

# Appendix 28

## Geometric Design Strategy Record

### M1 J15 & A45 improvement, M1 J15A Improvement



# BWB

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## TRANSPORT AND INFRASTRUCTURE

Roxhill Developments  
Northampton Gateway  
Strategic Rail Freight Interchange

Geometric Design Strategy Record  
(GDSR)  
M1 Junction 15 & A45 Improvement  
M1 J15A Improvement

## **TRANSPORT AND INFRASTRUCTURE**

Roxhill Developments  
Northampton Gateway  
Strategic Rail Freight  
Interchange

Geometric Design Strategy  
Record (GDSR)  
M1 Junction 15 & A45  
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## 1.0 INTRODUCTION

### Introduction

- 1.1 Roxhill (Junction 15) Limited (the Applicant), intends to submit an application for a Development Consent Order (DCO). The DCO will authorise the Applicant to construct and operate a Strategic Rail Freight Interchange (SRFI), which is a "nationally significant infrastructure project", as defined in the Planning Act 2008. It will therefore be the subject of an application to the Planning Inspectorate which will be determined by the Secretary of State for Transport.
- 1.2 The SRFI site is proposed on land to the west of the M1 motorway and to the east of the Northampton Loop railway line. It comprises a total of approximately 247 ha (610 acres) including the works associated with Junction 15.
- 1.3 A detailed description of the SRFI development is found at Chapter 2 of the Environmental Statement. The proposals include significant improvements to the existing A508 corridor.
- 1.4 The report is based on the following information:
  - Highways England design standards listed in Chapter 2 below
  - Topographical survey information prepared by Greenhatch
  - OS mapping, aerial photos and Google Streetview
  - Various site visit carried out during 2016 & 2017

### Purpose

- 1.5 The purpose of this report is to record the strategy for the geometric design for the new slip roads. Hence this report is the Design Strategy Record (DSR). It has been prepared in accordance with the principles for the DSR as set out in IAN149/17 and IAN198/17 and covers all of the trunk road works.
- 1.6 For each aspect of geometric design this report will describe the proposed geometry. Where relaxations are proposed then a justification will be provided. Where departures from standard are required, these will be highlighted and cross referenced to formal departure applications.
- 1.7 This report covers the M1 J15 improvements and associated works to the A45 as well as the M1 J15A improvements. It includes analysis of the local road works associated with these improvements which are namely changes to Saxon Avenue, Watering Lane and the A5123. However, this report does not include analysis of the A508 route upgrade and this is covered in a separate report.

### Overview of the Scheme

- 1.8 The purpose of the Scheme is to provide sufficient capacity on the highway network to facilitate the development of the SRFI. The Scheme would:
  - Provide a significant improvement in capacity to the current partially signalised roundabout at M1 Junction 15, via enlargement of the roundabout, widening of all approaches and additional signalisation

- Widen the A45 northbound to provide three lanes between M1 J15 and north of Watering Lane
- Provide a signalised junction between the A45 Northbound and Watering Lane
- Remove the existing parking lay-by
- Remove the existing bus lay-bys with a replacement facility provided on Watering Lane
- Provide a significant improvement in capacity to the eastern roundabouts at M1 Junction 15A, via widening of the A43 and A5123 approaches and partial signalisation

1.9 Highways England are developing their detailed proposals for construction of a smart motorway project (SMP) between M1 Junctions 13 and 16. This is due to commence on site in March 2018. The design for the improvements associated with the SRFI take into account the SMP proposals for the M1 mainline. Assuming the SMP is constructed then this is referred to in this report as the 'with SMP' scenario. However, consideration is given to a 'without SMP' scenario in the highly unlikely event that the SMP does not proceed.

## Traffic flows

1.10 The traffic data presented in this report have been obtained from the Northamptonshire Strategic Transport Model 2 (NSTM2) and are for the DfT Circular 02/2013 complaint scenario which for the year 2021 with 100% of the SRFI development in place along with 100% of other committed development within the extent of the NSTM2.

## List of Drawings

1.11 The following drawings should be read in conjunction with this report:

Section of Scheme	Highway Plan: General Arrangement	Highway Plan: Long Section	Highway Plan: Cross Section	General Arrangement larger scale sketch	Vehicle Tracking
<b>M1 Junction 15 and A45</b>	NGW-BWB-HGN-01-DR-C-101-S3-P8 NGW-BWB-HGN-02-DR-C-102-S3-P9 NGW-BWB-HGN-01-DR-C-107-S3-P3 NGW-BWB-HGN-02-DR-C-108-S3-P3	NGW-BWB-HGN-01-DR-C-141-S3-P7 NGW-BWB-HGN-02-DR-C-142-S3-P6	NGW-BWB-HGN-01-DR-C-131-S3-P7	NGW-BWB-GEN-XX-SK-C-SK02-S3-P13 See <b>Appendix D</b>	NGW-BWB-GEN-XX-SK-C-SK38-S3-P4 NGW-BWB-GEN-XX-SK-C-SK47-S3-P3 See <b>Appendix D</b>
<b>M1 Junction 15A</b>	NGW-BWB-HGN-06-DR-C-106-S3-P9	NGW-BWB-HGN-05-DR-C-145-S3-P4	NGW-BWB-HGN-04-DR-C-134-S3-P6	NGW-BWB-GEN-XX-SK-C-SK20-S3-P5 See <b>Appendix E</b>	NGW-BWB-GEN-XX-SK-C-SK40-S3-P3 See <b>Appendix E</b>

1.12 The **Highway Plans** are found within the formal documentation associated with the Development Consent Order application.

## 2.0 GEOMETRIC DESIGN STANDARDS

### Existing situation

- 2.1 M1 Junction 15, to the south west of Northampton, is where the A45 Trunk Road and A508 meet the M1. The junction is currently a large single 'dumbbell' partially signalised roundabout with a single bridge over the M1, having been reconstructed from a two bridge roundabout in the late 1990s.
- 2.2 The M1 through J15 is a dual 3 lane motorway that will, between 2018 and 2021, be upgraded by Highways England to a dual 4 lane all-lane running "smart motorway" without a hard shoulder.
- 2.3 The A45 north of J15 is predominantly a dual 2 lane all-purpose road with various sections of auxiliary lanes and closely spaced junctions through Northampton. Analysis of the existing A45 is found at **Appendix A**.
- 2.4 The A508 south of J15 is a local road, predominantly a single carriageway of varying standard, connecting with the A5 north of Milton Keynes. The proposed upgrades to the A508 are reviewed in a separate report.
- 2.5 M1 Junction 15A, to the west of Northampton, is where the A43 Trunk Road and A5123 meet the M1. It was originally constructed in the early 1990s by repurposing the slip roads for the adjacent motorway services area. Further works took place to enhance the capacity of the junction during the 2000s. The junction between the A43, A5123 and connecting roads to the M1 are a twin dumbbell arrangement with no signalisation.

### Standards used

- 2.6 The Scheme layout does not include any managed motorway technology and will thus be designed in accordance with the following standards:
  - TA46/97 "Traffic flow ranges for use in the assessment of new rural roads"
  - TA91/05 "Provision for Non-motorised Users"
  - TD9/93 "Highway Link Design"
  - TD16/07 "Geometric Design of Roundabouts"
  - TD18/85 "Criteria for the Use of Gantries for Traffic Signs and Matrix Traffic Signals on Trunk Roads and Trunk Road Motorways"
  - TD22/06 "Layout of Grade Separated Junctions"
  - TD27/05 "Cross-Sections and Headrooms"
  - TD41/95 "Vehicular Access to All-Purpose Trunk Roads"
  - TD42/95 "Geometric Design of Major/Minor Priority Junctions"
  - TD46/05 "Motorway Signalling"
  - TD50/04 "The Geometric Layout of Signal-Controlled Junctions and Signalised Roundabouts"
  - TD51/17 "Segregated Left Turn Lanes and Subsidiary Deflection Islands at Roundabouts"
  - TD69/07 "The Location and Layout of Lay-bys and Rest Areas"
  - IAN69/15 "Designing for Maintenance"
  - IAN144/16 "Directional signs on motorway and all-purpose trunk roads grade separated junctions"
  - IAN145/16 "Directional signs on motorway and all-purpose trunk roads at grade and compact grade separated junctions"

- IAN149/17 "Existing Motorway Minimum Requirements"
- IAN161/15 "Smart Motorways"
- IAN198/17 "Existing Dual Carriageway All-Purpose Trunk Road Network: Additional Requirements and Relaxations"

## Design Speed

2.7 The design speeds for each section of the scheme are given as follows.

Road / Link Section	Road / Link Type	Design Speed (kph)	Derived from
<b>M1 Junction 15</b>			
<b>M1 SB diverge slip road</b>	Motorway Slip Road	70	TD22/06 Table 4/1
<b>M1 SB merge slip road</b>	Motorway Slip Road	70	TD22/06 Table 4/1
<b>M1 NB diverge slip road</b>	Motorway Slip Road	70	TD22/06 Table 4/1
<b>M1 NB merge slip road</b>	Motorway Slip Road	70	TD22/06 Table 4/1
<b>A45 (from M1 J15 to Grange Park merge)</b>	Urban dual carriageway	85	See <b>Appendix A</b> for derivation of design speed
<b>Saxon Avenue approach to J15</b>	Urban single carriageway (not trunk)	60	TD9/93 Table 3 for 30mph speed limit
<b>C67 Watering Lane approach to A45</b>	Urban single carriageway (not trunk)	70	TD9/93 Table 3 for 40mph speed limit
<b>M1 Junction 15A</b>			
<b>A43 south of J15A</b>	Rural dual carriageway	120	TD9/93
<b>A5123 north of J14A</b>	Rural dual carriageway	120	TD9/93
<b>Link within J15A</b>	'Dumb-bell' link road	70	TD22/06 Table 4/1

2.8 The design of the A508 (local highway) approach to M1 J15 is covered in the separate GDSR for the A508 route upgrade.

2.9 No significant alterations are proposed to Saxon Avenue, Watering Lane and the A5123 and hence these are covered within this report.

## Scheme Overview

### M1 Junction 15

2.10 The scheme increases capacity at Junction 15 by enlarging the existing roundabout to form a larger fully signalised gyratory.

2.11 The A45 to the immediate north of Junction 15 is widened to a minimum of three lanes in each direction to beyond the C67 Watering Lane, and the junction with Watering Lane is signalised.

2.12 All of the approaches to Junction 15 signalised gyratory are to be widened, with the diverge slip roads from the M1 which form the approaches to the signalised gyratory realigned accordingly. As these are existing slip roads it is considered that the scheme would modify these existing slip roads and that they are not 'new' slip roads.

- 
- 2.13 The M1 northbound merge slip road would be widened to two lanes and it is to be realigned at the southern end so it connects into the Junction 15 signalised gyratory. Again these works form a modification of an existing slip road.
- 2.14 There is an interface with the M1 J13-16 Smart Motorway Project (SMP) at both diverge slip roads and the M1 northbound merge slip road.

#### M1 Junction 15A

- 2.15 The scheme would increase capacity at the two roundabouts that connect the A43, A5123 and link roads to the M1. This would take the form of partial signalisation and widening.

## 3.0 HORIZONTAL DESIGN OF LINKS

- 3.1 The horizontal alignment consists of various elements, depending on the type of link. Each aspect is considered below.

### M1 slip roads

- 3.2 The following tables summarise the horizontal alignment elements for the M1 slip roads (excluding the SB merge which is not being amended).

#### M1 J15 SB diverge

Chainage	Element	Standard (70kph design speed)	Proposed Design	
			Details	Relaxations / Departures
	Diverge Type	See below	Layout B1	Relaxed dimensions, see below
<b>0-70.000</b>	Near Straight	Min radius of 1020m over 80m	1020m over 70m	Near straight length relaxed to 70m as road class is relaxed to "Rural All-Purpose 120kph" as described below for the diverge.
<b>70.000-138.000</b>	Transition	~136m transition length	~68m transition length	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints
<b>138.000-195.449</b>	Radius	360m desirable minimum	180m	Two steps below desirable minimum is a permitted relaxation
<b>195.449-</b>	<b>Signalised Junction</b>			

#### M1 J15 NB diverge

Chainage	Element	Standard (70kph design speed)	Proposed Design	
			Details	Relaxations / Departures
	Diverge Type	See below	Layout B1	Relaxed dimensions, see below
<b>0 -71.776</b>	Near Straight	Min radius of 1020m over 80m	1020m over 70m	Near straight length relaxed to 70m as road class is relaxed to "Rural All-Purpose 120kph" as described below for the diverge.
<b>71.776-105.776</b>	Transition	~68m transition length	~34m transition length	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints
<b>105.776-192.045</b>	Radius	360m desirable minimum	360m	None
<b>192.045-226.045</b>	Transition	~68m transition length	~34m transition length	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints
<b>226.045-260.308</b>	Straight	-	-	-
<b>260.308-</b>	<b>Signalised Junction</b>			

### M1 J15 NB merge

Chainage	Element	Standard (70kph design speed)	Proposed Design	
			Details	Relaxations / Departures
285.400	Signalised Junction			
258.400-282.596	Straight	-	-	-
282.596-214.596	Transition	~136m transition length	~68m transition length	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints
214.596-129.372	Radius	TD9/93: 360m desirable minimum	180m	Two steps below desirable minimum is a permitted relaxation
129.372-61.372	Transition	~136m transition length	~68m transition length	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints
61.372-0	Straight	-	-	-
85-0	Near Straight	TD22/06: Min radius of 1020m over 115m	Effective radius of 10213m over 85m (effective radius is a measured over the straight and the first section of the transition)	Near straight length relaxed to 85m as road class is relaxed to “Rural All-Purpose 120kph” as described below for the diverge.
	Merge Type	See below	Layout C	Relaxed dimensions, see below

## **A45 Mainline**

3.3 The following tables summarise the horizontal alignment elements for the A45 mainline north of M1 J15.

### A45 Northbound

Chainage	Element	Standard (85kph design speed)	Proposed Design	
			Details	Relaxations / Departures
0-24.710	Signalised Junction			
24.710-89.184	Left hand curve / exit from roundabout	510m desirable min radius (if designed to TD9)	360m	1 step below desirable minimum is a permitted relaxation
89.18-207.401	Straight	-	-	-
207.401-250.377	Transition to right hand curve	~86m transition length	~43m transition length	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints

Chainage	Element	Standard (85kph design speed)	Proposed Design	
			Details	Relaxations / Departures
<b>250.377-325.191</b>	Right Hand Curve	510m desirable min radius	510m	None
<b>325.191-368.167</b>	Transition to straight	~86m transition length	~43m transition length	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints
<b>368.196-390.000</b>	Straight	-	-	-
<b>390.000 onwards</b>	<b>Existing Alignment</b> (with taper on offside added for lane drop)			

3.4 The signalised junction with Watering Lane occurs around chainage 400, further details are provided in the chapter on junction design below.

### A45 Southbound

Chainage	Element	Standard (85kph design speed)	Proposed Design	
			Details	Relaxations / Departures
<b>488.044-421.618</b>	Right hand curve (existing)	510m desirable min radius	700m	-
<b>421.618-390.307</b>	Transition to straight	~63m transition length	~31m transition length	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints
<b>390.307-329.007</b>	Straight	-	-	-
<b>329.007-276.823</b>	Transition to left hand curve	~104m transition length	~52m transition length	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints
<b>276.823-205.385</b>	Left Hand Curve	510m desirable min radius	420m	Between 0 and 1 steps below desirable minimum as a permitted relaxation
<b>205.385-153.201</b>	Transition to straight	~104m transition length	~52m transition length	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints
<b>153.201-71.468</b>	Straight	-	-	-
<b>71.468-0</b>	<b>Signalised Junction</b>			

## **Saxon Avenue and Watering Lane**

3.5 No alterations to the horizontal alignment are proposed for the C67 Watering Lane or Saxon Avenue. Refer to the relevant chapters below for assessment of the junction designs.

## M1 Junction 15A

- 3.6 No alterations to the horizontal alignment are proposed for the A43 or the M1 Link roads beyond the modifications required for the roundabout alterations. Refer to the relevant chapters below for assessment of the junction designs.

## A5123 Mainline

- 3.7 The following tables summarise the horizontal alignment elements for the A5123 mainline north of M1 J15A.

### A5123 Northbound

Chainage	Element	Standard (120kph design speed)	Proposed Design	
			Details	Relaxations / Departures
0-39.419	Roundabout Exit			
39.419-182.177	Left hand curve	1020m desirable min radius	1020m	None
182.177-200.177	Transition to left hand curve	~36m transition length	18m	Relaxation of q to 0.6m permitted by TD9/93 para 3.16 due to geometrical constraints
200.177-221.000	Left hand curve (existing)	1020m desirable min radius	1440m	None

### A5123 Southbound

Chainage	Element	Standard (120kph design speed)	Proposed Design	
			Details	Relaxations / Departures
<b>0-86.148</b>	Right hand curve	1020m desirable min radius	1539m	None
<b>86.148-131.444</b>	<b>Roundabout Approach</b>			

## 4.0 SUPERELEVATION ON LINKS

4.1 The superelevation has been assessed for each link.

### M1 slip roads

4.2 The following tables summarise the superelevation for the M1 slip roads (excluding the SB merge which is not being amended).

#### M1 J15 SB diverge

Chainage	Horizontal Element	Standard superelevation (70kph design speed)	Proposed Design	
			Details	Relaxations / Departures
0	Back of Nose			
0-70.000	Near Straight R = 1020m	-	2.5% crossfall	-
70.000-138.000	Transition = 68m	Varies over transition	2.5% - 5%	-
138.000-195.449	Radius = 180m	7%	5%	The 5% superelevation is proposed as the alignment is approaching the junction where the superelevation needs to be reduced accordingly. The reduction in superelevation is permitted under IAN149/17 and IAN161/15.
195.449-	Signalised Junction			

#### M1 J15 NB diverge

Chainage	Element	Standard superelevation (70kph design speed)	Proposed Design	
			Details	Relaxations / Departures
0	Back of Nose			
0 -71.776	Near Straight R = 1020m	-	2.5%	-
71.776-105.776	Transition = 34m	-	2.5% - 5%	-
105.776-192.045	Radius = 360m	5%	5%	-
192.045-226.045	Transition = 34m	-	5% - 2.5%	-
226.045-260.308	Straight	-	2.5% - (-)1% (3.5% change)	-
260.308-	Signalised Junction			

### M1 J15 NB merge

Chainage	Element	Standard superelevation (70kph design speed)	Proposed Design	
			Details	Relaxations / Departures
285.400	Signalised Junction			
258.400-282.596	Straight	-	2.5%	-
282.596-214.596	Transition = 68m	-	2.5% - 7%	-
214.596-129.372	Radius = 180m	7%	7%	-
129.372-61.372	Transition = 68m	-	7% - 2.5%	-
61.372-0	Straight	-	2.5%	
0	Back of Nose			

## **A45 Mainline**

4.3 The following tables summarise the superelevation for the A45 mainline north of M1 J15.

### A45 Northbound

Chainage	Element	Standard superelevation (85kph design speed)	Proposed Design	
			Details	Relaxations / Departures
0-24.710	Signalised Junction			
24.710-89.184	Radius = 360m	7%	-5%	Superelevation limited to 5% due to the presence of the junction and need to align with the junction design, this is permitted under TD9.
89.18-207.401	Straight	-	(-)5% - 2.5% (7.5% change)	-
207.401-250.377	Transition = 43m	-	2.5% - 5%	-
250.377-325.191	Radius = 510m	5%	5%	-
325.191-368.167	Transition = 43m	-	5% - 2.5%	-
368.196-390.000	Straight	-	2.5%	-
390.000 onwards	Existing Alignment (with taper on offside added for lane drop)			

### A45 Southbound

Chainage	Element	Standard superelevation (85kph design speed)	Proposed Design	
			Details	Relaxations / Departures
<b>488.044- 421.618</b>	Radius (existing) = 700m	3.5%	6% - 5% (Existing)	This is an existing feature and is not being changed by the scheme
<b>421.618- 390.307</b>	Transition = 31m	-	5% - 2.5%	-
<b>390.307- 360</b>	Straight	-	2.5%	-
<b>360- 329.007</b>	Straight	-	2.5% - (-)2.5% (5% change)	-
<b>329.007- 276.823</b>	Transition = 52m	-	(-)2.5% - (-)5%	-
<b>276.823- 205.385</b>	Radius = 420m	6.1%	-5%	Superelevation limited to 5% due to the presence of the junction and need to align with the junction design, this is permitted under TD9.
<b>205.385- 153.201</b>	Transition = 52m	-	(-)5% - (-)2.5%	-
<b>153.201- 71.468</b>	Straight	-	2.5%	-
<b>71.468-0</b>	<b>Signalised Junction</b>			

### **Saxon Avenue and Watering Lane**

- 4.4 No alterations to the horizontal alignment are proposed for the C67 Watering Lane or Saxon Avenue, as such no significant amendments will be made to the existing superelevation. Refer to the relevant chapters below for assessment of the junction designs.

### **M1 Junction 15A**

- 4.5 No alterations to the horizontal alignment are proposed for the A43, A5123 or the M1 Link roads beyond the modifications required for the roundabout alterations as such no significant amendments will be made to the existing superelevation. Refer to the relevant chapters below for assessment of the junction designs.

## 5.0 SIGHT DISTANCE ON LINKS

5.1 The stopping sight distance has been assessed for each link.

### M1 slip roads

5.2 The following tables summarise the sight distance for the M1 slip roads (excluding the SB merge which is not being amended).

#### M1 J15 SB diverge

Chainage	Junction Features within Section	Standard (TD9) (70kph design speed)	Proposed Design	
			Details	Relaxations / Departures
	Immediate approach to M1 J15 signalised roundabout	295m desirable minimum (no relaxations permitted), see TD22/06 Figure 4/3B	295m	-
Length of slip road does not permit reduction in forward visibility to 70kph design speed beyond back of nose				

#### M1 J15 NB diverge

Chainage	Junction Features within Section	Standard (TD9) (70kph design speed)	Proposed Design	
			Details	Relaxations / Departures
	Immediate approach to M1 J15 signalised roundabout	295m desirable minimum (no relaxations permitted), see TD22/06 Figure 4/3B	295m	-
Length of slip road does not permit reduction in forward visibility to 70kph design speed beyond back of nose				

#### M1 J15 NB merge

Chainage	Junction Features within Section	Standard (TD9) (70kph design speed)	Proposed Design	
			Details	Relaxations / Departures
	Immediate approach to M1 merge	120m	≥120m	-
(back of merge nose)	M1 merge	295m	≥295m	-

## M1 J15 SB diverge A45 Mainline

5.3 The following tables summarise the sight distance for the A45 mainline north of M1 J15.

### A45 Northbound

Chainage	Junction Features within Section	Standard (TD9) (85kph design speed)	Proposed Design	
			Details	Relaxations / Departures
	Immediate approach to Watering Lane	160m desirable minimum (no relaxations permitted)	≥160m	-
	None	160m desirable minimum	≥160m	-

### A45 Southbound

Chainage	Junction Features within Section	Standard (TD9) (85kph design speed)	Proposed Design	
			Details	Relaxations / Departures
[Start at tip of merge nose from Grange Park], to point where 160 vis is lost	None	160m desirable minimum	≥160m	-
	None	160m desirable minimum	120m	One step below desirable minimum, in conjunction with between zero and one step below desirable minimum radius is a permitted relaxation
	Immediate approach to M1 J15 signalised roundabout	160m desirable minimum (no relaxations permitted)	≥160m	-

## Saxon Avenue and Watering Lane

5.4 No alterations to the stopping sight distance are proposed for the C67 Watering Lane or Saxon Avenue. Refer to the relevant chapters below for assessment of the junction designs.

## M1 Junction 15A

5.5 The changes at J15A do not affect stopping sight distance on the approaches. The junction visibility is assessed below.

## 6.0 VERTICAL DESIGN OF LINKS

6.1 The vertical alignment consists of various elements, depending on the type of link. Each aspect is considered below.

### M1 J15 slip roads

6.2 The following tables summarise the vertical alignment elements for the M1 slip roads.

#### M1 J15 SB Diverge

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (70kph design speed)	Proposed Design	
				Details	Relaxations / Departures
<b>0-1.685</b>	Grade		0.5% - 6%	0.33%	This gradient is as existing but detailed consideration will be given to drainage at the detailed design stage
<b>1.685-40.236</b>	Sag curve		20 KF	20KF	-
<b>40.236-77.597</b>	Sag curve	Immediate approach to Stop line	20 KF	20KF	-
<b>77.597-98.748</b>	Grade	Immediate approach to Stop line	0.5% - 6%	3.25%	-
<b>98.748-222.480</b>	Crest curve	Immediate approach to Stop line	30KF	55KF	-
<b>222.480-232.749</b>	Grade	Immediate approach to Stop line	0.5% - 6%	1%	-
<b>220.236</b>	<b>Signalised Junction Stop line</b>				

#### M1 J15 NB Diverge

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (70kph design speed)	Proposed Design	
				Details	Relaxations / Departures
<b>0-60.039</b>	Grade		0.5% - 6%	0.93%	-
<b>60.039-85.348</b>	Sag curve		20 KF	20KF	-
<b>85.348-158.902</b>	Sag curve	Immediate approach to Stop line	20 KF	20KF	-
<b>158.902-175.498</b>	Grade	Immediate approach to Stop line	0.5% - 6%	4.00%	-

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (70kph design speed)	Proposed Design	
				Details	Relaxations / Departures
175.498-263.718	Crest curve	Immediate approach to Stop line	30KF	30KF	-
263.718-265.347	Grade	Immediate approach to Stop line	0.5% - 6%	1.06%	-
265.347	<b>Signalised Junction Stop line</b>				

### M1 J15 NB Merge

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (70kph design speed)	Proposed Design	
				Details	Relaxations / Departures
318.987	Signalised Junction				
318.987-298.127	Grade		0.5% - 6%	0.98%	
298.160-180	Crest curve		30KF	100KF	-
180-168.767	Crest curve	Immediate approach to M1 merge	30KF	100KF	-
168.767-53.356	Grade	Immediate approach to M1 merge	0.5% - 6%	2.27%	-
53.356-16.221	Sag curve	Immediate approach to M1 merge	20 KF	20KF	-
16.221-0	Grade	Immediate approach to M1 merge	0.5% - 6%	0.42%	
0	Back of merge nose				

## **A45 Mainline**

6.3 The following tables summarise the vertical alignment elements for the A45 mainline north of M1 J15.

### A45 Northbound

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (85kph design speed)	Proposed Design	
				Details	Relaxations / Departures
0-20.994	Grade			1.09%	
20.994-53.510	Crest curve	Immediate approach to Watering Lane	55 KF	55KF	-

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (85kph design speed)	Proposed Design	
				Details	Relaxations / Departures
53.510-157.307	Grade	Immediate approach to Watering Lane	0.5% - 4%	0.50%	-
157.307-171.277	Sag curve	Immediate approach to Watering Lane	20KF	20KF	-
171.277-184.050	Grade	Immediate approach to Watering Lane	0.5% - 4%	1.20%	-
184.050-199.365	Crest curve	Immediate approach to Watering Lane	55KF	55KF	-
199.365-258.647	Grade	Immediate approach to Watering Lane	0.5% - 4%	0.92%	-
258.647-344.871	Crest curve	Immediate approach to Watering Lane	55KF	55KF	-
344.871-434.881	Grade	Immediate approach to Watering Lane	0.5% - 4%	0.65%	-
434.881-496.317	Crest curve	None	55KF	55KF	-
496.317-606.313	Grade	None	0.5% - 4%	1.76%	-
606.313-719.636	Grade	None	0.5% - 4%	1.99%	-

### A45 Southbound

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (85kph design speed)	Proposed Design	
				Details	Relaxations / Departures
488.044-389.963	Grade	None	0.5% - 4%	1.41%	-
389.963-386.143	Crest curve	None	55KF	55KF	-
386.143-367.524	Grade	None	0.5% - 4%	1.34%	-
367.524-250.056	Crest curve	None	55KF	55KF	-
250.056-211.226	Crest curve	Immediate approach to M1 J15 signalised roundabout	55KF	55KF	-
211.226-189.860	Grade	Immediate approach to M1 J15 signalised roundabout	0.5% - 4%	1.50%	-

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (85kph design speed)	Proposed Design	
				Details	Relaxations / Departures
<b>189.860-164.748</b>	Sag curve	Immediate approach to M1 J15 signalised roundabout	20 KF	30KF	-
<b>164.748-113.348</b>	Grade	Immediate approach to M1 J15 signalised roundabout	0.5% - 4%	0.66%	-
<b>113.348-104.278</b>	Sag curve	Immediate approach to M1 J15 signalised roundabout	20 KF	55KF	-
<b>104.278-0</b>	Grade	Immediate approach to M1 J15 signalised roundabout	0.5% - 4%	0.5%	-
<b>10.056</b>	<b>Signalised Junction Stop line</b>				

## Saxon Avenue and Watering Lane

- 6.4 No alterations to the vertical alignment are proposed for the C67 Watering Lane or Saxon Avenue. Refer to the relevant chapters below for assessment of the junction designs.

## M1 Junction 15A

### A43 Northbound approach

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (120kph design speed)	Proposed Design	
				Details	Relaxations / Departures
<b>0-74.144</b>	Grade	Immediate approach to Stop line	0.5% - 4%	1.10%	-
<b>74.144-91.543</b>	Sag curve	Immediate approach to Stop line	37 KF	37KF	-
<b>91.543-174.855</b>	Grade	Immediate approach to Stop line	0.5% - 4%	0.63%	-
<b>149.203</b>	<b>Signalised Roundabout Stop line</b>				

### A5123 Northbound Exit

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (120kph design speed)	Proposed Design	
				Details	Relaxations / Departures
<b>0-19.624</b>	Roundabout				
<b>19.624-128.404</b>	Crest curve		182 KF	182 KF	-
<b>128.404-167.649</b>	Sag curve		37KF	37KF	-
<b>167.649-221.000</b>	Grade		0.5% - 4%	1.8%	-

### A5123 Southbound approach

Chainage	Vertical Alignment Feature	Junction Features within this Section	Minimum Standard (120kph design speed)	Proposed Design	
				Details	Relaxations / Departures
<b>0-7.966</b>	Grade	Immediate approach to Stop line	0.5% - 4%	2.02%	-
<b>7.966-25.852</b>	Sag curve	Immediate approach to Stop line	37 KF	37 KF	-
<b>25.852-131.444</b>	Crest curve	Immediate approach to Stop line	182 KF	182 KF	-
<b>131.444</b>	<b>Roundabout give way line</b>				

## 7.0 MERGES AND DIVERGES

7.1 The following merges and diverges have been assessed:

- M1 Southbound Diverge at J15
- M1 Southbound Merge at J15
- M1 Northbound Diverge at J15
- M1 Northbound Merge at J15
- A45 Southbound Merge from Grange Park

7.2 Assessments of other merges and diverges are found in the Transport Assessment as required.

7.3 No works are proposed to the any of the M1 slip roads / interchange links at J15A.

### M1 J15 SB diverge

#### Motorway Diverge

7.4 Traffic flows have been obtained from the model and have been factored for %HGV and uphill gradient in accordance with TD22 Table 3/2 as follows:

	Uphill Gradient	AM %HGV	Adjustment Factor	PM %HGV	Adjustment Factor
<b>Mainline</b>	<2%	19.55	1.05	10.81	1.00

7.5 The adjusted flows have been applied to TD22/06 Figure 2/5MW found at **Appendix B** and the following Diverge layouts are indicated:

Peak Hour	AM	PM
<b>Layout Reference</b>	D	A
<b>Layout Type</b>	Lane drop with ghost island diverge (D1) or parallel diverge (D2)	Taper diverge
<b>No. lanes on upstream mainline</b>	3	3
<b>No. lanes on downstream mainline</b>	2	3
<b>No. lanes on slip road</b>	2	1

7.6 In both cases the traffic data is close to a boundary and as such there is no clear defined diverge type for this location derived from TD22 Figure 2/5MW. It would only take minor adjustments in traffic flows for a Layout B diverge to be indicated for both the AM and PM.

7.7 In the 'with SMP' scenario the M1 will be widened to four lanes. Although it can be seen from the above that the flows indicate that only three lanes on the mainline through J15 are required, under IAN161/15 para 2.2.3 having four lanes through the junction is preferred. This is the layout that is proposed as part of the SMP and as such it is considered that the improvement to J15 should not alter this. With a four lane mainline

and a two lane slip road being required, it is considered that a Layout B diverge is the most appropriate and this is a permitted relaxation under IAN161/15.

- 7.8 In the 'without SMP' scenario it is considered that it would not be appropriate to introduce a lane drop. With a three lane mainline and a two lane slip road being required, it is considered that a Layout B diverge is the most appropriate. IAN149/17 does not permit relaxations in diverge type and hence use of a Layout B diverge in this scenario would require a departure from standard.
- 7.9 TD22 gives two alternative options for Layout B. B1 is a ghost island diverge and B2 is a parallel diverge. Layout B1 is preferred over B2 due to potential safety concerns about last second 'swooping' at parallel diverges.
- 7.10 It is therefore considered that Layout B1 is the most appropriate solution for the M1 SB diverge at J15.
- 7.11 The exit datum point for the diverge is constrained by the existing Collingtree Footpath bridge near High Street, Collingtree. The exit datum point is proposed to be as near as possible to the bridge and the datum point would be at the location proposed by the SMP.
- 7.12 A detailed analysis has been undertaken using VISSIM microsimulation software of the proposed J15 layout including the Layout B1 diverge, designed to the full requirements of TD22. Further analysis is found in the VISSIM Modelling Summary that is appended to the Transport Assessment.
- 7.13 This analysis concluded that such a layout would result in a very short slip road length which has the potential to result in significant safety concerns and congestion due to weaving. This would also require a departure from standard between successive diverges on the slip road as they would be less than 262.5m (3.75 x 70kph).
- 7.14 In order to minimise these safety concerns it is proposed to reduce the length of the diverge by adopting the "Rural All-Purpose 120kph" standards which is a permitted relaxation under IAN161/15 and IAN149/17.

Element	Standard (TD22 dimensions)	Proposed Design	
		Details	Relaxations / Departures
<b>Taper</b>	170m	150m	Permitted relaxation under IAN161/15 & IAN149/17
<b>Ghost Island Head</b>	180m	160m	Permitted relaxation under IAN161/15 & IAN149/17
<b>Taper</b>	170m	150m	Permitted relaxation under IAN161/15 & IAN149/17
<b>Nose Length</b>	80m	70m	Permitted relaxation under IAN161/15 & IAN149/17
<b>Minimum Nose Ratio</b>	1:15	1:14	1:14 is permitted and is not considered to give an excessive angle at the diverge. It is considered that such a minor increase in the angle will not have any impact on network performance.
<b>Overlap</b>	50m	50m	None

#### *'With SMP' scenario*

- 7.15 When used in combination with a change in diverge layout the use of relaxed dimensions does not comply with IAN161/15 and is a **Departure from Standard** reference **NGW/M1/01A**. This is required as a result of the following:
- The need for a two lane slip diverge (as clearly identified by the traffic flows)
  - The unacceptability of providing a lane drop
  - The constraint that is the existing Collingtree Footpath bridge and properties within the adjacent village of Collingtree on the east of the M1.
- 7.16 It is considered that the diverge, with relaxed dimensions, should be constructed by the SMP as this could be provided with the existing slip road layout. This is under discussion with SMP. However, in the meantime, **Departure from Standard** reference **NGW/M1/01A** would therefore be sought by this project.

#### *'Without SMP' scenario*

- 7.17 If the 'without SMP' scenario is constructed then the layout proposed does not comply with IAN1149/17 or TD22 and is a **Departure from Standard** reference **NGW/M1/01B**. This is required as a result of the following:
- The need for a two lane slip diverge (as clearly identified by the traffic flows)
  - The unacceptability of providing a lane drop
  - The constraint that is the existing Collingtree Footpath bridge and properties within the adjacent village of Collingtree on the east of the M1.
- 7.18 This departure would be sought as part of this scheme in the unlikely event that the SMP does not proceed. It is noted that the departure would be sought against TD22/06 and not IAN149/17 (as per IAN149/17 para 1.12).

#### Diverge within the slip road

- 7.19 Due to the layout of the slip road, it can be argued that there is a diverge on the slip road itself between traffic heading left onto the A45 and traffic heading elsewhere onto the junction.
- 7.20 Successive diverges must be spaced in accordance with TD22 at  $3.75V$  where  $V$  is the design speed. In the case of the slip road, the design speed for the slip road is taken which is 70kph. Hence the minimum distance between successive diverges (measured between tips of noses) is 262.5m.
- 7.21 The distance proposed between the tip of nose on the M1 SB diverge and the tip of nose on the slip road diverge is 262.5m.

### **M1 J15 SB merge**

- 7.22 Traffic flows have been obtained from the model and have been factored for %HGV and uphill gradient in accordance with TD22 Tables 3/2 and 3/3 as follows:

	Uphill Gradient	AM %HGV	Adjustment Factor	PM %HGV	Adjustment Factor
<b>Mainline</b>	<2%	19.55	1.05	10.81	1.00
<b>Merge</b>	<2%	7.48	1.00	8.10	1.00

- 7.23 The adjusted flows have been applied to TD22/06 Figure 2/3MW found at **Appendix B** and the following Merge layouts are indicated:

Peak Hour	AM	PM
<b>Layout Reference</b>	E	B
<b>Layout Type</b>	Single lane gain	Parallel merge
<b>No. lanes on upstream mainline</b>	2	3
<b>No. lanes on downstream mainline</b>	3	3
<b>No. lanes on slip road</b>	1	1

- 7.24 The above is inconclusive, although if the mainline flows were slightly greater in the AM then a Layout B merge would be indicated.
- 7.25 In the 'with SMP' scenario then there will be four lanes on the upstream mainline. The relevant standard is IAN161/15 and para 2.4.6 permits merge Layout B to be provided in lieu of Layout E. The SMP proposals would implement the Layout B merge as shown on their design drawings.
- 7.26 In the 'without SMP' scenario IAN149/17 para 3.9 permits a Layout B merge to be substituted for a Layout E. There is already a Layout B merge at this location and hence no further work is considered necessary in this scenario.
- 7.27 It is therefore considered that no works to the M1 J15 SB merge are required as part of the SRFI.

## M1 J15 NB diverge

- 7.28 Traffic flows have been obtained from the model and have been factored for %HGV and uphill gradient in accordance with TD22 Table 3/2 as follows:

	Uphill Gradient	AM %HGV	Adjustment Factor	PM %HGV	Adjustment Factor
<b>Mainline</b>	<2%	15.07	1.01	14.21	1.00

- 7.29 The adjusted flows have been applied to TD22/06 Figure 2/5MW found at **Appendix B** and the following Diverge layouts are indicated:

Peak Hour	AM	PM
<b>Layout Reference</b>	D	D

Peak Hour	AM	PM
<b>Layout Type</b>	Single lane drop with ghost island (D1) or parallel diverge (D2)	Single lane drop with ghost island (D1) or parallel diverge (D2)
<b>No. lanes on upstream mainline</b>	3	3
<b>No. lanes on downstream mainline</b>	2	2
<b>No. lanes on slip road</b>	2	2

- 7.30 It is clear that a Layout D diverge is suggested. However, this is on the basis that the forecast flows would require 2 lanes downstream. If the downstream mainline flows increased then a Layout B diverge would be suggested.
- 7.31 In the 'with SMP' scenario there will be four lanes on the upstream mainline. Although it can be seen from the above that the flows indicate that three lanes on the mainline through J15 are required, under IAN161/15 para 2.2.3 having four lanes through the junction is preferred. This is the layout that is proposed as part of the SMP and as such it is considered that the improvement to J15 should not alter this. The most suitable diverge layout is therefore considered to be Layout B.
- 7.32 In the 'without SMP' scenario it is considered that a Layout B diverge should be provided as it would not be appropriate to introduce a lane drop to two lanes through the junction.
- 7.33 TD22 gives two alternative options for Layout B. B1 is a ghost island diverge and B2 is a parallel diverge. Layout B1 is preferred over B2 due to potential safety concerns about last second 'swooping' at parallel diverges.
- 7.34 A detailed analysis has been undertaken using VISSIM microsimulation software of the proposed J15 layout including the Layout B1 diverge, designed to the full requirements of TD22. Further analysis is found in the VISSIM Modelling Summary that is appended to the Transport Assessment.
- 7.35 The VISSIM analysis concluded that it is necessary, due to predicted queue lengths and the potential for weaving on the slip road, to maximise the length of the slip road. In order to achieve this it is proposed to reduce the length of the diverge by adopting the "Rural All-Purpose 120kph" standards which is a permitted relaxation under IAN161/15 and IAN149/17.

Element	Standard (TD22 dimensions)	Proposed Design	
		Details	Relaxations / Departures
<b>Taper</b>	170m	150m	Permitted relaxation under IAN161/15 & IAN149/17
<b>Ghost Island Head</b>	180m	160m	Permitted relaxation under IAN161/15 & IAN149/17
<b>Taper</b>	170m	150m	Permitted relaxation under IAN161/15 & IAN149/17
<b>Nose Length</b>	80m	70m	Permitted relaxation under IAN161/15 & IAN149/17

<b>Minimum Nose Ratio</b>	1:15	1:14	1:14 is permitted and is not considered to give an excessive angle at the diverge. It is considered that such a minor increase in the angle will not have any impact on network performance.
<b>Overlap</b>	50m	50m	None

#### *'With SMP' scenario*

7.36 When used in combination with a change in diverge layout the use of relaxed dimensions does not comply with IAN161/15 is a **Departure from Standard** reference **NGW/M1/02A**. This is required as a result of the following:

- The need for a two lane slip diverge (as clearly identified by the traffic flows)
- The unacceptability of providing a lane drop

7.37 **Departure from Standard** reference **NGW/M1/02A** would be a departure from IAN161/15 and is to be sought as part of this scheme. As this would result in a change to the SMP scheme this is under discussion with SMP.

#### *'Without SMP' scenario*

7.38 If the 'without SMP' scenario is constructed then the layout proposed does not comply with IAN1149/17 or TD22 and is a **Departure from Standard** reference **NGW/M1/02B**. This is required as a result of the following:

- The need for a two lane slip diverge (as clearly identified by the traffic flows)
- The unacceptability of providing a lane drop

7.39 This departure would be sought as part of this scheme in the unlikely event that the SMP does not proceed. It is noted that the departure would be sought against TD22/06 and not IAN149/17 (as per IAN149/17 para 1.12).

## **M1 J15 NB merge**

7.40 Traffic flows have been obtained from the model and have been factored for %HGV and uphill gradient in accordance with TD22 Tables 3/2 and 3/3 as follows:

	Uphill Gradient	AM %HGV	Adjustment Factor	PM %HGV	Adjustment Factor
<b>Mainline</b>	<2%	15.07	1.01	14.21	1.00
<b>Merge</b>	<2%	10.63	1.01	7.11	1.00

7.41 The adjusted flows have been applied to TD22/06 Figure 2/3MW found at **Appendix B** and the following Merge layouts are indicated:

Peak Hour	AM	PM
<b>Layout Reference</b>	F	F
<b>Layout Type</b>	Single lane gain with ghost island	Single lane gain with ghost island
<b>No. lanes on upstream mainline</b>	2	2
<b>No. lanes on downstream mainline</b>	3	3
<b>No. lanes on slip road</b>	2	2

- 7.42 As can be seen above it is clear that a Layout F should be provided with two lanes on the slip road.
- 7.43 In the 'with SMP' scenario there will be four lanes on the upstream mainline. The relevant standard is IAN161/15 and para 2.4.6 permits merge Layout C to be provided in lieu of Layout F.
- 7.44 In the 'without SMP' scenario, where no lane gain is to be introduced, IAN149/17 para 3.9 permits a Layout C merge to be provided in place of Layout F.
- 7.45 The entry datum point for the merge must be located prior to the Collingtree Footpath overbridge and due to the geometry it is not possible to locate the merge nose farther south. Hence in order to achieve this it is proposed to reduce the length of the merge by adopting the "Rural All-Purpose 120kph" standards which is a permitted relaxation under IAN161/15 and IAN149/17. The following dimensions are proposed

Element	Standard (TD22 dimensions)	Proposed Design	
		Details	Relaxations / Departures
<b>Overlap</b>	50m	50m	None
<b>Minimum Nose Ratio</b>	1:40	1:17	1:17 is permitted and is required to allow a 5m width with 85m nose length, it is not considered to give an excessive angle at the merge. It is considered that the increase in the angle will not have any impact on network performance as it will not have an impact on vehicle speeds before the merge.
<b>Nose Length</b>	115m	85m	Permitted relaxation under IAN161/15 & IAN149/17
<b>Taper</b>	205m	150m	Permitted relaxation under IAN161/15 & IAN149/17
<b>Ghost Island Head</b>	180m	150m	Permitted relaxation under IAN161/15 & IAN149/17
<b>Taper</b>	205m	150m	Permitted relaxation under IAN161/15 & IAN149/17

### *'With SMP' scenario*

- 7.46 When used in combination with a change in merge layout the use of relaxed dimensions does not comply with IAN161/15 is a **Departure from Standard** reference **NGW/M1/03A**. This is required as a result of the following:
- The need for a two lane slip merge (as clearly identified by the traffic flows)
  - The inability to provide a lane gain
  - The constraint that is the existing Collingtree Footpath bridge
- 7.47 **Departure from Standard** reference **NGW/M1/02A** would be a departure from IAN161/15 and is to be sought as part of this scheme. As this would result in a change to the SMP scheme this is under discussion with SMP.
- 7.48 In the 'with SMP' scenario it is important to consider merge over-run as there is no hardshoulder on the M1 mainline. It is therefore proposed that at the second taper, a full lane width of pavement is provided and with the element of this that does not form part of the standard running area in the merge taper hatched out. This hatched area would then terminate with a 40m taper. In accordance with IAN161/15 the merge over-run will need to be endorsed by the SMP's Project Safety Control Review Group (PSCRG).

### *'Without SMP' scenario*

- 7.49 When used in combination with a change in merge layout, the use of relaxed dimensions does not comply with IAN149/17 or TD22 and is a **Departure from Standard** reference **NGW/M1/03B**. This is required as a result of the following:
- The need for a two lane slip merge (as clearly identified by the traffic flows)
  - The inability to provide a lane gain
  - The constraint that is the existing Collingtree Footpath bridge
- 7.50 This departure would be sought as part of this scheme in the unlikely event that the SMP does not proceed. It is noted that the departure would be sought against TD22/06 and not IAN149/17 (as per IAN149/17 para 1.12).

## **A45 SB merge at Grange Park**

### Merge Layout

- 7.51 Traffic flows have been obtained from the model and have been factored for %HGV and uphill gradient in accordance with TD22 Tables 3/1 and 3/2 as follows:

	Uphill Gradient	AM %HGV	Adjustment Factor	PM %HGV	Adjustment Factor
<b>Mainline</b>	<2%	4.0	1.00	4.0	1.00
<b>Merge</b>	<2%	18.0	1.08	7.5	1.00

- 7.52 The adjusted flows have been applied to TD22/06 Figure 2/3AP found at **Appendix B** and the following Merge layouts are indicated:

Peak Hour	AM	PM
<b>Layout Reference</b>	E	E (Border line with B)
<b>Layout Type</b>	Single lane gain	Single lane gain
<b>No. lanes on upstream mainline</b>	2	2
<b>No. lanes on downstream mainline</b>	3	3
<b>No. lanes on slip road</b>	1	1

- 7.53 The existing slip road is a Layout E merge and this does not need to be amended based on the predicted design flows. However, the nose length and roadmarking layout do not comply with current standards and it is therefore proposed that the merge is amended as follows:

Element	Standard (TD22 dimensions)	Existing design	Proposed Design	
			Details	Relaxations / Departures
<b>Near straight</b>	Min radius of 510m over 40m	870m over 40m	870m over 40m	-
<b>Nose Length</b>	40m	70m	40m	-
<b>Minimum Nose Ratio</b>	1:12	1:9	1:8	1:8 is permitted under TD22 Table 4/3 Note 1 and it is not considered to give an excessive angle at the merge.

#### Weaving length

- 7.54 Downstream of the merge there is a weaving length to the M1 Junction 15 signalised roundabout. The predicted flows are as follows:

From	To	AM peak hour flow	PM peak hour flow	Weaving flow?
A45	A508 / M1 North	1988	1780	No
A45	M1 South / Saxon Avenue	754	717	Yes
Grange Park merge	A508 / M1 North	660	504	Yes
Grange Park merge	M1 South / Saxon Avenue	347	214	No
<b>Total weaving flow</b>		1414	1221	

- 7.55 Based on the A45 being an 85kph design speed urban road the minimum weaving distance, ( $L_{min}$ ), is based on TD22/06 Figure 4/14.

- 7.56 The worst case weaving flow is in the AM peak. The D/V value for TD22 Figure 4/14 (upper graph) is  $1600/85 = 18.8$ .
- 7.57 The minimum weaving distance, ( $L_{min}$ ), is the greater of the following:
- 175m as defined by TD22 Figure 4/14 (upper graph)
  - 250m as defined by TD22 Figure 4/14 (lower graph)
- 7.58  $L_{min}$ , i.e. 250m, must be provided between the tip of the merge nose (for a lane gain as per TD22 Figure 4/11) and the at-grade junction. The design would provide the following:
- 275m between the tip of the merge nose and the start of any widening / tapers for the signalised junction
  - 430m between the tip of the merge nose and tip of nose at the split in lanes at the signalised junction
  - 485m between the tip of the merge nose and the stop line.
- 7.59 As all the above distances are greater than  $L_{min}$  then the design meets the required minimum weaving length.

## Summary

- 7.60 The merges and diverges are summarised as follows:

Peak Hour	Existing layout	Layout required by TD22	Layout "With SMP"	Layout "Without SMP"
<b>M1 SB Diverge</b>	B2 (with single auxiliary lane)	Inconclusive (D or A suggested)	B1 (relaxation of diverge elements to 120kph all-purpose standards, but in combination with diverge type is <b>Departure NGW/M1/01A</b> )	B1 (relaxation of diverge elements to 120kph all-purpose standards, but in combination with diverge type is <b>Departure NGW/M1/01B</b> )
<b>M1 SB Merge</b>	B	B	B	B
<b>M1 NB Diverge</b>	B2 (with single auxiliary lane)	D	B1 (relaxation of diverge elements to 120kph all-purpose standards, but in combination with diverge type is <b>Departure NGW/M1/02A</b> )	B1 (relaxation of diverge elements to 120kph all-purpose standards, but in combination with diverge type is <b>Departure NGW/M1/02B</b> )
<b>M1 NB Merge</b>	B	F	C (relaxation of diverge elements to 120kph all-purpose standards, but in combination with merge type is <b>Departure NGW/M1/03A</b> )	C (relaxation of diverge elements to 120kph all-purpose standards, but in combination with merge type is <b>Departure NGW/M1/03B</b> )
<b>A45 SB Merge (Grange Park)</b>	E	E	E (not relevant to SMP)	

## 8.0 CROSS SECTIONS ON LINKS

- 8.1 The cross consists of various elements, depending on the type of link. Each aspect is considered below. Cross section reference names are as detailed in TD27/05.

### M1 J15 slip roads

- 8.2 The following tables summarise the cross section for each of the M1 slip roads based on the forecast traffic flows and TD22/06 Table 3/1b. Note that the flows are adjusted for gradient and heavy good vehicle % as required by TD22.

Slip Road	AM peak hour flow	PM peak hour flow	Required cross section (TD22)	Proposed Design	
				Cross section	Comments / Relaxations / Departures
<b>M1 SB diverge</b>	1,901	1,270	DG2A	DG2A	The cross section is only used for a short distance of the slip road as the slip road widens to the junction. See further comments below.
<b>M1 NB diverge</b>	1,611	1,551	DG2A	DG2A	The cross section is only used for a short distance of the slip road as the slip road widens to the junction. See further comments below.
<b>M1 NB merge</b>	2,005	2,024	MG2C	MG2C	None

- 8.3 As a result of the merge & diverge review no changes are proposed to the existing M1 SB merge slip road and hence this is not assessed.

#### Diverge slip road hardstrip provision

- 8.4 In accordance with TD27 para 4.10.2 and Figures 4/5 to 4/7 the hardstrips are to continue to the end of the slip road even when additional lanes are provided and this is shown on the design drawings.
- 8.5 It is considered that the hardstrips need to terminate prior to the signal controlled crossings at the junction. A suitable arrangement for the termination of the hardstrips is considered to be TD16 Figure 8/11, however, this will be reviewed and agreed at the detailed design stage.

## A45 Mainline

- 8.6 The following tables summarise the cross section elements for the A45 mainline north of M1 J15. The tables do not include for any widening associated with junctions, the junctions are analysed below.

### A45 Northbound

Chainage	Required cross section	Proposed Design	
		Cross section	Comments / Relaxations / Departures
<b>0-391.309</b>	D3UAP	D3UAP	
<b>391.309-715.600</b>	D3UAP to D2UAP	D3UAP to D2UAP	Northbound: merge from three to two lanes, see detailed analysis below
<b>715.600-719.636</b>	D2UAP	D2UAP	
<b>719.636+</b>	D2UAP	D2UAP	As Existing - unchanged

### A45 Southbound

Chainage	Required cross section	Proposed Design	
		Cross section	Comments / Relaxations / Departures
<b>To 570.000</b>	D2UAP	D2UAP	As Existing - unchanged
<b>570.000 – 530.000</b>			Southbound: lane gain from Grange Park merge As Existing - unchanged
<b>530.000-250.000</b>	D3UAP	D3UAP	Note existing nearside hardstrip is to be removed
<b>250.000-0</b>	<b>Widening for Signalised Junction</b>		

## Saxon Avenue and Watering Lane

- 8.7 The changes to cross section on Saxon Avenue and Watering Lane are as a result of the junction designs and these are assessed in the relevant chapter below.

## M1 Junction 15A

- 8.8 The changes to cross section on the road network at M1 J15A are as a result of the junction designs and this are assessed in the relevant chapter below.

## 9.0 M1 JUNCTION 15 SIGNALISED ROUNDABOUT

- 9.1 The improvement scheme at J15 would retain the existing bridge which has three standard (3.65m) lanes in each direction.
- 9.2 The proposed scheme, as shown on drawing **NGW-BWB-GEN-XX-SK-C-SK02**, would enlarge the "roundabout" on both sides of the existing bridge. The term roundabout is used loosely as the existing junction is a partially signalised 'dog bone' roundabout and the proposed junction would take the form of a fully signalised gyratory.
- 9.3 All of the approaches would be signalised operating full time (at present Saxon Avenue and the A508 are priority approaches).
- 9.4 Consideration has been given in the design to maintenance access and this is covered in a separate chapter below.
- 9.5 TD50 does not require an 'intra junction' design speed to be set for signalised roundabouts and hence even if we were to set an arbitrary design speed then it would not be possible or appropriate to apply TD9 type parameters to the junction design.

### Visibility

- 9.6 TD50 requires one primary signal head to be visible for each phase on each approach. The visibility to the traffic signals from the external approaches is assessed as follows:

Approach	Design speed (kph)	Visibility distance criteria (TD50)	Proposed design	Departure from Standard?
<b>M1 SB slip road</b>	70	120m	>120m	No
<b>A45 southbound</b>	85	160m	>160m	No
<b>Saxon Avenue</b>	60	90m	>90m	No
<b>M1 NB slip road</b>	70	120m	>120m	No
<b>A508 northbound</b>	85	160m	>160m	No

- 9.7 The potential need for mast arms and/or tall poles with repeater primary signals will be assessed during the detailed design stage.
- 9.8 There is no set design speed for the internal approaches and although the speed limit is 50mph it is considered that actual speeds would be much below this. For assessment of traffic signal visibility a design speed of 60kph has therefore been assumed for movements that are predominantly straight ahead (i.e. not within more standard roundabout circulatory areas). For these internal approaches the minimum visibility to signals is taken to be 90m and it is confirmed that this is achieved in the design.
- 9.9 TD50 requires traffic signals to be intervisible and it is confirmed that the requirements for intervisibility are met.

### Lane widths

- 9.10 As the layout is that of a signalised gyratory there are no fixed design standards for radii etc. TD50 para 2.33 advises that where provision is to be made for HGVs, as is the case here, lane and carriageway widths may require widening in accordance with TD42.

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- 9.11 TD42 table 7/2 has therefore been used as the basis for widening lanes where radii are 100m or less. This is an alternative to designing the widths based on tracking plus 1m (as per TD42 para 7.26).
- 9.12 In addition, a detailed tracking assessment has been undertaken to check that HGVs would stay within their lanes around the junction.
- 9.13 The vehicle tracking assessment has been based on a 15.5m long articulated vehicle with a single rear axle as this is more onerous as stated in TD42 para 7.16. Although this vehicle is relatively rare, it is considered that given the number of HGVs predicted to use J15 that this vehicle should be used. This is shown on drawing **NGW-BWB-GEN-XX-SK-C-SK38** which is found at **Appendix D**.
- 9.14 A further vehicle tracking assessment has been undertaken for the commonplace 16.5m articulated vehicle, this is shown on drawing **NGW-BWB-GEN-XX-SK-C-SK47** which is also found at **Appendix D**.

#### Crossfalls and drainage

- 9.15 It is proposed that the detailed design stage would include for the design of the crossfalls and drainage around the signalised roundabout. The low object visibility requirements of TD50 would also be checked as part of this process.

## 10.0A45 / C67 WATERING LANE JUNCTION

10.1 The scheme would include the following works at the A45 / C67 Watering Lane junction:

- Provision of three lanes on the A45 Northbound through the junction
- Removal of the taper merge and replacement with a traffic signal control junction
- Removal of the existing bus stop lay-by on the A45 (see chapter on other highway features below)

10.2 The various elements of the junction geometry are assessed as follows:

Requirement	Criteria (TD50) (85kph design speed for A45, 70kph design speed for Watering Lane)	Proposed design	Departure from Standard?
<b>Left turn lane storage length</b>	Queue length	55m	No
<b>Taper at start of deceleration lane</b>	1:5	1:5	No
<b>A45 lane widths</b>	3 to 3.65m per lane	3 x 3.65m	No
<b>Left turn radii into Watering Lane</b>	Minimum: 10m radius 30m taper	18m radius followed by 50m radius compound curve, checked with vehicle tracking – see further comments below	Greater than minimum requirement of TD50
<b>Left turn radii onto A45</b>	Minimum: 10m radius 30m taper	35m radius followed by short taper (to TD50 Figure 2/7)	Greater than minimum requirement of TD50
<b>A45 visibility to traffic signal heads</b>	160m	>160m	No
<b>Watering Lane visibility to traffic signal heads</b>	120m	>160m	No
<b>Traffic signal inter-visibility</b>	As set out in TD50, no relaxations permitted for new junctions	Fully compliant inter-visibility	No

10.3 On the left turn into Watering Lane the use of a compound curve to TD42 Figure 7/3 has been discounted due the land constraints and also because there is not anticipated to be a high proportion of HGVs. The low proportion of HGVs is because there is (a) a 7.5T weight restriction and (b) a low bridge between Collingtree and Milton Malsor. For these reasons we do not want to encourage ease of use by HGVs but obviously accept that they need to be accommodated (e.g. for access to the hotel).

10.4 Pedestrian and cycle crossings would be provided across Watering Lane as part of the traffic signal installation.

## 11.0M1 JUNCTION 15A PARTIALLY SIGNALISED ROUNDAOUBTS

- 11.1 The proposed scheme, as shown on drawing **NGW-BWB-GEN-XX-SK-C-SK20**, would enlarge the roundabouts on both sides M1 with the introduction of partial signalisation. The two existing underpasses for the A43 under the M1 will be retained, providing two standard (3.65m) lanes Northbound and Southbound.
- 11.2 The A43 Northbound, Northbound link and the M1 NB approaches would be signalised operating full time. The Southbound A5123, Southbound link and the M1 Southbound Link would remain as priority approaches.
- 11.3 Consideration has been given in the design to maintenance access and this is covered in a separate chapter below.

### Visibility

- 11.4 TD50 requires one primary signal head to be visible for each phase on each approach. The visibility to the traffic signals from the external approaches is assessed as follows:

Approach	Design speed (kph)	Visibility distance criteria (TD50)	Proposed design	Departure from Standard?
<b>A43 Northbound</b>	120	295m	≥295m	No
<b>A5123 Southbound</b>	120	295m	≥295m	No
<b>Dumbell link road</b>	70	120m	≥120m	No
<b>Link road south of M1</b>	100	215m	≥215m	No
<b>Link road north of M1</b>	70	120m	≥120m	No

- 11.5 The potential need for mast arms and/or tall poles with repeater primary signals will be assessed during the detailed design stage.
- 11.6 There is no set design speed for the internal approaches and although national speed limit it is considered that actual speeds would be much below this. For assessment of traffic signal visibility a design speed of 60kph has therefore been assumed for movements that are predominantly straight ahead (i.e. not within more standard roundabout circulatory areas). For these internal approaches the minimum visibility to signals is taken to be 90m and it is confirmed that this is achieved in the design.
- 11.7 TD50 requires traffic signals to be intervisible and it is confirmed that the requirements for intervisibility are met.

### Lane widths

- 11.8 As the layout is that of a signalised roundabout there are no fixed design standards for radii etc. TD50 para 2.33 advises that where provision is to be made for HGVs, as is the case here, lane and carriageway widths may require widening in accordance with TD42.

- 11.9 TD42 table 7/2 has therefore been used as the basis for widening lanes where radii are 100m or less. This is an alternative to designing the widths based on tracking plus 1m (as per TD42 para 7.26).
- 11.10 In addition, a detailed tracking assessment has been undertaken to check that HGVs would stay within their lanes around the junction.
- 11.11 The vehicle tracking assessment has been based on a 15.5m long articulated vehicle with a single rear axle as this is more onerous as stated in TD42 para 7.16. Although this vehicle is relatively rare, it is considered that given the number of HGVs predicted to use J15A that this vehicle should be used. In situations where there are multiple lanes for the same manoeuvre the outermost lane has been tracked with a 7.2m Rigid LGV design vehicle. The vehicle tracking assessment is shown on drawing **NGW-BWB-GEN-XX-SK-C-SK40** which is found at **Appendix E**.

### Crossfalls and drainage

- 11.12 It is proposed that the detailed design stage would include for the design of the crossfalls and drainage around the signalised roundabout. The low object visibility requirements of TD16 & TD50 would also be checked as part of this process.

## **J15A North roundabout**

- 11.13 The proposed ICD varies between 59.6m and 62m. The maximum circulatory width is 14.4m, which is between 1 and 1.2 times the maximum entry width of 13.5m. 50m circulatory visibility is provided in accordance with TD16 Table 8/1.
- 11.14 The circulatory width is proposed to vary due to the turning movements derived from the traffic capacity modelling. For example three lanes are required on some elements of the roundabout but not all and increasing the entire circulatory width to three lanes would result in areas of unnecessary carriageway and increased maintenance burden (especially as such locations see little traffic and can collect detritus).
- 11.15 There will be three approaches to the roundabout, the A43 Northbound Approach (dumbbell link road) is signalised and the others remain priority controlled. The two priority approaches have been assessed as follows:

<b>Southbound Approach from A5123 (Design speed: 120kph)</b>			
<b>Requirement</b>	<b>Criteria</b>	<b>Actual provided</b>	<b>Departure from Standard?</b>
<b>Visibility on approach</b>	295m for 442.5m (1.5 x SSD)	≥ 295m for 442.5m	No
<b>Visibility on entry</b>	50m at 15m back from give way line	≥ 50m at 15m back from give way line	No
<b>Visibility to right on entry</b>	50m from give way line and 15m back from give way line	≥ 50m in both circumstances	No
<b>Entry path curvature</b>	≤ 100m	91m	No
<b>Entry angle</b>	20° to 60°	42°	No
<b>Entry radius</b>	20m to 100m	25m	No

Southbound Approach from A5123 (Design speed: 120kph)			
Requirement	Criteria	Actual provided	Departure from Standard?
Lane width on entry	3-4.5m	3 x 4.5m	No

Approach from Link road north of M1 (Design speed: 70kph)			
Requirement	Criteria	Actual provided	Departure from Standard?
Visibility on approach	120m for 180m (1.5 x SSD)	≥ 120m for 180m	No
Visibility on entry	50m at 15m back from give way line	≥ 50m at 15m back from give way line	No
Visibility to right on entry	50m from give way line and 15m back from give way line	≥ 50m in both circumstances	No
Entry path curvature	≤ 100m	53m (existing)	No
Entry angle	20° to 60°	35°	No
Entry radius	20m to 100m	30m	No
Lane width on entry	3-4.5m	2 x 4.5m	No

## J15A South roundabout

- 11.16 The proposed ICD is 66m and the maximum circulatory width is 14.4m (3 lanes), which is between 1 and 1.2 times the maximum entry width of 13.5m. 50m circulatory visibility is provided in accordance with TD16 Table 8/1.
- 11.17 The circulatory width is proposed to vary due to the turning movements derived from the traffic capacity modelling. For example three lanes are required on some elements of the roundabout but not all and increasing the entire circulatory width to three lanes would result in areas of unnecessary carriageway and increased maintenance burden (especially as such locations see little traffic and can collect detritus).
- 11.18 There will be three approaches to the roundabout, the A43 Northbound Approach and the Approach from the link road south of the M1 are signalised. The priority approach has been assessed as follows:

Southbound Approach from Dumbbell Link (Design speed: 70kph)			
Requirement	Criteria	Actual provided	Departure from Standard?
Visibility on approach	120m for 180m (1.5 x SSD)	≥ 120m for 180m	No
Visibility on entry	50m at 15m back from give way line	≥ 50m at 15m back from give way line	No
Visibility to right on entry	50m from give way line and 15m back from give way line	≥ 50m in both circumstances	No
Entry path curvature	≤ 100m	95m	No
Entry angle	20° to 60°	22°	No
Entry radius	20m to 100m	20m	No
Lane width on entry	3-4.5m	2 x 4.5m	No

## 12.0 OTHER GEOMETRIC HIGHWAY FEATURES

### Lay-bys

- 12.1 The existing parking lay-by on the A45 northbound is to be removed as part of the scheme. Its existing location does not comply with TD69 and a compliant lay-by cannot be provided within the extents of the scheme. Further details on the existing departures are found in the analysis of the existing A45 (see **Appendix A**). Further information on the justification for removal of the lay-by is found in Technical Note 9 (TN9) Layby Capacity – this is appended to the Transport Assessment.
- 12.2 The two number bus stop lay-bys are to be removed from this section of the A45. Neither comply with TD69, see **Appendix A** for further details. Consultation with the bus companies and Northamptonshire County Council has taken place and it is concluded that:
- The southbound lay-by is disused as services now run through Grange Park on the local road network
  - The northbound lay-by is used and a replacement bus stop on the same bus route is proposed on Watering Lane which is closer to potential users (mainly from the hotel) and is considered to be a safer location for the bus stop.

### A45 Northbound lane merge

- 12.3 A merge from three lanes to two is proposed on the A45 Northbound, north of the Watering Lane junction.
- 12.4 Except for removal of climbing lanes TD22 does not permit lane drops “on the link between junctions” (para 5.32), assuming said junctions are designed to TD22. However, the junction to the south is signalised (and hence designed to TD50) and the existing Wootton junction to the north is a compact grade separated junction i.e. it is not designed to TD22. TD50 does permit lane reductions following traffic signal junctions as per para 2.31 of that standard.
- 12.5 The recommendation in TD50 is that the merge takes place over 100m downstream of the junction intervisibility zone. However, this is not a mandatory requirement and after review of the design, and based on the 85kph design speed, it is proposed to provide an extended merge which would include an overrun area.
- 12.6 TD27 table 4-2 does not state in itself what the requirements are for the reduction in the number of lanes on the mainline, only referring to TD9, TD22 and TD39. TD39 is not relevant to this scheme neither is TD22 as discussed above. TD9 only provides the design requirements for the removal of a climbing lane, as per Figure 5/20. This shows, irrespective of design speed, a 1:45 taper followed by an overrun area which then tapers at 1:45. The overall length, assuming 3.65m lanes, is  $2 \times 165\text{m} = 330\text{m}$ . TD27 does, however, state that for an 85kph design speed mainline lanes should transition at 1:45. As both standards use the value of 1:45 it is proposed that the transition in number of lanes on the A45 is as follows:
- Merge taper of 1:45 for a distance of 165m to remove the third lane, but with full paved width provided to allow for merge overrun.
  - Paved width to then taper at 1:45 for a distance of 165m.

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- 12.7 As the lane reduction in TD50 is not mandatory, and the merge distance is greater than that in TD50, the above proposal is not considered to be a departure from standards. It would, however, be subject to the road safety audit process.

## 13.0 SIGNAGE

### M1 Junction 15

- 13.1 The signage strategy for M1 Junction 15 (excluding mainline motorway signage) is shown on drawing **NGW-BWB-GEN-XX-SK-C-SK37** found at **Appendix C**.
- 13.2 Specific comments on the signage strategy is provided at **Appendix C** and this explains how the proposals shown on the strategy drawing have been developed.
- 13.3 In addition to the general strategy it is important determine where gantry signs are considered necessary as this will inform the layout, land take requirements and the Environmental Assessment. The design of all other signs would be undertaken during the detailed design stage.
- 13.4 TD18/85 and IAN145/16 give the criteria for where gantry mounted directional signage should be used. They should also be used for tiger tail diverges as required by TD22/06.
- 13.5 There are currently no signage gantries at M1 J15. TD18/85 is not amended by IAN149/17 for existing motorways nor IAN198/17 for existing all-purpose trunk roads.
- 13.6 TD18/85 chapter 5 and IAN145/16 para 2.7 give the criteria for where signage gantries should be considered. Each of the trunk road approaches to J15 is assessed below.
- 13.7 TD18/85 states that gantries can be used "to alleviate possible dangerous situations" and "where it is difficult to mount signs on the left-hand side of the road".
- 13.8 IAN145/16 states that "Gantry signs may be required at motorway or all-purpose dual carriageway, grade separated junction slip road approaches to roundabouts (for instance, where the route has gantry mounted signal systems which include the whole approach, or where the approach enters from a lane drop and there is a dedicated left turn slip road at the roundabout), or at complex gyratory systems/roundabouts where the use of verge mounted signs is impractical or would not be effective."
- 13.9 As noted above TD22/06 states that "A full sequence of gantry direction signing is essential for a Ghost Island diverge layout".

#### A45 Southbound approach

- 13.10 The A45 southbound approach would be three lanes, widening to five lanes at the traffic signal stop lines. The stop lines are separated by a central island, with the left two lanes for the M1 southbound (and Saxon Avenue, signed "Grange Park") and the right three lanes for the A508 and M1 Northbound.
- 13.11 On the A45 southbound the left hand verge width is relatively narrow and given the size of verge mounted sign that would be required for M1 J15 it is not considered that there would be sufficient space to provide such a sign. Furthermore, the junction spacing on this section of the A45 is less than 3km. Hence the criteria in TD18/85 for gantries are considered to be met.
- 13.12 Furthermore, the junction would be a complex gyratory system where the use of verge mounted signs is impractical of would not be effective. Hence the criteria for gantries in IAN145/16 is met.

13.13 For these reasons it is proposed that gantries should be provided on the A45 southbound approach. The proposed gantries are located as follows:

- A final sign gantry before the point where additional lanes are formed
- A confirmatory gantry

#### M1 mainline

13.14 As discussed above both northbound and southbound diverges are a Layout B1 tiger tail diverge. As such a full sequence of gantry signs is required on both approaches in accordance with TD22. However, it is noted that a confirmatory gantry is not required as per IAN161/15 para 2.7.4.

13.15 The primary, secondary and final gantries would be provided by the SMP.

13.16 It is proposed to provide a confirmatory gantry at both northbound and southbound diverges. This would be located above the slip road but not above the M1 mainline.

#### M1 Southbound diverge slip road

13.17 The M1 southbound diverge slip road has a two lane exit from the M1, widening to six lanes at the signal stop lines. The stop lines are separated by a central island, with the three left lanes for the A45, the three right lanes are then split further into lanes for Saxon Avenue (signed "Grange Park") and the A508.

13.18 Verge signs can be provided. However, the junction would be a complex gyratory system where sole reliance on verge mounted signs is not considered to be effective. Hence the for gantries criteria in IAN145/16 is met.

13.19 For this reason it is proposed that gantries should be provided on the M1 southbound diverge slip road. The proposed gantries are located as follows:

- A confirmatory gantry at the diverge on the slip road (as discussed above)
- A confirmatory gantry at the diverge on the M1 southbound, making it clear which lanes should be used for which destinations. This would comply with IAN144/15 Figure 4.1 and note that this would not include signage over the M1 mainline.

13.20 It is understood that the SMP scheme, at present, does not include any signage on the M1 southbound for the A508 primary route. It is important that the A508 destination is provided in the future if the SRFI were is constructed. Discussions with the SMP are underway to agree what the signage strategy for the SRFI and A508 would be on the M1.

#### M1 Northbound diverge slip road

13.21 The M1 northbound diverge slip road has a two lane exit from the M1, widening to five lanes at the signal stop lines. The stop lines are separated by a central island, with the two left lanes for the A508, and the three right lanes for the A508 and Saxon Avenue (signed "Grange Park").

13.22 Verge signs can be provided. However, the junction would be a complex gyratory system where sole reliance on verge mounted signs is not considered to be effective. Hence the criteria for gantries in IAN145/16 is met.

13.23 For these reasons it is proposed that gantries should be provided on the M1 northbound diverge slip road. The proposed gantries are located as follows:

- A confirmatory gantry at the diverge on the slip road (as discussed above)
- A confirmatory gantry at the diverge on the M1 southbound, making it clear which lanes should be used for which destinations. This would comply with IAN144/15 Figure 4.1 and note that this would not include signage over the M1 mainline.

13.24 It is understood that the SMP scheme, at present, does not include any signage on the M1 northbound for the A508 primary route. It is important that the A508 destination is provided in the future if the SRFI were is constructed. Discussions with the SMP are underway to agree what the signage strategy for the SRFI and A508 would be on the M1.

### **M1 Junction 15A**

13.25 As the changes to Junction 15A are far more localised than those for J15, the existing signage destinations will be maintained unless, at detailed design stage, there is considered to be sufficient reason to change them.

13.26 No additional gantry signs are proposed at Junction 15A and the existing gantries on the A43 and A5123 approaches will be retained with sign faces amended as appropriate.

## 14.0 MOTORWAY COMMUNICATIONS

### M1 Smart Motorway

- 14.1 On the assumption that the SMP is progressed then changes to the M1 mainline communications network would be undertaken by SMP. These would be substantial changes in order to implement the smart motorway system on the M1.
- 14.2 The SMP works would be likely to include upgrading the Entry Stop Signals at J15 and enhancements to CCTV coverage.
- 14.3 Due to the realignment of the signalised gyratory it is proposed that the SRFI scheme would provide replacement Entry Stop Signals in lieu of the SMP works.
- 14.4 The Entry Stop Signals would need careful design consideration due to the layout of the signalised gyratory and may need linking to the traffic signals so traffic is not 'trapped' at inappropriate locations on the junction. This is reviewed further below.
- 14.5 Locations of CCTV cameras would be agreed with SMP such that they would not require further relocation as part of the SRFI scheme. Replacement maintenance accesses to CCTV cameras at J15 would be provided by the SRFI scheme as necessary.

### A45

- 14.6 There is no existing communications equipment on the A45 at present and this would not be provided as part of the SRFI scheme.

### M1 Junction 15 Entry Stop Signals

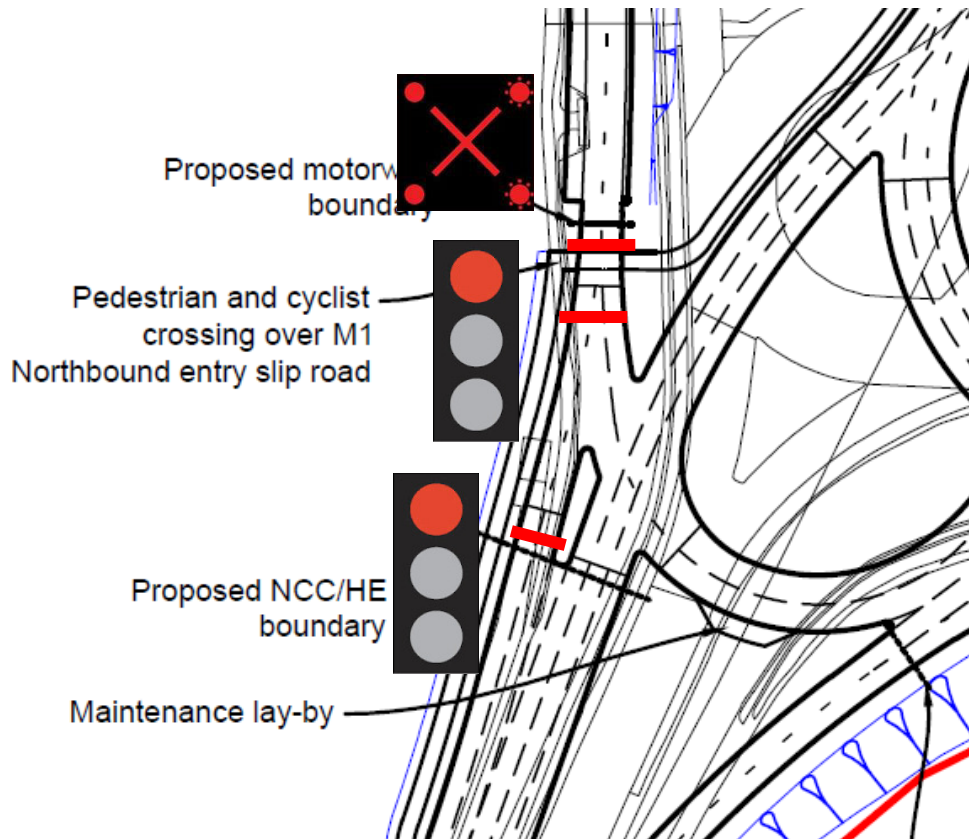
- 14.7 The control methodology for the junction in the event that one of the M1 slip roads is closed is set out below. This assumes that as a worst case the Entry Stop Signals (ESS) will display a red X and that there is no other information available for the driver (e.g. a parked police or traffic officer vehicle).

#### M1 Northbound

- 14.8 The proposed controls are outlined as follows and are shown on **Figure 13.1** below. The purpose of this is to demonstrate the methodology and not the exact locations of the equipment to be used.
- 14.9 In the event that the ESS display a red X (i.e. motorway slip road closed) then
  - The ESS would send a message to the traffic signal controller that the red X is displayed – this will be taken from the local sign rather than via the wider NRTS system
  - The signal controller would send a confirmatory signal back
  - The signal controller would then set the signals at the pedestrian/cyclist crossing to red by engaging a dummy stage
  - At the same time the signal controller would set the left turn signals from the A508 to red again by engaging a dummy stage
  - Both of these would be held on red until such time as the ESS sends a message to the signal controller that the red X is no longer displayed and the controller confirms the message.

- The signals would then revert to normal operation.

14.10 All other areas of the signal junction assumed to operate as normal

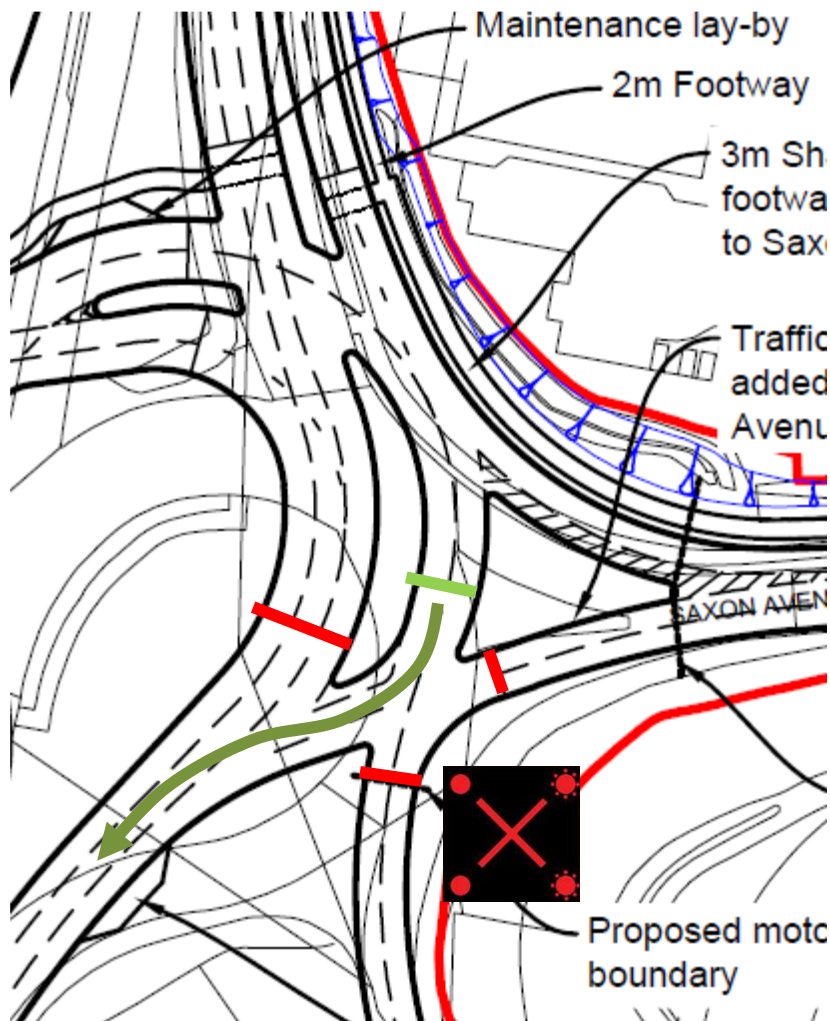


**Figure 13.1:** M1 Northbound slip road ESS

#### M1 Southbound

- 14.11 The proposed controls are outlined as follows and are shown on **Figure 13.2** below. The purpose of this is to demonstrate the methodology and not the exact locations of the equipment to be used.
- 14.12 The layout of the junction in the vicinity of the M1 Southbound is complicated by the need to maintain access to and from Saxon Avenue.
- 14.13 In the event that the ESS display a red X (i.e. motorway slip road closed) then:
- The ESS would send a message to the traffic signal controller that the red X is displayed – this will be taken from the local sign rather than via the wider NRTS system
  - The signal controller would send a confirmatory signal back
  - The signals would operate a dummy stage by separately controlling the circulatory stop line that would otherwise lead onto the M1. This stop line is deliberately set further back to allow closely associated secondary signals to be provided – thus avoiding the situation where a full green aspect could be displayed adjacent to a red X.
  - This would continue until such time as the ESS sends a message to the signal controller that the red X is no longer displayed and the controller confirms the message. The signals would then revert to normal operation.

- 14.14 All other areas of the signal junction assumed to operate as normal.
- 14.15 In addition to the above consideration will be given at detailed design stage to providing a variable message sign that would display the diversion information i.e. "M1 South Closed; Follow [Hollow Circle]" with a right turn arrow. This would replace the traditional 'flap' sign at the entry to the M1 and activation and deactivation of the sign would be linked to the signals.



**Figure 13.2:** M1 Southbound slip road ESS

## 16.0 DESIGNING FOR MAINTENANCE

16.1 Design for maintenance is an important requirement under CDM and it is also covered by IAN69. Whilst many issues would be dealt with at the detailed design stage, it is important to consider the need for maintenance at the geometrical design stage so that access can be achieved where necessary.

16.2 The following principles and allowances have therefore been made at this design stage:

### General layout considerations

16.3 It is recognised that the provision of a traffic signal gyratory system as proposed at J15 is not a typical junction layout such as a roundabout, albeit that such gyratories are becoming more commonplace.

16.4 Care has been taken in the development of the layout so that, as far as reasonably practicable, elements of the gyratory could be closed for maintenance without resulting in closure of the entire junction and the significant diversions that would be associated with such. The following table shows the envisaged alternative routes:

Gyratory link	Proposed no. lanes	Alternative route availability if area is closed
North side of M1 bridge, from M1 NB slip road exit to M1 SB slip road approach	3 (as existing), widening to 4 at next stop line	Would require closures and diversions (as existing)
Between A45 NB exit and A45 SB approach	2 (outer gyratory)	Local diversion to use A45 and U-turn at Wootton Junction
	2 (inner gyratory)	Local diversion to use outer section of gyratory
Between A45 SB approach and Saxon Avenue / M1 SB slip road exit	2 (outer gyratory)	Local diversion to use Saxon Avenue and U-turn at Grange Park roundabout
	3 (inner gyratory)	Local diversion to use outer section of gyratory
South side of M1 bridge, from M1 SB slip road exit to M1 NB slip road approach	3 (as existing), widening to 4 at next stop line	Would require closures and diversions (as existing)
Link from M1 NB slip road approach through junction	3	Local diversion to use outer section of gyratory
Between A508 SB exit and A508 NB approach / M1 NB slip road exit	2	Local diversion to use A508 and U-turn at SRFI access roundabout

### Boundaries and fencing

16.5 A minimum of 3m will be provided wherever possible between the toe of any embankment or crest of cutting and the highway boundary fence.

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### Drainage

- 16.6 Locations for any drainage attenuation measures have been determined and suitable maintenance access is provided to them. Refer to the drainage strategy **Drawing NGW-BWB-HDG-XX-DR-PD-0010** for further information.

### Sign gantries

- 16.7 At the sign gantries referred to above sufficient room will be available within the verge to permit access for maintenance.

### Traffic signals

- 16.8 The locations of signal controllers have been determined and maintenance lay-bys adjacent to each controller are provided.

### Street lighting

- 16.9 The locations of feeder pillars for street lighting have been determined and maintenance lay-bys adjacent to each feeder pillar are provided.

## APPENDICES

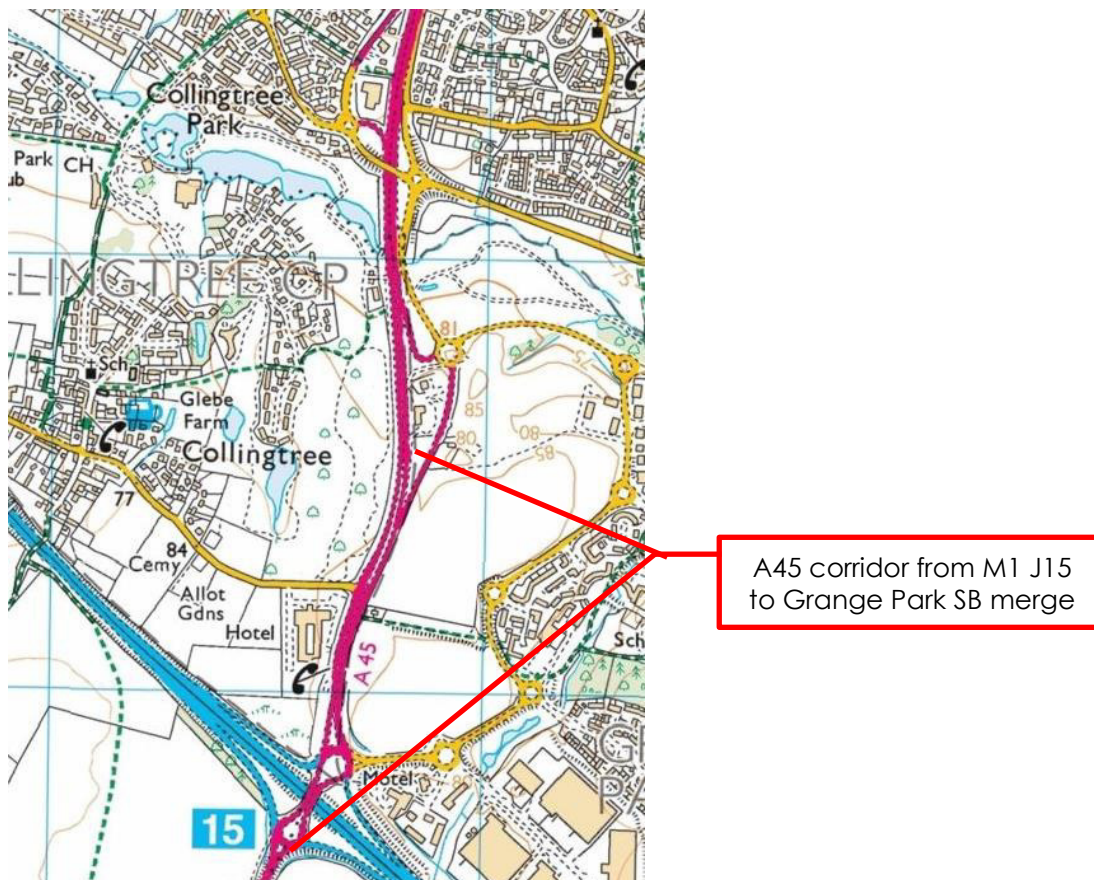
# APPENDIX A

## Appendix A: A45 corridor geometry and design standard

## Northampton Gateway SRFI A45 corridor geometry and design standard

### Introduction

1. The proposed improvements to M1 J15 associated with the Northampton Gateway Strategic Rail Freight Interchange necessitates improvements and realignment of the A45 between M1 J15 and the Grange Park junction.
2. The purpose of this technical note, appended to the Geometric Design Strategy Record, is to review the existing A45 geometry between M1 J15 and the Grange Park junction, as shown on **Figure 1** below. This is required in order to determine the design speed and design category for the improvement works.



**Figure 1:** A45 corridor

### Historical context

3. This section of the A45 was, until 2001, known as the A508 and was a County Road maintained by the local highway authority. Grange Park began to be developed in the late 1990s and as part of this work changes were made to the A508 (present A45) including reconfiguration of M1 J15 where a two bridge roundabout was replaced by single bridge dumbbell roundabout.
4. The A508 between M1 J15 and Queen Eleanor Roundabout (north of Grange Park) became a trunk road in 2001<sup>1</sup> and was renumbered part of the A45 at that time.

<sup>1</sup> SI 2001 No. 1989 "The A508 (M1 Junction 15 To A45 Queen Eleanor Roundabout) (Trunking) Order 2001"

- This section of the A45 is an example of a historical rural A road that has seen piecemeal upgrades including dualling over many years. It thus follows that it generally does not conform to current geometric standards for a dual carriageway trunk road.

## Setting

- This section of the A45, as noted above, was originally the A508 heading south from Northampton. The area between the M1 and Northampton has seen considerable development over recent years, notably the Grange Park development constructed from the late 1990s which most recently included construction of warehousing directly adjacent to the A45. As well as Grange Park within the local vicinity there is a large hotel, a golf course and a petrol station. Taken together the corridor is now a radial route that has become built up, with some roadside development.
- It is therefore considered that the route corridor has become more urban in character rather than the clear rural route that it was originally.

## Existing Geometry

- This section of the A45 is derestricted except for the immediate approach to M1 J15 which has a 40mph speed limit.
- Between M1 J15 and the Grange Park junction the following significant features are present on the A45:

Northbound	Southbound
Parking lay-by	Petrol station access and merge
Junction with Watering Lane (left-in left-out)	Grange park merge
Bus stop	Bus stop

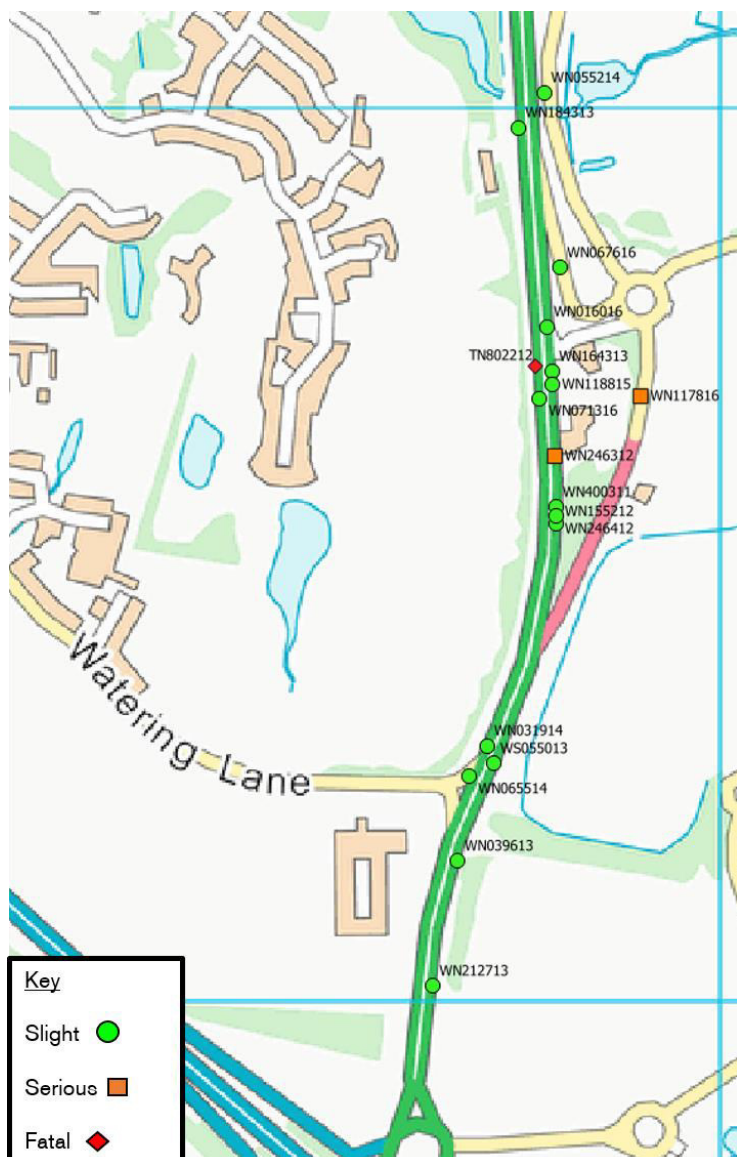
- The existing design speed is taken to be 120kph for a derestricted dual carriageway. However, it is clear from a review of the existing geometry that this section of the A45 does not conform to this standard. 21 departures from geometric standards (DMRB TD9, TD22, TD27, TD42 and TD69) have been identified on this section of the A45, although some are now considered permitted relaxations for existing all-purpose trunk roads under IAN198/17. Further departures from geometric standards are present at the M1 J15 roundabout. A detailed summary of these is found at **Table 1**.
- Although no detailed analysis has been undertaken it is clear from a review of the road alignment north of the Grange Park merge that further significant departures from geometric standards exist such as at the SB petrol station.
- The methodology for determining the design speed for the existing road is to be calculated using the methodology contained in TD9 para 1.7, i.e. in this case for a 2km distance heading north from J15. The alignment constraint (Ac) is calculated to be 10.2. However, the layout constraint (Lc) cannot be determined for a Dual 2 lane all purpose road, from TD9 Table 1, due to the fact that:
  - The number of accesses per km is 9 (i.e. High)
  - Standard verge width is not provided throughout
- This means that the existing design speed cannot be determined using the methodology in TD9.

## Geometric Analysis

14. The proposed M1 J15 improvement scheme includes upgrading of the A45 corridor between J15 and the Grange Park junction. As part of this it would be proposed to remove the NB parking layby and both bus stops. This will remove several of the existing departures from standard on this section of the A45.
15. However, many departures relate to the general alignment and overall geometry. Of particular note are:
  - Combined relaxations in stopping sight distance and horizontal alignment
  - Relaxations in stopping sight distance on the approaches to junctions
  - The weaving length on the A45 SB from the Grange Park merge and M1 J15
16. The alignment of the A45 is constrained by the built developments areas noted above, a golf course and several existing junctions. A significant realignment of the A45 in this location is therefore not possible.
17. The proposed improvement works would, if the design speed were to remain at 120kph and the existing geometry is to be changed, require these existing departures from standard to be assessed and formally approved by Highways England. This is an approach that could be pursued, and the broad case would be that the works would be improving this section of the A45 and such improvements would outweigh the disbenefits even with the departures from standard. However, the number of significant geometry departures and alignment generally does call into question if this section of the A45 is a rural road with a 120kph design speed.
18. It is considered that the alignment does generally comply with an 85kph design speed and as such many, if not all, of the existing departures from standard would not apply if this section of the A45 were to be considered to be an urban dual carriageway with an 85kph design speed.

## Accident review

19. A review of Personal Injury Accidents (PIAs) has been undertaken by ADC Consulting and is included within this report.
20. The PIA records between the M1 J15 and A45 Wootton Interchange were obtained from NCC for the five-year period between 1 November 2011 and 31 October 2016. A total of 18 accidents were recorded, 15 of which were of slight severity, two were classified as serious and the remaining accident resulted in a fatality.
21. The location of the respective accidents are shown in **Figure 2** below, which also includes a summary table and the police reference numbers of each PIA.



Severity	PIAs	Casualties
Slight	15	24
Serious	2	2
Fatal	1	1
<b>Total</b>	<b>18</b>	<b>27</b>

**Figure 2:** location and breakdown of respective accidents in study area

22. The recorded PIA categorised as fatal (TN802212), occurred northbound on the A45, near the petrol station. The accident involved a pedestrian crossing the carriageway of the A45 and causing a collision with a car. The accident happened at 04:08 in the morning and occurred in dry road conditions. Although dark, street lights were present and lit.
23. The recorded PIAs of serious nature (WN246312, WN117816) occurred along the A45 southbound; near the petrol station and on the A45 southbound merge slip, respectively. The former involved a car suddenly breaking and causing an oncoming car travelling in the same direction to swerve and overturn. The latter involved a pedal cycle colliding with the rear of a HGV which was parked, subsequently causing a serious injury to the cyclist.
24. Of the remaining 15 PIAs of slight severity there is a cluster of three PIAs which occurred at the exit of the petrol station along the A45 southbound (WN155212, WN246412, WN400311). Therefore, in combination with the PIA of serious severity described above (WN246312), there is a trend in the location of these PIAs as they all relate to the slip road of the petrol station, including two rear end shuts. Two of the four accidents of the cluster were also potentially driver error related (WN155212, WN400311). The former was deemed to involve a driver failing to look properly whilst the latter involved a vehicle performing a poor manoeuvre.

25. There were six other accidents of slight severity, listed below, which driver error was attributed as a causal factor:
- WN212713- car travelling southbound along the A45 held up in queue and was subsequently hit by oncoming car in the rear which was deemed to be travelling too fast for the conditions.
  - WN065514- incident occurred at the junction connecting Watering Lane to the A45 and involved a car colliding with the rear of another car which led to another rear shunt. The accident was deemed to be caused by a distraction in the vehicle which was attributed as a causal factor of the initial impact.
  - WS055013- car travelling southbound along the A45 collides into rear of another car which was slowing for traffic ahead, hence it was deemed sudden breaking and failing to look properly were the causes of the incident.
  - WN164313- car travelling southbound along the A45 collides into the rear of another car which is towing a caravan. It was deemed the driver of the first car failed to look properly and was subsequently following too closely.
  - WN067616- car exiting A45 mistakes slip road for entrance into petrol garage and resulted in the car colliding with a road sign/lamppost. Therefore, it was deemed junction overshoot and a poor manoeuvre were the causal factors of the incident.
  - WN184313- car which is towing a trailer, travelling northbound along the A45, commences to swerve, causing a collision with a car travelling in the same direction. The car towing the trailer then collides with the central reservation before coming to a standstill on the carriageway. It was deemed the driver of the first car was careless and inexperienced.
26. Three PIAs of slight severity, occurred in wet/damp road conditions (WN039613, WN031914, WN071316) which may have been a factor regarding the causation of the respective accidents.
27. There were three more PIAs of slight severity in the study area, listed below (WN118815, WN016016, WN055214) which did not indicate an apparent trend:
- WN118815- HGV travelling southbound along the A45, collides with kerb and results in a car breaking hard to avoid contact with the HGV before swerving to the right.
  - WN016016- car travelling southbound along the A45 collides into rear of another car.
  - WN055214- car travelling northbound on approach to Wootton Interchange, collides into rear of another car.

### Summary

28. In summary, 18 recorded PIAs occurred in the study area between M1 J15 and the Wootton Interchange for the five-year period between 1 November 2011 and 31 October 2016, one of which resulted in a fatality.
29. Regarding possible trends of the respective PIAs in the study area, driver error was a prominent factor, notably sudden breaking, rear end shuts, and travelling too fast for the road conditions were common causal factors.
30. It is therefore considered that there is a clear link to the substandard geometry (for a 120kph design speed) and the PIAs.

### **Urban versus Rural**

31. Whilst DMRB TD9 does provide the design standards for both urban and rural roads, very little is given by means of determining if a road is considered urban or rural in the first place. TD9 does state, however, that for Urban Roads, *"Low speed limits (30-40 mph) may be required due to the*

amount of frontage activity, but also where physical restrictions on the alignment make it impractical to achieve geometry relative to a higher Design Speed."

32. DMRB TA79 states that an Urban All-Purpose Road (UAP) is "An all-purpose road within a built up area, either a single carriageway with a speed limit of 40 mph or less or a dual carriageway with a speed limit of 60 mph or less."
33. It is therefore considered that the following criteria have to be achieved for a road to be considered 'Urban':
  - The road is in a built-up area
  - Significant amount of frontage activity or physical restrictions on the alignment make it impractical to achieve geometry relative to a higher Design Speed
  - A speed limit of 60mph or less is justified
34. As noted above, it is considered that the road is now within a built-up area following the developing out of Grange Park and there is some roadside development
35. Furthermore, it is clear from the analysis of the existing geometry and the constraints on the route that physical restrictions on the alignment, generally in the form of built development, make it impractical to achieve geometry relative to a higher Design Speed.
36. The first two criteria are therefore considered to be met and a review of the speed limit follows.

## Speed Limit

37. This section of the A45 is currently derestricted which means that it is subject to the national speed limit (i.e. 70mph for cars).
38. A review of the existing speed limit has therefore been undertaken in accordance with DfT Circular 01/2013.<sup>2</sup>
39. This circular states that 50mph limits may be used in urban areas in exceptional circumstances, and the typical use would be "On dual carriageway ring or radial routes or bypasses that have become partially built up, with little or no roadside development" (Table 1). As noted above the A45 now runs through a built-up area and there is some roadside development. Hence the use of a 50 mph limit is considered appropriate.
40. The speed data for this section of the A45, which is derived from permanent traffic counts, is as follows:

Location	Northbound		Southbound	
	Mean speed (mph)	85 <sup>th</sup> percentile speed (mph)	Mean speed (mph)	85 <sup>th</sup> percentile speed (mph)
At Southbound Petrol Station	49.2	57.2	47.9	52.5
Wootton Junction	55.8	61.3	58.5	63.2
Queen Eleanor Junction	56.4	58.5	53.2	64.4

<sup>2</sup> DfT Circular 01/2013 "Setting Local Speed Limits"

41. DfT Circular 01/2013 recommends that the speed limit appraisal tool (SLAT) is used. However, this tool does not include data for analysing a speed limit reduction from 70mph to 50mph. For the section of road between the Grange Park merge and J15, an approximation has therefore been undertaken by considering a reduction from 60mph to 50mph but it is noted that any results should be taken as a guide only.
42. The existing speed and accident data has been inputted into the SLAT and the results indicate that there would be a small reduction in both average and 85<sup>th</sup> percentile speeds, along with a small reduction in PIAs.
43. Based on the existing average (mean) speed being below 50mph, and the further reduction that would occur following a speed limit reduction, it is considered that a 50mph speed limit is appropriate and justifiable. It is therefore considered that the speed limit criteria is met.
44. The speed data would support termination of the 50mph speed limit in the vicinity of the southbound petrol station just before the Grange Park merge. On the northbound carriageway this would be at the end of the 3 to 2 lane merge, which is also where the alignment improves.
45. It is noted that the data may support a 60mph limit to the north of this, but this is outside the extents of the proposed improvement scheme and would therefore be a matter for consideration by others.

## **Conclusion**

46. It is considered that this section of the A45 should be considered as an urban road for the following reasons:
  - The road is in a built-up area
  - Significant amount of frontage activity or physical restrictions on the alignment make it impractical to achieve geometry relative to a higher Design Speed
  - A speed limit of 50mph is justified
47. It is considered that the reduction in speed limit would reduce the number of PIAs.
48. TD 9 para 1.1 states that *"The road alignment shall be designed so as to ensure that Standards of curvature, visibility, superelevation, etc. are provided for a Design Speed which shall be consistent with the anticipated vehicle speeds on the road"*. Given the recorded speeds on this section of the A45 it is considered that an 85kph design speed would comply with this requirement.
49. As a speed limit of 50mph is justified, in accordance with DMRB TD9 Table 2 the design speed should be 85kph.
50. Based on the above, this section of the A45 should be designed as an Urban All-purpose (UAP) road with a design speed of 85kph.

**Table 1**

Summary of departures from geometric standards between M1 J15 to the Grange Park SB merge (inclusive), based on a 70mph road with 120kph design speed.

The locations of departures are shown on drawing NGW-BWB-GEN-XX-SK-C-SK14

Ref	Location	Subject	Standard	Requirement	Existing situation	Permitted relaxation under IAN198/17	Removed by NGW scheme proposal in general	Removed if A45 classed as 50mph urban road in this location
<b>A45 Southbound</b>								
Ex1	A45 SB approach to Grange Park merge	Geometric alignment (link design)	TD9/93 para 1.24	Combinations of relaxations are not permitted (except 1 step below desirable minimum horizontal alignment and 1 step below desirable minimum SSD)	Combination of 2 step below desirable minimum horizontal alignment and 3 step below desirable minimum SSD	Yes	No	Yes
Ex2	A45 SB approach to Grange Park merge	Geometric alignment (link design)	TD9/93 para 1.26	Relaxation in SSD not permitted on immediate approach to junction	3 step below desirable minimum SSD on immediate approach to Grange Park merge	No	No	Yes if VRS realigned as part of scheme
Ex3	Grange Park merge	Geometric design (merge)	TD22/06 para 4.22	Merge nose to be 85m long	Merge nose is 67m long	No	No	Yes if amended to 40m nose length
Ex4	A45 SB between Grange Park merge and J15	Weaving distance	TD22/06 para 4.36 / 4.38	1km minimum weaving distance required	Weaving distance between Grange Park merge (lane gain designed to TD22) and J15 signal stop line is approximately 430m, some 570m below standard	Yes	No	Likely to be yes, subject to review of weaving flows
Ex5	A45 SB between Grange Park merge and bus stop	Weaving distance	TD22/06 para 4.36 / 4.38	1km minimum weaving distance required	Weaving distance between Grange Park merge (lane gain designed to TD22) and bus lay-by is 155m	Yes	Yes	n/a

Ref	Location	Subject	Standard	Requirement	Existing situation	Permitted relaxation under IAN198/17	Removed by NGW scheme proposal in general	Removed if A45 classed as 50mph urban road in this location
Ex6	A45 SB between Grange Park merge and J15	Geometric alignment (link design)	TD9/93 para 1.24	Combinations of relaxations are not permitted (except 1 step below desirable minimum horizontal alignment and 1 step below desirable minimum SSD)	Combination of 3 step below desirable minimum horizontal alignment, 3 step below desirable minimum SSD and 2 step below desirable minimum Crest K	Yes	No	Yes
Ex7	A45 SB approach to J15	Geometric alignment (link design)	TD9/93 para 1.26	Relaxation in SSD not permitted on immediate approach to junction	3 step below desirable minimum SSD on immediate approach to J15	No	No	Yes
Ex7A	A45 SB approach to J15	Geometric alignment (link design)	TD9/93 para 1.26	Relaxation in crest K value not permitted on immediate approach to junction	2 step below desirable minimum Crest K	No	No	Yes
Ex8	A45 SB between Grange Park merge and J15	Cross section	TD27/05 para 4.2.1	Cross section must comply with Figure 4-3a D2AP (or D3AP due to auxiliary lane)	No offside hardstrip is provided	Yes	Yes	Yes, amended to D3UAP and nearside hardstrip is removed
Ex9	A45 SB bus lay-by*	Siting of lay-by	TD69/07 para 3.7	Separation between upstream junction and lay-by to be 450m (3.75Vm)	Separation between Grange Park merge and lay-by is 156m	No	Yes (bus lay-by removed)	n/a
Ex10	A45 SB bus lay-by*	Siting of lay-by	TD69/07 para 3.7	Separation between downstream junction and lay-by to be 450m (3.75Vm)	Separation between bus lay-by and J15 signal stop line is 250m. (Lay-by is also located after first direction sign for junction).	No	Yes (bus lay-by removed)	n/a

Ref	Location	Subject	Standard	Requirement	Existing situation	Permitted relaxation under IAN198/17	Removed by NGW scheme proposal in general	Removed if A45 classed as 50mph urban road in this location
<b>A45 Northbound</b>								
Ex11	A45 NB between J15 and Watering Lane	Geometric alignment (link design)	TD9/93 para 1.24	Combinations of relaxations are not permitted (except 1 step below desirable minimum horizontal alignment and 1 step below desirable minimum SSD)	Combination of 2 step below desirable minimum horizontal alignment, 3 step below desirable minimum SSD and 3 step below desirable minimum Crest K	Yes	No	Yes, assuming crest K improved from 50 to 55 as part of works
Ex12	A45 NB approach to Watering Lane	Geometric alignment (link design)	TD9/93 para 1.26; TD42/95 para 7.5	Relaxation in SSD not permitted on immediate approach to junction	3 step below desirable minimum SSD on immediate approach to Watering Lane and parking Lay-by	No	No	Yes if VRS realigned as part of scheme
Ex12A	A45 NB approach to Watering Lane	Geometric alignment (link design)	TD9/93 para 1.26	Relaxation in Crest K not permitted on immediate approach to junction	3 step below desirable minimum Crest K on immediate approach to Watering Lane and parking Lay-by	No	No	Yes, assuming crest K improved from 50 to 55 as part of works
Ex13	A45 NB between J15 and downstream of Watering Lane	Cross section	TD27/05 para 4.2.1	Cross section must comply with Figure 4-3a D2AP	No hardstrips are provided	Yes	No	Yes as cross section would be D2UAP
Ex14	A45 NB parking lay-by	Siting of lay-by	TD69/07 para 3.6	Lay-by must not be sited within 1km of the end of a dual carriageway	Lay-by is sited 150m from the end of the dual carriageway	No	Yes (lay-by removed)	n/a
Ex15	A45 NB parking lay-by	Siting of lay-by	TD69/07 para 3.7	Separation between upstream junction and lay-by to be 450m (3.75Vm)	Separation between J15 exit and lay-by is 150m, and there is no separation between private access and lay-by.	No	Yes (lay-by removed)	n/a

Ref	Location	Subject	Standard	Requirement	Existing situation	Permitted relaxation under IAN198/17	Removed by NGW scheme proposal in general	Removed if A45 classed as 50mph urban road in this location
Ex16	A45 NB parking lay-by	Siting of lay-by	TD69/07 para 3.7	Separation between downstream junction and lay-by to be 450m (3.75Vm)	Separation between lay-by and Watering Lane junction is 10m.	No	Yes (lay-by removed)	n/a
Ex17	A45 NB parking lay-by	Design of lay-by	TD69/07 para 4.4	Type B lay-bys not permitted on dual carriageway roads	Type B lay-by provided	No	Yes (lay-by removed)	n/a
Ex18	A45 NB parking lay-by	Design of lay-by	TD69/07 para 4.19	2m footway to be provided	1.3m footway is provided	No	Yes	n/a
Ex19	A45 NB Watering Lane junction	Geometric layout of junction	TD42/95 para 7.55	Nearside diverging taper shall be 110m long	Nearside diverging taper is 55m long	No	Yes as amended to auxiliary lane of required length	n/a
Ex20	A45 NB after Watering Lane	Geometric alignment (link design)	TD9/93 para 1.24	Combinations of relaxations are not permitted (except 1 step below desirable minimum horizontal alignment and 1 step below desirable minimum SSD)	Combination of 2 step below desirable minimum horizontal alignment, 1 step below desirable minimum SSD and 2 step below desirable minimum Crest K	Yes	No	Yes
Ex21	A45 NB bus lay-by*	Design of lay-by	TD69/07 para 3.8	Lay-bys must not be combined with a junction or access	Lay-by is combined with Watering Lane junction	No	Yes (bus lay-by removed)	n/a
<b>M1 J15 roundabout</b>								
Ex22	A508 approach	Entry path radius	TD16/07 para 7.56	Entry path radius must not exceed 100m	Entry path radius is 280m	No	Yes, approach signalised	n/a

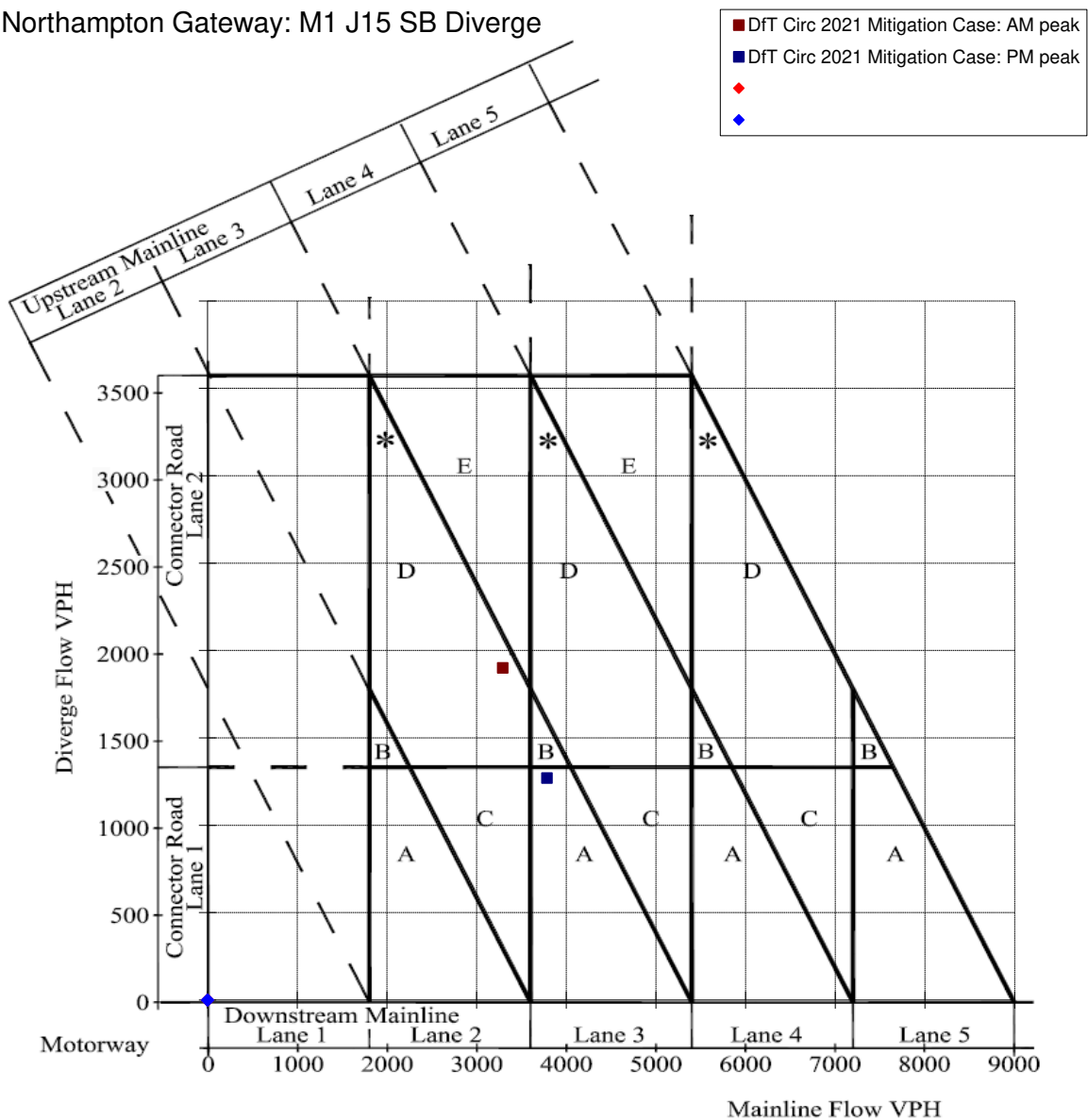
Ref	Location	Subject	Standard	Requirement	Existing situation	Permitted relaxation under IAN198/17	Removed by NGW scheme proposal in general	Removed if A45 classed as 50mph urban road in this location
Ex23	Saxon avenue approach	Entry path radius	TD16/07 para 7.56	Entry path radius must not exceed 100m	Entry path radius is 160m, ignoring subsidiary deflection island which is in itself a departure	No	Yes, approach signalised	n/a
Ex24	A508 approach	Forward visibility at give way line	TD16/07 para 8.9	Forward visibility to be 50m based on Table 8/1, using approx. 70m ICD in this area	Forward visibility is approximately 35m	No	Yes	n/a
Ex25	South side of M1	Circulatory visibility	TD16/07 para 8.9	Circulatory visibility to be 50m based on Table 8/1, using approx. 70m ICD in this area	Circulatory visibility is approximately 30m	No	Yes	n/a
Ex26	North side of M1	Circulatory visibility	TD16/07 para 8.9	Circulatory visibility to be 50m based on Table 8/1, using approx. 80m ICD in this area	Circulatory visibility is approximately 35m	No	Yes	n/a

\* As per paragraph 5.7 of TD69/07, paragraphs 3.7 and 3.8 apply to bus lay-bys but there is recognition that a departure could be granted to paragraph 3.7 where justified due to the need to serve a community.

## **APPENDIX B**

### **Appendix B: TD22/06 Merge and Diverge Assessments**

Northampton Gateway: M1 J15 SB Diverge



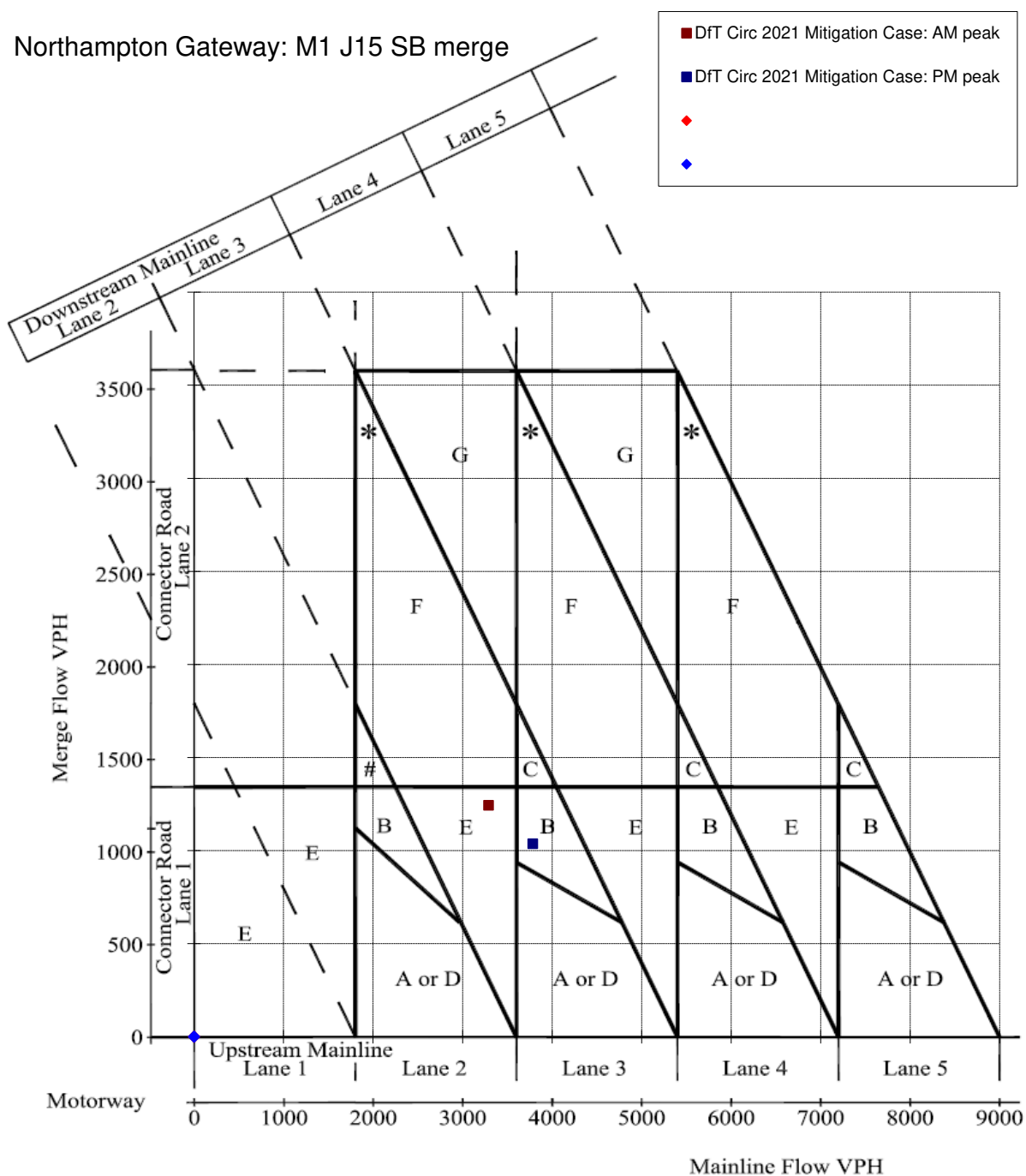
Notes:

- \* If Layout D Option 2 is used consider extended Auxiliary Lane (see paragraph 4.24).

See paragraph 2.43 for explanation of the usage of this diagram.

Figure 2/5 MW Motorway Diverging Diagram

Northampton Gateway: M1 J15 SB merge

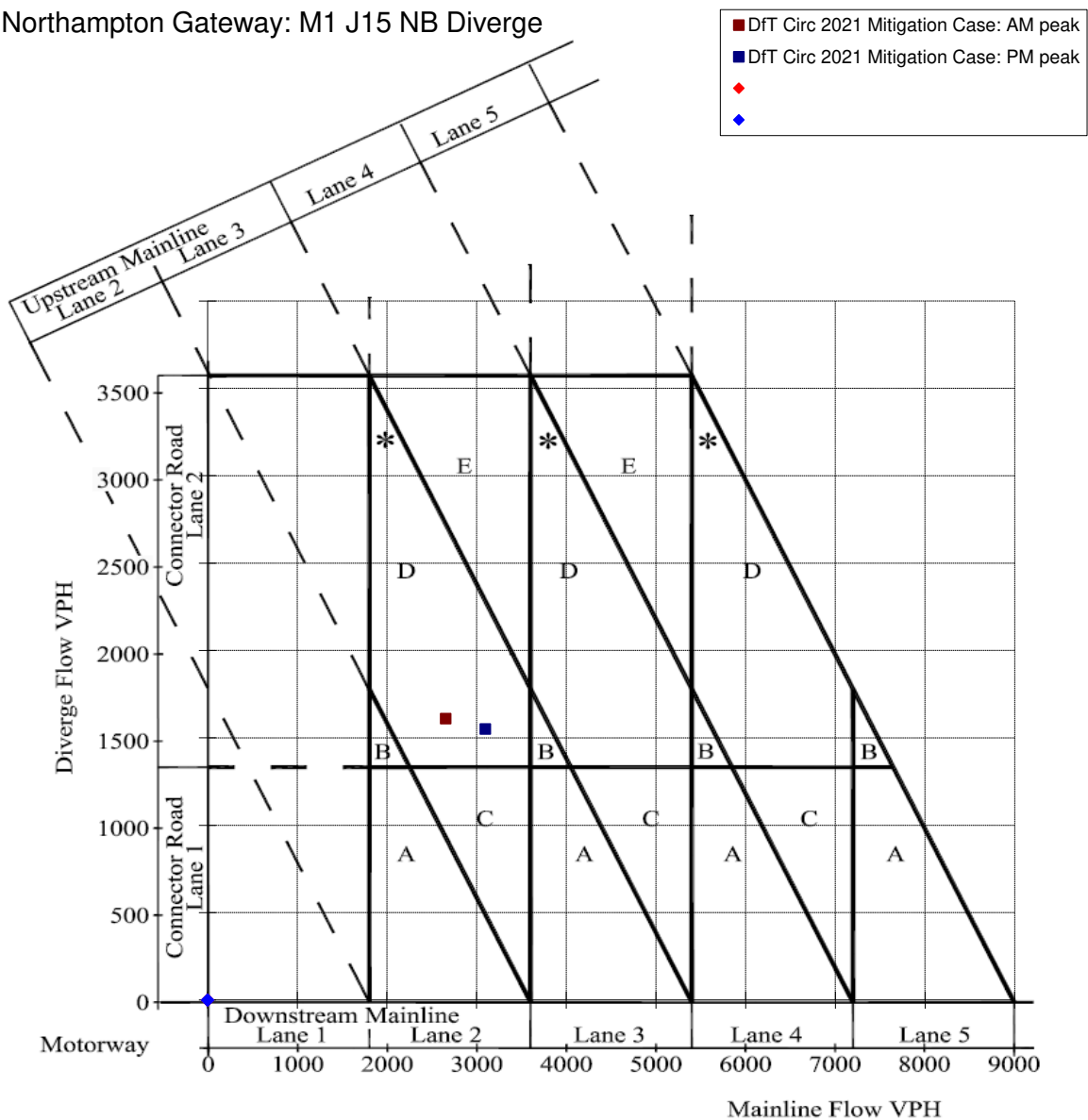


Notes:

- \* If Layout F Option 2 is used consider extended Auxiliary Lane (see paragraph 4.23).
  - # Area of uncertainty – In this area the choice will depend on the downstream provision. If there is a lane gain then use Layout E or F.
- See paragraph 2.29 for explanation of the usage of this diagram.

Figure 2/3 MW Motorway Merging Diagram

Northampton Gateway: M1 J15 NB Diverge



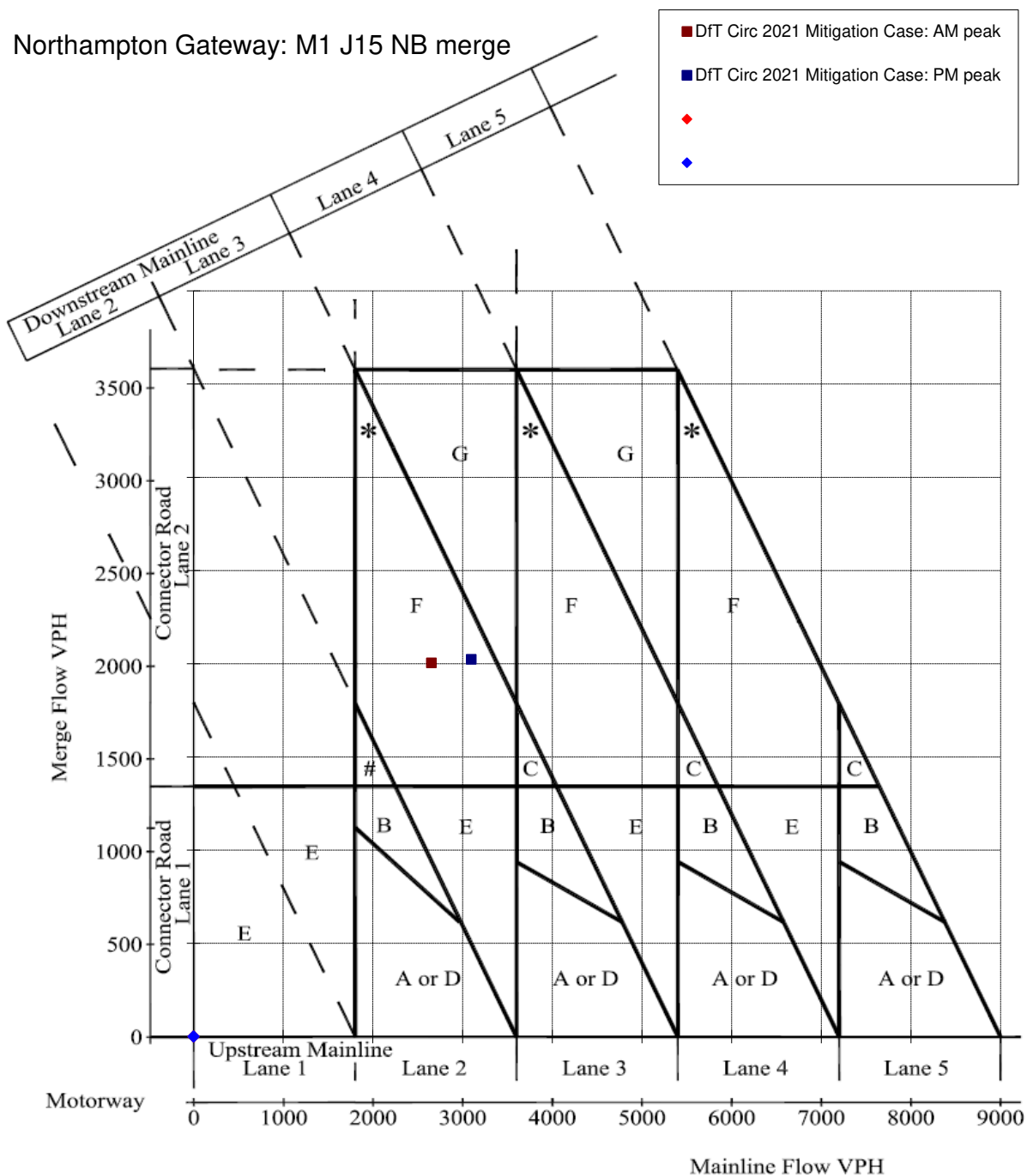
Notes:

- \* If Layout D Option 2 is used consider extended Auxiliary Lane (see paragraph 4.24).

See paragraph 2.43 for explanation of the usage of this diagram.

Figure 2/5 MW Motorway Diverging Diagram

Northampton Gateway: M1 J15 NB merge

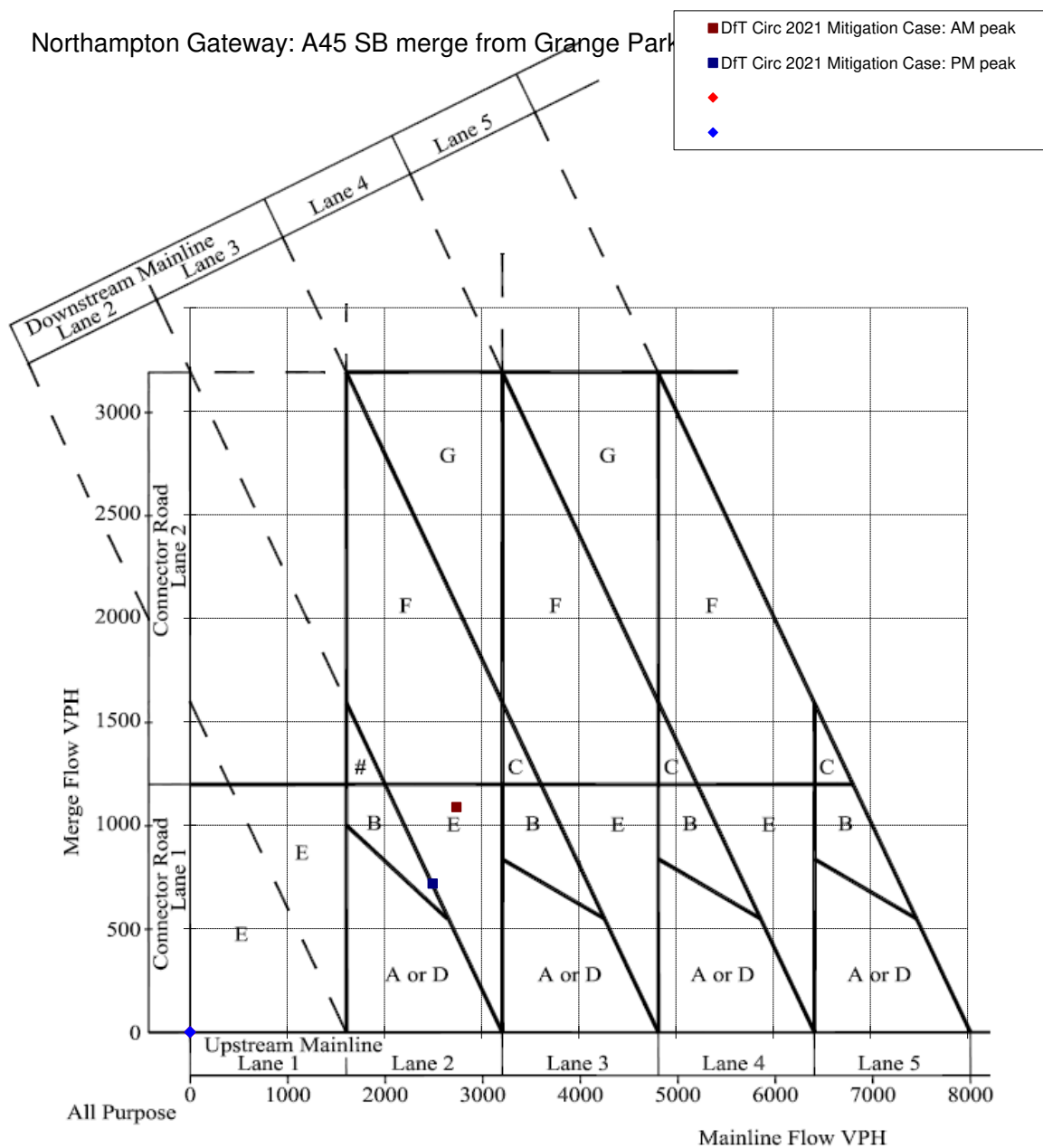


Notes:

- \* If Layout F Option 2 is used consider extended Auxiliary Lane (see paragraph 4.23).
  - # Area of uncertainty – In this area the choice will depend on the downstream provision. If there is a lane gain then use Layout E or F.
- See paragraph 2.29 for explanation of the usage of this diagram.

Figure 2/3 MW Motorway Merging Diagram

Northampton Gateway: A45 SB merge from Grange Park



Notes:

# Area of uncertainty – In this area the choice will depend on the downstream provision. If there is a lane gain then use Layout E or F.

See paragraph 2.29 and the example above, for explanation of the usage of this diagram.

Figure 2/3 AP All-Purpose Road Merging Diagram

## APPENDIX C

### Appendix C: M1 J15 signage strategy

## **Northampton Gateway SRFI Directional Signage Strategy: Trunk Road**

### **Introduction**

1. The proposed improvements to M1 J15 associated with the Northampton Gateway Strategic Rail Freight Interchange necessitate amendment of directional signage. This raises some queries about integration with existing signage, and offers opportunities for improvement of the overall signage scheme around J15.
2. The purpose of this technical note is to record queries arising during the course of directional signage design. This note covers the J15 trunk road works; a separate note covers the works on the A508.
3. The signage strategy for J15 is shown on drawing NGW-BWB-GEN-XX-SK-C-SK37.

### **General Signage Matters**

4. The A508 is currently generally signed southbound towards Stony Stratford after, but not from, the M1, occasionally supplemented or replaced, from Roade southwards, by Milton Keynes. Hence Stony Stratford has been used together with the SRFI as destinations for the A508. Alternatives include Buckingham (A422), Roade or Old Stratford (a smaller town than Stony Stratford) plus the SRFI, or simply the SRFI alone, replaced by one of those destinations at the SRFI access junction. Milton Keynes (North) is not recommended, and would need adjustment of other M1 Milton Keynes destinations to be logical.
5. The M1 route south has been signed as London rather than The SOUTH on the basis that the M1 enters The SOUTH (i.e. Northamptonshire / Bedfordshire border) before the next junction.
6. References to The WEST have been omitted from A45 signage as they are not replicated elsewhere on the route, which is more generally signed for Oxford (A43).
7. References to Daventry on the A45 have been replaced by Birmingham, for consistency with M1 signage. Daventry has been retained on a follow-on sign to provide continuity of signage for the interrupted A45 westbound.
8. The absence of any reference to Coventry was noted; as one of England's largest cities, and close by, should this appear before Birmingham? However, to include it would introduce inconsistency with some current M1 signage and it has therefore not been included.
9. Consideration was given to including (M6) in conjunction with Birmingham, but the downstream motorway number was excluded for simplicity of signage.
10. Due to lack of space, and given that the flow in question (from Grange Park) is very minor and local, Wellingborough has been omitted from certain signs. Kettering could have been omitted instead – but Kettering is the larger town and its inclusion affords the opportunity to reference the A43 (north) to avoid confusion with the Oxford route (A43 south) as outlined above. A follow-on sign could be added for Wellingborough, but is felt unnecessary.
11. A flag sign with route numbers has been included to catch vehicles on the northern circulatory which, not having entered Grange Park, would otherwise be forced onto M1 southbound.

## **SMP Integration Issues**

### Kettering

12. Kettering (A43) has been included as an additional destination from the direction of the M1 northbound, reflecting the southbound signage, the size of Kettering and the status of the A43. This inclusion also helps avoid confusion with references to the Oxford route (A43 south). Furthermore, this is considered beneficial as traffic seeking to use the M1/A14 route has to U-turn at M6 J1 or M1 J20.
13. It is recommended that the SMP also includes for Kettering (A43) on their northbound signs (as they do for Southbound).

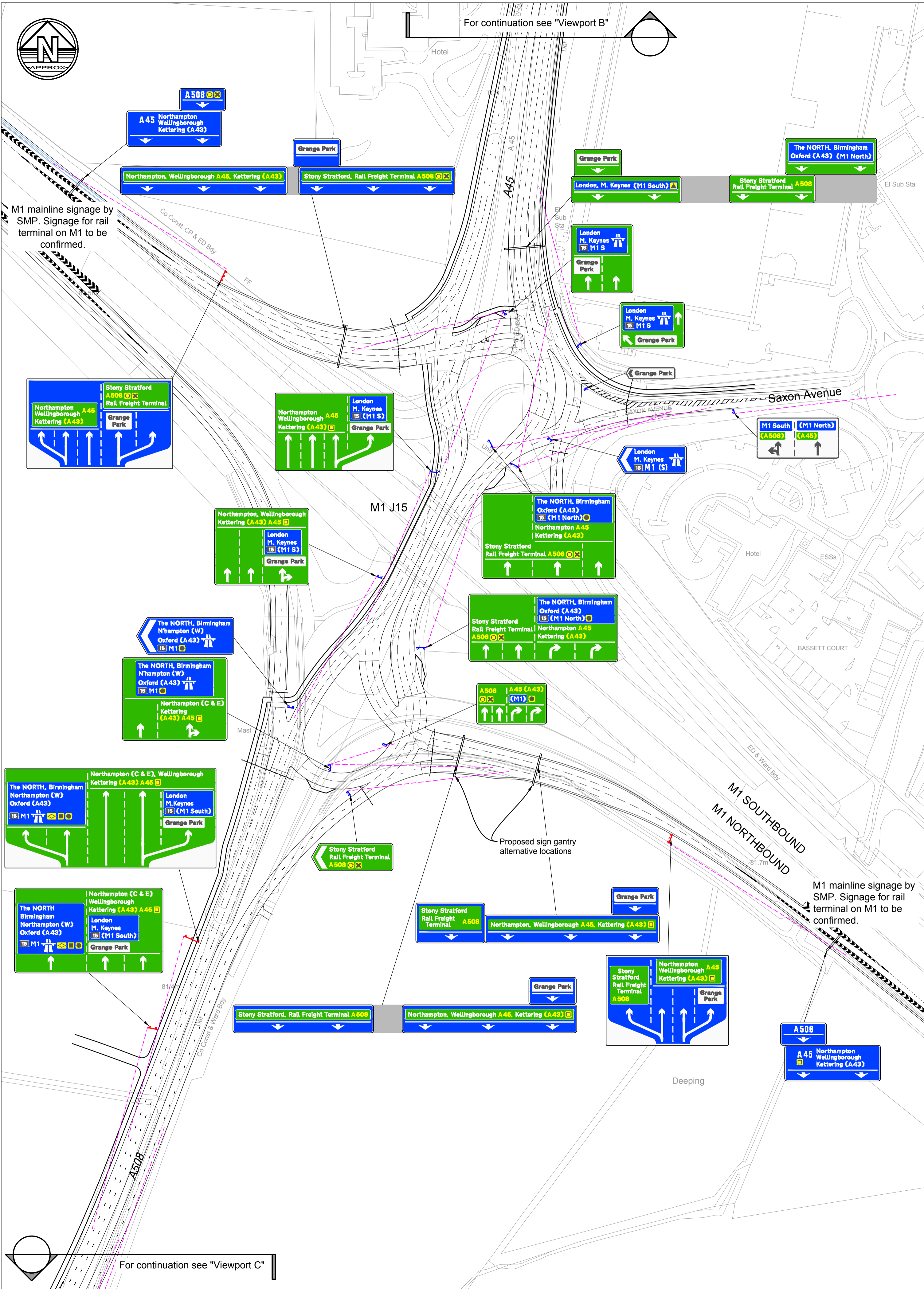
### A508

14. The A508 is not currently signed from the M1 and is not proposed to be included on the SMP signage, even though the A508 is a primary route and part of the envisaged major road network. It is recommended that this is reassessed by the SMP and that A508 signage is provided.
15. If the A508 were to be signed from the M1 say to Old Stratford, then the simple addition of supplementary signs such "For rail freight terminal follow Old Stratford A508" could be provided.
16. In the event that the SMP decide not to provide A508 signage then this would make signage to the SRFI from the M1 problematic. In this eventuality the following options are possible as part of the SRFI scheme:
  - a. Replace the gantry sign faces to include the A508 Old Stratford destination and then provide the supplementary signs for the SRFI
  - b. Replace the gantry sign faces to include the A508 with destination as the SRFI
17. In addition, even if the SMP does not include for the A508 on the gantry signs then it is recommended that the A508 is included on the verge mounted tiger tail diverge signs as it is important for A508 traffic to take a particular lane given the proposed tiger tail diverge layout.

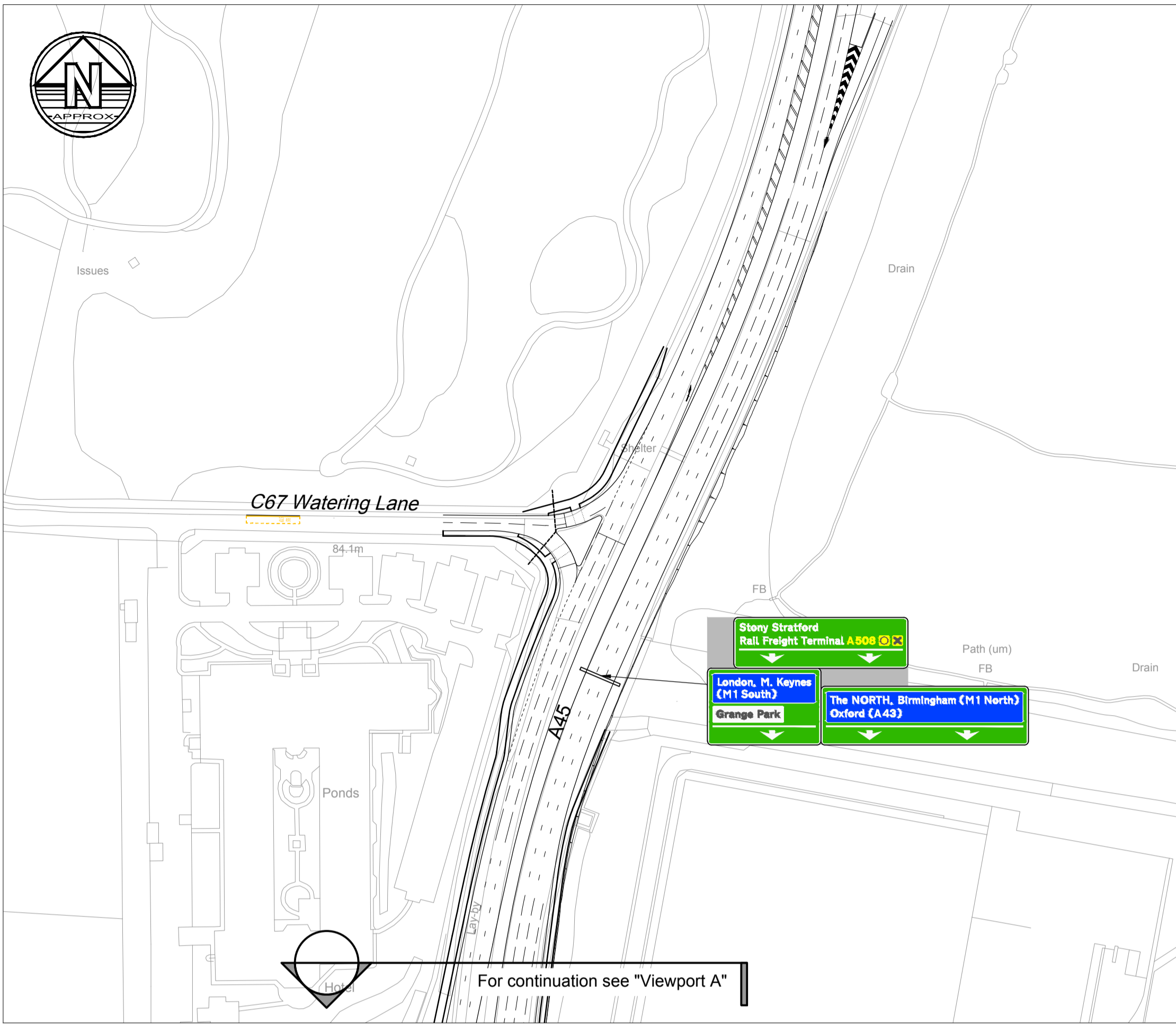
### Confirmatory gantries

18. At both northbound and southbound diverges, the SMP scheme does not include confirmatory gantries.
19. If the A508 destination is included on the SMP signage scheme then confirmatory gantries may be provided by the SMP. However, if this does not take place then confirmatory gantries would be provided as part of the SRFI scheme. These would only include destinations over the slip roads and the sign faces are shown on drawing NGW-BWB-GEN-XX-SK-C-SK37.

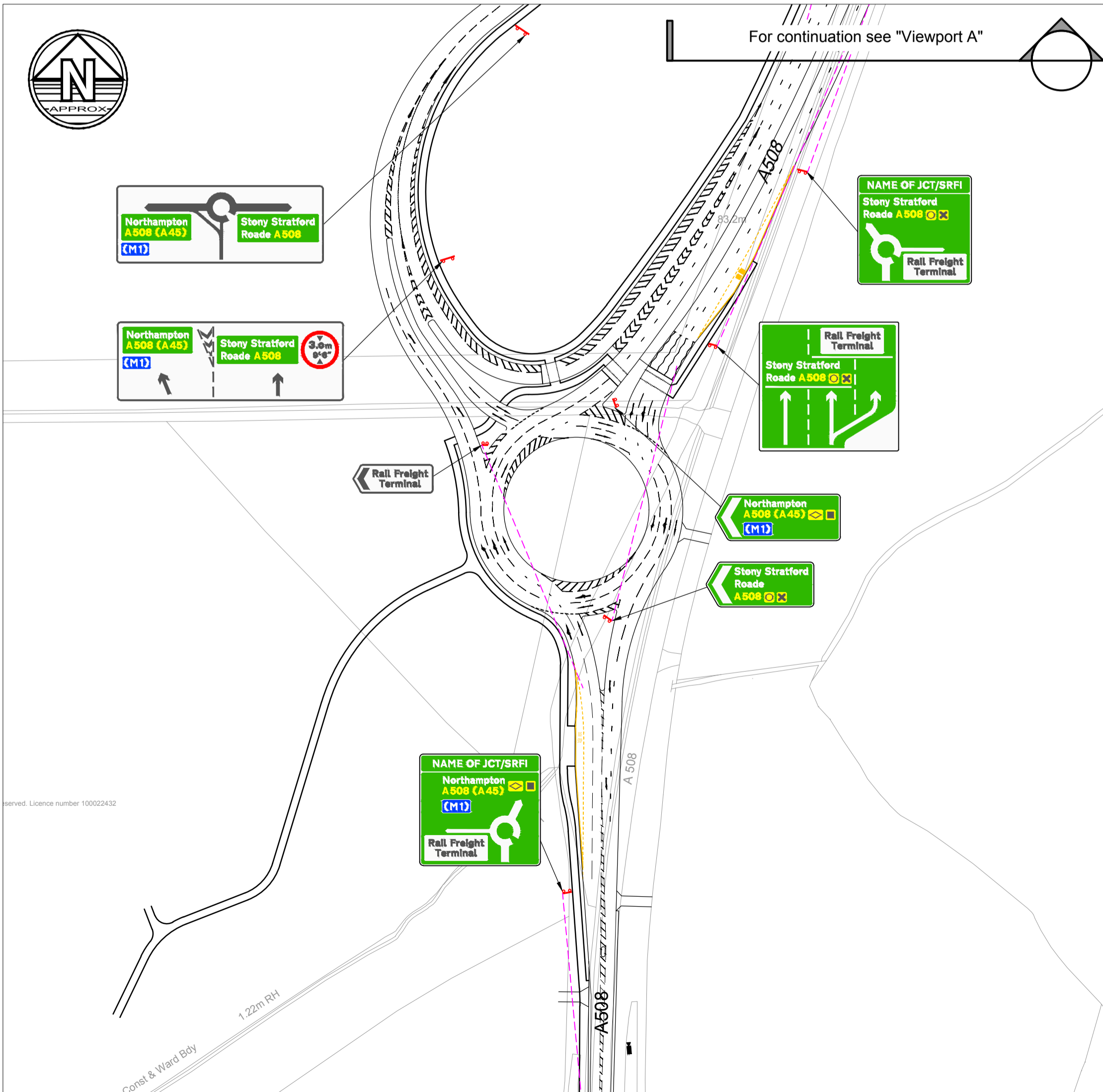
VIEWPORT A



VIEWPORT B



VIEWPORT C



Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

Important Notes:

- 1) Flap signs to activate emergency routes to be shown at detailed design stage.
- 2) Emergency diversion route symbols to be reviewed at detailed design stage.
- 3) Brown "Tourism" signage including eligibility to TD52/17 to be reviewed at detailed design stage.
- 4) Name of rail freight terminal to be confirmed.
- 5) Signage on all M1 Signs to be agreed with SMP.
- 6) Additional flag signs at the gyratory to be provided as necessary at detailed design stage.

Key

- Proposed sign to have X height of 125
- Proposed sign to have an X Height of 150
- Sign face visibility splay

P4	04.05.18	Updates following NCC Comments	GDJ	SRH
P3	25.04.18	Scheme Review	GDJ	SRH
P2	02.03.18	Added visibility splay and sign locations updated	GDJ	SRH
P1	08.12.17	Issued for Comment	GDJ	SRH
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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Project Title

**NORTHAMPTON  
GATEWAY RAIL FREIGHT  
INTERCHANGE**

Drawing Title

**M1 JUNCTION 15  
DIRECTIONAL SIGNAGE  
STRATEGY**

Drawn:	G.Jones	Reviewed:	S.Hilditch
BWB Ref:	NTH 2315	Date:	13.11.17
Scale:	A1:	1:2000	

**FOR COMMENT**

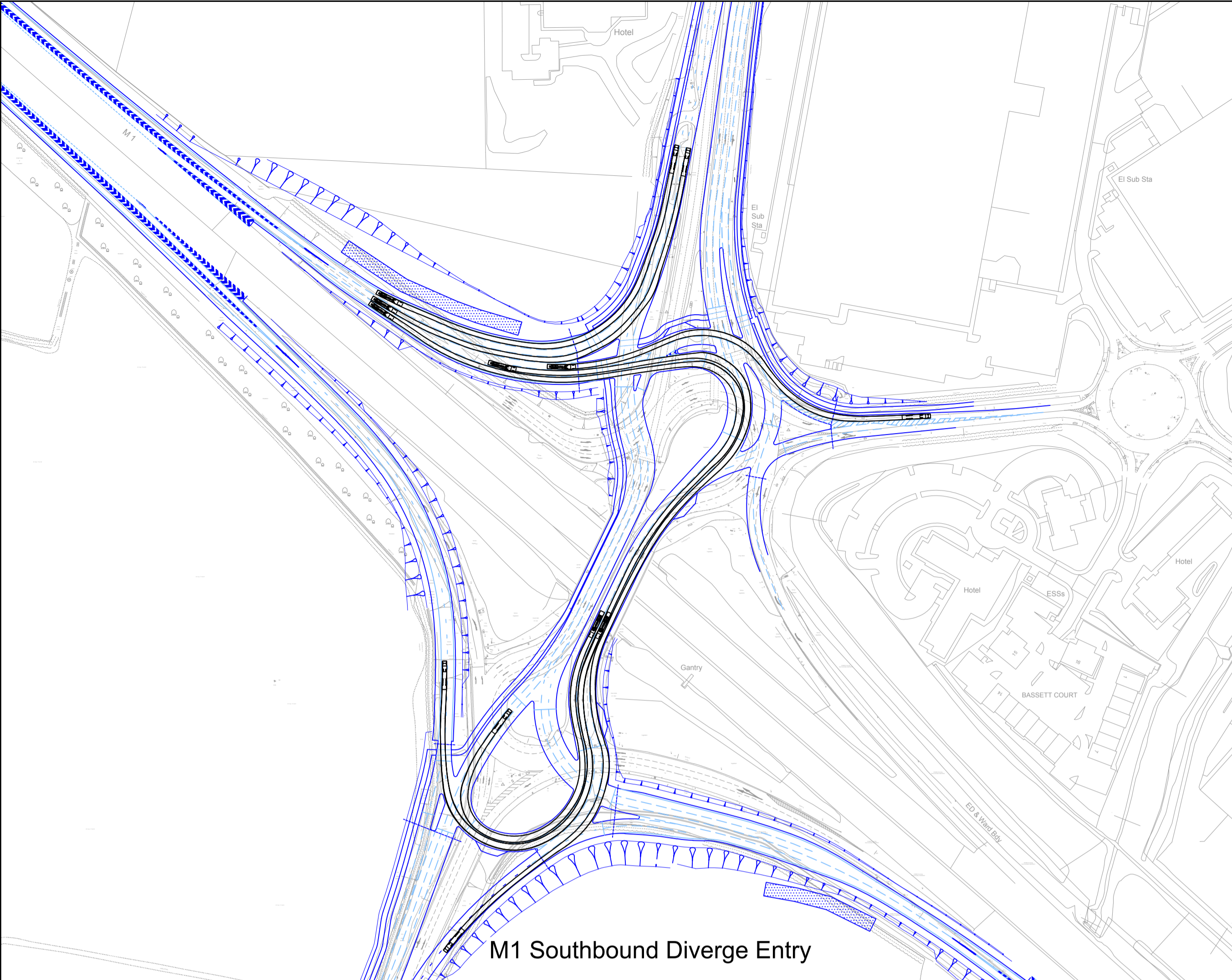
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NGW-BWB-GEN-XX-SK-C-SK37	S3	P4

## APPENDIX D

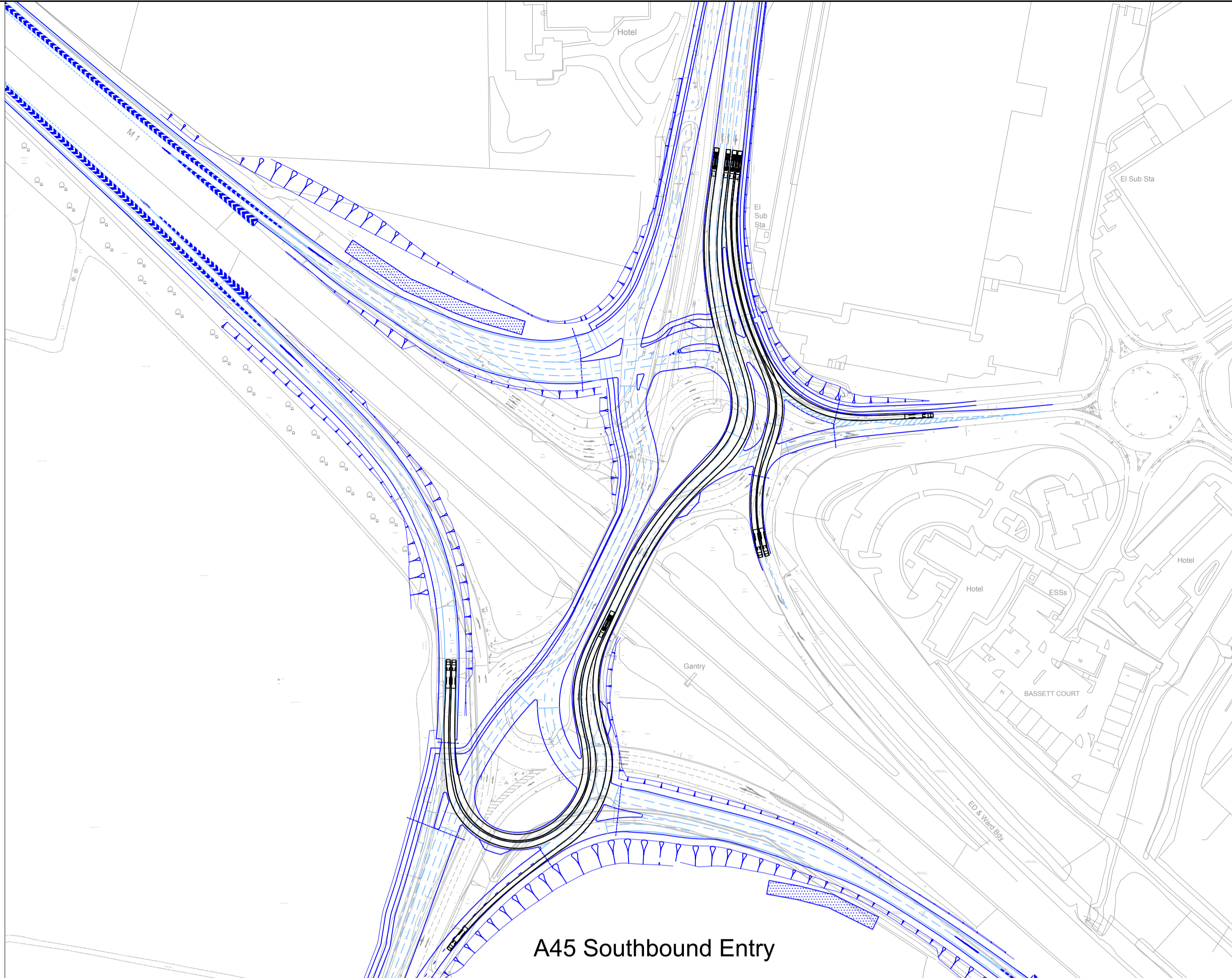
### Appendix D: M1 J15 layout and vehicle tracking assessment



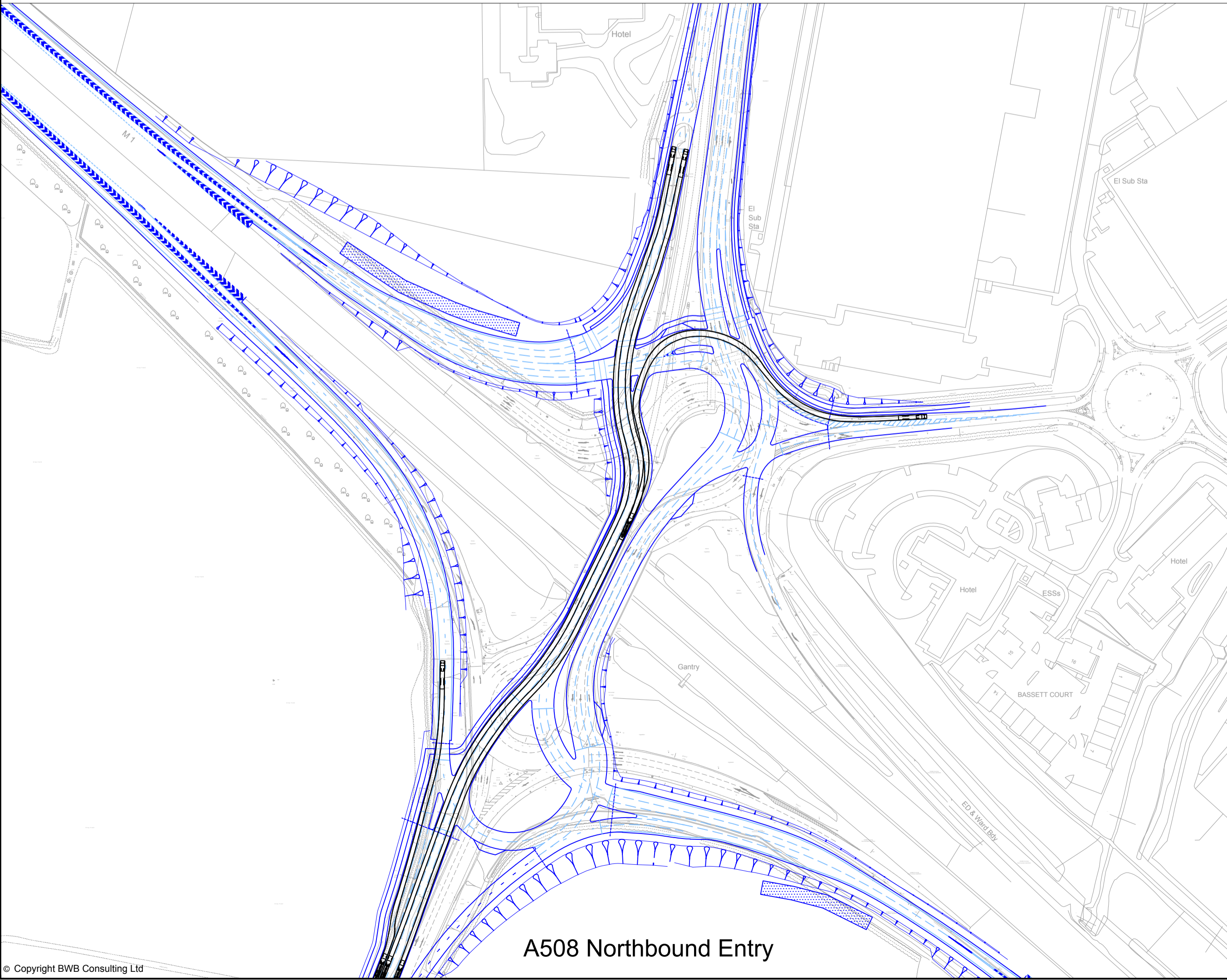
Notes		Legend		ISSUES & REVISIONS					<div><div><div>BWB</div><div>CONSULTANCY   ENVIRONMENT INFRASTRUCTURE   BUILDINGS</div></div><div><input type="checkbox"/> Birmingham   0121 233 3322 <input type="checkbox"/> Leeds   0113 233 8000 <input type="checkbox"/> London   020 7234 9122 <input type="checkbox"/> Manchester   0161 233 4260 <input checked="" type="checkbox"/> Nottingham   0115 924 1100 www.bwbconsulting.com</div></div>		Client <div><div><div></div><div>ROXHILL</div></div></div>		Project Title <div><div>NORTHAMPTON GATEWAY RAIL FREIGHT INTERCHANGE</div></div>		Drawing Title <div><div>M1 JUNCTION 15 GENERAL ARRANGEMENT</div></div>																																																	
<div><div>1.</div><div>Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.</div></div> <div><div>2.</div><div>This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.</div></div> <div><div>3.</div><div>All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.</div></div> <div><div>4.</div><div>Any discrepancies noted on site are to be reported to the engineer immediately.</div></div>		<div><div>Order Limits</div></div>		<table><tr><th>Rev</th><th>Date</th><th>Details of issue / revision</th><th>Drw</th><th>Rev</th></tr><tr><td>P5</td><td>19.07.17</td><td>M1 slip roads updated</td><td>SRH</td><td>SRH</td></tr><tr><td>P6</td><td>06.09.17</td><td>Gantries added, other minor updates</td><td>SRH</td><td>SRH</td></tr><tr><td>P7</td><td>15.09.17</td><td>Minor alignment updates on A45</td><td>SRH</td><td>SRH</td></tr><tr><td>P8</td><td>07.11.17</td><td>M1 SB diverge and associated node amended</td><td>SRH</td><td>SRH</td></tr><tr><td>P9</td><td>08.12.17</td><td>General updates and issued with draft GDSR</td><td>SRH</td><td>SRH</td></tr><tr><td>P10</td><td>29.01.18</td><td>General updates</td><td>PG</td><td>SRH</td></tr><tr><td>P11</td><td>07.03.18</td><td>General updates</td><td>PG</td><td>SRH</td></tr><tr><td>P12</td><td>16.04.18</td><td>General updates</td><td>PG</td><td>SRH</td></tr><tr><td>P13</td><td>30.04.18</td><td>Updates following HE review</td><td>PG</td><td>SRH</td></tr></table>					Rev	Date	Details of issue / revision	Drw	Rev	P5	19.07.17	M1 slip roads updated	SRH	SRH	P6	06.09.17	Gantries added, other minor updates	SRH	SRH	P7	15.09.17	Minor alignment updates on A45	SRH	SRH	P8	07.11.17	M1 SB diverge and associated node amended	SRH	SRH	P9	08.12.17	General updates and issued with draft GDSR	SRH	SRH	P10	29.01.18	General updates	PG	SRH	P11	07.03.18	General updates	PG	SRH	P12	16.04.18	General updates	PG	SRH	P13	30.04.18	Updates following HE review	PG	SRH	<div><div>Drawn:</div><div>S. Hilditch</div></div> <div><div>Reviewed:</div><div>S. Hilditch</div></div> <div><div>BWB Ref:</div><div>NTH 2315</div></div> <div><div>Date:</div><div>17.02.17</div></div> <div><div>Scale@A1:</div><div>1:2000</div></div>		<div><div>Drawing Status</div><div>FOR COMMENT</div></div>		<div><div>Project - Originator - Zone - Level - Type - Role - Number</div><div>NGW-BWB-GEN-XX-SK-C-SK02</div></div> <div><div>Status</div><div>S3</div></div> <div><div>Rev</div><div>P13</div></div>	
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P6	06.09.17	Gantries added, other minor updates	SRH	SRH																																																												
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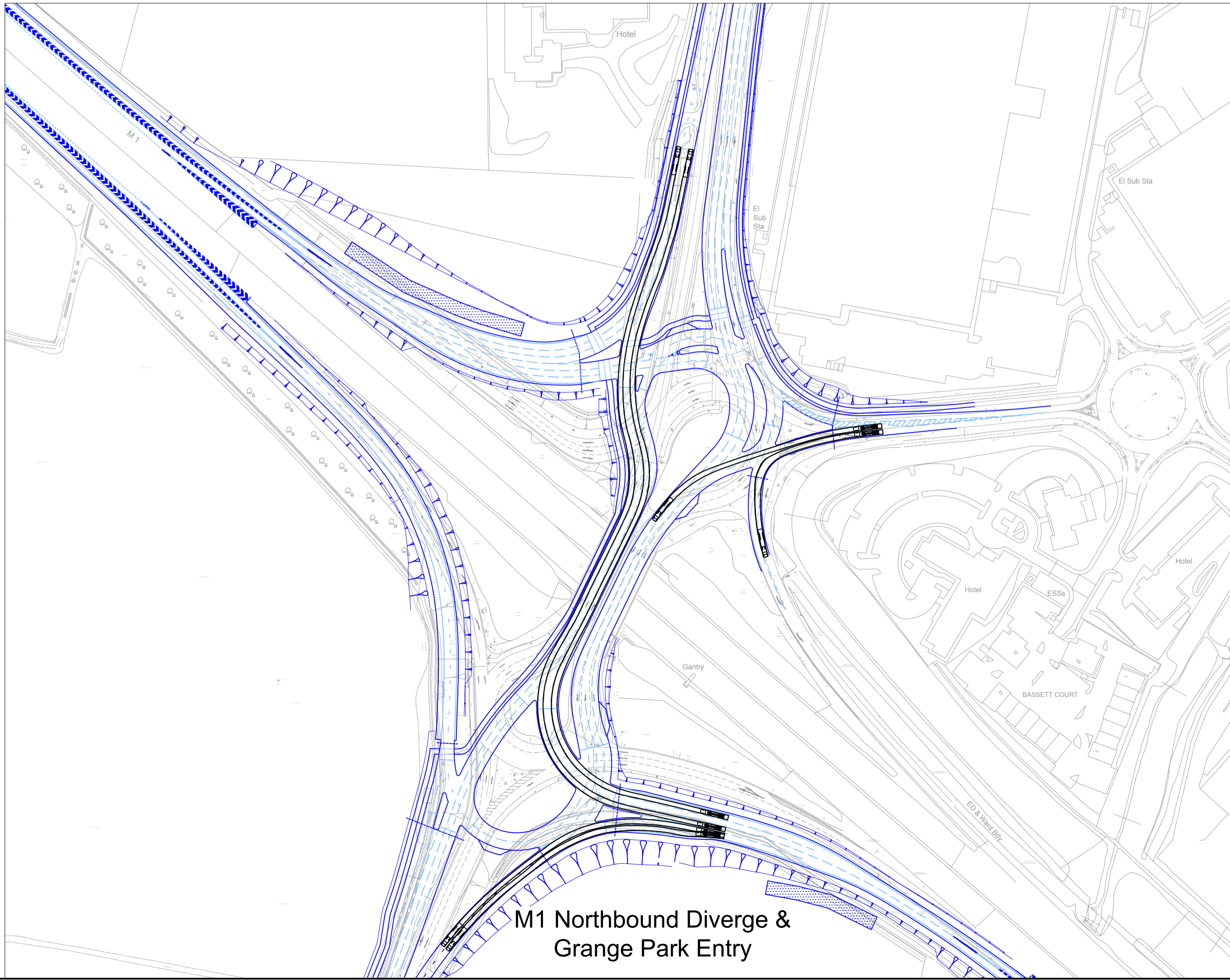
M1 Southbound Diverge Entry



A45 Southbound Entry



A508 Northbound Entry

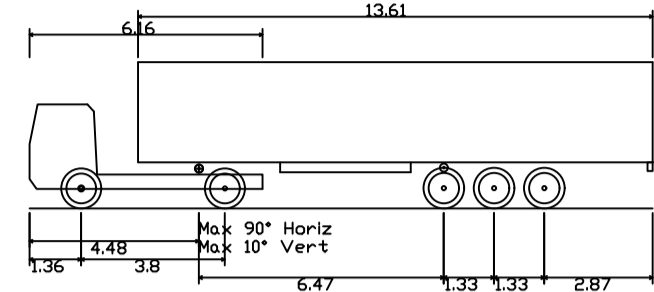


M1 Northbound Diverge &  
Grange Park Entry

Notes

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TRACKING VEHICLE



FTA Design Articulated Vehicle (1998)  
Overall Length 13.61m  
Overall Width 2.550m  
Overall Body Height 3.870m  
Min Body Ground Clearance 0.513m  
Max Track Width 2.470m  
Lock-to-lock time 3.00s  
Kerb to Kerb Turning Radius 6.550m  
Design Speed 15mph

Rev	Date	Details of issue / revision	Drw	Rev
P3	30.04.18	Layout & Tracking updated	PG	SRH
P2	07.03.18	Tracking updated	PG	SRH
P1	12.02.18	Preliminary Issue	PG	SRH

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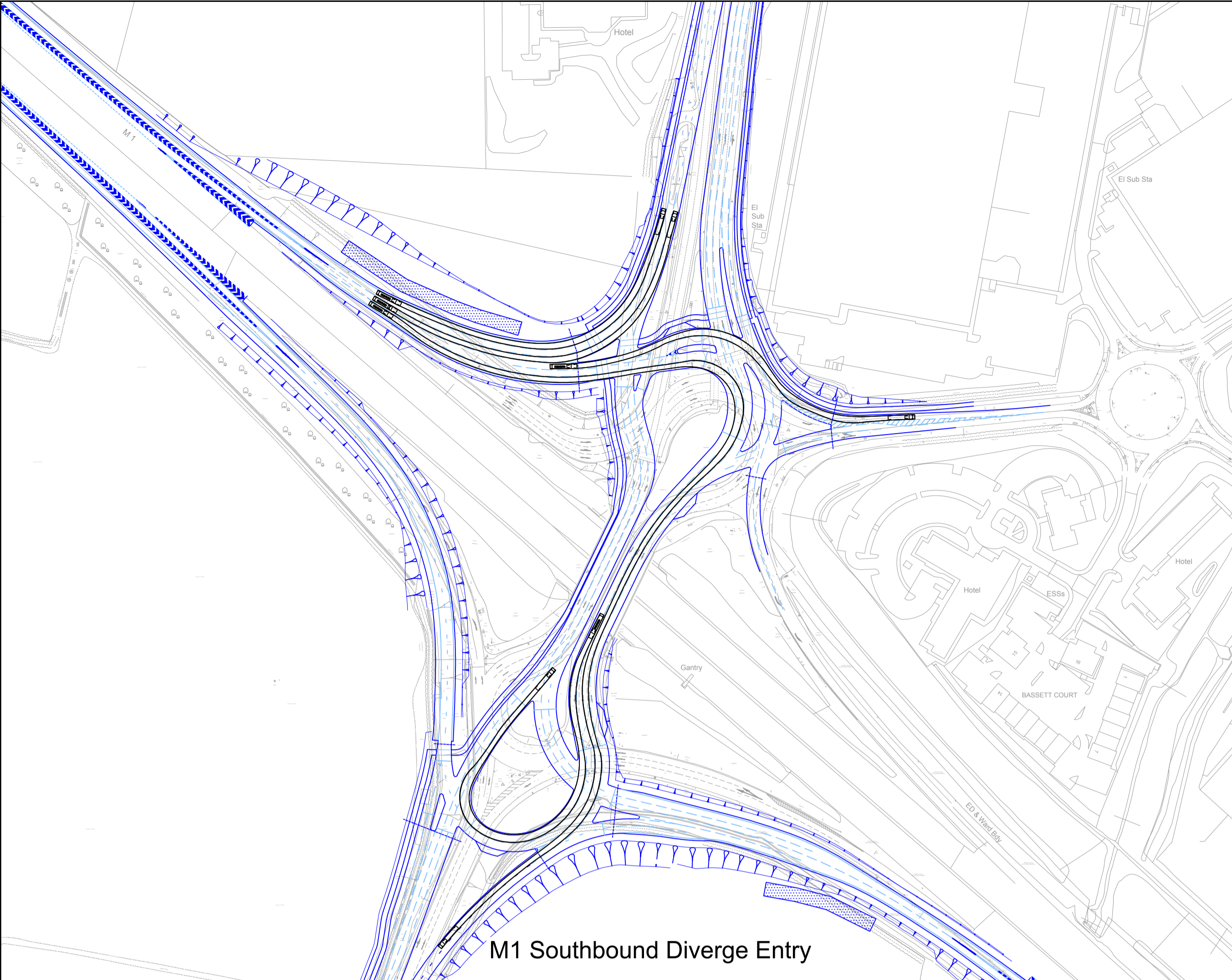
Project Title  
**THE NORTHAMPTON  
GATEWAY RAIL  
FREIGHT INTERCHANGE  
ORDER 201X**

Drawing Title  
**JUNCTION 15 VEHICLE  
TRACKING  
16.5m ARTICULATED  
VEHICLE**

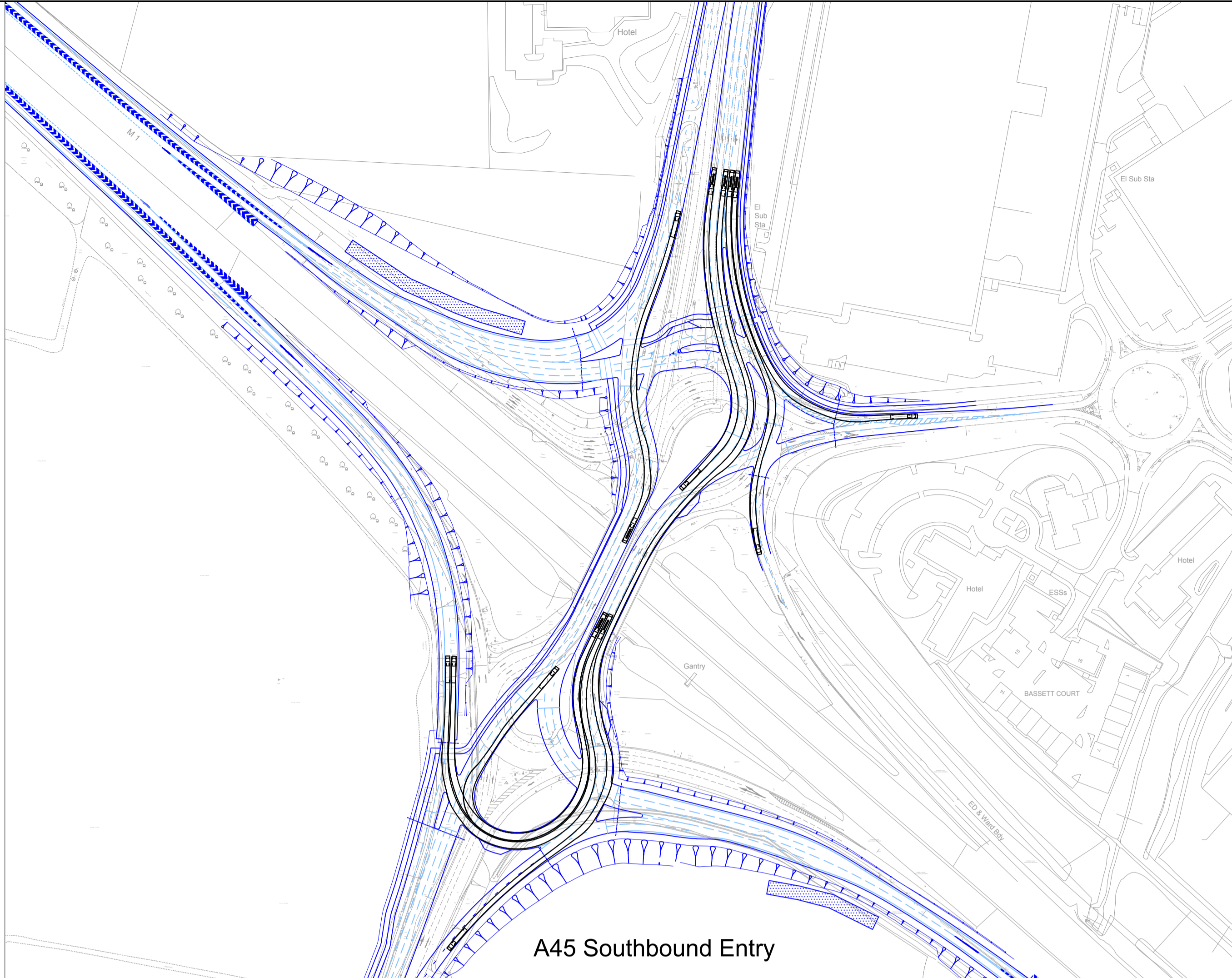
Drawn:	P. Goodyear	Reviewed:	S. Hilditch
BWB Ref:	NTH 2315	Date:	12.02.18
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Drawing Status  
**FOR COMMENT**

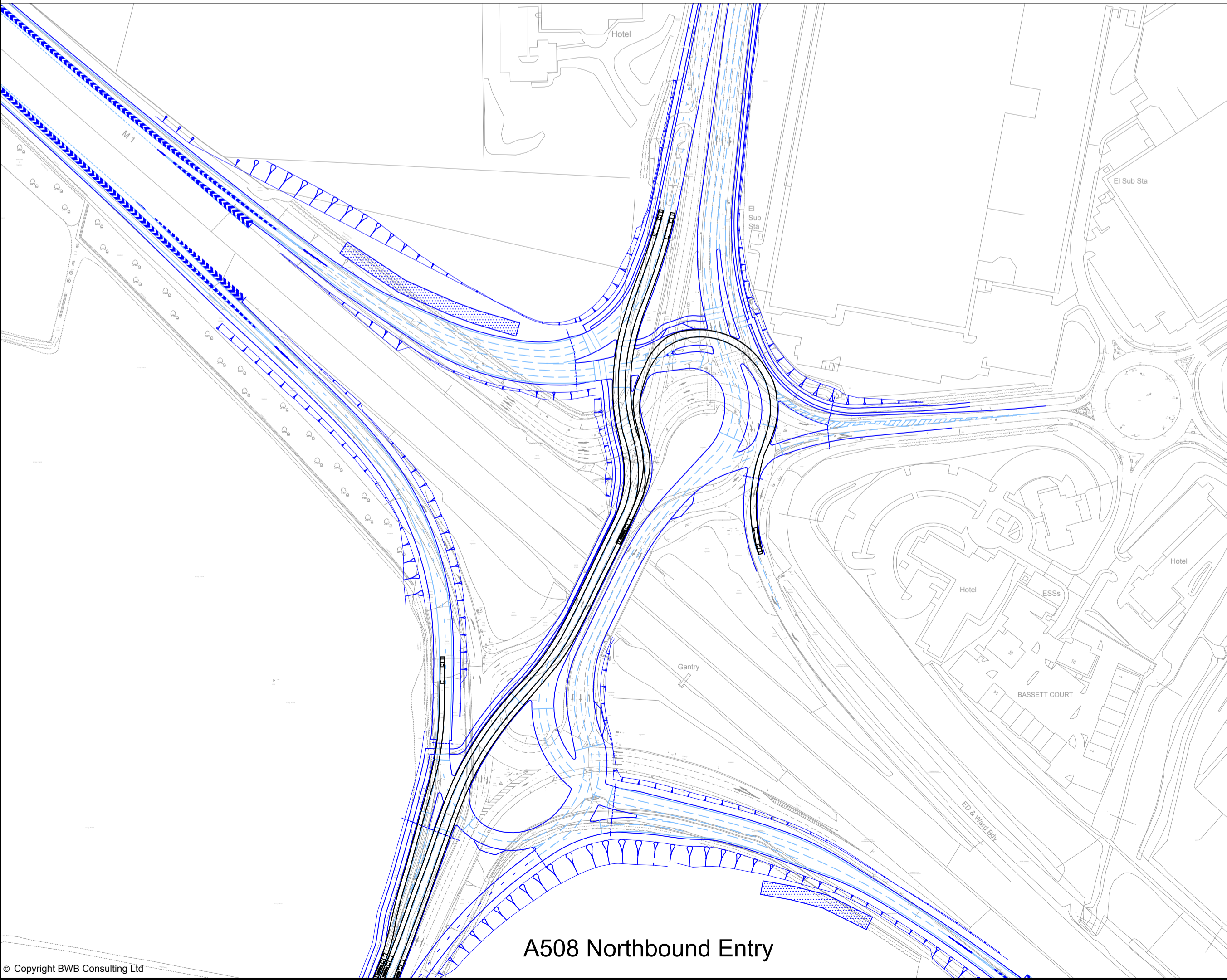
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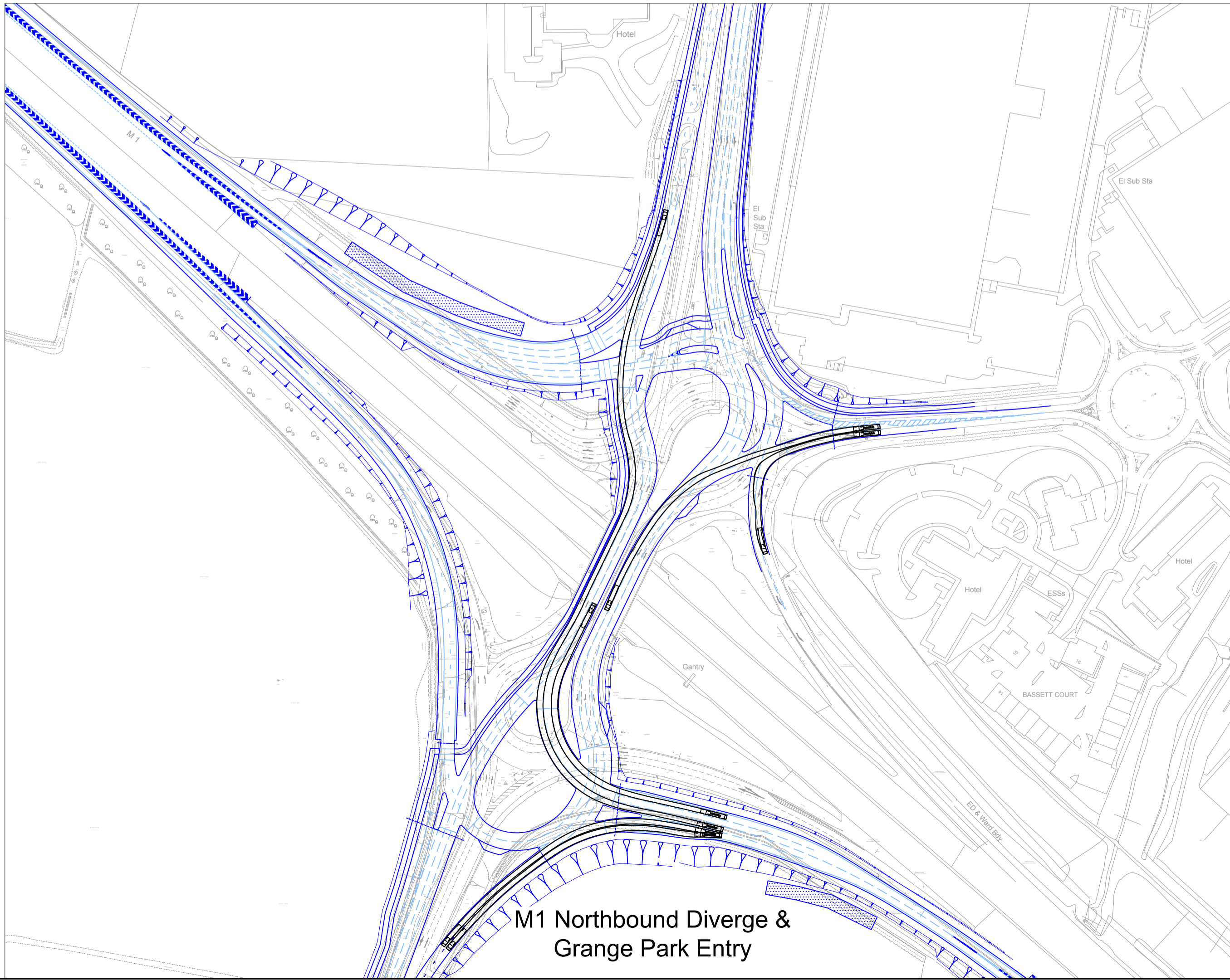
M1 Southbound Diverge Entry



A45 Southbound Entry



A508 Northbound Entry

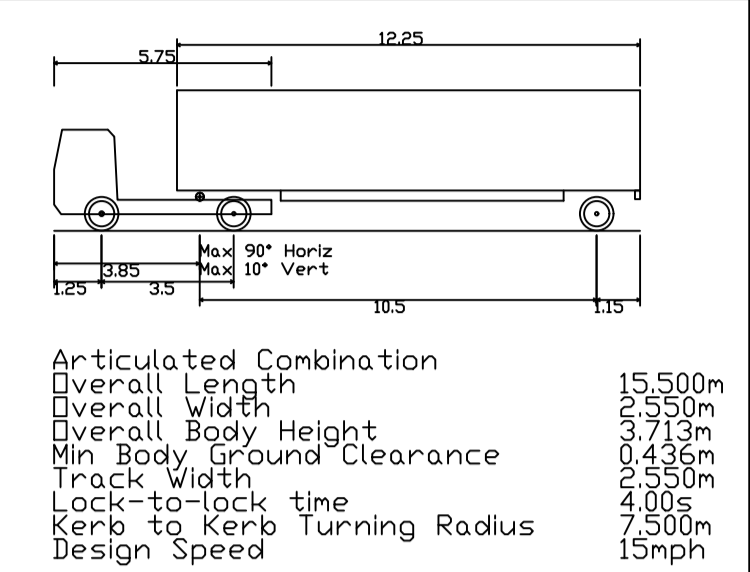


M1 Northbound Diverge & Grange Park Entry

Notes

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TRACKING VEHICLE



Rev	Date	Details of issue / revision	Drw	Rev
P4	30.04.18	Layout & Tracking Updated	PG	SRH
P3	07.03.18	Tracking Updated	PG	SRH
P2	12.02.18	Tracking Updated	PG	SRH
P1	08.12.17	Preliminary Issue	PG	SRH

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Project Title  
**THE NORTHAMPTON  
GATEWAY RAIL  
FREIGHT INTERCHANGE  
ORDER 201X**

Drawing Title  
**JUNCTION 15 VEHICLE  
TRACKING  
15.5m ARTICULATED  
VEHICLE**

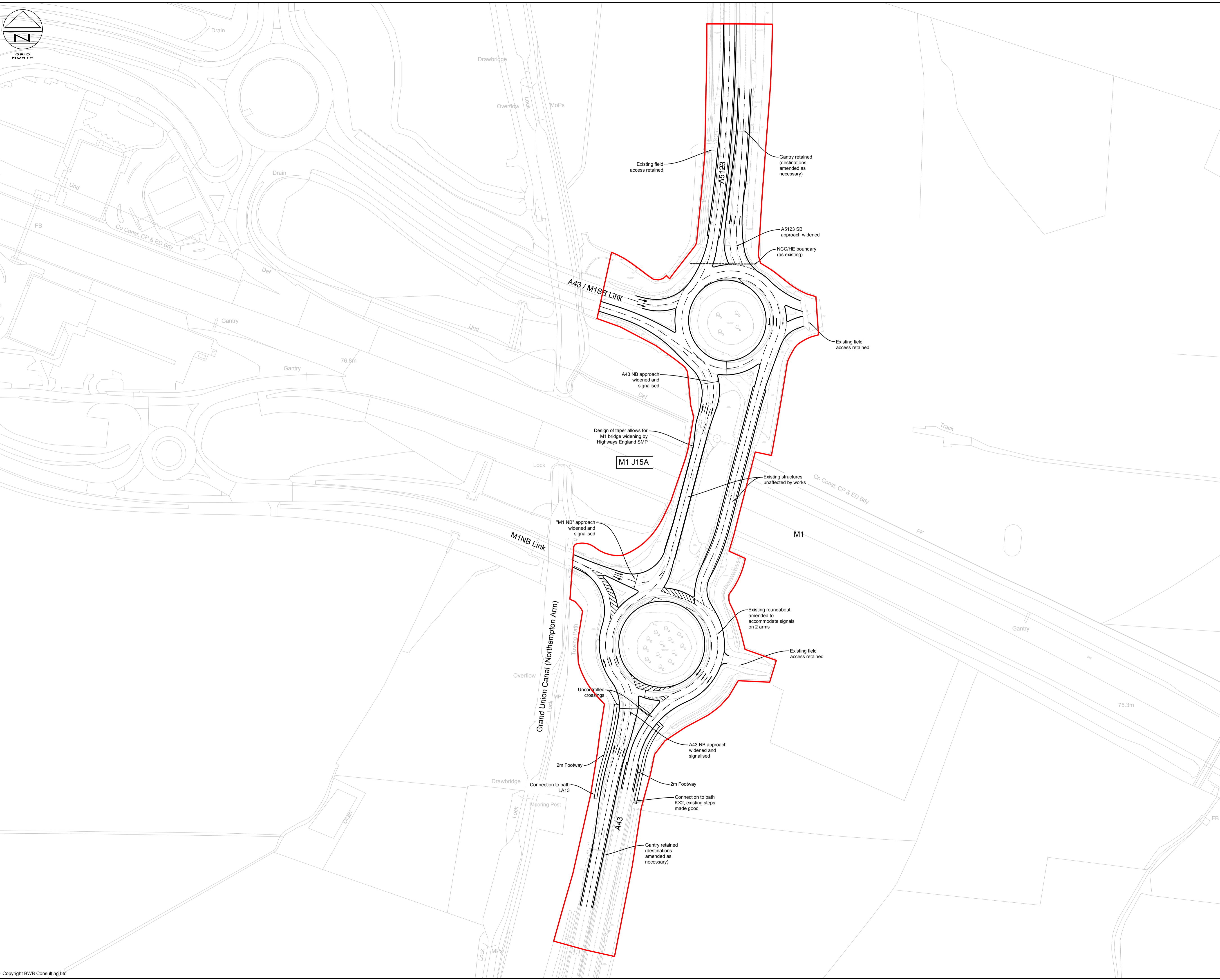
Drawn:	P. Goodyear	Reviewed:	S. Hilditch
BWB Ref:	NTH 2315	Date:	08.12.17
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Drawing Status  
**FOR COMMENT**

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
NGW-BWB-GEN-XX-SK-C-SK38	S3	P4

## **APPENDIX E**

### **Appendix E: M1 J15A layout and vehicle tracking assessment**



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**Order Limits**

## Issues & Revisions

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[illegible]

Project Title	
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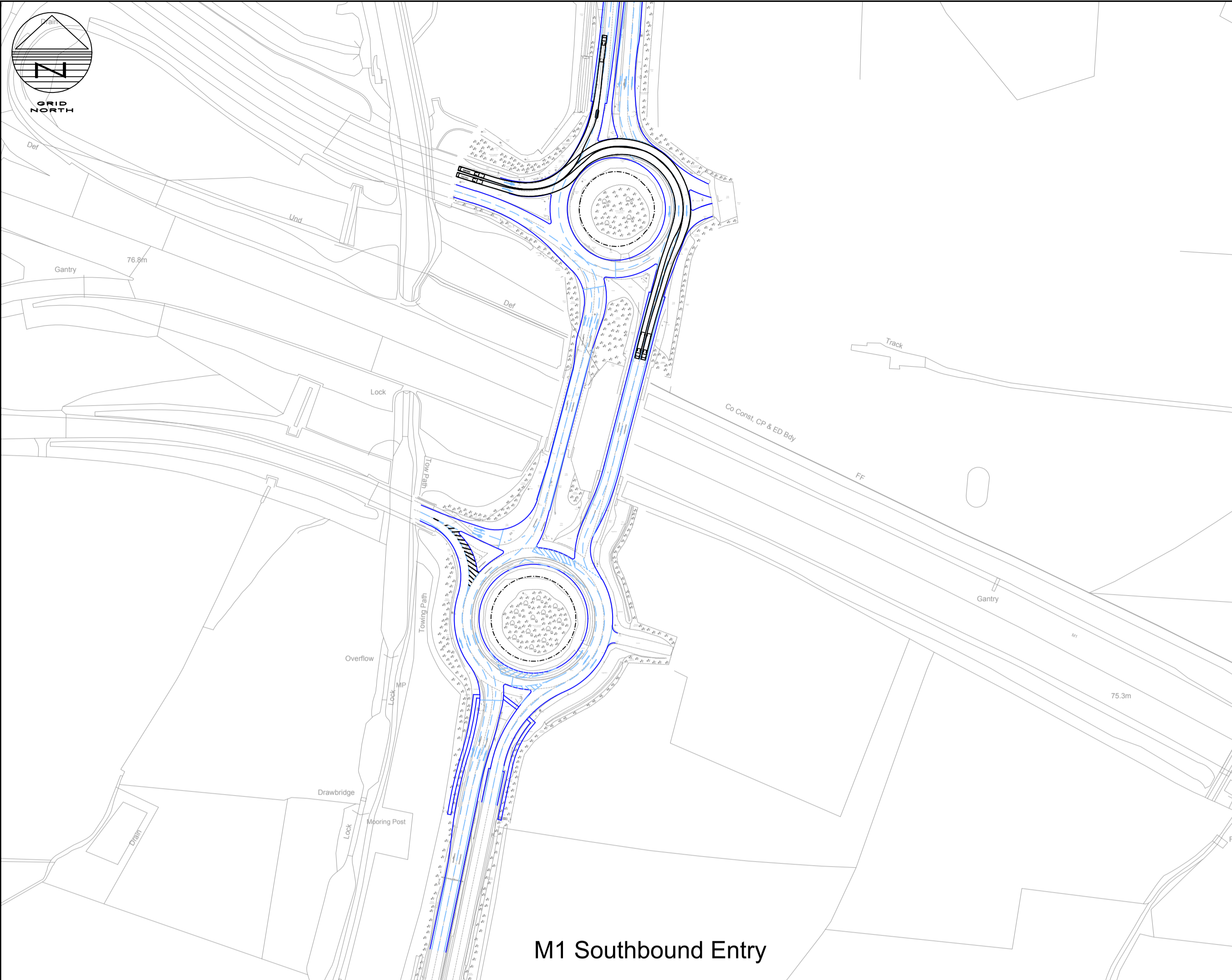
[illegible]

M1 J15A (A43/A5123)

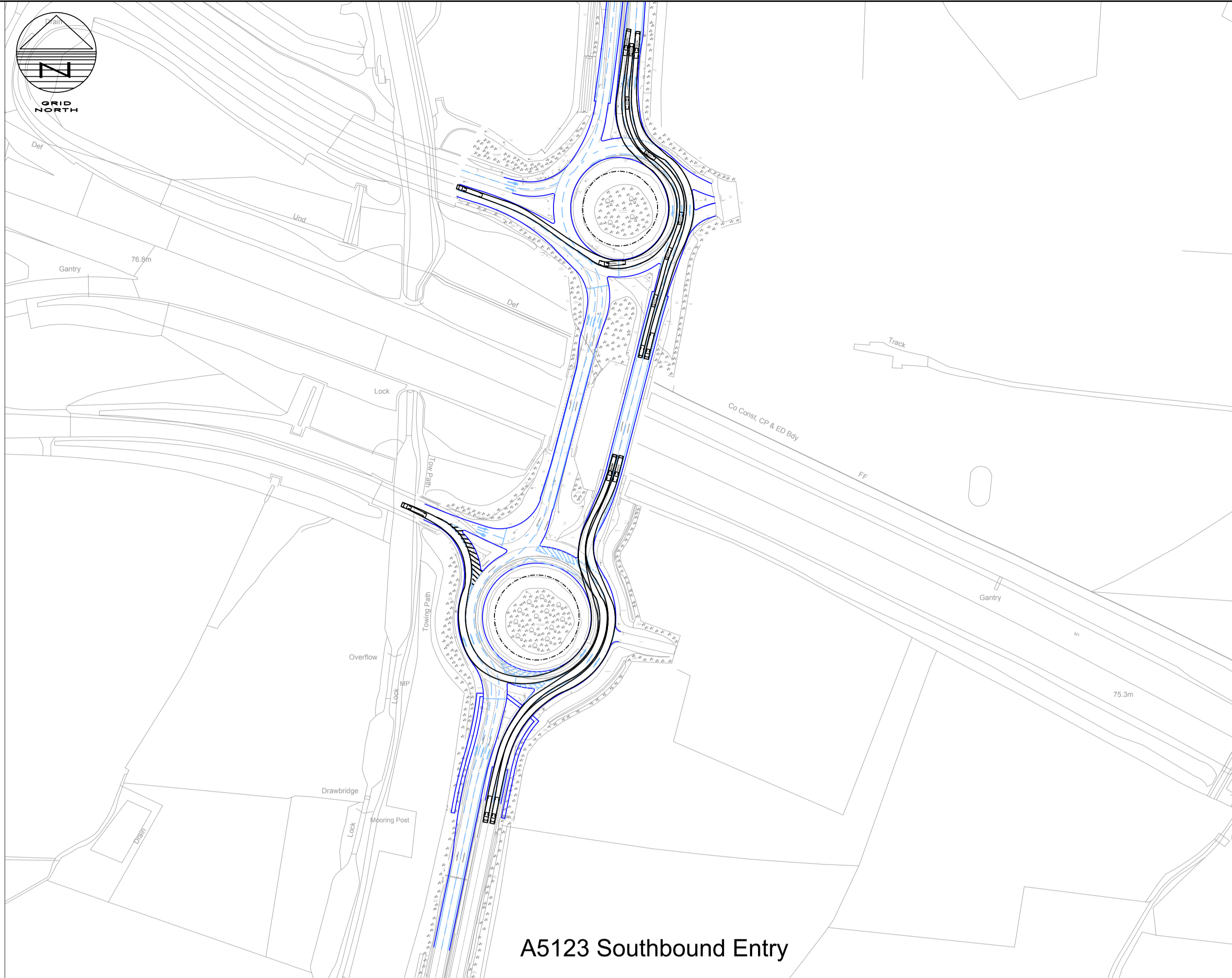
Drawing Status
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<p><b>POST-GRADUATE:</b></p>
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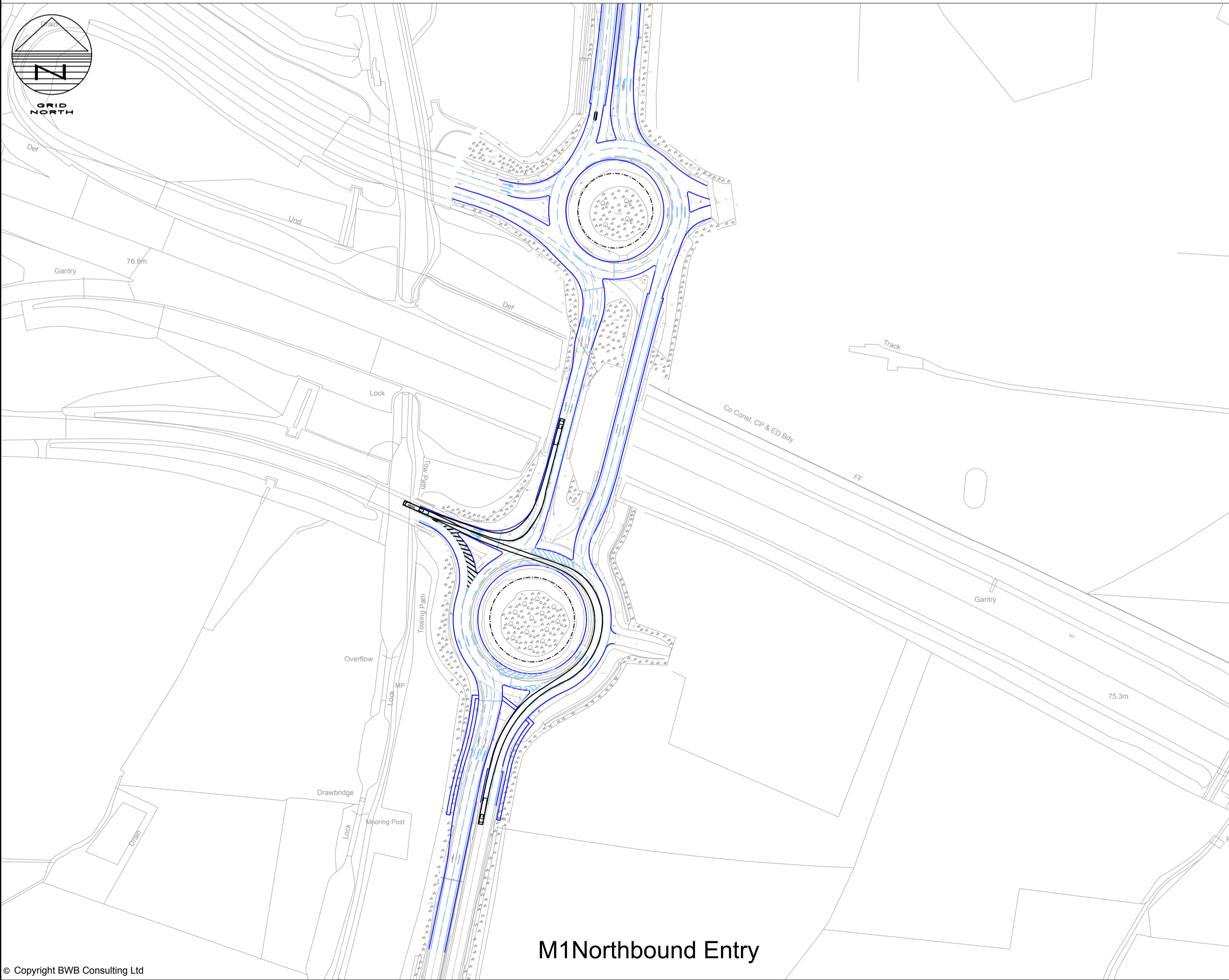
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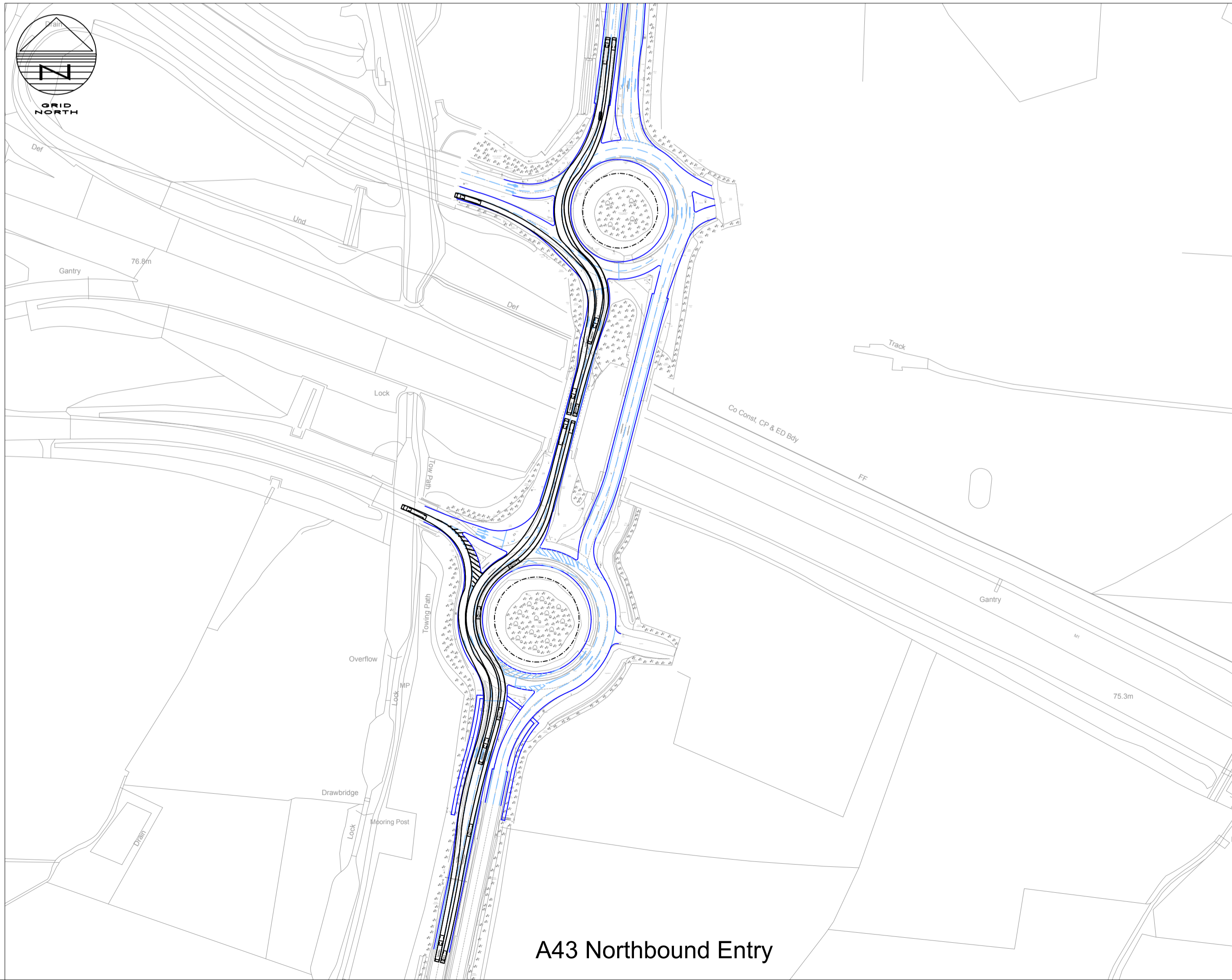
M1 Southbound Entry



A5123 Southbound Entry



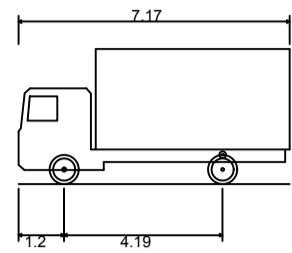
M1Northbound Entry



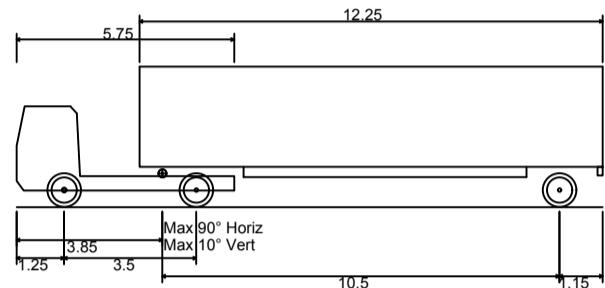
A43 Northbound Entry

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.



FTA Design LG Rigid Vehicle (1998)	
Overall Length	7.170m
Overall Width	2.300m
Overall Body Height	3.560m
Min Body Ground Clearance	0.375m
Track Width	2.120m
Lock-to-lock time	3.00s
Kerb to Kerb Turning Radius	7.000m
Design Speed	15mph



Articulated Combination	
Overall Length	15.500m
Overall Width	2.560m
Overall Body Height	3.713m
Min Body Ground Clearance	0.436m
Track Width	2.560m
Lock-to-lock time	4.00s
Kerb to Kerb Turning Radius	7.500m
Design Speed	15mph

P3	30.04.18	Layout & Tracking Updated	PG	SRH	
P2	07.03.18	Tracking Updated	PG	SRH	
P1	26.01.18	Preliminary Issue	PG	SRH	
Rev	Date	Details of issue / revision	Drw	Rev	

Issues & Revisions

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Client



Project Title  
**THE NORTHAMPTON  
GATEWAY RAIL  
FREIGHT INTERCHANGE  
ORDER 201X**

Drawing Title  
**JUNCTION 15A  
VEHICLE TRACKING  
15.5m ARTICULATED  
VEHICLE**

Drawn:	P. Goodyear	Reviewed:	S. Hilditch
BWB Ref:	NTH 2315	Date:	26.01.18
Scale:	A1: 1:2000		

Drawing Status  
**FOR COMMENT**

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
NGW-BWB-GEN-XX-SK-C-SK40	S3	P3

# BWB

