Sheffield Local Plan

Transport Assessment: Report on the Strategic Road Network Impacts and Potential Mitigation

May 2025

SYSTRA

TRANSPORT ASSESSMENT: REPORT ON THE STRATEGIC ROAD NETWORK IMPACTS AND POTENTIAL MITIGATION

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1.1.1 Sheffield City Council (SCC) have developed a series of Local Plan options corresponding to differing levels of development intensity. This report summarises the initial findings of the ongoing Transport Assessment of the predicted impact of the Local Plan on the operation of the SRN, and suggests and summarises some potential mitigation measures.

1.1.2 Impacts of the Local Plan have been assessed for two forecast years (2029 and 2039) focussing on a comparison with a Reference Case scenario. The Reference Case scenario includes committed land-use developments and transport schemes, which are independent of the scheme being tested, with overall demand for travel controlled to national forecasts (from Department for Transport).

1.2 Local Plan Assumptions

1.2.1 The Local Plan includes developments at over 400 sites, ranging from very small sites containing only a few dwellings to large sites with more than 1,000 dwellings or more than 100,000 square metres of employment space. The sites are primarily located on the fringes of the city centre, in the Lower Don Valley, along the A61/A6102 corridor and in the suburban areas in the south-east of the city. Figure 1 shows the location of the Local Plan sites.

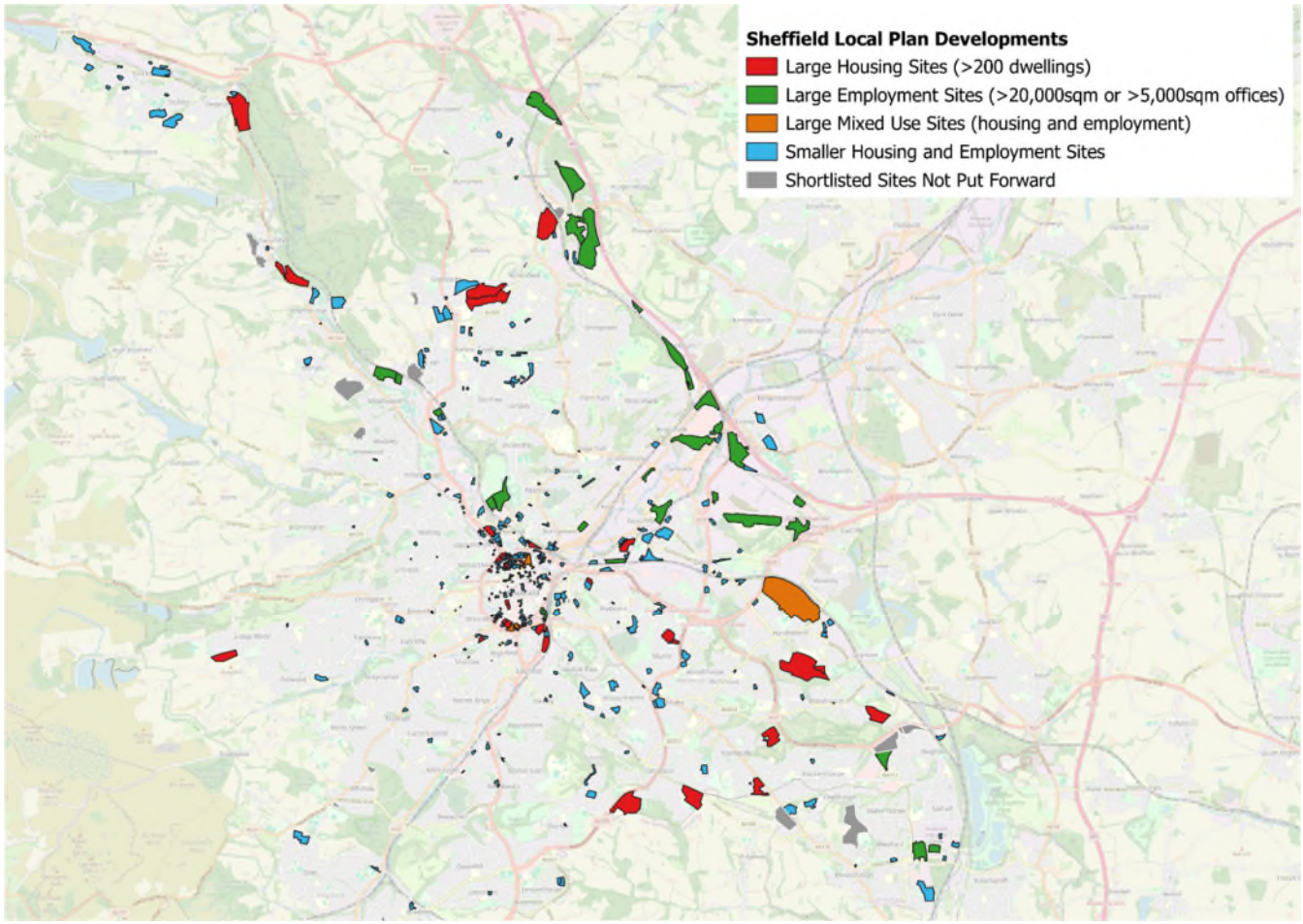


Figure 1. All Local Plan Sites[1]

[1] 'Shortlisted Sites Not Put Forward' includes three sites in north Sheffield that were included in the Assessment but which were not shortlisted (and therefore also not taken forward). Some site boundaries do not exactly match the boundaries of the proposed allocations due to adjustments made after the Assessment was undertaken.

1.3 Key Findings Relating to the Strategic Road Network (SRN)

1.3.1 Impacts of the Local Plan have been assessed for two forecast years (2029 and 2039) focussing on a comparison with a Reference Case scenario. Work has been undertaken with National Highways (NH) and their representatives to agree key input parameters to the analyses.

1.3.2 Based on the work undertaken to date, of the junctions tested, five require mitigation schemes to be developed :

- M1 Junction 31
- M1 Junction 35
- A616 / Thornfield Road Roundabout
- A616 / A61 Westwood Roundabout
- A616 / A629 Priority Interchange

1.3.3 Possible initial mitigation schemes have been proposed at these locations. The effectiveness of these schemes has been tested and confirmed.

1.3.4 Minimal severe impacts were found in terms of the motorway merge / diverge areas. The following merges/diverges are shown to potentially require physical alteration in order to bring them up to standard:

- M1 Junction 31 Southbound Diverge;
- M1 Junction 33:
  - Northbound Merge;
  - Southbound Diverge;
- M1 Junction 34 Northbound Merge;
- M1 Junction 35:
  - Northbound Merge;
  - Southbound Merge;
- M1 Junction 35a Southbound Merge;
- M1 Junction 36:

- Northbound Merge; and
- Southbound Diverge.

1.3.5 Further investigation on the impact of junction 36 may be required as the peak hour assessed in this study may not be the worst case scenario. Webtris data suggests an earlier peak period may have more traffic. In addition, there are external impacts from developments outside of Sheffield on this junction.

1.3.6 Overall, based on the work to date, there are no highway capacity issues on the Strategic Road Network caused by the trips generated by the Local Plan which cannot be successfully mitigated.

2. INTRODUCTION

2.1 Background

2.1.1 SYSTRA is supporting Sheffield City Council (SCC) with the development of their Local Plan. This is a complex undertaking which comprises a number of work stages. In late 2022 / early 2023, SYSTRA provided strategic transport modelling support to model the anticipated transport implications of the Local Plan developments. Between mid 2023 and early 2024, SYSTRA completed a more detailed analytical phase along with the consideration of potential mitigation measures.

2.1.2 During the Examination hearings in 2024, the Planning Inspectors agreed that some adjustments should be made to the housing land supply figures, and employment land supply. Having considered the latest evidence on housing and employment land supply, the Inspectors' conclusion, in February 2025, was that there would be a shortfall in supply, and that in order to address this the Council needed to undertake further work on housing delivery, and employment land supply. This included exploring opportunities to allocate further sites. As a consequence, SYSTRA has undertaken an updated assessment considering an additional 30 development sites across the local authority area. This is based on the short list of sites discussed with Members in February and March 2025, which includes the proposed additional site allocations, as well as other sites that were considered at that stage.

2.1.3 SCC have developed a series of Local Plan options corresponding to differing levels of development intensity. The Council's agreed spatial option maximises sites in the urban area, whilst allowing consideration of brownfield sites in the Green Belt that adjoin the existing urban area, striking a balance between provision of new homes and protection of the environment. This work focusses on the preferred spatial option site allocations comprising of 32,026 homes and 1.34 million square metres of employment floorspace2. These figures represent the full shortlist of sites

[2] Excluding Windfall Sites.

discussed with Members in February and March 2025, which includes those sites which were not taken forwards as allocated sites (these sites comprise approximately 1,300 homes and 60,000 square metres of employment floorspace. This represents a worst case scenario as it provides for more capacity than will be required.

2.1.4 The work has utilised the Sheffield City Region Transport Model 1 (SCRTM1), which is a Variable Demand Model (VDM) designed to estimate the effect of changes in transport infrastructure and travel cost upon patterns of demand.

2.1.5 The final phase of the work has focused upon identifying transport impacts and developing potential mitigation concepts under the following workstreams:

- public transport and active travel networks, in Sheffield City centre and in the vicinity of significant development sites;
- Local road network (LRN), in Sheffield City centre and in the vicinity of significant development sites; and
- Strategic Road Network (SRN) within the agreed area of influence.

2.2 Other Reports

2.2.1 This report should be read in conjunction with the reports documenting other workstreams, specifically:

- ***Summary Report on Strategic Models Results (May 2025)*** – documenting the strategic modelling work undertaken and the expected city-wide demand changes as a result of the Local Plan
- ***Report on Public Transport and Active Travel Impacts and Potential Mitigation (May 2025)*** – documenting the public transport and active travel demand analysis undertaken using SCRTM1 and potential recommendations for mitigation measures
- ***Report on Local Road Network Impacts and Potential Mitigation (May 2025)*** – documenting the LRN road capacity analysis undertaken using a range of

modelling tools and techniques along with potential recommendations for mitigation measures

2.3 Consultation

2.3.1 In addition to the technical components of the work, SYSTRA has also consulted with NH and their Spatial Planning consultants, the South Yorkshire Mayoral Combined Authority (SYMCA), Rotherham Metropolitan Borough Council (RMBC), Barnsley Metropolitan Borough Council (BMBC), and other neighbouring authorities. The methodology and key assumptions have been discussed with these stakeholders as the work progressed.

2.3.2 Prior to any mitigation schemes being developed, pre-existing committed infrastructure upgrades as outlined within Sheffield City Council's Infrastructure Development Plan (IDP Part 2) were reviewed. This was done to attempt to ensure that no mitigation strategies already exist for junctions identified through this study as needing intervention.

2.4 SRN Area of Impact

2.4.1 Table 1 shows the extent of the SRN considered in this work as agreed with NH.

Table 1. Extent of SRN Analysis

ROAD SECTION	ROAD JUNCTION / SECTION
M1	J30, J31, J32, J33, J34 (S), J34 (N), J35, J35A, J36
A616	From M1 J35A west to A628 (Flouch Roundabout)

2.4.2 Further detailed analysis of some specific SRN sections is being undertaken using the Aimsun microsimulation models held by SCC. As such, not all of the road junctions / sections set out in Table 1 are considered in this report. Table 2 describes the analytical tools used for specific SRN locations.

Table 2. Analytical Tools Utilised for Specific SRN Locations

ANALYTICAL TOOLS	ROAD JUNCTION / SECTION / AREA
Aimsun Microsimulation Models	M1 J34 (S), J34 (N)
Local Junction Models & Other Tools	M1 J30, J31, J32, J33, J35, J35A, J36 A616 from M1 J35A west to junction with A628

2.5 Scenarios

2.5.1 Transport demand, capacity impacts and mitigation requirements have been assessed for the following scenarios:

- Reference Case scenario 2029 and 2039 – without Sheffield Local Plan developments
- With Sheffield Local Plan 2029 and 2039

2.6 Purpose of this Report

2.6.1 The purpose of this report is to summarise the findings of the initial assessments of the strategic road network surrounding Sheffield, considering the impact of the Sheffield Local Plan.

2.6.2 The report is structured as follows:

- Chapter 3 - sets out the technical approach;
- Chapter 4 - provides a summary of link capacity and merge /diverge analysis;
- Chapter 5 - provides a summary junction capacity analysis and sets out identified potential mitigation measures;
- Chapter 6 -provides a summary of the current situation for each junction on the network; and
- Chapter 7 - summarises the findings of the report.

3. TECHNICAL APPROACH

3.1 Forecasting Approach

3.1.1 In order to support the development of the Sheffield Local Plan, a multi-modal transport model, called Sheffield City Region Transport Model 1 (SCRTM1), has been used. This model was developed by the South Yorkshire Mayoral Combined Authority (SYMCA). The SCRTM1 variable demand model (VDM) is designed to estimate the effect of changes in transport infrastructure and travel cost upon patterns of demand. Highway schemes that have been added to the SCRTM1 model to reflect network changes since 2016 are shown in Appendix A.

3.1.2 Further details of the characteristics of this model and how it was modified for use in this work can be found in Chapter 3 of the "*Summary Report on Strategic Model Results*" (May 2025).

3.2 Context

3.2.1 This assessment is considered to represent a worst case scenario in terms of traffic demand. The future year Reference Scenario forecasts do not include the representation of any transport interventions over and above already committed and funded interventions, nor the introduction of the policy proposals and mode shift proposals set out in the Sheffield Transport Strategy (https://www.sheffield.gov.uk/travel-transport/transport-strategy-plans). Hence the model tests described in this report are referred to as "Policy Off" tests. As a consequence of this, the strategic modelling does not capture the likely impacts of the land use policies and transport interventions intended to result in reduced trip lengths, as trips increasingly redistribute to local neighbourhood destinations. Nor do they take account of the expected increase in the use of public transport or active modes resulting from improved provision of facilities.

3.2.2 Furthermore, this assessment is considered to represent a worst-case scenario, as this report largely considers the SRN in isolation from other Local Plan schemes. For

example, the potential modal shift benefits of the proposed Local Plan Public Transport /Active Travel schemes have not been taken into account as part of this report

3.2.3 A separate report, **'Transport Assessment - Report on Potential Public Transport and Active Travel Mode Share'** presents the potential for corridor modal shift given implementation of the proposed Local Plan mitigation measures, using the best available tools, comparable case studies and relevant research, and sets out the anticipated corridor-by-corridor demand uplift associated with the public transport and active travel Local Plan mitigation measures

3.3 Junction Modelling

3.3.1 Local junction capacity assessments utilised the Junctions 10 and LinSig v3 software in order to conduct a more detailed review of the potential impacts associated with the Local Plan.

3.3.2 Signalised junctions were assessed in detail using industry-standard modelling software LinSig version 3. Junctions 10 is an industry standard software package used to assess priority and roundabout junctions. With each of these analysis tools, the measurement of impacts across these junctions has been based on the units used within each respective program – Degree of Saturation (DoS%) to represent LinSig models, and Ratio of Flow Capacity (RFC) for Junctions 10 models.

3.3.3 For signalised junctions, the threshold indicator is recognised as the Degree of Saturation (DoS%). Once the DoS value reaches 1.0 (100%) a junction is considered to be over-capacity.

3.3.4 It should be noted that once a RFC value reaches 0.85 (85%) in Junctions 10, further impacts are generally over-estimated, and the impacts on the approach from the introduction of traffic associated with the proposed traffic management would in reality be modest.

3.4 Merge / Diverge Analysis

3.4.1 The merge and diverge assessment evidence base is made up of the following:

- Corridor-based spreadsheet assessments, using the 'CD122: Geometric design of grade separated junctions' section from the Design Manual for Roads and Bridges (DMRB).
- The 'Sheffield Local Plan - M1 Corridor' Excel file, which summarises the required standard in 2029 and 2039 for both the 'Reference case' and ''with Local Plan'' scenarios, as well as a comparison with the existing layout.

3.5 Corridor-based Spreadsheets

3.5.1 The 'Sheffield Local Plan - M1 Corridor' spreadsheet covers the SRN in the study area, which corresponds to the M1 between Junction 30 and Junction 36. The 'Sheffield Local Plan – A616' spreadsheet covers the merge and diverge sections of the A616 / A629 junction.

3.5.2 The tabs within each spreadsheet work along the network, starting in the northbound direction from M1 Junction 30, and returning from M1 Junction 36 in the southbound direction. The usage of this convention then allows the standard from merge to diverge along the network to be followed.

3.5.3 Each spreadsheet references flows from the model under the following scenarios:

- 2029 Reference Case – AM and PM peak
- 2029 With Sheffield local Plan – AM and PM peak
- 2039 Reference Case – AM and PM peak
- 2039 With Sheffield local Plan – AM and PM peak

3.5.4 The above scenarios are colour coded in tables at the top of each tab, and markers of the appropriate colour are translated onto versions of Figure 3.12b (Motorway merging diagram) and Figure 3.26b (Motorway diverging diagram) from DMRB, which are shown in Appendix B.

3.6 Merge/Diverge Assessment Summary Sheet

3.6.1 Given the number of slip roads across the network and the number of scenarios for each, a summary sheet of the assessment results under each scenario was also compiled.

3.6.2 For each slip road type, the assessment uses the following convention:

- The first number is the upstream number of lanes;
- The letter is the CD122 slip road type; and
- The second number is the downstream number of lanes.

3.6.3 For example, a 3D4 merge would represent a three lane motorway with a lane gain which then becomes a four lane motorway.

3.6.4 For each slip road, a comparison was made between the Reference Case and 'with Local Plan' required standard, and if the standard required for 'with Local Plan' in both peaks was less than or equal to the standard required for the Reference Case in either peak, an upgrade was not considered required as a result of the Local Plan allocations.

3.6.5 Where merge/diverge assessments illustrated a different standard in either peak between scenarios, a qualitative assessment was undertaken to identify whether the standard was higher than the Reference Case in the 'with Local Plan' scenario, and whether it was higher than the Reference Case in the other peak – this was supported by a qualitative summary of the upgrade to the merge, diverge and consequent mainline sections required as a result of the Local Plan.

3.6.6 In the event an upgrade is considered necessary, this was measured against the backdrop of current flows and/or permitted DMRB standards. For the change in flows, the margin by which the increase in traffic between the scenarios, either by model year or between the Reference Case and 'with Local Plan' scenarios, was used as a means of considering whether the volume of traffic flow change would be enough to warrant an upgrade in DMRB standard.

3.6.7 Physical and environmental constraints were also considered as part of the delivery of upgraded DMRB standards, with natural barriers such as roads and bridges, bridges, adjacent roads, railways and other transport links, as well as other structures such as buildings, houses, and electricity pylons, being taken into account when considering the ability to accommodate upgraded standards. The need to remove or adjust potential constraints were subsequently measured against the margin of traffic flow change that required a new DMRB standard to be adopted, and whether implementing such an upgrade could be justified in light of these additional works.

3.7 Approach to Mitigation

3.7.1 As previously discussed and agreed with NH and their consultants, the 'with Local Plan' Scenario was compared to the future year Reference Scenario for the same assessment year, with analysis of the results being classified as per the criteria set out in 0. Assessment is considered to be in line with TAG unit M3.1. Where necessary, some professional judgement was required for individual instances, however, these general principles were be applied when determining the significance of the assessment results:

Table 3. Classification of Junction Capacity Results

REFERENCE SCENARIO RESULT	'WITH LOCAL PLAN' SCENARIO RESULT	CLASSIFICATION	MITIGATION
Result 85% or less	With Local Plan Scenario result 85% or less	No significant impact	No mitigation required
	With Local Plan Scenario result 100% or greater	Significant impact	Mitigation required
Result between 85% and 99%	With Local Plan Scenario between 85% and 99%	No significant impact	No mitigation required
	With Local Plan result is 10% + greater than Reference result	Significant impact	Mitigation required
100% or greater	With Local Plan result is <5% greater than Reference result	No significant impact	No Mitigation required
	With Local Plan result is 5% + greater than Reference result	Significant impact	Mitigation required

3.7.2 Further to any mitigation schemes developed as a result of impacts compared to the criteria set out in 0, pre-existing committed infrastructure upgrades as outlined within Sheffield City Council's Infrastructure Delivery Plan (IDP) have also been reviewed. This was done to attempt to ensure that no mitigation strategies already exist for junctions identified through this study as needing intervention. Schemes identified as having significant PT/Active and Highway capacity benefits have been listed in Table 4.

Table 4. SCC Infrastructure Development Plan Schemes - Road

SCHEME NAME	SCHEME TYPE	INFRASTRUCTURE TYPE	SCHEME DETAILS
TR07 (Shalesmoor)	Integrated transport improvements	Transport - Local Road Network	Provision of additional transport capacity to support housing and employment growth around Kelham and Neepsend in the Shalesmoor Gateway (A61 Penistone Road between Rutland Road and Shalesmoor). Encouragement of more travel by active modes (walking and cycling) and public transport (tram and bus). Improve journey times and reliability for all modes on the Inner Ring Road. Support emergency access to the Northern General Hospital.
TR08 (Broadfield Road)	Integrated transport improvements	Transport - Local Road Network	Provision of increased highway capacity on a localised section of the A61 Chesterfield Road corridor – complemented by the Sheaf Valley cycle route which takes active travel users away from the busy intersection at Broadfield Road
TR38 (Nether Edge to City Centre)	Integrated transport improvements	Transport - Sustainable / Public Transport	Enhanced transport connectivity between Sharrow, Nether Edge and Broomhall linking into the city centre while at the same time improving journeys in the local area.
TR44 (A61 Chesterfield Road South)	Integrated transport improvements	Transport - Sustainable / Public Transport	Proposed A61 South Chesterfield Road corridor improvements including the delivery of a range of public transport, pedestrian access, highways and signal interventions.
TR45 (A61 North - Penistone Road)	Integrated transport improvements	Transport - Sustainable / Public Transport	Proposed A61 North Penistone Road corridor improvements including the delivery of a range of public transport, pedestrian access, highways and signal interventions.
TR46 (Sheffield to high Green)	Integrated transport improvements	Transport - Sustainable / Public Transport	Proposed Sheffield to High Green corridor improvements including the delivery of a range of public transport, pedestrian access, highways and signal interventions.

4. STRATEGIC ROAD NETWORK – LINK CAPACITY AND MERGE/ DIVERGE IMPACTS

4.1 SRN Flows and Capacity

4.1.1 Analysis of traffic flows and capacities was undertaken for all Strategic Road Network (SRN) links. Appendix C presents the following analysis for all of these roads:

- Assumed Link Capacity;
- Observed Base Year Flows;
- Base Year, 2029 and 2039 Reference Case Flows, and 2029 and 2039 'with Local Plan' Scenario Flows in vehicles / hour;
- Flow Differences between the Reference Case and the 'with Local Plan' Models; and
- Calculated Volume Over Capacity Ratios – this is a ratio which gives a good overall guide to a road's capacity *(V/C ratio is calculated for each turning movement at each junction. It is calculated by dividing the flow arriving at the junction by the capacity, separately for each turning movement. When the V/C is 100% the junction is at capacity*).

4.1.2 A summary of the SRN links which are most affected by the local plan traffic in 2029 is shown in Table 5. This table shows links where there is an increase in *V/C* due to Local Plan traffic, and where the *V/C* in either peak hour is higher than the 85% desirable threshold.

4.1.3 In most of these cases, the increase in V/C due to Local Plan traffic is marginal, being in the range 1-4%. The links where the change in V/C exceeds this are listed below. The potential requirement for mitigation measures at these junctions is discussed in the following sections.

- M1 Junction 34 (South) (On Slip Road: Merge) – evening peak hour;
- M1 Junction 34 (North) (On Slip Road: Merge) – evening peak hour;
- M1 Junction 34 (North) (Off Slip Road: Diverge) – morning peak hour;

- M1 Junction 35A (At Junction) – evening peak hour; and
- M1 Junction 35A - M1 Junction – evening peak hour.

Table 5. 2029 Link Capacity Analysis for the SRN

		REF CASE V/C		LOCAL PLAN V/C	
DIRECTION	DESCRIPTION	AM	PM	AM	PM
Northbound	M1 Junction 31 - M1 Junction 32	87%	86%	88%	87%
Southbound	M1 Junction 32 - M1 Junction 31	79%	91%	80%	93%
Eastbound	M1 Junction 33 - M1 Junction 32	68%	89%	69%	93%
Eastbound	M1 Junction 33 (At Junction)	60%	82%	61%	85%
Southbound	M1 Junction 34 (South) (On Slip Road: Merge)	41%	92%	42%	108%
Northbound	M1 Junction 34 (North) (On Slip Road: Merge)	73%	111%	74%	114%
Southbound	M1 Junction 34 (North) (Off Slip Road: Diverge)	101%	71%	108%	69%
Northbound	M1 Junction 34 (North) - M1 Junction 35	61%	82%	63%	86%
Northbound	M1 Junction 35 - M1 Junction 35A	63%	84%	63%	87%
Northbound	M1 Junction 35A (At Junction)	71%	99%	70%	103%
Northbound	M1 Junction 35A - M1 Junction 36	71%	99%	70%	103%
Northbound	M1 Junction 36 - M1 Junction 37	85%	95%	86%	97%
Southbound	M1 Junction 37 - M1 Junction 36	82%	91%	82%	92%

4.2 SRN Mainline and Merge/Diverge Assessments

4.2.1 Merge/Diverge Assessments are conducted in order to determine the appropriate layout of merging and diverging facilities for grade separated trunk road and motorway junctions.

4.2.2 These assessments have been undertaken in accordance with criteria set out in the Design Manual for Roads and Bridges, CD122, Geometric Design of Grade Separated Junctions (latest version dated January 2022).

4.2.3 In order to further determine the likely effect of the Local Plan traffic on the operation of the SRN, assessments at Junctions 30 to 36 of the M1, and the junction of the A616 / A629, were based on merge and diverge standards and the potential need to improve merge and/or diverge standards at one or more locations. Table 6, Table 7, and Table 8 provide excerpts from the merge/ diverge summary sheet, covering the 2029 and 2039 Reference Case and 'with Local Plan' scenarios.

4.2.4 As stated in Section 3, for each slip road type, the assessment uses the following convention: the first number is the upstream number of lanes, the letter is the CD122 slip road type and the second number is the downstream number of lanes. For example, a '3D4' merge would represent a three lane motorway with a lane gain which then becomes a four lane motorway downstream.

4.2.5 Cells are highlighted orange if an upgrade is considered necessary, and yellow if an upgrade is only needed in 2029 versus the Reference Case or could be considered debateable against the backdrop of current flows and/or permitted DMRB standards.

Table 6. Merge and Diverge Assessment Summary – M1 Corridor Northbound

NORTHBOUND / SOUTHBOUND JUNCTIONS	EXISTING STANDARD	2029 REFERENCE		2029 'WITH LOCAL PLAN' ALLOCATIONS		2039 REFERENCE		2039 'WITH LOCAL PLAN' ALLOCATIONS	
		AM	PM	AM	PM	AM	PM	AM	PM
J30 NB Diverge	4A4	3A3	3A3	3A3	3A3	3A3	3A3	3A3	3A3
J30 NB Merge	4A4	3A3	3A3	3A3	3A3	3A3	3A3	3A3	3A3
J31 NB Diverge	4A4	3A3	3A3	3A3	3A3	3A3	4C3	3A3	4C3
J31 NB Merge	4C4	3E4	3D4	3E4	3D4	3E4	3D4	3E4	3D4
J32 NB Diverge	4D3	4E2	4E2	4E2	4E2	4D3	4D3	4D3	4D3
J32 NB Merge	3E4	2E4	2E4	2E4	2E4	3E4	3E4	3E4	3E4
J33 NB Diverge	4D3	4D3	4D3	4D3	4D3	4D3	4D3	4D3	4D3
J33 NB Merge	3D4	3B3	3B3	3B3	3E4	3B3	3D4	3E4	3E4
J34S NB Diverge	4D3	3D2	4C3	4E2	4C3	4E3	4C3	4E3	4C3
J34N NB Merge	3D4	2D3	3E4	2D3	3E4	3C3	3E4	3C3	3F5
J35 NB Diverge	4A4	3A3	4C3	3A3	4C3	3A3	4A4	3A3	4C4
J35 NB Merge	4A4	3A3	3D4	3A3	3D4	3A3	4A4	3A3	4B4
J35a NB Diverge	4C3	3A3	4C3	3A3	4C3	3A3	4A4	3A3	4A4
J36 NB Diverge	3A3	3C2	3A3	3C2	3A3	3C2	4C3	3C2	4C3
J36 NB Merge	3A3	2E3	3B3	2E3	3B3	2E3	3D4	2E3	3D4

Table 7. Merge and Diverge Assessment Summary – M1 Corridor Southbound

NORTHBOUND / SOUTHBOUND JUNCTIONS	EXISTING STANDARD	2029 REFERENCE		2029 'WITH LOCAL PLAN' ALLOCATIONS		2039 REFERENCE		2039 'WITH LOCAL PLAN' ALLOCATIONS	
		AM	PM	AM	PM	AM	PM	AM	PM
J36 SB Diverge	3A3	3A3	3C2	3A3	3D2	3A3	3A3	3A3	3A3
J36 SB Merge	3A3	3A3	2D3	3A3	3A3	3A3	3A3	3A3	3A3
J35a SB Merge	3D4	3D4	3B3	3D4	3B3	3D4	3D4	3D4	3E4
J35 SB Diverge	4A4	4C3	3A3	4C3	3A3	4A4	4C3	4A4	4C3
J35 SB Merge	4A4	3D4	3A3	3D4	3A3	4A4	3A3	4B4	3D3
J34N SB Diverge	4C3	4D3	3A3	4D3	3A3	4D3	3A3	4D3	3A3
J34S SB Merge	3E4	3A3	3C3	3A3	3E4	3B3	3E4	3B3	3E4
J33 SB Diverge	4C3	3A3	3A3	3A3	4C3	3A3	4C3	4C3	4D3
J33 SB Merge	3E4	3E4	3E4	3E4	3E4	3E4	3E4	3E4	3E4
J32 SB Diverge	4D3	3D2	4D3	3D2	4D3	4D3	4D3	4D3	4D3
J32 SB Merge	3E4	2F4	3E4	2F4	3E4	3E4	3E4	3E4	3E4
J31 SB Diverge	4B4	4C3	4D3	4C3	4D3	4C3	4D3	4C3	4D3
J31 SB Merge	4A4	3A3	3A3	3A3	3A3	3D4	3D4	3D4	4A4
J30 SB Diverge	4A4	3A3	3A3	3A3	3A3	4C3	4C3	4C3	4C3
J30 SB Merge	4A4	3A3	3B3	3A3	3B3	3D4	3D4	3D4	3D4

Table 8. Merge and Diverge Assessment Summary – A616 Corridor

NORTHBOUND / SOUTHBOUND JUNCTIONS	EXISTING STANDARD	2029 REFERENCE		2029 'WITH LOCAL PLAN' ALLOCATIONS		2039 REFERENCE		2039 'WITH LOCAL PLAN' ALLOCATIONS	
		AM	PM	AM	PM	AM	PM	AM	PM
Westbound									
A616-A629 WB Diverge	1A1	1A1	1A1	1A1	1A1	1A1	1A1	1A1	1A1
A616-A629 WB Merge	1A1	1D2	1D2	1D2	1D2	1D2	1D2	1D2	1D2
Eastbound									
A616-A629 EB Diverge	2A2	1A1	1A1	1A1	1A1	1A1	1A1	1A1	1A1
A616-A629 EB Merge	2A2	1D2	1D2	1D2	1D2	1D2	1D2	1D2	1D2

4.2.6 As a result of the merge/diverge assessment results indicated in Table 6, Table 7 and Table 8, there are potentially nine locations that may require a change in merge/diverge standard.

- M1 Junction 31 Southbound Diverge - A new diverge standard may be required at this location. Appendix D Figure D7 shows an illustrative scheme design, providing a ghost island lane drop, by reducing the number of mainline lanes through the junction and providing a lane gain south of the junction.
- M1 Junction 33
  - Northbound Merge - A new merge standard may be required at this location. Appendix D Figure D8 shows an illustrative scheme design for a ghost island lane gain, which takes the physical constraints of a pre-existing railway bridge into consideration.
  - Southbound Diverge - A new diverge standard may be required at this location. Appendix D Figure D9 shows an illustrative scheme design for

a ghost island lane drop, which takes the physical constraints of a pre-existing bridge over the railway and Orchard Road into consideration.

- M1 Junction 34 Northbound Merge – It is understood that an existing developer led scheme is progressing through the design process which is expected to resolve this issue.
- M1 Junction 35
  - Southbound Merge - A new merge standard may be required at this location. Appendix D Figure D9 shows an illustrative scheme design for a parallel merge, which takes into account an existing footbridge support structure.
  - Northbound Merge – A new merge standard may be required at this location. Appendix D Figure D10 shows an illustrative scheme design for a parallel merge.
- M1 Junction 35a Southbound Merge – A new merge standard may be required at this location. Appendix D Figure D11 shows an illustrative scheme design for a ghost island lane gain.
- M1 Junction 36:
  - Northbound Merge - A new merge standard may be required at this location. Appendix D Figure D12 shows an illustrative scheme design for a parallel merge.
  - Southbound Diverge - A new diverge standard may be required at this location. Appendix D Figure D13 shows an illustrative scheme design for an auxiliary lane diverge.

4.2.7 It is recommended that the operation of these six junctions is reviewed five years into the Local Plan. Further investigation on the impact of junction 36 may be required as the peak hour assessed in this study may not be the worst case at this junction. Webtris data suggests an earlier peak period may have more traffic. In addition, there are external impacts from developments outside of Sheffield on this junction.

4.2.8 All other merge and diverge facilities at junctions both northbound and southbound are considered to operate within their current standards, and will therefore not require a change in standard to accommodate development traffic associated with the Local Plan.

5. STRATEGIC ROAD NETWORK – JUNCTION IMPACTS

5.1 Introduction

5.1.1 As part of the assessment of impacts caused by the introduction of the Local Plan traffic, relevant sections of the Strategic Road Network (SRN) were measured due to their proximity to various allocations as outlined within the forthcoming plan – this included both the M1 Corridor and the A616 Corridor to the north of Sheffield.

5.1.2 Based on the potential impacts of the Sheffield Local Plan, the following junctions were considered for local junction impact assessments. Figure 2 also illustrates the location of these junctions and their individual type:

- M1 Junction 30 (w A616 / A6135);
- M1 Junction 31 (w A57);
- M1 Junction 32 (w M18);
- M1 Junction 33 (w A630);
- M1 Junction 34 South (w A637 / A6178);
- M1 Junction 34 North (w A6109);
- M1 Junction 35 (w A629);
- M1 Junction 35A (w A616);
- M1 Junction 36 (w A61 / A6195);
- A616 / Thorncliffe Road;
- A616 / A61;
- A616 / A629;
- A616 / A6102; and
- A616 / A628.

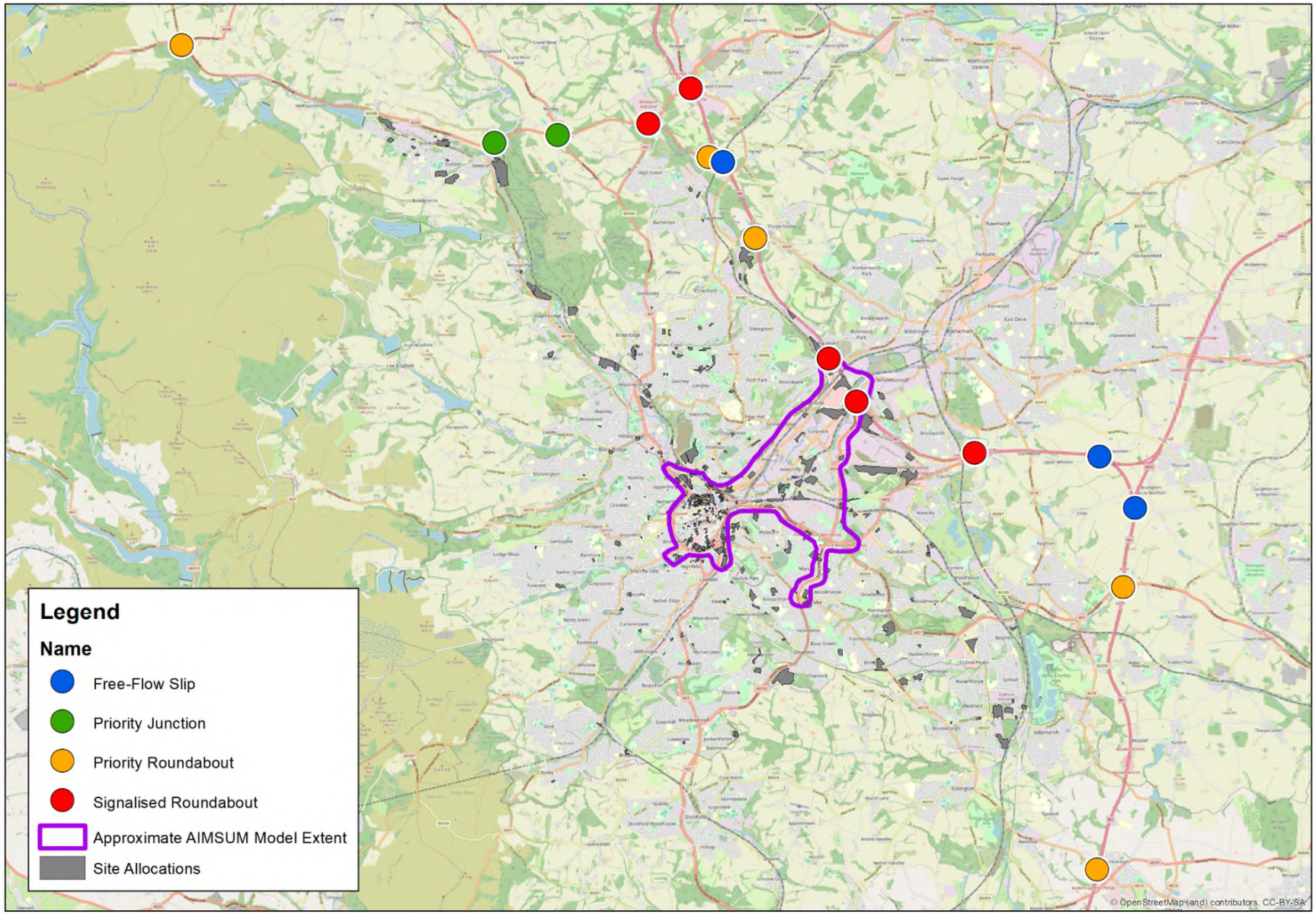


Figure 2. Strategic Road Network – Junctions Assessed

5.1.3 Of the above stated junctions, M1 Junction 32 and Junction 35a were not assessed using traffic modelling due to being free-flow junctions. These were measured using merge/diverge assessments as outlined in Section 6 of this report. M1 Junction 34 North and 34 South are part of the Aimsun microsimulation modelling work, and so are not included within this report.

5.1.4 The A616 / A628 junction was also discounted following a strategic modelling exercise that illustrated that the cumulative number of development trips associated with the Local Plan were not enough to warrant dedicated local junction assessments at this location.

Table 9. Method of Assessment– Strategic Road Network

ROAD	JUNCTION	REFERENCE NO	METHOD OF ASSESSMNET
M1	M1 Junction 30 (w A616 / A6135)	S1	Not included due to negligible impact from the Local Plan
	M1 Junction 31 (w A57)	S2	Junctions 10 ARCADY and LinSig Junction Models
	M1 Junction 32 (w M18)	S3	Free Flows Slip Roads (Merge/Diverge Assessment)
	M1 Junction 33 (w A630)	S4	LinSig Junction Model
	M1 Junction 34 South (w A637 / A6178)	S5	Aimsun Microsimulation Model
	M1 Junction 34 North (w A6109)	S6	Aimsun Microsimulation Model
	M1 Junction 35 (w A629)	S7	Junctions 10 ARCADY and LinSig Junction Models
	M1 Junction 35A (w A616)	S8	Free Flows Slip Roads (Merge/Diverge Assessment)
	M1 Junction 36 (w A61 / A6195)	S9	LinSig Junction Model
A616	A616 / Thorncliffe Road	S14	Junctions 10 ARCADY Junction Model.
	A616 / A61	S10	LinSig Junction Model
	A616 / A629	S11	Junctions 10 PICADY Junction Model.
	A616 / A6102	S12	Junctions 10 PICADY Junction Model.
	A616 / A628	S13	Not included due to negligible impact from the Local Plan

5.1.5 There is a known improvement scheme at M1 J30. Although the scheme is not fully committed it has been agreed with NH that the operation of this junction should be tested with this improvement scheme in place. Appendix D Figure D1 shows the layout of the proposed scheme. Further discussion of this junction can be found in Section 5.3.

5.1.6 Local junction capacity assessments utilised the Junctions 10 and LinSig v3 software in order to conduct a more detailed review of the potential impacts associated with the Local Plan.

5.1.7 Signalised junctions were assessed in detail using industry-standard modelling software LinSig version 3. Junctions 10 is an industry standard software package used to assess priority and roundabout junctions. With each of these analytical tools, the measurement of impacts across these junctions has been based on the units used within each respective program – Degree of Saturation (DoS%) to represent LinSig models, and Ratio of Flow Capacity (RFC) for Junctions 10 models.

5.1.8 For signalised junctions, the threshold indicator is recognised as the Degree of Saturation (DoS%). Once the DoS value reaches 1.0 (100%) a junction is considered to be over-capacity

5.1.9 It should be noted that once an RFC value reaches 0.85 (85%) in Junctions 10, further impacts are generally over-estimated, and the impacts on the approach from the introduction of traffic associated with the proposed traffic management would in reality be modest.

5.2 Junction Capacity Assessment Results

5.2.1 The analysis for those junctions outlined in Table 10 is based on which arm illustrates the highest capacity level within the junction, and is measured in RFC/DoS (the measurements of which are outlined above) depending on the type of junction and the software used to assess the traffic impacts.

Table 10. Junction Capacity Assessment Results – Strategic Road Network

JUNCTION NAME	JUNCTION MODELING RESULTS							
	2029 Reference Case		2029 'with Local Plan'		2039 Reference Case		2039 'with Local Plan'	
	MORNING PEAK	EVENING PEAK	MORNING PEAK	EVENING PEAK	MORNING PEAK	EVENING PEAK	MORNING PEAK	EVENING PEAK
M1 Junction 30 (w A616 / A6135)	68%	67%	67%	68%	78%	66%	75%	70%
M1 Junction 31 (w A57)	112%	136%	122%	146%	122%	145%	137%	153%
M1 Junction 33 (w A630)	85%	81%	85%	92%	98%	96%	98%	97%
M1 Junction 35 (w A629)	90%	90%	104%	104%	98%	93%	153%	163%
M1 Junction 36 (w A61 / A6195)	78%	86%	88%	86%	79%	97%	91%	103%
A616 / Thorncliffe Road	91%	100%	99%	102%	99%	103%	115%	120%
A616 / A61	102%	184%	111%	184%	107%	176%	121%	192%
A616 / A629	68%	87%	79%	121%	103%	128%	96%	167%
A616 / A6102	61%	78%	52%	92%	66%	77%	57%	93%

5.2.2 The junction modelling assessments indicate that, whilst there are several junctions currently operating over capacity in the Reference Case scenarios, the only junctions illustrated to be severely impacted by the introduction of the Local Plan trips are listed as follows:

- M1 Junction 31;
- M1 Junction 35;
- A616/ Thorncliffe Road Roundabout;
- A61 / A616 Westwood Roundabout; and
- A616 / A629 Priority Interchange.

5.2.3 With regard to potential impacts introduced by Local Plan related traffic, the following list of allocations have been identified that could give rise to implications at the five junctions listed above. For the A616 junctions, based on the proximity of allocation sites, flows associated with these allocations are considered to be corridor based as they travel along the A616 to reach these junctions rather than joining on one of the local road arms. For the M1 junctions, flows associated with allocation sites are considered to be a mixture of corridor based trips passing through the grade-separated motorway junctions, or are strategic trips accessing the M1 itself

Table 11. List of Identified Local Plan allocations with impacts on SRN junctions

SITE REF	ADDRESS	SITE USE	QUANTUM
S00763	Stocksbridge Steelworks, Fox Valley Way, S36 2BT	Residential	34 dwellings
S02091	Outokumpu site at Manchester Road, Stocksbridge	Retail	57,370sqm
S03857	Enterprise House Site Adjacent To 1 Hunshelf Park Sheffield S	Residential	10 dwellings
S04547	Land Adjacent Ford House 4 Fox Valley Way, Sheffield S36 2AD	Residential	33 dwellings
S00671	Stocksbridge Steelworks, Manchester Road, S36 1FT	Residential	190 dwellings
S00788	Land At The Rear Of 13 And 42 Coppice Close Sheffield S36 1LS	Residential	13 dwellings
S01274	Land at Manchester Road and adjacent to 14, Paterson Close, Park Drive Way, Stocksbridge, Sheffield.	Residential	55 dwellings
S01471	Sweeney House, Oxley Close, S36 1LG	Residential	18 dwellings
S03191	Balfour House, Coronation Road, S36 1LQ	Residential	33 dwellings
S03192	Land adjacent to the River Don, Station Road, S36 2UZ	Employment	8,886sqm
S03193	Former Steins Tip, Station Road, Deepcar	Residential	428 dwellings
S03474	49 Pot House Lane Sheffield S36 1ES	Residential	14 dwellings

SITE REF	ADDRESS	SITE USE	QUANTUM
S04143	Land at Junction with Carr Road, Hollin Busk Lane Sheffield S36 2NR	Residential	85 dwellings
S04144	Land to the south of Broomfield Lane, S36 1QQ	Residential	142 dwellings
S04307	Land Within The Curtilage Of Ingfield House 11 Bocking Hill Sheffield S36 2AL	Residential	14 dwellings
S03904	Swimming Baths Burncross Road Sheffield S35 1RX	Residential	10 dwellings
S03906	Former Chapeltown Training Centre 220 - 230 Lane End Sheffield S35 2UZ	Residential	14 dwellings
S00122	South Yorkshire trading Standards Unit	Mixed Use	8 dwellings 10,315 sqm employment
GBOM06	Land to the North of Parkers Lane, Dore	Residential	82 dwellings
S02898	Land to the south of White Lane, Gleadless Townend, S12 3HS	Residential	344 dwellings
S03020	Land between Bramley Lane and Beaver Hill Road, Handsworth	Residential	878 dwellings
S03028 / S03100	Land to the west of Grenoside Grange, Fox Hill Road, S35 8QS and Holme Lane Farm, Halifax Road, Grenoside, S35 8PB	Residential	235 dwellings
S03032	Land at Forge Lane, Oughtibridge, S35 0GG	Residential	69 dwellings

SITE REF	ADDRESS	SITE USE	QUANTUM
S03051	Land to the South of the Wheel S35 8RY and land between Creswick Avenue and Yew Lane, S35 8QN, Ecclesfield	Residential	671 dwellings
S03035	Land at Wheel Lane and Middleton Lane, S35 8PU	Residential	148 dwellings
S03038	Land to the East of Chapeltown Road, Chapeltown, S35 9ZX	Residential	549 dwellings
S03061	Handsworth Hall Farm	Residential	983 dwellings, 80,000 sqm employment
S03112	Land bordered by M1, Thorncliffe Road, Warren Lane, and White Lane	Employment	71,880 sqm employment
S04101	Land to the south of the M1 Motorway Junction 35, Ecclesfield	Employment	88,080 sqm employment
S04639	Hesley Wood, North of Cowley Hill, Chapeltown	Employment	56,480 sqm employment

5.2.4 Where the capacity figures demonstrate that the junction would operate above the agreed threshold set out in 0, mitigation was investigated to alleviate the overall effects of the Local Plan. For junctions already illustrated as being over capacity in the Reference Case scenarios, it is not the purpose of this study to present mitigation schemes to solve pre-existing problems, only to mitigate the impacts of the Local Plan traffic.

5.3 Junctions Requiring Mitigation

5.3.1 As identified in Table 10, five junctions across the assessment area are illustrated to be affected by significant levels of congestion or increased demand associated with the Local Plan allocations. Subsequently, five mitigation schemes have been developed, as outlined in Table 12. Figure 3 illustrates the location of these junctions and their individual type.

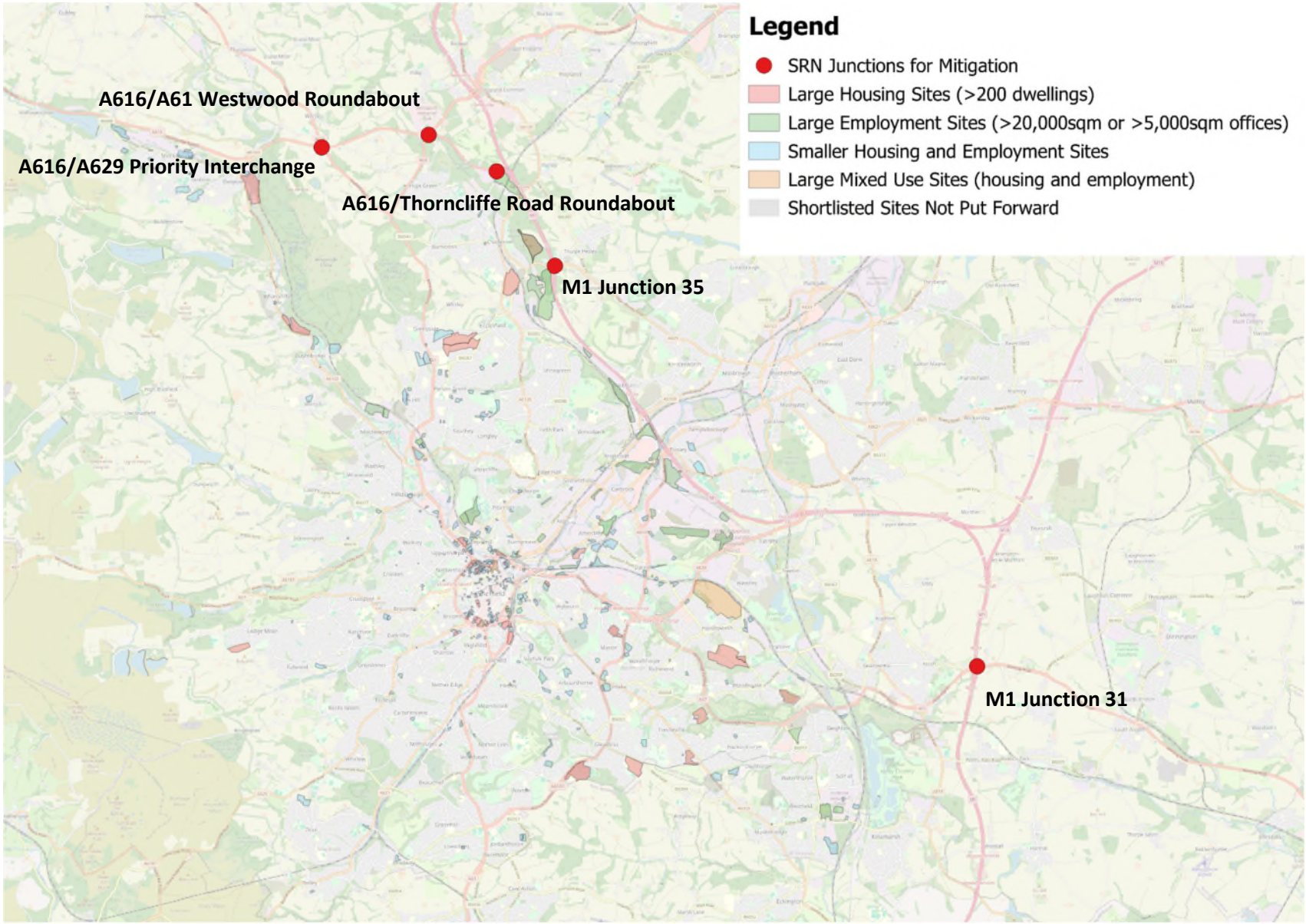


Figure 3. Strategic Road Network – Junctions Proposed for Mitigation

Table 12. List of Identified SRN Junction Mitigation schemes

JUNCTION	MITIGATION PROPOSED
M1 Junction 31	Signalisation of all arms together with widening to the M1 (N), A57 (W) and A57 (E) approach arms.
M1 Junction 35	Signalisation of all arms.
A616 / Thorncliffe Road	Provision of free-flow slip between A616 (W) and M1 (E) that removes through SRN traffic from circulatory – may require a departure from standard in order to accommodate merge of free-flow slip onto M1 slip road.
A616 / A61 Westwood Roundabout	Addition of third lane on south circulatory for dedicated right-turn movement into Industrial Estate and onto A61 (N) – extension of A616 (E) left-turn approach lane to 100m. Localised widening of A616 (W) to form flare and third lane at stopline. localised widening of A616 (W) to form flare and third lane at stopline. localised widening of A61 (N) to form flare and third lane at stopline.
A616/A629 Priority Interchange	Conversion of northern junction (A616 EB On/off slip with A629) to signalisation with two-lane approach at stopline from A616, and ghost island right-turn from A629 (N).

5.3.2 Following the identification of mitigation schemes illustrated in Table 12, junction capacity assessments have been conducted and are summarised in Table 13.

5.3.3 The analysis for those junctions outlined in Table 13 is based on which arm illustrates the highest capacity level within the junction, and is measured in RFC/DoS (the measurements of which are outlined above) depending on the type of junction and the software used to assess the traffic impacts

Table 13. Junction Assessment Results – With Mitigation

JUNCTION NAME	JUNCTION TYPE	2029 REF		2029 LOCAL PLAN		2039 REF		2039 LOCAL PLAN	
		AM PEAK	PM PEAK	AM PEAK	PM PEAK	AM PEAK	PM PEAK	AM PEAK	PM PEAK
M1 Junction 31 (w A57)	Existing	112%	136%	122%	146%	122%	145%	132%	153%
	Mitigation	N/A	N/A	92%	90%	N/A	N/A	109%	112%
M1 Junction 35 (w A629)	Existing	90%	90%	104%	104%	98%	93%	121%	115%
	Mitigation	N/A	N/A	79%	76%	N/A	N/A	96%	88%
A616 / Thorncliffe Road	Existing	91%	100%	99%	102%	99%	103%	109%	102%
	Mitigation	N/A	N/A	58%	83%	N/A	N/A	71%	85%
A616 / A61	Existing	102%	184%	111%	184%	107%	176%	118%	183%
	Mitigation	N/A	N/A	85%	88%	N/A	N/A	108%	98%
A616 / A629	Existing	68%	87%	79%	121%	103%	128%	96%	167%
	Mitigation	N/A	N/A	54%	65%	N/A	N/A	60%	77%

Note : The N/A results reflect the fact that mitigation would only be required with the Local Plan.

5.3.4 Further details of the development of the mitigation schemes and a description of what the improvement works entail are provided in the following sections.

M1 Junction 30 (w A616 / A6135)

5.3.1 Bolsover District Council are promoting an improvement scheme at M1 J30, relating to a development within Bolsover (Clowne Garden Village). As already noted in paragraph 5.1.5 above, the scheme is not fully committed, but it has been agreed with NH that the operation of this junction should be tested with this improvement scheme in place. Appendix D Figure D1 shows the layout of the proposed scheme. The capacity analysis results presented above include the traffic generated by the Clowne Garden Village development.

5.3.2 The junction capacity analysis results presented in Table 10 show no material impacts from Local Plan traffic at this location. The junction is forecast to operate satisfactorily with either arrangement in both the Reference and 'with Local Plan' scenarios.

M1 Junction 31 (w A57)

5.3.3 Congestion issues demonstrated at this location were found to be caused by the volume of traffic utilising the junction during the peak hours, with the non-signalised approaches of the existing junction causing traffic to be unable to exit due to the significant opposing flow.

5.3.4 A maximum queue length of 206 PCUs was measured in the 2029 'with Local Plan' PM Peak scenario on the M1 southern approach arm, with a maximum DoS of 153% illustrated on the M1 northern approach arm in the 2039 'with Local Plan' PM Peak scenario.

5.3.5 This junction is currently part-signalised, with the M1 Southbound Off Slip and corresponding north circulatory being signal-controlled, while all other arms are non-signalised.

5.3.6 The Local Plan mitigation developed at this location includes the signalisation of all other arms on the junction, and will include the widening of the M1 north and A57 west and east approach arms from two to three lanes in order to create additional capacity. This scheme is indicatively shown on in Appendix D Figure D2.

5.3.7 With the introduction of additional capacity at this location, significant improvements have been observed as the increased width of the approach arms and signal control at all arms have provided sufficient additional capacity to mitigate the impact of the local plan. Maximum queue lengths now exhibited at this junction are 73 PCUs on the A57 eastern approach arm during the 2039 'with Local Plan' PM Peak scenario, whilst maximum DoS is 112% during the same scenario on the same arm.

M1 Junction 33 (w A630)

5.3.1 This junction has been assessed based on its existing layout. M1 Junction 33 has recently been subject to a comprehensive upgrade in order to increase capacity on all approach arms through widening – this has been complimented through widening of the circulatory.

5.3.2 The junction is forecast to operate below capacity in both the 2029 and 2039 Reference and 'with Local Plan' scenarios, with the highest capacity of 98% DoS measured in the 2039 'with Local Plan' AM Peak. The junction capacity analysis results presented in Table 10 show no material worsening of this situation due to Local Plan traffic.

5.3.3 It is understood that a Motorway Service Area (MSA) is proposed to be constructed at this junction. The details of this scheme are still being reviewed. Therefore, the results of this junction assessment consider the junction as it is currently on the ground. It is recommended that the operation of this junction is reviewed five years into the Local Plan.

M1 Junction 34 (North and South)

5.3.1 As mentioned, this junction is included within the Aimsun microsimulation model. As further work is needed to understand the impact of the Local Plan associated traffic on the operation of these junctions, results are not included in this report.

5.3.2 It is understood that a potential mitigation scheme exists for these junctions. This mitigation scheme includes the widening of the circulatory and key approach arms to provide additional capacity.

5.3.3 Any mitigation will need to be tested to determine its suitability for accommodating the additional traffic generated by the Local Plan.

M1 Junction 35 (w A629)

5.3.4 Congestion issues demonstrated at this location were found to be caused by the volume of traffic utilising the junction during the peak hours, with all approach arms

of the existing junction reporting traffic being unable to enter the junction due to the significant opposing flow.

5.3.5 A maximum queue length of 138 PCUs was measured in the 2039 'with Local Plan' AM Peak scenario on the Upper Wortley Road eastern approach arm, while maximum RFC is 153% during the same scenario on the same arm.

5.3.6 The Local Plan mitigation developed at this location includes the signalisation of all arms at the junction, allowing for better traffic management and improved access to the circulatory for traffic entering the roundabout from the approach arms. This scheme is indicatively shown in Appendix D Figure D3.

5.3.7 With the introduction of traffic signals at this location, significant improvements to queue length and DoS have been observed as the signal control at all arms has provided sufficient additional capacity to mitigate the impact of the local plan. Maximum queue lengths now exhibited at this junction are 16 PCUs on the A629 eastern approach arm during the 2039 'with Local Plan' AM Peak scenario, whilst maximum DoS is 96% during the same scenario on the same arm.

M1 Junction 36 (w A61)

5.3.1 It is understood that a large quantum of development has recently been approved in the Barnsley district, in close proximity to this junction. Recent major infrastructure upgrades have been conducted on the surrounding local road network, which have included a fully revised signalised gyratory system to the north of M1 Junction 36 and a new link road to the southwest of Hoyland.

5.3.2 Following recent discussions with NH, it has been agreed that M1 Junction 36 can be assessed in isolation without the need to assess the surrounding local road network.

5.3.3 The junction is forecast to operate below capacity in both the 2029 and 2039 Reference and 'with Local Plan' scenarios, with the highest capacity of 97% DoS measured in the 2039 'with Local Plan' PM Peak. The junction capacity analysis results presented in Table 10 show no material worsening of this situation due to Local Plan traffic.

A616 / Thorncliffe Road

5.3.4 Congestion issues at this location were found to be caused by traffic being unable to efficiently exit the A616 western approach and M1 eastern approach arms due to the volume of conflicting traffic.

5.3.5 A maximum queue length of 151 PCUs was measured in the 2039 'with Local Plan' PM Peak scenario on the M1 eastern approach with a corresponding RFC of 119%. A maximum RFC of 115% is illustrated on the A616 western approach in the 2039 'with Local Plan' AM Peak scenario.

5.3.6 Mitigation was developed at this location that included the introduction of an eastbound free-flow bypass that would allow through traffic from the A616 western approach bound for the M1 southbound to bypass the roundabout unimpeded. This would significantly reduce the amount of traffic being routed onto the circulatory and thus result in fewer conflicting flows that would impede the access of traffic from the M1 eastern approach.

5.3.7 The delivery of this scheme may require a departure from standard due to the presence of a field access. Initial discussions have been undertaken with National Highways Safety Team as to the suitability of the design. This scheme is indicatively shown in Appendix D Figure D4.

5.3.8 With the introduction of the proposed scheme , significant improvements have been observed at this junction as traffic from the A616 western approach is now able to bypass the roundabout and sufficient additional capacity has been provided to mitigate the impact of the local plan. Maximum queue lengths now exhibited at this junction are 6 PCUs on the M1 eastern approach arm during the 2039 'with Local Plan' PM Peak scenario, whilst the maximum RFC is 85% during the same scenario on the same arm.

A616/A61 Westwood Roundabout

5.3.9 Congestion issues at this location were found to be caused by the inability of traffic to enter the junction from all approach arms due to the volume of conflicting traffic passing on the circulatory requiring the majority of the available green time.

5.3.10 A maximum queue length of 410 PCUs was measured in the 2039 'with Local Plan' PM Peak scenario on the A616 eastern approach arm, while maximum DoS is 192% during the same scenario on the same arm.

5.3.11 This junction has been subject to recent mitigation works undertaken in 2021, these included the introduction of traffic signals and road layout improvements, which have been included in this assessment. The Local Plan mitigation developed at this location includes further measures comprising; widening of the south circulatory to include a third lane for westbound A616 traffic, widening of the eastbound A616 to form a 3rd lane at the stop line, widening of the Westbound A61 to form a 3rd lane at the stop line and the extension of the A616 eastern approach arm to 100m to allow for additional storage. This scheme is indicatively shown in Appendix D Figure D5.

5.3.12 With the introduction of the proposed scheme at this location, significant improvements have been reported as the increased width of the circulatory and widening of approach arms has provided sufficient additional capacity to mitigate the impact of the local plan. Maximum queue lengths now exhibited at this junction are 41 PCUs on the A61 northbound approach arm during the 2039 'with Local Plan' AM Peak scenario, whilst maximum DoS is 108% during the same scenario on the same arm.

A616/A629

5.3.13 Congestion issues demonstrated at this location were found to be caused by the inability of traffic to successfully exit from the A616 north off-slip due to the volume of conflicting traffic on the A629.

5.3.14 A maximum queue length of 43 PCUs was measured in the 2039 'with Local Plan' PM Peak scenario on the A616 north off-slip, with a maximum RFC of 167% illustrated on the same arm in the same scenario.

5.3.15 Initial mitigation proposals involved localised widening on the A616 North off slip without signalisation. However, this did not provide sufficient additional capacity and therefore, this option was not explored further.

5.3.16 Mitigation was developed at this location that included the introduction of signalisation together with the provision of a separate left-turn lane on the A616 north off-slip – a pre-existing right-turn ghost island on the A629 northern approach arm was maintained. This scheme is indicatively shown in Appendix D Figure D6.

5.3.17 With the introduction of signals at this location, significant improvements have been reported as traffic from the A616 north off-slip is now able to exit within a suitable timeframe, without detrimentally affecting the current performance of the A629. Therefore, the proposed scheme provides sufficient additional capacity to mitigate the impact of the local plan. Maximum queue lengths now exhibited at this junction are 12 PCUs on the A629 southern approach arm during the 2039 'with Local Plan' PM Peak scenario, whilst the maximum DoS is 77% during the same scenario on the A616 north off-slip.

6. SUMMARY

6.1 Summary

6.1.1 SYSTRA are working on behalf of Sheffield City Council (SCC) who have developed a series of Local Plan options corresponding to differing levels of development intensity. This report summarises the findings of strategic transport model analysis of the transport impacts of the Local Plan Scenario on the SRN.

6.1.2 SCC have developed a series of Local Plan options corresponding to differing levels of development intensity. The Council's agreed spatial option maximises sites in the urban area, whilst allowing consideration of brownfield sites in the Green Belt that adjoin the existing urban area, striking a balance between provision of new homes and protection of the environment. This work focusses on the preferred spatial option site allocations comprising of 28,067 homes and 1.04 million square metres of employment floorspace.

6.1.3 Impacts of the Local Plan have been assessed for two forecast years (2029 and 2039) focussing on a comparison with a Reference Case scenario.

6.1.4 Of the junctions tested, five required mitigation schemes to be developed:

- M1 Junction 31;
- M1 Junction 35;
- A616/ Thorncliffe Road Roundabout;
- A61/A616 Westwood Roundabout; and
- A616 / A629.

6.1.5 Possible initial mitigation schemes have been proposed at these locations. The effectiveness of these schemes has been tested and confirmed.

6.1.6 Illustrative mitigation schemes have been developed at nine motorway merge / diverge locations which have shown a potential requirement for a change in merge/diverge standard. It is recommended that the operation of these junctions is reviewed five years into the local plan. All other merge and diverge facilities at

junctions both northbound and southbound are considered to operate within their current standards, and will therefore not require a change in standard to accommodate development traffic associated with the Local Plan.

6.1.7 Overall, based on the work to date, there are no highway capacity issues on the Strategic Road Network caused by the trips generated by the Local Plan which cannot be successfully mitigated. However, further work is required to confirm this conclusion as set out in the “Next Steps” section below.

APPENDIX A: Changes to Highway Network

The SCRTM1 has a base year of 2016. Since 2016, a number of new roads and junctions have been constructed and others upgraded or altered. There are also proposals for other transport schemes to be delivered over the coming years. The table below details the schemes that have been added to the SCRTM1 model.

Table 14. Highway Schemes Included in the Reference Forecasts

REF	AUTHORITY	SCHEME DESCRIPTION	OPENING YEAR	CERTAINTY LEVEL
B002	Barnsley	M1 Junction 36 - A6195 Dearne Valley Economic Growth Corridor (Phase 2 - Improvements to key junctions and creation of 2 new development accesses).	2019/20	More Than Likely
B004	Barnsley	M1 Junction 37, phase 1 (Dodworth road Crossroads)	2020	More Than Likely
B018	Barnsley	Darton Lane/Sackup Lane roundabout (Planning app now submitted)	2019	More Than Likely
R020	Rotherham	M1 J33/A630 Parkway	2021	More Than Likely
R021	Rotherham	M1 J33/A630 Parkway	2021	More Than Likely
R033	Rotherham	Signalise A631 Bawtry Road/B6060 Morthen Road roundabout (Mason's), Wickersley	2021	More Than Likely
S010-S012	Sheffield	A61 Chesterfield Road	2019	Near Certain
S026	Sheffield	North Sheffield Key Bus Route (BBA)	Completed	Completed
S033	Sheffield	Gleadless Key Bus Route	Completed	Completed
S041	Sheffield	City Centre	2019	Near Certain

REF	AUTHORITY	SCHEME DESCRIPTION	OPENING YEAR	CERTAINTY LEVEL
S043	Sheffield	City Centre	2019	Near Certain
S056	Sheffield	IRR / Castlegate	2019	More Than Likely
S080	Sheffield	ORR / Graves Centre	Completed	Completed
S107	Sheffield	SCRIF Bridgehouses	2020	More Than Likely
S108	Sheffield	IKEA junction improvements between A6178 / A6102 and Tinsley Roundabout, plus Meadowhall Roundabout.	Completed	Completed
DO1	Doncaster	FARRRS Phase 2, Great Yorkshire Way connection to Hayfield Lane	2018	Completed
DO3	Doncaster	Hatfield Link Road, Connection with J5 of M18 with Stainforth/Hatfield unlocking 3,100 houses and employment sites	2020	Near Certain
DO8	Doncaster	Quality Streets, Road closures and 1 way street changes to Town Centre	2019	On site
DO9	Doncaster	Trafford Way Station Improvements, Lane alterations and access to Doncaster Railway Station	2020	Near Certain
AMRC	Rotherham	AMRC	2019	More Than Likely

APPENDIX B: DMRB Merge / Diverge Diagrams

Figure 3.12b Motorway merging diagram

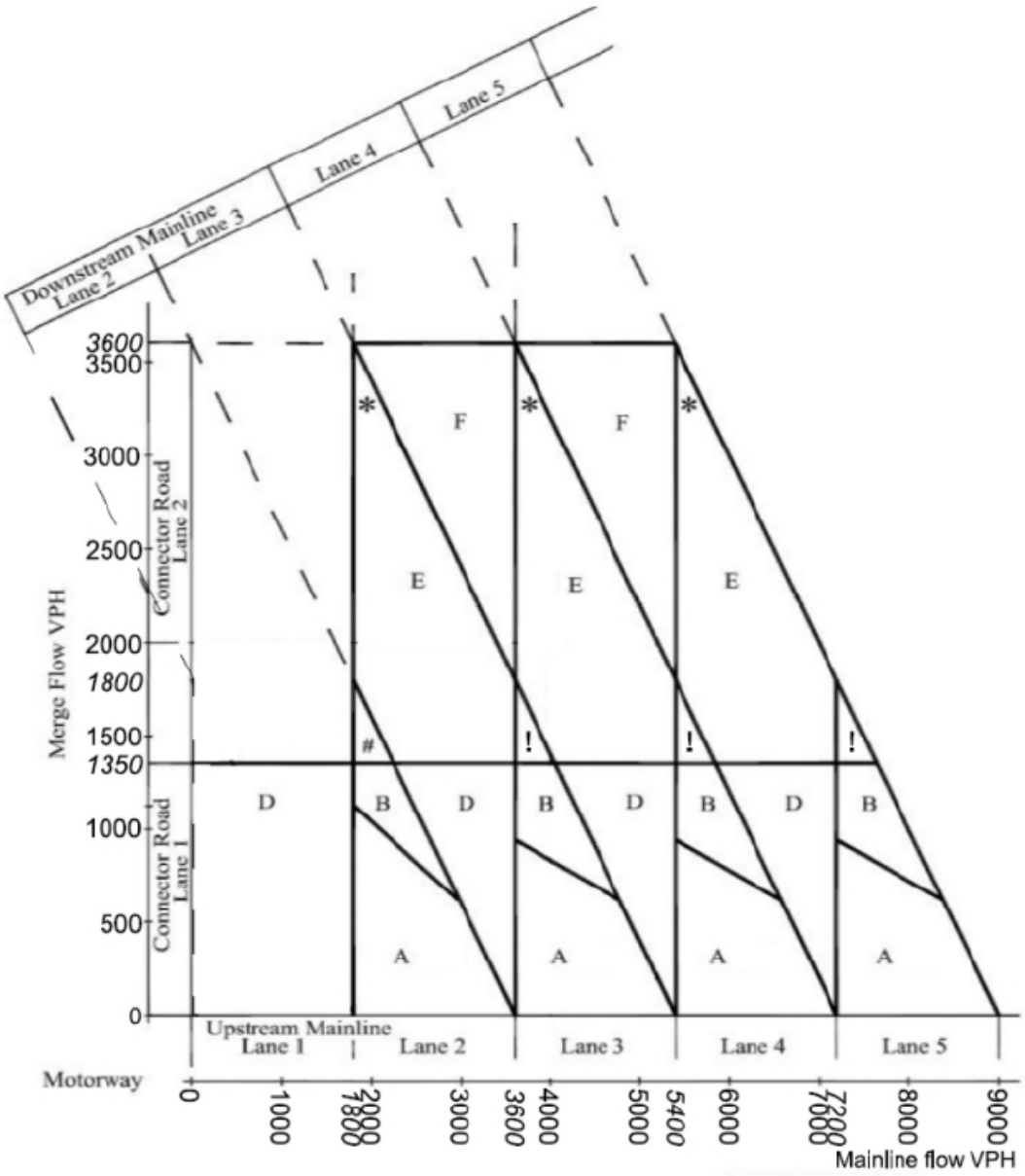
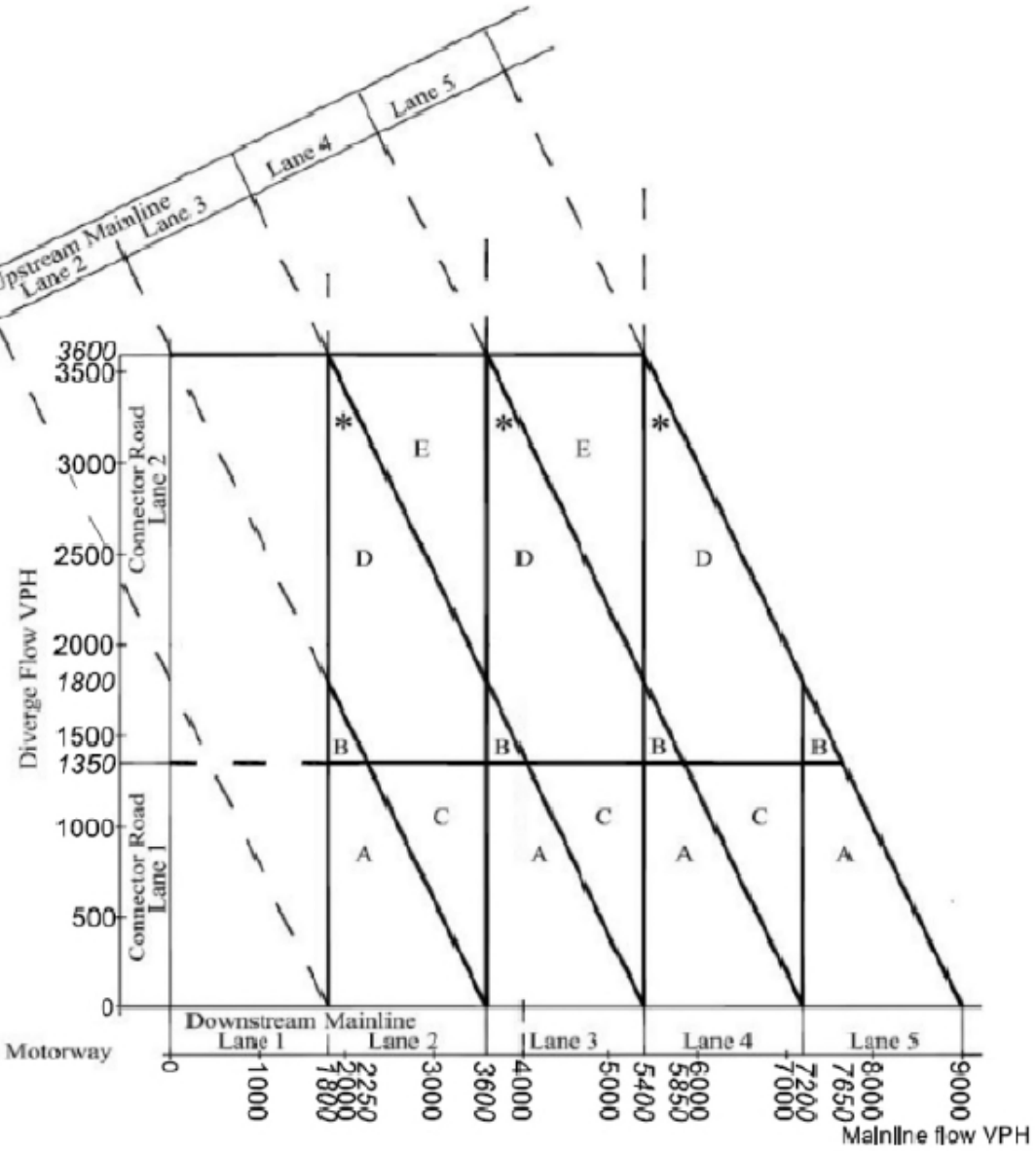


Figure 3.26b Motorway diverging diagram



Appendix C: 2029 and 2039 Link Capacity Analysis - SRN

			Number of Lanes	Assumed Lane Capacity	2029 Ref		2029 Option 3		Flow Difference 2029 Ref-> 2029 With Option 3		2029 Ref		2029 Option 3	
Units				Vehs	Vehs		Vehs		Vehs					
Source					Demand Flows		Demand Flows		Demand Flows		VoC		VoC	
Motorway Route	Direction	Link name			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
M1	Northbound	M1 Junction 30 (At Junction)	4	7,200	3,924	4,833	3,985	4,826	62	- 7	54%	67%	55%	67%
M1	Southbound	M1 Junction 30 (At Junction)	4	7,200	4,286	4,417	4,331	4,479	45	62	60%	61%	60%	62%
M1	Northbound	M1 Junction 30 - M1 Junction 31	4	7,200	4,562	5,442	4,646	5,446	84	4	63%	76%	65%	76%
M1	Southbound	M1 Junction 31 - M1 Junction 30	4	7,200	4,835	5,084	4,885	5,181	50	97	67%	71%	68%	72%
M1	Northbound	M1 Junction 30 (Off Slip Road Diverge)	1	1,800	676	721	673	720	- 3	- 1	38%	40%	37%	40%
M1	Southbound	M1 Junction 30 (Off Slip Road Diverge)	1	1,800	549	667	554	702	5	36	30%	37%	31%	39%
M1	Northbound	M1 Junction 30 (On Slip Road Merge)	1	1,800	639	609	661	620	22	11	35%	34%	37%	34%
M1	Southbound	M1 Junction 30 (On Slip Road Merge)	1	1,800	705	747	725	757	20	10	39%	42%	40%	42%
M1	Northbound	M1 Junction 31 (At Junction)	4	7,200	4,266	4,858	4,345	4,868	79	10	59%	67%	60%	68%
M1	Southbound	M1 Junction 31 (At Junction)	4	7,200	4,322	4,832	4,382	4,932	60	101	60%	67%	61%	69%
M1	Northbound	M1 Junction 31 - M1 Junction 32	4	7,200	6,252	6,213	6,325	6,247	72	34	87%	86%	88%	87%
M1	Southbound	M1 Junction 32 - M1 Junction 31	4	7,200	5,653	6,584	5,754	6,701	101	116	79%	91%	80%	93%
M1	Northbound	M1 Junction 31 (Off Slip Road Diverge)	1	1,800	296	584	301	578	5	- 5	16%	32%	17%	32%
M1	Southbound	M1 Junction 31 (Off Slip Road Diverge)	2	3,600	1,331	1,753	1,372	1,769	41	16	37%	49%	38%	49%
M1	Northbound	M1 Junction 31 (On Slip Road Merge)	2	3,600	1,986	1,355	1,980	1,379	- 6	25	55%	38%	55%	38%
M1	Southbound	M1 Junction 31 (On Slip Road Merge)	1	1,800	513	252	503	249	- 10	- 3	28%	14%	28%	14%

			Number of Lanes	Assumed Lane Capacity	2029 Ref		2029 Option 3		Flow Difference 2029 Ref-> 2029 With Option 3		2029 Ref		2029 Option 3	
Units				Vehs	Vehs		Vehs		Vehs					
Source					Demand Flows		Demand Flows		Demand Flows		VoC		VoC	
Motorway Route	Direction	Link name			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
M1	Northbound	M1 Junction 32 (At Junction)	3	5,400	3,717	3,450	3,790	3,503	73	53	69%	64%	70%	65%
M1	Southbound	M1 Junction 32 (At Junction)	3	5,400	3,099	4,181	3,160	4,317	61	136	57%	77%	59%	80%
M1	Westbound	M1 Junction 32 - M1 Junction 33	4	7,200	5,837	5,805	5,969	5,818	132	12	81%	81%	83%	81%
M1	Eastbound	M1 Junction 33 - M1 Junction 32	4	7,200	4,920	6,390	4,978	6,711	58	321	68%	89%	69%	93%
M1	Northbound	M1 Junction 32 (Off Slip Road Diverge)	2	3,600	2,536	2,762	2,535	2,744	- 0	- 19	70%	77%	70%	76%
M1	Eastbound	M1 Junction 32 (Off Slip Road Diverge)	2	3,600	1,821	2,209	1,818	2,394	- 3	185	51%	61%	51%	66%
M1	Westbound	M1 Junction 32 (On Slip Road Merge)	2	3,600	2,120	2,355	2,179	2,315	59	- 41	59%	65%	61%	64%
M1	Southbound	M1 Junction 32 (On Slip Road Merge)	2	3,600	2,554	2,403	2,594	2,383	41	- 20	71%	67%	72%	66%
M1	Eastbound	M1 Junction 33 (Off Slip Road: Diverge)	1	1,800	977	1,143	1,042	1,231	65	88	54%	63%	58%	68%
M1	Westbound	M1 Junction 33 (On Slip Road: Merge)	1	1,800	1,163	1,276	1,263	1,465	100	189	65%	71%	70%	81%
M1	Eastbound	M1 Junction 33 (On Slip Road: Merge)	2	3,600	1,667	1,983	1,666	2,102	- 1	119	46%	55%	46%	58%
M1	Westbound	M1 Junction 33 (Off Slip Road: Diverge)	2	3,600	2,119	1,948	2,097	1,895	- 22	- 53	59%	54%	58%	53%
M1	Eastbound	M1 Junction 33 (At Junction)	3	5,400	3,253	4,407	3,312	4,609	59	202	60%	82%	61%	85%
M1	Westbound	M1 Junction 33 (At Junction)	3	5,400	3,718	3,857	3,872	3,923	154	65	69%	71%	72%	73%
M1	Northbound	M1 Junction 33 - M1 Junction 34 (South)	4	7,200	4,881	5,134	5,135	5,388	254	254	68%	71%	71%	75%

			Number of Lanes	Assumed Lane Capacity	2029 Ref		2029 Option 3		Flow Difference 2029 Ref-> 2029 With Option 3		2029 Ref		2029 Option 3	
Units				Vehs	Vehs		Vehs		Vehs					
Source					Demand Flows		Demand Flows		Demand Flows		VoC		VoC	
Motorway Route	Direction	Link name			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
M1	Southbound	M1 Junction 34 (South) - M1 Junction 33	4	7,200	4,230	5,550	4,355	5,840	125	290	59%	77%	60%	81%
M1	Northbound	M1 Junction 34 (South) (Off Slip Road: Diverge)	2	3,600	1,778	1,203	1,946	1,227	168	24	49%	33%	54%	34%
M1	Southbound	M1 Junction 34 (South) (On Slip Road: Merge)	1	1,800	737	1,647	761	1,949	23	301	41%	92%	42%	108%
M1	Northbound	M1 Junction 34 (South) (At Junction)	3	5,400	3,102	3,930	3,188	4,161	86	230	57%	73%	59%	77%
M1	Southbound	M1 Junction 34 (South) (At Junction)	3	5,400	3,493	3,903	3,594	3,891	101	- 11	65%	72%	67%	72%
M1	Northbound	M1 Junction 34 (North) (On Slip Road: Merge)	1	1,800	1,314	2,002	1,333	2,057	18	55	73%	111%	74%	114%
M1	Southbound	M1 Junction 34 (North) (Off Slip Road: Diverge)	1	1,800	1,822	1,274	1,942	1,243	120	- 31	101%	71%	108%	69%
M1	Northbound	M1 Junction 34 (North) (At Junction)	3	5,400	3,102	3,930	3,188	4,161	86	230	57%	73%	59%	77%
M1	Southbound	M1 Junction 34 (North) (At Junction)	3	5,400	3,493	3,903	3,594	3,891	101	- 11	65%	72%	67%	72%
M1	Northbound	M1 Junction 34 (North) - M1 Junction 35	4	7,200	4,416	5,933	4,521	6,218	104	285	61%	82%	63%	86%
M1	Southbound	M1 Junction 35 - M1 Junction 34 (North)	4	7,200	5,314	5,176	5,536	5,134	221	- 42	74%	72%	77%	71%
M1	Northbound	M1 Junction 35 (Off Slip Road: Diverge)	1	1,800	658	801	744	841	85	41	37%	44%	41%	47%
M1	Southbound	M1 Junction 35 (On Slip Road: Merge)	1	1,800	593	599	709	647	116	48	33%	33%	39%	36%
M1	Northbound	M1 Junction 35 (On Slip Road: Merge)	1	1,800	802	907	782	909	- 21	2	45%	50%	43%	51%
M1	Southbound	M1 Junction 35 (Off Slip Road: Diverge)	1	1,800	689	854	695	869	6	15	38%	47%	39%	48%
M1	Northbound	M1 Junction 35 (At Junction)	4	7,200	3,758	5,132	3,777	5,377	19	244	52%	71%	52%	75%
M1	Southbound	M1 Junction 35 (At Junction)	4	7,200	4,722	4,577	4,827	4,487	105	- 90	66%	64%	67%	62%

			Number of Lanes	Assumed Lane Capacity	2029 Ref		2029 Option 3		Flow Difference 2029 Ref-> 2029 With Option 3		2029 Ref		2029 Option 3	
Units				Vehs	Vehs		Vehs		Vehs					
Source					Demand Flows		Demand Flows		Demand Flows		VoC		VoC	
Motorway Route	Direction	Link name			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
M1	Northbound	M1 Junction 35 - M1 Junction 35A	4	7,200	4,560	6,040	4,559	6,286	- 1	246	63%	84%	63%	87%
M1	Southbound	M1 Junction 35A - M1 Junction 35	4	7,200	5,411	5,431	5,522	5,356	111	- 75	75%	75%	77%	74%
M1	Northbound	M1 Junction 35A (Off Slip Road: Diverge)	1	1,800	749	696	755	716	6	20	42%	39%	42%	40%
M1	Southbound	M1 Junction 35A (On Slip Road: Merge)	1	1,800	1,078	1,026	1,121	1,020	44	- 6	60%	57%	62%	57%
M1	Northbound	M1 Junction 35A (At Junction)	3	5,400	3,811	5,344	3,804	5,570	- 8	226	71%	99%	70%	103%
M1	Southbound	M1 Junction 35A (At Junction)	3	5,400	4,333	4,405	4,400	4,336	67	- 69	80%	82%	81%	80%
M1	Northbound	M1 Junction 36 (At Junction)	3	5,400	3,271	4,092	3,270	4,201	- 0	109	61%	76%	61%	78%
M1	Southbound	M1 Junction 36 (At Junction)	3	5,400	3,567	3,745	3,610	3,702	43	- 43	66%	69%	67%	69%
M1	Northbound	M1 Junction 35A - M1 Junction 36	3	5,400	3,811	5,344	3,804	5,570	- 8	226	71%	99%	70%	103%
M1	Southbound	M1 Junction 36 - M1 Junction 35A	3	5,400	4,333	4,405	4,400	4,336	67	- 69	80%	82%	81%	80%
M1	Northbound	M1 Junction 36 - M1 Junction 37	3	5,400	4,609	5,110	4,653	5,224	44	114	85%	95%	86%	97%
M1	Southbound	M1 Junction 37 - M1 Junction 36	3	5,400	4,419	4,940	4,432	4,968	13	28	82%	91%	82%	92%
M1	Northbound	M1 Junction 36 (Off Slip Road Diverge)	1	1,800	541	1,251	533	1,369	- 7	117	30%	70%	30%	76%
M1	Southbound	M1 Junction 36 (Off Slip Road Diverge)	1	1,800	851	1,195	822	1,266	- 30	71	47%	66%	46%	70%
M1	Northbound	M1 Junction 36 (On Slip Road Merge)	1	1,800	1,339	1,018	1,383	1,023	44	5	74%	57%	77%	57%
M1	Southbound	M1 Junction 36 (On Slip Road Merge)	1	1,800	766	660	790	634	24	- 26	43%	37%	44%	35%

			Number of Lanes	Assumed Lane Capacity	2029 Ref		2029 Option 3		Flow Difference 2029 Ref-> 2029 With Option 3		2029 Ref		2029 Option 3	
Units				Vehs	Vehs		Vehs		Vehs					
Source					Demand Flows		Demand Flows		Demand Flows		VoC		VoC	
Motorway Route	Direction	Link name			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
---	Westbound	A616 (M1 - A61)	1	1,500	671	398	687	408	16	10	45%	27%	46%	27%
---	Eastbound	A616 (A61 - M1)	1	1,500	866	725	888	736	22	11	58%	48%	59%	49%
---	Westbound	A616 (A61 - A629)	2	3,000	921	1,051	908	1,070	- 13	19	31%	35%	30%	36%
---	Eastbound	A616 (A629 - A61)	1	1,500	1,062	1,067	1,075	1,074	13	7	71%	71%	72%	72%
---	Westbound	A616 (A629 - A6102)	1	1,500	977	1,207	977	1,250	- 1	43	65%	80%	65%	83%
---	Eastbound	A616 (A6102 - A629)	2	3,000	1,006	954	1,156	994	150	40	34%	32%	39%	33%

			Number of Lanes	Assumed Lane Capacity	2039 Ref		2039 Option 3		Flow Difference 2039 Ref-> 2039 With Option 3		2039 Ref		2039 Option 3	
Units				Vehs	Vehs		Vehs		Vehs					
Source					Demand Flows		Demand Flows		Demand Flows		VoC		VoC	
Motorway Route	Direction	Link name			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
M1	Northbound	M1 Junction 30 (At Junction)	4	7200	4,264	5,022	4,366	5,030	102	8	59%	70%	61%	70%
M1	Southbound	M1 Junction 30 (At Junction)	4	7200	4,760	4,937	4,827	4,974	67	37	66%	69%	67%	69%
M1	Northbound	M1 Junction 30 - M1 Junction 31	4	7200	4,930	5,647	5,075	5,671	145	24	68%	78%	70%	79%
M1	Southbound	M1 Junction 31 - M1 Junction 30	4	7200	5,380	5,644	5,412	5,730	31	86	75%	78%	75%	80%
M1	Northbound	M1 Junction 30 (Off Slip Road Diverge)	1	1800	740	746	729	789	- 11	43	41%	41%	41%	44%
M1	Southbound	M1 Junction 30 (Off Slip Road Diverge)	1	1800	620	707	585	756	- 35	49	34%	39%	32%	42%
M1	Northbound	M1 Junction 30 (On Slip Road Merge)	1	1800	666	626	709	641	43	15	37%	35%	39%	36%
M1	Southbound	M1 Junction 30 (On Slip Road Merge)	1	1800	731	784	775	835	44	51	41%	44%	43%	46%
M1	Northbound	M1 Junction 31 (At Junction)	4	7200	4,603	5,047	4,738	5,082	135	35	64%	70%	66%	71%
M1	Southbound	M1 Junction 31 (At Junction)	4	7200	4,825	5,362	4,886	5,446	61	85	67%	74%	68%	76%
M1	Northbound	M1 Junction 31 - M1 Junction 32	4	7200	6,538	6,426	6,685	6,500	147	74	91%	89%	93%	90%
M1	Southbound	M1 Junction 32 - M1 Junction 31	4	7200	6,120	7,035	6,259	7,178	139	143	85%	98%	87%	100%
M1	Northbound	M1 Junction 31 (Off Slip Road Diverge)	1	1800	327	601	337	590	10	- 11	18%	33%	19%	33%
M1	Southbound	M1 Junction 31 (Off Slip Road Diverge)	2	3600	1,295	1,673	1,373	1,732	78	59	36%	46%	38%	48%
M1	Northbound	M1 Junction 31 (On Slip Road Merge)	2	3600	1,935	1,380	1,947	1,418	12	39	54%	38%	54%	39%
M1	Southbound	M1 Junction 31 (On Slip Road Merge)	1	1800	555	282	525	283	- 29	1	31%	16%	29%	16%

			Number of Lanes	Assumed Lane Capacity	2039 Ref		2039 Option 3		Flow Difference 2039 Ref-> 2039 With Option 3		2039 Ref		2039 Option 3	
Units				Vehs	Vehs		Vehs		Vehs					
Source					Demand Flows		Demand Flows		Demand Flows		VoC		VoC	
Motorway Route	Direction	Link name			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
M1	Northbound	M1 Junction 32 (At Junction)	3	5400	3,933	4,227	4,070	4,244	138	17	73%	78%	75%	79%
M1	Southbound	M1 Junction 32 (At Junction)	3	5400	3,642	4,518	3,724	4,698	82	179	67%	84%	69%	87%
M1	Westbound	M1 Junction 32 - M1 Junction 33	4	7200	6,164	6,658	6,352	6,655	188	-3	86%	92%	88%	92%
M1	Eastbound	M1 Junction 33 - M1 Junction 32	4	7200	5,643	6,853	5,725	7,247	82	394	78%	95%	80%	101%
M1	Northbound	M1 Junction 32 (Off Slip Road Diverge)	2	3600	2,605	2,199	2,614	2,256	9	57	72%	61%	73%	63%
M1	Eastbound	M1 Junction 32 (Off Slip Road Diverge)	2	3600	2,001	2,335	2,001	2,550	-0	215	56%	65%	56%	71%
M1	Westbound	M1 Junction 32 (On Slip Road Merge)	2	3600	2,232	2,431	2,282	2,411	50	-20	62%	68%	63%	67%
M1	Southbound	M1 Junction 32 (On Slip Road Merge)	2	3600	2,478	2,516	2,535	2,481	57	-36	69%	70%	70%	69%
M1	Eastbound	M1 Junction 33 (Off Slip Road: Diverge)	1	1800	1,018	1,207	1,212	1,377	194	171	57%	67%	67%	77%
M1	Westbound	M1 Junction 33 (On Slip Road: Merge)	1	1800	1,276	1,360	1,620	1,697	344	337	71%	76%	90%	94%
M1	Eastbound	M1 Junction 33 (On Slip Road: Merge)	2	3600	1,725	2,035	1,719	2,132	-7	97	48%	57%	48%	59%
M1	Westbound	M1 Junction 33 (Off Slip Road: Diverge)	2	3600	2,164	2,016	2,152	2,009	-12	-7	60%	56%	60%	56%
M1	Eastbound	M1 Junction 33 (At Junction)	3	5400	3,917	4,818	4,006	5,116	89	298	73%	89%	74%	95%
M1	Westbound	M1 Junction 33 (At Junction)	3	5400	4,000	4,642	4,200	4,646	200	4	74%	86%	78%	86%
M1	Northbound	M1 Junction 33 - M1 Junction 34 (South)	4	7200	5,276	6,002	5,819	6,343	544	341	73%	83%	81%	88%

			Number of Lanes	Assumed Lane Capacity	2039 Ref		2039 Option 3		Flow Difference 2039 Ref-> 2039 With Option 3		2039 Ref		2039 Option 3	
Units				Vehs	Vehs		Vehs		Vehs					
Source					Demand Flows		Demand Flows		Demand Flows		VoC		VoC	
Motorway Route	Direction	Link name			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
M1	Southbound	M1 Junction 34 (South) - M1 Junction 33	4	7200	4,935	6,025	5,218	6,493	283	468	69%	84%	72%	90%
M1	Northbound	M1 Junction 34 (South) (Off Slip Road: Diverge)	2	3600	1,820	1,259	1,963	1,287	143	28	51%	35%	55%	36%
M1	Southbound	M1 Junction 34 (South) (On Slip Road: Merge)	1	1800	805	1,757	864	1,987	58	230	45%	98%	48%	110%
M1	Northbound	M1 Junction 34 (South) (At Junction)	3	5400	3,456	4,743	3,856	5,056	401	313	64%	88%	71%	94%
M1	Southbound	M1 Junction 34 (South) (At Junction)	3	5400	4,130	4,268	4,354	4,507	224	239	76%	79%	81%	83%
M1	Northbound	M1 Junction 34 (North) (On Slip Road: Merge)	1	1800	1,371	2,027	1,408	2,081	38	53	76%	113%	78%	116%
M1	Southbound	M1 Junction 34 (North) (Off Slip Road: Diverge)	1	1800	1,862	1,324	1,983	1,272	121	- 52	103%	74%	110%	71%
M1	Northbound	M1 Junction 34 (North) (At Junction)	3	5400	3,456	4,743	3,856	5,056	401	313	64%	88%	71%	94%
M1	Southbound	M1 Junction 34 (North) (At Junction)	3	5400	4,130	4,268	4,354	4,507	224	239	76%	79%	81%	83%
M1	Northbound	M1 Junction 34 (North) - M1 Junction 35	4	7200	4,826	6,770	5,265	7,136	438	366	67%	94%	73%	99%
M1	Southbound	M1 Junction 35 - M1 Junction 34 (North)	4	7200	5,992	5,592	6,338	5,779	345	187	83%	78%	88%	80%
M1	Northbound	M1 Junction 35 (Off Slip Road: Diverge)	1	1800	697	815	954	964	257	149	39%	45%	53%	54%
M1	Southbound	M1 Junction 35 (On Slip Road: Merge)	1	1800	666	639	940	851	274	212	37%	35%	52%	47%
M1	Northbound	M1 Junction 35 (On Slip Road: Merge)	1	1800	809	893	842	934	33	41	45%	50%	47%	52%

			Number of Lanes	Assumed Lane Capacity	2039 Ref		2039 Option 3		Flow Difference 2039 Ref-> 2039 With Option 3		2039 Ref		2039 Option 3	
Units				Vehs	Vehs		Vehs		Vehs					
Source					Demand Flows		Demand Flows		Demand Flows		VoC		VoC	
Motorway Route	Direction	Link name			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
M1	Southbound	M1 Junction 35 (Off Slip Road: Diverge)	1	1800	658	768	672	816	14	48	37%	43%	37%	45%
M1	Northbound	M1 Junction 35 (At Junction)	4	7200	4,129	5,955	4,311	6,172	182	217	57%	83%	60%	86%
M1	Southbound	M1 Junction 35 (At Junction)	4	7200	5,326	4,953	5,398	4,928	72	- 25	74%	69%	75%	68%
M1	Northbound	M1 Junction 35 - M1 Junction 35A	4	7200	4,938	6,848	5,153	7,106	214	258	69%	95%	72%	99%
M1	Southbound	M1 Junction 35A - M1 Junction 35	4	7200	5,984	5,721	6,070	5,744	86	23	83%	79%	84%	80%
M1	Northbound	M1 Junction 35A (Off Slip Road: Diverge)	1	1800	813	1,192	1,042	1,274	229	82	45%	66%	58%	71%
M1	Southbound	M1 Junction 35A (On Slip Road: Merge)	1	1800	1,307	1,090	1,388	1,205	81	114	73%	61%	77%	67%
M1	Northbound	M1 Junction 35A (At Junction)	3	5400	4,126	5,656	4,111	5,832	- 14	176	76%	105%	76%	108%
M1	Southbound	M1 Junction 35A (At Junction)	3	5400	4,677	4,631	4,682	4,539	5	- 91	87%	86%	87%	84%
M1	Northbound	M1 Junction 36 (At Junction)	3	5400	3,533	4,652	3,528	4,750	- 5	97	65%	86%	65%	88%
M1	Southbound	M1 Junction 36 (At Junction)	3	5400	4,116	3,876	4,103	3,790	- 12	- 86	76%	72%	76%	70%
M1	Northbound	M1 Junction 35A - M1 Junction 36	3	5400	4,126	5,656	4,111	5,832	- 14	176	76%	105%	76%	108%
M1	Southbound	M1 Junction 36 - M1 Junction 35A	3	5400	4,677	4,631	4,682	4,539	5	- 91	87%	86%	87%	84%
M1	Northbound	M1 Junction 36 - M1 Junction 37	3	5400	5,025	5,692	5,079	5,815	54	123	93%	105%	94%	108%
M1	Southbound	M1 Junction 37 - M1 Junction 36	3	5400	4,819	4,991	4,784	4,994	- 35	3	89%	92%	89%	92%

			Number of Lanes	Assumed Lane Capacity	2039 Ref		2039 Option 3		Flow Difference 2039 Ref-> 2039 With Option 3		2039 Ref		2039 Option 3	
Units				Vehs	Vehs		Vehs		Vehs					
Source					Demand Flows		Demand Flows		Demand Flows		VoC		VoC	
Motorway Route	Direction	Link name			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
M1	Northbound	M1 Junction 36 (Off Slip Road Diverge)	1	1800	593	1,004	584	1,082	- 9	79	33%	56%	32%	60%
M1	Southbound	M1 Junction 36 (Off Slip Road Diverge)	1	1800	703	1,114	680	1,203	- 23	89	39%	62%	38%	67%
M1	Northbound	M1 Junction 36 (On Slip Road Merge)	1	1800	1,492	1,040	1,551	1,065	59	25	83%	58%	86%	59%
M1	Southbound	M1 Junction 36 (On Slip Road Merge)	1	1800	561	754	578	749	17	- 5	31%	42%	32%	42%
---	Westbound	A616 (M1 - A61)	1	1500	661	974	680	1,101	19	128	44%	65%	45%	73%
---	Eastbound	A616 (A61 - M1)	1	1500	972	814	1,038	810	66	- 4	65%	54%	69%	54%
---	Westbound	A616 (A61 - A629)	2	3000	919	1,146	906	1,172	- 13	26	31%	38%	30%	39%
---	Eastbound	A616 (A629 - A61)	1	1500	1,171	1,130	1,213	1,128	42	- 2	78%	75%	81%	75%
---	Westbound	A616 (A629 - A6102)	1	1500	1,022	1,208	1,010	1,264	- 11	56	68%	81%	67%	84%
---	Eastbound	A616 (A6102 - A629)	2	3000	1,086	1,000	1,313	1,043	227	43	36%	33%	44%	35%

Appendix D Mitigation Schemes Proposed to Address Local Plan Impacts

Figure D1: Proposed Improvements by Others at M1 J30

210 **xi) Improvements to M1 J30 roundabout**

As set out in the Clowne Transport Study.

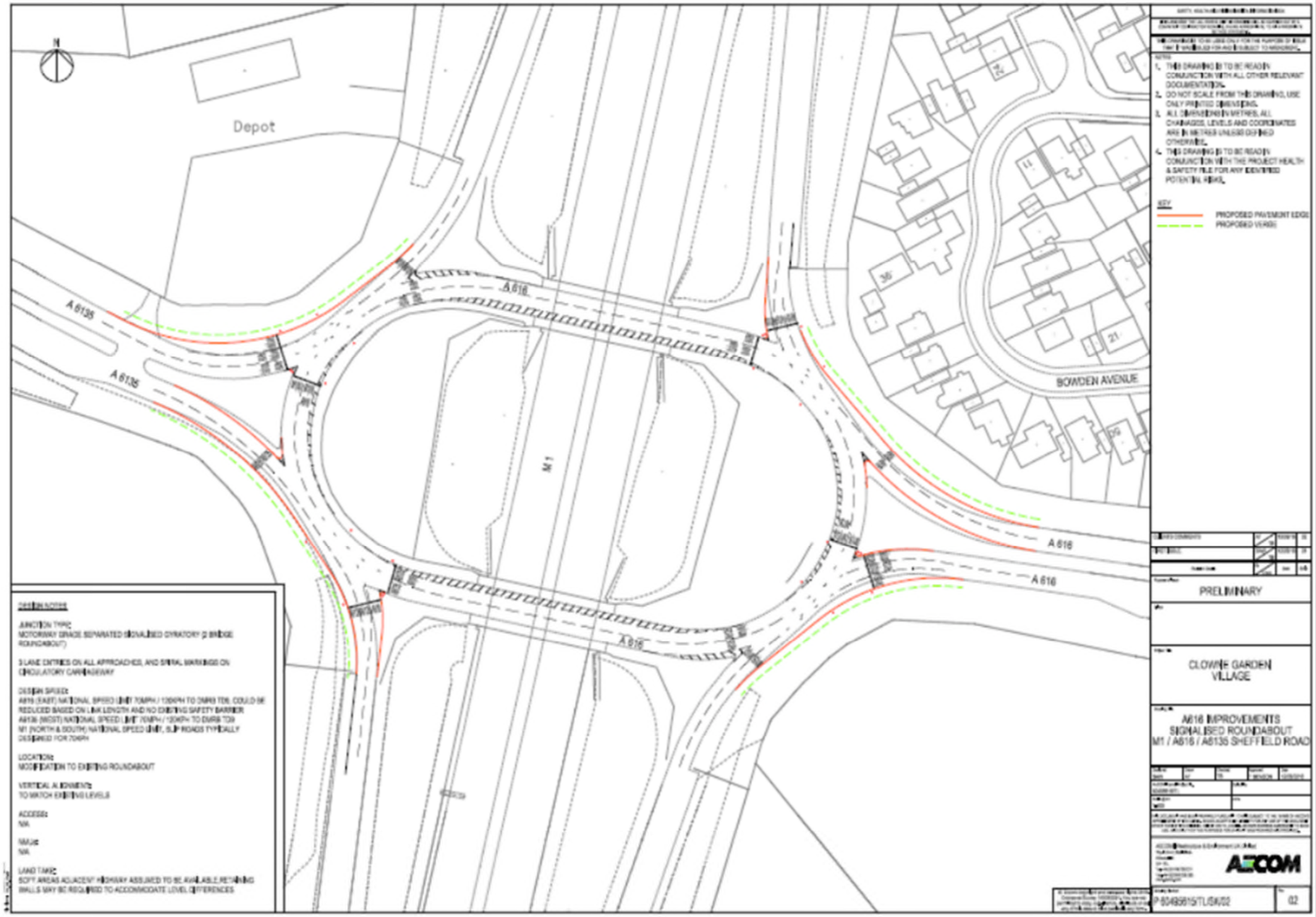


Figure D2: Proposed Local Plan Mitigation Scheme at M1 Junction 31

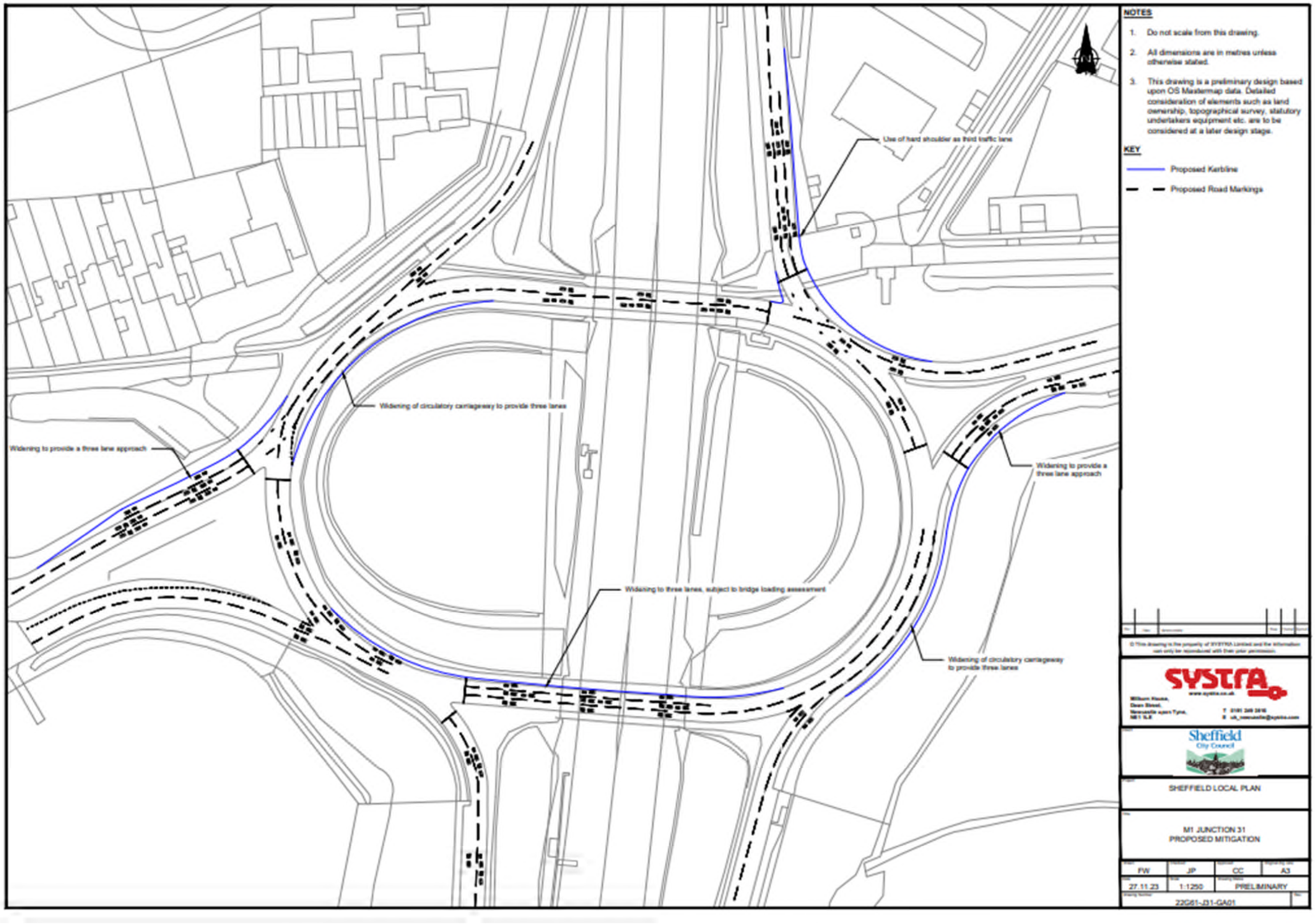


Figure D3: Proposed Local Plan Mitigation Scheme at M1 Junction 35

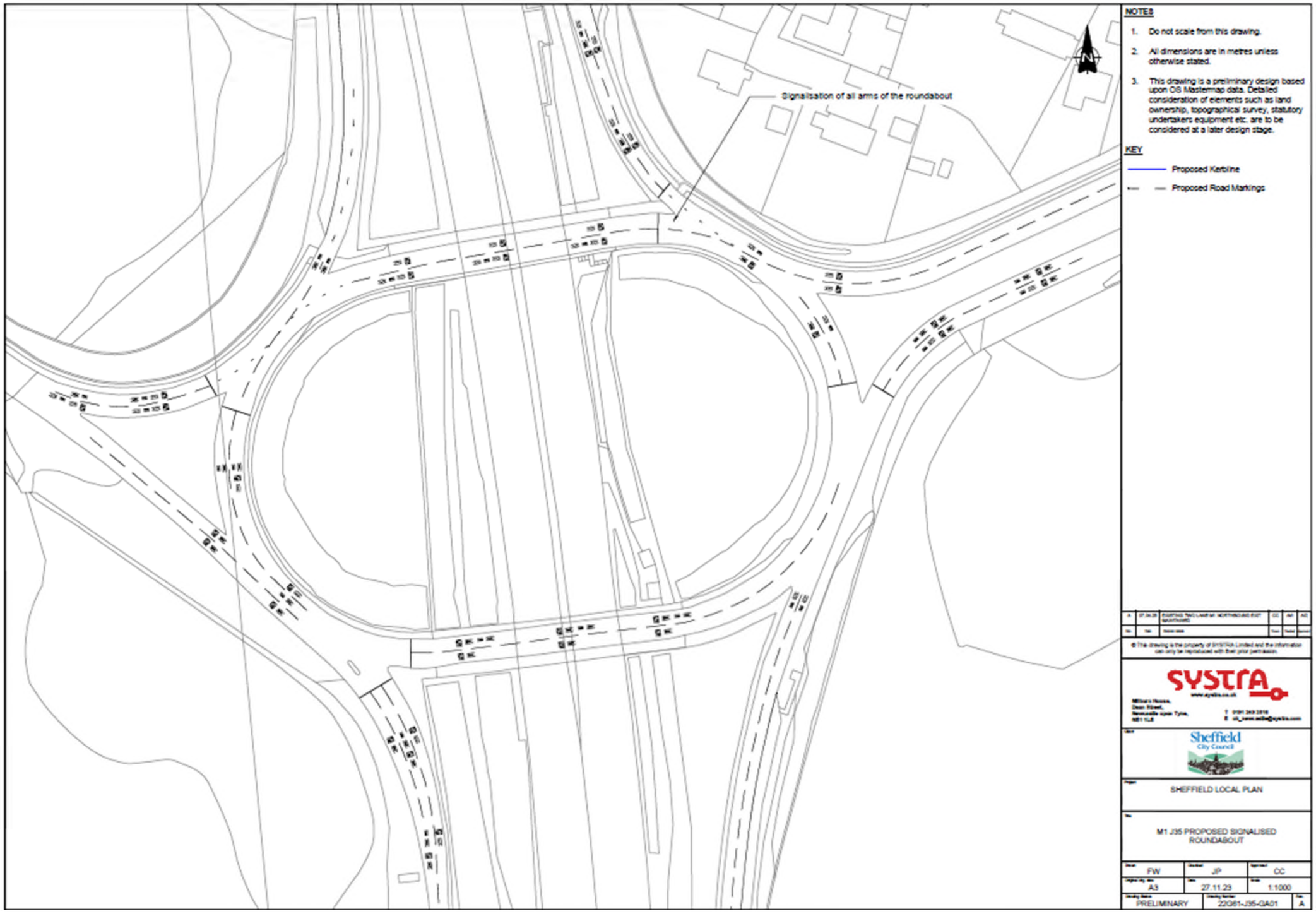


Figure D4: Proposed Local Plan Mitigation Scheme at A616 / Thorncliffe Road

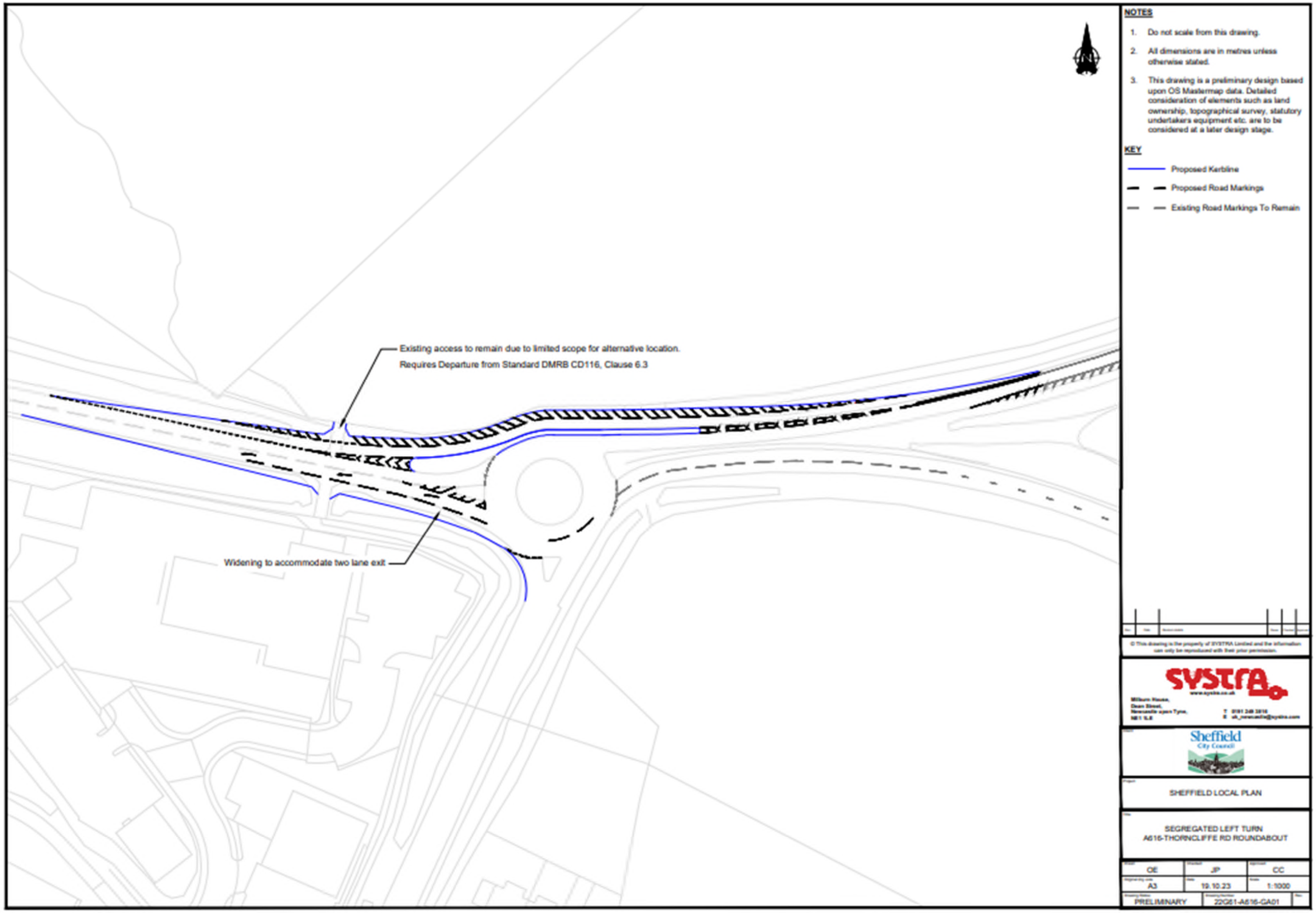


Figure D5: Proposed Local Plan Mitigation Scheme at A616 / Westwood Roundabout

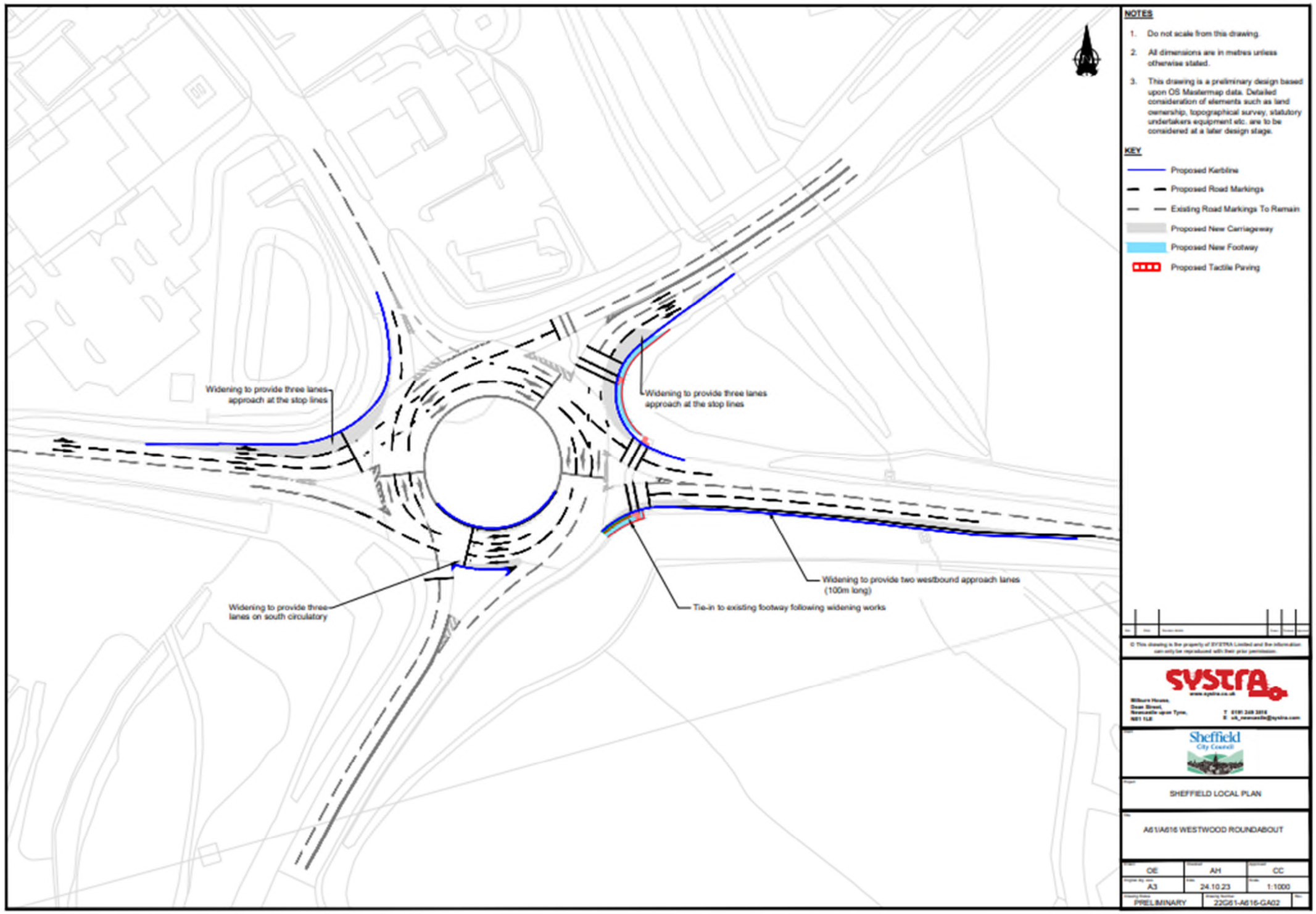


Figure D6: Proposed Local Plan Mitigation Scheme at A616 / A629

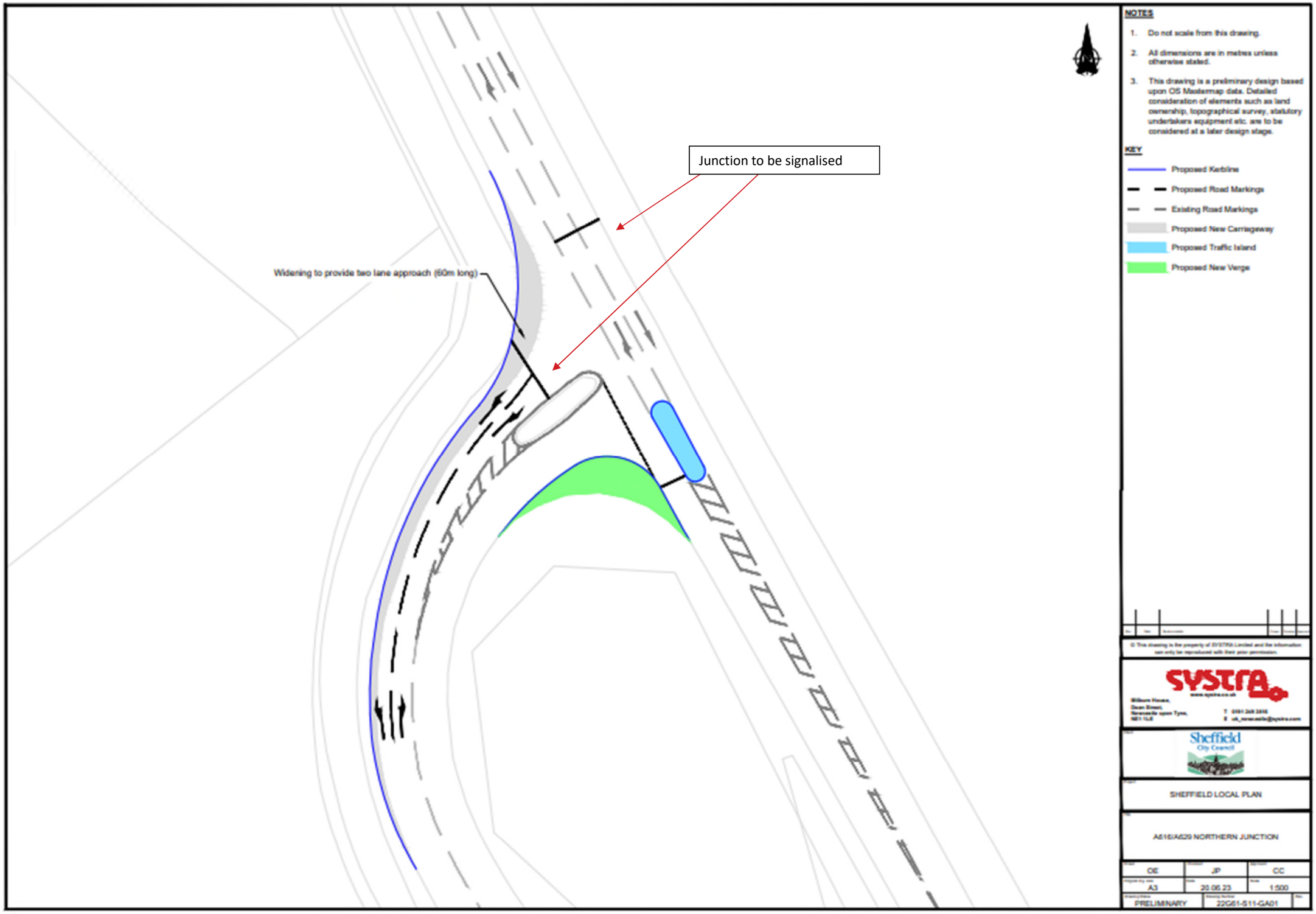


Figure D7: Illustrative Local Plan Mitigation Scheme at M1 J31 Southbound Diverge

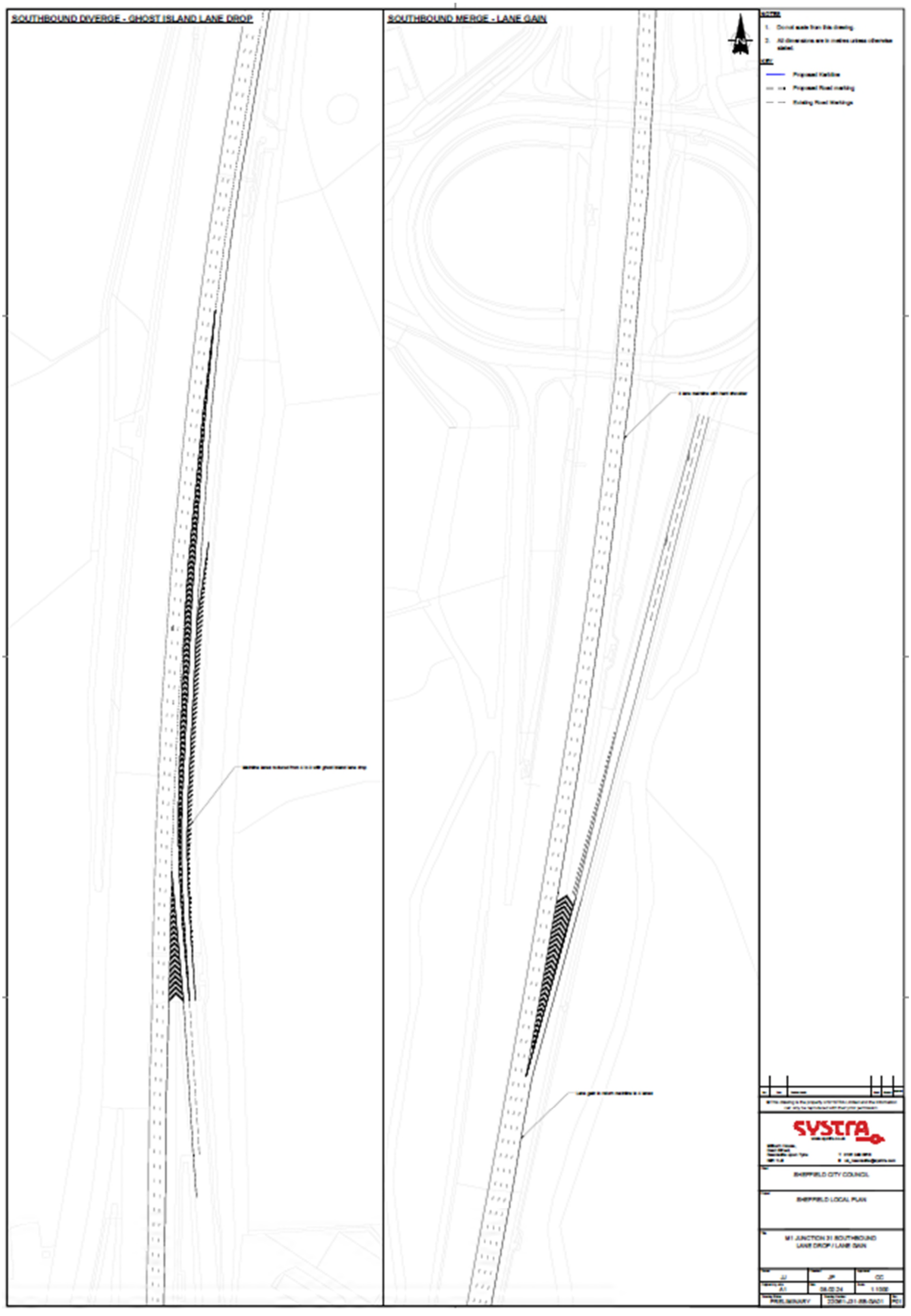


Figure D8: Illustrative Local Plan Mitigation Scheme at M1 J33 Northbound Merge

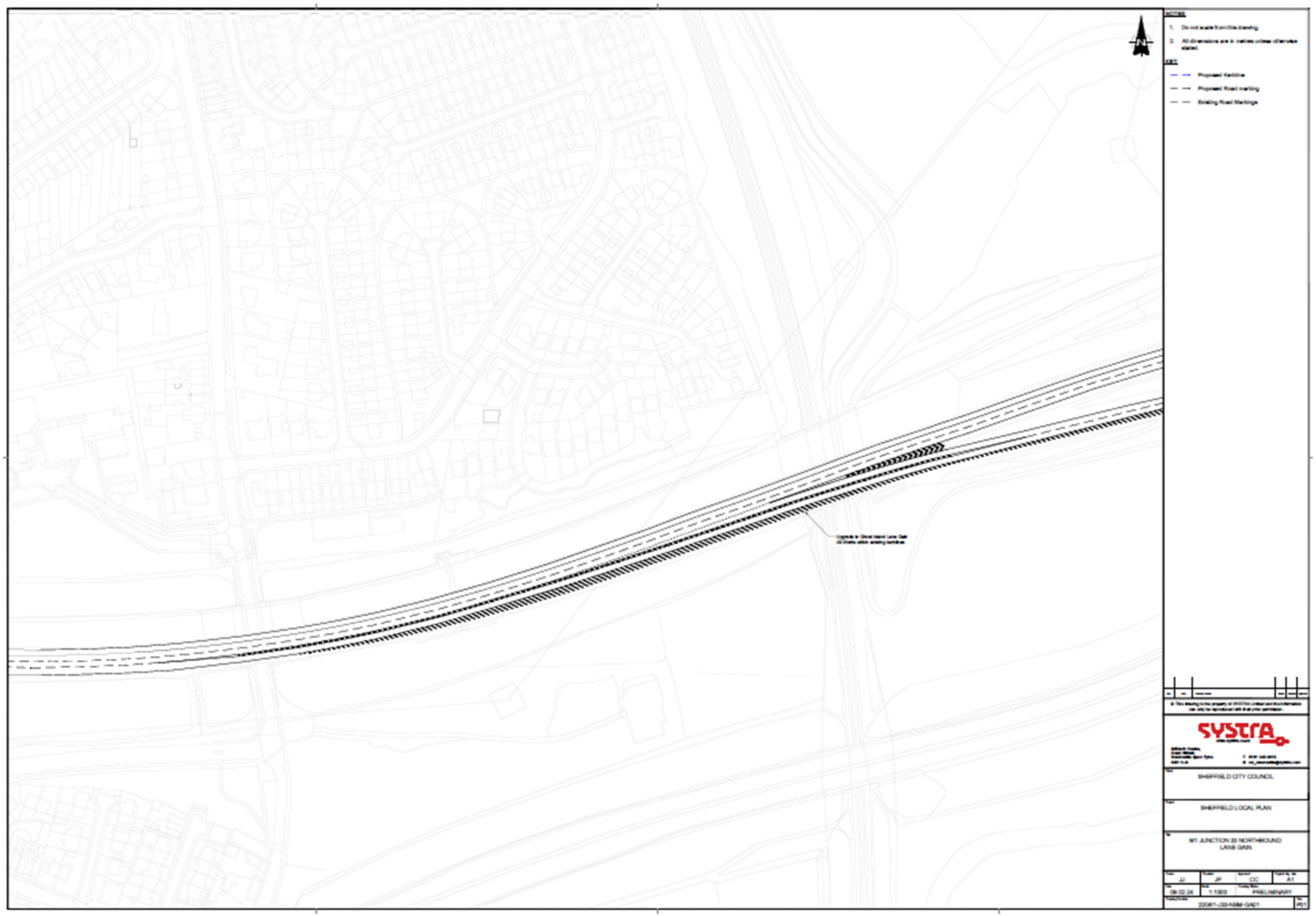


Figure D9: Illustrative Local Plan Mitigation Scheme at M1 J33 Southbound Diverge

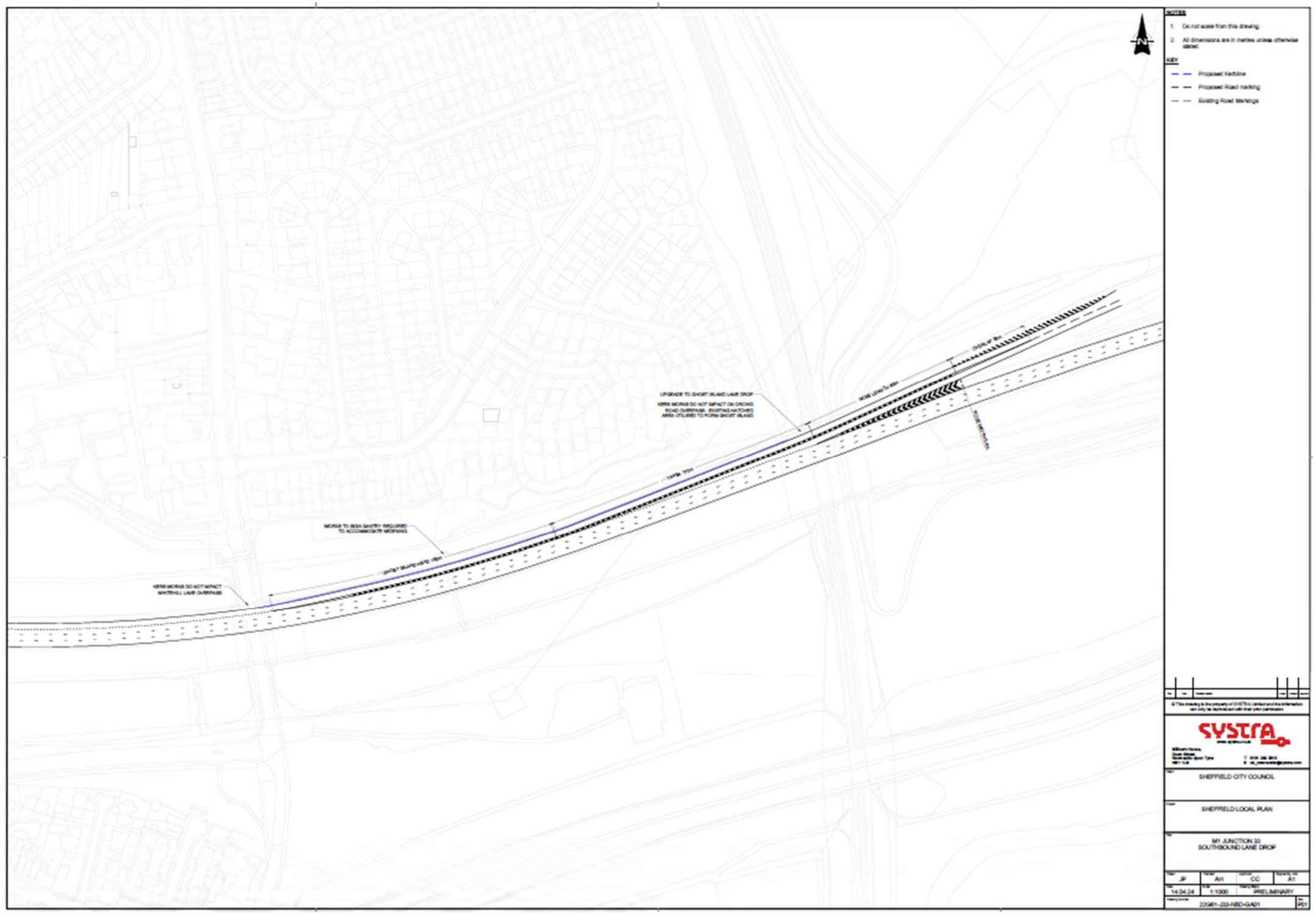


Figure D10: Illustrative Local Plan Mitigation Scheme at M1 J35 Northbound Merge

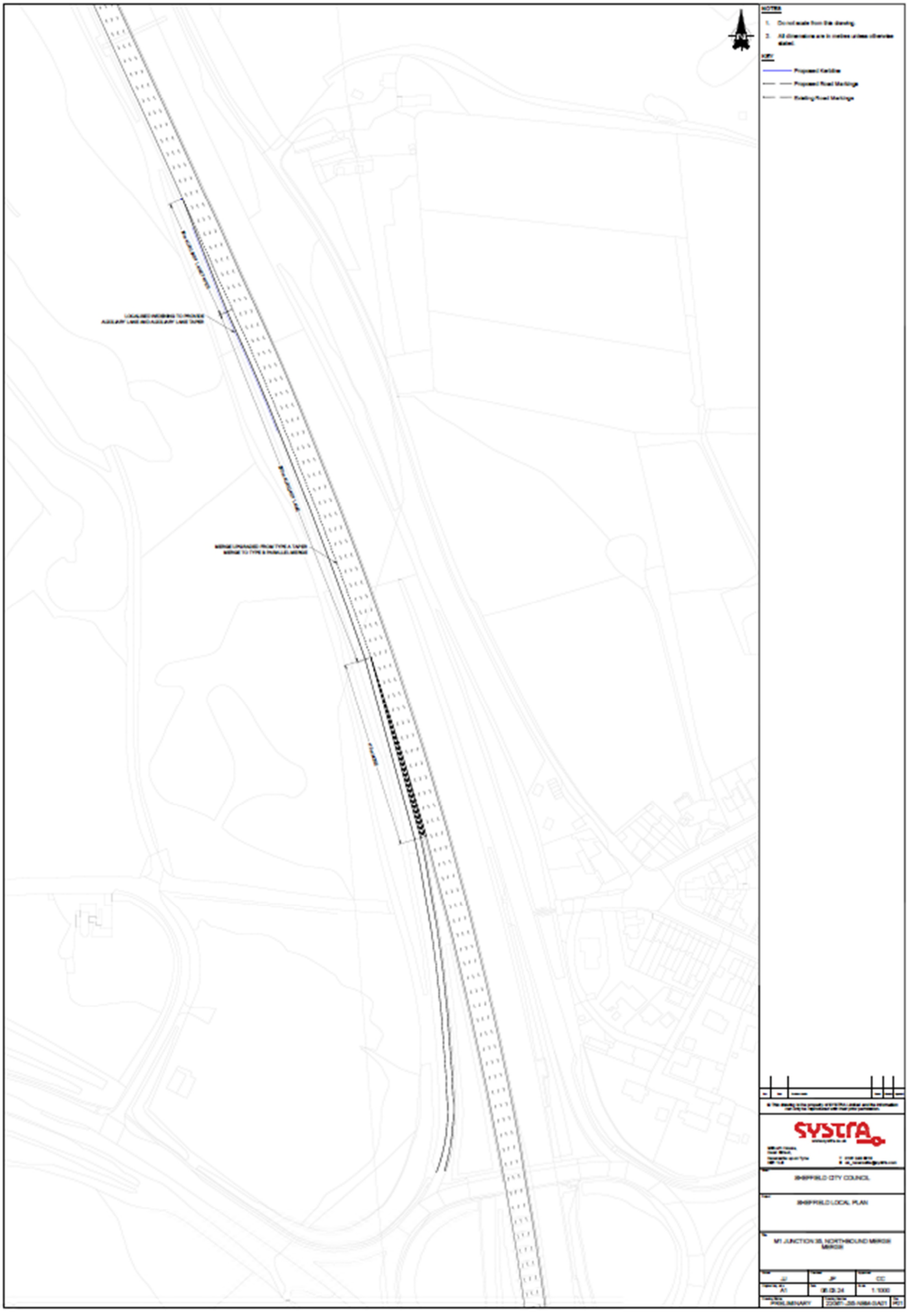


Figure D11: Illustrative Local Plan Mitigation Scheme at M1 J35 Southbound Merge

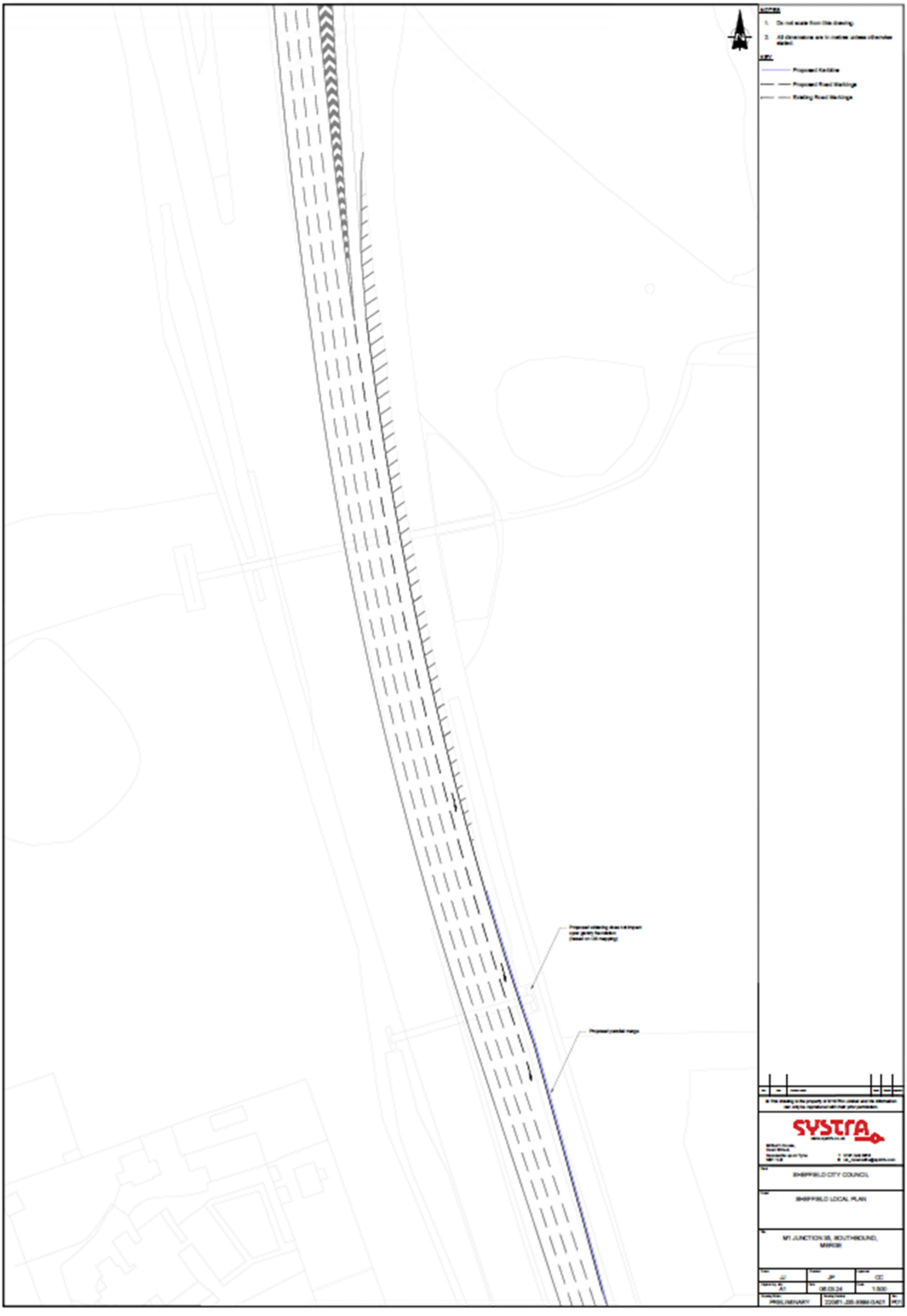


Figure D12: Illustrative Local Plan Mitigation Scheme at M1 J35a Southbound Merge

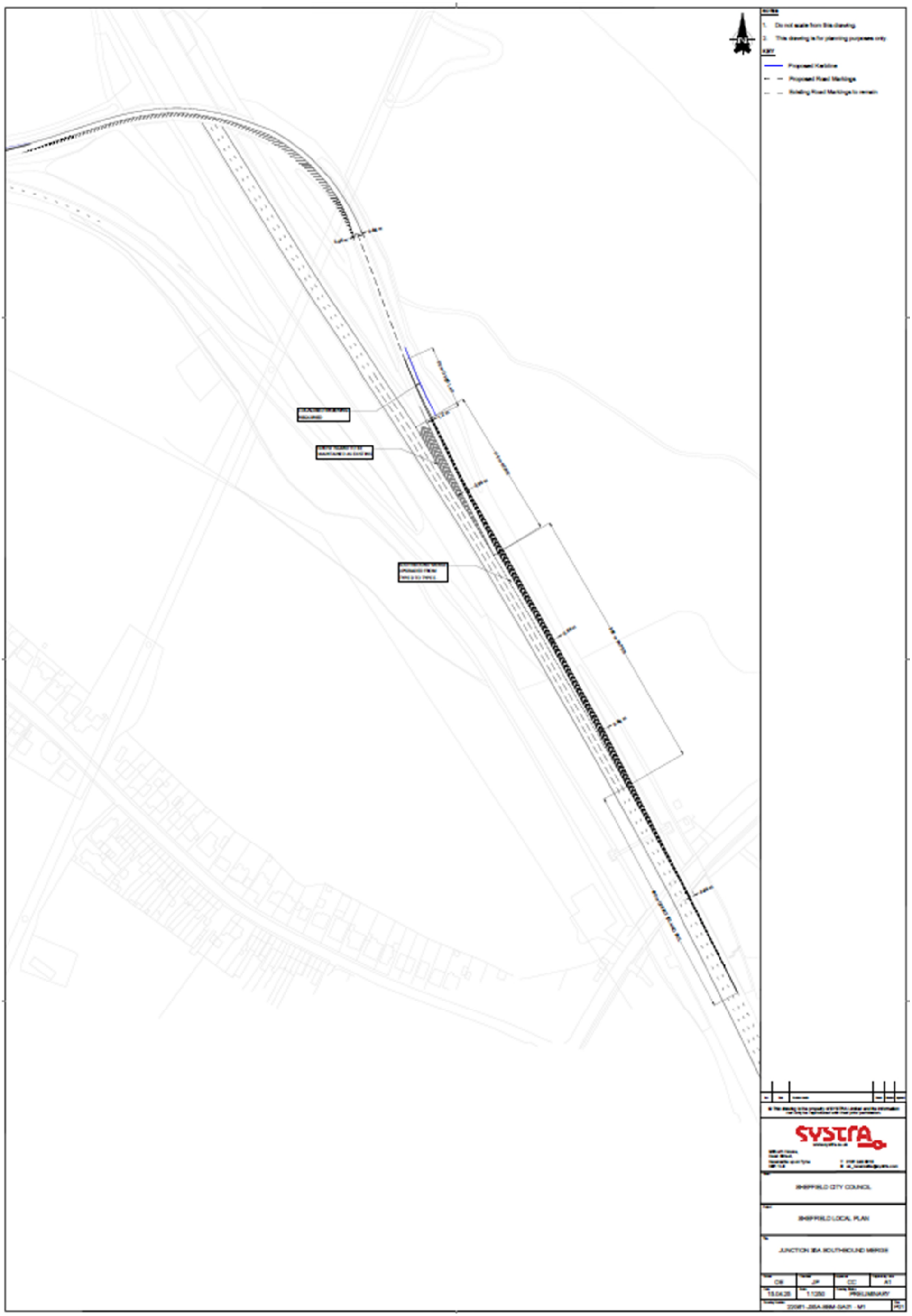


Figure D13: Illustrative Local Plan Mitigation Scheme at M1 J36 Northbound Merge

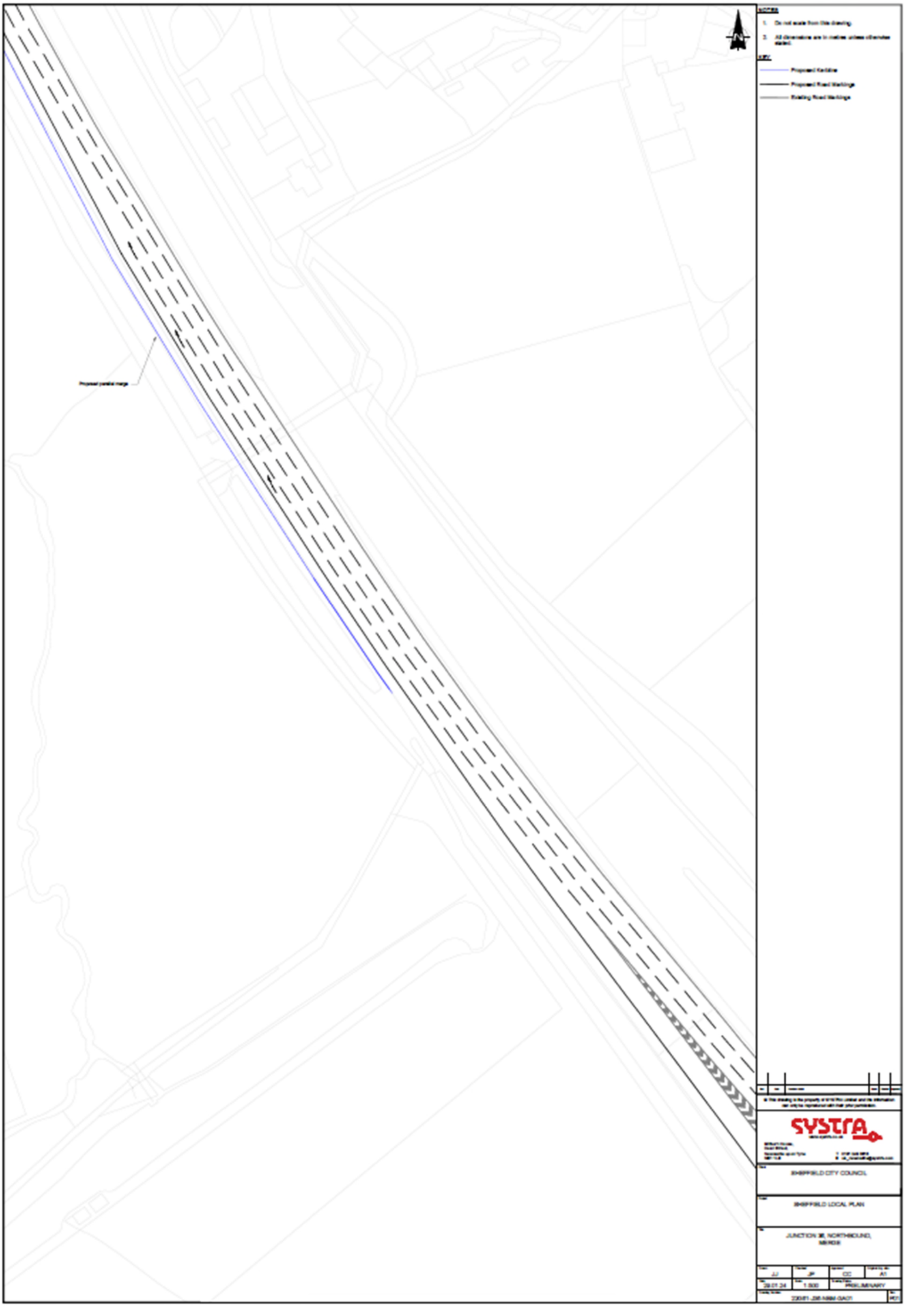
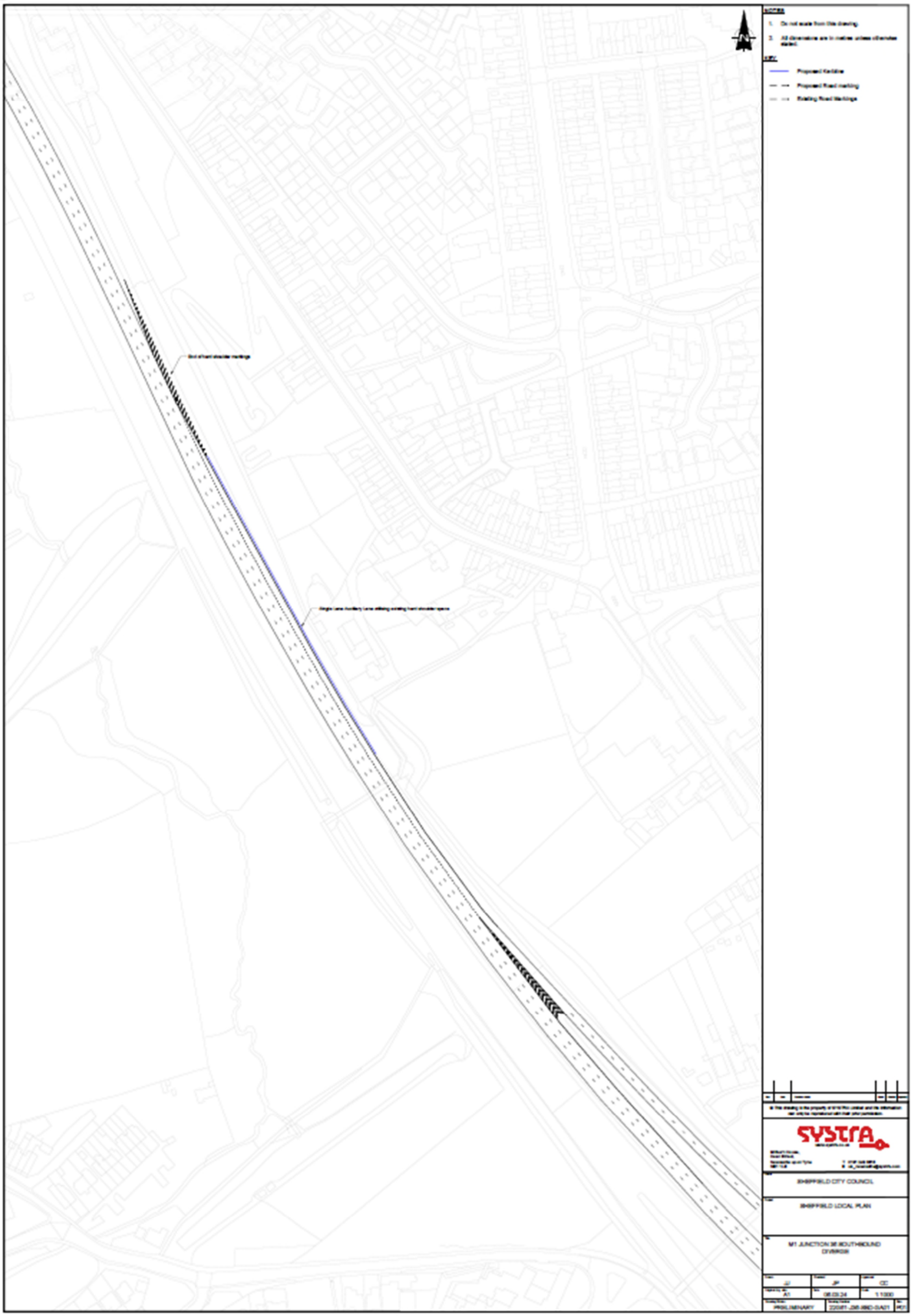


Figure D14: Illustrative Local Plan Mitigation Scheme at M1 J36 Southbound Diverge



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