highways england

M271 Redbridge Roundabout Scheme Assessment Report

M271 REDBRIDGE ROUNDABOUT

PCF STAGE 2

SCHEME ASSESSMENT REPORT

Highways England

Project no: 70019110
Date: March 2017

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1 EXECUTIVE SUMMARY

1.1.1 The primary objective of the scheme is to deliver cost effective infrastructure improvements at the Redbridge Roundabout to relieve congestion and improve local and national economic growth, whilst minimising the impact on the environment.

1.1.2 The existing roundabout has a number of performance issues including:

- The journey time reliability of M271 between the M27 and A33/A35 was ranked the second least reliable route according to the SMRSE[1] report, April 2014.
- Over the next ten years, the development at Southampton container port is forecast to increase the flow of heavy goods traffic, through the roundabout, to and from Southampton Ports.
- The container traffic is also expected to double from 2005 levels by 2020, whilst during the same period the automotive volume is expected to increase by 33% (SMRSE).

1.1.3 The purpose of this PCF[2] Stage 2 SAR[3] is to provide a summary of the PCF Stage 1 TAR[4] whilst reporting on the impact of the results of the Public Consultation event. It will also recommend a preferred option to be taken forward for further assessment and development at PCF Stage 3 subject to SGAR Stage 2 approval and Investment Decision Committee funding approval.

1.1.4 As outlined in the PCF Stage 1 Public Information Strategy, a public consultation event seeking the views and comments from local residents and relevant stakeholders was organised and delivered during November and December 2016.

1.1.5 During PCF Stage 1, three options were assessed and fully discussed on the basis of their engineering, economic and environmental impacts, the results of which are reported in detail in the TAR. These options were described as:

- Option 1: Provides a new two lane at-grade through-about link joining A33 westbound off-slip to M271 northbound.
- Option 2: Provides enhanced circulatory capacity to the south side of the roundabout.
- Option 3: Provides enhanced circulatory capacity to the south and west sides of the roundabout as well as wider lane widths than those proposed in Option 2.

[1] SMRSE - Solent to Midlands – Route Strategy Evidence Report / Technical Annex
[2] PCF - Project Control Framework
[3] SAR – Scheme Assessment Report
[4] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03

1.1.6 All three proposed options include the provision of a segregated free-flow left turning link between M271 southbound and A33 eastbound on-slip, as committed within the Highways England Road Investment Strategy[1]. In addition, the bus gate on the A33 westbound off-slip entry to the Redbridge Roundabout would be removed but with the bus lane retained along the slip road to the roundabout entry stop line.

1.1.7 In terms of NMU[2] journey experience, Option 2 and Option 3 both offered improvements by way of enhancement of the existing grade separated crossing facilities (subways and a new footbridge). Option 1, with the presence of the cut-through link, would require replacement of these grade-separated facilities with new at-grade crossing facilities. Option 1 was not considered to be an Option suitable for implementation as a consequence of the proposed additional three at-grade crossing facilities that would introduce significant additional conflict points between NMUs and the general traffic. This resulted in noncompliance with the CSR[3] and the NMU Objectives.

1.1.8 This report also includes a quantitative assessment of the environmental, traffic economics and costs impacts of Option 2 and Option 3.

1.1.9 In terms of the environmental consideration, both Option 2 and Option 3 result in an overall air quality dis-benefit in the opening year, and worsen exposure to pollution where concentrations exceed the air quality objective, including within the Redbridge/Millbrook AQMA[4]. However, the number of properties affected is relatively low and does not exceed the guideline for significant effects (IAN 174/13[5]). For topics such as landscape and geology and soils, a neutral effect is anticipated.

1.1.10 The results of the modelling and economic appraisal have shown that both scheme options provide good BCR[6] values (Option 2: 5.64; Option 3: 8.84). These BCRs would represent a very high value for money category. Option 3 offers a higher BCR ratio than Option 2 mainly due to the extra capacity provided by the additional lane along the western circulatory carriageway. The user benefits and BCRs option costs are discussed in further detail in Section 7 of this report.

1.1.11 The modelling results show that both Option 2 and Option 3 provide significant benefits in both 2019 and 2025. The westbound traffic along the mainline towards M271 and Totton sees benefits in all periods in both years. The proposed fourth circulatory lane along the southern circulatory carriageway shows a direct benefit to the northbound traffic towards M271. This prevents traffic blocking back from the westbound on-slip and obstructing the right turners whilst freeing up capacity on the mainline for traffic travelling westbound towards Totton.

1.1.12 A Yes/No/Maybe analysis of the predicted PIA[7] savings for each scheme option was undertaken by examining each PIA record at Redbridge Roundabout for the five year period between August 2010 and July 2015. The calculated accident savings for both scheme options were positive.

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[1] Highways England Road Investment Strategy for the 2015/16 – 2019/20 Road Period- https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/408514/ris-for-2015-16-road-period-web-version.pdf
[2] NMU - Non-Motorised Users
[3] CSR – Client Scheme Requirements
[4] AQMA – Air Quality Management Area
[5] IAN 174/13 – Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality (HA207/07)
[6] BCR – Benefit Cost Ratio
[7] PIA – Personal Injury Accident

1.1.13 The public consultation event conducted during November/December 2016 highlighted a clear and strong objection from local residents and businesses against the proposed removal of the existing toucan crossings across the A33 slip roads.

1.1.14 On 20 January 2017 a workshop was held by Highways England, SCC[1] and WSP | Parsons Brinckerhoff to review the results of the public consultation and agree the most suitable proposal to take forward to PCF[2] Stage 3. Upon the workshop's conclusions and as instructed by Highways England, a revised scheme (Revised Option 2) has been prepared as presented in Chapter 12. Chapter 12 includes a qualitative assessment and outlines the further assessments that will be needed during PCF Stage 3 in order to determine the suitability of the option in greater detail.

[1] SCC – Southampton City Council
[2] PCF – Project Control Framework

2 INTRODUCTION

2.1 PURPOSE OF THIS REPORT

2.1.1 The purpose of this PCF[1] Stage 2 SAR[2] is to provide a summary of the PCF Stage 1 TAR[3] and the Report on Public Consultation and to recommend a 'Preferred Option' to be taken forward for further assessment into the development phases.

2.1.2 This report has been produced as defined in Highways England's Major Projects: Projects Control Framework and in accordance with DMRB[4] TD 37/93[5]. It is based on the findings from PCF Stage 1 and sets out the engineering, environmental, traffic and economic impact of Options 2 and 3 developed at that stage. The report also provides further research into the option impacts at PCF Stage 2.

2.1.3 The results of the Public Consultation event conducted in November/December 2016 showed clear concerns from local businesses and the public regarding the proposed removal of the existing toucan crossings across the A33 slip roads. On 20 January 2017, at a workshop attended by Highways England, SCC[6] and WSP | Parsons Brinckerhoff, the outcomes of the public event were discussed in depth to agree the most suitable proposal to develop in response to the consultation feedback, and recommend for PCF Stage 3.

2.1.4 Upon instruction from Highways England, a revised layout based on Option 2 has been developed which is described in Chapter 12 of this report along with qualitative environmental and economic assessments. Recommendations for further more detailed assessments that will need to be completed during PCF Stage 3 are also provided.

2.1.5 All quantitative assessments provided throughout this report, are based solely on the original Options 2 and 3 developed at PCF Stage 1.

2.2 USE OF ACRONYMS AND FOOTNOTE

2.2.1 All abbreviations are expanded within the footnote on the same page where they appear in order to improve both the readability of the report and remove the need for the reader to remember an acronym's definition after its first use. Numbering of footnotes will start at '1' on each page throughout the report to avoid large suffix numbers and to avoid changes within any page affecting any subsequent page or numbering.

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[1] PCF – Project Control Framework
[2] SAR – Scheme Assessment Report
[3] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[4] DMRB – Design Manual for Roads and Bridges
[5] TD 37/93 – Scheme Assessment Reporting (Volume 5 Section 1 Part 2)
[6] SCC – Southampton City Council

3 SUMMARY OF EXISTING CONDITIONS

3.1 INTRODUCTION

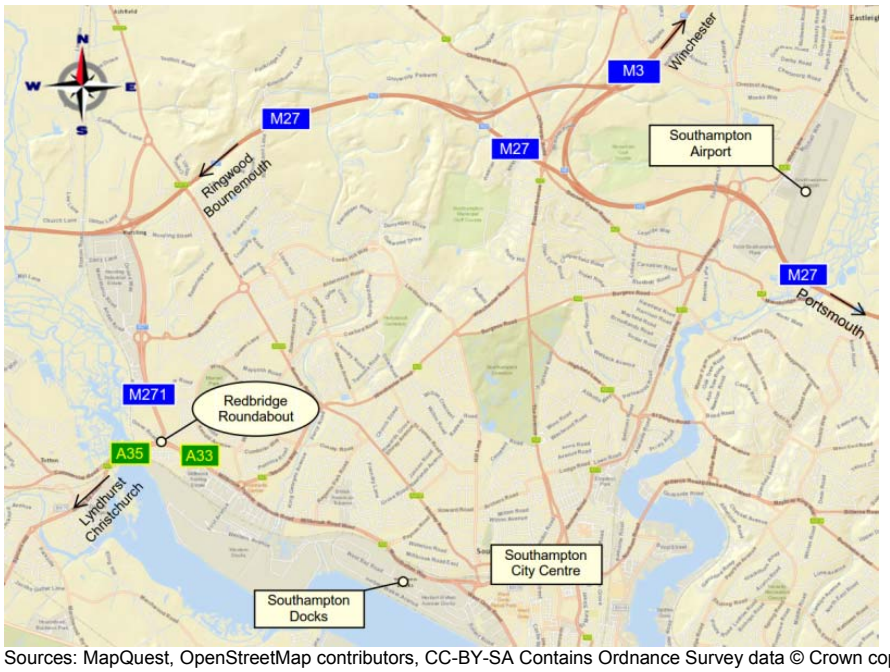
3.1.1 This section summarises the existing conditions of the M271 Redbridge Roundabout in terms of traffic, engineering and environmental conditions. In order to avoid repetition of information in other PCF[1] products, the purpose of this section is to provide an overview of features and information known up to this stage. More detail of the various discipline information discussed can be found in the PCF Stage 1 TAR[2] and an overview of conditions in the PCF Stage 2 CSR[3].

3.2 STATEMENT OF THE PROBLEM AND PERFORMANCE ISSUES

3.2.1 The location of the roundabout in relation to the local, regional and national highway network is illustrated in Figure 3-1 below.

3.2.2 The existing conditions and locality of Redbridge Roundabout in relation to its surrounding community has been discussed in detail in Section 3 of the PCF Stage 1 TAR.

Figure 3-1 Locality and Relation to the Wider SRN[4]



Sources: MapQuest, OpenStreetMap contributors, CC-BY-SA Contains Ordnance Survey data © Crown copyright

[1] PCF – Project Control Framework
[2] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[3] CSR – Client Scheme Requirements
[4] SRN – Strategic Road Network

3.2.3 The existing heavy congestion at Redbridge Roundabout has an impact on the strategic movements through the M271 to and from Southampton City Centre and the Port of Southampton.

3.2.4 The congestion through the roundabout is observed to be caused by a number of factors:

- Observed queuing along M271 Southbound approach to the roundabout during the morning peak hours which prevent steady flow of left turning traffic on to the A33 eastbound slip-road.
- Acute queuing back of westbound traffic along the A35 westbound on-slip from the Redbridge Causeway signals which can block entry and circulatory movements through the roundabout.
- High volume of heavy goods traffic generated to and from Southampton port through the roundabout towards M271 and A35 during the inter peak.

3.2.5 Section 3.3 of this report provides quantitative data on existing traffic flows that have contributed to the traffic conditions described here.

3.2.6 The journey time reliability of M271 between the M27 and A33/A35 was ranked the second least reliable route according to the SMRSE[1] report, April 2014.

3.2.7 The development at Southampton container port is forecast to increase HGV[2] traffic to and from Southampton Ports through the roundabout over the next 10 years whilst the container traffic is expected to double from 2005 levels by 2020 and automotive volume is expected to increase by 33% during the same period (SMRSE).

3.2.8 The Port of Southampton is a nationally important international gateway as recognised by the Government. The strategic road access to Southampton is via the M27, M271 and A33 Western Approach Route which has been designated by Government as Strategic National Corridor infrastructure from 2014. With this view the Redbridge Roundabout is being considered for improvement as it provides the main – and crucial – access to Southampton and the Port of Southampton, the two of which are very important economically and has significant growth aspiration.

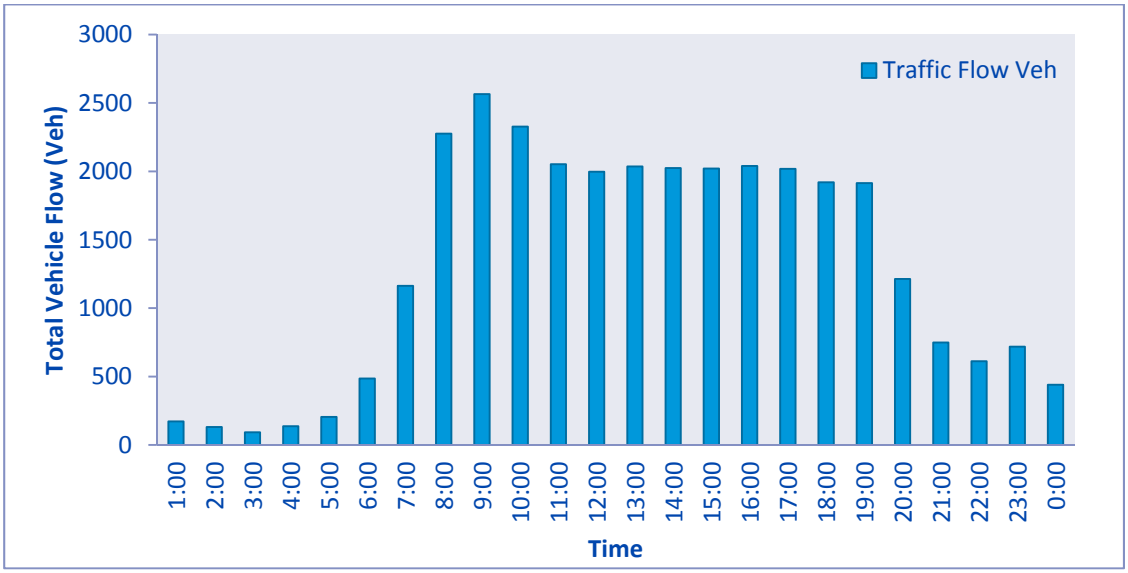
3.3 EXISTING TRAFFIC

3.3.1 Traffic data obtained from DfT[3] for the M271 (immediately north of the Redbridge Roundabout) demonstrates the number of vehicles travelling along the M271 on an average day has increased from 50,850 in 2009 to 52,990 in 2014, this equates to a 4.2% increase in traffic in 5 years. Based on annual traffic flows from the DfT, the average growth in traffic along major roads in South East England between 2009 and 2014 was 2.8%. As a result, it is possible to conclude that traffic growth on the M271 is higher than the local growth.

3.3.2 The DfT's TRADS[4] site number 5201 provides traffic data along the M271 north of the Redbridge Flyover and shows the average daily profile in both directions for 2014. As seen in Figure 3-2, there is a significant peak in traffic flow between 07:00 and 09:00, while the inter-peak period maintains a high flow of traffic and into the PM Peak and only starts to reduce after 19:00.

[1] SMRSE – Solent to Midlands – Route Strategy Evidence Report / Technical Annex
[2] HGV – Heavy Goods Vehicle
[3] DfT – Department for Transport
[4] TRADS – Traffic Flow Data System

Figure 3-2 M271 Daily Traffic Profile



3.3.3 MCC[1] were undertaken in November 2014 to ascertain the baseline traffic condition through the Redbridge Roundabout. Table 3-1 presents an overview of the vehicles entering and exiting the roundabout via the M271 and the A33 throughout the day.

Table 3-1 Observed Vehicles through the Roundabout

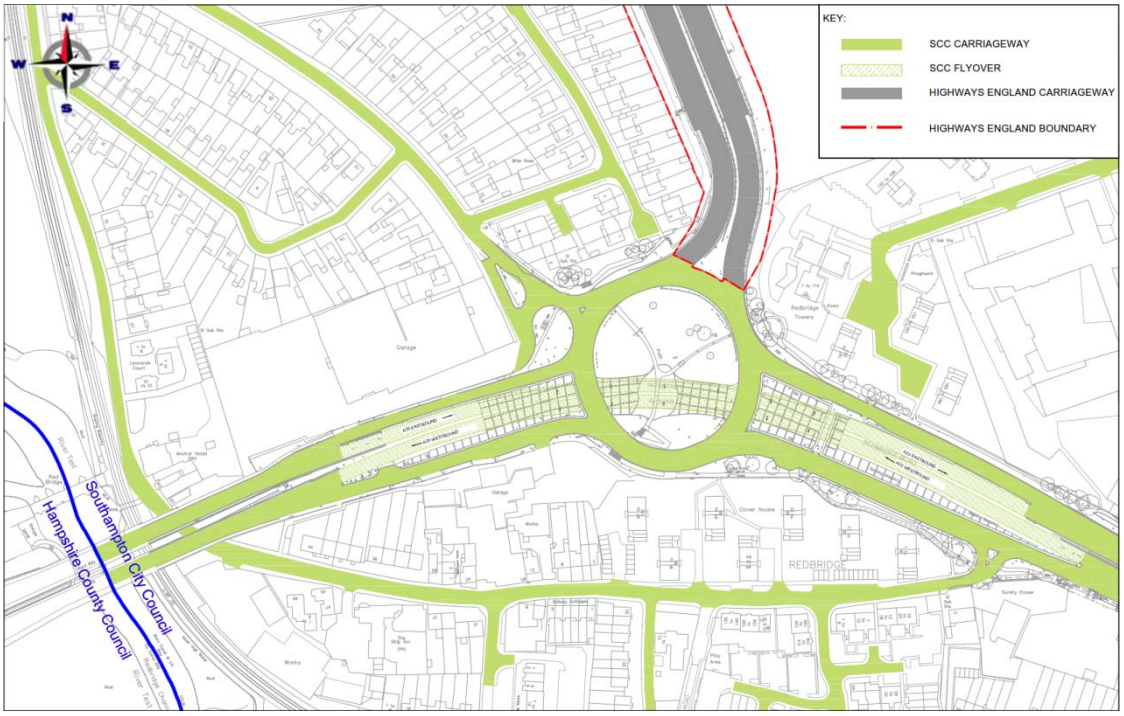
PEAK	TO M271	TO A33	FROM M271	FROM A33	FLYOVER TWO-WAY
AM (06:30 – 10:00)	6,979	5,362	7,742	3,450	6,817
IP (10:00 – 15:30)	9,956	6,885	10,545	6,267	6,935
PM (15:30 – 19:00)	7,308	3,929	6,776	4,612	5,082

3.4 EXISTING LAND USE

3.4.1 The M271 up to its approaches to Redbridge Roundabout is part of the SRN[2] maintained by Highways England, and all other approaches east of the River Test are a part of the adopted highways maintained by SCC[3], as shown in Figure 3-3.

[1] MCC – Manual Classified Counts
[2] SRN – Strategic Road Network
[3] SCC – Southampton City Council

Figure 3-3 Highway Authority Extents



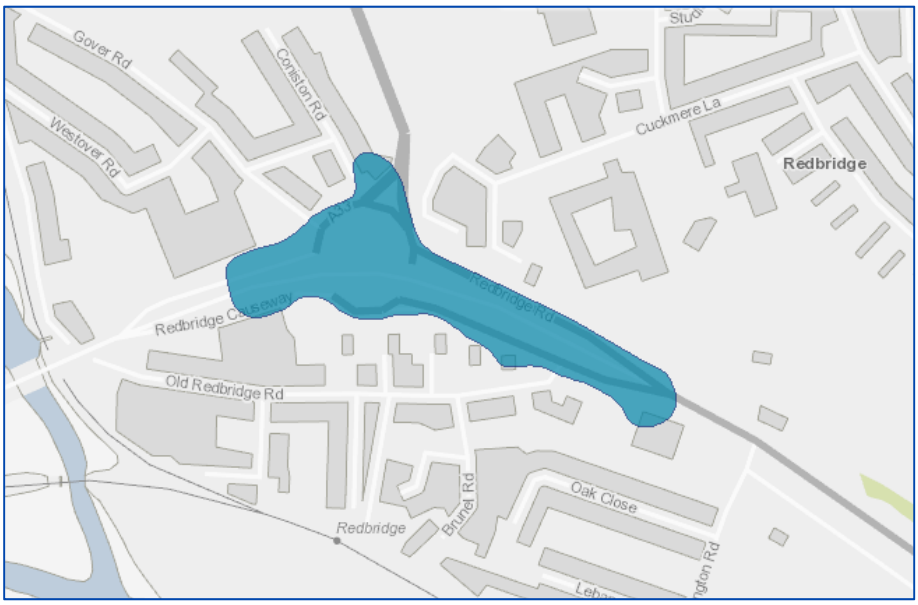
3.5 ENVIRONMENTAL CONDITIONS

LOCAL AIR QUALITY

3.5.1 The M271 Redbridge Roundabout is located within the Redbridge AQMA[1] as shown in Figure 3-4. The scheme has the potential to affect four AQMAs (declared by SCC[2]) for exceedance of the UK's objective for annual mean NO_2[3], due to high volumes of traffic on major roads and their associated exhaust emissions.

[1] AQMA – Air Quality Management Area
[2] SCC – Southampton City Council
[3] NO_2 – Nitrogen Dioxide

Figure 3-4 Location and extent of the Redbridge Road AQMA



3.5.2 There are a further three AQMAs[1] within 2km of the scheme, namely:

- Millbrook Road AQMA, located 1.4km south east of the scheme;
- Totton AQMA, located 1.2km west of the scheme; and
- Romsey Road AQMA, located 1.9km to the east of the scheme.

3.5.3 Defra[2] pollution background concentration mapping for the area within which the M271 Redbridge Roundabout is located provides the following background concentrations from 2012 to 2014:

- Total roadside concentrations of NO_2[3] were 22.99-38.57 µg/m3;
- NO_X[4] were 32.91-65.41 µg/m^3;
- PM_{10}[5] were 18.14-21.28 µg/m^3; and
- $PM_{2.5}$[6] were 12.47-14.92 µg/m^3.

3.5.4 The PCM[7] shows that of all the road links leading into the M271 Redbridge Roundabout, the M271 is the lowest contributor to the total pollutant concentrations, when compared with the A33 and the A35. However, the data indicates that all the road links have high NO_2 concentrations within 4m of the road and are liable to exceeding the UK objective and EU limits values.

[1] AQMA – Air Quality Management Area
[2] Defra – Department for Environment, Food and Rural Affairs
[3] NO_2 – Nitrogen Dioxide
[4] NO_X – Nitrogen Oxides
[5] PM_{10} – particulate matter 10 micrometres or less in diameter
[6] $PM_{2.5}$ – particulate matter 2.5 micrometres or less in diameter
[7] PCM – Pollution Climate Mapping

3.5.5 The scheme lies within the Redbridge/Millbrook AQMA[1], where SCC[2] operates 12 NO_2[3] diffusion tube monitoring sites, and an AMS[4] relevant to this AQMA. The closest diffusion tube to the scheme is situated on Coniston Road (N153). The closest AMS is Millbrook Road AMS situated 1.4km south east of the scheme. There was an AMS immediately adjacent to the M271 Redbridge Roundabout, which was decommissioned in 2013; this AMS data is still relevant for establishing the air quality baseline.

3.5.6 Southampton City Council conduct air quality monitoring across Southampton and the surrounding area, using both continuous automatic air samplers and passive NO_2 diffusion tubes to measure pollutant concentrations in ambient air. The scheme site lies within the Redbridge / Millbrook Road AQMA; within which SCC operate 12 NO_2 diffusion tube monitoring sites and 2 continuous automatic monitors.

3.5.7 The concentrations measured by passive diffusion tube sampling are presented in Table 3-2 and those measured by the continuous analysers in Table 3-3. The EU limit value for NO_2 is 40µg/m^3.

Table 3-2 NO_2 diffusion tube results collected by Southampton City Council (exceedances of the UK objective are highlighted in gold)

Site Name	Site ID	Annual mean NO_2 (Limit Value: 40µg/m^3)				
		2011	2012	2013	2014	2015
Redbridge School AMS	N101	**42.6**	**44.6**	**42.7**	**41.7**	-
485 Millbrook Road	N103	33.6	34.7	32.3	34.9	31.7
Regents Park Junction	N104	**42.4**	**41.6**	**41.2**	**42.3**	38.4
54 Redbridge Road	N115	**40.2**	**43.3**	37.5	**40.5**	36.4
57 Redbridge Road	N116	**40.3**	**43.2**	**42.1**	**41.9**	38.1
151 Paynes Road	N122	33.4	36.3	30.4	32.6	31.5
305 Millbrook Road	N124	**40.1**	**43.1**	39.9	**41.1**	37.3
367A Millbrook Road	N130	**40.8**	**47.9**	**42.2**	**46.6**	**44.8**
539 Millbrook Road	N133	33.3	34.5	31.5	32.4	30.7
Ladbrokes	N134	**40.3**	39.2	**41.2**	39.6	37.6
M271	N152	**61.9**	**59.7**	**58.4**	**56.9**	**49.1**
Coniston road	N153	**42.3**	35.5	31.7	37.7	31.2

3.5.8 Two monitoring sites (M271 – 49.1µg/m^3 and 367 Millbrook Road – 44.8µg/m^3) exceed the annual mean limit value for NO_2 in 2015 and a further 5 sites were just below the limit value. In 2014, more than half of the monitoring sites in the area exceeded the limit value, and concentrations at the remaining sites were also relatively high (the lowest being 32.4µg/m^3 – 81% of the objective value). No unified trend is apparent in the data; nine sites across the period 2011-2015 show slight decreases in annual mean concentration while 3 sites indicate increasing NO_2 concentrations in the area.

[1] AQMA – Air Quality Management Area
[2] SCC – Southampton City Council
[3] NO_2 – Nitrogen Dioxide
[4] AMS – Automatic Monitor Station

3.5.9 The two diffusion tube sites nearest to the scheme are the Redbridge School AMS[1] (N101) immediately to the south east and the Coniston Road site (N153) immediately to the north of the M271 Redbridge Roundabout. During the survey period 2007-2015 the Redbridge School site shows a marginal decrease with no overall trend. The Coniston Road site decreased consistently and markedly until 2014 when concentrations increased by 18.9% over the 2013 value. However, it is unknown whether this trend will continue into the future.

Table 3-3 Results of continuous monitoring conducted by Southampton City Council (exceedances of the UK objective are highlighted in gold)

Site Name	Site ID	Annual mean NO_2[2] (Limit Value: 40µg/m^3)							
		2009	2010	2011	2012	2013	2014	2015	2016
Redbridge School AMS	N101	40	39	**48**	-	**45***	-	-	-
485 Millbrook Road	N103	**50**	**52**	**50**	**43.2**	**41**	**42**	-	-
Southampton A33 (AURN[3])		-	-	-	-	-	-	-	**43**
*58% data capture rate in 2013 (decommissioned at the end of 2013)									

3.5.10 The Millbrook Road AMS is located 1.4km to the south east of the scheme and shows a marked decrease in NO_2 concentrations until 2014, when concentrations increased by 2.4%. It is to be noted, however, that the site remained in exceedance of the UK objective throughout the monitoring period.

3.5.11 The Redbridge School AMS, located immediately adjacent to the scheme, shows no consistent trend in pollutant concentrations. The automatic monitor regularly exceeded the annual mean NO_2 objective between 2008 and 2013, although results were erratic. The monitor was decommissioned in 2013.

3.5.12 The air quality receptors that are most likely to be relevant to the scheme include: the residential area to the north west of the M271 Redbridge Roundabout near Coniston Road; and the high-rise residential building – the Redbridge Towers – to the east on Cuckmere Lane due to their proximity to the roadside. Residential areas to the south of the scheme as well as residential areas and two schools to the north of the A33, namely Redbridge Community School and Redbridge Primary School, are also likely to experience changes in air pollutant concentrations.

CULTURAL HERITAGE

3.5.13 There is one Scheduled Monument, one Grade II* and eight Grade II listed buildings within the 500m study area (see Figure 1 in Appendix A). The closest are the Grade II Listed 2-8 Old Redbridge Road, situated approximately 60m to the south of the site boundary (see Figure 1 in Appendix A), and the Grade II 63 and 65 Test Lane approximately 90m to the west of the site boundary.

3.5.14 There are two LAAP[4] within 500m of the M271 Redbridge Roundabout. There are also 20 non-designated heritage assets within 200m of the site boundary, including the regionally important Andover Canal (also known as the Old Canal see Figure 2 in Appendix A) which roughly followed the existing Gover Road alignment until residential units were built at this location. The state of preservation of which, remains unknown.

[1] AMS – Automatic Monitoring Station
[2] NO_2 – Nitrogen Dioxide
[3] AURN - Automatic Urban and Rural Network
[4] LAAP – Local Areas of Archaeological Potential

3.5.15 Additionally, it is likely that there are remains of a former brewery of local significance, located on the western edge of the scheme. There is moderate to high potential for other previously unrecorded buried archaeology from the prehistoric to the modern period.

LANDSCAPE AND VISUAL IMPACT

3.5.16 There are no national or local landscape related designations within the study area (as shown in Figure 3 in Appendix A). The study area lies within Natural England's NCA[1] 128 - South Hampshire Lowlands. This area is described as a low lying plain between the chalk hills of Hampshire, the South Downs and Southampton Water.

3.5.17 The central island of the M271 Redbridge Roundabout is classed as 'Amenity Green Space' within the SCC[2] GSS[3] and is considered to be of value to the local community (see Figure 3 in Appendix A).

3.5.18 SCC's City Centre Urban Design Guide (SPG[4]) (2000) identifies character areas within the city. However, it does not extend as far as the study area, and therefore townscape character was determined through a site survey undertaken in January 2016.

3.5.19 The majority of the study area comprises various types of residential developments, constructed between the mid and late 20th century. To the north, between Gover Road and the M271 are low density, two storey semi-detached houses and detached bungalows. To the east and south of the scheme, the 20 storey Redbridge Towers is surrounded by three to four storey high residential blocks set within amenity space. To the west of the scheme are two commercial / industrial units that are low rise. Overall, these buildings lack local distinctiveness, and are fragmented by roads. The pedestrian environment is also dominated by the road network.

3.5.20 At ground level the M271 Redbridge Roundabout is visible from approximately 130m away. Longer views are available where there are clear lines of sight including views from 300m on Gover Road (north west), 160m on the A33 (south east) and 200m on the A35 (200m south west).

3.5.21 Longer views are also available from Old Redbridge Road, through the amenity space within Clover Nooke to the south of the scheme. Residents in Redbridge Tower and Clover Nooke flats have elevated views of the scheme with the amenity space on the roundabout being the focal point.

3.5.22 Motorised travellers approaching the site from the west will have open views over the River Test on the A35 as it crosses Redbridge Causeway and intermittent views of the Redbridge old bridges, (a Scheduled Monument) on the northern side of the road.

3.5.23 Once over the Redbridge causeway, views are of residential and commercial development on both sides, views which are restricted by roadside vegetation. The road then splits, with the A35 continuing on the fly-over and the other routes extending to the slip roads of the Redbridge roundabout below the flyover.

3.5.24 Views from the flyover are relatively open whereas views from the roundabout are restricted. There are a few intermittent, long distance views which may open up during winter months because of leaf fall from trees. The views from the roundabout carriageways are restricted by buildings, roadside vegetation, the flyover and a pedestrian footbridge.

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[1] NCA – National Character Area
[2] SCC – Southampton City Council
[3] GSS – Green Space Strategy
[4] SPG – Supplementary Planning Guidance

NATURE CONSERVATION

3.5.25 A number of protected species records were identified within 2km of the site. However the habitats on site were considered unsuitable to support several of these species, including: badgers, otters, water voles, GCN[1] and reptiles.

3.5.26 The M271 Redbridge Roundabout site (extent shown in Figure 4 in Appendix A) has the potential to support breeding birds. The Extended Phase 1 Habitat Survey and PBRA[2] identified 11 buildings that could have the potential to support bats. Ten buildings were identified as having low potential to support a roost, and one had moderate potential. The Extended Phase 1 Habitat Survey found six habitat types on-site or immediately adjacent to the site boundary. The dominant habitat present was poor semi-improved grassland. Also present on site was amenity grassland, plantation broadleaved woodland, mixed semi-natural plantation woodland, intact species poor hedge and scattered trees.

3.5.27 A total of 48 Schedule 1 bird species were identified within 2km of the scheme. Although a wide variety of birds have been recorded in the area, it is unlikely that the scheme will have an impact on bird species. There is a small amount of habitat that is suitable for nesting birds within the site. However Schedule 1 birds identified are associated with the Ramsar, SPA[3] and SAC[4] sites nearby and it is highly unlikely that these species are utilising the scrub habitats identified at the site.

3.5.28 The desk study identified 17 statutory and non-designated sites within the 2 km study area, details of which are provided in Table 3-4.

[1] GCN – Great Crested Newt
[2] PBRA – Preliminary Bat Roost Assessment
[3] SPA – Special Protection Area
[4] SAC - Special Area for Conservation

Table 3-4 Statutory and Non Statutory Designated Sites

SITE DESIGNATION	SITE NAME	APPROXIMATE DISTANCE AND ASPECT FROM CENTRE OF THE SITE
Ramsar	Solent and Southampton Water	0.3km west
SPA	Solent and Southampton Water	0.3km west
pSPA	Solent and Dorset Coast	0.3km west
SAC	Solent Maritime	0.3km west
SSSI	Lower Test Valley	0.3km north west
SSSI	Eling and Bury Marshes	0.5km south east
SSSI	River Test	2km north
SINC	Redbridge Mud Flats	0.3km west
SINC	Redbridge Wharf	0.4km south
SINC	Eling Hill Mudflats	1.2km south west
SINC	Kingfisher and Nutsey Lakes	1.5km north west
SINC	Eling Hill Salt Marsh	1.5km south west
SINC	Land East of Tebourba Way	1.7km east
SINC	Home Covert, Nursling and Rownhams	1.7km north
SINC	Bartley Water Meadow South	1.8km south west
SINC	Jacobs Gutter Copse	1.8km south west
SINC	Lordsdale Greenway	1.8km north east
SINC	A326 Roadside Woodland and Little Copse	1.9km south west

In addition, two statutory designated sites within 30km that are designated for bats were identified. The details are shown in Table 3-5.

Table 3-5 Statutory Designated Sites for bats

SITE DESIGNATION	SITE NAME	APPROXIMATE DISTANCE AND ASPECT FROM CENTRE OF THE SITE
SAC	Mottisfont bats	17km north
SAC	Briddlesford Copses	28km south east

NOISE

3.5.29 A baseline noise survey was undertaken on the 11 February 2016, which confirmed that the existing noise climate is dominated by road traffic. Noise measurements were taken at 15m from the roadside on the A33 westbound off-slip to the M271 Redbridge Roundabout (ML1); and also to the north of the roundabout, on Lower Brownhill Road, adjacent to Test Valley sports facility (ML2). The survey measured values of $L_{A10,\ 18h}$[1] 78 dB at ML1, which is above $L_{A10,\ 18h}$ 68 dB[2]. Measurements at ML2 were $L_{A10,18h}$ 62 dB which would suggest that the noise levels within 30m (distance to the closest residential properties) from the M271 are likely to be around $L_{A10,18h}$ 68 dB or higher.

3.5.30 Within the study area (300m as shown in Figure 5 of Appendix A) there are 2185 residential receptors and 6 non-residential receptors (including schools and places of worship).

3.5.31 There are a number of NIA's[3] identified along the A33 / A35 corridor. The scheme is located within a road traffic NIA (NIA 2192) (see Figure 5 in Appendix A). Two other NIA's, NIA 2240 west of the roundabout, and NIA 2250 east of the roundabout are within 600m from the scheme. Two rail NIA's (RI 372 and RI 373) have been also identified within close proximity to the scheme, and they are also incorporated in the figure as an indication.

PEOPLE AND COMMUNITIES

3.5.32 The M271 Redbridge Roundabout is located to the north west of Southampton City Centre, within Southampton's Redbridge Ward. The nearest communities are Southampton, Totton and Eling, Calmore, Marchwood and Hythe. It is a primary gateway into the City of Southampton, providing links from Salisbury, Winchester, Poole and Bournemouth, and is considered important for the movement of people into and out of the city centre from other local, smaller communities.

3.5.33 There are a number of tourist and recreational facilities located within Southampton and the surrounding area that can be accessed via roads that use the M271 Redbridge Roundabout, for example, the Southampton docks area and associated attractions and facilities including cinemas and ferry terminals, Mayflower Theatre and The Quays Swimming and Diving Complex.

3.5.34 The Indices of Multiple Deprivation uses a combination of information related to income, employment, education, health, skills and training, barriers to housing, services and crime to create an overall score of deprivation. The M271 Redbridge Roundabout is located within the LSOA[4] Southampton 012D, which has an Index of Multiple Deprivation score of 2.063. This is the lowest index of multiple deprivation score of the LSOAs in the immediate area, indicating that it has greater deprivation than the surrounding areas.

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[1] $L_{A10,\ 18hr}$ – L_{A10} is the A-weighted sound level in dB that is exceeded 10 per cent of the time. $L_{A10,\ 18hr}$ is the arithmetic mean of the L_{A10} levels measured during an 18 hour period.

[2] Part of the criteria used to determine the entitlement for noise insulation treatment within residential buildings is that combined expected maximum noise traffic level, i.e. the relevant noise level from the new or altered highway together with any other traffic in the vicinity must not be less than the specified noise level $L_{A10,\ 18h}$ 68 dB.

[3] NIA – Noise Important Area

[4] LSOA – Lower Layer Super Output Area

3.5.35 The Indices of Multiple Deprivation also indicate that the employment and income levels within this area are some of the lowest in the UK. With regards to health, the 2011 census indicates that the overall number of people in very good and good health in Southampton is above the national average. Furthermore the number of people in bad and very bad health is lower than the national average. Life expectancy in more deprived areas of Southampton are on average 8.9 years lower for men and 4.5 years lower for women when compared to less deprived areas.

3.5.36 There are several footpaths adjacent to or in the vicinity of the M271 Redbridge Roundabout. They include un-named pavements surrounding the outer extent of the roundabout, and an un-named footbridge on the north eastern side that connects the roundabout to residential areas within the vicinity of Redbridge Towers.

ROAD DRAINAGE AND THE WATER ENVIRONMENT

3.5.37 The proposed scheme is situated approximately 300m east of the River Test. The river flows in a southerly direction and has several tributaries and land drains that flow through the Lower Test Nature Reserve. The River Test continues to flow in a south-easterly direction where it discharges into the Solent approximately 15km downstream of the study area. This stretch of the River Test, close to the port of Southampton is heavily navigated by commercial and leisure vessels.

3.5.38 The Lower Test Nature Reserve comprises large extents of saltmarsh and reed beds providing valuable habitat for internationally important populations of waders and waterfowl.

3.5.39 The River Test is designated a Main River and is under the jurisdiction of the EA[1]. Water quality within the tidal part of the River Test is assessed against the WFD[2] objectives and is considered moderate for ecological quality and good for chemical quality.

3.5.40 The EA has classified the site as being situated in the operational catchment of the Central Hants Bracklesham Group. The EA has assessed the groundwater against the WFD and it is considered to have Good chemical quality.

3.5.41 The Environment Agency Flood Map for Planning (Rivers and Sea, viewed in 2016) shows the scheme area to be located entirely within Flood Zone 1, meaning there is an annual probability of flooding of less than 1 in 1000 (<0.1%).

3.5.42 There is land categorised as Flood Zone 2, approximately 200m to the west of the scheme location, and an area categorised as Flood Zone 3, closer to the River Test. Flood Zone 2 equates to an annual probability of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) for fluvial flood risk and 1 in 200 (0.5%) for tidal flood risk. Flood Zone 3 is assessed as having a greater than 1 in 100 (>1%) annual probability of fluvial flooding or a greater than 1 in 200 (>0.5%) annual probability of tidal flooding.

3.6 GEOLOGY

3.6.1 A geological assessment was carried out in PCF[3] Stage 1 based on desk research this is summarised in Section 3.12 of the TAR[4]. This assessment was developed further in PCF Stage 2 and more information is provided in the PSSR[5].

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[1] EA – Environment Agency
[2] WFD – Water Framework Directive
[3] PCF – Project Control Framework
[4] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[5] PSSR – PCF Stage 2 M271 Redbridge Roundabout - Preliminary Sources Study Report (Dec 2016 HAGDMS[5] No. 29368)

GROUND CHARACTERISATION

3.6.2 The M271 Redbridge Roundabout is located within an urban area whereby groundcover comprises mixed topsoil and hard standing. There are known historical surface ground workings associated with a former canal (Old Canal) on the south and south west sides of the roundabout.

3.6.3 The BGS[1] maps indicate Made Ground across the majority of the site. BGS borehole logs variously indicate tarmacadam, topsoil containing gravel and concrete, hoggin and mixed fill, to depths of 0.6-1.2m BGL[2]. The permeability of the Made Ground is likely to be variable (low to very high, mixed flow).

3.6.4 The site contains River Terrace Deposits (sand and gravel), which BGS borehole records describe as fine gravel intermixed with varying proportions of clay, silt, and sand, to depths of 3.7-5.7m BGL. The permeability of the River Terrace Deposits is likely to be high or very high (intergranular flow). Tidal Flat Deposits (clay and silt) are present within 250m of the study area (see Figure 1 in Appendix A for Study Area), to the south and west, associated with Southampton Water.

3.6.5 The site is underlain by the Earnley Sand Formation (sand, silt, and clay). BGS borehole records describe firm silty or sandy clay (0.9-1.8m thickness) overlying fine or medium sand containing thin clay lenses.

3.6.6 The Wittering Formation (sand, silt, and clay) outcrops are present within 250m of the south and south east of the study area. Published stratigraphy indicates that the Wittering Formation underlies the Earnley Sand Formation.

3.6.7 There are no faults within 500m of the study area. The permeability of the bedrock is likely to be variable (low to high, intergranular flow).

MINING, SUBSIDENCE AND STABILITY INFORMATION

3.6.8 Using data gathered from the 2016 Groundsure Report, potential geological risks and risk ranges in the study area have been identified and classified as follows:

- Potential for collapsible ground stability hazards (Very Low);
- Potential for compressible ground stability hazards (Negligible – Very Low);
- Potential for ground dissolution stability hazards (Negligible);
- Potential for landslide ground stability hazards (Very Low);
- Potential for running sand ground stability hazards (Very Low); and
- Potential for shrinking or swelling clay ground stability hazards (Negligible – Moderate).

[1] BGS – British Geological Survey
[2] BGL – Below Ground Level

HYDROGEOLOGY

3.6.9 The information obtained in the 2016 Groundsure Report classifies the superficial deposits and the bedrock geology as Secondary 'A' Aquifers. Furthermore, the Environment Agency classifies the groundwater in the area as having Minor Aquifer High vulnerability and there are no groundwater protection zones within or at close proximity to the site.

3.7 EXISTING STATUTORY PUBLIC UTILITIES

3.7.1 Utility enquiries at C2[1] and C3[2] stages were carried out in PCF[3] Stage 1 to identify the presence of existing services within the extent of the roundabout and the potential impact that changes to Redbridge Roundabout may have on them. The results are presented in Section 3.13 and Appendix B of the TAR[4]. The main list of utility services contacted and found to be affected include:

- Scottish Southern Energy
- Openreach / British Telecom
- Southern Gas Network
- Southern Water
- Virgin Media
- Vodafone
- SCC[5] Highway Surface Water Drainage

[1] C2 preliminary enquiry - Refers to request of the potential presence of statutory undertakers apparatus as defined in The New Roads & Street Works Act 1991 - Diversionary Works
[2] C3 budget estimate - Refers to draft scheme and budget estimates of relocating statutory undertakers apparatus as defined in The New Roads & Street Works Act 1991 - Diversionary Works
[3] PCF – Project Control Framework
[4] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[5] SCC – Southampton City Council

4 PLANNING FACTORS

4.1.1 A number of planning factors in terms of local, strategic and national plans have been considered under contexts summarised by the following:

- Housing and Employment;
- Transport and Connectivity;
- Transport Technology;
- Programming;
- Environmental;
- Statutory Process; and
- Interface with Third Parties

4.2 HOUSING AND EMPLOYMENT

4.2.1 SCC's[1] City Centre Action Plan[2] has outlined the proposed levels of growth in Southampton city centre over the 20 years from 2006 to 2026. This includes:

- 97,000 sqm. of new industry and warehouses (34,000 sqm. built by 2013);
- An additional 90,000 sqm. of new shopping (76,000 sqm. built by 2013);
- 110,000 sqm. of new office development; and
- Approximately 5,450 new homes.

4.2.2 Redbridge Roundabout plays a key role in catering for the extra traffic that may be generated by these developments, the impact of which has been analysed within the relevant traffic modelling assessments for this scheme as agreed together with SCC.

4.3 TRANSPORT AND CONNECTIVITY

4.3.1 In conjunction with its housing and employment development strategies, SCC and Highways England are both considering other improvement schemes on the SRN[3]. These schemes include M27 Southampton Junctions as part of the Regional Investment Programme, and M27 Smart Motorway Programme.

4.4 TRANSPORT TECHNOLOGY

4.4.1 Whilst it is not a main priority to deliver significant enhancements in transport technology as part of this scheme, considerations will be made to take account of any plans for improvements or major upgrades that may arise moving forward.

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[1] SCC – Southampton City Council
[2] SCC City Centre Action Plan - https://www.southampton.gov.uk/Images/CCAP-18-March-2015_tcm63-371356.pdf
[3] SRN – Strategic Road Network

4.5 PROGRAMMING

4.5.1 There are two key constraints that will need to be considered:

- → The construction phasing and resourcing in Highways England's supply chain. This needs to be considered as current delivery is expected to be the same time as a large number of national schemes in line with the current Delivery Plan.
- → In addition, much coordination is required between this scheme and other planned works in the area to minimise the extent of cumulative traffic impacts that may arise. There are currently planned maintenance or improvement schemes at the Millbrook Roundabout, Romsey Bridge and the Redbridge Viaduct.

4.6 ENVIRONMENTAL

4.6.1 The scheme is located within an AQMA[1] which is a key consideration, as the scheme will need to ensure that it will not have a significant adverse effect on air quality within the AQMA.

4.6.2 There are a number of nature conservation designations within 2km of the scheme, as outlined in Section 4 and Section 5 of the TAR[2]. An Assessment of Implications on European Sites[3] screening exercise has been undertaken. Impacts on European sites are considered unlikely; but this assessment will be updated with further details as the scheme design develops in consultation with Natural England.

4.6.3 There are designated heritage assets within 500m of the site boundary (see Figure 1 in Appendix A) including a Scheduled Monument, a Grade II* Listed Building, 8 Grade II Listed Buildings and 2 LAAP[4]. Impacts on setting of these assets will need to be considered. In addition there is a non-designated heritage asset, the Andover Canal, which may be present beneath the site boundary. A programme of investigative archaeological fieldwork will be required to assess the potential for archaeological remains to be present within the scheme area, the approach of which will need to be agreed with the SCC[5] Planning Archaeology Team.

4.6.4 There are a number of NIAs[6] identified along the A33 / A35 corridor. The scheme is located within a road traffic NIA (NIA 2192). Two other NIA's are located within the vicinity of the scheme including: NIA 2240 west of the roundabout, and NIA 2250 east of the roundabout, both of which are within 600m from the scheme. Two rail NIA's (RI 372 and RI 373) have been also identified within 500m of the scheme.

[1] AQMA – Air Quality Management Area
[2] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[3] AIES – Assessment of Implications on European Sites (Version 3 dated 13 Feb 2017)
[4] LAAP – Local Areas of Archaeological Potential
[5] SCC – Southampton City Council
[6] NIA – Noise Important Area

4.7 STATUTORY PROCESS

4.7.1 For programming purposes it has been assumed that the scheme will require environmental assessments in the form of an Environmental Impact Assessment (EIA), but a DCO[1] is not expected to be required. Confirmation of whether a statutory EIA is required will be sought at the outset of PCF[2] Stage 3 with the submission of an EIA Screening Letter. The exact scope of any subsequent EIA would be determined through consultation with the Southampton City Council (the local planning authority). This assessment will be based upon further studies including ground investigations and archaeological surveys (to be determined). If a statutory EIA is not required, a non-statutory environmental assessment will be undertaken at PCF Stage 3 for the single option brought forward.

4.8 INTERFACE WITH THIRD PARTIES - UTILITIES

4.8.1 A key planning factor will be to ensure that the design and the subsequent construction work will be planned such that there would be minimal disruption and minimal need for diversion. This will contribute to reducing overall construction costs, and reducing disruptions to all road users.

[1] DCO – Development Consent Order
[2] PCF – Project Control Framework

5 SUMMARY OF DO NOTHING CONSEQUENCES

5.1 INTRODUCTION

5.1.1 For the M271 Traffic Analysis in PCF[1] Stage 1 it was agreed with TAME[2] the scheme options would be modelled in the SRTM[3], a wide-area strategic model with a variable demand function and a SATURN[4] highway assignment model. It was agreed that the scheme options would be compared with a Do Minimum or 'comparison base' scenario. While this was referred to as the Do Minimum scenario, it is essentially a "Do Nothing" scenario with regards to the proposed scheme at Redbridge Roundabout in that the roundabout was assumed to be the same layout in the future years as in the base year. The Do Minimum SRTM scenario included all identified committed schemes (by Highways England and the local authorities) within the extents of the model, including:

- M27 J9 sliproad widening;
- M27 J10 – provision of new slip roads;
- Smart motorways (M3 J9-14 and M27 J4-11); and
- M27 Southampton Junctions improvements, including M27 Junction 8 signalisation.

5.1.2 The scheme options were tested within the SRTM (including the committed schemes) which allowed for the performance of the Redbridge Roundabout scheme options to be assessed in terms of forecast regional traffic growth and wider area reassignment effects. Further information on the SRTM and traffic analysis can be found in Appendix A of the PCF Stage 2 FER[5].

5.1.3 The Do Minimum scenario simulates the conditions where no Redbridge Roundabout improvement scheme is undertaken to eliminate the congestion on the roundabout with the exception of maintenance works assumed to keep the road open. During PCF Stage 2, two Do Minimum scenarios were considered under 2019 and 2036 traffic growth conditions in order to simulate the effects of traffic growth on the operation of the roundabout.

5.2 TRAFFIC GROWTH AND DELAYS

5.2.1 The forecast year traffic growth scenarios against which the scheme options were assessed represent the core growth (based on land use changes) included within the SRTM.

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[1] PCF – Project Control Framework
[2] Traffic Appraisal Modelling and Economics
[3] SRTM - Sub-Regional Transport Model. It is an area-wide multi-modal, variable demand model developed by Systra on behalf of Solent Transport (formerly Transport for South Hampshire)
[4] SATURN - Simulation and Assignment of Traffic to Urban Road Networks
[5] FER – M271/A35 Redbridge Roundabout (RIS1) - Forecasting and Economics Report – PCF Stage 2 (Doc Ref HE551515-WSPPB-GEN-M271PCF2-RP-ZM-FER001), February 2017

5.2.2 The growth forecasts resulted in the relative growth from 2014 to 2019 and 2036 as shown in Table 5-1. This relative growth (from the SRTM[1]) was applied to the 2014 base year S-Paramics model matrices, resulting in increases in the forecast matrix totals which represent additional trips in the modelled area as shown in Table 5-2.

Table 5-1 Traffic Growth 2014 to 2019 and 2036 (based on SRTM Core Growth)

TIME PERIOD	2019	2036
AM Peak	7%	15%
Inter-Peak	11%	24%
PM Peak	7%	18%

Table 5-2 Additional Future Traffic Flows through Redbridge Roundabout S-Paramics Modelled Area

ADDITIONAL FORECAST FLOW IN S-PARAMICS MODEL	DO MINIMUM SCENARIOS	
	2019	2036
AM Peak (0630 - 1000 hours)	2,035	4,288
Inter-Peak (1000 - 1530 hours)	4,643	10,384
PM Peak (1530 - 1900 hours)	2,211	5,775

5.2.3 The S-Paramics modelling indicates that in the Do Minimum scenario the forecast traffic growth results in an increase in delays from 2014 to 2019 in the key movement between the M271 and the A33 into Southampton (both directions combined) of 54% in the morning peak hour and 19% in the evening peak hour.

5.2.4 2014 conditions represent a delay (as compared to free-flow conditions) in the morning peak hour of 16% (equivalent to 47 seconds). Therefore, the traffic modelling indicates an increase in delays from 16% to 54% (more than threefold) during the morning peak hour if no scheme is implemented. These delays would further increase beyond 2019 based on the forecast growth to 2036.

5.3 CONCLUSION

5.3.1 The forecast traffic modelling indicates that there will be an increase in the demand for trips through the Redbridge Roundabout to 2019 and 2036 which will result in an increase in congestion and delays at the junction if no improvement scheme at Redbridge Roundabout is implemented.

[1] SRTM - Sub-Regional Transport Model

6 SUMMARY OF SCHEME OPTIONS

6.1 INTRODUCTION

6.1.1 Chapter 11 of the PCF[1] Stage 1 TAR[2] outlines the scheme options and accounts for the decision on which options would be taken forward to PCF Stage 2.

6.1.2 Option 1 was rejected for any further consideration due to the following main factor:

- → Significant additional conflict points between NMUs[3] and the general traffic due to proposed additional at-grade crossings. This results in noncompliance with the CSR[4] and the NMU Objectives.

6.1.3 Nonetheless, upon Highways England decision, Option 1 was still retained in the PCF Stage 1 publications for comparative reasons and was also presented at PCF Stage 2 in the public consultation events to illustrate the narration of the scheme. For this reason, this chapter also includes a summary description of Option 1.

6.2 KEY DESIGN CONSIDERATIONS

6.2.1 One of the key design considerations was to relieve congestion at the roundabout. Ultimately, the proposed design layouts aim to offer additional traffic capacity through the roundabout by maximising the use of available space within the existing highway boundary whilst avoiding impact on the existing physical constraints, particularly the Redbridge Flyover.

6.2.2 A primary cause of congestion identified, was that queues from the A35 westbound on-slip merge with westbound traffic crossing the Redbridge Flyover could back up into the Redbridge Roundabout during peak periods.

6.2.3 Previous studies by CH2M Hill[5] identified the concept of a cut-through link as a way of providing extra lane capacity at the junction. WSP | Parsons Brinckerhoff retained this as an option and formed the basis of Option 1 on this concept.

[1] PCF – Project Control Framework
[2] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[3] NMU – Non Motorised User
[4] CSR – Client Scheme Requirements (19 Sep 2016)
[5] Redbridge (A33) Roundabout Improvement Strategy – Preliminary Design Report. CH2M Hill, October 2013.

6.2.4 Through design meetings with SCC[1] in PCF Stage 1, three key design considerations were taken on board:

- → Provision of a dedicated free-flow left turning link between M271 southbound and A33 eastbound on-slip;
- → Removal of bus gate on A33 westbound off-slip; and
- → Provisions to accommodate Sustrans's cycle route facilities.

6.2.5 A number of design considerations were also discussed at the PCF[2] Stage 1 Value Management workshop. Among the discussions were NMU[3] provisions and the importance of taking these into account when proposing / reviewing crossing facilities.

6.2.6 Consequently, it was noted that Option 1 would be unable to satisfy all the NMU requirements due to the presence of the cut-through link. This will result in the need for the introduction of three additional at-grade crossings across the western arms of the roundabout in order to maintain NMU accessibility. This would result in significant additional conflict points between NMUs and the general traffic.

6.2.7 The presence of the existing toucan crossings on the east-facing slips was also reviewed on safety grounds. The free-flow left turn from M271 – aimed at improving flow conditions at the junction – could lead to higher speeds and thus a greater safety risk exposure for NMUs. It was therefore agreed that the toucan crossing across the eastbound A33 slip road would be removed; consequently the toucan across the westbound slip road would have to be removed as well.

6.2.8 Sections 6.3 to 6.6 summarise the options that have been considered, including the relevant drawings presented in Appendix B. Chapter 11 in the TAR[4] presents a summary of other options discounted earlier in the design phases (PCF Stages 0-1).

6.3 COMMON DESIGN ELEMENTS IN ALL OPTIONS

- → A segregated 4.5m wide free-flow left turning link between M271 southbound and A33 eastbound on-slip (Redbridge Road), as committed within the Highways England Road Investment Strategy[5]. A 1.5m wide physical traffic island extending into A33 is proposed to maintain separation between the M271 left turning traffic and the eastbound circulatory traffic.
- → On A33 westbound off-slip, remove bus gate and its corresponding bus stage signals, but maintaining the existing bus lane on the approach to the roundabout.

[1] SCC – Southampton City Council
[2] PCF – Project Control Framework
[3] NMU – Non Motorised User
[4] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[5] Highways England Road Investment Strategy for the 2015/16 – 2019/20 Road Period- https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/408514/ris-for-2015-16-road-period-web-version.pdf

6.4 OPTION 1 – MAIN DESIGN ELEMENTS

- This option features a new at-grade through-about link with two 4.5m wide lanes, creating a "Hamburger" type junction at the roundabout. The new link is dedicated to right turning traffic from A33 westbound to M271 northbound only.
- The intersection of the through-about link with the roundabout junction circulatory carriageway would be signal controlled.
- New toucan crossings across the A35 slip roads.
- The existing toucan crossing across the A33 westbound off-slip would be removed and relocated closer to the roundabout and incorporated within the roundabout's traffic signal operation.
- In order to accommodate this option, the existing pedestrian footbridge and subways from the existing roundabout junction central island would need to be removed. The loss of these existing NMU[1] facilities would require replacement with alternative at-grade crossings at the roundabout.

6.5 OPTION 2 – MAIN DESIGN ELEMENTS

- Four 3.65m wide circulatory lanes to the south of the roundabout. This requires widening of the roundabout which could be accommodated within the inner central island.
- Remove both at-grade toucan crossings across the A33 east-facing slip roads due to its close proximity to the new free-flow left turning link between M271 southbound and A33 eastbound on-slip.
- Maintain and upgrade both subways and the existing footbridge to provide a total segregation of NMUs from the general traffic through the centre of the roundabout. Whilst the actual subway remains in place, its approach ramps and steps would be reconstructed to accommodate the new kerb lines. This also creates an opportunity to improve the ramps and steps currently in provision.
- Maintain, as far as feasible, the proposed 4.0m wide shared surface along the southern footway. To accommodate a constant width of 4.0m cycle track additional land take will be required. This is in order to avoid relocating utility apparatus and the subway entrance on the south side. It is understood that the affected southern boundary hedge and the required additional land along the northern boundary of Clover Nooke residential estate is owned by SCC[2] Housing.
- SCC has confirmed that they are in agreement to rededicate the land from SCC Housing to SCC Highways to enable the cycle path to be constructed. This is subject to Highways England securing the necessary consents, covering the landscaping and fencing to a specification agreed with SCC and meet all legal and other costs in preparing the documentations.

[1] NMU – Non Motorised User
[2] SCC – Southampton City Council

6.6 OPTION 3 – MAIN DESIGN ELEMENTS

- Four 4.0m wide circulatory lanes to the southern arm and three lanes to the western arm of the roundabout circulatory carriageway. This option requires a slightly increased extent of widening within the central island compared to Option 2.
- Remove both at-grade toucan crossings across the A33 east facing slip roads, as per Option 2.
- Also similarly to Option 2, maintain and upgrade both subways and the existing footbridge to provide a total segregation of NMUs[1] from general traffic through the centre of the roundabout as existing. As the proposed widening of the circulatory carriageways is more extensive in this option compared to Option 2, modifications to the centre island would be slightly more extensive. The opportunity to improve existing ramps and steps to the subways and the footbridge would also apply here.
- Maintain, as far as feasible, the proposed 4.0m wide shared surface along the southern footway. The observation in Option 2 regarding potential land take is also relevant here.

[1] NMU – Non Motorised User

7 SUMMARY OF TABLES OF TRAFFIC, ECONOMICS AND COSTS

7.1 SUMMARY OF ECONOMIC ASSESSMENT

7.1.1 The results of the modelling and economic appraisal have shown that both scheme options provide good BCR[1] values (Option 2: 5.64; Option 3: 8.84 – calculated from a combination of TUBA[2] benefits, accident benefits and monetised environmental impacts). These BCRs would represent a very high value for money category.

7.2 MODELLING METHODOLOGY

7.2.1 Traffic modelling in PCF[3] Stage 2 focused on addressing the problems and constraints identified in PCF Stage 1 due to excessive demand forecast by the SRTM[4] that couldn't be accommodated by the detailed S-Paramics model. The Stage 2 forecast methodology was split into three phases, and the forecast flows were based on the S-Paramics demand matrices developed during Stage 1 from a combination of SRTM cordon demand and the base year average weekday S-Paramics matrix.

7.2.2 The three phases included in the forecast methodology were as follows:

- Phase 1 - Converting the Stage 1 demand matrices from growth forecasts constrained to TEMPro[5] 6.2 to TEMPro 7.0. This resulted in lower growth to the 2019 opening year, but higher growth in 2031;
- Phase 2 - Analysing the SRTM demand matrices to determine if there were any excessive changes due to reassignment in the scheme options. This investigation determined that there were no excessive changes in 2019 and 2031;
- Phase 3 - Interpolating demand between 2019 and 2031 to find the maximum amount of traffic growth that could realistically be accommodated by the S-Paramics model. This "demand capping" exercise also looked at model network capacity and signal timings. This phase determined that 2025 was the latest year that could reasonably be accommodated, and this was selected as the future year for the purpose of scheme options assessment.

[1] BCR – Benefit Cost Ratio
[2] TUBA – Transport User Benefit Analysis (transport economic appraisal software developed by Atkins Limited on behalf of the Department for Transport)
[3] PCF – Project Control Framework
[4] SRTM – Sub Regional Transport Model
[5] TEMPro – Trip End Model Presentation Program

7.2.3 The forecast methodology resulted in adjusted S-Paramics demand matrices ready for modelling, with different matrices for the Do Minimum and each scheme option. These were run through S-Paramics for 2019 and 2025.

7.2.4 The impacts of the scheme on Saturday mid-day peak traffic were not assessed in Stage 2 due to the absence of a validated Saturday peak S-Paramics model. However, a review of the traffic count data from November 2014 (weekday) and March 2015 (Saturday) indicate that the mid-day peak flows on a Saturday are not higher on any of the approaches (nor in combination) than a flow that is typical during a weekday morning peak. Hence, the impacts of the scheme on a Saturday can be reasonably estimated from the weekday peak assessments. The impacts of the scheme on Saturday traffic will be assessed in PCF Stage 3.

7.3 SUMMARY OF S-PARAMICS MODEL RESULTS

7.3.1 Link flow and journey time results were extracted for the S-Paramics models run as part of the economic analysis, including the 2019 and 2025 years for each scenario. Each model was run with 20 random seeds and the runs averaged to obtain the results. Results are shown for AM and PM peak hours, 08:00-09:00 and 17:00-18:00 respectively in Table 7-1.

7.3.2 There are some sections where flows seem to have reduced between 2019 and 2025. In all scenarios, the M271 entry to the roundabout reduces in this way during the AM peak hour. This is due to flow breakdown on approach to the roundabout in 2025. In 2019, traffic levels are high, but not at the level where flow breakdown occurs yet. However by 2025, the level of traffic is such that flow breakdown occurs. This is only slightly noticeable in the Do Minimum scenario, where the 2025 M271 peak hour flow is seven vehicles fewer than in 2019. However in the scheme options, the free-flow left-turn slip-lane seems to create a conflict point where traffic is trying to move into the nearside lane to use the free-flow left-turn slip-lane. The lane is particularly attractive to traffic and this results in increased lane changing. This causes flow breakdown and excessive queuing on approach to the roundabout.

Table 7-1 Link Flows for all scenarios

	M271 SB	FREE LEFT	WB OFF-SLIP MAIN	WB OFF-SLIP BUS	EB OFF-SLIP	GOVER ROAD	A33 MAINLINE WB	A33 MAINLINE EB
Base 2014 AM	2499	-	1069	8	1142	55	1367	2400
Base 2014 PM	2046	-	1348	9	950	97	2141	1649
DM 2019 AM	2595	-	1116	8	1084	65	1398	2483
DM 2019 PM	2220	-	1385	9	965	96	2278	1882
Op2 2019 AM	2601	1880	1195	8	1067	65	1436	2511
Op2 2019 PM	2281	1251	1466	9	919	72	2272	1897
Op3 2019 AM	2625	1897	1198	8	1092	65	1439	2493
Op3 2019 PM	2291	1258	1455	9	967	140	2270	1891
DM 2025 AM	2588	-	1197	8	1068	77	1550	2547
DM 2025 PM	2270	-	1362	9	977	106	2289	1964
Op2 2025 AM	2519	1835	1246	8	1047	76	1533	2579
Op2 2025 PM	2328	1291	1458	9	928	78	2302	1982
Op3 2025 AM	2548	1852	1245	8	1074	78	1530	2552
Op3 2025 PM	2317	1284	1440	9	970	150	2271	1968

7.3.3 Journey time results are shown for the key routes in each direction between the A33 Southampton and the M271, in Table 7-2 for 2019 and Table 7-3 for 2025. Results are shown for the AM and PM peak hours of 08:00-09:00 and 17:00-18:00, respectively. All figures are in seconds.

Table 7-2 Journey time results in 2019 (all scenarios)

		2019		
		Do Min	**Option 2**	**Option 3**
AM	Southampton (A33) to M271	296	230	144
	M271 to Southampton (A33)	233	289	267
PM	Southampton (A33) to M271	198	150	145
	M271 to Southampton (A33)	150	119	121

Table 7-3 Journey time results in 2025 (all scenarios)

		2025		
		Do Min	**Option 2**	**Option 3**
AM	Southampton (A33) to M271	180	165	141
	M271 to Southampton (A33)	345	445	407
PM	Southampton (A33) to M271	258	202	215
	M271 to Southampton (A33)	164	124	146

7.3.4 The tables show that generally the proposed options improve journey times for vehicles travelling on both routes; however there does at first appear to be some counterintuitive journey time results.

7.3.5 In both options, there is a free-flow left-turn slip-lane included on the southbound M271 going eastbound towards Southampton. It might be expected that this provides a decrease in journey time. However, in 2019 and 2025, the proposed options actually show increased journey times for traffic going southbound along the M271 in the morning peak. This appears to be due to the free-flow left-turn slip-lane creating a conflict point where traffic in the model along the M271 southbound is trying to move into the nearside lane to use the free left-turn slip-lane. The slip-lane is particularly attractive to traffic and this results in increased lane changing and extra delay is created due to this behaviour.

7.3.6 The lane changing behaviour – and associated impacts on journey times – is a product of the traffic modelling software and is unlikely to be as significant in reality. In reality during the morning peak period (when a larger proportion of traffic is commuters who are familiar with the network) drivers will make their lane choice much sooner (e.g. when exiting M27 Junction 3) and as a result the lane changing behaviour close to Redbridge Roundabout will not be required. There will be the opportunity to refine the traffic modelling to more closely reflect this in future stages.

7.4 SUMMARY OF MODELLED BENEFITS – USER BENEFITS

7.4.1 TUBA[1] Version 1.9.7 (64-bit) was used for the economic appraisal. Outputs from the S-Paramics models for 2019 and 2025 have been used to derive the PVBs[2] of each scheme option by comparison to the Do Minimum scenario. Traffic growth has been capped at the modelled future year of 2025.

7.4.2 The user benefits are summarised in the TEE[3] tables in Table 7-4 and Table 7-5. The BCRs[4] calculated by TUBA[5] (i.e. excluding accident benefits) were Option 2 (5.7) and Option 3 (8.8).

Table 7-4 Option 2 TEE table (values in '000s, in 2010 prices discounted to 2010)

CONSUMER - COMMUTING USER BENEFITS	ALL MODES	ROAD	
Travel Time	5118	5118	
Vehicle operating costs	167	167	
User charges	0	0	
Construction maintenance delays	0	0	
NET CONSUMER - COMMUTING BENEFITS	5286	5286	
Consumer - Other user benefits	**All modes**	**Road**	
Travel Time	13373	13373	
Vehicle operating costs	364	364	
User charges	0	0	
Construction maintenance delays	0	0	
NET CONSUMER - OTHER BENEFITS	13737	13737	
Business user benefits	**All modes**	**Road Personal**	**Road Freight**
Travel Time	13566	10873	2693
Vehicle operating costs	332	483	-151
User charges	0	0	0
Construction maintenance delays	0	0	0
Subtotal	13899	11356	2542
Private Sector Provider Impacts	**All modes**	**Road**	
Revenue	0	0	
Operating costs	0	0	
Investment costs	0	0	
Grant/subsidy	0	0	
Subtotal	0	0	
Other business Impacts	**All modes**	**Road**	
Developer contributions	0	0	
NET BUSINESS IMPACT	13899		
TOTAL			
Present Value of Transport Economic Efficiency Benefits (TEE)	**32922**		

[1] TUBA – Transport User Benefit Analysis (transport economic appraisal software developed by Atkins Limited on behalf of the Department for Transport)
[2] PVBs – Present Value of Benefits
[3] TEE – Economic Efficiency of the Transport System
[4] BCR – Benefit Cost Ratio
[5] TUBA – Transport User Benefit Analysis (transport economic appraisal software developed by Atkins Limited on behalf of the Department for Transport)

Table 7-5 Option 3 TEE[1] table (values in '000s, in 2010 prices discounted to 2010)

CONSUMER - COMMUTING USER BENEFITS	ALL MODES	ROAD	
Travel Time	8913	8913	
Vehicle operating costs	332	332	
User charges	0	0	
Construction maintenance delays	0	0	
NET CONSUMER - COMMUTING BENEFITS	9245	9245	
Consumer - Other user benefits	**All modes**	**Road**	
Travel Time	21860	21860	
Vehicle operating costs	620	620	
User charges	0	0	
Construction maintenance delays	0	0	
NET CONSUMER - OTHER BENEFITS	22479	22479	
Business user benefits	**All modes**	**Road Personal**	**Road Freight**
Travel Time	25200	18365	6835
Vehicle operating costs	1639	806	832
User charges	0	0	0
Construction maintenance delays	0	0	0
Subtotal	26838	19171	7667
Private Sector Provider Impacts	**All modes**	**Road**	
Revenue	0	0	
Operating costs	0	0	
Investment costs	0	0	
Grant/subsidy	0	0	
Subtotal	0	0	
Other business Impacts	**All modes**	**Road**	
Developer contributions	0	0	
NET BUSINESS IMPACT	26838		
TOTAL			
Present Value of Transport Economic Efficiency Benefits (TEE)	**58562**		

ZERO GROWTH SENSITIVITY TEST

7.4.3 A sensitivity test was undertaken to explore the effects of zero traffic growth on the scheme modelling and economics, and whether a positive BCR[2] could be achieved for the scheme options. This test used the average weekday 2014 demand matrices. The same demand matrices were applied in the Do Minimum and scheme option models and there was no reassignment of traffic in either of the scheme option models.

7.4.4 The S-Paramics model results were run through TUBA[3], which calculated BCRs of Option 2 (3.3) and Option 3 (9.9).

7.4.5 The zero growth sensitivity test provides a measure of confidence that the scheme provides benefits / value for money without the requirement for future traffic growth (and complications regarding the re-assignment of traffic).

[1] TEE – Economic Efficiency of the Transport System
[2] BCR – Benefit Cost Ratio

TUBA 1.9.8 SENSITIVITY TEST

7.4.6 The latest (interim) version (TUBA[1] 1.9.8) was used to evaluate the potential impact of varying the value of time by distance as an additional Sensitivity Test.

7.4.7 The exact trip distance information is not available, as the Paramics modelling is based upon closed cordon ANPR[2] data with future growth and route choice / VDM[3] effects derived from a cordon version of matrices from SRTM[4]. Four different sensitivity tests were undertaken to gauge the effect of the distance banding on the scheme BCRs[5]. Each test assumed all trips fell within a single distance band. The BCRs are shown in Table 7-6.

Table 7-6 BCRs from TUBA 1.9.8 sensitivity tests

		OPTION 2	OPTION 3
BCRs using v1.9.7		**5.7**	**8.8**
BCRs using 1.9.8	<50kms	4.5	7.1
	50 - 100kms	4.9	7.7
	100 - 200kms	5.2	8.2
	>200kms	5.6	8.8

7.4.8 The table shows that scheme BCRs still represent very high value for money even when assuming a worst case scenario where all trips are assumed to be less than 50kms in length (the lowest banding for value of time).

[1] TUBA – Transport User Benefit Analysis (transport economic appraisal software developed by Atkins Limited on behalf of the Department for Transport)
[2] ANPR – Automatic Number Plate Recognition
[3] VDM – Variable Demand Modelling
[4] SRTM – Sub Regional Transport Model
[5] BCR – Benefit Cost Ratio

7.5 SUMMARY OF SCHEME OPTIONS COSTS

7.5.1 The scheme options costs are summarised in the PA[1] tables in Table 7-7 and Table 7-8.

Table 7-7 Option 2 PA results (values in '000s, in 2010 prices discounted to 2010)

LOCAL GOVERNMENT FUNDING	ALL MODES	ROAD
Revenue	0	0
Operating Costs	0	0
Investment Costs	0	0
Developer Contributions	0	0
Grant/Subsidy	0	0
NET IMPACT	0	0
Central Government Funding: Transport	**All modes**	**Road**
Revenue	0	0
Operating costs	0	0
Investment costs	5829	5829
Developer contributions	0	0
Grant/Subsidy	0	0
NET IMPACT	5829	5829
Central Government Funding: Non-Transport		
Indirect tax revenues	37	37
TOTALS		
Broad Transport Budget	5829	5829
Wider Public Finances	37	37

Table 7-8 Option 3 PA results (values in '000s, in 2010 prices discounted to 2010)

LOCAL GOVERNMENT FUNDING	ALL MODES	ROAD
Revenue	0	0
Operating Costs	0	0
Investment Costs	0	0
Developer Contributions	0	0
Grant/Subsidy	0	0
NET IMPACT	0	0
Central Government Funding: Transport	**All modes**	**Road**
Revenue	0	0
Operating costs	0	0
Investment costs	6586	6586
Developer contributions	0	0
Grant/Subsidy	0	0
NET IMPACT	6586	6586
Central Government Funding: Non-Transport		
Indirect tax revenues	622	622
TOTALS		
Broad Transport Budget	6586	6586
Wider Public Finances	622	622

[1] PA – Public Accounts

7.6 SUMMARY OF ACCIDENT BENEFITS

7.6.1 WSP | Parsons Brinckerhoff undertook the Yes/No/Maybe analysis of the predicted PIA[1] savings for each scheme option. This was undertaken by examining each PIA record at Redbridge Roundabout for the five year period between August 2010 and July 2015. The Yes/No/Maybe analysis was undertaken by an experienced road safety specialist.

7.6.2 Each of the above categories was given a rating factor for how likely they were to be prevented. These were 0.9 for "yes", 0.35 for "maybe" and 0 for "no". The predicted number of PIAs/casualties saved was then calculated as the sum of the average number of PIAs/casualties in each category in each year multiplied by the "likelihood factor" i.e. 0.9 x Yes + 0.35 x Maybe.

7.6.3 The predicted number of PIAs and casualties saved were then monetised making use of appropriate economic parameters contained in the 'WebTAG Data Book 2015', as issued by the DfT[2]. The majority of the cost savings were allocated by casualty but other non-injury related cost savings (insurance, vehicle damage, police costs) were allocated on a per PIA basis.

7.6.4 The calculated accident savings for both scheme options were positive - Option 2 (£1.199m) and Option 3 (£1.445m), which represents the total accident benefits over a 60-year appraisal period from scheme opening.

7.7 MONETISED COSTS AND BENEFITS (AMCB) TABLES

7.7.1 The combination of the user benefits calculated using TUBA[3] and the accident benefits is summarised in the AMCB[4] in Table 7-9 and Table 7-10. These tables indicate BCRs[5] of 5.8 for Option 2 and 9.1 for Option 3.

Table 7-9 Option 2 AMCB[6] results (values in '000s, in 2010 prices discounted to 2010)

ELEMENT	VALUE
Greenhouse Gases	-22
Economic Efficiency: Consumer Users (Commuting)	5286
Economic Efficiency: Consumer Users (Other)	13737
Economic Efficiency: Business Users and Providers	13899
Wider Public Finances (Indirect Taxation Revenues)	-37
Present Value of Benefits (PVB)	32863
Accident benefits	1199
Broad Transport Budget	5829
Present Value of Costs (PVC)	5829
OVERALL IMPACTS	
Net Present Value (NPV)	28233
Benefit to Cost Ratio (BCR)	**5.8**

[1] PIA – Personal Injury Accident
[2] DfT – Department for Transport
[3] TUBA – Transport User Benefit Analysis (transport economic appraisal software developed by Atkins Limited on behalf of the Department for Transport)
[4] AMCB – Analysis of Monetised Costs and Benefits
[5] BCR – Benefit Cost Ratio
[6] AMCB – Analysis of Monetised Costs and Benefits

Table 7-10 Option 3 AMCB results (values in '000s, in 2010 prices discounted to 2010)

ELEMENT	VALUE
Greenhouse Gases	228
Economic Efficiency: Consumer Users (Commuting)	9245
Economic Efficiency: Consumer Users (Other)	22479
Economic Efficiency: Business Users and Providers	26838
Wider Public Finances (Indirect Taxation Revenues)	-622
Present Value of Benefits (PVB)	58168
Accident benefits	1445
Broad Transport Budget	6586
Present Value of Costs (PVC)	6586
OVERALL IMPACTS	
Net Present Value (NPV)	53027
Benefit to Cost Ratio (BCR)	**9.1**

7.8 COMMENTARY ON BENEFITS CALCULATED

7.8.1 Both options provide significant benefits in both 2019 and 2025. Traffic travelling westbound along the mainline to both the M271 and Totton sees benefits in all periods in both years. Traffic going to the M271 is directly benefited by the fourth circulatory lane on the southern section of the roundabout. This prevents traffic blocking back from the westbound on-slip and obstructing the right turners. This in turn frees up capacity on the mainline for traffic travelling westbound towards Totton.

7.8.2 The Option 3 BCR[1] is higher than Option 2, and this is largely due to the differences on the western circulatory at Redbridge Roundabout. In Option 2, there are only two lanes (as per the Do Minimum layout). With the extra traffic attracted to the roundabout because of the extra capacity provided by the option layout, Gover Road experiences significant disbenefits as there are fewer gaps for traffic entering the roundabout from this approach. Option 3 provides a third lane at the western circulatory. Right turning traffic to the M271 uses the centre and offside lanes of the roundabout, leaving the nearside lane less congested. This allows traffic from Gover Road to enter the roundabout much easier, providing positive benefits for this traffic.

7.8.3 The retention of two circulatory lanes under Option 2 is understood to be a design decision aimed at addressing local concerns about the number of lanes that traffic from Gover Road would need to cross if a third lane is included. Hence, if Option 2 is taken forward into future stages the perceived benefits of fewer circulatory lanes would need to be balanced against the extra modelled delays resulting from fewer opportunities to join the circulatory carriageway from the Gover Road approach. If the circulatory is widened to three lanes (as in Option 3) the disbenefits to Gover Road are alleviated.

[1] BCR – Benefit Cost Ratio

7.8.4 The free-flow left-turn slip-lane provides benefits in the inter-peak and PM in both options. However in the AM, it causes excessive queuing on the M271 approach to the roundabout in both options, particularly in 2025. This is due to lane changing as vehicles try to move into the nearside lane of the M271 to use the free left turn. There is a very high level of traffic in the morning peak and the lane changing leads to significant queuing. A sensitivity test was undertaken to extend the M271 approach to a point north of the Nursling junction, to test whether this extra link length allowed enough time for vehicles to change lane. It did eliminate queuing on the approach to the roundabout, but there was still some flow breakdown further upstream. It is proposed to look at this issue in more detail during the operational assessment.

7.9 MONETISED BENEFITS FROM ENVIRONMENTAL ASSESSMENT

7.9.1 During PCF[1] Stage 2 a detailed environmental assessment was undertaken which included the monetisation of noise, air quality and greenhouse gas impacts of the scheme options.

7.9.2 The PCF Stage 2 Appraisal Summary Tables (refer to Chapter **Error! Reference source not found.**) include the transport economic assessment values as well as the monetised environmental impacts calculated. The noise, air quality and greenhouse gases impacts were assessed using the same strategic traffic modelling outputs used as input to the economic assessment (i.e. the PCF Stage 1 SRTM[2] outputs).

7.9.3 Monetised environmental impacts (noise, air quality and greenhouse gases) were negative. The inclusion of the monetised environmental impacts results in the scheme option benefit-cost ratios as set out in Table 7-11 and Table 7-12.

Table 7-11 Option 2 BCR with inclusion of environmental impacts

ELEMENT	VALUE
Noise	**-237.28**
Air Quality	**-87.64**
Greenhouse Gases (*replacing TUBA value*)	**-888.50**
Economic Efficiency: Consumer Users (Commuting)	5286
Economic Efficiency: Consumer Users (Other)	13737
Economic Efficiency: Business Users and Providers	13899
Wider Public Finances (Indirect Taxation Revenues)	-37
Present Value of Benefits (PVB)	31672
Accident benefits	1199
Broad Transport Budget	5829
Present Value of Costs (PVC)	5829
OVERALL IMPACTS	
Net Present Value (NPV)	27042
Benefit to Cost Ratio (BCR)	**5.64**

[1] PCF – Project Control Framework
[2] SRTM - Sub-Regional Transport Model

Table 7-12 Option 3 BCR with inclusion of environmental impacts

ELEMENT	VALUE
Noise	**-198.94**
Air Quality	**-84.52**
Greenhouse Gases (*replacing TUBA value*)	**-878.77**
Economic Efficiency: Consumer Users (Commuting)	9245
Economic Efficiency: Consumer Users (Other)	22479
Economic Efficiency: Business Users and Providers	26838
Wider Public Finances (Indirect Taxation Revenues)	-622
Present Value of Benefits (PVB)	56778
Accident benefits	1445
Broad Transport Budget	6586
Present Value of Costs (PVC)	6586
OVERALL IMPACTS	
Net Present Value (NPV)	51637
Benefit to Cost Ratio (BCR)	**8.84**

7.10 ASSESSMENT OF ALTERNATIVE MODES

7.10.1 An assessment of alternative modes was undertaken in accordance with TAME[1] Advice Note 2 v1.0. The alternative modes considered and their assessments are set out in Table 7-13. Commentary on their ability to address the traffic flows and distributions and their ability to meet the scheme objectives is included.

[1] TAME – Traffic Appraisal, Modelling and Economics

Table 7-13 Alternative Mode Consideration

ALTERNATIVE MODE CONSIDERED	COMMENTARY ON POTENTIAL CAPACITY
Cycling	The wide spread of origins and destinations, and the length of trips (the majority of trips exceeding 6 miles in length), indicates that cycling would not be able to impact significantly upon the current and future traffic demand for any of the key origin-destination pairs.
Rail-based public transport	The wide spread of origins and destinations and the high costs of any new rail infrastructure would render any rail-based options non-viable. There are existing rail links between Southampton City Centre and Totton, and whilst this link could alleviate some demand on the A35 and A33 it would not directly impact upon the demand through Redbridge Roundabout. Assessment of 2011 Census Journey to Work data indicated that there are a number of origin-destination "pairs" that could represent significant demand, with the potential for mode change to rail. Rail trips to/from all the key surrounding areas (including the Test Valley (Salisbury, Andover, Romsey), Winchester and the New Forest) were considered and the current journey lengths for train and car compared. The analysis identified that for the majority of these the rail journey times are current significantly lower than car journey times to/from Southampton. The conclusion is that whilst there is a theoretical opportunity for mode change to rail, the lack of current uptake (despite the favourable comparative journey time) indicates that other factors (e.g. station accessibility) play a significant role. It would be outside the scope of this project to address these challenges and the impact of any mode shift on the Redbridge Roundabout would be very small.
Road-based public transport (bus services)	The wide spread of origins and destinations would limit the impact of any new bus routes and/or services. The commercial viability of any longer-distance services would be low. There are existing bus services links between Southampton City Centre and Totton, and whilst this could alleviate some demand on the A35 and A33 it would not directly impact upon the demand through Redbridge Roundabout.
Road-based public transport (Park and Ride)	A PnR[1] service based along the M271 north of Redbridge Roundabout could potentially serve a large proportion of the trips heading into Redbridge Roundabout in the AM peak (and the reverse in the PM peak). The constraints to such a service would be the availability of land for a PnR site, the ability of the PnR service to serve the appropriate destinations in the city centre, and the commercial viability of a service. All of the previous studies into PnR in Southampton indicated that there is in general an oversupply of car parking spaces, both on and off road, in the city centre. The City Council only manages a small proportion of off-road spaces, making it difficult to influence wider pricing regimes. The current and historic pricing structure in the city centre car parks is lower than comparable centres in the UK. *Test of PnR service:* The best case scenario would be a PnR service that runs between the M271 (located approximately at M271 Junction 1) and the Southampton City Centre. This movement represents 21% (543 trips) of the traffic along the M271 (southbound) in the AM peak hour. In order to address the growth to 2025, 75% of the 250 new trips would need to be captured by the PnR service, which would represent an intercept rate of 34%. This is far in excess of intercept rates for existing PnR services in the UK. A more realistic intercept rate of 10% would represent 55 trips which would not relieve sufficient congestion at Redbridge Roundabout.

7.10.2 The conclusion is that there are no alternative modes which would address current and future congestion and achieve the scheme objectives.

[1] PnR – Park and Ride

7.11 CONCLUSION

7.11.1 Overall, both options provide strong positive BCRs[1] when analysed over the 60-year assessment period. It is considered that there continues to be an economic justification for both scheme options.

[1] BCR – Benefit Cost Ratio

8 SUMMARY OF OPERATIONAL ASSESSMENT

8.1 INTRODUCTION

8.1.1 The Operational Assessment outlines the road characteristics and option design implications for:

- → Scheme's Operating Regime; and
- → Driver Compliance.

8.2 SCHEME'S OPERATING REGIME

8.2.1 The scheme's existing maintenance access has been outlined in Section 3.15 of the PCF[1] Stage 1 TAR[2]. The technology and maintenance assessment is discussed further in Chapter 9 of this report and a detailed description of the proposed design options, including specific dimensions, is discussed in Chapter 6.

8.2.1 SCC[3] and BBLP[4], in their respective capacities as the local highway authority and the maintenance contractor, are responsible for the routine inspection, maintenance and operation of the roundabout. Both Options 2 and 3 are designed to improve the roundabout's layout and capacity; as a result the proposed upgrade should reduce the likelihood of the circulatory carriageway locking up, as well as other issues as described in Section 3.2.

8.2.2 As documented in the Safety Plan[5], it is not envisaged that the proposed works will introduce any new or exceptional maintenance or operational experience requirements. The operation of the facilities will have no new or different implications or issues for competence or roles and responsibilities within Highways England or its suppliers when compared with the existing requirements. Therefore, it is not currently envisaged that the existing operating regime would need to be altered as a result of the proposed modifications, or would they cause any impact on resource requirements, whether at the NTOC[6], the RCC[7], or the TOS[8].

8.2.3 However, SCC and BBLP's current response to incidents should be updated to recognise how incidents should be managed in future. Even though the scheme will not alter the layout of roundabout greatly, the incident response may be affected by other changes such as traffic volumes and behaviours once the new scheme is operational.

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[1] PCF – Project Control Framework
[2] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[3] SCC – Southampton City Council
[4] BBLP – Balfour Beatty Living Places
[5] Safety Plan - M271 / A35 Redbridge Roundabout Safety Plan (16 Nov 2016) – HE551515-WSPPB-GHS-M271PCF2-HS-ZS-HSP001
[6] NTOC – National Traffic Operations Centre
[7] RCC – Regional Control Centre
[8] TOS – Traffic Officer Service

8.2.4 In terms of winter service, a slight increase in road salt will need to be procured due to additional carriageway and footway surface areas. The additional amount required, and any changes to storage requirements at depots are to be assessed by SCC[1] or BBLP[2] in due course.

8.2.5 Any existing methods of snow clearance are unlikely to change. The need for this arrangement, and the level of resources required are dependent on actual weather conditions and to be assessed by SCC and BBLP accordingly.

8.2.6 Proposed relocation of the existing toucan crossing across the A33 slip roads would require additional new guard railings which would impose increased maintenance liability in terms of potential for future vehicular impact and need for replacement.

8.3 DRIVER COMPLIANCE

8.3.1 Redbridge Roundabout currently has a speed limit of 50mph. The Departures from Standards Checklist outlined; due to the tight radius of the free flow link towards the A33, a 30 mph limit would need to be imposed to safely manoeuvre the dedicated free flow lane and in compliance of with the DMRB[3] TD 9/93[4].

8.3.2 The imposed speed limit is proposed to be achieved through a stepped reduction from 70 mph to 50 mph on the M271 Southbound approach to the roundabout junction and down to 30 mph on the roundabout junction and through the segregated lane.

8.3.3 The successful operation of the roundabout requires clear directional signage as well as appropriate lane markings in order to efficiently and safely direct the traffic through the roundabout and encourage driver compliance.

8.3.4 With all options, driver compliance is also a contributory factor in successful operation of the roundabout, particularly along the southern circulatory carriageway where late lane changing manoeuvres could result in greater risk of collisions

[1] SCC – Southampton City Council
[2] BBLP – Balfour Beatty Living Places
[3] DMRB – Design Manual for Road and Bridges
[4] TD 9/93 – Highway Link Design Road Geometry (Volume 6 Section1 Part 1)

9 SUMMARY OF TECHNOLOGY AND MAINTENANCE ASSESSMENT

9.1 INTRODUCTION

9.1.1 In agreement with Highways England it was decided to defer the preparation of the MRSS[1] to PCF[2] Stage 3 when additional design information is available.

9.1.2 The MRSS will outline key strategic design assumptions and decisions taken during the design and construction of the scheme. These relate to how the maintenance of assets within the scheme limits can be carried out efficiently during its lifetime, and how risks to road workers are kept as low as reasonably practicable. It should detail the likely impact on network availability, identify any specific resource requirements and highlight any safety issues for road users and operatives.

9.1.3 The aim is to provide a high level strategic document demonstrating that a design for maintenance approach has been taken during the design and construction of roads, roadside assets, and associated technology. This is to enable maintenance to be carried out safely and cost effectively whilst ensuring that any future maintenance interventions which expose road workers to risk are minimised.

9.1.4 The MRSS is not intended to provide a detailed statement describing how the maintenance is to be undertaken. It is the responsibility of the maintenance service provider to identify and implement appropriate methods of work for the required maintenance activities.

9.1.5 This chapter summarises the maintenance assessment based on Chapters 8 and 18 of the TAR[3]. Collectively this will all feed into the MRSS in PCF Stage 3. This Chapter also includes a summary of Chapter 17 of the TAR the technological assessment. This provides more information on the additional road side technology and a safe maintenance procedure once the scheme is completed.

9.2 EXISTING MAINTENANCE ACCESS

9.2.1 BBLP[4], working in partnership with SCC[5], monitors, controls and carries out routine, and any necessary maintenance for SCC's highway assets.

9.2.2 The routine maintenance requirements for this section of A33 at its intersection with M271 through the roundabout are typical of other busy D2AP[6] trunk roads; whilst the A33 flyover also has potential maintenance requirements.

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[1] MRSS – Maintenance and Repair Strategy Statement
[2] PCF – Project Control Framework
[3] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[4] BBLP – Balfour Beatty Living Places
[5] SCC – Southampton City Council
[6] D2AP – Dual 2 Lane All Purpose

9.2.3 Access to undertake routine maintenance of the verges and particularly inspection of the flyover structure may require closure of traffic lanes. The existing maintenance access provision for the roundabout has been described in Section 3.15 of the TAR[1]. It outlined a substantial portion of maintenance tasks may be carried out without interrupting traffic flow through the roundabout.

9.3 OPTION DESIGN IMPLICATIONS ON EXISTING TECHNOLOGY

9.3.1 All three proposed Redbridge Roundabout Improvement Options contain changes to existing traffic signal operations, including the existing toucan crossings on the A33 east-facing slip roads.

9.3.2 Option 1 moves the toucan crossing on the A33 westbound off-slip further towards the roundabout, and incorporates this facility with the new set of traffic signal arrangements required to operate the through-roundabout layout. In relation to this, a further set of toucan crossings is also required across both A35 west-facing slip roads. Both Options 2 and 3 propose to remove all toucan crossings from the roundabout junction and its immediate vicinity.

9.3.3 Other than changes associated with the above, the roundabout upgrades considered in this report are not dependent on additional technology, and would have no operational effect on the existing ITS[2] / RCC[3] systems or communication network. Nevertheless, there remains an opportunity to explore potential improvements to these facilities, should it become a preference, a requirement, or otherwise beneficial for either Highways England or SCC[4] to incorporate as part of the scheme's requirements. These would be revisited in subsequent PCF[5] Stages.

9.4 MAINTENANCE AND REPAIR STRATEGY FOR CIVILS INFRASTRUCTURE

9.4.1 The scheme is at an existing location; therefore maintenance needs are not anticipated to change as a result of the modifications arising from the proposals. That said, the design of the proposed options will take the opportunity of making maintenance access easier and hence reduce the need for implementing TTM[6] wherever possible. Any new or refreshed assets should also achieve a specified maintenance-free period after construction. This approach will reduce the risk exposure of traffic management operatives and other road workers.

9.4.2 The above is particularly relevant for Options 2 and 3 where the existing footbridge on the north-east side of the roundabout would be modified, which spans across a busy circulatory with high speed traffic using the left turn free-flow link.

9.4.3 Although the Redbridge Flyover will be unaffected by this scheme, all existing maintenance provisions for the structure will be retained, and enhanced where it would be beneficial to do so, such that the piers can be inspected and maintained, thus minimising TTM requirements.

9.4.4 Options 2 and 3 will enhance both subways at the roundabout. As part of the modification and enhancement works, low maintenance materials would be considered and adopted wherever possible to both prolong the initial maintenance-free period, and reduce maintenance frequencies thereafter.

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[1] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[2] ITS – Intelligent Transport System
[3] RCC – Regional Control Centre
[4] SCC – Southampton City Council
[5] PCF – Project Control Framework
[6] TTM – Temporary Traffic Management

9.4.5 The scheme will also potentially introduce enhanced landscaping features at the centre of the roundabout. Landscape maintenance could be reduced using low maintenance, low growth grass and planting, and by avoiding close proximity to visibility splays. This would reduce the frequency of maintenance workers being exposed to hazards and risks when undertaking their duties. Other potential opportunities to make maintenance easier include:

- Utilising a mechanical system to sweep drainage channels and gullies, thereby eliminating the need for manual attendance;
- Provide paint systems with extended maintenance periods so as to achieve a very long design life with minimal maintenance treatments. This could be particularly relevant for handrails for access to subways, and guardrails;
- Use self-cleansing facings for any new or replacement traffic signs so as to reduce cleaning requirement; and
- Combine cyclic maintenance activities to minimise the frequency when traffic management is implemented, thereby reducing risk exposure to traffic management operatives.

9.5 MAINTENANCE AND REPAIR STRATEGY FOR ROAD SIDE TECHNOLOGY

9.5.1 An overview of the existing technology provision is presented in Section 3.14 of the TAR[1]. This section describes the implication of the options on the maintenance and repair of the existing road side technology.

9.5.2 Applicable to all options, it is likely that the following equipment will be retained in their current locations, and the maintenance and repair requirements would remain unchanged:

- Motorway matrix signals;
- Highways England 609 cabinet;
- CCTV[2] cameras;
- Spot speed enforcement cameras;
- Meteorological air quality monitoring outstation; and
- Traffic Signals Enforcement camera (A35 westbound on-slip / Redbridge Flyover)

9.5.3 Conversely, there will be option-specific modifications to the existing traffic signals. Details of these modifications and the technology to be adopted will be determined in subsequent PCF[3] Stages. The maintenance and repair strategy is therefore unknown at this stage.

ALL OPTIONS

- The removal of the bus gate (and the associated bus priority signal stage) on A33 westbound off-slip.

OPTION 1

- Merging of the toucan crossing on A33 westbound off-slip with the existing traffic signals controlling this arm and the east-side circulatory. Pedestrian stages to be incorporated as part of the roundabout's overall operation.

[1] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[2] CCTV – Closed Circuit Television
[3] PCF – Project Control Framework

- Additional traffic signals to control the cut-through link on both sides and the circulatory movements.
- An additional pair of toucan crossings on the entry and exit arms of the A35 west-facing slip roads.

OPTIONS 2 AND 3

- The removal of the pair of toucan crossings on the A33 east-facing slip roads.

9.5.4 When taking the above into consideration, the design options will also consider these opportunities, where possible, to make maintenance easier and safer:

- Provide additional off network access with footway provision for maintenance access.
- If it is necessary to place any new equipment in the verges, ensure where possible, that they are placed as far from live traffic as possible. This would reduce the risk of collision by errant vehicles and the need for TTM[1].
- Reduce maintenance access points through grouping infrastructure and equipment.

[1] TTM – Temporary Traffic Management

10 SUMMARY OF ENVIRONMENTAL ASSESSMENT AND ENVIRONMENTAL DESIGN

10.1 AIR QUALITY

OPTION 2 AND 3

10.1.1 Both options result in the worsening of an exceedance of EU limit values due to an increase in concentrations on the A33. This worsening triggers the need for a Scheme Air Quality Action Plan (SAQAP), although it does not affect compliance of the Southampton Urban Agglomeration zone.

10.1.2 Both options result in an overall air quality dis-benefit in the opening year, and worsen exposure to pollution where concentrations exceed the air quality objective, including within the Redbridge/Millbrook AQMA[1]. However, the number of properties affected is relatively low and does not exceed the guideline for significant effects (IAN 174/13[2]).

10.1.3 Both options result in an increase in overall emissions from the study area, but the increase is negligible at the regional scale.

10.1.4 Further air quality investigations of traffic modelling should be undertaken at PCF Stage 3. The focus of the further investigations should be the development of a SAQAP[1] and an evaluation of its effectiveness, in accordance with IAN175/13. The SAQAP should take into account the Air Quality Plan which will be published by the UK Government by the end of July 2017. In addition, future PCM[2] model forecasts will be updated in line with the Air Quality Plan, which could impact on the EU compliance assessment undertaken as part of the PCF Stage 2 works.

10.2 CULTURAL HERITAGE

OPTION 2 AND 3

10.2.1 Potential disturbance to any buried heritage assets for Option 2 would be caused during the widening of existing carriageway. The construction of new or improved footways may also create an impact particularly where they are located on grass verges, rather than on areas of hard standing. Landscaping and the removal of existing infrastructure would create an impact where they may disturb deposits below modern overburden or make-up layers.

[1] AQMA – Air Quality Management Area
[2] IAN 174/13 – Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality (HA207/07)
[1] SAQAP – Scheme Air Quality Action Plan
[2] PCM - Pollution Climate Mapping

10.2.2 The course of the regionally important Andover Canal is located within the scheme area, the state of preservation of which remains unknown. There are no remains or earthworks currently visible, although buried remains are presumed to exist. Additionally, it is likely that there are remains of a former brewery of local significance, located directly on the western edge of the scheme. Impacts on the Andover Canal or other known assets could be mitigated for through an appropriate programme of investigation and recording.

10.2.3 The level of mitigation required during construction will be confirmed following detailed assessment to be undertaken at PCF Stage 3. Measures could include watching briefs and preservation in situ.

10.3 LANDSCAPE AND VISUAL IMPACT

OPTION 2

10.3.1 Potential landscape effects from Option 2 include an overall minor increase in the extent of roads and footpaths at Redbridge Roundabout and the new elements, which would be in keeping with the existing character and scale of the existing junction. Tree losses could be compensated with new planting. The magnitude of landscape impact would be Negligible Adverse. The significance of landscape effects is assessed to be Slight (Negative) reducing to Neutral as mitigation / enhancement planting matures. The significance of effects on visual receptors would be Slight (Negative) reducing to Neutral as mitigation planting matures.

OPTION 3

10.3.2 Option 3 comprises similar improvements to Option 2 with additional widening and hard standing areas to accommodate an additional lane on the northern edge of the roundabout. Option 3 would have a marginally greater impact (adverse) on landscape resources due to the greater loss of Amenity Green Space within the central island at Redbridge Roundabout, which could not be mitigated. However, it is unlikely to restrict the amount of replacement tree planting that could be undertaken within the roundabout and the overall significance of landscape and visual effects would be similar to Option 2.

10.3.3 The following actions would contribute to avoiding and/or reducing potential landscape and visual effects:

- → Undertaking the works within highway land where possible and minimising land-take requirements outside the existing highway boundary.
- → Minimising land-take in the inner central island, including impacts upon trees, to minimise loss of Amenity Green Space and tree loss.

10.3.4 The extent of new tree planting would comply with SCC's[1] guidelines for replacement tree planting, which requires between two and three new trees to be planted for each mature tree removed. In this respect, it is possible that the proposed mitigation would improve and enhance the landscape and visual amenity of the project site and its wider setting beyond its baseline condition. This aspect of the proposed mitigation has been taken into consideration in the assessment of landscape and visual effects.

[1] SCC – Southampton City Council

10.3.5 The design of the new planting should reflect the significance of this Amenity Green Space as a focal point for local residents and as a gateway to the city. Planting with large size trees for immediate visual impact and seasonal interest would be appropriate. Further interest could be created with species rich grassland and/or under planting with bulbs.

10.3.6 Due to limitations on the space available for replacement mitigation planting, it is likely that offsite screen planting will be necessary at Redbridge Tower and Clover Nooke to reduce visual impacts in relation to residential properties to match the baseline situation. The feasibility of offsite planting requires further consideration.

10.4 NATURE CONSERVATION

OPTION 2 AND 3

10.4.1 The scheme is likely to cause the loss or disturbance and loss of habitat suitable to support common species of nesting birds. Scrub habitats are widespread and commonplace in the area; however loss of available nesting habitat within an urban setting would result in a probable permanent adverse effect of low magnitude at a site level, which is not significant. As outlined in paragraph 3.5.27, Schedule 1 birds associated with Ramsar, SAC[1] and SPA[2] sites are unlikely to utilise the scrub on site. To avoid any potential impacts on the above, works (including clearance) will be carried out outside of nesting season.

10.4.2 Both options would have a low impact on local bat populations. During the construction process, any night works may have the potential to displace or disturb foraging or commuting of common bat species through lighting. This is considered to have a probable temporary adverse effect of low magnitude at a site level, which is not significant.

10.4.3 As outlined in the AIES[3], the two options are not considered likely to cause effects on nearby European sites. However, for some sites, the screening outcome is that 'sufficient uncertainties remain' so further assessment will be required at PCF Stage 3. It is recommended that once detailed information on construction traffic (including vehicle numbers and routing) is known that the screening reports are updated to ensure that the conclusions remain valid.

10.5 GEOLOGY AND SOILS

OPTION 2 AND 3

10.5.1 The options all involve limited topsoil stripping and minimal land take and earthworks. As the spatial extent of the options is similar, effects relating to soil, geology, and land contamination, are expected to be similar. The proposed options have therefore been assessed together.

10.5.2 Effects on geology, geomorphology, and soil, during construction and operation, are likely to be Neutral or Slight Adverse. Effects on groundwater, surface water, the built environment, construction workers, and end users are likely to be Neutral.

[1] SAC - Special Area for Conservation
[2] SPA – Special Protection Area
[3] AIES – Assessment of Implications on European Sites (Version 3 dated 13 Feb 2017)

10.6 NOISE

OPTION 2 AND 3

10.6.1 A quantitative assessment using TAG[1] Unit A3[2] demonstrated that the scheme presents a 'dis-benefit' in the terms of noise however; the magnitude of that impact is described as negligible in accordance with DMRB[3]. The TAG Unit A3 values for Option 2 present a slight worse outcome when comparing both the total net value and those resulting in each impact pathway.

10.6.2 Mitigation measures will be considered as appropriate to minimise any impact arising from the operation of the scheme. Based on the noise modelling undertaken at this stage, it is considered that noise mitigation measures are unlikely to be necessary. This will be confirmed once the single preferred option is selected and a more detailed modelling is prepared in PCF[4] Stage 3. If necessary, noise barriers and low noise road surface will be considered.

10.7 PEOPLE AND COMMUNITIES

OPTION 2 AND 3

10.7.1 Views from the road are unlikely to change as a result of the works associated with the options as the improvements would largely comprise widening of the carriageway on the existing roundabout, reconstruction of the footbridge and the installation of new crossing facilities for pedestrians and cyclists. Driver stress may be temporarily increased as a result of construction works and associated traffic issues. However, it is expected that the design improvements would improve traffic flows and reduce congestion locally resulting in a more effective network. Overall this would decrease driver stress.

10.7.2 Both options would result in the loss of the at-grade crossings to the east of the roundabout which has the potential to impact the accessibility of the area for nearby residents. It is predicted that improvements to existing subways and footpaths would not fully mitigate the loss of amenity for all users. During construction, travel times are expected to increase slightly due the disruption to the road network as well as for NMUs[5] through the disruption of local footpaths. During operation, motorised travellers' journey times are expected to be reduced as a result of improved traffic flows and reduced levels of congestion. Improvements to existing footpaths would likely have little impact on journey time. However, this improvement would have the potential to improve connections to community facilities.

10.7.3 Due to the increased levels of accessibility (for motorised travellers) in the local area it is predicted that the scheme and its options would have a positive impact on tourism and recreation in the local and regional area. The scheme is expected to provide benefit to the local economy through improved vehicular infrastructure at one of Southampton's key road gateways and increased capacity for goods.

[1] TAG – Transport Analysis Guidance
[2] TAG Unit A3 – Environmental Impact Appraisal
[3] DMRB – Design Manual for Roads and Bridges
[4] PCF – Project Control Framework
[5] NMU – Non Motorised User

10.7.4 All options are expected to have positive long term impacts on the health profile of the area due to the potential for reduced congestion. Additionally, improvements to the local footpath network has the potential to increase the level of active means of movement in the area such as cycling and walking, which is likely to have positive impacts on the health and wellbeing of local people. It should be noted that the removal of the at-grade crossings is likely to have an adverse impact for certain groups (elderly and disabled users).

10.8 ROAD DRAINAGE AND THE WATER ENVIRONMENT

OPTION 2 AND 3

10.8.1 There is a residual risk to surface water features, most notably the River Test / Southampton Water to the west of the Redbridge Roundabout exists. This is due to the potential short distance of the highway drainage system to the River Test, and therefore is considered to be Slight Adverse.

10.8.2 A Flood Risk Assessment may be required for the scheme. However, this will need to be confirmed with the Lead Local Flood Agency once the preferred option has been selected. The capacity of the drainage system will be investigated at PCF Stage 3 and an appropriate surface water drainage system will be put in place.

11 SUMMARY OF PUBLIC CONSULTATION

11.1.1 The public consultation period commenced on 9 November 2016 and concluded on 16 December 2016. The proposed option presented during the public consultation was Option 2 (as outlined in Chapter 6 of this report).

11.1.2 The objective of the public consultation was to provide the local residents in the surrounding area of Redbridge roundabout with:

- An overview of the M271/A33/A35 Redbridge roundabout improvements scheme;
- The benefits of the scheme and effect on the local area;
- An explanation of the additional features that are being considered, subject to available funding and further traffic modelling;
- An opportunity to comment on the proposed option as well as provide feedback and concerns for the proposals;
- An understanding of what happens next;
- What has been accomplished so far; and
- How they can raise issues and concerns to Highways England.

11.1.3 A three tier approach was implemented during the consultation period. This began with an exhibition preview for local Members of Parliament and Councillors on 14 November 2016. Letters were also sent to local businesses inviting them to a pre-exhibition briefing on Thursday 17 November. The public consultation exhibition was then held on Friday 25 November between 16:00 and 20:00 and on Saturday 26 November between 10:00 and 16:00 at Redbridge School, Cuckmere Lane, Southampton, SO16 9RJ.

11.1.4 Consultation leaflets were produced which included an invitation to the event and a questionnaire. The leaflets contained a brief overview of the option, the benefits of the scheme to the region and the progress to date of the scheme. Within the leaflet there was a questionnaire which asked respondents to provide feedback on the proposal, their current use of Redbridge Roundabout and optional general information about themselves. The questionnaire was detachable so that it could be completed and returned to Highways England by freepost or completed online using the Highways England webpage www.highways.gov.uk/M271A35redbridge.

11.1.5 Overall, 43 questionnaires were returned by post, 105 online questionnaires were received, 20 event questionnaires were completed, 6 free format letters were received, and 10 free format emails were received. This gives a total of 184 responses during the public consultation period. Included within these responses were nine responses representing businesses.

11.1.6 The responses provided during the public consultation displayed that there is considerable dissatisfaction and a desire for improvement at Redbridge Roundabout that is shared amongst car users, pedestrians and cyclists as a result of the current levels of congestion (76% of respondents), poor standard footways (48%) and the safety concerns (43%) at the roundabout. This shows there is a substantial level of support for improvements at Redbridge Roundabout.

11.1.7 A wide range of opinions have been collected from the public by including a free format comment section in the questionnaire for any topics that were not covered elsewhere. These have been, and will continue to be, considered to help progress the proposals and ensure that a suitable design can be achieved to meet the objectives of the scheme.

11.1.8 In particular, recurring comments from the public have asked for consideration of:

- the pedestrian and cyclist connectivity at the roundabout;
- the existing condition of the subways and footbridge;
- safety concerns at the roundabout, including the inclusion of toucan crossings; and
- air quality concerns.

11.1.9 During January 2017, the Project Team conducted a design workshop to discuss the findings from the public consultation and agree on a proposal to be recommended for further consideration during PCF[1] Stage 3. During this workshop a Revised Option 2 was developed. This option has been developed to address the recurring concern from the public regarding the removal of the existing toucan crossings and the connectivity and safety issues that would be created. This option will be presented in greater detail in Chapter 12.

11.1.10 Another common topic raised amongst the public was wider network concerns. This included support for improvements at Millbrook Roundabout, the Redbridge Roundabout flyover, and the approach to the roundabout from Gover Road. All comments relating to wider network issues have been received by Highways England and will be considered appropriately. Where suitable, these will be used to help inform the decision making process on the wider strategic and local road networks.

11.1.11 Full details of the public consultation process, materials and responses can be found in the PCF Stage 2 Report on Public Consultation[2].

[1] PCF – Project Control Framework
[2] Report on Public Consultation – M271/A33/A35 Redbridge Roundabout Report on Public Consultation (07 Feb 2017) - HE551515-WSPPB-GEN-M271PCF2-RP-ZH-RPC002

12 REVISED OPTION 2

12.1 OPTION DESCRIPTION

12.1.1 This option has been developed following feedback received from the public consultation period and subsequent design workshop process. This revised option is primarily based on Option 2 (described in Chapter 6 of this report).

12.1.2 The option is presented in Appendix B and entails the following:

- Four 4m wide circulatory lanes on the southern side of the roundabout;
- Two 4m wide lanes on the western side of the roundabout and leading up to the M271 exit;
- Maintain and relocate the existing toucan crossing across the A33 eastbound on-slip to approximately 100m east of the roundabout to improve the SSD[1]. This is to bring it in compliance with the requirements of TD 9/93[2] where the desirable minimum SSD is 70m for a design speed of 50kph. This is also in compliance with TD 51/03[3] where the desirable minimum SSD is 90m, considering that the maximum curve radius for the left turn from M271 to A33 is approximately 46m;
- Remove the existing "bus gate priority signals" on the A33 westbound off-slip and relocate the existing toucan crossing closer to the roundabout to operate within the controlling traffic signals;
- Close the southern subway and mitigate the loss of connectivity between the northern subway and the southern/eastern side of the roundabout by providing an additional toucan crossing across the east-side roundabout circulatory carriageway to link with the two toucan crossings across the A33 slip roads; and
- Replace the existing footbridge with a new/upgraded bridge.

12.2 FOOTBRIDGE ALIGNMENT INVESTIGATION

12.2.1 A high level investigation into the feasibility of upgrading the new footbridge was undertaken to assess the footbridge alignment in compliance with DMRB[4] requirements. The investigation is primarily based on the following standards requirements:

- TA 90/05[5], clause 7.16 states that 'Unsegregated shared facilities have operated satisfactorily down to 2.0m wide with combined pedestrian and cycle use of up to 200 per hour. However, the preferred minimum width for an unsegregated facility is 3.0m'. Furthermore, BD 29/04[6] clause 12.4 states that the minimum width for unsegregated footpaths is 2.0m.

[1] SSD – Stopping Sight Distance
[2] TD 9/93 – Highway Link Design
[3] TD 51/03 – Segregated Left Turns and Subsidiary Deflection Islands at Roundabouts
[4] DMRB – Design Manual for Roads and Bridges
[5] TA 90/05 – The Geometric Design of Pedestrian, Cycle and Equestrian Routes
[6] BD 29/04 – Design Criteria for Footbridges

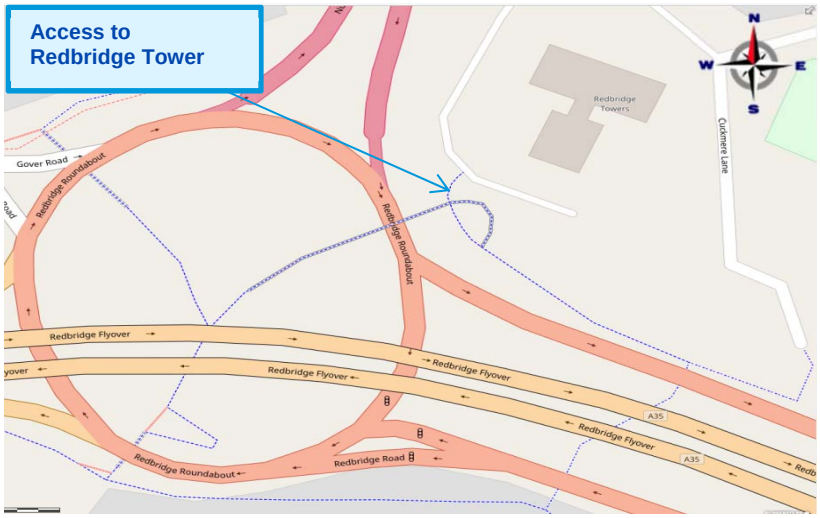
- DfT's[1] 'Inclusive mobility guide' recommends a maximum gradient of 8% (1 in 12) along ramps whilst for shorter distances (1000mm or less), the guidance allows up to 10% (1 in 10) but maintains that even for these shorter distances the maximum gradient of 8% (1 in 12) should be used. Therefore a preferred gradient of not greater than 8% (1 in 12) has been utilised in the investigation.

12.2.2 The following assumptions where made in the assessment:

- **Footbridge, ramp and footways/cycleway (off the bridge) widths:** As per the NMU[2] Context Report[3], the pedestrian/cycle counts carried out between 07:00 to 18:00 on a typical Thursday and Saturday observed a combined flow of 226 movements on Thursday and 123 movements on Saturday. This suggests that the combined movements at this location are significantly less than 200 per hour and in accordance with the TA 90/05[4], a 2.0m width shared use path should be adequate. However, the assessment was based on the preferred minimum width of 3.0m in accordance with TA 90/05.
- **Gradient:** As stated above, 8% gradient was utilised as the absolute maximum.
- **Location of the new footbridge:** At the existing location of the footbridge and within the existing highway boundary.
- **Structural depth:** 600mm.
- **Headroom from the carriageway:** 5.3m (TD 27/05)[5].

12.2.3 Based on the above parameters, a basic geometric design for the footbridge was developed for the Revised Option 2 and is presented in Appendix B. Whilst the 3.0m wide shared pedestrian/cycle bridge may appear to be feasible there is a major issue for maintaining current access to the Redbridge tower (see Figure 12-1).

Figure 12-1 Access to Redbridge Tower



Sources: Map data © OpenStreetMap contributors, CC-BY-SA

[1] DfT – Department for Transport
[2] NMU – Non Motorised User
[3] NMU Context Report – PCF Stage 1 M271/A35 Redbridge Roundabout (21 Apr 2016) - HE551515-WSP-ENM-M271A35PCF1-RE-PM-NMUCR02
[4] TA 90/05 – The Geometric Design of Pedestrian, Cycle and Equestrian Routes
[5] TD 27/05 – Cross-sections and Headrooms

12.2.4 In order to accommodate a 3.0m wide bridge and access ramp, the levels of the circular access ramp will have to be revised which will result in a steeper (up to 16%) gradient path to tie back into the current levels of access to the Redbridge Tower which would not comply with inclusive requirements of an 8% maximum gradient.

12.2.5 To mitigate this problem a zig-zag ramp and landing arrangement has been investigated in order to maximise the use of the existing space. Whilst this provided a compliant access to the Redbridge Tower, it directly impacted the forward visibility of the dedicated left turn lane. The height of the zig-zag access requires construction of retaining walls which obstructs the forward visibility of the dedicated left turn lane to a higher degree than the existing and hence renders it non-compliant. The departure for the non-compliant visibility requirements is unlikely to receive approval and the proposal is likely to fail in the road safety audit. Therefore this zig-zag ramp and landing arrangement is not recommended. The sketch in Appendix B demonstrates this more clearly.

12.2.6 Whilst the above investigation has been based on the assumption that any proposal for improvement of the current paths will have to be within the existing highways land boundary, the desired 3.0m wide bridge and associated approach ramps may still be achieved if additional land could be acquired from outside Redbridge Tower. This should be further assessed and concluded in PCF[1] Stage 3. It should be noted that a new topographical survey covering this area would also be required as the existing topographical data does not extend beyond the boundary of the existing footbridge and footpath.

12.2.7 However, following consultations with SCC[2], they recommended on 08 March 2017 to upgrade the footbridge to 3.0m, without acquiring additional land, which can be achieved by closing the existing access to Redbridge Towers directly beneath the footbridge. Pedestrians and cyclists will be able to access Redbridge Towers via Cuckmere Lane instead. The footpath in Cuckmere Lane will be continued to finish the route to Redbridge Towers (see Appendix B for further details of the proposed footbridge details). It should be noted however that this proposal to close this local access could potentially result in local objection, and therefore the feasibility of this proposal must be thoroughly explored at the early stages of PCF Stage 3, prior to proceeding any further with it.

12.3 FURTHER INVESTIGATIONS REQUIRED IN PCF STAGE 3

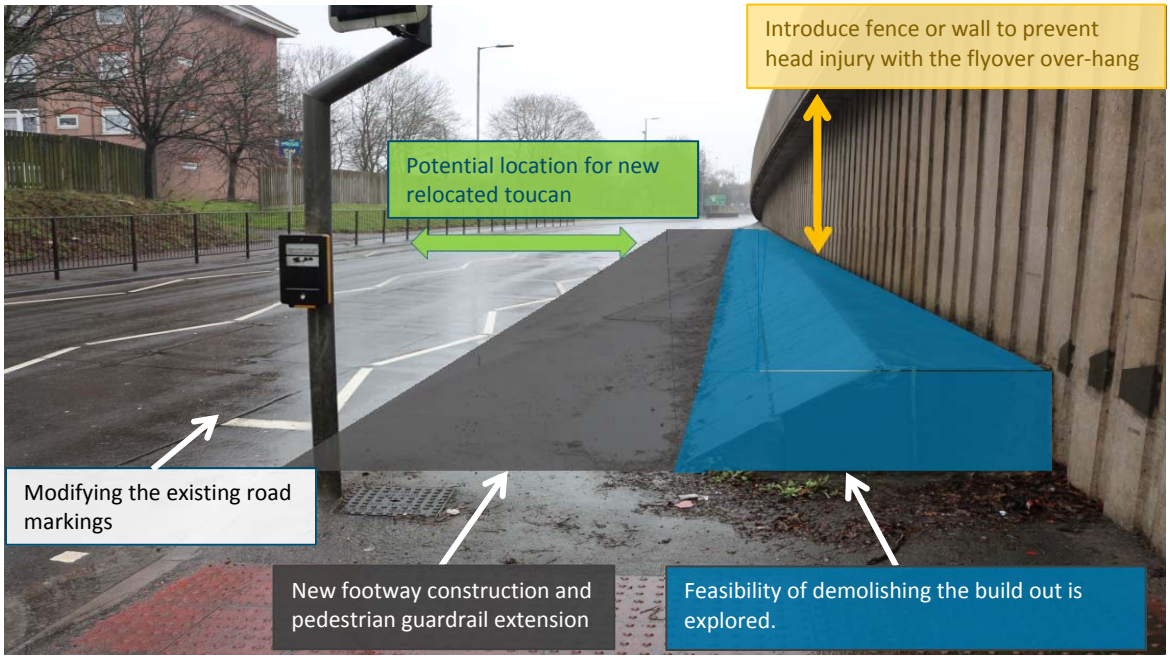
12.3.1 The Revised Option 2 will need to be subjected to further investigations, particularly the design refinement along the A33 eastbound slip road, during PCF Stage 3. These include, but are not limited to the following preliminary issues identified during PCF Stage 2:

- New footway construction;
- Modifying the existing road markings;
- Flyover overhang height limits – potential use of fencing or similar barrier to prevent head injury;
- Feasibility of demolishing the physical structure at the base of the flyover;
- New pedestrian guardrail extension. This may increase maintenance liability in terms of potential for future vehicular impact and need for replacement;
- Signal relocation of the toucan crossing;
- New lighting design to cater for new pedestrian crossing position; and
- Impact on NMUs[3] due to the longer walking routes for access to Redbridge Tower from the southern side of the roundabout.

[1] PCF – Project Control Framework
[2] SCC – Southampton City Council
[3] NMUs – Non Motorised Users

12.3.2 Figure 12-2 illustrates a number of design elements that need to be further assessed in PCF[1] Stage 3.

Figure 12-2 A33 eastbound on-slip proposed modifications



12.4 QUALITATIVE ASSESSMENTS OF THE REVISED OPTION 2

ECONOMICS

12.4.1 The Revised Option 2 layout is largely the same as the Option 2 layout modelled in PCF Stage 2, but with the addition of toucan crossings at three locations:

- Eastbound onslip to A33, further east of the crossing location in the Do Minimum layout to improve sightlines;
- New crossing located at the stopline across the westbound offslip entry at Redbridge roundabout; and
- New crossing located at the stopline across the eastern circulatory section of Redbridge roundabout.

12.4.2 The revised location of the toucan crossing proposed on the eastbound onslip from Redbridge Roundabout to the A33 in the Revised Option 2 may reduce the effectiveness of the free flow left turn compared to the Option 2 layout modelled at PCF Stage 2 with the introduction of the additional traffic stopline before merging on to the A33. However, due to the intermittent nature of pedestrian movements this could represent a small delay. The full impact of the relocation of the crossing point would require further modelling assessment as part of the further scheme development during PCF Stage 3.

[1] PCF – Project Control Framework

12.4.3 It is likely that the crossings at the westbound offslip and eastern circulatory will have a negligible impact on the operation of the junction. The two arms share a stage stream and are the only stages in the stream, so pedestrians will not need their own stage; they will be able to cross while the arm is stopped on a red signal. The traffic stage lengths should be long enough to safely incorporate a pedestrian phase. The exception would be if the pedestrian stage length is controlled by sensors and is elongated due to a large number of pedestrians crossing or slow pedestrians, although current NMU[1] usage does not indicate this would be an issue.

12.4.4 The crossings on these two arms will have an effect on the physical layout. The crossing width will remove a small amount of stacking capacity because the traffic stopline will need to be pushed back. The crossing will remove approximately one car's length per lane. This means that fewer cars will be able to stack in the available space and they will have to travel slightly further to be clear of the conflict point. Slightly fewer vehicles may be able to get through the signals in the same amount of green time.

12.4.5 If this layout is to be modelled at PCF[2] Stage 3, it will require a pedestrian origin-destination survey to be carried out. This would be required in order to identify any pedestrian reassignment due to closures of any subways. The Stage 3 modelling would further require updated information about current pedestrian crossing signal timings and volumes, with specific data on when pedestrian stages are called and how long the pedestrian and traffic stages last. This signal timing information has been previously provided for November 2016 and could potentially be used in Stage 3 if it is agreed to be acceptable.

12.4.6 The Revised Option 2 layout would then be tested in the microsimulation model.

ENVIRONMENT

12.4.7 The Revised Option 2 has not been formally assessed as part of the PCF Stage 2 ESR[3]. The following section provides a high level commentary on the potential environmental effects associated with this revised option.

AIR QUALITY

12.4.8 Based on the assumption that the re-instatement of the at grade crossings will not have a notable effect on the traffic flows that were utilised in the PCF Stage 2 air quality assessment, the conclusions outlined above for Option 2 and Option 3 remain applicable.

12.4.9 As with Options 2 and 3, the Revised Option 2 will need to be assessed quantitatively at PCF Stage 3. This would constitute a detailed assessment as set out in DMRB[4].

[1] NMU – Non Motorised User
[2] PCF – Project Control Framework
[3] ESR – PCF Stage 2 M271/A35 Redbridge Roundabout – Environmental Study Report (14 Feb 2017) HE551515-WSP-GEN-M271PCF-RE-PM-ESR001
[4] DMRB – Design Manual for Roads and Bridges

CULTURAL HERITAGE

12.4.10 As with Option 2 and 3, there is the potential for disturbance of buried heritage assets due to the widening of the existing roundabout circulatory carriageway. The construction of new footways may also create an impact particularly where they are located on grass verges, rather than on areas of hard standing. Landscaping and the removal of existing infrastructure would create an impact where they may disturb deposits below modern overburden or make-up layers.

12.4.11 The Revised Option 2 will need to be assessed in detail at PCF Stage 3.

LANDSCAPE

12.4.12 The Revised Option 2 will result in some loss of Amenity Green Space due to the new PRoW[1] cutting across the central island of the roundabout to connect to the new at-grade crossing on the eastern side of the circulatory. There wouldn't be a net loss of Amenity Green Space as the existing footpath to the southern subway will be removed as part of the subway removal. As with the other options, tree losses could be compensated with new planting. The magnitude of landscape impact would be Negligible Adverse. The significance of landscape effects is assessed to be Slight (Negative) reducing to Neutral as mitigation / enhancement planting matures. The significance of effects on visual receptors would be Neutral.

12.4.13 The Revised Option 2 will need to be assessed in detail at PCF[2] Stage 3. The option provides opportunities to improve the existing Amenity Green Space and public realm surrounding the roundabout through the planting design, and choice of materials for the hard landscape elements, including new paving and the reconstruction of the footbridge to Redbridge Tower. These aspects should be considered at PCF Stage 3 to ensure the scheme delivers landscape benefits where possible.

12.4.14 Due to limitations on the space available for replacement mitigation planting, it is likely that offsite screen planting will be necessary at Redbridge Tower and Clover Nooke to reduce visual impacts in relation to residential properties to match the baseline situation. The feasibility of offsite planting requires further consideration.

NATURE CONSERVATION

12.4.15 The Revised Option 2 is likely to cause the loss or disturbance and loss of habitat suitable to support common species of nesting birds. Scrub habitats are widespread and commonplace in the area; however loss of available nesting habitat within an urban setting would result in a probable permanent adverse effect of low magnitude at a site level, which is not significant.

12.4.16 Revised Option 2 would have a low impact on the local bat populations.

12.4.17 The Revised Option 2 will need to be assessed in detail at PCF Stage 3.

[1] PRoW – Public Rights of Way
[2] PCF – Project Control Framework

GEOLOGY AND SOILS

12.4.18 As with Option 2 and 3, this option will involve limited topsoil stripping and minimal land take and earthworks. It is expected to have a neutral effect on geology, geomorphology and soils. Effects on groundwater, surface water, the built environment, construction workers and end users are likely to be Neutral.

12.4.19 The Revised Option 2 will need to be assessed in detail at PCF Stage 3.

NOISE AND VIBRATION

12.4.20 As with Air Quality, based on the assumption that the re-instatement of the at grade crossings will not have an impact on the traffic flows, the noise and vibration effects are likely to be comparable to Option 2. The Revised Option 2 is expected to have an overall dis-benefit when assessed using TAG[1] Unit A3.

12.4.21 The Revised Option 2 will need to be assessed quantitatively at PCF[2] Stage 3. This would constitute a detailed assessment as set out in DMRB[3].

PEOPLE AND COMMUNITIES

12.4.22 The Revised Option 2 is expected to have the same impacts in regards to views, driver stress and local businesses as Option 2 and 3 as assessed in the PCF Stage 2 ESR[4]. The reinstatement of the at grade crossings will have a positive effect over Option 2 and 3 as there will be a reduced impact in regards to amenity and NMU[5] severance. There would be an overall negligible effect on non-motorised users.

12.4.23 The Revised Option 2 will need to be assessed in detail at PCF[6] Stage 3.

ROAD DRAINAGE AND THE WATER ENVIRONMENT

12.4.24 The Revised Option 2 will result in a small amount of additional hard standing in the central island of the roundabout. The overall effect is considered to be slight adverse, as per Option 2 and Option 3.

12.4.25 The Revised Option 2 will need to be assessed in detail at PCF Stage 3.

12.5 SUMMARY

12.5.1 This option has been developed following feedback received from the public consultation process, and is based on Option 2 (described in Chapter 6 of this report). It addresses the main concern raised by the public relating to the removal of all at-grade crossings under the original Option 2. However, this option must be subjected to further investigations and assessments at PCF Stage 3 to ascertain the suitability of this option in relation to the CSR[7].

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[1] TAG – Transport Analysis Guidance
[2] PCF – Project Control Framework
[3] DMRB – Design Manual for Roads and Bridges
[4] ESR – PCF Stage 2 M271/A35 Redbridge Roundabout – Environmental Study Report (14 Feb 2017) HE551515-WSP-GEN-M271PCF-RE-PM-ESR001
[5] NMU – Non Motorised User
[6] PCF – Project Control Framework
[7] CSR – Client Scheme Requirements

13 CONCLUSIONS & RECOMMENDED OPTION

13.1 OPTIONS 2 AND 3

13.1.1 Option 2 and Option 3 presented in this report have been assessed under the following headings:

- Brief summary description of the option;
- Environmental Impact;
- Buildability and Programme;
- Compatibility with Key Design Considerations; and
- Benefit to Cost Ratio and Value for Money.

BRIEF SUMMARY DESCRIPTION OF THE OPTION

13.1.2 During PCF[1] Stage 1 three options were assessed and fully discussed on the basis of their engineering, economic and environmental impacts, the result of which is reported in detail in the TAR[2]. These options were described as:

- Option 1: Provides a new two lane at-grade through-about link joining A33 westbound off-slip to M271 northbound.
- Option 2: Provides enhanced circulatory capacity to the south side of the Roundabout.
- Option 3: Provides enhanced circulatory capacity to the south and west sides of the roundabout as well as wider lane widths than those proposed in Option 2.
- All three proposed options include the provision of a segregated free-flow left turning link between M271 southbound and A33 eastbound on-slip. In addition, the bus gate on the A33 westbound off-slip leading to the roundabout would be removed. The bus lane approaching the roundabout on the A33 westbound off slip road would continue in operation up to the roundabout.

ENVIRONMENTAL IMPACT

13.1.3 The scheme worsens EU limit value compliance along Defra's Pollution Climate Mapping model links and triggers the need for Air Quality mitigation.

13.1.4 The results of the environmental assessments carried out on Options 2 and 3 have shown that there is an overall air quality dis-benefit in the opening year. However, the impact is relatively low and does not exceed the guideline for significant effects (IAN 174/13[3]).

13.1.5 The apparent increase in emissions in both options is negligible at regional scale.

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[1] PCF – Project Control Framework
[2] TAR – PCF Stage 1 M271 / A35 Redbridge Roundabout Upgrade - Technical Appraisal Report (06 Sep 2016) – HE551515-WSP-GEN-M271PCF1-RE-PM-TAR03
[3] IAN 174/13 – Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality (HA207/07)

BUILDABILITY AND PROGRAMME

13.1.6 At present it is anticipated that the adopted option could be constructed within 12 months with no impact on the Redbridge Flyover or any of its structural elements such as the piers and foundations.

13.1.7 In general the proposed changes are associated with widening of the existing carriageway within the existing highway boundaries, whilst the construction of the free-flow left turn lane from M271 may require the construction of a retaining wall upon further detailed investigation in PCF[1] Stage 3. It is required that all NMU[2] routes are to remain open during construction.

COMPATIBILITY WITH KEY DESIGN CONSIDERATIONS

13.1.8 Both Options 2 and 3 are considered to be generally compatible with the key design considerations set out within the CSR[3]. However, Option 1 would not be acceptable as a consequence of the proposed cut- through link within the central island of the existing roundabout junction, removing the existing grade-separated NMU crossing facilities and requiring their replacement with at grade crossings throughout the junction, which would significantly increase the conflict points between general traffic and NMUs.

BENEFIT TO COST RATIO AND VALUE FOR MONEY

13.1.9 The economic quantitative assessment and cost benefit analysis of Options 2 and 3 have been discussed in detail in Chapter 7 of this report. The modelling and economic appraisals have shown good BCR[4] values (Option 2: 5.64; Option 3: 8.84) for both scheme options when analysed over the 60-year assessment period. It is considered that there continues to be an economic justification for both scheme options as they would represent a very high value for money category.

13.2 PUBLIC CONSULTATION AND THE REVISED OPTION 2

13.2.1 The public consultation event displayed a clear public perception that Redbridge Roundabout operates under heavy congestion and has a poor standard of NMU facilities and safety concerns for all users. As such, there is widespread support for improvements at this location. The concerns raised by the public, local organisations and statutory bodies have already been subject of a design review at a workshop in January 2017 and will continue to be considered as the design progresses towards PCF Stage 3.

13.2.2 The results of the public consultation event demonstrated a clear disapproval of the proposed removal of the existing at-grade pedestrian crossings along the A33 slip roads; and that the alternative grade separated facilities (existing subways) through the centre of the roundabout are undesirable due to their poor state of maintenance and the perception of them being unsafe.

[1] PCF – Project Control Framework
[2] NMU – Non Motorised User
[3] CSR – Client Scheme Requirements
[4] BCR – Benefit to Cost Ratio

13.2.3 The proposed layout as presented here is based on the assessed Option 2 at PCF[1] Stage 1 including a revised strategy for provision of at grade NMU[2] facilities with the least impact on potential interaction with general vehicular traffic.

13.2.4 The Revised Option 2 proposes to maintain the existing at grade toucan crossings across the eastbound A33 slip road. However, a primary NMU safety concern is the present location of the crossing in relation to the proposed free flow left turning link from the M271; where a perceived potential increase in traffic speed on the approach would force the Desirable Minimum Stopping Sight Distance outside the permitted standards (TD 51/03[3]). In order to mitigate this and adhere to the requirements of the DMRB[4] standards, it is proposed to relocate the toucan crossing to approximately 100m east of the roundabout. This will impact on NMU desire lines but represents the only means of ensuring compliance with relevant safety standards.

13.2.5 It is also proposed to relocate the toucan crossing across the westbound A33 slip road closer to the roundabout and operate it within the traffic signals at the roundabout. At the same time, the option proposes to remove the southern subway and adopt 4m wide traffic lanes as in Option 3 of PCF Stage 1. The removal of the subway will create a gap in continuity for NMUs through the centre of the roundabout and increase their travel distance. To mitigate this it was apparent and logical to introduce a new toucan crossing and connection to the northern subway and the footbridge.

13.2.6 Further detailed consideration of the individual elements of the proposed layout would need to be carried out at PCF Stage 3 with a view of exploring additional enhancements and safety improvement features.

13.3 RECOMMENDED OPTION

13.3.1 The outcome from PCF Stage 2 is a recommended route for progression to PCF Stage for further assessment and refinement. This option is the Revised Option 2. As the Revised Option 2 was developed during PCF Stage 2, and has not been subject to appropriate quantitative assessments, this recommendation is subject to the required assessments being completed in PCF Stage 3 to confirm the suitability of the option (as outlined in Section 12.3 and Section 12.4 of this report).

13.3.2 The Revised Option 2, as agreed in the design workshop of 20 January 2017, is developed from the original Option 2 that was considered at PCF Stage 1, with additional elements such as the removal of the southern subway and adoption of wider 4m lanes around the roundabout to improve capacity and free flow movement.

13.3.3 The proposed NMU facilities should satisfy the desired outcome from the public consultation event whilst providing connectivity and continuity of flow through the roundabout. Opportunities to further improve on the proposed layout, such as the footbridge layout, should be explored during PCF Stage 3.

[1] PCF – Project Control Framework
[2] NMU – Non Motorised User
[3] TD 51/03 – Segregated Left Turns and Subsidiary Deflection Islands at Roundabouts
[4] DMRB – Design Manual for Roads and Bridges

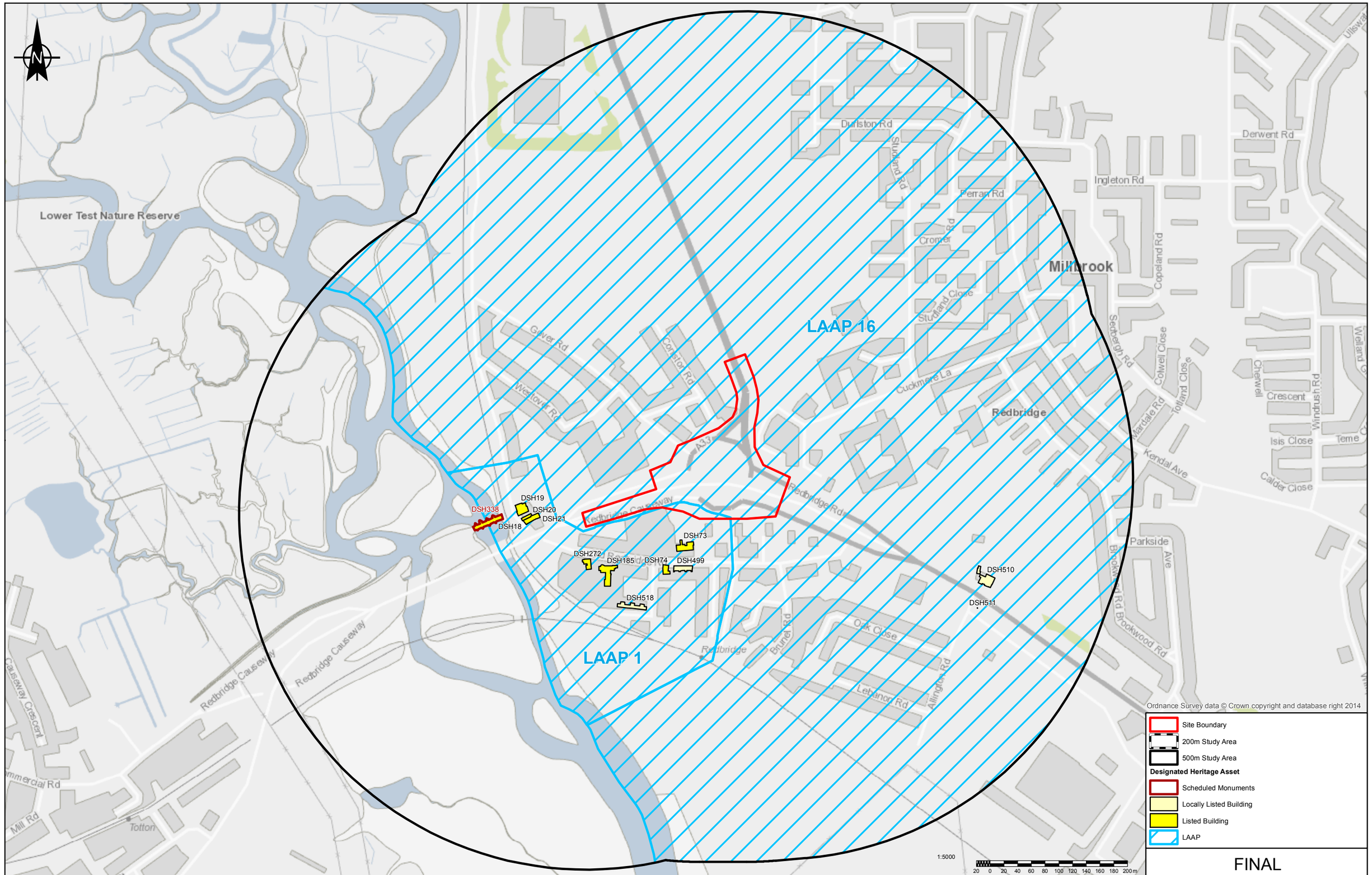
13.3.4 It should be noted that in future stages, an updated (2015) base SRTM[1] model should be considered, and/or alternative models such as the Highways England South East Regional Models, alongside refinement of the model coding in the local area. This may yield lesser or greater air quality impacts along the key links affected by the scheme. Therefore there is a risk of on-going exceedances of the UK's air quality standards throughout the AQMA[2]. Notwithstanding further investigation of traffic modelling, the focus of further Air Quality investigation should be towards the development of a SAQAP[3], and an evaluation of its effectiveness, in accordance with IAN 175/13[4]. In addition, future PCM[5] model forecasts will be updated in line with the Air Quality Plan, which could impact on the EU compliance assessment undertaken as part of this assessment. Further details can be found in the Technical Note addendum to the ESR[6], issued on 23 February 2016.

13.3.5 In conclusion, this recommended option must be subjected to further investigations and assessments at PCF Stage 3 to ascertain the suitability of this option in relation to the CSR[7].

[1] SRTM – Sub Regional Transport Model
[2] AQMA – Air Quality Management Area
[3] SAQAP – Scheme Air Quality Action Plan
[4] IAN 175/13 – Risk assessment of compliance with the EU Directive on ambient air quality and production of Scheme Air Quality Action Plans
[5] PCM – Pollution Climate Mapping
[6] ESR – PCF Stage 2 M271/A35 Redbridge Roundabout – Environmental Study Report (14 Feb 2017) HE551515-WSP-GEN-M271PCF-RE-PM-ESR001
[7] CSR – Client Scheme Requirements

Appendix A

ENVIRONMENTAL CONSTRAINTS MAPS



FINAL

Rev	Date	Description	By	Chk	App
A	16/02/16	Removed monuments, changed labels	CB	LM	LM

Notes:

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Fax: 020 7337 1701

Client: highways england driving forward

Project: M271 A35 REDBRIDGE ROUNDABOUT

Title: **Figure 1**

HERITAGE ASSETS

Drawn: C.Broughton		Checked: C.Davies	
Designed: L.Morrison		Approved: L.Morrison	
Date: 16/02/16	Scale: 1:5000	A3	Sheet:
Drawing Number: 20160212-3514305H-03			Revision: A

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Groundsure INSIGHTS

Site Details:

437335, 113779

Client Ref: M271-A35_Junction
Report Ref: GS-2724343
Grid Ref: 437337, 113782

Map Name: National Grid

Map date: **1993-1995**

Scale: 1:1,250

Printed at: 1:2,000

N
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Surveyed 1993
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

Surveyed 1995 Revised 1995 Edition N/A Copyright 1995 Levelled N/A	Surveyed 1993 Revised N/A Edition N/A Copyright 1993 Levelled N/A

Figure 2

Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 05 February 2016

To view map legend click here *Legend*

Rev	Date	Description	By	Chk	App

Notes

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Client: highways england driving forward

Project: M271/A35 Redbridge Roundabout

Title:

Figure 3

LVIA STUDY AREA AND ZONE OF VISUAL INFLUENCE

FINAL

Drawn: C.Davies		Checked: C.Davies	
Designed: K.Lewis		Approved: R.Bailey	
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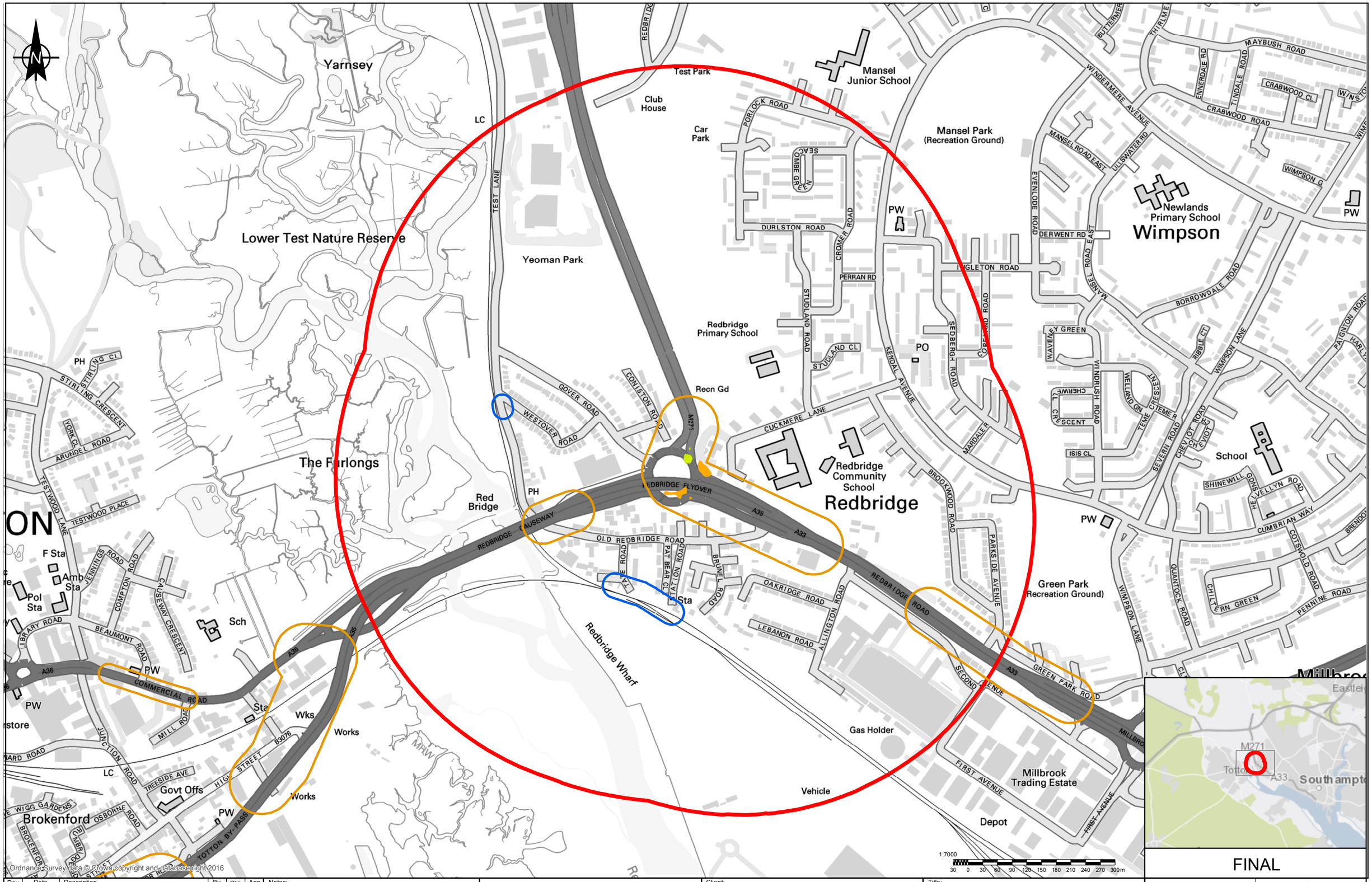

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Rev	Date	Description	By	Chk	App
-	-	-	---	---	---

Notes:
- Calculation area
- NIAs Railway
- NIAs Road

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Project: 70019110 M271 Redbridge

Title: **Figure 5**

Noise Important Areas

FINAL

Drawn: J.Aves		Checked: M.Shepherd	
Designed: J.Aves		Approved: E.Olmos	
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FINAL

Rev	Date	Description	By	Chk	App
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Notes:

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Client: highways england driving forward

Project: RIS AREA 3 IMPROVEMENTS

Title:

Figure 4
M271 A35
REDBRIDGE ROUNDABOUT
PHASE 1 HABITAT SURVEY

Drawn: A.Durston		Checked: C.Davies	
Designed: L.Morrison		Approved: L.Morrison	
Date: 12/02/16	Scale: 1:1250	A3	Sheet:
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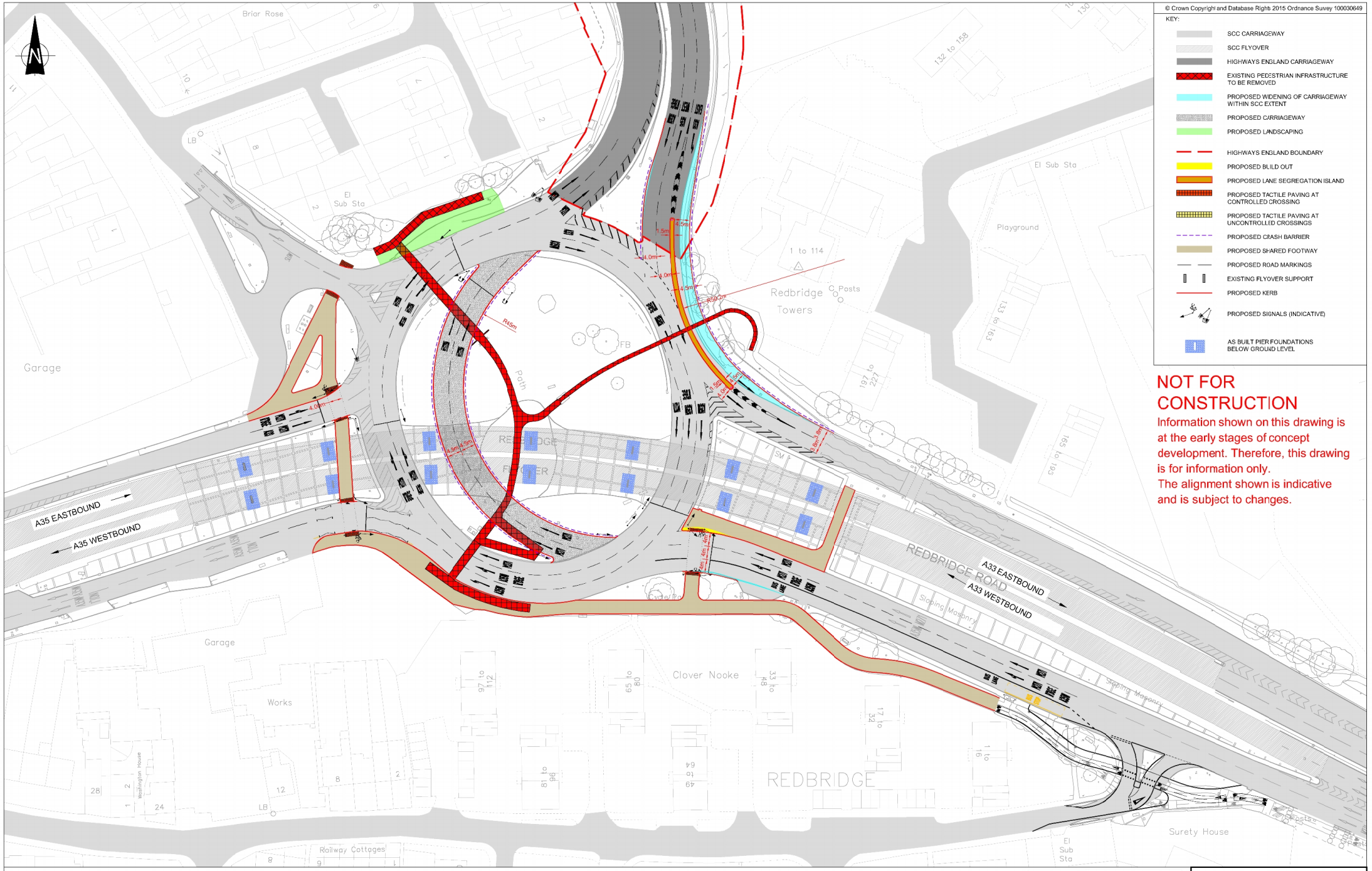
Appendix B

PROPOSED OPTION DRAWINGS



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P5	28.07.16	ISSUED FOR CONSULTATION	ML	MB	WC
P6	11.10.16	ISSUED FOR CONSULTATION Removed Sustrans Text	ML	MB	EC

Key:

Notes:

- 2 lane throughabout A33 westbound to M271 northbound
- free flowing lane M271 southbound to A33 eastbound

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Site/Project: M271/A33/A35 REDBRIDGE ROUNDABOUT

Title: OPTION 1 PROPOSED ALIGNMENT

FOR CONSULTATION

Drawn: IRC	Checked: MB
Designed: ML	Approved: EC
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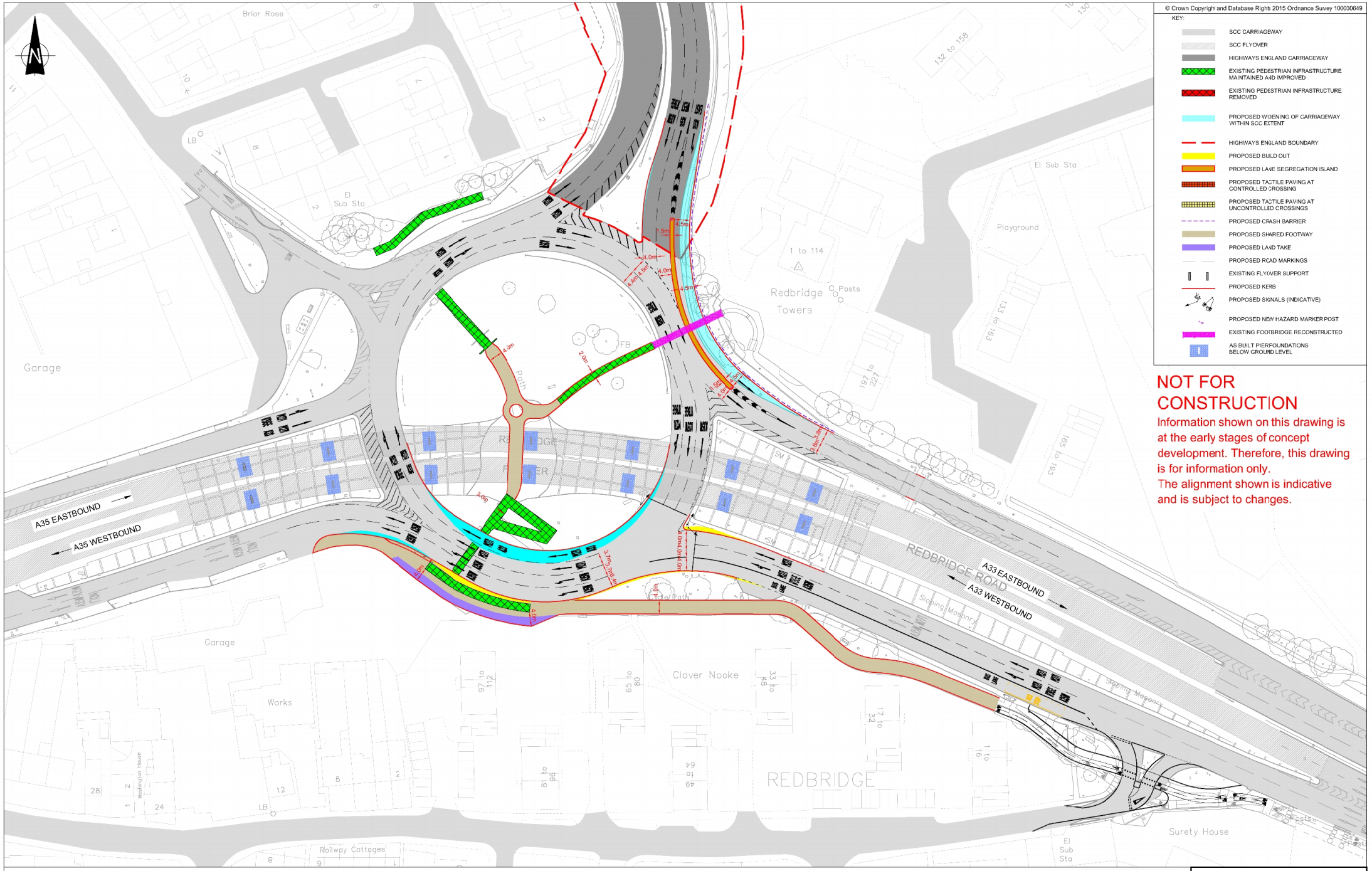

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P6	11.10.16	ISSUED FOR CONSULTATION Removed Sustrans Text	ML	MB	EC

Key:

Notes:

- 2 lane throughabout A33 westbound to M271 northbound
- free flowing lane M271 southbound to A33 eastbound

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Site/Project: M271/A33/A35 REDBRIDGE ROUNDABOUT

Title: OPTION 2 PROPOSED ALIGNMENT

FOR CONSULTATION

Drawn: IRC	Checked: MB
Designed: ML	Approved: EC
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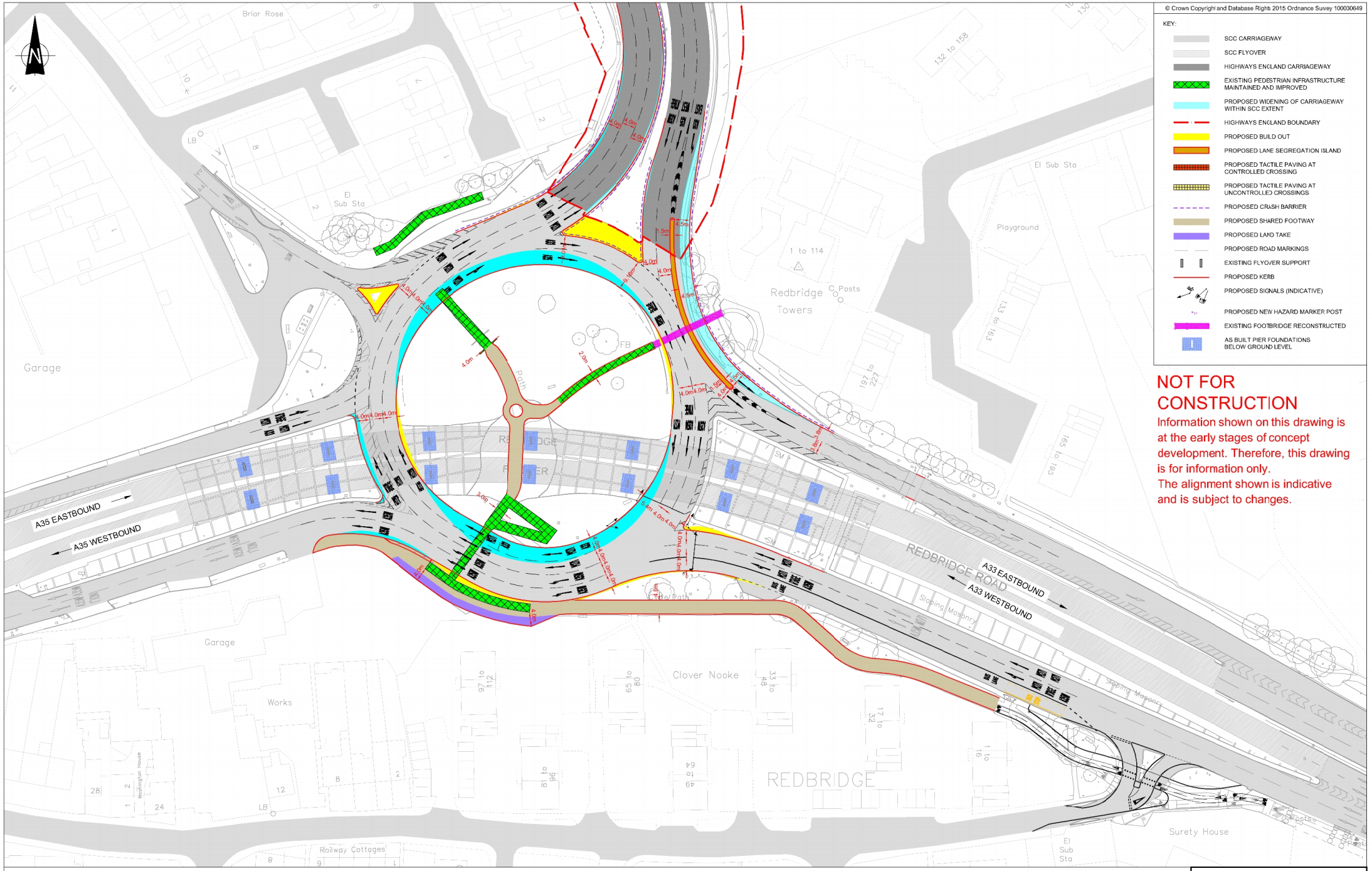

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Key:

Notes:

- 2 lane throughabout A33 westbound to M271 northbound
- free flowing lane M271 southbound to A33 eastbound

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Client: highways england driving forward

Site/Project: M271/A33/A35 REDBRIDGE ROUNDABOUT

Title: OPTION 3 PROPOSED ALIGNMENT

FOR CONSULTATION

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Designed: ML	Approved: EC
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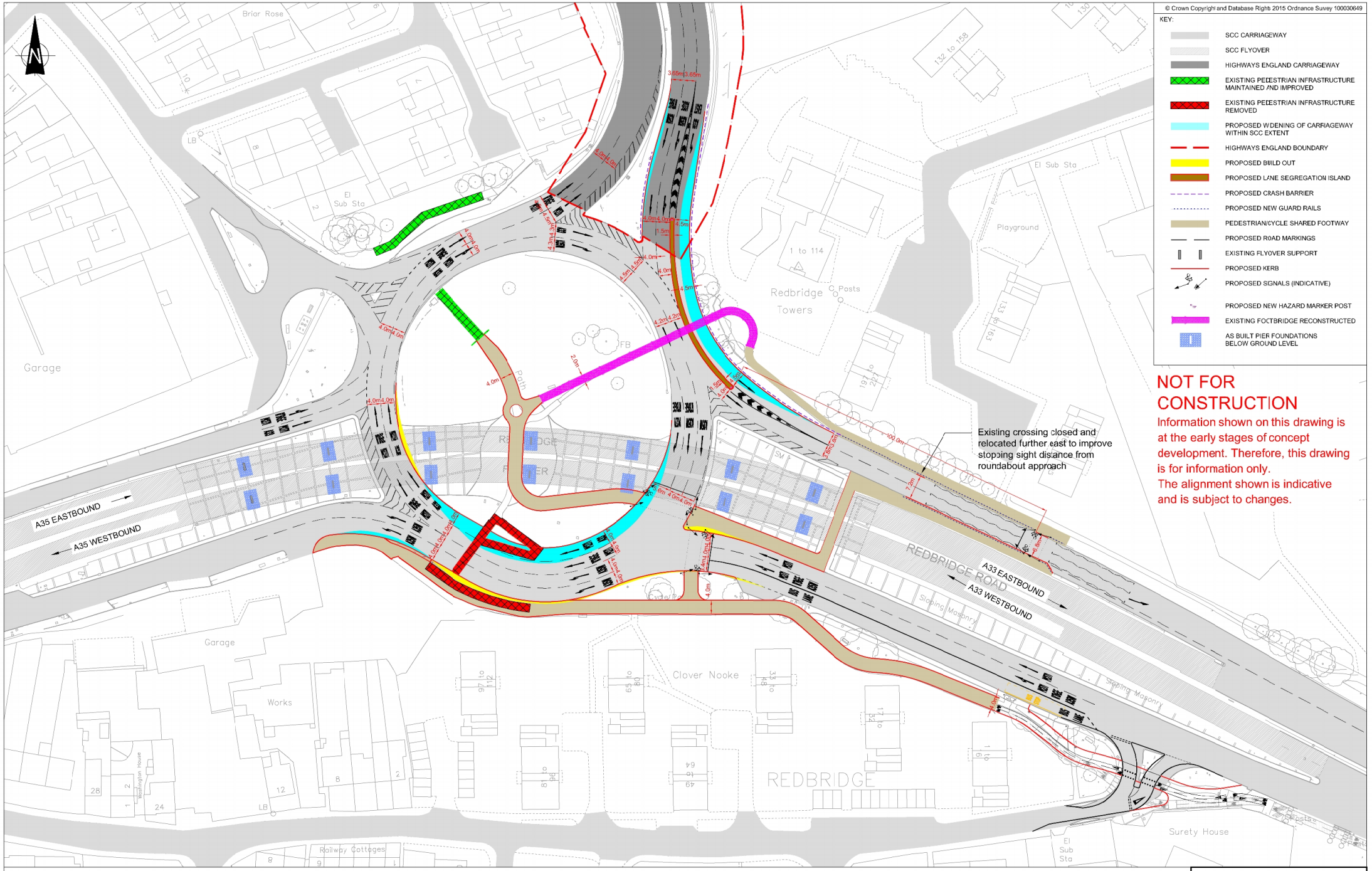
Revision: P6



Rev	Date	Description	By	Chk	App
1	31.01.17	FINAL STAGE 2 DESIGN FOR APPROVAL	MB	VM	RD

Key:

Notes:

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Client: highways england driving forward

Site/Project: M271/A33/A35 REDBRIDGE ROUNDABOUT

Title: REVISED OPTION 2 PROPOSED ALIGNMENT FINAL

FOR APPROVAL

Drawn: IRC	Checked: VM
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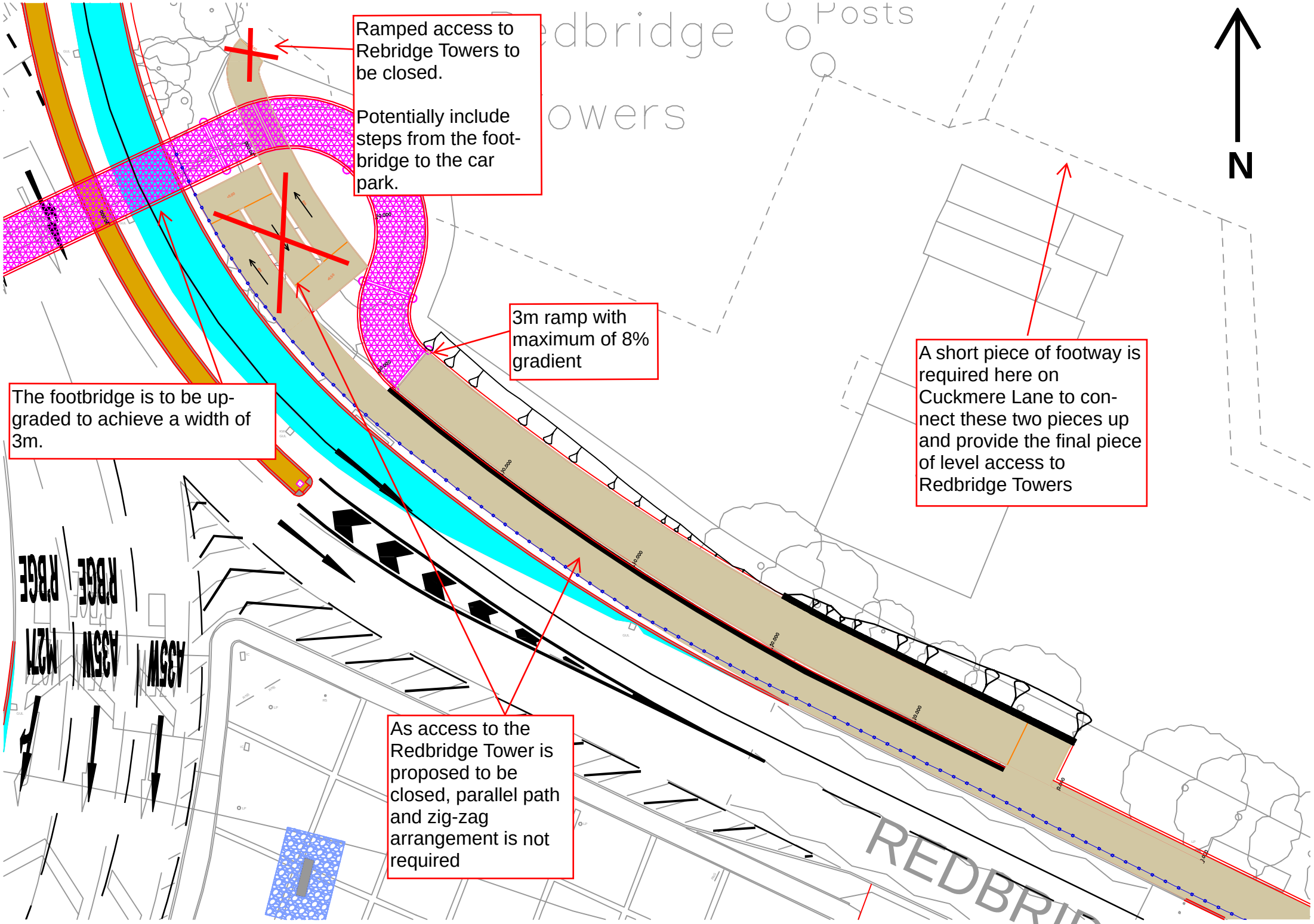
Ramped access to Rebridge Towers to be closed.
Potentially include steps from the foot-bridge to the car park.
3m ramp with maximum of 8% gradient
A short piece of footway is required here on Cuckmere Lane to con-nect these two pieces up and provide the final piece of level access to Redbridge Towers
The footbridge is to be up-graded to achieve a width of 3m.
As access to the Redbridge Tower is proposed to be closed, parallel path and zig-zag arrangement is not required
N

If you need help accessing this or any other Highways England information, please call **0300 123 5000** and we will help you.

S170126