



Mid Sussex Transport Study

MSTS Stage 2 Report

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1. Introduction

1.1. Overview and Objectives

1.1.1. Stage 1 of the Mid Sussex District Council Transport Study (MSTS) was completed in early 2013. Its purpose was to assess the impact on the transport network of land uses proposed in the Council's District Plan. It used a variant of the West Sussex County Transport Model (WSCTM) to predict the highway and passenger travel patterns associated with committed, strategic and neighbourhood development. It then tested the ability of the transport network to handle the level of trip demand arising from the development scenarios. Various types of transport intervention were modelled to mitigate the impact.

1.1.2. Stage 2 is a refinement of the study. It assesses the final, definitive, version of the Mid Sussex District Plan (May 2013) and considers the outline design of interventions needed to accommodate the development. The scope of demand forecasts and transport schemes for stage 2 is similar to that for stage 1, so limited detail of the modelling is given here. The focus of this report is to show:

- If the District Plan can be delivered without adverse or unacceptable effects, in excess of National Planning Policy Framework criteria, at 2031; and
- How its transport impacts can be successfully resolved, to be no worse than in an equivalent reference case at 2031.

1.1.3. Amey was commissioned by Mid Sussex District Council (MSDC), in February 2013, to undertake the stage 2 study, using a derivative of the SATURN highway and CUBE public transport (PT) multi-modal transport model.

1.1.4. Future scenarios have been tested in stage 2, for the weekday AM peak at 2031, to coincide with the District Plan horizon year. The future scenarios comprise:

- A 'Reference Case', with committed developments and transport schemes, only; and
- A 'Development Case', with committed and strategic land-use developments (i.e. developments allocated in the District Plan and Neighbourhood Plans) and with committed and remedial transport schemes.

1.2. Scope of Report

1.2.1. In scope, the stage 2 report comprises the following:

- Chapter 2 outlines the content of the multi-modal model;
- Chapter 3 describes the forecast demand scenarios at 2031;
- Chapter 4 discusses the future year transport supply networks;
- Chapter 5 summarises the modelling results and output analysis;
- Chapter 6 draws conclusions from the findings.

2. Outline of Stage-2 Model

2.1. Overview

2.1.1. This section provides a description of the structure and content of the transport model that has been used to appraise the MSDC District Plan. Fuller details of the model were set out in the stage-1 report.

2.2. Base Year Model

2.2.1. The West Sussex County Transport Model from 2008 was re-based and refined in key areas of interest, mainly Burgess Hill, to become the 2010 AM peak base for the MSTS stage-2. The revised model was satisfactorily validated against recorded AM peak conditions in 2010. It used information from the recent Burgess Hill Transport Model (BHTM). Validation was mainly judged against the traffic flow 'GEH' accuracy statistic and percentage difference in journey times. 'GEH' is calculated using the following formula:

$$GEH = \sqrt{[(Modelled - Observed)^2 / (Modelled + Observed)/2]}$$

2.2.2. The model includes all significant roads in the West Sussex County road network, together with intra-urban bus routes and railways. The extent of the model network is shown in Figure 1. The wider-area zoning system, used to represent trip origin to destination (O-D) movement matrix is shown in Figure 2. A more detailed view of the local zoning system around Burgess Hill is shown in Figure 3.

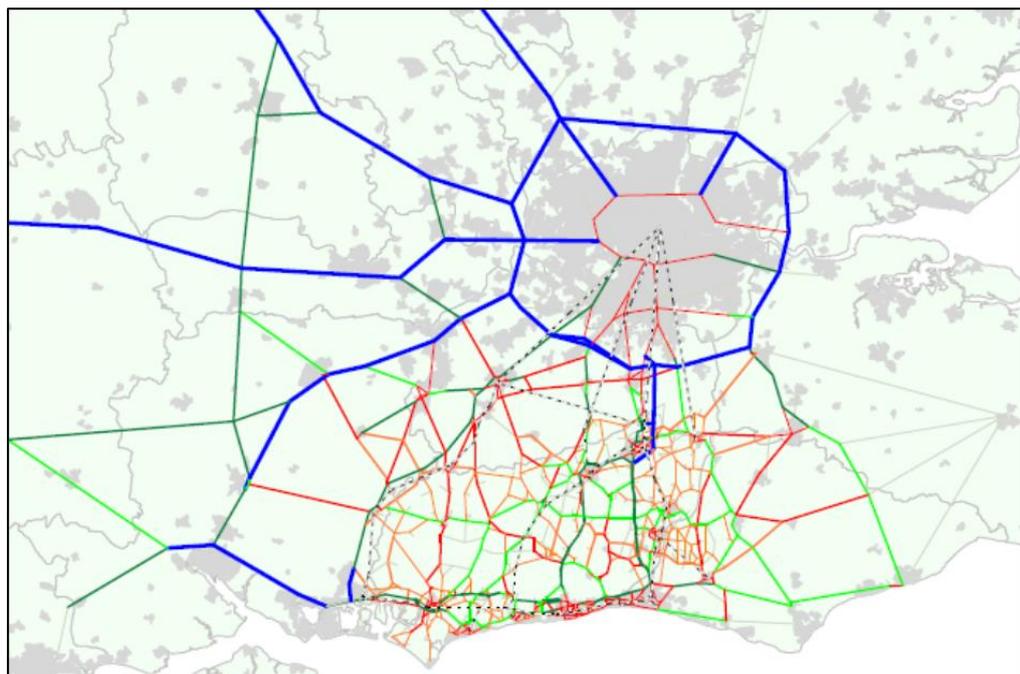


Figure 1: West Sussex Strategic Model Area

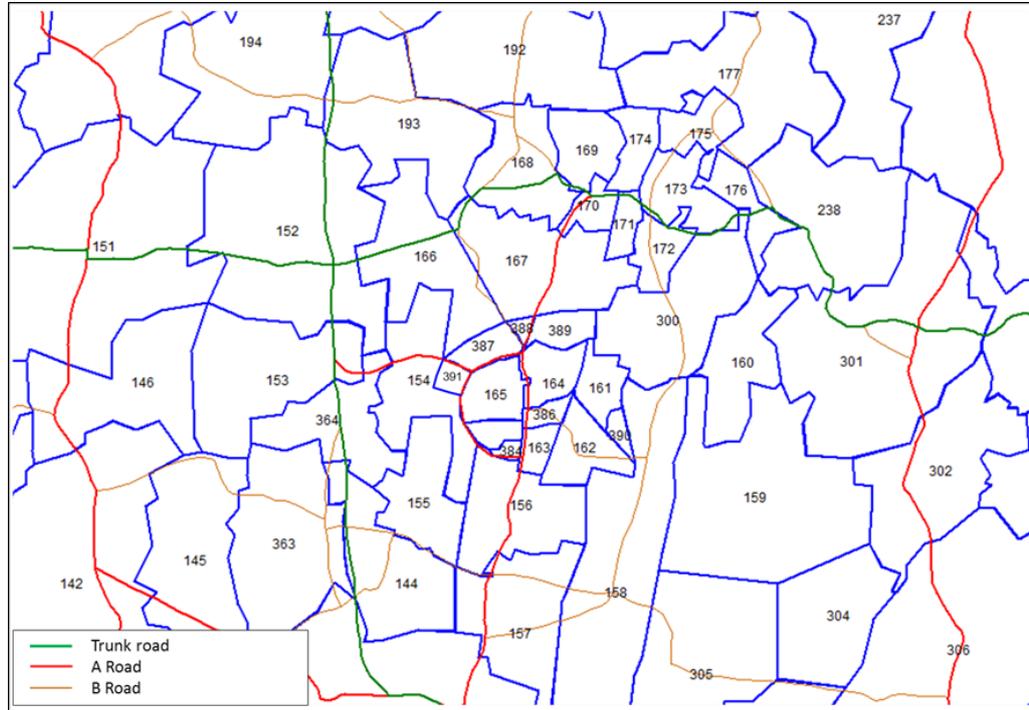


Figure 2: Mid Sussex Wider Area Model Zones

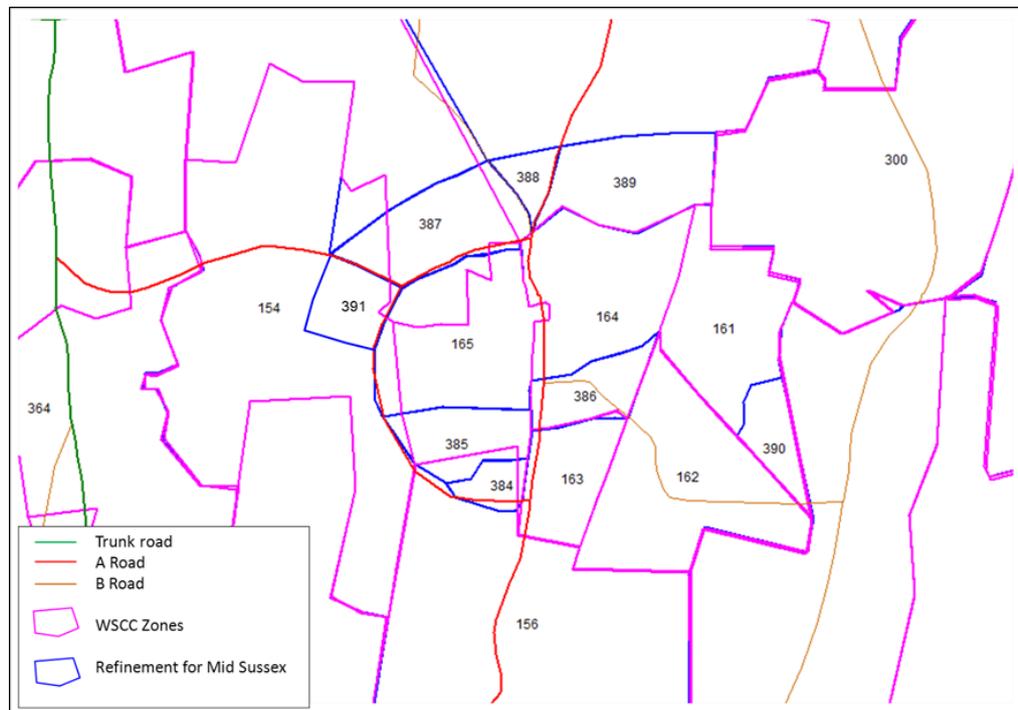


Figure 3: Burgess Hill Model Zones

2.2.3. Changes have been made in the MSTS base model to incorporate extra local detail absent from the WSCTM, specifically:

- More accurate trip patterns in Burgess Hill, derived from surveys for the BHTM;
- More detailed transport network and land use zones in Burgess Hill, to include strategic development sites and accesses (391 O-D zones);
- New network detail for roads between Burgess Hill and North / South Chailey, to the east, through Ashdown Forest and between Ditchling and Brighton;
- Revised rail services, for peak time extension of London – Gatwick express trains to and from Brighton; and
- Updated local bus services in Burgess Hill.

2.2.4. The AM peak base MSTS model represents three travel modes; highway (all vehicles); bus; and rail; and five journey purposes:

- Home-based work;
- Home-based education;
- Home-based other;
- Employer's business; and
- Non home-based other.

2.2.1. The performance of the revised 2010 base model was considered to be acceptable with respect to Department for Transport (DfT) validation criteria. Taking all links in Burgess Hill, where modelled and observed flows were available, the overall GEH accuracy statistic showed 86% of links with GEH less than 5.0 (target 85%). Similarly, across the wider area model 86% of links had a GEH of less than 5.0 (target 85%).

2.2.2. Journey time validation was less accurate but nevertheless reasonably acceptable. In Burgess Hill, 75% of routes gave a modelled time within 15% of observed (target criterion 85%), whilst across the wider area, 85% of routes satisfied the criteria (target criterion 85%).

2.2.3. Satisfactory convergence and stability were achieved in the 2010 base model, such that running further iterations of the model would not change outcomes significantly.

2.3. Future Year Model

2.3.1. The base MSTS model has been projected to forecast year 2031. The future year models include the following travel choice mechanisms to represent changes in the level of trip demand, changes in available transport facilities and changes in travel costs:

- Trip generation and attraction at O-D zones;
- Trip distribution and destination choice;
- Travel mode choice;
- SATURN highway route choice assignments; and
- CUBE PT route choice assignments.

2.3.2. Again, the future year models have been checked for satisfactory convergence and stability.

2.3.3. In stage 2 of MSTS, various future scenarios have been forecast from the 2010 base and tested to cover a range of possible outcomes with respect to trip demand and transport supply. The scenarios are as follows:

- A 'Reference Case', representing:
 - Background trip end growth based on adjusted NTEM planning data (applied to cars and transit passengers) and RTF11 vehicle kilometres (applied to goods vehicles), at district level;
 - Committed land use development trip O-D movements (for sites with planning permissions), in specific model zones; and
 - Committed transport schemes (highway and PT interventions, with funding and approvals).
- A 'Development Case', representing:
 - Background trip end growth as Reference Case, but with further adjustments;
 - Committed land use development trip O-D movements, (as Reference Case);
 - Strategic, District Plan development trip O-D movements (for sites with planning allocations), in specific model zones;
 - Neighbourhood Plan development (defined as changes to NTEM planning data and trip end growth), spread across the District in line with the distribution determined by town and parish councils, as reported to MSDC in June 2012;
 - Committed transport schemes, (as Reference Case);
 - 'Primary' remedial transport interventions, and supplementary 'secondary' interventions, to mitigate District Plan impacts (Planned infrastructure, policy and PT service schemes, as defined by WSCC and in line with Burgess Hill Town Wide Strategy);
- A 'Remedial Development Case', representing:
 - Background trip end growth. (as Development case);
 - Committed land use development trip O-D movements, (as Development Case);

-
- Strategic, District Plan development trip O-D movements, (as Development Case);
 - Neighbourhood Plan development, (as Development case);
 - Committed transport schemes, (as Development Case);
 - Primary and Secondary remedial transport interventions, (as Development Case);
 - Additional highway intervention schemes tested to mitigate unacceptable congestion impacts at key road links and junctions.

3. Forecast Demand Scenarios

3.1. Overview

- 3.1.1. This section describes the elements of trip demand that have been combined to form the future year model scenarios ('trip matrices') for the District Plan stage-2 appraisal. The key components are similar to, but slightly changed from, the stage-1 model. The differences arise from amendments to the land-use configuration in the District Plan and from the operation of the 'variable demand model' which determines trip patterns from changes in travel costs.
- 3.1.2. A broader picture of how the demand scenarios were developed was given in the stage-1 report.

3.2. Trip Demand Scenarios

- 3.2.1. Two AM peak demand scenarios have been assembled for stage-2, for each forecast year (2021 and 2031), namely:

- Reference Case; and
- Development Case.

- 3.2.2. There are common threads within both the Reference Case and Development Case scenarios, as described below.

Reference Case and Development Case Demand

- 3.2.3. Growth in car and PT trip volumes from base year 2010 is assumed to be in line with the National Trip End Model (NTEM V6.2), which calculates trip growth factors by district (using TEMPRO) from the year-on-year profile of planning data (i.e. households and jobs) that it contains. The planning data in NTEM has been adjusted for stage-2 using MSDC local predictions. Resulting growth factors have been applied in the transport model by identifying the model zones that correspond with each NTEM district.
- 3.2.4. Where details of specific future land-use allocations are known, these have been included in the model by applying TRICS trip rates to the site characteristics. The resulting trip arrivals and departures have been added to the appropriate model zone and distributed amongst origins and destinations on gravity principles. At the same time, the planning data associated with the specific developments have been removed from NTEM to avoid duplication of growth.
- 3.2.5. Site-specific trip patterns have been represented for all committed developments, including East of Kingsway in Burgess Hill, in both the Reference Case and Development Case scenarios.
- 3.2.6. Growth in goods vehicle movements has been calculated from the National Transport Model (NTM), which predicts vehicle kilometres by road type and location from the Road Traffic Forecasts 2011 (RTF11).

Development Case Demand

- 3.2.7. In the Development Case, only, allowance has also been made for zone-specific trips at strategic development sites. These comprise the Northern Arc and A2300 Business Park land uses, in Burgess Hill.
- 3.2.8. Also, in the Development Case only, predictions of households and jobs arising from Neighbourhood Plan development have been included as changes to NTEM data, by appropriate district. The Neighbourhood Plan allocations have not been modelled as site-specific trips.

Planned Households and Jobs

- 3.2.9. Predicted numbers of households and jobs across Mid Sussex, which have been substituted for the NTEM planning data to derive baseline trip end growth factors, are summarised in Table 1. The figures are taken from latest MSDC stage-2 forecasts, as of March 2013 and supersede those in the stage-1 study. Then, in model zones where specific development sites have been identified, the updated plan allocations in Table 1 have next been removed from NTEM and replaced in the model as trip O-D arrivals and departures.
- 3.2.10. Neighbourhood Plan housing development has been spread across the District in line with the distribution determined by town and parish councils, as reported to MSDC in June 2012.
- 3.2.11. Under the stage-2 assumptions for Mid Sussex District (excluding Crawley and Horsham), at 2031, the forecast numbers of residential households under the various development categories are as follows:
- Mid Sussex committed sites – 4,612 households; (4,393 households in stage 1);
 - Mid Sussex Strategic sites – 3,385 households; (4,000 households in stage 1);
 - Mid Sussex Neighbourhood Plan sites – 2,805 households; (2,301 households in stage 1);
 - Mid Sussex overall – 10,802 households; (10,694 households in stage 1).
- 3.2.12. Note that the Neighbourhood Plan housing allocation in the Submission District Plan is for 2,000 dwellings. This has been increased to 2,805 dwellings, to represent the maximum number of households that town and parish councils may be able to accommodate, as reported to MSDC in June 2012.
- 3.2.13. Similarly the forecast numbers of jobs are as follows:
- Mid Sussex committed sites – 1,162 jobs; (1,162 jobs in stage 1)
 - Mid Sussex Strategic sites – 3,502 jobs; (4,845 jobs in stage 1);
 - Mid Sussex Neighbourhood Plan sites – 4,101 jobs; (2,760 jobs in stage 1);
 - Mid Sussex overall – 8,765 jobs; (8,767 jobs in stage 1).

Table 1: Planning Data Adjustments to NTEM in Development Scenarios							
Location/Description	Planning Data				Plan Data Substituted for NTEM6.2	Plan Data Removed from NTEM6.2 and Modelled as Zone-Specific Trips	
	Dwellings		Jobs		Ref. Case and Dev. Case	Ref. Case	Dev. Case
	2021	2031	2021	2031			
Committed Developments							
Rural (Mid Sussex)	150	150	375	375	✓	✓	✓
Burgess Hill (Main)	1326	2145	15	15	✓	✓	✓
Haywards Heath	1353	1378	562	562	✓	✓	✓
East Grinstead (Main)	618	643	92	92	✓	✓	✓
Hurstpierpoint/Keymer	120	120	0	0	✓	✓	✓
Crawley Down	103	103	118	118	✓	✓	✓
Copthorne	3	3	0	0	✓	✓	✓
Cuckfield	70	70	0	0	✓	✓	✓
Crawley (Main)	2700	2700	180	180	✓	✓	✓
Rural (Horsham)	2100	2650	698	721	✓	✓	✓
Neighbourhood Plan Developments							
Rural (Mid Sussex)	209	417	305	610	✓	x	✓
Burgess Hill (Main)	251	502	367	734	✓	x	✓
Haywards Heath	475	950	695	1389	✓	x	✓
East Grinstead (Main)	103	206	151	301	✓	x	✓
Hurstpierpoint/Keymer	100	200	146	292	✓	x	✓
Crawley Down	0	0	0	0	✓	x	✓
Copthorne	250	500	366	731	✓	x	✓
Cuckfield	15	30	22	44	✓	x	✓
Strategic Developments							
Northern Arc	1693	3385	0	0	✓	x	✓
East of Kingsway	0	0	0	0	✓	x	✓
A2300 Business Park	0	0	1751	3502	✓	x	✓

3.2.14. The strategic employment allocation at A2300 Business Park has been represented in the ‘Development Case’ model as zone-specific trip arrivals and departures. The number of jobs here has been converted to equivalent person trips by applying appropriate land-use trip rates to the calculated floor area of the development, in the same way as in MSTS stage-1. The details are given in Table 2.

Table 2: Calculation of Jobs and Trips at A2300 Business Park (2031)									
Assumed 40% of 22ha site will be developed, i.e. 8.68ha									
Land-Use Type	% of Total Area	GEA (ha)	Ratio of NIA / GEA	NIA (sqm) per Job	No. Jobs	Trip Arrivals per 100sqm GFA (GEA) (Persons, all modes)	Trip Departures per 100sqm GFA (GEA) (Persons, all modes)	Total AM Peak Person Trip Arrivals	Total AM Peak Person Trip Departures
B1a Office	25%	2.17	85%	12.0	1537	1.789	0.074	388	16
B1b Research and Development	17%	1.488	85%	12.0	1054	2.235	0.305	333	45
B1c Business Park	30%	2.604	85%	47.0	471	0.601	0.235	157	61
B2 Industry	13%	1.116	85%	36.0	264	0.600	0.253	67	28
B8 Distribution	15%	1.302	95%	70.0	177	0.038	0.019	5	2
Overall	100%	8.68			3503			950	152

3.3. NTEM (TEMPRO) Trip End Growth

3.3.1. At 2031, each model zone has residual trip end growth applied in line with the National Trip End Model (NTEM V6.2), after the factors have been adjusted to exclude any new site-specific development (i.e. trips associated with committed and strategic households and jobs).

3.3.2. The trip end growth factors were derived using the TEMPRO tool, for the following areas of Mid Sussex:

- Rural (Mid Sussex);
- Burgess Hill (Main);
- Haywards Heath;
- East Grinstead (Main);
- Hurstpierpoint / Keymer;
- Crawley Down;

- Copthorne; and
- Cuckfield.

3.3.3. Factors were similarly derived for surrounding administrative districts. The respective person trip end factors (for all travel modes combined) were then applied in the transport model to all zones within each district, by trip purpose.

3.4. Heavy Goods Vehicle Forecasts

3.4.1. Trip end growth, to 2031, for goods vehicles has been represented in the model using National Transport Model RTF11 forecasts. The base model goods vehicle movements are unchanged from 2008. The growth factors used were therefore as follows:

- 2008 to 2021: +19.1% (x1.191);
- 2008 to 2031: +36.3% (x1.363).

3.5. Trip Rate Estimates for Site-Specific Developments

3.5.1. Person-trip arrivals and departures at identified development sites, during the AM peak, were calculated by applying agreed trip rates to the land use characteristics of each site (committed and strategic). The trip rates were extracted from the TRICS database for similar UK sites.

3.5.2. Since the movement patterns were calculated as person-trips, they are different from the mode-specific trip rates (e.g. vehicles and public transport passengers) determined by developers for the respective sites in the study area. However, they have been calculated in a similarly rigorous manner.

3.5.3. The trip rates for stage 2 are consistent with those used in stage 1 and are as shown in Table 3.

Table 3: Person Trip Rates for Site-Specific Developments (Derived from TRICS)			
Land Use Type	Unit	Arrivals	Departures
Mid Sussex Developments (Committed and Strategic)			
Residential	per dwelling	0.121	0.681
A1: Retailing	per 100m2	5.285	3.564
A2: Financial/Professional Services	per 100m2	1.789	0.074
B1a: Offices	per 100m2	1.789	0.074
B1b: Research/Development	per 100m2	2.235	0.305
B1c: Light Industry	per 100m2	0.601	0.235
B2: General Industry	per 100m2	0.600	0.253
B8: Storage & Distribution	per 100m2	0.038	0.019
C1: Hotel	per 100m2	0.455	0.816

D2: Leisure	per 100m2	0.868	1.06
Crawley Kilnwood Vale			
Residential	per dwelling	0.359	0.757
Employment	per 100m2	1.88	0.390
Food Store	per 100m2 RFA	8.12	4.811
Crawley North East Sector			
Residential - Private Houses	per dwelling	0.240	0.759
Residential - Non Private Houses	per dwelling	0.206	0.665
Residential - Private Flats	per dwelling	0.114	0.451
Residential - Non Private Flats	per dwelling	0.185	0.445
B1	per 100m2	1.789	0.074
B2	per 100m2	0.600	0.253
B8	per 100m2	0.038	0.019

3.6. Calculated Site-Specific Person Trips

3.6.1. By applying the trip rates in Table 3 to the identified development sites, AM peak trip arrivals and departures were calculated as summarised, by local district, in Table 4. These total person trips were added to the adjusted NTEM growth for the appropriate O-D zones in the model matrix, to give overall 2031 trip patterns. Negative values in the table indicate a trip reduction associated with change of land use.

Table 4: Additional Person Trips (All Travel Modes)				
Location/Description	2021		2031	
	Arrivals	Departures	Arrivals	Departures
Committed Residential Developments				
Rural (Mid Sussex)	27	150	27	150
Burgess Hill (Main)	184	1034	234	1317
Haywards Heath	158	891	158	891
East Grinstead (Main)	69	388	74	415
Hurstpierpoint/Keymer	23	127	23	127
Crawley Down	18	102	18	102
Copthorne	1	8	1	8
Cuckfield	11	65	11	65

Crawley Kilnwood Vale	754	1590	951	2006
Crawley North East Sector	475	1456	475	1456
Committed Commercial Developments				
Rural (Mid Sussex)	122	42	138	42
Burgess Hill (Main)	-5	-3	-7	-3
Haywards Heath	202	52	177	52
East Grinstead (Main)	238	190	77	190
Hurstpierpoint/Keymer	0	0	0	0
Crawley Down	28	4	751	4
Copthorne	0	0	0	0
Cuckfield	0	0	0	0
Crawley Kilnwood Vale	353	151	353	151
Crawley North East Sector	40	6	40	6
Strategic Residential Developments				
Northern Arc	205	1153	410	2305
East of Kingsway	0	0	0	0
A2300 Business Park	0	0	0	0
Strategic Community Developments				
Northern Arc Primary and Secondary Schools	235	0	1199	0
Strategic Employment Developments				
Northern Arc	0	0	0	0
East of Kingsway	0	0	0	0
A2300 Business Park	475	77	949	153

- 3.6.2. The trips in Table 4 were further adjusted by the workings of the variable demand model, in terms of destination choice and mode choice, to produce the final assigned trip matrices at 2031.
- 3.6.3. Comparing the person trip arrivals and departures from Table 3 with the previous values produced in stage-1, there is no change for committed residential or employment developments, except for an increase at Burgess Hill, where the East of Kingsway housing allocation has now become committed at stage-2.
- 3.6.4. Although the MSDC (2013) amendments to overall committed dwellings, by district, for stage-2, have been taken into account in the NTEM planning data (Table 1), they have not been changed at a site-specific level (Table 3). This is because no new details were available and because they have not changed substantially from stage-1.

3.7. Forecast Person Trip Matrices

3.7.1. Once the various components of the model trip matrices were assembled, (i.e. residual NTEM growth and site-specific arrivals and departures), the resulting matrix person-trip totals were derived as shown in Table 5. These are the numbers of trips in the reference case and development case scenarios, before assignment in the model. They precede any further changes made within the demand model, in each matrix / network scenario, to allow for mode choice and destination choice in response to changing transport costs. The table also indicates the amount of change in stage-2 person trips, compared with the stage-1 appraisal.

Table 5: Stage-2 Base and Forecast Person Trip Matrix Totals				
	2008	2031		
Trip Purpose	Stages-1&2	Stage-1	Stage-2	Change from Stage-1 to Stage-2
Reference Case				
Home-based Work	105228	115119	116124	1005
Home-based Education	13546	14167	14320	153
Home-based Other	24762	29628	29668	40
Employers Business	33964	37848	38071	223
Non home-based Other	26100	30328	30370	42
Total	203599	227090	228553	1463
Development Case				
Home-based Work	105228	117276	118224	948
Home-based Education	13546	14442	14612	170
Home-based Other	24762	30149	30214	65
Employers Business	33964	38577	38749	172
Non home-based Other	26100	30960	31078	118
Total	203599	231404	232877	1473

3.7.2. It can be seen that the AM 2031 pre-assignment matrix trip totals at stage 2 are very consistent with those at stage-1. The overall change in both the reference case and the development case trips is less than 1%. The differences simply reflect minor refinements to the MSDC District Plan data.

3.8. Travel Choice Mechanisms in the Demand Model

3.8.1. As indicated in section 2.3, the trip demand model contains several mechanisms to represent travel choices in response to journey costs, namely: trip O-D generation and attraction; trip distribution and destination choice; and travel mode choice. As the model covers only the AM peak period, it does not include time-of-day choice.

Trip End Generation and Attraction Model

- 3.8.2. The trip end model derives future year demands from changes in socio-economic data (car ownership/availability), demographic data (population and employment trends), and development plans. The output from the trip end model, which is based on NTEM and local planning projections, is a set of growth factors, by purpose, at a zone level, for use in a 'Fratar' growth factoring process, which updates the demand matrices to a set of balanced trip ends.

Trip Distribution and Destination Choice

- 3.8.3. Trip destination choice is calculated as a function of observed trip length distribution and the generalised time of travel.
- 3.8.4. The distribution functions determine the incremental change in demand to be applied to the observed base year flows, taking account of the effect of generalised travel time on average distance travelled. The functions are 'doubly-constrained' to origin and destination totals and are applied by journey purpose.
- 3.8.5. Trip distribution has been refined in the MSTS stage-2 model to try to reduce stage-1 differences between modelled and 2001 Census journey to work patterns. Although the stage-1 model was derived from a satisfactorily validated 2008 base, East Sussex county Council (ESCC) identified a shortcoming in the model with respect to a shortfall in the modelled proportion of journey to work trips travelling from the south (primarily Brighton) to Burgess Hill and to the proposed A2300 business park, when compared with the Census. Although the 2001 Census is outdated, the stage-2 model does now show a more consistent proportion of AM work trips travelling into Burgess Hill from the south.

Travel Mode Choice

- 3.8.6. Travel mode choice is applied by journey purpose and is calibrated in line with initial spread parameters (λ), based upon WebTAG guidance. It then undergoes incremental adjustment of the spread parameters and modal constants for each purpose, until the modelled mode shares match the observed shares from the car, bus and rail matrices.
- 3.8.7. The above components of the trip demand models are applied in an iterative process. The outturn demands derived from the first iteration are used to create new generalised times for input to the second iteration of the demand models. This process is repeated until an acceptable level of convergence between trip demand and network supply costs is achieved.

4. Future Year Transport Supply Networks

4.1. Overview

- 4.1.1. This section describes the transport networks that have been included in the future year multi-modal model, under the respective stage-2 forecast scenarios. The network elements represent the supply side of the model.
- 4.1.2. Many of the network components are consistent with those in the stage-1 appraisal, but changes have been made to reflect the evolving WSCC strategy and schemes associated with recent changes to development access proposals.

4.2. Transport Network Scenarios

- 4.2.1. Three network scenarios have been modelled under stage-2 of the MSTS, for the AM peak at 2031, namely:
- Reference Case;
 - Development Primary and Secondary (P&S) Intervention Case; and
 - Development Further Remedial Intervention Case.

Reference Case

- 4.2.2. The 'Reference Case' represents the supply situation if only committed transport interventions are introduced on to the current highway and PT network. This is the scenario against which the planned development impacts are to be judged, to identify if they cause the network to become worse off, in terms of operational 'stress' (i.e. congestion and delay).

Development Primary and Secondary Intervention Case

- 4.2.3. The 'Development Primary and Secondary Intervention Case' is a hybrid amendment of previously identified schemes, proposed to allow access at development sites and to ease expected future network stress. These schemes were agreed with MSDC and WSCC at stage-1 and further refined for stage-2 of the study. This scenario includes the reference case interventions.

Development Primary Intervention Case

- 4.2.4. It should be noted that an intermediate 'primary intervention' case was also assembled for testing in the model. However, as the stage-2 study progressed it was evident that this scenario could not deliver the development case trip demand at 2031 and so it has been incorporated with secondary interventions to become a single scenario. The reasons for omitting the primary intervention case were primarily as follows:
- The anticipated highway demand on the A2300 and at the access intersection of the A2300, the Northern Arc Link Road and the Burgess Hill Employment Site is predicted to exceed the capacity of a conventional 2-3 arm roundabout and the capacity of the single 2-lane carriageway A2300;

- Hence, the ‘secondary’ improvement of the A2300, to dual 2-lane carriageway standard, will be required, to accommodate the traffic; this has therefore been designated the hybrid ‘primary and secondary intervention case’;
- Furthermore, it is important that the model should not suppress traffic from using the A2300 / Northern Arc / Employment Site junction, because the model would not then show the true impact of the District Plan and likely routing of traffic; consequently a ‘maximum’ capacity, 4-lane approach, roundabout and dual carriageway A2300 have been modelled at this location.

Development Further Remedial Intervention Case

4.2.5. The final network supply scenario to be tested entails all of the reference case and the primary and secondary intervention schemes, but also includes newly identified remedial measures, aimed at resolving network stress in the following circumstances:

- At highway locations where the development case demand will cause significant excess stress, when compared with the reference case; and
- At highway locations where significant stress will arise with both development case and reference case demand, but where mitigation is still likely to be needed and also feasible, in order to deliver the District Plan.

4.2.6. There are some other locations where stress will occur in both reference case and development case, but where no straightforward mitigation can be identified. Here, the sites have been noted in the report but no further remedial interventions have been tested in the transport model.

4.2.7. Details of the highway and PT network interventions included in each model scenario, at AM 2031, are described in the following sections. The objective has been to represent a balanced range of highway, PT and policy initiatives, within the limitations of a broad-scale strategic model.

4.3. Reference Case Network Scenario

4.3.1. Table 6 summarises the committed transport schemes that have been represented in the stage-2 reference case and also in the P&S intervention case scenarios.

Table 6: MSTS Stage-2 Committed Transport Interventions (Modified from Stage-1 Report Table 15)				
Change from Stage-1?	General Location	Description	Type of Scheme	MSTS Modelling Assumptions
No – Retained	Haywards Heath	Completion of the Haywards Heath Relief Road Stages 5 & 6 (Stages 1 – 4 already implemented)	Highway Improvement	New highway links and junctions, with capacity and speed improvements, where appropriate
No – Retained (but model representation has been refined from stage-1)	A23	A23 Handcross - Warninglid (HA scheme)	Highway Improvement	Link speed and capacity improvements, comprising: A23 widening from dual 2-lane to 3-lane all-purpose carriageway; closure of direct A23 accesses; local access



Table 6: MSTs Stage-2 Committed Transport Interventions (Modified from Stage-1 Report Table 15)

Change from Stage-1?	General Location	Description	Type of Scheme	MSTs Modelling Assumptions
				road along west side of A23; dual 2-lane slips, dual 2-lane over-bridges and dumbbell roundabouts at both terminal junctions.
Yes – Interventions not committed at stage-1:	Burgess Hill	East of Kingsway Development – Committed Interventions, see below:	Highway Improvements:	
Yes – New	Burgess Hill	B2113 Station Rd / Keymer Rd / Silverdale Rd (Hoadleys Corner)	Highway Improvement	Signals to replace roundabout, with one-way E/B on Silverdale Rd
Yes – Moved from primary remedial scheme	Burgess Hill	Leylands Rd / Valebridge Rd / Janes La / Junction Rd	Highway Improvement	Linked signals to replace roundabout and priority junctions
Yes – Moved from primary remedial scheme	Burgess Hill	B2113 Folders La / Kingsway	Highway Improvement	Signals to replace priority junction
Yes – New	Burgess Hill	B2113 Station Rd / Church Rd	Highway Improvement	Signals to replace roundabout, with one-way NW/B on Church Rd
Yes – Moved from primary remedial scheme	Burgess Hill	B2113 Keymer Rd / Folders La	Highway Improvement	Signals to replace roundabout
Yes – Moved from primary remedial scheme	Burgess Hill	Junction Rd / Cants La	Highway Improvement	Signals to replace priority junction
Yes – New	Burgess Hill	B2112 Ditchling Rd Traffic calming between B2113 Folders La and St Georges Pk / Janes La	Highway Improvement	Road link capacity and speed reduction
Yes – New	Burgess Hill	Kingsway	Highway Improvement	Carriageway widening for right turn ghost islands between Burdocks Dr and Longhurst
Yes - New	Burgess Hill	East of Kingsway Development – Committed Interventions: Traffic management and Pegasus crossing on Ditchling Common; Community Transport Improvement Contribution (£1,473,080) – partly for Wivelsfield station car park improvements; Pedestrian and Equestrian contribution (£540,697) – partly for central, northern and eastern cycleways, various Pegasus and Toucan crossings, public rights of way and safer routes to school improvements	Non-Highway Improvement	Road link capacity and speed reduction Not represented in model, as too detailed for strategic-level appraisal Not represented in model, as too detailed for strategic-level appraisal

- 4.3.2. It should be noted that certain localised non-highway interventions, identified in Table 6, have not been represented in the Reference Case model, because they would entail a level of detail beyond the scope of the strategic model.
- 4.3.3. Committed schemes that will be located in West Sussex, but outside Mid Sussex District, have been retained in the forecast model as in the stage-1 MSTS.

4.4. Development Primary and Secondary Intervention Case Scenario

- 4.4.1. Previously proposed network interventions that are intended to enable delivery of the MSDC District Plan have been added to the committed interventions from Table 5, to form the Development P&S Intervention Case. As mentioned in sections 4.2.3 and 4.2.4, this scenario is a ‘hybrid’ of two scenarios tested in stage-1.
- 4.4.2. The components of the P&S interventions are summarised in Table 7. Interventions that are shaded in grey were present in stage-1, but have now been omitted or moved from the proposed schemes at stage-2.

Table 7: MSTS Stage-2 Primary and Secondary Remedial Transport Interventions (Stage-1 Report Tables 16 and 17)				
Change from Stage-1?	General Location	Description	Type of Scheme	MSTS Modelling Assumptions
Primary Remedial Interventions				
Yes – Amended	Burgess Hill	Northern Arc Link Road between A273(S), A2300 & A273(N) in 3 sections: A273(S) Jane Murray Wy – A2300 A2300 – A273(N) Isaacs La A273(N) Isaacs LA – Maple Dr	Highway Access for Development	Single 2-lane all-purpose carriageway (30mph), with access roundabouts, between A273, A2300, B2036, A273 and Maple Drive. S2AP 40mph S2AP 30mph S2AP bus-only 30mph Assume A2300 business park accesses at: N Arc / A2300; N Arc / A273 Jane Murray Way; N Arc mid-link between A2300 and A273 JMW; and at Cuckfield Rd (to the west).
No – Retained	Burgess Hill	Parking Strategy scheme - Introduction of a CPZ for the centre of Burgess Hill - potential extensions (e.g. Wivelsfield Station)	Car Parking Regulations	Highway parking charge increase, applied to all land uses and trip purposes within Burgess Hill town centre zones only; the charge increase is £6, i.e. doubling of the typical, all-day charge.
No – Retained	Burgess Hill	Bus service frequency and route connectivity enhancements, combined with sustainable transport	Bus Route Connectivity – New routes and services	New local bus services connecting: Kingsway development - B2113 - Burgess Hill Stn - Mill Rd - Leylands

Table 7: MSTS Stage-2 Primary and Secondary Remedial Transport Interventions (Stage-1 Report Tables 16 and 17)

Change from Stage-1?	General Location	Description	Type of Scheme	MSTS Modelling Assumptions
		links, improved passenger / parking facilities at bus / rail interchanges and links to development sites, including construction of Charles Avenue - Victoria Road bus-only link.		Rd - B2036 - N Arc - Wivelsfield Stn - Junction Rd - Cants La (2-way; 20-min headway). A2300 Business Park and Northern Arc development - Wivelsfield Stn - Junction Rd - Burgess Hill Stn - B2113 - Victoria Rd - Charles Av - A273 JMW (2-way; 20-min headway).
Yes – Included	Burgess Hill	Victoria Road – York Road highway link	New single carriageway link connecting London Road with Jane Murray Way	Road open two-way to all traffic. Include new bus routing along new link. Combine with new HGV ban on Victoria Avenue, between Royal George Road and Victoria Road
Yes – Amended	Burgess Hill	Traffic management strategy on the B2036, between Burgess Hill and Ansty, to mitigate the impact of future developments in Burgess Hill and Haywards Heath	Highway Traffic Restraint, such as carriageway build-outs, narrowing, alternate priority working and reduced speed limit, giving 15% speed reduction and 10% capacity reduction	40mph speed limit and capacity constraint over entire length of B2036 between A272 Ansty and N Arc Spine Rd; 30mph between N Arc Spine and A273 Fairplace Bridge; Add: 30mph between A272 Ansty and Cuckfield Rd / B2036 Harvest Hill; 40mph between Cuckfield Rd / B2036 Harvest Hill and N Arc Spine
Yes – Amended	Burgess Hill ./ Haywards Heath	Safety-led improvements to A273 Isaac's Lane, between Burgess Hill and Bolnore	Highway Traffic Restraint, giving 15% speed reduction	40mph speed limit over entire length of route between N Arc Spine and A272 Bolnore; 30mph between B2036 Fairplace Br and N Arc Spine
Yes – Amended	Burgess Hill	Downgrading the A273 Jane Murray Way / Sussex Way, between A2300 and A273 Fairplace Bridge	Highway Traffic Restraint	30mph speed limit and capacity constraint on A273 between A2300 and B2036 Fairplace Bridge
No – Retained	Burgess Hill	Route Strategy Improvement - A2300 A23 Hickstead junction to Burgess Hill. Localised carriageway widening at junctions A23 – A273	Highway Improvement	Widen junction approaches on A2300 to 3 lanes at A23, Hickstead, Cuckfield Rd and A273 Jane Murray Way
No – Retained	Hickstead	Junction improvements - A23 trunk road with the A2300 (Highways Agency scheme)	Highway Junction Improvement – localised widening	Junction capacity improvement with 3-lane dumbbell junction approaches from all arms, dual 2-lane over-bridge and dedicated left turn lanes at both roundabouts, with single lane slips
Yes – Checked (Minor adjustments to	Burgess Hill	Junction improvement - A273 Fairplace Bridge double mini-	Highway Junction Improvement –	Linked traffic signals with localised widening to give increased approach



Table 7: MSTs Stage-2 Primary and Secondary Remedial Transport Interventions (Stage-1 Report Tables 16 and 17)

Change from Stage-1?	General Location	Description	Type of Scheme	MSTs Modelling Assumptions
lane and signal configurations and inclusion of signal optimisation)		roundabout junction	widening on approaches	capacity on all arms from single to two lanes Review and amend this proposal as appropriate to fit with N Arc Spine traffic impacts
Yes – Checked (Minor adjustments to lane and signal configurations and inclusion of signal optimisation)	Burgess Hill	London Road / Leylands Road and London Road / West Street junctions - potential signal control	Highway Junction Improvement	Linked traffic signals with localised widening to give increased approach capacity on all arms from single to two lanes Ensure consistency with Burgess Hill Town-Wide Strategy and E Kingsway improvements
Yes – Checked (Minor adjustments to lane and signal configurations and inclusion of signal optimisation)	Burgess Hill	London Road / Royal George Road / Lower Church Road - signal upgrade	Highway Junction Improvement	Improved traffic signals with localised widening to give increased approach capacity on all arms from single to two lanes Ensure consistency with Burgess Hill Town-Wide Strategy and E Kingsway improvements
Yes – Now moved to a Do Min (E Kingsway) Scheme	Burgess Hill	Junction Road / Leylands Road / Valebridge Road / Janes Lane junctions – potential signal control	Highway Junction Improvement	Linked traffic signals with localised widening to give increased approach capacity on all arms from single to two lanes Ensure consistency with Burgess Hill Town-Wide Strategy and E Kingsway improvements
Yes – Omitted	Burgess Hill	B2113 / B2112 junction – potential signal control	Highway Junction Improvement	Traffic signals with localised widening to give increased approach capacity on all arms from single to three lanes
Yes – Now moved to a Do Min (E Kingsway) Scheme	Burgess Hill	Folders Lane / Kings Way junction – potential signal control	Highway Junction Improvement	Traffic signals with localised widening to give increased approach capacity on all arms from single to two lanes Ensure consistency with Burgess Hill Town-Wide Strategy and E Kingsway improvements
Yes – Now moved to a Do Min (E Kingsway) Scheme	Burgess Hill	Folders Lane / Keymer Road junction – potential signal control	Highway Junction Improvement	Traffic signals with localised widening to give increased approach capacity on all arms from single to two lanes Ensure consistency with Burgess Hill Town-Wide Strategy and E Kingsway improvements
Yes – Now moved to a Do Min (E Kingsway) Scheme	Burgess Hill	Junction Road / Cants Lane junction – potential signal control	Highway Junction Improvement	Traffic signals with localised widening to give increased approach capacity on all arms from single to two lanes Ensure consistency with Burgess Hill Town-Wide Strategy and E Kingsway



Table 7: MSTS Stage-2 Primary and Secondary Remedial Transport Interventions (Stage-1 Report Tables 16 and 17)

Change from Stage-1?	General Location	Description	Type of Scheme	MSTS Modelling Assumptions
				improvements
No – Retained	Burgess Hill	Smarter Choices car share / car club schemes	6% modal Shift from Car	6% transfer of trips, from car-available person-trip O-D matrix to non-car-available, by each journey purpose group; the matrix adjustment will be applied to all zones in Burgess Hill.
Yes – Amended	East Grinstead	Smarter Choices - Area-wide Travel Plans (multi-stakeholder approach - not site specific) and establishment Transport Management Associations (TMAs) to implement their delivery	4% modal Shift from Car	4% transfer of trips, from car-available person-trip O-D matrix to non-car-available, by each journey purpose group; the matrix adjustment will be applied to all zones in East Grinstead.
No – Retained	East Grinstead	Controlled Parking Zone (CPZ) review for East Grinstead - potential extensions	Car Parking Regulations – Assumed doubling of long stay charges	Highway parking charge increase, applied to all land uses and trip purposes within East Grinstead town centre zones only; the charge increase is £6, i.e. doubling of the typical, all-day charge.
Yes – New	Haywards Heath	Smarter Choices car share / car club schemes	3% modal Shift from Car	3% transfer of trips, from car-available person-trip O-D matrix to non-car-available, by each journey purpose group; the matrix adjustment will be applied to all zones in Haywards Heath.
Yes – Included	Haywards Heath	Parking Strategy Aim - Provision of a CPZ (dependent on regeneration scheme) to address issue of lack of off-street parking in Haywards Heath (long-term aspirational) - follow up review to be undertaken	Car Parking Regulations	Highway parking charge increase, applied to all land uses and trip purposes within Haywards Heath town centre zones only; the charge increase is £6, i.e. doubling of the typical, all-day charge.
Secondary Remedial Interventions				
Yes – Omitted	Burgess Hill	A273 Jane Murray Way extension (further modelling work required), between London Road and Keymer Road	Highway Improvement	A273 extension as single 2-lane all-purpose carriageway (40mph), with intermediate access roundabout, between B2036 London Rd/Jane Murray Way and B2113 Keymer Rd/Folders La. Assume terminal roundabouts with 2-lane approaches on all arms.
No – Retained	Burgess Hill	Additional bus service frequency and route connectivity enhancements, combined with sustainable transport links, improved passenger / parking facilities at bus / rail interchange.	Bus Route Connectivity – New routes and services, with higher frequency than in primary	Higher frequency, new, local bus services connecting: Kingsway development - B2113 - Burgess Hill Stn - Mill Rd - Leylands Rd - B2036 - N Arc - Wivelsfield Stn - Junction Rd - Cants La (2-way; 20-

Table 7: MSTS Stage-2 Primary and Secondary Remedial Transport Interventions (Stage-1 Report Tables 16 and 17)

Change from Stage-1?	General Location	Description	Type of Scheme	MSTS Modelling Assumptions
			interventions	min headway). A2300 Business Park and Northern Arc development - Wivelsfield Stn - Junction Rd - Burgess Hill Stn - B2113 - Victoria Rd - Charles Av - A273 JMW (2-way; 10-min headway).
Yes – Omitted	Ansty	A272 localised traffic calming through Ansty village, to mitigate the impact of future developments in Burgess Hill and Haywards Heath	Highway Traffic Restraint, such as signing, line-marking and reduced speed limit, giving 25% speed reduction and 20% capacity reduction	30mph speed limit and capacity constraint on A272 through Ansty village
No – Retained	Burgess Hill	A2300 full widening to dual 2-lane carriageway A23 - A273	Highway Improvement	Dual 2-lane all-purpose carriageway with 3-lane junction approaches and 60mph speed limit, between A23 at Hickstead and A273 Jane Murray Way.
Yes – Checked (No changes needed from stage-1 to ensure adequate roundabout capacity)	Burgess Hill	A273 Jane Murray Way other junction enhancements (x4 junctions)	Highway Junction Improvement	Approach capacity improvements (3 lanes) at A273 roundabouts: A273 / Sussex Way; A273 / Malthouse Lane; A273 / York Road; A273 / Charles Avenue.
Yes – Omitted	Burgess Hill	B2112 / Janes Lane junction – potential signal control	Highway Junction Improvement	Traffic signals with localised widening to give increased approach capacity on all arms from single to two lanes
Yes – Moved to a primary remedial scheme	Haywards Heath	Parking Strategy Aim - Provision of a CPZ (dependent on regeneration scheme) to address issue of lack of off-street parking in Haywards Heath (long-term aspirational) - follow up review to be undertaken	Car Parking Regulations	Highway parking charge increase, applied to all land uses and trip purposes within Haywards Heath town centre zones only; the charge increase is £6, i.e. doubling of the typical, all-day charge.
Yes – Omitted	Haywards Heath	Bus Scheme - Improved bus / rail interchange at Haywards Heath railway station	Bus Route Connectivity – Existing routes with 10-minute frequency	Increased bus frequency (10 min headway) for services accessing central Haywards Heath, i.e. through junction of B2038 Perryment Rd / Market PI / Mill Green Rd / Sydney Rd.
Yes – Added	East Grinstead	Housing development mitigation schemes (Atkins stage-3 study)	Assume linked signals at: A22 London Rd / A264 Copthorne	Revisions to highway junction layouts and control systems. SATURN-optimised traffic signals

Table 7: MSTS Stage-2 Primary and Secondary Remedial Transport Interventions (Stage-1 Report Tables 16 and 17)				
Change from Stage-1?	General Location	Description	Type of Scheme	MSTS Modelling Assumptions
			Rd, Felbridge; and A22 London Rd / Imberhorne La; Also assume: A22 London Rd / Lingfield Rd – signals; A22 London Rd / Moat Rd – signals	SATURN-optimised traffic signals SATURN-optimised traffic signals SATURN-optimised traffic signals

4.4.3. The schemes to be removed from the primary and secondary interventions were as specified by WSCC. They were removed on grounds of being undeliverable, or re-designated as committed interventions.

4.5. Model Assignment Packages

4.5.1. The forecast demand components, identified in section 3, have been combined with the future transport interventions, noted in section 4, to produce the MSTS model assignment packages shown in Table 8.

Table 8: Summary of MSTS Stage-2 Model Assignment Packages			
	Model Assignment Package AM Peak 2031		
	Reference Case	Development Primary and Secondary Intervention Case	Development Further Remedial Intervention Case
Demand Components			
Committed Development	Yes	Yes	Yes
Strategic Development	No	Yes	Yes
Neighbourhood Plan Development	No	Yes	Yes
Intervention Scenarios			
Committed Schemes	Yes	Yes	Yes
Primary and secondary remedial Schemes	No	Yes	Yes
Further Remedial Schemes	No	No	Yes

4.5.2. The packages shown in Table 8 have been assessed using the stage-2 MSTS AM peak model at 2031.

5. Model Results and Output Analysis

5.1. Overview

5.1.1. This section discusses the outcomes from the respective MSTS model assignments at AM 2031. The scope of outputs extracted from the model is the same as in stage-1. However, for brevity and because many of the findings are similar to those in the first stage, the following discussion covers only the key outcomes from stage-2.

5.1.2. Table 9 outlines the key items of analysis that were reported at stage-1 and undertaken at stage-2. It also indicates whether or not each item has been referred to in detail in the stage-2 reporting.

Table 9: MSTS Stage-2 Scope of Output Analysis				
Main Analysis Item	Detailed Analysis Task	Analysis and Report at Stage-1	Analysis and Report at Stage-2	Analysis but no Report at Stage-2
Overall Network Travel Statistics	Overall Network Trip Movements	●	●	
	Overall Network Mode Split	●	●	
	Overall Network Travel Distance	●	●	
	Overall Network Travel Time	●	●	
Highway Trip Demand	Mid Sussex Highway Network Trip Movements	●		●
Development Case Strategic Land Uses	Trip Contribution amongst Strategic Development Sites	●		●
	Modal Split of Strategic Development Trips	●		●
	Travel Distance of Strategic Development Trips	●		●
	Orientation of Strategic Development Trips	●		●
	Strategic Development Contribution to Highway Network Traffic	●		●
Highway Analysis of Key Links and Junctions	Highway Junction Ratio of Flow to Capacity	●	●	
	Highway Link Ratio of Flow to Capacity	●	●	
	Highway Network Link Flows	●	●	
	Highway Network Junction Turning Flows	●		●
	Average Junction Delays	●		●
	Analysis of Traffic Flows Through Ashdown Forest	●	●	
	Analysis of Traffic Flows Through Ansty		●	
Further Remedial Interventions	Repeat analysis of highway link and junction performance after modelling further remedial interventions		●	

- 5.1.3. In this section, overall network statistics and trip demand have been analysed and reported from the stage-2 model runs, as have highway ratios of flow to capacity (RFC) at links and junctions and also link traffic flows. In addition, the traffic impact on Ashdown Forest has also been included, along with the impact on Ansty.
- 5.1.4. Analysis of localised impacts from developments in Burgess Hill has not been reported at stage-2, because the outcomes will not be significantly different from those at stage-1. For the same reason, the proportion of trip movements within and outside Mid Sussex in the strategic model, have also been omitted from the stage-2 report.
- 5.1.5. Furthermore, reporting of highway network delays has been excluded from stage-2, since the results are not meaningful at average vehicle level and show the same patterns as for RFC. In addition, there is no analysis of junction turning flows at stage-2, because the impact of changes in flow is more meaningfully revealed through the RFC analysis.

5.2. Overall Network Travel Statistics

- 5.2.1. Outline statistics from each model forecast scenario at AM 2031, have been extracted and presented in Table 10.
- 5.2.2. It is not possible to provide complete network fuel consumption statistics, because the highway model is divided into detailed 'simulation' areas and less refined 'buffer' areas. Whilst the SATURN model can provide fuel consumption values for the simulation network, it cannot do likewise for the buffer network.



Table 10: MSTs Stage-2 Strategic Multi-Modal Model Summary Statistics (AM Peak)

Strategic Model Parameter	Travel mode	Units	Base Year 2008	Forecast Scenario Year 2031		
			Existing	Reference Case	Development case with P&S Interventions	Development case with P&S and Remedial Interventions
Total Network Trips	Highway	Persons	186660	209851	211978	211988
	PT	Persons	16939	18702	20899	20890
	Combined	Persons	203599	228553	232877	232878
	Proportion of Highway Trips	%	91.7%	91.8%	91.0%	91.0%
	Proportion of PT Trips	%	8.3%	8.2%	9.0%	9.0%
Total Network Travel Distance	Highway	PCU-Kms	3690921	4196921	4200322	4200745
	Bus	Person-Kms	58731	57320	65563	65528
	Rail	Person-Kms	534209	608449	656845	656743
	Combined	Net Kms	4283861	4862689	4922730	4923016
Total Network Travel Time	Highway	PCU-Hrs	48428	56368	57000	56844
	Bus	Person-Hrs	2292	2229	2579	2577
	Rail	Person-Hrs	9234	10500	11321	11320
	Combined	Net Hrs	59954	69097	70900	70741
Total Network Delay	Highway	PCU Hrs/Hr	5970	7976	8280	8105

- 5.2.3. From Table 10 it can be seen that the total volume of person trips in the AM 2031 strategic model is the same in the development case with and without remedial schemes enhancing the P&S interventions, at around 233,000. The volume in the reference case is less, by about 4,500 trips, at 228,500, because it excludes site-specific trips associated with strategic and neighbourhood plan developments.
- 5.2.4. The increase in trips from 2008 to 2031 is about 25,000 in the reference case and 29,500 in the development cases, from a base of about 203,500. This represents a percentage growth of 12.3% and 14.5%, respectively. This growth is similar to, but slightly higher than, the DfT National Trip end Model (NTEM6.2) growth for West Sussex (11%). It is almost identical to the NTEM growth for the South East (14%).
- 5.2.5. The modal share is dominated by car use, at 91% in the development cases and 92% in the reference case, mainly because the strategic model excludes much of the localised detail of bus journeys within towns. Although the primary and secondary interventions include some initiatives to encourage use of smarter choices and PT, the effect has been outweighed by schemes that would release additional highway capacity.
- 5.2.6. Highway travel time and distance increases slightly in the development cases, compared with the reference case, owing to the greater number of trips on the network. However, the time reduces slightly and the distance rises slightly with the remedial schemes, compared with P&S interventions, because of highway improvements that enable vehicles to travel further in a shorter time.

5.3. Highway Analysis of Key Links and Junctions

- 5.3.1. The focus of this analysis has been to consider three forecast scenarios at AM peak 2031, namely:
- The reference case;
 - The development case with P&S interventions; and
 - The development case with P&S and further remedial interventions.
- 5.3.2. The aim has then been to identify the following critical parts of the road network where unacceptable 'stress' (i.e. congestion) is likely to occur, as measured by Ratio of Flow to Capacity (RFC):
- Junctions that will experience RFC >100% in the development case (with P&S interventions), but not in the reference case;
 - Links that will experience RFC >100% in the development case scenario (with P&S interventions), but not in the reference case; and
 - Links on which the development case (with P&S interventions) will entail a flow change of >10%, alongside an RFC >85%, when compared with the reference case.

5.3.3. The results from this analysis have been used to devise potential further remedial interventions, which, when combined with the P&S interventions should resolve the ‘stress’ issues. These further interventions have only been examined at an indicative, outline level, to determine that they could be accommodated within the highway boundaries. However, they have not been developed as detailed designs.

Junctions with Unacceptably High RFC

5.3.4. Table 11 gives a summary of those road junctions where the RFC on the most congested arm would exceed 100% in the development case, with P&S interventions, but would remain below 100% in the reference case. Table 11 also shows, separately, those junctions where the RFC would exceed 100% in both scenarios.

Table 11: Highway Junctions with RFC >100% in Development Case with P&S Interventions		
Road Junction Location	Reference Case RFC (Most Congested Arm)	Development Case RFC with P&S Interventions (Most Congested Arm)
Junctions with RFC >100% in Development Case with P&S Interventions Only		
A2300 / Cuckfield Road	84%	102%
A272 / A273 Butlers Green	96%	101%
B2036 / Northern Arc Spine Road	26%	105%
B2115 / B2110 Leechpond Hill, Lower Beeding	99%	101%
B2113 Station Road / Mill Road, Burgess Hill	91%	101%
Junctions with RFC >100% in Reference Case and Development Case with P&S Interventions		
M23 / A23 Pease Pottage	105%	106%
A264 / A220 Copthorne	104%	104%
A272 / A281 Cowfold	101%	101%
A272 / B2111 Bedales, Haywards Heath	101%	101%
A273 / B2116 Stonepound, Hassocks	113%	112%
B2112 Fox Hill / Haywards Heath Relief Road	103%	104%
B2113 Folders Lane / Keymer Road, Burgess Hill	107%	106%
B2113 Station Road / Junction Road, Burgess Hill	104%	104%
B2036 London Road / Ardingly Road, Cuckfield	108%	107%

5.3.5. Table 11 indicates where further remedial mitigation would be needed, in order to allow the junctions to perform satisfactorily and hence enable the District Plan to be implemented.

5.3.6. Note that Table 11 does not identify B2036 / A272 roundabout at Ansty as having an unacceptable RFC in the development case with P&S interventions. This is because a maximum capacity roundabout has been assumed at the A2300 / Northern Arc spine road junction, encouraging local Burgess Hill, Haywards Heath and Northern Arc traffic to access the A23 via the A2300.

- 5.3.7. If, however there are unforeseen reasons for a lower capacity roundabout or signals at A2300 / Northern Arc spine, then more traffic would route through Ansty, causing an unacceptable RFC at B2036 / A272 junction.

Remedial Interventions to Resolve High Junction RFC in Development Case

- 5.3.8. Further remedial schemes have been investigated to resolve the problem of high junction RFC in the development case with P&S interventions, revealed in Table 10. These schemes have been included in a further model assignment and also tested in outline using detailed junction assessment software.

- 5.3.9. It should be noted that the development case with P&S interventions already includes an enlarged roundabout at the A2300 / Northern Arc Spine junction. As discussed in section 4.2, it was considered prudent to run the transport model with maximum capacity here, so as not to distort the routing of traffic on critical parts of the road network. An ARCADY junction model of the roundabout (with 60m ICD) has indicated that the following layout provision should perform satisfactorily:

- 3-lane approaches, widening to 4 lanes, from A2300 west and from A2300 east; and
- 2-lane approaches, widening to 3 lanes, from Jane Murray Way / Business Park south and from Northern Arc Spine Road north.

- 5.3.10. Junctions where the development case with P&S interventions would entail unacceptable RFC, compared with the reference case, are discussed below. These are junctions where remedial interventions are considered to be necessary. Results of detailed junction analysis of proposed interventions are given later, in section 5.4.

- A2300 / Cuckfield Road – Once a maximum capacity roundabout is introduced at A2300 / Northern Arc Spine, it will encourage higher traffic flows along the A2300 through the Cuckfield Road roundabout. This in turn will require slightly improved capacity on the Cuckfield Road south arm of this junction. However, the pattern of movements and congestion at the two adjacent junctions will be sensitive to their respective layouts, capacity and mutual interaction of traffic accessing the surrounding development sites. Further model runs indicate that localised widening of the roundabout approaches at Cuckfield Road would resolve the problem.
- A272 / A273 Butlers Green – The impact of additional traffic to and from development sites in Burgess Hill, when combined with greater flows around Haywards Heath relief road will cause slight congestion on the A273 south arm at this roundabout. Further detailed analysis using ARCADY suggests that widening the approach on A273 south to 3 lanes should resolve the problem. It would also help if the eastbound exit on A272 was widened to two lanes, merging down to one lane after about 100m. Scrutiny of plans from WSCC indicates that the proposed widening could be accommodated within the highway boundaries.

- B2036 / Northern Arc Spine – There will not be a congestion problem here. The high RFC derives from the model underrepresenting the link capacity between the staggered junctions on the Spine Road sections, not from shortage of junction turning capacity. The underestimate of link capacity can easily be rectified in the remedial intervention tests.
 - B2115 / B2110 Leechpond Hill, Lower Beeding – The slight increase in traffic flows on B2110 and B2115 accessing the A23 improvement scheme, between Handcross and Warninglid, under the MSDC District Plan, will cause mild congestion on the westbound approach from B2110 east, where right turning traffic will block ahead movements on this arm. Detailed modelling using PICADY suggests that widening of the eastern arm to allow a ghost-island right turn should resolve the issue. There seems to be available land on the south side verge to enable this widening. Scrutiny of plans from WSCC confirms that the proposed widening could be accommodated within the highway boundaries.
 - B2113 Station Road / Mill Road, Burgess Hill – There will not be a congestion problem here. The high RFC derives from the model underrepresenting the capacity of the proposed new signals at this junction. This will be rectified in the remedial intervention tests.
- 5.3.11. In some of the strategic model runs with a smaller, lower-capacity, roundabout, or traffic signals, at the junction of A2300 / Northern Arc Spine, there was also shown to be a congestion problem at A272 / B2036 Ansty, in the development case with P&S interventions. This would occur if more traffic is forced to access Burgess Hill by using B2036 and A272 to reach the A23, rather than A2300.
- 5.3.12. There is potential to shift the Ansty junction several metres northwards into the available verge space and convert the mini-roundabout to signals, which would remove the current need for entry deflections. This should allow 2-lane flared approaches on each arm at the signals. Detailed analysis using LINSIG indicates that signals would perform satisfactorily with a pedestrian facility across the eastern arm. If occasional peaks in traffic result in congestion at the signals, the timings could be adjusted to give priority to the A272 approaches, displacing any queuing on to the B2036.
- 5.3.13. The Ansty junction layout would have to be carefully designed around the constraints of the service station access on the south east corner and the bus stop layby and minor road junction on the northwest corner. Scrutiny of plans from WSCC suggests that the proposed widening could be accommodated within the highway boundaries.

Remedial Interventions to Resolve High Junction RFC in Reference Case

- 5.3.14. There are a number of other junctions in Table 10, where the RFC on the most congested arm exceeds 100% in both the reference case and the development case with P&S interventions. These are potential problems that will have to be mitigated regardless of the MSDC District Plan. None of these junctions shows significantly higher RFC in the development case than in the reference case and so should not be constraints on the District Plan being approved and implemented.
- 5.3.15. However, consideration has been given to how these congestion problems might be resolved:
- M23 / A23 Pease Pottage – The congestion at the signalised gyratory will not be easy to resolve, because it would require further widening of the roundabout approaches from A23 northbound off-slip at signals and from A264 west major/minor roundabout entry. The model suggests that improvements here will tend to ‘induce’ more traffic to use the junction, thereby using up new capacity and maintaining a high RFC.
 - A264 / A2220 Copthorne – Outline tests in the model show that widening the roundabout approach from A264 east approach from 2 to 3 lanes, through to the A2220 west exit should resolve the problem. Land seems to be available on the southern verge of the roundabout.
 - A272 / A281 Cowfold – Highway model tests show that at the northern mini roundabout, widening the approach on A272 south from 1 to 2 lanes should resolve the problem. Also, at the southern mini roundabout, widening may then be needed to the approach on A272 east from 1 to 2 lanes. Land seems to be available for widening on to the verges. However, further detailed modelling in ARCADY has shown that the mini roundabout arrangement is unlikely to cope with future demand, whereas LINSIG suggests that a constricted, linked signal layout would resolve the congestion with 2-lane flared approaches, on the following arms:
 - At the northern junction – from A281 south; A272 west; and A281 north;
 - At the southern junction – from A272 east.
 - Successful signal operation would probably depend upon restricting on-street parking and possibly heavy goods vehicle movements.
 - A272 / B2111 Bedales, Haywards Heath – Model tests show that introducing signals at the major/minor priority junction should resolve the congestion on the minor arm that results from the opposing heavy right turn from A272 east.

- A273 / B2116 Stonepound crossroads, Hassocks – There is very little scope for reducing the high RFC at the signals, because there is no available land for widening the approaches. Model tests have been run with an extended cycle time of 120 seconds, but this will not resolve the congestion. The only solution may be to ban some turning movements at the junction, although there are no obvious alternative routes that traffic could use.
- B2112 Fox Hill / Haywards Heath Relief Road – Congestion would arise on the roundabout approach from Rocky Lane south west, which is the western leg of the Haywards Heath Relief Road. Model tests show that widening the roundabout approach from 2 to 3 lanes would resolve the issue. Scrutiny of plans from WSCC suggests that the proposed widening could be accommodated within the highway boundaries, if a short flare is provided, but this would need careful design to maintain entry deflection at the roundabout.
- B2113 Folders Lane / Keymer Road, Burgess Hill – The proposed single lane approach to the signal junction from Keymer Road north would not provide sufficient capacity within the available signal green time. Model tests show that widening the northern arm from 1 to 2 lanes, to give a left turn and straight ahead lane, should resolve the problem.
- B2113 Station Road / Junction Road, Burgess Hill – The proposed single lane approach from Junction Road north, would not provide sufficient capacity for the heavy right turn flow, within the available green time. Model tests show that widening the northern arm from 1 to 2 lanes, to give a straight ahead and a right turn lane, should resolve the problem.
- B2036 London Road / Ardingly Road, Cuckfield – Congestion would arise on the northbound approach to the mini roundabout, from B2036 south, where the heavy right turn from Ardingly Road east would block the opposed traffic movement. Model tests show that widening the southern arm at the mini roundabout from 1 to 2 lanes should resolve the issue. Alternatively, simple traffic signals would reallocate the necessary priority to the south arm, keeping the existing single lane approaches on all arms.

Junction RFC Analysis in Development Case with P&S and Remedial Interventions

- 5.3.14. An additional assignment has been undertaken, using the strategic model with the further remedial schemes, in the development case with P&S interventions at AM 2031, to assess the impact of the District Plan after necessary mitigation. Table 11 shows where the RFC on the most congested arm would exceed 100% in the development case with P&S and remedial interventions, but would remain below 100% in the reference case.

5.3.15. Table 12 also shows, separately, those junctions where the RFC would exceed 100% in both the development case with P&S and remedial interventions and the reference case scenarios. The number of locations has been reduced from Table 11, by including further interventions in the model as described above. However, at the remaining junctions some extra scheme modifications may still be needed to reduce the most congested arm RFC to below 100%. This is not a constraint on delivering the District Plan.

Table 12: Highway Junctions with RFC >100% in Development Case with P&S and Remedial Interventions		
Road Junction Location	Ref Case RFC (Most Congested Arm)	Dev Case RFC with P&S and Remedial Interventions (Most Congested Arm)
Junctions with RFC >100% in Development Case with P&S and Remedial Interventions Only		
None		
Junctions with RFC >100% in Reference Case and Development Case with P&S and Remedial Interventions		
M23 / A23 Pease Pottage	105%	106%
A273 / B2116 Stonepound, Hassocks	113%	113%
B2113 Keymer Road / Junction Road, Burgess Hill	104%	101%
B2036 London Road / Ardingly Road, Cuckfield	108%	100%

5.3.16. The results in Table 12 confirm that the proposed remedial schemes will avoid any junctions having an excess RFC in the development case but not in the reference case. The table also confirms that further interventions will more or less remove congestion at B2113 Keymer Road / Junction Road in Burgess Hill and at B2036 London Road / Ardingly Road in Cuckfield. However, there are no straightforward initiatives to resolve likely congestion at either A23 / M23 Pease Pottage, or at A273 / B2116 Hassocks.

Link Traffic Flow Change in development Case with P&S Interventions

5.3.17. Table 13 gives a summary of road links where there will be traffic flow change in the development case (with P&S interventions) of more than 10% from the reference case and also a link RFC exceeding 85%. This gives an indication of where highway link stress will be significant, accompanied by a large increase in flow volume.

Table 13: Highway Links with Flow Change >10% in Development Case with P&S Interventions and RFC >85%				
Road Link Location	Ref Case Flow PCU	Dev Case Flow with P&S Interventions PCU	Flow Change from Ref Case to Dev Case PCU and (Link RFC %)	% Flow Change (>10%) Dev Case with P&S interventions
A272 E/B from A273 to B2028 Haywards Heath	1060	1403	343 (108%)	32%
Junction Road N/B from Leylands Road to Janes Lane, Burgess Hill	919	1046	127 (94%)	14%

- 5.3.18. The results in Table 13 show that there are two roads where there would be a material flow increase, in terms of increased stress, in the development case with P&S interventions. The first is the A272 eastbound between A273 at Butlers Green and B2028, The Broadway, in Haywards Heath. Here, the flow would increase by 32% from the reference case and link RFC would be 108%. The problem is a reflection of inadequate capacity on the alternative Haywards Heath Relief Road at Fox Hill, which would be rectified by the earlier proposed roundabout improvement, thereby drawing traffic away from the A272.
- 5.3.19. The second link is Junction Road in Burgess Hill, northbound between the proposed adjacent signal junctions of Leylands Road and Janes Lane. Here there will be a flow increase of 14%, but an acceptable link RFC of 94%. The proposed East of Kingsway scheme includes widening to two lanes southbound, but it would also be prudent to include two lanes northbound.

Link Traffic Flow Change in development Case with P&S and Remedial Interventions

- 5.3.20. Taking the results from the additional assignment of the development case with P&S and further remedial interventions, the link flow changes were found as shown in Table 14.

Table 14: Highway Links with Flow Change >10% in Development Case with P&S and Remedial Interventions and RFC >85%				
Road Link Location	Reference Case Flow PCU	Development Case Flow with P&S and Remedial Interventions PCU	Flow Change from Reference Case to Development Case with remedial Interventions PCU and (Link RFC %)	% Flow Change (>10%) Dev Case with P&S and remedial Interventions
A264 W/B from A2220 to M23, Copthorne	1101	1377	276 (102%)	25%
A264 W/B from B2028 to A2220, Copthorne Common	1598	1871	273 (138%)	17%
A272 E/B from B2036 Ansty to High Br	949	1143	194 (88%)	20%
A272 W/B from A273 to B2184, Butlers Green	957	1184	227 (91%)	24%
B2036 N/B from London Rd to Ardingly Rd, Cuckfield	886	1295	409 (96%)	46%
B2036 N/B from Ardingly Rd to Staplefield Rd, Cuckfield	1273	1610	337 (119%)	26%
B2110 S/B from B2115 Sandygate Lane to A281, Lower Beeding	851	939	88 (89%)	10%
B2115 W/B from B2036 to B2114 Slough Grn	872	1126	254 (106%)	29%

- 5.3.21. The outcomes in Table 14 show a number of road links where congestion will be caused by the release of certain junction 'bottlenecks' by the remedial schemes. The most critical link appears to be the A264 westbound between B2028 turners Hill Road and M23, where the RFC will be up to 138% and flow increase up to 25%. From map data it appears that there could be scope for expanding the capacity on these links to wide single carriageway, which would be sufficient for the predicted flows.
- 5.3.22. There would also be a large flow increase of 46% and RFC of 119% on B2036 London Road northbound through Cuckfield, as converging traffic finds the route more accessible between Haywards Heath / Burgess Hill and A23 Warninglid / Crawley. Again, from map data it appears that there could be scope for expanding the capacity on this link to wide single carriageway, which would be sufficient for the predicted flows. However, this would require restriction of on-street parking and possibly of heavy goods vehicle movements.
- 5.3.23. On B2114 / B2115 Staplefield Road westbound, between Cuckfield and Slough Green there would be a traffic flow increase of 29% and an RFC of 106%. Despite its modest width this is a good-standard, straight, single carriageway and could probably be widened to accommodate demand.

Links with Unacceptably High RFC

- 5.3.24. Model outputs have also revealed some road links where the RFC will exceed 100% in the forecast scenarios. Table 15 shows roads which would have high RFC in the development case with P&S interventions, but not in the reference case. It also shows, separately, links that have high RFC in both scenarios.

Table 15: Highway Links with RFC >100% in Development Case with P&S Interventions		
Road Link Location	Reference Case RFC	Development Case RFC with P&S Interventions
Links with RFC >100% in Development Case with P&S Interventions Only		
A272 E/B from A273 to B2028 Haywards Heath	82%	108%
Links with RFC >100% in Reference Case and Development Case with P&S Interventions		
A264 E/B from A2220 to B2028, Copthorne Common	101%	103%
A264 W/B from B2028 to A2220, Copthorne Common	118%	116%
A277 S/B from A275 to A27, Lewes	115%	113%
B2113 Station Road W/B from Mill road to Civic Way	109%	113%

Remedial Interventions to Resolve High Link RFC in Development Case

- 5.3.25. Further remedial schemes have been considered, to resolve the problem of high link RFC in the development case with P&S interventions in Table 15. There is only one critical link, as mentioned previously, comprising:
- A272 eastbound, Haywards Heath – No capacity increase would be needed, because improved junction on the relief road at B2112 Fox Hill / Rocky Lane would attract traffic away from this link section.

5.3.26. The relief road junction improvement has been included in a further model assignment of the development case with P&S and remedial interventions.

Remedial Interventions to Resolve High Link RFC in Reference Case

5.3.27. Link RFC issues from Table 15 that are predicted to arise in both development case and reference case scenarios should not be constraints on the District Plan being approved and implemented.

Link RFC Analysis in Development Case with P&S and Remedial Interventions

5.3.28. A further assignment has been undertaken, using the strategic model with extra remedial schemes, in the development case with P&S interventions at AM 2031, to assess the impact of the District Plan after necessary mitigation.

5.3.29. Table 16 shows roads which would have high link RFC in the development case with P&S and remedial interventions, but not in the reference case. It also shows, separately, links that have high RFC in both scenarios.

Table 16: Highway Links with RFC >100% in Development Case with P&S and Remedial Interventions		
Road Link Location	Reference Case RFC	Development Case RFC with P&S and Remedial Interventions
Links with RFC >100% in Development Case with P&S and Remedial Interventions Only		
A264 W/B from A2220 to M23	81%	102%
B2036 N/B from Ardingly Rd to Staplefield Rd, Cuckfield	94%	119%
B2115 W/B from B2036 to B2114 Slough Grn	82%	106%
Links with RFC >100% in Reference Case and Development Case with P&S and Remedial Interventions		
A264 E/B from A2220 to B2028, Copthorne Common	101%	104%
A264 W/B from B2028 to A2220, Copthorne Common	118%	138%
A277 S/B from A275 to A27, Lewes	115%	112%
B2113 Station Road W/B from Mill road to Civic Way	109%	120%

Remedial Interventions to Resolve High Link RFC in Development Case

5.3.30. Further mitigation has been considered, to resolve the problem of high link RFC in the development case with P&S and remedial interventions in Table 16. The interventions are as mentioned previously, comprising:

- A264 westbound, Copthorne Way – Capacity increase to wide single carriageway standard.
- B2036 northbound, Cuckfield – Capacity increase to wide single carriageway standard;
- B2115 westbound, Slough Green – Capacity increase to wide single carriageway standard;

- 5.3.31. Link capacity enhancement to wide single 2-lane all-purpose carriageway standard, would be in line with DfT standards in Design Manual for Roads and Bridges (DMRB) Volume 6 TD9/93 'Highway Link Design' (Feb 2002). Typically, wide single carriageway entails wider lanes than a normal single carriageway (2x 5.0m lanes instead of 2x 3.65m lanes), which allows greater capacity for heavy goods vehicles and safer overtaking.
- 5.3.32. These schemes have not been included in a further model assignment, as they would not have a material impact upon the outcomes in terms of routing and mode choice.
- 5.3.33. The link RFC issues from Table 15 that are predicted to arise in both development case and reference case scenarios should not be constraints on the District Plan being approved and implemented.

5.4. Analysis of Traffic Impact at A23 Junctions

- 5.4.1. The Highways Agency (HA) requires that the Mid Sussex District Plan should not have an adverse impact upon operation of the A23 trunk road and its access junctions. Full analysis of the forecast model outcomes has been undertaken at AM 2031, for the reference case, development case with P&S interventions and the development case with P&S and remedial interventions, in order to understand the impacts.
- 5.4.2. Findings show that there are no concerns surrounding links, junctions or bridges in terms of high RFC, or congestion and delay, in any of the scenarios, on most sections of the A23, namely:
 - A23 / A273 / A281 – Pyecombe intersection;
 - A23 / B2117 – Hurstpierpoint;
 - A23 / B2118 – Sayers Common;
 - A23 / A272 – Bolney;
 - A23 / B2115 – Warninglid; and
 - A23 / B2110 / B2114 – Handcross;
- 5.4.3. There will, however, be two locations where impact mitigation will be required, if congestion is to be avoided in all scenarios. These are as follows:
 - A23 / A2300 – Hickstead:
 - Here, the planned HA junction improvement scheme (see Table 5) will partly resolve the District Plan traffic impacts, but it will need to be enhanced by widening the A2300 to dual 2-lane carriageway standard, between A23 and A273, to accommodate the traffic demand at the Burgess Hill development sites; and
 - A23 / M23 – Pease Pottage:

- Here, there are predicted to be congestion problems at the A23 northbound exit slip and the A264 west, where these roads intersect with the grade-separated roundabout. However the problems will arise in the reference case and should not be a constraint on the District Plan being delivered. Resolving these issues should not be a condition for approval of the District Plan.

5.5. Analysis of Traffic Flows Through Ashdown Forest

- 5.5.1. An assessment has been made of whether or not the MSDC District Plan would impact upon the local air quality of the environmentally sensitive area of Ashdown Forest Special Area of Conservation (SAC), lying to the south east of East Grinstead.
- 5.5.2. The MSTS model includes several key roads that access or cross Ashdown Forest, namely:
- A275 (Lewes – East Grinstead);
 - A22 (Uckfield – East Grinstead);
 - A26 (Uckfield – Crowborough);
 - B2110 (East Grinstead – Royal Tunbridge Wells);
 - B2188 (Maresfield – Groombridge);
 - B2026 (B2188 – B2110); and
 - Coleman’s Hatch road (East – West through Ashdown Forest).
- 5.5.3. Owing to the strategic nature of the MSTS and the location of Ashdown Forest on the north east periphery of the network, the model will not provide meaningful flow assignments for B2188, B2026 or Coleman’s Hatch Road. However, an assessment has been made of future traffic impacts on A275, A22, A26 and B2110, which pass by, or through, Ashdown Forest. The assessment represents a ‘worst case’ for these routes, which are modelled as carrying additional traffic that might otherwise travel on B2118, B2026 and Coleman’s Hatch Road, within the SAC.
- 5.5.4. Local air quality in Ashdown Forest is required to conform to the Habitats Directive. The threshold for determining significant traffic impact upon air quality is set in the Habitats Regulations Assessment, using the Department for Transport’s Design Manual for Roads and Bridges (DMRB). The threshold is defined as a 2-way flow increase of 1,000 vehicles or more, annual average daily traffic (AADT).
- 5.5.5. Representative local flow factors have been used to convert AM peak hour model outputs, at 2031, to AADT. The resulting flows on the Ashdown Forest routes, for the forecast scenarios, have been compared with the reference case. Outcomes are shown in Table 17.

Table 17: Daily Traffic Impact on Ashdown Forest Highway Routes			
	Two-Way Annual Average Daily Traffic Flow (Vehicles)		
Road Link Section	Reference Case	Development Case RFC with P&S Interventions	Development Case RFC with P&S and Remedial Interventions
<u>Two-Way Annual Average Daily Traffic Flow (Vehicles)</u>			
A275	5913	5976	5825
A22	6029	5965	5727
A26	3826	3856	3869
B2110	2493	2511	2386
<u>Two-Way AADT Change from Reference Case (Vehicles)</u>			
A275	-	63	-88
A22	-	-64	-302
A26	-	30	42
B2110	-	18	-107

5.5.6. There would be a small AADT increase in Ashdown Forest, with the development case and P&S interventions at 2031, on A275, A26 and B2110, but this would amount to considerably less than the threshold of 1,000 vehicles AADT. With further remedial interventions, the impact would be reduced and still insignificant, owing to the freeing-up of road capacity for accessing the strategic network at A2300, A23 and A264.

5.5.7. It is evident that the Mid Sussex District Plan would not cause traffic flows on the key routes to impact significantly upon Ashdown Forest.

5.6. Analysis of Traffic Flows Through Ansty

5.6.1. The model outputs have been analysed to assess change in traffic flows across two east-west screen-lines of routes around Ansty village on the A272. The screen-line alignment to the east of Ansty is as follows:

- A273 Jane Murray Way, between A2300 and Sussex Way;
- Northern Arc Spine Road between A2300 and B2036;
- B2036 Harvest Hill between Fairplace Bridge and Cuckfield Road;
- A272 between Ansty and Cuckfield; and
- B2114 Staplefield Road between Slough Green and Cuckfield.

5.6.2. The screen-line alignment to the west of Ansty is as follows:

- A2300 between Cuckfield Road and Pookbourne Lane;
- A272 Bolney Road between Bishopstone Lane and Stairbridge Lane; and
- B2115 Slough Green Lane between B2114 and A23.



5.6.3. Modelled flow comparisons for the Ansty eastern screen-line are shown in Table 18.

Table 18: Daily Traffic Flows across Ansty Eastern Screen-Line			
	Two-Way Annual Average Daily Traffic Flow (Vehicles)		
Road Link Section	Reference Case	Development Case RFC with P&S Interventions	Development Case RFC with P&S and Remedial Interventions
<u>Two-Way Annual Average Daily Traffic Flow (Vehicles)</u>			
A273 Jane Murray Way (A2300 to Sussex Way)	16887	9467	7783
Northern Arc Spine Road (A2300 to B2036)	5	22028	23650
B2036 Harvest Hill (Fairplace Bridge to Cuckfield Road)	10933	10240	11592
A272 (Ansty to Cuckfield)	22366	24216	23734
B2114 Staplefield Road (Slough Green to Cuckfield)	17447	17737	21072
Total Screen-Line Flow	67638	83687	87831
<u>Two-Way AADT Change from Reference Case (Vehicles)</u>			
A273 Jane Murray Way (A2300 to Sussex Way)	-	-7420	-9104
Northern Arc Spine Road (A2300 to B2036)	-	22023	23646
B2036 Harvest Hill (Fairplace Bridge to Cuckfield Road)	-	-693	659
A272 (Ansty to Cuckfield)	-	1849	1367
B2114 Staplefield Road (Slough Green to Cuckfield)	-	290	3625
Total Screen-Line Flow	-	16049	20194

5.6.4. Similarly, modelled flow comparisons for the Ansty western screen-line are shown in Table 19.

Table 19: Daily Traffic Flows across Ansty Western Screen-Line			
	Two-Way Annual Average Daily Traffic Flow (Vehicles)		
Road Link Section	Reference Case	Development Case RFC with P&S Interventions	Development Case RFC with P&S and Remedial Interventions
<u>Two-Way Annual Average Daily Traffic Flow (Vehicles)</u>			
A2300 (Cuckfield Road to Pookbourne Lane)	29921	46102	47811
A272 Bolney Road (Bishopstone Lane to Stairbridge Lane)	14102	15729	14064
B2115 Slough Green Lane (B2114 to A23)	11978	11969	13707
Total Screen-Line Flow	56002	73800	75581
<u>Two-Way AADT Change from Reference Case (Vehicles)</u>			
A2300 (Cuckfield Road to Pookbourne Lane)	-	16181	17890
A272 Bolney Road (Bishopstone Lane to Stairbridge Lane)	-	1627	-39
B2115 Slough Green Lane (B2114 to A23)	-	-9	1728
Total Screen-Line Flow	-	17799	19579

5.6.5. From Tables 18 and 19, the following general trends can be identified regarding traffic flows around Ansty village:

- In each forecast scenario at AM 2031, there will be roughly 11,000 vehicles more (2-way AADT) crossing the east/west corridor to the east of Ansty than crossing the east/west corridor to the west of Ansty. – The eastern and western screen-lines are not comparable, because the eastern includes five routes whilst the western includes only three.
- Across both east and west screen-lines, the total 2-way AADT flow, compared with the reference case, will be approximately 17,000 vehicles greater in the development case with P&S interventions and 20,000 vehicles greater in the development case with P&S and further remedial interventions. – This suggests that the further remedial schemes will draw additional traffic through the corridor.
- The majority of the flow increase above the reference case, both with and without the further remedial schemes, will be concentrated on the A2300 and Northern Arc Spine, rather than on A272, B2036, B2114, or A273 Jane Murray Way. – This reflects the capacity improvements on the A2300 and Haywards Heath Relief Road, which are necessary to facilitate the development plans.

- The impact of the P&S interventions will be to control any increase in traffic on the A272 through Ansty, to and from the east, by maintaining traffic capacity of links and junctions on alternative routes, especially if further remedial schemes are introduced. In particular, the Northern Arc spine road, with appropriate junction capacities at its junctions with A2300, B2036 and A273, will dampen any traffic increase through Ansty. Further junction capacity enhancements at A2300/A23 Hickstead and A273/A272 Butlers Green would reinforce this effect.

5.7. Outline Layout of Remedial Junction Improvements

5.7.1. Following from the investigation into further remedial transport schemes, (in section 5.3), to resolve congestion arising from the District Plan, in the development case with P&S interventions, some outline highway junction improvements have been assessed.

5.7.2. The assessment, using detailed junction modelling tools, indicated that the following interventions could perform satisfactorily:

- A2300 / Northern Arc Spine – Enlarged roundabout on dual 2-lane carriageway, with –
 - 3-lane approaches, widening to 4 lanes, from A2300 west and from A2300 east; and
 - 2-lane approaches, widening to 3 lanes, from Jane Murray Way / Business Park south and from Northern Arc Spine Road north.
- A272 / A273 Butlers Green –
 - Widened roundabout approach on A273 south to 3 lanes, with dedicated left turn lane from A273 south to A272 west;
 - Widened eastbound exit on A272 east to 2 lanes, merging to one lane after about 100m.
- A272 / B2036 Ansty –
 - Replacement of mini-roundabout with traffic signals;
 - 2-lane flared approaches on each arm at traffic signals; and
 - Pedestrian facility across eastern arm.
- B2115 / B2110 Leechpond Hill, Lower Beeding –
 - Widened B2110 eastern arm, to allow a ghost-island right turn.
- A272 / A281 Cowfold –
 - Constricted, linked traffic signals, with 2-lane flared approaches, on the following arms:
 - At the northern junction – from A281 south; A272 west; and A281 north; and
 - At the southern junction – from A272 east.

5.7.3. The above outline schemes are shown indicatively in Figures 4, 5, 6, 7 and 8, respectively. It should be noted that the sketch drawings are notional only and are not to scale, geometrically accurate, or designed in any detail. Further topographical surveys, design work and modelling will be required, in order to determine if the proposed improvements are feasible and viable.

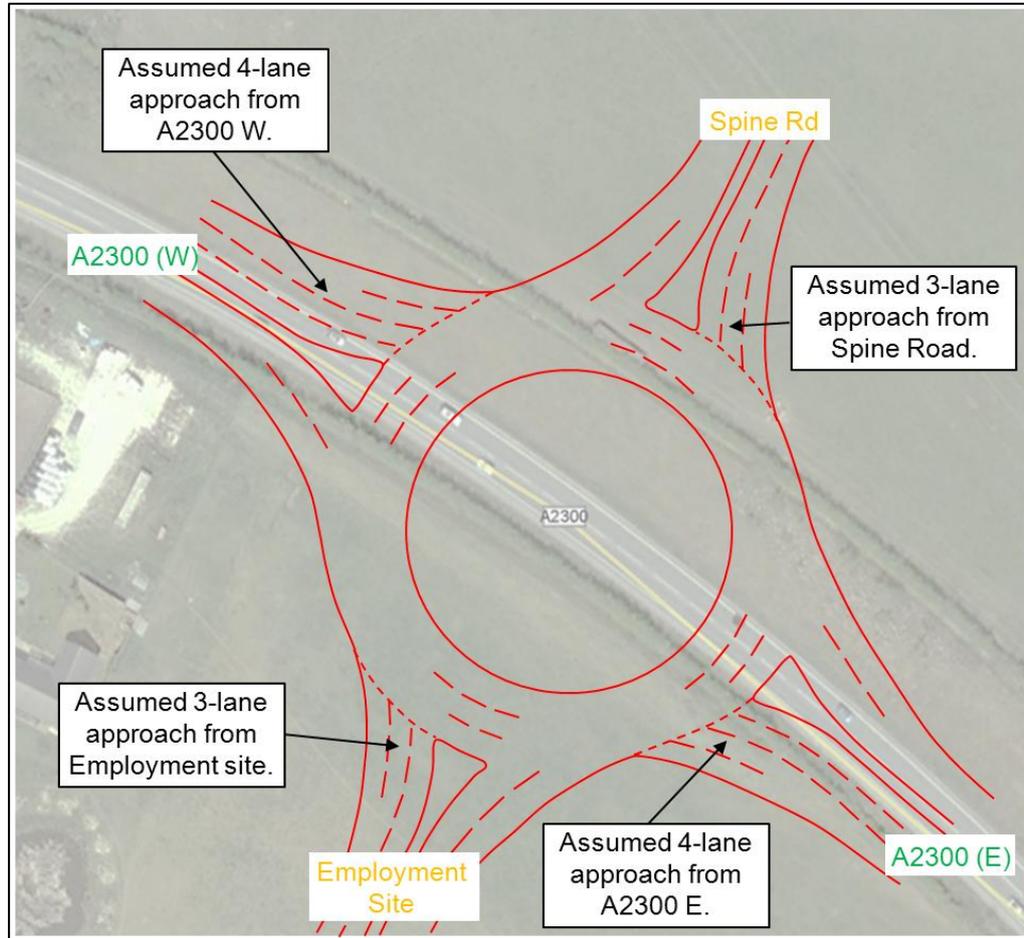


Figure 4: A2300 / Northern Arc Spine – Enlarged Roundabout

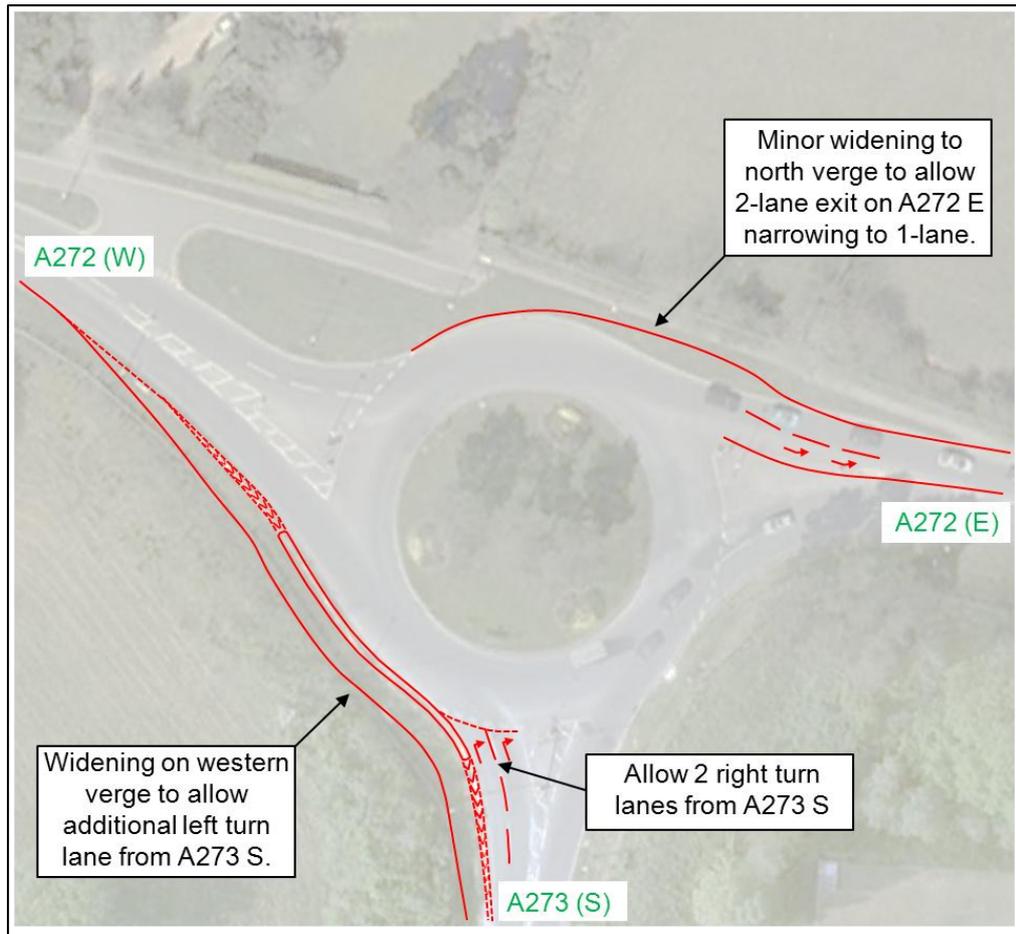


Figure 5: A272 / A273 Butlers Green – Widened Roundabout Approach and Exit

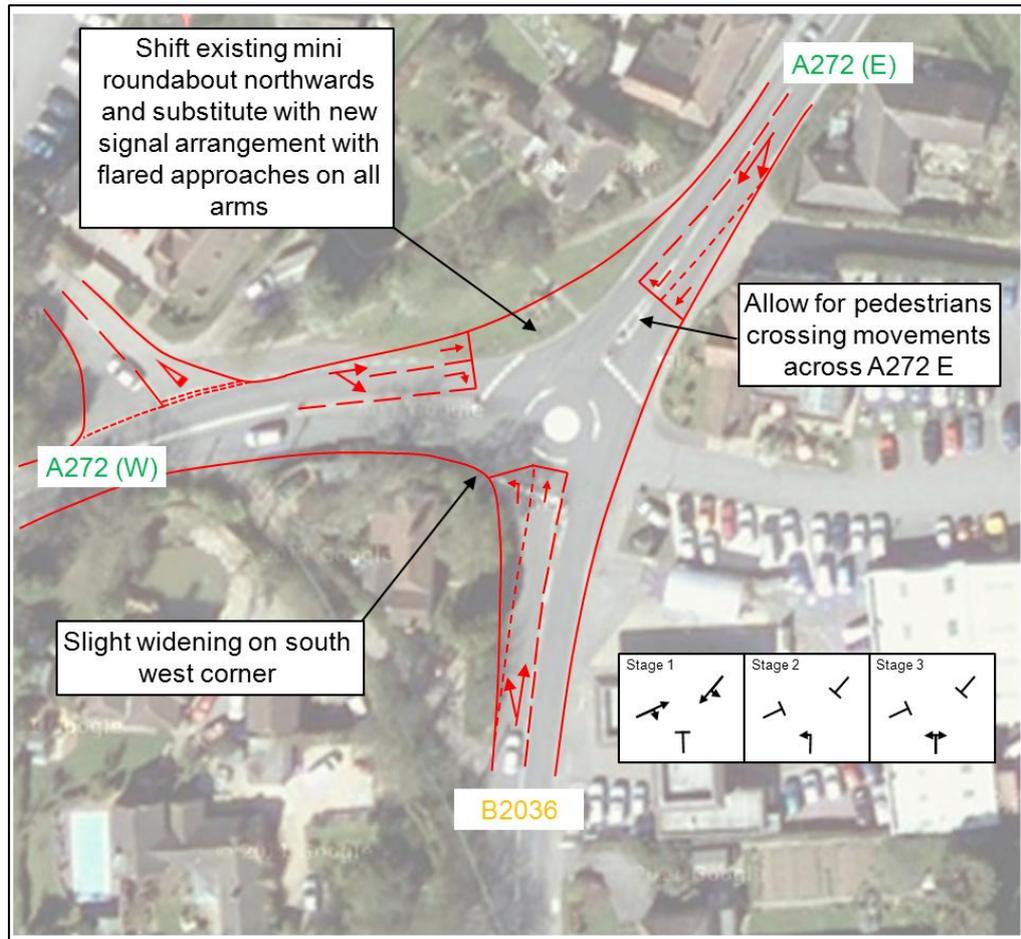


Figure 6: A272 / B2036 Ansty – 2-lane Approaches on Each Arm at Traffic Signals

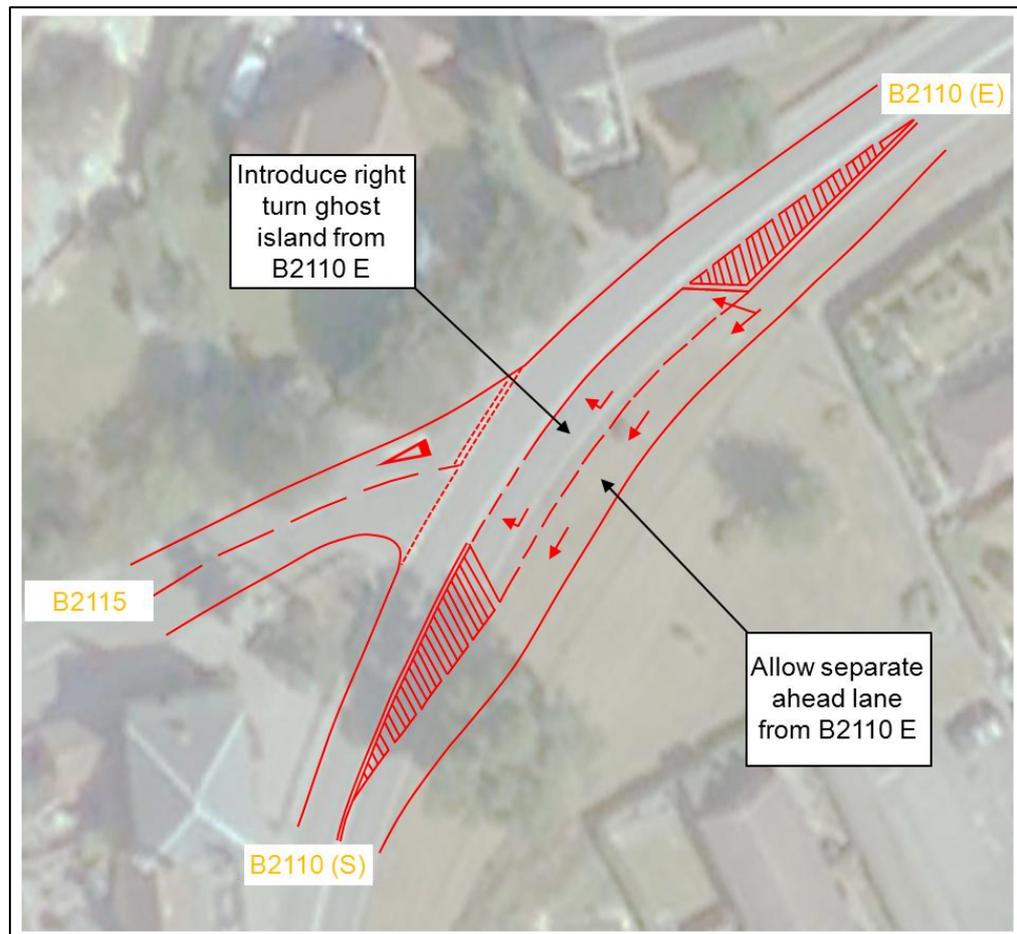


Figure 7: B2115 / B2110 Leechpond Hill, Lower Beeding – Ghost-Island Right Turn from B2110 East

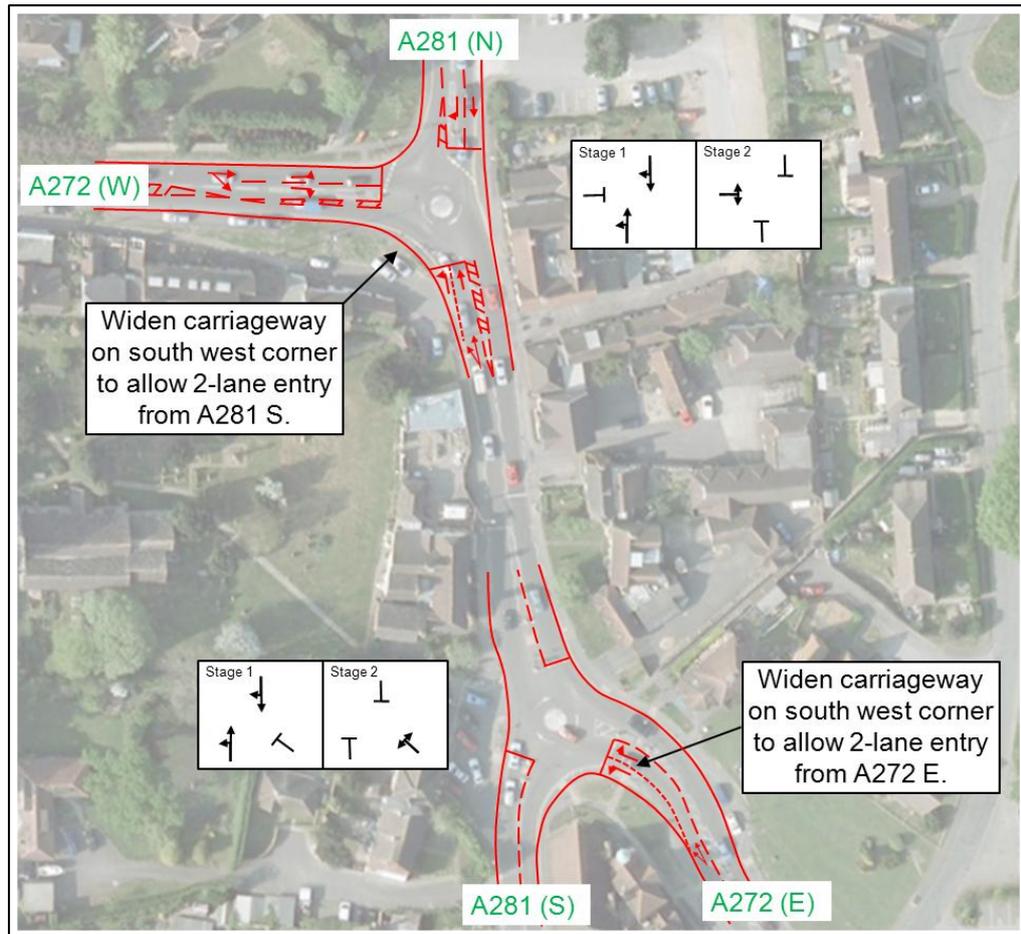


Figure 8: A272 / A281 Cowfold – Linked Traffic Signals, with 2-Lane Approaches

6. Summary and Conclusions

- 6.1.1. Stage 2 of the Mid Sussex Transport study has been undertaken to verify that the Mid Sussex District Plan can be implemented without transport impacts in excess of National Planning Policy Framework (NPPF) guidelines and also verify that any such impacts may feasibly be resolved by remedial interventions. The NPPF guidelines indicate that planning decisions in relation to transport impacts should ultimately consider if:
- The opportunities for sustainable transport modes have been taken up, depending on the nature and location of the site, to reduce the need for major transport infrastructure;
 - Safe and suitable access to the site can be achieved for all people; and
 - Improvements can be undertaken, within the transport network that, cost effectively, limit the significant impacts of the development. Development should only be prevented or refused, on transport grounds, where the residual cumulative impacts of development are severe.
- 6.1.2. The study has been carried out using a validated variant of the West Sussex County Transport Model, to represent the strategic, multi-modal, interaction of trip demand and network supply, to produce route choice assignments at AM peak 2031. The assignment outcomes have been used to assess the performance of the transport system under the following scenarios:
- A reference case with committed land-use and transport plans; and
 - A development case with additional District Plan development and enabling transport schemes (primary and secondary interventions).
- 6.1.3. An additional model scenario has then been tested, to include further remedial interventions, which are intended to resolve any outstanding network operation or congestion problems that were apparent from the initial model runs.
- 6.1.4. The District Plan mainly comprises strategic residential development at the Northern Arc site in Burgess Hill and employment activity at the Burgess Hill A2300 site. In addition, it includes households and jobs distributed across Mid Sussex as brought forward through neighbourhood plans being prepared by town and parish councils.
- 6.1.5. Network improvements to accommodate the District Plan and background growth have been proposed by West Sussex County Council (WSCC) and Mid Sussex district Council (MSDC), across a variety of highway, public transport and policy interventions, focussed mainly on Burgess Hill, but also the other key towns of Haywards Heath and East Grinstead.
- 6.1.6. Under these assumptions, overall growth in network trips in West Sussex, from a 2008 base to 2031, on highway and public transport, is predicted to be about 12% in the reference case and 14% in the development case, from a base of around 203,500 person trips.

- 6.1.7. Outcomes from the transport model showed that the District Plan, with accompanying network improvements, would cause potential network congestion problems (ratio of flow to capacity >100%), in contrast to the reference case, at the following highway locations:
- A2300 / Northern Arc Spine junction, Burgess Hill;
 - A2300 / Cuckfield Road junction, Burgess Hill;
 - A23 / A2300 Hickstead interchange;
 - A272 / A273 Butlers Green junction, Haywards Heath;
 - B2115 / B2110 Leechpond Hill junction, Lower Beeding;
- 6.1.8. In addition, there is a potential for congestion at:
- A272 / B2036 junction, Ansty – if the configuration of the Northern Arc and employment site accesses have lower capacity and cause traffic to route to and from A23 via B2036 and A272.
- 6.1.9. Outline investigation and modelling confirmed that all of the above junction issues could be resolved by introducing further remedial interventions at each of the junctions and by providing dual 2-lane carriageway on the A2300, between the A273 Jane Murray Way and the A23 enhanced Hickstead interchange. However, more detailed design and appraisal will be required to verify, fully, that each of the remedial schemes would operate satisfactorily.
- 6.1.10. In addition to certain junction problems, the model showed that the District Plan would raise highway link congestion issues (RFC >100%) at several locations, in contrast with the reference case, as follows:
- A272 eastbound between A273 Butlers Green and Haywards Heath; – this would be resolved by the further remedial interventions, which would encourage traffic to re-route on to Haywards Heath relief road;
 - A264 westbound between A2220 Copthorne and M23 Crawley;
 - B2036 northbound between Ardingly Road and Staplefield road, Cuckfield;
 - B2115 westbound between B2036, Cuckfield and B2114, Slough Green.
- 6.1.11. The latter three issues above would be a consequence of the further remedial junction interventions, in the development case, which would release queued traffic to overload downstream links.
- 6.1.12. It was considered that all of the above link congestion issues could probably be resolved by providing a capacity enhancement to wide single 2-lane carriageway standard, within the existing highway boundaries.
- 6.1.13. The District Plan, with accompanying interventions, would not result in any congestion issues for the A23 trunk road intersections, provided that necessary improvements are made to A2300 carriageway and the A23 Hickstead interchange.

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- 6.1.14. No adverse impacts of the District Plan on annual average daily traffic flows, or air quality, around Ashdown Forest have been shown by the study.
 - 6.1.15. The effect of the development case P&S and remedial transport interventions on screen-line traffic movements around Ansty would be to increase overall traffic volumes across the full screen-line, but also constrain growth on A272 through the village. It would also encourage traffic to favour the A2300 / Northern Arc Spine / A73 Isaacs Lane route between A23 Burgess Hill and Haywards Heath.
 - 6.1.16. In conclusion, the stage-2 study has indicated that the MSDC District Plan could be successfully delivered at AM peak 2031, in transport impact terms, provided that recommended remedial interventions are introduced to mitigate localised highway congestion.



Appendix A

MSTS Stage 2 Model Output Analyses (Excel Spread Sheet Format)