TRAFFIC & HIGHWAYS ENGINEERING LIMITED

TRANSPORT ASSESSMENT

SHOREHAM CEMENT WORKS AREA ACTION PLAN

A283 SHOREHAM ROAD

UPPER BEEDING

BN44 3TX

South Downs National Park Authority

ADL/AP/5201/05A

April 2022

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EXECUTIVE SUMMARY

South Downs National Park Authority (SDNPA) are currently preparing Shoreham Cement Works Area Action Plan (AAP). The AAP will sit alongside the recently adopted South Downs Local Plan (SDLP) which covers the plan period 2014-2033.

Shoreham Cement Works (SCW) is allocated under Policy SD56 of the SDLP for an exemplar sustainable mixed-use development, which delivers a substantially enhanced landscape and uses that are compatible with the purposes of National Park. ADL Traffic and Highways Engineering Ltd has been commissioned by SDNPA to prepare a Transport Assessment to inform the AAP.

Shoreham Cement Works is located within the South Downs National Park which has the highest level of landscape protection in the country. This has been taken into account in the preparation of this study, particularly in terms of the site access options.

Four development scenarios have been tested to determine whether any of the scenarios in this AAP can be accommodated without any adverse traffic impact in terms of traffic capacity, sustainable travel options, road safety, key junctions, or accident hot spots.

For the baseline traffic situation, through discussion with National Highways (NH) and West Sussex County Council (WSCC), it was agreed that it would not be acceptable to use data from the Worthing and Shoreham Harbour strategic models because neither model is up-to-date and therefore not considered to be sufficiently robust for SCW. The use of traffic surveys undertaken in 2021 was also deemed to be an unacceptable approach due to unknowns regarding traffic levels in the post-Covid period. A bespoke approach was therefore taken, where WSCC provided observed traffic data from the National Highways A27 data collection programme in 2015 and from the Shoreham Free Wharf Transport Assessment in 2017.

There are a number of land use schemes already consented within the wider study area, including New Monks Farm and Shoreham Airport, as well as a number of Local Plan allocation sites within Horsham and Adur & Worthing Councils which have been considered within this study to formulate baseline traffic conditions for the year 2033.

A number of site access options have been tested, ranging from retention of existing junction improvements, priority junctions with right-turn lanes option, priority junctions with right-turn lanes and right-out movements banned option, two three-armed roundabouts option and a single four-armed roundabout option. Through rigorous modelling and consultation with SDNP and WSCC, the four-armed roundabout option was considered to be the most optimum from transport perspective. The access solutions have been developed with Roads in the South Downs 2015 guidance in mind.

A vehicular trip generation exercise with no restraint to car trips has been undertaken which establishes the worst-case weekday AM and PM peak hour trips for all four proposed development scenarios. This exercise demonstrated that the development scenarios would generate between approximately 350 and 570 vehicular movements per hour during peak hours. The four scenarios are summarised as follow:

- Scenario 1 – Mixed use, residential focus – generates 570 (AM) and 542 (PM) two-way peak hour vehicle trips, primarily private car;
- Scenario 2 – Mixed use, smaller residential focus – generates 488 (AM) and 465 (PM) peak hour two-way vehicle trips, primarily private car;
- Scenario 3 – Leisure focused – generates 325 (AM) and 417 (PM) two-way peak hour vehicle trips, with increased proportion of bus/coach movements (190 leisure related car + 3 coach trips daily); and
- Scenario 4 – Appeal scenario – generates 385 (AM) and 350 (PM) two-way peak hour vehicle trips, significant reduction in all factors.

Discussions with SDNPA and WSCC took place regarding potential reduction in car trips by taking into account sustainable transport initiatives. ADL researched Local Plan transport studies within West Sussex to ascertain a robust approach to apply reduction to car trips.

Reduction in car trips within Local Plan transport studies in West Sussex was partly based on reduction factors prescribed with DfT's Sustainable Travel Towns 2010 document *The Effects of Smarter Choices Programmes in Sustainable Travel Towns: Research Report (*2010). However, the later study *Sustainable Travel Towns: An Evaluation of The Longer-Term Impacts* (2016) demonstrated that the overall reduction in traffic was far less than previously envisaged. The reasons being that promotion activities were reduced or discontinued after initial project funding ceased or increase in public transport fares. The study therefore shows that a consistent reduction in car trips without continuous funding towards sustainable transport measures is unlikely.

Due to these reasons, it was decided that the reduction in car trips cannot be used as a first step to assess the traffic impact as this approach could result in underestimating the actual traffic impact leading to a significant funding gap for improvements in the future.

ADL has therefore formulated an approach whereby a package of sustainable measures (such as improvements to the bus services that travel along the A283 past the site, improvements to cycling and walking infrastructure such as enhanced linkages and crossings to increase the use of Downs Link cycle path) could be delivered in lieu of the physical improvements to mitigate severe traffic impact at certain junctions. The construction costs to mitigate the severe traffic impact have therefore been based on worst-case scenario (i.e., no restraint to car trips) and the costs towards some junctions are then diverted towards sustainable initiatives in the areas where these junctions are located.

Other sustainable measures, including the provision of adequate cycle parking, Car Clubs and Travel Planning, have also been proposed within this transport study.

It is acknowledged that a large number of trips associated with the development proposals would be concentrated in areas such as Shoreham-by-Sea followed by Worthing and hence there is an opportunity to maximise sustainable mode share to the trips to these areas. It was therefore considered appropriate that the proposed sustainable initiatives (and funding for these initiatives) to be mainly targeted to those travelling in these areas. As discussed above, costs to implement physical improvements to the junctions within Shoreham-by-Sea in order to mitigate severe traffic impact of the development proposals would be redirected towards sustainable travel initiatives instead.

With regard to the National Highways' (NH) junctions on the A27 (i.e., A27/A283 roundabout and A27/Grinstead Lane roundabout) and given the strategic nature of these junctions, severe traffic impact caused by the SCW development proposals on these junctions have been mitigated by way of physical junction improvements. Costs to implement these improvements have been calculated.

At the time of publishing this report, ADL are awaiting comments from NH regarding the proposed highways improvements' compliance with DMRB CD 116 (Geometric Design of Roundabouts), at the A283/A27 slips roundabout and Lancing Manor Roundabout. These compliance checks were requested by NH, but in the interest of progressing with the AAP, SDNPA have requested to proceed without their comments.

Whilst it is acknowledged that the development proposals would also impact junctions to the north of the site i.e., within Steyning and Pulborough, the sustainable travel initiatives in these locations are unlikely to reduce development car trips in these areas, given that these junctions provide connection to a wide range of destinations further afield and hence improvement to sustainable travel initiatives in these locations such as increase in bus services would not result in a material benefit. Hence, physical junction improvements within these areas have been considered as more appropriate method to mitigate traffic impact of the development proposals.

Overall, the conclusion of this study is that delivery of the proposed development scenarios is feasible from a transport perspective, but this will require highway improvement measures at the junctions located to the north of the site and on the A27 coupled with funding towards sustainable transport measures with a view to reducing private car trips.

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1.0 INTRODUCTION

1.1 Background

1.1.1 South Downs National Park Authority (SDNPA) are in the process of preparing Shoreham Cement Works Area Action Plan (AAP), which will sit alongside the recently adopted South Downs Local Plan (SDLP), which covers the plan period 2014-2033.

1.1.2 ADL Traffic and Highways Engineering Ltd have been instructed by SDNPA to prepare this Transport Assessment (TA) to assess the transport impacts of four development scenarios in connection with Shoreham Cement Works, thus informing the preparation of the AAP.

1.1.3 ADL undertook extensive discussions with stakeholders, including SDNPA, West Sussex County Council (WSCC) and National Highways (NH), throughout the process to ensure that a number of transport planning elements such as trip generation, trip distribution, traffic growth factoring and traffic impact analysis were agreed as early as possible.

1.1.4 This TA has been prepared in accordance with the Planning Practice Guidance, National Planning Policy Framework (2021) and South Downs Local Plan (July 2019).

1.2 Supporting Documents

1.2.1 ADL have prepared four Technical Notes which supplement this final Transport Assessment. These outline and assess the various elements required to carry out this transport study, they are as follows:

- Technical Note 1: Permitted and Proposed Trip Generation and Distribution
- Technical Note 2: Committed Development
- Technical Note 3: Junction Capacity Assessment
- Technical Note 4: A27 Merge/Diverge Assessment

1.2.2 Each of the Technical Notes have been reviewed by stakeholders in order to reach an agreement to guide this transport study. Details of this are elaborated on in Section 2.0 of this report.

1.3 Scope of Study

1.3.1 Section 2.0 summarises the discussion that have taken place between ADL and the stakeholders (SDNPA, WSCC and NH).

1.3.2 Section 3.0 describes the site and surrounding area, including the highway network in the vicinity of the site and broader context.

1.3.3 Section 4.0 analyses the official accident data for the latest 5-year period, provided by WSCC for the study area.

1.3.4 Section 5.0 summarises the permitted trip generation of the site.

1.3.5 Section 6.0 summarises the baseline traffic scenario in Year 2033 and committed development traffic.

1.3.6 Section 7.0 describes the accessibility of the site to non-car modes of transport, including walking, cycling and public transport.

1.3.7 Section 8.0 outlines the four development scenarios tested in this transport study.

1.3.8 Section 9.0 outlines the proposed trip generation of each of the site uses for each development scenario.

1.3.9 Section 10.0 outlines the trip distribution methodology for the proposed trip generation.

1.3.10 Section 11.0 describes the sustainable transport measures which would act as mitigation for the proposed development.

1.3.11 Section 12.0 describes the proposed access arrangements for the site.

1.3.12 Section 13.0 undertakes a junction capacity assessment of each of the junctions in this study, for each development scenario, compared to the 2033 baseline scenario (i.e., no development).

1.3.13 Section 14.0 details the budget cost estimates for the proposed off-site highways works.

1.3.14 Section 15.0 summarises and concludes this transport study.

2.0 DISCUSSIONS WITH SHAREHOLDERS

2.1 Inception Meeting

2.1.1 An Inception Meeting took place on 14th July 2021, this included ADL as well as officers from SDNPA, WSCC and NH.

2.1.2 Various aspects of the transport assessment were discussed, such as:

- The site's context in terms of policy, permitted use, constraints and local highway network;
- Proposed methodology for data collection;
- Proposed methodology for trip distribution;
- Forecasting;
- Capacity assessments of specific junctions to be affected;
- Road safety, including collision data acquisition and assessment;
- Air quality,
- Mitigation strategy of affected junctions and proposed site accesses; and
- Design and costing principles.

2.1.3 The notes of meeting are provided as Appendix 1.1.

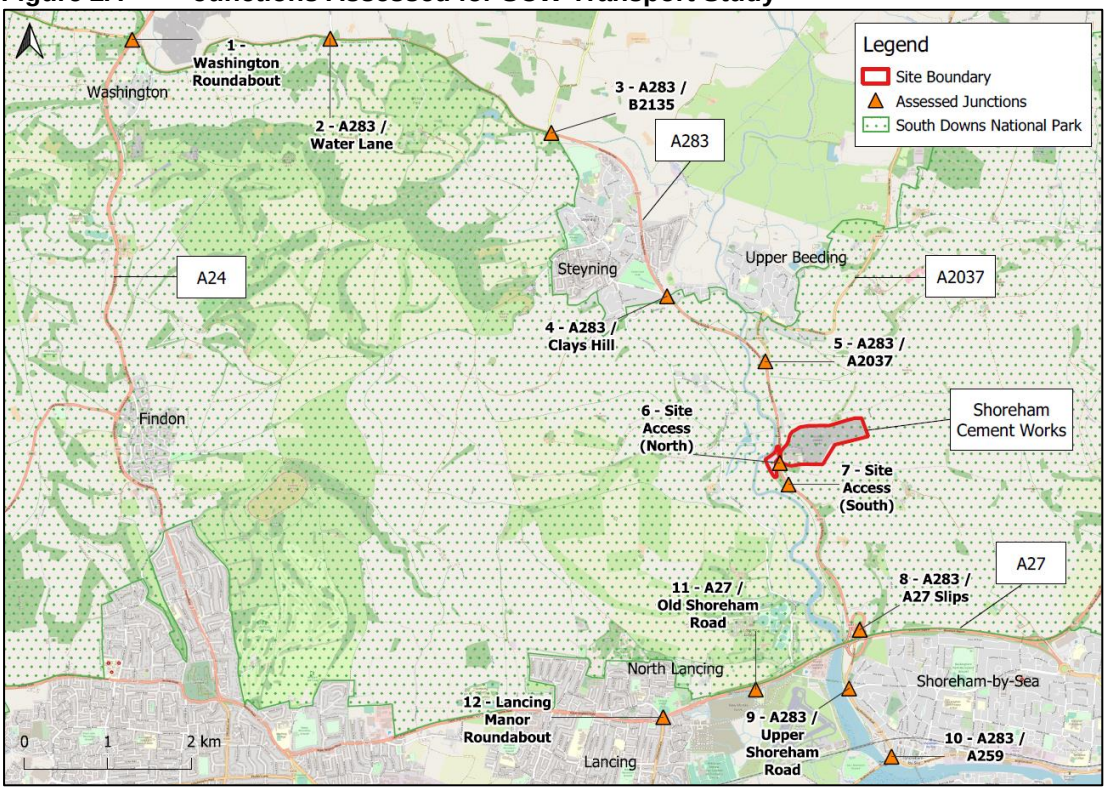
2.1.4 As per discussions with WSCC and NH, it has been agreed that the following junctions are to be assessed for each of the development scenarios:

1) A283 / A24 (Washington) Roundabout;
2) A283 / Water Lane / Chanctonbury Ring Road Crossroads;
3) A283 / Horsham Road (B2135) Staggered Junction;
4) A283 / Maudlin Lane / Clays Hill / Castle Lane / The Street Roundabout;
5) A283 / A2037 Roundabout;
6) Site Access (North);
7) Site Access (South);
8) A283 / A27 Slips Roundabout;
9) A283 / Upper Shoreham Road Roundabout;
10) A283 / A259 Roundabout;
11) A27 / New Monks Farm Committed Signalised Roundabout; and

12) A27 / A2025 / Manor Road (Lancing Manor) Roundabout.

2.1.5 A plan of these junctions, and the scope of the transport study, is shown in Figure 2A.

Figure 2A Junctions Assessed for SCW Transport Study



2.2 Technical Note 1

2.2.1 ADL prepared Technical Note 1 (TN1) on 19th August 2021, which provided the following elements:

- Vehicular trip generation associated with existing uses on site;
- Vehicular trip generation associated with development scenarios; and,
- Trip distribution and assignment methodology.

2.2.2 Prior to preparation of TN1, ADL met with SDNPA and WSCC officers on 5th August 2021. Notes of this meeting are provided in Appendix 1.2.

2.2.3 A copy of TN1 is provided as Appendix 1.3.

2.2.4 The copy of TN1 was then submitted to NH on 19th August 2021. Two sets of comments were obtained from NH on TN1 via emails, on 8th September 2021. Copy of the email is provided in Appendix 1.4. Comments from NH have been taken into account within this TA, salient points raised are as follows:

- NH accepted that permitted trips will be subtracted from the proposed use to obtain 'net' increase in trip generation.
- NH requested TRICS data for E(d) Leisure use.
- NH accepted total trip generation (taking into account school internalised trips) will be considered within our Transport Study Report.
- NH did not accept ADL's methodology with regard to internalised employment trips.
- NH requested for the acronyms HBW, HBO and NHB to be defined and explained within the Transport Study report.
- NH accepted that a CMP would be prepared as part of any future planning application subject to the decision made by the LPA.

2.2.5 The leisure use trips are discussed in more detail in Section 2.4. The school use discussed in TN1 is no longer proposed as part of SCW. Initial work as part of TN1 included an assumption that development scenarios 1, 2 and 3 included a large school facility with a total area of 10,000 sqm. This assumption resulted in significant development trips for these scenarios which in turn caused majority of the junctions along the A283 and A27 within study area to experience severe traffic impact.

2.2.6 Employment trips have not been internalised, and hence the residential and employment trips reflect a worst-case scenario.

2.2.7 The different forms of Mobile Network Data are defined and described in Section 10.1.

2.3 Technical Note 2

2.3.1 ADL prepared Technical Note 2 (TN2) which provided the following elements:

- Committed developments in Adur & Worthing Councils;
- Committed developments in SDNPA; and
- New Monks Farm and Shoreham Airport Development.

2.3.2 TN2 was a product of a continued positive discussion with WSCC officers. A copy of TN2 is provided as Appendix 1.5.

2.3.3 NH provided their comments on 30th September 2021, whereby ADL's adjusted TEMPRO growth factors were agreed, as well as assumptions regarding traffic growth in SDNPA. Copy of these emails are provided as Appendix 1.6.

New Monks Farm

2.3.4 With regards to New Monks Farm, NH suggested that the non-residential element of New Monks Farm, other than IKEA should be tested and that discussions with local authority to be carried out to obtain further details regarding the maximum quantum of employment use.

2.3.5 In response to that, ADL met with Adur & Worthing Councils Planning Officer on 4th October 2021 to discuss what assumptions are to be tested. ADL were directed towards Adur & Worthing Councils Second Addendum Revised Reissue September 2016 version of the Adur Local Plan modelling work. As stated within this document, the following breakdown was assumed for employment uses which comprised of 10,000sqm floorspace:

- Jobs
  - B1 – 333 jobs
  - B2 – 143 jobs
  - B8 – 0 jobs

2.3.6 Adur's Second Addendum Report provided trip rates for residential element of New Monks Farm and total trip generation (i.e., residential + employment) for the entire site. Using this information, employment trips were separated out.

2.3.7 The employment trips in the AM peak hour are significantly higher than IKEA trips, whilst during the PM peak hour, IKEA generated the most trips. Hence, for a robust assessment, employment trips during AM peak hour and IKEA trips during PM peak hour were used for New Monks Farm's non-residential element.

2.3.8 This strategy was emailed to SDNPA, WSCC and NH officers on 6th October 2021. In their response of 27th October 2021, NH confirmed that they found this methodology acceptable.

2.4 Further Correspondence with National Highways

Proposed Leisure Use (Use Class (E(d))

2.4.1 With regard to the proposed leisure trip generation use in Scenario 3, ADL derived annual visitor trips from four Zip World sites in Wales.

2.4.2 There are four Zip World sites in Wales (Fforest in Betws-y-Coed, Penrhyn Quarry in Bethesda, Slate Caverns in Blaenau Ffestiniog and Tower in Aberdare). In 2019, the number of visitors to all four Zip World sites was 400,000 per year; given each site has differing number of adventure activities, it is assumed that the site with most adventures (Fforest with six) could attract 150,00 visitors per year.

2.4.3 For the purpose of trip generation, ADL have made the following assumptions:

- Average car occupancy = 3 visitors per car
- Average coach occupancy = 50 visitors per coach
- 80% visitors arrive by car and 20% visitors arrive by coach
- For robust assessment, 30-week activity period (Zip World is open for longer than this).

2.4.4 NH requested supporting evidence in relation to how the above assumptions were made, in their email on 27th October 2021. Unless detailed traffic surveys at Zip World are undertaken, it is not possible to determine the exact mode split. Whilst the COVID restrictions are lifted, ADL are of the view that certain sites may continue to operate at less capacity than pre-COVID times and hence it would not be appropriate to undertake traffic surveys in 2021.

2.4.5 Furthermore, the submission of transport study timescales would not provide sufficient time to undertake the survey and analysis. Therefore, it is recommended that any future planning application(s) associated with the Use Class E(d) would need to be accompanied by a detailed traffic survey at a comparable site.

2.4.6 However, for the purpose of the SCW Transport Study, ADL can draw upon a development proposal in Ashford (Kent) for a tourist attraction based on a model railway, which ADL assisted on in 2016/17. Whilst it is appreciated that this facility is different in nature to what is being proposed on SCW, it provides some proxy for mode split given that it is a destination that would attract tourist. For this site, Kent County Council suggested that mode split based on 60% cars, 40% coach/train should be used as sensitivity test.

2.4.7 Using the Ashford site to come up with assumptions for mode split, and on the basis that the site is remote from any major public transport facility, our assumption based on 80% arriving by car and 20% by coach is considered to be robust.

2.4.8 With regard to occupancies, given the leisure use of the site, it would not be unreasonable to assume an occupancy of three people per car. Coach capacities vary from 38 to 79 depending on various size of the coaches. Hence, coach occupancy of 50 people per coach is considered to be a reasonable assumption.

Based on the above assumptions, the following is calculated:

- 120,000 visitors in cars OR 40,000 cars per year OR 1,333 cars per week 190 cars per day;
- 30,000 visitors in coaches per year OR 600 coaches per year OR 20 coaches per week OR three coaches per day.

2.4.9 A copy of email correspondence with NH regarding leisure use trips is provided as Appendix 1.7.

2.4.10 In order to gauge the arrival and departure profile for a weekday, ADL and WSCC agreed to use profile from leisure centre sites in TRICS. It was agreed that the leisure centre use profile was more representative than that of leisure park use, as the pattern of use in terms of times of day and length of stay may be reasonably similar. The intensity of daily and peak use was considered to be appropriate, and it would produce a robust PM peak assessment.

2.4.11 A copy of email correspondence with WSCC, from 1st October 2021, is provided as Appendix 1.8.

2.5 Technical Notes 3 and 4

2.5.1 ADL prepared Technical Note 3 (TN3) on 15th November 2021, which provided the following elements:

- Junction capacity assessment of each of the assessed junctions across the SCW transport study area, in the 2033 Baseline Scenario (i.e., no development);
- Junction capacity assessment of each of the assessed junctions across the SCW transport study area, in the 2033 Total Scenarios (i.e., 2033 Baseline Scenario minus Permitted Development, plus the four Proposed Development Scenarios);
- Where the proposed development scenarios result in the junction not operating within theoretical capacity (i.e., RFC value greater than 0.85), or significant increase in queue lengths when compared with the 2033 Baseline Scenario, ADL proposed mitigation in the form of junction improvements to alleviate potential traffic issues identified at certain arms of junctions;
- Any junction improvements were remodelled to test the extent to which the improved junction improvements can accommodate the proposed development scenarios without severe residual traffic impact; and
- Where off-site highways improvements were proposed as mitigation, a budget cost estimate was drawn up for each of the affected junctions.

2.5.2 The preparation of TN3 was supplemented by TN1, TN2, and subsequent discussions with SDNPA, WASS and NH. A copy of TN3 is provided as Appendix 1.9.

2.5.3 ADL met with SDNPA, WSCC and NH on 1st December 2021 to discussion TN3. Comments from NH have been taken into account within this TA, salient points raised are as follows:

- WSCC requested merge and diverge lane capacity assessment to be undertaken on A27**.**
- Assessment should include sustainable transport mitigation impacts on the junctions.
- ADL confirmed that except for Lancing Manor Roundabout highway improvements, all other junction improvements are within adopted highway.

- Sustainable Transport Mitigation should be those that the development would actually be able to provide. The development should not be dependent on possible measures that are likely to be put forward by third parties.
- Modelling assessment should be based on RFCs, queues, and average delay per vehicle.
- Whilst increase in delays on Washington Roundabout as a result of SCW developments is marginal it is a key junction and hence WSCC would expect this junction to be improved. WSCC are working on their own scheme at Washington Roundabout and a proportion of contribution as per the cost estimate within TN3 should be allocated towards.
- WSCC confirmed that there would be no need to improve the A283/Water Lane crossroads as any improvements are likely to result in an increase in rat-running along Water Lane which would not be desirable.
- A283 staggered junction with B2135 and Horsham Road to be assessed.
- Cost estimates to include optimism bias.
- WSCC would not be looking to make any physical improvements to the urban roundabouts to the south of the A27 i.e. A283/Upper Shoreham Road and A283/A259.
- Meeting is to be held on 8th December with the SDNPA to discuss site access options.
- A three-armed roundabout option would only provide access to the eastern part of the site. Therefore, based on ADL's initial assessment, there will be a need for a second three-armed roundabout access for the western part of the site.
- There is an option to provide left in left out junction for western part of the site instead of three-armed roundabout but would require widening of the tunnel.

2.5.4 The Notes of Meeting are provided as Appendix 1.10.

2.5.5 Technical Note 4 (TN4) undertakes a merge/diverge lane capacity assessment of the A27 slips with A283 roundabout using DMRB's CD122 *Geometric Design of Grade-Separated Junction* methodology. A copy of TN4 is provided as Appendix 1.11.

2.5.6 TN4 concludes that the required merge/diverge type does not alter between the 2033 baseline scenario and SCW development scenarios i.e., SCW development scenarios do not require any mitigation over and above what would be required for the 2033 baseline scenario.

2.5.7 In response to the meeting, ADL have included junction capacity assessment of the A283 junction with B2135 and Horsham Road. WSCC provided 2019 modelled flows in the absence of observed flows. The straight-ahead movements were found to be significantly lower than the 2019 observed flows at the Clays Hill Roundabout and Water Lane crossroad.

2.5.8 As such, to be robust it was agreed with WSCC to use the straight ahead flows on the A283 from the neighbouring junctions but maintain the turning movements to/from B2135 and Horsham Road. The junction capacity assessment of these junctions is included in Section 12.4.

2.5.9 Optimism bias has been considered for each of the budget cost-estimates for each of the junctions where mitigation is proposed. An optimism bias of 46% agreed with WSCC. This is included in Section 14.0.

2.5.10 As agreed with WSCC, instead of any physical improvements A283/Upper Shoreham Road roundabout and A283/A259 roundabout, the contribution stated in TN3 could be put forward towards improving sustainable transport infrastructure. A decrease of 2% of SCW Proposed Development Trips would be discounted to account for this.

2.5.11 The following site access arrangement for SCW have been tested for capacity using Junctions 9 modelling software:

- Two x all movement T-Junctions with A283;
- Two x left in/left out T-Junctions with A283, using tunnel beneath A283 to connect east and west portions of the site;
- Two x three-armed roundabouts;
- North Access (Left out/All in T-junction) and South Access (three-armed roundabout); and
- Four-armed roundabout.

2.5.12 Based on the junction capacity assessments of the above site access arrangements, the four-armed roundabout is the only option which works in terms of capacity. As such for the purpose of the Transport Study, the four-armed roundabout site access option has been brought forward. This is elaborated on in Section 12.0.

2.6 DMRB CD 116 Compliance Checks

2.6.1 As requested by NH, ADL undertook DMRB CD 116 (Geometric Design of Roundabouts) compliance checks the proposed improvements of the A283/A27 Slips Roundabout and A27/Grinstead Lane (Lancing Manor) Roundabouts. This considers the following parameters at each junction:

- Inscribed circle diameter
- Circulatory width
- Central island diameter, overrun area
- Splitter island width
- Flare lengths
- Entry widths, lane alignments, angles, path radii
- Exit widths, kerb radii
- Visibility on approaches, entries

2.6.2 The parameters of the proposed junction geometries, as designed by ADL, have been checked against the existing geometry of the A283/A27 Slips Roundabout, and against the committed junction arrangement of Lancing Manor Roundabout. These checks are tabulated and provided as Appendix 19.4, and 23.4, respectively.

2.6.3 The proposed junction designs meet all the CD 116 requirements, except for the following deviations, which can be justified:

<u>A283/A27 Slips Roundabout:</u>

- Exit Kerb Radius, Arm 3 (southeast) – no kerb radius (straight), however as per existing situation.
- Visibility on Approach, Arm 1 (northwest)– visibility is 94.0 metres, this is a significant improvement from the existing situation because the existing roundabout provides 78.0 metres visibility.
- Visibility on Approach, Arm 2 (northeast) – visibility is 96.0 metres, existing roundabout is 107 metres (reduction in forward visibility by 11 metre).
- Visibility on Approach, Arm 3 (southeast) – visibility is 69.4 metres, a significant improvement from the existing situation because the existing roundabout provides 50 metres visibility.

A27/Grinstead Lane (Lancing Manor) Roundabout:

- Entry width, Arm 3 – width is 11.6 metres, however, permitted roundabout design (NMF) has 11.2 metres, which is already above practical limit for single carriageway approach (i.e., 10.5 metres).
- Visibility on Approach, Arm 1 – visibility is 90.0 metres, Manor Road is 30mph and the speed limit changes to 40mph only 24 metres from the give-way. Hence, using 30mph as speed limit for approach, it meets the standards. Standard for 40mph approach speed limit is met by applying one-step below desirable minimum.
- Visibility on Approach, Arm 4 – visibility is 79.8 metres, which is the same as the permitted roundabout design from New Monks Farm.

2.6.4 It is summarised that the improvements meet CD 116 requirement for the majority of the parameters. For others, it is demonstrated that there would not be worsening of the junction safety when compared to the existing situation for A283/A27 Slips Roundabout, and to the permitted NMF's scheme for A27/Grinstead Lane Roundabout.

2.6.5 SDNPA provided comments via email on 9th February 2022, accepting the DMRB compliance checks, stating the only deviations are due to existing infrastructure, so deviating from standard shouldn't make things worse.

2.6.6 WSCC's provided their initial comments on A285/A27 slips roundabout via email on 16th February 2022, stating the following:

- ***"I note that the designers used the speed limit to calculate forward visibility. In my view, the SSD should be judged against the speed that cars are driving due to the curvature – see Equation from Annex B of "Provision of Road Restraint Systems on Local Authority Roads" UK Roads Liaison Group and DfT 2011. It is unlikely that motorists will be driving at national speed limit on the slip roads. Alternatively, measured speeds might inform the design.***

WSCC recommend that stopping sight distances for forward visibility are assessed based on the curve design speeds.

- ***The designers will need to review accidents statistics at the roundabout and their possible causes. There appears to be a few injury accidents which are almost exclusively to do with the shallow entry angles. Approaching drivers are looking over their shoulders at circulating traffic to anticipate their go/no-go decision and then colliding with drivers waiting at the give way line. This could be effectively countered by the use of visibility screening at arms 1, 3 and 4 like the ones WSCC installed at A24 Southwater. Drivers would then be more likely to look where they are going until they are much closer to the give way line. I note that the proposals for Arm 2 provide a major improvement in entry angle to the extent that such screening is not necessary here. However, let's let the designer decide what measures they propose to counter accidents they will identify after analysing the accident trends.***

Section 4.0 of this TA provides detailed study of accidents at both roundabouts. It is noted that visibility screening would provide effective mitigation against this for Arms 1, 3 and 4.

- ***Looking at the Design Audit spreadsheet, the designers seem to have captured most of them and I haven't picked up additional ones. However, what they have not provided is a plan that shows the available forward visibility splays and the required splays. They will also need to identify the constraints that stand in the way of achieving the required forward visibility splays.***

The forward visibility has been reviewed based on the curve design speeds, using the equation from Annex B of *Provision of Road Restraint Systems on Local Authority Roads* UK Roads Liaison Group and DfT 2011. For the purpose of calculation, crossfall values for all approaches is assumed as zero due to the minimal observed crossfalls. Based on this, the resultant curve design speed for Approaches 1, 2 and 3 were calculated as 31km/hr, 20km/hr and 24km/hr respectively. Such low speeds would require far less forward visibilities than that provided in paragraph 2.6.3. It should be noted that the calculated curve design speeds are much lower than expected and hence, further assessment in terms of undertaking speed surveys on the approaches may be required at a later stage. It is agreed that appropriate visibility screening measures would be proposed to resolve any concerns associated with accidents on the approaches.

- ***In my view, the road safety audit needs to be undertaken and submitted to us to inform the design review"***

It is considered that, as these are outline drawings for the initial AAP assessment, Stage 1 Road Safety Audit (RSA) and Walking, Cycling and Horse-Riding Assessment (WCHAR) would be undertaken either at individual planning application stage or the later stage of AAP. This approach is not unique and is generally applied to AAP and Local Plan studies.

2.6.7 At the time of producing this report (April 2022), ADL are awaiting review of these proposed junction improvements from National Highways. Until such time, it has been agreed by SDNPA that these compliance checks would be reviewed further in due course.

2.6.8 It is acknowledged that a Stage 1 RSA and WCHAR have not been undertaken, this adds a layer of uncertainty. Stage 1 RSA and WCHAR will be undertaken going forward to resolve possible risk to achieving successful design within highway constraints.

3.0 SITE AND SURROUNDING AREA

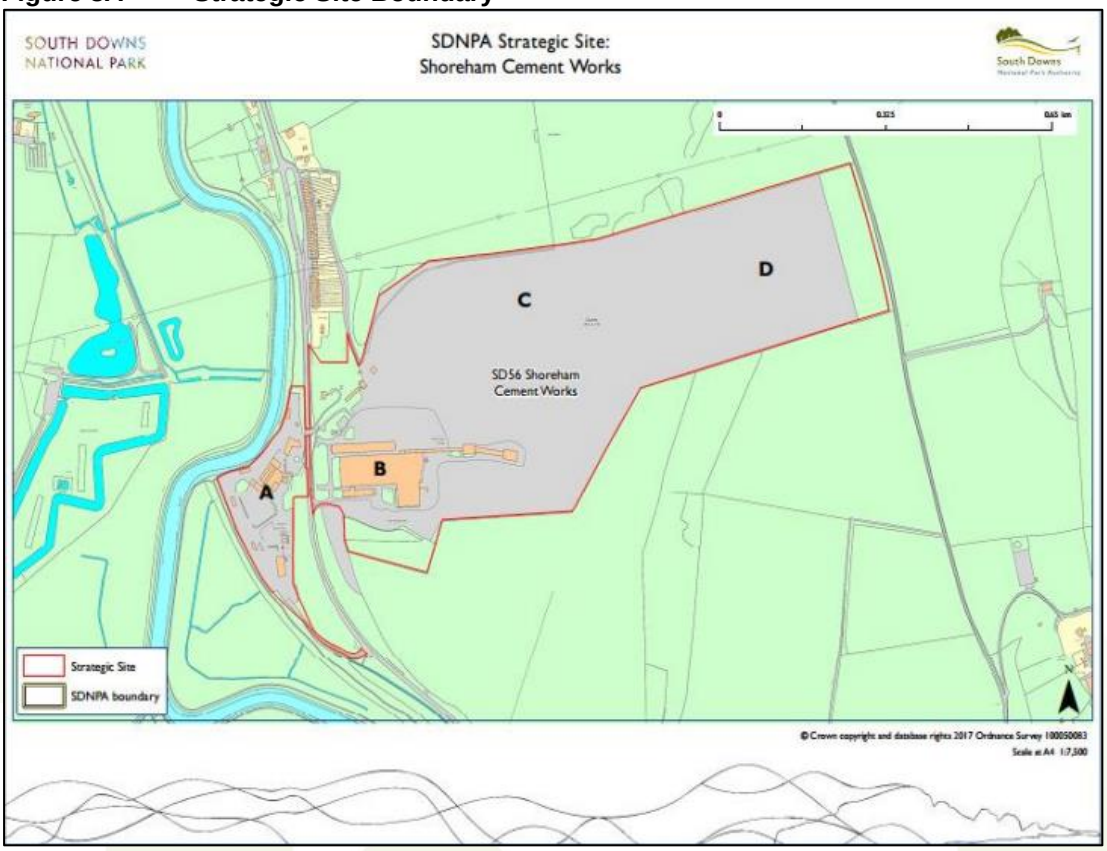
3.1 Site Location

3.1.1 Shoreham Cement Works (the 'Site') is approximately 44-hectare portion of land including a semi-derelict cement works, inactive chalk quarry, temporary inert recycling facility and a mix of temporary business uses.

3.1.2 The site is located on both sides of the A283 Steyning Road, approximately five kilometres north of Shoreham-by-Sea and two kilometres south of Upper Beeding and Steyning. The site location is provided as Appendix 2.0.

3.1.3 The strategic site boundary is shown in Figure 3A below.

Figure 3A Strategic Site Boundary



3.1.4 Large-scale cement production began on the site at the end of the 19th Century. The buildings were completed in 1948-50, permission having first been granted for chalk extraction in 1946. Chalk extraction and cement production ceased in 1991, but the permission (for Area C) was kept alive by an application for registration of the old mining permission in 1992. This extant permission for the extraction of chalk runs to 2042, when a basic restoration scheme would have to be implemented.

3.1.5 Existing use rights exist for general industrial uses within existing buildings and for associated uses (such as storage) taking place in the open air. Areas A and B can be classed as brownfield land, but not Areas C and D, since minerals sites are excluded from the NPPF definition of previously developed land.

3.1.6 The site is located wholly within the South Downs National Park (SDNP). The whole site is in single private ownership and the SDNPA is the sole Local Planning Authority.

3.2 Local Highway Network

Existing Site Accesses

3.2.1 The site lies either side of the A283 Steyning Road. The northern access, to the eastern portion of the site, is a left in/left out priority T-junction. It is approximately 45 metres wide where is meets the A283 and narrows to approximately ten metres. The site access roads within this portion of the site are approximately 5.5 metres wide.

3.2.2 The southern access, to the western portion of the site, is an all-movements priority T-junction. It is approximately 40 metres wide at the A283 and narrows to approximately 5.5 metres wide.

3.2.3 The two portions of the site are connected by an underpass beneath the A283. The carriageway width at this point is approximately 5.6 metres wide (this includes 1.4-metre-wide footway). The headroom height of the tunnel is approximately 4.4 metres high, and the length of the tunnel is approximately 25 metres.

A283 Steyning Road

3.2.4 The A283 is a single carriageway road, approximately seven metres wide and subject to national speed limit, i.e., 60mph.

3.2.5 In the vicinity of the site, the A283 runs in a north-south direction, broadly parallel to the River Adur. The A283 connects the site with Shoreham-by-Sea to the south, and Storrington to the northwest.

3.3 Broader Highway Network: A283

A283 (South of the Site)

3.3.1 Approximately 2.3 kilometres south of the site, the A283 meets the A27 slips at a four-arm roundabout. To the south of this roundabout, the A283 leads to Shoreham and then the A259. Approximately 500 metres south of the A27 roundabout, the speed limit is reduced to 30mph.

3.3.2 Approximately 3.1 kilometres south of the site, the A283 meets Upper Shoreham Road at a three-arm mini roundabout, which leads through Shoreham, up to the Holmbush Roundabout (with A270). On all approaches, the roads are approximately 7.0 – 8.5 metres wide.

3.3.3 Approximately 4.1 kilometres south of the site, the A283 meets the A259 at a three-arm roundabout. The A259 which leads to South Lancing the west, and along the south of Shoreham to the east. On all approaches, the roads are approximately 6.5 – 10.0 metres wide.

A283 (North of the Site)

3.3.4 Approximately 1.2 kilometres north of the site, the A283 meets the A2037 Shoreham Road at a three-arm roundabout. The A2037 is a single carriageway road, approximately 8.0 metres wide, which leads to the village of Upper Beeding, and beyond to Henfield.

3.3.5 Approximately 2.6 kilometres north of the site, the A283 meets a six-arm roundabout with Clays Hill, Mauldin Lane, Castle Lane, and The Steet. The speed limit is reduced to 30mph at the roundabout. The Maudlin Lane, Clays Hill and Castle Lane arms of the roundabout provide link to different areas of Steyning, whilst The Street leads to Bamber and Upper Beeding.

3.3.6 Approximately 5.5 kilometres north of the site, the A283 meets B2135 Horsham Road at a left-right staggered junction. Horsham Road, north of the A283 is approximately 6.6 metres which leads to Ashurst and Partridge Green, and eventually the A24, approximately 1.3 kilometres south of the A272. Horsham Road south of the A283 is approximately 6.0 metres wide and leads to Steyning High Street.

3.3.7 Approximately 8.3 kilometres north of the site, the A283 meets Water Lane and Chanctonbury Ring Road at a simple crossroads junction. Water Lane is a rural road, with a width of approximately 4.5 metres which leads to Ashington, and A24. Chanctonbury Ring Road is a rural road which leads to a small number of residential dwellings and provides access to the South Downs Way.

3.3.8 Approximately 11.0 kilometres northwest of the site, the A283 meets the A24 at a four arm-roundabout (known as Washington Roundabout). The A283 west of the roundabout leads to Storrington. The A24 is a dual carriageway road which leads to Worthing to the south and Horsham to the north.

3.4 Broader Highway Network: A27 Shoreham By-Pass

3.4.1 The A27 in the vicinity of the site forms part of the strategic road network. It is a key east-west link providing access between Brighton, Shoreham, Lancing, and Worthing.

3.4.2 Within the vicinity of Shoreham, the A27 is a dual carriageway providing two lanes in either direction with a speed limit of 70mph. The carriageway in the vicinity of the site is straight with good forward visibility.

3.4.3 Approximately 700 metres west of the A27 Slips to the A283 roundabout, the A27 is met by Old Shoreham Road and Coombes Road at a staggered signal crossroads. At this point, the A27 widens to three lanes.

3.4.4 Old Shoreham Road is approximately 6.7 metres wide and leads to Shoreham to the east. Coombes Road is approximately 7.1 metres wide and leads to Lancing College. This junction configuration is to be upgraded to a signalized four arm roundabout as part of the New Monks Farm development. This is detailed in Section 3.5.

3.4.5 Approximately 2.4 kilometres west of the A27 Slips to the A283 roundabout, the A27 meets the A2025 Grinstead Lane and Manor Road at a four-arm roundabout (known as the Lancing Manor Roundabout).

3.4.6 The Lancing Manor roundabout includes two lanes on the A27 approach arms with two lanes continuing around the circulatory carriageway. The circulatory carriageway also includes 'Keep Clear' markings to ensure that entry arms are not blocked. On the Grinstead Lane and Manor Road arms, the approaches consist of single lanes which then flare to separate turning movements at the junction.

3.4.7 Grinstead Lane is a single carriageway road approximately 9.5 metres wide and leads to Lancing / South Lancing. Manor Road is a single carriageway road approximately 9.3 metres wide and leads to North Lancing.

3.5 Committed Highways Works

Access to New Monks Farm/Shoreham Airport Development

3.5.1 Access to the New Monks Farm/Shoreham Airport development is to be gained via a new signalised roundabout on the A27. This builds on the principles noted in the Adur Local Plan Submission (2016) and associated technical traffic assessments which informed the emerging Plan. Specifically, this includes:

- A new, high capacity, signalised roundabout on the A27 fronting the New Monks Farm development site;
- A new 50mph speed limit on the A27 on approach to, and including, the new signalised roundabout;
- Internal roundabout with a link to the New Monks Farm development (west);
- A link east (Airport Link Road) from the internal roundabout to Old Shoreham Road, which will provide access to Shoreham Airport and Ricardo Engineering;

- Removal of the existing Old Shoreham Road traffic signal-controlled junction with the A27;
- Removal of the existing Coombes Road traffic signal operation with access retained via a left in/left out arrangement from the eastbound A27 carriageway, allowing access to Lancing College and the South Downs National Park; Removal of the two existing accesses on the A27 to the Withy Patch Gypsy and Travellers Site, with the relocation of this site to be accessed from the Airport Link Road;
- Retention of the existing off-carriageway foot/cycle links along the southern side of the A27;
- Creation of a new off-carriageway foot/cycle link along the northern side of the A27 linking to Hoe Court and Lancing College;
- Provision of at-grade Toucan crossing facilities at the new roundabout retaining controlled crossing facilities on the A27 for north-south movements;
- Creation of new off-carriageway foot/cycle links as part of the internal road layout, providing an alternative route away from the A27;
- Consideration of an upgrade of the existing public footpath (PRoW Ref: 2049) to a bridleway, thereby providing an additional north-south link for the benefit of leisure trips; and
- Inclusion of a new foot/cycle link into the site from the existing Mash Barn estate, which can also serve as an alternative emergency vehicle access.

3.5.2 A plan of the committed A27 Old Shoreham Road improvements for New Monks Farm development access and Sussex Pad works, drawing number VN40408/PL-015 (Revision A) prepared by Vectos, is provided as Appendix 3.1.

3.5.3 Subsequently, additional highway works comprising construction of a Fourth Arm from the approved New Monks Farm A27 roundabout to Coombes Road (west) and; closure of the existing Coombes Road (east) junction with the A27 has been approved in October 2021 (planning ref. AWDM/1906/20).

3.5.4 A plan of the committed roundabout improvements, drawing number VN201557/PL-03 (Revision J) prepared by Vectos, is provided as Appendix 3.2.

A27 / Grinstead Lane Roundabout

3.5.5 As part of the New Monks Farm/Shoreham Airport development, mitigation was proposed at the A27/Grinstead Lane roundabout to accommodate development traffic and improve the operation of the strategic road network. This is in the form of additional lanes on the A27 arms, increased flare lengths, signage and lane markings to advise drivers of the lanes that can be used to complete certain manoevures.

3.5.6 An agreement between Highways England (now National Highways) and Adur District Council and the New Monks Farm applicant requirement that the Monks Farm applicant either enters into a S278 Agreement to undertake traffic improvements to the Lancing Manor Roundabout in accordance with Vectos' drawing number VN40408/PL-010 or pays contributions in full for the cost of the works. The junction improvements as per Vectos' drawing number VN40408/PL-010 is therefore regarded as 'committed highway improvements' and are therefore used to assess the baseline as well as development scenario traffic impact associated with Shoreham Cement Works study.

3.5.7 A plan of the committed roundabout improvements, drawing number VN40408/PL-010 (Revision D) prepared by Vectos, is provided as Appendix 3.3.

4.0 ROAD SAFETY STUDY

4.1 Scope of Road Safety Study

4.1.1 ADL obtained official accident data from WSCC for the latest five-year period up to the first Covid-19 lockdown – i.e., 1st April 2015 – 31st March 2020. This period of time was advised by WSCC.

4.1.2 As advised by WSCC, the extent of the search included each of the 12 junctions as well as the links between them.

4.1.3 The first pass through the safety study is a high-level statistical analysis to identify clusters of accidents at particular locations and to examine the accident rates along links in comparison with national averages for the same type of road.

4.1.4 Then, these cluster locations are correlated with where the trip distributions for generated trips to/from the proposed development are showing a significant increase in flows through locations (junctions or links) where the existing accident record is of concern compared to what might be reasonably expected from its level of use.

4.2 Network Overview

4.2.1 Across the study area, which comprises approximately 18.5 kilometres of highway, there were a total of 269 personal injury accidents, which involved a total of 556 vehicles, and 380 casualties (i.e., pedestrian, cyclists, rider, passenger, or driver).

4.2.2 A plot of these accidents is provided as Appendix 4.1. Table 4A summarises the accidents by year.

Table 4A Accident Severity by Year

Severity	Year						Total
	2015 April - December	2016	2017	2018	2019	2020 January - March	
Fatal	0	0	1	0	0	0	1
Serious	10	11	6	9	12	4	52
Slight	38	52	41	36	43	6	216
Damage	0	0	0	0	0	0	0
Total	**48**	**63**	**48**	**45**	**55**	**10**	**269**

4.2.3 Of the 269 accidents, approximately 80% resulted in slight injury; whilst 20% of the collisions were Killed or Seriously Injured (KSI) – 19% resulted in serious injury, and less than 1% resulted in fatality. This is equal to the national average of 19%, based on the Department for Transport accident statistics for the same period.

4.2.4 Table 4B summarises the accidents by Junction Type and Table 4C summarises the accidents by road type.

Table 4B Accident by Junction Type

Severity	Number	%
Slip Road	19	7%
Multiple Junction	1	0%
Other Junction	1	0%
Crossroads	11	4%
Not at Junction	97	36%
Private Drive	11	4%
Roundabout and Mini	68	25%
T or Staggered	61	23%
Total	**269**	**100%**

Table 4C Accident by Road Type

Speed Limit		Number	%
Urban / Built Up Roads	20mph	3	1%
	30mph	53	20%
	40mph	27	10%
	Sub Total	***83***	***31%***
Rural / Non-built-up roads	50mph	15	6%
	60mph	103	38%
	70mph	68	25%
	Sub Total	***186***	***69%***
Total		**269**	**100%**

4.2.5 Table 4B demonstrates that the 36% of accidents on links between roads not at a junction; 25% of accidents occurred at roundabouts; and 23% of accidents occurred at T or staggered junctions. Table 4C demonstrates that the majority of the accidents occurred on non-built-up roads (69%) and fewer accidents occurred on built up roads (31%) – this also reflects the national average. The accident summary data is provided as Appendix 4.2.

Collision Cluster Analysis

4.2.6 Based on the *Adur Local Plan Second Addendum: Revised Reissue September 2016 Transport Study*, a cluster of collisions is defined as eight of more collisions within a 60-metre diameter, over the five-year study period.

4.2.7 Using this methodology, across the Shoreham Cement Works transport study area, one cluster site has been identified as having eight or more collisions in five the year period. The locations of the collision clusters are listed as follows:

- A283/A27 slips roundabout, A283 North arm approach (10 collisions);

A plan of this collision cluster is provided as Appendix 4.3.

4.2.8 This collision cluster between the A283/A27 slips roundabout, on the A283 north arm approach has been investigated further. The full reports for each of these collisions is provided as Appendix 4.4. A summary is provided in Table 4D.

Table 4D Accident Details: Cluster at A283/A27 slips roundabout, A283 North arm approach

Ref	Severity	No. Veh	No. Cas	Date	Time	Cause(s)
1604996	Serious	2	1	18/08/2016	16:01	1. Failed to judge other person's path/speed (Driver/Rider - Error)
1606787	Slight	2	2	11/11/2016	14:20	1. Failed to look properly (Driver/Rider - Error) 2. Failed to judge other person's path/speed (Driver/Rider - Error)
1703357	Slight	2	2	18/06/2017	18:30	N/A
1704775	Slight	3	1	23/08/2017	18:00	1.Failed to judge other person's path/speed (Driver/Rider - Error)
1800093	Slight	2	5	06/01/2018	10:17	1. Failed to look properly (Driver/Rider - Error)
1806033	Slight	2	1	01/11/2018	13:31	1. Failed to look properly (Driver/Rider - Error)
1807174	Slight	2	1	24/12/2018	09:19	N/A
1902466	Slight	2	1	13/05/2019	15:45	1. Careless/Reckless (Driver/Rider - Behaviour) 2. Junction overshoot (Driver/Rider - Error) 3. Nervous/Uncertain (Driver/Rider - Behaviour)
852932	Slight	2	3	01/07/2019	10:30	1. Sudden braking (Driver/Rider - Error) 2. Failed to judge other person's path/speed (Driver/Rider - Error) 3. Following too close (Driver/Rider - Injudicious) 4. Failed to look properly (Driver/Rider - Error)
896395	Serious	2	1	07/11/2019	16:49	1. Aggressive driving (Driver/Rider - Behaviour) 2. Exceeding speed limit (Driver/Rider - Injudicious)

4.2.9 Table 4D demonstrates that of these ten collisions, six involved a vehicle which either failed to judge other persons path or speed, failed to look properly, or sudden braking (i.e., driver/rider error); two involved vehicles whose driver/rider was careless/reckless (i.e., driver/rider behaviour); and one involved a vehicle exceeding the speed limit (i.e., driver/rider injudicious).

4.2.10 A study by Loughborough University (Wang, 2010) found that traffic congestion is positively associated with the frequency of fatal and serious injury accidents. Hence, the causes of collisions could be a result of drivers taking higher risks when congestion reaches higher conditions.

4.2.11 As detailed in Section 12.0 ADL have proposed junction improvements at the A283/A27 Slips roundabout, which includes widening and of the A283 North arm, dedicated left hand lane for A27 Eastbound traffic; and lane direction road markings. It is therefore considered that the accident situation would be improved should these improvements be implemented.

4.3 Assessed Junctions

4.3.1 The cluster analysis demonstrates that there are no collision clusters (i.e., eight or more collisions within 60 metres) on the other junctions (other than one discussed in Section 4.2) that are being assessed within the scope of this transport study, nor on any of the links between them.

4.3.2 However, for completeness, the accident situation at each of the assessed junctions have been analysed. The number and severity of accidents which have occurred at each of the junctions within this transport study are summarized in Table 4E.

Table 4E Accidents at Assessed Junctions

Junction		Severity			Total
		Slight	Serious	Fatal	
1	Washington Roundabout	19	1	0	20
2	A283 / Water Lane	5	2	0	7
3	A283 / B2135 Junction	3	1	0	4
4	A283 / Clays Hill Roundabout	6	0	0	6
5	A283 / A2037 Roundabout	4	1	0	5
6	Site Access (North)	0	0	0	0
7	Site Access (South)	2	0	0	2
8	A283 / A27 Slips Roundabout	21	5	0	26
9	A283 / Upper Shoreham Road Roundabout	2	0	0	2
10	A283 / A259 Roundabout	4	0	0	4
11	A27 / New Monks Farm Committed Roundabout (Based on existing A27 / Old Shoreham Road / Coombes Road junctions)	15	4	0	19
12	Lancing Manor Roundabout	9	0	0	9
Total		**90**	**14**	**0**	**104**

4.3.3 Based on the previous threshold of eight collisions, Table 4E demonstrates that the accident rate at Junctions 2, 3, 4, 5, 6, 7, 9, and 10 do not require any further in-depth analysis. However, Table 4E demonstrates that the following junctions require further analysis to understand the nature of accidents which are occurring:

- Junction 1: Washington Roundabout
- Junction 8: A283/A27 Slips Roundabout
- Junction 11: A27/Old Shoreham Road/Coombes Road T-Junctions
- Junction 12: Lancing Manor Roundabout

4.3.4 At each of these four junctions, the casual factors for the collisions and the specific arm on which they occurred has been investigated.

Junction 1: Washington Roundabout

4.3.5 At the Washington Roundabout, 20 accidents were recorded, of which 19 were slight severity and one was serious. Of the 20 accidents, 46 vehicles were involved and 27 casualties were recorded. The causation factors are summarised for each arm of the junction, and circulatory lanes, in Table 4F.

Table 4F Accident Details: Washington Roundabout

Cause		Arm					Total
		A283 West	A24 North	A283 East	A24 South	Circulatory Lane	
Driver / Rider - Error	Failed to judge other person's path/speed			2	3	3	8
	Failed to look properly	1		2	2		5
	Sudden braking				1		1
	Junction restart			1			1
Driver / Rider - Behaviour	Inexperience with vehicle type			1			1
	Careless/Reckless	1				1	2
Driver / Rider - Injudicious	Following too close			1			1
	Disobeyed give way or stop sign markings			1			1
	Travelling too fast for conditions			1			1
Total		**2**	**0**	**9**	**6**	**4**	**21**

Not all accident reports provided causation factor

4.3.6 Table 4F demonstrates that the most common cause of accident was failure to judge other persons path/speed (8), followed by failure to look properly (5). Driver/rider error is therefore considered to be the prevailing issue regarding accidents at this junction.

Junction 8: A283/A27 Slips Roundabout

4.3.7 At the A283/A27 Slips roundabout, 26 accidents were recorded, of which 21 were slight severity and five were serious. Of the 26 accidents, 52 vehicles were involved and 37 casualties were recorded. The causation factors are summarised for each arm of the junction in Table 4G.

Table 4G Accident Details: A283/A27 Slips Roundabout

Cause		Arm				Total
		A283 North	A27 Eastbound Slips	A27 Westbound Slips	A283 South	
Driver / Rider - Error	Failed to judge other person's path/speed	6	2			8
	Failed to look properly	5	3	2		10
	Sudden braking	1				1
	Junction restart			1		1
	Loss of control			1	1	2
	Poor turn or manoeuvre	2				2
	Junction overshoot	1				1
Driver / Rider - Behaviour	Careless/Reckless	1	1	1	1	4
	Aggressive driving	2			1	3
	Nervous/Uncertain	1			1	2
	Inexperienced or learner driver/rider				1	1
Driver / Rider - Injudicious	Following too close	1				1
	Exceeding speed limit	1			1	2
Driver / Rider Impairment	Illness or disability, mental or physical			1		1
Total		**21**	**6**	**6**	**6**	**39**

Not all accident reports provided causation factor

4.3.8 Table 4G demonstrates that the most common cause of accident was failure to look properly (10) followed by failure to judge other persons path/speed (8). Driver/rider error is therefore considered to be the prevailing issue regarding accidents at this junction.

Junction 11: A27/Old Shoreham Road/Coombes Road T-Junctions

4.3.9 At the existing A27 junction with Old Shoreham Road and Coombes Road, 19 accidents were recorded, of which 15 were slight severity and five were serious. Of the 19 accidents, 44 vehicles were involved and 32 casualties were recorded. The causation factors are summarised for each arm of the junctions in Table 4H.

Table 4H Accident Details: A27 / Old Shoreham Road / Coombes Road

Cause		Arm				Total
		A27 Westbound (at Coombes Road)	A27 Westbound (at Old Shoreham Road)	A27 Eastbound (at Old Shoreham Road)	A27 Eastbound (at Coombes Road)	
Driver / Rider - Error	Failed to judge other person's path/speed	3	1	3	2	**9**
	Failed to look properly	2		3		**5**
	Sudden braking	1				**1**
	Poor turn or manoeuvre				1	**1**
Driver / Rider - Behaviour	Careless/Reckless	2			2	**4**
Driver / Rider - Injudicious	Following too close	1			1	**2**
	Travelling too fast for conditions			1		**1**
Driver / Rider Impairment	Uncorrected, defective eyesight	1				**1**
Road Environment Contributed	Deposit on road e.g., oil, mud, chippings				1	**1**
Total		**10**	**1**	**7**	**7**	**25**

Not all accident reports provided causation factor

4.3.10 Table 4H demonstrates that the most common cause of accident was failure to judge other persons path/speed (9) followed by failure to look properly (5). Driver/rider error is therefore considered to be the prevailing issue regarding accidents at these junctions.

4.3.11 It should be noted that this junction arrangement is due to be improved as per the New Monks Farm committed development. A new four-arm signalized roundabout is committed, as described in Section 3.5. Based on this, it is to be expected that the accident situation would be improved, and by closing off both off these junctions on the A27, it is expected that the accident rate would be reduced.

Junction 12: Lancing Manor

4.3.12 At the Lancing Manor Roundabout, nine accidents were recorded, of which all were slight severity. Of the nine accidents, 18 vehicles were involved, and ten casualties were recorded. The causation factors are summarised for each arm of the junction, and circulatory lanes, in Table 4I.

Table 4I Accident Details: Lancing Manor Roundabout

Cause		Arm					Total
		A27 East	Grinstead Lane	A27 West	Manor Road	Circulatory Lane	
Driver / Rider - Error	Failed to judge other person's path/speed		2			1	**3**
	Failed to look properly					1	**1**
	Poor turn or manoeuvre	1					**1**
Driver / Rider - Behaviour	Aggressive driving	1					**1**
Total		**2**	**2**	**0**	**0**	**2**	**6**

Not all accident reports provided causation factor

4.3.13 Table 4H demonstrates that the most common cause of accident was failure to judge other persons path/speed (3). Four of the nine accidents were not provided with a causation factor, however, based on the description of the accident, one accident was the result of an undertake manoeuvre; one accident involved a pulling out onto roundabout as cyclist is circulating, one accident involved a shunt as a result of a driver waiting for a gap in traffic; and one accident was the result of a motorcycle filtering along the side of queuing traffic, hit by vehicle moving across to left hand lane.

4.3.14 It is therefore considered that the majority of accidents at this junction were the result of driver/rider error. The Lancing Manor Roundabout has committed junction improvements as part of the New Monks Farm development. ADL have also proposed further improvements to this junction to increase the capacity of the junction which is expected to improve the accident situation.

4.4 Conclusion

4.4.1 ADL have investigated the official accident data provided by WSCC for the latest five-year period across the SCW transport study area.

4.4.2 A total of 269 accidents occurred, of which 19% were KSI, which is equal to the national average. By defining a collision cluster as at least eight accidents within 60 metres in the five-year period, one collision cluster has been identified. However, only the A283/A27 Slips roundabout, where the A283 North arm meets the roundabout, has been investigated.

4.4.3 ADL have also investigated the collisions across the 12 junctions assessed as part of this transport study. Of the 12 junctions, four have recorded eight or more collisions, and the causation factors at each of these junctions have been analysed.

4.4.4 ADL have proposed mitigation in the form of junction improvements to alleviate potential traffic issues identified at certain arms of junctions, as a result of the proposed development scenarios. These improvements would improve the capacity of the junction, as well as theoretically improving the accident situation. There are also committed junction improvements as part of the New Monks Farm development, which is expected to improve the accident situation on the A27.

4.4.5 It is also noted that any proposed capacity mitigation measures (either committed or proposed by ADL) 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.

5.0 PERMITTED VEHICULAR TRIP GENERATION

5.1 As mentioned previously, the permitted uses of the site, and their associated trip generation has been detailed in TN1.

5.2 SDNPA's Major Projects Head provided the following information regarding existing permitted uses on site that have been active during the last five years:

East of A283 (main cement works site)

- Site area = 6.23 hectares
- Importation, storage, and treatment if inept material to produce recycled/secondary aggregate
- 50,000 tonnes per annum between hours 07:00 and 18:00 weekdays and 07:00 and 13:00 Saturdays
- Maximum daily movements = 100 HGVs but may be as low as 10

West of A283

- Site area = 3.45 hectares
- Vehicle repair, coach and bus parking, scrap recycling, scaffold storage etc.
- Use Classes B1, B2 and B8 including residential security, caravan.
- 30 businesses employing 150 people

5.3 Based on the above information provided by SDNPA, the cement works site (east of the A283) generates a maximum of 100 HGV movements (i.e., 50 inbound and 50 outbound) on a weekday. Typical peak hour trips (AM and PM peak hours) equate to 10% of the daily trips.

5.4 Therefore, the cement works site would generate:

- AM Peak (08:00 – 09:00): 10 HGV movements (i.e., 5 inbound and 5 outbound)
- PM Peak (17:00 – 18:00): 10 HGV movements (i.e., 5 inbound and 5 outbound)

5.5 With regards to the part of the site to the west of the A283, planning permission SDNP/20/00110/CND was granted on 6th July 2020 which would allow the site to be used for purposes falling with use classes B1, B2 and B8 (business, industry and storage) until 31st January 2025.

5.6 It is noted that there are 30 businesses on this part of the site. The list of these businesses was included as part of the 2015/15 planning application. These are provided in Table 5A.

Table 5A Occupants of The Site to the West of A283

Plan Ref	Parcel Description	Occupier Name	Nature Of Business	Description Of Use/Activities	Area (Sqm)
1	Container & Hardstanding #27	Peter Taylor	Vehicle recovery	Hardstanding for vehicle storage and a container for the storage of innate material	444
2	Garage Bays 1 & 2	Martin Memory	Mechanic	Garage bay for vehicle repair and adjoining area for vehicle parking	150
3	Garage Bay 3	Vantech Sussex Limited - Chris Carpenter	Mechanic	Garage bay for vehicle repair and adjoining area for vehicle parking	75
4	Garage Bay 4	Vantech Sussex Limited - Chris Carpenter	Mechanic	Garage bay for vehicle repair and adjoining area for vehicle parking	75
5	Garage Bay 5	Ace Travel Ltd	Coach operator	Garage bay for vehicle repair and adjoining area for vehicle parking	75
6	Garage Bay 6 & Container 5	Brightonian & Ocean Coaches - Peter Woodcock	Coach operator	Garage bay for vehicle repair and a container for the storage of innate material	194
7	Garage Bay 7	Heritage Travel	Coach operator	Garage bay for vehicle repair and adjoining area for vehicle parking	75
8	Garage Bay 8	Neil Bird t/a Southern Transit	Bus & coach operator	Garage bay for vehicle repair and adjoining area for vehicle parking	75
9	Hardstanding #1	Vantech Sussex Limited – Chris Carpenter	Mechanic	Hardstanding for coach parking/storage	525
10	Hardstanding #2	Heritage Travel - as 7 (same lease)	Coach operator	Hardstanding for vehicle parking/storage	640
11	Hardstanding #3	C Jenkin & Son	Mobile Home dealer	Hardstanding for mobile home storage	1193
12	Hardstanding #4	Neil Bird t/a Southern Transit	Bus & coach operator	Hardstanding for bus & coach parking/storage	1139
13	Hardstanding #5	Crawley Luxury Coaches - Dave Brown	Coach operator	Hardstanding for coach parking/storage	76
14	Hardstanding #7	Jason Hodge	Scrap/recycling operator	Enclosed yard for the storage of recyclable material	1132
15	Hardstanding #9	S. Holman & C. English	storage of coaches	Hardstanding for coach parking/storage	410
16	Hardstanding #10A & B	J Messham	storage of equipment	storage of Wall of Death equipment	1252
17	Hardstanding #12	Neil Bird t/a Southern Transit	Bus & coach operator	Hardstanding for bus & coach parking/storage	197
18	Hardstanding #13	David Savage	Scrap/recycling operator	Hardstanding for vehicle parking/storage and storage of a boat	49
19	Hardstanding #15	Dave Hunt t/a DSH Leisure	Fairground ride operator	Hardstanding for fairground rides	496
20	Hardstanding #17	Ryan Cunningham	Car storage	Yard and building for paving slab and vehicle storage	207

21	Hardstanding #18	C Jenkin & Son	Mobile Home dealer	Hardstanding for mobile home storage	2009
22	Hardstanding #21	Nigel Crickmore	Vehicle recovery	Hardstanding for vehicle parking/storage	87
23	Hardstanding #22	Steven Wright	Scrap/recycling operator	Hardstanding for vehicle parking/storage	80
24	Hardstanding #23	Avery Howell & Oliver Glover	Vehicle recovery	Hardstanding for vehicle parking/storage	342
25	Hardstanding #25	Neil Bird t/a Southern Transit	Bus & coach operator	Hardstanding for bus & coach parking/storage	634
26	Hardstanding #28	Kristian Dutton	Scrap/reclamation operator	Hardstanding for vehicle parking/storage and an office for associated uses	603
27	Loading Bay	Philip Malkin	Vehicle storage	Yard and building for vehicle storage	410
28	Loco Shed	Ace Travel Ltd	Coach operator	Garage bay for vehicle repair and adjoining hardstanding for vehicle parking	384
29	Packing Plant	Scaffold It (UK) Limited	Scaffolding Company	Yard and building for scaffold storage	917
30	Hardstanding #10C	DC Geoghegen Ltd	Builders	Storage of building materials & skips	

5.7 Table 5A shows that 1,698 sqm area is occupied by vehicle recovery and repair businesses, 8,970 sqm area is used for vehicle storage (cars/coaches/buses), including by mobile home sales company and, 2,781 sqm is occupied by general industrial units. This matches well within the information provided by SDNPA's Major Projects Head (see paragraph 5.2).

5.8 For the purpose of estimating trip generation, vehicle repair garages, commercial warehousing and industrial units are the sub-land uses within TRICS would be chosen. The TRICS reports are provided as Appendices 5.1, 5.2, and 5.3, respectively. The weekday peak hour trip rates and vehicular trips is provided in Table 5B.

Table 5B Permitted Development to West of A283

Use	Time	Trip Rate per 100sqm		Vehicle Trips		
		In	Out	In	Out	2-way
Vehicle Repair Garages	08:00-09:00 17:00-18:00	1.220 0.530	0.670 0.850	27 9	11 14	38 23
Commercial Warehousing	08:00-09:00 17:00-18:00	0.217 0.078	0.097 0.224	19 7	9 20	28 27
Industrial Unit	08:00-09:00 17:00-18:00	0.509 0.044	0.087 0.479	14 1	2 13	16 14
Total	**08:00-09:00 17:00-18:00**			**60 17**	**22 47**	**82 64**

5.9 The total permitted vehicular trip generation associated with the entire site is provided in Table 5C.

Table 5C Total Permitted Vehicular Trip Generation

	Peak Hour	In	Out	Two-way
Cement Works Site	08:00-09:00 17:00-18:00	5 5	5 5	10 10
West of A283	08:00-09:00 17:00-18:00	60 17	22 47	82 64
Total	**08:00-09:00** **17:00-18:00**	**65** **22**	**27** **52**	**92** **74**

5.10 Table 5C shows that the overall permitted vehicular trip generation associated with the entire site is estimated to be 92 and 74 two-way vehicular movements during AM and PM peak hours, respectively. These trips were accepted by SDNPA, WSCC and NH.

5.11 As discussed in TN1, the vehicular trips associated with the permitted used of the site would be distributed across the road network accordingly to 2011 O-D census data and Mobile Network Data.

5.12 The permitted development traffic flows are shown diagrammatically as Appendix 5.4 and 5.5 for the AM and PM peak hours, respectively.

6.0 BASELINE TRAFFIC SITUATION

6.1 Raw Traffic Data

6.1.1 NH advised that it would not be acceptable to use of data from the Worthing and Shoreham Harbour strategic models for the SCW transport study. This is because neither model is up-to-date and therefore not considered to be sufficiently robust for SCW. A bespoke approach was therefore advised – as per email on 2nd August 2021.

6.1.2 The use of traffic surveys undertaken in 2021 was also deemed to be an unacceptable approach due to unknowns regarding traffic levels in the post-Covid period.

6.1.3 Therefore, WSCC provided observed traffic data for use in the Shoreham Cement Works project. These are from the National Highways A27 data collection programme in 2015 and from the Shoreham Free Wharf Transport Assessment in 2017.

6.1.4 Data from the following manual traffic surveys have been derived for the junctions assessed:

<u>Highways England A27 Data Collection Programme 2015 (Tuesday 23rd June 2015)</u>

- A283 / A27 Slips Roundabout;
- A283 / A259 Roundabout;
- A27 / Old Shoreham Road
- A27 / Coombes Road
- A27 / A2025 / Manor Road (Lancing Manor) Roundabout

<u>Shoreham Free Wharf Transport Assessment (2017)</u>

- A283 / Upper Shoreham Road Roundabout;

<u>Horsham Study Data (Thursday 23rd May 2019)</u>

- A283 / A24 (Washington) Roundabout;
- A283 / Water Lane / Chanctonbury Ring Road Crossroads;
- A283 / Maudlin Lane / Clays Hill / Castle Lane / The Street Roundabout;
- A283 / A2037 Roundabout;

6.1.5 In the absence of observed flows for the A283 / B2135 Horsham Road staggered junction, WSCC provided modelled flows for 2019. As discussed in Section 2.5, the straight-ahead movements were found to be significantly lower than the 2019 observed flows at the Clays Hill Roundabout and Water Lane crossroad.

6.1.6 As such, to be robust it was agreed with WSCC to use the straight ahead flows on the A283 from the neighbouring junctions but maintain the turning movements to/from B2135 and Horsham Road.

6.1.7 The observed traffic flows are shown diagrammatically as Appendix 6.1 and 6.2 for the AM and PM peak hours, respectively.

6.2 Baseline Year 2033 – Growth Factors

6.2.1 The observed traffic flows have been upscaled to year 2033, this is the year of assessment as agreed with WSCC and NH. The traffic surveys used and area specific TEMPro growth factors have been outlined in TN2.

6.2.2 Planning Policy Manager Mr T Moody of Adur & Worthing Councils provided a list of committed developments from 2018. In addition to these committed developments, Mr Moody also provided a list of allocated developments within emerging Worthing Local Plan.

6.2.3 The following Local Plan Allocation sites within Adur Local Plans were also noted:

- 1,100 dwellings allocated at Shoreham Harbour Regeneration Area: 1100 (minus the Free Wharf and Kingston Wharf consents);
- Land at West Sompting;
- New Monks Farm – as IKEA has announced that this store will not be delivered, the Council are seeking employment floorspace on the former IKEA land (Consistent with the Adur Local Plan 2017 Policy 5);
- AWDM/2139/20 Pilot Pub – Consent granted on 6th April 2021 for 34 dwellings.

6.2.4 A list of all committed developments and Local Plan Allocations is provided in Appendix 6.3.

6.2.5 The proposed methodology that has been accepted by WSCC and NH is to represent committed developments and Local Plan allocations within overall growth for small to medium sites and to those that lie outside the immediate study area (i.e., beyond the area where the junction impacts are considered).

6.2.6 Therefore, except for New Monks Farm development and Shoreham Airport development, other sites will be represented within overall growth. New Monks Farm and Shoreham Airport development flows have been added manually and hence these developments are not listed in Appendix 6.3.

6.2.7 The number of dwellings and jobs (based on Employment Densities 3rd Edition) that would be generated as a result of the committed developments and Local Plan allocations (bar New Monks Farm and Shoreham Airport developments) is also provided in Appendix 6.3.

6.2.8 Based on this, there will be a total of 1,753 homes and 592 jobs created within Adur and 2,330 homes and 3,174 jobs created within Worthing as a result of all the committed developments and Local Plan allocations (excluding New Monks Farm and Shoreham Airport development).

6.2.9 Adding the aforementioned homes and jobs to the 2018 baseline number of homes and jobs in TEMPRO would provide 2033 baseline number of homes and jobs (bar New Monks Farm and Shoreham Airport developments). **[Note: The year 2018 has been used because the developments considered have been granted planning permissions since 2018].**

6.2.10 The TEMPRO adjusted assumptions for the year 2033 based on the above methodology are provided in Table 6A.

Table 6A 2033 TEMPRO Adjusted Assumption

District	Use	Year 2033
Adur DC	Homes	30,665
	Jobs	27,051
Worthing DC	Homes	52,179
	Jobs	62,432

6.2.11 These 2033 TEMPRO adjusted assumptions were agreed with NH on 30th September 2021. They have been applied to obtain growth factors for:

- 2015-2033 (for surveys along A27 which were undertaken in 2015); and
- 2017-2033 (for surveys at A283/Upper Shoreham Road roundabout which were undertaken in 2017).

6.2.12 Based on the above, the TEMPRO growth factors that would be used are provided in Table 6B.

Table 6B TEMPRO Growth Factors

Area	Period	Trunk Road	All roads
Adur DC (2015-2033)	AM	1.1600 (urban)	1.1534 (urban)
	PM	1.1574 (urban)	1.1508 (urban)
Adur DC (2017-2033)	AM	1.1352 (urban)	1.1294 (urban)
	PM	1.1315 (urban)	1.1257 (urban)
Worthing DC (2015-2033)	AM	1.1808 (urban)	1.1741 (urban)
	PM	1.1777 (urban)	1.1710 (urban)

6.2.13 With regard to Horsham DC, traffic surveys were carried out in 2019. The increase in the number of households from 2019 to 2033 equates to 10,789. The TEMPRO growth factors (2019 to 2033) for Horsham DC are obtained as 1.1620 (AM) and 1.1647 (PM). These TEMPRO growth factors are considered to be reasonably robust as they are likely to include all commitments within this district.

6.2.14 The 2033 Traffic Flows (Without Major Committed Development) are shown diagrammatically as Appendices 6.4 and 6.5 for AM and PM peak hours, respectively.

6.3 Major Committed Development – New Monks Farm and Shoreham Airport

6.3.1 As mentioned previously, there are two major committed developments in the vicinity of the site:

- New Monks Farm (planning ref. AWDM/0961/17); and
- Shoreham Airport (planning ref. AWDM/1093/17)

6.3.2 These developments were supported by a Joint Transport Assessment prepared by Vectos in May 2017.

New Monks Farm Trips

Residential

6.3.3 The New Monks Farm development comprises 600 dwellings. The associated vehicle trips were distributed across the road network in the Joint TA as per Census 2011 O-D data – see Figure 8. The New Monks Farm residential development traffic flows are shown diagrammatically as Appendices 6.6 and 6.7 for AM and PM peak hours, respectively.

Employment

6.3.4 The New Monks Farm development also comprises consented IKEA, however IKEA have since decided not to build a store in this location.

6.3.5 Therefore, to determine what vehicle trips to represent this element of the New Monks Farm development, ADL met with Moira Hayes, Adur Planning Policy Manager. It was agreed that IKEA trips are the consented trips and therefore these should be tested. With regard to alternative employment use on IKEA land, Moira advised that ADL should use the employment assumptions that were tested within Local Plan modelling. For this, Moira directed us to the Second Addendum Revised Reissue September 2016.

6.3.6 Based on that email, for the purpose of Shoreham Cement Works transport study, ADL have used the employment breakdown for New Monks Farm as:

- B1 - 333 jobs
- B2 – 143 jobs
- B8 – 0 jobs

6.3.7 It is noted that Tables 2.7 and 2.8 of Second Addendum Revised Reissue September 2016 provide trip generation for New Monks Farm site. However, this trip generation includes both 600 homes and the employment use all in one. Subtracting residential trips based on trip rates for residential element (provided in Table 2.6), we were able to separate out the employment trip generation as follows:

- AM peak hour: IN = 132 OUT = 14
- PM peak hour: IN = 9 OUT = 107

6.3.8 As can be seen, the employment trips in the AM peak are significantly higher than IKEA trips and vice versa is true during PM peak. Hence, ADL have decided to go with the following for representing New Monks Farm's non-residential element for our SCW Transport Study project:

- AM peak hour: NMF employment trips i.e., 132 inbound and 14 outbound
- PM peak hour: IKEA trips i.e., 171 inbound and 180 outbound (taken from Vectos' Joint TA)
  [National Highways accepted this approach on 27th October 2021]

6.3.9 The New Monks Farm non-residential traffic flows are shown diagrammatically as Appendix 6.8 (i.e., NMF employment trips) for the AM peak hour, and Appendix 6.9 (IKEA trips).

Shoreham Airport Trips

6.3.10 The Shoreham Airport employment trips were also distributed based on Census 2011 O-D data – see Figure 16 of Vectos Joint TA. The Shoreham Airport traffic flows are shown diagrammatically as Appendices 6.10 and 6.11 for AM and PM peak hours, respectively.

Total Committed Development Trips

6.3.11 The Total Committed Development trips therefore comprise the following traffic flows:

- AM Peak Hour: New Monks Farm Residential + New Monks Farm Employment + Shoreham Airport
- PM Peak Hour: New Monks Farm Residential + IKEA + Shoreham Airport

6.3.12 The Total Committed Development traffic flows are shown diagrammatically as Appendices 6.12 and 6.13 for AM and PM peak hours, respectively.

2033 Baseline Trips

6.3.13 The 2033 (Without Major Committed Development) Traffic Flows plus Total Committed Development Traffic Flows therefore result in the 2033 Baseline Traffic Flows. The 2033 Baseline Traffic Flows are shown diagrammatically as Appendices 6.14 and 6.15 for AM and PM peak hours, respectively.

6.3.14 It should be noted that the 2033 Baseline Traffic Flows include the Permitted Development Traffic Flows.

6.4 Speed Survey Data on A283

6.4.1 ADL commissioned Auto Surveys Ltd to undertake two ATC (Automated Traffic Count) surveys on the A283, between Friday 16th July 2021 and Thursday 22nd July 2021, adjacent to both site access:

- ATC 1: approximately 50 metres north of northern access
- ATC 2: approximately 50 metres south of southern site access

6.4.2 This speed survey data for ATC 1 and ATC 2 is provided in Appendix 7.1 and Appendix 7.2, respectively. The average and 85th percentile speeds are summarised in Table 6C.

Table 6C A283 Speed Summary

		Average	85th Percentile	%HGV
ATC 1	Northbound	46.4 mph	53.4 mph	2.2 %
	Southbound	44.0 mph	50.1 mph	2.1 %
ATC 2	Northbound	48.6 mph	55.2 mph	2.3 %
	Southbound	47.4 mph	54.5 mph	2.2 %

* HGV = heavy goods vehicle

6.4.3 The recorded speeds on A283 have been used to inform the required visibility splays at any proposed site access.

6.4.4 The results of the speed survey should be treated with caution because the traffic levels in July 2021 were lower than pre-Covid on a typical day. Hence, junction speed surveys would need to be undertaken at planning application stage to ensure the visibility splay calculations are robust.

7.0 EXISTING ACCESSIBILITY BY NON-CAR MODES OF TRANSPORT

7.1 Walking

7.1.1 The site is located in a rural setting, with the nearest town to the north being Steyning, and the nearest town to the south being Shoreham-By-Sea, both approximately four kilometres from the site. However, the site does benefit from some existing pedestrian infrastructure, and the public rights of way within the vicinity of the site are very good.

Pedestrian Infrastructure

7.1.2 There is a footway on the southbound side of the A283, north of the northern site access. This is approximately two metres wide adjacent to the site and narrows to approximately one metre up to Dacre Gardens (a village comprising approximately 30 dwellings, fronting the eastern side of A283). There are no footways on the northbound side of the A283, nor south of the northern access.

7.1.3 The two portions of the site are connected by an underpass beneath the A283. The carriageway width at this point is approximately 5.6 metres wide (this includes 1.4-metre-wide footway). The headroom height of the tunnel is approximately 4.4 metres high, and the length of the tunnel is approximately 25 metres.

Public Rights of Way

7.1.4 The site benefits from several public rights of way (PROW) in the vicinity of the site, including footpaths bridleways and by-ways.

7.1.5 There is a footpath on both sides of the River Adur. Footpath number 3139 runs along the east side of the river and footpath number 2049 runs along the western side of the river.

7.1.6 The nearest crossing point across the River Adur is the footbridge approximately 650 metres north of the site. This is where path number 3209 intersects the two above mentioned footpaths. At this point, the South Downs Way traverses the River Adur, and then the A283.

7.1.7 The South Downs Way is a 100-mile/160-kilometre-long national trail which follows the old routes and droveways along the chalk escarpment and ridges of the South Downs. The South Downs Way crosses the A283 approximately 800 metres north of the site. The accesses on either side of the carriageway are staggered, approximately 90 metres distance. Here, there is an approximately two-metre footway on the eastern side of the carriageway, but no formal crossing facility from the western side of the carriageway to this footway. There have been no collisions involving pedestrians or cyclists recorded at this location and as such, there are no known highway safety issues that need to be addressed. However, as is described in Section 11.4, there is an opportunity to improve the crossing facility at this location.

7.1.8 A plan of the existing pedestrian infrastructure and the PROW network is provided as Appendix 8.1.

7.1.9 As described in Section 11.0 of this report, it is proposed to provide a link between the site and the public right of way along the River Adur, via the western portion of the site. It is also proposed to improve the pedestrian (and cycle/horse rider) crossing where the South Downs Way crosses the A283, approximately 800 metres north of the site.

7.2 Cycling

National Cycle Network

7.2.1 The site is well served by the National Cycle Network (NCN), which is a network of signed on-road and off-line cycle links. NCN Route 223 is known as the “Downs Link” from Chertsey to Shoreham-by-Sea, which runs along the east of the River Adur, adjacent to the site.

7.2.2 NCN 223 is traffic free between Shoreham (at the A283/A259 roundabout) up to the A283/Clays Hill roundabout to the south of Steyning. North of this point, there is a segment of on-road cycle route through Bamber, before returning to predominantly traffic-free routeing towards Henfield.

7.2.3 The provision of the NCN Route 223 adjacent to the site facilitates travel to/from the site by bicycle, between the site and Shoreham to the south and Steyning/Bamber/Upper Beeding to the north.

7.2.4 NCN Route 223 crosses the A283 approximately 900 metres northwest of the A283/A2037 roundabout. As is described in Section 11.4, this crossing point could be improved (for all users) by way of maintaining visibility in both directions and signage warning drivers of the crossing point for walkers, cyclists and horse riders.

Cycling Distance

7.2.5 According to the Department for Transport Cycle Infrastructure Design Local Transport Note (1/20), eight kilometres is considered a suitable distance to cycle for local journeys. This extent is shown on a plan provided as Appendix 8.2. This also shows the NCN within the vicinity of the site.

7.2.6 As mentioned previously, it is also proposed to improve the crossing where the South Downs Way crosses the A283, approximately 800 metres north of the site.

7.3 Public Transport

Bus

7.3.1 There are two bus stops on the A283 adjacent to the site's northern access. Both bus stops are equipped with bus flagpoles and timetable information.

7.3.2 The southbound bus stop is approximately 60 metres north of the northern access. The northbound bus stop is located opposite the northern site access.

7.3.3 These stops are therefore within the recommended maximum walking distance as per CIHT's *Buses in Urban Development* report (2018).

7.3.4 A plan showing the existing bus stop locations is provided as Appendix 8.3. Table 7A summarises the bus services at these bus stops.

Table 7A Bus Services Summary

Service №	Route	Frequency		
		Mon-Fri	Sat	Sun
2	Rottingdean to Steyning via Woodingdean, Race Hill, City Centre, Hove, Portslade, Southlands Hospital, Shoreham, Bramber	1 / hr	1 / hr	1 / hr
2B	Hove to Steyning via Portslade	2 / day	2 / day	1 / day
60	Old Steine to Steyning via Hove, Portslade, Manor Hall Road, Southwick, Shoreham, Bramber	1 / day	-	-
106	Henfield - Upper Beeding - Steyning - Lancing – Worthing (Tuesday / Wednesday / Friday)	1 / day	-	-
740	Lancing - Sompting – Steyning (school service)	1 / day	-	-

Source: https://www.buses.co.uk/, https://www.compass-travel.co.uk/ (as of 26/01/2022)

7.3.5 Table 3A demonstrates that the bus stops on the A283, adjacent to the site, serve five bus routes (includes one school service) which link the site with Shoreham, Worthing, Lancing and Hove to the south, and Steyning and Bamber to the north. Bus Route 2 provides an hourly service between Rottingdean and Steyning.

7.3.6 As described in Section 11.4 of this report, it is proposed to increase the frequency of Bus Route 2, and provide bus infrastructure within the site, and on A283, which would include bus shelter, seating, and real time information. This would improve the connectivity of the site to Steyning and Shoreham.

Rail

7.3.7 The nearest railway station to the site is Shoreham-by-Sea which is approximately five kilometres south of the site. This is equivalent to 15-minute cycle, or 55-minute walk.

7.3.8 Bus Route 2 also stops at this station, which takes 19 minutes from Shoreham Cement Works. Increased bus frequency of this route would make rail travel from this station more accessible and convenient for residents/staff/visitors of the site.

7.3.9 This station is served by Southern and provides rail links to Littlehampton, Portsmouth & Southsea and Southampton to the west; Brighton to the east; and London Victoria to the north.

7.3.10 The station is equipped with 131 car parking spaces and 42 cycle parking spaces. The station is Category B1 station, i.e., step free access to platforms via separate entrances.

8.0 PROPOSED DEVELOPMENT SCENARIOS

8.1 There are four development scenarios for the Shoreham Cement Works Area Action Plan which have been drawn up by SDNPA. All four have been assessed as part of this transport study.

8.2 Each of the four proposed development scenarios comprises a mix of land uses, across both sides of the A283. These scenarios, and their respective schedule of development, are summarised in Table 8A.

Table 8A Development Scenarios

Current Use Class	Former Use Class	1	2	3	4
		Housing / Employment Led	Housing / Employment Led	Leisure Led	Appeal scheme
B2: General industrial	B2	16,200	16,200	0	13,250
B8: Storage or distribution	B8	20,000	20,000	0	13,250
C1: Hotel*	C1	7,500	7,500	7,500	7,500
E(a): Retail	A1	0	0	500	0
E(b): Consumption of food & drink on premises	A3	0	0	1,500	1,500
E(d): Indoor sport, recreation & fitness**	D2	0	0	18,500	0
E(g)(i): Offices	B1(a)	0	0	0	12,000
E(g)(ii): Research & Development / E(g)(iii) Industrial processes	B1 (b/c)	32,000	32,000	32,000	0
F1: Learning & non-residential institution	D1	2,000	2,000	10,000	0
F2(a): Local shop	A1	280	280	280	0
C3: Dwellings	C3	400	240	200	84
Total commercial floorspace		**77,980**	**77,980**	**70,280**	**47,500**
Total homes		**400**	**240**	**200**	**84**

*Possibility of sui generis for hostel
**Possibility of sui generis for live music venue

Notes:
Floorspace of hotel kept constant at 7,500 m2. This is approx equivalent to a 130-bed hotel based on the TRICS database
Floorspace of a local shop kept constant in first 3 scenarios. Floorspace of 280 m2 is the maximum allowed under this use class.
The employment floorspace figure for the appeal scheme has been split equally between B2 and B8
The E(b): Consumption of food & drink on premises in scenario 3 is a pub/restaurant but is not sui generis drinking establishment

8.3 The western portion of the site is allocated for residential use only.

9.0 PROPOSED TRIP GENERATION

9.1 Traffic Impact Assessment Methodology

9.1.1 The trip generation associated with each element of the four scenarios has been calculated using TRICS database.

9.1.2 As stated within Adur Local Plan Transport Assessment, Horsham Transport Study and Shoreham Harbour Transport Study, the experience from the Sustainable Travel Towns (Worcester, Peterborough, and Darlington) as per the DfT document *The Effects of Smarter Choices Programmes in Sustainable Travel Towns; Research Report* (2010) saw a reduction of 9% in car driver trips in 2008 compared to 2004.

9.1.3 However this initial reduction was not necessarily maintained in full over time. DfT's 2016 document *Sustainable Travel Towns: An Evaluation of The Longer Term Impacts* which provides evaluation conducted by Transport Research Laboratory (TRL) on behalf of DfT of the impact of the Sustainable Travel Towns project states that the overall there was a reduction in total traffic levels in the order of 2%.

9.1.4 The reasons that the initial reduction was not maintained was due to promotion activities being reduced or discontinued after initial project funding ceased or increase in public transport fares. Hence, reduction in car trips based on Sustainable Travel Towns report was not considered as suitable for use within this transport study.

9.1.5 Moreover, it should be noted that in Section 12.0 (proposed site access arrangement) and 13.0 (off-site junctions) of this report, the junction capacity assessments are based on typical commuter peak hours and during these periods, it is considered that the likelihood of walking (and to some extent, cycling) related improvements is unlikely to tip the balance from private cars to walking (and cycling) to any material extent. This is mainly due to the semi-rural nature of site's location and also due to sparsity of trip-attracting destinations in the vicinity of the site. Hence, applying a reduction to car trips without robust evidence to substantiate the reduction is not considered appropriate.

9.1.6 The trip generation has therefore been based on worst-case assumption whereby no restraint to car trips have been applied. This assumption has been used to calculate the 'true' cost of implementing physical improvements to the junctions that are severely impacted by the development proposals.

9.1.7 In the areas where a large number of development trips are concentrated and where the investment in buses, cycle routes and other sustainable initiatives can be seen as most effective, the aforementioned calculated true cost (to implement physical improvements to the junctions) have been set aside for sustainable initiatives instead (as discussed in Section 11.0); namely junctions in Shoreham-by-Sea.

9.1.8 In the areas such as Steyning and Pulborough, where the development trips travel through to get to the wide range of destinations further afield, and sustainable initiatives in these areas would not result in a material reduction in car traffic. Hence, the costs to implement physical improvements to the junctions based on the aforementioned worst-case assumption are in fact set aside to bring about these physical improvements. Similar approach has been taken for the roundabout junctions of the A27 slips with the A283 and A27 with Grinstead Lane due to the strategic nature of these junctions.

9.1.9 The trip rates outlined in this chapter have been agreed as per Technical Note 1, and ongoing discussion between ADL, WSCC and NH.

9.2 Proposed Trip Rates – TRICS Assessment

Residential (Use Class C3)

9.2.1 To represent the residential element of the proposed development scenarios (i.e., Scenario 1, 2, 3, and 4), the following parameters in the TRICS database were selected:

- Main land use: Residential
- Sub land use: Houses privately owned
- Regions: England (excl. London), Wales, Scotland
- № of dwellings: Between 60 and 600 units
- Location: Edge of town

- Other:
    - Multi-modal surveys
    - Sites with Travel Plan excluded
    - Sites which flats excluded (flats typically have lower car ownership)

9.2.2 The TRICS report is provided as Appendix 9.1. The trip rates and trip generation for each proposed development scenario are summarised in Table 9A.

Table 9A Proposed Trip Generation: Residential

Trip Rate				
	Peak Hour	**In**	**Out**	**Two-Way**
Per Dwelling	08:00-09:00	0.125	0.385	0.510
	17:00-18:00	0.342	0.135	0.477
Trip Generation				
Scenario	**Peak Hour**	**In**	**Out**	**Two-Way**
1	08:00-09:00	50	154	204
400 Dwellings	17:00-18:00	137	54	191
2	08:00-09:00	30	92	122
240 Dwellings	17:00-18:00	82	32	114
3	08:00-09:00	25	77	102
200 Dwellings	17:00-18:00	68	27	95
4	08:00-09:00	11	32	43
84 Dwellings	17:00-18:00	29	11	40

**Trip rates agreed as per Technical Note 1*

9.2.3 Table 9A demonstrates that the residential element of the proposed development scenarios would generate the following two-way vehicle movements in the AM and PM peak hours:

- Scenario 1: AM = 204 PM = 191
- Scenario 2: AM = 122 PM = 114
- Scenario 3: AM = 102 PM = 95
- Scenario 4: AM = 43 PM = 40

R&D/Light Industrial/Storage & Distribution (Use Classes B2, B8, E(g)(ii), E(g)(iii))

9.2.4 To represent the employment elements of the proposed development scenarios (i.e., Scenario 1, 2, 3, and 4), the following parameters in the TRICS database were selected:

- Main Land use: Employment
- Sub Land use: Industrial estate
- Regions: England (excl. London), Wales, Scotland
- Location: Edge of town

- Other:
    - Multi-modal surveys
    - Sites which do not contain any of the B1/B2/B8 excluded

9.2.5 The TRICS report is provided as Appendix 9.2. The trip rates and trip generation for each proposed development scenario are summarised in Table 9B.

Table 9B Proposed Trip Generation: Employment

Trip Rate				
	Peak Hour	**In**	**Out**	**Two-Way**
Per 100 sqm	08:00-09:00	0.317	0.121	0.438
	17:00-18:00	0.094	0.336	0.430
Trip Generation				
Scenario	**Peak Hour**	**In**	**Out**	**Two-Way**
1 68,200 sqm	08:00-09:00	216	83	299
	17:00-18:00	64	229	293
2 68,200 sqm	08:00-09:00	216	83	299
	17:00-18:00	64	229	293
3 32,000 sqm	08:00-09:00	101	39	140
	17:00-18:00	30	108	138
4 36,500 sqm	08:00-09:00	84	32	116
	17:00-18:00	25	89	114

**Trip rates agreed as per Technical Note 1*

9.2.6 Table 9B demonstrates that the employment elements of proposed development scenarios would generate the following two-way vehicle movements in the AM and PM peak hours:

- Scenario 1: AM = 299 PM = 293
- Scenario 2: AM = 299 PM = 293
- Scenario 3: AM = 140 PM = 138
- Scenario 4: AM = 116 PM = 114

Local Shop (Use Class F2(a))

9.2.7 To represent the local shop element of the proposed development scenarios (i.e., Scenario 1, 2, and 3), the following parameters in the TRICS database were selected:

- Main Land use: Retail
- Sub Land use: Convenience store
- Regions: England (excl. London), Wales, Scotland
- Location: Suburban (edge of town sites not available)

- Other:
  - Multi-modal surveys
  - Area between 100sqm and 300sqm (+/- 50% of proposed area)

9.2.8 The TRICS report is provided as Appendix 9.3. The trip rates and trip generation for each proposed development scenario are summarised in Table 9C.

Table 9C Proposed Trip Generation: Local Shop

Trip Rate				
	Peak Hour	**In**	**Out**	**Two-Way**
Per 100 sqm	08:00-09:00	11.148	10.983	22.131
	17:00-18:00	11.449	10.258	21.707
Trip Generation				
Scenario	**Peak Hour**	**In**	**Out**	**Two-Way**
1, 2, and 3 280 sqm	08:00-09:00	31	31	62
	17:00-18:00	32	29	61

**Trip rates agreed as per Technical Note 1*

9.2.9 Table 9C demonstrates that the local shop element of proposed development scenarios would generate the following two-way vehicle movements in the AM and PM peak hours:

- Scenario 1, 2 and 3: AM = 62 PM = 61

Hotel (Use Class C1)

9.2.10 To represent the hotel element of the proposed development scenarios (i.e., Scenario 1, 2, 3, and 4), the following parameters in the TRICS database were selected:

- Main Land use: Hotel, Food and Drink
- Sub Land use: Hotels
- Regions: England (excl. London), Wales, Scotland
- Location: Edge of town
- Other:
  - Multi-modal surveys

9.2.11 The TRICS report is provided as Appendix 9.4. The trip rates and trip generation for each proposed development scenario are summarised in Table 9D.

Table 9D Proposed Trip Generation: Hotel

Trip Rate				
	Peak Hour	**In**	**Out**	**Two-Way**
Per 100 sqm	08:00-09:00	0.383	0.509	0.892
	17:00-18:00	0.350	0.304	0.654
Trip Generation				
Scenario	**Peak Hour**	**In**	**Out**	**Two-Way**
1, 2, 3 and 4 7,500 sqm	08:00-09:00	29	38	67
	17:00-18:00	26	23	49

**Trip rates agreed as per Technical Note 1*

9.2.12 Table 9D demonstrates that the hotel element of proposed development scenarios would generate the following two-way vehicle movements in the AM and PM peak hours:

- Scenario 1, 2, 3 and 4: AM = 67 PM = 49

Offices (Use Class E(g)(i))

9.2.13 To represent the offices element of the proposed development scenarios (i.e., Scenario 4), the following parameters in the TRICS database were selected:

- Main Land use: Employment
- Sub Land use: Business Park
- Regions: England (excl. London), Wales, Scotland
- Location: Edge of town
- Other:
  - Multi-modal surveys

9.2.14 The TRICS report is provided as Appendix 9.5. The trip rates and trip generation for each proposed development scenario are summarised in Table 9E.

Table 9E Proposed Trip Generation: Offices

Trip Rate				
	Peak Hour	**In**	**Out**	**Two-Way**
Per 100 sqm	08:00-09:00	1.182	0.138	1.320
	17:00-18:00	0.079	0.843	0.922
Trip Generation				
Scenario	**Peak Hour**	**In**	**Out**	**Two-Way**
4 12,000 sqm	08:00-09:00	142	17	159
	17:00-18:00	9	101	110

9.2.15 Table 9E demonstrates that the offices element of proposed development scenarios would generate the following two-way vehicle movements in the AM and PM peak hours:

- Scenario 4: AM = 159 PM = 110

Consumption of Food & Drink on Premises (Use Class E(b))

9.2.16 To represent the pub/restaurant element of the proposed development scenarios (i.e., Scenario 3 and 4), the following parameters in the TRICS database were selected, as per WSCC's suggestions via email on 27th October 2021:

- Main Land use: Hotel, Food and Drink
- Sub Land use: Pub/Restaurant
- Regions: England (excl. London), Wales, Scotland
- Location: Edge of town

9.2.17 The TRICS report is provided as Appendix 9.6. The trip rates and trip generation for each proposed development scenario agreed with WSCC are summarised in Table 9F.

Table 9F Proposed Trip Generation: Pub/Restaurant

Trip Rate				
	Peak Hour	**In**	**Out**	**Two-Way**
Per 100 sqm	08:00-09:00	0.000	0.000	0.000
	17:00-18:00	4.987	3.003	7.990
Trip Generation				
Scenario	**Peak Hour**	**In**	**Out**	**Two-Way**
3 and 4	08:00-09:00	0	0	0
1,500 sqm	17:00-18:00	75	45	120

**Trip rates agreed via email with WSCC on 27/10/2021*

9.2.18 Table 9F demonstrates that the pub/restaurant element of proposed development scenarios would generate the following two-way vehicle movements in the AM and PM peak hours:

- Scenario 3 and 4: AM = 0 PM = 120

Learning & Non-Residential Institution (Use Class F2(a))

9.2.19 To represent the learning/non-residential institution element of the proposed development scenarios (i.e., Scenarios 1, 2, and 3), it was agreed with SDNPA and WSCC on 27th October 2021 that this use would be treated as museums/art galleries/exhibition centres. The following parameters in the TRICS database were selected:

- Main Land use: Leisure
- Sub Land use: Art Galleries / Museums / Exhibitions
- Regions: England (excl. London), Wales, Scotland
- Location: Edge of town

9.2.20 The TRICS report is provided as Appendix 9.7. The trip rates and trip generation for each proposed development scenario are summarised in Table 9G.

Table 9G Proposed Trip Generation: Art Galleries/Museums/Exhibitions

Trip Rate				
	Peak Hour	**In**	**Out**	**Two-Way**
Per 100 sqm	08:00-09:00	0.000	0.000	0.000
	17:00-18:00	0.038	0.385	0.423
Trip Generation				
Scenario	**Peak Hour**	**In**	**Out**	**Two-Way**
1 2,000 sqm	08:00-09:00	0	0	0
	17:00-18:00	1	8	9
2 2,000 sqm	08:00-09:00	0	0	0
	17:00-18:00	1	8	9
3 10,000 sqm	08:00-09:00	0	0	0
	17:00-18:00	4	39	43

**Trip rates agreed via email with WSCC on 26/10/2021*

9.2.21 Table 9G demonstrates that the employment elements of proposed development scenarios would generate the following two-way vehicle movements in the AM and PM peak hours:

- Scenario 1: AM = 0 PM = 9
- Scenario 2: AM = 0 PM = 9
- Scenario 3: AM = 0 PM = 43

9.3 Proposed Trip Rates – Leisure Use, Scenario 3

9.3.1 With regard to the proposed leisure trip generation use in Scenario 3, ADL derived annual visitor trips from four Zip World sites in Wales.

9.3.2 There are four Zip World sites in Wales (Fforest in Betws-y-Coed, Penrhyn Quarry in Bethesda, Slate Caverns in Blaenau Ffestiniog and Tower in Aberdare). In 2019, the number of visitors to all four Zip World sites was 400,00 per year; given each site has differing number of adventure activities, it is assumed that the site with most adventures (Fforest with six) could attract 150,00 visitors per year.

9.3.3 For the purpose of trip generation, ADL have made the following assumptions:

- Average car occupancy = 3 visitors per car
- Average coach occupancy = 50 visitors per coach
- 80% visitors arrive by car and 20% visitors arrive by coach
- For robust assessment, 30-week activity period (Zip World is open for longer than this).

9.3.4 Based on the above assumptions, the following is calculated:

- 120,000 visitors in cars OR 40,000 cars per year OR 1,333 cars per week 190 cars per day;
- 30,000 visitors in coaches per year OR 600 coaches per year OR 20 coaches per week OR three coaches per day.

9.3.5 In order to gauge the arrival and departure profile for a weekday, ADL and WSCC agreed to use profile from leisure centre sites in TRICS. As explained in Section 2.4, the assumptions were made because the pattern of use in terms of times of day and length of stay may be reasonably similar, albeit there is still significant evening use, but more representative in the evening than the leisure park.

9.3.6 Given that the intensity of daily and peak use is similar between both uses, the trip distribution based on leisure centre sites is likely to produce a robust PM peak assessment.

9.3.7 This TRICS output is provided as Appendix 9.8. The arrival/departure profile and trip generation for each proposed development scenario are summarised in Table 9H.

Table 9H Proposed Trip Generation: Leisure Use

Arrival / Departure Profile			
	Peak Hour	**Arrival**	**Departure**
Trip %	08:00-09:00	4.7%	3.6%
	17:00-18:00	15.8%	13.0%

Trip Generation				
Scenario	**Peak Hour**	**In**	**Out**	**Two-Way**
3	08:00-09:00	9	7	16
18,500 sqm	17:00-18:00	30	25	55

**Arrival/departure profile agreed via email with WSCC on 01/10/2021*

9.3.8 Table 9H demonstrates that the leisure use element of proposed development scenarios would generate the following two-way vehicle movements in the AM and PM peak hours:

- Scenario 3: AM = 16 PM = 55

9.4 Trip Internalisation

Residential and Employment

9.4.1 Although it is likely that the mix of residential use and employment use in the proposed development scenarios would result in internal trips being made (i.e., residents would also be employed on site and therefore would not need to travel by car), this is considered to be limited because of relatively small-scale residential element. However, no internalisation of employment trips has been accounted for within the traffic impact assessment exercise. The proposed trip generation is therefore considered to be robust.

Local Shop

9.4.2 The proposed convenience store would be a local facility predominantly used by the residents and staff living and working within the development. During peak hours, there is unlikely to be any external trips or servicing trips that would be generated by this convenience store. This is agreed with SDNPA and WSCC at the meeting on 5th August 2021.

Consumption of Food & Drink on Premises

9.4.3 It is considered that this Use Class provides a complimentary facility to the proposed hotel + leisure + F1 + dwellings (in case of Scenario 3) and employment uses + hotel + dwellings (in case of Scenario 4).

9.4.4 Given the (more or less) remote location of the site in terms of its proximity to the nearest conurbations, it is unlikely that there will be people from further afield travelling to the site to visit this Use Class i.e., the proposed public house / restaurant would not be point of destination.

9.4.5 It was agreed with WSCC that, for the purposes of robust assessment, 70% of the trips to this Use Class would be internal trips and the remaining 30% would be external, i.e., those passing by along the A283. Therefore, the new two-way vehicle movements in the AM and PM peak hours would be:

- Scenario 3 and 4: AM = 0 PM = 37 (23 IN + 14 OUT)

9.5 Total Proposed Trip Generation

9.5.1 Based on the trip rates outline in Section 9.1 and 9.2, and factoring the internalisation of trip from Section 9.3, the total trip generation can be calculated for each of the Proposed Development Scenarios.

Scenario 1

9.5.2 The total proposed trip generation for Scenario 1 is summarised in Table 9I.

Table 9I Proposed Trip Generation: Scenario 1

Use	Peak Hour	In	Out	Two-Way
Residential	08:00 – 09:00	50	154	204
	17:00 – 18:00	137	54	191
Employment	08:00 – 09:00	216	83	299
	17:00 – 18:00	64	229	293
Hotel	08:00 – 09:00	29	38	67
	17:00 – 18:00	26	23	49
Learning/Non-Residential Institution	08:00 – 09:00	0	0	0
	17:00 – 18:00	1	8	9
Total	**08:00 – 09:00**	**295**	**275**	**570**
	17:00 – 18:00	**228**	**314**	**542**

9.5.3 Table 9I demonstrates that Scenario 1 would generate 570 and 542 two-way vehicle trips during the AM and PM peak hours, respectively. Given that car trips are not restrained (either by way of sustainable initiatives or taking into account internalisation trips and increase in working from home pattern), these trips reflect a worst-case scenario.

Scenario 2

9.5.4 The total proposed trip generation for Scenario 2 is summarised in Table 9J.

Table 9J Proposed Trip Generation: Scenario 2

Use	Peak Hour	In	Out	Two-Way
Residential	08:00 – 09:00	30	92	122
	17:00 – 18:00	82	32	114
Employment	08:00 – 09:00	216	83	299
	17:00 – 18:00	64	229	293
Hotel	08:00 – 09:00	29	38	67
	17:00 – 18:00	26	23	49
Learning/Non-Residential Institution	08:00 – 09:00	0	0	0
	17:00 – 18:00	1	8	9
Total	**08:00 – 09:00**	**275**	**213**	**488**
	17:00 – 18:00	**173**	**292**	**465**

9.5.5 Table 9J demonstrates that Scenario 2 would generate 488 and 465 two-way vehicle trips during the AM and PM peak hours, respectively. Given that car trips are not restrained (either by way of sustainable initiatives or taking into account internalisation trips and increase in working from home pattern), these trips reflect a worst-case scenario.

Scenario 3

9.5.6 The total proposed trip generation for Scenario 3 is summarised in Table 9K.

Table 9K Proposed Trip Generation: Scenario 3

Use	Peak Hour	In	Out	Two-Way
Residential	08:00 – 09:00	25	77	102
	17:00 – 18:00	68	27	95
Employment	08:00 – 09:00	101	39	140
	17:00 – 18:00	30	108	138
Hotel	08:00 – 09:00	29	38	67
	17:00 – 18:00	26	23	49
Learning/Non-Residential Institution	08:00 – 09:00	0	0	0
	17:00 – 18:00	4	39	43
Pub/Restaurant	08:00 – 09:00	0	0	0
	17:00 – 18:00	23	14	37
Leisure Use	08:00 – 09:00	9	7	16
	17:00 – 18:00	30	25	55
Total	**08:00 – 09:00**	**164**	**161**	**325**
	17:00 – 18:00	**181**	**236**	**417**

9.5.7 Table 9K demonstrates that Scenario 3 would generate 325 and 417 two-way vehicle trips during the AM and PM peak hours, respectively. Given that car trips are not restrained (either by way of sustainable initiatives or taking into account internalisation trips and increase in working from home pattern), these trips reflect a worst-case scenario.

Scenario 4

9.5.8 The total proposed trip generation for Scenario 4 is summarised in Table 9L.

Table 9L Proposed Trip Generation: Scenario 4

Use	Peak Hour	In	Out	Two-Way
Residential	08:00 – 09:00	11	32	43
	17:00 – 18:00	29	11	40
Employment	08:00 – 09:00	84	32	116
	17:00 – 18:00	25	89	114
Hotel	08:00 – 09:00	29	38	67
	17:00 – 18:00	26	23	49
Offices	08:00 – 09:00	142	17	159
	17:00 – 18:00	9	101	110
Pub/Restaurant	08:00 – 09:00	0	0	0
	17:00 – 18:00	23	14	37
Total	**08:00 – 09:00**	**266**	**119**	**385**
	17:00 – 18:00	**112**	**238**	**350**

9.5.9 Table 9L demonstrates that Scenario 4 would generate 385 and 350 two-way vehicle trips during the AM and PM peak hours, respectively. Given that car trips are not restrained (either by way of sustainable initiatives or taking into account internalisation trips and increase in working from home pattern), these trips reflect a worst-case scenario.

10.0 TRIP DISTRIBUTION

10.1 Methodology

10.1.1 The proposed vehicular trip generation from each of the proposed development scenarios have been distributed across the transport study area.

10.1.2 Different elements of proposed development scenarios have been distributed differently. The methodology has been agreed as per TN1 and through further discussion with WSCC and NH.

Residential and Employment Trips

10.1.3 ADL reviewed the Joint Transport Assessment prepared in support of New Monks Farm and Shoreham Airport developments by Vectos. Here, both residential and employment trips were distributed using Census 2011 Origin-Destination (O-D) dataset – *WU03EW - Location of usual residence and place of work by method of travel to work (MSOA level).* This approach was approved by the Highway Authority. All the residents and employment trips were assigned on to the local road network using web-based journey planning tools.

10.1.4 Following the meeting with SDNPA and WSCC on 5th August 2021, it was agreed that whilst the census is the best source for travel to work trips, the Mobile Network Data (MND) is the best source for distribution of other trip purposes.

10.1.5 The West Sussex Mobile Network Data Origin-Destination Matrix for 2015, as produced by Telefonica, was provided by WSCC on 30th July 2021. The data is separated into different modes (road, rail and HGV). The data is split by purpose into the following categories:

- Non-Home Based (NHB) Trips – trips starting and ending in other locations and/or workplaces
- Outbound Home-Based Work (OB_HBW) Trips – trips between a place of residence and a regular place of work
- Outbound Home Based Other (OB_HBO) Trips – trips starting from place of residence to other locations

- Inbound Home-Based Work (IB_HBW) Trips – trips between a regular place of work and a place of residence
- Inbound Home Based Other (IB_HBO) Trips – trips starting in other locations and to place of residence

10.1.6 Given that the strategic transport models were not considered to be appropriate for the use for this study, due to various deficiencies on the A27 within Worthing Model and Shoreham Harbour Model being based on 2009 data, trip assignment/routeing has been based upon Google Maps as agreed with SDNPA and WSCC.

10.1.7 Trip distribution has been based on the following Middle Super Output Areas with Census and MND:

- Residential: Horsham 016A to 016E MSOA
- Employment: Adur 007A MSOA

10.1.8 For residential trips, appropriate split for Census desired journey to work trips and MND desired home-based trips (HBO) would be used, as advised by WSCC. For employment trips, appropriate split for Census desired journey to work trips and MND desired other trips (NHB) would be used as advised by WSCC.

10.1.9 Based on the agreed trip distribution methodology, trip distribution split between Census and MND for residential and employment elements are provided in Table 10A and 10B.

Table 10A Residential Trip Distribution Split

	In		Out	
	Census HBW	**MND HBO**	**Census HBW**	**MND HBO**
AM Peak Hour	4%	96%	58%	42%
PM Peak Hour	52%	48%	0%	100%

Table 10B Employment Trip Distribution Split

	In		Out	
	Census HBW	**MND NHB**	**Census HBW**	**MND NHB**
AM Peak Hour	69%	31%	0%	100%
PM Peak Hour	3%	97%	53%	47%

Hotel, Learning/Non-residential Institution Leisure, and Pub/Restaurant Trips

10.1.10 For Hotel, Learning/Non-residential Institution, Leisure, and Pub/Restaurant trip distribution, MND desired NHB trips has been used.

10.2 Trip Distribution Assignment

10.2.1 The trip distribution for Census O-D (Residential) is shown diagrammatically for both AM and PM peak hours as Appendix 10.1.

10.2.2 The trip distribution for Census O-D (Employment) is shown diagrammatically for both AM and PM peak hours as Appendix 10.2.

10.2.3 The trip distribution for MND HBO for residential trips are shown diagrammatically as Appendices 10.3 and 10.4, for the AM and PM peak hours, respectively.

10.2.4 The trip distribution for MND NHB for employment trips are shown diagrammatically as Appendices 10.5 and 10.6, for the AM and PM peak hours, respectively.

10.2.5 The trip distribution for MND NHB for Hotel, Learning/Non-residential Institution Leisure, and Pub/Restaurant trips are shown diagrammatically as Appendices 10.7 and 10.8, for the AM and PM peak hours, respectively.

10.3 Proposed Trip Distribution

Residential

10.3.1 The proposed residential traffic flows for each proposed development scenario are shown diagrammatically as the following Appendices:

- Scenario 1 AM Peak Hour – Appendix 11.1
- Scenario 1 PM Peak Hour – Appendix 11.2
- Scenario 2 AM Peak Hour – Appendix 11.3
- Scenario 2 PM Peak Hour – Appendix 11.4
- Scenario 3 AM Peak Hour – Appendix 11.5
- Scenario 3 PM Peak Hour – Appendix 11.6

- Scenario 4 AM Peak Hour – Appendix 11.7
- Scenario 4 PM Peak Hour – Appendix 11.8

Employment

10.3.2 The proposed employment traffic flows for each proposed development scenario are shown diagrammatically as the following Appendices:

- Scenario 1 AM Peak Hour – Appendix 11.9
- Scenario 1 PM Peak Hour – Appendix 11.10
- Scenario 2 AM Peak Hour – Appendix 11.11
- Scenario 2 PM Peak Hour – Appendix 11.12
- Scenario 3 AM Peak Hour – Appendix 11.13
- Scenario 3 PM Peak Hour – Appendix 11.14
- Scenario 4 AM Peak Hour – Appendix 11.15
- Scenario 4 PM Peak Hour – Appendix 11.16

Hotel

10.3.3 The proposed hotel traffic flows for all proposed development scenario are shown diagrammatically as Appendices 11.17 and 11.18 for the AM and PM peak hours, respectively.

Offices

10.3.4 The proposed offices traffic flows for proposed development scenario 4 are shown diagrammatically as Appendices 11.19 and 11.20 for the AM and PM peak hours, respectively.

Pub/Restaurant

10.3.5 The proposed pub/restaurant traffic flows for proposed development scenario 3 and 4 are shown diagrammatically as Appendix 11.21 for the PM peak hour.

Learning/Non-residential Institution

10.3.6 The proposed Learning/Non-residential Institution traffic flows for each proposed development scenario are shown diagrammatically as the following Appendices:

- Scenario 1 PM Peak Hour – Appendix 11.22
- Scenario 2 PM Peak Hour – Appendix 11.23
- Scenario 3 PM Peak Hour – Appendix 11.24

Leisure Use

10.3.7 The proposed leisure use traffic flows for proposed development scenario 3 are shown diagrammatically as Appendices 11.25 and 11.26 for the AM and PM peak hours, respectively.

10.4 Proposed Trip Distribution – Total Scenario Flows

Total Proposed Scenario Flows

10.4.1 The proposed traffic flows for each proposed development scenario are shown diagrammatically as the following Appendices:

- Scenario 1 AM Peak Hour – Appendix 12.1
- Scenario 1 PM Peak Hour – Appendix 12.2
- Scenario 2 AM Peak Hour – Appendix 12.3
- Scenario 2 PM Peak Hour – Appendix 12.4
- Scenario 3 AM Peak Hour – Appendix 12.5
- Scenario 3 PM Peak Hour – Appendix 12.6
- Scenario 4 AM Peak Hour – Appendix 12.7
- Scenario 4 PM Peak Hour – Appendix 12.8

2033 Total Flows

10.4.2 The 2033 total traffic situation in each of the proposed development scenarios comprises the 2033 Baseline Traffic Flows (see para. 6.3.13) minus Permitted Development Traffic Flows (to account for the loss of the permitted uses) plus Proposed Development Scenario Traffic Flows.

10.4.3 As such, **2033 Total Flows** are as follows:

Scenario 1:

- 2033 Baseline Traffic Flows – Permitted Development Traffic Flows + Scenario 1 Proposed Development Traffic Flows

Scenario 2:

- 2033 Baseline Traffic Flows – Permitted Development Traffic Flows + Scenario 2 Proposed Development Traffic Flows

Scenario 3:

- 2033 Baseline Traffic Flows – Permitted Development Traffic Flows + Scenario 3 Proposed Development Traffic Flows

Scenario 4:

- 2033 Baseline Traffic Flows – Permitted Development Traffic Flows + Scenario 4 Proposed Development Traffic Flows

10.4.4 The 2033 Total Traffic Flows are shown diagrammatically as the following Appendices:

- Scenario 1 AM Peak Hour – Appendix 12.9
- Scenario 1 PM Peak Hour – Appendix 12.10
- Scenario 2 AM Peak Hour – Appendix 12.11
- Scenario 2 PM Peak Hour – Appendix 12.12
- Scenario 3 AM Peak Hour – Appendix 12.13
- Scenario 3 PM Peak Hour – Appendix 12.14
- Scenario 4 AM Peak Hour – Appendix 12.15
- Scenario 4 PM Peak Hour – Appendix 12.16

11.0 SUSTAINABLE TRANSPORT MITIGATION

11.1 Introduction

11.1.1 The aim of a sustainable transport mitigation is to promote and encourage more sustainable ways for people to travel and to reduce the need for trips to be made by the private car, which is preferred over increasing highway capacity. This will involve the following:

- Internalisation of trips
- Reduction the need to travel
- Hard measures
- Soft measures

11.1.2 Any developer putting forward for a planning application for development at Shoreham Cement Works would be expected to provide a range of hard and soft sustainable transport measures to improve the connectivity within the site, and from outside the site, by alternative transport modes, and reducing the need to travel by private car.

11.2 Trip Internalisation

11.2.1 The Horsham Transport Study (May 2021) uses 12% reduction in trips for sites where housing, jobs, schools, and other auxiliary uses are provided together. This internalisation rate is based on previous evidence gathered for the North Horsham development. The internalisation rate is also in line with that seen in TRICS for a mixed-use site located at Camborne to the west of Cambridge (noting that this is the only mixed-use site with data available within TRICS database).

11.2.2 With particular reference to residential trips, reducing the need to travel centres on both the benefit from auxiliary uses within the site (i.e., trip internalisation) as well as making fewer journeys, typically commuting journeys as a result of working from home.

11.2.3 The residential element within the development proposals which have been tested as part of the AAP are smaller in size than those within Cambourne and Cambridge and hence the propensity of trip internalisation between residential and employment uses is likely to be limited. Hence, this was not considered within the trip generation exercise. Nonetheless, given the development scenarios comprise mixed uses, they are considered to be conducive to generate some level of internalised trips as trips associated with the proposed local shop and public house has been internalised either partially or fully.

11.3 Reducing the Need to Travel

11.3.1 Along with the fact that the development scenarios benefit from auxiliary uses which would reduce the need to travel, the impact of the Covid-19 pandemic is likely to have lasting impacts in terms of flexible working patterns and remote working options from employers. This has reduced the need for residents to make external trips during network peak hours.

11.3.2 Fast broadband connection would be made available to all residents which enables working from home and therefore reducing the need to travel. Changing shopping patterns, i.e., increase online/deliveries is also reducing the likelihood of residents travelling for these purposes.

11.4 On and Off-Site Infrastructure (Hard Measures)

11.4.1 Hard measures are defined as physical infrastructure provided to encourage and facilitate sustainable travel. Hard measures for walking, cycling and public transport are discussed in the following paragraph.

Walking – On-site

11.4.2 The tunnel which links the two portions of the site, beneath the A283 would be improved in accordance with DfT's Local Transport Note 1/20 (LTN 1/20). This would include resurfacing and lighting. Appropriate mitigation measures in the form of automated bollards on either end of this tunnel would be installed to stop motor vehicles from using the tunnel, except for emergency vehicles.

Walking – Proposed Site Access Roundabout

11.4.3 Pedestrian ramps will be provided which would connect the tunnel to the footways on the proposed site access roundabout (see Section 12.2). These ramps would be no steeper than 1 in 20 gradient and subject to detailed design at a later stage of planning process.

11.4.4 The proposed site access roundabout will be provided with footways on all sides along with pedestrian crossing facility in the form of dropped kerbs, tactile paving, and splitter islands. This facility will provide safe access to the bus stops on the A283.

11.4.5 Any subsequent planning application and design of the site would ensure a footway network, both within the site, and externally to the existing footways and public rights of way within the vicinity of the site, would be integrated and ensure step-free access for those with reduced mobility.

Walking – Off-site

11.4.6 Funding for the installation of off-site interpretation boards, wooden mile marker posts and way markers for public rights of way in the vicinity of the site could be made available by utilising some of the off-site highway contribution costs calculated as per Section 14.9 of this report.

11.4.7 Where the South Downs Way crosses the A283, approximately 800 metres north of the site, the crossing facility from the western side of the carriageway to the footway on the eastern side of the carriageway could be improved by way of dropped kerbs and tactile paving. This would be of benefit to residents/staff/visitors of the site, but also leisure users not associated with Shoreham Cement Works.

Cycling – On-site

11.4.8 The development proposals would ensure there is appropriate cycle parking facilities to residents, staff, and visitors. Cycle stores would be covered and secure, and for employment uses would include the provision of lockers, showers and pump/repair stands (to facilitate longer journeys to/from work by cycle). There would be provision for large/adapted bikes as well as electric bikes.

11.4.9 Ramp access from the proposed site access roundabout would cater not only for pedestrians (as discussed above) but also cyclist to enter/exit the site from the A283. The ramps would adhere to maximum gradient and geometry as per LTN 1/20 and lead to the tunnel which connects the two portions of the site. The design of which would be dealt with at detailed design stage.

Linkage to Downs Link Path

11.4.10 At present there is no direct access into the site from the Downs Link path. It is proposed that an access is provided between the western portion of the site and the Downs Link path. This would be designed at per LTN 1/20, with appropriate gradient of the ramp to account for the levels difference between the site and the path.

National Cycle Route 223

11.4.11 Funding towards an upgrade of the surface of the National Cycle Network Route 223 (Downs Link), which runs alongside the site could also be made available by utilising some of the off-site highway contribution costs calculated as per Section 14.9 of this report. This could involve weatherproofing (i.e., upgraded surface material and drainage) to improve access all year round. This would be of benefit to walkers and horse riders too.

11.4.12 It is proposed that the NCN Route 223 crossing point across the A283 (approximately 2.2km northwest of the site) is improved by way of increasing the visibility in either direction on the A283, from both sides of the carriageway, and providing signage for motorists to indicate that a pedestrian/cyclist/horse rider crossing point is oncoming.

11.4.13 Improvements to the NCN Route 223 would improve the accessibility of the site for residents, as well as staff/visitors to the site. These improvements would also be of benefit to leisure users not associated with the site who are passing.

11.4.14 Through travel planning measures, all elements of the site would be equipped with appropriate cycle parking and facilities for staff and visitors of employment and leisure uses to shower and store cycle equipment.

Public Transport

11.4.15 As discussed in Section 7.3, out of four public bus services that serve the bus stop on the A283 adjacent to the site, Route 2 is the most frequent one. Funding towards increase in Route 2 service frequency from the current hourly service to twice hourly service could be done by way of:

- Extending one of the services between Shoreham High Street and Rottingdean AND/OR
- By an additional increase in number of bus services by one between Steyning-Shoreham-Brighton.

11.4.16 This would be subject to further discussions with the bus operator and site promoter and could be funded through the contributions which have been calculated for off-site junction improvements, as per Section 14.9 of this report. The subsequent planning application could look to liaise with a local bus operator to provide a service (or re-route) a service into SCW.

11.4.17 Bus stops on the A283 would be upgraded to be provided with shelter, seating, and real time information (RTIs). This would form part of S278/S106 contributions.

11.4.18 Similarly, should the development proposals in future provide on-site bus stops, these will also be provided with shelter, seating, and real time information (RTIs).

11.4.19 Beyond the site, bus services which serve the site could be given traffic signal priority or other motorists, improving their convenience.

Car Travel

11.4.20 Appropriate car parking provision, in accordance with SDNPA parking standards would be provided. As part of Travel Planning, employment uses could be provided with priority car parking for car sharers, thus reducing the overall number of car parking on site. However, this should be integrated within the Travel Plan proposals and agreed with WSCC.

11.4.21 All elements of the site would look to be equipped with a proportion of active/passive electric vehicle charging points. An electric vehicle charging station could also be proposed on site. This is to facilitate the uptake of electric vehicles which are more environmentally friendly.

Car Clubs

11.4.22 Any subsequent planning application should look to provide car clubs on site. These would be of use to all site users. Liaison with car club operators would look to encourage residents of the site to use car clubs through incentive schemes.

11.4.23 Co-Wheels operates in Worthing, Horsham, and Lewes while Enterprise Car Club operates in Worthing, Brighton, and Shoreham, which are all key employment locations for potential residents of SCW.

11.4.24 According to the *2020 Car Club Annual Report* published by CoMoUK, car clubs replace privately owned cars with a smaller number of more efficiently used vehicles freeing up street space for other uses. When combining the percentages of respondents who had either reduced the number of cars they owned or deferred a purchase we can estimate that 18.5 cars are removed per car club vehicle.

11.4.25 The result of reduced car ownership as a result of car clubs on site would have a positive impact on reducing private car trips associated with the site and could result in reduced traffic impact on the junctions assessed in this transport study.

Active Travel Fund Projects

11.4.26 SCW could also contribute towards Active Travel fund Projects, which could take the form of:

- Cycling Facility in Upper Shoreham Rd; and
- Signalled controlled toucan exiting point on Steyning Road, between Shoreham Tollbridge and Upper Shoreham Road.

11.4.27 Funding and contributions would be agreed between all relevant stakeholders to ensure investment in sustainable transport mitigation is effective.

11.5 Travel Planning (Soft Measures)

11.5.1 Soft sustainable transport measures would be promoted to reduce demand for travel by private car in innovative ways. These may include:

- Personal travel planning
- Workplace travel planning
- Cycling and walking promotion
- Public transport information and marketing

11.5.2 Any subsequent planning application would be required to design, implement, and monitor a travel plan. This would set aims, objectives and targets for improve mode share in favour of sustainable modes and decrease single occupancy car travel where possible.

11.5.3 Travel planning measures would likely take the form of:

- Promotion and marketing material of the travel plan;
- Walking, cycling, and public transport (bus) route maps;
- Links to websites with relevant information regarding walking, cycling and public transport; and
- Promotion of car club and car sharing.

11.5.4 Residents and staff of the site could be incentivised to adopt sustainable modes of transport through voucher schemes for buses and car clubs. This would be subject to discussion and agreement with providers.

11.5.5 Funding for soft sustainable transport measures could be made available by utilising some of the off-site highway contribution costs calculated as per Section 14.9 of this report.

11.6 Funding for Sustainable Transport Mitigation

11.6.1 The Shoreham Cement Works Transport Study has outlined the estimate costs associated with providing junction improvements at key junctions which would be affected by the worst-case scenario trip generation associated with the site.

11.6.2 As has been agreed by WSCC, the contributions of £203,519 for the proposed highway improvements at urban junctions in Shoreham-By-Sea, i.e., A283/Upper Shoreham Road Roundabout, and A283/A259 Roundabout, could be used to allocate funding towards sustainable transport mitigation. In addition to this, the contributions of £30,038 towards improvements at A283/Water Lane junction and £475,874 toward improvement at Washington Roundabout could also be used to fund sustainable transport initiatives as mentioned within this section

12.0 PROPOSED ACCESS ARRANGEMENTS

12.1 Proposed Site Access Arrangement Methodology

12.1.1 ADL have investigated a number of site access arrangement for SCW as part of the transport study. Given the nature of the site's location, and aspirations of SDNPA and WSCC, any proposed site access arrangement would seek to reach a balance between the desire to restore and enhance the natural environment, whilst creating safe access options for all users.

12.1.2 As discussed previously, sustainable transport mitigation could be provided for SCW to reduce the number of vehicle trips associated with the proposed development scenarios. However, for the purpose of this transport study, junction capacity assessment of any proposed site access arrangement has been based on worst-case scenario, using the robust baseline traffic situation, and robust proposed development vehicular trip generation, during the weekday network peak hours.

12.1.3 In line with SDNPA's aim to enhance the natural environment, and offer maximal land for landscaping, ADL tested access options which required minimal change to the existing infrastructure which serves the site, in the first instance, before testing alternative options.

Existing Site Accesses (No Change)

12.1.4 The existing site accesses comprise a left in/left out priority junction at the northern access which serves the eastern portion of the site and an all-movement priority T-junction at the southern access which serves the western portion of the site. Junction capacity assessment demonstrated that these two junctions in their current arrangement would result in severe residual impact in traffic engineering terms due to significant delays, queue lengths and ratio to flow capacity (RFC) both within the site, and on A283.

Existing Site Accesses (All Movements)

12.1.5 ADL then tested the viability of using the existing site accesses, but with all movements for the northern access as well as the southern access and providing right turn lanes

on A283 for right turners into the site. Although an improvement on the existing arrangement, the delay and queues within the site and on A283 were considered severe.

Existing Site Accesses (Left In/Left Out)

12.1.6 A left in/left out priority junction arrangement was explored, whereby the tunnel beneath the A283 would be used to link the two portions of the site, and therefore negate the need for right turn movement from A283 into the site or from site onto A283. However, the dimensions of the existing tunnel do not accommodate the two-way movement of vehicular traffic and therefore it would need to be widened should this arrangement allow all movements between the site and A283.

12.1.7 It should also be noted that given the volume of traffic associated with all four development scenarios, it is not considered appropriate for all non-residential traffic associated with the site to pass through the residential element of the development (on the western portion of the site), i.e., non-residential trips from south entering the eastern portion of the site, or non-residential trips from the north exiting the eastern portion of the site. As such, widening the tunnel to accommodate this two-way movement of traffic is not considered desirable.

Two x Three-Arm Roundabouts

12.1.8 Following this, two moderately sized three-arm roundabouts, both with inscribed circle diameters of 40 metres, at the locations of existing accesses, was explored.

12.1.9 However, it was found that the northern access roundabout exhibits queues of up to 153 vehicles on south arm, and 38 vehicles on north arm., whilst the southern access roundabout exhibits queues of up to 282 vehicles on south arm, 53 vehicles on north arm. It clearly shows that the three-armed moderately sized roundabouts cannot accommodate the traffic on the A283.

12.1.10 Also, given the aspirations of SDNPA, the provision of two sizeable roundabouts to serve the site is not considered to be appropriate and as such, a single four-arm round was explored, at the location of the existing northern access, which would serve both eastern and western portions of the site.

Left-Out/All-In Northern Site Access Junction and Three-Armed Southern Site Access Roundabout

12.1.11 ADL investigated how a left-out/all-in northern site access Junction with three-armed southern site access roundabout would operate from a capacity perspective. This makes the presumption that vehicles originating from the eastern portion of the site would turn left (south) of the northern access and perform a U-turn at the southern access roundabout in order to travel north from the site.

12.1.12 However, it was found that the northern T-junction with right turn lane would exhibit significant queues on the right turn lane with up to 22 vehicles queuing. The queues on the south access (three-armed roundabout) would also be worsened due to additional U-turners associated with the eastern part of the site.

Four-Arm Roundabout

12.1.13 Ultimately, a four-arm roundabout, with inscribed circle diameter of 60 metres, has been considered, at the location of the northern site access. This would enable the existing southern access to be closed.

12.1.14 From a junction capacity perspective, this arrangement is considered to be the only appropriate site access arrangement with no severe traffic impact. This arrangement is considered to balance with the aspirations of SDNPA in terms of environmental impact and impact on landscaping by only providing one point of access.

12.1.15 The access solutions have been developed with Roads in the South Downs guidance (RitSD, 2015) in mind.

12.2 Proposed Site Access Arrangement: Four-Arm Roundabout

12.2.1 As mentioned previously, it is proposed to provide a four-arm roundabout on A283, at the location of the existing northern access to the site. It is proposed to provide three-lane approaches on A283 north and A283 south arms of the roundabout, and two-lane approaches on east and west arms of the roundabout.

12.2.2 Pedestrian crossing points are proposed across all arms, with pedestrian refuge islands, dropped kerbs, and tactile paving. Two-metre-wide footways are proposed along all arms of the junction, and ramped access between the roundabout and the existing underpass beneath the A283 for pedestrians, cyclists, and horse riders.

12.2.3 A plan of the proposed site access arrangement is provided as Appendix 13.1.

12.2.4 For the purpose of Shoreham Cement Works AAP, the proposed site access plan is indicative and would be subject to detailed design at planning application stage. The site access would be developed with Roads in the South Downs guidance (RitSD, 2015) in mind.

12.3 Stage 1 Road Safety Audit

12.3.1 In the interest of highway safety, ADL commissioned Highways Associates (independent auditor) to undertake a Stage 1 Road Safety Audit (RSA) of the proposed site access.

12.3.2 The brief of the RSA was agreed by WSCC on 28th February 2022, and the audit was undertaken on 6th March 2022.

12.3.3 The RSA report is provided as Appendix 13.2. The audit report has identified seven problems:

Problem 1: Risk of excessive approach speeds

ADL Response: It is accepted that at later planning application stage or detailed design stage, measures would be proposed and agreed with SDNPA and WSCC with regards to incorporating advanced warning and map type signage.

Problem 2: Risk of excessive circulating speed due to roundabout geometry

ADL Response: This is accepted. The geometry has been further amended as shown RSA DR Appendix B. This has resulted in achieving appropriate deflection.

Problem 3: Risk of loss of control / conflict with buses due to alignment

ADL Response: This is accepted. The southbound bus stop has been relocated further away from the roundabout.

Problem 4: Risk of side swipe conflicts

ADL Response: This is accepted. Swept path assessment as requested is provided as RSA DR Appendix C.

Problem 5: Insufficient pedestrian crossing provision

ADL Response: This is accepted. The tunnel would be improved in accordance with the LTN 1/20 and would be the main pedestrian crossing route between the eastern and western part of the site and provide connection to Downs Link. Majority of the pedestrians who may choose to use the crossing points on this proposed roundabout are those who would be travelling by bus and therefore require to walk to the proposed bus layby on the A283. It should be noted that as an alternative, there could be bus stops provided on site subject to future Masterplanning. If this occurs, then the number of pedestrians using splitter islands on the roundabout would be very low.

Problem 6: Right turn arrows could cause driver confusion

ADL Response: This is accepted. A review of the proposed road markings on the proposed roundabout would be undertaken at a later stage such as planning application stage or detailed design stage, in discussion with SDNPA and WSCC.

Problem 7: Risk of incursion

ADL Response: This is accepted. A suitable mitigation measure to protect vehicles from incursion. This will be discussed at a later stage such as planning application stage or detailed design stage, in discussion with SDNPA and WSCC.

12.3.4 The problems raised within the RSA do not suggest that the proposed development would have any material highway safety impact on A283 adjacent to the site, or within the site.

12.4 Junction Capacity Assessment

12.4.1 The proposed four-arm roundabout site access has been assessed for capacity using TRL's Junction's 9 Software.

12.4.2 The junction capacity assessment is based on typical commuter peak hours and during these periods. It is considered that the likelihood of walking (and to some extent, cycling) related improvements is unlikely to tip the balance from private cars to walking (and cycling) to a material extent due to the semi-rural nature of site location and sparsity of trip-attracting destinations in the vicinity of the site. As such, junction capacity assessment has been undertaken to assume worst case scenario, for robustness.

12.4.3 The ARCADY model output for Proposed Development Scenarios in year 2033 is provided as Appendix 13.3. The results are summarised in Table 12A.

Table 12A ARCADY Outputs: Site Access Roundabout – 2033 Total Scenarios

Scenario	Arm	AM Peak Hour			PM Peak Hour		
		Queue	Delay	RFC	Queue	Delay	RFC
1	A283 North	2	5	0.68	2	4	0.62
	Site Access East	0	5	0.22	1	5	0.32
	A283 South	2	4	0.64	4	7	0.79
	Site Access West	0	4	0.11	0	5	0.05
	Total	**4**	**18**	**-**	**7**	**21**	**-**
2	A283 North	2	5	0.67	2	4	0.61
	Site Access East	0	5	0.18	0	5	0.30
	A283 South	2	4	0.63	3	6	0.77
	Site Access West	0	4	0.07	0	5	0.03
	Total	**4**	**18**	**-**	**5**	**20**	**-**
3	A283 North	2	4	0.64	2	4	0.61
	Site Access East	0	4	0.14	0	5	0.24
	A283 South	1	4	0.58	3	6	0.76
	Site Access West	0	4	0.04	0	5	0.02
	Total	**3**	**16**	**-**	**5**	**20**	**-**
4	A283 North	2	5	0.67	1	4	0.59
	Site Access East	0	4	0.10	0	5	0.25
	A283 South	2	4	0.62	3	5	0.74
	Site Access West	0	4	0.04	0	5	0.02
	Total	**4**	**17**	**-**	**4**	**19**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

12.4.4 Table 12A demonstrates that the proposed junction arrangement operates within theoretical capacity (i.e., RFC value less than 0.85) in each of the proposed development scenarios. The maximum queue length is four vehicles only on A283, and the maximum delay on any arm in any scenario is seven seconds which is not considered severe.

12.4.5 It should be reiterated that this junction capacity assessment is based on worst-case scenario and is considered to be robust.

12.4.6 Also, it should be reiterated that site access has been assessed during the typical commuter peak hours, where the baseline traffic on A283 and vehicular trip generation of the proposed development scenarios are at their highest levels. Therefore, the capacity of the site access, including delays and queues, would be significantly less outside of these hours and on weekends.

13.0 OFF-SITE JUNCTION CAPACITY ASSESSMENT

13.1 Introduction

13.1.1 A junction capacity assessment has been undertaken for each of the junctions assessed as part of this transport study for the year 2033 using industry standard modeling software, such as TRL's Junctions 9 (for priority junctions and roundabouts) and JCT's LinSig V3 (for signalised junctions). This is compiled in Technical Note 3 and subsequently updated as per discussions with SDNPA, WSCC and NH.

13.1.2 Each of the four development scenarios have been tested against the 2033 Baseline Scenario without development (i.e., 2033 Base + Total Committed Development) to test the impact of the proposed development scenarios.

13.1.3 WSCC state that drivers tend to notice delay over 30 seconds. Delay over two minutes (120 seconds) represents a congested situation and one should avoid delay over three minutes (180 seconds).

13.1.4 Should the proposed development scenarios result in the junction not operating within theoretical capacity (i.e., RFC value greater than 0.85), or significant increase in queue lengths and delays when compared with the 2033 Baseline scenario, ADL have proposed mitigation in the form of junction improvements ensure that the proposed development scenarios would not result in an unacceptable impact on highway safety or cause severe residual cumulative impacts on the road network (National Planning Policy Framework (2021) paragraph 111).

13.1.5 ADL have confirmed that the proposed junction improvements have been made within the constraints of adopted highway extent, as provided by WSCC. The only exception is the Lancing Manor Roundabout (Junction 12) which requires third-party land-take (Lancing Manor Estate).

13.1.6 As mentioned previously, it should be noted that the junction capacity assessment of each of the junctions considers a worst-case scenario, given that no reduction to the vehicular trip rates has been applied.

13.1.7 However, whilst the junction capacity assessments consider a worst-case scenario, transport contributions calculated to mitigate the impact of the development by way of physical highway improvements to certain junctions namely in Shoreham-by-Sea could be used for sustainable transport improvements; and this would apply mostly in urban junctions due to the fact that a large number of trips associated with the development proposals would be concentrated in areas such as Shoreham-by-Sea and as a result, there is an opportunity to maximise sustainable mode share to the trips to this area. Hence, it is considered appropriate that the proposed sustainable initiatives (and funding for these initiatives) to be mainly targeted to those travelling in these areas.

13.2 Junction 1 – A283 / A24 (Washington) Roundabout

13.2.1 The Washington Roundabout, i.e., A283 / A24 junction has been assessed for capacity using TRL's Junction's 9 Software.

Existing Junction Arrangement

13.2.2 The ARCADY model output for Washington Roundabout with existing junction arrangement is provided as Appendix 14.1. The results for 2033 Baseline Scenario are summarised in Table 13A.

Table 13A ARCADY Outputs: Washington Roundabout – 2033 Baseline Scenario

Arm	AM Peak Hour			PM Peak Hour		
	Queue (Veh)	Delay (S)	RFC	Queue (Veh)	Delay (S)	RFC
A283 East	4	16	0.80	5	20	0.83
A24 South	6	13	0.86	2	4	0.63
A283 West	44	124	1.06	10	30	0.93
A24 North	9	21	0.91	162	255	1.17
Total	**63**	**174**	**-**	**179**	**309**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.2.3 The results for Proposed Development Scenarios, with difference in queue length and delay compared to 2033 Baseline Scenario, are summarised in Table 13B.

Table 13B ARCADY Outputs: Washington Roundabout – 2033 Total Scenarios, with Existing Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A283 East	5	+1	18	+2	0.83	5	0	20	0	0.84
	A24 South	7	+1	14	+1	0.87	2	0	4	0	0.63
	A283 West	55	+11	150	+26	1.08	12	+2	34	+4	0.94
	A24 North	9	0	21	0	0.91	176	+14	286	+31	1.18
	Total	**76**	**+13**	**203**	**+29**	**-**	**195**	**+16**	**344**	**+35**	**-**
2	A283 East	4	0	17	+1	0.82	5	0	21	+1	0.84
	A24 South	6	0	14	+1	0.87	2	0	4	0	0.63
	A283 West	53	+9	145	+21	1.08	11	+1	33	+3	0.94
	A24 North	9	0	21	0	0.91	172	+10	277	+22	1.18
	Total	**72**	**+9**	**197**	**+23**	**-**	**190**	**+11**	**335**	**+26**	**-**
3	A283 East	4	0	17	+1	0.82	5	0	21	+1	0.84
	A24 South	6	0	14	+1	0.87	2	0	4	0	0.63
	A283 West	52	+8	141	+17	1.08	11	+1	33	+3	0.93
	A24 North	9	0	21	0	0.91	171	+9	276	+21	1.18
	Total	**71**	**+8**	**193**	**+19**	**-**	**189**	**+10**	**344**	**+25**	**-**
4	A283 East	4	0	16	0	0.81	5	0	20	0	0.84
	A24 South	6	0	13	0	0.87	2	0	4	0	0.63
	A283 West	51	+7	139	+15	1.07	11	+1	31	+1	0.93
	A24 North	9	0	21	0	0.91	166	+4	264	+9	1.17
	Total	**70**	**+7**	**189**	**+15**	**-**	**184**	**+5**	**319**	**+10**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.2.4 Table 13B demonstrates that all proposed development scenarios result in an increase in queueing on the A283 West arm of the roundabout during the AM peak hour. The increase in queues is +11 vehicles in Scenario 1; +9 vehicles in Scenario 2; +8 vehicles in Scenario 3; and +7 vehicles in Scenario 4.

13.2.5 Table 13B demonstrates that all proposed development scenarios result in an increase in queueing on the A24 North arm of the roundabout during the PM peak hour. The increase in queues is +12 vehicles in Scenario 1; +5 vehicles in Scenario 2; +6 vehicles in Scenario 3; and +2 vehicles in Scenario 4.

13.2.6 Table 13B demonstrates that the proposed development scenarios result in maximum increase of +26 seconds compared to baseline scenario (Scenario 1, A283 West arm) in the AM peak which remains below three minutes, and +31 seconds in PM peak (A24 North arm). There is shown to be negligible increase, or no increase in delays on the other arms.

Proposed Junction Improvements

13.2.7 Whilst increase in queues and delays on Washington Roundabout as a result of SCW developments is marginal, it is considered a key junction and hence WSCC would expect this junction to be improved. WSCC are working on their own scheme at Washington Roundabout and a proportion of contribution as per the cost estimate within TN3 should be allocated towards this.

13.2.8 ADL proposed the following mitigation to improve the capacity of the junction and minimise the impact of the proposed development scenarios:

A283 West:

- Increase entry width from 8.5 metres to 11.3 metres (i.e., increase from two to three lanes); and
- Lane direction road markings.

A24 North:

- Increase entry width from 8.2 metres to 11.4 metres (i.e., increase from two to three lanes);
- Flare length increased from 4.8 metres to 53 metres; and
- Lane direction road markings – left lane dedicated to left turners, two lanes dedicated for straight ahead and right/U-turners.

A283 East:

- Lane direction road markings.

A24 South:

- Lane direction road markings.

Circulatory lanes:

- Lane direction road markings.

13.2.9 A plan of the proposed junction improvements are provided as Appendix 14.2. The model output for the Proposed Development Scenarios, with proposed junction improvements is provided as Appendix 14.3. The results are summarised in Table 13C.

Table 13C ARCADY Outputs: A283 / A24 Roundabout – 2033 Total Scenarios, with Proposed Junction Improvements

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A283 East	5	+1	19	+3	0.84	22	+17	86	+66	1.01
	A24 South	7	+1	16	+3	0.89	2	0	5	+1	0.65
	A283 West	6	-38	18	-106	0.86	3	-7	9	-21	0.76
	A24 North	2	-7	5	-16	0.68	6	-156	10	-245	0.86
	Total	**20**	**-43**	**58**	**-116**	**-**	**33**	**-146**	**110**	**-199**	**-**
2	A283 East	5	+1	18	+2	0.83	22	+17	84	+64	1.01
	A24 South	7	+1	16	+3	0.89	2	0	5	+1	0.65
	A283 West	5	-39	17	-107	0.85	3	-7	9	-21	0.76
	A24 North	2	-7	5	-16	0.68	6	-156	10	-245	0.86
	Total	**19**	**-44**	**56**	**-118**	**-**	**33**	**-146**	**108**	**-201**	**-**
3	A283 East	4	0	18	+2	0.82	22	+17	86	+66	1.01
	A24 South	7	+1	15	+2	0.88	2	0	5	+1	0.65
	A283 West	5	-39	17	-107	0.85	3	-7	9	-21	0.76
	A24 North	2	-7	5	-16	0.68	6	-156	10	-245	0.86
	Total	**18**	**-45**	**55**	**-119**	**-**	**33**	**-146**	**110**	**-199**	**-**
4	A283 East	4	0	17	+1	0.82	19	+14	79	+59	1.00
	A24 South	7	+1	15	+2	0.88	2	0	5	+1	0.65
	A283 West	5	-39	17	-107	0.85	3	-7	8	-21	0.76
	A24 North	2	-7	5	-16	0.68	6	-156	10	-245	0.85
	Total	**18**	**-45**	**54**	**-120**	**-**	**30**	**-149**	**102**	**-206**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.2.10 Table 13C demonstrates that the proposed junction improvements would result in significant increase the capacity of the junction.

13.2.11 During the AM Peak Hour, compared to the 2033 Base Scenario, the on the A283 West arm, the decrease in queues is -38 vehicles in Scenario 1; and -39 vehicles in Scenario 2, 3 and 4. In all proposed development scenarios, there would be decrease of -7 vehicles on A24 North arm during AM peak hour. Delays on these arms would also decrease by at least -106 seconds on A283 West, and -16 seconds on A24 North.

13.2.12 Table 12C also shows that during the PM peak hour, in all proposed development scenarios compared to the 2033 Base Scenario, on the A24 North arm there would be decrease of at least -156 vehicle queues and -245 seconds delay, and on the A283 West arm there would be decrease of -7 vehicle queues and -21 second delays.

13.2.13 Whilst the proposed junction improvements do incur an increase in queue lengths and delay on the A283 East arm of the roundabout, during the PM peak hour, the total queues and delays are significantly decreased compared the 2033 Baseline Scenario in all proposed development scenarios.

13.3 Junction 2 – A283 / Water Lane / Chanctonbury Ring Road Crossroads

13.3.1 The A283 / Water Lane / Chanctonbury Ring Road crossroads junction has been assessed for capacity using TRL's Junction's 9 Software.

Existing Junction Arrangement

13.3.2 The PICADY model output for Water Lane Crossroads with existing junction arrangement is provided as Appendix 15.1. The results for 2033 Baseline Scenario are summarised in Table 13D.

Table 13D PICADY Outputs: A283 / Water Lane – 2033 Baseline Scenario

Arm	AM Peak Hour			PM Peak Hour		
	Queue	Delay	RFC	Queue	Delay	RFC
Chanctonbury Ring Road (Left Out)	0	22	0.03	2	1366	99999999
Chanctonbury Ring Road (Right Out)	0	167	0.34	1	1440	99999999
A283 East (Right Turn)	2	12	0.55	1	10	0.46
Water Lane (Left Out)	2	22	0.68	22	165	1.09
Water Lane (Right Out)	0	50	0.12	5	304	1.01
A283 West (Right Turn)	0	0	0.00	0	0	0.00
Total	**4**	**273**	**-**	**31**	**3285**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.3.3 The results for Proposed Development Scenarios, with difference in queue length and delay compared to 2033 Baseline Scenario, are summarised in Table 13E.

Table 13E PICADY Outputs: A283 / Water Lane – 2033 Total Scenarios, with Existing Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	C-Ring Road (Left Out)	0	0	47	+25	0.08	2	0	1366	0	9999 999
	C-Ring Road (Right Out)	1	+1	394	+227	0.59	1	0	1491	+51	9999 999
	A283 East (Right Turn)	2	0	12	0	0.56	1	0	10	0	0.47
	Water Lane (Left Out)	2	0	23	+1	0.70	32	+10	235	+70	1.19
	Water Lane (Right Out)	0	0	58	+8	0.14	6	+1	375	+71	1.09
	A283 West (Right Turn)	0	0	0	0	0.00	0	0	0	0	0.00
	Total	**5**	**+1**	**534**	**+261**	**-**	**42**	**+11**	**3477**	**+192**	**-**
2	C-Ring Road (Left Out)	0	0	32	+10	0.05	2	0	1366	0	9999 999
	C-Ring Road (Right Out)	1	+1	292	+125	0.49	1	0	1474	+34	9999 999
	A283 East (Right Turn)	2	0	12	0	0.56	1	0	10	0	0.47
	Water Lane (Left Out)	2	0	23	+1	0.69	32	+7	215	+50	1.16
	Water Lane (Right Out)	0	0	56	+6	0.14	6	+1	352	+48	1.07
	A283 West (Right Turn)	0	0	0	0	0.00	0	0	0	0	0.00
	Total	**5**	**+1**	**415**	**+142**	**-**	**42**	**+8**	**3417**	**+132**	**-**
3	C-Ring Road (Left Out)	0	0	29	+7	0.05	2	0	1366	0	9999 999
	C-Ring Road (Right Out)	1	+1	267	+98	0.46	1	0	1473	+33	9999 999
	A283 East (Right Turn)	2	0	12	0	0.55	1	0	10	0	0.47
	Water Lane (Left Out)	2	0	22	0	0.69	31	+6	213	+48	1.16
	Water Lane (Right Out)	0	0	55	+5	0.14	5	0	350	+46	1.06
	A283 West (Right Turn)	0	0	0	0	0.00	0	0	0	0	0.00
	Total	**5**	**+1**	**385**	**+112**	**-**	**40**	**+6**	**3412**	**+127**	**-**
4	C-Ring Road (Left Out)	0	0	27	+5	0.04	2	0	1366	0	9999 999
	C-Ring Road (Right Out)	1	+1	237	+70	0.43	1	0	1453	+13	9999 999
	A283 East (Right Turn)	2	0	12	0	0.56	1	0	10	0	0.47
	Water Lane (Left Out)	2	0	23	+1	0.69	28	+3	185	+20	1.13
	Water Lane (Right Out)	0	0	54	+4	0.13	5	0	323	+19	1.04
	A283 West (Right Turn)	0	0	0	0	0.00	0	0	0	0	0.00
	Total	**5**	**+1**	**353**	**+80**	**-**	**37**	**+3**	**3337**	**+52**	**-**

*Queue = Measured in vehicles *Delay = Measured in seconds *RFC = Ratio of flow to capacity

13.3.4 Table 13E shows that the junction operates within theoretical capacity (i.e., RFC value of less than 0.85) under all development scenarios, with negligible increase in queues in the AM peak hour.

13.3.5 Table 13E also shows that all proposed development scenarios result in an increase in queueing on Water Lane (left out) during the PM peak hour. The increase in queues is +11 vehicles in Scenario 1; +7 vehicles in Scenario 2; +6 vehicles in Scenario 3; and +3 vehicles in Scenario 4.

Proposed Junction Improvements

13.3.6 It is proposed to provide the following mitigation to improve the capacity of the junction and minimise the impact of the proposed development scenarios:

Water Lane:

- Increase width to 6.0 metres at 10 metres back from give-way, and up to 5.5 metres at 15 metre back from give-way (i.e., increase flare length from two PCU to three PCU); and
- Increase visibility to left onto A283 to 100 metres – WSCC to maintain the vegetation within adopted highway extent.

13.3.7 A plan of the proposed junction improvements are provided as Appendix 15.2. The model output for the Proposed Development Scenarios, with proposed junction improvements is provided as Appendix 15.3. The results are summarised in Table 13F.

Table 13F PICADY Outputs: A283 / Water Lane – 2033 Total Scenarios, with Proposed Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	C-Ring Road (Left Out)	0	0	46	+24	0.07	2	0	1366	0	9999 999
	C-Ring Road (Right Out)	1	+1	389	+222	0.58	1	0	1467	+27	9999 999
	A283 East (Right Turn)	2	0	12	0	0.56	1	0	10	0	0.47
	Water Lane (Left Out)	2	0	21	-1	0.68	25	+3	188	+23	1.12
	Water Lane (Right Out)	0	0	56	+6	0.14	5	0	324	+20	1.02
	A283 West (Right Turn)	0	0	0	0	0.00	0	0	0	0	0.00
	Total	**5**	**+1**	**524**	**+251**	**-**	**34**	**+3**	**3355**	**+70**	**-**
2	C-Ring Road (Left Out)	0	0	31	+9	0.05	2	0	1366	0	9999 999
	C-Ring Road (Right Out)	1	+1	289	+122	0.49	1	0	1455	+15	9999 999
	A283 East (Right Turn)	2	0	12	0	0.56	1	0	10	0	0.47
	Water Lane (Left Out)	2	0	21	-1	0.68	23	+1	170	+5	1.10
	Water Lane (Right Out)	0	0	54	+4	0.13	5	0	308	+4	1.01
	A283 West (Right Turn)	0	0	0	0	0.00	0	0	0	0	0.00
	Total	**5**	**+1**	**407**	**+134**	**-**	**32**	**+1**	**3309**	**+24**	**-**
3	C-Ring Road (Left Out)	0	0	29	+7	0.05	2	0	1366	0	9999 999
	C-Ring Road (Right Out)	1	+1	265	+98	0.46	1	0	1455	+15	9999 999
	A283 East (Right Turn)	2	0	12	0	0.55	1	0	10	0	0.47
	Water Lane (Left Out)	2	0	21	-1	0.67	23	+1	170	+5	1.10
	Water Lane (Right Out)	0	0	53	+3	0.13	5	0	308	+4	1.01
	A283 West (Right Turn)	0	0	0	0	0.00	0	0	0	0	0.00
	Total	**5**	**+1**	**380**	**+107**	**-**	**32**	**+1**	**3309**	**+24**	**-**
4	C-Ring Road (Left Out)	0	0	27	+5	0.04	2	0	1366	0	9999 999
	C-Ring Road (Right Out)	1	+1	235	+68	0.43	1	0	1440	0	9999 999
	A283 East (Right Turn)	2	0	12	0	0.56	1	0	10	0	0.47
	Water Lane (Left Out)	2	0	21	-1	0.67	19	-3	145	-20	1.06
	Water Lane (Right Out)	0	0	52	+2	0.13	4	-1	284	-20	0.98
	A283 West (Right Turn)	0	0	0	0	0.00	0	0	0	0	0.00
	Total	**5**	**+1**	**347**	**+74**	**-**	**27**	**-4**	**3245**	**-40**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.3.8 Table 13F shows that the proposed junction improvements improve the capacity of the junction in terms of queues and delays, compared to the 2033 Base scenario.

WSCC confirmed that there would be no need to improve the A283/Water Lane crossroads as any improvements are likely to result in an increase in rat-running along Water Lane which would not be desirable.

13.4 Junction 3 – A283 / B2135 / Horsham Road Junctions

13.4.1 The A283 / B2135 / Horsham Road junctions have been assessed for capacity using TRL's Junction's 9 Software.

Existing Junction Arrangement

A283 / B2135 Junction

13.4.2 PICADY model output for A283 / B2135 priority T-junction with existing junction arrangement is provided as Appendix 16.1. The results for 2033 Baseline Scenario are summarised in Table 13G.

Table 13G PICADY Outputs: A283 / B2135 – 2033 Baseline Scenario

Arm	AM Peak Hour			PM Peak Hour		
	Queue	Delay	RFC	Queue	Delay	RFC
B2135 (Left Out)	0	9	0.24	0	9	0.25
B2135 (Right Out)	0	0	0.00	0	0	0.00
A283 (Right In)	1	15	0.40	1	20	0.55
Total	**1**	**24**	**-**	**1**	**29**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.4.3 The results for the Proposed Development Scenarios, with difference in queue length and delay compared to 2033 Baseline, are summarised in Table 13H.

Table 13H PICADY Outputs: A283 / B2135 – 2033 Total Scenarios, with Existing Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	B2135 (Left Out)	0	0	10	+1	0.24	1	+1	15	+6	0.35
	B2135 (Right Out)	0	0	0	0	0.00	0	0	0	0	0.00
	A283 (Right In)	1	0	16	+1	0.42	1	0	21	+1	0.57
	Total	**1**	**0**	**26**	**+2**	**-**	**2**	**+1**	**36**	**+7**	**-**
2	B2135 (Left Out)	0	0	10	+1	0.24	1	+1	15	+6	0.34
	B2135 (Right Out)	0	0	0	0	0.00	0	0	0	0	0.00
	A283 (Right In)	1	0	15	0	0.41	1	0	21	+1	0.57
	Total	**1**	**0**	**25**	**+1**	**-**	**2**	**+1**	**36**	**+7**	**-**
3	B2135 (Left Out)	0	0	9	0	0.24	1	+1	15	+6	0.34
	B2135 (Right Out)	0	0	0	0	0.00	0	0	0	0	0.00
	A283 (Right In)	1	0	15	0	0.41	1	0	20	0	0.56
	Total	**1**	**0**	**24**	**0**	**-**	**2**	**+1**	**35**	**+6**	**-**
4	B2135 (Left Out)	0	0	10	+1	0.24	1	+1	14	+5	0.33
	B2135 (Right Out)	0	0	0	0	0.00	0	0	0	0	0.00
	A283 (Right In)	1	0	15	0	0.41	1	0	20	0	0.56
	Total	**1**	**0**	**25**	**+1**	**-**	**2**	**+1**	**24**	**+5**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

A283 / Horsham Road Junction

13.4.4 PICADY model output for A283 / Horsham Road priority T-junction with existing junction arrangement is provided as Appendix 16.2. The results for 2033 Baseline Scenario are summarised in Table 13I.

Table 13I PICADY Outputs: A283 / Horsham Road – 2033 Baseline Scenario

Arm	AM Peak Hour			PM Peak Hour		
	Queue	Delay	RFC	Queue	Delay	RFC
Horsham Road (Left Out)	0	11	0.25	2	23	0.62
Horsham Road (Right Out)	0	0	0.00	0	0	0.00
A283 (Right In)	1	19	0.55	1	18	0.49
Total	**1**	**30**	**-**	**3**	**41**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.4.5 The results for the Proposed Development Scenarios, with difference in queue length and delay compared to 2033 Baseline, are summarised in Table 13J.

Table 13J PICADY Outputs: A283 / Horsham Road – 2033 Total Scenarios, with Existing Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	Horsham Road (Left Out)	0	0	11	0	0.25	2	0	24	+1	0.63
	Horsham Road (Right Out)	0	0	0	0	0.00	0	0	0	0	0.00
	A283 (Right In)	1	0	20	+1	0.56	1	0	19	+1	0.50
	Total	**1**	**0**	**31**	**+1**	**-**	**3**	**0**	**43**	**+2**	**-**
2	Horsham Road (Left Out)	0	0	11	0	0.25	2	0	24	+1	0.63
	Horsham Road (Right Out)	0	0	0	0	0.00	0	0	0	0	0.00
	A283 (Right In)	1	0	20	+1	0.56	1	0	19	+1	0.50
	Total	**1**	**0**	**31**	**+1**	**-**	**3**	**0**	**43**	**+2**	**-**
3	Horsham Road (Left Out)	0	0	11	0	0.25	2	0	24	+1	0.63
	Horsham Road (Right Out)	0	0	0	0	0.00	0	0	0	0	0.00
	A283 (Right In)	1	0	20	+1	0.55	1	0	19	+1	0.50
	Total	**1**	**0**	**31**	**+1**	**-**	**3**	**0**	**43**	**+2**	**-**
4	Horsham Road (Left Out)	0	0	11	0	0.25	2	0	24	+1	0.63
	Horsham Road (Right Out)	0	0	0	0	0.00	0	0	0	0	0.00
	A283 (Right In)	1	0	20	+1	0.55	1	0	19	+1	0.49
	Total	**1**	**0**	**31**	**+1**	**-**	**3**	**0**	**43**	**+2**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.4.6 Tables 13I and 13J demonstrates that the two junctions would continue to operate within theoretical capacity (RFC value of 0.85) under all proposed development scenarios. All development scenarios do not result in significant increase in queueing or delay on all arms of the junction during AM and PM peak hours. As such it is not deemed necessary to propose any mitigation at these junctions.

13.5 Junction 4 – A283 / Maudlin Lane / Clays Hill / Castle Lane / The Street Roundabout

13.5.1 The A283 / Maudlin Lane / Clays Hill / Castle Lane / The Street Roundabout has been assessed for capacity using TRL's Junction's 9 Software.

Existing Junction Arrangement

13.5.2 ARCADY model output with existing junction arrangement is provided as Appendix 17.1. The results for 2033 Baseline Scenario are summarised in Table 13K.

Table 13K ARCADY Outputs: A283 / Clays Hill Roundabout – 2033 Baseline Scenario

Arm	AM Peak Hour			PM Peak Hour		
	Queue	Delay	RFC	Queue	Delay	RFC
A283 South	52	133	1.06	166	459	1.24
Maudlin Lane	0	9	0.04	0	8	0.04
Clays Hill	8	47	0.91	1	11	0.54
A283 North	6	25	0.87	7	23	0.88
Castle Lane	1	16	0.34	0	10	0.15
The Street	1	8	0.33	1	7	0.34
Total	**68**	**238**	**-**	**175**	**518**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.5.3 The results for the Proposed Development Scenarios, with difference in queue length and delay compared to 2033 Baseline, are summarised in Table 13L.

Table 13L ARCADY Outputs: A283 / Clays Hill Roundabout – 2033 Total Scenarios, with Existing Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A283 South	74	+22	179	+46	1.10	186	+20	515	+56	1.26
	Maudlin Lane	0	0	9	0	0.04	0	0	8	0	0.04
	Clays Hill	9	+1	53	+6	0.93	1	0	11	0	0.55
	A283 North	7	+1	30	+5	0.90	9	+2	29	+6	0.91
	Castle Lane	1	0	17	+1	0.36	0	0	11	+1	0.16
	The Street	1	0	9	+1	0.34	1	0	8	+1	0.35
	Total	**92**	**+24**	**297**	**+59**	**-**	**197**	**+22**	**582**	**+64**	**-**
2	A283 South	67	+15	164	+31	1.09	189	+23	507	+48	1.26
	Maudlin Lane	0	0	9	0	0.04	0	0	8	0	0.04
	Clays Hill	9	+1	52	+5	0.92	1	0	11	0	0.55
	A283 North	7	+1	29	+4	0.89	8	+1	27	+4	0.90
	Castle Lane	1	0	17	+1	0.35	0	0	11	+1	0.15
	The Street	1	0	8	0	0.33	1	0	8	+1	0.35
	Total	**85**	**+17**	**279**	**+41**	**-**	**199**	**+24**	**572**	**+54**	**-**
3	A283 South	66	+14	160	+27	1.08	179	+13	509	+50	1.26
	Maudlin Lane	0	0	9	0	0.04	0	0	8	0	0.04
	Clays Hill	9	+1	50	+3	0.92	1	0	11	0	0.55
	A283 North	7	+1	28	+3	0.89	8	+1	27	+4	0.90
	Castle Lane	1	0	16	0	0.35	0	0	11	+1	0.15
	The Street	1	0	8	0	0.33	1	0	8	+1	0.35
	Total	**84**	**+16**	**271**	**+33**	**-**	**189**	**+14**	**574**	**+56**	**-**
4	A283 South	60	+8	149	+16	1.07	174	+12	486	+27	1.25
	Maudlin Lane	0	0	9	0	0.04	0	0	8	0	0.04
	Clays Hill	9	+1	50	+3	0.92	1	0	11	0	0.55
	A283 North	7	+1	28	+3	0.89	7	0	24	+1	0.89
	Castle Lane	1	0	17	+1	0.35	0	0	10	0	0.15
	The Street	1	0	8	0	0.33	1	0	7	0	0.34
	Total	**78**	**+10**	**261**	**+23**	**-**	**183**	**+12**	**546**	**+28**	**-**

*Queue = Measured in vehicles *Delay = Measured in seconds *RFC = Ratio of flow to capacity

13.5.4 Table 13L demonstrates that all development scenarios result in increased queuing and delay on the A283 South arm of the roundabout during AM and PM peak hours. There is no increase, or only minor increase in queue or delay on all other arms of the roundabout.

Proposed Junction Improvements

13.5.5 It is proposed to provide the following mitigation to improve the capacity of the junction and minimise the impact of the proposed development scenarios:

A283 South:

- Increase entry width from 6.7 metres to 7.2 metres (i.e., increase effective flare length from 8.0 metres to 23.5 metres).

13.5.6 A plan of the proposed junction improvements are provided as Appendix 17.2. The model output for the Proposed Development Scenarios, with proposed junction improvements is provided as Appendix 17.3. The results are summarised in Table 13M.

Table 13M ARCADY Outputs: A283 / Clays Hill Roundabout – 2033 Total Scenarios, with Proposed Junction Improvements

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A283 South	17	-35	47	-86	0.97	85	-81	172	-287	1.10
	Maudlin Lane	0	0	10	+1	0.05	0	0	11	+3	0.05
	Clays Hill	17	+9	91	+44	1.00	2	+1	15	+4	0.61
	A283 North	7	-1	28	+3	0.89	9	+2	30	+7	0.91
	Castle Lane	1	0	16	0	0.35	0	0	11	+1	0.16
	The Street	1	0	8	0	0.34	1	0	8	+1	0.35
	Total	**43**	**-25**	**200**	**-38**	**-**	**97**	**-78**	**247**	**-271**	**-**
2	A283 South	15	-37	42	-91	0.96	83	-83	169	-290	1.10
	Maudlin Lane	0	0	10	+1	0.05	0	0	11	+3	0.05
	Clays Hill	15	+7	84	+37	0.99	2	+1	15	+4	0.61
	A283 North	7	+1	28	+3	0.89	8	+1	28	+5	0.90
	Castle Lane	1	0	16	0	0.35	0	0	11	+1	0.15
	The Street	1	0	8	0	0.34	1	0	8	+1	0.35
	Total	**39**	**-29**	**188**	**-50**	**-**	**94**	**-81**	**242**	**-276**	**-**
3	A283 South	14	-38	40	-93	0.95	84	-82	169	-290	1.10
	Maudlin Lane	0	0	10	+1	0.05	0	0	11	+3	0.05
	Clays Hill	14	+6	80	+33	0.98	2	+1	15	+4	0.61
	A283 North	7	+1	27	+2	0.88	8	+1	27	+4	0.90
	Castle Lane	1	0	16	0	0.34	0	0	11	+1	0.15
	The Street	1	0	8	0	0.33	1	0	8	+1	0.35
	Total	**37**	**-31**	**181**	**-57**	**-**	**95**	**-80**	**241**	**-277**	**-**
4	A283 South	13	-39	37	-96	0.95	78	-88	159	-300	1.09
	Maudlin Lane	0	0	10	+1	0.05	0	0	11	+3	0.05
	Clays Hill	14	+6	77	+30	0.98	2	+1	14	+3	0.61
	A283 North	7	+1	28	+3	0.89	7	0	25	+2	0.89
	Castle Lane	1	0	16	0	0.35	0	0	10	0	0.15
	The Street	1	0	8	0	0.34	1	0	7	0	0.34
	Total	**36**	**-32**	**176**	**-62**	**-**	**88**	**-87**	**266**	**-252**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.5.7 Table 13M demonstrates that the proposed junction improvements would significantly increase the capacity of the junction, by decreasing the queue lengths and delay on the A283 South arm of the roundabout. In the AM peak hour, on the A283 South arm, the queue length decreases by -35 vehicles in Scenario 1; -37 vehicles in Scenario 2; -38 vehicles in Scenario 3; and -39 vehicles in Scenario 4.

13.5.8 In the PM peak hour, on the A283 South arm, the queue length decreases by -81 vehicles in Scenario 1; -83 vehicles in Scenario 2; -82 vehicles in Scenario 3; and -88 vehicles in Scenario 4.

13.5.9 Whilst Table 13M shows that the proposed junction arrangement would decrease queues on the A283 South arm, there would be some increase in queue length on Clays Hill (maximum increase of +9 vehicles in Scenario 1) and on A283 North arm (maximum increase of +1 vehicle). However, Table 13M demonstrates that the total queues across the roundabout during the peak hours would be significantly decreased, thus improving the performance of the junction.

13.6 Junction 5 – A283 / A2037 Roundabout

13.6.1 The A283 / A2037 junction has been assessed for capacity using TRL's Junction's 9 Software.

Existing Junction Arrangement

13.6.2 ARCADY model output with existing junction arrangement is provided as Appendix 18.1. The results for 2033 Baseline Scenario are summarised in Table 13N.

Table 13N ARCADY Outputs: A283 / A2037 Roundabout – 2033 Baseline Scenario

Arm	AM Peak Hour			PM Peak Hour		
	Queue	Delay	RFC	Queue	Delay	RFC
A2037	4	19	0.81	4	16	0.79
A283 South	5	12	0.83	9	21	0.91
A283 North	11	31	0.93	4	12	0.81
Total	**20**	**62**	**-**	**17**	**49**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.6.3 The results for the Proposed Development Scenarios, with difference in queue length and delay compared to 2033 Baseline, are summarised in Table 13O.

Table 13O ARCADY Outputs: A283 / A2037 Roundabout – 2033 Total Scenarios, with Existing Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A2037	5	+1	22	+3	0.84	5	+1	20	+4	0.83
	A283 South	6	+1	15	+3	0.87	12	+3	26	+5	0.93
	A283 North	16	+5	42	+11	0.96	5	+1	14	+2	0.84
	Total	**27**	**+7**	**79**	**+17**	**-**	**22**	**+5**	**60**	**+11**	**-**
2	A2037	5	+1	22	+3	0.83	4	0	19	+3	0.82
	A283 South	6	+1	14	+2	0.86	11	+2	25	+4	0.93
	A283 North	15	+3	40	+9	0.96	5	+1	14	+2	0.83
	Total	**26**	**+5**	**76**	**+14**	**-**	**20**	**+3**	**58**	**+9**	**-**
3	A2037	4	0	21	+2	0.82	4	0	18	+2	0.82
	A283 South	6	+1	14	+2	0.86	11	+2	25	+4	0.93
	A283 North	14	+2	38	+7	0.95	5	+1	13	+1	0.83
	Total	**26**	**+5**	**73**	**+11**	**-**	**20**	**+3**	**56**	**+7**	**-**
4	A2037	5	+1	21	+2	0.83	4	0	17	+1	0.80
	A283 South	5	0	13	+1	0.85	10	+1	23	+2	0.92
	A283 North	14	+3	38	+7	0.95	4	0	13	+1	0.82
	Total	**24**	**+4**	**72**	**+10**	**-**	**18**	**+1**	**53**	**+4**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.6.4 Table 13O demonstrates that all development scenarios do not result in significant increase in queueing or delay on all arms of the junction during AM and PM peak hours. As such it is not deemed necessary to propose any mitigation at this junction.

13.7 Junction 8 – A283 / A27 Slips Roundabout

13.7.1 The A283 / A27 Slips junction has been assessed for capacity using TRL's Junction's 9 Software.

Existing Junction Arrangement

13.7.2 ARCADY model output with existing junction arrangement is provided as Appendix 19.1. The results for 2033 Baseline Scenario are summarised in Table 13P.

Table 13P ARCADY Outputs: A283 / A27 Slips Roundabout – 2033 Baseline Scenario

Arm	AM Peak Hour			PM Peak Hour		
	Queue	Delay	RFC	Queue	Delay	RFC
A27 Westbound Slips	1	5	0.59	19	40	0.97
A283 South	58	171	1.09	58	187	1.11
A283 North	10	25	0.92	4	11	0.81
A27 Eastbound Slips	1	3	0.34	0	3	0.31
Total	**70**	**204**	**-**	**81**	**241**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.7.3 The results for the Proposed Development Scenarios, with difference in queue length and delay compared to 2033 Baseline, are summarised in Table 13Q.

Table 13Q ARCADY Outputs: A283 / A27 Slips Roundabout – 2033 Total Scenarios, with Existing Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A27 W-bound Slips	2	+1	6	+1	0.65	55	+36	99	+59	1.05
	A283 South	114	+56	363	+192	1.22	93	+35	335	+148	1.19
	A283 North	37	+27	76	+51	1.02	13	+9	30	+19	0.94
	A27 E-bound Slips	1	0	4	+1	0.39	1	+1	4	+1	0.36
	Total	**154**	**+84**	**449**	**+245**	**-**	**162**	**+81**	**468**	**+227**	**-**
2	A27 W-bound Slips	2	+1	6	+1	0.64	40	+21	82	+42	1.03
	A283 South	110	+52	345	+174	1.21	80	+22	288	+101	1.18
	A283 North	25	+15	55	+30	0.99	16	+12	27	+16	0.93
	A27 E-bound Slips	1	0	4	+1	0.39	1	+1	12	+9	0.35
	Total	**138**	**+68**	**410**	**+206**	**-**	**137**	**+56**	**401**	**+160**	**-**
3	A27 W-bound Slips	2	+1	5	0	0.62	33	+14	72	+32	1.02
	A283 South	78	+20	227	+56	1.14	77	+19	274	+87	1.17
	A283 North	18	+8	44	+19	0.97	7	+3	18	+7	0.89
	A27 E-bound Slips	1	0	4	+1	0.36	1	+1	3	0	0.34
	Total	**99**	**+29**	**280**	**+76**	**-**	**118**	**+37**	**367**	**+126**	**-**
4	A27 W-bound Slips	2	+1	6	+1	0.64	28	+9	57	+17	1.00
	A283 South	109	+51	340	+169	1.21	71	+13	226	+39	1.14
	A283 North	13	+3	32	+7	0.94	8	+4	20	+9	0.90
	A27 E-bound Slips	1	0	4	+1	0.39	1	+1	3	0	0.33
	Total	**125**	**+55**	**382**	**+178**	**-**	**108**	**+27**	**306**	**+65**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.7.4 Table 13Q demonstrates that under all development scenarios, there would be increased queuing and delays on A283 South arm of the roundabout during AM peak, and on A283 North arm under Scenario 1 and 2.

13.7.5 Table 13Q also demonstrates that under all development scenarios, there would be increased queuing and delays on A27 westbound slips and A283 South arms of the roundabout during PM peak, and on A283 North arm under Scenario 1 and 2.

Proposed Junction Improvements

13.7.6 It is proposed to provide the following mitigation to improve the capacity of the junction and minimise the impact of the proposed development scenarios:

A27 Westbound Slips:

- Increase entry width from 7.4 metres to 11.3 metres (i.e., increase flare length from 12.2 metres to 32.5 metres);
- Dedicated left hand lane for A283 South traffic; and
- Lane direction road markings.

A283 South:

- Increase entry width from 9.7 metres to 12.0 metres (i.e., increase flare length from 4.1 metres to 26.4 metres);
- Dedicated left hand lane for A283 North traffic; and
- Lane direction road markings.

A283 North:

- Increase entry width from 7.0 metres to 11.2 metres (i.e., increase flare length from 11.5 metres to 26.3 metres);
- Dedicated left hand lane for A27 Eastbound traffic; and
- Lane direction road markings.

A27 Eastbound Slips:

- Increase entry width from 6.6 metres to 11.1 metres (i.e., increase flare length from 11.5 metres to 37.4 metres);
- Dedicated left hand lane for A27 Westbound traffic and
- Lane direction road markings.

Circulatory Lanes:

- Increase from two lanes to three lanes;
- Lane direction road markings.

13.7.7 A plan of the proposed junction improvements are provided as Appendix 19.2. The model output for the Proposed Development Scenarios, with proposed junction improvements is provided as Appendix 19.3. The results are summarised in Table 12R.

Table 13R ARCADY Outputs: A283 / A27 Slips Roundabout – 2033 Total Scenarios, with Proposed Junction Improvements

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A27 W-bound Slips	1	0	3	-2	0.46	3	-16	6	-34	0.74
	A283 South	2	-56	6	-165	0.64	2	-56	6	-181	0.62
	A283 North	2	-8	4	-21	0.67	2	-2	4	-7	0.62
	A27 E-bound Slips	0	-1	2	-1	0.27	0	0	2	-1	0.25
	Total	**5**	**-65**	**15**	**-189**	**-**	**7**	**-74**	**18**	**-223**	**-**
2	A27 W-bound Slips	1	0	3	-2	0.46	3	-16	5	-35	0.73
	A283 South	2	-56	5	-166	0.64	2	-56	5	-182	0.60
	A283 North	2	-8	4	-21	0.66	2	-2	3	-8	0.63
	A27 E-bound Slips	0	-1	2	-1	0.27	0	0	2	-1	0.24
	Total	**4**	**-66**	**14**	**-190**	**-**	**7**	**-74**	**15**	**-226**	**-**
3	A27 W-bound Slips	1	0	3	-2	0.44	3	-16	5	-35	0.72
	A283 South	2	-56	5	-166	0.61	2	-56	5	-182	0.60
	A283 North	2	-8	4	-21	0.64	1	-3	3	-8	0.58
	A27 E-bound Slips	0	-1	2	-1	0.25	0	0	2	-1	0.23
	Total	**5**	**-65**	**14**	**-190**	**-**	**6**	**-75**	**15**	**-226**	**-**
4	A27 W-bound Slips	1	0	3	-2	0.45	3	-16	5	-35	0.71
	A283 South	2	-56	5	-166	0.64	1	-57	5	-182	0.59
	A283 North	2	-8	4	-21	0.62	2	-2	3	-8	0.59
	A27 E-bound Slips	0	-1	2	-1	0.26	0	0	2	-1	0.23
	Total	**5**	**-65**	**14**	**-190**	**-**	**6**	**-75**	**15**	**-226**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.7.8 Table 13Q demonstrates that the proposed junction improvements would result in all arms of the roundabout operating with theoretical capacity (i.e., RFC of less than 0.85) in all proposed development scenarios in AM and PM peak hours.

13.7.9 Table 13Q also demonstrates that there would be significantly decrease in queuing, with maximum queue length of two vehicles in AM peak (on A283 South and A293 North arms), and maximum queue length of three vehicles in PM peak (on A27 Westbound slips arm). Also, delays are decreased significantly on all arms in all scenarios.

DMRB CD 116 Compliance Checks

13.7.10 The proposed junction arrangement adheres to DMRB CD 116 (Geometric design of roundabouts). This document provides the geometric design requirements for roundabouts applicable to new and improved junctions on trunk roads. Compliance checks are provided as Appendix 19.4.

13.8 Junction 9 – A283 / Upper Shoreham Road Roundabout

13.8.1 The A283 / Upper Shoreham Road junction has been assessed for capacity using TRL's Junction's 9 Software.

Existing Junction Arrangement

13.8.2 ARCADY model output with existing junction arrangement is provided as Appendix 20.1. The results for 2033 Baseline Scenario are summarised in Table 13S.

Table 13S ARCADY Outputs: A283 / Upper Shoreham Road Roundabout – 2033 Baseline Scenario

Arm	AM Peak Hour			PM Peak Hour		
	Queue	Delay	RFC	Queue	Delay	RFC
Upper Shoreham Road	6	30	0.88	9	40	0.91
A283 South	25	138	1.04	26	135	1.04
A283 North	50	196	1.10	239	1048	1.43
Total	**81**	**364**	**-**	**274**	**1223**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.8.3 The results for the Proposed Development Scenarios, with difference in queue length and delay compared to 2033 Baseline, are summarised in Table 13T.

Table 13T ARCADY Outputs: A283 / Upper Shoreham Road Roundabout – 2033 Total Scenarios, with Existing Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	Upper Shoreham Rd	8	+2	35	+5	0.90	11	+2	50	+10	0.94
	A283 South	47	+22	234	+96	1.13	38	+12	188	+53	1.10
	A283 North	62	+12	261	+65	1.13	306	+67	1379	+331	1.51
	Total	**117**	**+36**	**530**	**+166**	**-**	**355**	**+81**	**1617**	**+394**	**-**
2	Upper Shoreham Rd	8	+2	35	+5	0.90	11	+2	49	+9	0.94
	A283 South	46	+21	229	+91	1.13	36	+10	178	+43	1.09
	A283 North	59	+9	245	+49	1.12	301	+62	1355	+307	1.48
	Total	**113**	**+32**	**509**	**+145**	**-**	**348**	**+74**	**1582**	**+359**	**-**
3	Upper Shoreham Rd	7	+1	32	+2	0.89	10	+1	46	+6	0.93
	A283 South	31	+6	165	+27	1.07	34	+8	172	+37	1.08
	A283 North	55	+5	225	+29	1.11	275	+36	1229	+181	1.48
	Total	**93**	**+12**	**422**	**+58**	**-**	**319**	**+45**	**1447**	**+224**	**-**
4	Upper Shoreham Rd	7	+1	33	+3	0.89	10	+1	44	+4	0.93
	A283 South	46	+21	230	+52	1.13	31	+5	156	+21	1.07
	A283 North	52	+2	211	+15	1.10	277	+38	1231	+83	1.48
	Total	**105**	**+24**	**474**	**+110**	**-**	**318**	**+44**	**1431**	**+108**	**-**

*Queue = Measured in vehicles *Delay = Measured in seconds *RFC = Ratio of flow to capacity

13.8.4 Table 13T demonstrates that all proposed development scenarios result in increased queues and delays on all arms of the roundabout during AM and PM peak hours.

Proposed Junction Improvements

13.8.5 It is proposed to provide the following mitigation to improve the capacity of the junction and minimise the impact of the proposed development scenarios:

A283 South:

- Increase entry width from 4.5 metres to 6.2 metres (effective flare length increase from 2.8 metres to 22.1 metres) by realigning the western kerbline within adopted highway,

A283 North:

- Increase entry width from 4.5 metres to 5.5 metres (effective flare length increase from 0.8 metres to 2.8 metres) by realigning the northeastern kerbline, and amending the splitter island.

Distance Between Arms:

- Increase distance between arms (i.e., increase size of roundabout):
  - Between A283 South and A283 North, from 17.7 metres to 18.3 metres;

- Between A283 North and Upper Shoreham Road, from 15.4 metres to 16.7 metres;
- Between Upper Shoreham Road and A283 South, from 15.9 metres to 16.8 metres.

13.8.6 A plan of the proposed junction improvements are provided as Appendix 20.2. The model output for the Proposed Development Scenarios, with proposed junction improvements is provided as Appendix 20.3. The results are summarised in Table 13U.

Table 13U ARCADY Outputs: A283 / Upper Shoreham Road Roundabout – 2033 Total Scenarios, with Proposed Junction Improvements

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	Upper Shoreham Rd	9	+3	43	+13	0.92	14	+5	65	+25	0.97
	A283 South	4	-21	24	-114	0.82	4	-22	21	-114	0.80
	A283 North	44	-6	162	-34	1.08	251	+12	1025	-23	1.44
	Total	**57**	**-24**	**229**	**-135**	**-**	**269**	**-5**	**1111**	**-112**	**-**
2	Upper Shoreham Rd	9	+3	42	+12	0.92	14	+5	63	+23	0.96
	A283 South	4	-21	24	-114	0.82	4	-22	20	-115	0.79
	A283 North	41	-9	153	-43	1.07	247	+8	1006	-42	1.44
	Total	**54**	**-27**	**219**	**-145**	**-**	**265**	**+11**	**1089**	**-134**	**-**
3	Upper Shoreham Rd	8	+2	38	+8	0.91	13	+4	59	+19	0.96
	A283 South	3	-22	19	-119	0.78	4	-22	20	-115	0.79
	A283 North	36	-14	138	-58	1.06	222	-17	896	-152	1.40
	Total	**47**	**-34**	**195**	**-169**	**-**	**239**	**-35**	**975**	**-248**	**-**
4	Upper Shoreham Rd	9	+3	40	+10	0.92	12	+3	56	+16	0.95
	A283 South	4	-21	24	-114	0.82	3	-23	19	-116	0.78
	A283 North	35	-35	136	-60	1.05	223	-16	900	-148	1.40
	Total	**48**	**-33**	**200**	**-164**	**-**	**238**	**-36**	**975**	**-248**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.8.7 Table 13U demonstrates that the proposed junction improvements would result in decreased queuing on A283 South and A283 North arms of the roundabout under all development scenarios in AM peak hour. There would continue to be minor increase in queuing on Upper Shoreham Road.

13.8.8 Table 13U demonstrates that the proposed junction improvements would result in decreased queuing on A283 South arm in all development scenarios in PM peak hour. There would also be decrease queuing on A283 North arm in Scenario 3 and 4.

WSCC confirmed that they would not be looking to make any physical improvements to the urban roundabouts to the south of the A27 i.e. A283/Upper Shoreham Road and A283/A259. The contributions calculated for physical improvements could be put forward towards improving sustainable transport infrastructure in the area instead.

13.9 Junction 10 – A283 / A259 Roundabout

13.9.1 The A283 / A259 junction has been assessed for capacity using TRL's Junction's 9 Software.

Existing Junction Arrangement

13.9.2 ARCADY model output with existing junction arrangement is provided as Appendix 21.1. The results for 2033 Baseline Scenario are summarised in Table 13V.

Table 13V ARCADY Outputs: A283 / A259 Roundabout – 2033 Baseline Scenario

Arm	AM Peak Hour			PM Peak Hour		
	Queue	Delay	RFC	Queue	Delay	RFC
A259 East	29	110	1.03	326	1373	1.65
A259 West	356	1221	1.48	64	175	1.09
A283	1	9	0.58	10	46	0.93
Total	**386**	**1340**	**-**	**400**	**1594**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.9.3 The results for the Proposed Development Scenarios, with difference in queue length and delay compared to 2033 Baseline, are summarised in Table 13W.

Table 13W ARCADY Outputs: A283 / A259 – 2033 Total Scenarios, with Existing Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A259 East	38	+9	137	+27	1.06	365	+39	1570	+197	1.71
	A259 West	396	+40	1376	+155	1.52	69	+5	194	+19	1.10
	A283	1	0	9	0	0.59	19	+9	78	+32	0.99
	Total	**435**	**+49**	**1552**	**212**	**-**	**453**	**+53**	**1842**	**+248**	**-**
2	A259 East	38	+9	136	+26	1.06	359	+33	1545	+172	1.70
	A259 West	394	+38	1369	+148	1.52	68	+4	191	+16	1.10
	A283	1	0	9	0	0.59	18	+8	76	+30	1.99
	Total	**433**	**+47**	**1514**	**+174**	**-**	**445**	**+45**	**1812**	**+218**	**-**
3	A259 East	32	+3	119	+9	1.04	348	+22	1475	+102	1.68
	A259 West	368	+12	1267	+46	1.49	67	+3	187	+12	1.10
	A283	1	0	9	0	0.58	13	+3	58	+12	0.96
	Total	**401**	**+15**	**1395**	**+55**	**-**	**428**	**+28**	**1720**	**+126**	**-**
4	A259 East	38	+9	136	+26	1.06	342	+16	1452	+79	1.68
	A259 West	394	+38	1368	+147	1.52	66	+2	183	+8	1.10
	A283	1	0	9	0	0.58	13	+3	59	+13	0.96
	Total	**433**	**+47**	**1513**	**+173**	**-**	**421**	**+21**	**1694**	**+100**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.9.4 Table 13W demonstrates that under all development scenarios, there is increased queueing and delays on A259 East and A259 West arms of the roundabout in the AM peak hour, and on all arms of the junction in PM peak hour.

Proposed Junction Improvements

13.9.5 It is proposed to provide the following mitigation to improve the capacity of the junction and minimise the impact of the proposed development scenarios:

Roundabout Size:

- Increase size of roundabout from ICD of 26 metres to ICD of 28.5 metres; and
- Give way lines for A259 West and A283 arms of roundabout moved back, making sure visibilities work.

A259 West:

- Decrease entry width from 7.0 metres to 6.6 metres, effective flare length increased from 1.9 metres to 26 metres.

13.9.6 A plan of the proposed junction improvements are provided as Appendix 21.2. The model output for the Proposed Development Scenarios, with proposed junction improvements is provided as Appendix 21.3. The results are summarised in Table 13X.

Table 13X ARCADY Outputs: A283 / A259 Roundabout – 2033 Total Scenarios, with Proposed Junction Improvements

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A259 East	3	-26	13	-97	0.77	88	-238	242	-1131	1.15
	A259 West	12	-344	30	-1191	0.94	2	-62	7	-168	0.70
	A283	1	0	6	-3	0.49	2	-8	9	-37	0.69
	Total	**16**	**-370**	**49**	**-1291**	**-**	**92**	**-308**	**258**	**-1336**	**-**
2	A259 East	3	-26	12	-98	0.77	86	-240	235	-1138	1.15
	A259 West	12	-344	29	-1192	0.93	2	-62	7	-168	0.70
	A283	1	0	6	-3	0.49	2	-8	9	-37	0.68
	Total	**16**	**-370**	**47**	**-1293**	**-**	**90**	**-310**	**251**	**-1343**	**-**
3	A259 East	3	-26	12	-98	0.76	80	-246	219	-1154	1.14
	A259 West	10	-346	25	-1196	0.92	2	-62	7	-168	0.70
	A283	1	0	6	-3	0.48	2	-8	8	-38	0.66
	Total	**14**	**-372**	**43**	**-1297**	**-**	**84**	**-316**	**234**	**-1361**	**-**
4	A259 East	3	-26	13	-97	0.77	77	-249	212	-1161	1.13
	A259 West	12	-346	29	-1192	0.93	2	-62	7	-168	0.70
	A283	1	0	6	-3	0.48	2	-8	8	-38	0.66
	Total	**14**	**-372**	**48**	**-1292**	**-**	**81**	**-319**	**227**	**-1368**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.9.7 Table 13X demonstrates that the proposed junction improvements result in a significant decrease in queuing and delays on A259 East and A259 West arms of the roundabout (with no increase in queuing on A283 North) in the AM peak hour. The proposed junction improvements result in a significant decrease in queuing and delays on all arms of the roundabout in the PM peak hour.

13.9.8 However, Table 13X also shows that the RFC value on A259 West arm remains above 0.85 in all proposed scenarios in AM peak hour. This is the case for A259 East arm in PM peak hour, with significant queue lengths and delays.

13.10 Junction 11 – A27 / New Monks Farm Signal Roundabout

13.10.1 The committed New Monks Farm signal junction (between A27 / Old Shoreham Road) has been assessed for capacity using JCT's LinSig V3 Software.

Committed Junction Arrangement

13.10.2 The committed junction plan is described in Section 3.5. The plan of the committed junction arrangement (i.e., Vectos drawing number VN201557/PL-03) is provided as Appendix 3.2.

13.10.3 The LinSig model output for 2033 Baseline Scenario and Proposed Development Scenarios is provided as Appendix 22.1. The results for the 2033 Baseline Scenario are summarised in Table 13Y.

Table 13Y LinSig Outputs: A27 / New Monks Farm – 2033 Baseline Scenario

Arm/Lane		AM Peak Hour			PM Peak Hour		
		DoS	Delay	Queue	DoS	Delay	Queue
1/1	A27 East Left Ahead	72.2%	9	15	69.8%	9	14
1/2	A27 East Ahead	60.2%	7	10	61.7%	7	10
1/3	A27 East Ahead	60.3%	7	10	61.7%	7	10
2/1	Old Shoreham Rd (New Monks Farm Access) Left	47.1%	45	4	69.8%	47	8
2/2+ 2/3	Old Shoreham Rd (New Monks Farm Access) Left Ahead	78.9%	62	8	113.9%	306	45
3/1	A27 West Left Ahead	81.5%	19	21	89.5%	35	24
3/2	A27 West Ahead	81.6%	19	21	89.6%	35	24
3/3	A27 West Ahead	81.5%	19	21	89.5%	35	24
4/1	Sussex Pad Left Ahead	34.4%	33	2	44.5%	24	3
Total		**-**	**220**	**112**	**-**	**505**	**162**

*DoS = Degree of Saturation (%)
*Delay = Average Delays Per PCU, measured in seconds per hour
*Queue = Mean Max Queue, measured in PCUs

13.10.4 The results for the Proposed Development Scenarios, under the committed junction arrangement, are summarised in Table 13Z.

Table 13Z LinSig Outputs: A27 / New Monks Farm – 2033 Total Scenarios

Scenario	Arm/Lane		AM Peak Hour					PM Peak Hour				
			DoS	Delay		Queue		DoS	Delay		Queue	
				S	Diff.	PCU	Diff.		S	Diff.	PCU	Diff.
1	1/1	A27 East Left Ahead	66.9%	8	-1	12	-3	74.7%	10	+1	16	+2
	1/2	A27 East Ahead	66.6%	8	+1	12	+2	64.1%	8	+1	11	+1
	1/3	A27 East Ahead	66.5%	8	+1	12	+2	64.1%	8	+1	11	+1
	2/1	Old Shoreham Rd Left	47.1%	45	0	4	0	69.8%	47	0	8	0
	2/2+ 2/3	Old Shoreham Rd Left Ahead	78.9%	62	0	8	0	113.9%	306	0	45	0
	3/1	A27 West Left Ahead	81.9%	18	-1	21	0	92.0%	39	+4	26	+2
	3/2	A27 West Ahead	81.9%	18	-1	21	0	92.1%	39	+4	26	+2
	3/3	A27 West Ahead	81.9%	18	-1	21	0	92.0%	39	+4	26	+2
	4/1	Sussex Pad Left Ahead	38.0%	37	+4	2	0	45.1%	25	+1	3	0
	Total		**-**	**220**	**0**	**113**	**+1**	**-**	**521**	**+16**	**172**	**+10**
2	1/1	A27 East Left Ahead	72.9%	9	0	15	0	74.9%	10	+1	16	+2
	1/2	A27 East Ahead	61.6%	7	0	10	0	64.2%	8	+1	11	+1
	1/3	A27 East Ahead	61.6%	7	0	10	0	64.2%	8	+1	11	+1
	2/1	Old Shoreham Rd Left	47.1%	45	0	4	0	69.8%	47	0	8	0
	2/2+ 2/3	Old Shoreham Rd Left Ahead	78.9%	62	0	8	0	113.9%	306	0	45	0
	3/1	A27 West Left Ahead	83.2%	19	0	22	+1	91.3%	38	+3	26	+2
	3/2	A27 West Ahead	83.2%	19	0	22	+1	91.3%	38	+3	26	+2
	3/3	A27 West Ahead	83.2%	19	0	22	+1	91.4%	38	+3	26	+2
	4/1	Sussex Pad Left Ahead	36.2%	35	+2	2	0	44.9%	25	+1	3	0
	Total		**-**	**222**	**+2**	**115**	**+3**	**-**	**518**	**+13**	**172**	**+10**
3	1/1	A27 East Left Ahead	73.8%	10	+1	15	0	73.5%	10	+1	15	+1
	1/2	A27 East Ahead	61.7%	7	0	10	0	62.9%	8	+1	11	+1
	1/3	A27 East Ahead	61.7%	7	0	10	0	62.9%	8	+1	11	+1
	2/1	Old Shoreham Rd Left	44.1%	43	-2	4	0	69.8%	47	0	8	0
	2/2+ 2/3	Old Shoreham Rd Left Ahead	74.0%	55	-7	7	-1	113.9%	306	0	45	0
	3/1	A27 West Left Ahead	83.5%	20	+1	22	+1	91.1%	37	+2	25	+1
	3/2	A27 West Ahead	83.4%	20	+1	22	+1	91.1%	37	+2	25	+1
	3/3	A27 West Ahead	83.5%	20	+1	22	+1	91.1%	37	+2	25	+1
	4/1	Sussex Pad Left Ahead	34.5%	33	0	2	0	44.9%	25	+1	3	0
	Total		**-**	**215**	**-5**	**114**	**+2**	**-**	**515**	**+10**	**168**	**+6**
4	1/1	A27 East Left Ahead	73.5%	10	+1	15	0	73.9%	10	+1	16	+2
	1/2	A27 East Ahead	61.6%	7	0	10	0	63.1%	8	+1	11	+1
	1/3	A27 East Ahead	61.6%	7	0	10	0	63.2%	8	+1	11	+1
	2/1	Old Shoreham Rd Left	47.1%	45	0	4	0	69.8%	47	0	8	0
	2/2+ 2/3	Old Shoreham Rd Left Ahead	78.9%	62	0	8	0	113.9%	306	0	45	0

	3/1	A27 West Left Ahead	83.2%	19	0	22	+1	90.8%	37	+2	25	+1
	3/2	A27 West Ahead	83.2%	19	0	22	+1	90.8%	37	+2	25	+1
	3/3	A27 West Ahead	83.2%	19	0	22	+1	90.8%	37	+2	25	+1
	4/1	Sussex Pad Left Ahead	36.2%	35	0	2	0	44.8%	25	+1	3	0
	Total		**-**	**223**	**+1**	**115**	**+3**	**-**	**515**	**+10**	**169**	**+7**

*DoS = Degree of Saturation (%)
*Delay = Average Delays Per PCU, measured in seconds per hour
*Queue = Mean Max Queue, measured in PCUs

13.10.5 Table 13Z shows that, with the exception of the Old Shoreham Road (Left Ahead) arm in the PM peak hour, all arms/lanes in both AM and PM peak hours in all proposed development scenarios operate within theoretical capacity (i.e., DoS less than 100%) with committed junction arrangement.

13.10.6 It should be noted that on the Old Shoreham Road (Left Ahead) arm in the PM peak hour, there would be no increase the DoS, queue length or delay in all development scenarios and therefore they result in nil detriment compared to the baseline scenario.

13.10.7 In light of the above, it is considered that there is no requirement to propose improvements to the committed junction arrangement.

13.11 Junction 12 – A27 / A2025 (Lancing Manor) Roundabout

13.11.1 The Lancing Manor Roundabout, i.e., A27 / A2025 Grinstead Lane / Manor Road junction has been assessed for capacity using TRL's Junction's 9 Software.

Committed Junction Arrangement

13.11.2 As part of planning permission re. AWDM/0961/17, an agreement between Highways England (now National Highways) and Adur District Council and the New Monks Farm applicant requires that the Monks Farm applicant either enters into a S278 Agreement to undertake traffic improvements to the Lancing Manor Roundabout in accordance with Vectos' drawing number VN40408/PL-010 or pays a contribution in full for the cost of the works. The junction improvements as per Vectos' drawing number VN40408/PL-010 is therefore regarded as 'committed highway improvements' and are therefore used to assess the baseline as well as development scenario traffic impact associated with Shoreham Cement Works study.

13.11.3 As such, the Lancing Manor Roundabout has been modelled as per ARCADY outputs provided by Vectos in the Transport Assessment for the New Monks Farm development. A plan of the committed junction arrangement is provided as Appendix 3.3.

13.11.4 ARCADY model output with committed junction arrangement is provided as Appendix 23.1. The results for 2033 Baseline Scenario are summarised in Table 13AA.

Table 13AA ARCADY Outputs: Lancing Manor Roundabout – 2033 Baseline Scenario with Committed Junction Arrangement

Arm	AM Peak Hour			PM Peak Hour		
	Queue	Delay	RFC	Queue	Delay	RFC
A27 East	342	512	1.25	446	649	1.30
A2025	542	2131	1.72	7	34	0.89
A27 West	361	633	1.29	508	961	1.45
Manor Road	23	176	1.06	1	16	0.53
Total	**1,268**	**3,452**	**-**	**963**	**1,660**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.11.5 The results for the Proposed Development Scenarios, with difference in queue length and delay compared to 2033 Baseline, are summarised in Table 13AB.

Table 13AB ARCADY Outputs: Lancing Manor Roundabout – 2033 Total Scenarios, with Committed Junction Arrangement

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A27 East	412	+70	603	+91	1.29	544	+98	783	+134	1.35
	A2025	565	+23	2,197	+66	1.73	8	+1	37	+3	0.90
	A27 West	414	+53	721	+88	1.32	549	+41	1,036	+75	1.48
	Manor Road	25	+2	188	+12	1.07	1	0	17	+1	0.55
	Total	**1,416**	**+148**	**3,709**	**+257**	**-**	**1,102**	**+139**	**1,873**	**+213**	**-**
2	A27 East	398	+56	585	+73	1.28	540	+94	776	+127	1.35
	A2025	561	+19	2,184	+53	1.73	7	0	36	+2	0.89
	A27 West	412	+51	716	+83	1.32	537	+29	1,013	+70	1.47
	Manor Road	25	+2	189	+13	1.07	1	0	17	+1	0.54
	Total	**1,396**	**+128**	**3,674**	**+222**	**-**	**1,085**	**+122**	**1,842**	**+182**	**-**
3	A27 East	375	+33	554	+42	1.27	501	+55	721	+72	1.33
	A2025	552	+10	2,159	+28	1.57	8	+1	37	+3	0.90
	A27 West	382	+21	669	+36	1.73	536	+28	1,012	+51	1.47
	Manor Road	24	+1	180	+4	1.06	1	0	17	+1	0.54
	Total	**1,333**	**+65**	**3,562**	**+110**	**-**	**1,015**	**+52**	**1,787**	**+127**	**-**
4	A27 East	367	+25	544	+42	1.26	507	+61	729	+80	1.33
	A2025	563	+21	2,200	+69	1.74	7	0	33	-1	0.88
	A27 West	411	+50	714	+81	1.32	520	+12	981	+20	1.46
	Manor Road	25	+2	191	+15	1.07	1	0	17	+1	0.54
	Total	**1,366**	**+98**	**3,649**	**+197**	**-**	**1,035**	**+72**	**1,760**	**+100**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.11.6 Table 13AB shows that all proposed development scenarios result in an increase in queueing on the A27 East arm and A27 West arm of the roundabout during the AM and PM peak hours. Despite a decrease in queues on A2025 Grinstead Lane and Manor Road in the AM peak hour, and on Grinstead Lane in PM peak hour, the total queues increase in all development scenarios.

Proposed Junction Improvements

13.11.7 It is proposed to provide the following mitigation to improve the capacity of the junction further and minimise the impact of the proposed development scenarios:

Roundabout Size:

- Increase size of roundabout to ICD of 60 metres; and
- Circulatory lanes broadly as per committed arrangement, with additional road markings and directional arrows

A27 East

- Increase entry width from 9.8 metres to 11.3 metres

A2025 Grinstead Lane:

- Increase entry width from 11.5 metres to 12.8 metres (effective flare length increased from 10.0 metres to 15.0 metres)

A27 West:

- Increase entry width from 11.5 metres to 13.1 metres

Manor Road:

- Increase approach road half width from 4.1 metres to 5.4 metres
- Increase entry width from 7.4 metres to 8.0 metres

It should be noted that these improvements require land take from Lancing Manor Estate.

13.11.8 A plan of the proposed junction improvements are provided as Appendix 23.2. The model output for the Proposed Development Scenarios, with proposed junction improvements is provided as Appendix 23.3. The results are summarised in Table 13AC.

Table 13AC ARCADY Outputs: Lancing Manor Roundabout – 2033 Total Scenarios, with Proposed Junction Improvements

Scenario	Arm	AM Peak Hour					PM Peak Hour				
		Queue		Delay		RFC	Queue		Delay		RFC
		Vehs	Diff.	S	Diff.		Vehs	Diff.	S	Diff.	
1	A27 East	154	-188	159	-353	1.10	228	-218	270	-379	1.15
	A2025	464	-78	1,537	-594	1.71	7	0	34	0	0.89
	A27 West	339	-22	583	-50	1.27	467	-41	840	-121	1.41
	Manor Road	7	-16	54	-122	0.89	1	0	12	-4	0.46
	Total	**964**	**-304**	**2,333**	**-1,119**	**-**	**703**	**-260**	**1,156**	**-504**	**-**
2	A27 East	147	-195	151	-361	1.10	226	-220	266	-383	1.15
	A2025	460	-82	1,510	-621	1.71	7	0	33	-1	0.89
	A27 West	336	-25	580	-53	1.27	455	-53	820	-141	1.41
	Manor Road	7	-16	54	-122	0.89	1	0	12	-4	0.45
	Total	**950**	**-318**	**2,295**	**-1,157**	**-**	**689**	**-274**	**1,131**	**-529**	**-**
3	A27 East	133	-209	139	-373	1.09	203	-243	232	-417	1.14
	A2025	452	-90	1,467	-664	1.70	7	0	35	+1	0.89
	A27 West	308	-53	536	-97	1.25	453	-55	818	-143	1.40
	Manor Road	6	-17	52	-124	0.89	1	0	12	-4	0.45
	Total	**894**	**-374**	**2,194**	**-1,258**	**-**	**664**	**-299**	**1,097**	**-563**	**-**
4	A27 East	129	-213	135	-377	1.08	207	-239	237	-412	1.14
	A2025	460	-82	1,481	-650	1.72	6	-1	31	-3	0.89
	A27 West	336	-25	580	-53	1.27	438	-70	790	-171	1.39
	Manor Road	7	-16	55	-121	0.89	1	0	12	-4	0.45
	Total	**932**	**-336**	**2,251**	**-1,201**	**-**	**652**	**-311**	**1,070**	**-590**	**-**

*Queue = Measured in vehicles
*Delay = Measured in seconds
*RFC = Ratio of flow to capacity

13.11.9 Table 13AC demonstrates that the proposed junction improvements would produce significant decrease in queueing compared to the 2033 Baseline Scenario with the committed junction arrangement.

13.11.10 The proposed junction arrangement adheres to DMRB CD 116 (Geometric design of roundabouts). This document provides the geometric design requirements for roundabouts applicable to new and improved junctions on trunk roads. Compliance checks are provided as Appendix 23.4.

14.0 BUDGET COST ESTIMATE FOR OFF-SITE HIGHWAY WORKS

14.1 Introduction

14.1.1 Where off-site highways improvements have been proposed as mitigation, a budget cost estimate has been drawn up for each of the affected junctions.

14.1.2 These is a budget estimate only, which excludes design and council fees, and underground service diversion costs and costs to purchase third party land (in the case of Lancing Manor Roundabout). It has been assumed that the existing road, where retained, will be resurfaced and the whole gyratory has been resurfaced. ADL are not qualified quantity surveyors and the estimates provided should not be used for any contract documents.

14.1.3 As requested by WSCC an optimism bias of 46% has been applied to all cost estimates.

14.2 Junction 1 – Washington Roundabout

14.2.1 A summary of the budget cost estimate for the off-site highways works for the proposed junction improvements at the Washington Roundabout is provided in Table 14A.

Table 14A Budget Cost Estimate: A283 / A24 Roundabout

Item	Description	Cost (£)
	Preliminaries 15%	£35,670.00
1.0	Site Clearance Works	£17,786.00
2.0	Earthworks	£58,749.00
3.0	Pavement	£143,267.00
4.0	Drainage	£5,500.00
5.0	Signs and Markings	£12,500.00
6.0	Other	£22,837.50
	Total	**£296,310**
	Contingency 10%	£29,631
	Civils Total	£325,941
	Including Optimism Bias (46%)	**£475,874**

14.2.2 Full details for the budget cost estimate are provided as Appendix 24.1.

14.3 Junction 2 – A283 / Water Lane / Chanctonbury Ring Road Crossroads

14.3.1 A summary of the budget cost estimate for the off-site highways works for the proposed junction improvements is provided in Table 14B.

Table 14B Budget Cost Estimate: A283 / Water Lane

Item	Description	Cost (£)
	Preliminaries 15%	£2,178.75
1.0	Site Clearance Works	£1,515.00
2.0	Earthworks	£2,736.00
3.0	Pavement	£8,524.00
4.0	Drainage	£0.00
5.0	Signs and Markings	£1,750.00
6.0	Other	£2,000.00
	Total	**£18,704**
	Contingency 10%	£1,870
	Civils Total	£20,574
	Including Optimism Bias (46%)	**£30,038**

14.3.2 Full details for the budget cost estimate are provided as Appendix 24.2.

14.3.3 As discussed previously, it is not proposed to improve this junction as there are fears that such improvements could result in an increase in rat-running along Water Lane. Hence the budget cost of £30,038 could be out towards sustainable transport measures.

14.4 Junction 4 – A283 / Clays Hill

14.4.1 A summary of the budget cost estimate for the off-site highways works for the proposed junction improvements is provided in Table 14C.

Table 14C Budget Cost Estimate: A283 / Clays Hill Roundabout

Item	Description	Cost (£)
	Preliminaries 15%	£5,011.95
1.0	Site Clearance Works	£6,644.00
2.0	Earthworks	£6,328.00
3.0	Pavement	£13,991.00
4.0	Drainage	£2,200.00
5.0	Signs and Markings	£4,250.00
6.0	Other	£5,500.00
	Total	**£43,925**
	Contingency 10%	£4,392
	Civils Total	£48,317
	Including Optimism Bias (46%)	**£70,543**

14.4.2 Full details for the budget cost estimate are provided as Appendix 24.3.

14.5 Junction 8 – A283 / A27 Slips Roundabout

14.5.1 A summary of the budget cost estimate for the off-site highways works for the proposed junction improvements is provided in Table 14D.

Table 14D Budget Cost Estimate: A283 / A27 Slips Roundabout

Item	Description	Cost (£)
	Preliminaries 15%	£54,804.30
1.0	Site Clearance Works	£31,655.00
2.0	Earthworks	£112,263.00
3.0	Pavement	£207,944.00
4.0	Drainage	£0.00
5.0	Signs and Markings	£13,500.00
6.0	Other	£57.362.50
	Total	**£477,529**
	Contingency 10%	£47,753
	Civils Total	£525,282
	Including Optimism Bias (46%)	**£766,912**

14.5.2 Full details for the budget cost estimate are provided as Appendix 24.4.

14.6 Junction 9 – A283 / Upper Shoreham Road Roundabout

14.6.1 A summary of the budget cost estimate for the off-site highways works for the proposed junction improvements is provided in Table 14E.

Table 14E Budget Cost Estimate: A283 / Upper Shoreham Road Roundabout

Item	Description	Cost (£)
	Preliminaries 15%	£8,405.18
1.0	Site Clearance Works	£7,922.00
2.0	Earthworks	£10,427.00
3.0	Pavement	£27,335.00
4.0	Drainage	£4,400.00
5.0	Signs and Markings	£5,950.00
6.0	Other	£9,600.00
	Total	**£74,040**
	Contingency 10%	£7,404
	Civils Total	£81,144
	Including Optimism Bias (46%)	**£118,908**

14.6.2 Full details for the budget cost estimate are provided as Appendix 24.5.

14.6.3 As discussed previously, it is not proposed to improve this junction as WSCC confirmed that they would not be looking to make any physical improvements to the urban roundabouts to the south of the A27 i.e. A283/Upper Shoreham Road and A283/A259. The budget cost of £118,908 could be out towards sustainable transport measures.

14.7 Junction 10 – A283 / A259 Roundabout

14.7.1 A summary of the budget cost estimate for the off-site highways works for the proposed junction improvements is provided in Table 14F.

Table 14F Budget Cost Estimate: A283 / A259 Roundabout

Item	Description	Cost (£)
	Preliminaries 15%	£6,350.10
1.0	Site Clearance Works	£6,875.00
2.0	Earthworks	£7,415.00
3.0	Pavement	£17,344.00
4.0	Drainage	£0.00
5.0	Signs and Markings	£10,700.00
6.0	Other	£4,000.00
	Total	**£52,684**
	Contingency 10%	£5,268
	Civils Total	£57,953
	Including Optimism Bias (46%)	**£84,611**

14.7.2 Full details for the budget cost estimate are provided as Appendix 24.6.

14.7.3 As discussed previously, it is not proposed to improve this junction as WSCC confirmed that they would not be looking to make any physical improvements to the urban roundabouts to the south of the A27 i.e. A283/Upper Shoreham Road and A283/A259. The budget cost of £84,611 could be out towards sustainable transport measures.

14.8 Junction 12 – A27 / A2025 (Lancing Manor) Roundabout

14.8.1 A summary of the budget cost estimate for the off-site highways works associated with the committed junction arrangements and ADL's proposed junction arrangements is provided in Table 14G.

14.8.2 The costs associated with the ADL's proposed junction arrangements have been calculated on the assumption that committed junction as per Vectos' drawing number VN40408/PL-010 is not built by 2033.

Table 14G Budget Cost Estimate: Lancing Manor Roundabout

		Committed Junction Arrangement	ADL Proposed Arrangement	Difference
Item	**Description**	**Cost (£)**	**Cost (£)**	**Cost (£)**
	Preliminaries 15%	£25,993.86	£66,238.47	£40,244.61
1.0	Site Clearance Works	£27,933.00	£55,084.00	£27,151.00
2.0	Earthworks	£37,995.40	£158,493.80	£120,498.40
3.0	Pavement	£91,764.00	£183,812.00	£92,048.00
4.0	Drainage	£5,500.00	£18,200.00	£12,700.00
5.0	Signs and Markings	£10,100.00	£26,000.00	£15,900.00
6.0	Other	£33,250.00	£55,475.00	£22,225.00
Total		**£232,536.00**	**£563,303.00**	**£330,767.00**
Contingency 10%		£23,254	£56,330.00	£33,076.00
Civils Total		£255,790	£619,634	£363,844
Including Optimism Bias (46%)		**373,453**	**£904,666**	**£531,213**

14.8.3 Table 14G shows that the committed junction arrangement could cost approximately £256,000 to construct, whilst the proposed junction arrangement put forward by ADL to mitigate the impact of Shoreham Cement Works development could cost approximately £620,000 to construct. This excludes costs related to purchase of land from Lancing Manor.

14.8.4 Therefore, the proposed junction arrangement to mitigate Shoreham Cement Works development over and above the permitted scheme could require an additional £531,213 to build when compared to the committed junction arrangement. As discussed above, this does not take into account cost related to purchase of land from Lancing Manor Estate.

14.8.5 Full details for the budget cost estimate for the committed junction improvements, and ADL's proposed junction improvements are provided as Appendix 24.7 and Appendix 24.8, respectively.

14.9 Summary and Conclusions

14.9.1 ADL have assessed each of the offsite junctions with their existing (or committed) junction arrangement in the 2033 Baseline Scenario, and with the four proposed development scenarios. The following junctions are predicted to be severely impacted by the proposed development:

- Junction 1: A283/A24 (Washington) Roundabout;
- Junction 2: A283/Water Lane/Chanctonbury Ring Road crossroads;

- Junction 4: A283/Maudlin Lane/Clays Hill/Castle Lane/The Street Roundabout;
- Junction 8: A283/A27 Slips Roundabout;
- Junction 9: A283/Upper Shoreham Road Roundabout;
- Junction 10: A283/A259 Roundabout; and
- Junction 12: A27/A2025/Manor Road (Lancing Manor) Roundabout.

14.9.2 ADL have proposed mitigation at each of these junctions to improve capacity of the junction and reduce the impact of the proposed development scenarios, compared to the 2033 Baseline Scenario with existing (or committed) junction arrangement.

14.9.3 ADL have also provided budget cost estimates for the proposed off-site highways works and these are summarised in Table 14H.

Table 14H Budget Cost Estimate Summary – Total Off Site Highway Works

Junction	Junction Name	Total Cost (inc. Contingency 10% + Optimism Bias 46%)
1	A283/A24 (Washington) Roundabout	£475,874
2	A283/Water Lane/Chanctonbury Ring Road Crossroads	£30,038**
4	A283/Maudlin Lane/Clays Hill/Castle Lane/The Street Roundabout	£70,543
8	A283/A27 Slips Roundabout	£766,912
9	A283/Upper Shoreham Road Roundabout	£118,908***
10	A283/A259 Roundabout	£84,611***
12	A27/A2025/Manor Road (Lancing Manor) Roundabout	£904,666
Including Optimism Bias (46%)		**£2,451,552**

****See paragraph 13.9.6**
*****See paragraph 13.9.7**

14.9.4 Table 14H shows that the overall costs associated with the total off-site highway works is approximately £2,451,552. This excludes cost associated with purchase of land from Lancing Manor Estate in relation to Lancing Manor Roundabout improvements.

14.9.5 WSCC confirmed that there would be no need to improve the A283/Water Lane crossroads (Junction 2) as any improvements are likely to result in an increase in rat-running along Water Lane which would not be desirable. The highway improvement contribution of £30,038 towards this junction could be put forward towards improving sustainable transport infrastructure.

14.9.6 WSCC also confirmed that they would not be looking to make any physical improvements to the urban mini roundabouts to the south of the A27 i.e. A283/Upper Shoreham Road and A283/A259. The total highway improvement contributions of £203,519 towards both these mini roundabouts could be put forward towards improving sustainable transport infrastructure in the area instead.

15.0 SUMMARY AND CONCLUSIONS

15.1 Summary

15.1.1 South Downs National Park Authority (SDNPA) are currently preparing Shoreham Cement Works Area Action Plan (AAP). The AAP will sit alongside the recently adopted South Downs Local Plan (SDLP) which covers the plan period 2014-2033.

15.1.2 Shoreham Cement Works (SCW) is allocated under Policy SD56 of the SDLP for an exemplar sustainable mixed use development, which delivers a substantially enhanced landscape and uses that are compatible with the purposes of National Park. ADL has been commissioned by SDNPA to prepare a Transport Assessment to inform the AAP.

15.1.3 This Transport Assessment assesses four proposed development scenarios against the 2033 Baseline traffic scenario. The extent of the transport study covers an approximately 18.5-kilometre length of highway, from the Washington Roundabout to the northwest of the site, to the A283/A259 junction to the south, and Lancing Manor Roundabout to the southwest. The following key junctions have been assessed:

1) A283 / A24 (Washington) Roundabout;
2) A283 / Water Lane / Chanctonbury Ring Road crossroads;
3) A283 / Maudlin Lane / Clays Hill / Castle Lane / The Street Roundabout;
4) A283 / B2135 / Horsham Road Priority Junctions;
5) A283 / A2037 Roundabout;
6) Site Access (North);
7) Site Access (South);
8) A283 / A27 Slips Roundabout;
9) A283 / Upper Shoreham Road Roundabout;
10) A283 / A259 Roundabout;
11) A27 / New Monks Farm Committed Signalised Roundabout; and
12) A27 / A2025 / Manor Road (Lancing Manor) Roundabout.

15.1.4 This TA is supplemented by four Technical Notes (TN1, TN2, TN3, and TN4) as well as extensive discussions with key stakeholders, including SDNPA, WSCC and NH.

15.2 Baseline Traffic Situation

15.2.1 WSCC provided observed traffic data for use in the Shoreham Cement Works project. These are from the National Highways A27 data collection programme in 2015 and from the Shoreham Free Wharf Transport Assessment in 2017.

15.2.2 The observed traffic flows have been upscaled to year 2033, this is the year of assessment as agreed with WSCC and NH.

15.2.3 The proposed methodology that has been accepted by WSCC is to represent committed developments and Local Plan allocations within overall growth for small to medium sites and to those that lie outside the immediate study area (i.e., beyond the area where the junction impacts are considered).

15.2.4 Therefore, except for New Monks Farm development (planning ref. AWDM/0961/17) and Shoreham Airport development (planning ref. AWDM/1093/17), other sites will be represented within overall growth. New Monks Farm and Shoreham Airport development flows have been added manually.

15.3 Proposed Development Scenarios

15.3.1 Four development scenarios have been tested to determine whether any of the scenarios in this AAP can be accommodated without any adverse traffic impact in terms of traffic capacity, sustainable travel options, road safety, key junctions or accident hot spots.

15.3.2 There are a number of land use schemes already consented within the study area which will increase residential and employment levels. The four development scenarios being potentially considered for the AAP involve a further significant increase in residential and employment levels, plus a mix of ancillary uses to maximise internalisation of trips and leisure uses.

15.4 Sustainable Transport Mitigation

15.4.1 Sustainable transport mitigation in the form of improvements to the accessibility of the site by non-car modes has been considered. The following have been put forward to reduce mode share of single occupancy car travel:

- Proposed site access to be provided with ramp access to existing underpass beneath A283;
- Underpass beneath A283 to be upgraded at per LTN 1/20 standards for pedestrians and cyclists;
- Proposed pedestrian/cyclist/horse rider linkage to Downs Link (NCN Route 223) from western portion of the site, as per LTN 1/20;
- Weather proofing of Downs Link/NCN 223;
- Improvement to NCN Route 223 A283 crossing;
- Provision of bus stops on A283 and within the site, with bus shelter, seating and Real Time Information;
- Increased frequency of Bus Route 2, to two services per hour in each direction;
- Provision of car club bays within the site; and
- Travel planning measures to promote uptake of non-car modes for residents/staff/visitors of the site.

15.4.2 Reduction in car trips within Local Plan transport studies in West Sussex was partly based on reduction factors prescribed with DfT's Sustainable Travel Towns 2010 document The Effects of Smarter Choices Programmes in Sustainable Travel Towns: Research Report (2010). However, the later study Sustainable Travel Towns: An Evaluation of The Longer-Term Impacts (2016) demonstrated that the overall reduction in traffic was far less than previously envisaged. The reasons being that promotion activities being reduced or discontinued after initial project funding ceased or increase in public transport fares.

15.4.3 Due to these reasons, it was decided that the reduction in car trips cannot be used as a first step to assess the traffic impact as this approach could result in underestimating the actual traffic impact leading to a significant funding gap for improvements in the future.

15.4.3 ADL has therefore formulated an approach whereby a package of sustainable measures could be delivered in lieu of the physical improvements to mitigate severe traffic impact at certain junctions. The construction costs to mitigate the severe traffic impact have therefore been based on worst-case scenario (i.e., no restraint to car trips) and the costs towards some junctions are then diverted towards sustainable initiatives in the areas where these junctions are located.

15.4.4 It is acknowledged that a large number of trips associated with the development proposals would be concentrated in areas such as Shoreham-by-Sea followed by Worthing and hence there is an opportunity to maximise sustainable mode share to the trips to these areas.

15.4.5 As has been agreed by WSCC, the contributions of £203,519 for the proposed highway improvements at urban junctions in Shoreham-By-Sea, i.e., A283/Upper Shoreham Road Roundabout, and A283/A259 Roundabout, could be used to allocate funding towards sustainable transport mitigation. In addition to this, the contributions of £30,038 towards improvements at A283/Water Lane junction could also be used to fund sustainable transport mitigation.

15.5 Proposed Access Arrangement

15.5.1 Several site access options from the A283 to both portions of the site have been assessed to determine a most suitable site access arrangement.

15.5.2 It is proposed to provide a four-arm roundabout on A283, at point of the existing northern access to the site. It is proposed to provide three-lane approaches on A283 north and A283 south arms of the roundabout, and two-lane approaches on east and west arms of the roundabout. This is considered the most suitable access arrangement, from a capacity perspective.

15.5.3 The junction capacity assessment is based on typical commuter peak hours and during these periods. It is considered that the likelihood of walking (and to some extent, cycling) related improvements is unlikely to tip the balance from private cars to walking (and cycling) to a material extent due to the semi-rural nature of site location and sparsity of trip-attracting destinations in the vicinity of the site. As such, junction capacity assessment has been undertaken to assume worst case scenario, for robustness.

15.6 Proposed Trip Generation

15.6.1 Vehicular trip generation exercise has been undertaken which establishes the following two-way peak hour trip levels:

Proposed Development Scenario 1:

- AM Peak Hour: 570
- PM Peak Hour: 542

Proposed Development Scenario 2:

- AM Peak Hour: 488
- PM Peak Hour: 465

Proposed Development Scenario 3:

- AM Peak Hour: 325
- PM Peak Hour: 417

Proposed Development Scenario 4:

- AM Peak Hour: 385
- PM Peak Hour: 350

15.6.2 These development vehicular trips are likely to impact a number of junctions within the study area. The suggested mitigation measures are:

Junction 1: Washington Roundabout:

- A283 West arm – increase entry width, with lane direction road markings;
- A24 North arm – increase entry width, with lane direction road markings – left lane dedicated to left turners, two lanes dedicated for straight ahead and right/U-turners;
- A283 East arm – lane direction road markings;
- A24 South arm – lane direction road markings; and

- Circulatory lane direction road markings

Junction 2: A283 / Water Lane Crossroads

- Water Lane – increase width to 6.0 metres at 10 metres back from give-way, and up to 5.5 metres at 15 metre back from give-way; and
- Increase visibility to left onto A283 to 100 metres – WSCC to maintain the vegetation within adopted highway extent.

Junction 4: A283/Clays Hill Roundabout:

- A283 South arm – increase entry width

Junction 8: A283/A27 Slips Roundabout:

- Westbound Slips arm – increase entry width, dedicated left hand lane for A283 South traffic, and lane direction road markings;
- A283 South arm – increase entry width, dedicated left hand lane for A283 North traffic; and lane direction road markings;
- A283 North arm – increase entry width, dedicated left hand lane for A27 eastbound traffic; and lane direction road markings;
- A27 Eastbound Slips arm – increase entry width, dedicated left hand lane for A27 Westbound traffic and lane direction road markings; and
- Circulatory lanes – increase from two lanes to three lanes.

Junction 9: A283/Upper Shoreham Road Roundabout:

- A283 South arm – increase entry width by realigning the western kerbline within adopted highway,
- A283 North arm – increase entry width by realigning the northeastern kerbline, and amending the splitter island.
- Increase distance between arms (i.e., increase size of roundabout):

Junction 10: A283/A259 Roundabout:

- Increase size of roundabout from ICD of 26 metres to ICD of 28.5 metres; and
- Give way lines for A259 West and A283 arms of roundabout moved back, making sure visibilities work;

Junction 12: Lancing Manor Roundabout:

- Increase size of roundabout to ICD of 60 metres;
- Circulatory lanes broadly as per committed arrangement, with additional road markings and directional arrows;
- A27 East arm – increase entry width;
- A2025 Grinstead Lane arm – increase entry width;
- A27 West arm – increase entry width
- Manor Road arm – increase approach road half width and increase entry width

15.6.3 The measures tested improve the theoretical capacity of the junctions listed above to give a significant improvement in the individual junction performance and the journey times along key routes 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.

15.6.4 The overall costs associated with the off-site highway works is approximately £2,451,552. This excludes cost associated with purchase of land from Lancing Manor Estate in relation to Lancing Manor Roundabout improvements.

15.6.5 As mentioned previously, Junction 1 may not require any mitigation should Highway Authority consider that the increase in queues as a result of the development scenarios does not warrant any improvements.

15.6.6 WSCC confirmed that there would be no need to improve the A283/Water Lane crossroads (Junction 2) as any improvements are likely to result in an increase in rat-running along Water Lane which would not be desirable.

15.6.7 WSCC also confirmed that they would not be looking to make any physical improvements to the urban mini roundabouts to the south of the A27 i.e. A283/Upper Shoreham Road and A283/A259. The total highway improvement contributions of £203,519 towards both these mini roundabouts could be put forward towards improving sustainable transport infrastructure in the area instead.

15.6.8 The proposed improvements to A283/A27 Slips Roundabout and A27/Grinstead Lane (Lancing Manor) Roundabout have been scrutinised using DMRB's CD 116 Geometric Design of Roundabouts compliance checklist. It is summarised that the improvements meet CD 116 requirement for the majority of the parameters. For others, it is demonstrated that there would not be worsening of the junction safety when compared to the existing situation for A283/A27 Slips Roundabout, and to the permitted NMF's scheme for A27/Grinstead Lane Roundabout.

15.6.9 Overall, the conclusion of this study is that delivery of the proposed development scenarios is feasible from a transport perspective, but this will require significant highway improvement measures coupled with reduction in private car mode share.