A12 Chelmsford to A120 widening scheme

TR010060

6.3 ENVIRONMENTAL STATEMENT

APPENDIX 3.3 JUNCTION 24, INWORTH ROAD AND COMMUNITY BYPASS TECHNICAL REPORT

APFP Regulation 5(2)(a)

Planning Act 2008

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A12 Chelmsford to A120 widening scheme

Development Consent Order 202[ ]

ENVIRONMENTAL STATEMENT

APPENDIX 3.3 JUNCTION 24, INWORTH ROAD AND COMMUNITY BYPASS TECHNICAL REPORT

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CONTENTS

LIST OF PLATES

LIST OF TABLES

1 Executive summary

1.1.1 This Technical Report has been produced to record work that has been carried out regarding the B1023 Inworth Road, the proposed junction 24 (J24) and the surrounding area as part of the local roads strategy for the Project Control Framework (PCF) Stage 3 on the A12 Chelmsford to A120 Widening Scheme.

1.1.2 This report captures and summarizes the information contained within various existing technical notes produced documenting work undertaken on J24, the B1023 Inworth road and the surrounding area.

1.1.3 This report briefly documents the history of the proposed J24 design development, the existing conditions on the B1023 Inworth Road, and the traffic assessment and the projected increase in traffic on the B1023 Inworth Road associated with the A12 scheme.

1.1.4 This report describes the history of the community bypass concept, which has been raised by local stakeholders as an alternative route from J24 to Tiptree. This report presents the detailed assessments of the bypass options, including projected traffic and noise impacts of these throughout the wider area.

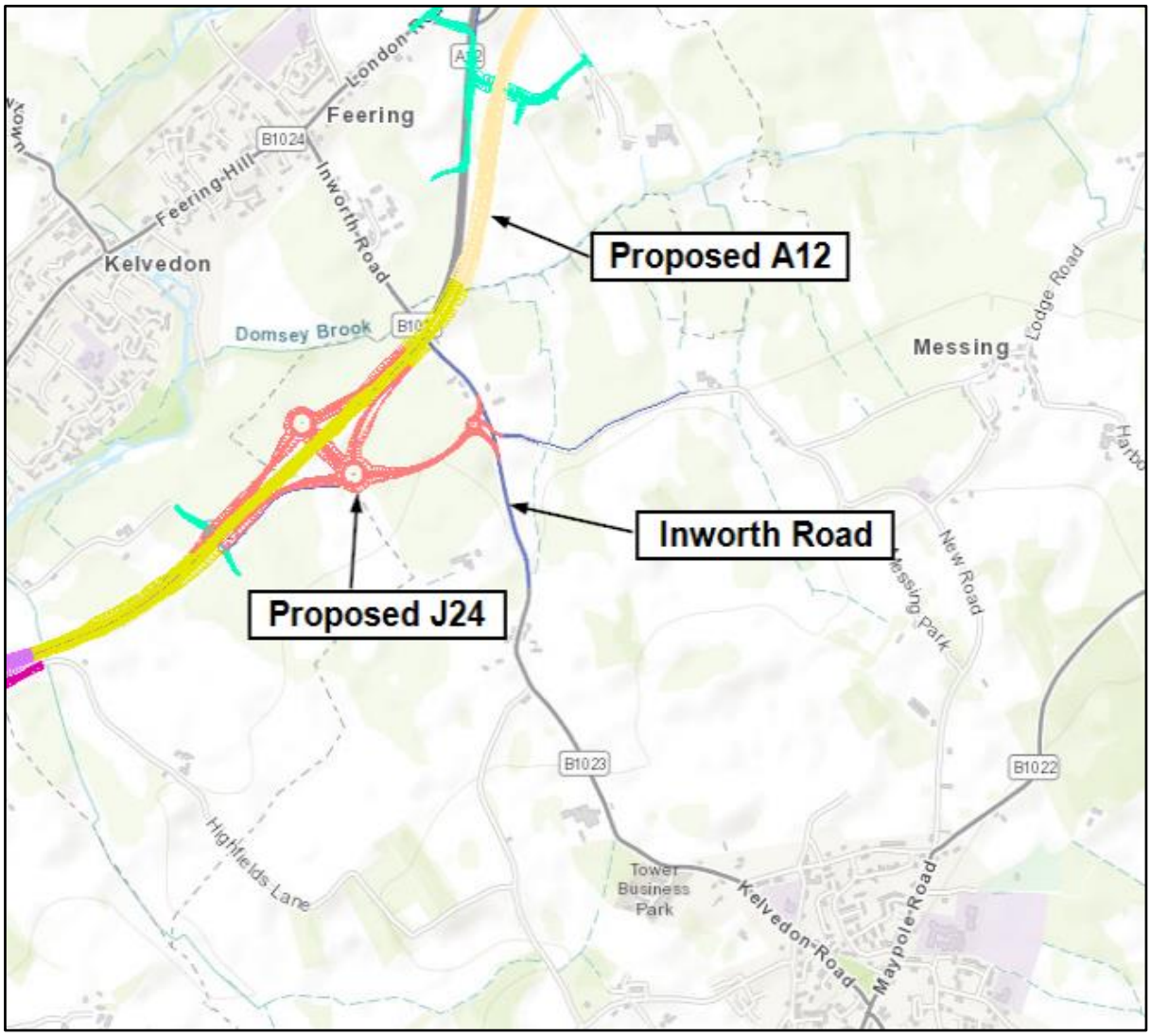
1.1.5 Options for mitigation and improvement of Inworth Road through localised interventions to cater for both the existing traffic and flooding issues and the projected increase in traffic are described, as well as the design principles underpinning these options. This corridor was modelled through microsimulation to assess the traffic capacity and delays.

1.1.6 This report presents an options assessment of the community bypass options compared to the online localised interventions, across several criteria including land acquisition, environmental impact, constructability, safety, stakeholder feedback and cost. Neither bypass was deemed to mitigate the forecasted increase traffic as well as the current proposal, while considering these assessment criteria.

1.1.7 The report includes an assessment of J24 and the compatibility of a future bypass with the current design proposals, including the impact on the performance of the current J24 because of a bypass.

1.1.8 The B1023 Inworth Road connects Kelvedon to the northwest with Tiptree to the southeast as shown in Plate 1.1. The proposed J24 location has been requested by various key stakeholders, including Essex County Council (ECC), and has several key benefits including a reduction in traffic through Feering and Kelvedon.

Plate 1.1 Plan of the B1023 Inworth Road, the proposed A12 and the proposed J24



2 History of junction 24

2.1 Junction 24 design development

2.1.1 In August 2020 the Preferred Route Announcement (PRA) for Junction 23 to 25 of the A12 Chelmsford to A120 widening scheme was announced. The announcement included J24 at its preferred location just off Inworth Road, which can be seen in Plate 2.1.

2.1.2 The proposed J24 was strategically placed to provide an all-movements junction to replace the existing Junction 23 (J23) and existing junction 24 arrangement, which serve Kelvedon south and Kelvedon North respectively, and afford access to Tiptree traffic. This junction is expected to promote the right traffic on the right roads, reduce traffic on cross-country routes and provide economic benefits through reductions in journey times. It was also proposed by statutory stakeholders, including ECC, in response to the 2017 route options consultation.

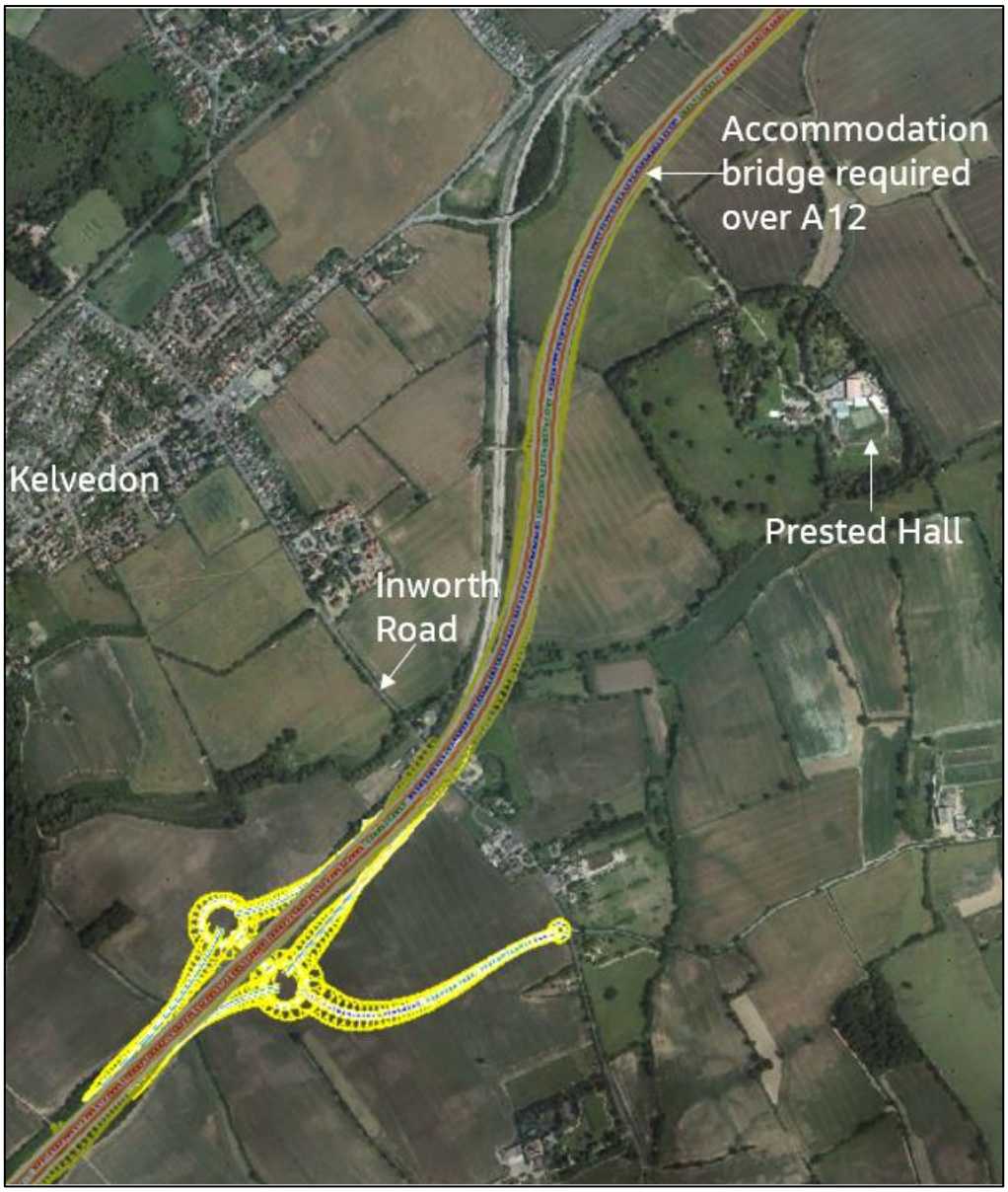
2.1.3 Our technical assessments for this preferred location are contained within Appendix D of the publicly available Scheme Assessment Report (SAR) Addendum.

2.1.4 In summary, and taken from the SAR Addendum, our technical assessments of the current J24 proposals (Option F from previous assessments) show the following benefits over other options, including Option E:

- Promotes the right traffic on the right roads
- Provides a clear economic benefit to the overall scheme
- Reduced traffic on Kelvedon High Street
- Most cost efficient
- Tiptree to A12 (southbound) traffic joins the A12 at the new J24 location, instead of travelling via Rivenhall End to Junction 22 (J22)
- Significant reduction in traffic on cross-country route along Braxted Park Road, and therefore lower traffic at J22 compared with the PCF Stage 2 J24 location
- The reduction in traffic on Braxted Park Road and Rivenhall End should have the effect of reducing accident and casualty rates in those areas
- Reduction in embodied carbon and carbon generated during construction when compared to other assessed options
- Lowest level of traffic on the B1023 Inworth Road between Junction 24 and Gore Pit junction
- Addresses statutory stakeholder request to move the junction towards the B1023 Inworth Road

- Reduced impact on Crown Estate land
- Reduced height of J24 in the landscape and associated reduced visual intrusion
- Utilises potential existing borrow pit location
- Provides a reduced impact on Prested Hall from the previous PCF Stage 2 proposal

Plate 2.1 The layout of junction 24, as it was presented in the Preferred Route Announcement



2.2 Existing conditions on Inworth Road

2.2.1 Following the announcement of the preferred route, and the associated traffic information, the local community raised concerns with the existing B1023 Inworth Road, and its capacity to accommodate an increase in traffic. Amongst other things, they raised concerns regarding several existing pinch points where two large vehicles cannot safely pass, air quality and existing flooding issues on the road.

2.2.2 The existing pinch points are caused by the existing narrow road geometry and corridor. The existing flooding issues may be caused by damage and poor maintenance to the local drainage network.

2.2.3 Images received from the local community showing these existing issues are presented in Plate 2.2 and Plate 2.3.

2.2.4 Analysis of the existing road width of the B1023 confirms that two large vehicles will have difficulty passing each other at pinch points on the road. This means that even when stopping to give way, they may be required to mount the kerb and drive partly on the verge to pass on the narrowest sections of the road.

Plate 2.2 Images provided by the local community of surface water flooding along the B1023 Inworth Road and surrounding area

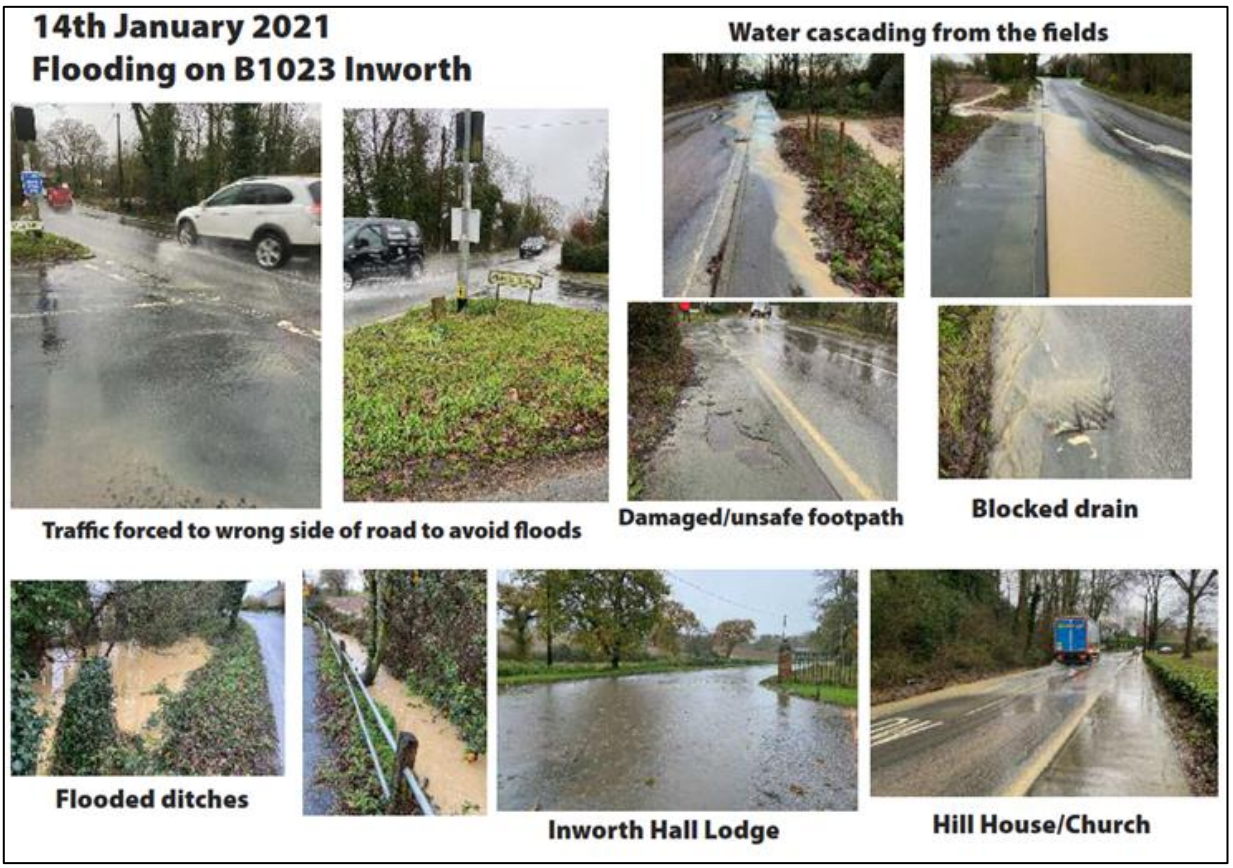


Plate 2.3 Images provided by the community of surface water flooding and existing pinch points along the B1023 Inworth Road

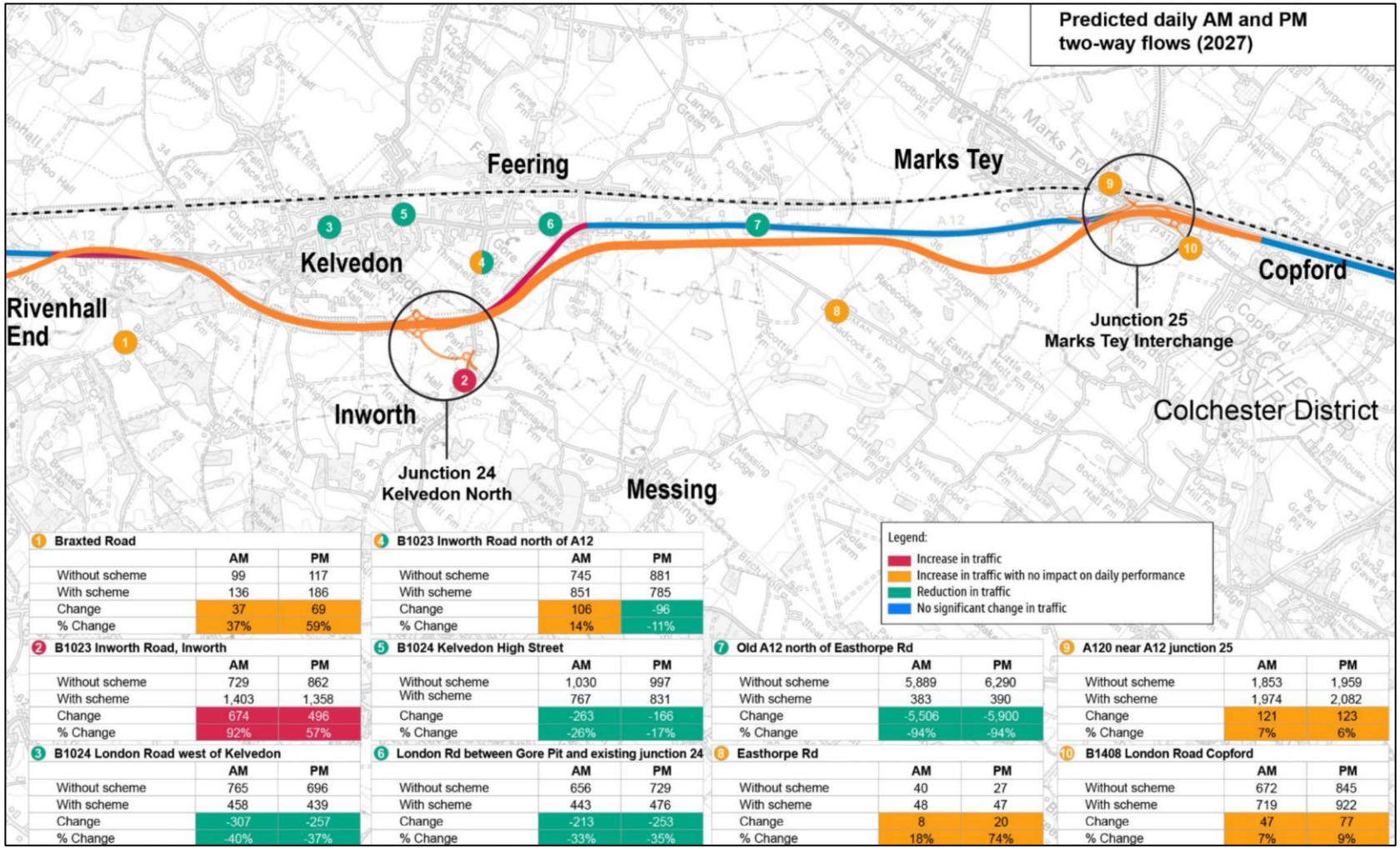
3 Junction 24 traffic assessment

3.1.1 The proposed J24 provides a direct connection to the B1023 Inworth Road as requested by several key stakeholders, will encourage strategic traffic onto the A12, reduce traffic on cross-country routes and provide economic benefits to the scheme through journey time reductions achieved partly by being more attractive to traffic from Tiptree.

3.1.2 As presented in the Traffic Modelling Report for Consultation, (produced for statutory consultation in summer 2021) traffic on the B1023 Inworth Road north of the A12 would remain broadly similar with or without the A12 scheme in place, as traffic from Tiptree would be able to join the A12 directly at the new J24 rather than travel via Kelvedon or Feering.

3.1.3 However, the proposals would see an increase in traffic on the B1023 Inworth Road south of the A12 and J24, with traffic using this link to access J24 from the south. This is presented in Plate 3.1.

Plate 3.1 Excerpt from the Traffic Modelling Report for Consultation, showing the predicted 2027 daily AM and PM two-way traffic flows due to the A12 being in place



1 Braxted Road	AM	PM
Without scheme	99	117
With scheme	136	186
Change	37	69
% Change	37%	59%

2 B1023 Inworth Road, Inworth	AM	PM
Without scheme	729	862
With scheme	1,403	1,358
Change	674	496
% Change	92%	57%

3 B1024 London Road west of Kelvedon	AM	PM
Without scheme	765	696
With scheme	458	439
Change	-307	-257
% Change	-40%	-37%

4 B1023 Inworth Road north of A12	AM	PM
Without scheme	745	881
With scheme	851	785
Change	106	-96
% Change	14%	-11%

5 B1024 Kelvedon High Street	AM	PM
Without scheme	1,030	997
With scheme	767	831
Change	-263	-166
% Change	-26%	-17%

6 London Rd between Gore Pit and existing junction 24	AM	PM
Without scheme	656	729
With scheme	443	476
Change	-213	-253
% Change	-33%	-35%

7 Old A12 north of Easthorpe Rd	AM	PM
Without scheme	5,889	6,290
With scheme	383	390
Change	-5,506	-5,900
% Change	-94%	-94%

8 Easthorpe Rd	AM	PM
Without scheme	40	27
With scheme	48	47
Change	8	20
% Change	18%	74%

9 A120 near A12 junction 25	AM	PM
Without scheme	1,853	1,959
With scheme	1,974	2,082
Change	121	123
% Change	7%	6%

10 B1408 London Road Copford	AM	PM
Without scheme	672	845
With scheme	719	922
Change	47	77
% Change	7%	9%

3.1.4 Following the statutory consultation in summer 2021, the scheme wide traffic model was updated ahead of the Development Consent Order (DCO) submission. Traffic flows in the 'with proposed A12 scheme' Do Something (DS) scenario are approximately 20% lower in the updated version of the model. The reasons for this are explained in the below paragraphs.

3.1.5 In line with standard traffic modelling practice, each road in our traffic model is assigned a 'speed-flow curve'. This defines how fast traffic will travel in the model when the road is quiet, and how traffic speed will reduce as the road gets busier. The speed-flow curve for each road is assigned based on observations of the road conditions and on traffic flow/speed data collected as part of the model development. Speed-flow curves are assigned to the thousands of links within the traffic model, based on a library of available speed-flow curves.

3.1.6 For Inworth Road, the speed-flow curves were updated as part of the DCO traffic model refresh. This was based on improved knowledge of the road's physical constraints, and to better reflect the posted speed limit. For example, the speed-flow curve was changed for the section of the B1023 through Inworth from 'Village Single Carriageway B Road, 40mph' to 'Village Single Carriageway B Road, 30mph'.

3.1.7 This change in speed-flow curve makes Inworth Road slightly less attractive to drivers in the traffic model. When deciding which route to take, the model predicts that some drivers will choose to take a different route to their destination or to make fewer journeys.

3.1.8 In addition to this, when updating the base year traffic model to incorporate additional traffic counts from 2019, the pattern of trips within the model was changed. This had the effect of changing trip patterns even in places where no new traffic count data was incorporated. The list of future housing & employment developments used in the model was also updated, which changes future year traffic patterns.

3.1.9 These impacts together have resulted in a lower level of traffic on Inworth Road in the DCO traffic model.

3.1.10 Table 3.1 and Table 3.2 show a predicted traffic volume comparison with percentage change, from the Statutory Consultation (Stat Con) SATURN model to the DCO SATURN model for the proposed scheme opening year of 2027. These are in the Do Minimum (DM) scenario without the proposed A12 scheme, and the DS scenario with the proposed A12 scheme.

3.1.11 Table 3.3 and Table 3.4 show a predicted traffic volume comparison with percentage change, from the Statutory Consultation (Stat Con) SATURN model to the DCO SATURN model for the proposed scheme design year of 2042. These are in the DM scenario without the proposed A12 scheme, and the DS scenario with the proposed A12 scheme.

3.1.12 The traffic volumes in Tables 3.1 to 3.4 are presented for the weekday AM and PM peak hour summed over both directions, as well as the total 24-hour daily traffic averaged over a year. The locations refer to those shown above in Plate 3.1.

Table 3.1 Traffic Modelling Report for Consultation June 2021 (Location 2: B1023 Inworth Rd – south of J24) vs. DCO SATURN model, 2027 flows

	Stat con model		DCO model	
	AM Peak	PM Peak	AM Peak	PM Peak
DM (Without Scheme)	729	862	784	846
DS (With scheme)	1403	1358	1,111	1,132
% Change	+92%	+57%	+42%	+34%

Table 3.2 Traffic Modelling Report for Consultation June 2021 (Location 4: B1023 Inworth Rd – north of J24) vs. DCO SATURN model, 2027 flows

	Stat con model		DCO model	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
DM (Without Scheme)	745	881	822	892
DS (With scheme)	851	785	779	900
% Change	+14%	-11%	-5%	+1%

Table 3.3 Traffic Modelling Report for Consultation June 2021 App. C (Location 2: B1023 Inworth Rd, Inworth – south of J24) vs. DCO SATURN model, 2042 flows

	Stat con model		DCO model	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
DM (Without Scheme)	716	855	815	835
DS (With scheme)	1509	1471	1,160	1,162
% Change	+111%	+72%	+42%	+39%

Table 3.4 Traffic Modelling Report for Consultation June 2021 App. C (Location 4: B1023 Inworth Rd, Inworth – north of J24) vs. DCO SATURN model, 2042 flows

	Stat con model		DCO model	
	AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
DM (Without Scheme)	730	872	859	883
DS (With scheme)	930	798	880	965
% Change	+28%	-8%	+2%	+9%

4 Challenges to the project design: Inworth Road community bypass

4.1 Evolution of the community bypass – initial concept

4.1.1 Following the release of the PRA, and further engagement with the community, several members of the local community raised concerns about the reported increase in traffic on the B1023 Inworth Road. As part of these concerns, they proposed an alternative community bypass connector road, connecting the southern dumbbell roundabout of J24 with the B1023 Inworth Road, at a point south of Inworth village thereby bypassing Inworth. The connection to Inworth Road to the south would be via a new roundabout.

4.1.2 An indicative conceptual design of a possible Inworth Road community bypass as proposed by the community in response to the PRA is shown in Plate 4.1. The route follows an old railway line south of J24, and connects via a new roundabout on Inworth Road, slightly to the north of the Perrywood Garden Centre.

Plate 4.1 Indicative J24 Inworth community bypass alternative route to Tiptree, as proposed stakeholders in response to the PRA

4.1.3 Upon receiving this proposal from the community, this option was investigated and at the time this investigation found that the alternative bypass as expected does provide some benefits, particularly for those who live within Inworth

village, and on the eastern side of Inworth Road. However, it does not provide benefits across the whole scheme area that we would consider enough to justify the additional costs. At that time, it was concluded that the additional costs would be disproportionate considering all other factors, and therefore this option was discontinued.

4.1.4 In a meeting with the local Parish in March 2021, the Project presented the assessment of the Inworth Road bypass. This presentation covered the wide range of assessments in; traffic, environmental impact, planning, operational safety, walking cycling and horse riding (WCH), flooding, construction, and cost.

4.2 Evolution of the community bypass – second concept

4.2.1 At the time of engaging on the community's bypass proposals, ECC suggested that to address the traffic problems caused by the Parishes initial bypass proposal, two links could be provided both joining to the southern dumbbell.

4.2.2 Plate 4.2 shows this arrangement. This is the Do Something 3 (DS3) arrangement that has been further investigated within this technical report.

Plate 4.2 Indicative J24 Inworth community bypass alternative route to Tiptree, with southern J24 link road as proposed by ECC indicated with an arrow. This was developed into the DS3 option

4.3 Evolution of the community bypass – latest concept

4.3.1 The latest proposal from Messing cum Inworth Parish Council was provided in response to the scheme's Statutory and Supplementary consultations. It was also sent to the scheme by the Messing Action Group in February 2022. The proposal utilised the new junction 24, with the current southern link road removed, in favour of both a new link road to the north of J24 and the A12, and the bypass to the same location as previously requested, south of Inworth Village.

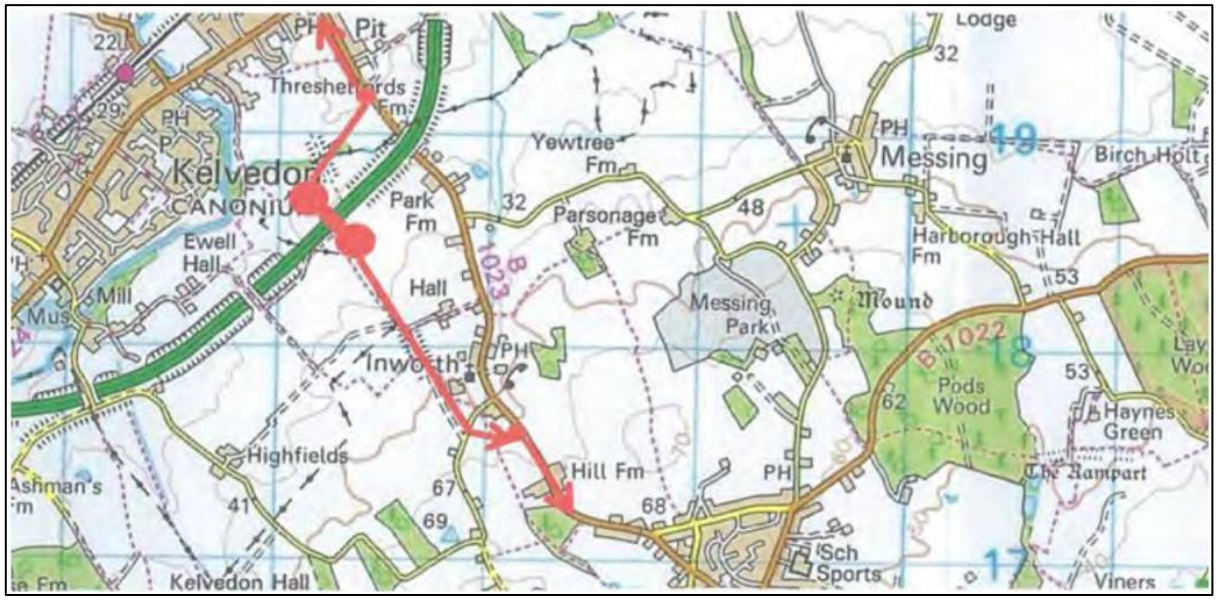
4.3.2 These latest proposals can be seen in Plate 4.3. The community proposed that this would remove all traffic not just away from Inworth Road, but also through the community of Messing. This is the Do Something 4 (DS4) arrangement that has been further investigated within this technical report.

4.3.3 The northern link road to the northern J24 dumbbell roundabout is the same link from the previously investigated and discounted J24 Option E.

4.3.4 The reasons behind the discounting of J24 Option E in favour of Option F (which are also described in Section 2.1 of this appendix) at the time included:

- Lowest impact on Crown Estate Land
- Reduced environmental impact including the need for a crossing of Domsey Brook
- Reduced traffic on Kelvedon High Street
- Lower level of traffic on the B1023 Inworth Road between J24 and Gore Pit
- Less cost efficient, as a second link is not required for the junction to perform adequately

Plate 4.3 A later alternative proposal for the community bypass, received from the Messing Action Group and Messing cum Inworth parish council, showing in red the bypass as previously assessed, with the previously discounted J24 Option E northern link road



4.3.5 Following the new community proposals, representation on the bypass was made by ECC in the form of a tabulated A12 ECC Requirements detailed response, received by the project on 1 April 2022. An excerpt of this is presented below.

> 4. A community bypass should be delivered as part of the scheme, linking the proposed new southern Junction 24 dumbbell roundabout to the B1023 south of All Saints Church. This should be built to DMRB and Essex highway standards as appropriate. Fundamentally, further assessment is needed of a new additional east-west link which connects the new junction with the B1023 close to the A12 to reduce the need for traffic between the new junction and Feering/Kelvedon to travel through Inworth to access the bypass. An alternative arrangement which should be considered, in consultation with the County Council, is a new link between the B1023 and the southern dumbbell south of the A12 which has the effect of segregating Inworth Road at the point it connects to the link road. This would have the effect of making the stretch of Inworth Road between the A12 and the bypass a no through route and for local traffic only meaning that traffic between Feering/Kelvedon and Tiptree would be required to use the bypass.

4.3.6 As noted above, this included a statement that the community bypass should be delivered as part of the scheme and proposed the solution could be similar to the DS3 option. The response did go on however to welcome the Widening Option 2 mitigation measures being proposed to ensure Inworth Road can safely accommodate the increase in traffic. These measures are further investigated within this technical report.

5 J24 Inworth Road community bypass

5.1 Concept design of the community bypass

5.1.1 As assured to the local community and ECC, a detailed investigation has taken place into feasibility of their bypass proposals considering factors such as traffic modelling, cost and buildability, construction, operational safety, environmental impacts, and the impact to residents in the area.

5.1.2 The proposed bypass options were developed into a concept 3D layout, with a DMRB CD 127 rural single carriageway cross section, consistent with a future proofed link that would be expected to be an Essex Highways Priority 1, and ECC Highways Design Guide Category B Road.

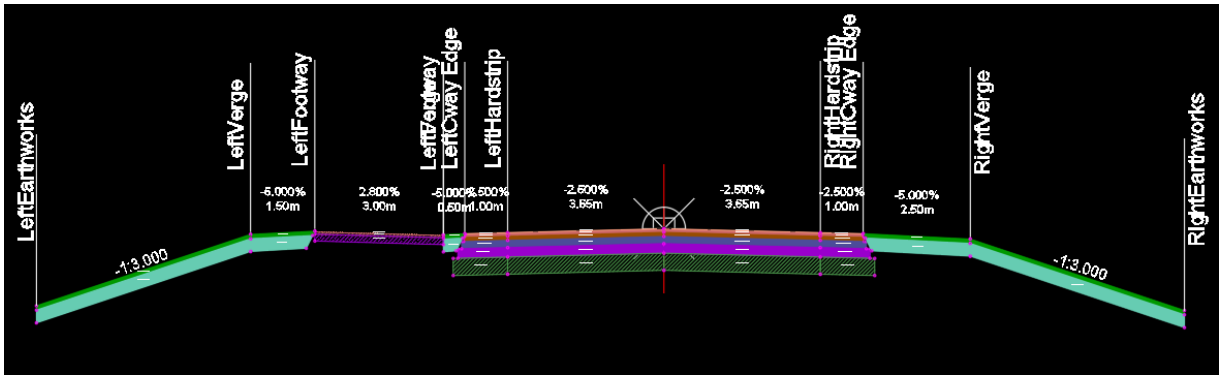
5.1.3 An indicative 3.0m wide WCH route was included within the corridor, however the exact positioning of this is flexible within the wider potential red line boundary corridor of the bypass.

5.1.4 The approximate total length of the community bypass is 1,160m between J24 and the proposed Inworth Road roundabout adjacent to Perrywood Garden Centre. To tie into this new roundabout, the B1023 Inworth Road would be realigned over approximately 83m to the north and 113m to the south. Windmill Hill, a small rural lane, would be required to be stopped up, or alternatively a priority junction provided on the bypass road.

5.1.5 Plate 5.1 shows the concept cross section. Note that the earthworks are indicative only, the bypass is designed to utilise existing ground level as closely as possible.

5.1.6 Topographical survey was not available for the full extents of the community bypass design. From Ch 0+200 to Ch0+650 where survey was not available assumptions were made that this approximately follows existing ground level. This is consistent with contour mapping which show a relatively even gradient in this location.

Plate 5.1 The concept community bypass cross section, developed as part of and to inform the assessment



5.1.7 An outline drainage design was then produced, to inform a potential land use corridor for the bypass.

5.1.8 A theoretical red line boundary was then designed, using the same assumptions and standard offsets from the works as used in the rest of the Project.

5.1.9 Plate 5.2 and Plate 5.3 show the outline designs of the two community bypass concepts assessed within this report.

Plate 5.2 The second concept community bypass with southern J24 link. This is the DS3 option assessed within this technical report

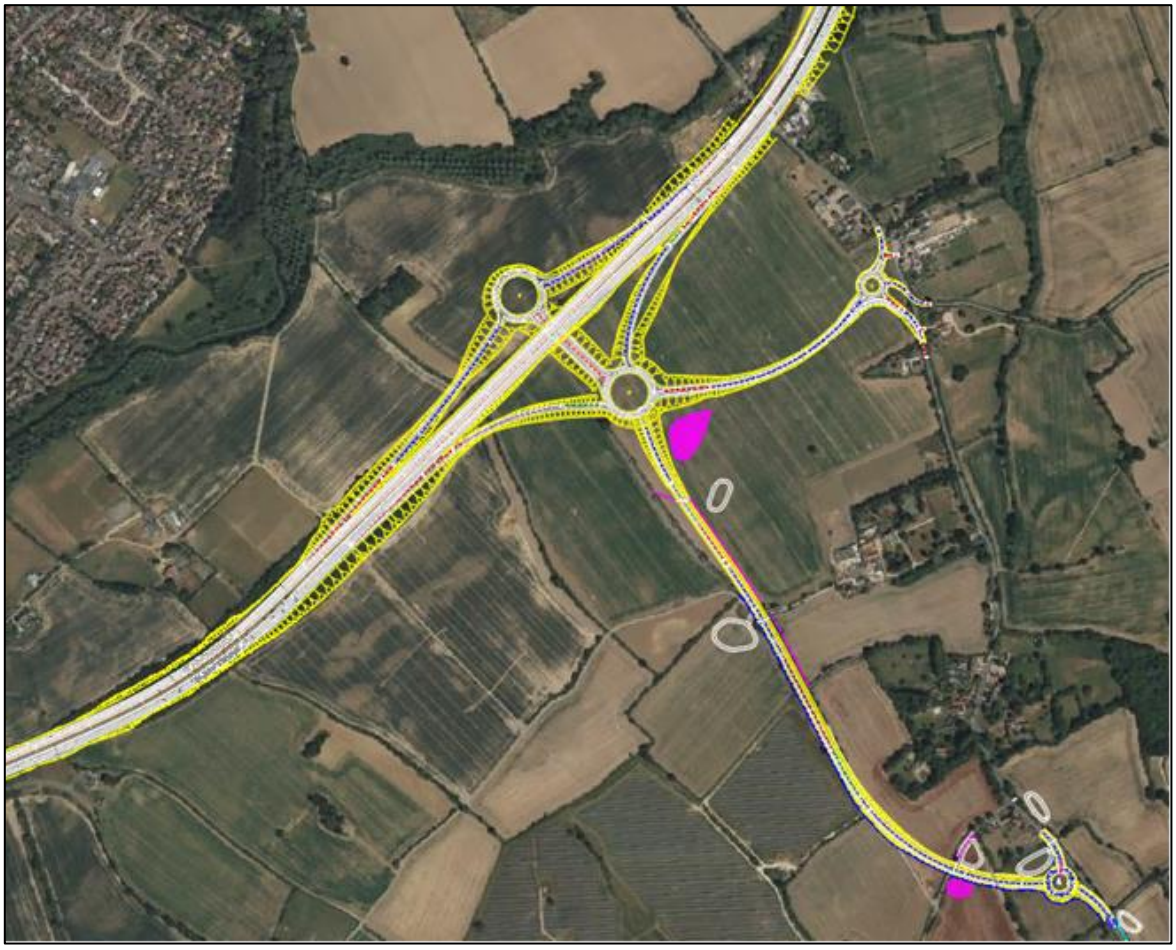
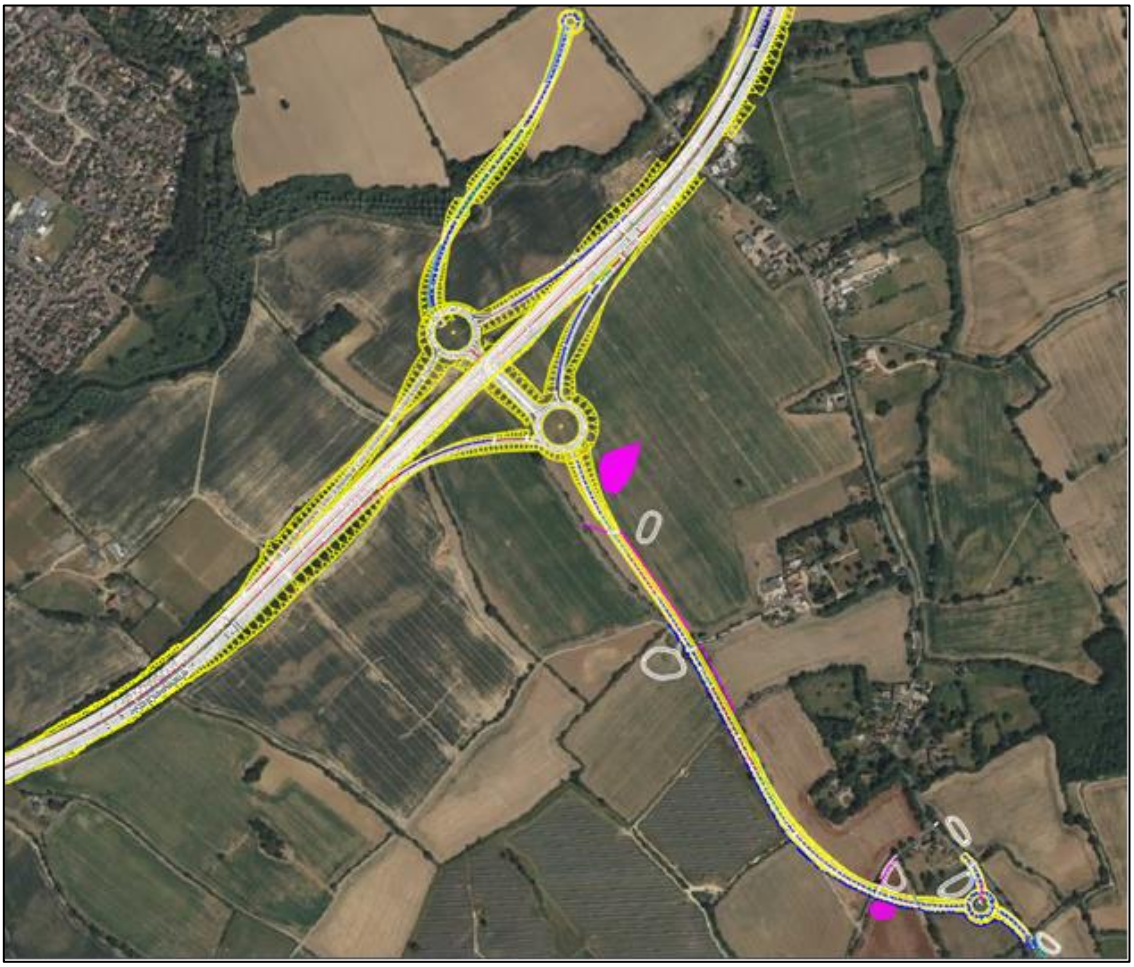


Plate 5.3 The latest concept community bypass with northern J24 link replacing the southern link. This is the DS4 option assessed within this technical report



5.2 Community bypass traffic assessment

5.2.1 A traffic assessment of the community bypass was undertaken to assess the traffic impact to the local area and wider local network. The following scenarios were tested:

- Do Minimum (DM) – 2042 flows, no A12 scheme in place, and no mitigation measures on Inworth Road
- Do Something 2 (DS2) – 2042 flows, the A12 scheme in place and the mitigation measures including localised widening on Inworth Road in place
- Do Something 3 (DS3) – 2042 flows, the A12 scheme in place and the community bypass in place with the J24 southern link road
- Do Something 4 (DS4) – 2042 flows, the A12 scheme in place and the community bypass in place with the J24 northern link road

5.2.2 The results in two-way peak hour traffic flows (vehicles per hour) in the design year 2042 are presented below in Table 5.1 and Table 5.2, and the location numbers corresponding to these figures can be seen in Plate 5.4.

Plate 5.4 Location plan of the projected 2024 traffic flows, for reference to the numbered items in the following DM, DS2, DS3 and DS4 scenario tables

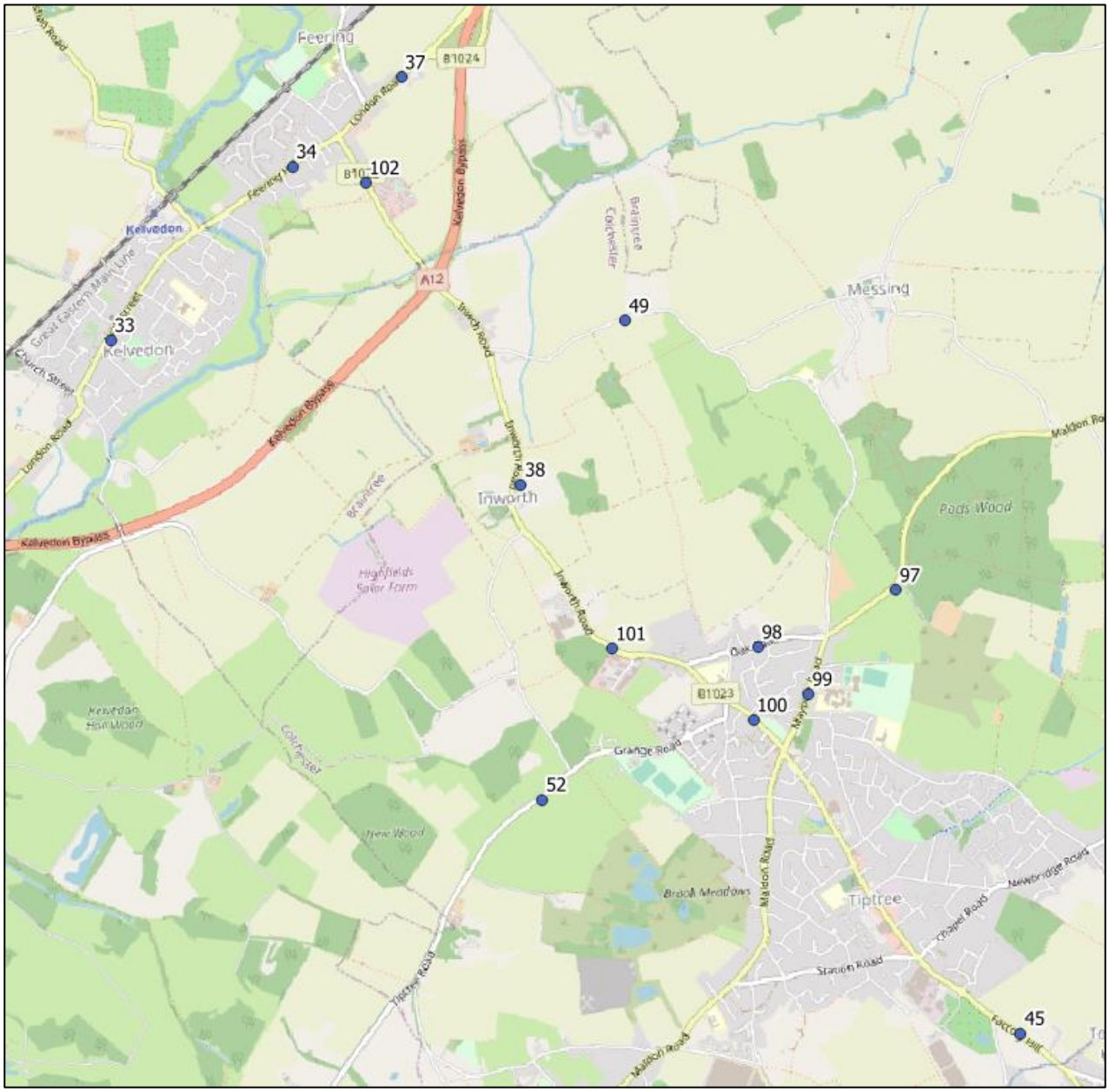


Table 5.1 Change in 2042 flows between the DS2 J24 with Inworth Road mitigation and the DS3 community bypass

Ref.	Location	Peak	DM - Without A12 Scheme	DS2 - With A12 scheme	With scheme & DS3 bypass	Change due to DS3 bypass
33	B1024 Kelvedon High Street	AM	1,129	871	883	+12
		PM	1,135	976	983	+7
34	B1024 Feering Hill, Kelvedon	AM	1,087	767	779	+12
		PM	1,115	881	878	-3
37	B1024 London Rd between Gore Pit & existing junction 24	AM	995	665	652	-13
		PM	1,009	673	498	-175
38	B1023 Inworth Road, Inworth	AM	815	1,160	401	-759
		PM	835	1,162	403	-759
45	B1023 Oxley Hill, Tiptree	AM	446	421	420	-1
		PM	450	468	457	-10
49	Kelvedon Road (between Messing & B1023 Inworth Road)	AM	44	147	116	-31
		PM	47	134	113	-20
52	Grange Road, west of Tiptree	AM	170	59	72	+13
		PM	197	100	99	-1
97	Colchester Road, east of Tiptree	AM	750	581	561	-19
		PM	836	640	621	-19
98	Oak Road, Tiptree	AM	198	236	292	+56
		PM	215	249	315	+66
99	B1022 Maypole Road, Tiptree	AM	695	510	441	-69
		PM	746	556	476	-80
100	B1023 Kelvedon Road, Tiptree	AM	795	940	1,061	+120
		PM	858	964	1,055	+90
101	B1023 Kelvedon Road, north of Tiptree	AM	863	1,193	1,372	+179
		PM	912	1,220	1,399	+179
102	B1023 Inworth Road, Kelvedon	AM	859	880	894	+14
		PM	883	965	1,110	+145

Table 5.2 Change in 2042 flows between the DS2 J24 with Inworth Road mitigation and the DS4 community bypass

Ref.	Location	Peak	DM - Without A12 Scheme	DS2 - With A12 scheme	With scheme & DS4 bypass	Change due to bypass
33	B1024 Kelvedon High Street	AM	1,129	871	867	-5
		PM	1,135	976	966	-10
34	B1024 Feering Hill, Kelvedon	AM	1,087	767	845	+78
		PM	1,115	881	925	+44
37	B1024 London Rd between Gore Pit and existing junction 24	AM	995	665	492	-173
		PM	1,009	673	358	-315
38	B1023 Inworth Road, Inworth	AM	815	1,160	375	-785
		PM	835	1,162	358	-804
45	B1023 Oxley Hill, Tiptree	AM	446	421	415	-6
		PM	450	468	463	-4
49	Kelvedon Road (between Messing & B1023 Inworth Road)	AM	44	147	58	-89
		PM	47	134	74	-60
52	Grange Road, west of Tiptree	AM	170	59	64	+5
		PM	197	100	98	-2
97	Colchester Road, east of Tiptree	AM	750	581	631	+50
		PM	836	640	644	+4
98	Oak Road, Tiptree	AM	198	236	347	+111
		PM	215	249	328	+79
99	B1022 Maypole Road, Tiptree	AM	695	510	462	-48
		PM	746	556	487	-69
100	B1023 Kelvedon Road, Tiptree	AM	795	940	1,026	+85
		PM	858	964	1,039	+75
101	B1023 Kelvedon Road, north of Tiptree	AM	863	1,193	1,385	+192
		PM	912	1,220	1,393	+173
102	B1023 Inworth Road, Kelvedon	AM	859	880	1,204	+323
		PM	883	965	1,394	+429

5.2.3 These traffic changes show that both the DS3 and DS4 options for the community bypass would significantly reduce traffic through Inworth Village, as strategic traffic from the south heading to the A12 via J24 now travels via the new bypass. There is a slightly larger reduction in traffic with the DS4 bypass when compared to the DS3 bypass.

5.2.4 In the village of Messing, both the DS3 and DS4 community bypass options result in a projected reduction in traffic in 2042, when compared to DS2. DS3 still results in an increase when compared to the DM, however this is slightly less of an increase than the DS2 option. The DS4 option results in a very small increase, when compared to the DM.

5.2.5 Both the DS3 and DS4 bypass options increase traffic in Oak Road Tiptree, with the DS4 option resulting in a larger increase. This is because of traffic that would otherwise have gone through Messing, re-routing through Oak Road in the DS4 option.

5.2.6 Both bypass options increase traffic on the B1023 Kelvedon Road in Tiptree. The DS4 bypass generates an approximate 8-10% traffic increase on the B1023 Kelvedon Road through Tiptree as it creates a more attractive route to J24, and drivers divert from alternative routes. Similarly, the DS3 option generates an approximate 9-13% traffic increase on the B1023 Kelvedon Road through Tiptree.

5.2.7 The DS4 option in particular results in the section of the B1023 south of the bypass being near capacity with some delays, resulting in some traffic finding alternative routes.

5.2.8 Both options increase traffic on the B1023 Inworth Road north of the connector road from J24, with DS4 having a larger increase due to the northern J24 link road making J24 more attractive for people travelling from or to Kelvedon/Feering. This would mean extra traffic from this road going through the Gore Pit junction (between B1023 Inworth Road and the B1024 Feering Hill).

5.2.9 At the Gore Pit junction, under all scenarios the worst performing arm is the B1023 Inworth Road approaching the junction from the south. Under the proposed scheme this arm would improve compared to a DM scenario, although it would still be over capacity by 2042. The impact is similar with the DS3 option. However, under the DS4 community bypass proposal this arm would become worse than the DM scenario, meaning queues and delays would become worse. A summary of the performance of this Inworth Road arm is shown in Table 5.3.

5.2.10 The DS4 option increases traffic on Kelvedon High Street through Feering due to the DS4 J24 northern link road attracting additional traffic to J24. There is a very slight reduction further west on Kelvedon High Street, this being due to more traffic using J24 with the northern link, to access Feering and Kelvedon through Gore Pit junction, rather than exiting at J22 and using the de-trunked section of the A12 through Rivenhall End.

Table 5.3 Performance of B1023 Inworth Road arm of Gore Pit junction

	Ratio of Flow to Capacity (over 1 = over capacity)	
	AM	PM
Do Minimum	1.74	1.76
DS2 (A12 & Widening Option 2)	1.12	1.44
DS3 (A12 & bypass with southern link road)	1.12	1.54
DS4 (A12 & bypass with northern link road)	1.60	1.98

5.2.11 The impact on the double-mini roundabout at Tiptree was also assessed. This showed no significant change in junction performance due to the bypass. For completeness, the performance of the worst performing arm in each scenario is shown in Table 5.4.

Table 5.4 Performance of Tiptree double-mini roundabout's worst performing arm

	Ratio of Flow to Capacity (over 1 = over capacity)	
	AM	PM
Do Minimum	0.79	1.04
DS2 (A12 & Widening Option 2)	0.68	1.03
DS3 (A12 & bypass with southern link road)	0.68	1.05
DS4 (A12 & bypass with northern link road)	0.68	1.05

5.3 Order of magnitude costing

5.3.1 An order of magnitude cost estimate of both the preferred widening option 2 (DS2) and the community bypass was produced by Costain. A comparison of these costs shows the bypass to be approximately 3.5 times the cost of the mitigation measures proposed for Inworth Road. The net cost difference between the DS2 and a bypass is £9-12m.

5.3.2 The costs presented below and in this section of the appendix are for the bypass element only, over and above any J24 configuration, and exclude either the DS3 southern or DS4 northern J24 link roads. The cost of these link roads are within the overall J24 cost. When comparing DS3 to DS4, it is reasonable to assume that the northern link within DS4 will lead to an overall more costly J24, being longer than the southern link and having an additional structure over Domsey Brook.

5.3.3 To inform this costing, an indicative land use corridor for a red line boundary was designed for the bypass, using the same offsets used throughout the scheme and including drainage attenuation. This showed that the bypass alone (irrespective of DS3 or DS4 J24 link road), required approximately 104,000sqm of land, compared to the DS2 Inworth Road widening 67,200sqm.

5.3.4 It should be noted that the Order of Magnitude Cost Estimate is based on a concept design and should only be used to inform the feasibility assessment of the engineering solution.

5.3.5 The estimated order of magnitude cost for the community bypass over and above any J24 configuration is £13-15m.

5.3.6 The estimated order of magnitude cost for the Preferred Option 2 Widening is £3-4m.

5.3.7 The following assumptions were used to produce this costing:

- The estimate assumes both options are being constructed in parallel with the A12 Widening Scheme Schedule
- The base date of the cost estimates is Q4 2021
- These costs do not include allowances for inflation, environmental mitigation, archaeological mitigation, repairs to third party infrastructure, some National Highways Costs i.e. Historical Costs, NR VAT

6 Assessment of localised widening options

6.1.1 Following the findings of the J24 traffic assessment as presented in Section 3 of this appendix, a decision was made to investigate mitigation measures to address the projected increase in traffic. Several options were investigated which are detailed in this section of the appendix. This section also details the design standards and assumptions underpinning these options.

6.1.2 A preferred localised widening option and the reasoning for this is also presented within this section, with risks being noted. This option (Widening Option 2) has then been carried forward to be assessed against the community bypass options in Section 8 of this appendix.

6.2 Inworth Road design assumptions

6.2.1 The following assumptions have been used in development of the highway alignment options contained within this report:

- The proposed widening of the B1023 Inworth Road to cater for the increased traffic has been investigated to the south of the J24 link road only. Inworth Road to the north of J24 is projected to have an overall reduction in traffic.
- Vehicle tracking analysis was carried out in Civil 3D 2020. The tracked design vehicle was an FTA Design Articulated Vehicle 1998 which has a width of 2.55m and length of 16.48m.
- Vehicle tracking software does not provide for the wing mirrors and does not always represent real driver behaviour. Therefore, a margin of error has been provided between vehicle chassis and the kerb line and between vehicles travelling in opposite directions.
- Several irregularities within the available lidar topographic survey have been noted. Additional survey has been used to validate the design results where required. This have been noted for clarification at detailed design, through additional survey.
- At the time of writing this Technical Report, the available existing utility and telecom services drawing is the C2 drawings, refreshed in February 2021 supplied by Gattica Associates. Further investigation is required into the exact location of utilities along Inworth Rd.

6.3 Design standards and option development

6.3.1 For road alignment design, the Design Manual for Roads and Bridges (DMRB) is only applicable to the trunk road and motorway network, and there are no clear alternative design standards for rural single carriageways that are part of the local roads network. The Essex Highways Design Guide and Manual for Streets provide useful information on the design of the local roads network, but are focused more heavily on urban streets, town centres and residential developments, rather than rural roads.

6.3.2 Therefore, a range of design decisions and assumptions have been made to inform the widening options, which are detailed within this section of the appendix. The following design standards have been used either directly or indirectly when developing the localised widening options presented below:

- DMRB CD-109 Highway Link Design
- DMRB CD-127 Cross-sections and Headroom
- The Essex Highway Design Guide
- DMRB TA 79/99 Traffic Capacity of Urban Roads
- Manual for Streets 1 and 2

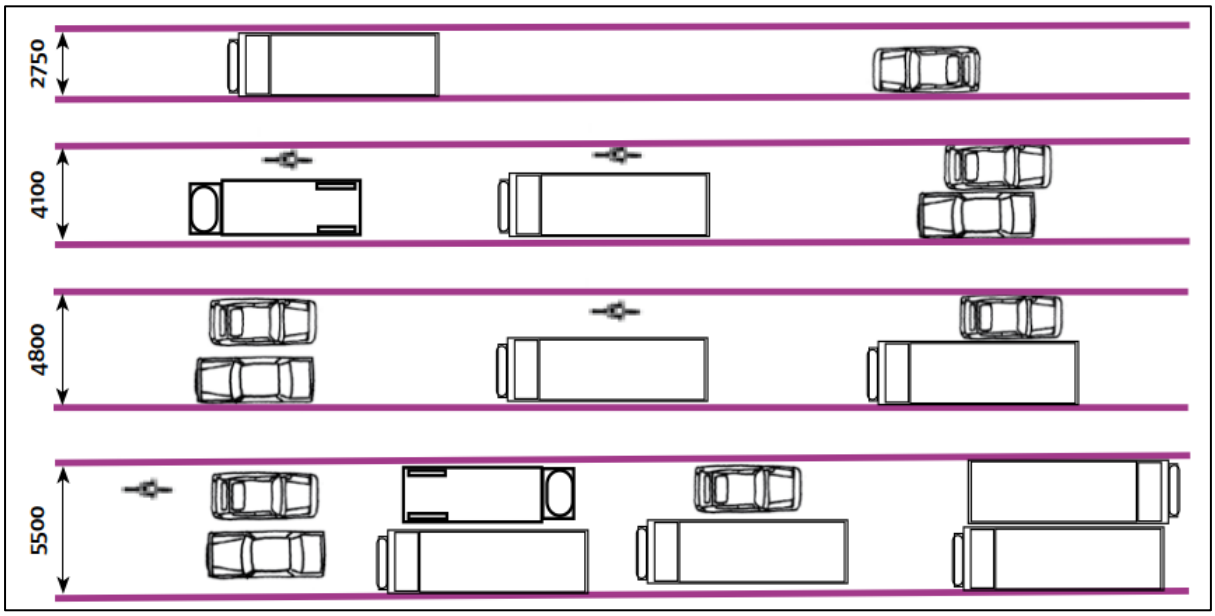
6.3.3 The vertical and horizontal geometry of the road are set by the existing constraints, and it is not proposed to alter these, as this is not feasible given the current property direct accesses onto the road.

6.3.4 A rural single carriageway as described by DMRB CD 127 consists of a 7.3m wide carriageway with additional 1m minimum hard strips. While this may be appropriate for new trunk roads, for existing smaller roads this level of provision is often unachievable (including for the B1023 Inworth Rd) without significant impacts on surrounding land and properties. It also may encourage higher speed than the existing environment, horizontal and vertical curvature safely allow for, indirectly becoming a safety issue. For these reasons a fully DMRB compliant design was not pursued as a feasible option.

6.3.5 The Essex Highways Design Guide recommends a variety of widths dependent on the Design Category, or the expected nature of the road. These vary from 5.5m or below, to a 7.3m width in accordance with DMRB. It is expected that Inworth Road will be a Category B link road, linking neighbourhoods and serving non-residential or industrial uses, and therefore a 6.75m wide road would be recommended. A 6.75m Widening Option 1 was therefore investigated.

6.3.6 Based on the widths of the largest articulated heavy goods vehicles expected to regularly use the road, a width of 6.1m was developed as Widening Option 2. This will allow for two 2.55m wide articulated heavy goods vehicles to pass, with an additional 250mm allowed all around for wing mirrors and as a margin of error. This is wider than the 5.5m that Manual for Streets recommends as a minimum to allow two large vehicles to pass slowly (see Plate 6.1). With no footways present, the additional 250mm on both kerbsides also allows for some additional space where the largest vehicles when passing could move into the kerb channel, providing additional space in between.

Plate 6.1 A figure from Manual for Streets showing two large vehicles passing slowly on a 5.5m wide carriageway (Source: Manual for Streets 1 Figure 7.1)



6.3.7 While the above standards describe the minimum widths to physically accommodate large vehicles passing, there are few standards available which link these widths to traffic capacity, and none in a rural context. DMRB TA 79/99 Traffic Capacity of Urban Roads is an advice note produced by National Highways (at the time the Highways Agency) that does link these in an urban context, and its findings were used to inform the minimum theoretical capacity widths.

6.3.8 The design team consider that although this advice note is not directly applicable as a standard, it is relevant to the roads theoretical capacity. Due to the uncertainty in application of this note to a rural context, these widths and the roads traffic capacity were then confirmed through microsimulation which is detailed in this section of the appendix. The microsimulation assists in testing the theoretical capacity provided by the advice note, taking into account additional factors such as bus stops and direct accesses.

6.3.9 Plate 6.2 and Plate 6.3 are taken from this advice note. Considering this section of the B1023 Inworth Road to most closely resemble a UAP3 road type, this indicates that a 6.1m carriageway provides the minimum acceptable theoretical capacity to accommodate the 2042 DS flows.

6.3.10 Two options were developed based on the above principles, with Widening Options 1 and 2 being modelled to understand impact. These are described below.

Plate 6.2 Table 1 from TA 79/99 Traffic Capacity of Urban Roads showing different road types. Inworth Road has been assigned to road type UAP3 by the design team

Feature	ROAD TYPE				
	Urban Motorway	Urban All-purpose			
	UM	UAP1	UAP2	UAP3	UAP4
General Description	Through route with grade separated junctions, hardshoulders or hardstrips, and motorway restrictions.	High standard single/dual carriageway road carrying predominantly through traffic with limited access.	Good standard single/dual carriageway road with frontage access and more than two side roads per km.	Variable standard road carrying mixed traffic with frontage access, side roads, bus stops and at-grade pedestrian crossings.	Busy high street carrying predominantly local traffic with frontage activity including loading and unloading.
Speed Limit	60mph or less	40 to 60 mph for dual, & generally 40mph for single carriageway	Generally 40 mph	30 mph to 40 mph	30mph
Side Roads	None	0 to 2 per km	more than 2 per km	more than 2 per km	more than 2 per km
Access to roadside development	None. Grade separated for major only.	limited access	access to residential properties	frontage access	unlimited access to houses, shops & businesses
Parking and loading	none	restricted	restricted	unrestricted	unrestricted
Pedestrian crossings	grade separated	mostly grade separated	some at-grade	some at-grade	frequent at-grade
Bus stops	none	in lay-bys	at kerbside	at kerbside	at kerbside

Plate 6.3 Table 2 from TA 79/99 Traffic Capacity of Urban Roads, showing capacities of urban roads in One-Way hourly flows in each direction

		Two-way Single Carriageway- Busiest direction flow (Assumes a 60/40 directional split)									Dual Carriageway			
		Total number of Lanes									Number of Lanes in each direction			
		2				2-3	3	3-4	4	4+	2		3	4
Carriageway width		6.1m	6.75m	7.3m	9.0m	10.0m	12.3m	13.5m	14.6m	18.0m	6.75m	7.3m	11.0m	14.6m
Road type	UM	Not applicable										4000	5600	7200
	UAP1	1020	1320	1590	1860	2010	2550	2800	3050	3300	3350	3600	5200	*
	UAP2	1020	1260	1470	1550	1650	1700	1900	2100	2700	2950	3200	4800	*
	UAP3	900	1110	1300	1530	1620	*	*	*	*	2300	2600	3300	*
	UAP4	750	900	1140	1320	1410	*	*	*	*	*	*	*	*

6.4 Widening Option 1 – 6.75m minimum carriageway width

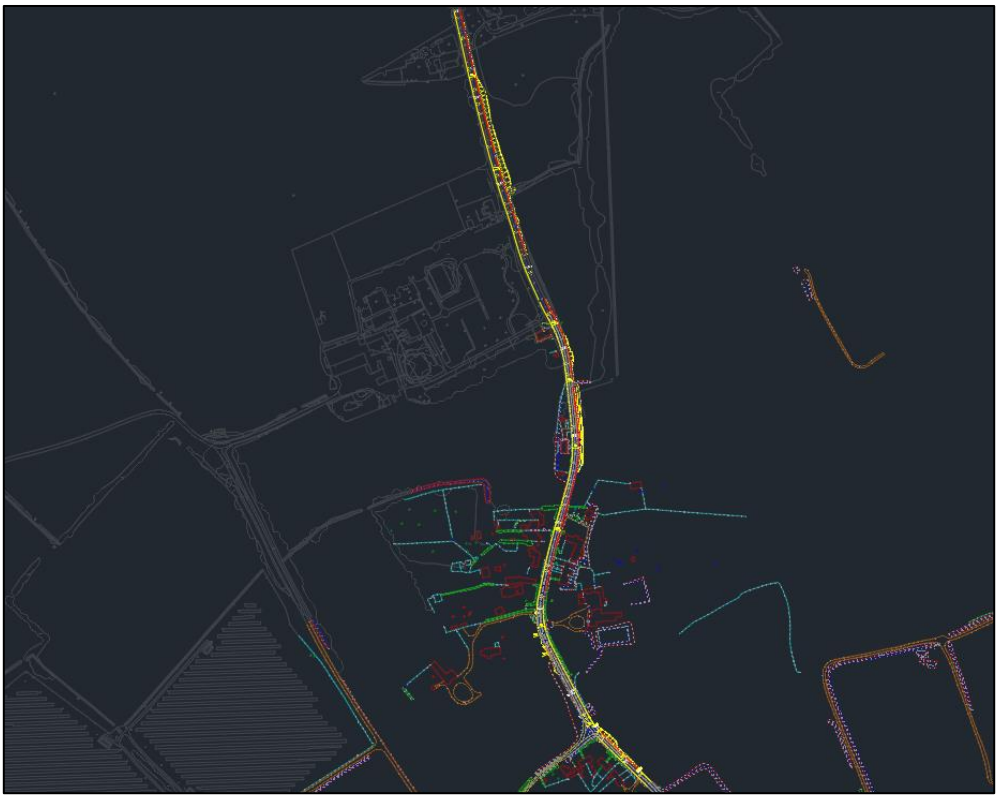
6.4.1 This option proposes a minimum carriageway width of 6.75m (online widening) on straights and wider cross sections on bends to cater for two opposing heavy goods vehicles. The widening on the bends is based on the vehicle tracking analysis detailed below in this report.

6.4.2 This option provides a cross-section that complies with the local Essex Highways Design Guide standard for this category of road, however it does not consider the existing site constraints. When modelled this option had a more severe impact on third party land and existing roadside vegetation.

6.4.3 The benefits of this additional width when compared to Widening Option 2, were not considered to outweigh the additional impact. This also considers that on the known pinch points, the widening on bends strategy applies which is determined by swept path analysis and not a minimum width.

6.4.4 Detailed 3D geometrical modelling of Option 1 has been undertaken using AutoCAD Civil 3D, an image of which is shown in Plate 6.4.

Plate 6.4 Inworth Road - 6.75m wide option (Widening Option 1) 3D model, developed to assess the impacts of this option



6.5 Widening Option 2 – 6.10m minimum carriageway width

6.5.1 This option proposes a minimum carriageway width of 6.10m (online widening) on straights and wider cross sections on bends to cater for two opposing heavy goods vehicles. The widening on the bends is based on the vehicle tracking analysis detailed below in this report. An image of this option is shown in Plate 6.5.

Plate 6.5 Inworth Road - 6.1m wide option (Widening Option 2)

6.5.2 The cross section provided by this option is a departure from the standards mentioned above in Section 6.3 of this appendix. This departure is being considered as it provides benefits such as reduced impact on adjacent land and properties, ditches, reduced construction work required, and reduced vegetation clearance and mature tree cuttings which will reduce the impact on the cost and programme of the scheme in addition to having environmental benefits.

6.5.3 Moreover, this cross section is expected to aid in providing self-enforcing speed limits to address concerns raised by residents in several stakeholder meetings. This cross section does address capacity and safety concerns at pinch points, providing a balance between this and a wider carriageway.

6.5.4 Following investigation of the benefits and impacts of this option when compared to the other widening options, while considering that it removed pinch points and provided adequate capacity, it was decided to carry this option forward as the preferred localised widening option.

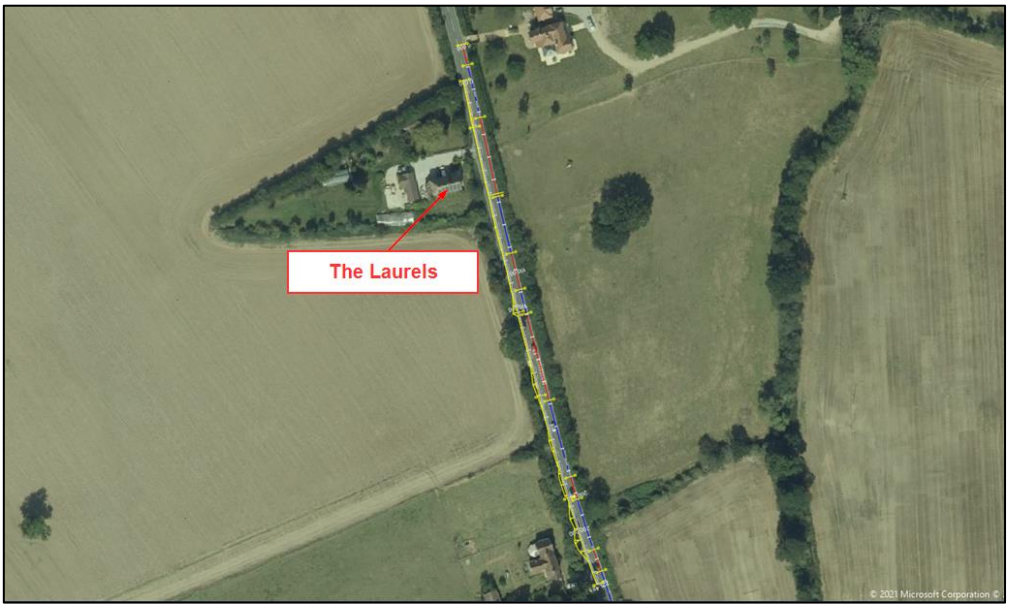
6.5.5 The widening strategy in within this option can be split into the following regions, with the below going into more detail on each section.

Pinch point at The Laurels (Ch. 0+015m to 0+225m):

6.5.6 The carriageway on this section of the road is proposed to be widened from a minimum existing width of 5.6m to a proposed minimum of 6.1m for approximately 210m to cater for two opposing large vehicles.

6.5.7 This widening is expected to be primarily asymmetric on the northbound lane, while the edge of carriageway is maintained on the southbound lane as shown in Plate 6.6. This will avoid impacting the ditch running parallel to the southbound lane and will utilise the verge space in front of The Laurels property. This option will also provide 0.5m verge on the widened edge.

Plate 6.6 Pinch point at The Laurels (Ch. 0+015m to 0+225m)



Between Ch. 0+225m to 0+366m

6.5.8 This section has a consistent minimum width of at least 6.1m and being approximately straight no widening is assessed as being required.

Pinch point at Inworth Hall (Ch. 0+366m to 0+443m)

6.5.9 The carriageway on this section is proposed to be widened from a minimum of existing width of 6.0m or less through the bend. This widening may be asymmetric on the SB lane, while the edge of carriageway is maintained on the northbound lane as shown in Plate 6.7. This will avoid impacting the Inworth Hall entrance. The widening will impact the existing roadside ditch however will avoid impacting the tree in front of Inworth Hall.

Plate 6.7 Pinch point between Ch. 0+366m to 0+443m (Inworth Hall)

Pinch point between Ch. 0+443m to 0+470m

6.5.10 The carriageway on this section of the road is proposed to be widened from a minimum of existing width of approximately 5.5m to cater for two opposing large vehicles on the straight. This widening will be asymmetrically on the SB lane, while the edge of carriageway is maintained on the northbound lane as shown in Plate 6.8.

6.5.11 The existing ditch is expected to be likely affected by the construction of the widened carriageway and 0.5m verge. It is also proposed to provide a 2.0m footway with 0.5m verge on either side to provide a connection to the public right of way footpath to the north.

Plate 6.8 Pinch point between Ch. 0+443m to 0+470m

Pinch point at The Thatched Cottage (Ch. 0+470m to 0+584m)

6.5.12 The carriageway on this section of the road is proposed to be widened from an existing minimum width of approximately 5.3m or less (Ch. 0+470m to 0+584m) to cater for two opposing large vehicles on the bend. This widening will be asymmetric on the southbound lane, while the edge of carriageway is maintained on the northbound lane as shown in Plate 6.9. This will avoid impacting the Thatched Cottage property. The option will also provide 2.0m footway tapering to the existing, narrower footway width.

6.5.13 It is proposed to adjust the existing ditch to allow for the construction of the widened carriageway and 0.5m verge. It is also proposed to provide a footway with buffer zone adjacent to carriageway, to connect to the nearby public right of way footpath, and the thatched cottage entrance. It is proposed that subject to detailed design, the footway be located on the opposing side of the ditch to potentially minimise impact to existing vegetation if possible.

6.5.14 It is proposed that the existing footway width be maintained near the southern tie in point for as short a distance as possible in order to minimise impacts to vegetation, while providing an acceptable connection.

6.5.15 If the carriageway widening cannot be provided without impacting the ditch, a ditch crossing will be required for access to the cottage. Although it was considered, moving the footway behind the cottage is not ideal due to safety issues as it requires the pedestrians to cross the road twice to access the nearby public right of way footpath.

Plate 6.9 Pinch point at The Thatched Cottage (Ch. 0+470m to 0+584m)

Pinch point through Inworth village (Ch. 0+584m to 0+705m)

6.5.16 This section of the carriageway has property frontage either side through Inworth Village as shown in Plate 6.10. There is no intention to widen the carriage here to avoid impacting the surrounding properties or reducing the existing footway provision.

6.5.17 Note that the carriageway is relatively straight in this section, and the risk of collision is expected be reduced due to reduced speeds through the village, which a narrower cross section encourages. This reduced width through the village is expected to act as a traffic calming measure and does allow for two large vehicles to pass slowly. The minimum existing carriageway width in this section is approximately 6.0m.

Plate 6.10 Pinch point between Ch. 0+584m to 0+705m (through Inworth village)

Pinch point between Ch. 0+705m to 0+822m

6.5.18 The carriageway in this section of the road tapers out to be widened by from Ch. 0+727m to 0+753m. Then the widening tapers down to have a 6.1m wide carriageway between Ch. 0+775m to 0+822m to cater for two opposing large

vehicles on the straight. This widening will be asymmetric on the NB lane, while the edge of carriageway is maintained on the southbound lane as shown in Plate 6.11. This will avoid impacting the listed building and the existing footway on the southbound side.

6.5.19 The existing parking layby in front of All Saints Church is expected to be able to be maintained albeit to a reduced width due to tie in to the widened carriageway to the south. Although this width is expected to still be above the absolute minimum 2.5m used in exceptional circumstances. The reduced with is being considered to eliminate impact on church land beyond the fence line.

Plate 6.11 Pinch point from Ch. 0+705m to 0+822m

Between Ch. 0+822m to 0+853m

6.5.20 This section has a minimum width of approximately 6.1m as it covers the junction therefore no carriageway widening into verge is required. There will be a slight modification to the island edge to cater for two opposing large vehicles on the bend.

Pinch point between Ch. 0+853m to 0+907m

6.5.21 The carriageway on this section of the road is proposed to be widened from a minimum existing width of 5.7m or less (Ch. 0+853 to Ch. 0+907) to cater for two opposing large vehicles. This widening will be asymmetric on the southbound lane, while the edge of carriageway is maintained on the northbound lane as shown in Plate 6.12. This will avoid impacting properties and the existing footway. The widening will also impact the existing traffic island at the T-junction as shown in Plate 6.12.

Plate 6.12 Pinch point from Ch. 0+853m to 0+907m

6.6 Widening Option 3 – 6.00m and narrower minimum carriageway width

6.6.1 This option proposes 6.0m minimum wide carriageway. The total length of this option is 605m.

6.6.2 This option is a departure from standards outlined in Section 6.3 of this appendix, and although it does provide the required minimum width for two heavy good vehicles to pass each other safely at slow speed, it does not provide the capacity required. This option was investigated as a potential for a narrower road to operate safely, however 6.1m was determined to be the minimum acceptable width for both safety and capacity, and Option 3 and any other narrower optioned were discounted.

6.7 Vehicle swept path analysis

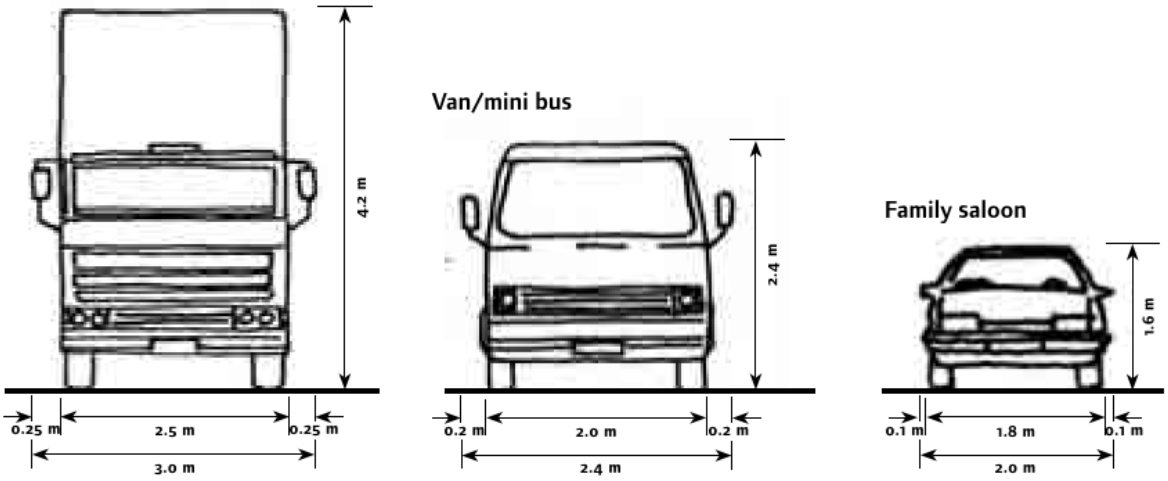
6.7.1 Vehicle tracking or swept path analysis was carried out to determine the required width for two design vehicles to pass one another safely, primarily at bends. On straights, the minimum widths based on vehicle size are described above, however the tracking being based on these principles accommodates two design vehicles passing safely as well.

6.7.2 Vehicle tracking analysis was carried out in Civil 3D 2020. The tracked vehicle was FTA Design Articulated Vehicle 1998 which has a width of 2.55m and length of 16.48m.

6.7.3 An additional buffer zone was provided on all sides of the tracked vehicle to account for side mirrors and as a margin of error. This value was taken taking into account wing mirrors from Manual for Streets 1 Figure 6.18 as shown in Plate 6.13. This will provide a total minimum space at all points between the chassis of opposing vehicles for safe passing.

6.7.4 As is the case for straight sections of road there is the possibility that where there are no footways present, a vehicle may move closer to the kerb or edge or carriageway if required, with their mirrors overhanging the verge.

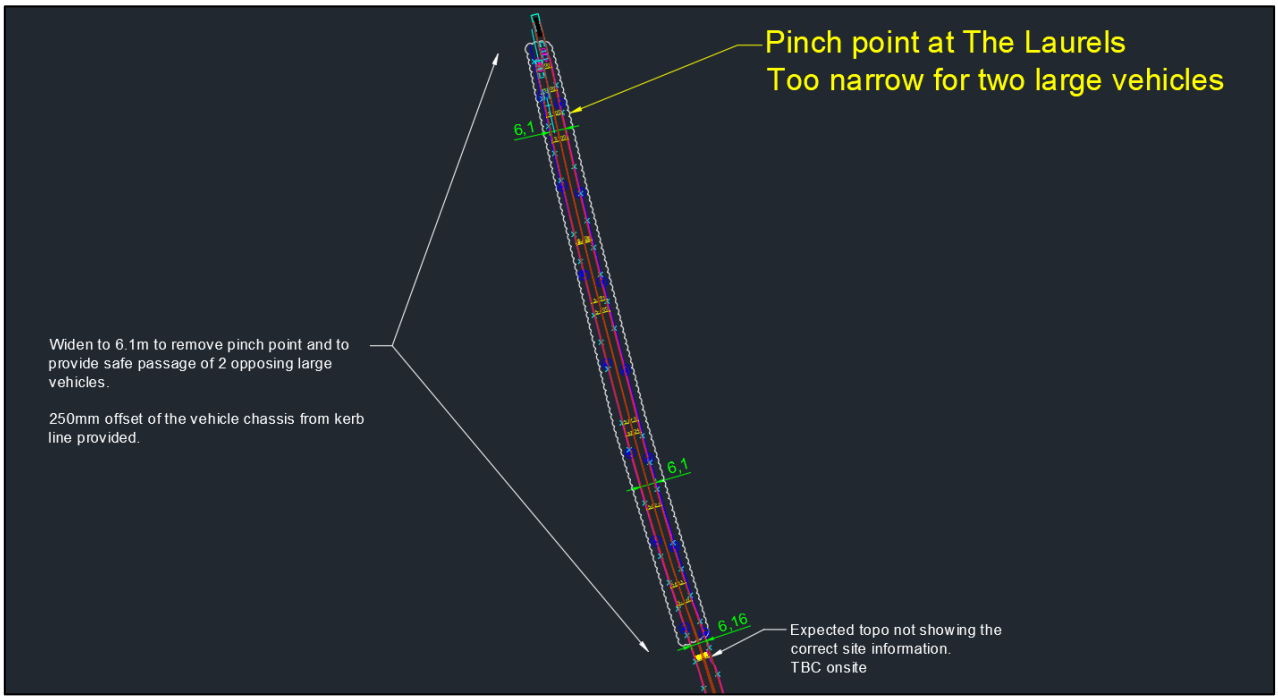
Plate 6.13 Private and commercial motor-vehicles – typical dimensions (Source: Manual for Streets 1 Figure 6.18)



Pinch point at The Laurels (Ch. 0+015m to 0+240m)

6.7.5 The carriageway on this section of the road is proposed to be widened to a minimum of 6.1m to cater for two opposing large vehicle as shown in Plate 6.14.

Plate 6.14 Vehicle tracking at the pinch point at The Laurels. The comments received from the community are shown in yellow text

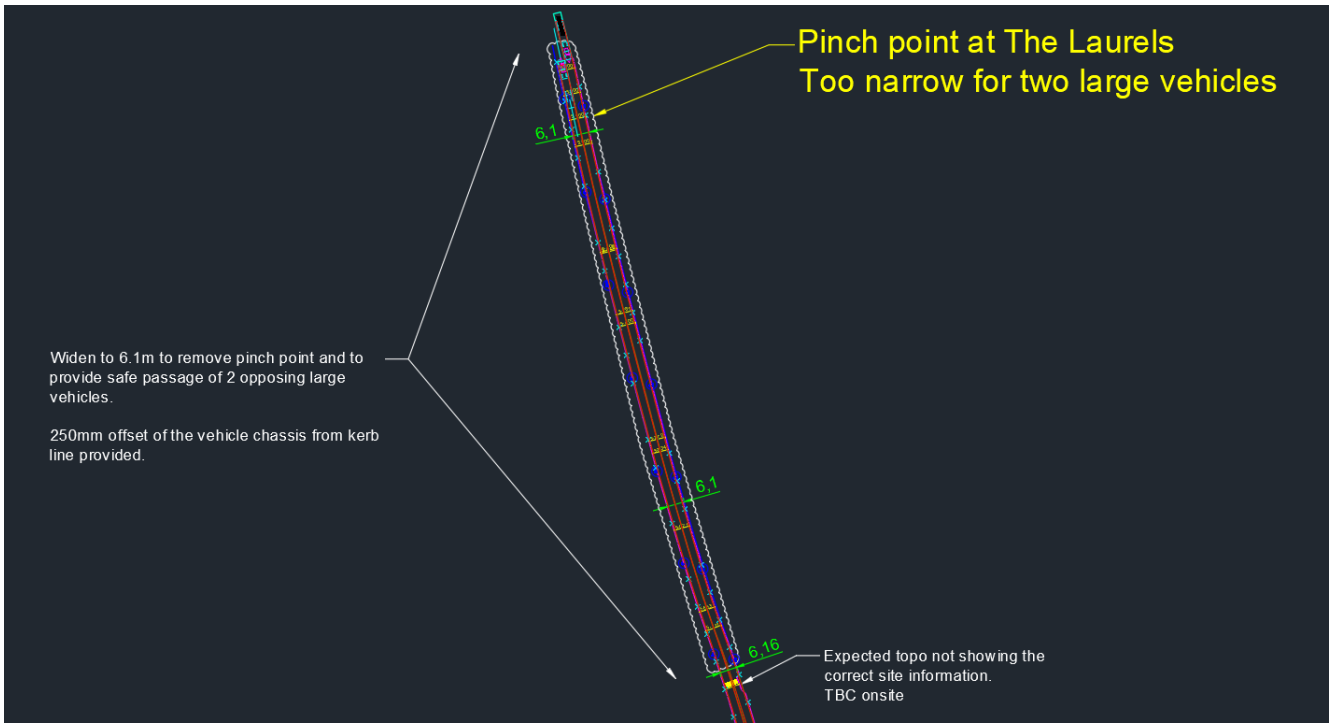


Pinch point between Ch. 0+366m and 0+584m

6.7.6 As shown in Plate 6.15, to accommodate the swept path of the design vehicle, the carriageway through this section of the road requires widening at:

- (Ch. 0+366m to 0+440m) on the bend near Inworth Hall.
- (Ch. 0+440m to 0+483m) on the straight section between the two bends.
- (Ch. 0+483m to 0+584m) on the bend near the Thatched Cottage.

Plate 6.15 Vehicle tracking of pinch points between chainage 0+366m and 0+584m. The comments received from the community are shown in yellow text

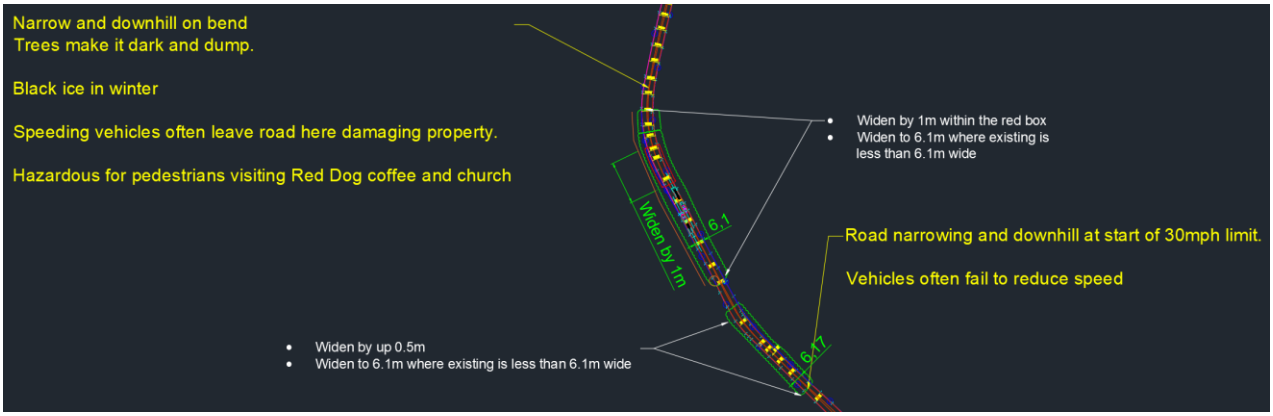


Pinch point between Ch. 0+705m and 0+822m

6.7.7 As shown in Plate 6.16, to accommodate the swept path of the design vehicle, the carriageway through this section of the road requires widening at:

- (Ch. 0+727m to 0+753m) outside the All Saints Church.
- (Ch. 0+775m to 0+822m) outside the All Saints Church and to the south.
- (Ch. 0+853 to Ch. 0+907m) at the junction with Wind Mill Hill.

Plate 6.16 Vehicle tracking at pinch points between Ch. 0+705 and 0+907. The comments received from the community are shown in yellow text



6.8 Microsimulation of corridor

6.8.1 Following identification of the preferred Widening Option 2, which was shown to accommodate the movements of an articulated heavy goods vehicle, the theoretical capacity of the road with these improvements was tested using detailed microsimulation traffic modelling software. This type of modelling takes into account road widths and the ability of traffic in different lanes to pass each other.

6.8.2 Microsimulation modelling has been undertaken by the traffic team using Vissim software to assess the suitability of Widening Option 2 (6.1m minimum width carriageway) to cater for the predicted traffic for the design year 2042 for Inworth Road.

6.8.3 The following scenarios were assessed:

- Do Minimum (DM) – The existing Inworth Road, as it would be in 2042 with no A12 scheme in place, and no mitigation measures.
- Do Something 1 (DS1) – The existing Inworth Road, as it would be in 2042 with the A12 scheme in place, and no mitigation measures.
- Do Something 2 (DS2) – Inworth Road in 2042, with the A12 scheme in place and the Widening Option 2 mitigation measures in place.

Vissim assessment assumptions

6.8.4 The following assumptions were used in development of the Vissim model

- The DCO SATURN model flows (2042) have been used in the Inworth Road Vissim assessments.
- The layout of the Vissim model has been developed based upon the Topographical Survey (Topo) of Inworth Road. The Topo has been loaded into Vissim in five sections which have been stitched together and overlayed with Vissim's background mapping to ensure the positioning of the road layout is as accurate as possible.

- The carriageway widths have been determined purely by the Topo that has been loaded into Vissim. This has then been sensed checked with a detailed review of Google 'street-view' and vehicle positioning within the lanes (where vehicles are shown on street-view).
- The assumed size of the largest vehicles using Inworth Road which have been coded into the Vissim models include:
  - HGV – based upon the size of vehicle assessed in the tracking/swept path analysis undertaken for Inworth Road; length 16.48m, width 2.55m
  - Bus – average standard size of a UK bus; length 13m, width 2.6m
- The sections of Inworth Road which are deemed too narrow for two HGVs, two buses and one HGV and one bus to pass at the same time (one travelling northbound and one travelling southbound) have been identified using the Topo survey. Sections of the carriageway which are below 2.55m in width and those confirmed through swept path analysis have been identified as pinch points where an HGV and/or bus would be required to stop to enable a vehicle of this size to pass in the opposite lane. Priority has been given to the first arriving vehicle to these pinch point areas.
- Posted speed limits for traffic in the Vissim models is based upon the existing speed limits of 30mph and 50mph on Inworth Road. Reduced speed areas of 20mph have been used on the approach and through the pinch point sections of Inworth Road associated with slower moving HGVs and buses due to pinch points.
- Desktop study identified bus services that travel northbound and southbound along Inworth Road during the AM and PM peaks assessed in the Vissim models. All bus services in the model have been assigned to each bus stop which is served by each service, meaning the buses stop at each stop – representing a 'worst case' scenario for the impact of buses on traffic flow along Inworth Road.
- The time (in seconds) that buses are stopped in the bus stops on the northbound and southbound carriageways is based upon a 1% alighting of the full available bus occupancy. Given the rural nature of Inworth, this is deemed to represent a 'worst case' scenario for the impact of buses on traffic flow along Inworth Road.
- It has been assumed that cars can overtake buses when they are stopped at the bus stops. This only happens when the opposing traffic flow on the opposite side of the carriageway is low enough to provide safe gap times for vehicles to use the oncoming traffic lane road to overtake buses. This is in accordance with the existing on-carriageway (non-lay-by) bus stops.
- Cyclists have not been included in the traffic vehicle mix.

- The priority junctions along Inworth Road have not been included within the Vissim model.
- A number of residential access points have been included in the Vissim models. The decision to include the individual links was based upon the number of vehicles parked on driveways. This was to ensure that interaction between Inworth Road and residential access points were captured in some form. Vehicles entering and leaving these properties have been assumed to drive forwards (as opposed to reversing). Without undertaking site observations to determine how residents access their properties, this was deemed the most appropriate form of driver behaviour.
- Perrywood Garden Centre is the largest land-use along Inworth Road. The calculation of a trip rate for the AM and PM peaks using the TRICs database was considered to enable the inclusion of traffic arrival and departures to/from the garden centre. However, there are no surveys or trip rates for garden centres for weekday periods contained within the TRICs database and therefore, trips travelling to the garden centre have not been included within the Vissim models.
- Ad-hoc/infrequent etc vehicle behaviour on Inworth Road, such as delivery vehicles (DPD, Hermes, Royal Mail) have not been assessed as there is no available data to determine the frequency of these vehicles travelling northbound and southbound on Inworth Road.

Vissim assessment results

6.8.5 The results of the Vissim assessment are presented in Table 6.1. These show that the average journey time in 2042 over the Inworth Road corridor would be negatively affected from the DM to the DS1 scenario. That is if the A12 were built with no intervention on Inworth road, journey times and delays would increase as a result of the increase in traffic, when compared to Inworth Road with no A12 scheme in 2042.

6.8.6 However, with the interventions in place in the DS2 scenario, the journey times and delays are comparable with the DM scenario, which shows a nil detriment in 2042 with the scheme in place. These results show that a suitable theoretical capacity of the road as described in Plate 6.2 and Plate 6.3 is also supported by microsimulation of the corridor, and that the Widening Option 2 proposals provide the road with a suitable capacity for the projected traffic levels.

Table 6.1 Microsimulation results of Inworth Rd considering the Do Minimum (DM), Do Something 1 (DS1) and Do Something 2 (DS2) traffic scenarios. The figures listed are the average journey times (seconds) and the average delay (seconds)

Inworth Road

Journey Times	Distance
Northbound	1371.61m
Southbound	1371.61m

DCO Traffic Flows

Average Journey Times, in seconds (10 runs)

	DM	DS1	DS2
AM Peak	Existing Inworth Road Network	Existing Inworth Road Network	Existing Inworth Road Network - with Improvement Proposals
Northbound	92	96	92
Southbound	91	97	90

Average Journey Times, in seconds (10 runs)

In Seconds	DM	DS1	DS2
PM Peak	Existing Inworth Road Network	Existing Inworth Road Network	Existing Inworth Road Network - with Improvement Proposals
Northbound	87	89	88
Southbound	89	94	91

Average Delay, in seconds (10 runs)

	DM	DS1	DS2
AM Peak	Existing Inworth Road Network	Existing Inworth Road Network	Existing Inworth Road Network - with Improvement Proposals
Northbound	8	12	9
Southbound	8	12	7

Average Delay, in seconds (10 runs)

	DM	DS1	DS2
PM Peak	Existing Inworth Road Network	Existing Inworth Road Network	Existing Inworth Road Network - with Improvement Proposals
Northbound	4	6	5
Southbound	6	10	7

7 Traffic and noise impact though Messing

7.1.1 In response to the consultation several consultees raised concerns about traffic flow through the community of Messing. In response, the project team ran several sensitivity tests on the traffic model to better understand these impacts and possible mitigations.

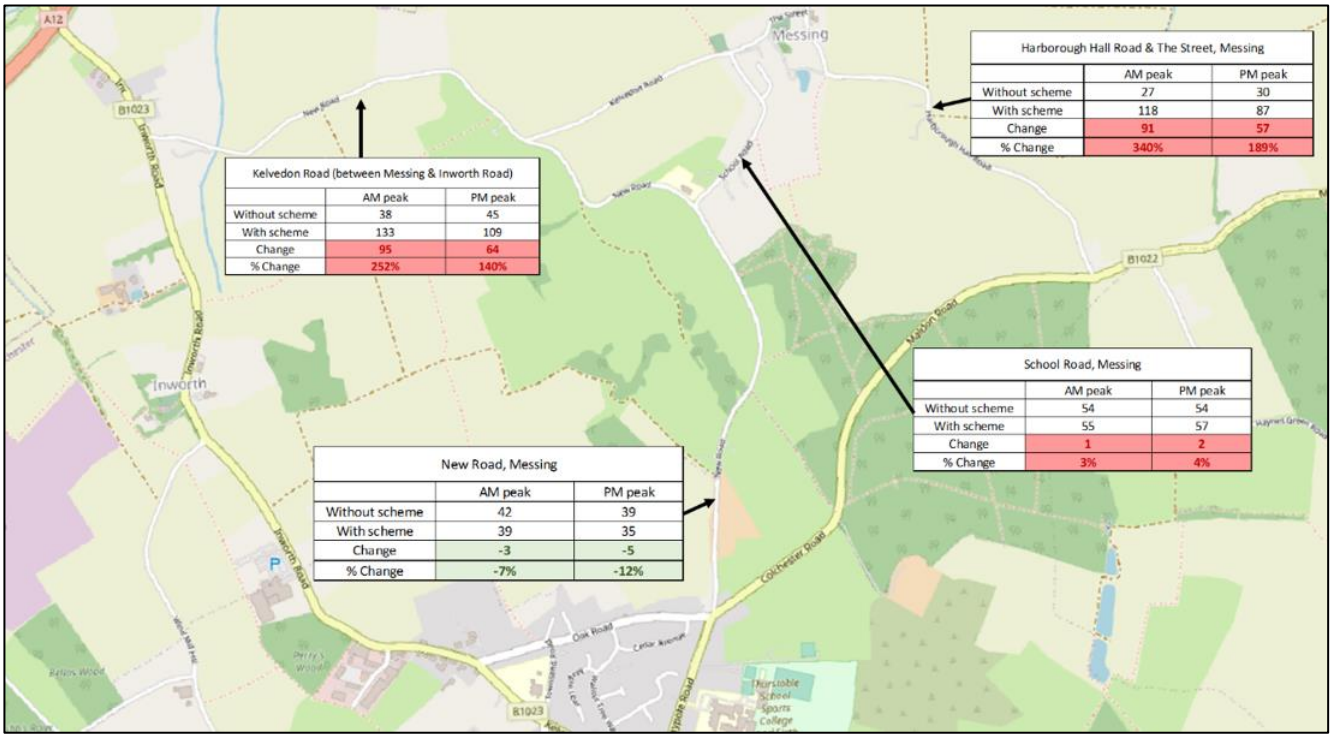
7.1.2 The traffic modelling of the proposed scheme predicts that, when the scheme is open, there would be an increase in traffic through Messing. This section of the appendix presents the traffic and noise assessments undertaken at this location, with options for a reduction in traffic through Messing

7.1.3 Our traffic model includes four roads in the village of Messing:

- Harborough Hall Road between the B1022 and Messing, continuing into The Street through the village centre. This is coded as one single road
- Kelvedon Road, between B1023 Inworth Road and the three-way junction with New Road
- New Road, between the B1022 and the three-way junction with Kelvedon Road
- School Road

7.1.4 The map in Plate 7.1 shows the predicted change in traffic on these roads in 2027 due to our proposed scheme. Traffic is shown in vehicles per hour, for the AM and PM peak hours. The predicted increase in traffic through the village is because of people coming from the B1022 in the east turning off at Harborough Hall Road and travelling through the village then along Kelvedon Road to J24. Without our proposed scheme, this traffic would have travelled to Inworth Road via the B1022 instead of via Messing.

Plate 7.1 2027 traffic flows and predicted change through Messing and surrounding roads, with the A12 scheme in place (DS2 Do Something scenario)



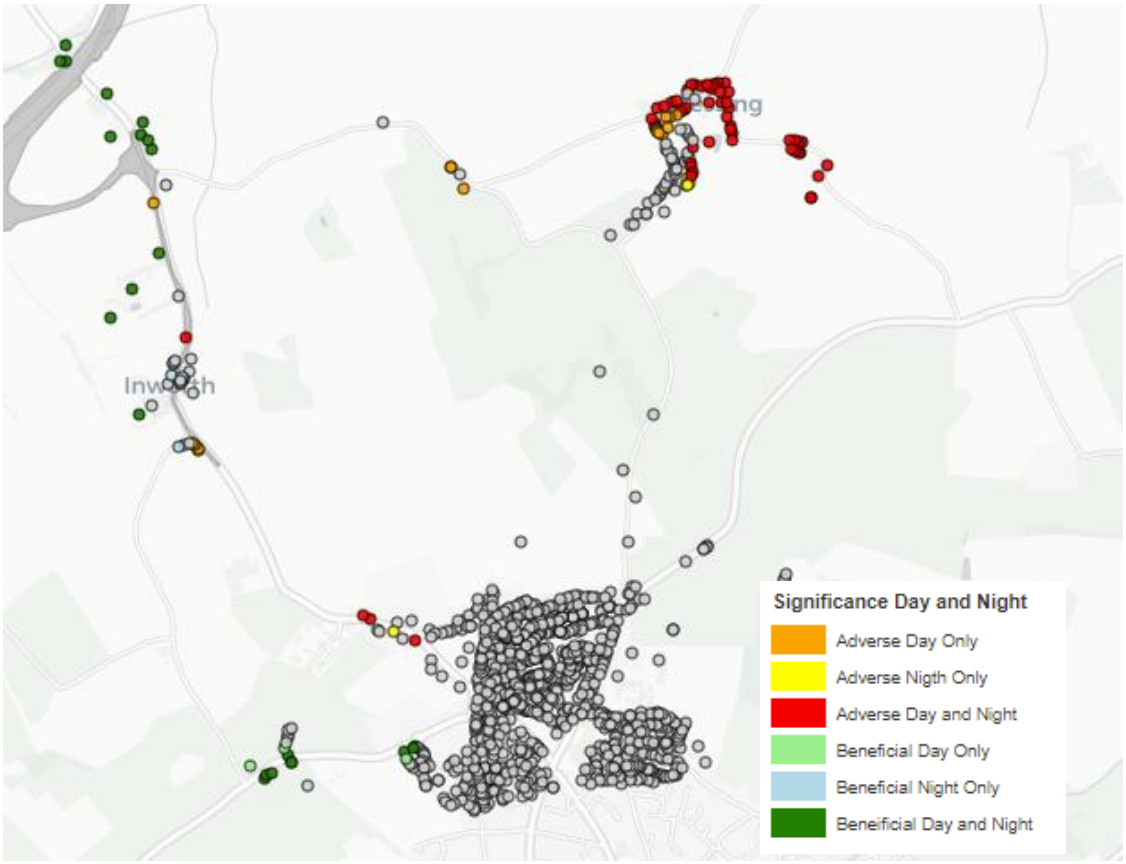
7.1.5 The increase in traffic on Harborough Hall Road / The Street / Kelvedon Road includes an increase of 6 HGVs in the AM peak hour, and 4 HGVs in the PM peak hour, with the rest being light vehicles such as cars. No change in HGVs is predicted on School Road or New Road.

7.1.6 Although the overall traffic flows are still low in Messing, the change caused a predicted increase in noise of around 5 dB(A) This caused significant adverse effects at around 70 dwellings within Messing. None of the dwellings within Messing had an overall noise level above the Significant Observed Adverse Effect Level (SOAEL). The SOAEL is the noise level above which significant adverse effects on health and quality of life can occur.

7.1.7 The four predicted Significant adverse effects within Inworth and the four on the northern approach to Tiptree are above the SOAEL.

7.1.8 These significant adverse effects are shown graphically in Plate 7.2, together with the significant beneficial effects.

Plate 7.2 Significant effects from noise with the proposed scheme



7.1.9 To try to mitigate these noise impacts through Messing, different design options were considered with the aim of avoiding a traffic increase through Messing. These are described below.

7.2 Closure of Kelvedon Road

7.2.1 The option most effective at reducing traffic in Messing was to close off the access between the B1023 Inworth Road and Kelvedon Road, Messing. This would stop Messing acting as a potential shortcut between the B1022 and the B1023 Inworth Road.

7.2.2 In terms of noise, the closure of Kelvedon Road would remove the predicted significant adverse effects within Messing, and there would now be significant beneficial effects due to the removal of the through traffic. However, the increase in traffic through Tiptree would cause around 60 significant adverse effects at dwellings along Oak Road and five along Kelvedon Road in Tiptree. Of these dwellings along Oak Road and Kelvedon Road, eight would have an overall noise above the SOAEL. In addition, there would be two additional significant adverse effects within Inworth.

7.3 Closure of Kelvedon Road and interventions on Oak Road

7.3.1 To avoid the increase in traffic on Oak Road described above, different interventions could be considered. These could include Traffic Regulation Orders to prohibit the road being used as a 'through road', allowing it to be used by residents only.

7.3.2 A traffic model test was produced to reflect this. For the traffic which had previously diverted onto Oak Road when Kelvedon Road in Messing was closed, this was assumed to instead travel via the B1022 Maypole Road to the double mini-roundabouts in the centre of Tiptree, then travel north via the B1023 Church Road / Inworth Road.

7.3.3 In terms of noise, the closure of Kelvedon Road would remove the predicted significant adverse effects within Messing, and these would now be significant beneficial effects due to the removal of the through traffic. However, the increase in traffic through Tiptree would cause significant adverse effects at 10 dwellings along Kelvedon Road in Tiptree. Some of these dwellings would have an overall noise above the Significant Observed Adverse Effect Level (SOAEL). In addition, there would be two additional significant adverse effects within Inworth. There would also be additional pressure on the double-mini roundabouts in Tiptree town centre due to extra traffic using them.

7.4 Addition of a junction 24 northern link to the community bypass option (DS4)

7.4.1 As described in Section 4.3 of this appendix, the Inworth cum Messing Parish Council and Messing Action Group requested that a northern link was added to the earlier DS3 J24 community bypass request, as with the DS3 southern link, the bypass would not be expected to significantly reduce the forecasted traffic through Messing to access the A12 via the proposed J24. This has been confirmed through traffic analysis of the DS3 and DS4 bypass proposals presented in Section 5.2 of this appendix.

7.4.2 Due to the reasons outlined within the A12 Chelmsford to A120 Scheme Assessment Report Addendum regarding J24 Option E, this option including a J24 northern link to the B1023 Inworth Road was at the time discounted.

8 Options assessment and scoring

8.1.1 Following the development of both the B1023 Inworth Road mitigation measures widening option 2, as well as the conceptual community bypass designs, these were assessed and scored in a multidisciplinary exercise. The following sub-sections contain these assessments and scoring, against a baseline scenario. The results of the scoring can be seen below in Table 8.2, and the scoring criteria guidance in Table 8.1. Further notes on these scores from each design discipline are contained in the below sub-sections.

8.1.2 The baseline scenario for this assessment was set as a 'Do Something 1' (DS1) scenario. This was in order to assess the various options available for addressing the traffic increase on the B1023 Inworth Road, against each other as potential solutions.

8.1.3 An initial multidiscipline scoring workshop was held on the 03/09/2021, to compare the widening option 2, second bypass concept option and the baseline. This workshop used the available information at the time and involved several disciplines leads from Jacobs. Attendees from Costain were present to give their views on the construction challenges and benefits of each option. In this workshop the DS2 Inworth Road widening was found to be the preferred option.

8.1.4 A second multidiscipline scoring workshop was held on the 20/05/2022, to validate the previous scores considering additional topographical survey data, traffic and noise modelling, and also to assess and score the latest community bypass concept. The outcome of this second assessment was similar to the first and DS2 was found to be the preferred option.

8.1.5 In order to keep the scoring consistent with previously assessed options on the scheme, the Road Investment Strategy (RIS) objectives were used as the scoring criteria.

8.1.6 The following option scenarios were assessed and scored, with the results presented in this section of the appendix:

- Do Something 1 (DS1) – The existing B1023 Inworth Road, as it would be in 2042 with the A12 scheme in place, and no mitigation measures. Set as the baseline
- Do Something 2 (DS2) – B1023 Inworth Road in 2042, with the A12 scheme in place and the Widening Option 2 mitigation measures in place
- Do Something 3 (DS3) – Inworth Road in 2042, with the A12 scheme in place and the second community bypass concept with southern J24 link road in place. No mitigation measures on Inworth Road
- Do Something 4 (DS4) – Inworth Road in 2042, with the A12 scheme in place and the latest community bypass concept with northern J24 link road in place. No mitigation measures on Inworth Road

8.1.7 The bypass options assessed can be seen below, with the second concept bypass DS3 shown in Plate 8.1, and the latest community bypass shown in Plate 8.2.

Plate 8.1 The DS3 bypass concept as assessed in the multidisciplinary workshop

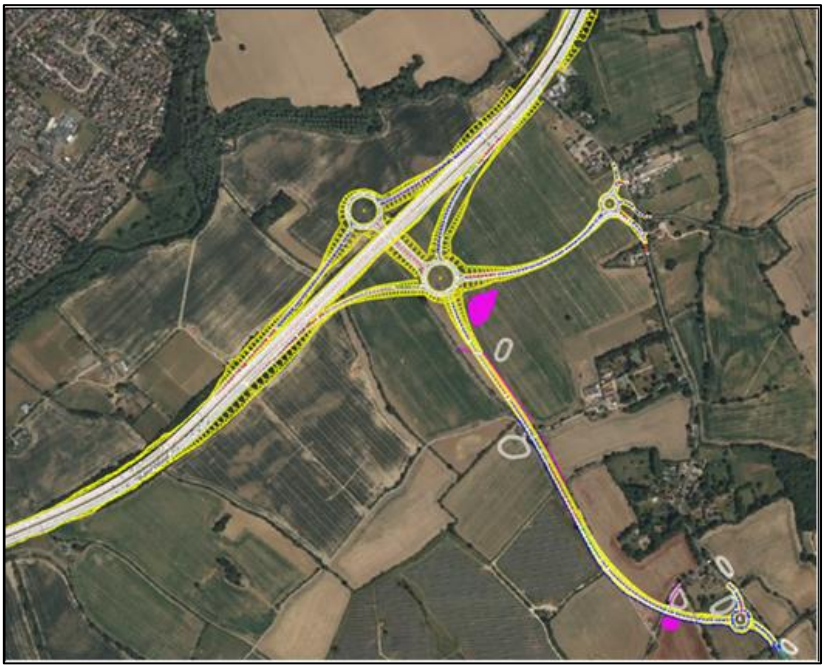
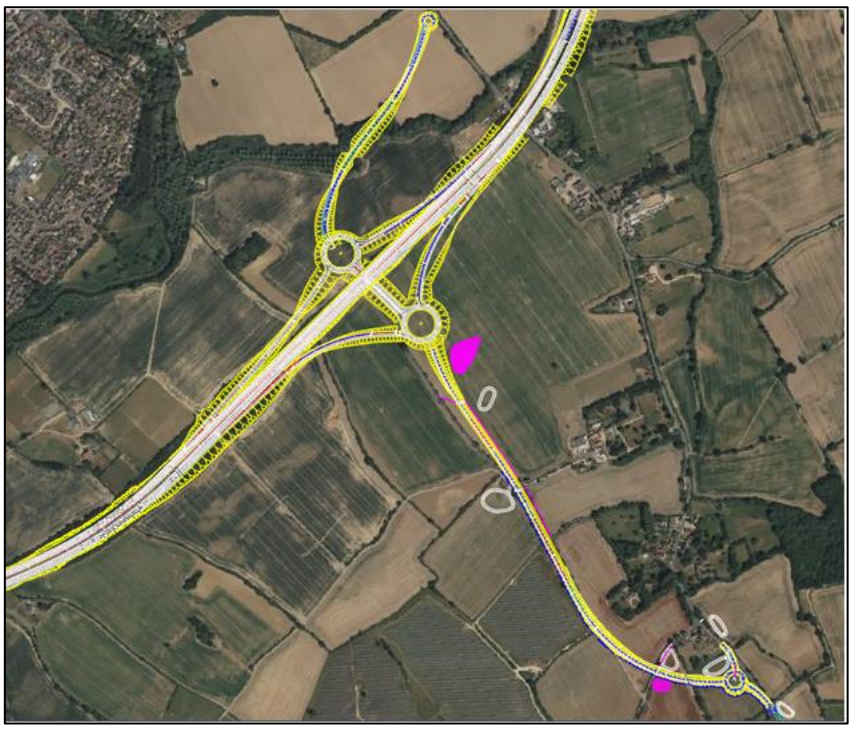


Plate 8.2 The DS4 bypass concept as assessed in the multidisciplinary workshop



8.1.8 The criteria scoring key and colour coding in shown in Table 8.1. This is the same criteria scoring key that has been used across the scheme for consistency.

Table 8.1 Criteria scoring key and colour coding (Road Investment Strategy Scoring System)

+3	Significant Impact – Significant beneficial impact
+2	Major Impact – Major beneficial impact
+1	Minor Impact – Minor beneficial impact
0	Neutral – No impact
-1	Minor Impact – Possible minor adverse impact – Not significant with mitigation
-2	Major Impact – Possible major adverse impact – Mitigation may be possible
-3	Significant Impact – Will likely have significant adverse impact – Not possible to mitigate

Table 8.2 Scoring workshop outcome

RIS Objectives	DS1	DS2	DS3	DS4
1) Supporting Economic Growth a) Proposed scheme supports the growth identified in Local Plans by reducing congestion related delay, improve journey time reliability and increase the overall transport capacity of the A12	0	0	0	0
1) Supporting Economic Growth b) Proposed scheme promotes specific traffic flow across the highway network	0	+1	+1	+1
2) A Safe and Serviceable Network a) Proposed scheme improves road user safety	0	+1	+1	+2
2) A Safe and Serviceable Network b) Proposed scheme improves road worker safety	0	0	0	0
3) A More Free-Flowing Network a) Proposed scheme increases the resilience of the transport network to cope with incidents including collisions, breakdowns, maintenance and extreme weather	0	0	+1	+2
3) A More Free-Flowing Network b) Proposed scheme fully understands the impacts of the other schemes and recognises other RIS schemes	0	0	0	0
4) An Improved Environment a) Improve the environmental impact of transport on communities along the existing A12	0	-1	-2	-2

RIS Objectives	DS1	DS2	DS3	DS4
4) An Improved Environment b) Reduce the impact of new infrastructure on the natural and built environment by design	0	-1	-2	-3
5) A More Accessible and Integrated Network a) Proposed scheme provides a safe WCH route between communities and seeks to address severance	0	0	+1	+2
5) A More Accessible and Integrated Network b) Improve safety and effective access for public transport users	0	0	+1	+1
6) Customer Satisfaction a) Improve customer satisfaction	0	+1	+1	+2
6) Customer Satisfaction b) Improve scheme profile	0	+1	+2	+2
7) Traffic & Economic Value for Money a) Economic Benefits	0	0	+1	+1
7) Traffic & Economic Value for Money b) Cost	0	-1	-3	-3
8) Deliverability/Construction a) Carbon	0	-1	-2	-2
8) Deliverability/Construction a) Highway Geometry	0	+1	+2	+2
8) Deliverability/Construction b) Construction Challenge	0	-1	-2	-3
8) Deliverability/Construction c) Drainage Challenge & Flood Risk	0	+1	0	-1
8) Deliverability/Construction d) Structures Challenge	0	0	0	-1
8) Deliverability/Construction e) Planning & Land Challenge	0	+1	-1	-2
TOTAL SCORE	**0**	**+2**	**-1**	**-2**

8.2 1a & 1b) Supporting economic growth

8.2.1 In terms of affecting the traffic flow, capacity and delays on the A12 mainline, none of the options are have a different impact than DS1. All have therefore been given a score of 0 for objective 1a.

8.2.2 Objective 1b considers the impacts on traffic flow, capacity and delays on the local road network. DS2 would provide a benefit to the capacity of the B1023 Inworth Road by removing existing pinch points and has therefore been given a score of +1.

8.2.3 DS3 would provide traffic relief to Inworth Road through Inworth, as traffic travelling between Tiptree and A12 junction 24 would divert to use the new bypass instead of Inworth Road. However, the bypass would attract extra traffic to the sections of the B1023 south of the proposed bypass, including through Tiptree. On balance, it has been given a score of +1.

8.2.4 DS4 would provide similar positive and negative impacts to those described for DS3 above. It would also reduce the traffic projected increases through Messing village, as Messing would be less well connected to A12 junction 24. However, a side-effect of this would be either an increase in traffic on Oak Road in Tiptree, or an increase in traffic using the already busy double-mini roundabouts in Tiptree town centre. In addition, the provision of a northern connection in DS4 would increase the amount of traffic travelling between A12 junction 24 and Kelvedon/Feering. This would significantly increase the pressure on the Gore Pit junction between the B1023 and B1024, making its performance significantly worse than it would otherwise be. On balance, it has been given a score of +1.

8.3 2a & 2b) A safe and serviceable network

8.3.1 From an Operational Safety perspective only, and when scored against the baseline, it is envisaged that DS2 represents a very small improvement, being localised but beneficial within those extents with a short extension of footway to a PRoW. Both bypass options (DS3 and DS4) alleviate flow on the poor quality existing B1023 Inworth Road route, which brings a more serviceable and resilient network with user and worker safety benefits. However, this is offset by the fact that lower flows can result in higher speeds, which can increase risk in the event of a road user error leading to a collision. The benefits and offsetting effect of speed increase are greater with DS4 which reduces traffic flow on more of the Inworth Road route.

8.3.2 The net effect is that the localised widening scores a very small improvement (+1); the DS3 bypass option also +1 and the DS4 bypass option +2 reflecting the benefits to pedestrians and cyclists over the greatest extent.

8.3.3 In addition to road user safety, effect on workers' safety has been considered, and again there are offsetting effects. Both bypass options create a more resilient network, which makes maintenance easier, but the extent of network to maintain is higher too. These balance out and all three options are neutral for worker safety, when compared to the baseline DS1.

8.4 3a & 3b) A more free-flowing network

8.4.1 In respect of 3a (network resilience), DS2 localised widening represents a small improvement over the baseline DS1 by a modest easing of the route through Inworth. The localised widening of DS2 therefore provides a marginal benefit over DS1, but does not reassign flow in Inworth Road to a better quality route

so the changes are minimal and DS2 is scored at 0 when compared to the baseline.

8.4.2 DS3 and DS4 both provide a free flowing and more resilient network. They also provide better active travel provision, whereas the existing route has no cycle provision and localised poor quality pedestrian provision. Free movement for these users and for motorised traffic would be improved because cyclists currently using the carriageway affect traffic flow because drivers would not find passing a cycle easy in many locations. DS3 and 4 provide improved resilience for traffic because they create additional routes. Both bypass options therefore improve free-flow benefit for all motorised, cycle and public transport users, compared to DS1 and DS2.

8.4.3 DS3 provides alleviation of flow on a section of Inworth Road through the Inworth settlement, whereas DS4 provides an alternative for more of the route including more pinch points, and therefore free-flowing traffic (for motorised and non-motorised user groups) on a longer extent, because the current route is affected by a winding alignment, driveways and businesses which all affect flow. On this basis, DS4 provides a more free-flowing network than DS3 option, and both are improvements over the baseline DS1 option and DS2 enhancement. DS4 is therefore a +2 benefit reflecting the higher resilience over more of the network than DS3 which scores +1

8.4.4 In respect of 3b, this objective considers the impact on other proposed infrastructure schemes, including those named in the government's Road Investment Strategy (RIS) such as the A120 Braintree to A12 improvement scheme. No option is expected to have a significant impact in this respect compared to DS1, and therefore all options are given a score of 0.

8.5 4a) An improved environment – people

8.5.1 There may be an increase in noise, vibration, and a potential decrease in air quality through Inworth due to an increase in traffic on the B1023 Inworth Road as a result of the current J24 proposal. However, with the community bypass options, much of this traffic and the associated environmental impacts would be shifted to the rear of properties on the west side of the B1023. The residents in these properties would then experience impacts from a road on both sides.

8.5.2 The two bypass options DS3 and DS4 have been assessed against the proposed option DS2 to determine significant noise effects that would be created with their implementation. The noise effects for option DS2 are described in Section 7 of this appendix, with significant noise effects illustrated on Plate 7.2.

8.5.3 Significant effects for the two bypass options are illustrated in Plates 8.3 and 8.4 for options DS3 and DS4 respectively.

Plate 8.3 Significant noise effects from option DS3

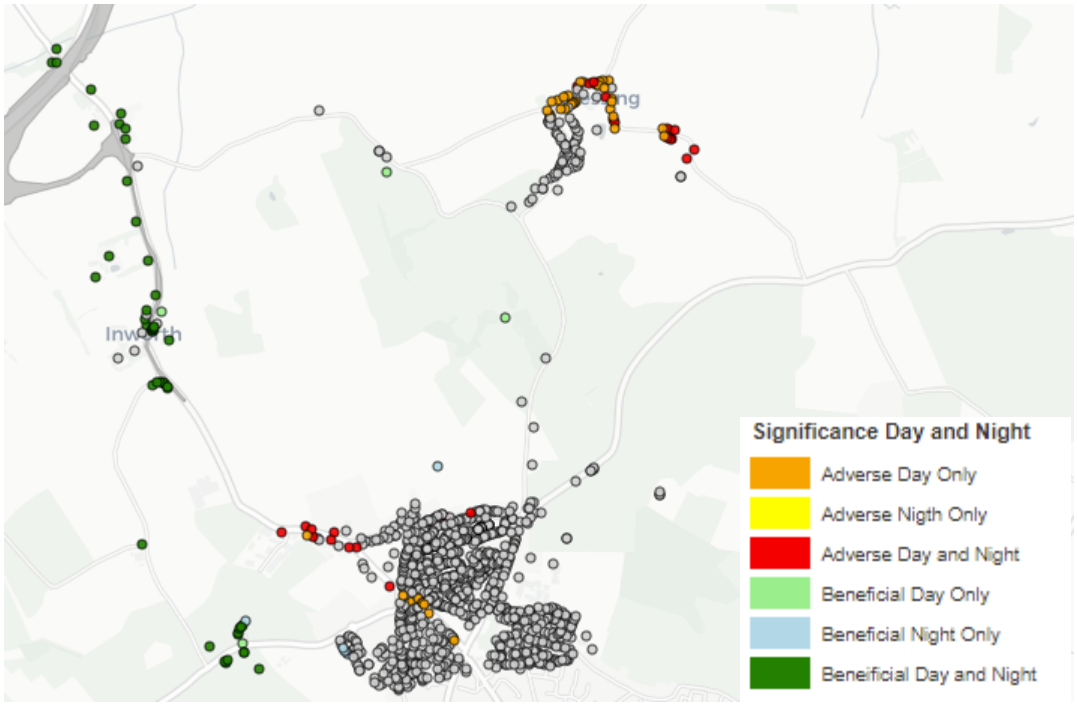
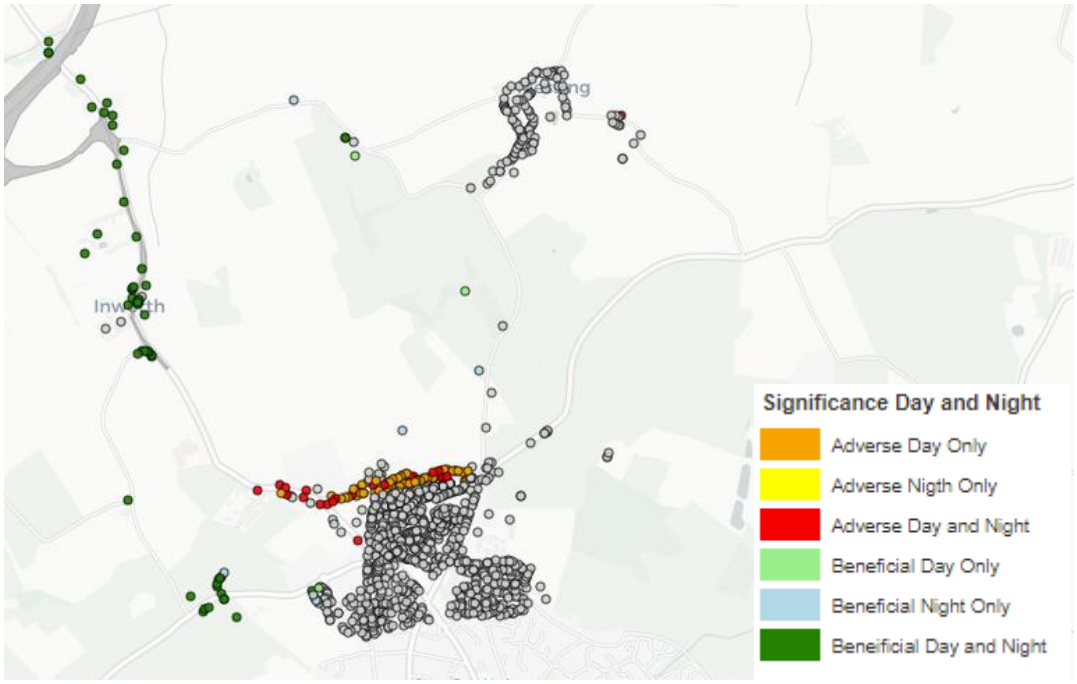


Plate 8.4 Significant noise effects from option DS4



8.5.4 A comparison of the three options in terms of significant noise effects is provided in Table 8.3. In mid-July 2022, the extent of noise modelling for DS2 was increased to match the extent used for DS3 and DS4 which has resulted in slightly different numbers of significant adverse effect, significant adverse effects above SOAEL, and significant beneficial effects to those previously shared in the draft version of this report issued to Essex County Council, Braintree District Council and Colchester Borough Council.

Table 8.3 Significant noise effects for proposed scheme and community bypass options

	Proposed scheme (DS2)	DS3	DS4
Significant adverse effects	79	63	90
Significant adverse effects above SOAEL	8	20	19
Significant beneficial effects	122	153	165

8.5.5 It should be noted that the number of significant beneficial effects for each option is higher than shown within Plates 8.3 and 8.4. This is because for comparison purposes the counting was extended north into Kelvedon to reflect any possible changes along that section of Kelvedon Road. There were no significant adverse effects along that part of Kelvedon Road for either option or for the proposed scheme.

8.5.6 Compared with DS2, the community bypass option DS3 decreases the traffic within Messing but not by a sufficient amount to remove all the significant adverse effects. The traffic removed from Messing now travels through the northern part of Tiptree and creates more significant adverse effects. Although the overall number of significant adverse effects is less than DS2, there are more of these above the SOAEL.

8.5.7 Compared with DS2, the community bypass option DS4 removes all but one of the significant adverse effects within Messing. However, there are now many significant adverse effects in the northern part of Tiptree. With this option, compared to DS2, the number of significant adverse effects and those above the SOAEL is greater.

8.5.8 With respect to air quality, assessment has not identified any likely significant effects at human health receptors in the operational phase for any of the options. Modelling results for option DS2 indicate that receptors in Inworth would be subject to annual mean NO_2 concentrations of between 12-15 ug/m^3 at the opening year of 2027. Although the bypass would reduce traffic through Inworth village, this level of NO_2 is considerably lower than the air quality objective for this pollutant of 40 ug/m^3.

8.5.9 In relation to community perception and wellbeing, the impacts of increased traffic through Inworth Village for option DS2 should be considered within the context of the existing relatively high traffic volumes through the village. It is uncertain whether the perception of severance would be particularly noticeable for most people. Option DS2 includes mitigation measures to replace hedgerows, as well provision for some localised widening and a lengthened pedestrian footway along Inworth Road which would provide improved access facilities for pedestrians. These measures would help to mitigate the visual and traffic impacts of this option. Although the bypass options would remove some of the traffic from the village, they would result in additional built development in the countryside with potential impacts on sense of place and tranquillity.

8.6 4b) An improved environment – place

8.6.1 Option DS2 would result in the loss of roadside hedgerows and trees for road widening through Inworth, potentially opening up views from some properties and users of public rights of way east and west of Inworth Road. The vegetation largely comprises mature to over-mature gapped hedgerows, that are generally unremarkable as individual specimens but contribute to the rural character of the road and setting of the village. Most sections of lost hedgerow would be mitigated by replanting. Whilst the road widening would exacerbate the prominence of Inworth Road, the proposals would be set within the context of the existing highway infrastructure.

8.6.2 The community bypass options DS3 and DS4 would comprise development across greenfield land and the loss of grade 3 agricultural land. Visual receptors would include residents within properties along Inworth Road and users of public rights of way west of Inworth Road.

8.6.3 Construction of a bypass would remove sections of hedgerow field boundaries associated with the modern agricultural historic landscape, as well as introducing an element of modern infrastructure which would cut across the grain of the landscape.

8.6.4 As currently illustrated (Plate 8.1 or Plate 8.2), the bypass south of J24 would likely result in loss and/or impacts on a potential veteran tree belt and potential individual veteran trees. Similar impacts are likely on mature trees along the old railway line, where the route crosses field boundaries and ties into Inworth Road. It is likely that some of the potential veteran tree belt and railway line trees could be avoided by moving the alignment of the bypass slightly to the east or west. However, if moved to the east, the bypass would be closer to Inworth Road and the rear of properties and All Saints Church. If moved west, the retained potential veteran tree belt and railway line trees would form a visual buffer between the bypass and properties and All Saints Church along Inworth Road, but the bypass would intrude further into open countryside. There would be close views of the bypass for users of the public rights of way that run adjacent to, or are crossed by, the alignment.

8.6.5 Overall, the two community bypass options DS3 and DS4 would cause similar landscape and visual effects and are assessed as -2 (major adverse impact) compared to -1 (minor adverse impact) for option DS2.

8.6.6 None of the three options would impact directly on designated ecology sites; however, all options have the potential to impact on habitat and protected species. Bypass options DS3 and DS4 cross open countryside and would likely result in the loss of mature and semi-mature trees within hedgerows and field boundaries. These trees could potentially support bat roosts and provide habitat for other species such as nesting birds and badgers. Option DS4 would also cross riparian habitat of Domsey Brook with potential to impact additional protected species. The alignment would directly impact on a confirmed otter couch.

8.6.7 Option DS2 traverses less open countryside and as such would be less ecologically damaging than options DS3 or DS4. Removal of some sections of hedgerow and trees would be required with potential to impact on bat roosts. There may also be buildings supporting bat roosts located close to the construction works.

8.6.8 Overall, the two community bypass options DS3 and DS4 would have similar potential for biodiversity impacts and are assessed as -2 compared to -1 for option DS2.

8.6.9 Option DS2 would not affect any known designated or non-designated archaeological remains and would not have a physical impact on any designated or non-designated built heritage assets. However, there would be temporary noise and visual impacts on the setting of ten grade 2 listed buildings and the grade 1 listed All Saints Church. The setting of the church would be impacted by road widening, removal of mature trees along the church frontage, and removal of roadside vegetation along the field boundary to the south of the church for the excavation of a flood compensation area. Overall construction impacts have been assessed as of moderate adverse significance, reducing to slight adverse following completion of construction and provision of landscape planting for mitigation.

8.6.10 Construction of the community bypass with southern connection (option DS3) would not impact on any known designated or non-designated archaeological remains, although findspots of Roman and medieval material have been found nearby and could indicate the potential for archaeological remains. Construction works would not have a physical impact on any known designated or non-designated built heritage assets; however, they would result in temporary noise and visual impacts on the setting of two grade 2 listed buildings and the grade I listed All Saints Church. There would also be impacts during operation due to visual and noise impacts from traffic using the bypass.

8.6.11 Construction of the community bypass with northern link (option DS4) would not affect any additional designated or non-designated built heritage assets. However, construction of this option would result in noise and visual effects on the setting of a Scheduled Anglo-Saxon cemetery 150m east of Easterford Mill and would also remove archaeological remains connected with Cropmarks associated with the Anglo-Saxon cemetery. Operation of the northern link would also potentially result in noise and visual effects on the setting of the scheduled monument from traffic. The impacts from the introduction of the new section of road could be mitigated up to a point, but it may not be possible to avoid a permanent significant effect.

8.6.12 In summary, the assessment for cultural heritage concludes that options DS2 and DS3 would be scored as -1 (minor adverse impact) while option DS4 would be scored as -3 (likely significant adverse impact which it may not be possible to mitigate).

8.6.13 The aggregate scores for impact on place also taking into account the worst scoring among each assessment are therefore -1 for the DS2 option, -2 for the DS3 option and -3 for the DS4 option.

8.7 5a & b) A more accessible and integrated network

8.7.1 Widening option 2 proposes only limited improvements to the WCH network and is therefore scored as neutral against the baseline for 5a. These improvements are localised to a footway extension to the north of Inworth Village, to replace lost connectivity due to widening, and to provide a link to public right of way (PRoW) footpath 145_15.

8.7.2 The community bypass options provide an indicative 3.0m wide shared footway / cycleway, compliant with modern standard and guidance. Although shown adjacent to the carriageway (with appropriate separation), as the road is near ground level for the majority, it is possible to locate this parallel to the link road, anywhere within the corridor. This would provide a future proofed WCH link which could provide a link to PRoW footpaths and the Ewell Hall chase A12 overbridge, however its use beyond this may be limited. There would also be an improvement to walking and cycling along a section of Inworth Road, due to reduced conflict with traffic. Therefore, for 5a, the DS3 option scores a minor beneficial impact +1, with the DS4 scoring +2 due to the additional distance over which Inworth Road would be improved, and the opportunity to provide a better connection through the longer corridor.

8.7.3 In respect of 5b, The safety and convenience of public transport safety has also been considered, and both bypass options DS3 and DS4 reassign more through traffic to the bypass, making use of bus stops easier for drivers and passengers. DS2 is scored as neutral to the baseline DS1 as changes are minimal for these users. DS 3 and 4 are both scored +1 reflecting better conditions on Inworth Road for bus users.

8.8 6a) Customer satisfaction – improved customer satisfaction

8.8.1 Regarding the DS2 option, the proposed interventions on Inworth Road address pinch points and will ensure that the experience of a customer along the road will be improved. In addition, drainage works will help to ensure that the road is more reliable and therefore the customer would experience a more reliable journey. As such, the scheme's proposed interventions would have a positive effect on the customer experience and this has been scored as +1 beneficial effect.

8.8.2 Regarding the DS3 option, for customers seeking to join the A12 to and from the south at the proposed J24, the introduction of a bypass will move them off the B1023 Inworth Road sooner, onto a new piece of infrastructure. Whilst this would not be a significant length of new infrastructure, it would, on balance, provide a better experience for the customer than the proposed interventions on Inworth Road. However, as this betterment is only experienced for a short period of an overall strategic journey, and only to those traveling to and from the south the benefit is not significant enough to move the score to a +2 and has also been scored as +1.

8.8.3 Regarding the DS4 option, the introduction of a northern link and a bypass will mean that customers coming from any direction to join the A12 at J24 will be moved off the existing local road network and onto new infrastructure sooner. This will in turn provide them with a better experience than DS2, and more people will get that better experience than under DS3 due to it applying to drivers coming from both the north and south, and therefore this has been scored as +2.

8.9 6b) Customer satisfaction – improved scheme profile

8.9.1 Regarding the DS2 option, while this does not provide the bypass that many members of the Messing and Inworth Community have requested, it does address two of the fundamental concerns raised with the project, flooding and the passing of large vehicles. Therefore, this has been scored as +1 minor beneficial impact.

8.9.2 Regarding the DS3 option, the central concerns raised in this area by stakeholders have related to traffic on local roads. ECC at the time of writing this report has requested the project provides a bypass for Inworth Road. As such, this proposal would fulfil a central ask of the highway authority and therefore requires a positive score. However, it is worth noting this proposal would pass traffic directly to the community of Tiptree and as such one would expect opposition to it preventing it from getting the maximum score. It is also worth noting that this bypass appears to provide a slightly more balanced approach than DS4 so while they have the same score, on balance this version of the bypass would likely be slightly more favourable although still scores +2.

8.9.3 Regarding the DS4 option, the central concerns raised in this area by stakeholders have related to traffic on local roads. ECC at the time of writing this report has requested the project provides a bypass for Inworth Road. As such, this proposal would fulfil a central ask of the highway authority and therefore requires a positive score. However, it is worth noting this proposal would pass traffic directly to the community of Tiptree as well as add traffic to Kelvedon and as such one would expect opposition to it preventing it from getting the maximum score, and the score is therefore the same +2 as for the DS3 option.

8.10 7a) Traffic and economic value for money – benefits

8.10.1 This objective considers the economic benefits that each option would provide in terms of providing faster and more reliable journeys. Although DS2 would remove pinch points on Inworth Road and therefore reduce journey times, the impacts are limited to Inworth Road and therefore a score of 0 has been given. DS3 and DS4 provide new dedicated bypasses to access A12 junction 24, providing faster journeys for those movements as well as reducing congestion on Inworth Road. However, the overall scale of these economic benefits would be modest, and as noted elsewhere there would be associated negative impacts in some parts of the road network. Overall, a score of +1 has been given to both the DS3 and DS4 options.

8.11 7b) Traffic and economic value for money – cost

8.11.1 Following the order of magnitude costing presented above in Section 5.3 of this appendix, the community bypass was found to be a significantly more costly option than the widening option 2 (DS2), at approximately three to four times the estimated cost.

8.11.2 Therefore, both DS3 and DS4 bypass options have been scored as a -3, with the Inworth Road widening DS2 option at -1, relative to the baseline scenario.

8.12 8a) Deliverability/construction - carbon

8.12.1 This has been based solely on the additional construction required, which carries with it the embodied carbon impact of construction materials as well as emissions from the construction itself. Therefore, the DS2 option has been scored at a minor adverse impact -1, and both DS3 and DS4 bypass options, which involve significantly more civils works at -2.

8.13 8b) Deliverability/construction - highway geometry

8.13.1 The bypass concepts (DS3 and DS4) are offline options that offer a benefit in that a compliant design to both ECC and DMRB standard could be provided within a new corridor, where the existing constraints on Inworth Road are not present. This would be expected to be a high-quality link road, with future proofed traffic capacity.

8.13.2 A bypass does not have a direct impact on private properties along Inworth Road, although may have an indirect impact to the rear of the properties on the western side of Inworth Road. Therefore, this would show a major beneficial impact and both DS3 and DS4 were scored as +2 in the scoring exercise.

8.13.3 Widening Option 2 (DS2) is the recommended option for any online widening based on the existing constraints, however this is also a departure from ECC standard (and from DMRB, although this is not a trunk road and therefore direct application of DMRB regarding highway geometry is not suitable). However, against the baseline DS1 scenario this does improve the safety and capacity of Inworth Road, and is in accordance with other relevant local roads standards discussed in this report, and therefore this is scored as a +1, with minor beneficial impact.

8.14 8c) Deliverability/construction – construction challenge

8.14.1 The DS2 option will involve some construction challenge being online widening on an existing narrow corridor, however this is expected to be mitigatable and therefore this has been scored as -1.

8.14.2 The DS3 option involves construction of a new link road over approximately 1km including a new link into J24 which is in cutting. This is expected to result in some additional construction challenge and has therefore been scored as -2.

8.14.3 The DS4 option involves the same bypass link as DS3, but now has the addition of the northern link road which will need to ramp up steeply from the depressed J24 to cross Domsey Brook with a new structure. This is expected to be more challenging than the DS3 option and is therefore scored as -3 against the baseline.

8.15 8d) Deliverability/construction – drainage challenge and flood risk

Drainage

8.15.1 For the widening option 2, the proposed highway drainage will be designed to cope with increased run-off from the increased road surface (paved area). Attenuation storage would be required as mitigation to address any existing flood risk problems. It is also likely that the majority of existing drainage assets on Inworth Road would either be affected by the proposal of road widening or may be found to be undersized to meet the current requirements of DMRB, requiring a new highway drainage system. Any potential risk of overland flows would also need to be addressed as part of highway drainage design and surface water flood risk mitigation.

8.15.2 To understand the existing drainage capacity, flood risk and development of mitigation proposals, drainage network modelling for existing site conditions would be required in detailed design. The current assumption is that existing Inworth road drains via gravity that would be maintained to accommodate the proposed mitigations.

8.15.3 For the bypass option DS3, the development of a drainage proposal would be a relatively straightforward process without requiring much of existing drainage surveys. There would be fewer challenges with regards to spatial constraints that could be a potential issue to address the existing flood risk to Inworth Road. However, this option would not improve any existing flooding issues on Inworth Road, that could have been due to an undersized or damaged existing drainage system.

8.15.4 For the bypass option DS4, the development of a drainage proposal is expected to be more difficult, due to the northern link to a J24 in cutting, ramping up to the interface with the flood plain at Domsey Brook. The interface with the floodplain, could also result in additional flood mitigation works being required.

8.15.5 Despite the challenges associated with the DS2 Inworth Road widening option, it will provide a drainage system which will be suitable and perform as intended. All options would provide a compliant drainage solution for the proposed scheme, however all options would also require more significant drainage works than the DS1 scenario. DS2 Option would have challenges during construction, for example traffic disruption/potential road closures, potential clashes with underground utilities and need for diversions whereas DS3 Option would require more significant drainage works. Therefore, both DS2 and DS3 are scored as a minor adverse impact -1, however due to the difficulty regarding Domsey Brook, DS4 is scored at -2.

Flood risk

8.15.6 Inworth Rd crosses ordinary watercourses and areas shown by the Environmental Agency (EA) Risk of Flooding from Surface Water mapping to be at medium and high risk of flooding. This can represent both flood risk associated with ordinary watercourses and overland flows not associated with a watercourse.

8.15.7 Residents have told us (and provided photos as evidence) that the road has flooded in the past following heavy rainfall. Without any further investigation it is impossible to determine the precise mechanism of flooding to the road. It is possible that existing drainage and ditches are blocked, or that existing drainage is undersized for more extreme events, or it could be that the catchment results in a highly significant volume of flow.

8.15.8 To comply with National Policy Statement for National Networks (NPS-NN), if the project is undertaking works to Inworth Road then it needs to ensure the finished road is 'operational and safe for users in times of flood'. It is possible that even if no physical works to Inworth Rd are undertaken, as there is a significant increase in traffic on the road, flood risk would be considered to have increased by increasing the number of receptors (people in cars) exposed to an area at risk of flooding. We are not aware of precedent for this scenario, however this should be noted as a risk, were a scenario of increased traffic due to A12 with no mitigation on Inworth Road pursued (the baseline scenario).

8.15.9 Regarding scoring DS2 Inworth Road widening, the option in itself may not increase flood risk (as drainage would be designed appropriately to cope with increased run-off from increased road surface etc). However, as the road would need to be 'operational and safe for users in times of flood' (NPS-NN) we would be required to assess, and if required mitigate, any existing flood risk problems. Anecdotal evidence from residents as well as the EA RoFSW mapping both suggest the road is at risk from flooding.

8.15.10 Without further investigation, the designer scores for the worst case finding – which is that investigations reveal a significant flood risk to the road and that flood mitigation works are required for this option. With these mitigation works in place as proposed, the option scores a major beneficial impact +2, against the baseline scenario.

8.15.11 In regard to scoring the community bypass options, this would reduce amount of traffic exposed to the assumed flood risk on the existing Inworth Road, therefore reducing flood risk to receptors. However the option wouldn't improve any flooding issues on the existing Inworth Road. For this reason, it scores a minor beneficial impact +1. DS4 is also scored as a +1, on the assumption that the interface with the Domsey Brook described above, could be designed such as to avoid significant impacts on the watercourse.

8.15.12 In summary, the combined drainage and flood risk scores for each option are: DS2: +1 (-1+2). DS3: 0 (-1+1). DS4: -1 (-2 +1)

8.16 8e) Deliverability/construction – structures challenge

8.16.1 The widening option 2 (DS2) and bypass concept DS3 require one underbridge to carry the offline A12 over the J24 dumbbell roundabout link road, which is the same for baseline DS1 option and therefore these are scored as neutral 0.

8.16.2 The bypass concept DS4 will require an underbridge or culvert over the Domsey Brook, in additional to the offline A12 underbridge. The Domsey Brook structure over the watercourse could have some challenges during construction, for example disturbance on any habitats and species within the river environment, risk of contamination to the watercourse and need for temporary watercourse diversion. Without further investigation into the structure requirement to mitigate the flooding risks in the area, this option scores slightly worst at -1.

8.17 8e) Deliverability/construction – planning and land challenge

8.17.1 The proposed scheme (DS2) requires less land take and reduces the amount of green field impacted when compared to DS3 and DS4 options. DS2 also represents a better balance between the junction attractiveness to both north and south communities compared to DS4. The bypass to the south in both DS3 and DS4 results in more significant environmental receptors being impacted than when compared with DS2 in relation to noise and traffic in Tiptree village.

8.17.2 The DS3 bypass would not have the environmental impacts caused by a new bridge over Domsey Brook, But the southern bypass would still have an impact to the openness of the countryside, noise and visual impacts (no mitigation) to the rear of properties to the West of Inworth Rd. It would also impact on noise and traffic around North of Tiptree village. For that reason DS3 scores -1.

8.17.3 The DS4 community bypass layout has a southern and northern connection to Inworth Road, the northern connection would cross a river and its floodplain, resulting in more loss of countryside, increase in cost, visual intrusion of these new structures in the landscape and more land to be compulsory purchase (value for money to the taxpayer. The community bypass would result in the loss of countryside and change the setting of the listed buildings to on the west side of the village as these cannot be mitigated it is given a score of -2.

8.17.4 The localised interventions will have no significant impacts to the residents of Inworth over and above of those already experienced (noise), whilst the proposal will reduce the speed limit to 30mph across the intervention and the proposal would resolve the flooding issues on the road.

8.17.5 Overall DS2 represents a +1 improvement to the traffic flow and minor impact to the community (due to the number of vehicles), this would be mitigated by the overall speed reduction to 30mph and increased width of the road for a free flow movement. The DS2 intervention represents a better value for money and is more in keeping with the character of the area (less urbanising) whilst resolving the narrow passage and flooding issues on the road. In balance between the options (DS2, DS3 and DS4) DS2 is more in keeping with the local rural landscape and would be less intrusive to listed buildings and avoid the loss of

countryside and good quality farmland. For the reasons above the DS2 localised widening option scores +1.

8.18 Conclusion of assessment and scoring

8.18.1 Following assessment of the above options against the scoring criteria, the DS2 online localised widening of the B1023 is the preferred option, scoring higher than both the DS3 and DS4 bypass options. The DS4 bypass option was assessed as the worst performing option when all criteria are taken into account.

9 Community bypass compatibility with junction 24

9.1.1 This section of the appendix details the work the project has undertaken work to consider if a link road came forward in the future, the proposed J24 could accommodate it.

9.1.2 It is expected that a future B1023 Inworth Road bypass funded outside of the A12 scheme would relieve traffic on the existing Inworth Road, not impacting adversely on the proposed J24. Based on the results of modelling undertaken by the A12 project team, the proposed J24 to be constructed as part of the A12 scheme will not preclude a Inworth Road Bypass.

9.1.3 An indictive Inworth Road bypass was tested as part of the investigation, which is compatible with the latest A12 scheme design proposals (Design Fix 4). The bypass connects proposed J24 southern roundabout, bypasses Inworth Road (B1023) and ties into a new roundabout at Inworth Road (B1023) between Windmill Hill Junction and Perrywood Garden Centre, Tiptree (Inworth Village). The new roundabout enables access towards south of Inworth Village and the proposed Inworth Road. It is assumed that the bypass would consist of a single carriageway road as per assessments within this report, as this would accommodate the predicted levels of traffic.

9.1.4 The bypass will have an impact on other design elements such as the proposed ditch to the south of the southern roundabout, which will need to be realigned to suit additional infrastructure.

9.1.5 The current J24 design is proposed to be constructed below existing ground level. Aside from the vertical geometry of a potential bypass needing to be sunk below existing ground level at its northern end, National Highways is not aware of any significant topographical constraints that would prevent a potential bypass from connecting to the southern roundabout of J24.

9.2 Operational performance

9.2.1 The Inworth Road bypass was tested using Vissim Microsimulation modelling software to investigate the impact on the proposed J24 (Southern and Northern Roundabouts, Inworth road Junction Roundabout) for the 2042 design year in the AM and PM peak. The traffic flows derived by using the SATURN model results described above were used for the input.

9.2.2 The proposed scheme design for J24, consists of a dumbbell layout with connector road to Inworth Road which ties with Inworth Junction Roundabout. The connector road from Inworth Road consists of a single carriageway road and includes two lane approaches to the southern dumbbell. The proposed J24 will work as a priority roundabout and will not be signalised.

9.2.3 The level of Service (LOS) was assessed for each of the respective roundabouts, which defines the performance based on the amount of time lost considering delays, queuing, and journey times. The LOS is assigned a letter from A to F as detailed in Table 9.1. Information on the average queues and delays at each roundabout are also provided.

Table 9.1 Level of Service (LOS) Key

Level of Service for None Signal Junctions		
LOS_A	loss time < 10 seconds	Best operating conditions
LOS_B	loss time > 10 to 15 seconds	
LOS_C	loss time > 15 to 25 seconds	
LOS_D	loss time > 25 to 35 seconds	
LOS_E	loss time >35 to 50 seconds	
LOS_F	loss time > 50 seconds	Worst operating conditions

9.2.4 Following scenarios were tested in Vissim:

- The proposed scheme (2042) without an Inworth Road Bypass
- The proposed scheme (2042) with an Inworth Road Bypass constructed and no signalisation at junction 24 dumbbell roundabouts

9.2.5 The Inworth Road Bypass is based on the conceptual design detailed in this technical note earlier. The results of the Microsimulation LOS Analysis presented in Table 9.2 and Table 9.3.

Table 9.2 Microsimulation LOS Analysis (AM Peak)

Roundabout	LOS AM Peak	
	Without bypass	With bypass
Northern Dumbbell	**A**	**A**
Southern Dumbbell	**A**	**A**
Inworth Road Junction	**A**	**A**

Table 9.3 Microsimulation LOS Analysis (PM Peak)

Roundabout	LOS PM Peak	
	Without bypass	With bypass
Northern Dumbbell	**A**	**A**
Southern Dumbbell	**A**	**A**
Inworth Road Junction	**A**	**A**

9.2.6 It is forecast that the J24 southern roundabout would have sufficient capacity to facilitate the Inworth Road Bypass in the A12 project's design year. The preliminary design caters for 3 arms worth of traffic, and a construction of a bypass would be expected to transfer most of the demand from the proposed Inworth Road link to a new arm on the roundabout.

9.2.7 In summary the current proposed J24 is not expected to preclude the construction of a Bypass at Inworth Road. It is important to note that this design is considerate of the existing constraints in the area, and any proposed bypass alignment will need to factor in any impact on those constraints.

9.2.8 In conclusion, the traffic assessment suggests that the construction of a Inworth Road Bypass would not adversely impact the performance of the proposed J24 constructed as part of the A12 scheme but increases the desirability of J24 as a whole and is predicted to increase traffic coming from Tiptree via Inworth Road. It can be concluded that performance of J24 would remain at an acceptable level should a potential Inworth Road Bypass be constructed. A bypass would be expected to transfer most of the demand from the proposed Inworth Road link to a new arm on the roundabout.

10 Conclusion

10.1.1 A thorough investigation has been undertaken on multiple options to address the projected traffic increase on Inworth Road, as a result of the A12 scheme.

10.1.2 Two options for a community bypass in DS3 (bypass with J24 southern link road) and DS4 (bypass with J24 northern link road) were investigated.

10.1.3 Multiple options for online widening of the B1023 Inworth Road were investigated, based on a range of design standards, engineering judgement and first principles. These were then tested with swept path analysis and the preferred option tested for capacity with microsimulation. This has shown that the proposed widening option 2, removes pinch points allowing for safe movement of traffic in particular large vehicles, and provides an acceptable capacity for free-flowing traffic.

10.1.4 Following selection of a preferred widening option, this was assessed and scored using a consistent range of criteria against the community bypass options and a baseline scenario. Although the scoring was close, on balance of all considerations the mitigation measures on Inworth road were found to be the preferred option when scored against either a DS3 or DS4 community bypass.

10.1.5 The mitigation measures proposed address the existing poor conditions on Inworth Road, and address the concerns the community has raised, although they do not remove traffic from the road. The existing pinch points which are at present a safety concern of the local community will be mitigated allowing for better, free flow of traffic. The existing flood risk will be reduced, through provision of a package of flood alleviation measures.

10.1.6 While either the DS3 or DS4 bypass options reduce traffic in Inworth village, only the DS4 bypass reduces traffic in Messing. Both bypass options increase traffic in Tiptree, and the DS4 option increases traffic in Feering and the B1023 to the north of J24. While a bypass does solve issues of traffic in some locations, it creates the same issues in other locations, to other communities. In addition, a bypass would add an additional approximate cost of £10milllion to the scheme and require around 40% more land for the bypass road alone.

10.1.7 The community bypass does provide some clear benefits, especially for some residents of Inworth who would see a large reduction of traffic on the road, however this would be moved to a new link road to the rear of some properties.

10.1.8 However, considering all criteria it does not provide benefits across the whole scheme area that are considered enough to justify the additional costs. Indeed, we have concluded that the additional costs would be disproportionate considering all other factors.

10.1.9 The project has therefore concluded it is more appropriate to provide a range of measures to improve an existing B road that currently acts as a strategic Priority 2 road within the Essex local highway network, than to provide an alternative parallel route through the countryside that provides the same purpose. A bypass would directly benefit relatively few people, have the associated environmental impacts and carbon footprint of a new road through green space, and have disbenefits to other communities.

Acronyms

Abbreviation	Term
DMRB	Design Manual for Roads and Bridges
DN	Do Nothing scenario - The existing Inworth Road, as it would be in 2042 with no A12 scheme in place, and no mitigation measures in place.
DS1	Do Something 1 scenario - The existing Inworth Road, as it would be in 2042 with the A12 scheme in place, and no mitigation measures in place.
DS2	Do Something 2 scenario - B1023 Inworth Road in 2042, with the A12 scheme in place and the Widening Option 2 mitigation measures in place.
DS3	Do Something 3 scenario - Inworth Road in 2042, with the A12 scheme in place and the second community bypass concept with southern J24 link road in place. No mitigation measures on Inworth Road.
DS4	Do Something 4 scenario - Inworth Road in 2042, with the A12 scheme in place and the latest community bypass concept with northern J24 link road in place. No mitigation measures on Inworth Road.
EA	Environmental Agency
ECC	Essex County Council
J22	A12 Junction 22
J23	A12 Junction 23
J24	A12 Junction 24
PRA	Preferred Route Announcement
RIS	Road Investment Strategy
SAR	Scheme Assessment Report
SOAEL	Significant Observed Adverse Effect Level
WCH	Walking, Cycling and Horse Riding