

A12 Chelmsford to A120 widening

Scheme Assessment Report Addendum

Highways England

2020

Scheme Assessment Report Addendum - 2020

Due to changes and additional information since 2017, this addendum has been produced to supplement the original 2017 SAR (Scheme Assessment Report). Notable changes include the removal of junction 23, a descoped area between junction 19 and junction 20a, and changes to the earthworks strategy which will reduce the quantity of fill materials required.

This report also details the refinement to the alignment between junction 22 and junction 23, which was brought about in an effort to mitigate the negative environmental impacts of Route 2.

Contents

Executive Summary	1
1. Introduction	2
2. Assessment of changes	3
2.1 Value Engineering Technical Note	3
2.2 Junction 23 Removal Technical Note	3
2.3 J22 to J23 Local Access Road Technical Note	4
3. Route Refinement	6
3.1 National Networks National Policy Statement (NNNPS) Compliance	6
3.2 Route Refinements (J19 to J23)	7
3.3 Route Refinement (J23 to J25)	9
3.3.1 Mainline Alignment (J23 to J25)	9
3.3.2 Junction 24	9
4. Route Description	11
4.1 Route Description (J19 to J23)	11
4.2 Route Description (J23 to J25)	11
5. Cost Estimates	13
6. Traffic Forecasts, Economics and Costs	14
7. Operational Assessment	15
8. Maintenance Assessment	18
9. Environmental Assessment and Environmental Design	19
9.1 Air Quality	19
9.2 Cultural Heritage	20
9.3 Landscape	20
9.4 Biodiversity	21
9.5 Geology and Soils	21
9.6 Material Assets and Waste	22
9.7 Noise and Vibration	22
9.8 Population and Health	23
9.9 Road Drainage and the Water Environment	23
9.10 Climate Change	24
9.11 Overall Summary	24
10. Public Consultation	25
11. Route Comparison	26
12. Conclusion	29

13.	Appraisal Summary Table	31
------------	--------------------------------------	-----------

Appendix A. Value Engineering Technical Note

Appendix B. Junction 23 Removal Technical Note

Appendix C. J22 to J23 Local Access Road Technical Note

Appendix D. J24 Junction Strategy Technical Note

Executive Summary

A Scheme Assessment Report (SAR) was produced in 2017 during Project Control Framework (PCF) Stage 2 for the A12 Chelmsford to A120 Widening Scheme. This was part of the suite of products prepared to support Stage Gate Assessment Review 2 (SGAR 2).

Following detailed technical analysis, the SAR concluded that Route 2 was the best performing option overall and recommended Route 2 to be taken forward as the preferred route for the A12 scheme.

This report has been produced as an Addendum to the 2017 SAR, to document new information which has become available since 2017 and other factors which are relevant to the selection of a preferred route. This information supports the initial Preferred Route Announcement (PRA) between junctions 19 to 23 and the subsequent PRA between junctions 23 to 25.

During PCF Stage 2 alternative alignments which could accommodate the Colchester Braintree Borders Garden Community (CBBGC) were investigated and presented in a 2019 non-statutory consultation. However, CBBGC and the West of Braintree Garden Community were found not to meet the relevant policy tests and were removed from the Local Plan as a result of the planning inspectors report. Highways England has gone through internal and Department for Transport (DfT) governance to gain approval for proceeding with the routes from the original 2017 consultation. DfT has approved the approach. As such, route options accommodating the garden communities and presented in the 2019 non-statutory consultation will no longer be considered.

1. Introduction

A SAR was produced in 2017 during PCF Stage 2 for the A12 Chelmsford to A120 Widening scheme to support SGAR 2. The SAR concluded that Route 2 was the best performing option and was recommended to be taken forward as the preferred route. This recommendation was informed by a combination of factors including public consultation responses, value for money, health and safety, environmental impacts and meeting of scheme objectives.

Route 2 emerged as the preferred option by the public at non-statutory consultation held between 23 January and 3 March 2017, where 49% of responses expressed a preference for Route 2 as their favoured route. Route 2 was seen to be the most resilient and was considered to generate the greatest capacity across both the strategic and local road networks. It would also have the highest safety performance for road users, would provide the greatest lengths of segregated Walker, Cyclist and Horse-rider (WCH) provision away from the A12 mainline, and would be safest for road workers during both construction and operation due to the length of offline working.

However, following the recommendation of the preferred route in the 2017 SAR, the scheme has undergone several changes, including Value Engineering (VE) and option refinement to address environmental concerns and policy requirements in accordance to the National Networks National Policy Statement (NNNPS). Additionally, alternative alignments were developed to address the impacts of CBBGC. These alignments were presented at a non-statutory consultation in 2019. Following a recommendation from the Local Plan Inquiry Inspector, this proposed garden community as well as the West of Braintree Garden Community will no longer be proceeded with. As such these alternative alignments are no longer considered and are not detailed in this report. The purpose of this report is to consider the impact of any new information and changes and assess whether the recommendation of the preferred route from 2017 is still valid.

2. Assessment of changes

Following the recommendation of the preferred route in the 2017 SAR, the scheme has undergone numerous changes. Several technical notes have been written detailing the impact of these changes. The findings have been summarised below, and full detailed analysis can be found in the appendices.

2.1 Value Engineering Technical Note

To ensure value for money, the Value Engineering Technical Note presents a list of potential changes for Route 2 identified during the VE workshop held on 22 January 2019. Route 2 is referred to as Option 2 throughout the Value Engineering Technical Note, as per the naming convention from the 2017 assessment. This technical note is also included in Appendix A.

- De-scoping the works between junction 19 and junction 20a, and instead retaining the existing three-lane carriageway. This would still be consistent with the RIS commitment for three lane provision. The removal of this item will reduce construction time and scheme cost.
- Removal of junction 23 which will reduce construction time and save on imported fill requirements and other works.
- A proposed change in the earthworks strategy, which will assume the use of borrow pits, and therefore reduce the imported fill materials requirements. This will increase land cost allowances and the risk associated with installing any remedial works at borrow pit sites but could result in a reduction in the length of the construction programme.
- By retaining the existing River Ter Bridge cross section, structural widening works and associated costs will be reduced, although this potentially raises safety concerns during construction and maintenance, due to possible substandard cross sections resulting in narrower working widths.
- Rather than replacing Wellington Bridge with a new road bridge, a proposed Walking, Cycling and Horse-Riders (WCH) bridge will provide connectivity between Hatfield Peverel and B1389 Hatfield Road towards Witham, enabling these users to bypass the grade separated junction and slip road crossings at J21. As well as WCH benefits and safety benefits, this could reduce construction time. Vehicular access to properties on the north side will be via junction 21.

2.2 Junction 23 Removal Technical Note

The Junction 23 Removal Technical Note details the proposal of removing junction 23 (Kelvedon south) from the scope of works and the implications of removing junction 23 from the scheme. This technical note is also included in Appendix B.

It is proposed to remove junction 23 from the A12 scheme, which includes removal of a proposed new overbridge, road pavement works, existing statutory utilities diversion, gantry signage, related technology, drainage work and associated environmental risks and costs.

By demolishing the existing junction 23, access and equivalent movements will need to be provided by junction 22 and the surrounding local access roads (LARs), particularly to and from

Kelvedon. According to traffic figures, without junction 23 traffic movements will be resolved by junction 22 and the new LAR.

The removal of junction 23 is expected to improve safety in the area by:

- Eliminating the need for merge and diverge movements;
- Avoiding collisions associated with slip road movements;
- Removing potential weaving issues between junction 22 and junction 23;
- Reducing collision risk associated with at grade crossing movements by WCH;
- Removing the risk of injury during construction and maintenance.

The environmental impacts in the area are reduced particularly due to the smaller footprint of the scheme without junction 23. This means that there are fewer impacts on the surrounding habitats, on the land graded as Grade II under the Agricultural Land Classification and on the visual effects around the Rivenhall Long Mortuary scheduled monument and a Grade II* listed building.

The removal of the junction will also reduce the construction programme, as well as result in savings on imported fill material.

Public opinion was relatively split regarding junction 23 adjustments, with 51% in favour of improvements to the junction, citing reasons such as:

- Safety/accidents at the junction
- Poor visibility
- The speed of cars exiting the A12
- Poor signage

In summary, it is proposed for junction 23 to be removed from the scheme. The removal of the junction is unlikely to have significant adverse impacts on traffic, economics and safety. The removal of junction 23 will however result in benefits to the scheme including a reduction in adverse environmental impacts and addresses concerns raised by stakeholders in the public consultation held in 2017. Lastly, the removal of junction 23 will provide significant cost savings to the scheme.

The A12 scheme without junction 23 will be taken forward into PCF Stage 3 as the proposed solution. The A12 scheme will provide passive provision for the A120, as the alignment will allow sufficient space between the road and adjacent constraints to enable a new junction 23 to be constructed in the future.

2.3 J22 to J23 Local Access Road Technical Note

The Junction 22 to Junction 23 Local Access Road (LAR) Technical Note details the proposals for the LAR between junction 22 to 23 for the online and offline routes. Routes 1 and 2 are referred to as Options 1 and 2 throughout the Junction 22 to Junction 23 Local Access Road Technical Note, as per the naming convention from the 2017 assessment. This technical note is included in Appendix C.

A LAR strategy between junction 22 and junction 23 has been proposed to facilitate the assessment of removing junction 23. It will tie in to the B1024 to provide access for local areas in and around Kelvedon. Given the removal of junction 23, the LAR strategy is particularly important to ensure that vehicle traffic movements are resolved around Kelvedon.

For Route 1 (online), the LAR consists of converting the northbound carriageway of the existing A12 into a single carriageway road, with a partial new section constructed north of the A12 east of Essex Fire and Rescue HQ. There would be a new road constructed to provide access to Essex Fire and Rescue HQ, tying into a new roundabout on the LAR.

With Route 2 (offline), the existing A12 between junctions 22 and 23 will be retained as a LAR, with access to Essex Fire and Rescue HQ. The LAR is designed as a dual carriageway from junction 22 to Essex Fire and Rescue HQ, continuing as a single carriageway until it ties into B1024.

Further design development will take place in PCF Stage 3, which will include stakeholder engagement and detailed traffic modelling.

3. Route Refinement

Following the recommendation of the preferred route in 2017, possible refinements to Route 2 have been investigated and are described below. For the purpose of this report, the preferred route recommended in the 2017 SAR is referred to as Route 2 (2017).

3.1 National Networks National Policy Statement (NNNPS) Compliance

The A12 scheme is classed as a Nationally Significant Infrastructure Project (NSIP) and will require an application for a Development Consent Order (DCO). The relevant National Policy Statement (NPS) for determining development consent is the one for National Networks. This sets out the policy requirements that will need to be met in order for the Secretary of State to grant consent.

Route 2 (2017) was the least favourable in terms of environmental impact and this meant it had a lower compliance with the NNNPS and therefore associated risks during examination and consenting. The key risks are identified in the NNNPS Risk Table and include risks of compliance due to:

- **Flood risk:** The NNNPS states that development should be located away from areas of highest flood risk, although essential transport infrastructure is permissible in areas of high flood risk subject to the Exception Test. To pass the Exception Test, it must be demonstrated that the project provides wider sustainability benefits to the community that outweigh flood risk; and a Flood Risk Assessment must demonstrate that the project will be safe for its lifetime, without increasing flood risk elsewhere and, where possible, will reduce flood risk overall. There is a risk that Route 2 (2017) would not meet this test due to the large footprint within the River Blackwater floodplain, particularly if an alternative route is deliverable which avoids the floodplain.
- **Historic environment:** Where the proposed development will lead to substantial harm to or total loss of significance of a designated heritage asset, the Secretary of State should refuse consent unless it can be demonstrated that the substantial harm or loss of significance is necessary in order to deliver substantial public benefits that outweigh that loss or harm. Historic England have raised concerns over Route 2 (2017), as the new offline bypass may impact the Rivenhall Long Mortuary Enclosure scheduled monument, as well as associated archaeological remains that contribute to the wider historic setting of the monument.
- **Minerals sterilisation:** Where a proposed development has an impact on a Mineral Safeguarding Area (MSA), the Secretary of State should ensure that the applicant has put forward appropriate mitigation measures to safeguard mineral resources. Route 2 (2017) has the largest offline footprint within a sand and gravel MSA and is therefore least compliant with this policy.
- **Best and most versatile agricultural land:** Applicants should take into account the economic and other benefits of the best and most versatile (BMV) agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification). Where significant development of agricultural land is demonstrated to be necessary, applicants should seek to use areas of poorer quality land in preference to that of a higher quality. Route 2 (2017) has the largest offline footprint in areas of BMV land and creating a dissonant feature to the current rural background and is therefore least compliant with this policy.

3.2 Route Refinements (J19 to J23)

Potential refinement of the Route 2 (2017) alignment has been investigated to improve the design, reduce the adverse environmental impacts of the route and to better meet the policy requirements of the NNNPS. The offline sections between junction 22 and 23, and junction 24 and 25 result in the most adverse environmental impact.

As a result of the uncertainty that surrounded the proposed CBBGC, only refinement of the alignment between junctions 22 and 23 was initially investigated, with the aim to reduce impacts on the Rivenhall Long Mortuary scheduled monument and the River Blackwater flood zone. For the remainder of this report, the refinement to 2017 design is referred to as Route 2 (2019).

Route 2 (2019) largely follows the original 2017 design; it leaves the existing corridor at junction 22 and runs parallel to the south of the existing A12, bypassing Rivenhall End. However, at Braxted Road the route then re-joins the existing corridor near Essex Fire and Rescue HQ (see Figure 3.1 overleaf).

The Route 2 (2019) alignment would reduce impacts on the Rivenhall Long Mortuary scheduled monument and the River Blackwater flood zone. The length of the bypass between junctions 22 and 23 would be shorter than for the original Route 2 (2017), re-joining the existing A12 at a point just east of Rivenhall End, thereby taking the alignment away from the scheduled monument and reducing potential development in the floodplain. The design refinements would also result in reduced loss of BMV land and sterilisation of minerals compared to Route 2 (2017). By reducing the impacts on these receptors, Route 2 (2019) better complies with the NNNPS.

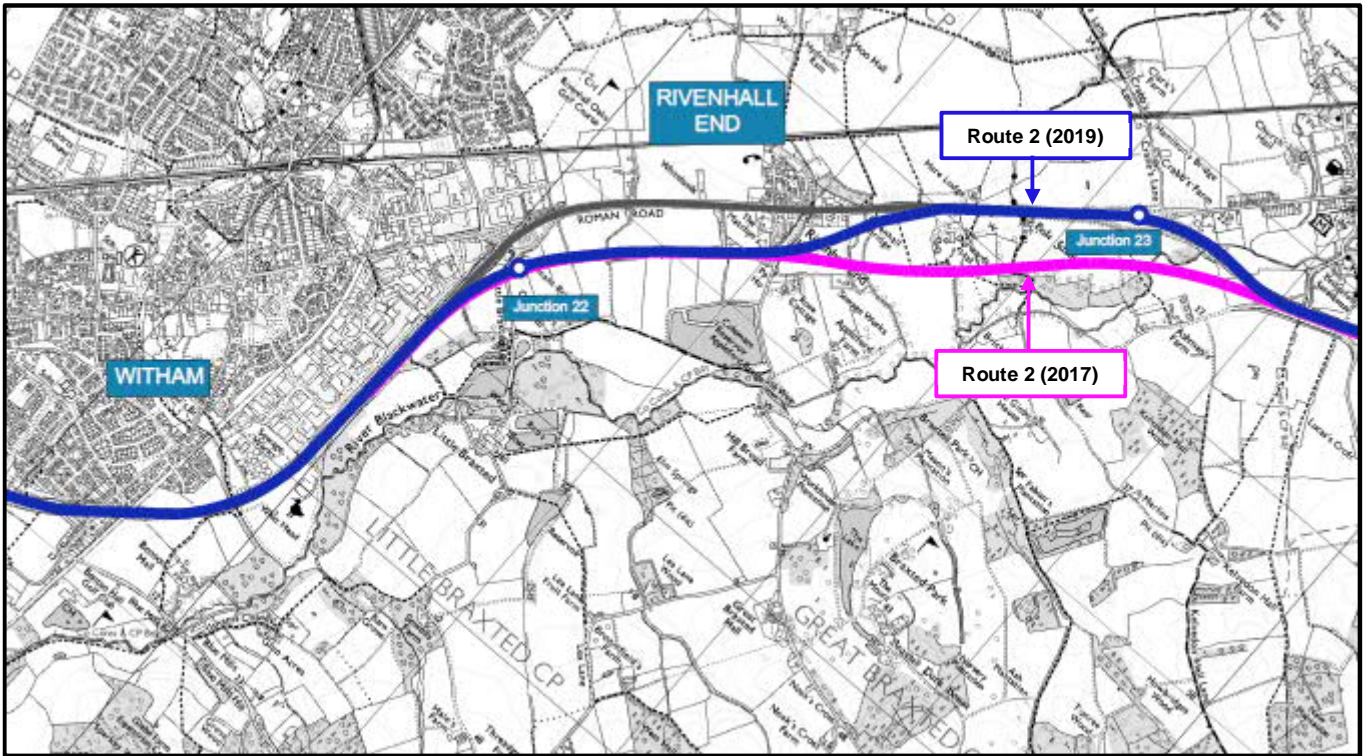


Figure 3.1 Map showing Route 2 (2017) and (2019) between junction 22 and 23

3.3 Route Refinement (J23 to J25)

Following the recommendation given by the Local Plan Inquiry Inspector towards the proposed CBBGC, the associated realigned routes are no longer considered. However, a potential refinement of Route 2 (2017) was investigated to better meet the policy requirements of the NNNPS and improve the design. For the remainder of this report, the refinement to 2017 design is referred to as Route 2 (2019).

3.3.1 Mainline Alignment (J23 to J25)

A bypass between junction 23 and junction 25 was considered to be less favourable in terms of environmental impact. Route 2 previously raised concerns due to its impact on the historic environment which includes designated heritage assets. Between junction 23 and J25, the proposed mainline alignment passed through Doggetts Hammer Farm which is a Grade II Listed building, and subsequently would require demolition of this property.

The mainline alignment between junction 23 and junction 25 largely follows the original 2017 design, however it has undergone a slight refinement near the existing junction 25. The new proposed mainline alignment now bypasses Doggetts Hammer Farm and then joins the existing A12 near junction 25. This slight refinement moves the mainline alignment away from the Doggetts Hammer Farm, which as a result no longer requires demolition.

3.3.2 Junction 24

A Junction Strategy Refinement exercise was undertaken to confirm junction proposals in advanced of PCF Stage 3. The most significant change from the 2017 design is the refinement to junction 24. Following the Junction Strategy Refinement work, it was recommended to relocate the proposed junction 24 further south to the west of Inworth Road. The proposed junction 24 design consists of an all movements dumbbell junction with a direct connection to Inworth Road.

Following the Non Statutory Public Consultation events held in 2017, it emerged that there was a preference for a junction on Inworth Road. It is also understood that the provision of a junction close to Inworth Road provides an overall benefit to the A12 scheme, as it provides better connectivity between Tiptree and the Strategic Road Network (SRN). In addition, it promotes the right traffic on the right roads as it reduces the volume of strategic traffic making journeys on the wider local road network in comparison to the previous design from 2017. It is also understood that a junction near Inworth Road provides an economic benefit to the scheme in comparison to the previous design from 2017, particularly because the junction becomes more attractive for traffic from Tiptree and reduced journey times from traffic.

Further information on the proposed junction 24 is detailed in Appendix D Junction 24 Strategy Technical Note.

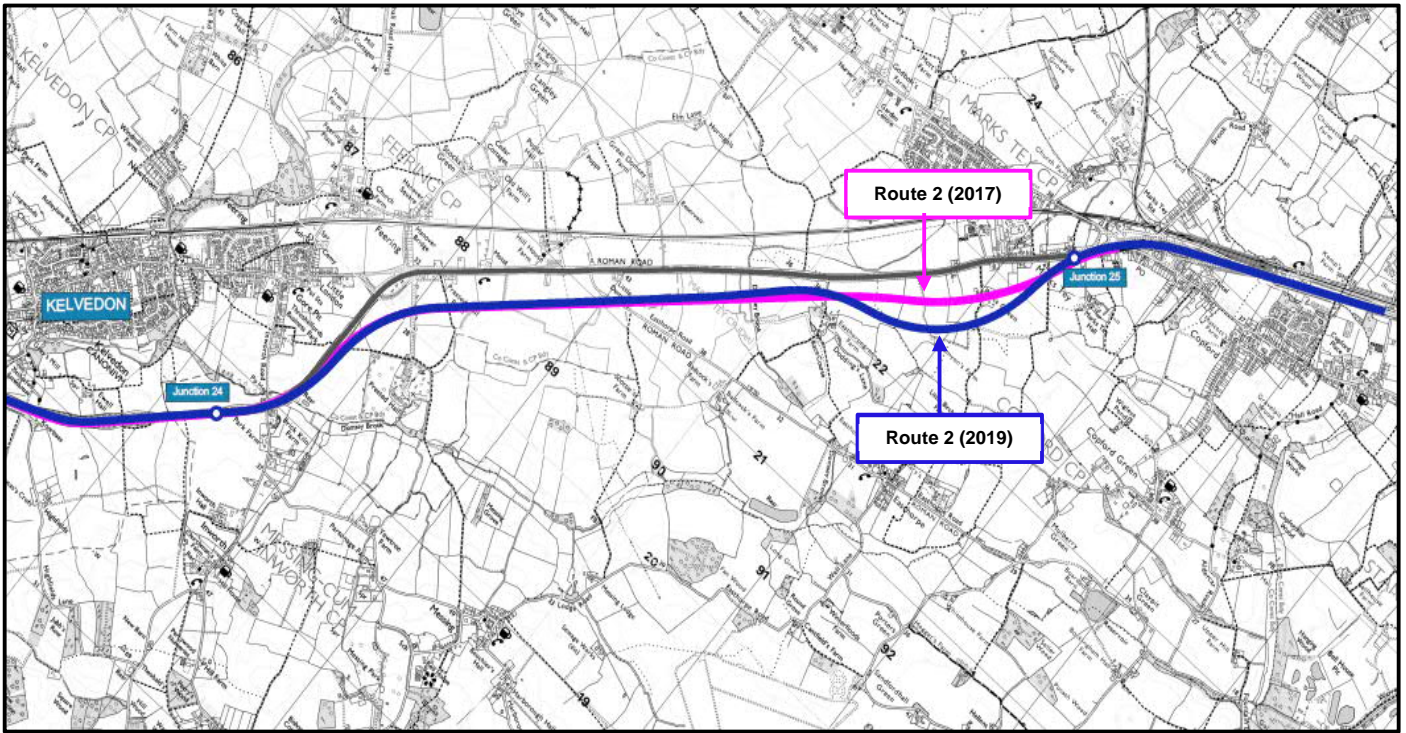


Figure 3.2: Map of proposed route between junction 23 and junction 25

4. Route Description

4.1 Route Description (J19 to J23)

The Route 2 (2019) design remains consistent with the Route 2 (2017) route description presented in the A12 Public Consultation Brochure (2017). The key design changes from the VE workshop is the de-scoped section of carriageway works between junction 19 and 20a and the removal of junction 23 from the scheme. The other key change following route refinement is between junction 22 and 23. The offline bypass between junction 22 and 23 re-joins the existing corridor earlier than was originally suggested, although it still bypasses Rivenhall End.

Although the refinements have changed the original design slightly, they can still be classified as Route 2 based on the Public Consultation description:

“Route 2 would widen the existing A12 corridor between junctions 19 to 22 to three lanes in each direction as with Route 1.” – There is no change between junction 19 and junction 22.

“At junction 22, it leaves the existing corridor and creates a new 3 lane bypass to the south, running in parallel with the existing A12. At around junction 23, it would re-join the current corridor.” – The design still runs parallel to the south and re-joins the current corridor before junction 23.

“The existing A12 corridor between junction 23 and 24 would widen to 3 lanes in each direction.” – There is no change between junction 23 and junction 24.

4.2 Route Description (J23 to J25)

Route 2 (2017) has undergone some slight refinement between junction 23 and 25 since the original design was developed. The most substantial changes are with the relocation of junction 24 and the mainline alignment refinement near junction 25. However, it is considered that despite these refinements, the Route 2 (2019) design is broadly consistent with the Route 2 presented in Public Consultation description.

“The existing A12 corridor between junction 23-24 would widen to 3 lanes in each direction.” – There is no change to the design between junction 23 and 24.

“At junction 24, the road leaves the existing A12 and creates a second 3 lane bypass to the south, running in parallel with the existing A12, re-joining at junction 25.” - The road still leaves the existing A12 near junction 24 and runs in parallel with the existing A12. There is a bypass around Doggetts Hammer Farm before the road re-joins the existing A12.

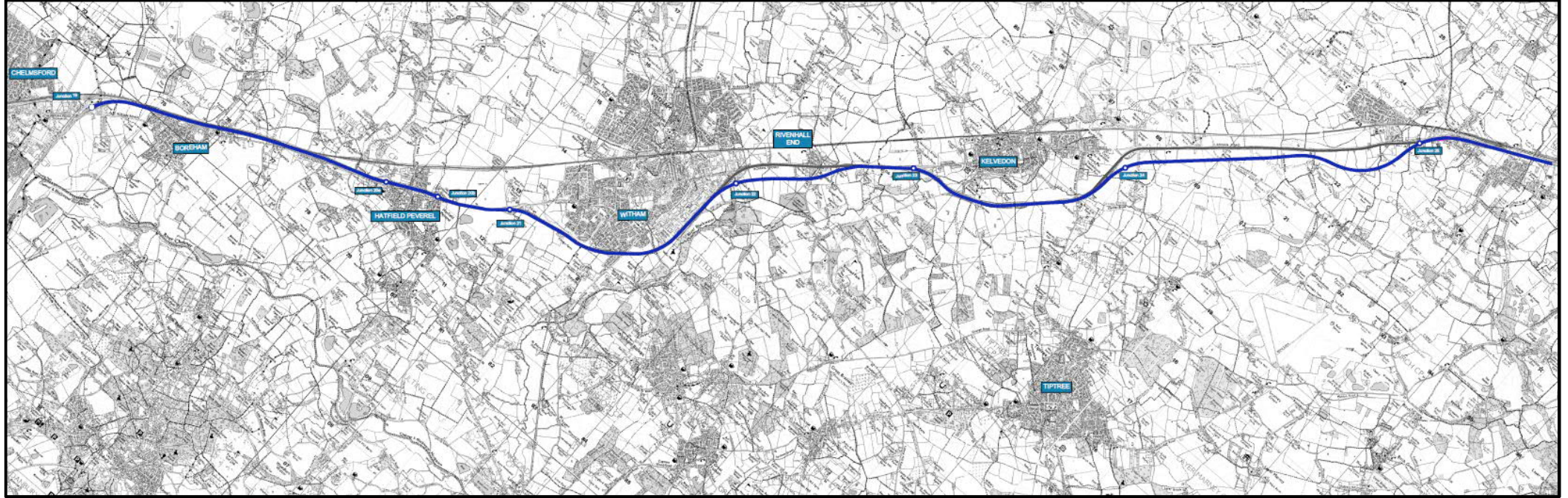


Figure 4.1: Map of proposed route between junction 19 and 25

5. Cost Estimates

The A12 scheme has undergone several changes including Value Engineering (VE) and route refinement. Cost estimates have continuously been refreshed following these significant changes and based on the latest cost estimate it is expected that the A12 scheme will cost in the region of £1,045 million.

6. Traffic Forecasts, Economics and Costs

An economic assessment was undertaken on the four better-performing routes, as detailed in the 2017 SAR. This included the derivation of scheme benefits, and a comparison of these against the scheme costs to produce a Benefit to Cost Ratio.

As development of the scheme continued, an updated economic assessment of the emerging preferred route which is Route 2 (2019) was undertaken in 2020. This includes a new assessment of benefits, as well as the most recent scheme cost estimates. The updated assessment incorporated the following updates compared to the assessment of four routes reported in the 2017 SAR:

- Based on an updated traffic model, which incorporated the latest modelling parameters required by the DfT, and the latest design updates including the removal of junction 23 from the scheme design.
- Additional economic impacts not assessed in the 2017 SAR, such as monetised environmental impacts.
- Use of the latest scheme costs, provided in December 2019 by Highways England commercial division.

Through its economic assessment, Route 2 (2019) was found to have total economic benefits of £925.4m (Present Value of Benefits, 2010 prices discounted to 2010). It has a Present Value Cost of £509.6m (2010 prices discounted to 2010). This results in an Adjusted Benefit to Cost Ratio of 1.8.

Table 6.1: Monetised economic assessment summary

Travel time and Vehicle Operating Costs	£589,368
Delays during construction and maintenance	£6,726
Change in accidents	£5,039
Noise, Air Quality and Greenhouse Gases	-£100,559
Change in Indirect Tax Revenues	£48,736
Initial Present Value of Benefits	£549,309
Present Value of Costs	£509,600
Initial Benefit to Cost Ratio (BCR)	1.1
Wider Impacts	£225,673
Journey Time Reliability	£150,455
Adjusted Present Value of Benefits (PVB) including JTR and WI	£925,438
Adjusted Benefit to Cost Ratio (BCR) including JTR and WI	1.8

7. Operational Assessment

The operational assessment can be baselined from April 2017 when the 2017 Safety Plan was issued, since this date the scheme has progressively evolved with some key dates indicated below:

- On April 27 2017 the scheme commenced initial PCF Stage 3 activities
- On May 23 2017 the project team was instructed to develop the scheme to D3AP without the provision for Expressway
- On August 23 2017 the scheme's scope was changed to consider only junction 19 to 21 for Advanced PCF Stage 3 works
- On February 26 2018 an instruction was received to change the scope to focus on re-alignment of junction 24 to 25 to account for the CBBGC development
- On February 1 2018 the PSCRG (meeting number 5) endorsed triple pack technology as part of the scheme's remit
- On December 19 2018 the scope of the scheme was changed, to include only junction 19 to 23 (note this was for PCF Stage 2)
- On January 22 2019 a VE meeting with HE / Costain and Jacobs took place from which junction 23 was de-scoped, as well as carriageway works between junction 19 and 20a
- On June 26 2019 the SCRG (meeting number 6) rejected the revised safety objectives for the scheme as detailed in the Safety Plan
- Between October 21 and December 1 2019, an additional public consultation was undertaken on revised route alignment options for junction 23 to junction 25.
- On 11 December 2019 members of the project team met with Highways England to discuss the remit of designated funds and how they may be applied to the scheme
- On December 12 2019 an updated PCF Stage 2 Safety Plan was issued, with revised safety objectives following SCRG feedback, updated to new standards and the latest PCF template
- During January 2020 a technical note comparing the proposed scheme details against the specification of GD 300 was produced, at the request of Highways England.

The proposed operating regime for the scheme remains as D3AP with triple pack technology, so as to provide safety and operational benefits, and allow mitigation of departures from standards at junction merges and changes (noting that the removal of junction 23 will reduce the number of associated departures). In addition, the removal of junction 23 will reduce the risk of rear end shunts associated with vehicle movements at the slip roads. It will also provide further separation of local traffic movements from the Strategic Road Network (SRN) between Witham and Kelvedon via a new LAR. Existing direct accesses to the A12 are still to be closed and re-directed to the grade separated junctions. The proposed relocation of Junction 24 will also not impact the operating regime of the strategic network, but will have a significant impact on Inworth Road which will require an alteration to its operation in the form of speed limit boundary changes, as well as potential localised improvement works such as footway provision and removal of a pinch point at Hinds Bridge.

Following the review of the scheme against the specification of GD 300, it is now intended to pursue a strategy of achieving Level 3 compliance during PCF Stage 3. Whilst the scheme already had ambition to meet most components such as the provision of emergency areas, grade separated junctions and concrete central reserve barrier, it will seek to include technology provision in accordance with GD 300, prohibition of WCH users (already being considered for alternative suitable routes by the scheme) and slow moving vehicles.

The proposed strategy for WCH users also remains unchanged, that being to seek a continuous high quality link, with funding for sections through Witham and Kelvedon to be considered for designated funds. The removal of junction 23 also removes a collision risk of at grade crossing movements by WCH at the junction.

Although the scheme's final safety baseline will not be fixed until PCF Stage 6, baselines have been determined over the timeline based on the latest available data. This has demonstrated that the scheme extents currently perform in line with national values for dual carriageway roads (it is not possible to distinguish between D2AP and D3AP). A comprehensive data analysis has been undertaken on this data baseline and has been extended to a five year analysis period so as to provide a much more robust analysis in terms of trends. This analysis has been used to determine collisions which have occurred at the direct accesses on to the A12, as well as to support strategies including the use of technology and whether additional safety mitigation is required by the scheme. Due to the current performance of the scheme and its remit the safety objective for the scheme has been presented as follows:

- 1) The average number of FWI casualties per year is at least 10% below the safety baseline.
- 2) The average rate of FWI per billion vehicle miles per year for the three years post scheme opening is at least 10%* below the average baseline rate.
- 3) No road user population (e.g. car drivers, pedestrians, cyclists, powered two wheelers, HGV drivers etc) should be disproportionately adversely affected in terms of safety and risk to each population remains tolerable.

* The 10% saving is based on current proposals for use of technology on all purpose trunk roads. If the scheme in Stage 3 incorporates variable mandatory speed limits and other components of GD 300 then the 10% saving can be revised higher.

The roadworker objective remains unchanged, that being to ensure risk to roads workers during maintenance and operation are managed in accordance with the So Far As Is Reasonably Practicable (SFAIRP) principle. The scheme will now utilise the Home Safe and Well Strategy which has superseded the Health and Safety five year plan.

The scheme's Safety Management System (SMS) was previously evaluated using IAN 191/16, which has since been superseded by GG 104 Requirements for Safety Risk Assessment. The outcome has remained a Type B classification and as such the existing SCRG will be required to continue endorsement of Operational Safety aspects. The latest workshop took place on January 8 2020 following the workshop held on June 26 2019 in order to present the revised Safety Plan objectives for endorsement.

In summary, the operational assessment of the scheme for PCF Stage 2 has not changed since the 2017 SAR, however, the operational safety team has considered the schemes current compliance with GD 300 Requirements for new and upgraded all-purpose trunk roads and this will be evolved later in PCF Stage 3 during preliminary design. This will result in a change to

the operational regime as Level 3 compliance is achieved, from which additional safety benefits can be realised.

8. Maintenance Assessment

The operational regime for the scheme is largely unaltered and there are no substantial changes to key maintenance elements for PCF Stage 2, such as technology infrastructure provision of centre reserve concrete barriers, the removal of lay-bys for Emergency Areas (EAs) and the objective to provide a five-year maintenance period after completion.

The most substantial changes relate to the descoping of works between junction 19 and 20a, as well as the removal of junction 23. There is no substantial change or maintenance challenge anticipated from the relocation of junction 24. The provision of a new LAR will also have maintenance implications for the Local Authority Essex County Council (ECC) and will also be evaluated to seek off-network access opportunities for maintenance on the SRN if deemed practical.

The descoping of works between junction 19 and 20a will result in existing assets being retained, many of which are already beyond their intended design life. This would impact the scheme's ability to provide a five-year maintenance period after completion; however, the Maintaining Provider for Area 6 would likely renew such assets during this time (subject to funding). Alternatively, and again subject to funding, such works can be provided during the scheme's construction to maximise traffic management arrangements. Between junction 22 and junction 23, Route 2 (2019) re-joins the existing corridor earlier than previously anticipated as a result of environmental concerns. This may affect the facilitation of safe means of access for maintenance including off network access or combining assets at emergency area points. As the scheme is no longer required to consider the CBBGC development there is no anticipated maintenance impacts with the scheme reverting back to the alignment proposed in 2017 with the minor amendments previously noted.

Removing junction 23 from the scheme's remit will result in zero maintenance being required for the junction and its associated assets. Improvements to winter maintenance regime routes would also be realised with slip roads no longer present that require vehicles to take detours from the SRN to re-join. However, there would be some negative consequences, including fewer access points for emergency/maintenance vehicles and increased traffic on the LAR with increased risk during maintenance activities.

A Maintenance and Repair Strategy Statement was produced in 2017 and an Addendum was produced in 2019. The current proposals to provide more route online will result in Highways England assuming more maintenance responsibility with additional potential issues relating to safe means of access at online widening locations, particularly off network. Essex County Council's maintenance ownership will reduce as a result from that previously considered, but this will be offset against the ownership of the LAR to be provided as a result of the closure of junction 23 which will increase the maintenance ownership subject to final confirmation of de-trunking arrangements.

9. Environmental Assessment and Environmental Design

An Environmental Assessment Report (EAR) for PCF Stage 2 was produced in September 2017. It drew heavily on the PCF Stage 1 EAR, which was completed in December 2016, particularly as there was little additional information or design available other than the outputs of the non-statutory engagement in January and February 2017. The EAR formed part of the suite of products submitted at SGAR 2 in December 2017.

The 2017 EAR concluded that Route 1 was the environmentally preferred route option. This was because the route would be constructed online within the existing A12 corridor rather than creating a new infrastructure feature within the landscape. This would have less ecological, landscape and setting effects than Routes 2, 3 and 4.

Since the production of the 2017 EAR, further data have been collected and potential design refinements considered. The environmental assessment has been updated to reflect these changes.

As noted in Sections 3.2 and 3.3 respectively, the key substantive design changes are the revised route alignment for Route 2 between junctions 22 and 23, and the revised location for the new junction 24. This J22-23 design refinement was specifically aimed at reducing impacts on the Rivenhall Long Mortuary scheduled monument but has additional benefits in reducing impacts to the scenic Blackwater valley, reducing potential new development in the floodplain, and reducing potential take of BMV land (best and most versatile agricultural land). These benefits contribute to improved compliance with the NNNPS, as described in Section 3.1. Key changes between the conclusions of the 2017 EAR and 2019 EAR as a result of further investigations and design refinements are summarised below.

9.1 Air Quality

Initial assessment for the original PCF Stage 2 route options (Routes 1, 2, 3 and 4) was undertaken on a qualitative basis in 2017 due to traffic data not being available at that stage. Quantitative modelling was subsequently undertaken (post-PRA announcement) for Route 2 (2019) to provide inputs to the business case. This quantitative air quality assessment has been undertaken using the Screening Method, as described in Annex D of DMRB HA 207/07. This indicates that the scheme is unlikely to exceed Air Quality Objectives but could have a worsening of air quality in some areas.

For the offline sections of Route 2 (between junctions 22 and 23, and between junctions 24 and 25), air quality is likely to worsen where traffic is being brought closer to receptors, while improvements are likely to be experienced along the existing road. Route 2 (2017) and Route 2 (2019) both bypass the village of Rivenhall End and only a small number of isolated receptors would be affected by each route for this offline section. In this respect, Route 2 (both 2017 and 2019) would be preferable to Route 1 which would include on-line widening through Rivenhall End.

No specific mitigation has been identified at PCF Stage 2, other than standard good practice to control dust and other emissions during construction. Detailed modelling at PCF Stage 3 will fully assess the effects and the locations of any specific mitigation.

9.2 Cultural Heritage

A Cultural Heritage Desk-Based Assessment (DBA) was completed in September 2018. The DBA concludes that the A12 corridor is likely to be rich in cultural heritage remains, particularly around the Rivenhall Long Mortuary Enclosure scheduled monument located just south of the A12 between junctions 22 and 23. The initial evaluation of the sensitivity of the historic environment around Rivenhall End, as reported in the 2017 EAR, was revised in the 2019 EAR following further consideration of the value of designated or undesignated archaeological remains that could contribute to regional research objectives, along with the potential Palaeolithic landscape. This has resulted in stronger weight being given within the environmental assessment and within the discussions around meeting the requirements of the NNNPS.

The offline route of Route 2 (2017) passed within 30m of the Rivenhall Long Mortuary Enclosure scheduled monument, which would have a major impact on the setting of this asset. Route 2 (2019) was developed to re-route the offline section back onto the A12 just east of Rivenhall End. This has increased the distance to the scheduled monument to just over 300m which removes the severity of the impact on its setting. Some impact would still be experienced; however, it is located at a sufficient distance that any impacts on the setting could potentially be mitigated through screening.

Route 1 is likely to have the least impact on cultural heritage assets compared with all other route options because it is largely online and would be set within the context of the existing highway infrastructure, with the smallest area of offline construction. The offline section between junctions 24 and 25 has the potential to impact on the setting of a number of listed buildings including Prested Hall, Doggetts Hammer Farm and at Marks Tey Hall. The revised location for the new junction 24 will reduce potential impacts on Prested Hall but the proposed mainline would still have to cross the attractive tree-lined driveway leading up to the hall.

Areas of previously undisturbed ground (such as along the offline bypasses and at the new all movement junctions) are likely to require a large amount of archaeological investigation and mitigation (in the form of excavation and recording post consent). This will result in higher mitigation costs and a longer programme post consent to undertake mitigation work.

9.3 Landscape

The principal landscape constraint between junctions 22 and 23 comprises the sensitive landscape of the River Blackwater Valley, which lies to the east of Witham. An offline section at this location would cause field severance and vegetation loss, significantly affecting the landscape pattern, land use and therefore character.

Route 2 (2017) is likely to have the greatest effect on the landscape compared with all other route options, because it would incorporate the greatest extent of offline alignment and severance to the wider rural landscape, including the Blackwater Valley. Route 2 (2019) would have a reduced impact on severance to the Blackwater Valley compared to Route 2 (2017) because it would tie the route alignment back in to the existing A12 to the east of Rivenhall End.

The offline section of Route 2 between junctions 24 and 25 would impact on the rural character of the landscape. Route 1 is likely to cause the lowest landscape effects compared with all

other route options because it is largely online and would be set within the context of the existing highway infrastructure. At PCF Stage 3, a detailed landscape and visual impact assessment (LVIA) will be undertaken in line with DMRB LA 107 Landscape and Visual Effects. Site surveys will inform the assessment and a tree survey will also be completed in accordance with British Standard 5837:2012 (BSI, 2012).

9.4 Biodiversity

A key biodiversity constraint for offline routes between junctions 22 and 23 is the presence of an operational quarry at Colemans Farm, because this has a planning condition for restoration to provide one of Essex's flagship biodiversity sites. If the footprint of the road were to impinge on the planned restoration area, then equivalent biodiversity areas would need to be provided elsewhere. Southern Ecological Solutions produced a Biodiversity Enhancement Plan (BEP) on behalf of the quarry in August 2016 with proposals that would lead to a net gain of 760 biodiversity units across the site and a net gain of 31.75ha of priority habitat to biodiversity habitat targets.

Offline options for this section of the route would also pass through the River Blackwater Valley, an area of arable farmland. Although there are no designated areas of nature conservation, priority habitat hedgerow can be found and small areas of broadleaved woodland.

Route 2 (2017) and Route 2 (2019) take the same route across the operational quarry area and would both affect the amount of priority habitat that could be achieved at the site. It is likely that additional land would be required to mitigate the loss due to the road footprint and to maintain the amount of priority habitat proposed within the BEP. Discussions are ongoing with both the quarry owners and Essex County Council around potential restoration options, including responsibilities for future management and monitoring.

Route 2 (2019) would be preferable to Route 2 (2017) as it comprises a shorter offline section which would avoid habitat loss and severance to the sensitive Blackwater Valley.

Route 1 would have the least impact on the Colemans Farm Quarry BEP and habitats and species within the River Blackwater Valley. Route 2 would have the greatest ecological mitigation costs due to the level of habitat compensation required with respect to the quarry restoration. Route 1 would also have the least impact between junctions 24-25.

Route 1 would also be preferable to Route 2 between junctions 24 and 25 where the offline section of Route 2 has the potential to impact on priority habitats (deciduous woodland, hedgerows, ponds, rivers) and protected species.

A full programme of protected species surveys will be undertaken at PCF Stage 3 to inform the assessment of the preferred route option and to identify any required mitigation measures.

9.5 Geology and Soils

The majority of the route from junction 19 to 25 is located within Minerals Safeguarding Areas (MSA) for sand and gravel. Essex County Council may expect any minerals to be extracted prior to construction which could significantly affect the construction programme and have very large financial implications. The offline section between junction 22 and 23 includes the operational quarry at Colemans Farm and would also pass through a combination of Grade 2 and Grade 3 agricultural land (i.e. best and most versatile (BMV) agricultural land).

Route 2 (2017 and 2019) are aligned through the Colemans Farm Quarry and discussions are ongoing with the quarry owners to develop a phased programme of work to enable extraction of the minerals prior to road construction.

Colemans Farm aside, impacts on minerals and soils would be greatest for Route 2 (2017) due to it having the largest offline footprint. For Route 2 (2019), re-aligning the route back into the existing A12 east of Rivenhall End would reduce the potential impacts on Grade 2 BMV land and sterilisation of minerals from the MSA underlying the route. Route 1 would result in the least impacts to MSA and BMV land.

At PCF Stage 3, soil surveys will be undertaken to better characterise the extent of BMV land along the route of the preferred option. Discussions will continue with the quarry operators and Essex County Council to develop appropriate mitigation measures.

9.6 Material Assets and Waste

Route 1 would potentially generate the most waste due to re-surfacing requirements for an online option. Route 2 (2017) comprises a longer offline section than Route 2 (2019) and so could potentially require additional construction material. Further studies have been undertaken to understand the amount of material required for construction of Route 2 (2019), the preferred route. It was assumed that material would be gained through borrow (steal) pits, in order to meet the required construction programme and to limit construction vehicle movements on the road network. Further work was undertaken to identify the location of potential borrow (steal) pits and 11 borrow pits have been identified for further investigation during PCF Stage 3, which would need further environmental assessment. Ground investigations are ongoing to narrow this down to a short list of suitable sites from a materials perspective; environmental assessment work will then be undertaken on these sites to identify potential constraints and opportunities.

9.7 Noise and Vibration

Initial assessment for the original PCF Stage 2 route options (Routes 1, 2, 3 and 4) was undertaken on a qualitative basis in 2017 due to traffic data not being available at that stage. Quantitative noise assessment was subsequently undertaken (post-PRA announcement) for Route 2 (2019) to provide inputs to the business case. This was undertaken using the Calculation of Road Traffic Noise (CRTN) methodology along with DMRB HD 213/11. This indicated that the scheme has the potential to generate significant noise effects (both adverse and beneficial) as noise level increases/decreases above 3 dB(A) and 5 dB(A) are expected in the short-term and long-term respectively.

For the offline sections of Route 2 (between junctions 22 and 23, and between junctions 24 and 25) noise is likely to worsen where traffic is being brought closer to receptors, while improvements are likely to be experienced along the existing road. Route 2 (2017) and Route 2 (2019) both bypass the village of Rivenhall End and only a small number of isolated receptors would be affected by each route for this offline section. In this respect, Route 2 (both 2017 and 2019) would be preferable to Route 1 which would include on-line widening through Rivenhall End.

Detailed modelling at PCF Stage 3 will fully assess the effects and the locations of any specific mitigation. At this stage, without the consideration of mitigation and prior to undertaking a

detailed assessment, it is not possible to determine if one route would create more significant noise effects than another. With the application of mitigation, all routes are likely to be compliant with NNNPS policy.

9.8 Population and Health

The key constraint in relation to population and health for the section between junctions 22 and 23 is the village of Rivenhall End located along the existing A12. Route 1 is likely to have the greatest impact on people and properties at Rivenhall End, as it would increase severance of the community and move the carriageway closer to residential properties. This route may require a greater number of property demolitions than the other routes (particularly at Rivenhall End). Route 2 (2017) would likely have the highest impact on land use and associated severance due to having the greatest proportion of offline works, which would sever land parcels and public rights of way (PRoW). Route 2 (2019) would reduce impacts from land severance between junctions 22 and 23 due to a greater proportion of this section being online, including avoiding the severance of PRoW between Rivenhall End and junction 23.

PCF Stage 3 will include a more detailed assessment of land use, land holdings and potential effects of severance on farm viability.

9.9 Road Drainage and the Water Environment

The 2017 EAR identified potential loss of floodplain and changes to existing structures that were likely to trigger the exception and sequential tests as part of the flood risk assessment. The section of the route between junctions 22 and 23 includes the Blackwater valley, with the existing A12 crossing the River Blackwater to the south-west of Kelvedon. A second main river, Rivenhall Brook, passes under the A12 at Rivenhall End to join the Blackwater midway between junctions 22 and 23.

Route 2 (2017) would take a route through the Blackwater floodplain, with a new bridge across the River Blackwater, to join the A12 just to the east of the existing A12 bridge. The alignment would involve an asymmetric crossing of the river adding to the footprint within the floodplain and increasing potential flood risk impacts. Route 1 would require widening of the existing bridge or construction of a new bridge immediately adjacent to the existing bridge. This would be preferable to Route 2 (2017) from a flood risk perspective and also in relation to potential impacts on water quality, geomorphology and Water Framework Directive (WFD) considerations.

Route 2 (2019) would take the same route across the Blackwater as Route 1 and is therefore preferred to Route 2 (2017).

Route 2 (2017) and Route 2 (2019) would also require a new crossing of Rivenhall Brook and so would not be as favourable as Route 1 in this respect.

Between junctions 24 and 25, the offline section of Route 2 would require a new crossing of Domsey Brook, while both Routes 1 and 2 would require widening at a second existing crossing of Domsey Brook and across the Roman River.

The PCF Stage 3 assessment will include a detailed flood risk assessment and WFD compliance assessment.

9.10 Climate Change

Insufficient information is available at PCF Stage 2 to undertake a climate change assessment. This will be undertaken at PCF Stage 3 for the preferred route and will include an assessment of the contribution of the preferred route to carbon emissions (using Highways England's Carbon Tool) and an assessment of the vulnerability of the new road to climate change.

9.11 Overall Summary

The main environmental differentiator between the routes is the section between junction 22 and 23. On balance, Route 1 is preferable because it minimises the amount of new land take and therefore has benefits in relation to cultural heritage; landscape; biodiversity; geology and soils; drainage and the water environment. With these effects in mind, Route 1 would better meet the requirements under the NNNPS.

The offline routes have potential benefits to residents at Rivenhall End in relation to air quality and noise effects because they would move traffic away from the existing A12. Route 2 (2019) has significant benefits over Route 2 (2017) in reducing the length of the offline section. The principal benefit of this is to reduce the potential impacts on Rivenhall Long Mortuary Enclosure scheduled monument, but also in reducing landscape and biodiversity impacts in the sensitive Blackwater valley, and reducing the impacts to BMV agricultural land and minerals safeguarded areas.

10. Public Consultation

Between 23 January and 3 March 2017 Highways England consulted on the A12 Chelmsford to A120 scheme. The consultation included 7 public information events at various suitable locations along the scheme's length. The consultation received 907 responses, including responses from all key local authorities. 824 respondents expressed a preference for one of the four routes or supported none of the routes. The most popular route was Route 2 (2017) (bypass between junctions 22 and 23, and a bypass between junctions 24 and 25) with 49%.

The consultation also asked whether respondents felt improvements were needed at each junction along the length of the scheme. All junctions received a majority of support for improvements, with many respondents citing poor visibility, unclear signage and dangerous slip roads. Junction 23 received the least amount of support for improvement with 51% feeling improvements were needed. For those who did support the need for improvements, the primary concern was the existing junction arrangement which respondents suggested led to congestion in the village of Kelvedon.

11. Route Comparison

An assessment of Route 1, Route 2 (2017) and Route 2 (2019) was carried out locally between junction 22 and 23, as this is the only differentiator between the routes between junction 19 and 23.

There is not a significant change in routes between junction 23 and 25 since 2017, as a result they have not been subject to another assessment.

Using the same criteria as the 2017 SAR, a colour coding system was used as detailed in Table 11.1, which highlights the major factors which have been considered for the routes against the project objectives, ranging from “significant beneficial impacts to significant adverse impacts”. The classifications were used for the routes comparison in Table 11.2.

Table 11.1: Routes Comparison Key

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

Table 11.2: Routes Comparison Table

Criteria	Route 1	Route 2 (2017)	Route 2 (2019)
Economic Benefit:			
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			
Supporting Economic Growth			
b) Proposed scheme promotes specific traffic flow across the highway network			
A Safe and Serviceable Network			
a) Proposed scheme improves road user safety			
A Safe and Serviceable Network			
c) Proposed scheme improves road worker safety			
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			
A More Free-Flowing Network			
b) The proposed scheme fully understands the impacts of other schemes and recognises other RIS schemes			

An Improved Environment a) Improve the environmental impact of transport on communities along the existing A12 corridor	Yellow	Light Green	Light Green
An Improved Environment b) Reduce the impact of new infrastructure on the natural and built environment by design	Yellow	Red	Orange
A More Accessible and Integrated Network a) Proposed scheme provides a safe NMU route between communities and seeks to address severance	Yellow	Light Green	Blue
A More Accessible and Integrated Network b) Improve safe and effective access for public transport users	Yellow	Light Green	Blue
Customer Satisfaction a) Improve customer satisfaction	Light Green	Dark Green	Dark Green
Customer Satisfaction b) Improve scheme profile	Yellow	Light Green	Light Green
Traffic & Economic Value for Money	Dark Green	Dark Green	Dark Green
Deliverability/ Construction (impact on traffic during construction)	Yellow	Light Green	Blue

All three routes were considered to support economic growth equally by supporting growth in local plans and promoting specific traffic flow across the highway network equally.

In terms of improving road user safety, Route 2 (2017) and Route 2 (2019) score better than Route 1, as they both result in a safer access being provided to the existing A12 from the Rivenhall End junction. Route 1 removes the southern access from the junction and requires traffic to access the existing A12 from Oak Road, which consists of residential properties, and would require local traffic (including HGVs accessing premises and other generators to use Oak Road, which would require mitigation.

Route 2 (2017) and Route 2 (2019) score better than Route 1 for improving road worker safety, as the offline routes are considered to be safer during construction and will also provide safer access for road workers.

Route 2 (2017) and Route 2 (2019) are both considered to provide better provision for the potential future A120 Braintree to A12 scheme than Route 1, as they consist of offline sections. Offline sections will better facilitate possible amendments if the A120 is built. As a result, the two routes score higher than Route 1, for understanding the impacts of other schemes and recognising other RIS schemes.

In relation to the environmental impact of transport on communities along the existing A12 corridor, Route 1 has the most adverse impact as it continues to sever the village of Rivenhall End and therefore scores the lowest. Route 2 (2017) and Route 2 (2019) score equal as they bypass Rivenhall End and do not sever the village.

A key area of comparison was the environmental impact, particularly on the natural and built environment. Route 1 has the least adverse impact on the natural and built environment, as it involves widening the A12 within the existing corridor, therefore scores the highest. Route 2 (2017) has the most adverse impact on the natural and built environment as the bypass impacts on a scheduled monument, Hole Farm which is a Grade II* listed building and the River Blackwater, therefore scores the lowest. Route 2 (2019) consists of an offline bypass, however re-joins the existing corridor to avoid impact on the scheduled monument, Hole Farm and the

River Blackwater. As a result, the Route 2 (2019) scores higher than Route 2 (2017), although lower than Route 1.

Route 2 (2017) consists of an offline bypass which remove traffic from the existing A12 onto the new A12. This allows for better WCH provision as it is easier to provide new crossing points to address severance and therefore scores the highest for providing safe WCH routes and addressing severance. Route 1 consists of online widening and does not allow for WCH provision as effectively, as a result scores the lowest. Route 2 (2019) scores higher than Route 1 due to its offline bypass, but lower than Route 2 (2017) as it re-joins the existing corridor earlier.

Route 2 (2017) consists of an offline bypass which remove traffic from the existing A12 onto the new A12. This provides safer and more effective access for public transport users, therefore scores the highest for this. Route 1 consists of online widening and does not allow for as effective access for public transport users, and therefore scores the lowest. Route 2 (2019) scores higher than Route 1 due to its offline bypass, but lower than Route 2 (2017) as it re-joins the existing corridor earlier.

Route 2 (2017) and Route 2 (2019) score higher than Route 1 for customer satisfaction, as they allow access to the existing A12 from the south. Bypassing Rivenhall was also favoured by the public consultation, therefore Route 2 (2017) and Route 2 (2019) score higher for improving scheme profile.

All routes are equal in terms of Value for Money, therefore score equally for this measure.

Route 2 (2017) consists of an offline bypass and will have the least impact on traffic during construction, therefore scores the highest for deliverability/construction. Route 1 consists of online widening and will require the most traffic management, therefore scores the lowest. Route 2 (2019) consists of a bypass but re-joins the existing corridor earlier, therefore scores higher than Route 1 but lower than Route 2 (2017).

12. Conclusion

This report has been produced as an Addendum to the 2017 SAR, to document new information which has become available since 2017 and other factors which are relevant to the selection of a preferred route. This information supports the initial PRA between junctions 19 to 23 the subsequent PRA between junctions 23 to 25. The purpose of this addendum is to consider the impact of any new information and changes, including VE and assess whether the recommendation of the Preferred Route from 2017 is still valid.

The final decision on the preferred route was informed by a combination of many factors including consultation responses, value for money, health and safety, environmental impacts, NNNPS risk assessment and meeting of the scheme objectives.

Route 2 (2017) emerged as the most popular route during the non-statutory consultation, 49% of responses expressed support for Route 2 (2017) as their favoured route option. A considerable amount of support for this route came from statutory authorities, as well as local communities. Amongst other things, respondents felt that Route 2 (2017) would be the most resilient and cause the least disruptions during construction. Furthermore, a number of statutory authorities felt it was the most “future-proof”, and others supported it as it would have the least impact on residents of Rivenhall End. There is no evidence to suggest that this will change with Route 2 (2019). However, there were objections to Route 2 (2017), and these primarily came from environmental stakeholders who preferred an online solution. Route 2 (2019) is likely to improve this situation, as it addresses areas of environmental concern.

Route 2 (2017) results in the most adverse impact on the environment, which between junction 22 and 23 includes a scheduled monument which sits within a Palaeolithic landscape, Hole Farm which is a Grade II* listed building, and the sensitive River Blackwater Valley. The impact on the environment is considered to be significant and would be difficult to mitigate.

However, Route 2 (2017) has been refined (i.e. Route 2 2019) to substantially reduce the environmental impact and to improve compliance with environmental policy within the NNNPS, whilst still providing many of the benefits of an offline bypass.

Route 2 (2017) is considered to have the highest safety performance for road users on the local roads and will be safest for road workers during both construction and operation as it has longer lengths of offline construction. Route 2 (2019) is considered to have a high safety performance due to the length of offline construction, however it is less than Route 2 (2017) as it re-joins the existing corridor earlier.

Route 2 (2017) will provide the greatest lengths of segregated WCH provision away from the A12 mainline where it provided adjacent to the local access road. Route 2 (2019) will still provide segregated WCH provision away from the A12 mainline. However, it will be for a lower length than Route 2 (2017).

Route 2 (2017) and Route 2 (2019) both allow the most efficient access to the network from the local communities due to the nature of the local access road and associated junctions. However, this may lead to increased long term maintenance costs, subject to a de-trunking agreement with Essex County Council.

As Route 2 (2017) and Route 2 (2019) bypass Rivenhall End, the impact on this community will be an improvement over the existing situation and an online route as the majority of traffic will be moved away from existing properties.

In conclusion, taking the above into consideration, Route 2 (2019) is recommended as the Preferred Route between junction 19 and 25, and will be taken forward into PCF Stage 3.

13. Appraisal Summary Table

An Appraisal Summary Table has been developed for Route 2 (2019) and is presented on the following page.

Appraisal Summary Table		Date produced:	1	5	2020	Contact:				
Name of scheme:		A12 Chelmsford to A120 (Junction 19 to 25) Widening Scheme				Name:	Shah Hussain			
Description of scheme:		Scheme Option 2 - A12 online widening to three lanes with two new off-line bypasses, one located between junctions 22 and 23 and re-joining the A12 just east of Rivenhall End; the second between J24 (Kelvedon North) and J25 (Marks Tey). Both the off-line bypasses would be three lanes and run to the south and parallel with the existing A12.				Organisation:	Highways England			
						Role:	Promoter/Official			
Impacts	Summary of key impacts	Assessment								
		Quantitative			Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp			
Economy	Business users & transport providers The Scheme will generate benefits for business users through addressing issues with the capacity and capability of the existing network. The Scheme will improve journey times along the route and reduce queuing at major junctions. The scheme is expected to provide significant journey time savings (£338.6m), and a small reduction in vehicle operating costs (£50.6m). The scheme is expected to provide disbenefits to road users during construction (-£18.5m). It will also provide a decrease in road user delays (£19.0m) during future maintenance compared to the 'without scheme' scenario.	Value of journey time changes(£)		£338.6m		N/A	£389.7m			
		Net journey time changes (£)			N/A				£389.7m	
		0 to 2min	2 to 5min	> 5min						
		£44.3m	£184.3m	£110.0m						
Reliability impact on Business users	The increase in capacity due to the scheme will result in journey time reliability benefits to business users, due to a decrease in travel time variability (£33.5m) and a decrease in delays caused by incidents (£31.7m)	N/A			N/A	£65.2m				
Regeneration	Not assessed at this stage.	N/A			N/A	N/A				
Wider impacts	The journey time savings provided by the scheme are expected to lead to increased agglomeration, giving productivity benefits of £184.3m. As commuting costs fall due to the journey time savings, some people who would otherwise be priced out of the labour market due to high commuting costs would now be able to seek employment (£2.4m benefits). Increased output (the profit that firms make on additional outputs generated as a result of reduced transport costs) has been valued at £38.9m.	N/A			N/A	£225.7m				
Environmental	Noise	The increases in noise are caused by the alignment changes to the route, which in places will take the A12 closer to receptors and increase the noise. In addition, the increase in traffic flow and speed will contribute to increase in noise, including on those parts of the route where there are online improvements. Decreases in noise are caused by the A12 being moved away from receptors in some locations. There are 121 properties that could be eligible for noise insulation, with 13 receptors likely to experience noise levels greater than 80 dB LAeq,16h.	Households experiencing increased daytime noise in forecast year: 2,036 Households experiencing reduced daytime noise in forecast year: 745 Households experiencing increased night time noise in forecast year: 1,825 Households experiencing reduced night time noise in forecast year: 640			N/A	-£3.9m	The scheme provides a mixture of benefits and disbenefits across different income quintiles: Quintile 1 (most deprived) Neutral Quintile 2 Large Adverse (x x x) Quintile 3 Moderate Beneficial (✓ ✓) Quintile 4 Slight Adverse (x) Quintile 5 (least deprived) Slight Adverse (x) The impact on both Older People and Children & Young People is predicted to be neutral		
	Air Quality	This option would result in a net disbenefit in local pollutant concentrations overall in the opening and design years. The spatial impact of the scheme option is variable, though this proposed scheme option worsens concentrations at a higher number of receptor locations. Total annual emissions of NO _x and PM ₁₀ are likely to increase with the scheme option.	Air quality effects at properties (Improvements / Deterioration / No change) NO _x 2027 (553 / 961 / 25127) Emissions NO _x (2027): +25.4 tonnes/year PM ₁₀ (2027): +4.1 tonnes/year			N/A	PM ₁₀ : -£20.9m NO _x : -£7.6m Total: -£28.4m Upper/lower bound: -£93.2m to -£5.1m	The scheme provides a mixture of benefits and disbenefits across different income quintiles: Impact on NO ₂ : Quintile 1 (most deprived), 2 and 4: Moderate Adverse (x x) Quintile 3: Slight Adverse (x) Quintile 5 (least deprived) Large Adverse (x x x) Impact on PM ₁₀ : Quintile 1 (most deprived), 2 and 5 (least deprived): Moderate Adverse (x x) Quintile 3: Slight Adverse (x) Quintile 4: Large Adverse (x x x) One nursery is predicted to have a small worsening in Air Quality; the impact on Children and Young People is therefore Slight Adverse.		
	Greenhouse gases	The forecast traffic data is for 2042; however, the latest year that best practice tools (IAN185-13 HE Speed Banding V3 EF) have CO ₂ emissions data for is 2030. By 2042, improved vehicular technologies should see the contributions become smaller than currently predicted reducing the carbon impact of the scheme.	Change in non-traded carbon over 60y (CO ₂ e)		1,559,330	CO ₂ : -£68.2m Upper/lower bound: -£105.8m to -£30.7m				
			Change in traded carbon over 60y (CO ₂ e)		0					
	Landscape	This option would introduce additional major junctions and two new off-line bypasses to the landscape, and a substantially widened highway corridor where the alignment would run immediately north and adjacent to the existing A12 between Rivenhall End and Junction 23. Field severance and vegetation loss would significantly affect the landscape pattern, land use and therefore character. Online widening would result in loss of established highway vegetation and/or introduce signs and other engineered features, opening up views of the road and changing the character of the highway landscape. There would potentially be views of the option from registered parks and gardens, particularly Boreham House and New Hall Boreham, as well as from Prested Hall and Marks Tey Hall (listed buildings). There would potentially be views of the option from residential properties, particularly from the edges of settlements including Hatfield Peverel, Witham, Rivenhall End, Kelvedon, Feering, Marks Tey and Copford as well as from scattered properties throughout the rural landscape. There would potentially be views of the option from surrounding public rights of way, areas of public and private open space, places of work, educational establishments and from vehicle travellers on surrounding roads where they cross or run within close proximity to the option. Planting where space would allow would potentially reduce landscape and visual effects in the longer term. A monetised assessment for landscape impacts has also been undertaken. From this assessment, it was estimated that the scheme will produce disbenefits of -£76.7m.	N/A			Large adverse	N/A			
	Townscape	N/A	N/A			N/A	N/A			
Historic Environment	The option includes two off-line bypasses and junction improvements and therefore has the potential for a direct physical impact on un-designated archaeological remains and historic landscape types of regional and local significance. The proposed off-line route between junctions 22-23 would have a large adverse effect through the direct physical removal of highly sensitive archaeological remains; this includes potential prehistoric settlement site(s), some of which are likely to be associated with the scheduled Rivenhall long mortuary enclosure. Previous excavation in the vicinity has indicated that these remains are likely to be in good condition and of high complexity. A robust archaeological programme involving desk-based assessment, invasive and non-invasive archaeological evaluation, and an extensive programme of archaeological excavation and dissemination of the results would likely be required in order to mitigate this impact. Although no designated historic buildings, registered parks and gardens or scheduled monuments lie within the footprint of the option, there is the potential for significant effects to the setting of these nationally and regionally significant cultural heritage assets.	N/A			Large adverse	N/A				
Biodiversity	This option would require widening of the A12 to the east between J21-J22, impacting the western boundary of the Whetmead LNR/Local Wildlife Site, which includes rough meadow, young woodland and scrub. Several veteran trees could potentially be directly impacted by option construction. Offline sections of this option (between J22-J23 and J24-J25) have the potential to impact priority habitats, including important hedgerows and woodland, through habitat loss and/or fragmentation. Potential impacts to protected species including badgers, bats, birds, dormouse, fish, great crested newt (GCN), invertebrates, reptiles, otter, water vole, white-clawed crayfish, and other priority species listed in Section 41 of the NERC Act 2006. Impacts could arise from direct mortality and injury, habitat loss/fragmentation, disturbance, hydrological changes and air quality changes. Mitigation for impacts to legally protected species is likely to require offsite mitigation or compensation, which in turn would require additional land take. The off-line bypass between J22-23 would sever Colemans Quarry and impact the site's post extraction restoration plan. As a result this option would need to develop a restoration plan which factors in the new A12. This would also potentially require offsite mitigation or compensation, which in turn would require additional land take. The site would also require long term management and maintenance, which could add considerable cost to the scheme.	N/A			Moderate adverse	N/A				
Water Environment	Flooding: the proposed development site for Option 2 is located predominantly within Flood Zone 1 and is at low risk of fluvial flooding. Potential for significant effects for flood risk around the new crossings of Rivenhall Brook and Domesey Brook where the Proposed Scheme crosses large areas of floodplain. The risk of flooding from other sources (groundwater, surface flooding from the upstream catchment, reservoir flooding) is thought to be low. Geomorphology, Water Framework Directive and Water Quality: the route option would require crossing a number of WFD surface water bodies with the potential to impact the geomorphology, hydrology and water quality of the watercourses. A detailed WFD compliance assessment to assess the potential for effects on biological, physico-chemical and hydromorphological WFD quality elements will be required. It is assumed that appropriate risk assessment of runoff and spillage risk would be carried out in accordance with the DMRB's LA113 to ensure that adequate treatment and spillage containment facilities are provided as part of the drainage design. These could include sustainable drainage systems (SuDS) such as swales, ponds or wetlands, or conventional measures such as storage tanks and oil interceptors where there are space constraints. Groundwater: the location and degree of groundwater dependency for GWDEs still needs to be determined. The current status and use of the borehole for which the SPZ1 is defined needs to be determined. Unlicensed abstractions may also be present.	N/A			Moderate adverse	N/A				
Social	Commuting and Other users	The Scheme will generate benefits for commuters & other users through addressing issues with the capacity and capability of the existing network. The Scheme will improve journey times along the route and reduce queuing at major junctions. The scheme is expected to provide significant journey time savings (£233.9m), and a small increase in vehicle operating costs (-£33.8m). The scheme is expected to provide disbenefits to road users during construction (-£18.6m). It will also provide a decrease in road user delays (£24.8m) during future maintenance compared to the 'without scheme' scenario.	Value of journey time changes(£)		£233.9m		N/A	£206.4m	The scheme provides benefits across all income quintiles. Quintile 1 (most deprived) Moderate Beneficial (✓ ✓) Quintile 2 Large Beneficial (✓ ✓ ✓) Quintile 3 Slight Beneficial (✓) Quintile 4 Slight Beneficial (✓) Quintile 5 (least deprived) Large Beneficial (✓ ✓ ✓)	
	Net journey time changes (£)			N/A	£206.4m					
	0 to 2min	2 to 5min	> 5min							
			£15.5m	£95.5m	£122.9m					
	Reliability impact on Commuting and Other users	The increase in capacity due to the scheme will result in journey time reliability benefits to commuting and other users, due to a decrease in travel time variability (£41.2m) and a decrease in delays caused by incidents (£44.0m).	N/A			N/A	£85.2m			
	Physical activity	Improving the A12 is unlikely to lead to increased numbers of walkers and cyclists nor is it likely to lead to longer trips for those that do. The Scheme is therefore expected to have minimal impact on physical activity.	N/A			Neutral	N/A			
	Journey quality	Improved journey quality due to a reduction in frustration from congestion and unreliability, simpler and more consistent junction layouts, and improved signing and other traveller information (e.g. Variable Message Signs). Existing issues with road surfacing, flooding and potholes will also be resolved as part of the scheme.	N/A			Large Beneficial	N/A			
	Accidents	The proposed scheme is predicted to result in an increase in slight casualties, but a decrease in the number of fatal and serious casualties.	Number of Accidents Saved by the Scheme: -114 Number of Casualties Saved by the Scheme: Fatal 1.4, Serious 82, Slight -233			N/A	£5.0m	Neutral for all vulnerable groups		
	Security	The proposed scheme would offer slight improvements in security compared to the existing situation. CCTV and emergency call facilities will be introduced, while limiting the access points to the A12 carriageway reduces the potential for disruption from unauthorised access. Moving bus stops away from high-speed heavily trafficked route may offer security benefits by improving car drivers awareness of bus stop users.	N/A			Slight beneficial	N/A	N/A		
	Access to services	The scheme is not expected to affect accessibility to transport services, outside the improvements to journey times considered elsewhere in this Appraisal Summary Table.	N/A			Neutral	N/A	N/A		
Affordability	No assessment has been undertaken, as the scheme is not expected to result in changes to public transport fares. A distributional impact assessment has been undertaken based on the changes in Vehicle Operating Costs to highway users.	N/A			N/A	N/A	The scheme provides affordability disbenefits across all income quintiles. Quintile 1 (most deprived) Moderate Adverse (x x) Quintile 2 Moderate Adverse (x x) Quintile 3 Moderate Adverse (x x) Quintile 4 Large Adverse (x x x) Quintile 5 (least deprived) Moderate Adverse (x x)			
Severance	Impact of severance for pedestrians is improved with the inclusion of improved crossing facilities. Grade-separated crossing points replace current at-grade points, this will provide better and safer access for users as they will no longer be required to wait for traffic to cross along the carriageway.	N/A			Moderate Beneficial	N/A	N/A			
Option and non-use values	The Scheme in itself does not substantially change the availability of transport services within the study area.	N/A			Neutral	N/A				
Public Account	Cost to Broad Transport Budget	Present Value of Costs includes cost of scheme (£519.4m) and impact on future maintenance costs (-£9.8m) over 60 year period.	N/A			N/A	-£509.6m			
	Indirect Tax Revenues	The scheme will generate an increase in indirect tax revenue from an increase in fuel consumption.	N/A			N/A	£48.7m			

Appendix A. Value Engineering Technical Note

Project:	A12 Chelmsford to A120 Stage 2	No:	HE551497-JAC-HGN-3_S0-TN-CH-0018
Subject:	VALUE ENGINEERING - TECHNICAL NOTE		
Prepared by:		Date:	
Checked by:		Date:	
Approved by:		Date:	

1. Introduction

The A12 Chelmsford to A120 Widening scheme ('the A12 scheme') aims to improve the accessibility and linkage between the regional towns of Essex and London, with significant growth being projected in the region. The scheme is looking to relieve traffic congestion on the A12 by increasing the capacity to a Dual Three Lane All Purpose (D3AP) carriageway and improving the flow of traffic.

During the previous Project Controls Framework (PCF) Stage 2 (Option Selection), Option 2 emerged as the preferred option. This option was costed in September 2017, originally for PCF Stage 2.

On 16 January 2019, Highways England (HE) required an ad-hoc/ formal cost request for a revised cost estimate on Option 2. This led to a cost challenge to reduce scheme costs from an internal HE investment committee.

Highways England requested a Value Engineering (VE) meeting to discuss a cost reduction for the A12 Chelmsford to A120 Widening scheme. A VE workshop was held on 22 January 2019 to challenge the costs. The proposed outcome of the meeting was to develop a list of potential VE or scope changes, to be considered for inclusion in a revised cost estimate.

The purpose of this technical note is to detail the items that were identified during the VE workshop and assess their potential impact.

2. Value Engineering (VE) Workshop

The purpose of the workshop was to apply collective experience and expertise to contribute to VE. To facilitate the VE, Option 2 was the basis for costs and changes.

The list of reduced scope and VE items for the Option 2 programme are summarised as follows:

- i) Removal of "Full Depth" road reconstruction of existing A12 Dual 3 lane pavements, between junction 19 and junction 20a (Ch. 31,500m and Ch. 35,300m) and all associated road infrastructure works. Technology is also descope in this area.
- ii) Removal of proposed new junction 23 (Kelvedon South) and associated technology.
- iii) Review of the latest design considerations for all junctions' earthworks quantities.
- iv) Reduction of overall imported fill materials using potential borrow pits, based on assumptions.

- v) Omission of proposed River Ter Bridge widening (subject to detailed safety risk assessment and departure agreement).
- vi) Provision of a new walking, cycling and horse riding (WCH) access bridge, instead of the online Wellington Bridge replacement at J20b in Hatfield Peverel, as part of a safe walking and cycling route from The Street, Hatfield Peverel to Hatfield Road, Witham, bypassing the grade separated junction 21.
- vii) Assumption that traffic management maximum length restrictions (6km) can be relaxed to allow greater concurrency of delivery of sections of online road improvements.

3. Value Engineering (VE) Items

The reduced scope items are discussed in further detail in the sections below. The items were agreed to be removed during the VE meeting on 22 January 2019, a detailed assessment of the impact of removing these from the scope will continue through subsequent PCF stages.

3.1 Removal of “Full Depth” road reconstruction on existing A12 dual 3 lane pavement, between J19 and J20a (Ch. 31,500m and Ch. 35,000m)

i) Highways

It is proposed to remove the “Full Depth” road reconstruction of existing A12 dual 3 lane pavements, between junction 19 and junction 20a (Ch. 31,500m and Ch. 35,000m). Between these junctions, the existing A12 consists of a three-lane carriageway both northbound and southbound, and if retained would still be consistent with the RIS commitment for three lane provision.

The existing A12 south of junction 19 consists of D2AP road, and there is a lane gain arrangement at junction 19 on the northbound carriageway, and a lane drop arrangement at junction 19 on the southbound carriageway. Any proposed works between Ch. 29,600m and Ch. 31,500m, and north-east of Ch 35,300m would tie into the existing A12 D3AP section.

Reducing this item from the scope also includes the removal of all associated carriageway works such as the new concrete safety barrier in the central reserve, central reserve hardening, verge widening, omission of verge widening, existing stats diversions in verges, verge safety barrier works, new drainage works in the verge and central reserve.

It is assumed that any carriageway resurfacing or any other renewals between junction 19 and 20a are to be carried out by the maintenance contractor and will not be part of the widening scheme proposed by HE. As such the works will not be included in the scheme costs.

Additional technology is also descope in this area (with the exception that any changes to existing provision required by changes to junction19 would be provided).

There is a risk that works such as provision of noise barriers, other environmental mitigation and / or technology may result in additional verge works within the de-scoped area. Currently, no verge works are proposed between Ch. 31,500m and Ch. 35,300m. If a cantilever gantry/ portal gantry is required, then there will be local verge widening and local land take may be required for the new technology foundations and access for the equipment.

ii) Construction

The removal of this item from the scope has a considerable impact on the construction programme, there is a saving of approximately 150 days (7.5 months).

The removal of this item from the scope results in a small increase in the overall total imported fill for the scheme by approximately 13,066m³, based on Stage 2 volumes, as previously gained material within this section would no longer be won.

iii) Environment

An environmental assessment is required to assess the effects of the overall scheme and to propose environmental mitigation to offset any significant effects. By improving capacity between junctions 20a and 25, this may increase traffic between 19 and 20a. This could increase noise levels in this location and may result in significant effects that require mitigation. Therefore, environmental mitigation works may be required in the descope section and extend the construction footprint and programme.

iv) Safety

There may be a slight adverse impact on road users, the existing pavement is most likely to be beyond its design life, as it consists of significant defects identified from the Stage 2 design. The existing road markings, traffic signs, drainage and safety barrier may also no longer perform as desired, which may also have an adverse impact on road users. However, it is assumed that all the works will be carried out by the maintenance contractor at some point in the future, so the impacts are not considered to be significant.

The removal of associated works, including central reserve and verge works, new drainage, and pavement re-surfacing, means that there may be additional maintenance tasks in the future. The removal of associated works from the scope means that a concrete central safety barrier will not be provided in this section, which will result in not achieving reductions in risk for road workers during maintenance which would have been provided by the scheme.

The removal of technology from the scope between junction 19 and junction 20a would result in a reduction in safety benefits, and thus may affect the overall scheme cost/benefit ratio. The southbound carriageway does currently have technology on the approach to junction 19, and this would be retained/modified to take account of any changes to the geometry included in the scheme at junction 19.

Further discussion on the above will be ongoing through the subsequent PCF design stages.

3.2 Removal of junction 23 (Kelvedon South)

i) Highways

The existing junction 23 will be demolished as part of the work, along with part of the old A12. However, as part of the VE, it is proposed for a replacement junction 23 (Kelvedon South) to be removed from the scheme, along with all associated junction works, including a new junction overbridge, road pavements works, existing static diversions, gantry signage, technology related to the junction 23, new culverts and drainage works, and environmental mitigation risk/cost allowances.

Traffic seeking to access the A12 would be required to either utilise the proposed junction 22 or alternatively the local network, if there is no provision of junction 23.

It is also worth noting that the preferred option for the A120 Braintree to A12 scheme consists of the A120 tying into junction 23. It is expected that the A120 scheme may need to allow for the costs of constructing a new junction 23 as part of the works.

Further details and assessment of this proposal can be found in the Junction 23 Removal Technical Note.

ii) Construction

The removal of this item has a considerable impact on the construction programme, there is a saving of approximately 120 days (six months) minimum.

The removal of this item from the scope will result in an estimated saving of 450,000m³ imported fill.

iii) Traffic

Traffic modelling suggests that the removal of junction 23 from the A12 scheme will result in minimal adverse impact to traffic, especially due to the relatively few vehicles that utilise the junction.

The removal of junction 23 will result in an increase in vehicles using the old A12, which will be converted to a Local Access Road (LAR) to travel to/from Kelvedon from junction 22, and a decrease in vehicles on the new A12. However, the amount of traffic on the LAR for a scheme with junction 23 or a scheme without junction 23 is still significantly lower than a current traffic on the A12.

iv) Environment

The removal of junction 23 will reduce the environmental impacts associated with the junction. A proposed junction 23 would have significant visual and landscape effects, particularly on a scheduled monument, Hole Farm which is a Grade II* listed building and the River Blackwater Valley.

v) Safety

The removal of junction 23 is expected to result in an improvement in safety for road users, as the existing slip roads will be removed, eliminating associated movements and potential collisions at this location.

The removal of junction 23 will also result in a benefit to road workers, as there will no longer be a maintenance liability for slip roads, structural aspects and assets associated with the junction.

3.3 Reduction of overall imported fill materials by using borrow pits

i) Construction

As part of the VE exercise, it was determined that the proposed use of on-site borrow pits to “win” bulk fill for the scheme is critical to reducing the length the overall construction programme.

It is proposed to change the earthworks strategy by assuming the use of borrow pits to reduce the bulk fill material deficit for the scheme and overall result in a reduction of the imported fill materials. This will cause an increase in the land cost allowance and risk associated to installing and remedial works at the borrow pits sites. However, this strategy will potentially result in a reduction in the length of the construction programme.

A strategy was developed which assumed that 70% of the total material required will be extracted from borrow pits, and 30% will be imported from external sources.

ii) *Environment*

Borrow areas can reduce traffic movements, reduce impacts on the road environment and to local residents, and have a benefit to importing material on these receptors. However, borrow pits can have a significant effect on the environment in terms of the physical footprint. Borrow areas can introduce unnatural features in the landscape, affecting landscape character and views / setting from sensitive sites. It can also result in the loss of habitat and impacts on archaeology. The borrow pits would require full environmental assessment as part of the wider project Environmental Impact Assessment (EIA) and are likely to require additional mitigation in the form of landscaping and screening.

In addition, there are legacy impacts from borrow areas in terms of what remains after the scheme is complete and whether this can be handed back to the landowner. Landowners may not want to take back water-filled lakes, if this serves no business or farming purpose. There are opportunities to tie in the borrow area reinstatement with the wider landscape and ecological management strategy and using borrow areas to provide compensatory habitat as part of the scheme.

3.4 Omission of River Ter Bridge Widening

i) *Highways*

Following a detailed assessment of the cross-section requirements, it is proposed to avoid any widening on the River Ter Bridge through Departures from Standard. Hence there will be a reduction in the works and costs associated with the bridge widening.

River Ter Bridge carries the existing A12 over the River Ter and the A12 currently consists of a D2AP across the bridge, with two 3.65 m wide lanes in each direction and a 4.57 m wide central reserve. There is a 4.65 m wide verge on the southbound carriageway, and a slip road and nose with varying widths on the northbound carriageway. The total width of the structure varies between 31.32 m (west) and 32.54 m (east). The proposed cross section for a standard D3AP road is 33.5m.

The proposed omission of this widening from the scheme is likely to prevent a standard cross-section being provided along the bridge on the A12. Cross-section relaxations and departures from standards are likely to be required to accommodate a D3AP along the bridge. This may include a narrow central reserve or narrow verges but will be confirmed in PCF Stage 3. Furthermore, these departures will need to be reviewed and assessed in further detail, and then endorsed by SCRG.

ii) *Construction*

The removal of this item from the scope is unlikely to have a significant impact on the construction programme.

vi) Environment

The removal of the River Ter bridge may reduce the environmental assessment required in this location. Changes to the bridge would have required assessment as part of the flood risk assessment, Water Framework Directive assessment and wider environmental surveys. Removal of this from the scope of works would reduce both the assessment work and potential mitigation identified through those assessments because of the change.

iii) Safety

The removal of River Ter Bridge Widening from the scheme may have a slight adverse impact on the operating regime of the scheme, due to the substandard cross-section, although this is not considered to be significant. There will be safety concerns at the River Ter Bridge for road workers during construction and maintenance, due to the substandard cross-section, which results in narrower working areas. This may be safer than widening River Ter Bridge but, the narrow cross-section will only be provided over approximately 40m and is not unusual when compared with typical proposals for widening schemes. The priority order for cross-section reductions will be followed as detailed in TD 27/05, during PCF Stage 3.

The sub-standard cross-section provided will need to be assessed at later stages to determine its impact on road users and provide mitigation if necessary. As mentioned earlier, the relaxations and departures will need to be reviewed and assessed, and then endorsed by SCRG.

3.5 Omission of Wellington Bridge replacement and provision of WCH Bridge

i) Highways

The existing Wellington Bridge (J20b) is the most easterly of the three bridges that cross the A12 at Hatfield Peverel and carries the two lane B1137. It allows traffic from Hatfield Peverel onto the northbound A12 slip road and to/from a small group of properties. To accommodate the widening of the A12 to D3AP, it was originally proposed for the existing Wellington Bridge to be demolished and replaced by a new wider online bridge.

A replacement Wellington Bridge is no longer proposed. Instead a lower cost WCH bridge is to be provided across the A12. The bridge will provide connectivity for WCH users to move across the A12 between Hatfield Peverel and B1389 towards Witham, bypassing the grade separated junction (junction 21), as well as linking a group of properties on the north side of A12 for these users. Vehicle access to the properties would be provided through a new access road alongside the WCH route from junction 21.

There is a risk that the bridge may be included in the scheme at a later stage, subject to DCO's Statement of Common Grounds (SoCG) demands from residents in Hatfield Peverel, local residents in the small group of properties and adjacent land owners. As such, the WCH bridge could also be changed to a small accommodation bridge at a later stage, which would increase the cost. The impact on WCH users would need to be assessed.

ii) Construction

The removal of this item from the scope has a small impact on the construction programme, there is an estimated saving of approximately 70 days (3.5 months).

iii) Traffic

This item is unlikely to have a significant impact in terms of traffic on the local roads. Vehicles seeking to access the small group of properties to the north of the A12 will now be required to travel to the new junction 21 and back along a new local access road from the northern J21 roundabout.

vii) Environment

The removal of this item from the scope is likely to reduce the environmental impacts. There are several listed buildings around this location. Reducing the scale of the bridge will reduce the impacts on the landscape and setting, and potentially result in less mitigation planting and screening. Further assessment is required to understand if there are effects associated with severance and access for local residents.

iv) Safety

This item is unlikely to have a significant adverse impact on safety, however a new WCH bridge is likely to require less maintenance than a full replacement road overbridge. It will provide a significant safety benefit for WCH users by allowing them to bypass junction 21.

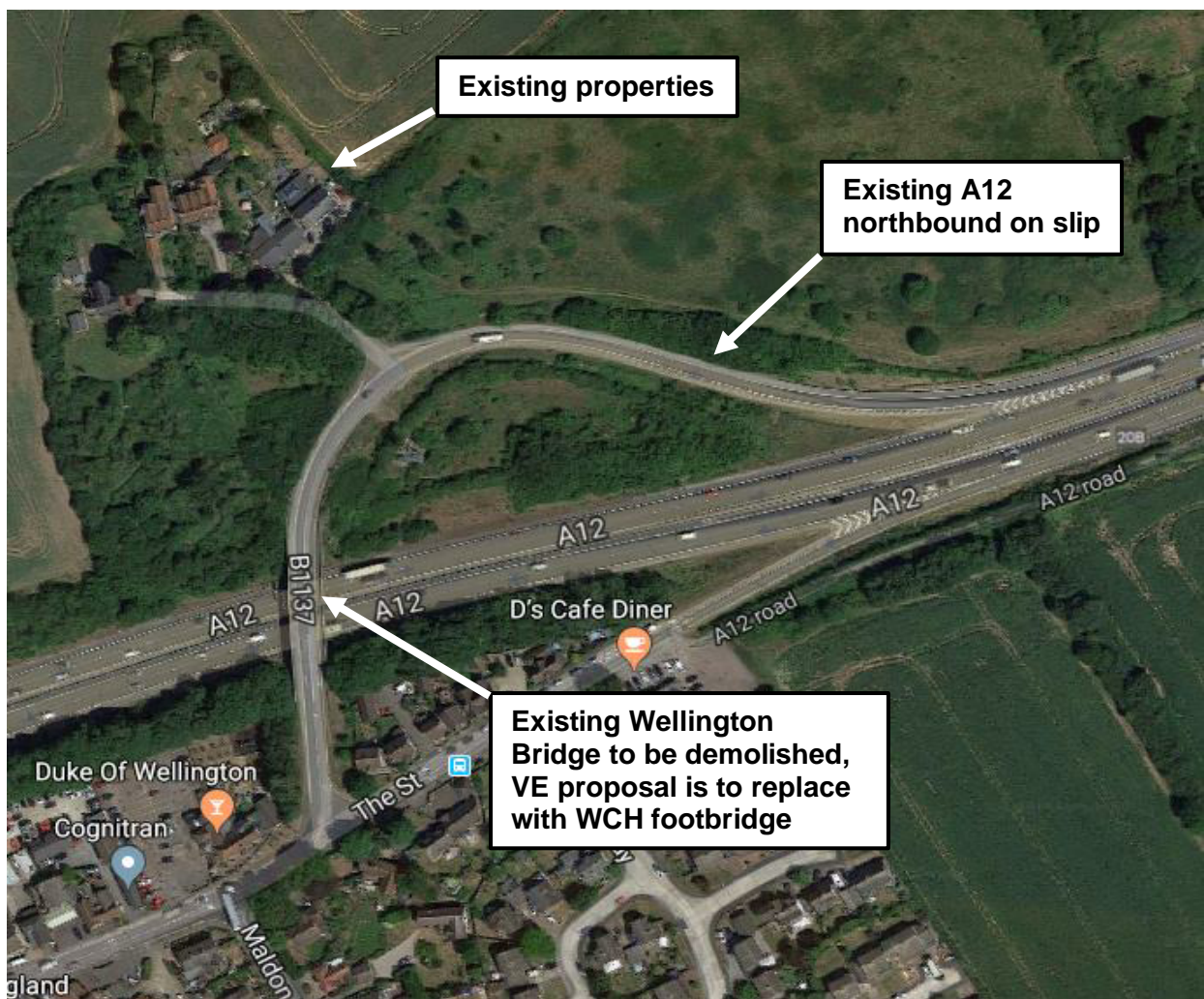


Figure 1: Existing Wellington Bridge

4. Conclusion

In summary, the items detailed in this Technical Note are to be removed from the scope of works for the A12 scheme as a result of VE. The impacts of removing these items from the scheme will continue to be assessed over the subsequent PCF stages, including safety risk assessment and departure proposals. There may be some residual risks for these items, associated with their potential re-inclusion after full assessment, however they are not included in the A12 Project Risk Register. The items to be removed from the scheme are considered to have low adverse impacts, however they do provide cost savings. As a result, the removal of these items will be taken forward as part of the updated scheme and are included in the March 2019 cost estimate.

Appendix B. Junction 23 Removal Technical Note



A12 Chelmsford to A120 Stage 2

JUNCTION 23 REMOVAL TECHNICAL NOTE

HE551497-JAC-HJU-3_S2_J23-TN-CH-0001 | P01

20/08/20

HE551497



Contents

1. Introduction.....3

1.1 General.....3

1.2 Value Engineering.....3

1.3 Purpose3

2. Existing Conditions.....4

2.1 General.....4

2.2 Existing traffic information4

3. Junction 23 Removal Proposal.....6

3.1 General.....6

3.2 Local Access Roads.....6

3.3 Passive Provision for A120.....7

4. Traffic Analysis8

5. Economic Assessment10

6. Safety Assessment11

7. Operational Assessment13

8. Environmental Assessment.....14

9. Construction Assessment15

9.1 Construction Programme.....15

9.2 Phasing.....15

10. Stakeholder16

11. Cost Estimate.....17

12. Conclusion18

Appendix A. Traffic Figures (Do Minimum and Route 2 with/without junction 23)

1. Introduction

1.1 General

The A12 Chelmsford to A120 Widening scheme aims to improve the accessibility and linkage between the regional towns of Essex and London, with the significant growth being projected in the region. The scheme will aim to relieve traffic congestion on the A12 by increasing the capacity to Dual Three Lane All Purpose (D3AP) and improving the flow of traffic. Route 2 has previously emerged as the preferred route during PCF Stage 2.

1.2 Value Engineering

There was a Value Engineering (VE) Meeting held on 22 January 2019 to challenge the scheme costs. The proposed outcome of the meeting was to develop a list of potential VE or scope changes, to be considered for inclusion in a revised cost estimate.

The list of reduced scope items for the Route 2 programme are summarised as follows:

- i) Removal of "Full Depth" road reconstruction of existing A12 dual 3 lane pavements, between junction 19 and junction 20a (Ch. 31,500m and Ch. 35,300m).
- ii) Removal of new junction 23 (Kelvedon south).
- iii) Review of the latest design considerations for all junction's earthworks quantities.
- iv) Reduction of overall imported fill materials by the use of borrow pits.
- v) Omission of River Ter Bridge widening.
- vi) Provision of a new WCH access bridge at junction 20b instead of the proposed online Wellington Bridge replacement at Hatfield Peverel.
- vii) Assumption that traffic management maximum length restrictions (6km) can be relaxed to allow greater concurrency of delivery of sections of online road improvements.

Further details on the reduced scope items which were agreed in the VE Meeting can be found in the Value Engineering Technical Note. Route 2 is referred to as Option 2 throughout the Value Engineering Technical Note, as per the naming convention from the 2017 assessment.

1.3 Purpose

The purpose of this technical note is to detail the proposal of removing junction 23 (Kelvedon south) from the scope of works and review the implications.

2. Existing Conditions

2.1 General

The existing junction 23 (Kelvedon South Interchange) is a grade separated interchange located to the south west of Kelvedon. The junction consists of only west facing slip roads between the A12 and London Road (B1024); there is an off-slip on the northbound carriageway and on-slip on the southbound carriageway. The existing A12 consists of a D2AP purpose road along this section. The existing A12 is carried over the southbound on-slip on the existing Cranes Bridge. Approximately 200m east of junction 23, the existing A12 is carried over the River Blackwater on the existing Ashmans Bridge. Figure 1 shows the arrangement of the existing junction 23.

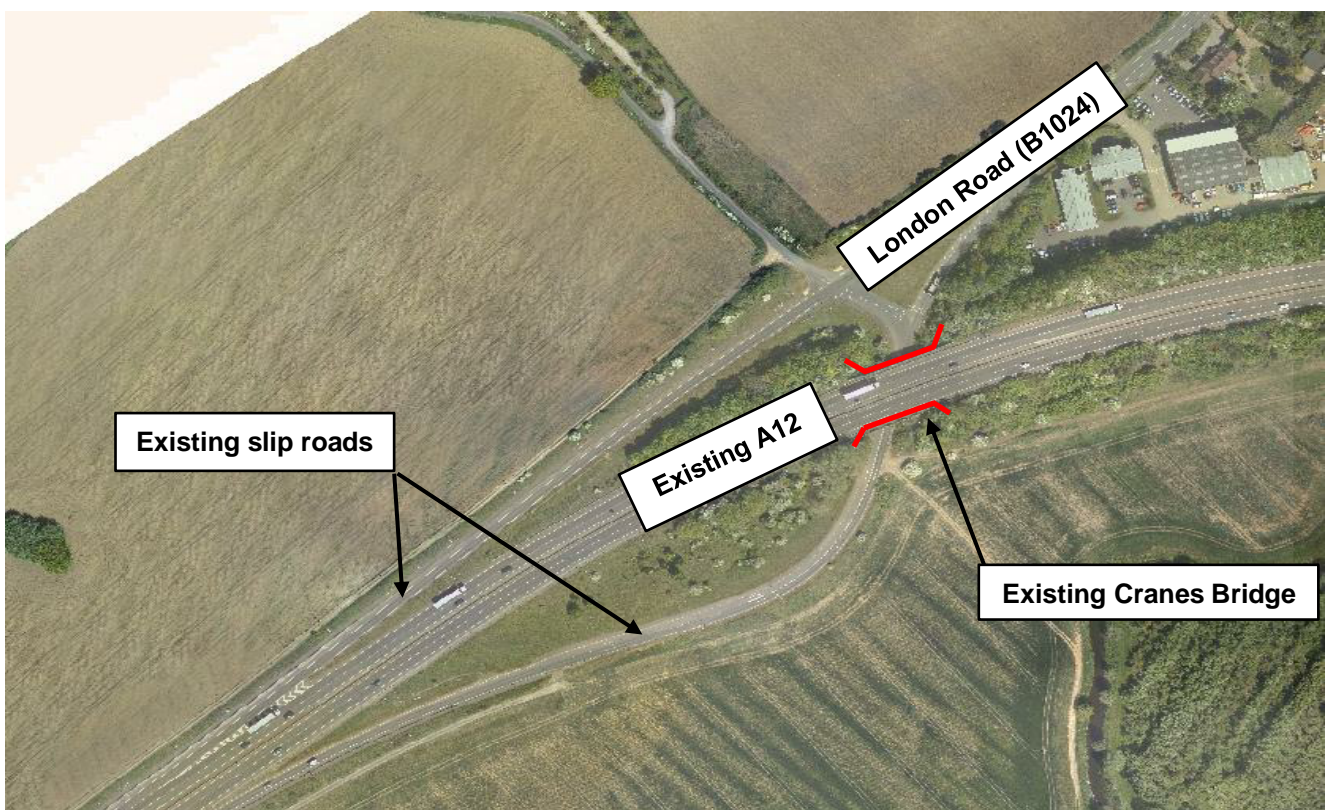


Figure 1: Existing Junction 23 Arrangement

2.2 Existing traffic information

The current congestion along the A12 in the AM and PM periods between each of the junctions from junction 19 to 25 is shown in Figure 2. In the AM period the northbound carriageway is operating near full capacity whereas the southbound carriageway is operating over capacity. In the PM period, the northbound carriageway is operating over capacity and the southbound carriageway is operating over capacity.

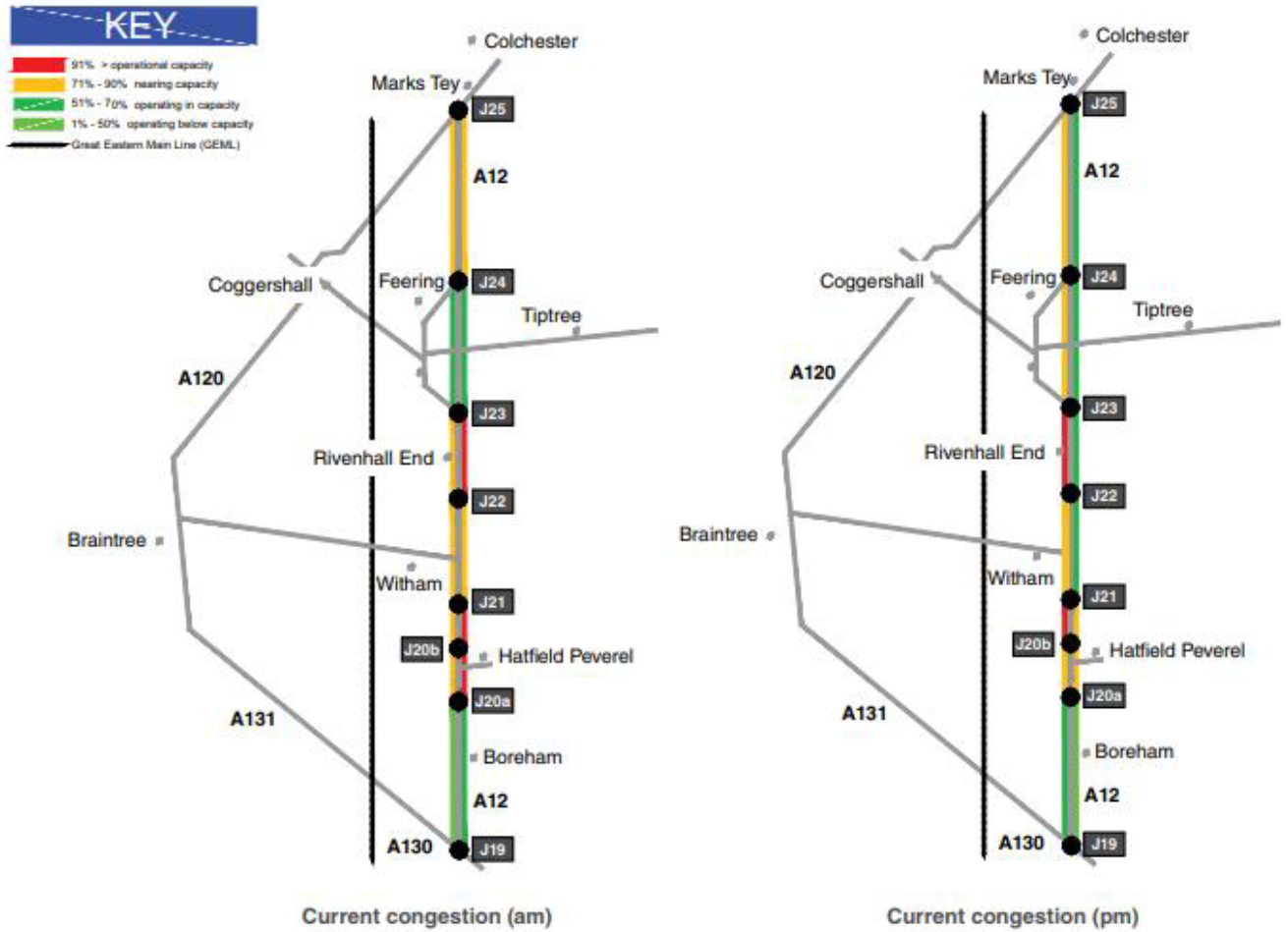


Figure 2: Existing A12 Congestion

The current traffic flows at junction 23 (average number of vehicles over 24 hours) show that there are approximately 8,250 vehicles using the junction which consists of 4,267 using the junction to leave the A12 and 3,983 vehicles using the junction to access the A12.

3. Junction 23 Removal Proposal

3.1 General

It is proposed for junction 23 (Kelvedon South) to be removed from the scheme, along with all associated junction works. This includes the proposed new junction overbridge, road pavement works, existing stats diversions, gantry signage, technology related to the junction 23, new culverts and drainage works, and environmental mitigation risk/cost.

The existing junction 23 will be demolished as part of the work, along with part of the old A12. Traffic seeking to access the A12 will be required to either utilise the proposed junction 22 via the de-trunked existing A12.

As part of the works it is proposed for the existing A12 to be retained and de-trunked for each of the routes. The Rivenhall junction is also to be retained, however a reduction in traffic on the de-trunked from A12 from the current situation should help to reduce the safety concerns with Rivenhall junction.

3.2 Local Access Roads

Due to the removal of junction 23 from the scope, a Local Access Road (LAR) between junction 22 and existing junction 23 would be required to provide a link between junction 22 and London Road (B1024) for access to and from Kelvedon, as previously the LAR would have tied into junction 23.

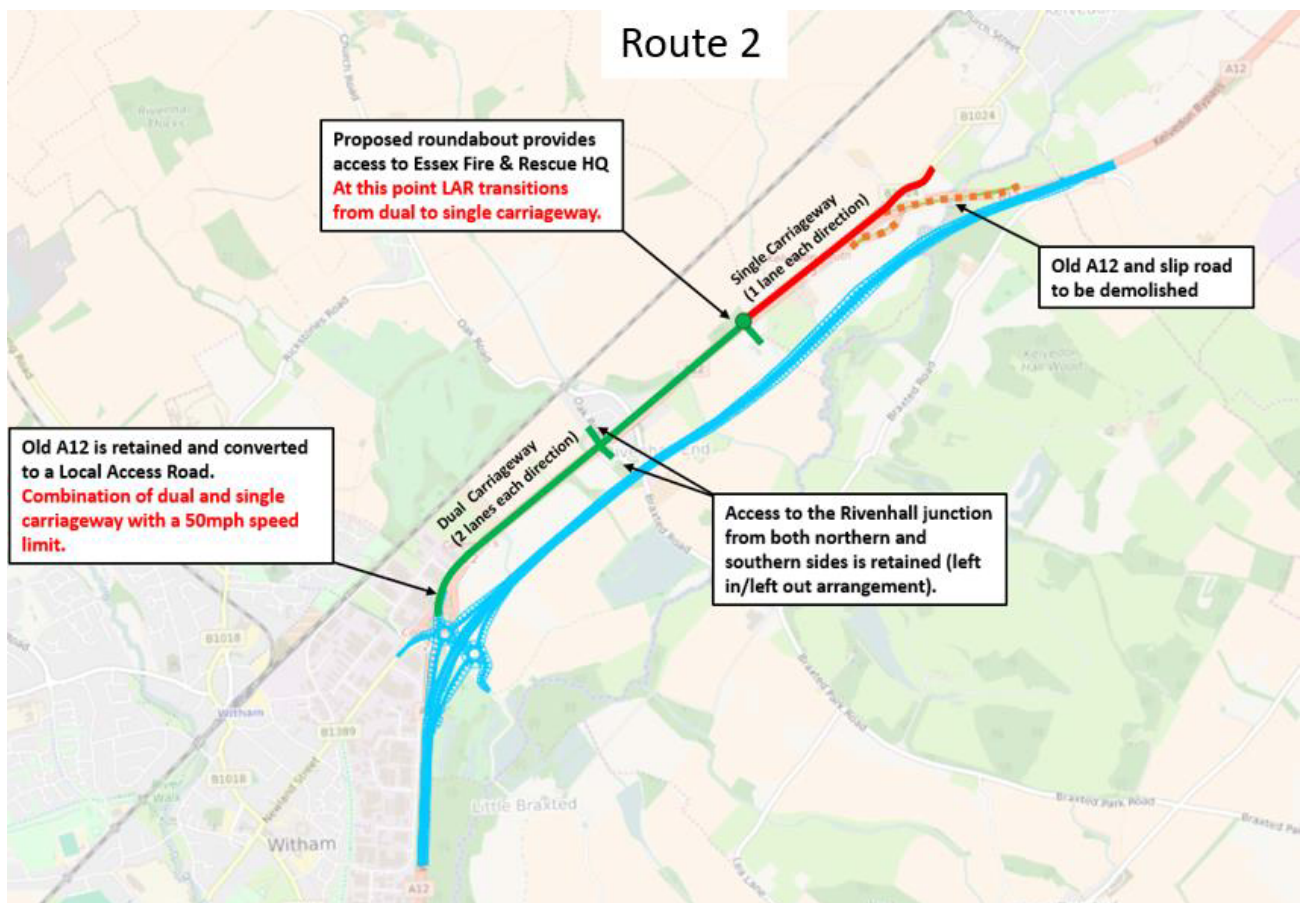


Figure 3: LAR arrangement with junction 23 removal

3.3 Passive Provision for A120

Essex County Council's recommended option for the A120 Braintree to A12 scheme involves the A120 joining the A12 at junction 23. Highways England has previously instructed Jacobs to allow for passive provision for the A120 Braintree to A12 scheme. The proposed A12 alignment allows for passive provision of the A120, as it leaves sufficient space between the road and adjacent constraints to enable a new junction 23 to be constructed in the future.

The development of the routes included designing the mainline with passive provision for junction 23. During the design development of the junction, three significant constraints were identified which affected the mainline and junctions. The first constraint was the existing Ashmans Bridge; the exit taper was designed to be 150m which is compliant with TD 22/06 Table 4/4, and the start of the exit taper for junction 23 was designed to be approximately 50m downstream of the existing Ashmans Bridge. The purpose of avoiding Ashmans Bridge was to ensure that excessive widening of the structure was not required. The other constraints included avoiding Hole Farm which is a Grade II Listed Building and providing access to the Essex County Fire & Rescue Service Headquarters. Although the routes do not include the provision of a new junction 23, this exercise ensured that a junction 23 could be constructed in the future.

4. Traffic Analysis

Two alternative traffic models have been developed to assess the performance of the A12 scheme: Route 2 (offline between junction 22 and 23) with an all movements dumbbell junction 23, and Route 2 with junction 23 removed. Note that neither of these scenarios include the A120 Braintree to A12 scheme.

This traffic modelling suggests that the removal of junction 23 from the A12 scheme will result in minimal adverse impact to traffic, particularly because relatively few vehicles would utilise the junction if it were built.

The removal of junction 23 results in an increase in traffic on the LAR and a reduction of traffic on the A12 compared to a scheme which includes junction 23, as shown in Table 1.

Table 1: Traffic figures for A12 (J22 – J23) Route 2 with/without junction 23 - AM and PM peak period 2027, vehicles per hour

Location	Route 2 (with junction 23)		Route 2 (without junction 23)	
	AM	PM	AM	PM
A12 (westbound)	4122	3273	3939	3045
A12 (eastbound)	3790	4079	3577	3887
LAR (westbound)	771	512	972	754
LAR (eastbound)	229	463	549	657

The removal of junction 23 results in an increase of traffic by approximately 200 - 250 vehicles on the LAR and a decrease of traffic by approximately 200 - 250 vehicles on the A12 in the AM and PM peak periods in 2027. This will mainly consist of vehicles accessing Kelvedon and the surrounding area using junction 22 and the LAR, instead of directly via junction 23.

In the 'Do Minimum' scenario where the A12 scheme is not built, there will be approximately 3000 vehicles using the A12 in each direction passing through Rivenhall End, in the AM and PM peak time periods in 2027. The amount of traffic passing through Rivenhall End on the LAR would be significantly lower than a 'Do Minimum' scheme, whether this includes junction 23 or not.

The removal of junction 23 does not have a significant effect on traffic in Kelvedon, there is a negligible difference (less than 10%) in traffic in Kelvedon between a scheme with junction 23 and a scheme without junction 23. There is also negligible difference (less than 10%) in traffic using Inworth Road between a scheme with junction 23 and a scheme without junction 23. A schematic of the two traffic models which includes traffic figures in Kelvedon and Inworth Road is included in Appendix A.

The impact of removing junction 23 on journey times for road users was also assessed. The impact on A12 through traffic (i.e. that wouldn't use junction 23 even if it exists) is extremely small: journey times between junction 21 and junction 24 are expected to increase by three seconds or less.

Journey times between junction 21 and Kelvedon were also assessed. If junction 23 is removed from the A12 scheme, the journey to Kelvedon via junction 22 and the LAR is around 30-40 seconds slower than the route via junction 23 would be. This reflects the fact that users must travel along a slower LAR rather than the 70mph A12.

Traffic modelling has not been undertaken to assess the impact of removing junction 23 on Route 1, as the differences in traffic models between Route 1 and Route 2 are marginal. The LAR arrangements are similar

between the options; the only difference being Route 1 consists of a single carriageway and Route 2 consists of a dual carriageway. As the differences in the traffic models is not significant, Route 1 without junction 23 is likely to perform similar to Route 2 without junction 23 from a traffic perspective

The traffic modelling undertaken primarily focusses on strategic traffic. The removal of junction 23 does result in a potential local issue relating to access to Essex Fire & Rescue HQ, this will be explored further during future design stages.

Overall, the traffic figures suggest that junction 23 is not required for the A12 scheme. Traffic movements can be resolved by junction 22 and the LAR.

5. Economic Assessment

An exact scheme cost for junction 23 is currently not available. However, it is assumed that the removal of junction 23 will save approximately £30 million, which is the scheme cost of a typical junction (excluding land acquisition costs, risk, inflation and VAT).

As described in Chapter 4, the removal of junction 23 would result in some small journey time increases to road users accessing Kelvedon. The effect that this has on the overall scheme benefits has therefore been assessed.

The majority of the scheme's benefits are due to journey time savings, which were assessed using TUBA software. Two alternative TUBA assessments were undertaken: one including junction 23, and one with junction 23 removed.

The journey time benefits of a scheme without junction 23 are approximately £10m (or 1.5%) lower than a scheme with junction 23 included.

Considering the changes to costs and benefits described above, it is unlikely that the removal of junction 23 from the A12 scheme would adversely affect the scheme's value for money. In fact, it is likely that the removal of junction 23 would result in a small increase in the scheme's Benefit to Cost Ratio.

6. Safety Assessment

Due to the change in scope of the A12 Junction 19-25, safety objectives are currently under review and are likely to be revised. However, these will still indicate that the 'Scheme improves road safety'.

Between the five year period 2012-2016, a total of six collisions were reported to have occurred at junction 23, consisting of one fatal collision and five slight collisions. The location of these collisions in relation to junction 23 are shown in Figure 3. Four occurred during 2014 and two occurred during 2016; albeit direction and description for the 2016 collisions are unavailable. The fatal collision recorded involved a single vehicle heading towards the A12 on-slip at junction 23 which lost control negotiating the nearside bend and collided with the road bridge. The collision occurred at 18:35 in June 2014, during daylight conditions with a dry road surface. This location also ranks 17th out of 29 collision hotspot locations between junctions 19 to 25.

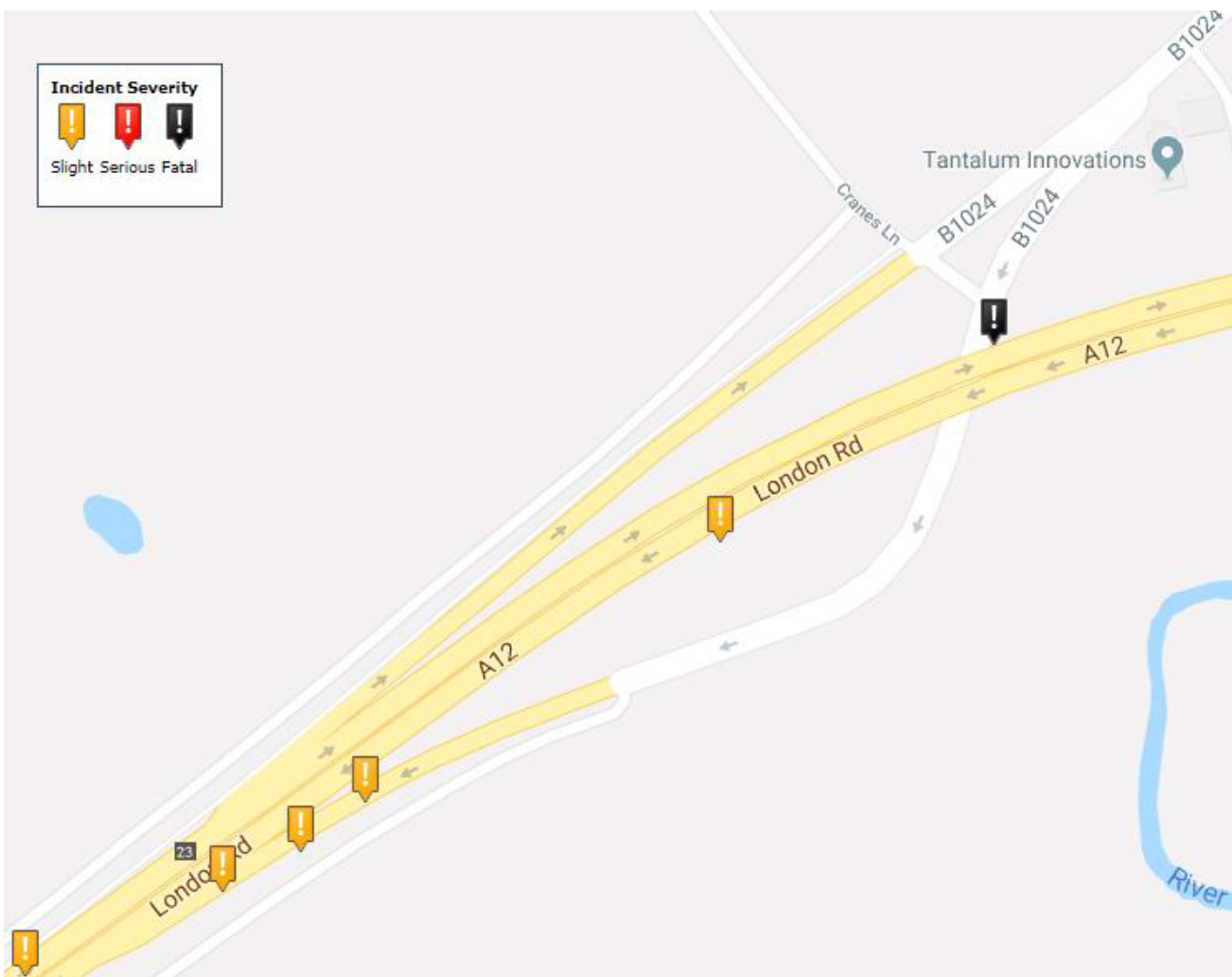


Figure 4: Reported collisions occurring at A12 junction 23 between 2012 – 2016 (Source: www.crashmap.co.uk/)

The removal of junction 23 can be expected to result in an improvement in safety on the new A12 due to the following:

- The removal of slip roads which eliminate the need for merge/diverge movements at this location
- Reduction in rear end shunt and avoiding action type collisions associated with vehicle movements at the slip roads

- There is approximately 2.5km between the existing junction 22 and existing junction 23, the removal of junction 23 would remove any potential weaving issues further along the link which may arise due to the close proximity of the two junctions.
- Reduction in collision risk associated with any at grade crossing movements by Walking, Cycling and Horse (WCH) users at the junction.

There is also an expected impact on road workers who will no longer be required to undertake maintenance on the slip roads, or the structural aspects and associated assets of the junction. This will aid in the overall objective that no-one should be harmed whilst using or working on the Strategic Road Network (SRN) and can be seen as a solution which limits risk to road workers to 'So Far As Is Reasonably Practical'.

7. Operational Assessment

The removal of junction 23 from the scheme's scope will affect a number of operational aspects. The main aspect will be the separation of local traffic movements from the SRN between Witham and Kelvedon. However, this will be offset against a reduction in resilience in the event of an incident which would allow traffic to bypass onto alternative routes. Although the current junction only provides a northbound off-slip and southbound on-slip, the removal of the junction will affect turn around ability for emergency services and winter maintenance operations which will need to be reviewed and revised accordingly. At present there is no Traffic Officer Service patrolling on the A12.

An additional aspect of the scheme is to provide WCH provision. By providing a LAR between Witham and Kelvedon, such provision will be diverted away from the SRN which will improve journey quality (reduced pollution and noise) and enhance safety for such road users (reduced speed limits).

The removal of the junction will also reduce the maintenance needs of the local Area Support Contractor significantly. The LAR can also be explored for providing safe off-network access, which would reduce the amount of traffic management closures required on the SRN and increase the amount of time lanes would be open to traffic.

Taken in isolation (not accounting for future developments and other scheme ambitions), from an operational perspective the removal of the junction can be expected to deliver several benefits which would outweigh any disbenefits resulting from the closure.

8. Environmental Assessment

The removal of junction 23 is likely to reduce the environmental effects associated with the routes. The junction would have significant landscape and visual effects, including on the setting on the Rivenhall Long Mortuary Enclosure Scheduled Monument and also on Hole Farmhouse Grade II* Listed Building (40m away from the junction). The Blackwater Valley has been identified as sensitive for landscape and ecology, so a smaller footprint is likely to have a lower impact on habitats and the landscape character. In addition, part of the footprint of the junction lay within land graded as Grade 2 under the Agricultural Land Classification and also areas identified as potential minerals.

The removal of the junction is unlikely to make net traffic through Rivenhall End significantly worse, as it would just change where the traffic was distributed (either on the A12 or the LAR) as detailed in Chapter 4. However, the traffic assessment has indicated that the removal of junction 23 does not have a significant effect on traffic in Kelvedon and that there is a negligible difference (less than 10%) in traffic in Kelvedon between a scheme with junction 23 and a scheme without junction 23. A schematic of the two traffic models which includes traffic figures in Kelvedon and Inworth Road is included in Appendix A. If traffic flows are not changing significantly, this may indicate that noise impacts are unlikely to be significant. This will need to be assessed further in PCF Stage 3.

9. Construction Assessment

9.1 Construction Programme

The removal of junction 23 has a considerable impact on the construction programme, there is a saving of approximately 100 days (five months) on section 2 of the project.

This removal of this item from the scope will result in an approximate saving of 450,000m³ imported fill based on typical junction figures.

The removal of junction 23 also reduces the footprint of the works in this location and reduces the amount of work to do in the proximity of the flood zone area of the River Blackwater and so reduces the risk of delays due to effects of inclement weather or flood events.

9.2 Phasing

The removal of junction 23 will have an impact on phasing, particularly on the construction of the A12 bypass between junction 22 and 23. A proposed junction 23 would have been utilised for traffic management from the existing A12 to the new A12. A new phasing strategy will need to be investigated in PCF Stage 3.

10. Stakeholder

Between 23rd January and 3rd March 2017 Highways England consulted on four routes for the A12 Chelmsford to A120 Widening scheme. The A12 Chelmsford to A120 Widening scheme Summary Report produced independently by Dialogue by Design provides further information.

Members of the public were consulted on their views on the need to improve junctions between junction 19 and 25. Approximately 49% of the responses were that improvements were not needed to junction 23, and 51% of responses were that improvements were needed.

The consultation showed that the primary concern of those that responded was that the current single direction arrangement contributes to congestion in the village of Kelvedon. Some of the other main reasons expressed for improving junction 23 are listed below:

- Safety/accidents at the junction
- Poor visibility
- The speed of cars exiting the A12
- Poor signage

In addition, since the consultation Essex County Council has announced their “recommended route” for the A120 improvements. While this option will be subject to further assessments, if their route was to progress it would join the A12 at junction 23. As such, in conversations with the council, it has expressed a clear preference that proposals for junction 23 do not prevent the A120 improvements from proceeding.

The removal of junction 23 from the scheme will not impact on the A120 proposals as the proposed A12 alignment allows for passive provision of the A120 and allows as it leaves sufficient space between to enable a new junction 23 to be constructed in the future.

11. Cost Estimate

It is assumed that the removal of junction 23 will save approximately £30 million, which is the scheme cost of a typical junction (excluding land acquisition costs, risk, inflation and VAT).

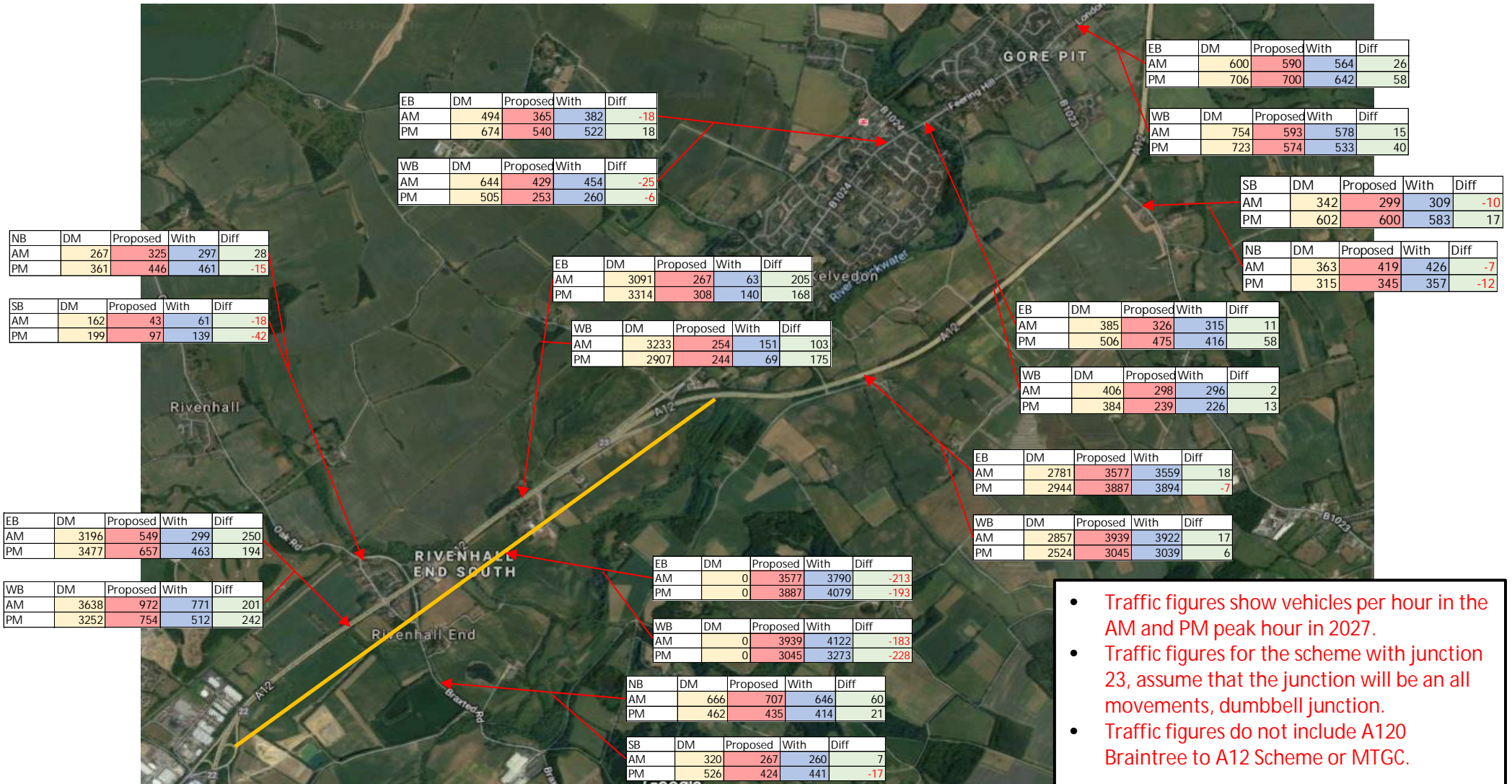
12. Conclusion

In summary, it is proposed for junction 23 to be removed from the scheme as a result of VE. As detailed in this technical note, the removal of the junction is unlikely to have significant adverse impacts on traffic, economics and safety. Traffic modelling undertaken primarily focusses on strategic traffic. However, the removal of junction 23 does result in a potential local issue relating to access to Essex Fire & Rescue HQ, Engagement with Essex Fire & Rescue HQ will be carried in the future and this will be taken into consideration during future PCF Stages.

The removal of junction 23 will however result in benefits to the scheme including a reduction in adverse environmental impacts and addresses concerns raised by stakeholders in the public consultation held in 2017. Lastly, the removal of junction 23 will provide significant cost savings to the scheme.

The A12 scheme without junction 23 will be taken forward into PCF Stage 3 as the proposed solution.

Appendix A. Traffic Figures (Do Minimum and Route 2 with/without junction 23)



- Traffic figures show vehicles per hour in the AM and PM peak hour in 2027.
- Traffic figures for the scheme with junction 23, assume that the junction will be an all movements, dumbbell junction.
- Traffic figures do not include A120 Braintree to A12 Scheme or MTGC.

Appendix C. J22 to J23 Local Access Road Technical Note

Project:	A12 Chelmsford to A120 Stage 2	No:	HE551497-JAC-HGN-3_S0-TN-CH-0004
Subject:	J22 TO J23 LOCAL ACCESS ROAD TECHNICAL NOTE		
Prepared by:	S. HOWE	Date:	03/01/20
Checked by:	R. MONAGHAN	Date:	03/01/20
Approved by:	D. THOMPSON	Date:	06/01/20

Introduction

The A12 Chelmsford (junction 19) to A120 (junction 25) scheme aims to improve the accessibility and linkage between the regional towns of Essex and London, with the significant growth being projected in the region. The scheme will aim to relieve traffic congestion on the A12 by increasing the capacity to Dual Three Lane All Purpose (D3AP) and improving the flow of traffic.

Following the removal of junction 23, as described in the Junction 23 Removal Technical Note, the local access road (LAR) between junction 22 and the area of junction 23 takes on added importance, as it will be the main access into the village of Kelvedon, Rivenhall End and the Essex County Fire and Rescue Headquarters (HQ) from the south. As such, this technical note presents a strategy which has been developed to allow further assessment into the operation of the LAR. Figures showing the LAR arrangement for each of the options can be found in Appendix A and B at the end of this technical note.

All proposals presented represent a proof of concept design used to assess the operation of the LAR following the removal of junction 23. However, the proposals require agreement with Essex County Council and other key stakeholders. Furthermore, additional assessment will be undertaken through the subsequent PCF stages.

Option 1

Option 1 involves widening the existing A12 to D3AP within the existing corridor. This option also involves converting some of the existing A12 northbound carriageway to a single carriageway LAR running parallel to the existing A12. A partial new section of LAR would be constructed to the north of the A12, east of Essex Fire & Rescue HQ up to the B1024 to accommodate the mainline alignment. A separation of 10m is proposed between the edge of pavements of the A12 and LAR, however, this can be refined through further design work. The LAR would consist of a single carriageway for the entire length, with a proposed speed limit of 50mph (subject to further assessment) throughout which would eventually become 30mph on B1024, to match the existing speed limit on the approach to Kelvedon.

The new section of LAR would be a single carriageway road with a design speed of 100B. For the new section of LAR, the vertical profile is to tie in to the existing vertical profile of the A12 and B1024 with a minimum gradient of 0.5%. The new section of LAR would have a standard cross-section for a rural all-purpose single carriageway as outlined in TD 27/05.

The at grade T-junction to access Rivenhall junction via Oak Road would be retained on the northern side of the junction, however access on the southern side of the junction would be removed, as it would be made impassable by the provision of the new A12.

Access could be provided to Essex Fire & Rescue HQ via a new road which would go over the A12 and tie into a new roundabout on the LAR. The access road would have a design speed of 30kph. The cross section is to consist of a 7.3m carriageway with 2m verges either side. The maximum gradient of the road is to be 4% and assumed distance of 8m between road level of A12 and LAR. The overbridge lies 500m from Hole Farmhouse (Grade II* Listed Building) and could have impacts on the setting of this designated site. Alternative options to this access arrangement would need to be explored and discussed with Essex County Council and Historic England during Stage 3.

Option 2

Option 2 consists of a new offline bypass between junction 22 and 23, it would leave the existing corridor at junction 22 and create a new three lane bypass to the south of the existing A12, running in parallel with the existing A12, and would re-join the existing corridor near Highfields Overbridge.

The existing A12 is to be retained and used as a LAR, the LAR would consist of D2AP dual carriageway for the majority of its length. A roundabout is proposed near Essex Fire & Rescue HQ, the LAR would consist of a dual carriageway up until the roundabout and single carriageway beyond, tying into B1024. A separation of 10m is proposed between the edge of pavements of the A12 and LAR however, this can be refined through further design work. The LAR would consist of a proposed 50mph speed limit (subject to further assessment), which would eventually become 30mph on the B1024, to match the existing speed limit on the approach to Kelvedon..

Rivenhall junction is to be retained, with access to the junction on both the northern and southern side via a left in/left out arrangement. There is potential to construct a new roundabout or crossroads at the junction, which would provide access to both carriageways from both the north and south of the junction. This is a benefit for traffic accessing or leaving the northbound carriageway on the LAR, to or from the southern side of the junction, as they would not be required to travel through the village of Rivenhall End to do so. This may also reduce delays on Oak Road, as it would allow traffic travelling south to use the southern arm of junction as opposed to travelling on Oak Road. This will be investigated further at stage 3.

Access could be provided to Essex Fire & Rescue HQ via a new road which would go over the A12 and tie into a new roundabout on the LAR. The access road is to have a design speed of 30kph. The cross section is to consist of a 7.3m carriageway with 2m verges either side. The maximum gradient of the road is to be 4% and assumed distance of 8m between road level of A12 and LAR. The overbridge lies 500m from Hole Farmhouse (Grade II* Listed Building) and could have impacts on the setting of this designated site. Alternative options to this access arrangement would need to be explored and discussed with Essex County Council and Historic England during Stage 3.

Conclusion

The impact on the LAR by each option is a key area for assessment and will have an influence on the selection of the preferred route. The LAR has an influence on the performance of the network, some of the critical areas are assessed in the Junction 23 Removal Technical Note.

Following the confirmation of the preferred option, further options and design development of the LAR and access to Essex Fire & Rescue HQ will take place in PCF Stage 3. Following the Preferred Route Announcement, there will be engagement with relevant stakeholders including Essex Fire & Rescue and Historic England, feedback will be considered during future design

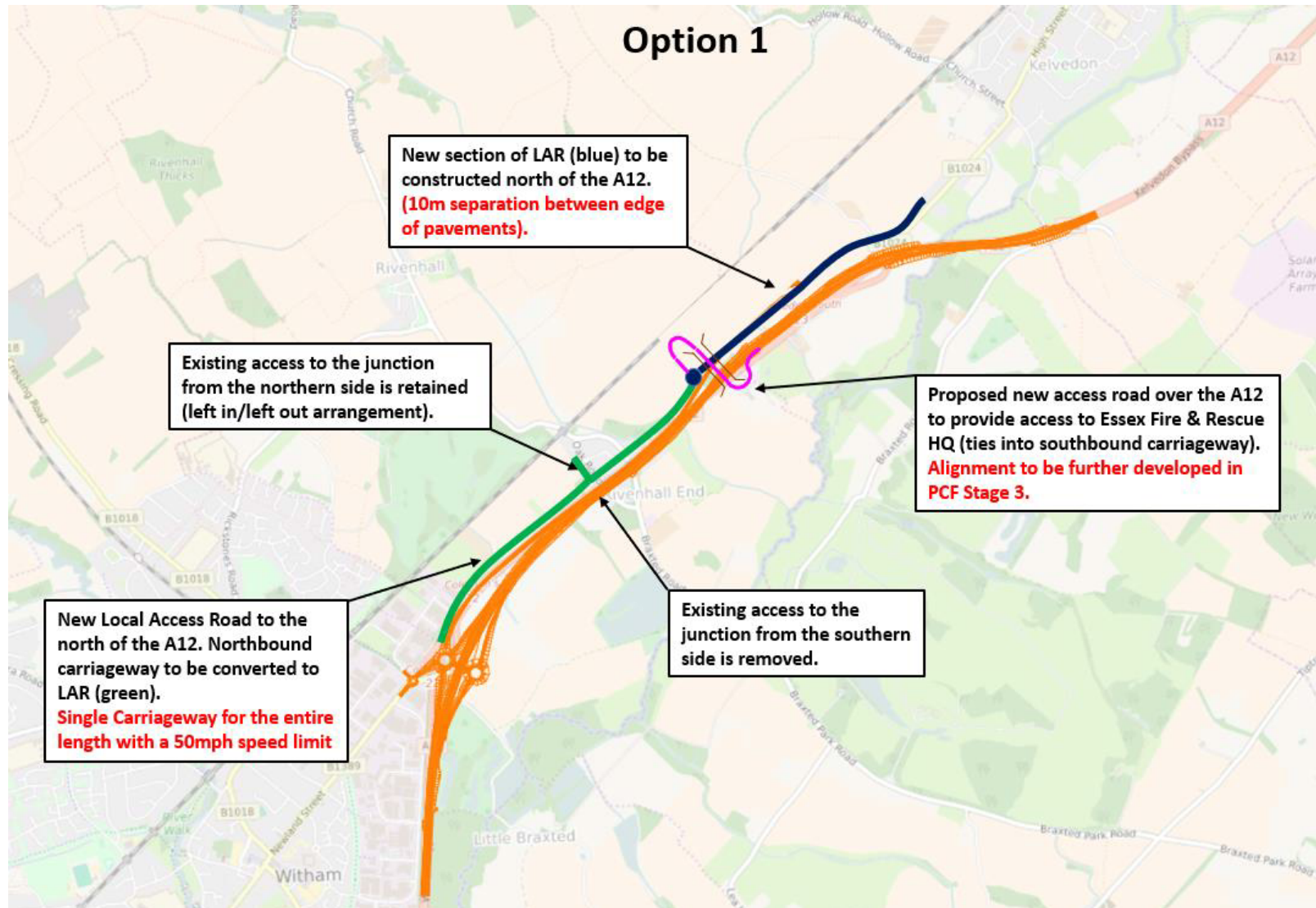
Technical Note

(Continued)

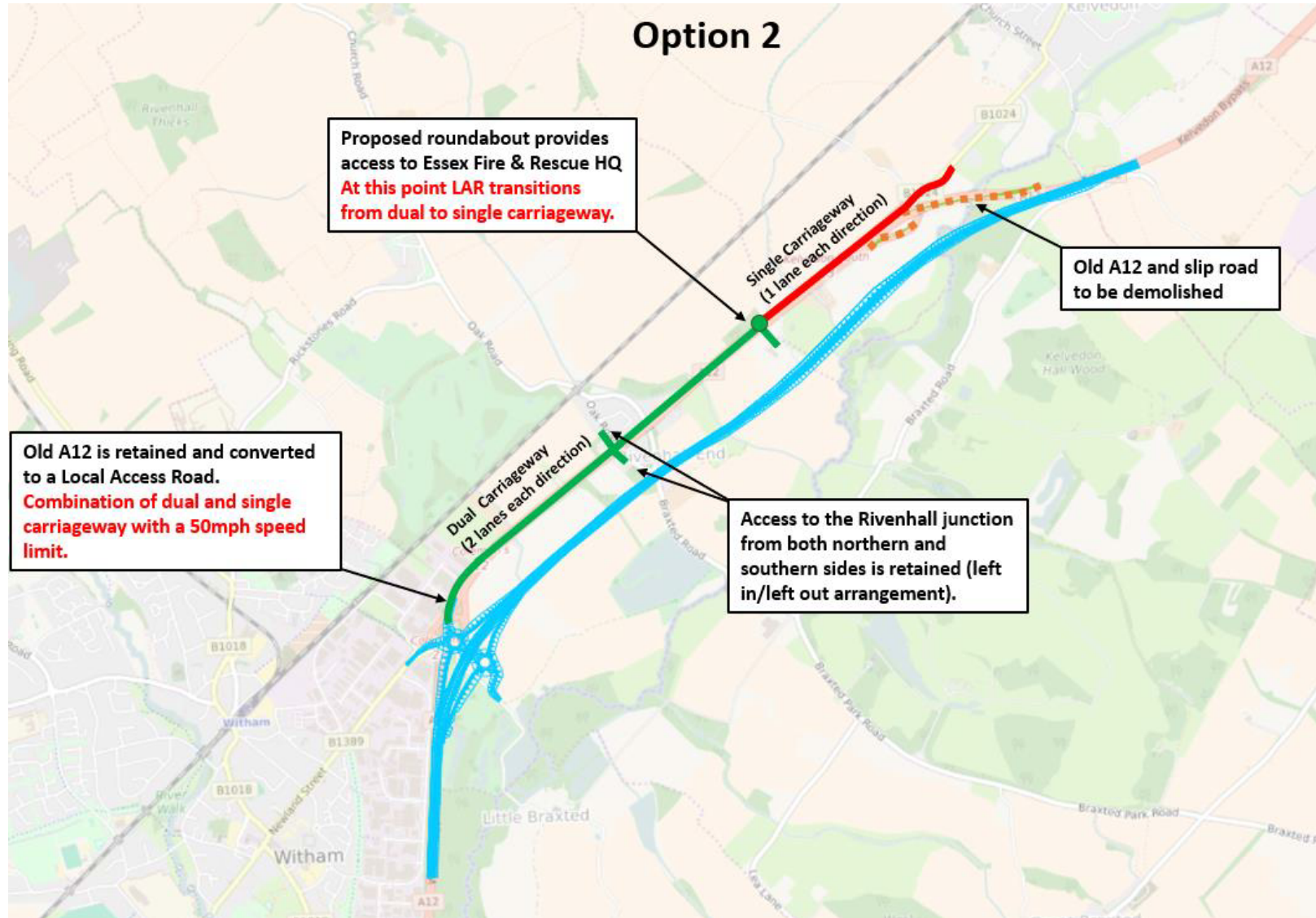
Page 3 of 5

development in PCF Stage 3. In addition, further detailed traffic modelling of the A12 and LAR through Rivenhall End will also take place during PCF Stage 3.

Appendix A: Option 1 Local Access Road Arrangement



Appendix B: Option 2 Local Access Road Arrangement



Appendix D. J24 Junction Strategy Technical Note

J23

Project:	A12 Chelmsford to A120 Widening scheme	
Doc No:	HE551497-JAC-HGN-S3_J24-TN-C-0001	
Subject:	JUNCTION 24 STRATEGY TECHNICAL NOTE	
Revision No.	P01	
Prepared by:	P. CUNNIFFE	Date: 24/07/20
Checked by:	M. PELAEZ	Date: 24/07/20
Reviewed by:	R. MONAGHAN	Date: 24/07/20
Approved by:	R. CARMONA	Date: 24/07/20

1. Introduction

This Technical Note details the work that has been carried out on junction 24, as part of the junction refinement exercise to confirm junction proposals ahead of Project Control Framework (PCF) Stage 3 on the A12 Chelmsford to A120 Widening Scheme.

Several next steps were recommended for each of the respective junctions in the junction strategy refinement exercise undertaken in Spring 2020, these have formed the basis of the refinement which has been carried out on junction 24.

The junction strategy refinement exercise recommended investigation of junction 24 Option D which is located on Inworth Road. Subsequently, through development and investigation, this option was dismissed in favour of Option E and Option F which were developed to address the unfavourable impacts of Option D. Option E and F, which are located west of Inworth Road, were then investigated further and scored together with the PCF Stage 2 Junction 24 Option in a multidiscipline workshop. As a result of the scoring workshop and further work to address any other factors, Option F has been recommended as the preferred option to be included in the Preferred Route Announcement (PRA) and taken forward to PCF Stage 3. Full details of this process and the factors leading to this decision are provided in this technical note.

2. Recommended Option

The initial junction strategy refinement exercise recommended junction 24 Option D, as shown in Figure 1, for further design development. Option D is relocated south of the existing junction 24 on Inworth Road.

The junction design consists of an all movements dumb-bell layout utilising the existing Park bridge to connect the roundabouts under the proposed A12. This option was intended to address a desired direct connection to Inworth Road and was expected to promote right traffic in the right road, reduce traffic on cross-country route and provide economic benefits to the scheme through journey time reductions achieved by being more attractive to traffic from Tiptree.

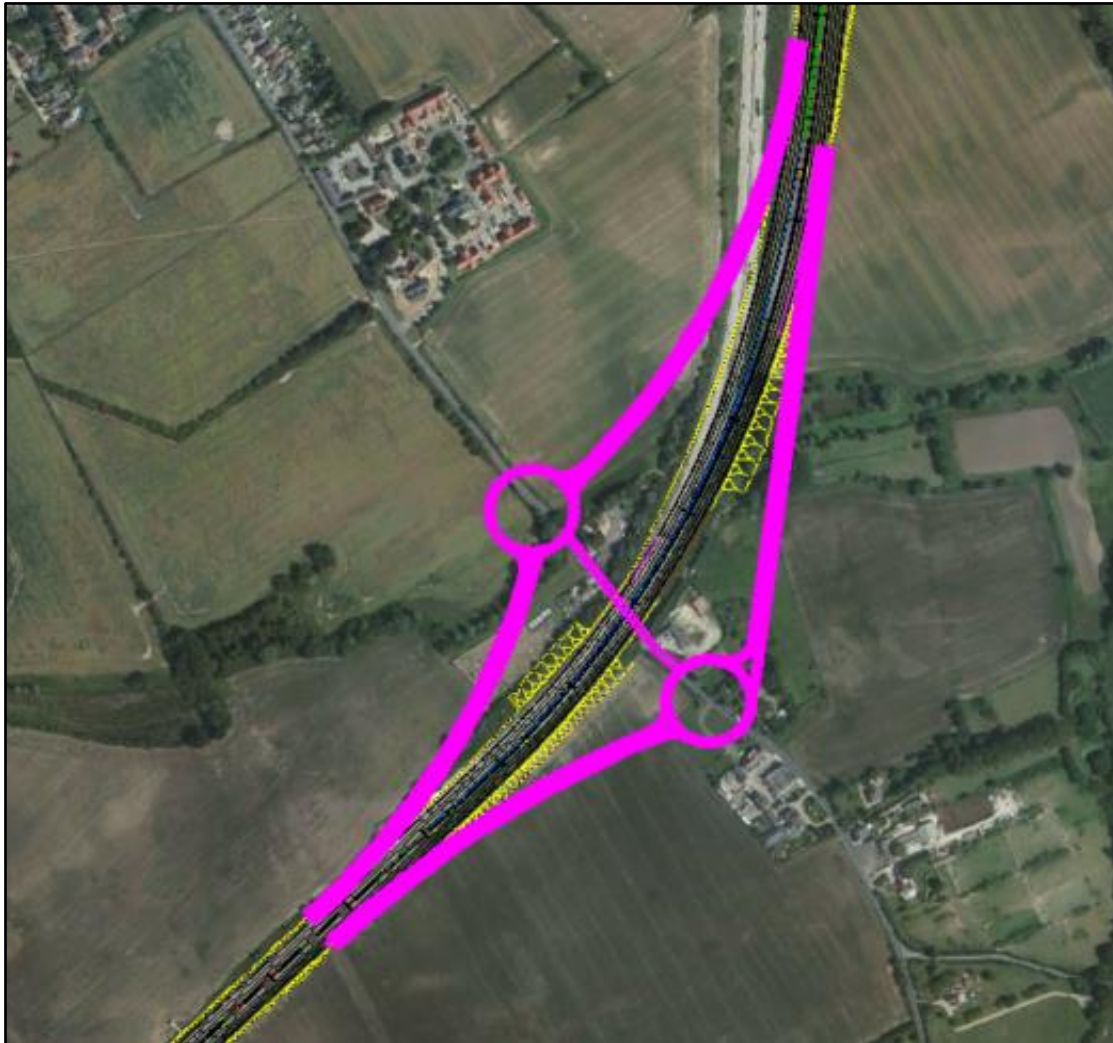


Figure 1: Indicative Junction 24 Option D

The Junction Strategy Refinement Technical Note recommended several next steps for Option D to be carried out prior to the start of Stage 3.

3. Option D - Detailed 3D Geometrical Modelling

Prior to detailed 3D geometrical modelling, existing constraints at this location were identified and taken into consideration for the junction design. The constraints identified are detailed below and discussed in further detail in Section 5.

- Inworth Road – The existing road is a narrow single carriageway road with a gradient of approximately 6% or higher in places.
- Existing properties – There are a number of existing properties on Inworth Road which are likely to be adversely impacted by this option and may require demolition. This includes residential properties and businesses.
- Flood Plain – Flood zones 2 and 3 cross Inworth Road and the existing A12 at this location. Therefore, part of the junction may be located within the flood plain.
- Existing culvert – There is an existing culvert beneath the existing A12 which carries the Domsey Brook river.
- Crown Estate land - Located to the east and west of the existing A12, the junction is likely to be positioned within this land and will result in impact.

Detailed 3D geometrical modelling of the junction has been undertaken using AutoCAD Civils 3D as shown in Figure 2. The design of the junction option underwent some changes due to the presence of existing constraints as detailed below:

- Slip roads are designed to standard and therefore are more representative of design requirements.
- Roundabouts on Inworth Road are in cutting to achieve 2% gradient as dictated by DMRB CD 116.
- The northern roundabout has shifted slightly to the north to avoid being located within the flood plain. Only the north facing slips now cross the flood plain.
- The southern roundabout has shifted slightly to north to reduce impact on existing properties on Inworth Road and to optimise the slip road vertical alignment.



Figure 2: Junction 24 design

4. Option D Junction Capacity

The first phase of the junction strategy refinement exercise recommended that a microsimulation model of junction 24 Option D would be required to ensure junction capacity. As such, microsimulation modelling using Vissim software was undertaken to ensure adequate

junction capacity would be provided and identify if any mitigation measures would be required to achieve desired capacity at the junction.

An initial microsimulation model was developed, which demonstrated significant queuing on Inworth Road on both approaches to the junction in the AM and PM peaks. This was primarily due to inadequate capacity on the junction, as the link between the two roundabouts consists of a single lane in each direction.

Following this, a refined microsimulation model was also developed to address the issues of queuing on Inworth Road, which consisted of two lanes in each direction on the link between the two roundabouts, in addition to other mitigation measures such as two lanes on approaches to the junction. This model resulted in an improvement in the performance of the junction and resolved issues with queuing on Inworth Road. However, the implementation of those mitigation measures would result on Park Bridge being demolished and re-built instead of reuse, as originally intended.

An additional microsimulation model was also developed, which consisted of an alternative compact signalised junction on Inworth Road, as shown in Figure 3. The layout involved the removal of roundabouts, the provision of signalised cross roads and one lane in each direction on Inworth Road. This model also demonstrated an improvement in the performance of the junction and resolved issues with queuing on Inworth Road. However, the highways team found this layout unfavourable as a dumbbell junction layout is preferred as roundabouts provide more capacity as well as potential to provide additional capacity in the future if required. Therefore, this option was dismissed

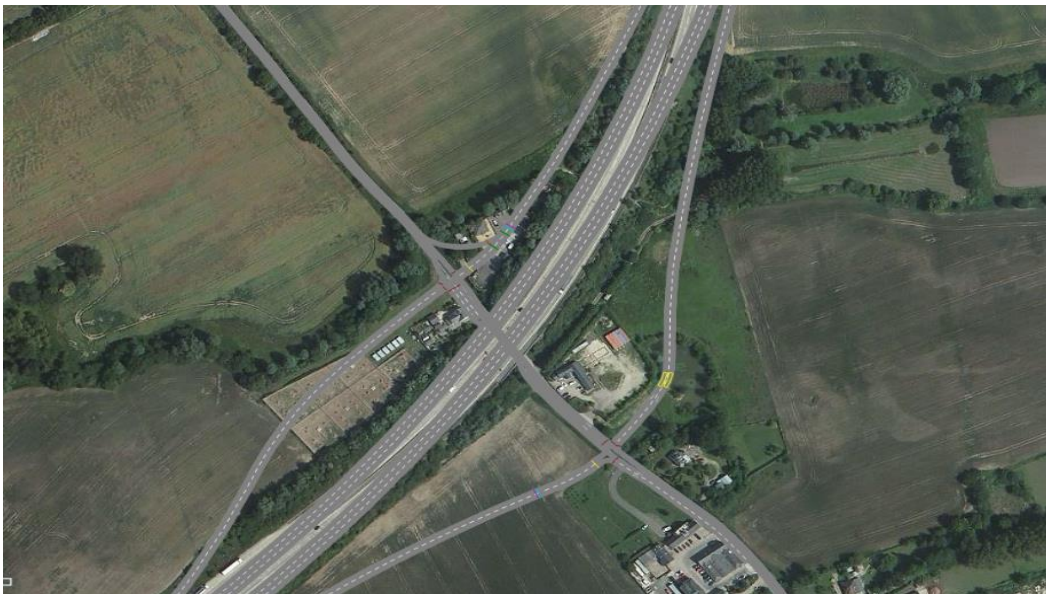


Figure 3: Compact Signalised Junction on Inworth Road

5. Option D - Technical Challenge Investigation

As recommended by the Junction Strategy Refinement Technical Note a further technical challenge investigation was carried out to assess the potential technical challenges with Option D due to the presence of existing constraints. The existing constraints are shown on Figure 4.

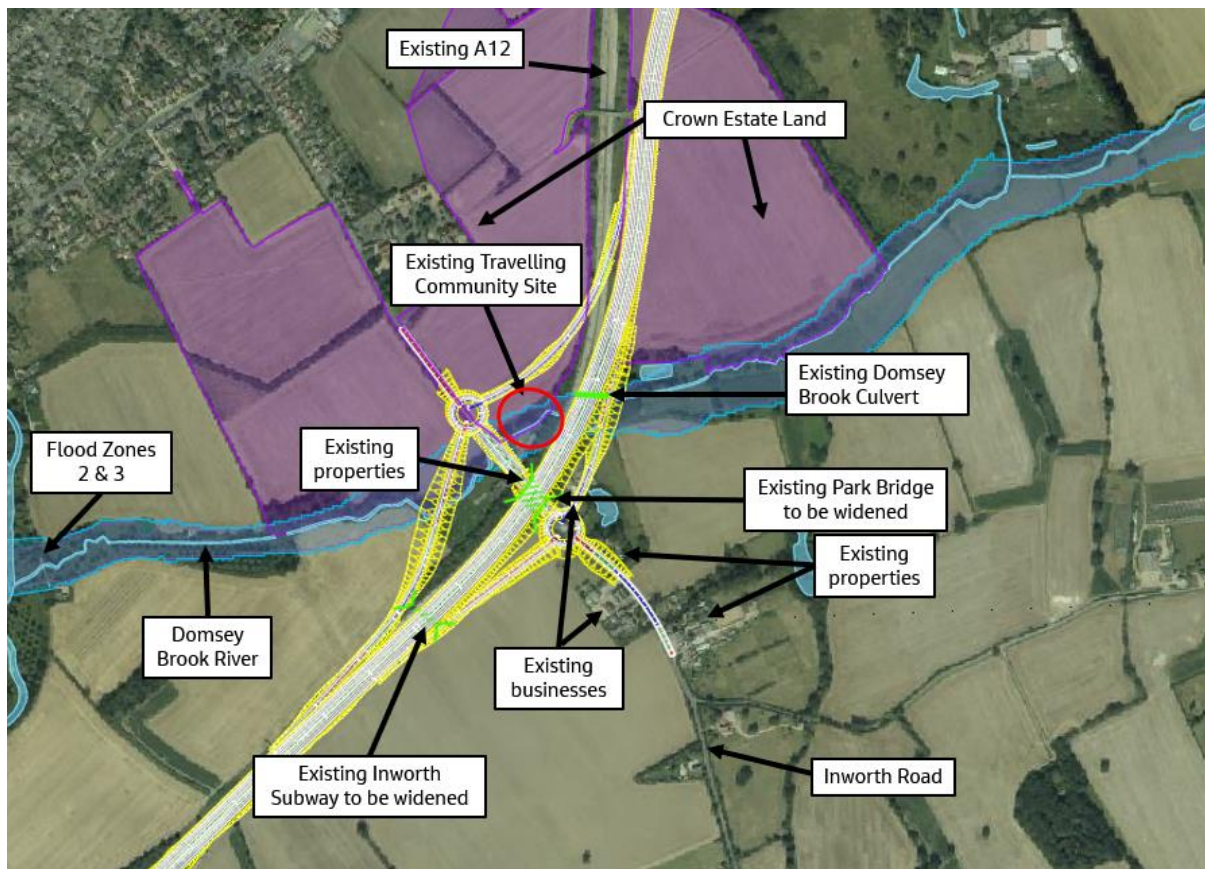


Figure 4: Existing constraints and affected stakeholders identified during the technical challenge investigation around junction 24 Option D.

A number of the constraints shown on Figure 4 result in significant technical challenges with locating junction 24 on Inworth Road as intended with Option D. The technical challenges are described below:

- **Park Bridge:** Park Bridge is an existing underbridge which carries the existing A12 over Inworth Road. The current proposals assume that Park Bridge will be widened to accommodate the widened A12 which would consist of three lanes in each direction over Inworth Road. Inworth Road will need to be widened to two lanes in each direction to provide adequate capacity for junction 24 Option D. As a result, this would require a new underbridge to accommodate the widening of Inworth Road. This will result in substantial cost implications to the A12 scheme and challenges during construction
- **Inworth Road:** Inworth Road passes beneath the existing A12 and poses technical challenges due to the existing road geometry. Inworth Road is very narrow and consists of one lane in each direction and no adjacent WCH facilities. Inworth Road will need to be widened to two lanes in each direction to provide adequate capacity for junction 24 Option D. Furthermore, Inworth Road is considered to be a fairly steep road and would pose some technical challenges with connecting slip roads from Inworth Road to the proposed A12 with junction 24 Option D.
- **Properties and businesses on Inworth Road:** There are a number of existing properties and businesses located along Inworth which are impacted by junction 24 Option D, and

it is likely that these properties and businesses would require acquisition and demolition to accommodate the junction.

- **Domsey Brook River:** The Domsey Brook River passes across the existing A12. The junction 24 Option D eastbound off slip passes over the Domsey Brook River and would require an additional structure. This will have additional cost implications to the A12 scheme.
- **Flood Zones 2 & 3:** Flood zones 2 and 3 pass across Inworth Road and the existing A12. Part of junction 24 Option D is located within the Flood Zones 2 and 3. This would require further assessment to assess the impact on the flood zones and may require additional flood compensation areas to mitigate against the loss of floodplain areas. This may have additional cost implications to the A12 scheme.
- **Existing Inworth Subway:** Additional widening of the Inworth Road Subway will be required to accommodate the widened A12 and junction 24 Option D slip roads, which will result in additional cost implications to the A12 scheme.
- **Travelling Community Site:** There is an existing site understood to be a Travelling Community Site located adjacent to Inworth Road. Travelling Community Sites have similar rights to homeowners and would be subject to home loss payment if acquisition of the site is required to accommodate the junction.
- **Crown Estate Land:** Land to the east and west of the existing A12 is owned by Crown Estate. It may be difficult to acquire the land from Crown Estate to accommodate the junction and may also have additional cost implications to the A12 scheme.

6. Dismissing Option D

As described above the VISSIM model for Option D demonstrated significant queuing on Inworth Road on both approaches to the junction in the AM and PM peaks, primarily due to inadequate capacity on the junction, as the link between the dumbbell roundabouts consists of a single lane in each direction.

Mitigating this capacity issue requires the provision of two lanes in each direction on the link between the dumbbell roundabouts on Inworth Road and two lanes on approaches to the junction. The mitigation measures investigated were found to improve the performance of the junction but would require the demolition and reconstruction of Park Bridge and would impact on the surrounding properties.

An alternative layout on Inworth Road was also investigated to mitigate the inadequate capacity highlighted by the Vissim model. This took the form of a compact signalised junction on Inworth Road. However, this layout was dismissed following investigation from the highways team.

There are significant technical challenges with providing the mitigation measures mentioned above due to the presence of existing constraints as detailed in Section 5. It is considered that there will be substantial cost implications to resolve these technical challenges and provide

the mitigation measures. As a result, junction 24 Option D was dismissed as a junction on Inworth Road was found to be unfeasible.

7. Dismissing Option A

Option A was suggested for further investigation in the Junction Strategy Refinement Technical Note. As shown in Figure 5, this option is a modification to the PCF Stage 2 Junction 24 Option, introducing an additional arm linking the western dumbbell roundabout to Inworth Road.

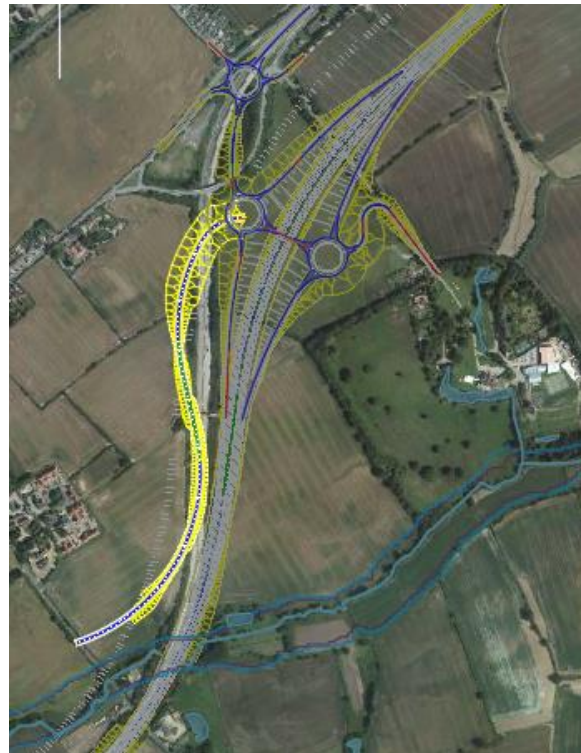


Figure 5: Junction 24 Option A.

Option A was modelled in Civil 3D. However, further investigation found it was expected to be less attractive for traffic than a junction closer to Inworth Road, it required additional crown estate land take, increased the earthwork fill requirement and increased overall cost compared to the PCF Stage 2 Junction 24 Option. As such this option was dismissed

8. Further junction 24 Options near Inworth Road

While technical challenges and constraints resulted in Option D being unfavourable, there was a desire to find a junction that maintained the benefits Option D but minimised the challenges. Option D met the stakeholder preference for a direct link to Inworth Road, reduced the impact on Prested Hall and was expected to promote right traffic in the right road and provide economic benefits to the scheme through journey time reductions achieved by being more attractive to traffic from Tiptree. To achieve this two junction Options were investigated West of Inworth Road.

9. Junction 24 Option E

Option E, as show in Figure 6, consists of an all movements dumb-bell layout passing under the A12 west of Inworth Road. The option has links proposed from the northern roundabout to Inworth Road and from the south roundabout to Inworth Road. A structure will be required to take the northern link to Inworth Road over the Domsey Brook. An accommodation Bridge will be required to maintain access to Prested Hall. An initial construction cost estimate of approximately £20m was produced for Option E, this is a high-level order of magnitude cost estimate for comparison purposes. The cost estimate does not include any allowance design fees, employers costs, land; environmental mitigation, risk allowance, optimism bias and inflation.

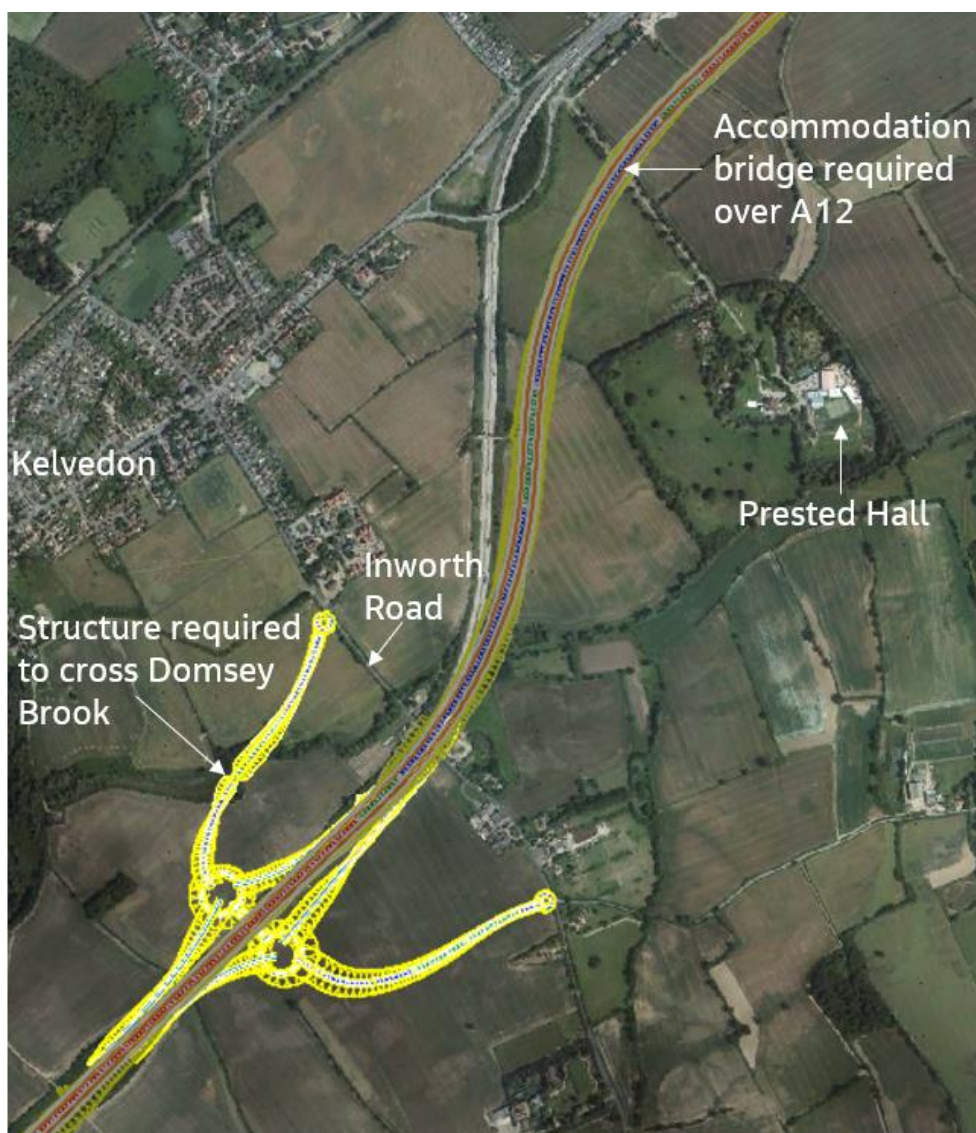


Figure 6: Junction 24 Option E

10. Junction 24 Option F

Option F, as shown in Figure 7, consists of the same layout as Option E but only has a link to Inworth Road from the southern roundabout. An accommodation Bridge will be required to maintain access to Prested Hall. An initial construction cost estimate of approximately £18m was produced for Option E, this is a high-level order of magnitude cost estimate for comparison purposes. The cost estimate does not include any allowance design fees, employers costs, land; environmental mitigation, risk allowance, optimism bias and inflation.

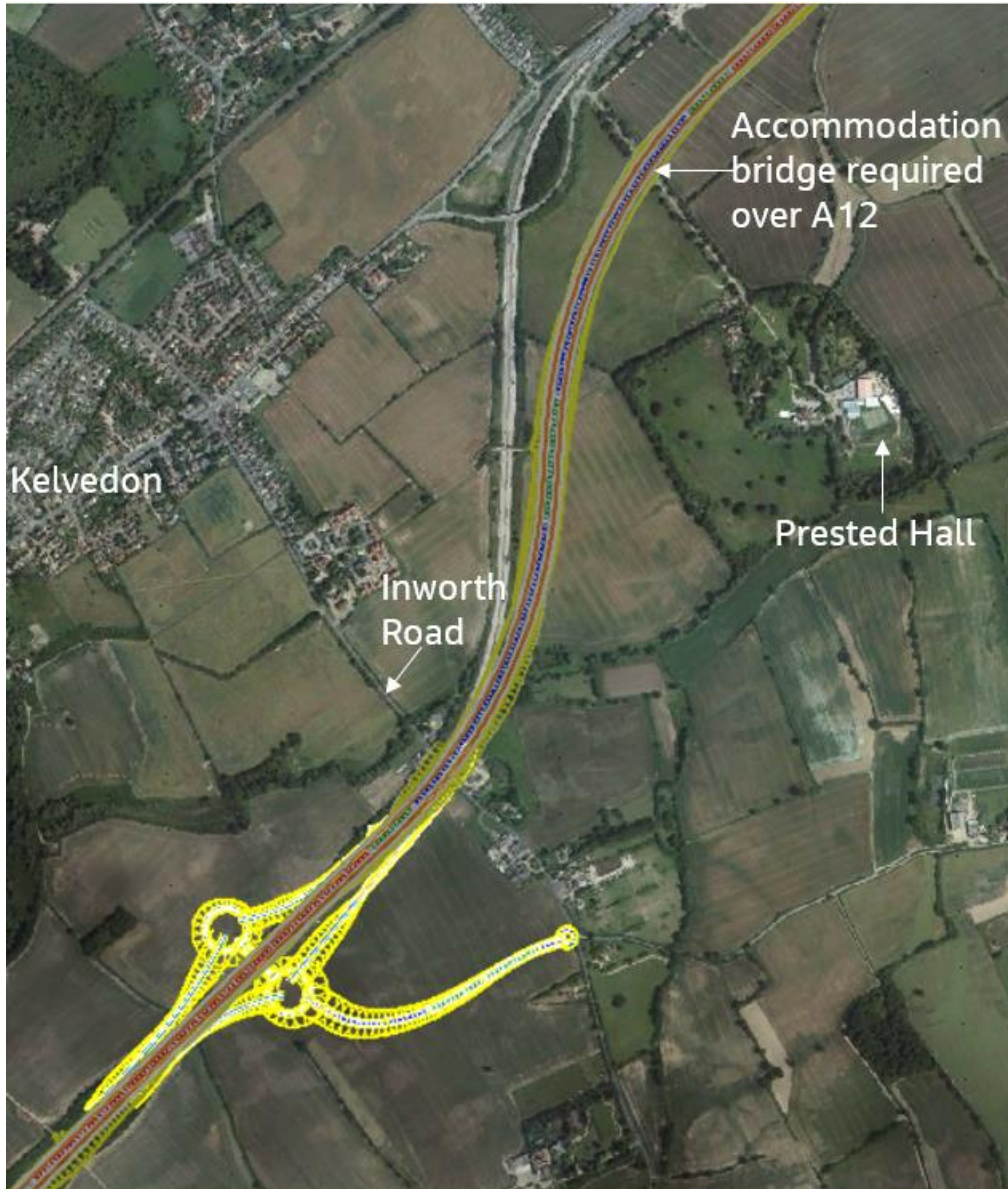


Figure 7: Junction 24 Option F

11. Traffic Assessment

A strategic traffic analysis has been undertaken using SATURN. Traffic models used are:

- 2042 Do Minimum (Stage 2.5 Do Minimum model)
- 2042 Do Something Stage 2 (Stage 2.5 Do Something model with J24 as per PCF stage 2)
- 2042 Do Something Option E (Stage 2.5 Do Something model with J24 as per Option E)
- 2042 Do Something Option F (Stage 2.5 Do Something model with J24 as per Option F)

Traffic Flows in each scenario can be seen in the figures below:

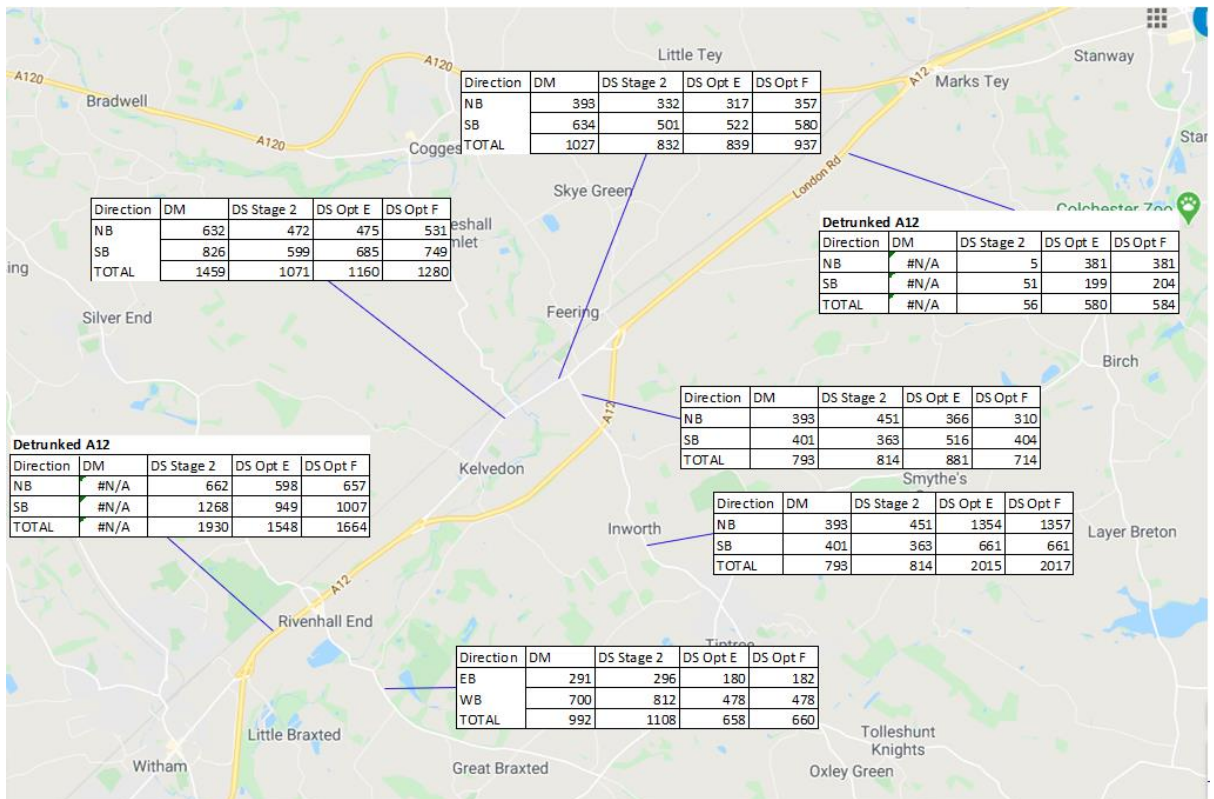


Figure 8: AM peak hour traffic flows (PCUs per hour) (2042).

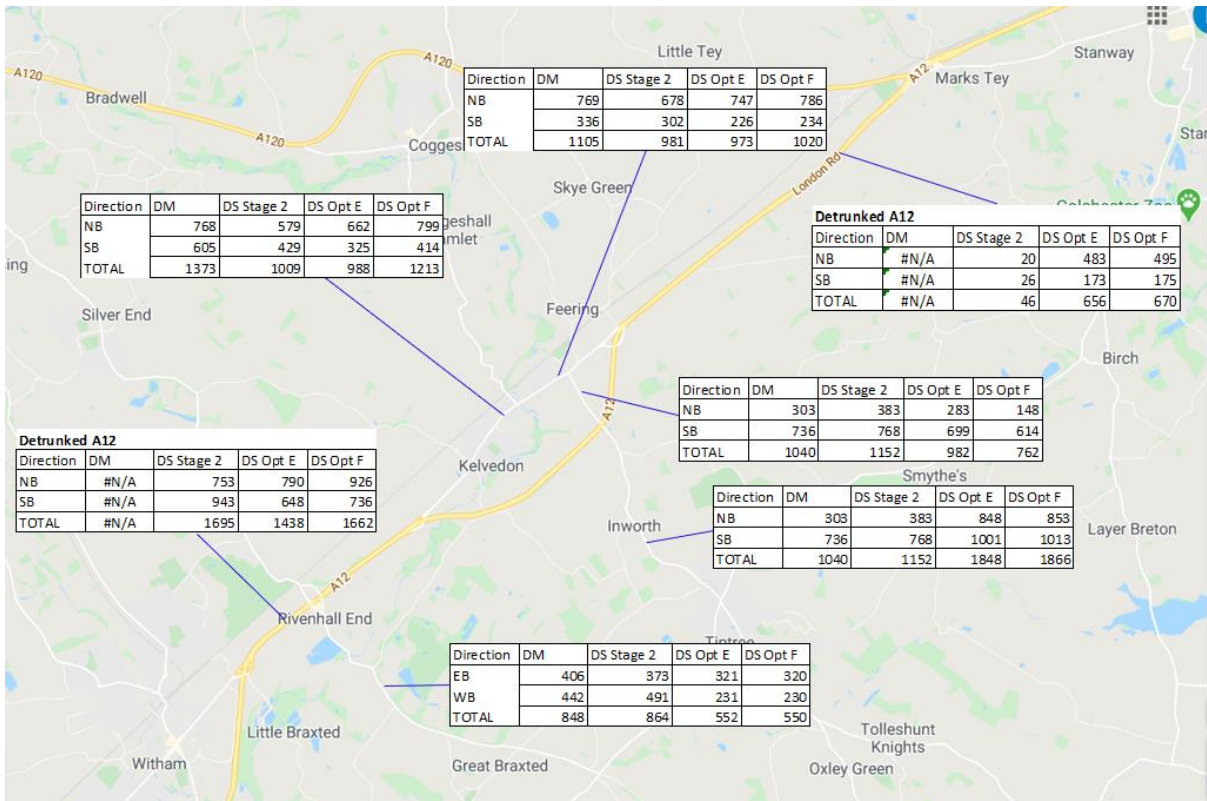


Figure 9: PM peak hour traffic flows (PCUs per hour) (2042).

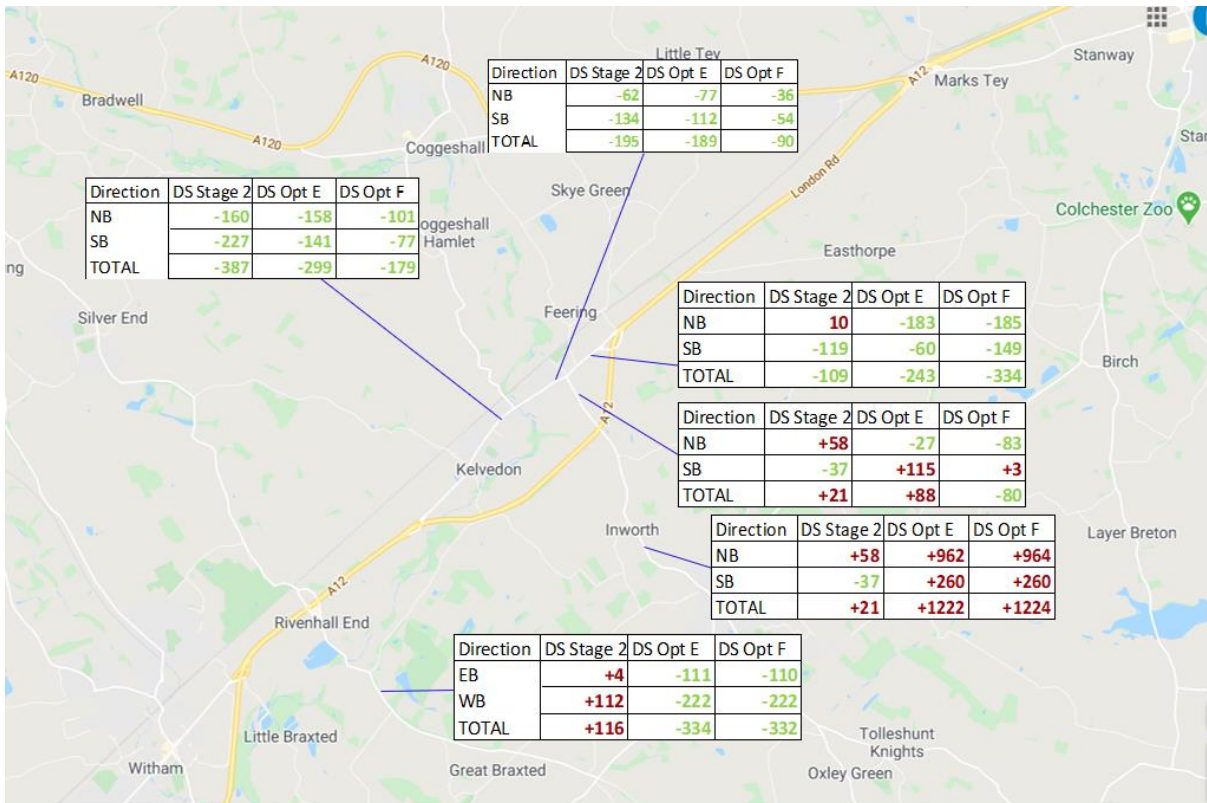


Figure 10: AM peak hour traffic flow change versus Do Minimum (PCUs per hour) (2042)

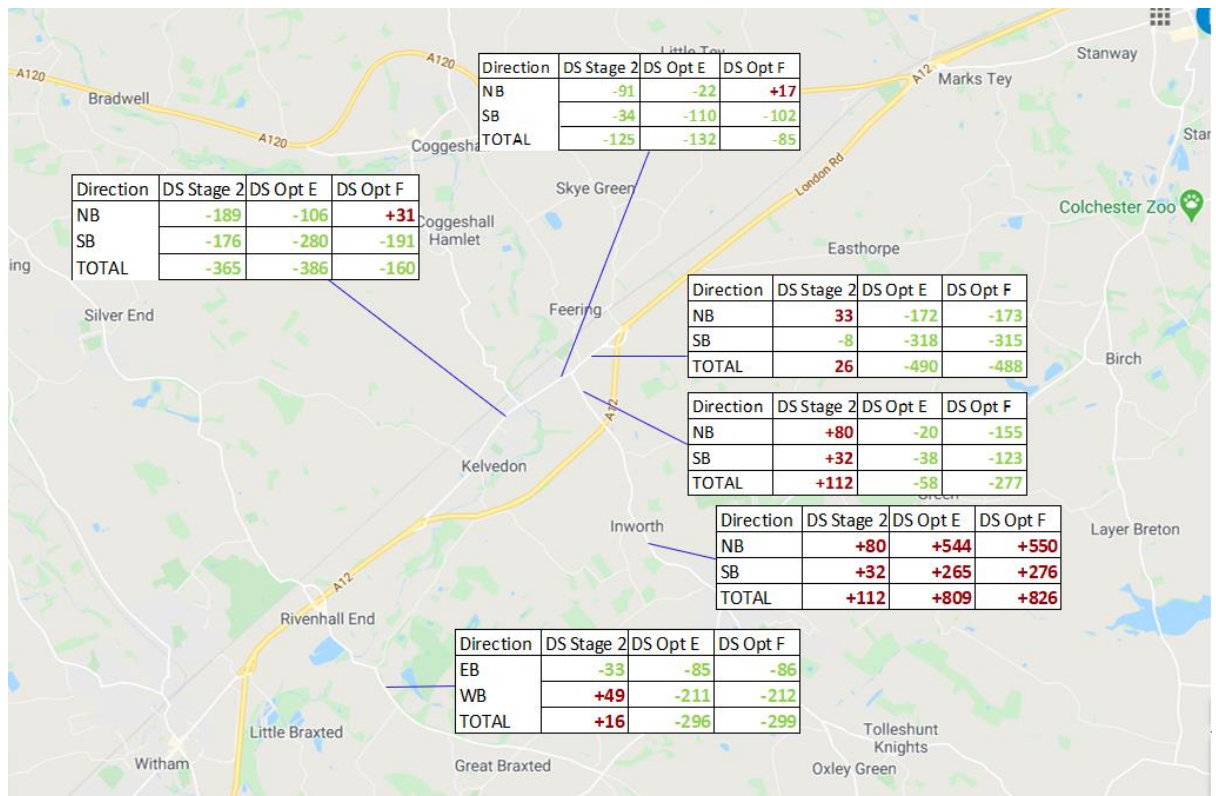


Figure 11: PM peak hour traffic flow change versus Do Minimum (PCUs per hour) (2042).

The Saturn model demonstrated the following changes between the PCF Stage 2 Junction 24 Option and Option F:

- Similar traffic impacts on Kelvedon High Street / Gore Pit between the PCF Stage 2 Junction 24 Option and Option E locations. (both show a decrease compared to Do Minimum)
- In Option E compared to the PCF Stage 2 Junction 24 Option location, traffic from Tiptree to Chelmsford joins A12 at junction 24 instead of going via Rivenhall End. The PCF Stage 2 Junction 24 Option therefore has more traffic using junction 22 from the de-trunked A12 at than in Option E.
- Additional traffic on the de-trunked A12 (Junction 24 to 25) in Option E. Moving junction 24 further south means traffic from Kelvedon area heading to Colchester chooses to go via the old A12 and join the A12 at junction 25. This causes an increase in traffic at the junction 25 Station Rd roundabout.
- Traffic levels are not too different on northern section of Inworth Road between the PCF Stage 2 Junction 24 Option and Option E locations. Option E gives a reduction in northbound traffic (as traffic has already joined A12 at new junction 24 location), but an increase in southbound traffic (as Feering/Coggeshall traffic heading south on A12 now has to travel on this section of Inworth Road to reach new junction 24 location)
- In Option E compared to the PCF Stage 2 Junction 24 Option location, traffic from Tiptree to Chelmsford joins A12 at junction 24 instead of going via Rivenhall End. Therefore, there is an increase in traffic through Inworth, and reduction on Braxted Park Road.

The Saturn model demonstrated the following changes between Option E and Option F:

- Slightly higher traffic levels along Kelvedon High Street / Gore Pit in Option F compared to Option E.
- Slightly higher traffic using J22 with Option F compared to Option E, but both likely to mean junction 22 operates acceptably.
- Similar traffic using the de-trunked A12 / junction 25.
- Southbound traffic is lower on Inworth Road north of Option E and F in Option F.
- The increase in traffic through Inworth, and reduction on Braxted Park Road is similar between Option E and Option F.

A summary of the traffic impacts for each option can be seen in the table below:

Table 1: Summary of traffic impacts

J24 location	Summary	Advantages	Disadvantages
PCF Stage 2 location	Reduction in traffic compared to Do Minimum in Kelvedon / Gore Pit (seen across all options), but otherwise generally retains existing traffic patterns across wider road network.	Minimises traffic on de-trunked A12 between J24 and J25.	Does not relieve Braxted Park Road traffic in the same way as Option E or F, leading to potential congestion problems at J22. Least effective option at reducing northbound delays for traffic approaching Gore Pit from Inworth Road (at Blue Anchor pub). Existing congestion raised as a concern at non-statutory consultation. Potential need to investigate if further mitigation is required.
Option E	Compared to Stage 2 location, moving junction closer to Inworth Road changes the existing travel patterns across wider road network.	Tiptree to A12 (SB) traffic joins A12 at new J24 location, instead of travelling via Rivenhall End. Significant reduction in traffic on cross-country route along Braxted Park Road, and therefore lower traffic at J22 compared to with Stage 2 location.	Tiptree traffic using new J24 leads to a <u>significant</u> increase in traffic on Inworth Road between Tiptree and new J24 location (this was raised as a concern at non-stat consultation). More difficult for Kelvedon to Colchester traffic to use J24 when it is moved further south. It uses de-trunked A12 instead, joining/leaving A12 at J25. Potential congestion problems at J25 as a result (further investigation being done).

Option F	Similar to Option E, but less attractive for Kelvedon traffic to/from Chelmsford direction to use J24 due to removal of northern link at junction.	As per Option E advantages, but slightly less significant Lowest level of traffic on Inworth Road between J24 and Gore Pit	This option has the highest level of traffic on Kelvedon High Street but still less than the Do Minimum. Traffic from A12 south to/from Kelvedon is less likely to use J24 than in Option E, as the northern link from the junction to Kelvedon is removed. Instead it travels via J22 / de-trunked A12 / Kelvedon High Street.
----------	--	---	---

12. Economic Assessment

The high-level economic study concluded there was economic benefit gained by moving the junction to the position of Option E or Option F.

However, it is likely that journey time benefits are being eroded by additional delays to A120 because of knock on effects from junction 24 Option F at junction 25. It is expected that higher economic benefits be achieved by introducing low cost mitigation measures to junction 25 which is the subject of a separate investigation.

13. Operational Safety Assessment of Inworth Road

An operational safety assessment is being carried out investigating the impact of increased traffic on Inworth Road as a result of junction 24 Options E and F. While mitigation measures such as revised speed limits and sign changes are under consideration as well as other localised works (Hinds Bridge Pinch Point and Footpath extents between Threshelfords Business Park and B1024 Feering Hill Junction), the single carriageway in each direction along Inworth Road is expected to be adequate for the anticipated increased traffic.

14. Option Scoring

On 15/06/2020 a multidiscipline scoring workshop was held to compare Option E, Option F and the PCF Stage 2 Junction 24 Option. This workshop involved several discipline leads from Jacobs and attendees from Costain were present to give their views on the construction challenges and benefits of each option.

14.1 Scoring Criteria

In order to keep the scoring system consistent with the rest of the scheme, the Road Investment Strategy (RIS) objectives were used for the scoring criteria.

+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

There are a number of disciplines which are not covered by the RIS objectives but would have an impact on the design decision at junction 24. Therefore, it was agreed that additional criteria would be scored under the Deliverability/Construction objectives that would cover the additional disciplines.

14.2 Scoring Result Table

The scoring resulting from this workshop can be seen in table 2 below, with Option F receiving the highest score.

Table 2: Scoring workshop outcome

RIS Objectives	PCF Stage 2 Option	Option E	Option F
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	+2	+2	+2
1) Supporting Economic Growth b) Proposed scheme promotes specific traffic flow across the highway network	+1	+2	+2
2) A Safe and Serviceable Network a) Proposed scheme improves road user safety	0	+1	+1
2) A Safe and Serviceable Network b) Proposed scheme improves road worker safety	+1	+1	+1
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	0
3) A More Free-Flowing Network b) Proposed scheme fully understands the impacts of the other schemes and recognises other RIS schemes	0	-1	-1
4) An Improved Environment a) Improve the environmental impact of transport on communities along the existing A12	-1	-1	-1
4) An Improved Environment b) Reduce the impact of new infrastructure on the natural and built environment by design	-2	-2	-2
5) A More Accessible and Integrated Network a) Proposed scheme provides a safe NMU route between communities and seeks to address severance	+1	+1	+1
5) A More Accessible and Integrated Network b) Improve safety and effective access for public transport users	+1	+1	+1
6) Customer Satisfaction a) Improve customer satisfaction	+1	+2	+2

6) Customer Satisfaction b) Improve scheme profile	+1	+2	+2
7) Traffic & Economic Value for Money a) Economic Benefits	+1	+1	+1
7) Traffic & Economic Value for Money b) Cost	0	+1	+2
8) Deliverability/Construction a) Highway Geometry	+1	+2	+2
8) Deliverability/Construction b) Construction Challenge	+1	-1	-1
8) Deliverability/Construction c) Drainage Challenge	+3	+1	+2
8) Deliverability/Construction d) Structures Challenge	0	-2	-1
8) Deliverability/Construction e) Planning Challenge	-1	0	+1
Total Score	+10	+10	+14

15. Benefits of Option F

Option F scored highest in the scoring workshop as this junction layout and location present several benefits. Benefits of Option F are summarised in the bullet points below:

- Promotes the right traffic on the right roads.
- Tiptree to A12 (SB) traffic joins the A12 at the new junction 24 location, instead of travelling via Rivenhall End.
- Significant reduction in traffic on cross-country route along Braxted Park Road, and therefore lower traffic at junction 22 compared to with Stage 2 location.
- The reduction in traffic on Braxted Park Road and Rivenhall End should have the effect of reducing casualty rates in those areas.
- Most cost efficient.
- Reduced impact on Prested Hall, as the junction moves west.
- Lowest level of traffic on Inworth Road between J24 and Gore Pit.
- Addresses statutory stakeholder request for moving the junction towards Inworth Road.
- Reduced impact on Crown Estate land.

16. Option F Considerations

Following Option F being scored most favourably as shown in table 2, an investigation took place into any risks or other factors that should be considered when recommending a preferred junction 24 option to be carried forward to PCF Stage 3 and to be included in the PRA. Four items were identified for Option F:

- Weaving distance between the potential Junction 23 required by the developing A120 scheme and Junction 24 Option F;
- Stakeholder View;
- Groundwater Levels;
- Junction 25 performance.

15.1 Option F Considerations: Weaving Distance Between the Potential Junction 23 required by the developing A120 scheme and Junction 24 Option F

The current A12 Chelmsford to A120 Widening Scheme removes junction 23 and the existing A120 continues to meet the A12 at junction 25 of the A12. A developing A120 scheme has proposed connecting to the A12 at a new junction 23. Although this scheme is not yet committed, the A12 widening scheme is considering the A120 proposal and is aiming to not preclude its future development.

Junction 24 Option F is expected to have a worst-case weaving section of approximately 1.2km to the proposed layout of junction 23, although the design is in the very early stages of its development.

For an all-purpose rural road, the minimum weaving length requirement is 1km as per DMRB CD122. If the A120 scheme is confirmed the A12 Junction 24 Option F would not preclude the A120s proposal for a junction 23 as Option F allows for more than this minimum requirement.

However, as the weaving section in this scenario is less than 2km, a weaving section lanes calculation would need to be satisfied. This calculation is based on the number of lanes available and the traffic flows present. At this time traffic flows with the A120 connecting at Junction 23 and Junction 24 positioned at Option F are not available. As such, there is a risk that once the data is available the weaving section lane calculation may state that 1.2km is inadequate. In this instance a departure would need to be sought by the A120 scheme to avoid providing a fourth lane. It is currently expected that if this risk transpires, a departure would be considered acceptable here. However, until this can be confirmed there remains a risk that a fourth lane between Junction 23 and Junction 24 of the A12 would need to be included in the A120 scheme scope.

Due to the expectation that a departure would be granted if this risk does transpire and considering the number of events that would have to occur for this risk to materialise, this risk is considered low/medium.

15.2 Option F Considerations: Stakeholder View

As Option F has not yet been presented to stakeholders there remains a risk that it is received unfavourably. However, as detailed below there are several reasons that this is unlikely. As such the level of risk is considered to be low.

There is strong support for improvements to junction 24. At the 2017 consultation when asked 'Do you support junction improvements' 439 responded yes for junction 24 compared to 290 responding no. Junction 24 Option F is a significant improvement across a number of metrics.

A key issue raised by many responders was traffic in Kelvedon as a result of the current junction 23 and junction 24 arrangements, particularly southbound traffic. The majority of responders asked for an all movements junction 24 which they felt would address the impact southbound traffic has having on the High Street. As with Option E and the PCF Stage 2 Junction 24 Option, Option F is an all movements junction and it reduces traffic through Kelvedon compared to the do minimum scenario

Statutory stakeholders Essex County Council and Colchester Borough Council made specific comments regarding the position of junction 24 and connection to Inworth Road. ECC stated junction 24 should be moved further south toward Inworth Road and made all movements (to be reassessed should new A120 tie in be to the south). Colchester Borough Council stated a new junction 24 with access from Inworth Road will allow for traffic from Tiptree and surrounding areas to access the A12 without the need to pass through Kelvedon and Feering. Option F address these comments moving the junction south of the current position and having direct connection to Inworth Road.

Option F is expected to be well received by stakeholders. However, it will remain a risk until this has been confirmed. There are meetings planned with ECC and CDC in Summer 2020 to confirm their views.

15.3 Option F Considerations: Groundwater Levels

Option F proposes a junction in cutting, passing under the proposed A12. As with any proposal in cutting, the impact of ground water needs to be fully assessed and understood. There are currently ongoing ground investigation surveys in the area considered for Option F. The emerging data at this time has been interpreted by the geotechnical and hydrology teams who have found no indication that passing under the A12 here would be unachievable. From the data available at this time dewatering during construction is thought to be likely, although this is a reasonably common practice when constructing a road or junction in cutting.

This initial assessment has used the emerging data and there remains ground investigation surveys ongoing until early 2021. Until all data has been collected and interpreted there remains a risk that mitigation measure may be required to achieve the junction in cutting or at the worst case, passing under the proposed A12 here could be found to be unfeasible. If that worst case does materialise the junction proposal would be modified to pass over the proposed A12 in the same location proposed for Option F. The junction layout would remain an all movements dumbbell with a link from the southern dumbbell roundabout to Inworth Road. In this scenario it is expected that a version of Option F above the A12 would remain the highest scoring option due to the traffic, stakeholder and cost benefits despite expected cost increase, increased visual impact and reduced earthworks balance benefit compared to the current proposal.

15.4 Option F Considerations: Junction 25 Performance

Junction 24 Option F is expected to see 600 PCUs per hour more traffic along the detrunked A12 between junctions 24 and 25 compared to the PCF Stage 2 Junction 24 Option. This increase in traffic is likely to result in some mitigation measure being required at junction 25. With the traffic flows predicted the mitigation measure are likely to be minor such as signalling roundabouts. As such this is considered to be a low-level risk despite the relatively high likelihood of occurring.

The impact of the A120 scheme's proposal to connect at a new A12 junction 23 would impact junction 25 with traffic significantly reduced. It is not expected that any mitigation measure as a result of junction 24 Option F would be required if the A120 schemes proposals are confirmed.

The traffic team are currently running ARCADY and Vissim models to assess this area. It is expected their results will be generated by Summer 2020 which will enable the extent of any mitigation measure if required to be assessed.

16 Preferred Option Recommendation and Next Steps

Following the scoring workshop and investigation into any other considerations, Option F was recommended as the preferred junction 24 option to be included in the PRA and to take forward to PCF Stage 3.

Specific next steps have been identified to address the risk and concerns identified for Option F. Weaving length calculations will be run between Option F and the junction 23 proposed by the emerging A120 scheme when the specific A120 traffic flows required are available. The timescale for this item will be dependent on the A120 programme.

Further engagement is required to introduce the location and layout of Option D to stakeholders. Meetings with stakeholders including Essex County Council and Braintree Borough Council are planned for August 2020.

Ongoing ground investigation surveys will be interpreted, and the data will be assessed against the current Option F proposal. The ground investigation surveys are expected to remain ongoing until early 2021.

Traffic modelling is currently assessing the impact of Option F on the A12 junction 25 proposal. It is expected by the end of Summer 2020 any mitigation measure required at junction 25 will be assessed and understood.

A microsimulation (Vissim) model will also be undertaken to understand junction operation and assess mitigation measures required.

17 Conclusion

Junction 24 has received extensive investigation to maximise the benefits of this important junction throughout the strategic and local road networks whilst minimising any negative impacts. This work has resulted in the development of junction 24 Option F, a junction west of



Inworth Road passing under the proposed A12 with a connection from the southern dumbbell roundabout to Inworth Road.

The proposed junction has been selected due to the wide array of benefits it provides. Option F has ability to get the right traffic to the right roads, it provides economic benefits to the scheme and is expected to reduce casualty rates on local roads where traffic is reduced as a result of this junction. Stakeholder requests for the junction to reduce traffic through Kelvedon High Street, move the junction south and connect directly to Inworth Road are all achieved with this option.

