M11 Junction 7a

Essex County Council (ECC)

Interim Stage 2 Road Safety Audit & Designer's Response

B3553F05-0000-RP-0170 | P00

November 2018

M11 Junction 7a

Project no:	B3553F05
Document title:	Interim Stage 2 Road Safety Audit & Designer's Response
Document No.:	B3553F05-0000-RP-0170
Revision:	P00
Date:	November 2018
Client name:	Essex County Council (ECC)
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File name:	B3553F05-0000-RP-0170.docx

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Document history and status

Revision	Date	Description	By	Review	Approved
P00	22/11/2018	Designer's Response added for inclusion within the ITT Contract Documents	DT	AK	PM

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1. Introduction

This report has been produced as a result of an Interim Stage 2 Road Safety Audit (RSA) based on the Stage 2 RSA scope set out in Essex County Council's Road Safety Audit Policy and Procedure 2016.

The audit was carried out on the proposals to provide a new grade separated junction (7a) on the M11 and road links to connect the new junction to the existing road network north-east of Harlow, in Essex. The RSA has been carried out at the request of Paul Manamike of Jacobs, on behalf of Essex County Council. The RSA was carried out during April and May 2018. The Audit Request and Brief (Document Reference B3553F05-REP-0146 Rev 0 dated 1 March 2018) gives the following description of the scheme:

"The proposed M11 J7A scheme includes the upgrade of Gilden Way / Sheering Road between London Road Roundabout and Pincey Brook Bridge (also known as Ealing Bridge); 1 new offline roundabout (The Campions Roundabout); a new link road to the M11 and; a new grade separated junction on the M11 between junctions 7 and 8".

"Improvements on Gilden Way include the widening of the existing two lane carriageway to three lanes and will operate as two lanes into Harlow and one lane towards the new junction on the M11. The existing footways and NMU crossings will also be upgraded and improvements to existing junctions /accesses along the route will also be carried out".

"The principal objectives of the scheme are:

- *To improve accessibility to and from Harlow;*
- *To ensure the proposed infrastructure is of the appropriate scale for the future traffic demands of the ECC stated growth.*
- *To facilitate future housing developments around Harlow and employment growth to the east of Harlow; and*
- *To reduce congestion primarily for the A414 corridor."*

The scheme location is shown by the red dashed shape below in Figure 1.

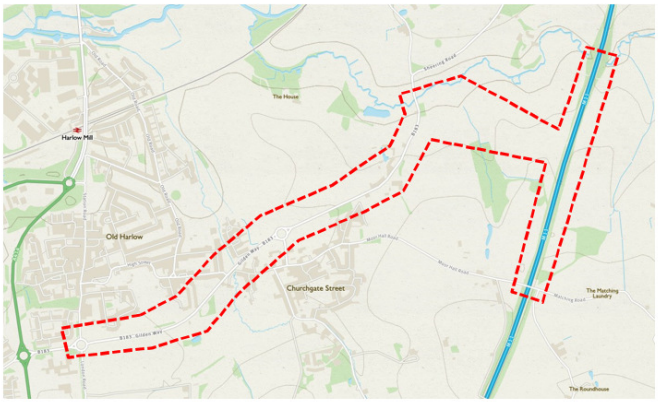


Figure 1 : M11 J7a scheme location

The RSA Team membership was as follows:

- Kate Yeo (RSA Team Leader)

  Associate, Jacobs London Tower Bridge office
- Kate Carpenter (RSA Team Member)

  Senior Consultant, Jacobs London Tower Bridge office

The terms of reference of this Road Safety Audit are as described in Design Manual for Roads and Bridges (DMRB) Volume 5, Section 2, HD19/15 Road Safety Audit (May 2017). The Audit Team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

This RSA does not perform a 'technical check' function on these proposals.

The Interim Stage 2 RSA comprised an examination of the documents provided to the Audit Team by the design team (and listed in Appendix A). A site visit was undertaken on Wednesday 25 April 2018 during daylight hours, between 08.30 and 10.40 hours approximately, and comprised a drive through all of the existing local road elements within the scheme extents, and observations made on foot at relevant locations including junctions, crossings and bus stop areas. The tie-in location with the M11 was not inspected on foot because of the high-speed character, narrow verge and lack of safe routes for pedestrians; detailed observation of internet-based street view imagery was undertaken as well as video recordings made during the site visit.

The traffic flow during the site visit was light and the weather was clear and fine. The road surface was dry.

All comments and recommendations are referenced to the supplied design drawings (where applicable) and the locations have been indicated on the plan in Appendix B.

2. Departures from Standard

A schedule of Relaxations and Departures from Standard have been notified to the Audit Team on the proposals and was included within the Audit Brief supplied. These are reproduced in Table 1 for reference purposes.

Departures and Relaxations are referenced to standards including:

- TD 9/93 - amendment no 1: Highway link design
- TD 27/05 Cross-Sections and Headrooms
- TD 22/06 Layout of Grade Separated Junctions
- TD 70/08 Design of Side Single 2+1 Roads
- HD 26/06 Pavement Design

TD9/93 and TD27/05 make reference to climbing lanes, but do not otherwise provide for a '2+1' cross section, i.e. a single carriageway form with more than one lane in either direction as proposed for substantial sections of this project. As such, it is the view of the Road Safety Audit Team that the design is outside the scope of the standards referenced in the above Schedules of Departures and Relaxations.

The Road Safety Audit Team is of the view that the relevant design standard for this project for Chainages 0-1150 and 1450-2200 should be *TD70/08 Design of Wide Single 2+1 Roads (WS2+1)* which post-dates the above-named standards and is therefore not referenced in those documents

TD70/08 defines Wide Single 2+1 (WS2+1) as: *A wide single carriageway road with two lanes of travel in one direction and a single lane in the opposite direction.* Its scope is given as follows:

1.2 This Standard applies to single carriageway trunk roads in rural areas. TD 9 (DMRB 6.1.1) is to be used to derive the design speed and the associated values for geometric design.
While the design speed for this project over the majority of its extents is given as 70kph with a speed limit of 40mph, the character of the route is rural, with almost no frontage development or other urban features.

TD70/08 contains significant constraints reflecting the asymmetric form and potential resulting road safety hazards and operational performance. Sections of TD70/08 relevant to safety of operation are reproduced below in italics. Mandatory 'black-boxed' sections, for which non-compliance requires a Departure from Standard, are shown in bold text.

2.2 Minor side roads and accesses are to be stopped up and alternative arrangements made, for example through the provision of collector roads. In all cases the question of access to new WS2+1 roads is to be discussed with the Overseeing Organisation during route preparation (see paragraphs 4.1 and 4.2).

4.1 Junctions and accesses require careful consideration with respect to their locations on a WS2+1 road. Junctions and accesses must only be located at changeovers, at WS2+1 interfaces or on the S2 or WS2 road at least 500 metres from that point where the road cross-section returns to S2 or WS2.

4.2 WS2+1 roads must be designed to minimise the number of junctions. This may be achieved by connecting side roads and accesses to a collector road running parallel to the WS2+1 road. The collector road junction with the trunk road should be located as described in paragraph 4.1.

4.4 Left-in/left-out junctions must not be provided on WS2+1 roads except where incorporated within grade separated junctions as described in paragraphs 4.13 to 4.18.

*4.6 An additional fourth lane for right turning vehicles must not be provided on WS2+1 roads. At major/minor priority junctions the middle lane must be dedicated to right-turning traffic, with a single lane provided in each direction through the junction. Priority junction layouts must be in accordance with the geometric standards of **TD 42 (DMRB 6.2.6)**, and to the layouts illustrated in Figures 4/1 and 4/2. Simple junctions must not be provided on WS2+1 roads.*

4.7 Roundabouts are appropriate for junctions on WS2+1 roads. They must be designed in accordance with the requirements of TD 16 (DMRB 6.2.3). Overtaking lane sections may start directly at the exit from the roundabout.

4.8 Differential Acceleration Lanes (DALs) may be provided on the exit from roundabouts to enable vehicles leaving the roundabout to overtake slower vehicles.

4.9 DALs must have a minimum length of 250 metres. Desirable Minimum Stopping Sight Distance must be provided throughout the full length of a DAL.

As part of the Stage 1 Road Safety Audit, the Road Safety Audit Team considered that additional Departures and Relaxations from Standard were therefore likely to be required, along with clarification of the Standards being applied to this design.

Table 1 : Departures from Standard

Ref. No.	Alignment Name	Design Element (Mandatory)	Design Standard	Comments	Current Status
D1	Gilden Way	Cross Section	TD 70/08, and Figure 3/1	Departure for approval to provide a modified TD 70/08 Wide Single 2+1 carriageway cross section in a Semi-Urban environment together with junction/access layouts not in accordance with Clauses 4.1, 4.2, 4.4, 4.6 and 6.2 of TD 70/08, along Gilden Way/Sheering Road.	Local authority geometric departure is in the process of being resubmitted to Essex County Council for approval.
D5	M11 Northbound Diverge	Diverge Layout	TD 22/06 clause 2.43 and fig 2/5 MW	The selected layout of the proposed M11 northbound diverge is not in accordance with the requirements of TD22/06 Cl. 2.43. This is due to the substitution of Type C (lane drop at taper diverge), derived from the use of Figure 2/5 MW, with a Type A (taper diverge). This constitutes a Departure from Standards.	Departure application has been submitted to Highways England and is pending approval.
D6	M11 Southbound Diverge	Diverge Layout	TD 22/06 clause 2.43 and fig 2/5 MW	The selected layout of the proposed M11 southbound diverge is not in accordance with the requirements of TD22/06 Cl. 2.43. This is due to the substitution of Type C (lane drop at taper diverge), derived from the use of Figure 2/5 MW, with a Type B (ghost island diverge). This constitutes a Departure from Standards.	Departure application has been submitted to Highways England and is pending approval.
D10	Link Road between Western Dumbbell Roundabout and Sheering Road Roundabout	Cross section	TD 27/05 Figure 4-3a	Departure for approval to use D2UAP road cross-section in TD27/05 Figure 4-4a instead of D2AP shown in Figure 4-3a of the same standard.	Local authority geometric departure is in the process of being resubmitted to Essex County Council for approval.
D12	M11 Northbound Diverge	Nose Length and Entry Exit Taper	TD 22/06 Table 4/4	The nose length and exit taper length for the proposed M11 northbound diverge are not in accordance with the requirements of TD22/06 Table 4/4 for rural motorways. These lengths are amended by relaxing the road class to 'Rural All-Purpose 120kph' as described in IAN149/17 clauses 3.12 and 3.13. This constitutes a	Departure application has been submitted to Highways England and is pending approval.

Ref. No.	Alignment Name	Design Element (Mandatory)	Design Standard	Comments	Current Status
				Departure from Standards.	
D13	M11 Northbound Merge	Merge Layout	TD 22/06 clause 2.29 and fig 2/3 MW	The selected layout of the proposed M11 northbound merge is not in accordance with the requirements of TD22/06 Cl. 2.29. This is due to the substitution of Type E (lane gain merge), derived from the use of Figure 2/3 MW, with a Type B (parallel merge). This constitutes a Departure from Standards.	Departure application has been submitted to Highways England and is pending approval.
D14	M11 Northbound Merge	Nose Length, Entry Exit Taper and Auxiliary length	TD 22/06 Table 4/3	The nose length, auxiliary lane length and auxiliary lane taper length for the proposed M11 northbound merge are not in accordance with the requirements of TD22/06 Table 4/3 for rural motorways. These lengths are amended by relaxing the road class to 'Rural All-Purpose 120kph' as described in IAN149/17 clauses 3.6 to 3.10. This constitutes a Departure from Standards.	Departure application has been submitted to Highways England and is pending approval.
D15	M11 Northbound Merge	Vertical Alignment, Sag K	TD 9/93, Table 3.	From ch. 86.292m to ch. 123.788m, the vertical alignment of the proposed M11 northbound merge slip road is not in accordance with the requirements of TD9/93 clause 4.14 for rural motorways. The vertical sag K value is one step below absolute minimum for 70kph design speed. The K value is reduced by relaxing the design speed to Band B as described in IAN149/17 clauses 2.3 to 2.5. This constitutes a Departure from Standards.	Departure application has been submitted to Highways England and is pending approval.
D16	M11 Northbound Merge	Vertical Alignment, Crest K	TD 9/93, Table 3.	From ch. 224.908m to ch. 292.908m, the vertical alignment of the proposed M11 northbound merge slip road is not in accordance with the requirements of TD9/93 clause 4.9 for rural motorways. The vertical crest K value is one step below desirable minimum for 70kph design speed. The K value is reduced by relaxing the design speed to Band B as described in IAN149/17 clauses 2.3 to 2.5. This constitutes a Departure from Standards.	Departure application has been submitted to Highways England and is pending approval.

Ref. No.	Alignment Name	Design Element (Mandatory)	Design Standard	Comments	Current Status
D17	M11 Southbound Diverge	Vertical Alignment, Gradient	TD 9/93, Table 3.	From ch. 53.573m to ch. 131.715m, the vertical alignment of the proposed M11 southbound diverge slip road is not in accordance with the requirements of TD9/93 clause 4.14 for rural motorways. The vertical sag K value is two steps below absolute minimum for 120kph mainline design speed. The K value is reduced by relaxing the design speed to Band B as described in IAN149/17 clauses 2.3 to 2.5. This constitutes a Departure from Standards	Departure application has been submitted to Highways England and is pending approval.
D18	Gilden Way	Use of Geogrid	HD 26/06, Para 3 for Figure 2.1 Notes	Departure to use composite asphalt reinforcement geogrid at the interface between the asphalt overlay and the JRC layer/HBM base. Approval is sought for the use of a composite asphalt reinforcement geogrid at the interface between the asphalt overlay and the JRC layer/HBM base to delay the onset of reflective cracking and reduce water ingress into the pavement construction and hence reduce future maintenance interventions.	Pavement departures have been approved and processed through technical approval within Essex County Council.
D19	Gilden Way	Use of granular subbase for traffic greater than 80msa	HD 26/06, Clause 2.8	Departure to use Class 2 foundation with unbound sub-base only design for new construction with design traffic in excess of 80msa. To permit use of unbound Class 2 foundation for new construction in the areas of road widening where the existing foundation is granular, where design traffic is in excess of 80msa. This foundation class is proposed to allow continuity of the existing sub-surface drainage paths by using similar sub-base material to construct the new pavement foundation.	Pavement departures have been approved and processed through technical approval within Essex County Council.
D20	Gilden Way	Use of JRC in widening	HD 26/06, Clause 2.25 (b)	Departure to use of Jointed Reinforced Concrete (JRC) pavement at the road widening sections of the existing carriageway. As stipulated in HD26/06 Clause 2.25(b), use of JRC pavement design is permitted for limited use and in special circumstances but only with approval from the Overseeing Organisation. The use of JRC for	Pavement departures have been approved and processed through technical approval within Essex County Council.

Ref. No.	Alignment Name	Design Element (Mandatory)	Design Standard	Comments	Current Status
				the widening would allow matching the existing pavement and the longitudinal joint between new and existing construction to be retained within the wheeltrack zone.	
D21	Gilden Way	Use of superseded HD25/94	HD 25/94 – Foundations (superseded version now replaced by IAN73/06 R1)	Departure to use superseded HD25/94 in place of IAN73/06 R1 for the design of the new foundation under the new construction/widening sections. It is assumed that the existing foundation (comprising approximately 150mm of CBGM) was based on the now superseded HD 25/94, and it is proposed that this document is used as it provides a similar pavement foundation option for the road widening sections. This is proposed to allow construction of a uniform pavement across the whole carriageway width and to ensure continuity of the existing sub-surface drainage paths by using similar unbound sub-base material.	Pavement departures have been approved and processed through technical approval within Essex County Council.
D22	Gilden Way/Sheering Road	NMU Cross Section	The Essex County Council Design Standard, Section - Pedestrian and Cycle Movement Page 116-117	Due to Highway Boundary Constraints Sections of the Footpaths/Cycleways along Gilden Way and Sheering Road are less than the minimum stated in the Essex County Council Design Standard. This constitutes a Departure from the ECC Standards.	Local authority geometric departure is in the process of being resubmitted to Essex County Council for approval.

3. Review of Personal Injury Collision Data

Collision data for the five-year period between 1 August 2012 and 31 July 2017 was provided to the Audit Team. A plot of collisions by severity in the vicinity of the proposed scheme extents was also provided, and this is replicated in Figure 2 below.

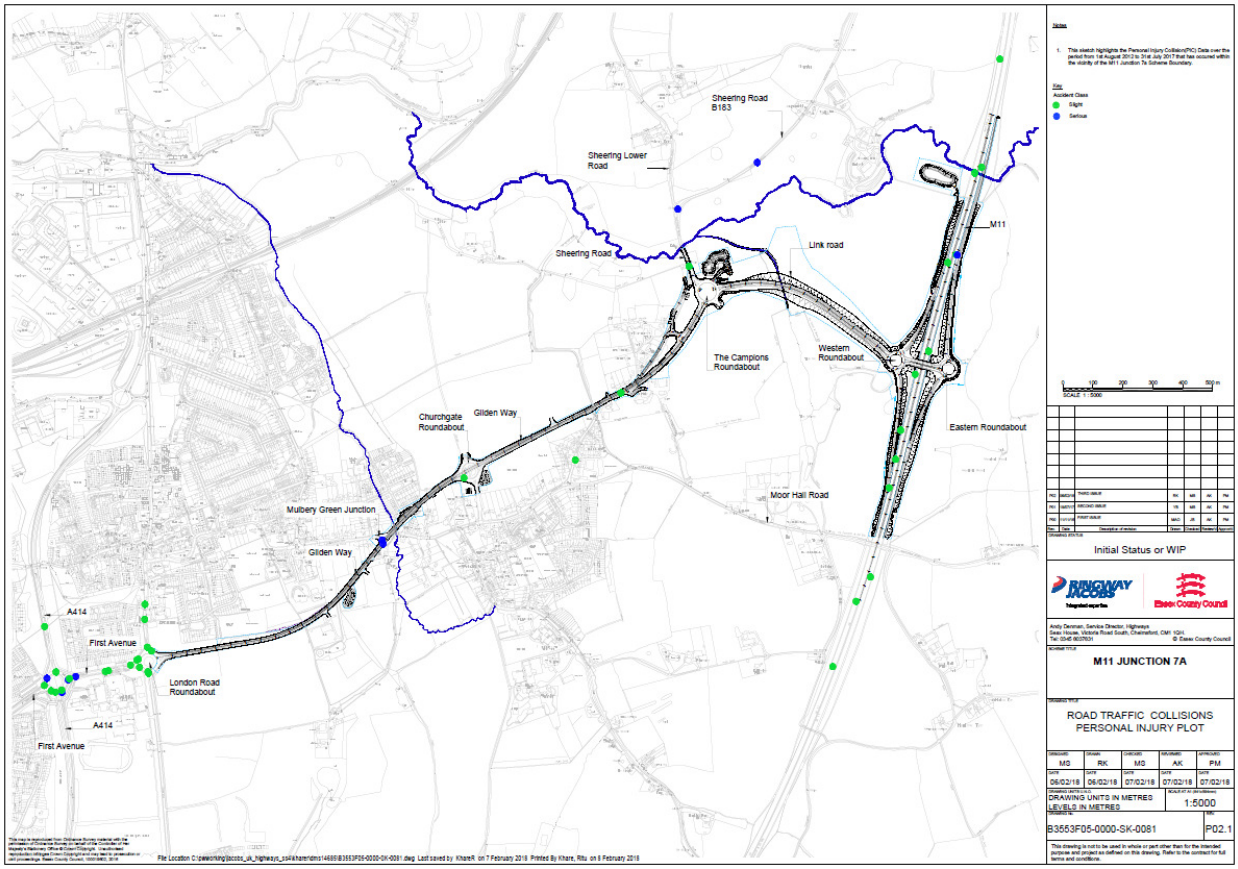


Figure 2 : Collision Plot

From the plot provided, the majority of collisions occurred at the roundabout junctions with London Road and First Avenue at the western end of the scheme, outside the scope of this study.

Two collisions resulting in serious injury occurred close to the junction of Gilden Way and Mulberry Green, and a single collision resulting in slight injury took place at the Churchgate Roundabout.

One collision in the vicinity of Mulberry Green/ Gilden Way involved a vehicle turning right onto Gilden Way from the minor road, and one collision resulted when a single westbound vehicle is described as having lost control on exiting the roundabout to the east before overturning. It is possible that this collision did not actually occur near Mulberry Green.

4. Problems raised at previous Road Safety Audits

An Interim Stage 1 Road Safety Audit was undertaken by the same Audit Team in July 2016 (Document Reference B3553F05-0000-REP-0064, Revision 0, dated 04 August 2016) Problems raised at that interim audit and which remain relevant to the design as shown in the supplied documents for this audit are raised as Problems below.

Given the differences between the design layouts for the Interim Stage 1 Road Safety Audit (RSA) and the Stage 1 RSA, the Audit Team has reviewed previous audit reports for full Road Safety Audits where relevant but has not referenced previous audit Problems in this report.

A Stage 1 Road Safety Audit was undertaken in January 2017 (Document Reference B3553F05-0000-REP-0083, Revision 0, dated 23 January 2017). Problems raised at that interim audit and which remain relevant to the design as shown in the supplied documents for this audit are raised as Problems below.

PROBLEM A

Location: B3553F05-0100-DR-0002 Rev P1 (Sheet 2) – Junction of Mulberry Green and Gilden Way Chainage 900.

Summary: Risk of vehicle collisions due to junction design.

Description: Under the proposals an existing right turn ghost island for traffic turning into Mulberry Green will be removed to create two westbound lanes throughout. The design team have advised that this junction will be left-in/left-out/right-out only which the Audit Team understand to mean a restriction implemented by a Traffic Regulation Order (TRO) and signing but with no physical measures such as kerbed traffic islands to prevent the banned turn. The diversion to London Road Roundabout and back for drivers wishing to turn into Mulberry Green is 1.8km and the Audit Team believes that drivers will still make the right turn manoeuvre, especially off-peak when flows are lowest and speeds are likely to be highest. They may alternatively see the restriction, pass the junction then utilise accesses downstream to undertake a U-turn which will be easier in a 3-lane carriageway than with S2 single carriageway form.

Vehicles indicating to turn right into Mulberry Green would slow and stop in the offside lane to wait for a gap in eastbound traffic. Following drivers may mistake the right-turn-indicator displayed before braking as indication for an intention to overtake leading to rear end shunts.

There were two serious-injury collisions at this junction in October 2014 and April 2015, and five additional collisions, including another serious injury, since January 2005. However, full STATS19 details for these collisions were not available to the Audit Team. The proposed changes may increase the likelihood of collisions and the expected higher speeds would be likely to increase average injury severity. See also Problems B and F below which are related to this problem.

Recommendation: Amend the design to either accommodate right-in movements, or to physically prevent the banned right-turns and ensure advance signing is provided to ensure drivers are aware of the arrangement in good time. This element of the scheme is likely to require additional Departures and Relaxations from Standard with respect to TD70/08.

Design Response: Further design will be undertaken in the next phase to mitigate the issue. However;

- No space is available within the highways boundary to accommodate a right turn lane as a result of the widening
- The junction will be adequately signed posted to indicate the TRO
- Speed limit will be reduced from 60mph to 40mph, which will reduce the speed of the vehicles passing and /or entering the junction
- It is not possible to physically ban right turn movements as local buses must be allowed to continue to use the junction

Current Status:

Drawing B3553f05-0100-dr-0002 Rev P2 shows the retention of two westbound traffic lanes with no physical measures to discourage or prevent right turn movements into Mulberry Green. Drawing B3553F005-1200-DR-0001 Rev P2 shows provision of a single banned right turn sign to Diagram 612 with sub plate 'Except local buses' located immediately prior to the junction, and a posted 40mph speed limit along the link.

Although the Audit Team notes that a specific Departure from Standards has been applied for which includes reference to the proposed layout at junctions along the link (Departure D1), this does not appear to adequately cover the circumstance by which right turns will continue to be permitted for certain vehicles (in this case local buses), whilst not providing a dedicated middle lane for right turning traffic. Collision data provided indicates that in the five-year period 1/8/2012 – 31/7/2017 there were two serious injury collisions at the junction of Gilden Way and Mulberry Green, involving vehicles overturning. The westbound collision resulted when a vehicle negotiated and exited the roundabout "too fast".

The proposal to reduce the posted speed limit to 40mph is noted, but the proposals to widen Gilden Way are contrary to the layout associated with a reduced speed limit and in the absence of additional measures or enforcement to reduce speeds, the signing alone may be insufficient to reduce traffic speeds.

The Audit Team therefore remains concerned that in the absence of measures to prevent all right turn movements into the junction, any vehicle turning right into Mulberry Way would be at risk of rear end shunt collisions involving westbound vehicles approaching at speed in lane 2. This Problem remains and is raised again as **Problem 5.3.1.**

Designer's Response: The sub-plate 'Except Local Buses', and thus the provision for buses to make a right turn movement into Mulberry Green, has now been removed from the design whereby banning all vehicles from making the right turn manoeuvre. The remodelling of the junction to become a left-in left-out configuration, which will include an enlarged splitter island to deter the right turn manoeuvre, will be written into the Works Information as an action for the Design & Build Contractor to take forward.

PROBLEM B

Location: B3553F05-0100-DR-0002 Rev P1 (Sheet 2) – Toucan crossing immediately east of the junction of Mulberry Green and Gilden Way Chainage 930.

Summary: Obscured signals in centre lane resulting in failure to stop at red signals.

Description: Peak predicted flows are high and heavy traffic is likely in all three lanes. At such times, westbound drivers in Lane 2 may have nearside sign and signal visibility obscured by high-sided vehicles in westbound Lane 1, and offside signal visibility obscured by oncoming traffic. Even high-level signals may not be visible. Drivers in the centre lane would also be unable to see pedestrians or cyclists waiting to cross. This may result in vehicles braking suddenly and/or failing to stop at a red or amber signal, and/or drivers failing to see a pedestrian attempting to cross at 'green-man' or 'red-man' phases. This could result in injuries to pedestrians or cyclists crossing the road, and vehicle users involved in shunt collisions. Motorcyclists would be especially vulnerable to sudden braking or collisions. See Problem A above which is related.

During off-peak periods, visibility to signals would be better but speeds would be higher; when signals change at such times, drivers may be unable to stop.

Recommendation: Design the crossing so that drivers in all lanes can see signals in good time.

Design Response: Agreed. Further design work will be undertaken to ensure adequate visibility to the signals from all lanes is achieved in both the westbound and eastbound approaches to the crossing.

Current Status: Nearside and offside signals are proposed on both approaches to the crossing, along with advanced warning signs to Diagram 543 (traffic signals ahead), as previously. The offside signal is still located where it could potentially be obscured by eastbound vehicles, and so this safety concern remains and is raised again as **Problem 5.4.1**.

Designer's Response: Association with Problem A (5.3.1) has now been removed due all vehicles (including buses) being prohibited from making right turn manoeuvres into Mulberry Green.

The Designer considers that when both eastbound and westbound traffic is halted at the red-light phase, the offside signal visibility for westbound vehicles in lane 2 would not be obscured by oncoming traffic, as the oncoming traffic would have advanced along the carriageway creating a gap in the line of traffic. The provision of cantilevered signals may be considered at detailed design stage by the Design & Build Contractor.

Additional mitigation by way of buff colour high friction grip surfacing which is proposed for the approach to the crossing will further assist in warning drivers that they are approaching a hazard.

PROBLEM C

Location: B3553F05-0100-DR-0002 Rev P1 (Sheet 2) – Nose-to-nose bus stop layout east of junction of Mulberry Green and Gilden Way
Chainage 1000.

Summary: Risk of injury to all groups of road users when buses are stationary or pull out from stops.

Description: Bus stops should be arranged 'tail-to-tail' where possible so that if buses pull out of both stops at once overtaking drivers do not get trapped between the two buses. The 2+1 layout increases this problem because eastbound drivers may react to a bus pulling out of the eastbound layby and encroach deliberately or unintentionally into the offside westbound lane.

The road is at a higher level than surrounding areas and there may not be sufficient space for containment or errant vehicles in this area.

Recommendation: Provide tail-to-tail bus stops and make appropriate provision for vehicle containment.

Design Response: Due to spatial constraints it is not physically possible to relocate the existing bus stops to create a tail to tail arrangement. As the buses in this location are infrequent, the probability of two buses stopping concurrently at the same time is likely to be low. However, the design team will look to mitigating this problem in the next phase.

Current Status: The proposals remain unchanged since the Stage 1 RSA was undertaken, but:

- The arrangement of bus stops is existing, and reference to the collision plot (Drawing No. B3553f05-0000-SK-0081 Rev P02.1) indicates that there have been no collisions resulting in injury in the vicinity of the bus stops in the five-year period to 31 July 2017, and

- Bus times were reviewed and the Audit Team can now concur with the design team response that the timing and frequency of services using the stop means that the likelihood of two buses stopping (or pulling out) concurrently to result in a collision would be very low.

As a result of the above, the Audit Team do not now consider that the addition of an additional westbound traffic lane in this location would have any further adverse safety impact, and so this Problem is now closed.

A related issue has been raised in **Problem 5.1.1.**

Designer's Response: Closure noted

PROBLEM D

Location: Private means of access at Chainages 600, 780, 820 on B3553F05-0100-DR-0002 Rev P1 (sheet 2) and Chainage 475 on B3553F05-0100-DR-0003 Rev P1 (Sheet 3).

Summary: Vehicles entering or leaving accesses may be involved in collisions.

Description: Accesses at Chainages 600, 780, 820 are adjacent to narrowed lanes and higher-speed traffic especially off-peak. No restrictions are shown regarding turning movements into or out of these accesses as no signs or markings are shown prohibiting right-turns and no kerbed islands restrict movements.

Existing accesses at Chainage 475 (which appear to comprise one lawful and one unlawful private means of access, based on kerb configurations) are neither shown as stopped up or not accommodated from alternative accesses.

Vehicles slowing to enter accesses, or turning left from them, may be involved in shunt collisions. Right-turns and/or U-turns to are likely to occur especially off-peak, and could result in side-impact collisions which tend to result in a high injury severity.

Recommendation: Amend access design to address the hazards described. This element of the scheme is likely to require additional Departures and Relaxations from Standard with respect to TD70/08.

Design Response:

- Chainage 600 is the location of an industrial unit. Further design work will be undertaken in the next phase to try and physically prevent vehicles turning right to and from the access.
- At Chainage 780 there is an access to a Thames water pumping station. The frequency of access to the location is very minimal and only for maintenance. It is therefore deemed very low risk. Further design work will be undertaken in the next phase to try and physically prevent vehicles turning right to and from the access.
- At Chainage 820 is a single dwelling that has direct access to the carriageway. Further design work on the access will be undertaken following consultation with the land owner to mitigate this issue.
- The property at Chainage 120 Sheering Road at Chainage 1775 has direct access to the carriageway. Further design work on the access will be undertaken following consultation with the land owner to mitigate this issue.

Current Status:

No measures to prevent or restrict right turn manoeuvres have been proposed at any of these minor or private accesses, and no rationalisation or reduction in the number of accesses has been made. Following the provision of an additional westbound traffic lane on Sheering Road, vehicles attempting to turn right may have their visibility of a vehicle in lane 2 obscured by a vehicle in the nearside lane, which could increase the potential for collisions. This problem remains and has been raised again as **Problem 5.3.2.**

Designer's Response: 'No Right Turn' signs to Dia. 612 have been provided on the nearside of the eastbound lane for access at Chainage locations 600m,780m and 820m, additionally at the exit of each minor access at Chainages 600m and 780m. It is not considered appropriate to provide signage for the private means of access at Chainages 820m and 1775m.

Kerbed splitter islands to physically prevent right turn manoeuvres or additional road markings at chainage 600m and 780m may be considered during the detailed design stage by the Design & Build Contractor in liaison with 3rd Party land owners as there is insufficient land to accommodate islands within the scheme boundary.

PROBLEM E

Location: B3553F05-0100-DR-0003 Rev 1 (Sheet 3): Churchgate roundabout and the eastbound exit Chainage 1250-1450.

Summary: Driver frustration may cause side-swipe or rear end shunt collisions and right-turning drivers may be confused by layout. Drivers may attempt to turn right and travel the wrong way around the roundabout.

Description: The Churchgate Roundabout is located at the end of a long section (Chainage 0 to 1200m) of single lane with prohibited overtaking for eastbound traffic. Drivers frustrated at being held up will be seeking overtaking opportunities. On the approach to the roundabout the single lane flares to two lanes; the left lane splits again close to the roundabout entry into a short left-diverge for those entering the circulatory carriageway to turn left or right; however, drivers in this lane could also go ahead onto Gilden Way eastbound from the circulatory carriageway. The two remaining eastbound and westbound lanes enter the junction in a dedicated signal-controlled route which takes traffic directly through the roundabout (i.e. ahead only). This unconventional and potentially complicated layout could result in a number of unanticipated driver behaviours which could result in collisions as follows. The scenarios described below refer to the eastbound carriageway only, but are equally applicable for traffic approaching the roundabout on the westbound carriageway unless otherwise stated.

- Signing and road markings on the approaches to the junction are insufficient. Plans B3553F05-1200-DR-0002 Rev P1 (Sheet 2) and B3553F05-1200-DR-0010 Rev P1 (Sheet 10) shows the Advance Direction Sign (ADS) for the eastbound approach to the junction) and B3553F05-1200-DR-0003 Rev P1 shows the proposed sign for the westbound approach to the junction. The information and layout of these signs is the same, with both signs directing traffic ahead towards London. In addition, the map type layout and single set of lane guidance markings to Diagram 1035 does not provide sufficient guidance for motorists with regard to lane positioning in advance of the junction. This may result in last minute lane changes and side swipe collisions.

- Drivers seeking to overtake slower-moving eastbound vehicles are likely to change lanes and this may lead to sudden movements approaching the first stop line, or in the section within the central island of the junction; resulting in side impact collisions

- For eastbound traffic only, it is also likely that overtaking will occur east of the junction on the short Differential Acceleration Lane (DAL) of approximately 125m, which is half the length required (mandatory design requirement) in TD70/08. This arrangement makes side-wipe collisions likely.

- Eastbound drivers seeking to turn right at the junction are likely to position themselves in the right hand lane, not realising that they must use the left hand lane to turn right, which is counter-

intuitive and likely to cause confusion in drivers familiar with the existing junction. The absence of lane configuration signs on the approach is likely to exacerbate this problem.

- Drivers following satellite navigation may also position themselves in the right hand lane on the approach to the roundabout, under instruction form the system approaching what might be identified as a conventional roundabout layout

- Drivers may turn right end by entering the circulatory carriageway in the wrong direction from the first signal stop line, leading to head-on collisions. They may also attempt to turn right at the second stop line within the circulatory carriageway, which may not be in conflict with another signal-controlled arm at that time, but as a vehicle would slow on a green signal to make the right turn, this could cause shunt collisions.

- Lane guidance for circulating traffic which has entered the roundabout from the left lane is potentially confusing. Two circulatory lanes are provided of which the nearside circulatory lane is most likely intended for use left turning traffic only, but drivers intending to turn right are guided into this lane from the stop line and will rapidly find themselves forced to exit ahead instead. This could result in sudden lane changes and braking, and may increase the likelihood of side –swipe collisions, collisions with the splitter island, and rear end shunts.

- The forecasted number of left or right turning vehicles relative to the volume of ahead traffic is unknown, but a single traffic lane only is provided for left and right turners. Drivers who may be unable to enter the nearside lane in time, or who may try to circumvent a queue in the nearside lane at busy times, may attempt instead to turn left from the nearside ahead lane, giving rise to merging conflicts at the exit from the roundabout.

- The volume of ahead traffic, and details of signal staging are both unknown. In the event that the number of ahead vehicles held at the internal stop line exceeds the storage space provided within the roundabout, blocking back could disrupt flows through the roundabout, and rear end shunts are likely. It is further noted that yellow box markings are proposed at the outset, which suggests that queuing is anticipated. Such markings can create confusion as to priority in the event that the signals change and vehicles travelling ahead are positioned forward of the stop line.

- The roundabout comprises a combination of stop lines and Give Way entries, as well as internal stop lines and 'Keep Clear' markings. Drivers entering the roundabout from the north or south may confuse the line associated with the Keep Clear as a signal stop line, resulting in unexpected braking and rear end shunts.

- On the westbound exit from the roundabout only, two lanes are provided for traffic exiting west. Only a single entry lane is provided on each of the northern and eastern arms, and it is unlikely that all vehicles entering from both lanes on the southern arm will intend to turn left. In the absence of swept paths, it was unknown whether two vehicles could safely exit alongside and so the proposed lane arrangement may give rise to poor lane discipline and side-swipe conflicts.

- The design of the junction makes it relatively easy for vehicles travelling ahead to use the nearside lane and circulate in order to exit ahead. The signal staging should be designed carefully to ensure that this is not possible, or drivers may circulate at speed in order to minimise delays, which could result in loss of control collisions. The Audit Team can provide examples of this occurring on the A4 Great West Road.

Recommendation: Obtain operational experience from other similar junctions, including the signs and markings which will be required to help drivers understand the new arrangement. Particular attention should be given to signing the need for drivers to position themselves in the nearside (left) lane in order to turn right at the junction. Develop the signing and road markings to minimise the hazards described above.

Design Response: Further design development of the Churchgate Junction will be carried out in the next phase to ensure the road markings and signage provides adequate information to drivers as recommended.

However:

- The initial design has been developed to closely match the design of the existing hamburger layout located nearby at Southern Way / A414.
- Capacity check and micro simulation modelling have been carried out for the design year of 2036 which has been fed into the design. There is no blocking back anticipated in the vicinity of the junction

Current Status:

Although additional road markings to Diagram 1035 have been added to the proposals, the layout is essentially unchanged and the concerns previously raised have not been addressed. Specifically relating to the bullet points above:

- Bullet 1: The information provided on traffic signs remains insufficient. This problem remains but due to the number of specific concerns relating to signing at this junction, this has been raised separately in the main body of the report in **Problems 5.5.1 to 5.5.4.**
- Bullets 2-8: Are still applicable, and these safety concerns are raised again here as **Problem 5.3.3.**
- Bullet 9: Forecasted traffic flows for each turning movement at this roundabout are still unknown, and the traffic data provided does not specifically include this junction. However, signal staging information has now been provided. The safety concerns raised have not been addressed and so this Problem is raised again here as part of **Problem 5.3.3.**
- Bullet 10: the provision of signal heads means that drivers may be less likely to confuse Keep Clear markings with signal stop lines. This issue is resolved.
- Bullet 11: Two westbound exit lanes are still provided in the south western sector of the roundabout but in the absence of swept paths it is still not possible to determine whether two vehicles could exit safely alongside. This Problem remains and is raised again here as part of **Problem 5.3.3.**
- Bullet 12: If it is assumed that streams 1 and stream 2 run concurrently (refer to Drawing No. B35553F05-1200-DR-0024 Rev P01), then it still appears possible for westbound drivers to bypass the signals by circulating in the southern section of the junction. This Problem therefore remains and is raised again here as part of **Problem 5.3.3.**

Designer's Response:

Bullet 1 – Refer to response under 5.5.1 to 5.5.4

Bullet 2 – Single lanes which become two lanes through junctions is not considered to be an uncommon arrangement and it is anticipated that drivers are familiar with this type of layout.

Bullet 3 – The designer questions whether the requirements of a Differential Acceleration Lane as stated in TD70/08 are appropriate for the proposed layout considering the circulatory carriageway only has one lane exit which is controlled. The minimum 250m is achieved when considering the through hamburger traffic flow.

Bullet 4 – The provision of additional lane configuration signs may be considered during detailed design stages by the Design & Build Contractor

Bullet 5 – Whilst the dangers of using satellite navigation devices (Sat Navs) are appreciated by the designer, they should be used to help plan a journey and not relied upon for detailed instructions. Drivers should make the same observations that they would do without the use of a Sat Nav.

Bullet 6 – The provision of 'Keep Left' signs to Dia. 610 combined with 'Ahead Only' road markings and the green arrow direction within the signal head is considered appropriate to inform the driver of the required direction of travel at both locations.

Bullet 7 – Concentric, or partial concentric, road markings are considered a common arrangement within the circulatory carriageway and it is expected drivers are familiar with this arrangement.

Bullet 8 – The single lane eastbound approach to the roundabout opens into two lanes approximately 150m before the junction. It is considered that vehicles wishing to turn left/right would position themselves in the left lane at the start of the taper where there is no merging conflict. For westbound traffic, there is well in excess of the Desirable Minimum Sight Stopping Distance approaching the junction and therefore it is considered that drivers have sufficient time to position themselves in the correct lane.

Bullet 9 – Micro simulation indicates that no blocking back will occur in the vicinity of the junction, however, should the storage space be exceeded, disruption of flows through the roundabout is mitigated by the use of yellow box markings. These markings are in accordance with the TSRGD and drivers are expected to understand their use.

Bullet 10 – Closure noted

Bullet 11 – Swept Path Analysis to justify the arrangement may be provided during the detailed design stage by the Design & Build Contractor

Bullet 12 – With reference to drawing B3553F05-1200-0024 Rev P01, stage 5 shows that when the ahead movement is red, so is the left lane onto the circulatory carriageway, preventing vehicles from bypassing the signals. Should a vehicle take the left lane onto the circulatory carriageway during the green phase in order to exit ahead, they will be held at a red phase. It is therefore unclear as to how a vehicle can bypass the signal.

PROBLEM F

Location: B3553F05-0100-DR-0003 Rev P1 (Sheet 3) and B3553F05-0100-DR-0004 Rev P1 (Sheet 4) Junctions between Gilden Way and side roads at Chainage 1580, 1730, 1850 and 2100 (retained Sheering Road cul-de-sac).

Summary: Left-in/left-out operation not controlled by physical measures.

Description: The sign design proposals show that these junctions are intended to operate left-in/left-out only with right turns prohibited, but with no physical features to prevent right turns, such turns will be easy to perform given the widened carriageway, and are likely to occur. This hazard is the reason why the design standard TD70/08 section 4.4 places a mandatory prohibition on left-in-left-out junctions.

Other drivers are unlikely to anticipate a driver stationary in westbound lane 2, leading to rear end shunts and head-on collisions should an eastbound vehicle overtake in the area. See Problem A above which raises similar hazards which are further complicated by the adjacent crossing.

Recommendation: Physically prevent illegal manoeuvres or accommodate them safely in the design.

Design Response: The Safety Auditor's may have misinterpreted the drawings as the design already includes bell-mouth physical islands to facilitate and control left-in / left-out manoeuvres. Notwithstanding, full details of the islands will be prepared at the next design phase to clarify the design intents.

Current Status:

The layout of these junctions is clearly to provide a left in, left turn out arrangement only, with signs to prohibit the right turn from the west provided on the major road. It is noted that an application for a Departure from Standards (Departure D10) has been applied for with regard to the sections of TD 70/08 applicable to the layout and provision of these minor junctions. TD 70/08 applies to single carriageway trunk roads in rural areas. This standard specifically prohibits junctions of this type on a wide single 2+1 carriageway layout.

Subject to the acceptance of the Departure, this Problem remains and is raised again here as **Problem 5.3.4**.

A number of related problems concerning these two left-in, left-out junctions have been raised separately in Section 5 of this report.

Designer's Response: Departure D10 has been approved and therefore it is considered that this issue is now resolved. Physical restrictions to prevent the right turn manoeuvres from accesses are covered in Problem 5.3.2

PROBLEM G

Location: B3553F05-0100-DR-0005 Rev P1 (Sheet 5) – Triangular link arrangement of eastbound merge link, westbound diverge link and connecting un-named third link (between the Sheering Road roundabout and the Pincey Brooke roundabout).

Summary: The triangular link arrangement is a mixture of one-way and two-way links likely to cause confusion and hazardous overtaking.

Description: The triangular arrangement will potentially be confusing for drivers, mixing one-way and two-way links. The southwest-bound lane of the two-way link (between the Pincey Brooke roundabout and the Sheering Road roundabout) is seemingly exclusively for U-turns resulting from drivers mistakenly entering that link from the Sheering Road roundabout, and vehicles leaving the access on the west side of that link to return to the west avoiding the M11 western dumbbell roundabout.

Vehicles which turn right from this access present a risk of side-impact collisions with northeast-bound vehicles.

Drivers using the route frequently will learn that the southwest-bound lane is empty almost all of the time every day, and may use it as a third northeast-bound lane to overtake. This could result in loss-of-control collisions or impacts with vehicles leaving the access. The curved alignment of the link will restrict forward visibility, increasing the risk of these collisions.

Recommendation: Make the link between the Sheering Road roundabout and the Pincey Brooke roundabout one-way, requiring the few vehicles leaving the access to use the M11 junction.

Design Response: It is intended to use Pincey Brook roundabout as accommodation access to the adjacent agricultural field and potential future development in the vicinity envisaged in the local plans. Signage details and road markings will be reviewed at the next design phase to mitigate the safety issues highlighted.

The design team are working collaboratively with the client to possibly rationalise the design in the next phase to obviate the need for the Pincey Brook roundabout and the current form of the eastbound link in the immediate future.

Current Status:

The Pincey Brook Roundabout and associated link roads do not appear on plans provided for the Stage 2 Road Safety Audit, and so this Problem is now resolved.

Designer's Response: Closure noted

PROBLEM H

Location: B3553F05-0100-DR-0005 Rev P1 (Sheet 5) – The eastbound merge link.

Summary: Tapered hard shoulder may result in side-swipe collisions.

Description: The eastbound merge link is shown as two lanes narrowing to one lane a short distance beyond the Pincey Brook roundabout, beyond which it becomes a single lane with hard shoulder. The hard shoulder width tapers out between Chainage 250 and 175 which may cause drivers to enter the hard shoulder as it narrows, not realising that it is not continuous as no warning signs are proposed. If the vehicle is still mobile, i.e. if the driver is making a discretionary stop, they may move off again, resulting in side-swipe and/or rear end shunt collisions whilst attempting to re-join the main carriageway.

Recommendation: Hatch the hard shoulder where it is not full width and provide warning signs to drivers.

Design Response: The road markings and signage are under development at this stage and subject to full consultation with the stakeholders. The road markings and signage details will be reviewed at the next design phase to mitigate the safety concerns highlighted by the safety auditors. See the Designer's Response to problem G.

Current Status:

The Pincey Brook Roundabout and associated link roads do not appear on plans provided for the Stage 2 Road Safety Audit, and so this Problem is now resolved.

Designer's Response: Closure noted

PROBLEM I

Location: B3553F05-0100-DR-0005 Rev P1 (Sheet 5) - Westbound entries to Sheering Road Roundabout.

Summary: Closely-spaced access and one largely-unused entry may cause driver confusion and the potential for error.

Description: The close spacing of the two westbound entries to Sheering Road Roundabout could lead to driver error and a failure of drivers to give precedence to circulating traffic. Frequent users entering on the westbound diverge link would come to realise that the westbound entry from Pincey Brook roundabout (positioned to their right at the give way line) is rarely used. When a vehicle does enter from Pincey Brook roundabout, this would be unexpected, and drivers entering without stopping or looking when there is a gap in circulating roundabout traffic may collide with a vehicle leaving the westbound diverge link.

Recommendation: See Problem G: make the link from Pincey Brook Roundabout to Sheering Road Roundabout one-way for northeast-bound traffic.

Design Response: Spatial constraints at this location affect the layout of westbound entries to Sheering Road Roundabout. However, the layout of the approaches to this roundabout will be reviewed at the next design phase to mitigate the problem identified.

See the Designer's Response to problem G.

Current Status:

The layout of the Sheering Road (now referred to as The Campions) roundabout has changed significantly on plans provided for the Stage 2 Road Safety Audit, and now provides a more conventional layout of entry and exit arms. This Problem is now resolved.

Designer's Response: Closure noted

5. Problems raised at this Interim Stage 2 Road Safety Audit

5.1 GENERAL

Problem 5.1.1

Location: Bus stop lay-bys within the proposed scheme.

Summary: Shallow entry and exit tapers at bus stop laybys may result in difficulties for buses when entering or exiting the bay, which could increase the likelihood of rear end shunt collisions between buses and following vehicles.

Description: It was noted that Transport for London guidance for the layout of the bus laybys has been applied to this scheme. This standard allows for a slightly shallower bay, and the entry and exit tapers are very much shorter than those which would be provided with bus laybys designed to TD 69/07 (with an entry taper of 20m rather than 45m, and an exit taper of 15m as opposed to 25m). The exit radius is also tighter (25m as opposed to 30m) a bus layby designed to Transport for London standards.

Speeds are currently derestricted on Gilden Way, although a 40mph speed limit will be implemented as part of this scheme. Swept paths suggest that the layby can be negotiated by a standard bus without overrunning the kerbs or adjacent or opposing traffic lanes, but the Audit Team remains concerned that buses may have to significantly reduce speed on approach in order to enter the bay, and that the length of the exit taper may be insufficient for buses to accelerate sufficiently in order to safely merge with traffic travelling at 40mph. Both of these scenarios may increase the likelihood of rear end shunts, as bus drivers brake on entry, or experience difficulties merging which may encourage them to accept unsafe gaps.

Furthermore, for vehicles travelling eastbound, where only a single traffic lane is provided, in the event of a driver swerving to avoid a bus entering the carriageway from the bus stop, the potential for head-on collisions could be increased.

The Audit Team observed a goods vehicle using the westbound bus stop; if such use continues, the problems described above will also involve these users as a result of the narrow lanes.

Also see **Problem 5.2.2**.

Recommendation: Provide a bus layby layout which enables buses to enter and exit the layby safely into or out of traffic travelling at 40mph.

Designer's Response: The taper lengths and width of the proposed bus lay-bys are in accordance with the TfL guidance and match the existing layout which is currently operational for a 60mph speed limit. Although the taper lengths are shorter than specified in TD 69/07, they are not considered by the Designer to be merging lanes (the 25m exit taper recommended in TD 69/07 would only be sufficient for a bus to accelerate to 16mph based on an acceleration of $2m/s^2$).

The event in which a driver may swerve to avoid a bus entering the carriageway from the bus stop is an inherent risk with any bus lay-by and not specific to this scheme or the geometry of the lay-by.

The design cannot accommodate illegal use by goods vehicles.

5.2 ALIGNMENT

Problem 5.2.1

Location: B187 Gilden Way

Summary: Insufficient separation between opposing traffic streams could increase the potential for head-on collisions.

Description: It is proposed to provide separation between north-eastbound and south-westbound traffic streams in all locations where a 2+1 arrangement is proposed, using a system of double white lines only, combined with narrower than recommended lane widths, and with no hard strip at the carriageway edges.

The Audit Team is aware that an application for a Departure from Standards has been applied for (D1) which covers these and other aspects of the proposed alignment, but that this Departure has not yet been granted.

There are a number of bends along Gilden Way, between the London Road roundabout and the Campions roundabout and although a speed limit of 40mph is proposed, the rural nature of this road environment, and existing derestricted speed limit means that drivers may travel at speeds higher than the posted limit.

This combination of factors together is of serious concern to the Audit Team, and it is considered likely that the potential for head-on collisions within the 2+1 sections of Gilden Way may be increased.

Also see **Problem 5.4.5**

Recommendation:

Provide a cross section which minimises the potential for head-on collisions between opposing traffic streams.

Designer's Response: The provision of a WS2+1 cross section compliant with TD70/08 would require significant land take outside the current highway boundary which is contrary to the scheme requirements. Subsequently a Departure from Standards (D1) application was submitted and approved on 16th August 2018.

Notwithstanding this, a 3.3m wide lane is considered acceptable for the given level of design traffic in urban areas (TA79/99). Therefore, given the semi-urban environment and ongoing development of the area, it is considered that the risk for head-on collisions is minimised. A dedicated combined footway and cycleway will be constructed along the northern side of Gilden Way, thus removing the need for cyclists to use the road and further mitigating against this risk.

Problem 5.2.2

Location: Bus stop lay-by at approximate Chainage 1950,000, on north-eastbound Gilden Way, on the approach to the Campions roundabout

Summary: Location of bus stop lay-by on a bend could increase the potential for collisions as a result of bus drivers exiting the lay-by unsafely as a result of failing to see an approaching vehicle.

Description: The proposals include the provision of a bus stop lay-by on the inside of a large left hand bend, and on a downhill gradient. There is concern that the combination of fast approach speeds as a result of the gradient, when combined with potential restrictions in visibility as a result of the horizontal alignment, could increase the likelihood of high speed collisions between buses and general traffic on Gilden Way,

Recommendation: Ensure that appropriate steps are taken to ensure that adequate sight stopping distance is provided for north eastbound vehicles approaching this bus stop.

Designer's Response: The northbound Sight Stopping Distance for this section of road is One Step Below the Desirable Minimum due to the requirement for 2.5m high noise barriers. However, the gradient at this location is -0.9%, occurring immediately after a crest curve and uphill gradient. Traffic speeds are not considered to be greatly increased due to the gradient.

Problem 5.2.3

Location: Proposed shared space area between Gilden Way and the old Sheering Road route to the south of the Campions roundabout.

Summary: Sharpness of bend, reduced forward visibility and road markings layout could increase the potential for head-on collisions between vehicles entering the link road from the south west, and vehicles within the link road.

Description: Although the link road is provided with road markings to delineate the two-way nature of this link, the lanes appear very narrow, and vehicles entering the link road from the south west may be unable to remain in lane as a result of both their approach speed, and the sharpness of the bend.

Drivers travelling east within the link road may be lulled into a false sense of security by the presence of the road markings, which could put them at risk of head-on collisions in the event of a loss of control or incursion by a driver entering the link road.

Also see **Problem 5.5.6**

Recommendation: Provide sufficient width to accommodate two vehicles passing in this location, or provide a road marking layout appropriate for the movements which can be accommodated.

Designer's Response: The carriageway width is 6.0m with a centre line radius of 30.0m. The junction radius are sufficiently large to allow both refuse vehicles and pantechnicons to turn without interfering with traffic on the non-priority road. Swept path analysis may be undertaken in the detailed design stage by the Design & Build contractor to demonstrate this.

Problem 5.2.4

Location: M11 Southbound diverge, within the tiger tail arrangement

Summary: Sag curve within the tiger tail diverge could increase the potential for high speed loss of control collisions.

Description: The proposed alignment of the exit slip gives rise to a steeping of the gradient on the approach to the junction for which a Departure from Standard (D17) would be required. This reportedly results in a vertical sag K value of two steps below absolute minimum for the type of road.

It should be noted that TD 9/93 Para 1.26 states that relaxations below desirable minimum for these parameters are not permitted on the approach to junctions.

There is concern that this could adversely affect forward visibility, and the alignment change when travelled through at speed may increase the potential for loss of control collisions within the diverge. This is predominantly a geometry problem, rather than one of adverse visual perception.

Recommendation: Provide an alignment which is free of abrupt changes in gradient, and which provides drivers with a smooth transition and unobstructed forward visibility throughout the diverge.

Designer's Response: Departure from Standards (D17) has been withdrawn and a compliant vertical sag curve provided.

Problem 5.2.5

Location: Drawing No. B3553F05-0100-DR-0005 Rev P2 in the vicinity of the bend on the proposed link road between Chainages 350,000 and 500,000.

Summary: Reduced carriageway cross section, when combined with a bend and steep downhill gradient could increase the potential for serious loss of control collisions on the westbound carriageway.

Description: The proposed Departure from Standard (D10) with regard to provision of a cross section without 1m hard strips, and with a narrower central reserve than would be normally required for a rural all-purpose dual carriageway is noted.

The proposed speed limit along this link is 50mph, and from Drawing B3553F05-0100-DR-0304 Rev P2, there is a downhill gradient of in excess of 4% along this link, from east to west, with a bend located towards the western end of the link. The downhill gradient may encourage excessive speeds. In the event of a vehicle losing control as a result of travelling too fast, the absence of hard strips may increase the likelihood of vehicles colliding with each other.

Recommendation: Provide a cross section which is appropriate to the nature of the road and its environment.

Designer's Response: The proposed link road is situated within agricultural land on the outskirts of Harlow. Consequently, the existing environment would ordinarily be classified as 'rural'. Given the projected growth proposed for the area the classification is likely to change to 'urban' within the next 5-10 years. Therefore, a design exception has been agreed whereby the link road is to be designed assuming an Urban Road classification and the Design Speed selected accordingly (TD9/93, Table 2) for the anticipated vehicle speeds. The D2UAP cross section is thus in accordance with TD27/05 and the horizontal and vertical alignment is in accordance with TD9/93. Furthermore, adequate Sight Stopping Distance is provided warning drivers of the approaching Campions roundabout.

5.3 JUNCTIONS

Problems 5.3.1 to 5.3.4 can be found in Section 4 of this report, and are unresolved Problems A, D, and F raised in the Stage 1 Road Safety Audit.

Problem 5.3.5

Location: Eastbound Gilden Way, between approximate changes 1550,000 – 1600,000, in the vicinity of the proposed new junction access.

Summary: Minor junction located immediately beyond the end of the merge taper may increase the potential for rear end shunt collisions.

Description: Drawing No. B3553F05-0100-DR-0003 Rev P2 shows the provision of a new left-in left-out access junction off the north side of Gilden Way, approximately 300m from the exit from Churchgate Roundabout to the southwest.

A Differential Acceleration Lane (DAL) of 250m in length is provided to the north-east of the junction, as Gilden Way reverts to a line lane for north-eastbound traffic, but a proposed new junction is then located only a short distance beyond the end of this merge.

Para 4.12 of TD 70/08 (Design of wide single 2+1 roads) states that *"Junctions and accesses must not be located on DALs, their associated tapers or within 500 metres of the end of the taper*".

There is concern that provision of a junction so close to the end of the merge taper may result in drivers engaged in a merging movement may fail to observe a driver ahead slowing in advance of turning, which could increase the likelihood of rear end shunt collisions at the junction. As this stretch of road provides the first opportunity for overtaking after the London Road roundabout, drivers may be keen to make use of the facility, which in turn could result in higher speeds and consequently higher severity collisions.

Recommendation: Relocate this junction access elsewhere.

Designer's Response: The junction forms the access to the new Gilden Park development which has entered a S278 agreement under the Highways Act 1980, the relocation of this junction is therefore not considered feasible. Further review required at detailed design stage by the Design & Build Contractor.

Problem 5.3.6

Location: B186 Gilden Way at its junction with Marsh Lane

Summary: Signed tourist destination access within the controlled area of a controlled pedestrian crossing may increase the potential for rear end shunts, prohibited right turn manoeuvres and collisions involving pedestrians on the crossing.

Description: Marsh Lane currently has tourist signing for Gibberd Gardens (both directions), which means that this track could potentially attract a large number of vehicles. Although signing for the Gibberd Garden is proposed in a single direction only, with the existing sign for traffic approaching from the north east being removed, this access and the proximity of the proposed pedestrian crossing here raises a number of safety concerns as follows:

- There are no proposals to ban right turns at this junction, which could potentially result in drivers waiting in south westbound lane 2 within the controlled area of the crossing in order to turn right into Marsh Lane, which could increase the potential for rear end shunts, and obscure visibility of and for pedestrians using the crossing.

- The narrow access on Marsh Lane is such that there is waiting space for only a small number of vehicles within the junction. In the event of a vehicle approaching from the south-west being unable to enter the junction fully, the potential for rear end shunts involving a following vehicle in the single north eastbound lane may be increased. In addition, as the access is located within the controlled zone of the crossing, the 2+1 lane configuration may not be immediately obvious to a following driver, who may change lanes in order to overtake a turning vehicle. This could increase the likelihood of head-on or pedestrian collisions.

- Vehicles turning right out of Marsh Lane will have to cross three lanes of traffic, which could increase the likelihood of side impact collisions.

- The junction is located very close to the crossing area and appears less than the 20m distance advised by LTN 2/95. Although there is a sign provided on the minor road to warn of pedestrians crossing, this is not specific, and drivers exiting left from the side road may be unable to see the crossing in time to stop safely as a result of visibility obstructions at this junction, and because drivers may be more concerned with looking to their right when seeking a gap to exit. These issues could result in fail to stop and pedestrian involved collisions.

- The junction is close to a westbound bus stop lay by which could potentially result in a westbound vehicle following a bus slowing to enter the lay by colliding with the bus as a result of being unable to overtake due to the presence of a vehicle slowing to turn right in the offside lane. Alternatively, a vehicle following a westbound bus slowing to enter the bus stop may overtake the bus and collide with a vehicle waiting to turn right. The potential for rear end shunt collisions could be increased.

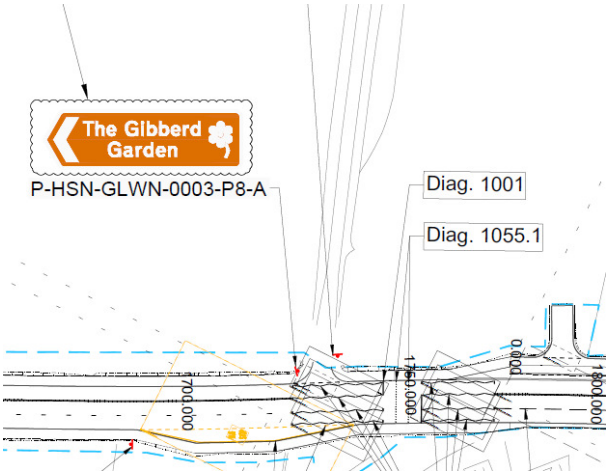


Figure 3 : Road layout in the vicinity of Marsh Lane

Recommendation: Revise the layout at and in the vicinity of this junction to facilitate left turns into the junction, prevent right turns into the junction, and reduce the potential for conflict with pedestrians.

Designer's Response: The existing 'No Right Turn' sign at chainage 1825m prohibiting westbound vehicles making a right hand turn into Marsh Lane to be relocated closer to the junction.

Additional 'No Right Turn' signage added for vehicles exiting Marsh Lane. The provision of a kerbed splitter island to reinforce the left in/left out manoeuvre is not considered feasible given the width of Marsh Lane, however, additional road markings to be considered during detailed design stage by the Design & Build Contractor.

Problem 5.3.7

Location: Western section of the dumbbell roundabout, at its junction with the northbound diverge slip

Summary: Traffic exiting the M11 from the south may experience difficulties entering the roundabout, which could result in queues forming on the slip road, and an increased potential for rear end shunt collisions.

Description: It was noted that traffic flows on the dumbbell roundabout approaching from the north and east are much heavier than flows entering the junction from the M11 from the south, with the former able to approach the roundabout in two lanes, and enter it unopposed. As a result, traffic on the northbound diverge slip road may have fewer opportunities to join the western roundabout, which could result in queues forming on the northbound diverge slip road.

Although it is noted that there are two proposed Departures from Standards with regard to the layout of this diverge slip, these may not be relevant to this particular problem. However, the formation of an extensive queues on the slip road during busy periods could increase the potential for rear end shunt collisions under the following circumstances:

- Rear end shunts and side swipe collisions between drivers accepting unsafe gaps on entering the roundabout as a result of high circulating flows, and drivers already circulating. Such incidents could result in high speed side swipe collisions because circulating drivers have not needed to give way on entering the junction, and the speed limit in this area is shown on Plan B3553F05-0000-SK00079 as 70mph.

- Rear end shunts involving drivers close to the give way line, and drivers at the give way line on the M11 northbound diverge entry to the roundabout entering the roundabout as a result of driver impatience, or misinterpretation of potential gap acceptance by either the driver ahead, or the following driver.

- In the event of the queue extending back down the northbound diverge slip road and potentially onto the M11 mainline, rear end shunts between traffic exiting the M11 and drivers at the end of the queue.

Recommendation: Verify the outputs of junction modelling to ensure that the proposed junction layout operates effectively, provides sufficient gaps for northbound M11 traffic exiting at J7a to enter the roundabout, and does not result in excessive queuing on the diverge slip. Monitor in the early months of operation to determine if further alterations are required.

Designer's Response: The above junction modelling results suggest that both proposed dumbbell roundabouts operate within capacity (maximum RFC is less than 0.70). The modelling results also suggest that the estimated queue lengths can be contained within the available physical stacking space.

It is considered unlikely that vehicles will be negotiating the circulatory carriageway at a speed of 70mph, especially at times of high flows. Therefore, the potential for high-speed side swipes is questioned.

Problem 5.3.8

Location: Southbound approach to the Campions roundabout

Summary: Sharp deflection on the approach to the roundabout, and possible see-through to the circulatory area could increase the potential for island strikes and fail to stop collisions with circulating traffic.

Description: The southbound approach to the Campions roundabout on Sheering Road follows a relatively straight alignment until a short distance before entry to the roundabout, where a sharp deflection to the left is proposed. The alignment of the circulatory area between Shearing Road and the new link road here is such that drivers may experience see-through and fail to appreciate the deflection or proximity of the roundabout entry, resulting in fail to stop collisions or collisions with the splitter island as a result of inappropriate approach speeds.

Recommendation: Although a map-type sign is provided on the approach to the roundabout, ensure that sufficient visual clues and guidance are provided to alert drivers to the road layout ahead.

Designer's Response: The approach to the roundabout is at a higher elevation with adequate Sight Stopping Distance, giving the driver good visibility of the layout ahead. Notwithstanding this, the provision of additional warning signs may be considered during the detailed design stage by the Design & Build contractor.

Problem 5.3.9

Location: Western dumbbell roundabout at M11 Junction 7a

Summary: Risk of side swipe collisions on entry to the roundabout

Description: Details of swept paths for a goods vehicle and another vehicle travelling alongside while entering and circulating this section of Junction 7a were reviewed as part of this RSA. This is shown in Figure 4.

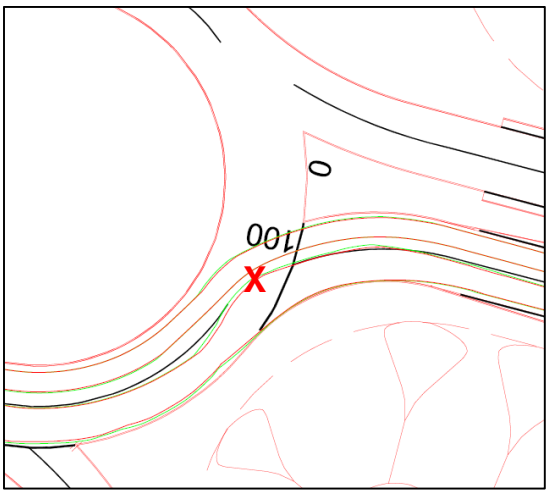


Figure 4 : Swept paths for vehicles travelling alongside on the eastern dumbell roundabout at J7a

Whilst the sketch confirms that there is sufficient space for another vehicle to travel alongside a goods vehicle in the nearside lane whilst entering and circulating in this location, the path taken by the vehicle in lane 2 does not appear representative of likely actual positioning. It is considered likely that a more direct path may be followed by a vehicle in lane 2. Under these circumstances, a side swipe collision between vehicles in adjacent lanes may potentially occur at point X on Figure 4. In addition, the HGV swept path shown is likely to result in nearside kerb over-runs, which could destabilise a vehicle and increase the potential for side swipe collisions.

Recommendation: Adjust the design of this entry to minimise the likely conflict between vehicles travelling two abreast.

Designer's Response: Further swept path analysis may be undertaken during the detailed design stage by the Design & Build Contractor and the alignment adjusted to suit if required.

Problem 5.3.10

Location: M11 J7a Northbound merge

Summary: Under provision of capacity for traffic joining the northbound M11 from J7a may result in merging, side swipe and rear end shunt collisions on the approach to, and at the merge.

Description: A number of separate Departures from Standard have been applied for with regard to this proposed merge, which when considered collectively may be severely detrimental to safety at this merge:

- The provision of a parallel merge rather than a lane gain arrangement (Departure D13) suggests that traffic flows are of a sufficiently high level for which a lane gain would be required to accommodate the additional traffic on the mainline, but that an arrangement which requires traffic in adjacent lanes to physically merge is to be provided instead. Poorly accommodated heavy merge flows could disrupt flow on the mainline, causing braking and flow breakdown, and increase the potential for rear end shunts.

- The provision of a reduced auxiliary lane length, taper length and nose length on this parallel merge (Departure D14) means that drivers on the merge slip will potentially have less time in which to identify and select a safe gap into which to merge with mainline traffic. This could result in unsafe gap choices, merging difficulties resulting in side swipe collisions between mainline and merge slip traffic, and sudden braking at the end of the merge slip, which could result in rear end shunt collisions.

Although not a reported Departure from Standard, it was noted from Drawing Number B3553F05-0100-DR-0306 Rev P02 that there appears to be a proposed downhill gradient of 6% over part of the northbound merge slip, approximately between Chainages 220,00 and 85,000. This is likely to encourage traffic speeds well in excess of the 70kph design speed, and more likely to be in the range of the proposed 70mph proposed speed limit. This disparity is shown in Figure 5.

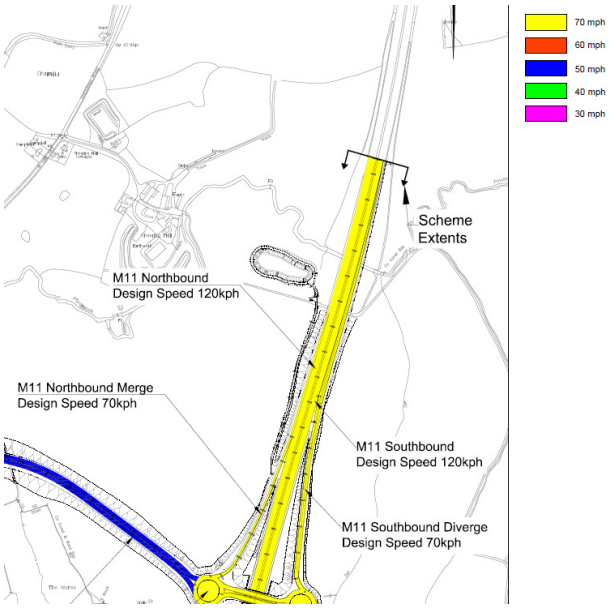


Figure 5 : Extract from speed limit and design speed information supplied

The disparity between design speed and speed limit is of greatest concern during off peak periods when flows are low and speeds are likely to be high. Vehicles travelling at speeds in excess of the design speed may be more likely to experience loss of control.

When considered together, these two proposed departures, the steep vertical alignment, and disparity between design speed and speed limit potentially combine to create a bottleneck at the merge, with too much traffic arriving at the merge point at too high a speed to be safely

accommodated, and with insufficient time and too little space to facilitate safe merging.

A further two proposed Departures from Standard in relation to sag and crest curves on this merge may further compromise safety, as follows:

- The vertical alignment at the start of the auxiliary lane (vertical sag K value one step below absolute minimum for a 70kph design speed, Departure Reference D15) is such that this may result in loss of control: vehicles in this location will be accelerating in preparation for the merge and would be expected to be travelling at speeds well in excess of the reported design speed. High speed loss of control collisions would be expected to result in higher severity incidents.

- The vertical alignment immediately beyond the exit from the roundabout junction is such that the crest value reportedly one step below desirable minimum (Departure Reference D16) which could result in drivers exiting the roundabout without being able to fully appreciate the road layout ahead as a result of forward visibility issues. In the event of congestion or collisions resulting in tailbacks on the merge slip (see earlier paragraphs of this Problem for potential reasons for this), the potential for vehicles exiting the roundabout and colliding with the back of a queue could be increased.

It should be noted that TD 9/93 Para 1.26 states that relaxations below desirable minimum for these parameters are not permitted on the approach to junctions.

In addition to all of the above, it appears from Drawing No. B3553F05-0100-DR-0306 Rev P2 that gradients of 6% are proposed on this merge slip, which could encourage higher speeds, result in higher braking and stopping distances being required by drivers and increase the severity of any collisions which do occur.

Recommendation: Provide an appropriate merge layout which is safe and suitable for the likely speeds and volumes of traffic using it.

Designer's Response: Traffic modelling suggests that the increase in the design year forecast traffic flows is not significant and that the M11 northbound carriageway, between J7 and J8, will continue to operate adequately as three lanes, without the need for additional widening. Provision of a betterment on the Desirable Minimum SSD visibility leading into the merge over the length of the slip road will ensure adequate inter-visibility between the slip road and M11 mainline to enable vehicles to adjust their speed in a controlled manner prior to the merging of vehicles onto the M11, reducing the risk of collision. The presence of a continuous hard shoulder immediately following the parallel merge can act as an escape lane in the event that a vehicle has insufficient time to merge, whereby reducing the potential for side swipe due to late merging manoeuvres. Departures D13 and D14 have been approved.

The slip roads have been designed in accordance with TD22/06 Table 4/1 "Connector Road Design Speeds". The concern with disparity between the design speed and speed limit is noted as being of greatest concern during off peak periods when flows are low. In this event, it is considered unlikely that a bottleneck at the merge will occur.

The vertical sag curve and crest curve (Departures D15 and D16 respectively), have been withdrawn and a compliant alignment provided.

Problem 5.3.11

Location: M11 Northbound diverge

Summary: Insufficient provision to accommodate drivers wishing to exit at this junction may result in sudden braking or dangerous last minute manoeuvres resulting in collisions at the diverge.

Description: There are two proposed Departures from Standard with regard to this diverge which together result in reduced capacity for exiting traffic:

- Departure D5 proposes the provision of a taper diverge layout when the Departure states that "the flows suggest that a lane drop at taper diverge would be more appropriate", and
- Departure D12 proposes a reduction in the nose length and taper length of the proposed taper diverge.

In combination, these departures could potentially result in less space being provided over which drivers can undertake an existing manoeuvre. This could increase the potential for last minute manoeuvres, sudden braking, driving across the solid hatch markings, and side swipe or rear end shunt collisions at the exit.

Recommendation: Provide an appropriate merge layout which is suitable for the likely speeds and volumes of traffic using it.

Designer's Response: The volume of diverging traffic is relatively low (maximum of 686 vehicles in the evening peak hour) and the junction capacity modelling (VISSIM Microsimulation) shows that the forecast average queue lengths for the design year of 2036 peak flow are negligible, any queues that form can be contained within the available stacking space on the slip road; and there is no impact on mainline traffic or traffic on other parts of the junction.

Providing a betterment on the SSD visibility over the length of the slip road in accordance with TD 22/06 clause 4.18, will ensure adequate visibility on the slip road diverge to enable vehicles to adjust their speed in a controlled manner, reducing the risk of collisions.

5.4 NON-MOTORISED ROAD USERS

Problem 5.4.1 can be found in Section 4 of this report, and is unresolved Problem B raised in the Stage 1 Road Safety Audit.

Problem 5.4.2

Location: West side of Churchgate Roundabout, for pedestrians travelling between the existing public footpath, or westbound bus stop on the south side of Gilden Way to the west of the roundabout, to the west and the north side of Gilden Way, and the new development at Harlowbury.

Summary: Pedestrians using the public footpath on the south west corner of the junction, or alighting at the westbound bus stop to the west of the roundabout, and wishing to access the footway on the north side of Gilden Way or the new development, may be at risk of collisions with vehicles whilst attempting attempt to cross Gilden Way (western arm).

Description: A public footpath emerges from the south a short distance to the west of the Churchgate roundabout, where no footway is provided along the south side of Gilden Way. There is also a bus layby serving westbound buses a short distance to the west of the Churchgate roundabout. Both are likely to generate pedestrian traffic.

Although pedestrian numbers are currently low, usage may increase following construction of the development at Harlowbury.

There are no formal pedestrian facilities existing or proposed along this stretch of Gilden Way, and the Audit Team considers it likely that pedestrians may attempt to cross at the traffic signals at the western end of the roundabout. Although there are splitter islands which may be used by pedestrians to cross in stages, these are small, and do not have dropped kerbs, which could increase the likelihood of mobility-impaired pedestrians either being stranded in the carriageway, or being involved in side swipe collisions with passing vehicles.

Recommendation: Provide crossing facilities which can be used by bus passengers and users of the public footpath to access the north side of Gilden Way.

Designer's Response:. There is insufficient space to provide a footpath on the south side of Gilden Way between the westbound bus stop and Churchgate roundabout. There is an existing underpass at the location of the bus stop for passengers to use in order to cross the carriageway and travel towards the Harlowbury development.

The existing public footpath is considerably overgrown and not satisfactory for use by mobility-impaired pedestrians. The main amenities are located to the northwest of the Harlowbury development, therefore it is considered that even following this development, the future pedestrian numbers will continue to be low.

Problem 5.4.3

Location: South side of Gilden Way, opposite the junction with Mulberry Green

Summary: Narrow footway could increase the potential for side swipe collisions involving pedestrians

Description: The footway adjacent to the controlled zone of a pedestrian crossing on the south side of Gilden Way close to Mulberry Green appears very narrow, but it was unclear why this was being provided (there is currently no footway here, and there do not appear to be any obvious pedestrian attractors here.

It is noted that an application for a Departure from Standards (D22) has been applied for with regard to the reduced footway width in a number of locations along Gilden Way, but until such time as these are approved, this issue remains.

Providing a footway here may encourage pedestrian use and increase exposure to the risk of involvement in side swipe collisions with passing vehicles, or of pedestrians being struck by the wing mirrors of close-passing buses or large vehicles. The reduced lane widths associated with the proposed narrow cross section of this 2+1 carriageway may exacerbate this problem.

Figure 6 : Looking north east towadrs Mulberry Green

Recommendation: Ensure the pedestrian routes are consistent with users' needs in accordance with the Non-Motorised User Audit for the scheme (WCHAR was not applicable to this scheme).

Designer's Response: There is an existing tarmac surface on the south side of Gilden Way between the existing pedestrian crossing, terminating at a concrete bellmouth opposite Mulberry Green junction. This ties in with an existing public footpath (FP185_22) that connects Gilden Way with FP20 and 21 to the south. This section of footway has been provided to retain connectivity to the existing footpath.

Departure from Standards D22 has been withdrawn. Departure from Standards D22 has been withdrawn. The removal of this section of footway will be considered.

Problem 5.4.4

Location: Between the existing staggered bus stops to the south west of Churchgate Roundabout and Churchgate roundabout itself, on the south east side of Gilden Way.

Summary: Failure to provide a safe route for pedestrians may result in an increased likelihood of pedestrian collisions and side swipe collisions.

Description: It was noted from plans that a narrow footway is proposed in this location, between the bus stop on the south-westbound carriageway and the Churchgate Roundabout, where none is currently provided. Whilst the intention is good, there is concern that encouraging pedestrians into an area where they are in close proximity to a narrow 2+1 road layout may increase the potential for side-swipes with passing vehicles (or their wing mirrors), or collisions involving pedestrians.

Recommendation: Provide a safe route for pedestrians accessing this bus stop.

Designer's Response: . There is currently no provision for a pedestrian footway along this stretch of carriageway. It is proposed that pedestrians alighting at the westbound bus stop will use the underpass should they wish to access north of Gilden Way. See also 5.4.2 regarding the provision of a pedestrian guard rail.

Problem 5.4.5

Location: B187 Gilden Way

Summary: Insufficient space for cyclists within the proposed cross section could increase the potential for cyclist side swipe collisions with passing traffic, and loss of control by cyclists as a result of passing too close.

Description: It is proposed to provide separation between north-eastbound and south-westbound traffic streams in all locations where a 2+1 arrangement is proposed, using a system of double white lines only, combined with narrower than recommended lane widths, and with no hard strip at the carriageway edges. No off-carriageway cycle route is provided along most of the link.

This arrangement leaves very little space for cyclists using the route, and in the absence of any signing to indicate that the footways are for shared use, it must be assumed that cyclists are expected to travel on the carriageway. In the event of a cyclist travelling north eastbound within the single lane section, it is considered likely that a following vehicle will attempt to pass, which could endanger a cyclist and increase the potential for head-on or side-swipe collisions between vehicles or with cyclists. However, cyclists travelling south-westbound may also be at risk of involvement in side swipe collisions or rear end shunts, as a result of the narrow lanes provided.

Also see **Problem 5.2.1.**

Recommendation: Provide safe routes for cyclists.

Designer's Response: Safe routes for cyclists will be provided by the combined footway/cycleway on the north side of Gilden Way. The requirement for additional signage/markings identifying this route as a shared space may be considered during detailed design stage by the Design & Build Contractor.

Problem 5.4.6

Location: In the vicinity of the north eastbound bus stop on Gilden Way, to the south west of the Campions roundabout.

Summary: Unclear route for pedestrians could result in tripping incidents or pedestrians becoming trapped in the carriageway, where they could be at risk of side swipe collisions.

Description: Although a footway link is provided in the immediate vicinity of the proposed bus stop, the route for pedestrians accessing or leaving this bus stop was unclear. It might be assumed that pedestrians would use the old route of Sheering Road, but in the absence of dropped kerbs close to the bus stop side it was unclear how the road would be accessed safely.

Figure 7 : Unclear route for cyclists and pedestrians

This may present additional hazards for visibility-impaired and/or mobility-impaired pedestrians.

Recommendation: Provide a clear and accessible route to and from the bus stop for pedestrians of all abilities.

Designer's Response: Point has been noted, a drop kerb will be provided on Chainage 120m on Old Sheering Road to allow pedestrian access the old route safely and avoid side swipe collisions.

5.5 SIGNING, LIGHTING, ROAD MARKINGS

Problem 5.5.1

Location: North east of Churchgate Roundabout, for vehicles travelling north eastbound.

Summary: Vehicles encouraged to merge from nearside to offside may increase the potential for merging and head-on collisions.

Description: A Differential Acceleration Lane (is provided on the exit from Churchgate Roundabout, within which vehicles must merge in advance of a return to a single traffic lane. Deflection arrows provided within this lane guide traffic to merge towards the offside, and centre line of the road in a cross-section with narrow lanes. This gives rise to a number of safety concerns as follows:

- In the event of a failure to merge, vehicles will be guided towards the centre of the road, making a head-on collision with vehicles in the opposing lanes more likely.
- Overseas drivers in left hand drive vehicles (especially goods vehicles with poorer offside visibility) may experience difficulties merging to the right, due to visibility issues associated with driver positioning within the vehicle, which could increase the potential for side swipe collisions.
- Slower vehicles would be required to merge with vehicles travelling at potentially higher speeds, with the result that vehicles in the nearside lane may be forced to accelerate in order to merge. In the event of a collision, this could result in higher severity outcomes.

Recommendation: Provide a conventional merge, from offside to nearside.

Designer's Response: The recommendation is accepted and the deflection arrows are to be moved to the offside lane and their direction mirrored, however, it shall be noted that deflection arrows should be placed in the centre of the lane that is being lost, in this case the near side lane.

Problem 5.5.2

Location: Eastbound and westbound approaches to Churchgate roundabout, for traffic turning right.

Summary: Potential for last minute lane changes involving right-turning vehicles on the immediate approach to the roundabout.

Description: Although touched upon in Problem E (bullet 1) of the Stage 1 Road Safety Audit, there is a very real risk that drivers approaching the roundabout intending to turn right may position themselves in the offside lane in preparation for the turn. The road markings advise drivers for the 'local route' to approach the junction in the nearside lane.

Drivers have approximately 50m from the start of the flared approach, to the exit left in order to position themselves appropriately in advance of the left turn, and the Audit Team considers that both the time provided and information given may be insufficient. The risk of sudden and/or late lane change movements may result in rear end shunt or side-swipe collisions.

Recommendation: Provide additional advance warning to motorists to ensure that drivers understand the need to take the nearside diverge to enter the circulatory carriageway in the nearside lane in order to turn right at this junction.

Designer's Response: Additional advance warning signs for vehicles wishing to turn right at the roundabout may be considered during detailed design stage by the Design & Build Contractor.

Problem 5.5.3

Location: Churchgate Roundabout

Summary: Inconsistent signing and road markings could create confusion, resulting in sudden braking or last minute lane changes, which could result in rear end shunt or side swipe collisions.

Description: There are a number of inconsistencies in terms of the destinations for which advance direction signs, flag-type direction signs, and associated road markings have been provided on the approaches to and at this junction, which could potentially confuse drivers. Abbreviations which may not be immediately obvious to drivers, 'missing destinations' (which appear on advance signs but not on the exit flag type signs), or road markings with conflicting or contrary information (A1025 North shown in both directions for example) may all create confusion and result in hesitation, sudden braking or unexpected manoeuvres resulting in nose to tail or side swipe collisions.

Recommendation: Provide consistency and clarity in direction signing and road markings throughout the scheme.

Designer's Response: It is accepted there are anomalies in the traffic signs and road markings at Churchgate roundabout and these will be amended.

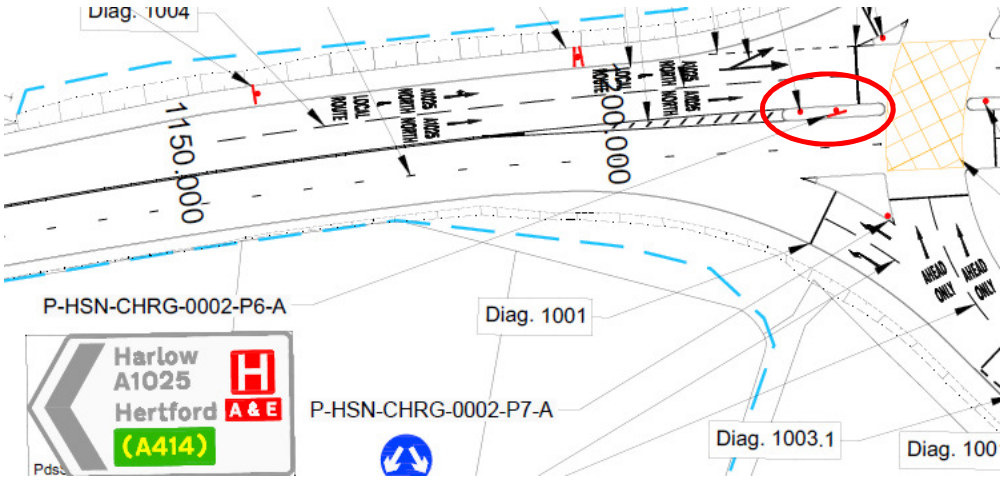
Problem 5.5.4

Location: Churchgate Roundabout, where flag type signs are located on the central reservation

Summary: Flag type signs may encourage unlawful left turns from the circulatory carriageway of the roundabout into the dedicated exit for the straight-through ahead movements, which could result in rear end shunts or side swipe collisions.

Description: Flag type signs are proposed on the splitter islands at the eastern and western ends of the route through the centre of the roundabout, on narrow splitter islands at the exits to Gilden Way (west and east). These signs are located where they are most likely to be visible to circulating, rather than left-turning drivers. This is illustrated below.

Figure 8 : Flag type signs may encourage inappropriate left turn movements



Although the road markings within the circulatory area include ahead arrows, the signs may suggest to drivers that they are able to turn left:

- A driver turning left unexpectedly may be struck from behind by a following driver, or
- A driver who turns left from within the circulatory area may conflict with a vehicle using the dedicated left slip appropriately, resulting in a side swipe collision.

Additionally, the clearance between these signs and the edge of carriageway is unknown and in the absence of sufficient clearance, drivers may be at risk of collision with these signs, resulting in vehicle damage and the creation of debris which may itself become a hazard.

Recommendation: Relocate the flag type signs to a location where they can be clearly seen only by those for which they are intended.

Designer's Response: The traffic signs will be reviewed and alternative locations for the flag signs may be considered during detailed design stage by the Design & Build Contractor.

Problem 5.5.5

Location: Eastbound exit from London Road roundabout, at the southwestern extent of the scheme

Summary: Increased potential for side swipe and merging collisions, and fail-to-stop collisions involving pedestrians on the approach to the pedestrian crossing, as a result of a failure to retain existing road markings.

Description: The eastbound exit from London Road roundabout is currently hatched to provide a single exit lane. All other road markings within the scheme boundary on Sheet B3553F05-1200-DR-0004 Rev P2 are shown as being refreshed, but it was unclear to the Audit Team whether these markings were being removed, or simply not refreshed.

A review of pavement drawings for this location indicate that local widening is planned which may affect the required location of hatched markings.

In the absence of hatched markings to channel vehicles into a single lane on exit, two drivers may attempt to exit the roundabout side by side on the approach to a what will be a controlled pedestrian crossing. This behaviour could increase the potential for merging collisions, and merging drivers may be sufficiently distracted to fail to see a red signal at the crossing point, which could also result in pedestrian collisions. A failure to merge may also result in an offside vehicle being forced into the opposing traffic lane at the merge point, resulting in head-on collisions with south westbound traffic.

Recommendation: Provide a layout which discourages north eastbound drivers from exiting the London Road roundabout two abreast.

Designer's Response: Hatched road markings have now been provided at the roundabout exit.

Problem 5.5.6

Location: Proposed shared space area between Gilden Way and the old Sheering Road route to the south of the Campions roundabout.

Summary: Provision of road markings may undermine the intention to share space, which could result in drivers assuming priority and increase the risk of collisions involving pedestrians or cyclists.

Description: Although signs to indicate that all road users should share space within this cul-de-sac, there is a proposal to provide road markings within parts of the area, along with warning signs regarding pedestrians and cyclists. This contrasts with the idea of shared space, could generate confusion, and increases the risk that different road users may perceive the layout (and priority) differently. This could increase the potential for collisions between pedestrians and vehicular traffic.

Recommendation: Provide a simple layout which gives clear and consistent messages to all road users.

Designer's Response: The shared space concept will be reviewed during detailed design stage by the Design & Build Contractor

Problem 5.5.7

Location: In the vicinity of the dumbbell roundabout at Junction 7a, and on the link road between the Campions roundabout, and the dumbbell roundabout at J7a.

Summary: Potential for drivers to negotiate the junction, or travel on the link road, at excessive speeds, which could increase the potential for loss of control collisions.

Description: It appears from the signs and road markings drawings provided that speeds are derestricted until drivers enter the link road beyond the dumbbell junction. In the absence of a reduction in speed limit, drivers exiting the motorway may assume that it is appropriate to travel at the higher speed, which could increase the potential for loss of control collisions on the dumbbell junction.

For drivers entering the motorway from the dumbbell junction, no indication of a change in speed limit from the previously signed 50mph was in evidence, which could give rise to collisions during merging on the M11 as a result of speed differentials between merging traffic and vehicles on the mainline.

In addition, it was unclear whether the signed 50mph speed limit on the link road was enforceable in the absence of repeater signs which could result in drivers travelling at excessive speeds. It was noted that a proposed Departure from Standard has been applied for with regard to the cross section of this link road, with a narrower cross section more appropriate to an urban dual carriageway (D2UAP) proposed. When combined with a road located in an area which is not otherwise obviously 'urban' the risk of drivers travelling at excess speed resulting in loss of control collisions may be increased.

Recommendation: Provide appropriate and correctly signed speeds limits on all parts of the network.

Designer's Response: 50 mph repeater signs have been provided at approximate chainage 300m to reinforce the restricted speed limit. National Speed Limit signs to Dia. 671 will be provided on the entrance to the dumbbell roundabout.

Problem 5.5.8

Location: The Campions Roundabout

Summary: Junction layout is inconsistent with the map-type sign provided, which could result in sudden lanes changes and inappropriate manoeuvres resulting in rear end shunts or side swipe collisions in the vicinity of the attenuation pond access.

Description: The map-type sign P-HSN-SHR-0005-P2-A provided on the southbound approach to the Campions roundabout on Sheering Way indicates a four arm junction, with the main route towards the M11 as the first exit.

However, it was noted from plans that the first exit is the double access associated with the attenuation pond and adjacent land. It is not clear from plans provided whether this access is gated, and there is concern that drivers wishing to follow routes to the M11 may mistakenly turn into this access, or start to. This could result in sudden braking, or late corrections and lane changes as drivers correct their position, which could result in rear end shunts with following vehicles, or side swipe collisions with vehicles traveling alongside.

Recommendation: Provide clear and accurate driver information for users of the roundabout and ensure the design of the access minimises scope for collisions.

Designer's Response: Map sign to be revised to show the attenuation pond access. It is also highlighted that gate Type 2, timber double field gate in accordance with HCD H22 with wire mesh in accordance with HCD/H23 has been proposed (see series 300 fencing drawings).

Problem 5.5.9

Location: The dumbbell roundabouts at Junction 7a, where the diverge slips approach the roundabout.

Summary: Failure of drivers to see the No Entry signs could result in inappropriate turning movements and head-on collisions.

Description: Although No Entry signs are provided at the top of the northbound diverge slip, these are co-located back-to-back with the End of Motorway signs. As a result, the angle at which they are mounted may make them very difficult for approaching drivers to see.

This could increase the potential for drivers to enter the motorway in error, which could result in head-on collisions with vehicles on the slip road.

Recommendation: Position and orientate these and other signs such that they can be clearly seen by approaching drivers.

Designer's Response: Back-to-back signs at the top of diverge slip roads are standard provision. The angle of the flare would mean that any vehicle that has attempted to turn left into the diverge would be facing the sign head on which is considered more appropriate.

Problem 5.5.10

Location: Northbound and southbound merge slips to the M11

Summary: Termination of street lighting part way dwn merge slips could increase the potential for loss of control or merging collisions during the hours of darkness.

Description: The street lighting proposals include lighting of only the upper sections of merge and diverge slips at the proposed new Junction 7a, with no lighting proposed at the merge and diverge points. Drivers travelling towards the merges on the slip roads during the hours of darkness will transition from a lit to an unlit carriageway only a few seconds before they must merge, and during this time, their eyes may still be adjusting to the change in ambient light. This could potentially result in drivers failing to clearly see and assess the road in time to identify any hazards and choose a safe time and location in which to merge. Motorcyclists on the mainline may be at particular risk of not being seen. This could result in loss of control, or merging collisions in the vicinity of the merges.

While this is a common arrangement, in this scheme it presents additional hazards associated with the Departures from Standards which may be less evident in unlit condition. These hazards are described in more detail in Problems 5.2.4, 5.3.7, 5.3.10 and 5.3.11 of this report.

Recommendation: Provide consistent lighting levels throughout the length of the merge slips.

Designer's Response: The Audit Team recognise this as a common arrangement but consider the scheme presents additional hazards associated with the Departures from Standards which may be less evident in the unlit condition.

It should be noted that the southbound merge does not have any associated departures and departures D15 & D16 associated with the northbound merge have been withdrawn and a compliant vertical alignment provided. Departures D13 & D14 associated with the northbound merge remain, however, departure D13 is concerned with the type of merge provided and thus is not considered to have an influence on the specific concerns raised. D14 is therefore the only relevant departure which is related to the Nose, Auxiliary and Exit Taper lengths.

The design provides a betterment on the requirement of 1.5 x SSD (from 180m to 205m) which will ensure inter-visibility between the slip road and M11 mainline to enable vehicles to adjust their speed in a controlled manner prior to the merging of vehicles onto the M11, reducing the risk of collisions. Furthermore, the last lamp column is positioned 135m from the back of nose. It would take a vehicle 7 seconds to travel this distance based on the design speed, which is considered sufficient time to allow a driver's eyes to adjust to the change in ambient light.

The extents of the lighting on the scheme were justified in the Appraisal of Road Lighting to TA 49/07 B3553F05-1300-REP-0001 R2. Any increase extents to the lighting on the slip roads would mean that the M11 Mainline would have to be lit to in accordance with TD 34. This is considered an over provision for the reasons given above at is it suggested that the current lighting arrangement is retained.

6. Audit Team Statement

I certify that this audit has been undertaken in accordance with Essex County Council Road Safety Audit Policy except where stated in the text.

AUDIT TEAM LEADER

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Associate, Operational Road Safety

Jacobs, Tower Bridge office

Date: 21 June 2018

AUDIT TEAM MEMBER

Kate Carpenter BEng CEng MICE FCIHT FSoRSA

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Jacobs, Tower Bridge office

Date: 21 June 2018

Both members of the Audit Team hold Certificates of Competency in Road Safety Audit, compliant with EC Directive 2008/96/EC and HD19/15, the national Road Safety Audit Standard.

Appendix A. Documents submitted for this Road Safety Audit

Series	Document/Drawing Number	Rev / Date	Title (or Description)
100	B3553F05-0100-DR-0000	P2	General Arrangement (Key Plan)
100	B3553F05-0100-DR-0001	P2	General Arrangement (Layout Plan) 1 of 8
100	B3553F05-0100-DR-0002	P2	General Arrangement (Layout Plan) 2 of 8
100	B3553F05-0100-DR-0003	P2	General Arrangement (Layout Plan) 3 of 8
100	B3553F05-0100-DR-0004	P2	General Arrangement (Layout Plan) 4 of 8
100	B3553F05-0100-DR-0005	P2	General Arrangement (Layout Plan) 5 of 8
100	B3553F05-0100-DR-0006	P2	General Arrangement (Layout Plan) 6 of 8
100	B3553F05-0100-DR-0007	P2	General Arrangement (Layout Plan) 7 of 8
100	B3553F05-0100-DR-0008	P1	General Arrangement (Layout Plan) 8 of 8
100	B3553F05-0100-DR-0301	P2	Longitudinal Sections, 1 of 8
100	B3553F05-0100-DR-0302	P2	Longitudinal Sections, 2 of 8
100	B3553F05-0100-DR-0303	P2	Longitudinal Sections, 3 of 8
100	B3553F05-0100-DR-0304	P2	Longitudinal Sections, 4 of 8
100	B3553F05-0100-DR-0305	P2	Longitudinal Sections, 5 of 8
100	B3553F05-0100-DR-0306	P2	Longitudinal Sections, 6 of 8
100	B3553F05-0100-DR-0307	P2	Longitudinal Sections, 7 of 8
100	B3553F05-0100-DR-0308	P2	Longitudinal Sections, 8 of 8
100	B3553F05-0100-DR-0860	P2	Departure Submission Sheet Reference
300	B3553F05-0300-DR-0000	P2	Fencing (Key Plan)
300	B3553F05-0300-DR-0001	P2	Fencing (Layout Plan), 1 of 8
300	B3553F05-0300-DR-0002	P2	Fencing (Layout Plan), 2 of 8
300	B3553F05-0300-DR-0003	P2	Fencing (Layout Plan), 3 of 8
300	B3553F05-0300-DR-0004	P2	Fencing (Layout Plan), 4 of 8
300	B3553F05-0300-DR-0005	P2	Fencing (Layout Plan), 5 of 8
300	B3553F05-0300-DR-0006	P2	Fencing (Layout Plan), 6 of 8
300	B3553F05-0300-DR-0007	P2	Fencing (Layout Plan), 7 of 8
300	B3553F05-0300-DR-0008	P1	Fencing (Layout Plan), 8 of 8
400	B3553F05-0300-DR-0000	P01.1	Road Restraint Systems Key Plan
400	B3553F05-0300-DR-0001	P01.1	Road Restraint System Sheet 1 of 8
400	B3553F05-0300-DR-0002	P01.1	Road Restraint System Sheet 2 of 8
400	B3553F05-0300-DR-0003	P01.1	Road Restraint System Sheet 3 of 8
400	B3553F05-0300-DR-0004	P01.1	Road Restraint System Sheet 4 of 8
400	B3553F05-0300-DR-0005	P01.1	Road Restraint System Sheet 5 of 8
400	B3553F05-0300-DR-0006	P01.1	Road Restraint System Sheet 6 of 8
400	B3553F05-0300-DR-0007	P01.1	Road Restraint System Sheet 7 of 8
400	B3553F05-0300-DR-0008	P01.1	Road Restraint System Sheet 8 of 8
500	B3553F05-0500-DR-0000	P01.1	Drainage (Key Plan)
500	B3553F05-0500-DR-0001	P01.1	Drainage (Layout Plan), 1 of 8

Series	Document/Drawing Number	Rev / Date	Title (or Description)
500	B3553F05-0500-DR-0002	P01.1	Drainage (Layout Plan), 2 of 8
500	B3553F05-0500-DR-0003	P01.1	Drainage (Layout Plan), 3 of 8
500	B3553F05-0500-DR-0004	P01.1	Drainage (Layout Plan), 4 of 8
500	B3553F05-0500-DR-0005	P01.1	Drainage (Layout Plan), 5 of 8
500	B3553F05-0500-DR-0006	P01.1	Drainage (Layout Plan), 6 of 8
500	B3553F05-0500-DR-0007	P01.1	Drainage (Layout Plan), 7 of 8
500	B3553F05-0500-DR-0008	P01.2	Drainage (Layout Plan), 8 of 8
700	B3553F05-0700-DR-0000	P2	Road Pavement (Key Plan)
700	B3553F05-0700-DR-0001	P2	Road Pavement (Layout Plan), 1 of 8
700	B3553F05-0700-DR-0002	P2	Road Pavement (Layout Plan), 2 of 8
700	B3553F05-0700-DR-0003	P2	Road Pavement (Layout Plan), 3 of 8
700	B3553F05-0700-DR-0004	P2	Road Pavement (Layout Plan), 4 of 8
700	B3553F05-0700-DR-0005	P2	Road Pavement (Layout Plan), 5 of 8
700	B3553F05-0700-DR-0006	P2	Road Pavement (Layout Plan), 6 of 8
700	B3553F05-0700-DR-0007	P2	Road Pavement (Layout Plan), 7 of 8
700	B3553F05-0700-DR-0008	P2	Road Pavement (Layout Plan), 8 of 8
1100	B3553F05-1100-DR-0000	P2	Kerbs, Footway & Paved Areas (Key Plan)
1100	B3553F05-1100-DR-0001	P2	Kerbs, Footway & Paved Areas (Layout Plan), 1 of 8
1100	B3553F05-1100-DR-0002	P2	Kerbs, Footway & Paved Areas (Layout Plan), 2 of 8
1100	B3553F05-1100-DR-0003	P2	Kerbs, Footway & Paved Areas (Layout Plan), 3 of 8
1100	B3553F05-1100-DR-0004	P2	Kerbs, Footway & Paved Areas (Layout Plan), 4 of 8
1100	B3553F05-1100-DR-0005	P2	Kerbs, Footway & Paved Areas (Layout Plan), 5 of 8
1100	B3553F05-1100-DR-0006	P2	Kerbs, Footway & Paved Areas (Layout Plan), 6 of 8
1100	B3553F05-1100-DR-0007	P2	Kerbs, Footway & Paved Areas (Layout Plan), 7 of 8
1100	B3553F05-1100-DR-0008	P2	Kerbs, Footway & Paved Areas (Layout Plan), 8 of 8
1200	B3553F05-1200-DR-0000	P2	Traffic Signs & Road Markings (Key Plan)
1200	B3553F05-1200-DR-0001	P2	Traffic Signs & Road Markings (Layout Plan), 1 of 10
1200	B3553F05-1200-DR-0002	P02.1	Traffic Signs & Road Markings (Layout Plan), 2 of 10
1200	B3553F05-1200-DR-0003	P2	Traffic Signs & Road Markings (Layout Plan), 3 of 10
1200	B3553F05-1200-DR-0004	P02.1	Traffic Signs & Road Markings (Layout Plan), 4 of 10
1200	B3553F05-1200-DR-0005	P2	Traffic Signs & Road Markings (Layout Plan), 5 of 10
1200	B3553F05-1200-DR-0006	P2	Traffic Signs & Road Markings (Layout Plan), 6 of 10
1200	B3553F05-1200-DR-0007	P2	Traffic Signs & Road Markings (Layout Plan), 7 of 10
1200	B3553F05-1200-DR-0008	P2	Traffic Signs & Road Markings (Layout Plan), 8 of 10
1200	B3553F05-1200-DR-0009	P1	Traffic Signs & Road Markings (Layout Plan), 9 of 10
1200	B3553F05-1200-DR-0010	P01.1	Traffic Signs & Road Markings (Layout Plan) 10 of 10
1200	B3553F05-1200-DR-0021	P01	Gildenway Toucan Crossing
1200	B3553F05-1200-DR-0022	P01	Gildenway Toucan Crossing
1200	B3553F05-1200-DR-0023	P01	Gilden way / Mulberry Green Toucan Crossing
1200	B3553F05-1200-DR-0024	P01	Churchgate Rbt Signals

Series	Document/Drawing Number	Rev / Date	Title (or Description)
1200	B3553F05-1200-DR-0025	P01	Gilden Way East of Churchgate Rbt Toucan
1300	B3553F05-1300-DR-0001	P00.1	Lighting (Layout Plan), 1 of 7
1300	B3553F05-1300-DR-0002	P00.1	Lighting (Layout Plan), 2 of 7
1300	B3553F05-1300-DR-0003	P00.1	Lighting (Layout Plan), 3 of 7
1300	B3553F05-1300-DR-0004	P00.1	Lighting (Layout Plan), 4 of 7
1300	B3553F05-1300-DR-0005	P00.1	Lighting (Layout Plan), 5 of 7
1300	B3553F05-1300-DR-0006	P00.1	Lighting (Layout Plan), 6 of 7
1300	B3553F05-1300-DR-0007	P00.1	Lighting (Layout Plan), 7 of 7
1500	B3553F05-1500-DR-0001	P2	TECHNOLOGY OVERVIEW SCHEMATIC SHEET 1 OF 2
1500	B3553F05-1500-DR-0002	P2	TECHNOLOGY OVERVIEW SCHEMATIC SHEET 2 OF 2
-	**Sketch Number**	**Rev / Date**	**Title (or Description)**
-	B3553F05-0000-SK-0079	P1	Design Speeds and Speed Limits
-	B3553F05-0000-SK-0081	P2	Personal Injury Collision plot
-	B3553F05-0000-SK-0113	P00.1	Variable Demand Model Flow (VDM) Design Year - 2036
-	B3553F05-0000-SK-0114	P00.1	Variable Demand Model Flow (VDM) Opening Year - 2021
-	**Other Documents/ Reports Provided**	**Rev / Date**	**Title (or Description)**
-	B3553F05-REP-0146	March 2018	Interim Road Safety Audit Brief – Stage 2 (Received 11 April 2018)
-	B3553F05/1300/REP/0001	2	Appraisal of Road Lighting to TA 49/07, June 2016
-	B3553F05-REP-0031	2	NMU Context Report, February 2016
-	B3553F05-0000-REP-0075	0	NMU Preliminary Design Audit Report, December 2016
-	B3553F05-0000-REP-0149	P00.1	NMU Illustrative Design Audit Report, March 2018
-	Traffic Flows (spreadsheet)	0	VDM Total Flows 21.09.16, September 2016 • Medium Growth Flows Used for Design • Traffic Flow Line Diagram
-	Accident Data (spreadsheets)	0	1st August 2012 to 31st July 2017 PICs Vehicles Cas data.xlsx, July 2017
-	B3553F05-REP-0148	0	RSA 1 with responses,23/01/17
-	B3553F05-0000-REP-0128	1	Departure D1 Report, March 2018
-	B3553F05-0000-REP-0121	1	Departure D10 Report, March 2018

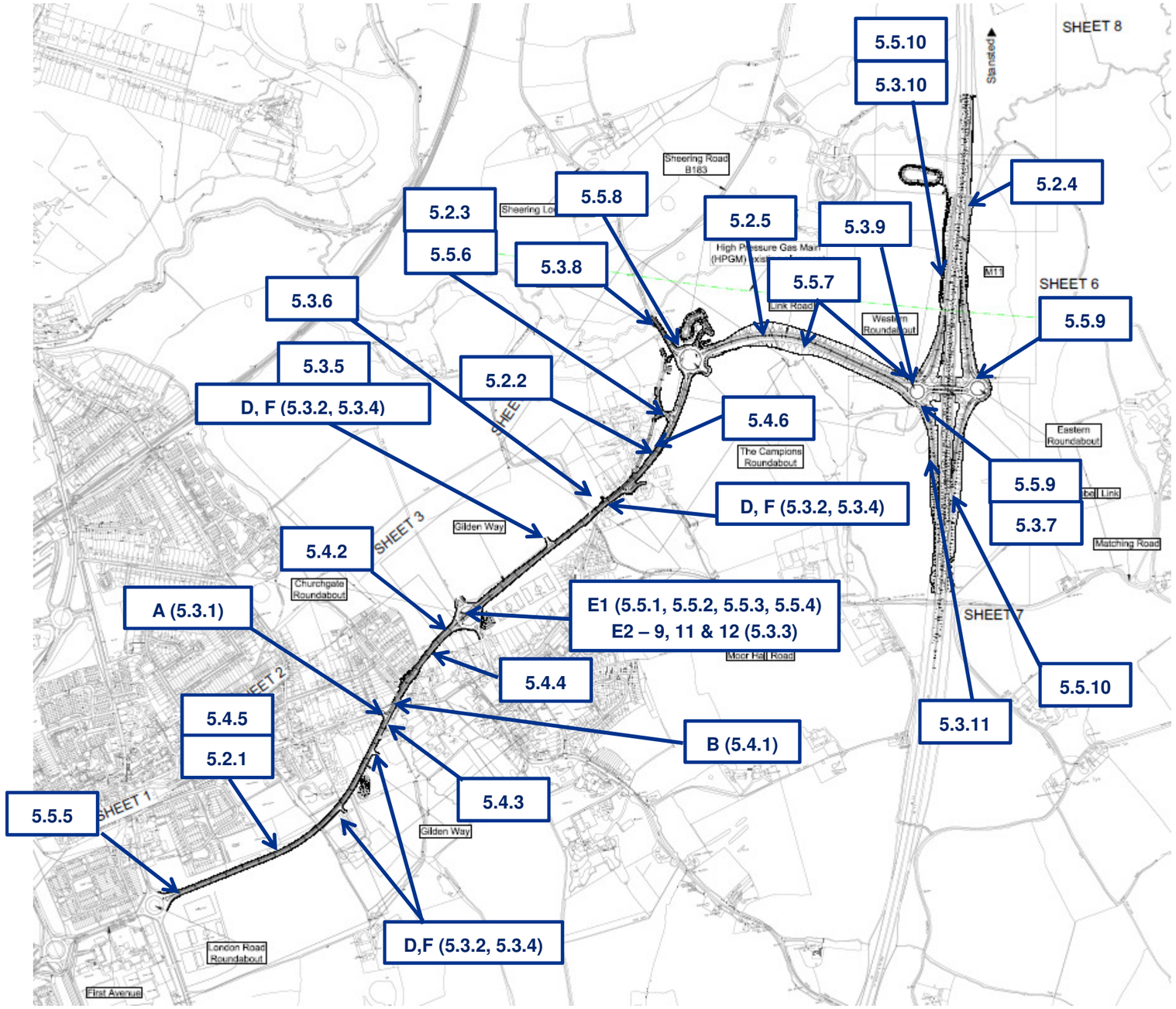
Appendix B. Problem Location Plan

On the following page an extract from Drawing No. B3553F05-0100-DR-0000 Rev P2 is displayed, upon which the locations of the Problems raised in this RSA are shown.

Where Problems raised in the Stage 1 Road safety Audit are raised again in this Audit, the references from both audits are shown on labels

A (5.3.1) Shows that Problem A raised at Stage 1 is raised again as Problem 5.3.1 at Stage 2.

Problem 5.1.1 affects all proposed bus stop lay-bys throughout the scheme and so has not been specifically labelled on the plan.


N
SHEET 8
Stansted
5.5.10
5.3.10
5.2.4
Sheering Road
B183
5.5.8
5.2.3
5.5.6
5.2.5
5.3.9
5.3.8
5.5.7
M11
SHEET 6
5.5.9
5.3.6
Link Road
Western Roundabout
5.3.5
5.2.2
D, F (5.3.2, 5.3.4)
5.4.6
The Campions Roundabout
Eastern Roundabout
5.5.9
5.3.7
D, F (5.3.2, 5.3.4)
Matching Road
SHEET 3
Gilden Way
5.4.2
Churchgate Roundabout
A (5.3.1)
E1 (5.5.1, 5.5.2, 5.5.3, 5.5.4)
E2 – 9, 11 & 12 (5.3.3)
SHEET 7
Moor Hall Road
5.4.4
5.5.10
5.4.5
5.2.1
5.3.11
B (5.4.1)
5.5.5
SHEET 1
5.4.3
Gilden Way
D,F (5.3.2, 5.3.4)
London Road Roundabout
First Avenue