy seeks to balance the increase in traffic flows on the A27, the traffic reductions elsewhere and the provision of new infrastructure in tunnel. The review of air quality modelling from the strategic model indicates that within the Adur and Worthing areas there would be 5 zones where NOx would increase, 14 zones with a decrease. Overall there is forecast to be a reduction in Nox.

6.3.4 **Physical Environment –** One of the key issues in relation to Worthing is the impact on the Physical Environment. A review has been undertaken of the potential impacts of infrastructure improvements in the A27 corridor.

6.3.5 **Adur District** –The majority of development in Adur is confined to the low South Coast Plain where the urban areas of Shoreham-by-Sea and Southwick are located, leaving the remaining northern half of the district within the boundary of the undulating South Downs AONB, proposed as a national park. Sections of the A27 and A283 (as part of the county strategic network) go through the AONB, which also borders Shoreham Airport. By means of the Downs Link, the district provides access to the nationally important South Downs Way long distance footpath. The district's biodiversity interests are split between the ESA of the South Downs, including a SSSI, SNCIs and Lancing Hill LNR, and similar levels of designation around the coastal habitats of Shoreham Beach and the Adur Estuary. The River Adur is also important to the setting of Shoreham-by-Sea, which is one of six original settlements designated as Conservation Areas. As well as many unscheduled monuments throughout the district, eight are nationally recognised SAMs and 120 buildings are recognised to be of special architectural or historic interest.

6.3.6 **Worthing District** – Set in the South Coast Plain Countryside Character Area, Worthing District is predominantly urban; approximately one third of the district outside the built-up area is termed 'countryside' and comprises agricultural land, woodland and recreational areas. To the north of the A27, a small part of the district is within the Sussex Downs AONB but the network of A-roads and the railway line in the small district does not afford the district any tranquillity. Locally 11 SNCIs and an ESA protect urban and rural nature conservation, the Cissbury Ring SSSI is the only nationally important designation reflecting biodiversity and is also the district's only SAM. Archaeologically sensitive areas, 12 Conservation Areas and National Trust land represent the heritage value of Worthing's built environment. The seafront is vital to the character and attractiveness of the area as well as being important to recreation and tourism.

6.3.7 **Impact of Options-** The provision of an off-line bypass into the Downland area would have significant impacts on the Physical Environment. An off-line bypass would have a Large Negative impact on Landscape. The offline dualed route is likely to have a potentially detrimental impact on the landform of the chalk downs of the area. There would also be a Very Serious Adverse impact on biodiversity. The bypass will bisect an area of nationally scarce calcareous grassland (Tenants Hill Reservoir SNCI). In terms of heritage, the bypass would have a Large Adverse impact. The scheme will have a substantially adverse affect on the built heritage resource of the area, including possible direct impacts on listed buildings. The scheme will directly affect two conservation areas. The scheme will also directly affect a number of potentially historic landscapes and parkscapes. The scheme may affect the setting of Castle Goring. The scheme is likely to affect currently identified and unidentified archaeological deposits and remains from a range of periods. Overall, the scheme is likely to have a significant adverse affect on the heritage resource of the area, however it has not been possible to accurately gauge the extent of that affect at this stage. A precautionary approach has been adopted in regard to the score. In relation to townscape, a bypass would also have a Large adverse impact. The online sections for improvement would involve the demolition and the degradation of a huge number of properties and valued townscapes, whilst the bypass proposal to the east would benefit townscapes along the existing A27. However the hamlet of Sompting Abbotts, possessing a large number of listed buildings, will be adversely affected.

6.3.8 An on-line dualling option at grade would have slight negative impact on landscape. The Online dualling will have some detrimental impacts on landcover particularly and landscape pattern. There would also be a Minor Adverse impact

on Biodiversity. The proposal may cause some disturbance to an area of nationally scarce calcareous grassland (Offington Cemetery SNCI). In terms of heritage, on-line improvements would have a large Adverse impact. The scheme will have a substantially adverse affect on the built heritage resource of the area, including possible direct impacts on listed buildings. The scheme will directly affect two conservation areas. The scheme will also directly affect a number of potentially historic parkscapes. The scheme may affect the setting of Castle Goring. The scheme is likely to affect currently identified and unidentified archaeological deposits and remains from a range of periods. Overall, the scheme is likely to have a significant adverse affect on the heritage resource of the area, however it has not been possible to accurately gauge the extent of that affect at this stage. A precautionary approach has been adopted in regard to the score. In terms of Townscape, an on-line option would also have a large adverse impact. Online dualling would involve the demolition and the degradation of a huge number of properties and valued townscapes.

6.3.9 The tunnel options have less impact on the physical environment. The tunnels would have a Slight Negative impact on Landscape. New cuttings associated with tunnel entrances will have some detrimental impact on landscape pattern and landcover. More information on extent of necessary cutting, position of tunnel portals is needed to fully assess impact. (It is noted that any more northerly route for the tunnel through the Downs is likely to result in a higher negative score).

6.3.10 In terms of biodiversity, the tunnels would have a Minor Adverse impact. The proposal may cause some disturbance to an area of nationally scarce calcareous grassland (Offington Cemetery SNCI). In relation to Heritage, the tunnels have a Neutral score. The beneficial affects of the reduction in overland traffic on historic resources along the scheme's length, seemingly balance out the potentially negative impacts on areas of historic parkland, areas of historic landscape and possible historic buildings. The scheme also has the potential to impact upon currently unidentified assets from a range of periods. Finally, in relation to Townscape, the tunnels have a Slight Positive impact. The existing A27 would be relieved of traffic, thus improving the townscape and potential for human interaction in the area, which is mainly residential, together with a retail park.

6.3.11 **Water Environment**- At the strategic level of assessment, either the GOMMMS methodology or MMEA (Multi Modal Environmental Assessment) methodology could be used. The MMEA methodology has been used on the recently completed South West Area Multi Modal Study (SWARMMS) appraisal. The methodology is

outlined in the Strategy Appraisal Report. For the SoCoMMS study, scoring and weighting systems developed for the SWARMMS study were adopted. In addition we have allowed for a greater commentary on the impact of individual schemes.

6.3.12 **Groundwater-** The major aquifers are the Upper Greensand and the Chalk in which groundwater flow is intergranular and predominantly fracture flow respectively. Yields under the right conditions can be significant and support large public supply abstractions for the majority of the population. The Chalk is the single most important aquifer both nationally and regionally, and occupies approximately 40% of the study area. Within the Southern Region of the Environment Agency it provides over 70% of public water supplies and 85% of all groundwater abstractions. The integrity and protection of these sources is therefore a very important issue and every precaution must be taken to ensure they are not contaminated as a consequence of transportation measures. Contamination could result from the discharge of runoff or spillage of chemicals. The vulnerability of these aquifers to contamination depends upon the flow mechanism and the ability of the unsaturated zone to attenuate contaminants. As a result , a significant proportion of the area is highly vulnerable to contamination.

6.3.13 For the minor aquifers, such as the Lower Greensand and the Hastings Beds, typically sand horizons within a major clay sequence, groundwater flow can be restricted to intergranular flow, localised fractures and weathered zones, and therefore yields are relatively low. They can, however, be an important local supply source, and where mains water is unavailable in rural communities, these minor aquifers may be the only source available and must therefore be protected. As a consequence of shallow water tables, groundwater in these minor aquifers is often vulnerable to contamination

6.3.14 Under the Water Resources Act 1991, the Environment Agency has a duty to monitor and protect the quality of groundwater (Section 84) and to conserve its use for water resources (Section 19). It also has a duty (Section 16) to maintain, and where appropriate, enhance conservation of the surface water environment.

6.3.15 The Agency has developed a policy framework for protecting groundwater. This framework is based on the vulnerability of groundwaters to pollution and the need to prevent pollution of the groundwater that drains to a groundwater abstraction point, known as a Source Protection Zone (SPZ). The Agency's policies relate to preventing certain types of development or engineering, to minimise risk in areas

where groundwater is vulnerable to pollution and in SPZs. These policies are set out in the Policy and Practice for the Protection of Groundwater.

6.3.16 The assessment of the measures indicates that the tunnel options pass through a regionally important groundwater resource with little scope for mitigation. This has in itself a major impact and is sufficient (by accumulation of all local measures) to rate the impact of the core strategy as significant.

6.3.17 The High scoring totals for the Worthing Tunnels relate to traversed length of major and minor aquifer (respectively). For a single Worthing tunnel, 60 % of the total route lies over SPZs, with 34% (of the total) over the most sensitive Zone 1.

6.3.18 Surface Water- All surface water bodies that are either crossed by a transportation route or receive runoff are vulnerable to contamination through both routine discharge and spillage of contaminants. The level of hazard will be increased when these discharges occur upstream of a public water supply abstraction point. The setting of objectives for river water quality in response to European Directives and their implementation under UK law falls within the remit of the EA. The EA would discourage any new development that poses a threat to the quality of surface water bodies but conversely, should encourage any development that allows for an improvement in river quality (however poor the existing water quality may be). Upgrading the method of disposal of drainage waters from existing road or rail schemes may thus be considered to contribute to enhancement of the water environment.

6.3.19 Significant flooding problems in the south east during the winter of 2000/01 have emphasised the need for determining the impact of any development on flooding potential. New transportation links may lead to an increased risk of flooding. The EA seek to guide new development and re-development away from areas where there is an unacceptable risk of flooding. Both locally and within the strategic context, nationally applied guidance must be followed in regional strategic planning, this should include:

- The principles set out in Planning, Policy Guidance Note 25 (PPG25 – Development and Flood Risk) that establish flooding as a material planning issue to which the precautionary principle is applied including the consideration of conditions brought about by climate change.

6.3.20 On this basis there is a general presumption against new development within the flood routes and flood storage areas, unless it can be demonstrated that the proposal would not itself, or cumulatively in conjunction with other development:

- impede the flow of flood water;
- reduce the capacity of the floodplain to store water;
- increase the number of people or properties at risk from flooding;
- obstruct land adjacent to watercourses required for access and/or maintenance purposes; and
- cause unacceptable effects to the environment.

6.3.21 To avoid these risks flood plains should be avoided wherever possible.

6.3.22 Increased flood risk may also arise from drainage of large impermeable areas (e.g. road carriageways; airport runways and aprons) with high run off rates and little attenuation of flow. Appropriate drainage control measures must be employed where risks of flooding have been identified.

6.3.23 In the case of Worthing, where schemes occur on the chalk (where there is little surface water), in general terms the overall impact on surface water is relatively limited.

6.4 ***South Downs National Park***

6.4.1 The Countryside Agency are putting forward proposals for a National Park for the South Downs area. A draft boundary has been produced for public consultation. The boundary of the proposed National Park is to the north of the urban areas, and between Worthing and Lancing, the A27 forms the boundary. Typically the boundary is the same as for the existing Area of Outstanding Natural Beauty. Thus, any off-line bypass would encroach into the proposed National Park.

7 Summary

7 Summary

7.1 ***Conclusions from the Worthing SDP***

7.1.1 A review has been undertaken of alternative options for the Worthing area. The tests show:

- **Do-minimum** – increased traffic levels in Worthing by 2016 and 2030
- Increased congestion in the urban area and on the A27 corridor;
- Worsening human environment
- Safety concerns
- Traffic Reduction option- would provide relief in Worthing
- Travel times on the A27 corridor worse than today
- **Traffic reduction options**
- Would reduce travel times and traffic flows in Worthing
- Travel times on the A27 would be greater than base levels
- Issue of the economic impact in a priority area for economic regeneration
- Traffic levels would remain high on the A27 causing impacts on safety and the human environment
- **Bypass**- would provide relief on the A27 corridor;
- Would reduce travel times on the A27 corridor
- Would have a very serious adverse impact on the physical environment
- Provide some relief to the human environment in Worthing
- **Tunnel options**- would provide traffic relief on the A27
- Improve travel times on the A27
- Provide wider benefits to the sub-region
- Would provide value for money despite the high cost
- Reduces the impact on the physical environment, although there is an issue in relation to groundwater

7.1.2 It is recommended that the tunnel options be included within the strategy, subject to further review and design, in addition to other elements which have been considered in other Strategy Development Plans.

7.2 ***Strategy Plan for the Area-***

7.2.1 In developing a strategy for the Worthing area, the following elements should be considered to provide the overall multi-modal package, including area wide initiatives:

- **Soft Measures**
- Safer routes to school- these should be encouraged in many of the towns along the corridor- A variety of initiatives can be pursued locally and the types of measure adopted will be dependent on local circumstances. This approach will require the continuation/ provision of resources to local authorities in order to develop, co-ordinate and deliver these improvements.
- Travel awareness education and marketing- this should be adopted across the study area. This should concentrate on providing information to users as to services that are available. This will be supplemented in key areas by up to date travel information such as bus stops and rail stations. Improved marketing of the transport system through new and improved ticket systems.
- Workplace Travel plans,- should be expanded to encompass major employers in the corridor, and for new major developments. Government guidance should be reviewed to include targets and regional guidance strengthened regarding parking standards. Local authorities should set modal targets in congested areas and also use the introduction of workplace parking levies as a means of regulating parking spaces. This approach will require the continuation/ provision of resources to local authorities in order to develop, co-ordinate and deliver these improvements.
- Home working- should be promoted nationally, as this would assist the region; this could be undertaken through the introduction of tax allowances for home offices and could form part of Workplace Travel Plans.
- Videoconferencing should be promoted through regional partnerships with local education authorities and health trusts taking a lead in its use

for teaching and other purposes. Government departments could also be similarly active in the use of video conferencing.

- Walking and Cycling- the strategy proposes that locally based pedestrian and cycle improvements should be pursued. These include the completion of the National Cycle network and links to the network, as well as completion of local walking and cycle networks, such as feeder networks to stations, hospitals and town centres

- **Rail service Enhancements**
- A strategy development plan has been undertaken for the potential for rail on the south coast network. This has sought to identify in more detail the range of improvements that are needed, what the timetable would look like and assess the costs and benefits of the approach. The aim is to make the use of rail an 'attractive alternative'. The elements included within this approach are:
- **Presentation of train services**
- Better marketing & promotion
- Modernisation of rolling stock
- Attention to special needs (e.g. bicycles on trains)
- Improved quality and reliability
- **Stations & interchanges**
- Improvements to station forecourts, access, short term parking, taxis, buses, interchange, "kiss and ride", bicycle storage, etc.
- Structural improvements to station buildings, platforms, canopies, etc.
- **Train service enhancements**
- Build on existing structure with new
- - Fast inter-urban services
- - High frequency local services
- **Improvements on the West Coastway**
- *Medium term developments*
- Half-hourly regional express - Brighton (Ashford) to Southampton calling, inter alia, Worthing, Barnham, Chichester, Havant and Fareham

- Increase from 3 to 4 trains per hour between Brighton and West Worthing
- Development of simplified and reliable timetable pattern with all Train Operating Companies
- Signalling improvements
- **Locally based Public Transport Improvements**
- Quality Bus Partnerships should be promoted so as to secure more frequent and extensive urban and rural bus services, particularly in the evening and at weekends
- Improvements to waiting facilities;
- Bus priority measures (e.g: bus lanes, traffic signal measures, etc);
- Real time information systems;
- New routes and frequency enhancements, along with estimates of additional resource requirements (buses, drivers, etc);
- Interchange facilities at Worthing station should be greatly improved,
- **Targeted Road based Improvements**
- Improvements to the two key A27 roundabouts and a third junction using traffic signal controls (short term)
- In the medium term (2008-2012) Road improvement to A27 through Worthing and Lancing
- The design of any highway improvements should take account of the needs of pedestrians and cyclists.
- The potential for bus priority measures arising from the introduction of the traffic schemes should be examined
- Traffic calming and environmental management measures on alternative routes
- Demand management
- Increased parking charges in town centres
- Review introduction of Workplace Parking Controls

7.2.2 It is recommended that in regard to the longer term A27 improvements, the Highways Agency should develop options and conduct further public consultation before finalising the way forward.