MID SUSSEX DISTRICT COUNCIL

MSTS Stage 3 Report

Mid Sussex Transport Study

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1 Introduction

1.1 Project Background

The Mid Sussex Transport Study (MSTS) has been published in two stages thus far. Stage 1 of the Mid Sussex Transport Study was completed in 2012. Its purpose was a broad, outline assessment of the likely transport impacts and feasibility of land use options proposed in Mid Sussex District Council's (MSDC) District Plan, without determining transport interventions to mitigate adverse outcomes.

Stage 2 of the Mid Sussex Transport Study was completed in mid-2013. Its purpose was to assess the impact on the transport network following an initial refinement of land uses proposed in the Mid Sussex District Plan 2014-2031 (MSDP). It used a variant of the West Sussex County Transport Model (WSCTM) to predict 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.

Mid Sussex Transport Study, Stage 3 (MSTS S3) was initially commissioned, in April 2015, as a further refinement of the study, to investigate the likely impacts of the MSDP Pre-Submission Draft (June 2015). Due to the timing of commissioning, it was not possible to examine the transport implications of the later Focused Amendments to the Pre-Submission Draft District Plan (November 2015), expressly an increase to the District Plan housing provision and the inclusion of a strategic development for 600 homes to the east of Pease Pottage. A S3 Interim Study was issued, in November 2015, noting the need for further work to be undertaken to cover 'Focused Amendments' to the MSDP.

This final draft MSTS S3 now considers the 'Focused Amendments' to MSDP; and 'Further Modifications' published as pre-submission draft in August 2016, which entails an increase in District Plan housing provision from 650 to 800 new homes per year and includes the proposed strategic development for 600 homes to the east of Pease Pottage.

This report considers a number of sensitivity tests, namely: the transport implications if the Pease Pottage Strategic site did not come forward in the plan period and the transport implications of an 'Alternative Development Case' scenario, which includes the development of a Science and Technology Park to the west of Burgess Hill, identified as a broad location in the development strategy proposed by the MSDP Pre-Submission Draft.

The amended Stage 3 study is required to:

- Inform the allocation of strategic development through the further revised MSDP (August 2016);
- Examine the impacts of a proposed science and technology park to the west of Burgess Hill (a proposed broad location within the District Plan).
- Inform consideration of the sustainable transport options and assumptions to be incorporated into the District Plan evidence; and the Mid Sussex Infrastructure Delivery Plan;
- Address the requirements of both West Sussex County Council as the Highway Authority and Highways England, both of whom aim for a sustainable approach to transport with the common objective of managing travel demand to minimise congestion, delays and adverse environmental / safety impact;
- Be in general conformity with current Government planning practice guidance on evidence bases in plan making;
- Identify forecast changes in traffic flow on roads entering the Ashdown Forest, as a result of housing and commercial development in Mid Sussex, to inform analysis under the Habitats Regulations; and
- Consider the traffic impacts through Ansty and Hassocks in Mid Sussex and Ditchling in Lewes District;

1.2 Study Approach

Amey was commissioned by MSDC, in February 2016, to undertake the amended Stage 3 Study, using a derivative of the SATURN highway and CUBE public transport (PT),

weekday AM peak, multi-modal transport model. The West Sussex County Transport Model from 2008 was re-based and refined in key areas of interest, mainly Burgess Hill and the Strategic Road Network (i.e. M23 / A23 between Crawley and Brighton).

Future scenarios have now been tested in Stage 3, for the weekday AM peak and synthesised PM peak at 2031, to coincide with the MSDP progression. The future scenarios comprise:

- A 'Reference Case' with committed land uses, windfalls and transport changes;
- A 'Development Case', with Reference Case components (above), MSDP strategic and Neighbourhood Plan land uses and previously identified remedial transport schemes;
- An 'Alternative Development Case', with Development Case components (above) and West Burgess Hill Science and Technology Park;
- A 'Development Case Sensitivity', as Development Case (above), but without Pease Pottage site; and
- An 'Alternative Development Case Sensitivity', as Alternative Development Case (above), but without Pease pottage site.

The MSTS S3 procedure identified areas on the network that will perform satisfactorily and those that are predicted to experience unacceptable levels of congestion, in the respective appraisal scenarios. These areas were then highlighted to MSDC, Highways England (HE), and West Sussex County Council (WSCC), to agree mitigation. Remedial schemes were then devised and assessed, so as to achieve a 'no worse off' outcome in the MSDP scenarios, when compared with the Reference Case. Areas were categorised according to designation within highway network hierarchy, comprising: motorway and trunk routes (HE); primary roads (WSCC); other 'A' roads (WSCC); and other 'B' roads (WSCC).

1.3 Report Structure

In scope, the stage 3 report comprises the following:

- Chapter 2 outlines the content and fitness for purpose 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 provides outline remedial schemes to mitigate identified highway problems arising with MSDP scenarios;
- Chapter 7 draws conclusions from the findings.

2 Outline of Stage-3 Model

2.1 Overview

This section provides a fitness for purpose assessment of the models along with a description of the structure and content of the future year transport model that has been used to appraise the MSDC District Plan.

2.2 Base Year Model

The West Sussex County Transport Model from 2008 was re-based and refined in key areas of interest, mainly Burgess Hill and the Strategic Road Network (i.e. M23 / A23 between Crawley and Brighton), to become the 2008 AM peak base model for MSTS S-3. No PM peak base model was used for MSTS, because this was never developed in the 2008 WSCTM. The MSTS model represented multi-modal transport conditions, using a package of SATURN highway, CUBE Public Transport (PT) and CUBE variable demand software. The revised MSTS highway model was checked for its accuracy against recorded AM peak flow conditions, in 2008, for the parts of the road network shown below.

- Burgess Hill – total directional movements across the following 2-way links:
  - Cordon – 8 sites;
  - North/South screen-line – 5 sites;
  - East/West screen-line (West of B2036 London Road) – 5 sites;
  - East/West screen-line (East of B2036 London Road) – 3 sites;
- Burgess Hill – individual directional movements on the following links:
  - All cordons and screen-lines – 42 sites;
- Strategic Road Network – total directional movements on the following 2-way links:
  - M23 – 28 sites;

- A23 – 24 sites;

- West Sussex County – total directional movements across the following 2-way links:

- East/West screen-line (A) – 6 sites;

- East/West screen-line (B) – 5 sites;

- East/West screen-line (C) – 7 sites;

- East/West screen-line (E) – 7 sites;

- East/West screen-line (F) – 11 sites;

- North/South screen-line (D) – 8 sites;

- North/South screen-line (G) – 9 sites;

- North/South screen-line (H) – 10 sites;

- North/South screen-line (I) – 6 sites;

The MSTS highway model was also checked for its reliability against vehicle journey times, through and around Burgess Hill, on 8 directional routes.

Base model flow and travel time validity were mainly judged in terms of percentage change from observed values to modelled values. Flows were also tested by means of the 'GEH' accuracy statistic. The validation criteria and thresholds of acceptability were set according to DfT WebTAG specifications (Unit M3.1).

2.2.1 Assigned Traffic Flow Validation Summary

Flow validation in the base traffic model has been judged against three criteria. Criteria 1 and 2 are each required to be met in at least 85% of cases. These two criteria are:

- Criterion 1 – Individual Flow Comparison (in at least 85% of cases):

- Individual flows within 100 veh/h of counts for flows less than 700 veh/h;

- Individual flows within 15% of counts for flows from 700 to 2,700 veh/h; and

- Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h.

- Criterion 2 - GEH Statistic (in at least 85% of cases):

– Links should have a GEH value of 5 or less.

Criterion 3 assesses the validity of aggregated model flows on links that are combined, to form directional cordons and screen-lines.

- Criterion 3 – Total Screen-line or cordon flow modelled change from observed:

– Modelled flow within +/- 5% of observed at 'nearly all' locations.

Burgess Hill Flow Validation

In the base 2008 AM peak traffic model, there was demonstrated to be a reasonably good fit between observed and modelled traffic flows on combined links in Burgess Hill, with the majority of cordon and screen-line flows (5 out of 8) meeting required thresholds (i.e. modelled flow within +/- 5% of observed at 'nearly all' locations). In the non-compliant cases, the observed total screen-line flows were relatively low, meaning that a small change in modelled flow volumes created a large percentage change, resulting in differences being greater than the WebTAG typical measure of 5%.

At all cordons and screen-lines the respective GEH values were less than 5, meaning that overall there remained a good fit between modelled and observed, once the scale of flow was allowed for.

The model accuracy was also generally good, when compared with WebTAG criteria at individual link locations in Burgess Hill, as follows:

- The percentage of individual flows within 100 veh/h of counts for flows less than 700 veh/h is 86%;
- The percentage of individual flows within 15% of counts for flows from 700 to 2,700 veh/h is 86%; and
- The total percentages of assigned flows in each model that have a 'GEH' value of 5.0 or less, when compared to observed counts is 86%.

These results show that the accuracy of the modelled flows exceeded all of the WebTAG criteria.

There were two link locations with modelled flow GEH greater than 10 (i.e. West Street eastbound and westbound). These flow inaccuracies reflected the necessary absence in the strategic model of some finer network and zoning detail in Burgess Hill, because this detail would be incompatible with the scope of available data and capabilities of the model's mechanisms. Although the base model could not truly replicate all route choices and traffic movements here, this is not a concern, as overall, the model did accurately represent base flows on the main corridors through the urban area.

Strategic Road Network Flow Validation

The accuracy of the AM peak 2008 base highway model was also shown to be generally very good, when compared with WebTAG flow criteria at individual locations on the M23/A23 Strategic Road Network. The main findings from the flow validation are summarised below:

- The percentage of individual flows within 100 veh/h of counts for flows less than 700 veh/h is 92%;
- The percentage of individual flows within 15% of counts for flows from 700 to 2,700 veh/h is 90%;
- The percentage of individual flows within 400 veh/h of counts for flows more than 2,700 veh/h is 94%; and
- The overall proportion of assigned flows that have a 'GEH' value of 5.0 or less, when compared to observed counts is 89%.

These results show that the modelled traffic flows on the SRN validated well and exceeded all of the WebTAG criteria.

M23 J9 (Gatwick) was less accurately modelled, because it lay outside the area of detailed validation in the original WSCTM and had no traffic counts with which to shape the model precision here. Overall, the modelling of the SRN was sufficiently accurate to give a robust assessment of the District Plan impact on the SRN.

West Sussex County Network Flow Validation

It was shown that the wider West Sussex model area validated reasonably well, in terms

of modelled and observed flow comparisons at 18 directional screen-lines across the county network, when assessed against WebTAG criteria (i.e. total modelled flow within +/- 5% of observed at 'nearly all' screen-lines). The majority, or 'nearly all' (14 out of 18, or 78%) of the directional screen-lines satisfactorily achieved the flow difference criteria of +/- 5%.

Considering screen-lines D, E and F separately, as they are the closest strategic screen-lines to the core Mid Sussex District, the majority, or 'nearly all' (4 out of 6, or 67%) of the directional data sets successfully met the flow difference criteria of +/- 5%.

The original, wider-area, WSCTM model validation accuracy was reduced by the necessary inclusion of additional road network detail in the MSTS model for links to the east of Mid Sussex, in Lewes and Wealden districts of East Sussex. These additional links at Ashdown Forest were needed to enable fuller appraisal of the District Plan impacts on the Special Area of Conservation and Special Protection Area, within the area bounded by A264 and B2110 to the north, A26 to the east and A22 to the west. The road links added to the MSTS model comprised B2188, B2026, Coleman's Hatch Road and Kidd's Hill.

The accuracy of the wider West Sussex County network validation could have been improved in the MSTS, by adding observed flows from the WSCC strategic screen-lines into the SATURN trip matrix estimation process. However, this was not done, because it would distort the previously-validated and approved trip matrix origin to destination (O-D) movements from the 2008 strategic model.

2.2.2 Highway Journey Time Validation Summary

Journey time validation in the 2008 MSTS S3 highway model was checked, on routes through and around Burgess Hill, against two criteria:

- Criterion 1 – Modelled, directional route journey times within +/-15% of observed times;
- Criterion 2 – Modelled, directional route journey times within +/-1 minute of observed, if modelled journey time exceeds observed by more than +15%.

Taken together, one or other of the above criteria are required to be met in at least 85%

of cases.

Burgess Hill Journey Time Validation

Accuracy of the modelled network travel times, in Burgess Hill, was found to be reasonably acceptable, with 75% of routes (six out of eight) showing modelled journey times within +/- 15% of observed (target 85%). There were no routes with modelled time exceeding observed by more than 15%.

The slight shortfall in journey time accuracy arose from the necessary omission from the transport model of some network and zoning detail in Burgess Hill, because this detail would be incompatible with the scope of available data and capabilities of the model's mechanisms. It means that the strategic model could not truly replicate all local junction congestion and delay. This was not a concern, as other validation checks have shown that the modelled flow patterns and chosen O-D routes were reliable.

2.2.3 Overall Validation Summary

Overall, in terms of the measured base model accuracy of assigned traffic flows and route travel times, the MSTS S3 model was considered to be robust and fit-for-purpose, within the limitations of its purpose, scope, content and mechanisms.

2.3 Future Year Model

The validated base MSTS S3 2008 AM peak model was projected to forecast year 2031. An additional PM peak highway-only model was also synthesised at forecast year 2031, derived from the AM forecast model.

The PM assignments were undertaken using the SATURN highway model only. It did not use the full multi-modal model mechanisms in the AM model, (e.g. destination choice and mode choice). Hence, the PM outcomes were not reliable as definitive results for the local Mid Sussex network. They were only intended as indicative of impacts on the Strategic Road Network (SRN), i.e. A23 / M23.

2.3.1 Model Mechanisms

The future year model included several mechanisms to determine traveller responses to: changes in the location and scale of land use activities, which trigger trip demands;

changes in network movement volumes; changes in available transport facilities and capacity; and changes in congestion and travel costs. These mechanisms were:

- 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.

Checks were made to ensure that the future year model achieved satisfactory convergence and stability, in all scenarios.

2.3.2 Model Scenarios

For the MSTS S3 work (as now amended), various 2031 scenarios have been forecast from the 2008 base and tested to cover a range of travel demand and transport supply combinations. These scenario assignments enabled a range of potential outcomes from MSDP and the consequent need for mitigation, to be assessed.

In broad terms, the scope of the multi-modal model assignments, for AM peak at 2031, and the scope of the synthesised highway model assignments, for PM peak at 2031, comprised the following five scenarios:

- 'Reference Case', representing:
  - Background trip growth, from the National Trip End Model (NTEM) and Road Traffic Forecasts;
  - Land-use trips associated with Committed sites, (including adopted Neighbourhood Plans), and ad hoc 'windfalls'; and
  - Committed transport schemes and specific development site access arrangements.
- 'Development Case', representing:
  - Background trip growth;
  - Land-use trips associated with Committed, MSDP strategic sites (at Burgess Hill and

Pease Pottage), SHLAA development, Windfalls and adopted and proposed Neighbourhood Plans;

- Committed transport schemes, specific development site access arrangements and 'Primary' and 'Secondary' remedial transport interventions (identified from previous MSTS stages).

- 'Alternative Development Case', representing:

- Background trip growth;

- Land-use trips associated with Committed, Pease Pottage and MSDP strategic sites (at Burgess Hill and Pease Pottage), SHLAA development, Windfalls and adopted and proposed Neighbourhood Plans; with additional trips at West of Burgess Hill Science and Technology Park;

- Committed transport schemes, specific development site access arrangements and 'Primary' and 'Secondary' remedial transport interventions (identified from previous MSTS stages).

- 'Development Case Sensitivity', representing:

- Background trip growth;

- Land-use trips associated with Committed and MSDP strategic development at Burgess Hill with the Pease Pottage site omitted and subsumed within SHLAA development, SHLAA development, Windfalls and adopted and proposed Neighbourhood Plans;

- Committed transport schemes, specific development site access arrangements and 'Primary' and 'Secondary' remedial transport interventions (identified from previous MSTS stages).

- 'Alternative Development Case Sensitivity', representing:

- Background trip growth;

- Land-use trips associated with Committed and MSDP strategic development at

Burgess Hill with the Pease Pottage site omitted and subsumed within SHLAA development, SHLAA development, Windfalls and adopted and proposed Neighbourhood Plans; with additional trips at West of Burgess Hill Science and Technology Park;

- Committed transport schemes, specific development site access arrangements and 'Primary' and 'Secondary' remedial transport interventions (identified from previous MSTS stages).

Outline components of the respective MSTS S3 model and appraisal scenarios are summarised in Table 1.

Table 1: Summary of MSTS S3 Model Scenario Content

Assignment Content	Model Assignment Package AM and PM Peak 2031				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
Travel Demand Components					
Existing Base Trip Demands	Yes	Yes	Yes	Yes	Yes
Background Growth in car & PT trips in line with NTEM (Planning data adjusted to match local situation and remove duplication of site-specific trips)	Yes	Yes	Yes	Yes	Yes
Background Growth in HGV trips in line with NTM	Yes	Yes	Yes	Yes	Yes
Completed Development	Yes	Yes	Yes	Yes	Yes
Committed Development (sites with planning permission, allocated sites including adopted Neighbourhood Plans - including key sites in Horsham DC & Crawley BC)	Yes	Yes	Yes	Yes	Yes
Burgess Hill Strategic Development – Northern Arc W&E	No	Yes	Yes	Yes	Yes
Pease Pottage strategic residential site, (as site-specific development)	No	Yes	Yes	No	No
Pease Pottage strategic residential site, (as addition in SHLAA)	No	No	No	Yes	Yes
Neighbourhood Plan Development (proposed)	No	Yes	Yes	Yes	Yes
SHLAA Development	No	Yes	Yes	Yes	Yes
Windfall Development	Yes	Yes	Yes	Yes	Yes
W Burgess Hill Science and Technology Park strategic employment site, (as site-specific development)	No	No	Yes	No	Yes
Transport Network Supply Components					
Existing Base Transport Network	Yes	Yes	Yes	Yes	Yes
Committed Schemes	Yes	Yes	Yes	Yes	Yes
Primary and Secondary Remedial Schemes & Strategic Site Access	No	Yes	Yes	Yes	Yes
Alternative Development Case Site Access	No	No	Yes	No	Yes

The travel demand elements of the above scenarios are discussed in more detail in section 3 of this report. The transport network supply components are described in more detail in section 4.

2.3.3 Rationale for Reference Case Scenario

The 'Reference Case' represents a situation in which only committed land use and transport decisions are resolved within the future timeline for MSDP. Key land-use initiatives are modelled as site-specific developments. This is the scenario against which the performance of other scenarios has been judged, to determine if they could operate satisfactorily without operational 'stress' (i.e. congestion and delay).

2.3.4 Development Case and Alternative Development Case Scenarios (and Sensitivity Tests)

The 'Development Case' and 'Alternative Development Case' are refinements of previously identified MSTS scenarios, in which committed and various aspirational, local land use and transport decisions are resolved within the MSDP timeline. Again, key land-use initiatives are modelled as site-specific developments.

The 'Alternative' scenarios also include an additional 'broad location' employment allocation, as a site-specific development, at west of Burgess Hill Science and Technology Park.

The 'Sensitivity Test' scenarios exclude a site-specific residential allocation at Pease Pottage and, instead, incorporate the equivalent housing increase within SHLAA development.

These are the scenarios whose performance has been compared with the Reference Case, so as to determine significant impacts on performance of the transport network (i.e. congestion and delay).

2.3.5 Further Remedial Interventions to Mitigate Scenario Impacts

The aim of the MSTS S3 model assignments above was to show if the content of the various scenarios could be successfully accommodated and enable satisfactory operation of the transport network, without adverse impacts. In the Development and Alternative scenarios, 'primary' and 'secondary' remedial transport improvement schemes, which had

been defined and agreed previously during earlier stages of MSTS, were included as a given commitment.

Scenario outcomes were compared with thresholds of acceptability for various agreed network performance criteria. Where unacceptable impacts were predicted, further remedial interventions were proposed and agreed with stakeholders (Mid Sussex District Council, West Sussex County Council, and Highways England), as mitigation schemes for the MSDP impacts.

These further mitigation schemes were then designed in outline and assessed using detailed junction models, as reported in section 5. No extra iterations of the transport model were undertaken to test the outcomes of the further mitigation schemes, for two sharply contrasting reasons, as follows:

- The SATURN / CUBE strategic model has only limited ability to represent route-choice sensitivity to small, localised changes in network infrastructure and performance, such as would arise with some of the mitigation schemes; consequently, there would be no further re-assignment of trips, if these schemes were introduced to the model; therefore, it was judged unnecessary to undertake further model runs for these schemes; but conversely
- The strategic model would also show that the more substantial infrastructure changes, such as would occur with the other mitigation schemes, would cause significant trip re-assignment and unstable, 'knock-on', route choices that would fluctuate over multiple model iterations, resulting in an open-ended and uncertain assessment process; this uncertainty could not be accommodated within the project constraints.

Owing to these two factors, it was agreed during a telephone conference with Mid Sussex District Council, West Sussex County Council and Highways England on 2 August 2016 that no iterative re-modelling of the identified mitigation schemes would be undertaken in the strategic model.

Further, detailed justification for not re-modelling each of the mitigation schemes is given in section 5.6.1 of this report.

2.3.6 Network Performance Criteria

Network performance criteria, used to determine the need for mitigation within an appropriate area of influence for the MSDP, were agreed as the MSTS S3 progressed, following discussions with stakeholders (MSDC, WSCC and HE). These criteria compare each MSDP scenario with the Reference Case and identify where impact mitigation is required in order for MSDP to achieve a 'no worse off' outcome.

Two principal criteria were used to indicate a mitigation requirement. These criteria, as provided by the SATURN highway model, were as follows:

- Any junction, where an approach arm RFC is >90%, in the MSDP scenario and the increase in average delay per vehicle is >30 seconds, compared with reference case; and
- Any junction, where an approach arm ratio of flow to capacity (RFC) is >90%, in the MSDP scenario and the increase in RFC is >5%, compared with reference case.

Although the SATURN model could not give conclusive evidence for the (first) traffic queue / delay criterion, owing to inherent limitations in the SATURN software procedures, the model outputs were considered to be reliable for the (second) RFC criterion.

For each network location where the above criteria showed a need for mitigation, the outcomes were sent to WSCC and HE and discussed with WSCC, to determine if a remedial intervention would be:

- Desirable in a wider transport strategy context; and
- Achievable for instance in terms of cost, disruption, land-take and environment, acceptability.

3 Forecast Demand Scenarios

3.1 Overview

This section describes the trip volume calculations in the Stage 3 appraisal, which form the 'demand' side of the future year model scenarios. It also summarises the total, outturn trip demand, by mode, in each model scenario which is determined by the operation of the 'variable demand model' and predicted responses to changes in travel costs.

3.2 Trip Demand Scenarios

Five AM and PM peak demand scenarios have been assembled for Stage 3, for a 2031 forecast year, as discussed in section 2.3.2, namely:

- Reference Case;
- Development Case;
- Alternative Development Case;
- Development Case Sensitivity; and
- Alternative Development Case Sensitivity.

3.2.1 Procedures Used to Assemble the Travel Demand Scenarios

Several important assumptions and techniques were applied in order to prepare the respective travel demand scenarios. The key procedures were as follows:

Procedures Common to All Scenarios

- **Background growth in car and PT trips** – Growth in car and PT trip volumes from base year 2008 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 Mid Sussex and neighbouring authorities (i.e. Crawley, Wealden, Lewes, Brighton & Hove, Horsham and Tandridge) using local predictions. Resulting growth factors have been applied in the transport model by

identifying the model zones that correspond with each NTEM district;

- **Site-specific land-use trips** – Where details of specific future land-use allocations are known and it is anticipated that these sites will have a significant impact within the MSDP area of influence, 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. Site-specific trip patterns have been represented for all large completed and committed developments and adopted Neighbourhood Plan sites, in both the Reference Case and Development Case scenarios. Small sites and windfalls have been included as changes to NTEM data;
- **Duplication of site-specific trips** – Duplication within NTEM growth was prevented by removing the planning data associated with the specific developments from the TEMPRO dataset; and
- **Background growth in goods vehicle movements** – 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 2015 (RTF15).

Procedures in Development Case / Alternative Development Case and Sensitivity Scenarios Only

- **Neighbourhood Plan proposed developments** – These have been handled differently to *adopted* Neighbourhood Plan sites, which have been included as site-specific trip movements in all scenarios. *Proposed* Neighbourhood Plan allocations have been represented by changes to NTEM growth, not as site-specific trips, in the Development Case and Alternative Development Case scenarios; and
- **District Plan strategic proposed developments** – In the Development and Alternative Development Case (including sensitivities), 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.

Procedures in Alternative Development Case and Sensitivity Scenario Only

- **Additional proposed strategic development site** – Allowance has also been made for zone-specific trips at the potential science and technology park to the west of Burgess Hill.

3.2.2 Breakdown of Land-Use Development Allocations by Scenario

Table 2 indicates the type and scale of land-use allocations in each MSTS S3 model scenario.

Table 2: MSTS Stage 3 Type and Scale of Land-Use Development Allocations

Assignment Content	Model Assignment Package AM Peak 2031				
	Reference Development Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
Travel Demand Components					
Completed Development Since 2008	4,071 households/6,382 jobs				
Committed Development (including Adopted Neighbourhood Plan sites)	5,799 households/2,652 jobs				
Strategic Development	N/A	3,500 households/1,411 jobs			
Neighbourhood Plan Proposed Development	N/A	1,512 households/2,737 jobs			
SHLAA Development	N/A	601 households		1219 households	
Windfalls	495 households				
Pease Pottage Land East of Brighton Road Development (previously included above)	N/A	600 households	600 households	N/A	N/A
Science and Technology Park	N/A	N/A	2,500 jobs	N/A	2,500 jobs
Total Land-Use Allocations	10,365 households/ 9,034 jobs	16578 households/ 13,182 jobs	16578 households/ 15,682 jobs	16,596 households/ 13,182 jobs	16,596 households/ 15,682 jobs

Table 2 shows that the MSTS S3 assessment represents the following change in land-use development allocations between the various scenarios:

- Development Case change from Reference Case:

  +6,213 households / +4,148 jobs;

- Alternative Development Case change from Reference Case:

  +6,213 households / +6,648 jobs;

- Development Sensitivity Case change from Reference Case:

  +6,231 households / +4,148 jobs;

- Alternative Development Sensitivity Case change from Reference Case:

  +6,231 households / +6,648 jobs.

3.3 NTEM (TEMPRO) Trip End Growth

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).

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.

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

Trip end growth, to 2031, for goods vehicles has been represented in the model using National Transport Model RTF15 forecasts. The base model goods vehicle movements are unchanged from 2008. The growth factors used were therefore as follows:

- 2008 to 2031: +19.45% (x1.1945).

3.5 Trip Rate Estimates for Site-Specific Developments

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, preferred and alternative allocations). The trip rates were extracted from the TRICS database for similar UK sites, by number of residential dwellings and size of employment Gross Floor Area (GFA in sqm).

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

The person-trip rates for stage 3 are consistent with those used in earlier MSTS stages and are as shown in Table 3.

Table 3: Person Trip Rates for Site-Specific Developments (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
Horsham Kilnwood Vale			
Residential	per dwelling	0.359	0.757
Employment	per 100m2	1.88	0.390
Foodstore	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

By applying the trip rates in Table 3 to the identified development sites, AM peak trip arrivals and departures were calculated as shown in Table 4 for the reference case, development case, alternative development case, development case sensitivity, and alternative development case sensitivity, scenarios.

These total person trips were added to the adjusted NTEM base year trip-end growth for the appropriate O-D zones in the model matrix, to give overall 2031 trip patterns.

It can be seen from Table 4 that the number of additional site-specific trips calculated for each appraisal scenario would rise from 18,887 in the reference case, to: 24,026 in the development case (i.e. a 27% increase from reference case); 27,015 in the alternative development case (i.e. a 43% increase from reference case); 23,599 in the development case sensitivity (i.e. a 25% increase from reference case); and 26,588 in the alternative development case sensitivity (i.e. a 40% increase from reference case).

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.

A detailed breakdown of the person-trip volumes calculated for each development site, under each model scenario is given in Appendix A.

Table 4: Person Trips at Development Sites (Added to Background Growth)

Description	Arrivals	Departures	2-way
In Reference Case, Development Case and Alternative Development Case			
Completed Residential Developments	267	1502	1768
Completed Employment Developments	2291	1615	3906
Committed Residential Developments	666	3746	4412
Committed Employment Developments	918	348	1266
Residential Developments Outside MSDC (N Horsham; Kilnwood Vale; Crawley NE Sector)	1665	4967	6632
Employment Developments Outside MSDC (N Horsham; Kilnwood Vale; Crawley NE Sector)	705	198	903
In Development Case (Includes Reference Case Sites)			
Strategic Housing	659	2384	3042
Neighbourhood Plan Development	183	1030	1213
Strategic Employment	361	97	458
Pease Pottage Land East of Brighton Road Development	107	320	427
In Alternative Development Case (Includes Reference Case Sites)			
Strategic Housing	659	2384	3042
Neighbourhood Plan Development	183	1030	1213
Strategic Employment	361	97	458
Pease Pottage Land East of Brighton Road Development	107	320	427
Science and Technology Park	2629	359	2988
In Development Case Sensitivity (Includes reference Case Sites)			
Strategic Housing	659	2384	3042
Neighbourhood Plan Development	183	1030	1213
Strategic Employment	361	97	458
Pease Pottage Land East of Brighton Road Development – Site Omitted	0	0	0
In Alternative Development Case Sensitivity (Includes Reference Case Sites)			
Strategic Housing	659	2384	3042
Neighbourhood Plan Development	183	1030	1213
Strategic Employment	361	97	458
Pease Pottage Land East of Brighton Road Development – Site Omitted	0	0	0
Science and Technology Park	2629	359	2988
Cumulative Summary of Overall Site-Specific Trip Totals, by Scenario, (Added to Background Growth)			
Reference Case	6511	12376	18887
Development Case	7820	16206	24026
Alternative Development Case	10449	16565	27015
Development Case Sensitivity	7713	15886	23599
Alternative Development Case Sensitivity	10342	16245	26588

3.7 Forecast Person Trip Matrices

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.

Table 5 shows the numbers of trips in the reference case, development case, development case sensitivity, alternative development case and alternative development case sensitivity scenarios, after assignment in the full, variable demand, multi-modal model. They include changes made within the demand model, in each matrix / network scenario, to reflect mode choice and destination choice in response to changing transport costs. The trip demands are shown as person-trips, by highway and public transport. It can be seen from the below table that the gap in total person trips between the reference case and development case is an increase of 3,830 all-mode person trips (AM), or 918 highway trips (AM) / 966 highway trips (PM).

Table 5: Stage 3 Base and Forecast Person Trip Matrix Totals

Model Scenario	All-Mode Person Trips			Highway Trips	
	2008 Base Year AM	Stage-3 2031 Forecast Year AM	Stage-3 2031 AM Change from 2008	Stage-3 2031 AM Forecast Year	Stage-3 2031 PM Forecast Year
Reference Development Case	205055	248274	+43219	180727	188650
Development Case	205055	252104	+47049	181645	189616
Development Case Sensitivity	205055	251784	+46729	181930	189912
Alternative Development Case	205055	252463	+47408	181389	189356
Alternative Development Case Sensitivity	205055	252143	+47088	181658	189647

3.8 Travel Choice Mechanisms in the Demand Model

As indicated in section 2, 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.

3.8.1 Trip End Generation and Attraction Model

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.

3.8.2 Trip Distribution and Destination Choice

Trip destination choice is calculated as a function of observed trip length distribution and the generalised time of travel.

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.

3.8.3 Travel Mode Choice

Travel mode choice is applied by journey purpose and is calibrated in line with initial spread parameters (lambda), 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.

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

This section describes the transport networks that have been included in the future year multi-modal model, under the respective Stage 3 forecast scenarios. The network elements represent the supply side of the model.

Many of the network components are consistent with those in the Stage 2 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

Descriptions of the highway and PT interventions included in the respective model network configurations, at AM and PM 2031, are outlined below. The objective has been to represent a balanced range of highway, PT and policy initiatives, within the limitations of a broad-scale strategic model.

As indicated in section 2.3.2, the broad scope of transport interventions, included in each model scenario, were as follows:

- In reference case scenario
  - Committed transport schemes and specific development site access arrangements, only.
- In all development scenarios: development case / alternative development case / development case sensitivity / alternative development case sensitivity
  - Committed transport schemes and specific development site access arrangements; and
  - Committed transport schemes, specific development site access arrangements and 'Primary' and 'Secondary' remedial transport interventions (identified from previous MSTS stages).

Details of the individual schemes in each intervention scenario are summarised below.

4.2.1 Reference Case Interventions

The Reference Case interventions entailed completed transport initiatives, which have been implemented since 2008, together with committed future schemes. These Reference Development Case schemes were as follows:

- Haywards Heath Relief Road Stages 5 & 6 (Stages 1 – 4 previously implemented);
- A23 Handcross - Warninglid (HE scheme) improvements;
- B2113 Station Road / Keymer Road / Silverdale Road (Hoadleys Corner) – traffic signals;
- Leylands Road / Valebridge Road / Janes Lane / Junction Road – linked traffic signals;
- B2113 Folders Lane / Kingsway – traffic signals;
- B2113 Station Road / Church Road – traffic signals;
- B2113 Keymer Road / Folders Lane – traffic signals;
- Junction Road / Cants Lane – traffic signals;
- B2112 Ditchling Road Traffic calming between B2113 Folders La and St Georges Park / Janes Lane;
- Kingsway – carriageway widening; and
- East of Kingsway Development – committed Interventions.

4.2.2 Primary and Secondary MSDP Interventions

The primary and secondary interventions were schemes identified by WSCC and were intended to enable delivery of the MS District Plan. They were refined at MSTS S3 from the configurations assumed at S1 and S2 and were included in the Development Case and Alternative Development Case (and also in the respective 'sensitivity' scenarios), as additional to the Reference Case interventions (listed above). The Primary and Secondary Interventions are summarised below:

- Northern Arc Link Road between A273(S), A2300 & A273 (N), in 2 sections; with further access improvements, to connect A273 Isaacs Lane / B2036 London Road

with Maple Drive to the east;

- Parking Strategy scheme – CPZ for the centre of Burgess Hill with extensions (e.g. Wivelsfield Station);
- Bus service frequency and route connectivity enhancements, district-wide, combined with sustainable transport links, improved passenger / parking facilities at bus / rail interchanges and links to development sites;
- Victoria Road – York Road highway link, 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;
- Safety-led improvements to A273 Isaac's Lane, between Burgess Hill and Bolnore;
- Traffic restraint on A273 Jane Murray Way / Sussex Way, between A2300 and A273 Fairplace Bridge;
- Junction capacity improvements – A23 / A2300 Hickstead, including traffic signals at western roundabout, uncontrolled eastern roundabout and single carriageway bridge over A23 (Highways England scheme);
- Junction improvement - A273 Fairplace Bridge double mini- roundabout junction;
- B2036 London Road / Leylands Road and London Road / West Street junctions – linked traffic signal control;
- B2036 London Road / Royal George Road / Lower Church Road – linked traffic signal upgrade;
- Burgess Hill Smarter Choices car share / car club schemes;
- East Grinstead Smarter Choices - Area-wide Travel Plans (multi-stakeholder approach - not site specific) and establishment Transport Management Associations (TMAs) to implement their delivery;
- Controlled Parking Zone (CPZ) review for East Grinstead - potential extensions;
- Haywards Heath Smarter Choices car share / car club schemes;
- 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;

- Burgess Hill, additional bus service frequency and route connectivity enhancements, combined with sustainable transport links, improved passenger / parking facilities at bus / rail interchange;
- A2300 widening to dual 2-lane carriageway A23 Hickstead – Northern Arc Link, with junction capacity improvements;
- A273 Jane Murray Way other junction enhancements (x4 junctions);
- East Grinstead housing development mitigation schemes (Atkins stage-3 study);
- A2300 / Science and Technology Park new roundabout access (Alternative Development Case only); and
- M23 Junction 11 / A264 and B2114 Brighton Road / Parish Lane / Horsham Road, Pease Pottage – Junction improvements to accommodate proposed residential development.

4.2.3 Development Primary Intervention Case

It should be noted that an intermediate 'primary intervention' case was also assembled for testing in the model. However, from the Stage-2 study 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 subsuming the primary intervention case within the overall primary and secondary interventions were 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.

4.2.4 Highway Improvements at Pease Pottage Site Access

A number of remedial improvements have been drafted for the M23 J11 / A264 and B2114 Brighton Road / Parish Lane / Horsham Road junctions, by highway engineers (Ardent), on behalf of developer of the Pease Pottage site (Thakeham Homes), in order to accommodate and mitigate the impact of the proposed residential development. These improvements are understood to comprise:

- Primary Site Access 4-arm Roundabout on Brighton Road, entailing:

– A shared cycle/footway and signal controlled crossing, to facilitate pedestrian and cycle movements to/from the site.

- Secondary Site Access Priority T-Junction with Parish Lane, entailing:

– A new footway and uncontrolled crossing, to facilitate pedestrian movements to/from the site.

- Improvements at M23 J11 Gyratory, entailing:

– Signalising A23 (north) and B2114 approaches;

– A264 approach signalised in conjunction with the Kilnwood Vale scheme;

– Widening the circulatory carriageway either side of the M23/A23(T);

– Widening to dual carriageway on the southern approach of the B2114 Brighton Road;

- Existing footway along the northern side of Horsham Road to be widened;
- New signal controlled crossing and footway on the southern side of Horsham Road, further to the west, to increase connections to/from Pease Pottage to

the west.

A Stage 1 Road Safety Audit (RSA) has been undertaken for all proposed improvements at Pease Pottage (above).

The remedial highway improvements for Pease Pottage have been incorporated in the MSTS transport model for the Development Case and Alternative Development Case scenarios.

4.2.5 Further, Remedial Schemes, to Mitigate Impacts of Forecast MSDP Scenarios

Once transport model assignments had been undertaken for each of the forecast MSDP scenarios, the need for further remedial schemes was assessed, as means of mitigating adverse development impacts, which could not be resolved by the primary and secondary interventions alone.

The scope, content and predicted outcome of these further remedial schemes is discussed in section 6.

4.3 Model Assignment Packages

4.3.1 Assignment Overview

The elements of forecast travel demand and the future transport network components, described above, were included in the various MSTS S3 model assignment scenarios for 2031.

4.3.2 Scope of Model Assignments

Forecast model assignments have been undertaken and analysed for the Reference Case, Development Case, Alternative Development Case, Development Case Sensitivity, and Alternative Development Case Sensitivity. These include planned development access arrangements and network improvements/remedial interventions previously identified in MSTS stages 1 and 2 (primary and secondary remedial schemes).

An outline summary of travel demand and transport infrastructure components in each model assignment scenario is given in Table 6.

Table 6: Outline Summary of MSTS S3 Model Assignment Scenarios

Assignment Content	Model Assignment Package AM and PM Peak 2031				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Case Sensitivity**	**Alternative Development Case Sensitivity**
Travel Demand Components					
Existing Base Land Use Trip Demand	Yes	Yes	Yes	Yes	Yes
Background Trip growth	Yes	Yes	Yes	Yes	Yes
Completed Development	Yes	Yes	Yes	Yes	Yes
Committed Development (including adopted Neighbourhood Plans)	Yes	Yes	Yes	Yes	Yes
Strategic Development – (Burgess Hill)	No	Yes	Yes	Yes	Yes
Strategic Development – (Pease Pottage)	No	Yes	Yes	No	No
Proposed Neighbourhood Plan Development – (MSDC)	No	Yes	Yes	Yes	Yes
SHLAA Development – (MSDC)	No	Yes	Yes	Yes	Yes
Windfalls – (MSDC)	Yes	Yes	Yes	Yes	Yes
Science and Technology Park – (W Burgess Hill)	No	No	Yes	No	Yes
Transport Network Supply Components					
Existing Base Transport Network	Yes	Yes	Yes	Yes	Yes
Committed Schemes	Yes	Yes	Yes	Yes	Yes
Primary and Secondary Remedial Schemes & Strategic Site Access	No	Yes	Yes	Yes	Yes
Alternative Development Case Site Access	No	No	Yes	No	Yes
Further Remedial Schemes – (No Model Assignments; Performance Tested in Local Junction Models, only)	No	Yes	Yes	Yes	Yes

5 Model Results and Output Analysis

5.1 Overview

This section describes the findings from the Stage 3 scenario modelling and analysis. The report analysis focuses on highway ratios of flow to capacity (RFC) at links and junctions suffering significant stress. In addition, the traffic impact on Ashdown Forest has been included, along with the impact on Ansty, Ditchling and Hassocks.

5.2 Forecast Model Reliability

The West Sussex County Transport Model forecast assignments at AM 2031 have been checked to ensure that the outcomes are robust and reliable, within the limitations of the model scope and content.

It was important to derive the results from satisfactorily converged and stable model assignments for each scenario. Model convergence, proximity and stability were judged against the following WebTAG criteria:

Proximity (Using both of two criteria):

- %GAP and %Delta (difference between total assigned/simulated costs and minimum route costs, as a proportion of total costs);

– Target <0.1%, over four successive iterations, for both GAP and Delta criteria;

Stability (Using at least one of two criteria):

- %FLOWS (P proportion of assigned flows within 1% of values from previous iteration);

– Target >98%; over four successive iterations, for FLOWS criterion; or

- %RAAD (relative average absolute difference);

– Target <0.1%; over four successive iterations, for RAAD criterion;

The statistics in Table 7 summarise the model convergence, proximity and

stability, values that were achieved in the forecast West Sussex model. They confirm that the assignments were satisfactorily converged and that the model outcomes, in each scenario, would not change significantly if further iterations were run.

Table 7: AM Peak 2031 Highway Model Proximity and Stability Checks

Model Iteration No. (Final Four Iterations)	Proximity Criteria		Stability Criteria	
	%Delta (<0.1%) rounded	%GAP (<0.1%) rounded	%Flows (P 98% <1%) rounded	%RAAD (<0.1%) rounded
Reference Case				
20	0.2	0.4	96.2	0.8
21	0.2	0.4	96.5	0.7
22	0.2	0.4	97.6	0.5
23	0.2	0.3	98.2	0.4
Development Case				
16	0.2	0.3	96.1	0.8
17	0.2	0.3	99.6	0.4
18	0.2	0.2	99.7	0.3
19	0.2	0.2	99.8	0.2
Alternative Development Case				
18	0.2	0.3	96.9	0.7
19	0.2	0.3	97.7	0.5
20	0.2	0.2	99.7	0.3
21	0.2	0.2	99.8	0.2
Development Case Sensitivity				
18	0.2	0.5	96.7	0.6
19	0.2	0.3	97.0	0.6
20	0.2	0.2	98.4	0.3
21	0.2	0.2	99.8	0.2
Alternative Development Case Sensitivity				
17	0.2	0.3	97.0	0.6
18	0.2	0.3	97.3	0.5
19	0.2	0.2	99.7	0.3
20	0.2	0.2	99.8	0.2

5.3 Overall Network Travel Statistics

A comparison of overall assignment output statistics has been made, between the

Reference Case and the Development Case and Alternative Development Case, (with and without sensitivities), with primary and secondary interventions only (i.e. without any further remedial interventions to mitigate the impact of developments), across the whole strategic model area. The statistics indicate the overall impact of the predicted growth in movements should any of the potential District Plan Strategies be implemented. A brief outline of each indicator is provided below:

- ***Distance travelled in the network*** - overall travel distance for all trips during the AM peak hour;
- ***Travel time in the network*** - overall travel time for all trips during the AM peak hour;
- ***Total network delay (highway only)*** - overall travel delay for all trips during the AM peak hour.

Table 8 shows the assignment output statistics.

The level of congestion delay on the highway network was shown to increase slightly during the AM peak hour, by between 1% and 3%, with the additional traffic generated in the MS District Plan strategies. This delay increase was significantly less than the level of traffic increase, because the MSDP development trips were loaded, predominantly, on to non-urban and largely uncongested parts of the wider network.

The overall travel time and distance was shown to increase slightly in the development case, alternative development case and sensitivity tests, compared with the reference case, owing to the greater number of trips on the network in these MSDP scenarios.

Table 8: MSTS Stage-3 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	Alternative Development Case with P&S Interventions	Development Case Sensitivity with P&S Interventions	Alternative Development Case Sensitivity with P&S Interventions
Total Network Travel Distance	Highway	PCU-Kms	3722897	4420564	4401714	4403878	4398273	4400617
	Bus	Person-Kms	58731	60248	68940	69218	68868	69202
	Rail	Person-Kms	534209	618519	666134	661101	666022	661035
	Combined	Net Kms	4315837	5099331	5136788	5134197	5133162	5130854
Total Network Travel Time	Highway	PCU-Hrs	48586	62037	62200	62522	62279	62393
	Bus	Person-Hrs	2292	2343	2707	2729	2704	2729
	Rail	Person-Hrs	9234	10590	11487	11402	11485	11401
	Combined	Net Hrs	60112	74971	76394	76653	76468	76523
Total Network Delay	Highway	PCU Hrs/Hr	5867	10166	10288	10451	10432	10379

5.4 Network Performance Criteria

As indicated in section 2.3.3, after stakeholder discussions, the network performance criteria used two critical measures, for which values were extracted from the model assignments, so as to assess the ability of the MSDP scenarios to perform satisfactorily and also judge the need for further impact mitigation for a no worse-off outcome. The two criteria for mitigation were:

- Any junction, where an approach arm ratio of flow to capacity (RFC) is >90%, in the MSDP scenario and the increase in RFC is >5%, compared with reference case; and
- Any junction, where an approach arm RFC is >90%, in the MSDP scenario and the increase in average delay per vehicle is >30 seconds, compared with reference case.

5.5 Highway Network Junction Performance

The Mid Sussex District Plan transport model impacts have been re-appraised according to the threshold criteria, indicated in section 5.4 above, for the MSTS modelled AM peak hour assignment and for the synthesised (highway-only) PM peak hour assignment, at 2031.

Note that the traffic flows shown in this analysis are 'demand' flows (i.e. including vehicles that may be queued elsewhere on the road network); they are not 'actual' flows (i.e. including only vehicles that arrive at the junction approaches during the modelled time periods).

Junctions with Approach RFC >90% and Delay Increase >30 Seconds

Table 9 and Table 10 show junction locations that failed this performance criterion, in the respective MSDP scenarios, in the AM and PM peak forecast assignments, respectively.

Junctions with Approach RFC >90% and RFC Increase >5%

Similarly, Table 11 and Table 12 show junction locations that failed this performance

criterion, in the respective MSDP scenarios, in the AM and PM peak forecast assignments, respectively.

(Note that the modelled traffic flow volumes, given in Tables 11, 12, 13 and 14, represent demand flows, in pcu/hour).

Table 9: AM Peak Junction RFC >90% in MSDP Scenario and average delay increase >30 seconds, compared with Reference Case

Junction Location & Approach Arm	Reference Case				Development Case				Development Case (Sensitivity)				Alternative Development Case				Alternative Development Case (sensitivity)			
	Dem. Flow pcu	RFC	Delay	Queue	Dem. Flow pcu	RFC	Delay	Queue	Dem. Flow pcu	RFC	Delay	Queue	Dem. Flow pcu	RFC	Delay	Queue	Dem. Flow pcu	RFC	Delay	Queue
A273/B2116 Hassocks Crossroads (From B2116 West)	700	112	246	42	680	114	292	47	681	115	293	47	692	116	324	52	690	116	317	51
A273/B2116 Hassocks Crossroads (From A273 North)	509	105	146	17	533	107	177	21	535	107	184	22	542	109	210	26	542	109	207	26
B2110/B2115 Leechpond Hill (From B2110 East)	963	101	48	8	949	104	96	19	959	103	83	16	952	103	79	15	-	-	-	-
A264 Copthorne Common Road/B2028 Turners Hill Road/A264 Snow Hill (From A264 Copthorne Common Road West)	1547	103	68	26	1582	106	109	43	1577	105	102	40	1585	105	102	40	1574	105	99	39
A2300/Northern Arc Spine Road (From N Arc North)	3	0	0	0	594	106	168	26	599	106	167	26	637	108	192	32	646	108	201	34
A2300/Northern Arc Spine Road (From A2300 East)	1368	80	9	0	510	103	124	16	511	104	125	16	549	107	178	25	547	106	171	24
A2300/Northern Arc Spine Road (From N Arc South)	0	0	0	0	620	103	98	15	615	102	93	14	593	104	117	18	586	103	108	16
A264/Kilnwood Vale Access Road (From A264 West)	2069	69	5	3	2186	103	59	31	-	-	-	-	2167	102	51	27	-	-	-	-
B2028 West Park Road/B2037 Effingham Road (From B2028 North East)	508	100	33	4	-	-	-	-	547	102	66	9	-	-	-	-	-	-	-	-
A273/B2116 Hassocks Crossroads (From B2116 East)	595	106	144	22	-	-	-	-	-	-	-	-	607	108	184	28	607	108	182	28
B2117/B2116 Hurstpierpoint (From B2116 East)	614	63	5	0	-	-	-	-	-	-	-	-	972	101	42	10	970	101	38	9
B2036 London Road/Whiteman's Green/Ardingly Road (From Ardingly Road East)	948	108	164	41	-	-	-	-	-	-	-	-	938	109	195	47	941	110	204	49
A264 Copthorne Common Road/A2220 Copthorne (From A264 East)	1284	106	137	43	-	-	-	-	-	-	-	-	1320	108	173	54	-	-	-	-
B2110/B2028 Turners Hill (From B2110 East)	415	100	48	5	-	-	-	-	-	-	-	-	-	-	-	-	432	102	79	8

Table 10: PM Peak Junction RFC >90% in MSDP Scenario and average delay increase >30 seconds, compared with Reference Case

Junction Location & Approach Arm	Reference Case				Development Case				Development Case (Sensitivity)				Alternative Development Case				Alternative Development Case (sensitivity)			
	Dem. Flow pcu	RFC	Delay	Queue	Dem. Flow pcu	RFC	Delay	Queue	Dem. Flow pcu	RFC	Delay	Queue	Dem. Flow pcu	RFC	Delay	Queue	Dem. Flow pcu	RFC	Delay	Queue
Junction Road/B2113 Keymer Road/B2113 Station Road, Burgess Hill (From Station Road West)	854	102	66	14	866	104	99	21	-	-	-	-	-	-	-	-	-	-	-	-
Junction Road/B2113 Keymer Road/B2113 Station Road, Burgess Hill(From Junction Road North)	442	105	118	13	451	107	169	19	451	107	166	18	454	107	171	19	453	107	167	19
A2300/Northern Arc Spine Road (From N Arc North)	3	0	0	0	503	100	74	9	498	100	61	7	474	101	96	11	473	102	97	12
A2300/Northern Arc Spine Road (From A2300 East)	1369	75	7	0	530	96	42	5	529	97	43	5	562	100	67	9	560	100	62	8
A2300/Northern Arc Spine Road (From N Arc South)	0	0	0	0	670	98	41	6	671	98	41	6	681	100	50	8	685	100	58	9
A264/Kilnwood Vale Access Road (From A264 East)	1891	110	186	84	1974	113	257	116	-	-	-	-	1956	112	229	103	-	-	-	-

Table 11: AM Peak Junction RFC >90% in MSDP Scenario and RFC increase >5%, compared with Reference Case

Junction Location & Approach Arm	Reference Case		Development Case		Development Case (Sensitivity)		Alternative Development Case		Alternative Development Case (sensitivity)	
	Dem. Flow pcu	RFC	Dem. Flow pcu	RFC	Dem. Flow pcu	RFC	Dem. Flow pcu	RFC	Dem. Flow pcu	RFC
A281 Junction, Cowfold (From A272 East)	881	83	999	93	978	91	-	-	-	-
A2220 Junction, Eastbound Copthorne (From A264 Copthorne Way West)	1207	85	1319	92	1314	91	1326	92	-	-
A2300/Northern Arc Spine Road (From Northern Arc North)	3	0	594	106	599	106	637	108	646	108
A2300/Northern Arc Spine Road (From A2300 East)	1368	80	510	103	511	104	549	107	547	106
A2300/Northern Arc Spine Road (From Northern Arc South)	0	0	620	103	615	102	593	104	586	103
A264/Kilnwood Vale Access Road (From A264 West)	2069	69	2186	103	-	-	2167	102	-	-
B2117/B2116 Hurstpierpoint (From B2116 East)	614	63	-	-	-	-	972	101	970	101
B2114 Staplefield Road/B2036 Whitemans Green Junction (From B2036 South)	1298	84	-	-	-	-	1418	91	1421	92
B2115 Junction, Slough Green (From B2114 East)	970	91	-	-	-	-	1070	99	1058	98

Table 12: PM Peak Junction RFC >90% in MSDP Scenario and RFC increase >5%, compared with Reference Case

Junction Location & Approach Arm	Reference Case		Development Case		Development Case (Sensitivity)		Alternative Development Case		Alternative Development Case (sensitivity)	
	Dem. Flow pcu	RFC	Dem. Flow pcu	RFC	Dem. Flow pcu	RFC	Dem. Flow pcu	RFC	Dem. Flow pcu	RFC
B2114 Junction, Handcross (From B2110 North)	894	92	980	100	-	-	946	98	-	-
A2300/Northern Arc Spine Road (From Northern Arc North)	3	0	503	100	498	100	474	101	473	102
A2300/Northern Arc Spine Road (From A2300 East)	1369	75	530	96	529	97	562	100	560	100
A2300/Northern Arc Spine Road (From Northern Arc South)	0	0	670	98	671	98	681	100	685	100
A23/A2300 (From A23 southbound off slip)	760	50	-	-	-	-	1281	93	1280	92

5.6 Proposed Remedial Actions to Mitigate Junction Impacts

Taking into account the 16 highway junctions that were found to fail one of the agreed performance criteria, in Tables 9, 10, 11 and 12, above, further discussions were held with West Sussex CC, Highways England and Mid Sussex DC, in order to agree remedial actions for the MSDP scenarios. Through these discussions, it was decided at which of the identified locations remedial action was considered desirable and achievable, so as to achieve a 'no worse off' outcome, compared with the reference case, at forecast year 2031.

The summary below indicates the rationale used to determine at which of the critical junctions remedial interventions should be developed. This rationale comprises a combination of HE's stance with respect to the strategic road network (i.e. A23 and M23 in Mid Sussex), together with WSCC's stance with respect to the County road network (i.e. primary 'A' roads, secondary 'A' and 'B' roads and other roads).

5.6.1 Junctions Requiring Remedial Mitigation

These are locations at which outline remedial intervention schemes have been drafted, as discussed later in section 6.

SRN Motorway and Trunk Routes

- **A23/A2300 Hickstead**: In Alternative Case & Alternative Case Sensitivity scenarios; PM peak RFC indicates deficient performance, compared with guideline thresholds.

  - HE stance: Mitigation is needed to achieve 'no worse off' outcome.

  - WSCC stance: The increase in RFCs on the southbound off-slip to above 0.9 in the Alternative Development cases is of concern and mitigation is required.

  - Final mitigation proposals for this junction will be subject to the outcomes of further modelling for the A2300 Business Case. It is important that this junction has sufficient capacity to minimise use of unsuitable rural routes.

- Decision: An outline design for a remedial scheme has been developed here; its satisfactory performance has been confirmed using a junction model (see section 6).
- No further model assignment iterations have been undertaken, to incorporate this localised remedial scheme, because it is considered unlikely to cause further re-routing of traffic as explained in section 2.3.5.

Primary Road Network

- **A264/B2028 Copthorne**: In all scenarios; AM peak delay indicates deficient performance, compared with guideline thresholds.
- HE stance: No concern.
- WSCC stance: Committed improvements assumed in MSTS do not include agreed mitigation measures for the strategic development of 500 homes at West of Copthorne, including minor modifications to this junction, also known as the Duke's Head Roundabout.
- We would accept the modifications proposed by developer St Modwen as sufficient mitigation for District Plan development.
- Decision: The WSCC / developer outline design for a remedial scheme here, has been acknowledged as acceptable mitigation; its satisfactory performance has been confirmed using a junction model (see section 6).
- No further model assignment iterations have been undertaken, to incorporate this localised remedial scheme, because it is considered unlikely to cause further re-routing of traffic as explained in section 2.3.5.

- **A264/A2220 Copthorne**: In all scenarios, except Alternative Case Sensitivity; AM peak delay and RFC indicate deficient performance, compared with guideline thresholds.
- HE stance: No concern.

- WSCC stance: Increases in flows and delays at this junction are sufficient to cause concern, albeit only in the Alternative Development case. The mitigation package for the West of Copthorne strategic development includes minor modifications.
- We would accept the modifications proposed by developer St Modwen, given that there appears to be little scope for additional mitigation and problems are confined to the Alternative Development case.
- Decision: The WSCC / developer outline design for a remedial scheme here, has been acknowledged as acceptable mitigation; its satisfactory performance has been confirmed using a junction model (see section 6).
- No further model assignment iterations have been undertaken, to incorporate this localised remedial scheme, because it is considered unlikely to cause further re-routing of traffic as explained in section 2.3.5.

- **A272/A281 Cowfold**: In Development Case & Development Case Sensitivity scenarios only; AM peak RFC indicate deficient performance, compared with guideline thresholds.
  - HE stance: No concern.
  - WSCC stance: Although not flagged on delay criteria, the flow increases exceed our TA threshold and RFCs have increased to more than 0.85. Mitigation is desirable because the A272 at this point is on the Primary Route Network and this junction is in the Cowfold Air Quality Management Area.
  - Advice on the feasibility of mitigation is needed.
  - Decision: An outline design for a remedial scheme here, was developed for a previous MSTS stage and confirmed as acceptable mitigation; however it is no longer required, because satisfactory performance of the existing layout has been confirmed using a junction model (see section 6).

Other 'A' Roads

- **A2300/Northern Arc Spine Road, Burgess Hill**: In all scenarios; AM and PM peak delay and RFC indicate deficient performance, compared with guideline thresholds.

– HE stance: No concern.

– WSCC stance: Given the extent of increases in delay, and the levels of total delay, detailed modelling and full mitigation are required.

– Decision: An outline design for a remedial scheme has been developed here; its satisfactory performance has been confirmed using a junction model (see section 6).

– No further model assignment iterations have been undertaken, to incorporate this substantial remedial scheme, because although it is likely to cause further re-routing of traffic, this could show an open-ended and uncertain outcome, beyond the agreed study scope, as explained in section 2.3.5.

Other 'B' Roads

- **B2117/B2116 Hurstpierpoint**: In Alternative Case & Alternative Case Sensitivity scenarios only; AM peak delay and RFC indicate deficient performance, compared with guideline thresholds.

– HE stance: No concern.

– WSCC stance: The increase in flows is undesirable in this village-centre location, albeit that the level of delay is not excessive and is only a problem in the Alternative Development cases.

– Improvements to the junction are not considered practicable therefore proposals for encouraging traffic to re-route away from this junction should be explored.

– Decision: No remedial scheme has been developed here, given WSCC's advice that wider traffic/demand management should, preferably, be used to relieve

traffic movements at this junction.

- It is judged that excess traffic at Hurstpierpoint could be encouraged to re-route through the A23/A2300 Hickstead junction; the performance of the proposed remedial improvement at the eastern dumbbell roundabout here (see section 6.2.1), has been predicted to entail maximum RFC of <90% in the AM and PM peaks, in the Alternative Cases, on any approach at either of the linked dumbbells; thus confirming that spare capacity would be available here to accommodate the re-routed traffic.

5.6.2 Junctions Not Requiring Remedial Mitigation

These are locations at which outline remedial intervention schemes have not been investigated further, because there are good reasons why improvements are either undesirable, or unachievable.

SRN Motorway and Trunk Routes

- **M23 Junction 11/A264, Pease Pottage**: No performance shortfall has been identified in the transport model scenarios.

- HE stance: No concern.

- WSCC stance: The prospective developer's TA has identified highway mitigation proposals that are acceptable to WSCC and HE.

- The mitigation assumptions in MSTS will need to be documented.

- Decision: No further mitigation scheme has been considered here, given that the developer's proposed remedial improvements for Pease Pottage have been included in the transport model, for the Development Case and Alternative Development Case scenarios.

- With the proposed Pease Pottage improvements modelled, the junction satisfies the performance criteria (RFCs are above 90%, but increase in delay when compared with the reference case is <30 seconds).

Primary Road Network

- **A264/Kilnwood Vale Development Site Access, Crawley**: In Development Case and Alternative Development Case scenarios, only; AM and PM peak delay and AM peak RFC indicate deficient performance, compared with guideline thresholds.

– HE stance: No concern.

– WSCC stance: Although increases in AM peak flow exceed WSCC TA criteria and there are RFCs in excess of 1.0, it is noted that total delay is below 1 minute and hence the case for mitigation is not overwhelming.

– The PM peak flow increase exceeds the TA threshold and total delay increases to over 4 minutes, which is of concern, given that this junction is on a County strategic route. The increases appear to be linked to the Land East of Pease Pottage strategic development, therefore mitigation should be investigated.

– Decision: The model cannot fully replicate the local detail and may not reflect the full capacity for access points at the development site and therefore the model outcomes are insufficiently reliable to justify a firm case for remedial mitigation here.

– A better indication of the network performance and need for mitigation should be sought through the developer's TA for the Pease Pottage site.

- **A272 Rocky Lane/B2112 Fox Hill/Relief Road, Haywards Heath**: No significant performance shortfall has been identified in the transport model scenarios.

– HE stance: No concern.

– WSCC stance: This outcome is unexpected given the proposed neighbourhood plan allocations, nearby, as well as existing peak period queueing. Re-assignment away from the junction is the most likely cause.

- Decision: No remedial scheme has been developed here, given that no performance shortfall, against the agreed criteria, has been identified in the transport model.
- Any unexpected absence of stress, here, is likely to be a consequence of traffic re-assignment and demand response mechanisms within the transport model.

- **A23/A272 Cowfold Road, Bolney**: No significant performance reduction has been identified in the transport model scenarios, compared with Reference Case.
- HE stance: No concern.
- WSCC stance: This outcome is unexpected in view of the existing peak period queueing, mainly on the A23 slip road.
- Decision: No remedial scheme has been developed here, given that no performance shortfall, against the agreed criteria, has been identified in the transport model.
- Any unexpected absence of stress, here, is likely to be a consequence of traffic re-assignment and demand response mechanisms within the transport model.

Other 'A' Roads

- **A273/B2116 Hassocks**: In all scenarios; AM peak delay indicates deficient performance, compared with guideline thresholds.
- HE stance: No concern.
- WSCC stance: The figures show delay increases greater than 1 minute on the A273 in the Alternative Development cases and on this basis mitigation is required to reduce delay increases to below 1 minute.
- However, the signals at this junction are equipped with MOVA, which is not modelled, and balancing of delays may in reality be achieved through this means.
- Decision: The model cannot fully replicate the local detail and true capacity of

the traffic signals at this junction, which operate under MOVA control.

– As the model outcomes are insufficiently reliable to justify remedial mitigation here, it is judged that MOVA is the best solution to delay problems at the junction.

Other 'B' Roads

- **B2110/B2115 Leechpond Hill**: In all scenarios, except Alternative Case Sensitivity; AM peak delay indicates deficient performance, compared with guideline thresholds.

– HE stance: No concern.

– WSCC stance: Total delay does not exceed 2 minutes in any scenario.

– No mitigation required.

– Decision: No remedial scheme has been developed here, given WSCC's advice that the performance reduction is not sufficiently great, compared with Reference Case.

- **B2028 West Park Road/B2037 Effingham Road**: In Development Case Sensitivity scenario, only; AM peak delay indicates deficient performance, compared with guideline thresholds.

– HE stance: No concern.

– WSCC stance: This junction is located in Surrey and has been upgraded from a (major/minor priority) crossroads to a roundabout relatively recently. As the model may not incorporate the current layout, it may misrepresent this junction as a stress location by not allowing for the capacity of the roundabout.

– It is recommended that Surrey County Council be approached for design details of the new (roundabout) junction, so that the likelihood of stress occurring can be assessed.

- Decision: Surrey CC were approached but were unable to provide suitable design drawings of the roundabout, for accurate junction modelling. Therefore, no remedial scheme has been developed.

- Given that the performance shortfall here, with the previous priority junction, is an increase in delay of only 33 seconds from the Reference Case (acceptable threshold is 30 seconds) and the new roundabout has 2-lane flared entries on all arms and 2-lanes circulating, it is judged that the performance of the current roundabout is likely to be acceptable in all MSDP scenarios, without any need for mitigation.

- **B2036 London Road/Whitemans Green/Ardingly Road**: In Alternative Development Case and Sensitivity scenarios, only; AM peak delay indicates deficient performance, compared with guideline thresholds.

- HE stance: No concern.

- WSCC stance: Although the increase in delays is less than 1 minute, total delay exceeds 3 minutes. Only the minor arm is affected and only in the Alternative Development cases.

- Undertaking physical mitigation would encourage more through-traffic onto this part of the network which would be undesirable and is therefore not considered to be justified.

- Decision: No remedial scheme has been developed here, given WSCC's advice that wider traffic/demand management should, preferably, be used to discourage through-traffic movements at this local, non-strategic, junction.

- **B2114 Staplefield Road/B2036 Whitemans Green**: In Alternative Development Case and Sensitivity scenarios, only; AM peak RFC indicates deficient performance, compared with guideline thresholds.

- HE stance: No concern.

- WSCC stance: No concerns specified.

- As above, undertaking physical mitigation is not justified, as it would encourage more through-traffic onto this part of the network which would be undesirable.
- Decision: No remedial scheme has been developed here, given WSCC's previous advice that wider traffic/demand management should, preferably, be used to discourage through-traffic movements at this local, non-strategic, junction.

- **B2110/B2028 Turners Hill**: In Alternative Development Case Sensitivity scenario, only; AM peak delay indicates deficient performance, compared with guideline thresholds.
  - HE stance: No concern.
  - WSCC stance: At less than 20 vehicles (per hour, extra), the increase in flow is under the TA threshold and total delay is under 2 minutes.
  - Mitigation is not considered to be justified.
  - Decision: No remedial scheme has been developed here, given WSCC's advice that the performance reduction is not sufficiently great, compared with Reference Case.
- **Junction Road/B2113 Keymer Road/B2113 Station Road, Burgess Hill**: All scenarios; PM peak delay indicates deficient performance, compared with guideline thresholds.
  - HE stance: No concern.
  - WSCC stance: The modelled flow increase is under the TA threshold and the increase in total delay is less than 1 minute. This junction is identified for improvement using funding from existing S106, but mitigation is not justified by the modelling results from the MSTS.
  - This location is outside of the scope (for accurately representing local traffic characteristics) of the strategic model. If mitigation cannot be reliably assessed within the study and the forecast flow increase is below WSCC's TA thresholds,

mitigation will have to be addressed through development TA's.

- The scope for increasing the capacity of the Station Road corridor is limited, (so any remedial intervention) should concentrate on options for accessing the town centre and rail station by sustainable modes.

- Decision: No remedial scheme has been developed here, given WSCC's advice that the performance reduction is not sufficiently great, compared with Reference Case.

- Also, the model is not sufficiently refined in Burgess Hill town centre to enable accurate prediction of MSDP impacts here, at a localised scale.

- **B2114/B2115 Slough Green**: In Alternative Development Case and Sensitivity scenarios, only; AM peak RFC indicates deficient performance, compared with guideline thresholds.

- HE stance: No concern.

- WSCC stance: This is a minor route and physical mitigation would encourage more through-traffic to use it, which would be undesirable.

- Mitigation is therefore not justified.

- Decision: No remedial scheme has been developed here, given WSCC's advice that wider traffic/demand management should, preferably, be used to discourage through-traffic movements at this local, non-strategic, junction.

- **B2110/B2114 Handcross**: In Development Case and Alternative Development Case scenarios, only; PM peak RFC indicates deficient performance, compared with guideline thresholds.

- HE stance: No concern.

- WSCC stance: The B2110 is a popular rural rat-run route and we would not want to see further use encouraged. Improvement of this junction might also add to flows and delays in Handcross High Street.

- For these reasons, mitigation is not considered desirable.
- Decision: No remedial scheme has been developed here, given WSCC's advice that wider traffic/demand management should, preferably, be used to discourage through-traffic movements at this local junction.

- **B2113 Station Road/Church Road/Mill Road, Burgess Hill**: No significant performance shortfall has been identified in the transport model scenarios.

- HE stance: No concern.
- WSCC stance: As the advice received is that mitigation at this location cannot be reliably assessed within the study, this means that the possible need for mitigation will have to be re-examined through development TA's.
- As the scope for increasing the capacity of the Station Road corridor is limited, (any remedial intervention) should concentrate on options for accessing the town centre and rail station by sustainable modes. The junction is not on a route where providing significant additional capacity for through movements from the Local Plan strategic sites would be desirable.
- Decision: No remedial scheme has been developed here, given that no performance shortfall, against the agreed criteria, has been identified in the transport model.
- Also, the model is not sufficiently refined in Burgess Hill town centre to enable accurate prediction of MSDP impacts here, at a localised scale.

5.7 Analysis of Traffic Impact at M23/A23 Grade Separated Junctions

An assessment has been made of the layout standard that would be required at the entry merging and exit diverging slip roads, at M23 and A23 grade-separated junctions, in the respective MSTS S3 scenarios, during AM and PM peaks at 2031.

5.7.1 Layout Improvement required in all MSDP Scenarios, including Reference Case

Junctions where layout improvements would be needed in the Development Case or Alternative Development Case and also in the Reference Case are itemised below. At these SRN locations, the mitigation would already be needed in the Reference Case at 2031, without MSDP in place, so this 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.

- *M23 J9 Gatwick*

– Northbound exit diverging slip in the AM peak;

– Northbound entry merging slip and southbound exit diverging slip in the AM and PM peaks;

– Southbound entry merging slip in the PM peak;

- *M23 J10 Copthorne*

– Southbound exit diverging slip in the AM and PM peaks;

- *M23 J11 Pease Pottage*

– Northbound exit diverging slip in the PM peak;

- *A23 / B2115 Warninglid*

– Northbound exit diverging upstream mainline in the AM peak;

- *A23 / A2300 Hickstead*

– Northbound exit diverging upstream mainline in the AM peak;

– Southbound exit diverging downstream mainline in the PM peak;

– Southbound entry merging upstream and downstream mainline in the PM peak;

- *A23 / B2118 Sayers Common*

– Northbound entry merging downstream mainline in the AM peak;

– Southbound exit diverging upstream mainline in the PM peak;

- *A23 / B2117 Hurstpierpoint*

– Northbound exit diverging upstream mainline in the AM peak;

– Southbound entry merging downstream mainline in the PM peak;

- *A23 / A281 Red House*

– Northbound exit diverging upstream and downstream mainline in the AM peak;

– Southbound entry merging upstream and downstream mainline in the PM peak;

- *A23 / A273 Pyecombe*

– Northbound exit diverging downstream mainline in the AM peak;

– Northbound entry merging upstream and downstream mainline in the AM peak;

– Southbound exit diverging upstream and downstream mainline in the PM peak;

– Southbound entry merging upstream and downstream mainline in the AM and PM peaks.

5.7.2 Layout Improvement required in Development Case Scenario, but not in Reference Case

There were no SRN junctions where layout improvements would be needed in the Development Case, but not in the Reference Case.

5.7.3 Layout Improvement required in Alternative Development Case Scenario, but not in Reference Case

There were several junctions where layout improvements would be needed in the Alternative Development Case, but not in the Reference Case, as follows:

- *A23 / B2115 Warninglid*

– Northbound exit diverging upstream mainline in the PM peak;

- *A23 / A2300 Hickstead*

– Northbound exit diverging upstream mainline in the PM peak;

- *A23 / B2118 Sayers Common*

– Northbound entry merging upstream mainline in the AM peak;

– Northbound entry merging downstream mainline in the PM peak;

– Southbound exit diverging downstream mainline in the PM peak;

- *A23 / B2117 Hurstpierpoint*

– Southbound entry merging upstream mainline in the PM peak;

- *A23 / A281 Red House*

– Northbound exit diverging upstream mainline in the PM peak;

- *A23 / A273 Pyecombe*

– Northbound exit diverging downstream mainline in the PM peak;

– Northbound entry merging upstream and downstream mainline in the PM peak;

At the above SRN locations, mitigation would not be needed in the Reference Case, so they could be a constraint on the Alternative Development Case MSDP scenario being delivered. Resolving these issues would probably be a condition for approval of the Alternative Development Case.

5.8 Analysis of Traffic Flows through Ashdown Forest

5.8.1 Overview

An assessment was made of whether or not the levels of development in the various MSDP scenarios 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.

The Habitats Regulations Assessment for the District Plan identified a potential impact on the Ashdown Forest SAC as a result of atmospheric pollution. This impact

would arise from increased traffic emissions as a consequence of new development. The threshold for determining significant traffic impact upon air quality was set in the Habitats Regulations Assessment, using the Department for Transport's Design Manual for Roads and Bridges (DMRB). The threshold was defined as a 2-way flow increase of 1,000 vehicles or more, annual average daily traffic (AADT).

5.8.2 Scope of Assessment

The MSTS S3 model included 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).

Owing to the strategic nature of the MSTS and the location of Ashdown Forest on the north east periphery of the network, the model could not provide meaningful flow assignments for B2188, B2026 or Coleman's Hatch Road. These links were added into the 2008 West Sussex model for the purpose of the MSTS S3 study, but the zoning was too coarse to enable reliable traffic assignment, here, in the model.

However, an assessment was made of future traffic impacts on A275, A22, A26 and B2110, which pass by, or through, Ashdown Forest. The assessment represented a 'worst case' for these routes, which were modelled as carrying additional traffic that might otherwise travel on B2118, B2026 and Coleman's Hatch Road, within the SAC.

Representative local flow factors were used to convert AM peak hour model outputs, at 2031, to AADT. Synthesised PM peak hour flows were not used, because the PM results had not been assembled from the same robust, multi-modal and variable

demand assignment as the AM. The resulting AADT flows on the Ashdown Forest routes in the forecast District Plan scenarios were compared with the Reference Case.

The modelled scenario outputs did not include proposed remedial interventions, identified in section 5.6 above as solutions to a shortfall in predicted performance of the highway network.

5.8.3 Assessment Findings

Outcomes from the Ashdown Forest analysis are shown in Table 13. It shows that there would be a small AADT increase in Ashdown Forest, at 2031, on A26 with the Alternative Development Case and Sensitivity, but these increases would fall a long way short of the threshold measure of significance, namely a flow increase of 1,000 vehicles or more, 2-way AADT, when compared with the forecast Reference Case.

It is evident that the Mid Sussex District Plan, as represented in MSTS S3, would not cause traffic flows on the key routes to impact significantly upon Ashdown Forest.

In fact, the District Plan scenarios with remedial mitigation would generally result in a modest reduction (or only a very slight increase) in traffic on the assessed routes in Ashdown Forest.

Table 13: Daily Traffic Impact on Ashdown Forest Highway Routes

Road Link Section	Two-Way Annual Average Daily Traffic Flow (Vehicles)				
	Reference Case	Development Case with P&S Interventions	Alternative Development Case with P&S Interventions	Development Case Sensitivity with P&S Interventions	Alternative Development Case Sensitivity with P&S Interventions
Two-Way Annual Average Daily Traffic Flow (Vehicles)					
A275	7535	7208	7166	7207	7143
A22	6337	6055	5928	6015	5881
A26	4300	4141	4314	4170	4328
B2110	2467	2191	2216	2227	2237
Two-Way AADT Change from Reference Case (Vehicles)					
A275	-	-328	-369	-328	-392
A22	-	-281	-409	-322	-455
A26	-	-159	14	-131	28
B2110	-	-275	-251	-240	-230

5.9 Analysis of Traffic Flows through Ansty

5.9.1 Scope of Assessment

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.

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.

5.9.2 Assessment Findings

Modelled flow comparisons for the Ansty eastern screen-line are shown in Table 14. Similarly, modelled flow comparisons for the Ansty western screen-line are shown in Table 15.

Table 14: Daily Traffic Flows across Ansty Eastern Screen-Line

Road Link Section	Two-Way Annual Average Daily Traffic Flow (Vehicles)				
	Reference Case	**Development Case with P&S Interventions**	**Alternative Development Case with P&S Interventions**	**Development Case Sensitivity with P&S Interventions**	**Alternative Development Case Sensitivity with P&S Interventions**
Two-Way Annual Average Daily Traffic Flow (Vehicles)					
A273 Jane Murray Way (A2300 to Sussex Way)	17665	15086	16320	15061	16242
Northern Arc Spine Road (A2300 to B2036)	39	16153	16814	16194	16803
B2036 Harvest Hill (Fairplace Bridge to Cuckfield Road)	12179	12683	12841	12691	12803
A272 (Ansty to Cuckfield)	27762	26311	26381	26319	26370
B2114 Staplefield Road (Slough Green to Cuckfield)	20201	20580	20757	20272	20397
Total Screen-Line Flow	**77848**	**90812**	**93113**	**90537**	**92615**
Two-Way AADT Change from Reference Case (Vehicles)					
A273 Jane Murray Way (A2300 to Sussex Way)	-	-2580	-1346	-2604	-1423
Northern Arc Spine Road (A2300 to B2036)	-	16113	16775	16155	16763
B2036 Harvest Hill (Fairplace Bridge to Cuckfield Road)	-	504	661	512	624
A272 (Ansty to Cuckfield)	-	-1451	-1381	-1443	-1392
B2114 Staplefield Road (Slough Green to Cuckfield)	-	378	556	70	196
Total Screen-Line Flow	-	**12964**	**15265**	**12689**	**14768**

Table 15: Daily Traffic Flows across Ansty Western Screen-Line

Road Link Section	Two-Way Annual Average Daily Traffic Flow (Vehicles)				
	Reference Case	**Development Case with P&S Interventions**	**Alternative Development Case with P&S Interventions**	**Development Case Sensitivity with P&S Interventions**	**Alternative Development Case Sensitivity with P&S Interventions**
Two-Way Annual Average Daily Traffic Flow (Vehicles)					
A2300 (Cuckfield Road to Pookbourne Lane)	34048	43878	47059	43801	46979
A272 Bolney Road (Bishopstone Lane to Stairbridge Lane)	18765	18380	18811	18279	18759
B2115 Slough Green Lane (B2114 to A23)	13292	13715	13994	13669	13961
Total Screen-Line Flow	**66105**	**75973**	**79865**	**75748**	**79698**
Two-Way AADT Change from Reference Case (Vehicles)					
A2300 (Cuckfield Road to Pookbourne Lane)	-	9830	13011	9752	12931
A272 Bolney Road (Bishopstone Lane to Stairbridge Lane)	-	-385	46	-486	-6
B2115 Slough Green Lane (B2114 to A23)	-	423	703	377	669
Total Screen-Line Flow	-	**9868**	**13760**	**9644**	**13594**

From Tables 14 and 15, the following general trends can be identified regarding traffic flows around Ansty village:

- In the development case and sensitivity there will be a balanced flow of roughly 80,000 vehicles (2-way AADT) crossing the east and west screen-lines. With the alternative development case and sensitivity this will be around 85,000;
- Across both east and west screen-lines, the total 2-way AADT flow, compared with the reference case, will be approximately 10,000 vehicles greater in the development case with P&S and remedial interventions and 14,000 vehicles greater in the alternative development case with P&S and remedial interventions. – This shows that the additional development will draw more traffic through the corridor; and
- The majority of the flow increase above the reference case in both the development case and alternative, 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.

5.10 Analysis of Traffic flows through Ditchling

The model outputs have been analysed to assess the impact upon the junctions in Ditchling in Lewes District. Performance of the core local highway network in the various scenarios at AM and PM 2031 are shown in Table 16.

Table 16: Highway Junctions RFC >100% in MSDP Scenarios

Road Junction Location	2031 AM Peak RFC (Most Congested Arm)					2031 PM Peak RFC (Most Congested Arm)				
	RDC	**DC**	**AC**	**DSC**	**ASC**	**RDC**	**DC**	**AC**	**DSC**	**ASC**
B2112/B2116	49.8%	46.4%	52.3%	46.8%	52.3%	58.8%	56.6%	54.2%	56.3%	53.6%
B2112/Beacon Road	92.1%	79.0%	88.7%	80.3%	88.7%	80.4%	69.3%	69.1%	69.0%	67.5%

RDC - Reference Development Case
DC - Development Case with P&S Schemes
AC - Alternative Case with P&S Schemes
DSC - Development Sensitivity Case with P&S Schemes
ASC - Alternative Sensitivity Case with P&S Scheme

Table 16 shows that the Mid Sussex District Plan, as represented in MSTS S3, would have little or no impact on junctions in Ditchling. The reason for this is likely to be traffic seeking alternative routes/modes within the model assignments, as a consequence of impacts elsewhere on the network.

There are several reasons why the MSDP scenarios would be unlikely to cause an adverse traffic impact through Ditchling, at 2031, as confirmed by the transport model outcomes, specifically:

- A number of significant primary and secondary remedial transport interventions have been agreed to be necessary in the MSDP scenarios (Development Case, Alternative Development Case and Sensitivities), which would not otherwise be forthcoming in the Reference Case and which would tend to reduce demand for traffic movements through Ditchling, between Mid Sussex, Brighton and Lewes and which would encourage traffic to use the strategic road network, primary 'A' roads and public transport, instead; these interventions include:

– A2300 corridor capacity improvements between A23, Burgess Hill and Haywards Heath;

– Northern Arc spine road, between A2300 and A273(N), Burgess Hill;

– Traffic restraint on B2036, between Burgess Hill and Ansty;

– District-wide bus service frequency and connectivity improvements;

- Junction capacity enhancements on A273, around Burgess Hill; and
- Smarter choices travel initiatives and car parking controls, to discourage car use, in Burgess Hill and Haywards Heath.

- At the same time, congestion at the A273 / B2116 Stonepound Crossroads, Hassocks, in the Reference Case and MSDP scenarios, would tend to discourage traffic movements, between A23 and Burgess Hill / Lewes, from using the local road network, e.g. through Ditchling. This congestion at Hassocks could most easily be managed using MOVA at the traffic signals (see 5.62).

5.11 Analysis of Traffic flows through Hassocks

5.11.1 Overview

An assessment has been made of whether or not the levels of development proposed by the MSDP would impact upon the Stone Pound Crossroads (A273 / B2116 junction) Air Quality Management Area (AQMA) in Hassocks.

This area was designated an Air Quality Management Area (AQMA) with DEFRA in March 2012, owing to the measured levels of nitrogen dioxide being above the objective.

The main reasons for the crossroads being affected by air pollution are the volumes of road traffic and the stop start routine of driving conditions at peak times, caused by the queuing traffic at the traffic lights. Therefore, an assessment has been made of the future traffic impacts on the A273 and B2116 which pass through Stone Pound Crossroads.

5.11.2 Scope of Assessment

The flows, queues and delays through the Hassocks AQMA area are shown in Table 17, Table 18 and Table 19, respectively. Note that the traffic flows shown are 'actual' flows (i.e. vehicles arriving at the junction approaches, during the peak periods) and are not pcu 'demand' flows, as shown in Tables 11, 12, 13 and 14.

Table 17: Traffic Inflows at Stone Pound Crossroads

Entry Arm	AM Peak 2031 (Actual Flows veh/hr)				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	685	666	676	666	674
B2116 (eastern approach, westbound flow)	585	579	598	580	597
A273 (northern approach, southbound flow)	495	518	527	520	526
A273 (southern approach, eastbound flow)	421	383	390	384	389
Entry Arm	**Synthesised PM Peak 2031 (Actual Flows veh/hr)**				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	601	599	609	597	607
B2116 (eastern approach, westbound flow)	602	597	609	599	608
A273 (northern approach, southbound flow)	581	578	578	578	581
A273 (southern approach, eastbound flow)	508	498	463	496	463
Entry Arm	**AM Peak 2031 (Flow Change from Reference Case)**				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	-	-19	-9	-19	-11
B2116 (eastern approach, westbound flow)	-	-6	13	-5	12
A273 (northern approach, southbound flow)	-	23	32	25	31
A273 (southern approach, eastbound flow)	-	-38	-31	-37	-32
Entry Arm	**Synthesised PM Peak 2031 (Flow Change from Reference Case)**				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	-	-3	7	-4	6
B2116 (eastern approach, westbound flow)	-	-6	7	-3	5
A273 (northern approach, southbound flow)	-	-3	-3	-3	0
A273 (southern approach, eastbound flow)	-	-10	-45	-12	-46

Table 18: Traffic Queues at Stone Pound Crossroads

Entry Arm	AM Peak 2031 (metres)				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	243	274	304	275	297
B2116 (eastern approach, westbound flow)	128	109	163	113	161
A273 (northern approach, southbound flow)	100	126	152	132	150
A273 (southern approach, northbound flow)	142	123	138	126	136
Entry Arm	**Synthesised PM Peak 2031 (metres)**				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	174	166	194	162	190
B2116 (eastern approach, westbound flow)	176	160	197	167	192
A273 (northern approach, southbound flow)	223	218	214	218	224
A273 (southern approach, northbound flow)	147	130	131	125	130
Entry Arm	**AM Peak 2031 (metres Change from Reference Case)**				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	-	31	60	32	54
B2116 (eastern approach, westbound flow)	-	-18	36	-14	34
A273 (northern approach, southbound flow)	-	26	53	32	50
A273 (southern approach, northbound flow)	-	-19	-4	-16	-6
Entry Arm	**Synthesised PM Peak 2031 (metres Change from Reference Case)**				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	-	-8	21	-12	17
B2116 (eastern approach, westbound flow)	-	-16	21	-10	16
A273 (northern approach, southbound flow)	-	-5	-8	-4	1
A273 (southern approach, northbound flow)	-	-17	-15	-22	-17

Table 19: Traffic Delays at Stone Pound Crossroads

Entry Arm	AM Peak 2031 (seconds/pcu)				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	246	293	324	294	317
B2116 (eastern approach, westbound flow)	144	124	185	129	182
A273 (northern approach, southbound flow)	146	178	210	185	207
A273 (southern approach, northbound flow)	235	222	248	227	245
Entry Arm	**Synthesised PM Peak 2031 (seconds/pcu)**				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	198	189	221	185	216
B2116 (eastern approach, westbound flow)	200	182	224	189	218
A273 (northern approach, southbound flow)	296	290	284	290	296
A273 (southern approach, northbound flow)	200	178	195	171	193
Entry Arm	**AM Peak 2031 (seconds/pcu Change from Reference Case)**				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	-	47	78	48	71
B2116 (eastern approach, westbound flow)	-	-19	41	-15	39
A273 (northern approach, southbound flow)	-	32	65	39	62
A273 (southern approach, northbound flow)	-	-14	13	-8	10
Entry Arm	**Synthesised PM Peak 2031 (seconds/pcu Change from Reference Case)**				
	Reference Case	**Development Case**	**Alternative Development Case**	**Development Sensitivity Case**	**Alternative Development Sensitivity Case**
B2116 (western approach, eastbound flow)	-	-8	23	-13	19
B2116 (eastern approach, westbound flow)	-	-18	23	-11	18
A273 (northern approach, southbound flow)	-	-6	-12	-5	1
A273 (southern approach, northbound flow)	-	-22	-5	-29	-8

5.11.3 Assessment Findings

The flows thorough the Stone Pound crossroads AQMA are shown to be higher in the PM than the AM peak hour (B2116 Western approach, eastbound aside). However, the PM peak assignments have been undertaken using the SATURN highway model only, not the full multi-modal mechanisms (e.g. destination choice and mode choice). Hence, the PM outcomes are not wholly reliable.

The junction queue and delay outcomes indicate that the MS District plan would not cause a significant impact at Stone Pound Crossroads. In fact, the MSDP scenarios would generally result in only a very slight increase during the AM peak and a modest reduction during the PM peak. The reason for this is likely to be traffic seeking alternative routes/modes within the model assignments, as a consequence of impacts elsewhere on the network.

6 Outline Remedial Mitigation Schemes for MSDP

6.1 Overview

Drawing together the findings from the assessment of highway network performance, as predicted in section 5.6, under the various MSDP forecast scenarios, at 2031, outline remedial scheme designs have been drafted for the road junctions where further mitigation was agreed to be desirable and achievable.

In summary, the junctions where remedial intervention was judged to be necessary were as follows:

- A23/A2300 Hickstead:
  - In Alternative Case & Alternative Case Sensitivity; PM peak.
- A264/B2028 Copthorne:
  - In all scenarios; AM peak.
- A264/A2220 Copthorne:
  - In all scenarios except Alternative Case Sensitivity; AM peak.
- A2300/Northern Arc Spine Road, Burgess Hill:
  - In all scenarios; AM and PM peaks.

6.2 Outline Remedial Scheme Designs

Figures 1, 2, 3 and 4 show the proposed and tested outline designs, for the junctions where mitigation of the likely MSDP impacts would be required, namely at A23/A2300, A264/B2028, A264/A2220 and A2300/Northern Arc Spine, respectively.

Figure 1: A23 Southbound/A2300/Hickstead Lane/Jobs Lane, Eastern Dumbbell, Hickstead

Figure 2: A264 Copthorne Common Road/Snow Hill/B2028 Turners Hill Road, Duke's Head

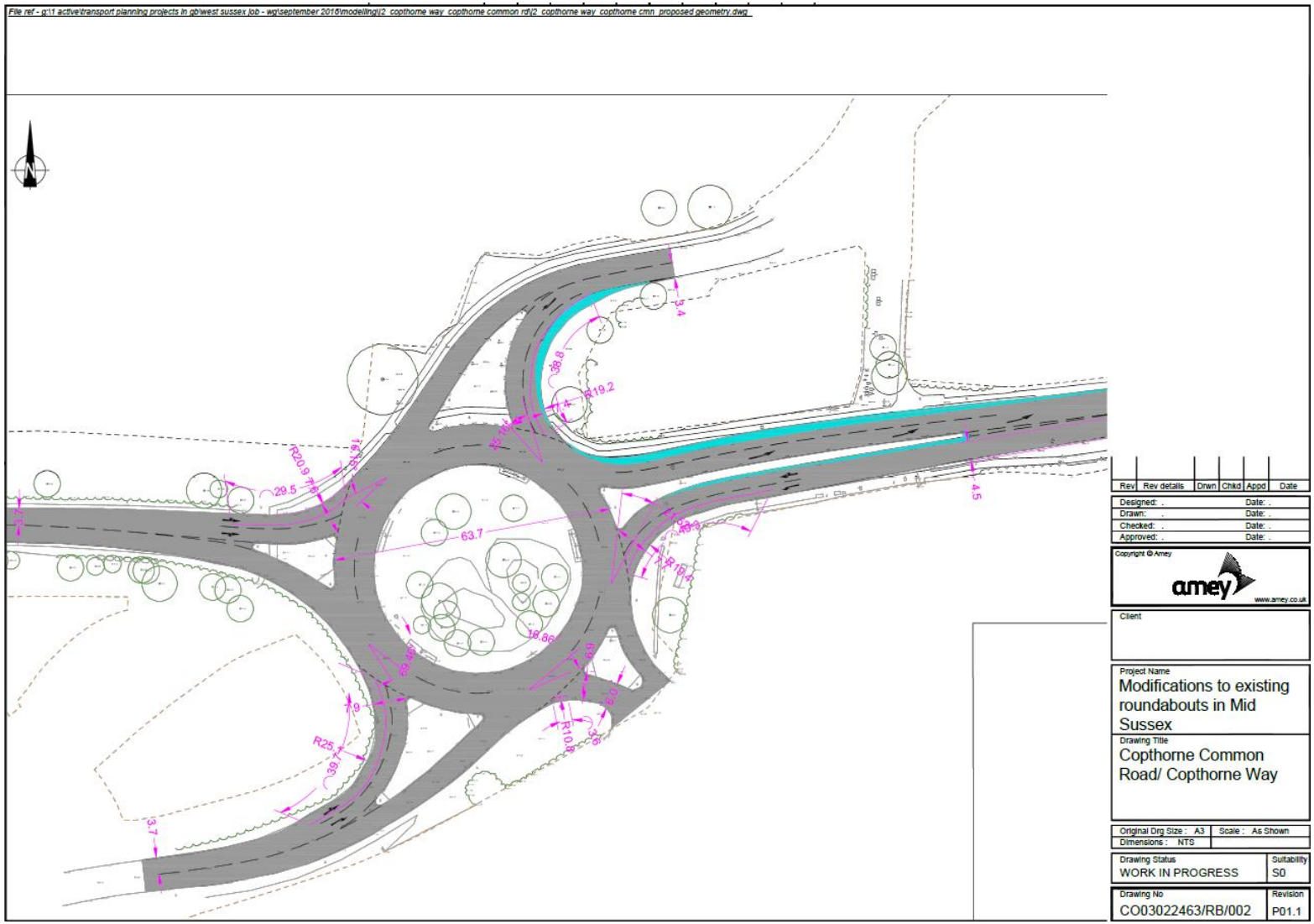

Figure 3: A264 Copthorne Way/Brookhill Road/A2220 Copthorne Road, Copthorne

Figure 4: A2300/Northern Arc Spine Road (Proposed), Burgess Hill

6.2.1 Limitations of Outline Scheme Layout Designs

Note that the geometric details of the scheme layouts have not been finely developed or their safety verified, at this stage, because the outline layouts are intended only to indicate that the improvements are feasible within the constraints of the sites and the existing infrastructure.

The finer details of the mitigation schemes would be developed and verified once components, commitments, procedures and approvals are in place to deliver the initiatives. The detailed layout designs would be prepared and agreed between the scheme developer, local highway authority (West Sussex County Council) and local district planning authority (Mid Sussex District Council), potentially through a S106 agreement (Town and Country Planning Act 1990) and S278 agreement (Highways Act 1980), so as to achieve satisfactory design standards.

6.2.2 Key Features of Remedial Schemes

The main design features of each of the proposed outline remedial schemes for MSDP are summarised below.

A23 Southbound/A2300/Hickstead Lane/Jobs Lane, Eastern Dumbbell, Hickstead

Key characteristics of the proposed improvement at A23/A2300 Hickstead (Figure 1) would comprise the following:

- Existing roundabout layout is largely retained;
- Signalising of three main approaches (which could be for part-time peak operations);
- Left slip free-flow lane, from A23 southbound off-slip to A2300 eastbound;
- Removal of north stub arm to accommodate free-flow left lane;
- Widening of A2300 to dual 2-lane carriageway; (the eastern arm approach and exit at the revised junction would tie into the proposed dual carriageway widening scheme, as proposed for the A2300 by WSCC, rather than into the

existing A2300);

- Roundabout layout designed to fit within constraints of A23 over bridge and hotel access arm;
- Satisfactory swept-paths have been achieved, for an articulated 'design' vehicle with a single axle at the rear of the trailer (length 15.5metres); and
- Satisfactory layout capacity design (preliminary) has been achieved and checked for successful operation, using LINSIG, with maximum RFC <90% and predicted 2031 traffic flows.
- Further development of the junction design will need to include a safe cycle and pedestrian access to the signed cycle route on Jobs Lane to the northeast of the junction, crossing the proposed left slip lane.

A264 Copthorne Common Road/Snow Hill/B2028 Turners Hill Road, Duke's Head

Key characteristics of the proposed improvement at A264/B2028 Duke's Head (Figure 2) would comprise the following:

- Proposed roundabout layout design is retained from Peter Brett Associates; as provisionally approved in outline by West Sussex County Council, according to their following requirements – 'The implementation of capacity improvements at the A264 Copthorne Way/B2028 Dukes Head roundabout broadly in accordance with PBA drawing no. 24205/014/004 but with full details to be submitted and approved by the LPA';
- Localised widening is required as an enhancement to PBA elongated roundabout design, (as delineated in blue on the outline drawing, Figure 2);
- The extent of widening, shown as additional carriageway in blue highlight in Figure 2, is simply to ensure a safe and effective layout, by providing appropriate entry flare, entry deflection and swept path, where possible;

- It may also be necessary to consider a mandatory localised speed limit (reduced from 50mph) around the junction, or signals on the A264E approach, so as to reduce risk where deflection is reduced;
- Roundabout and elongated central island have been configured, where possible, to provide appropriate deflection of vehicles entering the junction, in terms of entry path curvature, which governs the speed of vehicles on approaches and promotes drivers to give way to the circulating vehicles; however, the mitigation scheme, as shown, would not achieve sufficient deflection for vehicles entering the roundabout from A264 west (Copthorne Common Road), nor from A264 east (Snow Hill); these deficiencies would need to be resolved during detailed design;
- Satisfactory swept-paths have been achieved, for an articulated 'design' vehicle with a single axle at the rear of the trailer (length 15.5metres); and
- Satisfactory layout capacity design (preliminary) has been achieved and checked for successful operation, using ARCADY 9, with maximum RFC <90% and predicted 2031 traffic flows.
- Assumed safety features to be incorporated in the proposed roundabout design:

– It would be sited on level ground or in sags, rather than at or near crests, so as to avoid difficulty for drivers appreciating the layout when approaching on an up gradient;

– Materials used on roundabout approaches would have suitable skidding and deformation resistance (designed in accordance with AADT axle numbers);

– Visibility on the approach (Desirable Minimum Stopping Sight Distance for the design speed of the road) would conform to TD 9 (DMRB 6.1.1), with the position of the object at the give-way line indicated;

– Appropriate advanced junction signage and road markings would be provided on approaches.

–

A264 Copthorne Way/Brookhill Road/A2220 Copthorne Road, Copthorne

Key characteristics of the proposed improvement at A264/A2220 Copthorne (Figure 3) would comprise the following:

- Proposed roundabout layout design is retained from Peter Brett Associates;
- Localised widening is required as an enhancement to PBA elongated roundabout design, (as delineated in blue on the outline drawing, Figure 3);
- The extent of widening on A264 eastern arm, shown as additional carriageway in blue highlight in Figure 3, is simply to ensure a safe and effective layout, by providing appropriate entry flare, entry deflection, exit-merge (into a single lane) and swept path;
- It may also be necessary to consider a mandatory localised speed limit (reduced from 50mph) around the junction, so as to reduce risk to pedestrians where verge widths are reduced;
- Roundabout and elongated central island have been configured to provide appropriate deflection of vehicles entering the junction, in terms of entry path curvature, which governs the speed of vehicles on approaches and promotes drivers to give way to the circulating vehicles;
- Satisfactory swept-paths have been achieved, for an articulated 'design' vehicle with a single axle at the rear of the trailer (length 15.5metres); and
- Satisfactory layout capacity design (preliminary) has been achieved and checked for successful operation, using ARCADY 9, with maximum RFC <90% and predicted 2031 traffic flows.
- Assumed safety features in the proposed roundabout design:

– It would be sited on level ground or in sags, rather than at or near crests, so as to avoid difficulty for drivers appreciating the layout when approaching on an up gradient;

– Materials used on roundabout approaches would have suitable skidding and

deformation resistance (designed in accordance with AADT axle numbers);

- Visibility on the approach (Desirable Minimum Stopping Sight Distance for the design speed of the road) would conform to TD 9 (DMRB 6.1.1), with the position of the object at the give-way line indicated;
- Appropriate advanced junction signage and road markings would be provided on approaches.

A2300/Northern Arc Spine Road (Proposed), Burgess Hill

Key characteristics of the proposed improvement at A2300/Northern Arc Spine Road Burgess Hill (Figure 4) would comprise the following:

- Proposed layout design would entail a large normal roundabout (ICD 80m), designed (geometry only) in accordance with DMRB Vol 6 (Road Geometry section 2 Junctions), Part 3 TD 16/07, 'Geometric Design of Roundabouts';
- Widening is required to dual 2-lane carriageway standard on A2300 west;
- Concept design has focussed on accommodating vehicles and HGV as primary users of the junction;
- No crossing points for vulnerable users have been considered; however, signal-controlled crossings, appropriate for this type of roundabout, would be preferred, in accordance with AADT flows on busiest arm (see TD 16/07, 'Selection of Roundabout Type and Recommended Provision for NMU's', Table 6/1);
- Roundabout has been configured to provide appropriate deflection of vehicles entering the junction, in terms of entry path curvature, which governs the speed of vehicles on approaches and promotes drivers to give way to the circulating vehicles;
- Satisfactory swept-paths have been achieved, for an articulated 'design' vehicle with a single axle at the rear of the trailer (length 15.5metres); and
- Satisfactory layout capacity design (preliminary) has been achieved and checked for successful operation, using ARCADY 9, with maximum RFC <90% and

predicted 2031 traffic flows.

- Assumed safety features to be incorporated in the proposed roundabout design:

— It would be sited on level ground or in sags, rather than at or near crests, so as to avoid difficulty for drivers appreciating the layout when approaching on an up gradient;

— Materials used on roundabout approaches would have suitable skidding and deformation resistance (designed in accordance with AADT axle numbers);

— Visibility on the approach (Desirable Minimum Stopping Sight Distance for the design speed of the road) would conform to TD 9 (DMRB 6.1.1), with the position of the object at the give-way line indicated;

— Appropriate advanced junction signage and road markings would be provided on approaches.

A272/A281 Cowfold

As indicated in section 5.6.1, the potential requirement for mitigation at Cowfold was dismissed, because further analysis of the A272/A281 junction operation, using a detailed junction model, showed the following outcome:

- Satisfactory layout capacity within the existing highway junction configuration has been achieved and checked for successful operation, using ARCADY 9, with maximum RFC <90% and predicted 2031 traffic flows.

6.2.3 Indicative Construction Cost of Remedial Schemes

A broad estimate has been made of the likely indicative costs of constructing each of the proposed remedial schemes for MSDP. These costs are itemised below.

A23/A2300 Hickstead

Table 20 shows the indicative construction cost for the A23/A2300 Hickstead mitigation scheme.

Table 20: Indicative Cost of Junction Improvement at A23/A2300

Cost Item	Value
Construction	£776,015
Preliminaries (5%)	£40,842
Sub Total Construction	£816,858
Land	Not Included (will need to be factored in)
Optimism Bias (44% - limited detail available)	£359,417
Total Cost	£1,176,276

It is estimated that the total cost of the remedial improvement, at A23/A2300, would be in the order of £1.2m.

A264/B2028 Duke's Head

Table 21 shows the indicative construction cost for the A264/B2028 Duke's Head mitigation scheme.

Table 21: Indicative Cost of Junction Improvement at A264/B2028

Cost Item	Value
Construction	£451,898
Preliminaries (5%)	£23,784
Sub Total Construction	£475,683
Land	Not Included (will need to be factored in)
Optimism Bias (44% - limited detail available)	£209,300
Total Cost	£684,983

It is estimated that the total cost of the remedial improvement, at A264/B2028, would be in the order of £0.7m.

A264/A2220 Copthorne

Table 22 shows the indicative construction cost for the A264/B2220 Copthorne mitigation scheme.

Table 22: Indicative Cost of Junction Improvement at A264/A2220

Cost Item	Value
Construction	£992,604
Preliminaries (5%)	£52,242
Sub Total Construction	£1,044,846
Land	Not Included (will need to be factored in)
Optimism Bias (44% - limited detail available)	£459,732
Total Cost	£1,504,579

It is estimated that the total cost of the remedial improvement, at A264/A2220, would be in the order of £1.5m.

A2300/Northern Arc Spine Road, Burgess Hill

Table 23 shows the indicative construction cost for the A2300/Northern Arc Spine mitigation scheme.

Table 23: Indicative Cost of Junction Improvement at A2300/N Arc Spine

Cost Item	Value
Construction	£1,950,706
Preliminaries (5%)	£102,666
Sub Total Construction	£2,053,372
Land	Not Included (will need to be factored in)
Optimism Bias (44% - limited detail available)	£903,484
Total Cost	£2,956,856

It is estimated that the total cost of the remedial improvement, at A2300/Northern Arc Spine, would be in the order of £3.0m.

7 Summary and Conclusions

7.1 Task Summary

In summary, the multiple iterations in Stage-3 of the Mid Sussex Transport Study have been working towards the following objectives:

- Develop an accurate representation of the travel patterns and impacts that would arise with the finalised MS District Plan land use configurations;
- Assemble a reliable picture of how the transport network would perform if these travel patterns associated with MSDP occur;
- Determine what remedial transport interventions may be desirable and achievable, in order to overcome any unacceptable network performance, with MSDP travel patterns in place;
- Establish if any MSDP scenarios are unfeasible, because adverse outcomes could not be adequately resolved; and
- Initiate agreement with key stakeholders, regarding the acceptability of the MSDP transport outcomes and proposed mitigation, so as to ensure no objection to the District Plan on transport grounds.

7.2 Project Conclusions

Broadly, the project outcomes with respect to the above objectives can be defined as follows:

7.2.1 Travel patterns and impacts with finalised MS District Plan

There would be fairly significant increases in the volume of local trip movements associated with specific development sites, in the MSDP development scenarios, when compared with the Reference Case. These proportionate increases would amount to:

- +27% in the MSDP Development Case;
- +43% in the Alternative Development Case (with Science and Technology Park);
- +25% in the MSDP Development Case Sensitivity (without Pease Pottage); and
- +40% in the Alternative Development Case Sensitivity (with Science and Technology Park, but without Pease Pottage).

However, in terms of change in overall movements on the wider West Sussex transport network (including strategic and through trips), the MSDP would have a negligible impact.

7.2.2 Transport Network Performance with finalised MS District Plan

Generally speaking, the impacts of MSDP scenario trip movements on the transport network will not greatly affect its performance, in terms of capacity used, congestion and traffic delay.

This is, in part, because the increases in local trip volumes with MSDP will not be overwhelming, compared with reference Case and, in part, because certain 'primary', 'secondary' and development site access remedial interventions have already been defined as a requirement, to enable future development and economic buoyancy in West Sussex and the surrounding region. These remedial schemes are assumed to have been delivered by 2031.

After discussions between stakeholders, regarding likely network performance, against threshold traffic congestion and delay criteria, it was determined that additional transport interventions would be needed, to achieve a 'no worse off' outcome with MSDP, at the following network locations:

- A23/A2300 Hickstead:

– In Alternative Case & Alternative Case Sensitivity; PM peak.

- A264/B2028 Copthorne:

– In all scenarios; AM peak.

- A264/A2220 Copthorne:

— In all scenarios except Alternative Case Sensitivity; AM peak.

- A2300/Northern Arc Spine Road, Burgess Hill:

— In all scenarios; AM and PM peaks.

In addition, there may be a need for intervention at grade-separated junctions on the M23 / A23 trunk route, in order to resolve inadequacies in 'merge' and 'diverge' layouts, when compared with the Reference Case. These inadequacies would arise only in the Alternative Development Case and not in the MSDP Development Case. Furthermore, these layout shortfalls would not necessarily imply traffic congestion or delay problems. The layout inadequacies would occur at the following junctions:

- A23 / B2115 Warninglid – Northbound exit, PM peak;
- A23 / A2300 Hickstead – Northbound exit, PM peak;
- A23 / B2118 Sayers Common – Northbound entry, AM and PM peak; and Southbound exit, PM peak;
- A23 / B2117 Hurstpierpoint – Southbound entry, PM peak;
- A23 / A281 Red House – Northbound exit, PM peak;
- A23 / A273 Pyecombe – Northbound exit and Northbound entry, PM peak;

7.2.3 Determine Desirable and Achievable Transport interventions for MSDP

In order to mitigate the likely adverse impacts of MSDP at the junctions identified in section 7.2.2, feasible outline designs were devised for the critical locations. These designs would entail the following features:

- A23/A2300 Hickstead – Signalised roundabout improvement, with free flow left slip to and carriageway widening on, A2300 east;
- A264/B2028 Copthorne – Enlarged roundabout with localised widening;
- A264/A2220 Copthorne – Enlarged roundabout with localised widening; and

- A2300/Northern Arc Spine Road, Burgess Hill – Large roundabout with carriageway widening on A2300 west.

7.2.4 Establish if any MSDP Scenarios are Unfeasible

The findings from MSTS stage-3 suggest that the only reasons for rejecting any of the MSDP scenarios would be the A23 grade separated junction slip road layout inadequacies in the Alternative Development Case. However, these layout shortfalls do not imply that there would necessarily be a traffic congestion or delay problem in this scenario.

7.2.5 Initiate Agreement with Key Stakeholders regarding MSDP

At the time of issuing this report, it is understood that the study findings have enabled agreement to be reached between Mid Sussex DC, West Sussex CC and Highways England, regarding acceptability of the MSDP transport implications and proposed remedial interventions.

The MSTS S3 outcomes should provide satisfactory assurance for a Statement of Common Ground to be agreed between stakeholders, indicating acceptance of the MSDP transport implications and retraction of any objections on transport grounds.

Appendix A Site Specific Person Trip Volumes by Model Zone