Appendix D -The design Rationale Notes

M11 Junction 7A

Essex County Council

Highways Design Rationale

B3553F05-0000-SD-0012 | P1

15 May 2019

M11 Junction 7A

Project No:	B3553F05
Document Title:	Highways Design Rationale
Document No.:	B3553F05-0000-SD-0012
Revision:	P1
Date:	15 May 2019
Client Name:	Essex County Council
Client No:	Client Reference
Project Manager:	Paul Manamike
Author:	Soham Sikdar
File Name:	C:\Users\ThompsD5\Documents\02 - Projects\B3553F05 - M11 J7A\Proof of Evidence\Design Rationale\Design Rationale Re-Written rev1.docx

Jacobs U.K. Limited

Simpson House
6 Cherry Orchard Road
Croydon CR9 6BE
United Kingdom
T +44 (0)20 8686 8212
F +44 (0)20 8681 2499
www.jacobs.com

© Copyright 2019 Jacobs U.K. Limited. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This document has been prepared on behalf of, and for the exclusive use of Jacobs' client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this document by any third party.

Document history and status

Revision	Date	Description	By	Review	Approved
P0	31/05/2017	First Issue	S. Sikdar	A. Kontoh	P. Manamike
P1	15/05/2019	Updated to include further design changes	D. Thompson	A. Kontoh	P. Manamike

Contents

Executive Summary **1**
1. Introduction **2**
2. Design Rationale **3**
2.1 Design Fix 4 3
2.1.1 General Overview 3
2.1.2 Gilden Way South 3
2.1.3 Gilden Way North 3
2.1.4 Link Road 3
2.1.5 M11 Slip Roads & Dumbbell Roundabouts 3
2.2 Design fix 5 4
2.2.1 General Overview 4
2.2.2 Gilden Way South 4
2.2.3 Gilden Way North 4
2.2.4 Link Roads 5
2.2.5 M11 Slip Roads & Dumbbell Roundabouts 6
2.3 Design Stage 4/5 8
2.3.1 General Overview: 8
2.3.2 Gilden Way South 8
2.3.3 Gilden Way North 8
2.3.4 Link Road 8
2.3.5 M11 Slip Roads & Dumbbell Roundabouts 9

Appendix A. Design Rationale Checklists (Stage 4/5)
Appendix B. Design Rationale Checklist (Historic redline Fix)

Executive Summary

In 2013, Essex County Council (ECC) set out the scheme objectives and started the process of developing and sifting the strategic options. This process resulted in a short list of six viable options, of which the M11 J7A option was deemed to be the optimal solution and was taken forward to the next stage of design development. The design progressed through the options development stage and the Redline Fix was presented as the baseline scheme.

In December 2013, public information events were held from which it emerged there was support for a Northern Bypass as an alternative to the proposed scheme, or as a future scheme. Therefore, in November 2014 ECC instructed the project team that more improvement options were required prior to Public Consultation as the baseline scheme did not show the long-term strategic intent clearly. The development of the baseline scheme was therefore developed to include the future plans for a northern bypass, this was known as the Blue Route.

In July 2015 public information events were held to show the current technical designs of the proposed Blue Route scheme. The Blue Route was taken forward into Design Fix 4 where the removal of the 'loop' from the eastbound link was replaced with an at grade roundabout.

Between 11th May and 6th July 2016, Public consultation were undertaken to formally receive views from the public, communities, local council, organisations and businesses about the scheme.

Following consultation, Design Fix 5 was undertaken to address comments/concerns raised. Changes included the widening of Gilden Way and, following a technical review, the Churchgate roundabout was redesigned to be a fully incorporated 'hamburger' roundabout to further improve traffic movement.

The scheme went for Planning in 2017 and consent was given on 21st July 2017. Design Stage 4/5 follows on from this which includes a Phased construction and subsequent removal of Phase 2b which in turn required the Link Road to be developed with dual lanes to enable it to operate in the interim period.

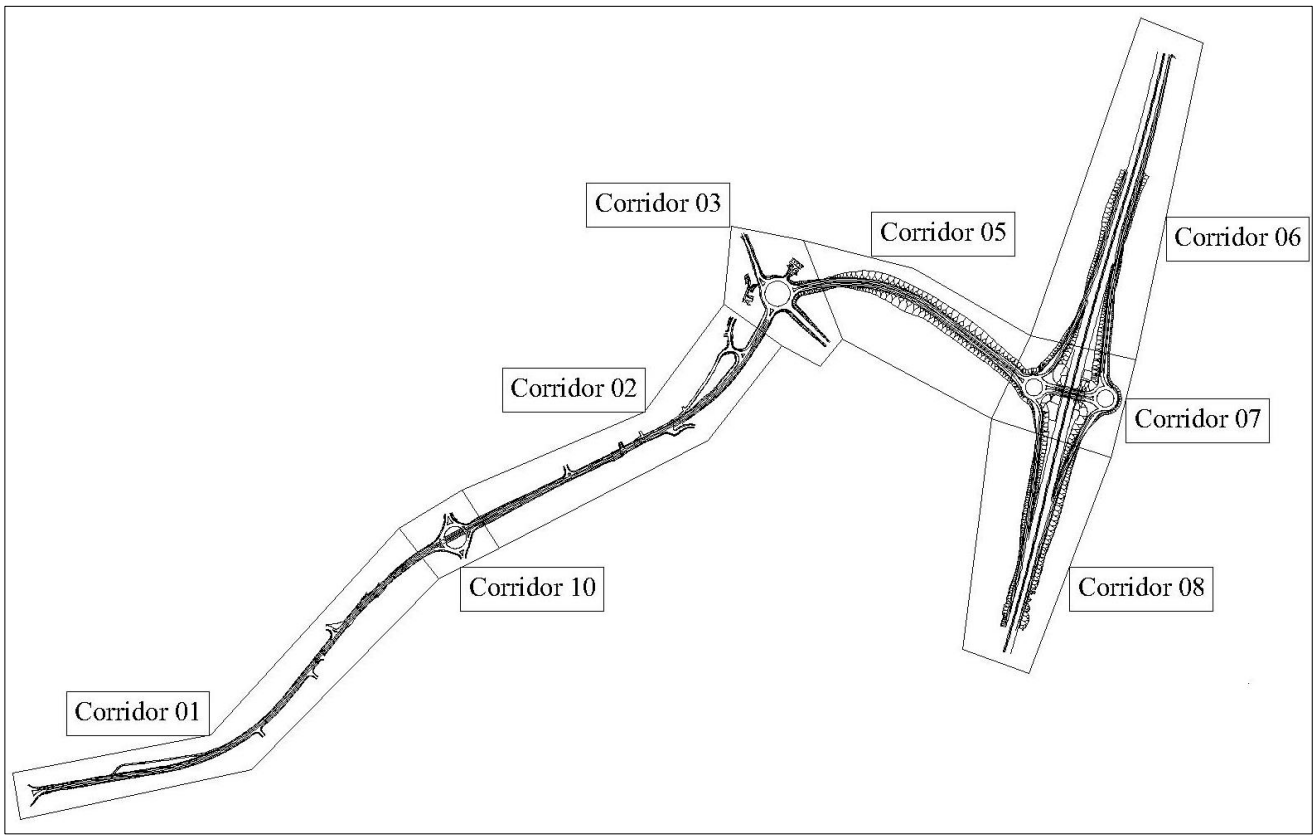
1. Introduction

The purpose of this Design Rationale is to document the changes and the reasons behind why decisions were made during the design development of the M11 J7A scheme.

To enhance production, the modelling of the scheme has been undertaken using Autodesk Civils 3D and broken down into ten corridor models as listed below;

- Corridor 01 – Gilden Way South
- Corridor 02 – Gilden Way North
- Corridor 03 – Sheering Road Roundabout
- Corridor 04 – NOT USED - Removed due to the phased design
- Corridor 05 – Link Road
- Corridor 06 – Northbound Merge & Southbound Diverge
- Corridor 07 – Eastern & Western Roundabouts and Dumbbell Link
- Corridor 08 – Northbound Diverge & Southbound Merge
- Corridor 09 – NOT USED - Northern Bypass Dummy Alignment
- Corridor 10 – Churchgate Roundabout

The corridor model listed above are shown in the diagram below;



A design rationale and alignment details for each corridor are described herein, structured in chronological order.

2. Design Rationale

2.1 Design Fix 4

2.1.1 General Overview

Following the public information events held in July 2015 the design for the Blue Route option was carried forward into Design Fix 4. Below is a summary of the changes which occurred during this design stage.

2.1.2 Gilden Way South

No changes have been incorporated during this stage of design.

2.1.3 Gilden Way North

Gilden Way was designed using a Design Speed of 70kph, 5% superelevation and a minimum horizontal curvature of 360m in accordance with the Design Manual for Roads and Bridges (DMRB). The proposed road terminates prior to the bus stop to minimise the impact on the existing road.

North of the Campion's roundabout, Sheering Road has been designed with the following sub-standard geometry in order to reduce the impact on the adjacent woodland to the east;

- Vertical curvature has been designed considering Absolute Minimum Sag K values to reduce the impact on property and adjacent woodland.
- Stopping Sight Distance is below Desirable Minimum at the immediate approach to the junction.
- The physical Island on this road has been designed based on the auto tracking of HGV vehicles.
- The alignment has been curtailed before the bridge over Pincey Brook.

The 'Link to Existing Sheering Road' (the Campion's Access), has been designed as an access road. It has been tied in with the existing Sheering Road at each end. The junction to Gilden Way has been designed for HGV vehicle access. Mayfield Farm junction has been designed for HGV Vehicles and visibility analysis carried out considering X=9m and Y =120m. Turning heads have been designed for refuse vehicles.

2.1.4 Link Road

Design Speed for the Northern Bypass is 100kph and 70kph for the associated links. The Northern Bypass has a D2AP cross section whilst the links have DG1C and MG1C cross sections.

To enable the earthworks to match in both options, a WS2 cross-section has been used for the eastbound merge loop which is a non-standard option and widening of the verge has been carried out near the nose of merge and diverge.

The radius of the loop has been kept the same as the original model. Thus, the horizontal curvature and Sight Stopping Distance is sub-standard.

For the eastbound merge loop and westbound diverge, swept path analysis for 15.5m and 16.5m articulated vehicles has been undertaken. The loop has been checked by auto tracking to ensure vehicles can pass a stranded 16.5m HGV.

2.1.5 M11 Slip Roads & Dumbbell Roundabouts

Northbound Diverge: Type A Diverge layout has been selected to best meet the requirements for AM and PM peak traffic flows, whilst not affecting current 3 lane provision on M11.

Northbound Merge: Type B Merge layout has been selected to lessen the impact on the existing Sheering Hall subway.

Southbound Diverge: Type A Diverge layout has been selected to avoid impact on existing Sheering Hall subway.

Southbound Merge: Type B Merge layout has been selected to best meet the requirements for AM and PM peak traffic flows, whilst not affecting current 3 lane provision on M11.

The relaxations and departures due to the choice of cross-section and layout type and the allowances permitted by IAN 149 are listed in relevant Checksheets and Appendix B.

2.2 Design fix 5

2.2.1 General Overview

The Link Road cross section was changed to a DG2E cross section. Gilden Way has been widened from a two-lane single carriageway to a WS2+1. Following a technical review, the Churchgate roundabout has been redesigned to be a fully incorporated 'hamburger' roundabout which will further improve traffic movement.

Details are given in Appendix B: Design Rationale Checklists (Historic Redline Fix).

2.2.2 Gilden Way South

Traffic modelling shows a requirement for the existing 2 lane single carriageway cross section to be changed to a WS2+1 with 2 x 3.3m lanes for southbound traffic and 1 x 3.3m lane for northbound traffic separated by double white lines (100mm wide lines at gap of 90mm). The design has been developed to keep levels as close to the existing pavement levels as possible, the primary purpose being to avoid land take from private properties. The design includes a 2.5m wide footway on the nearside of the northbound lane and verge on the nearside of southbound lane.

Constraints include a wooded area near London Road roundabout, the properties on the east and a retaining wall opposite to the Oxley's. The Churchgate subway (located near to the bus stop on the northbound carriageway) is also considered to be a constraint.

The tie-in to existing roundabout levels has been undertaken as no changes are proposed to the roundabout itself. Modifications to several approaching lanes and exit widths have been incorporated into the design to satisfy the traffic information. Taper ratio and lengths were taken from TD 27.

Gilden Way will have a posted speed limit of 40mph, therefore a Design Speed of 70kph has been selected. An objective of the design is to minimise land take from private lands, this has impacted on the horizontal and vertical geometry whereby introducing relaxations and departures, which the project was to avoid.

To avoid land take, the widths of footway/verge were reduced in some locations, earthworks slopes increase from 1:3 to 1:2 and the taper lengths and widths of bus stops were kept as existing. The verge widening for visibility at the exit from Churchgate Roundabout to Gilden Way South was done for one step below SSD also to avoid land take.

The design of the Mulberry Green junction was originally based on TD 42, considering it to be a left-in left-out junction with the exception of buses. Following comments raised in the Road Safety Audit, the provision of buses to make a right turn into Mulberry Green was removed. The tie-in along Mulberry Green was achieved in as short a distance as possible. The width of the pedestrian crossing was retained in the existing condition (this is a departure which is to be changed in future design).

Preliminary designs for the access roads were undertaken with the intention of carrying out detailed design in the next design stage. A minimum grade of 2% has been maintained for the access roads, except for the access to the driveway of the house near Mulberry Green junction which has a slope of approximately 14% and that has been retained in the current design.

The existing location for the Toucan crossing is maintained. An additional Toucan crossing was introduced further south and a Zebra crossing at the London Road roundabout. The Zebra crossing was subsequently changed to a Toucan crossing and shifted away from the roundabout following comments received from the Road Safety Audit.

2.2.3 Gilden Way North

As with Gilden Way South, the carriageway cross section for Gilden Way north has been changed to a WS2+1 and all junction islands have been modified to be left-in left-out as there are safety issues with allowing right turn manoeuvres across two lanes. All levels have been kept as close to the existing pavement levels as possible, the

primary purpose being to avoid land take from private properties. Slopes of earthworks were considered as 1:2 in certain stretches also to avoid land take.

The bus stop on the northbound lane has been shifted further north to avoid land take from the Campion's due to the increase in carriageway width. The bus lay-by on the southbound carriageway has also been shifted 30m south (opposite Marsh Lane) to avoid land take and fit in a reduced width footway. The alignment of Gilden Way mainline has been slightly modified to remove land take from land owners around Campion's (opposite of Mayfield farm access).

Preliminary design for Marsh lane access has been developed with detailed design for tie-in being undertaken in the next design stage.

The taper and subsequent verge widening of roundabout approach of Gilden Way to Sheering Road roundabout was modified as per traffic requirement.

Mayfield farm access was redesigned to provide appropriate dwell length.

The lane width of Sheering Road was increased to 3m from existing 2.65m. Roundabout entry of Sheering Road was also modified, as per traffic requirement. 2 x 3m lanes were provided for 40m at the approach of Sheering Road roundabout.

The changing of priority to Campion's will be taken up in next stage along with modelling of the turning head.

2.2.4 Link Roads

Cross sections for eastbound merge and westbound diverge links were provided as MG1C and DG2E respectively. However, for construction phasing, the carriageway width of westbound diverge was increased from 7.3m to 8.2m. This approach would satisfy the adequate paved width (8.2m carriageway and 1.0m Hard strip on both sides) for a lane arrangement similar to Gilden Way, i.e. three lanes of 3.3m and 0.3m lane marking.

The Northern Bypass was realigned by adjusting the bearing of the straight leading to the west dumbbell roundabout as J7A was shifted south and vertical alignment amended accordingly. Future proofing the scheme for the Northern Bypass is now a fundamental requirement of the project. The Design Speed remains the same.

The relocation of J7A also saw the 'loop' being replaced by a dumbbell roundabout arrangement. Care was taken so that the levels above Pincey brook and Sheering Road remain same, also providing sufficient clearance between the Sheering Road dumbbell link and Northern Bypass. It is assumed a clear gap of 10m (FRL to FRL) should be sufficient.

Geometric design of the eastbound merge and Link Road was undertaken in such a way to provide an approximate slope of 1:3 between the verge of the links and the verge of Northern Bypass.

According to the design speed of the Northern Bypass (100kph), the design speed of eastbound merge and Link Road would be 60kph. However, when operating singly in earlier phase of construction the design speed is 70kph, so the design speed of both links was considered as 70kph.

To prevent the diverge link earthworks encroaching into the land to the south, several options have been presented for the link road. Verge widening has thus been restricted for the through visibility of the diverge link operating singly. Verge widening for mainline visibility for exit slip (as per TD 22 fig 4/3) was not considered as this would have resulted in embankment encroaching to the wooded area.

For the Phase 1 option, the Northern Bypass would not be constructed. Therefore, the master alignment of eastbound merge and the westbound diverge link extended up to the western roundabout edge and tied in horizontally with the edge of carriageway of the Northern Bypass. The vertical design was tied in from the edge of western roundabout to the tip of the nose taper of the master alignment of both links and matched with the proposed surface of the Northern Bypass. Thus, this design is treated as future proof design.

The minimum radius of horizontal curvature is considered to be 360m, which requires 5% superelevation for 70kph Design Speed. It was considered a higher super-elevation would be unsafe when this links operates in the temporary phase during construction of the eastbound merge Link. Also, as the conditions are very tight, the q value for transition lengths is taken as 0.6 for the westbound diverge link.

Owing to level difference of the Northern Bypass nose and Pincey Brook roundabout, the vertical geometry of the eastbound merge link is on the steeper side. The gradient at the exit from Pincey Brook roundabout is 3.9% and increasing towards downstream. The maximum gradient provided is 7.9% as compared to the maximum allowed

gradient of 8%. This needs to be checked against the flow arrows to a smooth surface and looked to be modified in the next stage of design.

Entry path radius for eastbound merge link at western roundabout (130m) and the westbound diverge link at Sheering Road roundabout (105m) are both a departure. These will be readjusted in the next design stage.

At the beginning of the optioneering study, an Inscribed Circle Diameter (ICD) of the Pincey Brook roundabout was proposed to be the same as Sheering Road roundabout. However, according to traffic analysis of the layout arrangement, another two options have been presented for Pincey Brook roundabout by reducing ICD to 60m and 50m. Finally, 50m ICD was considered with some specified detail of flare length, entry width etc. for the dumbbell link, received from traffic department.

Horizontal alignment of the dumbbell link has been adjusted in response to the Tree Survey data. A horizontal curve of 520m has been provided to provide clearance from the tree line as well as to provide proper entry path radius for the roundabouts at both ends.

Sheering Road roundabout entry from dumbbell link and the exit of Link Road were too close. Several optioneering have been made to keep some distance in between these two links. Finally, 10m entry kerb radius has been opted for keeping distance between the links.

2.2.5 M11 Slip Roads & Dumbbell Roundabouts

Due to revised traffic data, there was no requirement of Type B Layout for Southbound Merge, so it was changed to Type A.

Lengths of taper of Southbound Diverge link have been corrected and verge widening for exit slip visibility of Southbound Diverge also carried out in accordance with TD 22. This affected the subway width which needed to be increased. As the subway was affected, it was decided to provide proper taper length for the Northbound Merge in accordance with TD 22, and thus not relaxing it by using IAN 149.

The Junction 7A Dumbbell roundabout shifted south as a part of optioneering to avoid extension of subway. It was endeavoured to fit in proper geometry and limit the extents within the subway on the north and bridge in the south. For this purpose, some of the geometric parameters were relaxed in some slip roads using IAN 149. They are discussed subsequently.

- Northbound Diverge:
  - Layout type C is needed in PM peak and type A is needed in AM peak. Layout type A is adopted in the design.
  - Length of exit taper reduced to 150m instead of 170m.
  - Nose length provided as 70m instead of 80m.
- Northbound Merge:
  - Layout type E is needed in PM peak and type B is needed in PM peak. Layout type B is adopted in the design.
  - Minimum Auxiliary Lane length reduced to 190m instead of 230m.
  - Nose length provided as 85m instead of 115m.
  - Length of Auxiliary Lane Taper (this would be entry taper as this is layout type B) reduced to 55m instead of 75m.
  - A sag curve with K=13 has been provided after the back of the nose in order to raise the vertical profile of the slip road.
  - A crest curve with K=17 has been provided on the approach to the roundabout in order to keep the exit longitudinal gradient to 2%.
- Southbound Diverge:
  - Layout type C is needed in AM peak and type A is needed in PM peak. Layout type A is adopted in the design.

    - A sag curve with K=20 (2 steps below for mainline) was provided along the nose length in order to raise the vertical profile of the slip road.

- Southbound Merge: No relaxation to this link is needed by the application of IAN 149.
    - Layout type is A for both AM and PM peaks.

An assumption made was that the changes in layout type do not affect the traffic flows of the related links. Salient features of the design are noted below;

- The ICD of both the roundabouts are kept the same as the Blue Route Option. There were no intimations to do otherwise from traffic point of view.
- The level difference of the dumbbell link from M11 mainline is 10m.
- The roundabout positions were fixed such that the dumbbell link is perpendicular to the mainline and the approach to the dumbbell roundabouts are to the right.
- Design speeds for all slip roads are 70kph.

2.3 Design Stage 4/5

2.3.1 General Overview:

A phased construction was introduced in Design Stage 4/5 and Phase 2B removed from the scope of works. This resulted in the need to redesign the Link Road to incorporate a dual lane cross section. The design is to future proof for the Northern Bypass and accommodate the modelled traffic flows. Emphasis was made on the need to keep the proposed southern earthworks toe line as for the stage 3 design in order to prevent impacting on The Mores Wood to the south.

Due to project requirements the Autodesk Civils 3D models were converted to BIM Level 2 in accordance to Highways England Data Asset Management. The phased constructions resulted in the removal of Corridor 04, a redesign of the westbound diverge alignment and remodelling of following models:

- Corridor 03 – Removal of Sheering Dumbbell link, remodelling of Sheering Road roundabout with new Westbound diverge alignment at the roundabout approach and providing new pond access from the roundabout.
- Corridor 05 – Remodelling of Link Road along with the revised alignment.
- Corridor 03 –Remodelling of Western roundabout approach with new Westbound diverge alignment.
- Detailed work done in each Civil3D Alignment and Corridor models are described corridor-wise.

Details are given in Appendix A: Design Rationale Checklists (Stage 45).

2.3.2 Gilden Way South

Proposals to infill the existing Churchgate subway at chainage 1050m on Gilden Way have been withdrawn.

No other changes have been incorporated during this design stage.

2.3.3 Gilden Way North

No changes have been incorporated during this design stage.

2.3.4 Link Road

The Link Road has been changed from DG2E cross section to a D2UAP. Although the current environment is classified as ‘rural’, the Client has instructed that the design of the Link Road should be based on the future use and thus an urban road classification is to be used. The D2UAP Link Road has been designed with the following;

- 1.8m Central Reserve, 2 lane (3.65m wide) carriageway without hard strip and a 2.5m wide verge
- In accordance with DMRB TD 22/06, clause 1.34, for urban all-purpose road cross section the speed limit for dual carriageway would be 60mph or less. The posted speed limit is 50mph and therefore a Design Speed of 85kph has been selected.
- To ensure the horizontal and vertical alignment will tie-in to the future Northern Bypass.
- Maintaining the line of the southern earthworks toe to avoid impacting on The Mores woodland.
- Verge width increased to achieve required Sight Stopping Distance.
- Entry path radius and other geometric parameters of the Sheering Road roundabout modified to accommodate the change in Link Road cross section.

The Northern Bypass alignment and cross section (D2AP) has been followed for the first 50m from the western roundabout.

The horizontal alignment then bifurcates towards the southern side in such a way that the inner edge of westbound carriageway of the westbound link and the outer edge of carriageway of the future Northern Bypass would be the determining factor to have minimum 130m exit taper length, 70m of nose and 1 in 15 nose ratio for the future

proposal of the diverge link in accordance with DMRB TD 22/06 (Type A diverge). For this bifurcation, the first 200m radius has been followed to align with the Northern bypass alignment. Following this, a 1020m horizontal radius followed by straight link to accommodate the future nose geometry.

To accommodate the entry and exit path geometry as per DMRB TD 16/07, the end of the alignment at the Sheering Road roundabout has been fixed with a straight link.

A horizontal radius of 360m has been fitted between the two straight links with the appropriate transitions. The transition length is restricted to a value of $\sqrt{24R}$, i.e. within 92.952m. Therefore, considering a gross value, 90m transition length has been proposed at the both sides of the horizontal curve.

Super elevation has been designed according to 85kph design speed for the entire alignment at one step below the Desirable Minimum. For a distance of 20m before the giveaway line to Sheering Road roundabout, a 2% crossfall has been provided.

The vertical geometry of the Link Road, up to the back of the nose location, has been based on the proposed Northern bypass top surface.

2.3.5 M11 Slip Roads & Dumbbell Roundabouts

Further design development has enabled two departures associated with the vertical alignment of the northbound merge and one departure associated with the vertical alignment of the southbound diverge to be designed out.

No other changes have been incorporated during this design stage.

Appendix A. Design Rationale Checklists (Stage 4/5)

Corridor 01 - Gilden Way South

Design Series:	100 series - Gilden Way South corridor modelling in Civil 3D (Design Stage 4/5)
Team member responsible for design/ modelling:	Abhik Ranjan Ghosh / Sudip Chakraborty
Design fix used	Design Stage 4/5
Design revision and date	Rev. P0 Date: 31-05-17
Design standards used:	• The DMRB guidelines: - TD 9/93,TD 27/05, TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	• Departure (Cross Sectional element): The proposed cross section is a modified TD 70/08 Wide Single 2+1 carriageway cross section in a Semi-Urban environment together with junction layouts not in accordance with Clauses 2.2. 4.2. 4.4 and 4.6 of TD 70/08, along Gilden Way/Sheering Road. • Bus laybys designed in accordance with Figure 19 of TFL Accessible Bus Stop Design Guidance Revised Edition 2017
Assumptions / Design Notes/ Methodology	• There is no change proposed before the finalisation of the operational assessment of traffic capacity for redesign the junctions. Hence, as mentioned in the General Overview earlier, the corridor model is updated with the revised assemblies with proper targeting as proposed in the previous design. The previous assemblies then deleted from the model file. All the broken reference of the surface and alignment rechecked.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	• Potential for NMUs to enter high speed road network at M11 J7A - Use of clear signage of carriageway restrictions directing NMUs away from high speed links to be incorporated. • Potential for a vehicle incident from impacting kerb face at high speed –splayed kerbs with 125mm upstand provided as discussed in meeting with UK.
Alternate design options considered	N/A
Recommendations for next stage:	• The access/junctions design may need change after finalisation of the operational assessment of traffic capacity. Junction visibility check will be followed thereon. • Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 02 - Gilden Way North

Design Series:	100 series - Gilden Way North corridor modelling in Civil 3D (Design Stage 4/5)
Team member responsible for design/modelling:	Abhik Ranjan Ghosh / Sudip Chakraborty
Design fix used	Design Stage 4/5
Design revision and date	Rev.P0 Date: 31-05-17
Design standards used:	• The DMRB guidelines: TD 9/93,TD 27/05, TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	• Departure (Cross Sectional element): The proposed cross section is a modified TD 70/08 Wide Single 2+1 carriageway cross section in a Semi-Urban environment together with junction layouts not in accordance with Clauses 2.2. 4.2. 4.4 and 4.6 of TD 70/08, along Gilden Way/Sheering Road. • Bus laybys designed in accordance with Figure 19 of TFL Accessible Bus Stop Design Guidance Revised Edition 2017
Assumptions / Design Notes/ Methodology	• There is no change proposed before the finalisation of the operational assessment of traffic capacity for redesign the junctions. Hence, as mentioned in the General Overview earlier, the corridor model is updated with the revised assemblies with proper targeting as proposed in the previous design. The previous assemblies then deleted from the model file. All the broken reference of the surface and alignment rechecked.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	• Potential for NMUs to enter high speed road network at M11 J7A - Use of clear signage of carriageway restrictions directing NMUs away from high speed links to be incorporated. • Potential for a vehicle incident from impacting kerb face at high speed –splayed kerbs with 125mm upstand proposed as discussed in meeting with UK.
Alternate design options considered	N/A
Recommendations for next stage:	• The access/junctions design may need change after finalisation of the operational assessment of traffic capacity. Junction visibility check will be followed thereon. • Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 03 - Sheering Road Roundabout & Links

Design Series:	100 series – Sheering Road Roundabout along with the links corridor modelling in Civil 3D (Design Stage 4/5)
Team member responsible for design/modelling:	Soham Sikdar Abhik Ranjan Ghosh
Design fix used	Design Stage 4/5
Design revision and date	Rev.P0 Date: 31-05-17
Design standards used:	• The DMRB guidelines: TD 9/93,TD 27/05, TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	• Departure on Sheering Road (Cross Sectional Element): The cross section is not as per standard at the tie in to the existing Sheering Road. • Relaxation on Sheering Road (Horizontal alignment radius): From ch. 64.391m to ch. 64.533m, the horizontal radii is 329.703m. These is one step below from the desirable minimum. • Relaxation on Sheering Road (Vertical Alignment, Sag K): From ch. 9.683m to ch. 90.266m, the vertical sag K is two step below desirable. • Relaxation on Sheering Road (Vertical Alignment, Crest K): From ch. 93.493m to ch. 153.333m, the vertical crest K is two step below desirable. • Relaxation on Sheering Road (Vertical Alignment, Gradient): From Ch: 90.266m to Ch: 93.493m vertical gradient > 6% (Desirable Max Grade).
Assumptions / Design Notes/ Methodology	• As mentioned in the General Overview, the corridor model is updated with the revised assemblies with proper targeting as proposed in the previous design. The previous assemblies then deleted from the model file. All the broken reference of the surface and alignment rechecked. • New assembly for D2UAP cross section has been prepared and according to the revised Westbound diverge alignment roundabout approach of the Link Road has been created. The inner and outer edge of the roundabout approach geometry proposed to maintain the TD 16 standard for entry-exit parameters. • Central Reserve has been proposed as paved with 0.125m raised kerbs. • Visibility for the roundabout approach has not been carried out. This will be carried out along with the proper verge widening after confirmation of the alignment layout plan. • The Pincey Brook dumbbell alignment and the corridor removed from the model. • A new pond access alignment is designed which is passing nearside of the pond earthwork toe line to provide space for the future Pincey Brook dumbbell link. • For special purpose, a developmental access of 2-lane 5.5m carriageway and 2m wide footway at both side has been designed between the Gilden Way and Link Road. A splitter island is also proposed for the access. However, this has been designed only to check for the space to accommodate the access. This will not be shown in the final design.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	• Potential for a vehicle incident from impacting kerb face at high speed –splayed kerbs with 125mm upstand proposed as discussed in meeting with UK.

Alternate design options considered	N/A
Recommendations for next stage:	• The access/junctions design may need change after finalisation of the operational assessment of traffic capacity. Junction visibility check will be followed thereon. • Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 05 - Link Road

Design Series:	100 series- Westbound Diverge corridor modelling in Civil 3D
Team member responsible for design/modelling:	Soham Sikdar
Design fix used	Design Stage 4/5
Design revision and date	Rev.P0 Date: 31-05-17
Design standards used:	• The DMRB guidelines: TD 9/93,TD 27/05, TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	• The proposed cross section (D2UAP in TD 27/05 Figure 4-4a) is not considered a departure and the environment is stated as urban
Assumptions / Design Notes/ Methodology	• As mentioned in the General Overview, the corridor model is updated with the revised assemblies with proper targeting as proposed in the previous design. The previous assemblies then deleted from the model file. All the broken reference of the surface and alignment rechecked. • New assembly for D2UAP cross section is prepared and has been applied for the entire link with 2.5m wide verge. • Central Reserve has been proposed as paved with 0.125m raised kerbs. The offset alignment is prepared from the edge of the central reserve modelled in Carriageway design. From these offset alignment, the raised kerb and footway proposed at the central reserve location. • The roundabout approaches have been modelled in accordance with DMRB TD 16/07. • The whole model has been exported to GENIO and imported in MX for visibility analysis. In MX, through visibility analysis made with 215m SSD, 1.05m Eye height and 0.26m object height. The visibility splay has been generated in MX and that was copied in Civil3D model.

	• According to the combined visibility splay of through visibility and roundabout visibility, the verge has been widened. • Due to the land constraint at wooded land and proximity of land between Redline boundary, few tweaks have been made on the vertical alignment of the diverge link and the steep earthwork slope (1in2) has been provided at the following chainages: from ch. 298 to ch. 410 from ch. 510 to ch. 580
Exclusions	•
Unusual elements:	•
H&S Risks / proposed mitigation	•
Alternate design options considered	NA
Recommendations for next stage:	• Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 06 - Northbound Merge & Southbound Diverge

Design Series:	100 series - Northbound Merge and Southbound Diverge corridor modelling in Civil 3D
Team member responsible for design/modelling:	Soham Sikdar
Design fix used	Design Stage 4/5
Design revision and date	Rev.P0 Date: 31-05-17 Rev. P1 Date: 16-11-17
Design standards used:	• The DMRB guidelines: TD 9/93,TD 27/05, TD 42/95,TD 41/95,HD 39/16,TD 16/07 • TA 66/95
Documents	•
Departures / Relaxations:	• Departure on Northbound Merge (Merge/Diverge Layout): At PM Peak the recommended merge layout is Type E, whereas the proposed merge layout is Type B. It is a departure from standard. • Departure on Northbound Merge (Nose Length, Entry Exit Tapper and Auxiliary length): Nose Length, Auxiliary taper length and Auxiliary lane length is less than the desirable as per TD 22/06 Table 4/4. It is a departure as per cl 4.22 of TD 22/06. • Departure on Southbound Diverge (Nose Length, Ghost Island Head, Entry Exit Tapper): Nose Length, Ghost Island Head and Entry exit tapper lengths proposed are 70m, 160m

	and 150m respectively, which is less than the desirable as per TD 22/06 Table 4/4. It is a departure as per cl 4.22 of TD 22/06. • The Southbound Diverge was changed to a Type B Ghost Island Diverge due to the large predicted traffic flow for design. This layout is deemed consistent with the general operational requirement of " the two lane westbound" traffic into Harlow Town. It is a departure from standard.
Assumptions / Design Notes/ Methodology	• There is no such change proposed before the finalisation of the operational assessment of traffic capacity for redesign the junctions. Hence, as mentioned in the General Overview, the corridor model is updated with the revised assemblies with proper targeting as proposed in the previous design. The previous assemblies then deleted from the model file. All the broken reference of the surface and alignment rechecked. • Only item added in this model is the proposed Police Layby. According to TA66/95, Figure 4/2, the horizontal alignment has been proposed. The location of the proposed layby has been confirmed by UK considering the visibility issue for existing M11. According to the standard, the vertical alignment has been designed. It is concluded that the proposed layby would be on the surface of the extended verge on M11 which tie-in with proposed earthwork toe of Northbound merge link. Due to this, M11 proposed surface scheme is copied to this model for the reference surface. The 3D modelling of the Police layby has been done on that surface for generating the earthwork toe line. However, finally the proposed surface of the police layby is incorporated in the Combined surface of the current file.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	• There might be change in scope in design of slip roads due to removal of available departures. Change in scope will consume total redesign of the whole Grade Separated junction.
Alternate design options considered	N/A
Recommendations for next stage:	• M11 Grade Separated junction design will be updated based on UK/Highways England requirement and design will be amended taking into account of planning conditions. • Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 07 - Eastern & Western Roundabouts and Dumbbell Link

Design Series:	100 series- Eastern and Western Roundabouts and Dumbbell link
Team member responsible for design/modelling:	Soham Sikdar
Design fix used	Design Stage 4/5

Design revision and date	Rev.P0 Date: 31-05-17
Design standards used:	• The DMRB guidelines: TD 9/93,TD 27/05, TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	•
Assumptions / Design Notes/ Methodology	• There is no change proposed before the finalisation of the operational assessment of traffic capacity for redesign the junctions. Hence, as mentioned in the General Overview, the corridor model is updated with the revised assemblies with proper targeting as proposed in the previous design. The previous assemblies then deleted from the model file. All the broken reference of the surface and alignment rechecked. • The proposed corridor model of the Eastbound merge link and Link Road has been removed. • New assembly for D2UAP cross section has been prepared and according to the revised Westbound diverge alignment roundabout approach of the Link Road has been created. The inner and outer edge of the roundabout approach geometry proposed to maintain the TD 16 standard for entry-exit parameters. • The verge width has been tapered from 5.85m to 2.5m from ch. 50 to ch. 100 because of the following calculation: - Total width of D2AP c/s including verge=28.1m - Total width of D2UAP c/s including verge=21.4m - Therefore, (28.1-21.4)/2 = 3.35m extra width required to match the total width. Hence, the verge width = 2.25+3.35=5.85m 50m stretch at the start of the link near the Western Roundabout, the verge has been widened to 5.85m to accommodate the entire road width of the future D2AP cross section of the Northern bypass. • Central Reserve has been proposed as paved with 0.125m raised kerbs. • Visibility for the roundabout approach has not been carried out. This will be carried out along with the proper verge widening after confirmation of the alignment layout plan.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	• There might be change in scope in design of slip roads due to removal of available departures. Change in scope will consume total redesign of the whole Grade Separated junction.
Alternate design options considered	N/A
Recommendations for next stage:	• M11 Grade Separated junction design will be updated based on UK/Highways England requirement and design will be amended taking into account of planning conditions. • Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 08 - Northbound Diverge & Southbound Merge

Design Series:	100 series- Northbound Diverge and Southbound Merge corridor modelling in Civil 3D
Team member responsible for design/modelling:	Soham Sikdar
Design fix used	Design Stage 4/5
Design revision and date	Rev.P0 Date: 31-05-17
Design standards used:	• The DMRB guidelines: TD 9/93,TD 27/05, TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	•
Assumptions / Design Notes/ Methodology	• There is no change proposed before the finalisation of the operational assessment of traffic capacity for redesign the junctions. Hence, as mentioned in the General Overview, the corridor model is updated with the revised assemblies with proper targeting as proposed in the previous design. The previous assemblies then deleted from the model file. All the broken reference of the surface and alignment rechecked.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	• According to the drainage information, vertical alignment of Southbound Merge link at the nose length may be revised. • There might be change in scope in design of slip roads due to removal of available departures. Change in scope will consume total redesign of the whole Grade Separated junction.
Alternate design options considered	NA
Recommendations for next stage:	• M11 Grade Separated junction design will be updated based on UK/Highways England requirement and design will be amended taking into account of planning conditions. • Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 10 - Churchgate Roundabout

Design Series:	100 series- Churchgate Roundabout corridor modelling in Civil 3D
Team member responsible for design/modelling:	Soham Sikdar
Design fix used	Design Stage 4/5

Design revision and date	Rev.P0 Date: 31-05-17
Design standards used:	• The DMRB guidelines: TD 9/93,TD 27/05, TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	•
Assumptions / Design Notes/ Methodology	• There is no change proposed before the finalisation of the operational assessment of traffic capacity for redesign the junctions. Hence, as mentioned in the General Overview, the corridor model is updated with the revised assemblies with proper targeting as proposed in the previous design. The previous assemblies then deleted from the model file. All the broken reference of the surface and alignment rechecked.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	•
Alternate design options considered	NA
Recommendations for next stage:	• Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Appendix B. Design Rationale Checklist (Historic redline Fix)

Corridor 01 – Gilden Way South

Design Series:	100 series - Gilden Way South corridor modelling in Civil 3D (Red Line Fix)
Team member responsible for design/ modelling:	Abhik Ranjan Ghosh
Design fix used	Redline Fix
Design revision and date	Rev. P0 Date: 31-05-16
Design standards used:	• The DMRB guidelines:- TD 9/93,TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	• Design Rationale • 100 Series: Gilden Way South corridor modelling in Civil 3D
Departures / Relaxations:	• Refer design check sheets in following ProjectWise folder : *pw://reaapp69.europe.jacobs.com:Jacobs_UK_Highways_SS4/Documents/Projects/B3553F05_M11_Junction_7A/0650BIM/Caculations/DesignChecksheets/* • There is no departure or relaxations in Gilden Way South alignment.
Assumptions / Design Notes/ Methodology	• GENIO files prepared from MX model-design Fix-5. The Alignment and Profile of Gilden Way South along with all necessary other alignments (near London and Churchgate Roundabouts i.e crown and splitter island, field access/cycletracks) have been imported in Civil 3D. Minor fractional corrections related to length of curve, transitions length done (the transition length corresponding to 70Kph, 490m radius & q=0.3 was 48m in MX model which is changed to 50m in civil 3D model) and an alignment model file created (B3553F05-0000-M-0001) as per file naming convention where Gilden Way South alignment saved & others remained in this corridor model. • Shortcuts created. • Corridor modelling done in file B3553F05-0000-C-0001 • The Cross section and the earthwork slope (1:2) have been followed as per MX model. • The splitter island and crown profiles required modification (approx. 50mm to 100mm) at their start and end point for proper tie in /modelling/Navisworks with existing surfaces comparing to MX model. • The footway cross fall has been amended towards the pavement side which was towards the outer side in MX model and discussed with UK.(Refer TA 90/05 ,Clause 6.1 & DMRB HD39/16,clause 2.12 & 2.14),due to this change the earthwork toe line extends slightly from MX model. • The cross fall of Bus Bay (only the tapering portion of west side bus bay) provided towards the outside in super elevation portion of Gilden Way South (near Chainage km 1000). • It is noticed that the contour plan inherited from MX model was not correct near exit lane from London Roundabout and this was modified after discussion with UK. • 0.5m verge on both sides of Field accesses have been added and the same carriageway width maintained in comparison to the MX model.

	• Vertical profile of the turning radii of field access have been designed in Civil 3D afresh as per requirement. Refer the junction strategy sheet which is prepared after discussion with UK. • The length of all three field accesses located south of Gilden Way have been kept as per MX model. It is observed that this length required to be increased to maintain a 2% gradient up to dwelling area of minimum 5m and maximum 10% gradient thereafter (Reference: TD 42/95,clause 3.6 and TD41/95 clause 2.7). Corner radii have been kept as minimum 6m in rural and 10m in urban area .These design may change following the "Junction strategy sheet "prepared after discussion with UK and after vehicle tracking with specific type of vehicle. • The kerb at field accesses have been provided up to turning radii only following the latest 1100 series (kerb, footways & paved areas) X-ref. • Navisworks file & BIM check sheet prepared. • The footway/cycleway running parallel to the west of Gilden Way south is abutting the carriageway in MX model and that has been followed in Civil 3D model also. It is confirmed/discussed with UK in that a verge of 0.5m will not be provided in between carriageway and footway/cycleway due to constraints (Refer: TA 90/05 clause 7.22.) • Gilden Way North and South alignment and profile combined first and then new profile designed based on 150mm overlay design. The baseline alignment and profile for this corridor have been changed to new combined alignment and profile. *The detailed methodology for overlay design has been explained later under subheading '**Model-B3553F05-M-0004**'.*
Exclusions	• Accommodation works.
Unusual elements:	• It is noticed that the contour plan prepared in MX model (Design Fix 5) between changes 920 to 1160 is not correct which is not reflecting the change in super elevation whereas the Civil3D model represents the super elevation correctly presents the scenario. • It is noticed that the earthwork toe in civil 3D exceeds the same from MX model at few locations. The possible reason may be the change of footway cross fall towards pavement side in Civil 3D model which was towards outer side in MX model.
H&S Risks / proposed mitigation	• Potential for NMUs to enter high speed road network at M11 J7A - Use of clear signage of carriageway restrictions directing NMUs away from high speed links to be incorporated. • Potential for a vehicle incident from impacting kerb face at high speed –splayed kerbs with 125mm upstand provided as discussed in meeting with UK.
Alternate design options considered	N/A
Recommendations for next stage:	• Update the design with revised alignment proposals, if any, with the next design fix. • All the access/junctions design may need change after finalisation of the "junction strategy". Junction visibility check will be followed thereon. • Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 02 - Gildenway North

Design Series:	100 series - Gilden Way North and Campions Access corridor modelling in Civil 3D (Red Line Fix)
Team member responsible for design/modelling:	Rajib Das Abhik Ranjan Ghosh
Design fix used	Redline Fix
Design revision and date	Rev.P0 Date: 30-05-16
Design standards used:	• The DMRB guidelines: TD 9/93,TD 42/95, TD 41/95,HD 39/16,TD 16/07
Documents	• Design Rationale • 100 Series: Gilden Way North corridor modelling in Civil 3D
Departures / Relaxations:	• Refer design check sheets in following ProjectWise folder : *pw://reaapp69.europe.jacobs.com:Jacobs_UK_Highways_SS4/Documents/Projects/B3553F05_M11_Junction_7A/0650BIM/Caculations/DesignChecksheets/* • There is no departure or relaxations in Gilden Way North alignment. The super elevation has been changed in Civil 3D comparing to Mx design.
Assumptions / Design Notes/ Methodology	• GENIO files prepared from MX model. The Alignment and Profile of Gilden Way Nouth along with all necessary other alignments (near at Churchgate Roundabouts i.e crown and splitter island, field access/cycletracks) have been imported in Civil 3D. Minor fractional corrections related to length of curve, transitions length done and an alignment model file created (B3553F05-0000-M-0001) as per file naming convention where the Gilden Way North alignment saved & others remained in this corridor model. • Shortcuts created. • Corridor modelling done in file B3553F05-0000-C-0002 • The earthwork slope (1:2 and 1:3) has been followed as per MX model. • The ICD of Church gate roundabout (North side) has been modified in Civil 3D as there was no proper geometry available in MX. • The splitter island and crown profiles required modification at their start and end point for proper tie in /modelling with existing surfaces comparing to MX model & done. • The footway cross fall has been amended towards the pavement side which was towards the outer side in MX model and discussed with UK.(Refer TA 90/05 ,Clause 6.1 & DMRB HD39/16,clause 2.12 & 2.14) • Vertical profile of the turning radii of field accesses/junctions have been designed in Civil 3D afresh as per requirement. • The kerb at field accesses have been provided as per the latest 1100 series (kerb, footways & paved areas) X-ref. This needs to be checked with hatching drawing prepared for 1100 series recently (Red Line Fix).Changes may require accordingly. It is checked and model updated on 13/06/2016. • BIM check sheet prepared. • Campions access has been designed with 50kph design speed hence the taper of carriageway from 3m to 6m has been kept in 1:25 • Verge widening has been done as per MX Design Fix. • The corner radius of access track at Ch.280 is required to increase w.r.t articulated vehicle although this will be carried out later. Regarding this “junction design strategy “has been

	prepared so these junctions may need change after confirmation of the above junction design strategy. • The slope at bus stop location has been provided is in the same direction as carriageway. • The priority arrangement of Campions access junction with main line has been changed from MX model. • Checked with BIM compliance & updated with proper naming conventions, styles, labels & point codes. • Bus bay location near Km 0+430 changed according to the 2D hatch plan & footways added accordingly. • The turning head near west of km 0+500 of Gilden Way North alignment is designed afresh as per Essex County Council Design guide (" Size 3 Side Turn"-Page 159) & checked with refuse vehicle. Accordingly necessary update in footway taper done in main model. The Sheering Road Access Alignment-1 (towards south) has been extended upto that turning head which is a change from previous MX model & The Sheering Road Access Alignment-2 (towards north)also extended following existing ground profile upto the Sheering Road Roundabout for smooth modelling work. • Gilden Way North and South alignment and profile combined first and then new profile designed based on 150mm overlay design. The baseline alignment and profile for this corridor have been changed to new combined alignment and profile. *The detailed methodology for overlay design has been explained later under subheading '**Model-B3553F05-M-0004**'.*
Exclusions	• Accommodation works.
Unusual elements:	• It is noticed that the earthwork toe in civil 3D exceeds the same from MX model after Ch.850 and link to sheering road from Campions access.
H&S Risks / proposed mitigation	• Potential for NMUs to enter high speed road network at M11 J7A - Use of clear signage of carriageway restrictions directing NMUs away from high speed links to be incorporated. • Potential for a vehicle incident from impacting kerb face at high speed –splayed kerbs with 125mm upstand proposed as discussed in meeting with UK.
Alternate design options considered	N/A
Recommendations for next stage:	• Update the design with revised alignment proposals, if any, with the next design fix. • Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs. • All the access/junctions design may need change after finalisation of the "junction strategy". Junction visibility check will be followed thereon.
Signed:	

Corridor 03 - Sheering Road Roundabout & Links

Design Series:	100 series – Sheering Road Roundabout along with the links corridor modelling in Civil 3D (Red Line Fix)

Team member responsible for design/modelling:	Soham Sikdar Abhik Ranjan Ghosh
Design fix used	Redline Fix
Design revision and date	Rev.P0 Date: 20-06-16
Design standards used:	• The DMRB guidelines: TD 9/93,TD 42/95, TD 41/95,HD 39/16,TD 16/07
Documents	• Design Rationale • 100 Series: Sheering Road Roundabout along with the links corridor modelling in Civil 3D
Departures / Relaxations:	• Refer design check sheets in following ProjectWise folder : *pw://reaapp69.europe.jacobs.com:Jacobs_UK_Highways_SS4/Documents/Projects/B3553F05_M11_Junction_7A/0650BIM/Caculations/DesignChecksheets/*
Assumptions / Design Notes/ Methodology	• GENIO files prepared from MX model. The horizontal and vertical alignment of Gilden Way Nouth, Sheering Road, Campion Access road, Sheering Road Roundabout, Pincey Brook Dumbbell link and WB Diverge links along with all necessary other alignments (i.e. alignment for splitter island, corner radius, access/footways etc.) have been imported in Civil 3D. Minor fractional corrections related to length of curve, transitions length done. The alignment for Campion Access saved in alignment model file (B3553F05-0000-M-0001) and rest of the other alignments are saved in another alignment model file (B3553F05-0000-M-0002) as per file naming convention. • Shortcuts created. • Corridor modelling done in file named as B3553F05-0000-C-0003. • The earthwork slope (1:2 and 1:3) has been followed as per MX model. In this model, especially southbound arm of Sheering Road roundabout consist of 1:2 earthwork slope. • Entry kerb radius for the Pincey Brook Dumbbell link provides as 10m to maintain distance with the entry of WB Link. • The splitter island and crown profiles required modification at their start and end point for proper tie in /modelling with existing surfaces comparing to MX model & done. • The footway cross fall has been amended towards the pavement side which was towards the outer side in MX model and discussed with UK. (Refer TA 90/05, Clause 6.1 & DMRB HD39/16, clause 2.12 & 2.14). Footway width provided as 1.5m both side of the Sheering Road to make similarity, this also differs from the MX model. The width of footway joining the Sheering road and Campion access also kept as 1.5m. • Constant footway width of 1.5m has been provided at the southbound link of Sheering road. The adjacent verge width is provided as 0.5m at this stretch. • Vertical profile of the turning radii of field accesses/junctions have been designed in Civil 3D afresh as per requirement. • In the MX design, roundabout exit link of Sheering road has not been tapered in proper way. In Civil3D, the lane width is kept as 3m and widen to 4.5m wide at the end of Splitter Island with 1 in 20 tapering and design the roundabout exit accordingly. • Campion access is kept as existing up to ch. 140m. Therefore, corridor has not been created up to this chainage. To provide the turning head at the RHS of the access near ch. 130m, a

	parallel alignment created which matched with the existing ground level and design the corner of turning head accordingly. • Both side kerbs with 125mm upstand have been provided at the Campion Access. • Transition/Drop kerb has been taken care at present design. • Verge widening has been done as per Visibility analysis. • BIM check sheet prepared. • Checked with BIM compliance & updated with proper naming conventions, styles, labels & point codes.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	• Potential for a vehicle incident from impacting kerb face at high speed –splayed kerbs with 125mm upstand proposed as discussed in meeting with UK.
Alternate design options considered	N/A
Recommendations for next stage:	• Update the design with revised alignment proposals, if any, with the next design fix. • Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs. • Splitter Island would need to be designed after finalisation of Kerb design.
Signed:	

Corridor 04 - Pincey Brook Roundabout and Dumbbell Link

Design Series:	100 series – Pincey Brook Roundabout along with the links corridor modelling in Civil 3D (Red Line Fix)
Team member responsible for design/modelling:	Soham Sikdar Abhik Ranjan Ghosh
Design fix used	Redline Fix
Design revision and date	Rev.P0 Date: 20-06-16
Design standards used:	• The DMRB guidelines: TD 9/93,TD 42/95, TD 41/95,HD 39/16,TD 16/07
Documents	• Design Rationale • 100 Series: Pincey Brook Roundabout along with the links corridor modelling in Civil 3D

Departures / Relaxations:	• Refer design check sheets in following ProjectWise folder : *pw://reaapp69.europe.jacobs.com:Jacobs_UK_Highways_SS4/Documents/Projects/B3553F05_M11_Junction_7A/0650BIM/Caculations/DesignChecksheets/*
Assumptions / Design Notes/ Methodology	• GENIO files prepared from MX model. The horizontal and vertical alignment of Pincey Brook Roundabout, Pincey Brook Dumbbell link and EB Merge links along with all necessary other alignments (i.e. alignment for splitter island, corner radius, etc.) have been imported in Civil 3D. Minor fractional corrections related to length of curve, transitions length done. • The vertical gradient at the start and end point of Sheering Road roundabout alignment was not the same as inherited from the MX design. This has been revised in Civil3D. Due to the amendment, there has no impact at the vertical profile of EB Merge alignment but the Pincey Brook Dumbbell link alignment has to be raised by 120mm. • The alignments are saved in alignment model file (B3553F05-0000-M-0002) as per file naming convention. • Shortcuts created. • Corridor modelling done in file named as B3553F05-0000-C-0004. • Create reference of the alignments of Pincey Brook roundabout, Pincey Brook Dumbbell link and EB Merge link from the alignment model. • The splitter island and crown profiles required modification at their start and end point for proper tie in /modelling with existing surfaces comparing to MX model & done. • Corridor modelling has been prepared as per the cross section received from the MX design model. • Transition/Drop kerb has not been taken care at present design. After finalisation of Kerb and Drainage design, finalisation of kerb modelling would be provided. • Splitter Island has been designed with 125mm kerb upstand at this stage. • Verge widening has been done as per visibility analysis. • BIM check sheet prepared. • Checked with BIM compliance & updated with proper naming conventions, styles, labels & point codes.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	• Potential for a vehicle incident from impacting kerb face at high speed –splayed kerbs with 125mm upstand proposed as discussed in meeting with UK.
Alternate design options considered	N/A
Recommendations for next stage:	• Update the design with revised alignment proposals, if any, with the next design fix. • Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs. •
Signed:	

Corridor 05 - Eastbound Merge & Link Road

Design Series:	100 series- Eastbound Merge and Westbound Diverge corridor modelling in Civil 3D
Team member responsible for design/modelling:	Soham Sikdar
Design fix used	Redline Fix
Design revision and date	Rev. P0 Date: 10-06-16
Design standards used:	• The DMRB guidelines:- TD 9/93,TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	• Refer design check sheets in following projectwise folder : *pw://reaapp69.europe.jacobs.com:Jacobs_UK_Highways_SS4/Documents/Projects/B3553F05_M11_Junction_7A/0650BIM/Caculations/DesignChecksheets/*
Assumptions / Design Notes/ Methodology	• The design methodology for creating the alignment for EB Merge and WB Diverge along with the Northern Bypass are given below: ○ First of all the geometry of Northern Bypass has been finalised and the bypass corridor has been designed as per given cross section. ○ The geometric design of EB Merge and WB Diverge has been designed up to the tip of the nose location and considering the all the constraint to join with Pincey Brook and Sheering road roundabout. ○ Both the alignments then extended to match the proposed inner edge of carriageway with 1020m horizontal curvature. ○ The vertical alignments of the links have been designed in such a way that proposed level of the alignments between the tip of the nose and edge of Western roundabout would match with the proposed surface of the Northern bypass. ○ Due to provision of 1020m radius curve, normal camber provided between the tip of the nose and the edge of roundabout. Therefore, it will match the cross fall of the future Northern bypass as well. • GENIO files prepared from Option 2 Phase 1 MX model. The Alignment and Profile of Pincey Brook & Sheering Road roundabout ICDs, Dumbbell link, Northern Bypass, Eastbound Merge and Westbound Diverge have been imported in Civil 3D. Minor fractional corrections related to length of curve, transitions length, vertical curve length etc. have been done. All the alignments are saved in Civil3D alignment model (file name B3553F05-0000-M-0002) as per file naming convention. • Superelevation provided to each alignment.

	• Shortcut created for the Northern Bypass only. A new corridor model file in Projectwise (B3553F05-0000-C-0009) created to prepare a dummy surface of the Northern Bypass. Shortcut created for the surface. • With the reference of Northern Bypass dummy surface, the vertical alignment of Eastbound Merge and Westbound Diverge has been adjusted in the section where the alignment is passing through in the future footprint of the Northern Bypass carriageway. Emphasis has been provided to maintain the level difference between the Northern Bypass dummy surface and the vertical alignment of these two alignments within 20-30mm. To maintain this level difference, vertical crest curve of K value less than 100 has been provided in between the tip of the nose and the tie-in location with the imaginary edge of Northern Bypass carriageway edge. • Shortcuts created for all the alignments. • Corridor modelling done in the file B3553F05-0000-C-0005. • Corridor modelling done from Ch. 50 to Ch. 460 for Eastbound Merge link and from Ch. 50 to Ch. 590 for Link Road in this file. Modelling of the remaining part of the link would be done in the adjacent model files (B3553F05-0000-C-0004 & B3553F05-0000-C-0003). • Separate corridor for each link need to be designed to provide the verge in between the edge of hardstrip of both the links and target the levels of edge of verge. • The Cross section and the earthwork slope (1:3) have been followed as per MX model. • Only verge have been proposed between EB Merge and WB Diverge link. A suitable alignment (radius= 32m) has provided to tie in the verges of each alignment from where earthwork has been provided. • 75mm upstand Kerb have been provided at the merge and diverge links. • Splitter Island has been designed with 125mm kerb upstand at this stage. • Verge widening has been done as per visibility analysis. • Navisworks file & BIM check sheet prepared. • As per UK information, the earthwork slope of WB Diverge link has been increased from 1in3 to 1in2 from ch. 290 to ch. 400 with 20m transition either side.
Exclusions	•
Unusual elements:	•
H&S Risks / proposed mitigation	•
Alternate design options considered	NA
Recommendations for next stage:	• Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.

Signed:	

Corridor 06 - Northbound Merge & Southbound Diverge

Design Series:	100 series - Northbound Merge and Southbound Diverge corridor modelling in Civil 3D
Team member responsible for design/modelling:	Soham Sikdar
Design fix used	Redline Fix
Design revision and date	Rev. P0 Date: 31-05-16
Design standards used:	• The DMRB guidelines:- TD 9/93,TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	• Refer design check sheets in following projectwise folder : *pw://reaapp69.europe.jacobs.com:Jacobs_UK_Highways_SS4/Documents/Projects/B3553F05_M11_Junction_7A/0650BIM/Caculations/DesignChecksheets/*
Assumptions / Design Notes/ Methodology	• Northbound Merge: ○ Type B Merge Layout provided instead of Type E Layout. ○ It is assumed that Type B merge Layout will not cause any adverse impact on the merging traffic to M11. ○ As per work information, MG1A cross section applied. Width of inside and outside verges are more than the standard. 2.5m wide verge applied in both ways whereas per standard inside and outside verge widths are 2.3m and 1.5m respectively. ○ Applying IAN 149, Nose Length of 85 m provided instead of 115m. ○ Applying IAN 149, Length of Entry Taper provided is 150m instead of 205 m. ○ Applying IAN 149, Length of Auxiliary lane provided is 190m instead of 230m. ○ Applying IAN 149, Length of Auxiliary lane Taper provided is 55m instead of 75 m. ○ A sag curve with K=13 has been provided after the back of the nose in order to raise the vertical profile of the slip road. This is considered as one step relaxation. ○ A crest curve with K=17 has been provided on the approach to the roundabout in order to reduce the approach longitudinal gradient to 2%. This is considered as one step relaxation. • Southbound Diverge: ○ Type A Diverge Layout provided instead of Type C Layout. ○ It is assumed that Type A Diverge Layout will not cause any adverse impact on the diverging traffic from M11. ○ As per traffic data, DG2A type cross section provided.

	○ Applying IAN 149, Nose Length of 70 m provided instead of 80m. ○ Applying IAN 149, Length of Exit Taper provided is 150m instead of 185 m. ○ A sag curve with K=20 has been provided along the nose length in order to raise the vertical profile of the slip road. This is considered as one step relaxation. ○ Due to provision of 1000m edge line radi at the tip of the exit taper, the length is cross the existing subway. Therefore, the verge and earthwork is restricted at the tip of the exit taper whereas the tapered carriageway and hard shoulder is continuing up to the end of the edge line radii. • IAN 149 has been applied to accommodate the link taper in within the existing subway at north. • The existing carriageway edge of M11 has been imported from the existing topo survey data and vertical profile has been designed matching with the existing surface. Therefore, there are very small level difference (5-10mm) has been observed. • The designed alignment of the edge of carriageway of M11 is not extended beyond the back of the nose in MX modelling. For design purpose, this alignment is redesigned in Civil3D by extended the alignment beyond the back of the nose and vertical profile readjusted according to the existing surface. • GENIO files prepared from Option 2 Phase 1 MX model. The Alignment and Profile of Northbound Merge and Southbound Diverge along with all necessary other alignments (existing carriageway edge of M11) have been imported in Civil 3D. Minor fractional corrections related to length of curve, transitions length, vertical curve length etc. have been done. All the alignments are saved in Civil3D alignment model (file name B3553F05-0000-M-0003) as per file naming convention. • Shortcuts created. • Corridor modelling done in the file B3553F05-0000-C-0006. • Corridor modelling done up to ch. 240 for Northbound Merge link and Ch. 310 for Southbound Diverge link in this file. Modelling of the remaining part of the link would be done in the adjacent model file (B3553F05-0000-C-0007). • The Cross section and the earthwork slope (1:3) have been followed as per MX model. • Kerb has not been provided at the merge and diverge links. 75mm upstand kerb has been proposed at Eastern and Western roundabout and only at the roundabout approach of the links. • Navisworks file & BIM check sheet prepared. •
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	•
Alternate design options considered	N/A

Recommendations for next stage:	• Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 07 - Eastern & Western Rondabouts and Dumbbell Link

Design Series:	100 series- Eastern and Western Roundabouts and Dumbbell link
Team member responsible for design/modelling:	Soham Sikdar
Design fix used	Redline Fix
Design revision and date	Rev. P0 Date: 06-06-16
Design standards used:	• The DMRB guidelines:- TD 9/93,TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	• Refer design check sheets in following projectwise folder : *pw://reaapp69.europe.jacobs.com:Jacobs_UK_Highways_SS4/Documents/Projects/B3553F05_M11_Junction_7A/0650BIM/Caculations/DesignChecksheets/*
Assumptions / Design Notes/ Methodology	• Corridor modelling done in the file B3553F05-0000-C-0008. • GENIO files prepared from M11 J7A DESIGN R4 - MX model. The Alignment and Profile of Diverge, Merge and Dumbbell links are imported from the alignment model (file name B3553F05-0000-M-0003). The corner radi alignments for each merge & diverge link and inner & outer edge radi of dumbbell link have been imported in the current Civil 3D model. Long sections for the corner and edge radi are prepared with respect to the vertical details of the respective 3D polyline which are imported from the MX model. All the alignments are saved as per file naming convention. • Corridor modelling done from Ch. 340 to start of corner radi for Northbound Diverge link, from Ch. 320 to start of corner radi for Southbound Merge link, from Ch. 240 to start of corner radi for Northbound Merge link and from Ch. 310 to start of corner radi for Southbound Diverge link in this file. Modelling of the remaining part of the merge and diverge links would be done in the adjacent model file (B3553F05-0000-C-0006 and B3553F05-0000-C-0008). • Corridor model prepare with respect to the corner radius up to the edge of roundabout. • Verge widening provided as per MX verge strings. Detail verge widening would be done after finalising the corridor and importing the model to MX for detail visibility check. • The Cross section and the earthwork slope (1:3) have been followed as per MX model.

	• 75mm upstand kerb has been proposed at Eastern and Western roundabout and at the roundabout approaches of each links.
	• It was discussed that 4.5m wide central segment of dumbbell link would be raised island. For this following 3 options has been identified:
	  ○ Prepare corridor with respect to Dumbbell link alignment with footway assembly 75mm kerb at the central segment. For this arrangement, whole corridor from carriageway onwards would be lowered down by 75mm and the edge radi need to be redesigned accordingly.
	  ○ Creating a second profile of 75mm upstand on the dumbbell link. This might be created some misperception in future modelling stage and not a good design approach.
	  ○ Creating dummy surface with respect to dumbbell link and creating parallel alignment 2.25m offset distance at both side and drip the level to the dummy surface. The assemblies are created at the edge of carriageway and prepare the corridor with respect to the parallel alignment.
	However, the third option has been opted.
	• Footway assembly has been provided at the raised central part of the dumbbell link.
	• To simplify the corridor modelling at the dumbbell link, the edge radi alignments are extended up to ch. 20 at the western side and ch. 100 at the eastern side with respect to the dumbbell link and edit the profile accordingly.
	• Navisworks file & BIM check sheet prepared.
	• The splitter islands have been modelled considering 75mm kerb upstand at the dumbbell link at present stage.

Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	•
Alternate design options considered	NA
Recommendations for next stage:	• Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 08 - Northbound Diverge & Southbound Merge

Design Series:	100 series- Northbound Diverge and Southbound Merge corridor modelling in Civil 3D
Team member responsible for	Soham Sikdar

design/modelling:	
Design fix used	Redline Fix
Design revision and date	Rev. P0 Date: 31-05-16
Design standards used:	• The DMRB guidelines:- TD 9/93,TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	• Refer design check sheets in following projectwise folder : *pw://reaapp69.europe.jacobs.com:Jacobs_UK_Highways_SS4/Documents/Projects/B3553F05_M11_Junction_7A/0650BIM/Caculations/DesignChecksheets/*
Assumptions / Design Notes/ Methodology	• Southbound Merge: ○ As traffic information, MG1A cross section applied. Width of inside and outside verges are more than the standard. 2.5m wide verge applied in both ways whereas per standard inside and outside verge widths are 2.3m and 1.5m respectively. ○ Due to match the level at the roundabout, the vertical alignment raised at the nose length from the extended crossfall of the existing carriageway. This need to be checked by the drainage team for the acceptability. Otherwise, vertical profile would be redesigned accordingly. • Northbound Diverge: ○ Type A Diverge Layout provided instead of Type C Layout. ○ It is assumed that Type A Diverge Layout will not cause any adverse impact on the diverging traffic from M11. ○ As per work information, DG1A cross section applied. Width of inside and outside verges are more than the standard. 2.5m wide verge applied in both ways whereas per standard inside and outside verge widths are 2.3m and 1.5m respectively. ○ Applying IAN 149, Nose Length of 70 m provided instead of 80m. ○ Applying IAN 149, Length of Exit Taper provided is 150m instead of 170 m. ○ Due to provision of 1000m edge line radi at the tip of the exit taper, the length is cross the existing subway. Therefore, the verge and earthwork is restricted at the tip of the exit taper whereas the tapered carriageway and hard shoulder is continuing up to the end of the edge line radi. • IAN 149 has been applied at the Northbound Diverge link to accommodate the link taper within the existing structure at south. • The existing carriageway edge of M11 has been imported from the existing topo survey data and vertical profile has been designed matching with the existing surface. Therefore, there are very small level difference (5-10mm) has been observed. • GENIO files prepared from Option 2 Phase 1 MX model. The Alignment and Profile of Northbound Diverge and Southbound Merge along with all necessary other alignments (existing carriageway edge of M11) have been imported in Civil 3D. Minor fractional corrections related to length of curve, transitions length, vertical curve length etc. have been done. All the alignments are saved in Civil3D alignment model (file name B3553F05-0000-M-0003) as per file naming convention. • Shortcuts created.

	• Corridor modelling done in the file B3553F05-0000-C-0008. • Corridor modelling done up to ch. 340 for Northbound Diverge link and Ch. 320 for Southbound Merge link in this file. Modelling of the remaining part of the link would be done in the adjacent model file (B3553F05-0000-C-0007). • The Cross section and the earthwork slope (1:3) have been followed as per MX model. • Kerb has not been provided at the merge and diverge links. 75mm upstand kerb has been proposed at Eastern and Western roundabout and only at the roundabout approach of the links. • Navisworks file & BIM check sheet prepared.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	• According to the drainage information, vertical alignment of Southbound Merge link at the nose length may be revised.
Alternate design options considered	NA
Recommendations for next stage:	• Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Corridor 10 - Churchgate Roundabout

Design Series:	100 series- Churchgate Roundabout corridor modelling in Civil 3D
Team member responsible for design/modelling:	Abhik Ranjan Ghosh
Design fix used	Redline Fix
Design revision and date	Rev. P0 Date: 21-07-16
Design standards used:	• The DMRB guidelines:- TD 9/93,TD 42/95,TD 41/95,HD 39/16,TD 16/07
Documents	•
Departures / Relaxations:	• Refer design check sheets in following projectwise folder : *pw://reaapp69.europe.jacobs.com:Jacobs_UK_Highways_SS4/Documents/Projects/B3553F05_M11_Junction_7A/0650BIM/Caculations/DesignChecksheets/*
Assumptions / Design Notes/ Methodology	• As per the latest traffic volume, tentative layout plan for Hamburger Arrangement roundabout layout plan drawing inherited from UK Traffic team. • For through Gildenway road, the proposed profile of Combined Gildenway (V-Gilden Way-N & S combined-2)

	• To maintain the existing carriageway level of the existing roundabout, the long section of the ICD was emphasised to match the existing roundabout level. • The long section of the circulatory carriageway was design as per Stockdale method. • Corridor modelling done in the file B3553F05-0000-C-0010. • The whole roundabout has been designed to maintain the earthwork toe line inside the proposed Redline boundary. • Navisworks file & BIM check sheet prepared. • The splitter islands and the central island at the Gildenway mainline have been modelled considering 125mm upstand kerb.
Exclusions	• Accommodation works.
Unusual elements:	•
H&S Risks / proposed mitigation	•
Alternate design options considered	NA
Recommendations for next stage:	• Kerb and footway proposal may change following update in safety audit and drainage design in future. • Pavement team to provide a proposed construction layers for paved areas. • Drainage team to confirm extent of CKDs and BDUs.
Signed:	

Civil3D Model 004: Profile Design for 150mm Overlay of Gilden Way Link

Design Series:	**100 series**- Design of combined Gilden Way North & South alignment and profile considering minimum 150mm overlay thickness at existing carriageway edges in C3D. Revised Alignment name: M-Gilden Way-N & S combined-1 Revised Overlay Profile Name: **V-Gilden Way-N & S combined-2** Reference Profile (Combined MX profile) : V-Gilden Way-N & S combined-1
Team member responsible for design/modelling:	Abhik Ranjan Ghosh
Design fix used	Redline Fix
Design revision and date	Rev. P0 Date: 13-07-16
Design standards used:	• The DMRB guidelines:- TD 9/93, TD 16/07
Documents	•

Departures / Relaxations:	• Refer design check sheets in following projectwise folder : *pw://reaapp69.europe.jacobs.com:Jacobs_UK_Highways_SS4/Documents/Projects/B3553F05_M11_Junction_7A/0650BIM/Caculations/DesignChecksheets/*
Assumptions / Design Notes/ Methodology	• <u>Design Methodology</u> ○ Gilden Way North and South alignment is combined into single alignment & named as "**M-Gilden Way-N & S combined-1**". ○ This horizontal alignment is modified for Hamburger arrangement of Churchgate roundabout. Between ch 1080 to 1550, the alignment is modified as little as possible from previous one considering the latest red line boundary. Other than this zone (ch 1080 to 1550), the alignments of previous Gilden Way North and South are followed horizontally. Super elevation updated as per new design. ○ The profile is also combined into one single profile named as "**V-Gilden Way-N & S combined-1**" & it is tried to keep the levels as close to ground as possible near the Churchgate RBT (ch 1080 to 1550). This is intended to avoid any excessive land-take out of redline boundary. • Steps taken to design the vertical profile are illustrated below: ○ Gilden Way existing carriageway surface is created. ○ Proposed dummy surface based on combined alignment & profile (V1) prepared. ○ Cross sections are generated based on the above two surfaces to identify where & how much lifting up of profile is required to achieve 150mm minimum overlay . ○ The Civil3D inbuilt subassembly for overlay design "OverlayMillAndLevel2" under "Metric Rehab Subassemblies" tab has been used to prepare a corridor-surface and a tentative quick design profile (to be used as a reference only). ○ A smooth profile with proper geometry over this tentative line is prepared. This is named "**V-Gilden Way-N & S combined-2**". And the previous proposed dummy surface is rebuilt with this V2 profile. ○ One target surface i.e. 150mm above the existing carriageway surface is prepared. ○ Two profiles each for the left and right carriageway edges are prepared by draping them on the following surfaces i. Proposed Dummy Surface, and ii. Target surface (150mm above the existing carriageway). ○ The purpose is to do a quick visual check of the availability of 150mm overlay thickness at existing carriageway edges. In the annotation box, their difference is also visible. ○ Based on this the combined profile-V2 is modified/optimised. This gives us the final profile as "**V-Gilden Way-N & S combined-2**". ○ For the iterations, it was also considered that lifting up of the profile does not affect the redline boundary. From ch 1080 to 1550, the profile was not raised significantly as it would have affected the red line boundary. Through the central island of the Churchgate roundabout, the profile was graded out as close to the ground surface for the through lanes. It was also considered that the remaining island would also be graded out.

	• <u>Design Check</u> ○ From the cross sections (prepared earlier) it is checked again that the proposed levels are above the existing ground. ○ Isopachyte surface also prepared to check the presence of any spot/location with level difference less than 150mm.
Exclusions	•
Unusual elements:	•
H&S Risks / proposed mitigation	•
Alternate design options considered	•
Recommendations for next stage:	• The alignment should be checked against safety comments, land take constraints and environmental requirements in future and will be amended accordingly, if required.
Signed:	