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ADUR LOCAL PLAN SECOND ADDENDUM: REVISED REISSUE SEPTEMBER 2016

TRANSPORT STUDY

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WSP | PARSONS BRINCKERHOFF

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Adur District Council

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1 EXECUTIVE SUMMARY

1.1 CONTEXT AND PURPOSE OF STUDY

1.1.1 The main study (Adur Local Plan & Shoreham Harbour Transport Study June 2013), the previous addendum (June 2014) and this second addendum (August 2016) consider the transport impacts of strategic residential and commercial site allocations within Adur and Brighton & Hove in 2031. This is to inform the preparation of the Adur District Council (ADC) Local Plan and the Shoreham Harbour Joint Area Action Plan (JAAP) that cover development in both Adur and Brighton & Hove.

1.1.2 They follow on from a previous study by WSP | Parsons Brinckerhoff (formerly Parsons Brinckerhoff) for Adur District Council (Adur Core Strategy and Shoreham Harbour Transport Study 2011) which:

- tested strategic locations for development
- considered a number of further strategic housing and employment developments in Adur to assist with setting out the spatial and strategic vision for the district.

1.1.3 The purpose of the study is to identify the highway impacts of the site allocations and to explore appropriate mitigation measures in addition to revising existing and potential future collision hotspots. The study is important because the Council needs to ensure that future population and employment growth do not result in severe impacts to the transport network within and around the District therefore meeting the provisions of paragraph 32 of the National Planning Policy Framework. The main activities in this study include:

- Produce a new 2031 reference case model
- Forecast travel demand from each of the proposed scenario site allocations
- Identify cumulative transport impacts from site allocations on the local and strategic network, focusing on selected key junctions
- Identify existing highway collision hotspots
- Understand anticipated sustainable travel initiatives and recommend appropriate highway mitigation measures
- Assess transport impacts from the above interventions
- Assess potential collision hotspots and recommend appropriate highway mitigation measures if required
- Assess indicative costs of the proposed highway mitigation measures.

1.1.4 In the development of the 2031 forecast year models the Department for Transport (DfT)'s Transport Analysis Guidance (TAG) has informed the model development process where relevant.

1.1.5 The 2031 forecast models have been used to assess the potential traffic impacts of the development strategy on the surrounding highway network to identify the location where mitigation schemes may be required to address adverse impacts of development traffic and demonstrate the efficacy of those schemes. It will be for an individual site Transport Assessment to assess local impacts in detail as part of the planning process.

1.1.6 **This addendum considers an additional development scenario** (referred to as Scenario C) which takes account of the evolution in the development strategy for the Adur district. The principal changes incorporated into Scenario C are:

- Refined development quanta for the strategic sites
- Revised access arrangements for the West Sompting sites
- Highway improvements at key junctions identified within the main report.

1.1.7 Scenario C represents the current strategy of Adur District Council for the submission Local Plan.

1.1.8 The impact of the site allocations and mitigation proposals were considered at key junctions across the whole network in the main study. This addendum revisits the modelling and proposed interventions in light of the revised growth forecasts, with improvements proposed at the following locations:

- **A27 / A283 Steyning Road** - Partially signalise roundabout with widening on the A283 north exit and A283 south entry.
- **A259 Brighton Road / A283 Old Shoreham Road** - Expand the roundabout and widen approach westbound.
- **A259 Brighton Road / A2025 South Street** - Widen the A259 west approach and enlarge circulatory.
- **A27 Old Shoreham Road / A2025 Grinstead** - Convert existing roundabout to traffic signal controlled junction.
- **A27 Sompting Bypass / Upper Brighton Road** - Widen the south approach to provide two lanes at the stop line.
- **A27 Shoreham Bypass / Hangleton Link south roundabout** - Convert existing roundabout to traffic signal controlled junction.

1.2 SUMMARY OF RESULTS

1.2.1 The modelling indicated the following results:

- The demand reduction ensures that all the measures suggested in the main report and first addendum remain effective in Scenario C. The scale of interventions suggested at the key junctions have been reviewed and subsequently reduced or removed where the demand reductions allowed.
- Improvements in journey time as a result of the mitigation are most noticeable at A259 Brighton Road / A283 Old Shoreham Road roundabout. The reduced impact of the development proposed for Scenario C leads to journey times which are similar to the Reference Case on most tested routes, in the modelled AM peak and PM peak hours.
- The additional capacity provided by the proposed mitigation at the key junctions listed above draws a number of trips onto the A2025 South Street / Grinstead Lane from surrounding residential roads in the Scenario C with Mitigation models.
- As a result of the reduced impact at the Steyning Road junction under Scenario C, it has also been possible to reduce the cost of the mitigation at this junction by widening only one roundabout entry and exit to accommodate partial traffic signal control.
- The mitigation suggested at A27 / Busticle Lane junction is no longer required under Scenario C.

- Existing collision hotspots are identified in relation to each development site, with potential future collision hotspots also identified. Where potential issues have been shown by the modelling improvement schemes have been identified.

1.3 CONCLUSIONS AND RECOMMENDATIONS

1.3.1 The findings of the study indicate that overall, the levels of development promoted through the preferred strategy for the Adur Local Plan and the emerging Shoreham Harbour JAAP can be accommodated in terms of both their traffic and highway safety impacts.

2 INTRODUCTION

2.1 PROJECT BACKGROUND

2.1.1 WSP | Parsons Brinckerhoff (formerly known as Parsons Brinckerhoff) was commissioned by Adur District Council (ADC) to undertake a transport study to inform the preparation of the updated Adur Local Plan as well as the Shoreham Harbour Transport Strategy for the Joint Area Action Plan (JAAP). Shoreham Harbour was designated as a Strategic Development Area (SDA) and its geographical area covers sites in both Adur and Brighton & Hove. The redevelopment and regeneration of Shoreham Harbour is a key element of the Adur District Local Plan and also of the Brighton & Hove City Plan. The final report from the transport study was published by Parsons Brinckerhoff in August 2013 (Report Number: 3511677A-PTG / 01).

2.1.2 This transport study follows on from a previous study by Parsons Brinckerhoff for Adur District Council (Adur Core Strategy and Shoreham Harbour Transport Study 2011). This assessed a variety of housing and employment numbers at strategic locations for development, including Shoreham Harbour where various housing and employment totals (varying from 2,000 homes and 1,800 jobs in 2026 to 12,000 homes and 10,000 jobs in 2036) were examined.

2.1.3 The findings of the main study indicated that the Local Plan development scenario and lower totals at Shoreham Harbour above were generally supportable albeit in that form there would be some residual issues at the A27 North Lancing and A259 / A283 Shoreham High Street junctions after mitigation strategies are applied. The subsequent addendum study (June 2014) therefore followed on from the findings of the 2011 main study and considered:

- a number of further strategic housing and employment site allocations in Adur
- the sustainable measures and infrastructure improvements required to mitigate the impacts of these site allocations and the requirements of West Sussex County Council (WSCC) and Highways England (formerly known as the Highways Agency).

2.1.4 An addendum to the 2013 transport study report was published in June 2014 (Report Number: 3511677A-PTG / 02), which considered an additional allocation (Scenario B2) as the plan for development in Adur evolved. The additional B2 scenario excluded the previously proposed Hasler development site and contained access changes for other sites along with proposed highway improvements.

2.1.5 This second addendum report (August 2016) considers the impacts of a further housing and employment site allocation (Scenario C) as an extension to the Adur Local Plan and Shoreham Harbour Transport Study (ASHTS), published by Parsons Brinckerhoff in August 2013.

The principal changes incorporated into Scenario C are:

- Refined development quanta for the strategic sites
- Revised access arrangements for the West Sompting sites
- Highway improvements at the key junctions identified by the main report
- Revise of existing collision hotspots, assessment of future hotspots & identification of safety improvements if required.

2.1.6 It is understood that Scenario C represents the preferred strategy of Adur District Council for the submission Local Plan.

2.2 SCOPE AND METHODOLOGY

2.2.1 This study addendum aims to assess the impact of the strategic site allocation (Scenario C) for Adur on the highway transport network. Scenario C has been tested to:

- Recommend mitigation measures where appropriate in the form of infrastructure and sustainable transport initiatives to 2031
- Assess the improvement on the transport network as a result of the proposed mitigation,
- Assess the approximate costs of the proposed highway mitigation.

2.2.2 A 2031 reference case was produced in this study using the same method as documented in the main ASHTS report (August 2013). The future demand was estimated by replacing part of the forecasted traffic growth with travel demand from individual developments in Adur and its neighbouring areas comprising known committed developments and background growth, but without the large site allocations examined as part of that study.

2.2.3 This report, the second addendum to the main report, covers a revised development scenario, which represents the preferred strategy of Adur District Council for the submission Local Plan.

2.2.4 The impact on the transport network of each scenario has been assessed over the whole network as well as in detail for individual junctions. Note that the junctions assessed in detail fall within the jurisdiction of WSCC other than the A27 Trunk Road junction, which is under the jurisdiction of Highways England.

2.2.5 Where the development scenario is seen to have a significant impact on the highway network, mitigation measures have been examined to address capacity constraints.

2.3 SCENARIO MODELLING

2.3.1 The latest Shoreham Harbour Transport Model (SHTM) was employed for this study addendum, which consists of a variable demand model[1] and a highway assignment model. Running the two models together allows travellers the choice between modes of transport and the impact of transport improvements may lead to travellers switching from one mode of transport to another in order to make the same journey. The resultant highway traffic and its routes through the road network are predicted using the highway assignment model.

2.3.2 Forecast demand matrices have been developed for 2031 based on different land use options with the district.

2.3.3 The forecast models will be used to assess the potential traffic impacts of the development strategy on the surrounding highway network to identify the location where mitigation schemes may be required to address adverse impacts of development traffic and demonstrate the efficacy of those schemes. It will be for an individual site Transport Assessment to assess local impacts in detail as part of the planning process.

2.3.4 These include the assessment of the following scenarios:

- 2031 Reference case – TEMPro plus committed development and transport schemes (excluding Local Plan developments)

[1] The OmniTRANS demand model is only focused on the mode choice response of travellers. The findings from an independent audit of the OmniTRANS model are included in Appendix A.

- 2031 with Local Plan developments (New Monks Farm, West Sompting, Shoreham Airport and Shoreham Harbour)
- 2031 with Development and Transport Mitigation measures.

2.3.5 SHTM has a base year of 2008 and a future forecast year of 2028. The proposed and committed development sites included in the Reference Case are detailed in Section 2.2 of the main ASHTS report.

2.3.6 The modelling for this addendum introduces a further future forecast year of 2031. The trip volumes in the initial matrices of the modelling process have been increased in line with TEMPro v6,2 forecasts prior to producing the 2031 Reference Case.

2.3.7 The TEMPro growth factors for Adur from 2028 to 2031 are:

- AM Peak: 1.0313
- PM Peak: 1.0331

2.3.8 There are two modelled time periods:

- AM peak: 08:00 – 09:00
- PM peak: 17:00 – 18:00

2.4 DEVELOPMENT ASSUMPTIONS

2.4.1 Strategic site allocations in Adur were included in the future year models for the 'with Local Plan development' scenario (Scenario C). They mainly include mixed-use residential and employment development proposed in Adur. The size of each potential development included in the tested scenario is detailed in Table 2.1 and Table 2.2.

2.4.2 Previous development scenarios were examined and reported on in the original Shoreham Harbour Transport Study (August 2013) and the First Addendum (June 2014).

Table 2.1 Adur Strategic Residential Site Allocations

Development Site	Number of Dwellings
New Monks Farm	600
West Sompting	480
Total	**1,080**

Table 2.2 Adur Strategic Employment Site Allocations

Development Site	B1 Jobs	B2 Jobs	B8 Jobs
Shoreham Airport*	416	139	71
New Monks Farm	333	143	0

**Reduced from previous work in line with floor area reduction to 15,000sqm*

2.4.3 Further allocations at Shoreham Harbour are also included in all development scenarios. They have been split into six areas for use in the transport modelling. The allocations and the anticipated sizes of each are listed in Table 2.3. The location of each area is shown in **Appendix B**.

Table 2.3 Proposed and committed future development sites - Shoreham Harbour

Development Site	Number of Dwellings	B1 Jobs	B2 Jobs	B8 Jobs
Shoreham Harbour - Western Arm	970	361	640	640
Shoreham Harbour - Aldrington Basin	300	0	196	196
Shoreham Harbour - South Portslade	0	638	364	364
Shoreham Harbour - Port Operational North	0	340	235	235
Shoreham Harbour - Port Operational South	0	0	235	235
Shoreham Harbour - Port Operational East	0	0	235	235
Total	**1,270**	**1,339**	**1,434**	**1,434**

2.4.4 The split between these housing categories at each site are shown in Table 2.4.

Table 2.4 Dwelling Type Split by Development Site

Development Site	Affordable Flats	Affordable Houses	Private Flats	Private Houses
Aldrington Basin	27.0%	3.0%	63.0%	7.0%
Western Harbour Arm	27.0%	3.0%	63.1%	6.9%
New Monks Farm	0.0%	30.0%	0.0%	70.0%
West Sompting	2.8%	27.3%	6.4%	63.6%

2.4.5 It should be noted that the future job figures at the harbour are based on ADC estimates only for the purpose of generating upper level model assumptions.

2.4.6 In the absence of an accurate employment survey at the time and in order to establish the number of trips associated with the existing jobs it was agreed with ADC that the current land use is assumed to be split equally between B2 (General Industrial) and B8 (Storage and Distribution) land uses in order to apply appropriate trip rates. In reality, this split is more complex and also includes employment in the other use classes, in particular B1, A uses and sui generis.

2.4.7 **Appendix C** details the estimated number of existing and new jobs included for each of the Shoreham Harbour development areas, and the resulting net number of trips. The AM peak model only is presented to maintain consistency with the analysis presented in the main ASHTS report and first Addendum. The AM peak hour was chosen over the PM peak for this analysis due to the greater proportion of development traffic expected to use the transport network during the modelled peak hour.

2.4.8 The traffic forecasting process, including the trip rates employed and matrix building technique have been kept consistent with previous work on this study, as detailed in the main ASHTS report. Background traffic growth within Adur, for example from small-scale 'windfall' developments, is included in this process. The current estimate for this growth is 1,456 dwellings within the built up area.

2.5 TRAFFIC FORECASTING

2.5.1 In order to determine the number of highway trips from each site, trip rates were established in collaboration with ADC for appropriate land use types. Corresponding person trip rates were used to determine the number of public transport trips. The trip rates for most of the land uses identified have been retained from those used in the main ASHTS report (August 2013). For the strategic allocation sites where more detail about the anticipated split in housing provision was available, the trip rates have been tailored to reflect that split.

2.5.2 The starting point for this process was the trip rates for each type of dwelling, shown in Table 2.5.

Table 2.5 Peak Hour Trip Rates per Dwelling

Dwelling Type	AM 08:00 – 09:00				PM 17:00 – 18:00			
	Highway		Public Transport		Highway		Public Transport	
	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep
Private House	0.172	0.456	0.004	0.021	0.449	0.262	0.021	0.022
Affordable House	0.097	0.187	0.003	0.018	0.223	0.164	0.018	0.010
Private Flat	0.078	0.236	0.003	0.081	0.217	0.094	0.081	0.026
Affordable Flat	0.065	0.092	0.017	0.046	0.157	0.116	0.046	0.025
Average	**0.080**	**0.172**	**0.008**	**0.048**	**0.199**	**0.125**	**0.048**	**0.020**

2.5.3 The dwelling type trip rates and proportions (shown in Table 2.4) for each category have then been combined to give the trip rates shown in Table 2.6.

Table 2.6 Residential Development Site Peak Hour Trip Rates per Dwelling

Development Site	AM 08:00 – 09:00				PM 17:00 – 18:00			
	Highway		Public Transport		Highway		Public Transport	
	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep
Aldrington Basin	0.081	0.210	0.007	0.066	0.216	0.113	0.066	0.025
Western Harbour Arm	0.081	0.210	0.007	0.066	0.216	0.113	0.066	0.025
New Monks Farm	0.150	0.375	0.004	0.020	0.381	0.233	0.020	0.018
West Sompting	0.140	0.347	0.008	0.029	0.361	0.218	0.029	0.023

2.5.4 The trip generation for each of the strategic development sites is shown in Table 2.7 for the AM peak hour and Table 2.8 for the PM peak hour. The tables also show the volume of trips arriving at and departing from each of the sites at each stage of the modelling process. The trips to and from each site have been distributed using the trip patterns of neighbouring zones with similar land uses.

2.5.5 The modelled trip volumes are presented in Passenger Car Units (PCUs), a standardised unit used to represent the impact of different vehicle types on the highway network equally. Each car trip expected from the development sites is represented by one PCU in the models.

Table 2.7: Scenario C Development Site Trip Generation (PCUs) - AM Peak

Model Stage	New Monks Farm		West Sompting		Aldrington Basin		Southwick Waterfront		South Portslade		Western Harbour Arm	
	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep
Initial Trip Generation	222	239	67	166	24	63	112	11	210	21	208	225
Demand Model Input	222	239	67	166	24	63	112	11	210	21	208	225
Demand Model Output	222	241	67	167	24	65	112	11	211	21	208	235
Scenario C Highway Assignment Matrix	222	241	67	167	24	65	112	11	211	21	208	235
Scenario C with Sustainable Travel Measures (see Section 5.2)	186	206	55	140	21	54	94	9	174	17	174	196

Table 2.8: Scenario C Development Site Trip Generation (PCUs) - PM Peak

Model Stage	New Monks Farm		West Sompting		Aldrington Basin		Southwick Waterfront		South Portslade		Western Harbour Arm	
	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep	Arr	Dep
Initial Trip Generation	238	247	173	105	65	34	8	91	15	171	229	218
Demand Model Input	238	247	173	105	65	34	8	91	15	171	229	218
Demand Model Output	239	249	174	106	66	35	8	91	15	172	233	221
Scenario C Highway Assignment Matrix	239	249	174	106	66	35	8	92	15	172	233	221
Scenario C with Sustainable Travel Measures (see Section 5.2)	204	205	147	84	55	29	7	78	12	145	192	184

2.5.6 The demand model element of SHTM makes subtle changes to the volume of trips between the input and output matrices in response to the relative costs of travel on the highway and public transport networks.

2.6 JUNCTION MODELLING METHODOLOGY

2.6.1 Junctions 8 (ARCADY and PICADY) and LinSig software was used to assess the capacity of each junction in forecast 2031 traffic conditions. The industry standard software was used to assess junction capacity as follows:

- → ARCADY for roundabout junctions
- → LinSig for signal controlled junctions.

2.6.2 The junction capacity assessments and any mitigation measures suggested in response are discussed in Section 3 and Section 5.

2.7 JUNCTION IMPACTS

2.7.1 The performance of the junctions was modelled to determine the impact of development Scenario C on the network compared to performance in the Reference Case. The criteria used to measure junction performance are Ratio of Flow to Capacity (RFC), Average delay per arriving vehicle and maximum queue length.

2.7.2 The RFC is the ratio of traffic flow to the calculated capacity of each entry to the roundabout. The normal practical maximum RFC value is 0.85, above which there is an increased risk of excessive queues and delays.

2.8 MITIGATION PROPOSALS

2.8.1 Mitigation schemes were identified for junctions, which had one or more arms shown to be exceeding capacity or where congestion was worsened relative to the reference case as a result of the local plan development traffic.

2.8.2 The mitigation measures have been designed with the following objectives:

- → Increasing junction capacity so that the overall junction works within capacity or is no worse than the Reference Case operation
- → Being provided within the existing highway boundary where possible
- → Providing a cost effective solution to capacity issues due to increases in highway traffic levels.

2.8.3 The mitigation schemes were assessed for capacity and the results are provided in Section 5.

2.9 REPORT STRUCTURE

2.9.1 The remainder of the report includes the following sections:

- Section 3 - Development Site – Collision Investigation
- Section 4 - 2031 Modelling Results – Without Mitigation Measures
- Section 5 - 2031 forecast year - Mitigation Results
- Section 6 – Hangleton Junction Analysis
- Section 7 – Scheme Cost Estimates
- Section 8 – Summary and Conclusions

3 DEVELOPMENT SITE – COLLISION INVESTIGATION

3.1 INTRODUCTION

3.1.1 This section looks at existing collision hotspots and provides an analysis of recent collision history of the affected areas and where proposed development allocations may worsen highway safety or even create highway safety issues. It also seeks where required to identify how these can be resolved so that development does not have a negative highway safety impact, addressing NPPF (paragraph 09) requirements.

3.1.2 All modes of transport are covered by safety considerations and collision analysis, taking into account the objective of facilitating, where reasonable to do so, the use of sustainable modes of transport.

3.1.3 Collision data for the period 1 January 2010 to 31 December 2014 has been obtained for Adur and Worthing from WSCC and used to assess the existing collision hotspots and identify where the proposed development allocations, as part of the West Sompting allocation, may worsen these issues.

3.2 NETWORK

3.2.1 Overall, 1,917 collisions were recorded in Adur and Worthing over the five year period and of these 14 were fatal and 340 were serious. 18% of the collisions were Killed or Seriously Injured (KSI) collisions which is slightly above the national average of 15% for all roads.

3.2.2 Throughout the Worthing and Adur study area, 40 cluster sites have been identified as having five collisions in three years and 27 cluster sites as having eight collisions in five years. A plot of the collisions in the study area is included in **Appendix I** with the clusters identified above also shown.

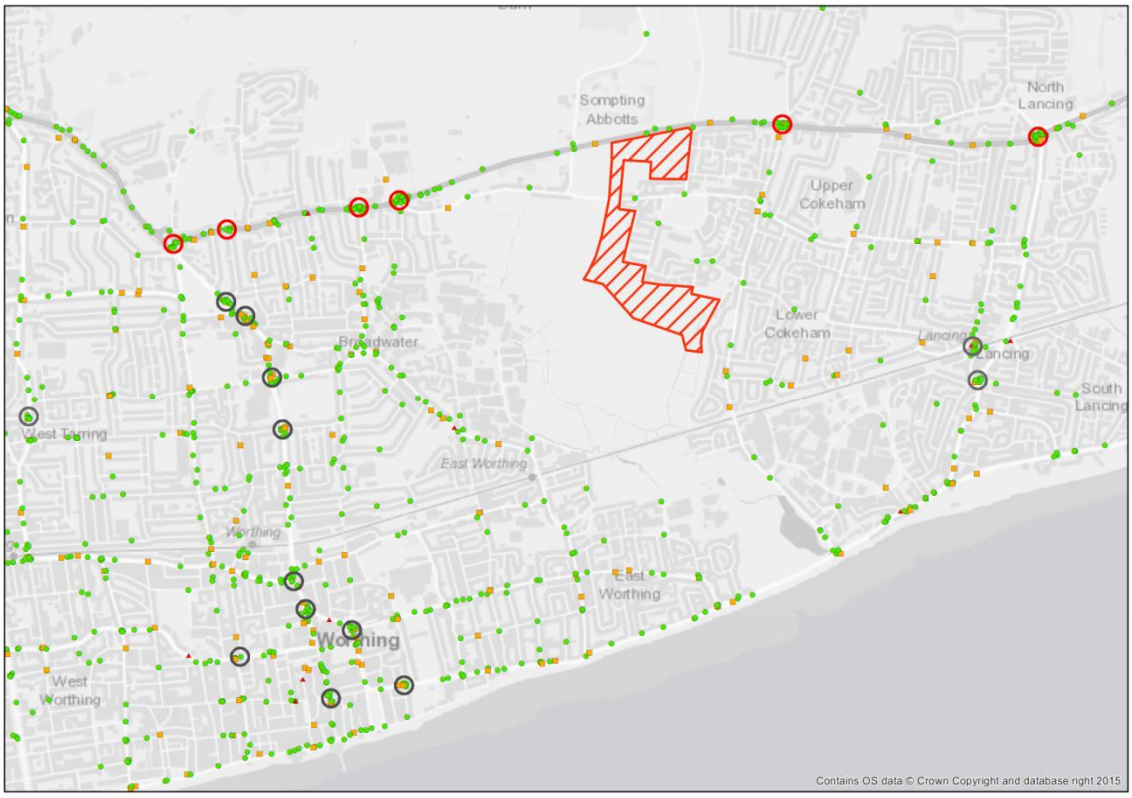
3.2.3 Of all cluster sites, 28 were recorded in the Worthing and Broadwater area, close to and west of the A24. The select link data (presented in Section 4) indicates that trips to / from all proposed developments are not anticipated to route through this area in any significant volumes and is therefore considered unlikely to exacerbate any of these existing clusters areas.

3.2.4 Eight collision cluster sites were identified with 1km of each other, centred around the Holmbush Roundabout. This is a restricted access junction with the A27, with to and from the A27 West only. Given the route choice at this junction and the development select link trips through this area, it is considered unlikely that the proposed developments would exacerbate the existing collision problems at these locations.

3.3 WEST SOMPTING

3.3.1 Personal Injury Collision (PIC) data has been assessed for the West Sompting residential site allocation. The location and nature of the collisions are shown in Figure 3.1.

Figure 3.1: West Sompting Development Site - Collision Location Map



3.3.2 Figure 3.1 indicates that there are a low number of collisions in the vicinity of the proposed development area on the A27 and surrounding local network. There are additional collision clusters on the A27 located at the three signal junctions at Busticle Lane, Lyons Way and Sompting Road. This section of the A27 has a Killed or Seriously Injured (KSI) figure of 17% KSI, which is below the national average for non-built-up roads of 22%.

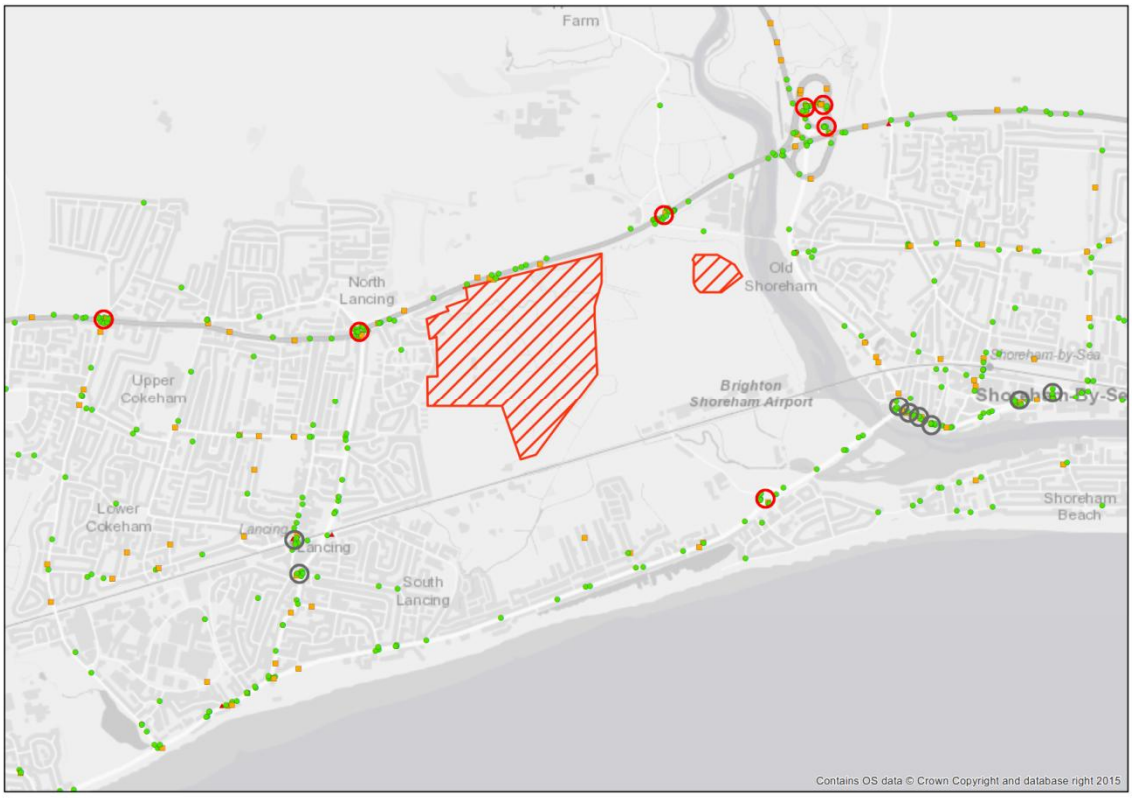
3.3.3 Based on the likely number of trips through this area due to the development at West Sompting, it is likely that any existing collision problems could be exacerbated at or on the approaches to the signalised junctions. It is noted however, this section of the A27 is subject to a proposed Highways England improvement scheme as part of the Roads Investment Strategy (RIS 1) 2015 – 2020 which forms part of their five year business plan.

3.3.4 A low number of collisions were reported on the local roads in the vicinity of the development site. A review of the collision data on the local roads in the vicinity of the site show that the collisions were typical of a local residential area, minor collisions at junctions and collisions involving pedestrians and cyclists. Therefore, it is anticipated that given the low level of trips from the proposed developments, there would be minimal road safety impact due the development.

3.4 NEW MONKS FARM AND SHOREHAM AIRPORT

3.4.1 Personal Injury Collision (PIC) data has been assessed for the New Monks Farm and Shoreham Airport residential and employment site allocation. The location and nature of the collisions are shown in Figure 3.2.

Figure 3.2: New Monks Farm and Shoreham Airport Development Sites - Collision Location Map



3.4.2 Figure 3.2 indicates that there are a number of collisions with a high proportion of serious incidents in the vicinity of the proposed development area on the A27 and surrounding local network. There are additional collision clusters on the A27 located at the roundabout with Grinstead Lane and also the signalised Sussex Pad junction. This stretch of the A27 suffers from severe queuing at peak times on the junction approaches.

3.4.3 Analysis of the PICs indicates that there are a number of common collisions including shunts on the A27, many including multiple vehicles. This section of the A27 has 5% KSI collisions, which is below the national average for non-built-up roads of 22%. Based on the modelled trips through the area, it is likely that the New Monks Farm development would exacerbate the existing collision problems on the A27. However, this section is subject to a proposed Highways England improvement scheme as part of the Roads Investment Strategy (RIS 1) 2015 – 2020, known as the Worthing & Lancing Improvement study, there is also a neighbouring study investigating improvements to the A27 at Arundel.

3.4.4 In addition to the Highways England RIS 1 schemes outlined above Shoreham Airport and new Monks Farm promoters are understood to be working on a joint access strategy, including a new access junction, which is to be agreed with Highways England and will further improve the highway network in and around the development site.

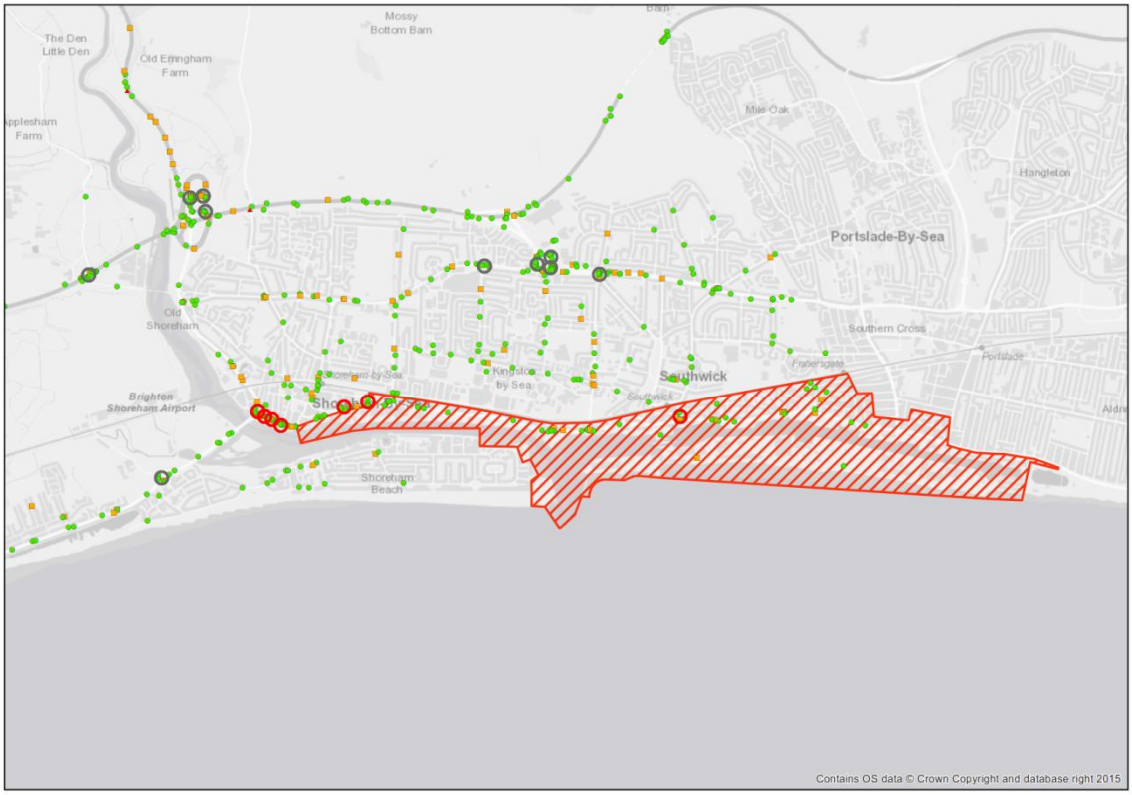
3.4.5 A number of collisions were reported at the A27 / A283 junction. The topographical conditions mean that the vertical alignment, slip road geometry and layout of the junction could lead to confusion. A number of collisions at this junction were due to motorcyclists losing control on the slip road bends. A number of shunts were also recorded at the roundabout. The remaining reported collisions at this location were sideswipes on the circulatory carriageway and due to drivers failing to look properly. Overall, driver behaviour or error was the cause for the majority of the collisions at this location.

3.4.6 It is considered likely that the existing collision issues at this junction could be exacerbated by the rise in trips through the junction as a result of the development. Given that for the majority of the collisions at this location driver behaviour or error was a cause and that there is currently high friction surfacing and chevron signage on the slip roads, the impact of any additional physical mitigation may be limited. Behavioural mitigation through vehicle activated signs and additional signage may reduce the impact of the developmental growth on the number of collisions at this location.

3.5 SHOREHAM HARBOUR

3.5.1 Personal Injury Collision data has been assessed for the residential and employment proposed and committed development sites in the Shoreham Harbour area. This site covers a large area, from Shoreham town centre to Southwick, including the southern side of The Canal. The Shoreham Harbour development area consists of smaller sites at Aldrington Basin, Eastern Harbour, Port Operational North, South Portslade and Western Harbour Arm. The location and nature of the collisions are shown in Figure 3.3.

Figure 3.3: Shoreham Harbour Development Site - Collision Location Map



3.5.2 There are a number of collisions and collision clusters at junctions along the length of the A259 through Shoreham and Southwick town centres. Two larger cluster sites are at the station Road / Old Shoreham Road and Surry Street / Old Shoreham Road junctions. A number of these collisions involved vehicles turning across the path of oncoming vehicles. A number of these were collisions between vehicles and cyclists or pedestrians. These types are typical of town centre locations.

3.5.3 Overall, 75% of collisions involved two or more vehicles, and typically resulted in a single casualty. 23% of all collisions were Killed or Seriously Injured (KSI) collisions; this is higher than the national average of 13% for 30mph built up roads. Given the congested town centre nature of

these roads, the collisions are generally associated with turning movements / manoeuvres, or involve collisions with pedestrians and cyclists.

3.5.4 Based on the forecasted trips associated with the development around Shoreham Harbour, it is likely that the increase in flows would have an impact on the collision problems on the A259 through Shoreham town centre between A283/A259 roundabout and Humphrey's Gap and on the A259 to the east of Shoreham including the A259/Station Road junction.

3.5.5 A previous study conducted by Parsons Brinckerhoff (documented in the Shoreham Town Centre Study Report, March 2014) explored potential highway improvements in the town centre as well as to the cycling and pedestrian infrastructure, it is recommended that this be used to identify mitigation measures in the Shoreham Town Centre area between A283/A259 roundabout and Humphrey's Gap.

3.5.6 It is anticipated that there would be minimal impact on A259 to the West of Shoreham and on the A283 south of the A27.

3.6 CONCLUSION

3.6.1 WSP | Parsons Brinckerhoff have undertaken an assessment of the existing collision problems identified through the collision data and the number of anticipated trips from the developments as identified using the select link data. It is likely that the existing collision problems identified will not be significantly exacerbated by the anticipated growth in most areas, although existing hotspots are apparent in a number of areas. Mitigation measures have been identified in the original Shoreham Harbour Transport Study (August 2013) and the Second Addendum (June 2014) at one of the cluster sites, the A27 / A283 junction, as discussed in Section 5.

3.6.2 A previous study conducted by Parsons Brinckerhoff (documented in the Shoreham Town Centre Study Report, March 2014) proposed measures for highway and cycling/pedestrian infrastructure improvements in the Shoreham Town Centre between A259/A283 and Humphrey's Gap. It is recommended that this study be used to identify mitigation measures for the Shoreham Town Centre area.

3.6.3 It is also noted that any proposed capacity mitigation measures would need to undergo Road Safety Audits during detailed design and following construction. These audits would consider current collision problems as well as consider any additional safety problems that might arise from the design.

3.6.4 The A27 through Worthing and Lancing is also subject to Highways England's Roads Investment Strategy (RIS 1) 2015 - 2020, and therefore significant highway improvements are anticipated to be in delivered prior this period. These improvements are expected to address existing congestion and safety issues.

4 2031 MODELLING RESULTS – WITHOUT MITIGATION MEASURES

4.1 OVERVIEW OF FINDINGS

4.1.1 2031 forecast year model runs using the Shoreham Harbour Transport Model (SHTM) have been undertaken for the development scenario detailed in Section 2.3. Results from the SHTM were then fed into the analysis of individual junctions in the study area. This section gives an overview of findings from the analysis of Scenario C, covering the aspects set out below.

2031 FORECAST YEAR - NETWORK PERFORMANCE

4.1.2 The network-wide impacts previously reported in SHTM are very similar across the four development scenarios in the main report (August 2013) and Scenario B2 in the first Addendum (June 2014). A similar impact is expected from Scenario C with a number of analyses undertaken as summarised below.

2031 FORECAST YEAR - NETWORK STATISTICS

4.1.3 The increase in travel demand in the development scenarios in comparison to the reference case is clear but not considered substantial. The largest network-wide demand increase for the main report scenarios was less than 3%, which occurred in Scenario B. With the introduction of additional trips, all scenarios from both the main report (August 2013) and this addendum (August 2016) result in higher congestion on the network as expected, and this is demonstrated by increased queuing and slower average speeds. The lower demand in Scenario C, compared to Scenario B2 leads to a lower level of queuing and delay.

2031 FORECAST YEAR - TRAFFIC FLOW VOLUMES

4.1.4 There are extensive variations in traffic volume throughout the network between the reference case and development scenarios due to traffic re-routing. In the study area to the west of the A283, increases in traffic for all forecast scenarios from both the main report (August 2013) and this addendum (August 2016) compared to the reference case mainly focus on the network at close vicinity to the strategic development sites, namely New Monks Farm and West Sompting. To the east of the A283, it is also clear that the increases in traffic primarily originate from Shoreham Harbour.

2031 FORECAST YEAR - DEVELOPMENT SELECT LINK ANALYSIS

4.1.5 Distribution and assignment of traffic to and from individual development sites was examined. It has been found that traffic impacts from individual sites are modest with a limited number of junctions receiving over 30 trips from a single development, per peak hour. However, the collective impacts from all developments are significant as demonstrated in the journey time analysis.

4.1.6 Details on the above analyses are presented in **Section 4.2** of this addendum.

2031 FORECAST YEAR - JUNCTION PERFORMANCE

4.1.7 In this section, a summary of the development traffic impact is provided using the junction capacity assessment results for the existing junction layouts. Table 4.1 to Table 4.3 gives the maximum ratio of flow to capacity (RFC), average delay and maximum queue length for all the approaches to each junction (Tranche 1 and Tranche 2) in the AM peak hour and PM peak hour.

4.1.8 The mitigation objective of increasing capacity so that the overall junction works within capacity or is no worse than the Reference Case operation informed the decision about whether mitigation would be required at each site.

Table 4.1 Summary of Junction Capacity Assessments – Max RFC

Junction	Mitigation Required?	AM Peak Max RFC		PM Peak Max RFC	
		Reference Case	Scenario C	Reference Case	Scenario C
Tranche 1					
A27 / A283 Steyning Road	Y	0.97	**1.00**	**1.29**	**3.30**
A259 Brighton Road / A283 Old Shoreham Road	Y	**1.73**	**1.75**	**1.59**	**1.80**
A259 Brighton Road / A2025 South Street	Y	**1.80**	**2.09**	**1.83**	**1.94**
A27 Old Shoreham Rd / A2025 Grinstead Ln	Y	**1.73**	**1.91**	**1.85**	**1.94**
Tranche 2					
A27 / Busticle Lane	N	0.92	0.90	0.80	0.86
A27 Shoreham Bypass / Hangleton Link north roundabout	N	**1.60**	0.92	0.40	0.92
A27 Shoreham Bypass / Hangleton Link south roundabout	Y	**1.20**	**1.22**	**1.28**	**1.56**
A259 Brighton Road / Western Road	N	0.93	0.87	0.81	0.82
A270 Upper Shoreham Road / B2167 Kingston Lane	N	0.87	0.89	0.78	0.87
A27 Sompting Bypass / Upper Brighton Road	Y	0.98	**1.17**	0.89	0.95
A270 Old Shoreham Road / A293 Hangleton Link	N	0.71	0.68	0.56	0.67
A270 Old Shoreham Road / A2038 Hangleton Road / B2194 Carlton Terrace	N	0.84	0.83	0.86	0.84
A259 Wellington Road / B2194 Station Road	N	0.96	0.95	0.88	0.87

Table 4.2 Summary of Junction Capacity Assessments – Average Delay per Arriving Vehicle (min)

Junction	Mitigation Required?	AM Peak		PM Peak	
		Reference Case	Scenario C	Reference Case	Scenario C
Tranche 1					
A27 / A283 Steyning Road	Y	0.83	1.32	10.05	31.39
A259 Brighton Road / A283 Old Shoreham Road	Y	19.02	19.38	16.79	20.15
A259 Brighton Road / A2025 South Street	Y	20.01	23.53	20.34	21.77
A27 Old Shoreham Rd / A2025 Grinstead Ln	Y	18.91	21.48	20.76	21.82
Tranche 2					
A27 / Busticle Lane	N	1.10	1.00	0.74	0.78
A27 Shoreham Bypass / Hangleton Link north roundabout	N	16.46	0.44	0.38	0.46
A27 Shoreham Bypass / Hangleton Link south roundabout	Y	7.69	8.30	9.98	16.27
A259 Brighton Road / Western Road	N	1.33	1.04	0.91	0.97
A270 Upper Shoreham Road / B2167 Kingston Lane	N	0.88	0.79	0.75	0.97
A27 Sompting Bypass / Upper Brighton Road	Y	2.23	5.81	1.00	1.75
A270 Old Shoreham Road / A293 Hangleton Link	N	0.82	0.83	0.79	0.82
A270 Old Shoreham Road / A2038 Hangleton Road / B2194 Carlton Terrace	N	1.18	1.12	1.15	1.07
A259 Wellington Road / B2194 Station Road	N	1.63	1.44	0.65	0.78

Table 4.3 Summary of Junction Capacity Assessments – Forecast Queue Length (PCU)

Junction	Mitigation Required?	AM Peak		PM Peak	
		Reference Case	Scenario C	Reference Case	Scenario C
Tranche 1					
A27 / A283 Steyning Road	Y	27.59	56.91	508.91	1037.23
A259 Brighton Road / A283 Old Shoreham Road	Y	1170.11	1177.48	556.35	743.22
A259 Brighton Road / A2025 South Street	Y	505.73	935.78	618.62	719.46
A27 Old Shoreham Road / A2025 Grinstead Lane	Y	1794.17	2205.57	2663.62	2993.84
Tranche 2					
A27 / Busticle Lane	N	29.2	29.0	17.0	19.5
A27 Shoreham Bypass / Hangleton Link north roundabout	N	443.33	10.56	3.95	11.03
A27 Shoreham Bypass / Hangleton Link south roundabout	Y	443.15	486.38	612.35	1224.09
A259 Brighton Road / Western Road	N	26.3	27.8	11.2	11.0
A270 Upper Shoreham Road / B2167 Kingston Lane	N	17.4	18.9	13.5	14.5
A27 Sompting Bypass / Upper Brighton Road	Y	40.9	105.3	23.2	32.6
A270 Old Shoreham Road / A293 Hangleton Link	N	14.7	14.6	9.8	10.6
A270 Old Shoreham Road / A2038 Hangleton Road / B2194 Carlton Terrace	N	17.3	17.9	17.8	16.6
A259 Wellington Road / B2194 Station Road	N	54.6	48.6	25.0	27.5

4.1.9 The turning flows used in the detailed assessment of these junctions are given for the Reference Case and Scenario C in **Appendix D**. Full details of the outputs from the detailed junction modelling are contained in **Appendix H** of this report.

4.1.10 The existing traffic signal controlled A27 Sussex Pad junction is expected to be replaced by the proposed New Monks Farm / Shoreham Airport / Lancing College combined access junction

(roundabout). Whilst the design of that junction has not been finalised at the time of writing, it is assumed to have sufficient capacity for forecast future demand and so no modelling is presented as part of this study.

4.1.11 The remaining four key junctions identified during previous stages of this study all require some mitigation to accommodate the future traffic forecasts with Scenario C development in place. The junction modelling results also suggest some mitigation could be required at the A27 Sompting Bypass / Upper Brighton Road junction and A27 Shoreham Bypass / Hangleton Link south roundabout to accommodate the forecast traffic demand.

4.1.12 The other junctions have comparable performance with both the Reference Case and Scenario C demand forecasts, so no interventions are proposed to accommodate the forecast traffic demand.

4.2 2031 FORECAST YEAR - NETWORK PERFORMANCE

NETWORK STATISTICS

4.2.1 The global network statistics for the 2031 forecast year AM peak and PM peak models are shown below in Table 4.4 and Table 4.5 respectively. The statistics show the total time vehicles spend moving through the network or delayed in queues during the chosen modelled hour. The number of PCUs making each movement is multiplied by the modelled journey time for that movement and summed to find the total pcu-hrs for each scenario.

Table 4.4 AM Peak Global Model Statistics

Statistic	Reference	Scenario C	Difference
Transient Queues (pcu-hrs / hr)	9,798	10,018	220
Over Capacity Queue (pcu-hrs / hr)	8,875	9,699	824
Total Travel Time (pcu-hrs / hr)	43,322	44,905	1,583
Total Travel Distance (pcu-km / hr)	1,541,563	1,560,795	19,232
Average Speed (kph)	35.6	34.8	-0.8

Table 4.5 PM Peak Global Model Statistics

Statistic	Reference	Scenario C	Difference
Transient Queues (pcu-hrs / hr)	13,099	13,395	296
Over Capacity Queue (pcu-hrs / hr)	24,522	25,367	845
Total Travel Time (pcu-hrs / hr)	67,730	69,423	1,693
Total Travel Distance (pcu-km / hr)	1,909,416	1,929,043	19,627
Average Speed (kph)	28.2	27.8	-0.4

4.2.2 Two types of queue are reported; transient queues and over-capacity queues. Over capacity queues are 'permanent' queues at an over capacity junction during the modelled peak hours. Transient queues are those that dissipate, for example the vehicles queuing at a red traffic signal, which clear during the next green phase. Any remaining queuing vehicles at the end of the green which queue for a second red phase represent an over capacity queue.

4.2.3 The increases in queuing and travel time, along with the reduction in the average speed, are all indicative of a general increase in congestion across the modelled network in Scenario C when compared to the Reference Case.

DEVELOPMENT SELECT LINK ANALYSIS

4.2.4 In common with the other development scenarios, in the main report, select link analysis for the individual development sites has been undertaken to demonstrate the distribution of traffic to and from these developments across the highway network in the study area. Illustration plots for Scenario C in the AM peak and PM peak hours are presented in **Appendix G** of this report. Similar trip distribution patterns were observed on all other development scenarios.

4.2.5 It can be observed that traffic impacts from individual sites on the network are modest in isolation. There are a very limited number of junctions receiving over 30 trips from a single development in a peak hour. Where this does happen, the point of access (the first junction where the development traffic hits the main roads in the highway network) is usually either one of the five key junctions in Tranche 1 or the eight junctions in Tranche 2, as identified by the main report (August 2013). It should be noted that the cumulative traffic impacts from all developments are still considered significant, as demonstrated in the journey time and congestion hotspot analyses presented in the SHTS report (August 2013).

4.2.6 Table 4.6 and Table 4.7 summarise the vehicle flows (PCU's) through the junctions of interest for each development location.

Table 4.6: Vehicle Flows (PCUs) by Development during the AM Peak

Junction	New Monks Farm		West Sompting		Aldrington Basin		Southwick Waterfront		South Portslade		Western Harbour Arm	
	From	To	From	To	From	To	From	To	From	To	From	To
A27 / A283 Steyning Road	18	32	26	3	0	0	0	0	0	1	76	41
A259 Brighton Road / A283 Old Shoreham Road	1	0	18	0	8	1	0	2	0	13	118	76
A259 Brighton Road / A2025 South Street	48	32	14	0	5	0	0	1	0	10	42	23
A27 Old Shoreham Road / A2025 Grinstead Lane	57	39	81	18	1	0	0	2	0	2	6	22

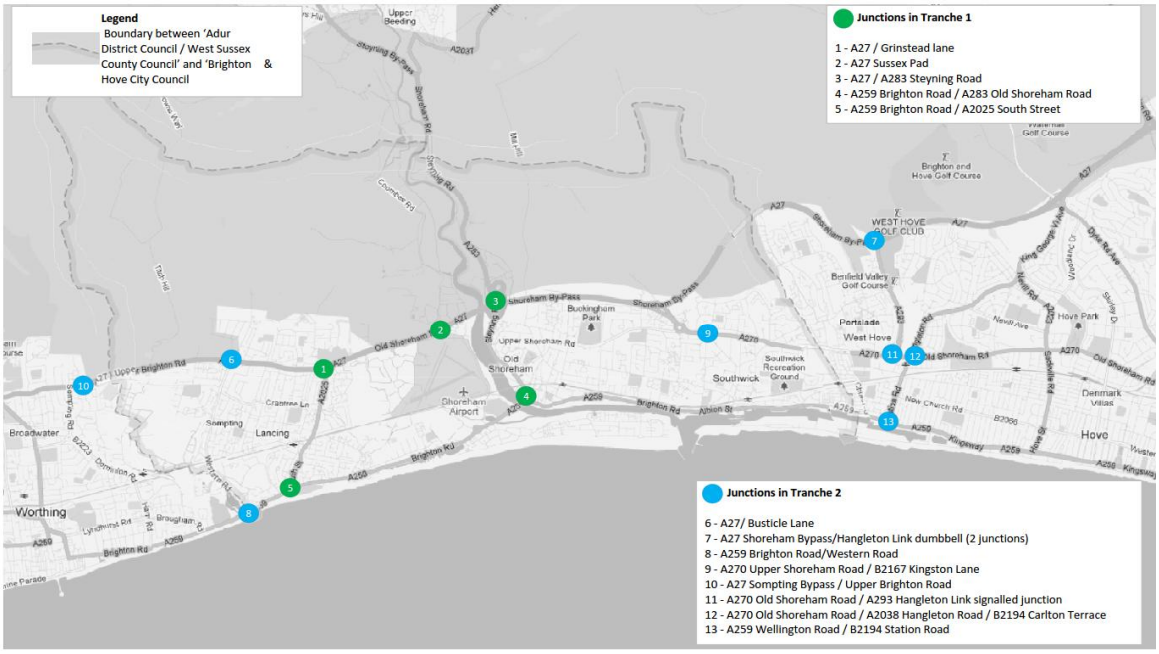
Table 4.7: Vehicle Flows (PCUs) by Development during the PM Peak

Junction	New Monks Farm		West Sompting		Aldrington Basin		Southwick Waterfront		South Portslade		Western Harbour Arm	
	From	To	From	To	From	To	From	To	From	To	From	To
A27 / A283 Steyning Road	6	11	5	4	0	0	0	0	0	0	8	70
A259 Brighton Road / A283 Old Shoreham Road	63	0	0	20	2	1	0	0	1	1	70	22
A259 Brighton Road / A2025 South Street	48	24	0	0	0	1	0	0	0	0	30	10
A27 Old Shoreham Road / A2025 Grinstead Lane	126	83	17	92	0	0	0	0	1	0	3	18

4.3 2031 FORECAST - JUNCTION PERFORMANCE

4.3.1 A brief description of the operation of each key junction is provided below. The impact on the existing junction layouts of the 2031 Reference Case and Scenario C demand forecasts are considered. Any junction where mitigation could be required is identified in this section. The figure below indicates the location of these key junctions.

Figure 4.1 Key Junction Locations



4.3.2 The capacity of each junction approach is the volume of traffic that could be expected to pass through that type and layout of junction in an hour under typical operating conditions. The junction models compare this with the traffic demand forecasts to calculate the ratio of flow to capacity (RFC) as a measure of how well the junction is expected to accommodate the future demand.

4.3.3 When the traffic demand is less than the junction capacity, all approaching vehicles are able pass through the junction within the modelled hour. A low level of queuing and delay could be experienced if several vehicles arrive together and have to wait for the preceding vehicle to complete their chosen turn. As the demand approaching a junction rises towards the capacity, the delay to vehicles from temporary, transient queues rises as some vehicles have to wait before making their intended turn.

TRANCHE 1

A27 / A283 STEYNING ROAD

4.3.4 The roundabout is expected to be operating close to capacity in the AM peak hour. Both A283 approaches come under similar pressure with the Reference Case and Scenario C demand forecasts.

4.3.5 During the PM peak hour, the junction is operating over capacity with the Reference Case demand forecast. When the Scenario C development traffic is added, the approach from the westbound A27 off-slip is pushed well over capacity with a significant queue predicted by the modelling.

4.3.6 Additional capacity at this junction is required to mitigate the expected impact of development proposals.

A259 BRIGHTON ROAD / A283 OLD SHOREHAM ROAD

4.3.7 The junction modelling indicates that this junction will be over capacity in the AM peak and PM peak hours. The Reference Case and Scenario C traffic demand forecasts. Improvements are therefore required to mitigate the expected impact of the development proposals.

A259 BRIGHTON ROAD / A2025 SOUTH STREET

4.3.8 The junction modelling indicates that all three approaches will be over capacity in the AM peak and PM peak hours. The Reference Case and Scenario C traffic demand forecasts. Improvements are therefore required to mitigate the expected impact of the development proposals.

A27 OLD SHOREHAM ROAD / A2025 GRINSTEAD LANE

4.3.9 Both the A27 Upper Brighton Road and A27 Old Shoreham Road approaches to this roundabout operate over capacity in all tested demand scenarios. The A2025 Grinstead Lane entry is also approaching capacity in all scenarios except the Scenario C AM peak hour, where demand exceeds capacity along with the A27 approaches.

4.3.10 Additional capacity at this junction is required to mitigate the expected impact of development proposals.

A27 SUSSEX PAD

4.3.11 The existing traffic signal controlled A27 Sussex Pad junction is expected to be replaced by a proposed New Monks Farm / Shoreham Airport / Lancing College combined access roundabout. Whilst the design of that junction has not been finalised at the time of writing, it is assumed to have sufficient capacity for forecast future demand and so no further modelling or mitigation is considered to be required.

TRANCHE 2

A27 / BUSTICLE LANE

4.3.12 The modelling indicates that this junction will operate just within capacity in both the AM peak and PM peak hours with the Reference Case and Scenario C traffic demand forecasts.

A27 SHOREHAM BYPASS / HANGLETON LINK DUMBBELL

4.3.13 The north and south roundabouts at this grade separated junction have been modelled and reported separately. The performance of the north roundabout improves with the Scenario C demand forecasts, so no changes are proposed for this junction. The performance of the south roundabout is no worse with the Scenario C AM peak hour demand forecasts, but in the PM peak hour, the existing over-capacity problems on the southern approach are exacerbated by the additional demand.

4.3.14 Additional capacity on the south approach to this junction could be required to mitigate the expected impact of development proposals.

A259 BRIGHTON ROAD / WESTERN ROAD

4.3.15 The modelling indicates that this junction will operate well within capacity in both the AM peak and PM peak hours with the Reference Case and Scenario C traffic demand forecasts.

A270 UPPER SHOREHAM ROAD / B2167 KINGSTON LANE

4.3.16 The modelling indicates that this junction will operate within capacity in both the AM peak and PM peak hours with the Reference Case and Scenario C traffic demand forecasts.

A27 SOMPTING BYPASS / UPPER BRIGHTON ROAD

4.3.17 The Upper Brighton Road approach to this junction moves from just within capacity to operating over-capacity in the morning peak hour following the introduction of the Scenario C demand. That entry is also approaching capacity in the PM peak hour in Scenario C.

4.3.18 Additional capacity on the south approach to this junction is required to mitigate the expected impact of development proposals.

A270 OLD SHOREHAM ROAD / A293 HANGLETON LINK

4.3.19 The modelling indicates that this junction will operate well within capacity in both the AM peak and PM peak hours with the Reference Case and Scenario C traffic demand forecasts.

A270 OLD SHOREHAM ROAD / A2038 HANGLETON ROAD / B2194 CARLTON TERRACE

4.3.20 The modelling indicates that this junction will operate within capacity in both the AM peak and PM peak hours with the Reference Case and Scenario C traffic demand forecasts.

A259 WELLINGTON ROAD / B2194 STATION ROAD

4.3.21 The modelling indicates that this junction will operate just within capacity in both the AM peak and PM peak hours with the Reference Case and Scenario C traffic demand forecasts.

5 2031 FORECAST YEAR - MITIGATION RESULTS

5.1 INTRODUCTION

5.1.1 The following junctions have been identified as having at least one arm, which is projected to be operating over capacity in 2031:

- A27 / A283 Steyning Road
- A259 Brighton Road / A283 Old Shoreham Road
- A259 Brighton Road / A2025 South Street
- A27 Old Shoreham Road / A2025 Grinstead Lane
- A27 Shoreham Bypass / Hangleton Link South Roundabout
- A27 Sompting Bypass / Upper Brighton Road.

5.1.2 The mitigation measures proposed for each of these junctions in the main report (August 2013) and addendum (June 2014) have been reviewed by the project team and, where appropriate, revised to suit the Scenario C traffic demand forecasts. Each mitigated junction has been modelled (using ARCADY or LinSig software) to assess the proposed alterations to the junction geometries.

5.1.3 Following the identification of the mitigation measures, new 2031 forecast year model runs were undertaken using the Shoreham Harbour Transport Model (SHTM).

5.1.4 Scenario C demand was run in SHTM with the updated network to reflect the mitigation proposed by ASHTS. This mitigation includes the schemes proposed for the Tranche 2 junctions in the main report. The additional junctions considered in the main ASHTS report (August 2013) were:

- A27 / Busticle Lane
- A27 Shoreham Bypass / Hangleton Link Dumbbell Junction
- A259 Brighton Road / Western Road
- A270 Upper Shoreham Road / B2167 Kingston Lane
- A270 Old Shoreham Road / A293 Hangleton Link signalled junction
- A270 Old Shoreham Road / A2038 Hangleton Road / B2194 Carlton Terrace
- A259 Wellington Road / B2194 Station Road.

5.1.5 Junction improvements were proposed at A27 / Busticle Lane, A27 Shoreham Bypass / Hangleton Link dumbbell, A27 Sompting Bypass / Upper Brighton Road and A259 Wellington Road / B2194 Station Road to mitigate the impact of the Scenario B demand forecasts expected in November 2012 when the main ASHTS report was produced.

5.1.6 The flows established by the Scenario C network model runs were then fed into individual junction models of key junctions in the study area. The results from the SHTM and the junction models are presented and discussed in this section. A summary of the impact from the demand and network changes on the junction modelling results is presented in Table 5.1. The mitigation objective of increasing capacity so that the overall junction works within capacity or is no worse than the Reference Case operation informed the decision about whether mitigation would be required at each site.

Table 5.1 Summary of Junction Capacity Assessments

Junction	AM Peak Max RFC			PM Peak Max RFC		
	Reference Case	Scenario C	With Mitigation	Reference Case	Scenario C	With Mitigation
A27 / A283 Steyning Road	0.97	**1.00**	0.98	**1.29**	**3.30**	0.95
A259 Brighton Road / A283 Old Shoreham Road	**1.73**	**1.75**	**1.08**	**1.59**	**1.80**	0.98
A259 Brighton Road / A2025 South Street	**1.80**	**2.09**	**1.09**	**1.83**	**1.94**	**1.40**
A27 Old Shoreham Road / A2025 Grinstead Lane	**1.73**	**1.91**	**1.24**	**1.85**	**1.94**	**1.39**
A27 Shoreham Bypass / Hangleton Link South Roundabout	**1.20**	**1.22**	0.93	**1.28**	**1.56**	**1.09**
A27 Sompting Bypass / Upper Brighton Road	0.98	**1.17**	1.00	0.89	0.95	0.85

5.1.7 The turning flows used in the detailed assessment of these junctions are given for the Reference Case, Scenario C and Scenario C with transport mitigation in **Appendix D**. Full details of the outputs from the detailed junction modelling are contained in **Appendix H** of this report.

5.2 SUSTAINABLE TRANSPORT MEASURES

5.2.1 Sustainable transport measures will be promoted to reduce demand for travel by private car in innovative ways. These may include:

- Personal travel planning
- School travel planning
- Workplace travel planning
- Cycling and walking promotion
- Public transport information and marketing
- Car clubs.

5.2.2 Collectively these sustainable transport measures are expected to reduce the highway traffic demand in the network.

5.2.3 Research for the main study (August 2013) showed that experience from the Sustainable Travel Towns (Worcester, Peterborough and Darlington) saw a reduction of 9% in car driver trips in 2008 compared to 2004[2]. The same study found the following reductions in car use based upon distance travelled;

[2] Sloman L, Cairns S, Newson C, Anable J, Pridmore A & Goodwin P (2010), *The Effects of Smarter Choices Programmes in Sustainable Travel Towns; Research Report*

- Less than 1km = 22% reduction
- 1km – 3km = 14% reduction
- 3km – 5km = 10% reduction
- 5km – 10km = 6% reduction
- 10km – 50km = 3% reduction
- Over 50km = No reduction.

5.2.4 As the existing modelling tool does not capture travellers' responses to most of these sustainable transport measures, it was agreed with ADC that a suitable approach to reflect their impacts on reducing private car use is to reduce the number of trips for certain movements and trip purposes for individual movements based upon the likely reductions above. In order to ensure that this factoring process does not over-estimate the amount of highway trip reduction, it is also agreed that such factoring should be solely related to trips to or from the site allocations and their immediately surrounding areas (within 0.4 – 0.8 km / 0.25 – 0.5 mile radius). This ensured that the scale of reduction is in proportion to the funding that may be available for Smarter Choices measures and accounts for the fact that large-scale new development may provide more opportunities for the financing of such measures.

5.2.5 Prior to the application of these factors, an additional reduction in trips was applied to each of the scenarios to remove those trips that would start and end within the same development site. An internalisation factor of 10% was therefore agreed for the strategic sites modelled explicitly in this analysis to account for commuting, shopping and educational escort trips starting and ending within the same site as per the pre-mitigation scenarios.

5.2.6 Although the impacts from sustainable transport measures were assumed to be focused on site allocation areas, it is believed a small group of these measures would still have a much wider impact. These measures are summarised in Table 5.2 and their respective impacts were applied to the remaining area of Adur but without double counting any of the above reductions. The exact percentages of reductions were established during the main study (August 2013) based on information in the Yeovil Transport Strategy Review[3], which provides empirical evidence on the likely scale of reductions and greater breakdown on the effects of individual measures than in other studies.

Table 5.2 Adur District Sustainable Travel Measures

Measure	Trip Reduction	Application
Travel Awareness Campaigns	1.3%	Trips < 5km
Increase in Cycling	3.0%	Trips < 6 km
Increase in Walking	1.0%	Trips < 2km
Public Transport Improvements	2.6%	Trips between zones within 500m of no. 2 and no. 700 services

5.2.7 These trip reductions have been applied to the forecast travel demand for Scenario C prior to assignment on the highway network model.

[3] Walford S (2009), *Second Yeovil Transport Strategy Review; Non-Modellable Interventions*

5.3 2031 FORECAST YEAR - NETWORK PERFORMANCE

NETWORK STATISTICS

5.3.1 The effect of the proposed sustainable travel initiatives and network mitigation measures on the global network statistics for each of the tested scenarios is examined in the following section.

5.3.2 Table 5.3 shows a comparison of results from the AM peak models and Table 5.4 compares the network statistics from the evening peak models. The statistics show the total time vehicles spend moving through the network or delayed in queues during the chosen modelled hour. The number of PCUs making each movement is multiplied by the modelled journey time for that movement and summed to find the total pcu-hrs for each scenario.

Table 5.3 AM Peak Global Model Statistics Comparison

Statistic	Reference	Scenario C	Scenario C with Mitigation	Mitigation Impact
Transient Queues (pcu-hrs / hr)	9,798	10,018	9,831	-187
Over Cap Queue (pcu-hrs / hr)	8,875	9,699	9,243	-456
Total Travel Time (pcu-hrs / hr)	43,322	44,905	44,095	-810
Total Travel Distance (pcu-km / hr)	1,541,563	1,560,795	1,550,732	-10,064
Average Speed (kph)	35.6	34.8	35.2	+0.4

5.3.3 The global network statistics from the morning peak model demonstrate that the network improvements, along with demand reduction from sustainable travel measures, result in overall network performance which is an improvement over the Scenario C models with the original demand forecasts. Therefore the mitigation measures identified accommodate the demand from the proposed developments and lead to a slightly beneficial impact overall on the operation of the road network compared to scenario C without mitigation.

Table 5.4 PM Peak Global Model Statistics Comparison

Statistic	Reference	Scenario C	Scenario C with Mitigation	Mitigation Impact
Transient Queues (pcu-hrs / hr)	13,099	13,395	13,212	-183
Over Cap Queue (pcu-hrs / hr)	24,522	25,367	24,470	-897
Total Travel Time (pcu-hrs / hr)	67,730	69,423	68,291	-1,131
Total Travel Distance (pcu-km / hr)	1,909,416	1,929,043	1,917,157	-11,886
Average Speed (kph)	28.2	27.8	28.1	+0.3

5.3.4 The PM peak results follow a similar pattern to the AM peak statistics. The network capacity improvements, development traffic growth and sustainable travel demand reductions from the original Reference Case to Scenario C combine to give a slightly beneficial impact on the modelled highway network compared to scenario C without mitigation.

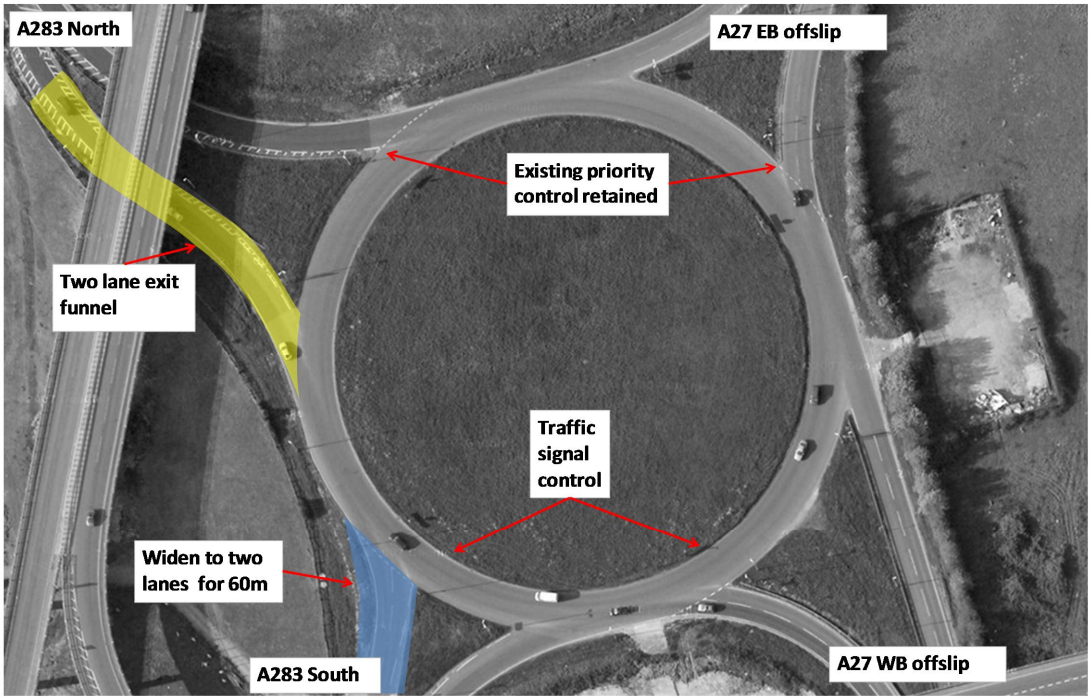
5.4 JUNCTION PERFORMANCE

A27 / A283 STEYNING ROAD

5.4.1 This highway mitigation is less extensive than the scheme proposed for this junction in the main report and first Addendum. The reduced number of dwellings and employment floor space in Scenario C compared to the previous tests reduces the traffic generated by the developments and allows for a reduction in the scale of capacity increase needed.

5.4.2 The signalisation of the roundabout can be reduced to just the A283 South and A27 Westbound Off-Slip approaches, with give-way control retained for the other two entries. The flare on the A283 South entry has been reduced and the widening of the A283 North approach is no longer required. The circulatory widening is also no longer required. These proposals are shown in Figure 5.1.

Figure 5.1 Proposed Mitigation at A27 / A283 Steyning Road Roundabout



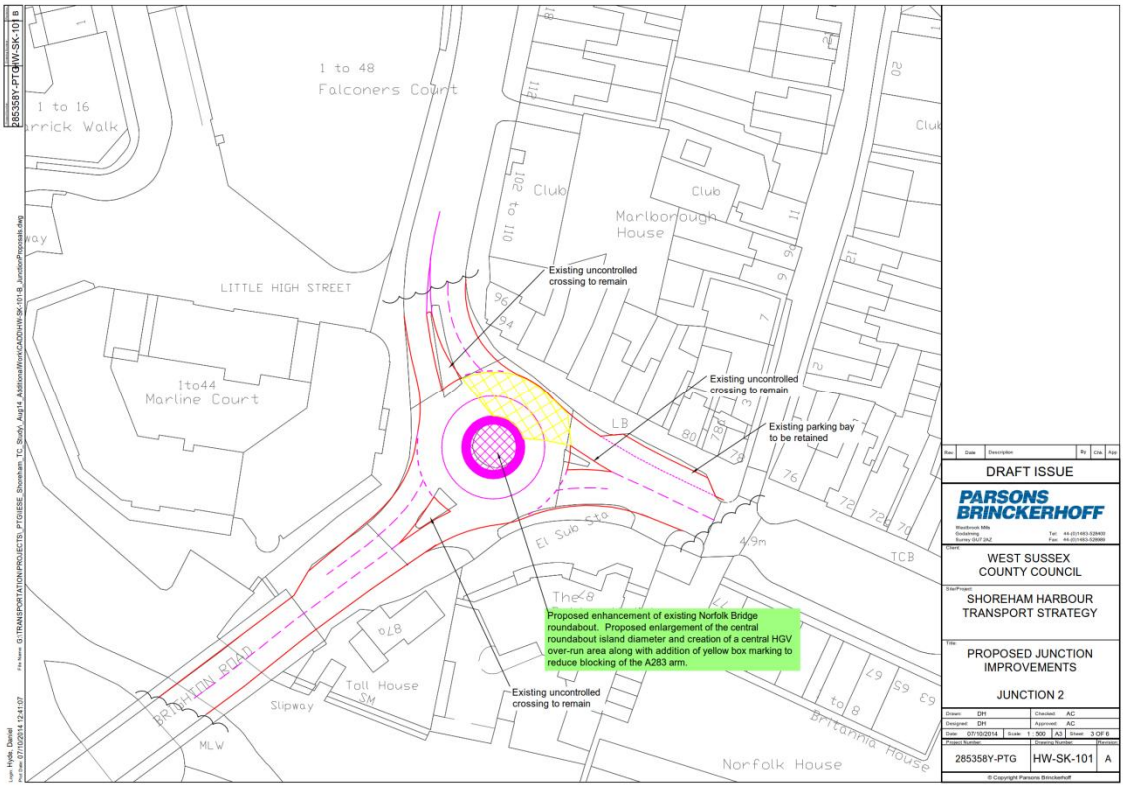
5.4.3 The proposed mitigation ensures the junction continues to operate within capacity in the morning peak hour and resolves the over-capacity issue identified in the evening peak hour. In both the AM peak and PM peak the A283 North entry experiences the highest ratio of flow to capacity.

A259 BRIGHTON ROAD / A283 OLD SHOREHAM ROAD

5.4.4 The mitigation proposal from the previous Addendum (June 2014), which considered Scenario B2, is also considered suitable for the Scenario C demand forecasts. In summary, the proposal is to expand the existing mini roundabout to a standard roundabout by realigning the footway across the south of the junction to develop the A259 High Street entry flare earlier, increasing the inscribed diameter of the roundabout to 28 metres to accommodate this.

5.4.5 The A259 Brighton Road approach is still slightly over capacity in the morning peak hour, but the constraints at this location prevent the creation of any further highway capacity at this site. The reduction in traffic demand compared to Scenario B2 (as reported in the June 2014 Addendum) means that the junction performance with the proposed mitigation is improved compared to the previously tested development allocation scenarios as well as compared to the existing layout in the reference case scenario. These proposals are shown in Figure 5.2.

Figure 5.2: Highway Mitigation Proposal for A259 Brighton Road / A283 Old Shoreham Road



5.4.6 Figure 5.2 is taken from Technical Note 01, part of the Shoreham Harbour Transport Study (March 2014) conducted by Parsons Brinckerhoff previously.

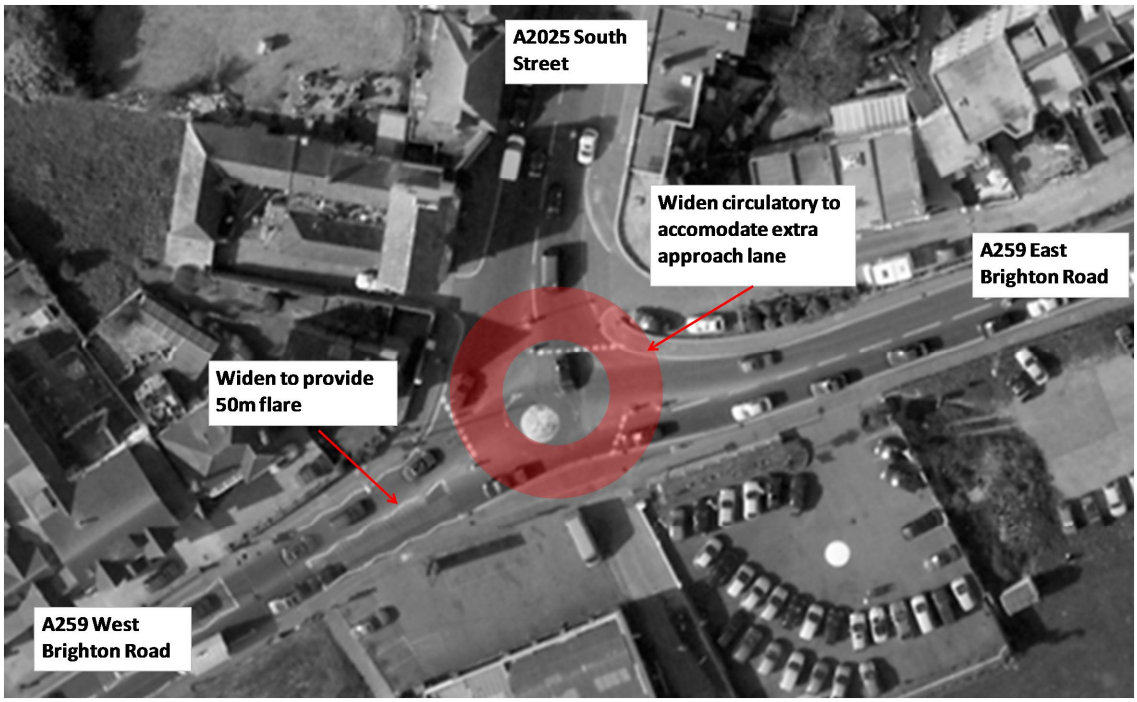
A259 BRIGHTON ROAD / A2025 SOUTH STREET

5.4.7 The highway mitigation proposal at the A259 Brighton Road / A2025 South Street is to expand the existing mini roundabout by widening the A259 west approach to provide a 50m flare and to enlarge the junction to a 30m diameter standard roundabout to accommodate this. This is also unchanged from the June 2014 Addendum.

5.4.8 The proposed mitigation at this location provides additional capacity to help accommodate the additional demand from the Local Plan development sites as well as relieving the congestion expected at this junction by 2031. The A259 Brighton Road East approach is still forecast to operate over capacity in the AM peak and PM peak hours, but with reduced queuing and vehicle delay compared to the existing layout with Reference Case demand.

5.4.9 The proposals are shown in Figure 5.3.

Figure 5.3: Highway Mitigation Proposal for A259 Brighton Road / A2025 South Street

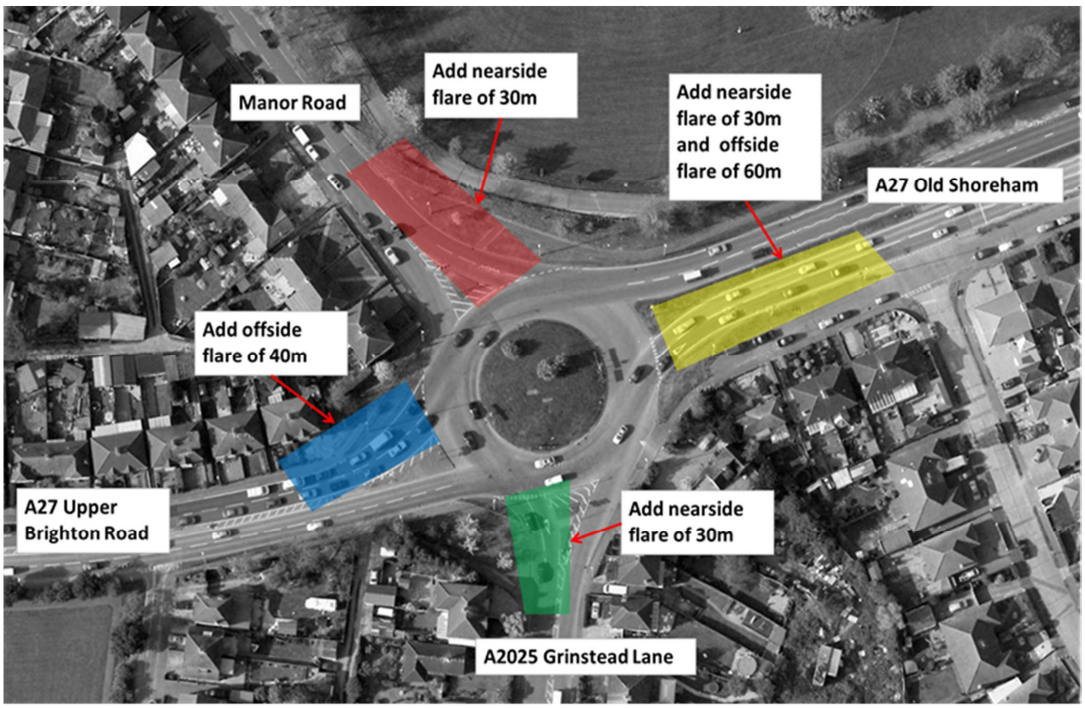


A27 OLD SHOREHAM ROAD / A2025 GRINSTEAD LANE

5.4.10 The highway mitigation proposal for the A27 / A2025 Grinstead Lane is to turn the existing roundabout into a signalised junction with a left turn slip lane from the A27 east and widened approaches. The A27 east approach would be widened to accommodate two full lanes with a flare either side, the A27 west approach have an additional offside flare, Manor road would have a nearside flare and Grinstead Lane would have one full lane with a flare either side.

5.4.11 The proposed mitigation for this junction gives a significant improvement in performance when compared to the existing layout in the reference case scenario, but does not completely eliminate the over-capacity issues identified. In both peak hours the conflict between high traffic volumes on the A27 and Grinstead Lane requires a compromise in the green time allocated to the controlling stages and leads to both approaches operating over calculated capacity. These proposals are shown in Figure 5.4.

Figure 5.4: Highway Mitigation Proposal for A27 Old Shoreham Road / A2025 Grinstead Lane



A27 / HANGLETON LINK SOUTH ROUNDABOUT

5.4.12 The proposed mitigation is to convert the southern roundabout of the existing dumbbell arrangement into a signalised junction. The junction would have flared approaches added to the A27 off-slip and Hangleton Link Road arms and operate as a three stage signal plan. Comprising of 1) Hangleton Link and North Roundabout Link; 2) Hangleton Link and A27 Off-slip left filter; and 3) A27 Off-slip all movements.

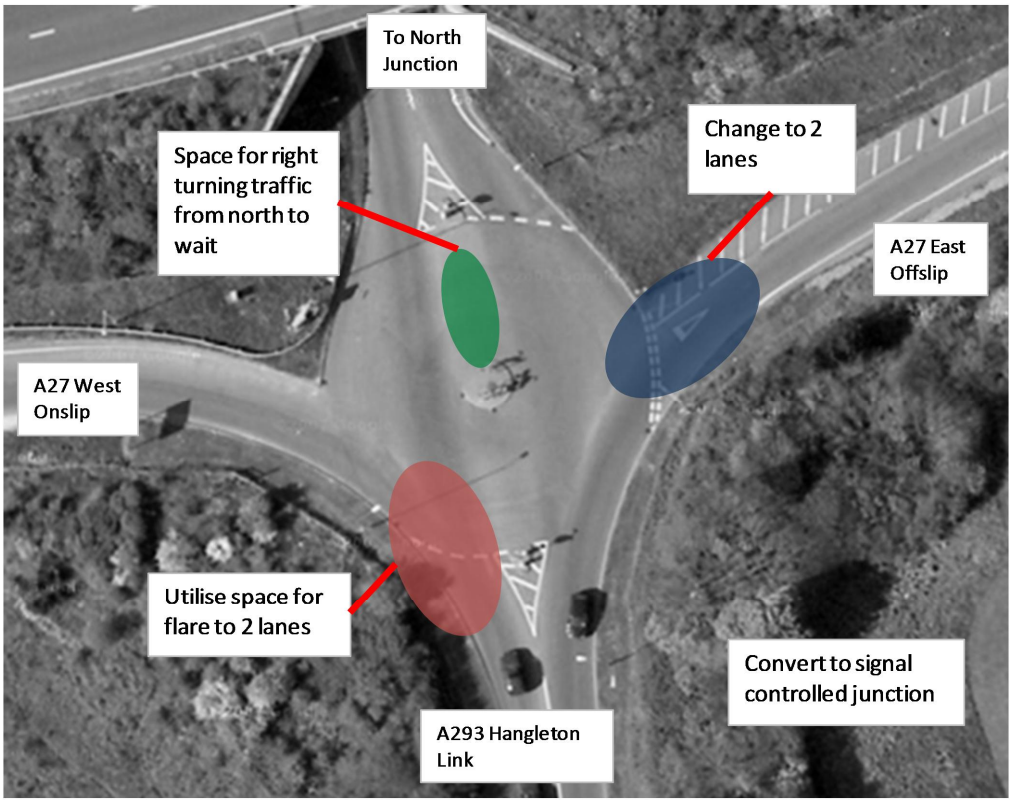
5.4.13 The signal control should be vehicle actuated, particularly as stage 3 is considered unlikely to be needed other than for trips heading to the golf course and for those who've erroneously left the A27, so is not assumed to be called every cycle.

5.4.14 The proposed mitigation for this junction gives a significant improvement in performance when compared to the existing layout in the reference case scenario, but does not completely eliminate the over-capacity issue on the Hangleton Link approach in the PM peak hour.

5.4.15 As shown in Table 5.1, the highest ratio of demand flow to capacity in the PM peak hour (for the southern A293 Hangleton Link approach) is 1.09 compared to 1.28 with the Reference Case demand using the existing layout. The proposed improvement provides one lane to turn left onto the A27 Westbound On-Slip and one to go straight ahead under the A27 to the north roundabout. Providing additional capacity at this location would require widening one or both of these junction exits and is likely to significantly increase the cost associated with the improvement.

5.4.16 The proposed mitigation is illustrated in Figure 5.5

Figure 5.5: Mitigation Proposal for A27 / Hangleton Link South Roundabout

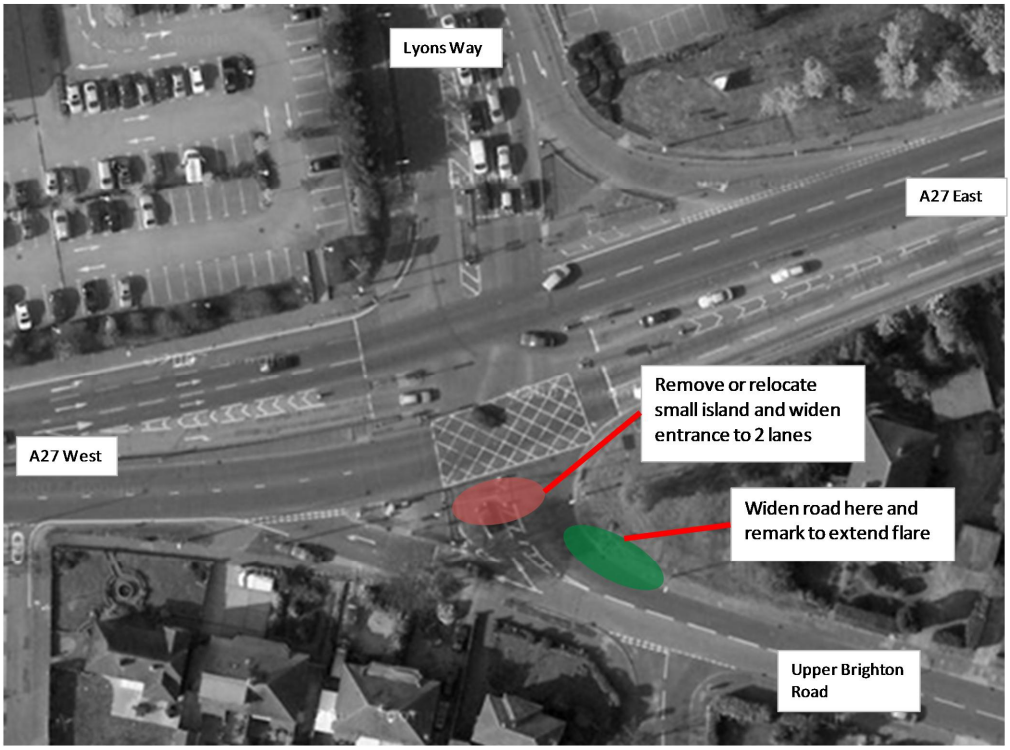


A27 SOMPTING BYPASS / UPPER BRIGHTON ROAD

5.4.17 The proposed mitigation is to widen the Upper Brighton Road approach to allow two lanes at the stop line with the left lane marked for ahead (to Lyons Way) and right turning (to A27 East) traffic and the right lane for right turning traffic only. The mitigation proposal is illustrated in Figure 5.6.

5.4.18 Some land take from the east verge of Upper Brighton Road may help the layout but the works would primarily consist of moving or removing the island on Upper Brighton Road and remarking of the road space. The physical constraints around the junction limit the scope for providing additional capacity within the existing highway boundary.

Figure 5.6: Mitigation Proposal for A27 Sompting Bypass / Upper Brighton Road



5.5 JOURNEY TIMES

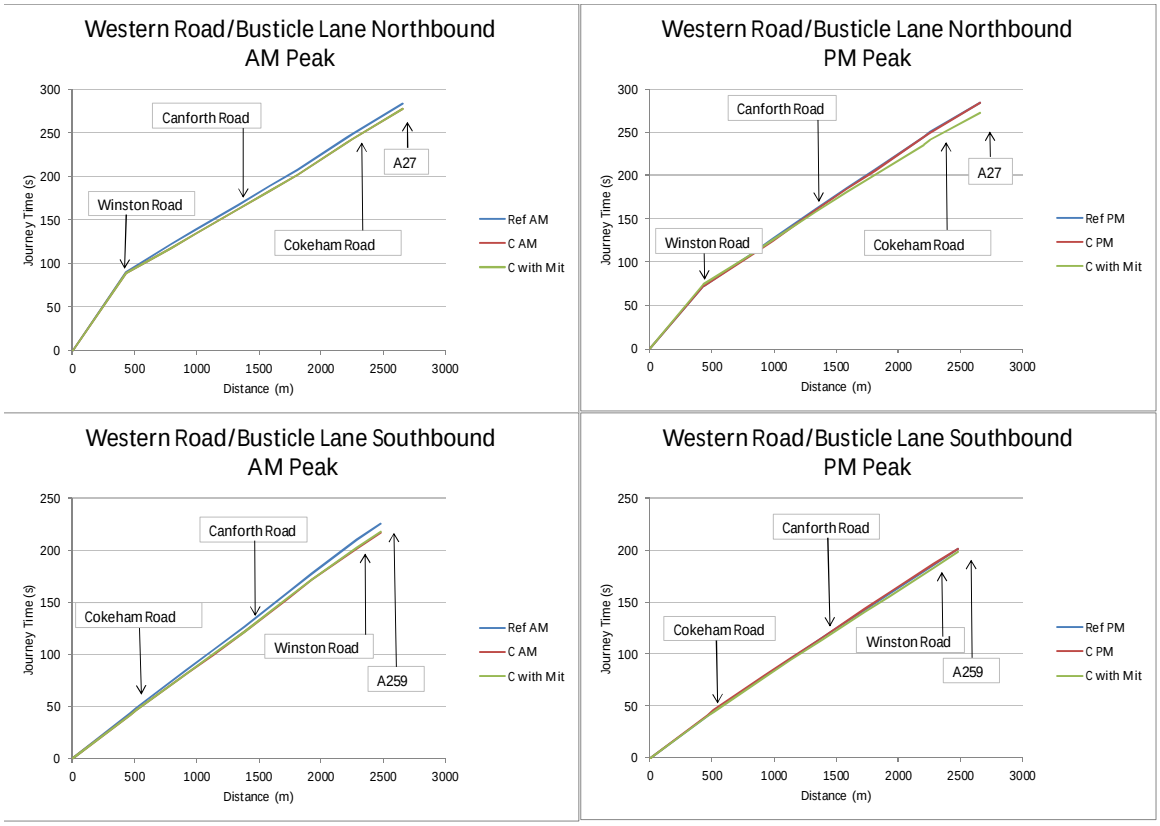
5.5.1 Seven journey time routes have been defined in order to assess the performance of key routes through the study area. The routes are listed below and are shown on a map in **Appendix E-1**. For clarity, larger versions of the journey time plots are contained in **Appendix E-2**.

1. Western Road / Busticle Lane
2. South Street / Grinstead Lane
3. A283 Old Shoreham Road / Steyning Road
4. B2194 Station Road / A293
5. A27
6. A27/A270
7. A259

5.5.2 The journey times have been assessed in both directions along each route for the reference case, the initial scenario models and the with-mitigation scenario models. The results of this analysis

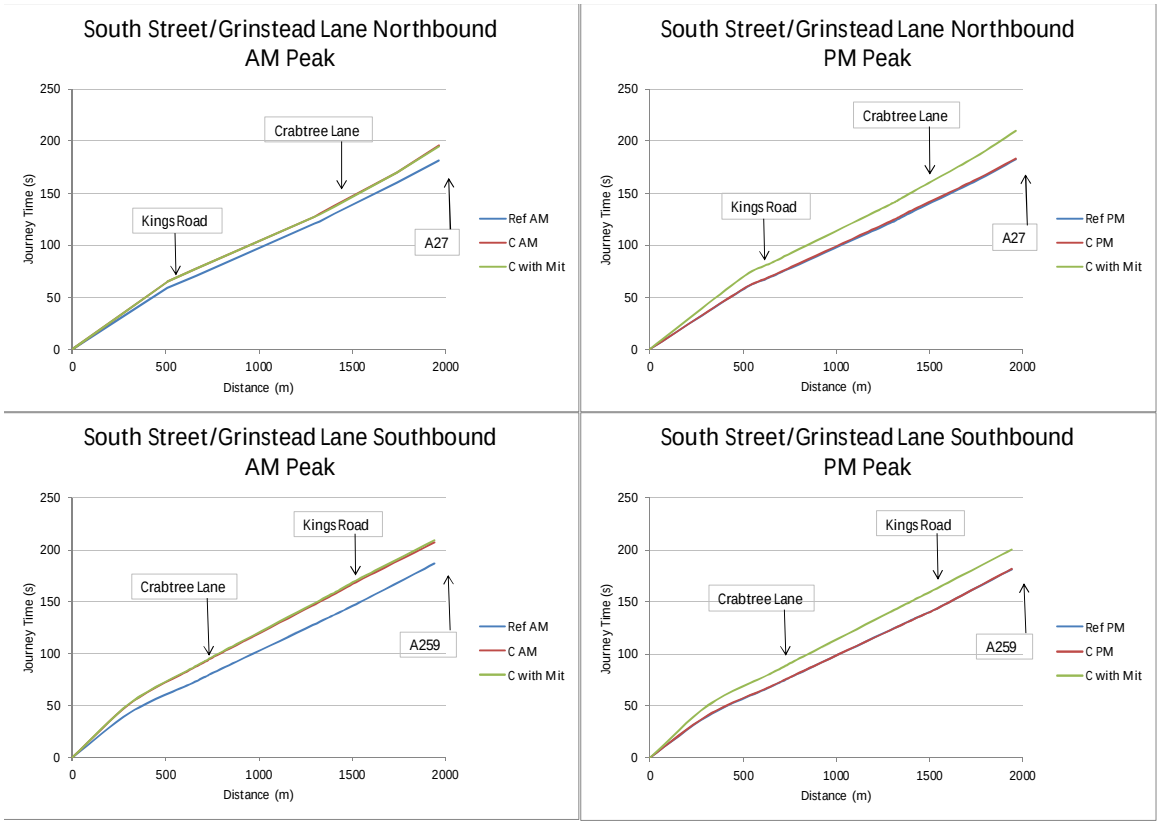
are shown below for scenario C. Intersections with other roads are marked along the route for reference.

Figure 5.7 Route 1 - Western Road / Busticle Lane Journey Time Graphs



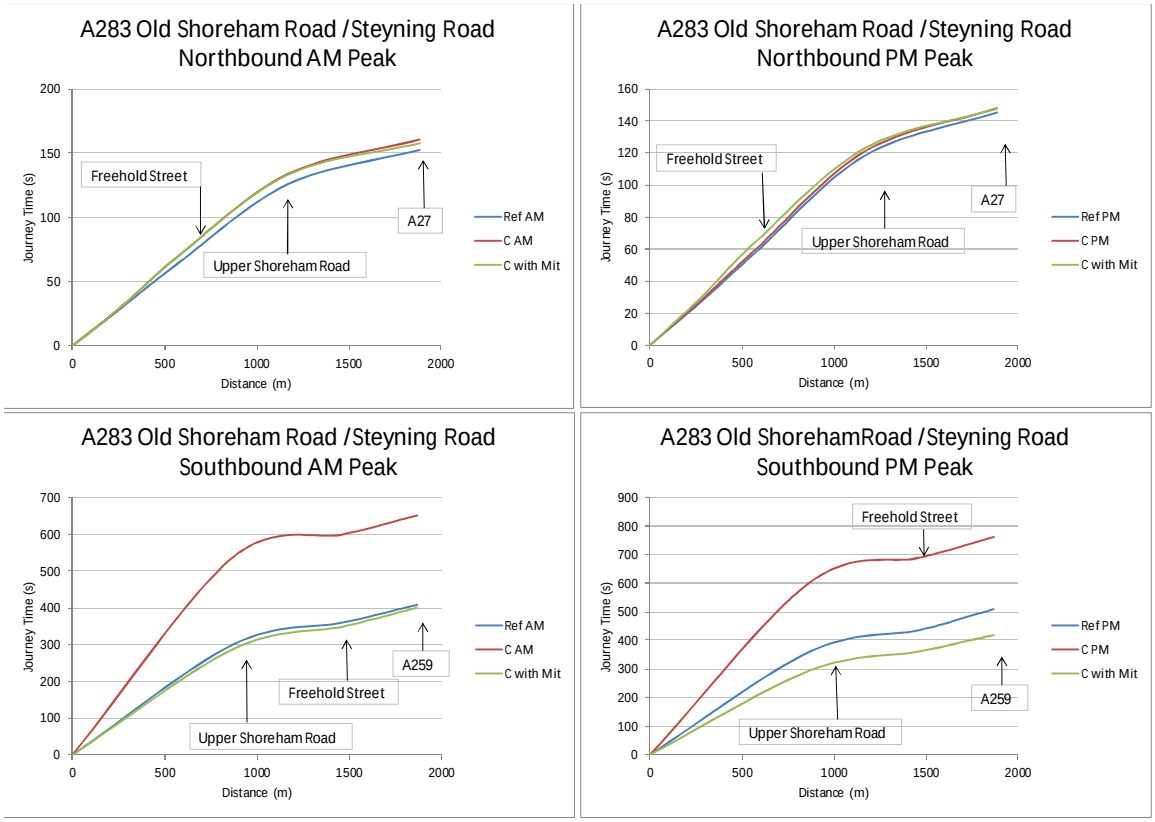
5.5.3 Along Western Road / Busticle Lane, the modelled journey time is very similar between the Reference case and Scenario C.

Figure 5.8 Route 2 - South Street / Grinstead Lane Journey Time Graphs



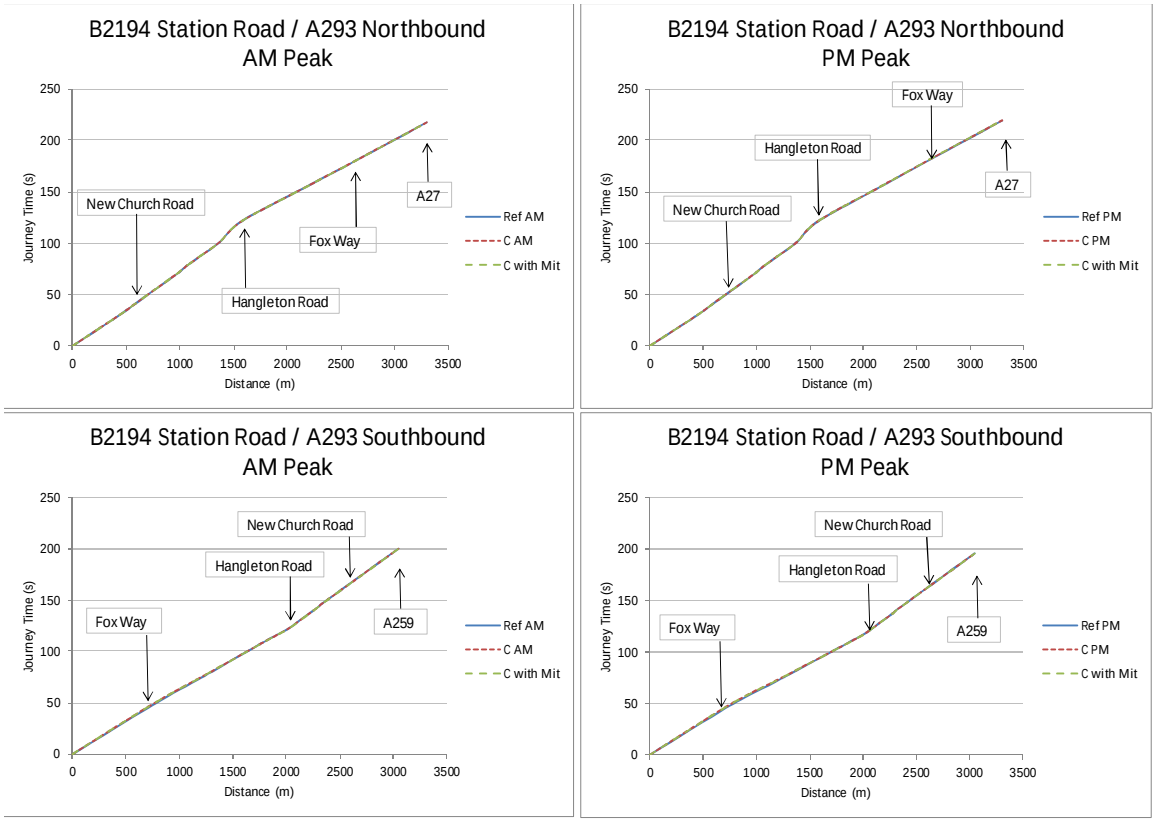
5.5.4 The capacity improvements at either end of South Street / Grinstead Lane attract additional demand from surrounding roads in Scenario C with mitigation when compared to the Reference case. This contributes to the slower journey times in the evening peak hour.

Figure 5.9 Route 3 - A283 Old Shoreham Road / Steyning Road



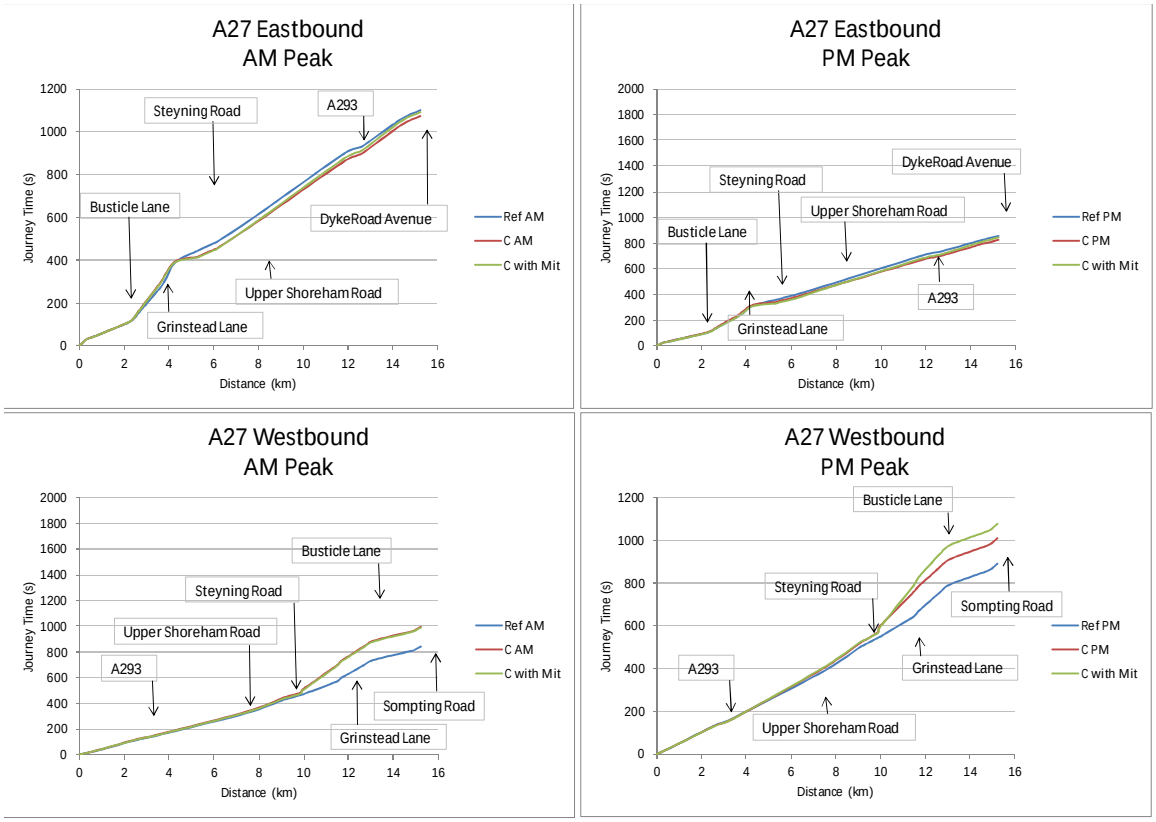
5.5.5 Southbound on Old Shoreham Road / Steyning Road the mitigation measures reduce the journey time by a noticeable amount, up to five minutes over the whole 2km length depending upon time period. In the PM peak hour, the Scenario C with Mitigation model has a faster journey time than the Reference Case. Northbound journey times are similar in all three scenarios.

Figure 5.10 Route 4 - B2194 Station Road / A293



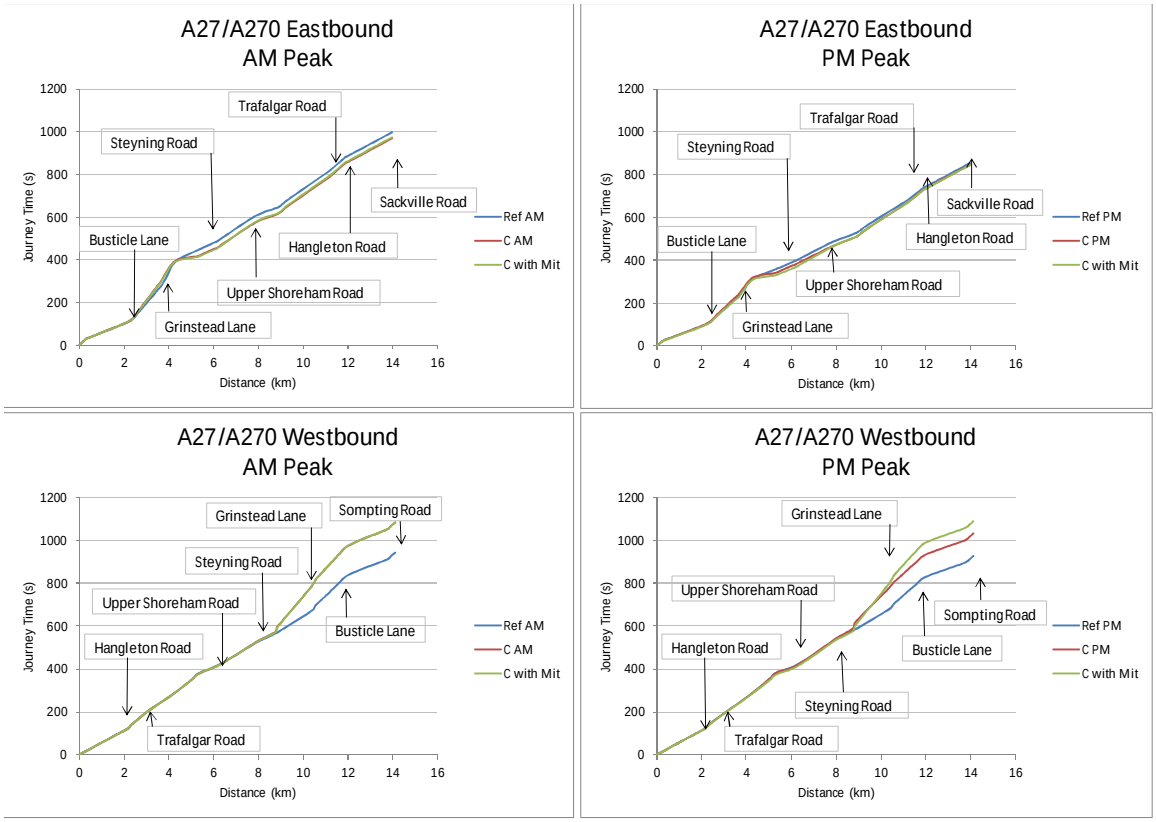
5.5.6 The junctions along this route do not receive any direct mitigation so the journey times are similar in all three scenarios.

Figure 5.11 Route 5 - A27 Journey Time Graphs



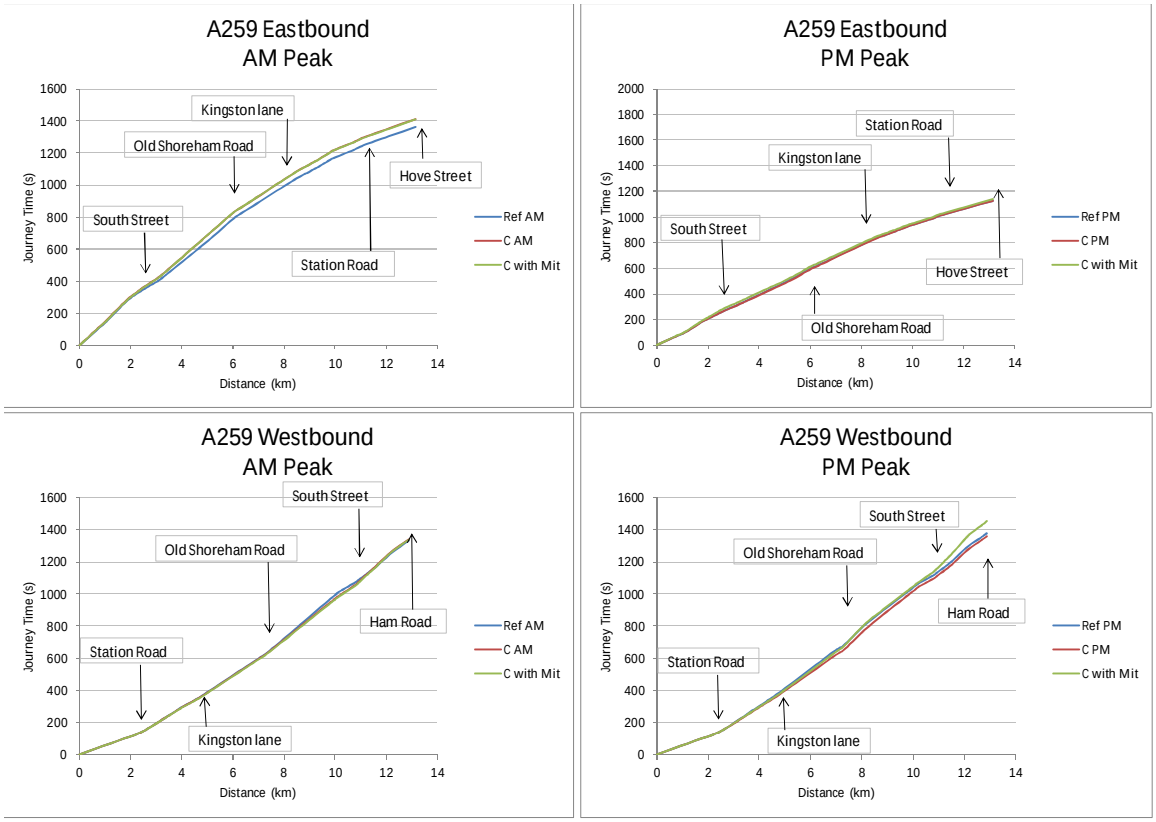
5.5.7 The eastbound journey times along Route 5 are similar in all three scenarios. The westbound journeys are slowed in the Scenario C models by the introduction of the roundabout, which replaces the Sussex Pad traffic signals on the A27.

Figure 5.12 Route 6 - A27 / A270 Journey Time Graphs



5.5.8 The eastbound journey times along Route 6 are similar in all three scenarios. The westbound journeys are slowed in the Scenario C models by the introduction of the roundabout, which replaces the Sussex Pad traffic signals on the A27.

Figure 5.13 Route 7 - A259 Journey Time Graphs



5.5.9 The journey times along Route 7 are similar in all three scenarios.

5.6 IMPACT ON AIR QUALITY MANAGEMENT AREAS

5.6.1 In addition to network statistics and individual junction assessment, traffic impacts on three local areas in Adur, where air quality is a major concern, were also investigated. These include two Air Quality Management Areas (AQMA) and one conservation area in the district as listed below:

- The A270 between the junctions with Kingston Lane and Lower Drive
- The A259 between Ropetackle Roundabout and Surry Street
- Sompting Conservation area, in particular a section of West Street, Sompting, between Church Lane and Lambley's Lane.

5.6.2 The flow, queue and delay through the AQMAs and the Sompting Conservation area are shown in Table 5.5, Table 5.6 and Table 5.7.

Table 5.5 Flow in pcu through AQMAs and Sompting Conservation Area

AQMAs			AM Peak			PM Peak		
Road	**From**	**To**	**Ref**	**C**	**C with Mitigation**	**Ref**	**C**	**C with Mitigation**
Old Shoreham Road	Kingston Lane junction	Lower Drive junction	1,186	1,225	1,242	1,012	1,145	1,118
	Lower Drive junction	Kingston Lane junction	1,472	1,461	1,461	1,530	1,548	1,446
A259 High Street	Ropetackle Roundabout	Surry Street	986	984	979	741	714	687
	Surry Street	Ropetackle Roundabout	1,033	1,016	1,003	952	862	1,128
Worthing Grove Lodge / Lyons Farm	Offington Roundabout	Upper Brighton Road	1,476	1,474	1,463	1,267	1,293	1,248
	Upper Brighton Road	Offington Roundabout	1,315	1,352	1,372	1,533	1,543	1,558
Sompting Conservation Area								
	Church Lane	Lambleys Lane	886	1,072	1,064	430	498	674
	Lambleys Lane	Church Lane	270	294	283	176	184	163

Table 5.6 Average Queue in Metres through AQMAs and Sompting Conservation Area

AQMAs			AM Peak			PM Peak		
Road	**From**	**To**	**Ref**	**C**	**C with Mitigation**	**Ref**	**C**	**C with Mitigation**
Old Shoreham Road	Kingston Lane junction	Lower Drive junction	0	0	0	0	0	0
	Lower Drive junction	Kingston Lane junction	9	9	9	9	10	9
A259 High Street	Ropetackle Roundabout	Surry Street	4	4	4	3	3	3
	Surry Street	Ropetackle Roundabout	3	1	1	84	117	41
Worthing Grove Lodge / Lyons Farm	Offington Roundabout	Upper Brighton Road	9	10	9	2	2	2
	Upper Brighton Road	Offington Roundabout	10	11	10	12	12	14
Sompting Conservation Area								
	Church Lane	Lambleys Lane	0	36	32	0	0	0
	Lambleys Lane	Church Lane	0	0	0	0	0	0

Table 5.7 Delay in seconds per PCU through AQMAs and Sompting Conservation Area

AQMAs			AM Peak			PM Peak		
Road	**From**	**To**	**Ref**	**C**	**C with Mitigation**	**Ref**	**C**	**C with Mitigation**
Old Shoreham Road	Kingston Lane junction	Lower Drive junction	8	9	9	6	8	7
	Lower Drive junction	Kingston Lane junction	53	51	51	72	83	49
A259 High Street	Ropetackle Roundabout	Surry Street	55	56	54	41	34	33
	Surry Street	Ropetackle Roundabout	49	38	37	559	682	158
Worthing Grove Lodge / Lyons Farm	Offington Roundabout	Upper Brighton Road	827	879	822	404	411	409
	Upper Brighton Road	Offington Roundabout	813	857	811	1,023	1,004	1,086
Sompting Conservation Area								
	Church Lane	Lambleys Lane	23	159	145	5	7	13
	Lambleys Lane	Church Lane	5	5	5	3	3	3

5.6.3 The flows through the A259 High Street AQMA and the Sompting Conservation area are higher in the AM peak than the PM peak hour. The PM peak queue and delay reductions illustrate the improvement in westbound flow along Shoreham High Street following the proposed improvements to Ropetackle Roundabout.

5.6.4 The westbound traffic through the Sompting Conservation area in the morning peak hour still experiences some queuing and delay in Scenario C with the proposed mitigation in place. The principle cause is the downstream A27 / Upper Brighton Road junction where some capacity improvement is proposed for Upper Brighton Road, but physical constraints prevent full provision to accommodate the forecast traffic demand. The AM peak hour performs worse in this section due to the tidal nature of trips from the surrounding residential areas being delayed while waiting to get out onto the A27.

5.6.5 There are some cases where no queue is reported but there is a delay. This is because the measure of delay includes transient delay (such as temporary queuing unrelated to junctions) and delays associated with heavy traffic flows that merely reduce vehicle speeds.

6 HANGLETON JUNCTION ANALYSIS

TRAFFIC PATTERNS

6.1.1 Additional analysis of traffic patterns at the A27 Hangleton Link junction has been conducted at the request of WSCC. This junction lies just outside the Adur District boundary, but was considered by the initial analysis in the main ASHTS report (August 2013).

6.1.2 The traffic using the Hangleton Link south of the A27 has been isolated using Select Link Analysis within the SATURN models. Hangleton Link traffic crossing the boundaries between Adur and the neighbouring districts has then been identified to isolate the origin and destination district. The Hangleton Link traffic has been grouped into the following districts:

- Worthing (including Arun and beyond)
- Horsham
- Adur
- Brighton and Hove
- East Sussex
- Mid Sussex
- Local traffic heading to/from West Hove Golf Club.

6.1.3 The breakdown of Hangleton Link traffic travelling to or from each of the identified areas is shown in Table 6.1 along with the total flow observed. The north and southbound traffic is shown separately to retain the observed pattern.

Table 6.1 Hangleton Link Traffic Summary

	Scenario C AM		Scenario C PM		Scenario C with Mitigation AM		Scenario C with Mitigation PM	
	NB	SB	NB	SB	NB	SB	NB	SB
Total Flow	1,985	1,510	2,499	1,550	1,906	1,492	2,425	1,422
Trip Origin District								
Worthing	0	117	0	49	0	121	0	41
Horsham	3	58	0	69	1	0	0	0
Adur	784	111	1,072	49	761	166	995	121
West Hove Golf Club	0	20	0	18	0	17	0	16
East Sussex	56	518	75	794	42	517	50	694
Mid Sussex	0	583	0	434	0	571	0	474
Brighton & Hove	1142	103	1352	138	1103	101	1,380	75
Trip Destination District								
Worthing	243	0	451	0	254	0	225	0
Horsham	230	0	307	0	0	0	0	0
Adur	91	687	332	565	280	671	850	468
West Hove Golf Club	44	0	24	0	41	0	21	0
East Sussex	625	0	593	3	600	0	604	3
Mid Sussex	586	0	756	0	586	0	686	0
Brighton & Hove	166	823	37	982	145	821	39	951

6.1.4 As expected, the northbound traffic mostly originates in Brighton and Hove or Adur with the southbound traffic mostly heading to those two districts. Traffic using the A27 (destinations of northbound Hangleton Link traffic and the origins of southbound traffic) has a wider spread of districts covered.

MERGE/DIVERGE ASSESSMENT

6.1.5 The impact of the future demand forecasts on the A27 merges and diverges has also been considered. The 2031 Reference Case and 2031 Scenario C with mitigation demand flows have been used to assess whether the existing merges and diverges on the main A27 carriageway provide sufficient capacity for the anticipated future traffic levels. The assessment uses TD22/06 – Layout of Grade Separated Junctions (DMRB Volume 6, Section 2, Part 1).

6.1.6 The existing layout consists of a two lane dual-carriageway in both directions with Type A – Taper Merges (TD 22/06 Figure 2/4.1) and Type A – Taper Diverges (TD 22/06 Figure 2/6.1) on both the east and westbound carriageways.

6.1.7 The 2031 future flow forecasts have been plotted on the charts in TD 22/06 Figure 2/3 AP - All-Purpose Road Merging Diagram and TD 22/06 Figure 2/5 AP - All-Purpose Road Diverging Diagram to determine the recommended provision for the anticipated traffic levels. The results of the assessment for the two modelled peaks are shown in Table 6.2 and Table 6.3.

Table 6.2 Merge/Diverge Comparison – AM Peak

Location	Existing Layout			Reference Case			Scenario C with Mitigation		
	U/S Lanes	Type	D/S Lanes	U/S Lanes	Type	D/S Lanes	U/S Lanes	Type	D/S Lanes
EB Diverge	2	A - Taper	2	3	C - Lane Drop	2	3	C - Lane Drop	2
EB Merge	2	A - Taper	2	2	F - Lane Gain with Ghost Island	3	2	E - Lane Gain	3
WB Diverge	2	A - Taper	2	2	A - Taper	2	2	A - Taper	2
WB Merge	2	A - Taper	2	2	A - Taper	2	2	A - Taper	2

Table 6.3 Merge/Diverge Comparison – PM Peak

Location	Existing Layout			Reference Case			Scenario C with Mitigation		
	U/S Lanes	Type	D/S Lanes	U/S Lanes	Type	D/S Lanes	U/S Lanes	Type	D/S Lanes
EB Diverge	2	A - Taper	2	2	A - Taper	2	2	A - Taper	2
EB Merge	2	A - Taper	2	2	B - Parallel	2	2	B - Parallel	2
WB Diverge	2	A - Taper	2	3	C - Lane Drop	2	3	C - Lane Drop	2
WB Merge	2	A - Taper	2	2	E - Lane Gain	3	2	E - Lane Gain	3

6.1.8 The provision required for Scenario C demand is the same or lower than the Reference Case due to impacts from smarter choice initiatives and network mitigation elsewhere. As the Scenario C demand reduces the impact at this junction compared to the Reference Case, no changes to the merges or diverges are proposed.

6.1.9 The analysis was conducted with demand flows for consistency with the other work in this study, so any congestion in the wider network will reduce arriving traffic volumes.

7 SCHEME COST ESTIMATES

7.1.1 Initial proposals have already been developed for the junctions in Section 5.1 after iterative discussion with WSCC and Brighton & Hove City Council based upon the Scenario C development assumptions (subject to further detailed study). Consideration has also been given to the available land surrounding each junction and the costs of each proposal in comparison with other options. Further detailed study may be required to refine the junction designs.

7.1.2 It should also be noted that all cost estimates have been prepared by project team quantity surveyors from the concept sketches in Section 5.4 and exclude land costs (including compensation), design and supervision, inflation, VAT or services. A contingency between 15% and 45% is included for each estimate depending on the perceived extent / difficulty of the works to be undertaken. This contingency takes account of uncertainty at the preliminary design stage and does not cover any of the exclusions set out above.

7.1.3 The cost estimates for each junction are summarised in Table 7.1.

Table 7.1 Scheme Cost Estimates

Junction	Estimated Total Cost
A27 / A283 Steyning Road	£541,597
A259 Brighton Road / A283 Old Shoreham Road	£342,780
A259 Brighton Road / A2025 South Street	£266,672
A27 Old Shoreham Road / A2025 Grinstead Lane	£878,829
A27 / Hangleton Link South Roundabout	£428,421
A27 Sompting Bypass / Upper Brighton Road	£ 39,159
Total	**£2,497,458**

8 SUMMARY AND CONCLUSIONS

8.1 SUMMARY

8.1.1 This addendum considers the transport impacts of an additional strategic residential and commercial site allocation scenario within Adur and Brighton & Hove in 2031 to inform the preparation of the Adur District Council Local Plan and Shoreham Harbour Joint Area Action Plan. It follows on from previous work for the Adur Local Plan and Shoreham Harbour Transport Study.

8.1.2 The principal changes incorporated into Scenario C are:

- Revised housing and employment allocations for the strategic development sites within Adur
- Revised access arrangements for the New Monks Farm and West Sompting sites
- Collision and safety hotspot identification and mitigation, if required
- Highway improvements at the key junctions identified by the main report.

8.1.3 It is understood that this scenario represents the preferred strategy of Adur District Council for the submission Local Plan.

8.2 TRAFFIC IMPACT OF DEVELOPMENT

8.2.1 The scenario tested for this addendum (Scenario C) yields an improvement over the previously tested Scenario B on the forecast traffic impact due to the combined impact from a reduced quantum of proposed development and demand management from sustainable travel initiatives, alongside the inclusion of highway capacity improvements identified during previous work. The effect of the proposed development on the key junctions was examined, along with the effect on journey times along key corridors as a means of assessing any area-wide impacts.

8.2.2 The potential impact of the development proposals on the highway network was considered sufficient to investigate interventions to mitigate the anticipated effects. Of the six junctions examined, five of the junctions require the same mitigation proposals as previously identified, but at the Steyning Road junction, it has been possible to reduce the scale and cost of the proposed mitigation layout, whilst enabling the junction to operate within capacity.

8.3 TRAFFIC IMPACT MITIGATION

8.3.1 Highway mitigation options were then explored for six junctions through individual junction assessment. The proposals seek to increase the capacity of the junctions whilst avoiding land take wherever possible and with minimum physical changes, as detailed below:

- **A27 / A283 Steyning Road** - Partially signalise roundabout with widening on the A283 north exit and A283 south entry.
- **A259 Brighton Road / A283 Old Shoreham Road** - Expand the roundabout and widen approach westbound.
- **A259 Brighton Road / A2025 South Street** - Widen the A259 west approach and enlarge circulatory.
- **A27 Old Shoreham Road / A2025 Grinstead Lane** - Convert existing roundabout to traffic signal controlled junction.

- **A27 / Hangleton Link South Roundabout** - Convert existing roundabout to traffic signal controlled junction.
- **A27 Sompting Bypass / Upper Brighton Road** - Widen the southern Upper Brighton Road approach to accommodate additional demand joining the A27.

8.3.2 The measures tested, in combination with reductions in overall travel demand, relieve the bottleneck effect of the junctions listed above to give a significant improvement in the individual junction performance and the journey times along key routes - such as the A27 and A259 corridors - through the study area. It is therefore concluded that the mitigation tested is generally sufficient to accommodate the increased traffic associated with all of the development scenarios examined.

8.3.3 It should be noted that the proposed junction improvements are initial concepts subject to further detailed study.

8.4 COLLISION / ROAD SAFETY

8.4.1 As required by NPPF paragraph 09, existing collision hotspots have been identified in relation to each development site. Potential future collision hotspots were also identified where issues could reasonably be anticipated due to traffic flow changes.

8.4.2 A number of existing hotspots have been identified where it is anticipated that development related flows could have the potential to increase collisions which are predominantly on the A27 corridor. Where these potential issues have been shown improvement schemes have been identified.

8.5 LIMITATIONS OF STUDY – COST ESTIMATES AND MITIGATION PHASING

8.5.1 The cost estimates presented are based on the concept diagrams presented and will need detailed designs to look at issues including potential alterations to the highway boundary, surrounding ground conditions, material and landscaping requirements etc. in greater detail. Until a detailed design process is completed, the costs presented may be subject to significant changes.

8.5.2 The study has not looked at any interim years between the present time and 2031 to better estimate when the implementation of mitigation measures will be required but has simply examined the “with” and “without” development scenarios in 2031.

8.5.3 Proper consideration of the time that mitigation will be required is not possible without better knowledge of when each of the site allocations are developed and the speed of development. These factors are currently not known and some sites in reality would be completed in a shorter timescale whereas others might be developed over many years. The timing of required mitigation can only be based upon general qualitative rather than detailed quantitative information and judgement.

8.5.4 For any site allocation, sustainable mitigation measures usually need to be implemented shortly after the first occupation of residential and commercial sites and be sustained on an on-going basis. However, it is also acknowledged that in some cases up-front mitigation / infrastructure may be required prior to new development commencing, subject to funding, so that these mitigation / infrastructure are in place when new residents move in. In both cases, investment will be required to implement and sustain these sustainable transport measures so the level of highway trip reduction assumed in this study can be achieved. Exact costs for these measures have not been included in this study.

8.5.5 Infrastructure improvements will be required at future year trigger points which will need to be determined as part of future planning applications. This will involve the assessment of when

traffic resulting from any development is deemed to have a material impact upon queues and/or delays on the road network compared to a "without" development scenario. For each development site, the scope of the network under consideration will be proportional to the traffic generated. This practice is in line with current planning guidance, namely the National Planning Policy Framework (2012) and Highways Agency Circular 02/2013.

8.5.6 Reference is made to a number of mitigation schemes on the A27, which is subject to a proposed Highways England improvement scheme as part of the Roads Investment Strategy (RIS 1) 2015 – 2020, known as the Worthing & Lancing Improvement study. There is also a neighbouring study investigating improvements to the A27 at Arundel.

8.5.7 Following the A27 Corridor Feasibility Study completed by DfT / Highways England, the scheme was included in the March 2015 Roads Investment Strategy (RIS). In response to inclusion within the RIS 1 period Highways England are understood to have developed a Delivery Plan, which outlines the next steps for taking the scheme forward (and can be found on the HE website) and include:

- developing and assessing a range of options to inform consultation with key stakeholders
- engaging more widely with local stakeholders
- further developing proposals and assessing traffic and environmental impacts
- making recommendations on the preferred route.

8.5.8 The estimated cost of this scheme is in the range of £50 million to £100million.

8.5.9 Due to the RIS 1 commitment to delivering improvements on the A27 along the Worthing and Lancing sections for construction prior to 2021 no additional mitigation scheme have been developed. It is therefore assumed that the Highways England proposals will address all existing and forecast capacity and highway safety issues along this section.