M2J1 Merge and Diverge Assessment

1. Methodology

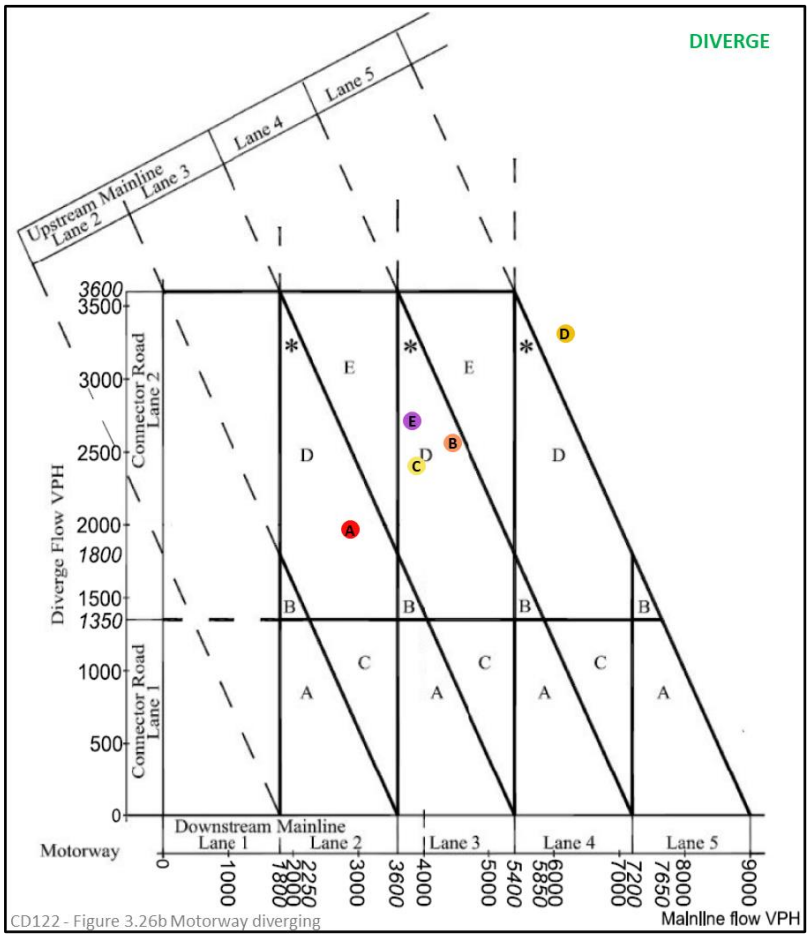
This document was prepared following Kent County Council's (KCC) request to examine the impacts of the Local Plan upon the slip road merges and diverges at M2J1.

The merge and diverge assessments present in this document were carried out in accordance with the diagrams in Design Manual for Road and Bridges – CD 122 Geometric design of grade separated junctions. The assessments compare the peak hour flows for the AM and PM merges/diverges with M2 mainline flows. For the merge assessment, the upstream mainline flows were used and for the diverge assessment, the downstream mainline flows were used.

The following figure shows the location of each merge/diverge.

2. M2J1

(1) M2 EASTBOUND: DIVERGE



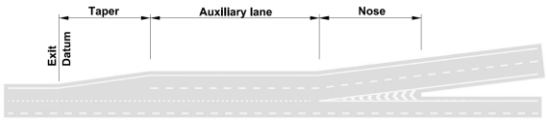
CD122 - Figure 3.26b Motorway diverging

Scenario	Description	Downstream Mainline	Diverge Flow
A	Base_AM	2853	1970
B	Base_PM	4433	2568
C	Ref Case LTC_AM	3872	2407
D	Ref Case LTC_PM	6158	3313
E	DS LTC_AM	3798	2716
F	DS LTC_PM	6110	3811

Scenario	Diverge Layouts	
	AM	PM
Current Layout	D2	
Base	D	D
Ref Case LTC	D	n/a
Do Something LTC	D	n/a

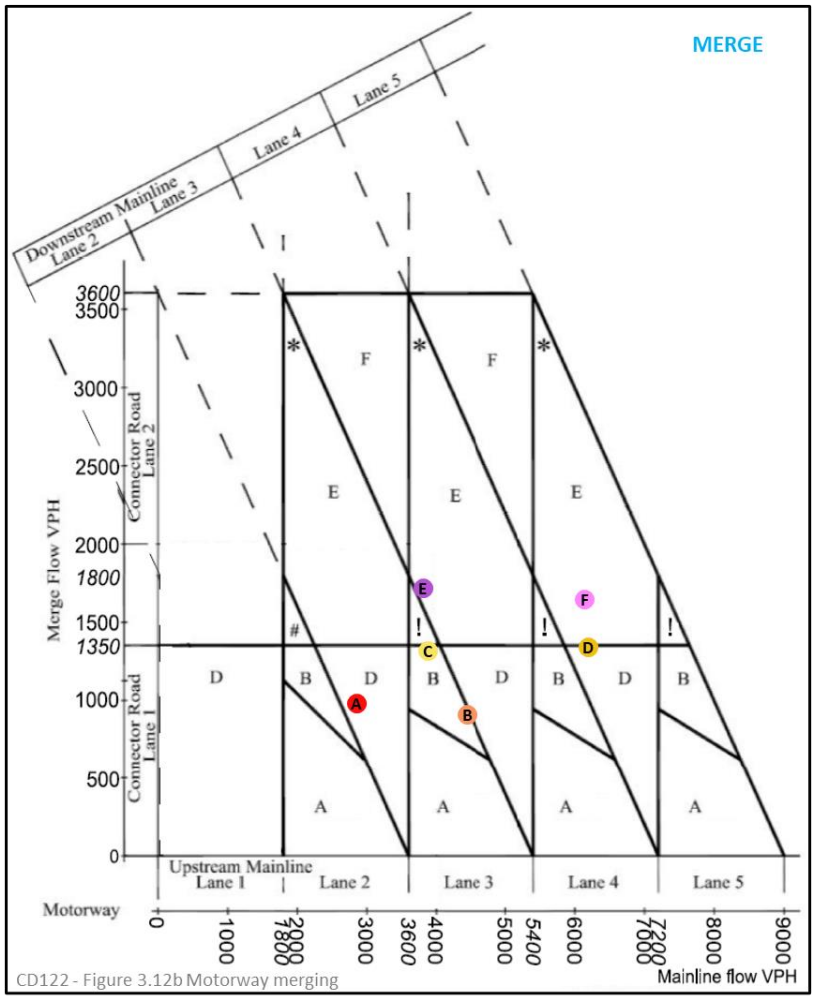
Notes:
- The M2J1 EB diverge (off-slip) is currently type D2 layout.
- All scenarios modelled show no increase required to level of provision.

Current scenario:



CD122 - Figure 3.30g Layout D option 2 - auxiliary lane drop

(2) M2 EASTBOUND: MERGE



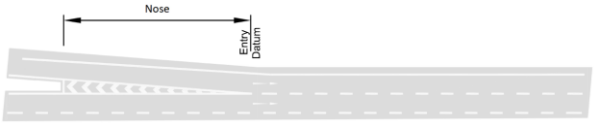
CD122 - Figure 3.12b Motorway merging

Scenario	Description	Upstream Mainline	Merge Flow
A	Base_AM	2853	960
B	Base_PM	4433	888
C	Ref Case LTC_AM	3872	1292
D	Ref Case LTC_PM	6158	1316
E	DS LTC_AM	3798	1691
F	DS LTC_PM	6110	1616

Scenario	Merge Layouts	
	AM	PM
Current Layout	D	
Base	D	B
Ref Case LTC	B	D
Do Something LTC	E	E

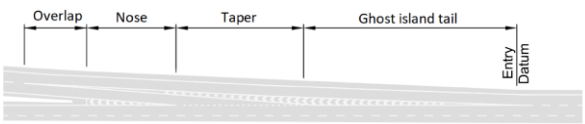
Notes:
- The M2J1 EB merge (on-slip) is currently type D layout.
- By the Do Something, an increase is required from type D to a type E*.

Current scenario:



CD122 - Figure 3.14e Layout D - lane gain

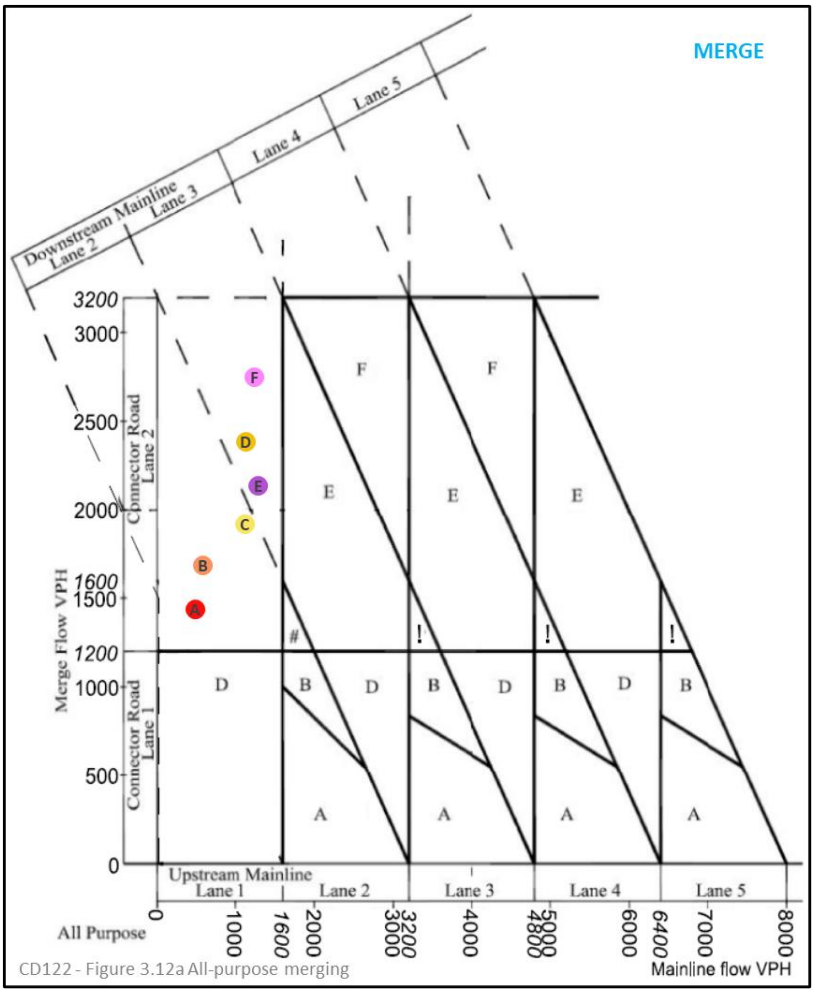
Reference Case and DS (with LTC) scenarios:



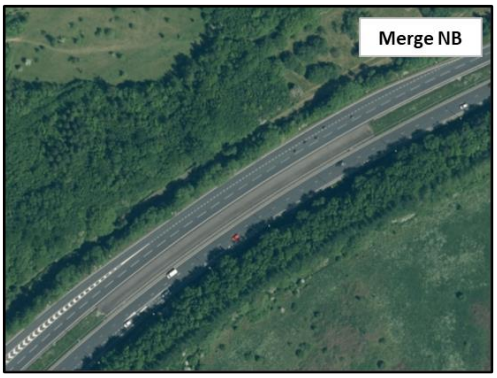
CD122 - Figure 3.14g Layout E Option 1 - lane gain with ghost island offside merge

*The proposed mitigation can be found in Section 3.

(3) A289 NORTHBOUND: MERGE



CD122 - Figure 3.12a All-purpose merging



Scenario	Description	Upstream Mainline	Merge Flow
A	Base_AM	462	1417
B	Base_PM	564	1661
C	Ref Case LTC_AM	1104	1896
D	Ref Case LTC_PM	1115	2355
E	DS LTC_AM	1268	2108
F	DS LTC_PM	1215	2720

Scenario	Merge Layouts	
	AM	PM
Current Layout	B	
Base	n/a	n/a
Ref Case LTC	n/a	n/a
Do Something LTC	n/a	n/a

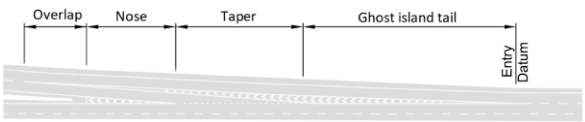
Notes:

- The A289 NB merge (on-slip) is currently type B layout.
- This is a complex merging situation where merging flow is higher than mainline flow. It is recommended that an E type layout would be more suitable here, but this is not due to the local plan scenarios as there is no change in provision likely to be required from the reference case.

Current scenario:

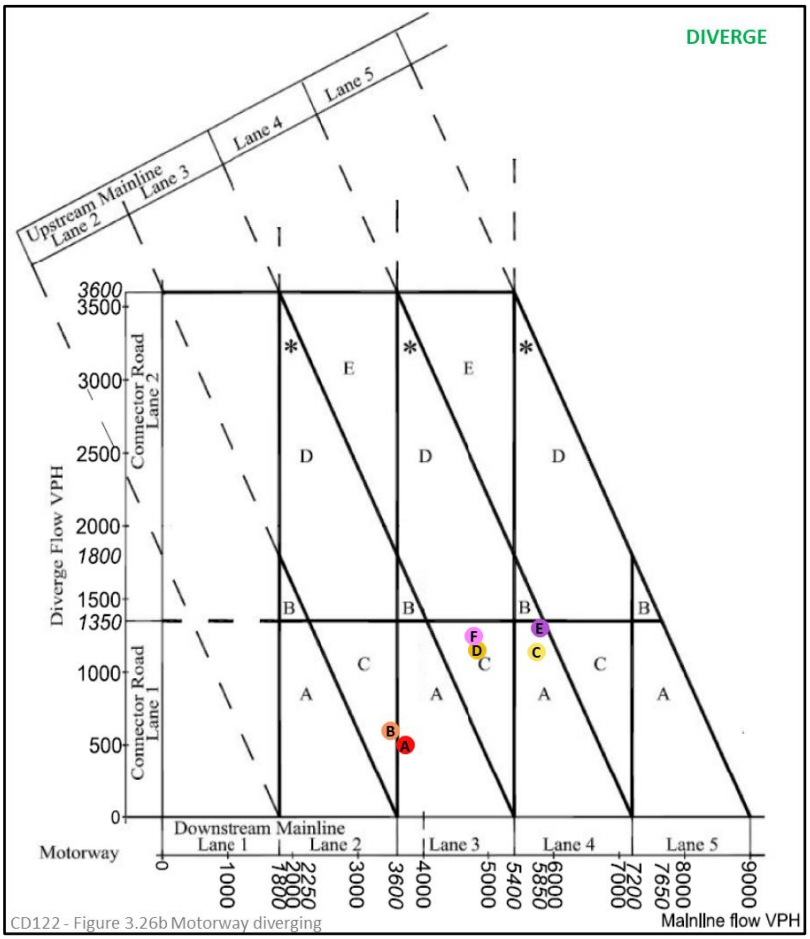
CD122 - Figure 3.14c Layout B - parallel merge

Recommended:



CD122 - Figure 3.14g Layout E Option 1 - lane gain with ghost island offside merge

(4) M2 WESTBOUND: DIVERGE



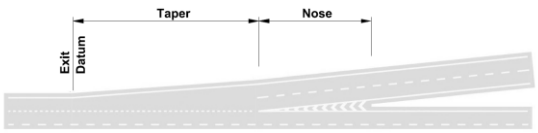
CD122 - Figure 3.26b Motorway diverging

Scenario	Description	Downstream Mainline	Diverge Flow
A	Base_AM	3768	462
B	Base_PM	3538	564
C	Ref Case LTC_AM	5769	1104
D	Ref Case LTC_PM	4865	1115
E	DS LTC_AM	5820	1268
F	DS LTC_PM	4809	1215

Scenario	Diverge Layouts	
	AM	PM
Current Layout	C	
Base	A	C
Ref Case LTC	A	C
Do Something LTC	A	C

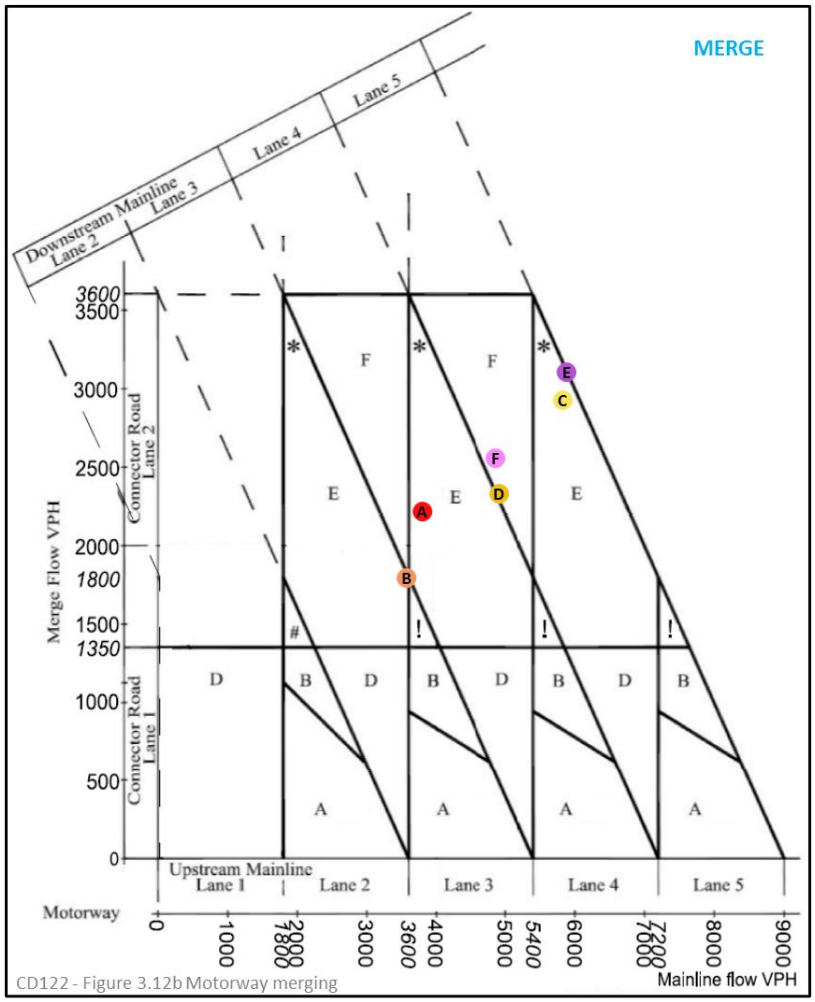
Notes:
- The M2J1 WB diverge (off-slip) is currently type C layout.
- All scenarios modelled show no increase required to level of provision.

Current scenario:



CD122 - Figure 3.30e Layout C - lane drop

(5) M2 WESTBOUND: MERGE



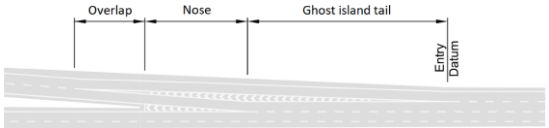
CD122 - Figure 3.12b Motorway merging

Scenario	Description	Upstream Mainline	Merge Flow
A	Base_AM	3768	2190
B	Base_PM	3538	1771
C	Ref Case LTC_AM	5769	2897
D	Ref Case LTC_PM	4865	2303
E	DS LTC_AM	5820	3075
F	DS LTC_PM	4809	2528

Scenario	Merge Layouts	
	AM	PM
Current Layout	F	
Base	E	E
Ref Case LTC	E	F
Do Something LTC	E	F

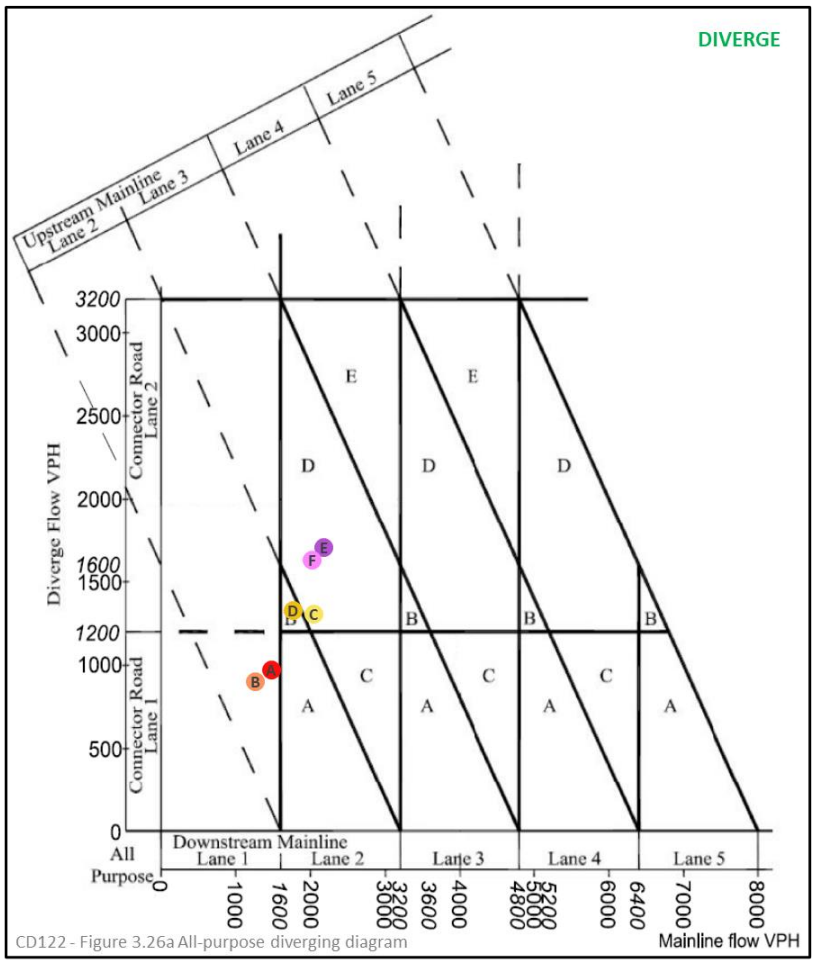
Notes:
- The M2J1 WB merge (on-slip) is currently type F layout.
- All scenarios modelled show no increase required to level of provision.

Current scenario:

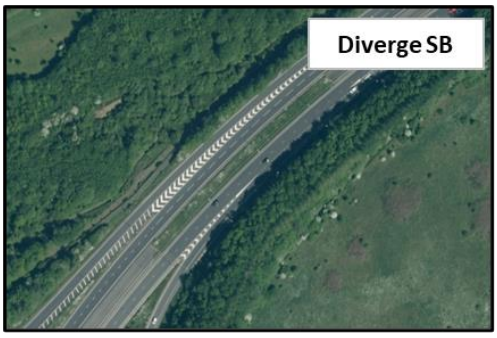


CD122 - Figure 3.14h Layout F - 2 lane gain with ghost

(6) A289 SOUTHBOUND: DIVERGE



CD122 - Figure 3.26a All-purpose diverging diagram

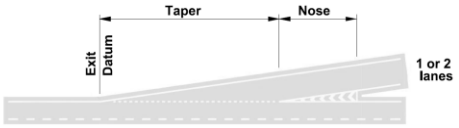


Scenario	Description	Downstream Mainline	Diverge Flow
A	Base_AM	1443	960
B	Base_PM	1226	888
C	Ref Case LTC_AM	2011	1292
D	Ref Case LTC_PM	1733	1316
E	DS LTC_AM	2148	1691
F	DS LTC_PM	1985	1616

Scenario	Diverge Layouts	
	AM	PM
Current Layout	A1	
Base	n/a	n/a
Ref Case LTC	D	B
Do Something LTC	D	D

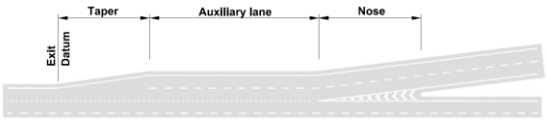
Notes:
- The A289 SB diverge (off-slip) is currently type A1 layout.
- As an increase in provision is required in the Reference Case LTC for the PM peak, the maximum required provision (type D) does not change between Reference Case and Do Something.

Current scenario:



CD122 - Figure 3.30a Layout A option 1 - taper diverge

Reference Case and DS (with LTC) scenarios:



CD122 - Figure 3.30g Layout D option 2 - auxiliary lane drop

3. Proposed Mitigation

(2) M2 EASTBOUND: MERGE

According to the Design Manual for Road and Bridges, the M2 Eastbound Merge required an improvement to a Type E layout. Figure below shows the proposed type E layout, provided by Stantec. Jacobs can confirm the layout provided by Stantec meets the requirements set out in the DMRB, but as this is a Stantec design, Jacobs cannot comment further. The proposed mitigation drawings can be found in Appendix A.

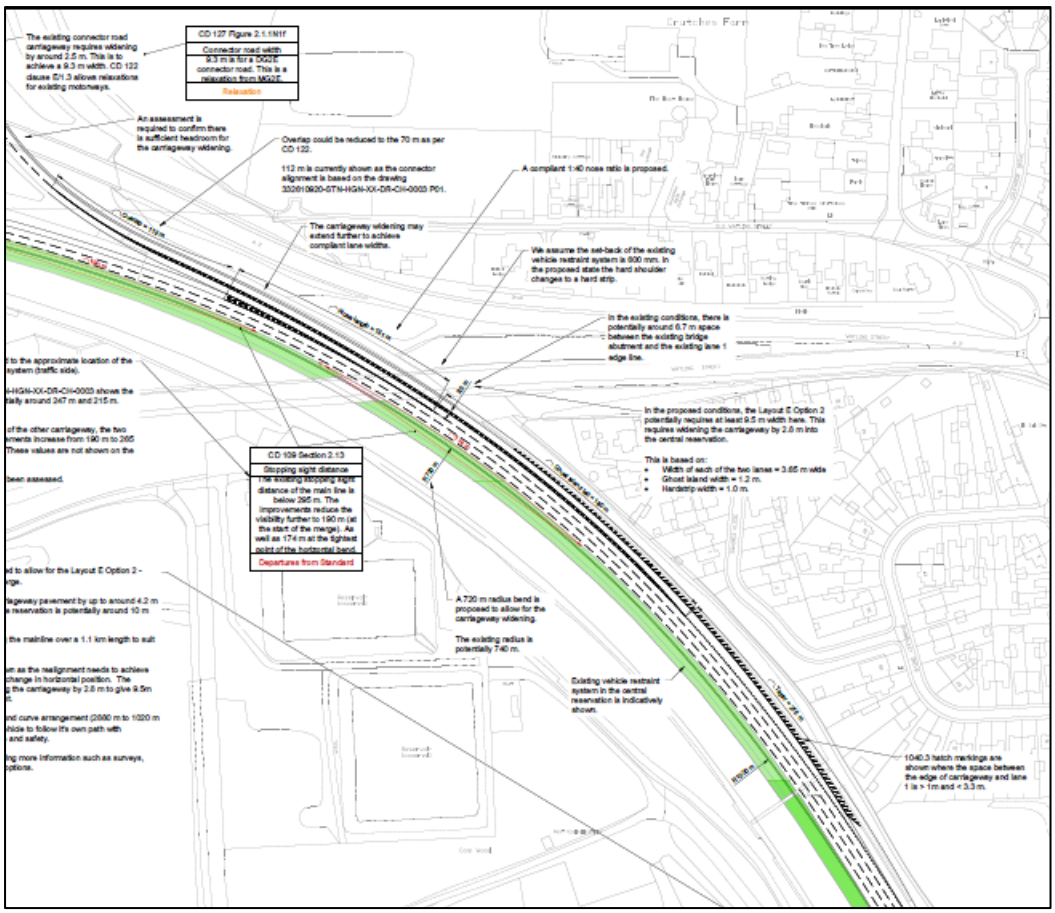


Figure 1: M2 J1 Mitigation Snippet Taken from Stantec Drawing

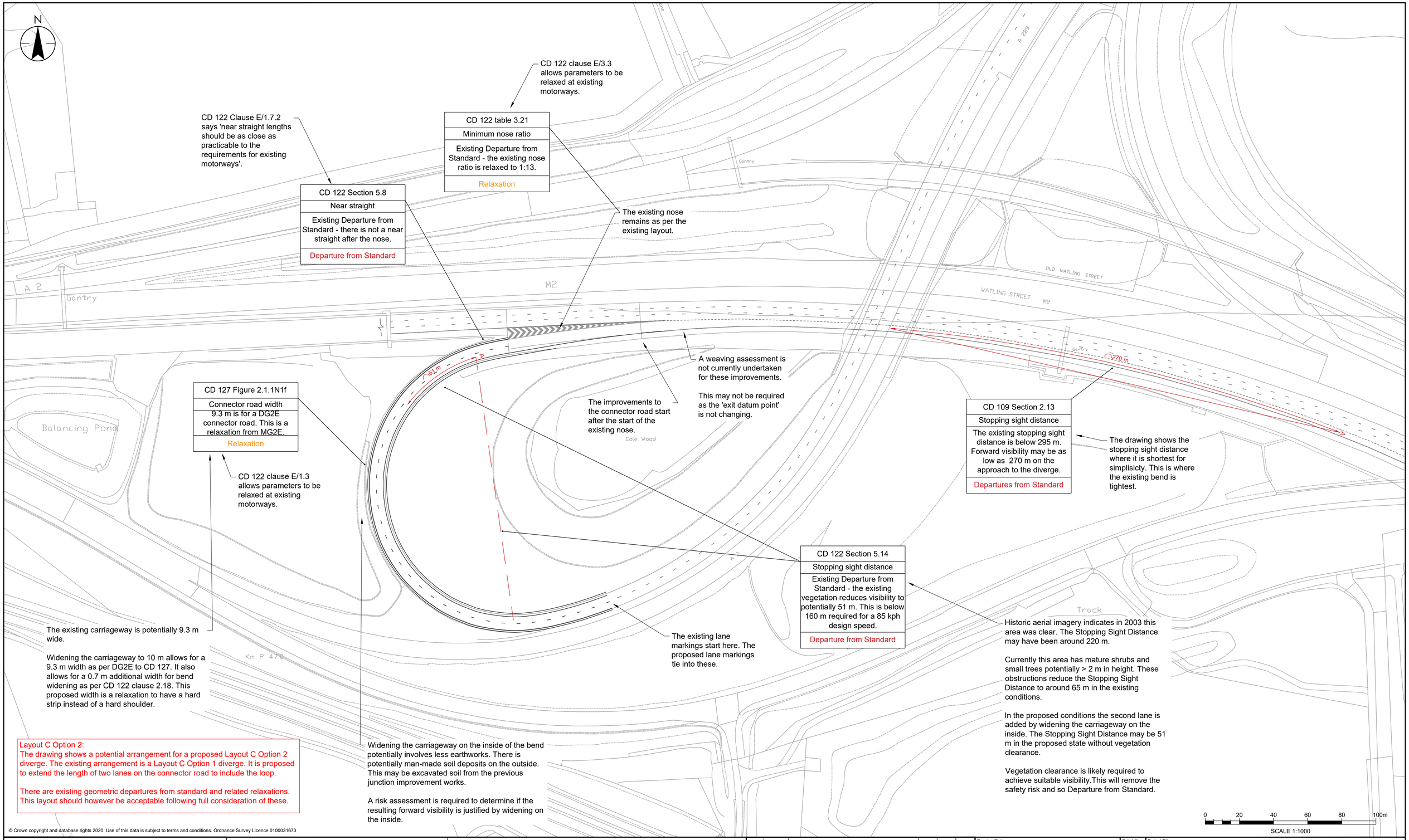
4. Summary

Most of the merges and diverges tested show no additional requirement as a result of the local plan Do Something Scenario. One diverge has been shown to require an increase in provision:

The M2 Eastbound Merge. The merge layout is type D for Reference Case and type E for Do Something LTC scenarios, an increase in provision is required (lane gain).

Stantec have provided a design drawing to Medway which shows a layout which appears to satisfy DMRB and National Highways requirements. As this is a Stantec design, Jacobs cannot comment further on the design, and it is recommended that this design is reviewed with both Stantec and National Highways.

5. Appendix A: Stantec Mitigation at M2 J1



CD 122 clause E/3.3 allows parameters to be relaxed at existing motorways.

CD 122 Clause E/1.7.2 says 'near straight lengths should be as close as practicable to the requirements for existing motorways'.

CD 122 table 3.21
Minimum nose ratio
Existing Departure from Standard - the existing nose ratio is relaxed to 1:13.
Relaxation

CD 122 Section 5.8
Near straight
Existing Departure from Standard - there is not a near straight after the nose.
Departure from Standard

The existing nose remains as per the existing layout.

A weaving assessment is not currently undertaken for these improvements.

This may not be required as the 'exit datum point' is not changing.

The improvements to the connector road start after the start of the existing nose.

CD 127 Figure 2.1.1N1f
Connector road width
9.3 m is for a DG2E connector road. This is a relaxation from MG2E.
Relaxation

CD 122 clause E/1.3 allows parameters to be relaxed at existing motorways.

CD 109 Section 2.13
Stopping sight distance
The existing stopping sight distance is below 295 m. Forward visibility may be as low as 270 m on the approach to the diverge.
Departures from Standard

The drawing shows the stopping sight distance where it is shortest for simplisicty. This is where the existing bend is tightest.

CD 122 Section 5.14
Stopping sight distance
Existing Departure from Standard - the existing vegetation reduces visibility to potentially 51 m. This is below 160 m required for a 85 kph design speed.
Departure from Standard

The existing lane markings start here. The proposed lane markings tie into these.

Historic aerial imagery indicates in 2003 this area was clear. The Stopping Sight Distance may have been around 220 m.

Currently this area has mature shrubs and small trees potentially > 2 m in height. These obstructions reduce the Stopping Sight Distance to around 65 m in the existing conditions.

In the proposed conditions the second lane is added by widening the carriageway on the inside. The Stopping Sight Distance may be 51 m in the proposed state without vegetation clearance.

Vegetation clearance is likely required to achieve suitable visibility.This will remove the safety risk and so Departure from Standard.

The existing carriageway is potentially 9.3 m wide.

Widening the carriageway to 10 m allows for a 9.3 m width as per DG2E to CD 127. It also allows for a 0.7 m additional width for bend widening as per CD 122 clause 2.18. This proposed width is a relaxation to have a hard strip instead of a hard shoulder.

Layout C Option 2:
The drawing shows a potential arrangement for a proposed Layout C Option 2 diverge. The existing arrangement is a Layout C Option 1 diverge. It is proposed to extend the length of two lanes on the connector road to include the loop.

There are existing geometric departures from standard and related relaxations. This layout should however be acceptable following full consideration of these.

Widening the carriageway on the inside of the bend potentially involves less earthworks. There is potentially man-made soil deposits on the outside. This may be excavated soil from the previous junction improvement works.

A risk assessment is required to determine if the resulting forward visibility is justified by widening on the inside.

0 20 40 60 80 100m

SCALE 1:1000

General Notes

1. This drawing shall be read in conjunction with all other relevant documentation.
2. Do not scale from this drawing.
3. All dimensions are in metres unless specified otherwise.
4. The information on this drawing is based on limited OS information.
5. The dimensions shown are assumed and require verifying through surveys.
6. This drawing shows a potential option(s) from an initial feasibility design. The potential option(s) is indicatively shown for information only. These are subject to outline and detailed design. Further changes may be required.
7. The constraints and potential departures from standard shown/listed are not exhaustive. More may become apparent through further investigations, surveys and during the detailed design.

Notes

This document is suitable only for the purpose noted above.
Use of this document for any other purpose is not permitted.

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Rev.	Date	Description	Drawn	Chk'd	App'd
P01	14.03.24	FIRST ISSUE	RC	JA	JA

Drawing Status: FOR INFORMATION
Suitability: S2

Stantec
www.stantec.com/uk

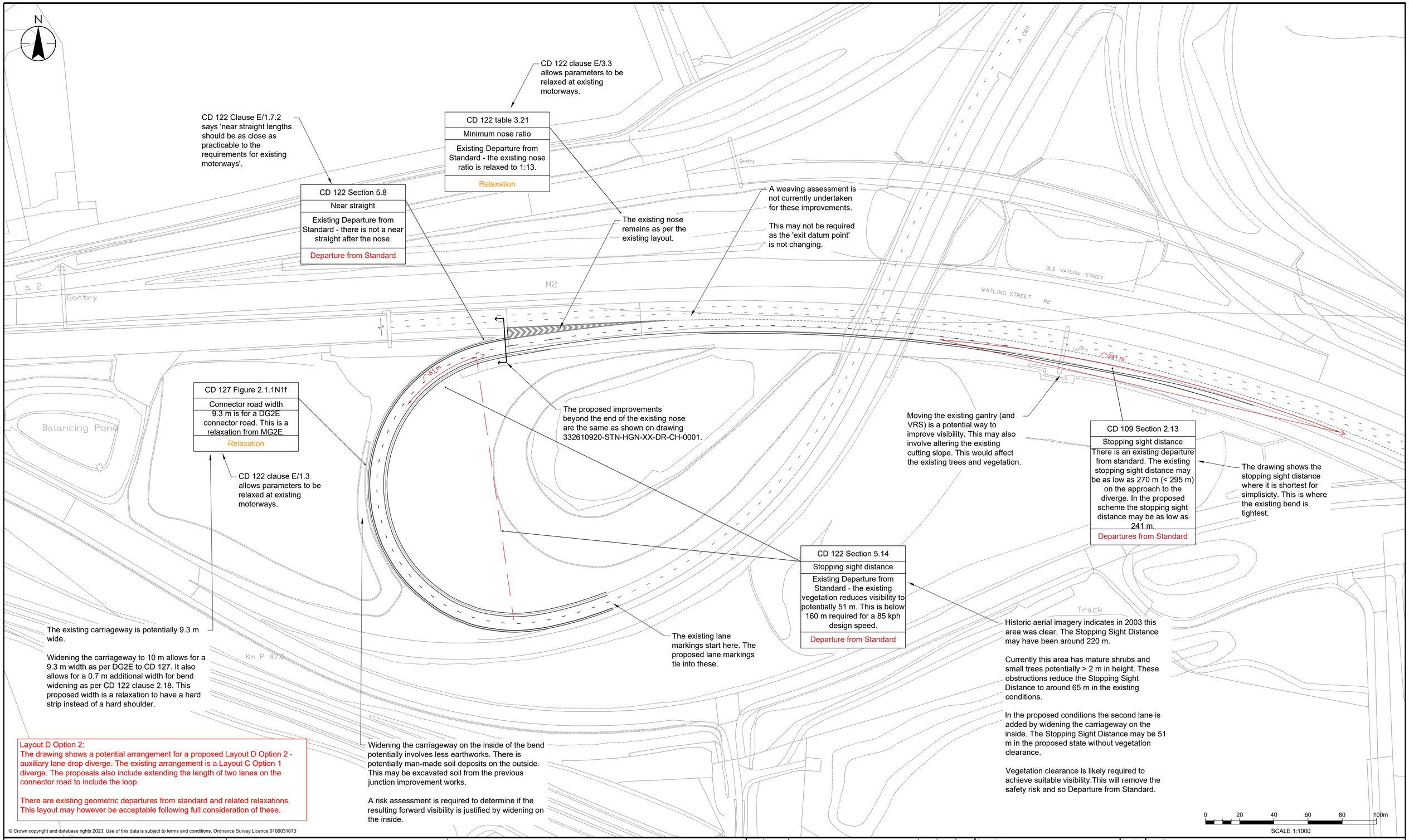
Client: Uniper SE

Project Title: MedwayOne M2J1

Drawing Title:
FEASIBILITY STUDY
M2 TO A289 DIVERGE (NB)
SCHEME A
IMPROVING THE CONNECTOR ROAD

Scale	Designed	Drawn	Checked	Approved
1:1000	-	RC	JA	JA
Original Size	**Date**	**Date**	**Date**	**Date**
A1	-	2024.03.14	2024.03.14	2024.03.14

Drawing Number: HE PIN 332610929 - Originator STN - Volume -HGN- Location XX - Type DR - Role CH - Number 0001
Project Ref. No.: 10569
Revision: P01



General Notes

1. This drawing shall be read in conjunction with all other relevant documentation.
2. Do not scale from this drawing.
3. All dimensions are in metres unless specified otherwise.
4. The information on this drawing is based on limited OS information.
5. The dimensions shown are assumed and require verifying through surveys.
6. This drawing shows a potential option(s) from an initial feasibility design. The potential option(s) is indicatively shown for information only. These are subject to outline and detailed design. Further changes may be required.
7. The constraints and potential departures from standard shown/listed are not exhaustive. More may become apparent through further investigations, surveys and during the detailed design.

Notes

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Rev.	Date	Description	Drawn	Chk'd	App'd
P01	14.03.24	FIRST ISSUE	RC	JA	JA

Drawing Status: FOR INFORMATION
Suitability: S2

Stantec
www.stantec.com/uk

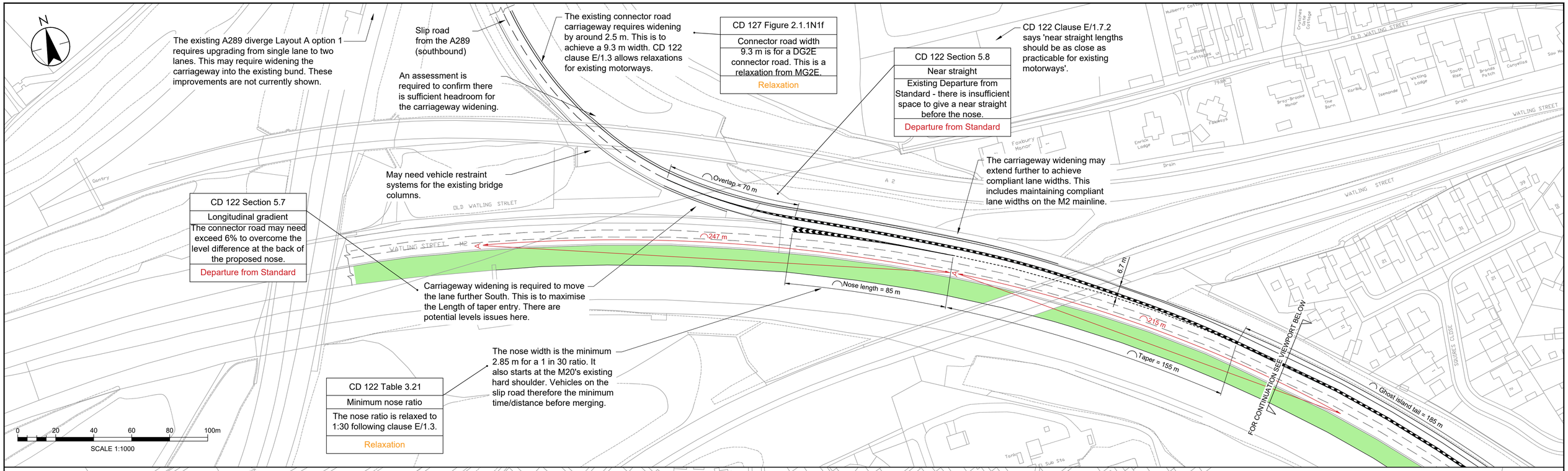
Client: Uniper SE

Project Title: MedwayOne M2J1

Drawing Title:
FEASIBILITY STUDY
M2 TO A289 DIVERGE (NB)
SCHEME B
IMPROVING THE CONNECTOR ROAD & DIVERGE

Scale	Designed	Drawn	Checked	Approved
1:1000	-	RC	JA	JA
Original Size	**Date**	**Date**	**Date**	**Date**
A1	-	2024.03.14	2024.03.14	2024.03.14

Drawing Number: HE PIN 332610929 - Originator STN - Volume -HGN- - Location XX - Type DR - Role CH - Number 0002
Project Ref. No.: 10569
Revision: P01



General Notes

1. This drawing shall be read in conjunction with all other relevant documentation.
2. Do not scale from this drawing.
3. All dimensions are in metres unless specified otherwise.
4. The information on this drawing is based on limited OS information.
5. The dimensions shown are assumed and require verifying through surveys.
6. This drawing shows a potential option(s) from an initial feasibility design. The potential option(s) is indicatively shown for information only. These are subject to outline and detailed design. Further changes may be required.
7. The constraints and potential departures from standard shown/listed are not exhaustive. More may become apparent through further investigations, surveys and during the detailed design.

Notes

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Rev.	Date	Description	Drawn	Chk'd	App'd
P01	14.03.24	FIRST ISSUE	RC	JA	JA

Drawing Status: FOR INFORMATION
Suitability: S2

Stantec
www.stantec.com/uk

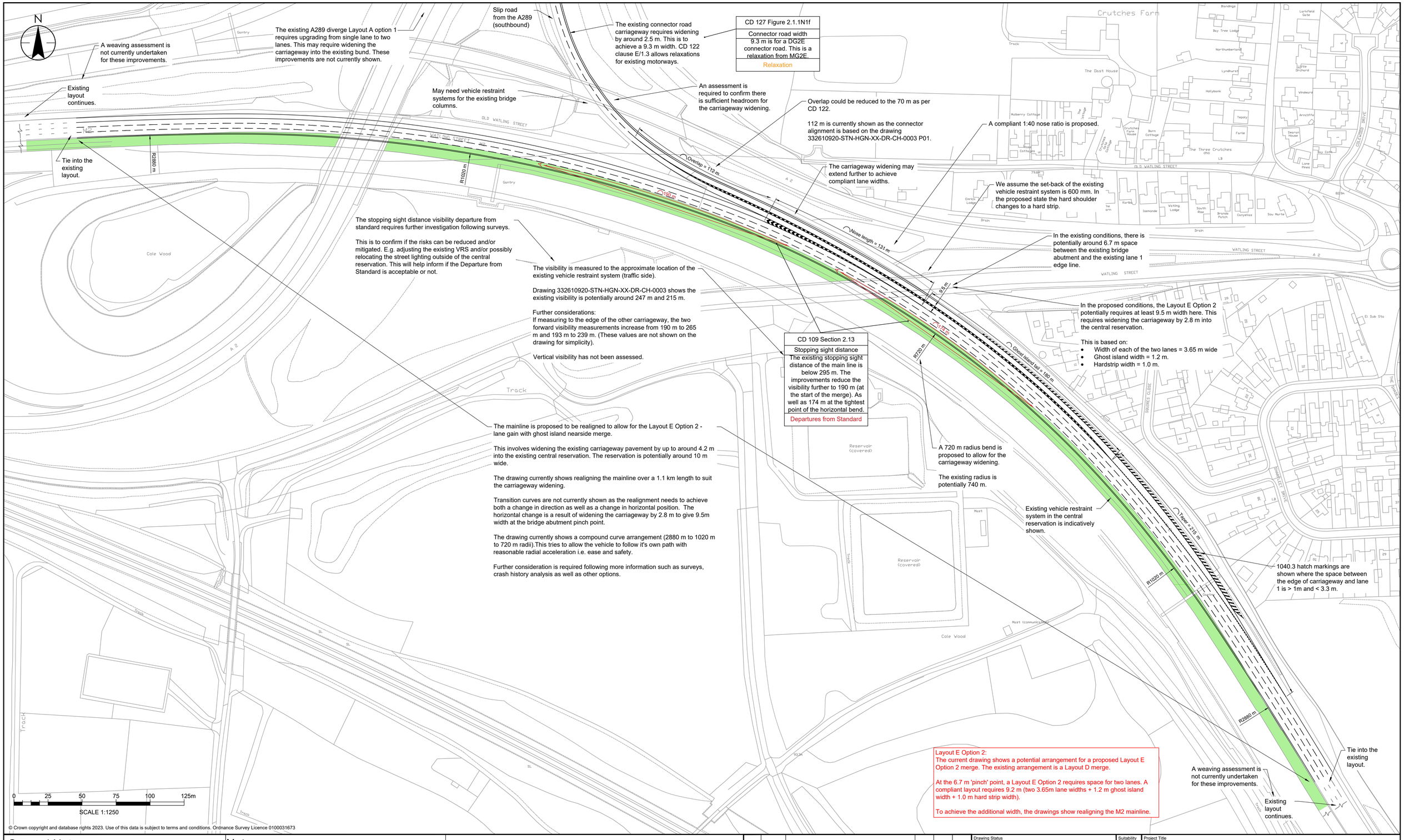
Client: Uniper SE

Project Title: MedwayOne M2J1

Drawing Title: FEASIBILITY STUDY
A289 TO M2 MERGE (SB)
SCHEME C
IMPROVING THE MERGE

Scale	Designed	Drawn	Checked	Approved
1:1000	-	RC	JA	JA
Original Size	**Date**	**Date**	**Date**	**Date**
A1	-	2024.03.14	2024.03.14	2024.03.14

Drawing Number: HE PIN 332610929 - Originator STN - Volume -HDG- Location XX - Type DR - Role CH - Number 0003
Project Ref. No.: 10569
Revision: P01



General Notes

1. This drawing shall be read in conjunction with all other relevant documentation.
2. Do not scale from this drawing.
3. All dimensions are in metres unless specified otherwise.
4. The information on this drawing is based on limited OS information.
5. The dimensions shown are assumed and require verifying through surveys.
6. This drawing shows a potential option(s) from an initial feasibility design. The potential option(s) is indicatively shown for information only. These are subject to outline and detailed design. Further changes may be required.
7. The constraints and potential departures from standard shown/listed are not exhaustive. More may become apparent through further investigations, surveys and during the detailed design.

Notes

This document is suitable only for the purpose noted above.
Use of this document for any other purpose is not permitted.

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Rev.	Date	Description	Drawn	Chk'd	App'd
P01	14.03.24	FIRST ISSUE	RC	JA	JA

Drawing Status: FOR INFORMATION
Suitability: S2

Stantec
www.stantec.com/uk

Client: Uniper SE

Project Title: MedwayOne M2J1

Drawing Title:
FEASIBILITY STUDY
A289 TO M2 MERGE (SB)
SCHEME D
IMPROVING THE MERGE & REALIGNING THE M2

Scale	Designed	Drawn	Checked	Approved
1:1250	-	RC	JA	JA
Original Size	**Date**	**Date**	**Date**	**Date**
A1	-	2024.03.14	2024.03.14	2024.03.14

Drawing Number: HE PIN 332610920 - Originator STN - Volume -HGN- Location XX - Type DR - Role CH - Number 0004
Project Ref. No.: 10569
Revision: P01