Agenda Item	**6**
Report No	**CIA/28/22**

HIGHLAND COUNCIL

Committee: **City of Inverness Area**

Date: **24 November 2022**

Report Title: **Inverness City Active Travel Network – Progress & Next Steps**

Report By: **Executive Chief Officer Infrastructure, Environment & Economy**

1 Purpose/Executive Summary

1.1 Inverness finds itself at a pivotal moment where significant efforts are underway to transform the City Centre into a vibrant successful place where people and business can enjoy a revival following the impacts of the Covid-19 pandemic and shifts in retail behaviours. Crucial to this change is how urban design and transport modes affect, positively or negatively, the quality, safety and enjoyment of our streets.

1.2 The Highland Council secured £2.46M from the Scottish Government to redesign Raigmore Interchange and Riverside Way in favour of walking, wheeling and cycling, undertake public consultation on design options and construct both schemes.

1.3 This report provides Members with an update on the results of Developed Designs, public engagement and consultation regarding proposals for Raigmore Interchange and Riverside Way, it also seeks a decision on further development actions.

2 Recommendations

2.1 Members are asked to:-

i. **Note** feedback from developed design, public consultation and engagement for Riverside Way and Raigmore Interchange; and
ii. **Agree** to progress Developed Designs for Raigmore Interchange and Riverside Way to Technical Design and Construction in early 2023.

3 Implications

3.1 **Resource** – The project team and design costs are externally funded through the Scottish Government. Subject to Committee approval funding for the construction has been met from the same source.

3.2 **Legal** – The Traffic Regulation Order for Riverside Way was actioned in June 2022 following Committee approval in February 2022. There are no further anticipated Traffic Regulation Orders for these schemes.

3.3 **Community (Equality, Poverty, Rural and Island)** – The schemes within Inverness City Active Travel Network aim to improve options for people to walk, wheel and cycle in Inverness which are typically low or zero cost travel options and therefore accessible to all socioeconomic groups. Equalities Impact Assessments have been undertaken and has informed the design development process for both Raigmore Interchange and Riverside Way. Direct engagement with people representing those with protected characteristics has also been undertaken.

3.4 **Climate Change / Carbon Clever –** If implemented, the current proposals for Inverness City Active Travel Network will support positive behaviour change towards more sustainable travel modes (walking, wheeling and cycling) and therefore make a positive contribution to reducing the carbon footprint of travel in Highland, contributing to the Council's response to the Climate and Ecological Emergency.

3.5 **Risk** – There is potential for reputational risk to the Council by not implementing improvements in terms of tackling the Climate and Ecological Emergency and the City Centre Air Quality Management Area. Depending on the options chosen to progress the network, there is potential for disruption to motorised users in the short term, both during and following construction until people develop new routing habits.

3.6 **Gaelic** – Future wayfinding will include Gaelic. No further implications.

4 Background

4.1 Scottish Government published the National Transport Strategy in 2020, in doing so it places people at the top of the priority for travel, and private cars at the bottom (Fig. 1). Scottish Government also published the draft Strategic Transport Projects Review 2 in 2022, identifying a requirement for widespread local interventions to decarbonise transport. Final reporting is expected at the end of 2022. A government review of how the major increase in national active travel funding should be distributed locally is also expected to report at the end of 2022.

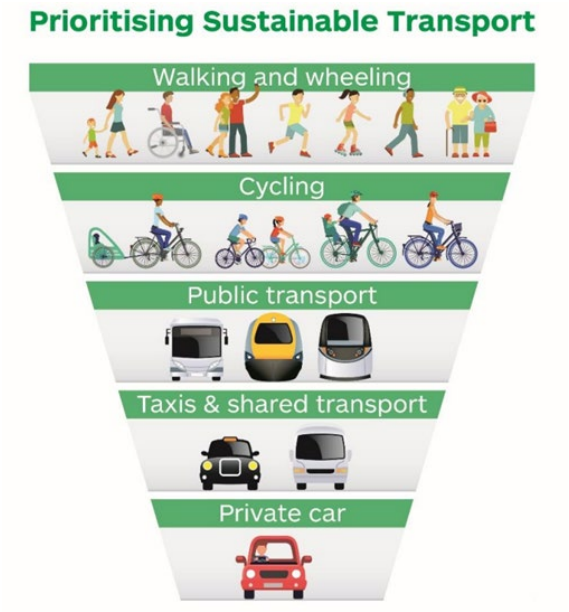


Figure 1: Sustainable Travel Hierarchy

4.2 Over three years ago The Highland Council declared a Climate and Ecological Emergency, identifying action to respond remains a priority. Transport contributes 37% of Scotland's greenhouse gas emissions and prioritising ways to reduce this will deliver a strong response to the Emergency. On 3 November 2022 Council Members agreed to sign the Edinburgh Declaration, underlining the Council's commitment to tackling this emergency.

4.3 The Covid-19 pandemic transformed how people lived their lives. One of the few positive aspects was people's increased appreciation of local natural and built environments, and walking, wheeling and cycling for daily exercise. It is expected that more people will seek to continue these positive lifestyle changes and policy should also harness this.

4.4 In response to the Covid-19 pandemic the Highland Council secured £1.9m from Scottish Government's 'Spaces for People' fund to implement immediate measures to ensure that people could walk, wheel or cycle whilst physically distancing and remaining safe from traffic in settlements across the Highland area.

4.5 The development of Riverside Way is an integral part of the Inverness 2035 vision and the city centre strategy previously considered by the City of Inverness Committee.

5 Riverside Way

5.1 Included in the *Spaces for People* measures was the one-way system and cycle contraflow along Riverside Way. A paper was brought to the City of Inverness Area Committee (CIAC) on 20 February 2020 to ask Members to approve an Experimental Road Traffic Regulation Order (ERTRO) to trial a one-way with cycle contraflow. This was approved by Members. This route is typically used for over 1000 walking, wheeling and cycling journeys every day and significantly more than this figure at peak periods since temporary measures were introduced.

5.2 Members will recall the subsequent decision made by this Committee on 17 February 2022 where Members agreed to “approve the making of the Road Traffic Regulation Order” for Riverside Way (Ness Walk and Bught Road). This permanent order was subsequently made and has been live since 21 June 2022.

5.3 All mode traffic sensor (Vivacity) data for Riverside Way shows a daily average of 1713 people walking or wheeling and 538 people on bikes using the route between May and June 2022. These comprise over half of all journeys (57%) during this period. It is of note that the sensor was not operational during most of July and August due to a power supply issue. Figures for active travel use of the corridor over these months would likely be higher for these months during school summer holidays and peak tourist trade in Inverness. More detailed data collected is available in **Appendix 1**.

5.4 Public feedback supports the Riverside Way as a fantastic piece of infrastructure which enables non-motorised users (NMU) of all ages to independently access the many leisure facilities in the Bught Park area and beyond through walking, wheeling or cycling. The Riverside Way is also a crucial link, contributing to the delivery of the overall sustainable Transport Strategy for the City.

5.5 Funding of £1.32m has been secured from the Scottish Government to design and construct the permanent solution on Riverside Way which, as can be seen from the designs at **Appendix 4**, greatly enhances the existing temporary arrangement that has been in place since summer 2020.

6 Raigmore Interchange

6.1 Scottish Government funding of £1.14m was secured to improve NMU provision at the Raigmore Interchange and consultants have been working on the Developed Designs which are due for completion in late 2022 ahead of Technical Designs being produced early in 2023.

6.2 Through a process of consultation with The Highland Council and Sustrans, a total of seven potential Intervention Scenarios (IS1, IS2, IS3, IS4, IS4.1, IS5 and IS6) were developed and assessed using a combination of desktop study and traffic sensitivity testing. These interventions were assessed against eight design principles, including both NMU and traffic-based criteria. IS6 was chosen by key stakeholders because they felt this option balanced the needs of non-motorised users and vehicular traffic using the gyratory. The intervention scenarios and their respective scorings are detailed in the table below. The full report from Jacobs is available in **Appendix 2**.

Table 5.2 Intervention Scenario Options Scoring Matrix

Design Principles Considered	Weighting	Intervention Scenario 1		Intervention Scenario 2		Intervention Scenario 3		Intervention Scenario 4		Intervention Scenario 4.1		Intervention Scenario 5		Intervention Scenario 6	
		Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score
NMU Safety	25	4	100	5	125	4	100	6	150	6	150	6	150	6	150
NMU Coherence	5	4	20	5	25	5	25	6	30	6	30	6	30	6	30
NMU Directness	5	3	15	2	10	3	15	2	10	2	10	3	15	3	15
NMU Comfort	5	3	15	4	20	4	20	6	30	6	30	5	25	6	30
NMU Attractiveness	5	4	20	5	25	5	25	6	30	4	20	5	25	6	30
NMU Journey Times	15	3	45	4	60	3	45	6	90	6	90	5	75	6	90
Traffic Safety	25	4	100	5	125	4	100	6	150	6	150	5	125	5	125
Traffic Queue Lengths	15	1	15	5	75	1	15	5	75	6	90	5	75	5	75
Basic Score		26		35		29		43		42		40		43	
NMU Weighted Score	60	215		265		230		340		330		320		345	
Traffic Weighted Score	40	115		200		115		225		240		200		200	
Combined weighted score	100	330		465		345		565		570		520		545	
0. Major Detriment, 1. Moderate Detriment, 2. Minor Detriment, 3. Neutral, 4. Minor Improvement, 5. Moderate Improvement, 6. Major Improvement															

7 Riverside Way – Stakeholder and Public Engagement

7.1 Previous engagement on the scheme included dialogue with Ward Members, letters issued to 19 stakeholder organisations and individuals and engagement with emergency services as detailed in the paper to this Committee on 20 February 2020. Further consultation on the scheme was carried out between July and August 2021 via the Commonplace online platform. Details from this consultation were used to refine design options. We have since consulted with disability and accessibility groups including two site visits in October 2022 with disabled and impaired people and an Equalities Impact Assessment Meeting at Eden Court on Thursday 13 October.

7.2 Ballifeary Community Council and other residents in the area have expressed concern over traffic volumes and driver behaviour in the community directly surrounding the Riverside Way scheme (Ballifeary Road / Lane junction). Officers have met with community members on-site to observe and denote their concerns and proposed solutions. Roads colleagues have drafted six potential solutions to observed issues and these will be presented to the community at a meeting arranged on the afternoon of 9 November 2022. A verbal update will be provided to the Committee following this event.

7.3 On the afternoon of 6 October 2022, a Public Engagement Session was hosted at the Bught Stop on Torvean Avenue, Inverness. This session displayed the Developed Designs for Riverside Way via posters and design booklets and was attended by around 40 stakeholders over a four-hour period. Feedback from this event was generally positive particularly from active users of the route. There were some points raised by disabled users and local community members about design aspects and impacts of the scheme. Officers have continued to work with these groups to address concerns and compile an Equalities Impact Assessment for the route.

8 Designs

8.1 Developed Designs have been produced for both Raigmore Interchange (**Appendix 3**) and Riverside Way (**Appendix 4**) following detailed options appraisals and stakeholder feedback. These designs are ready to be progressed to Technical Design and Construction phases if approved by this committee.

8.2 No planning or roads permissions are required for either Raigmore Interchange or Riverside Way projects.

9 Next Steps

9.1 Pending approval by this Committee, both schemes will be subject to a phased construction period of six to nine months commencing in Spring 2023.

9.2 Timeline for both projects is as follows:-

- detailed design to be completed by 31 December 2022;
- technical design and construction to be completed by 30 April 2023; and
- construction to be completed by 31 December 2023

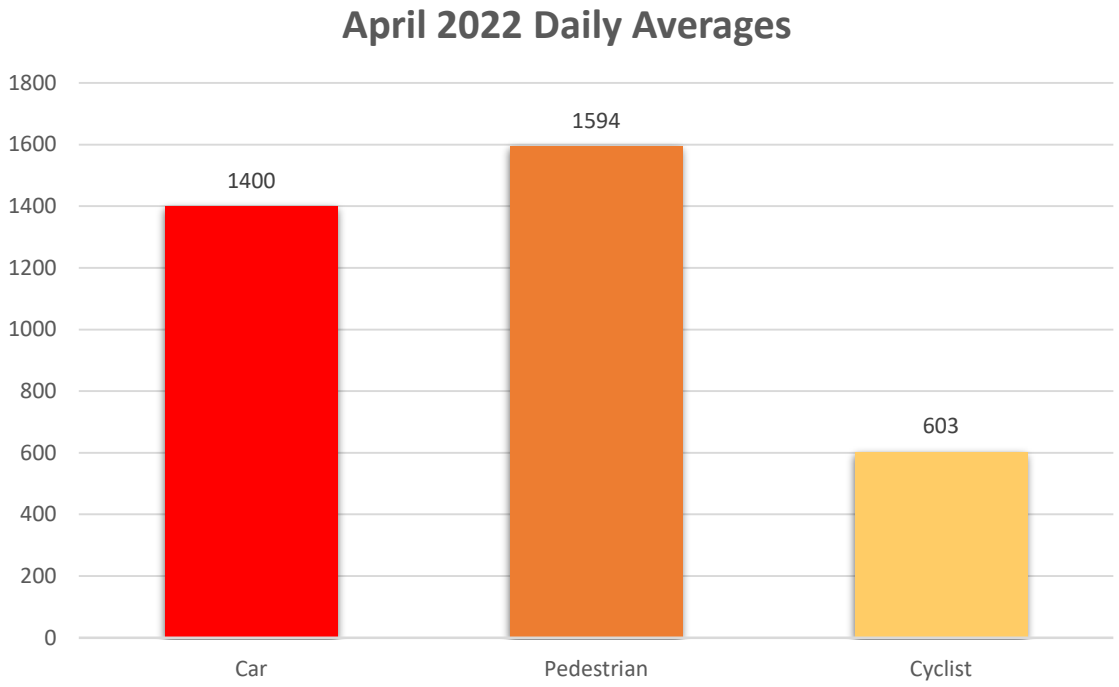
The above allows for a 3-month contingency period as allocated funding must be spent by 31 March 2024.

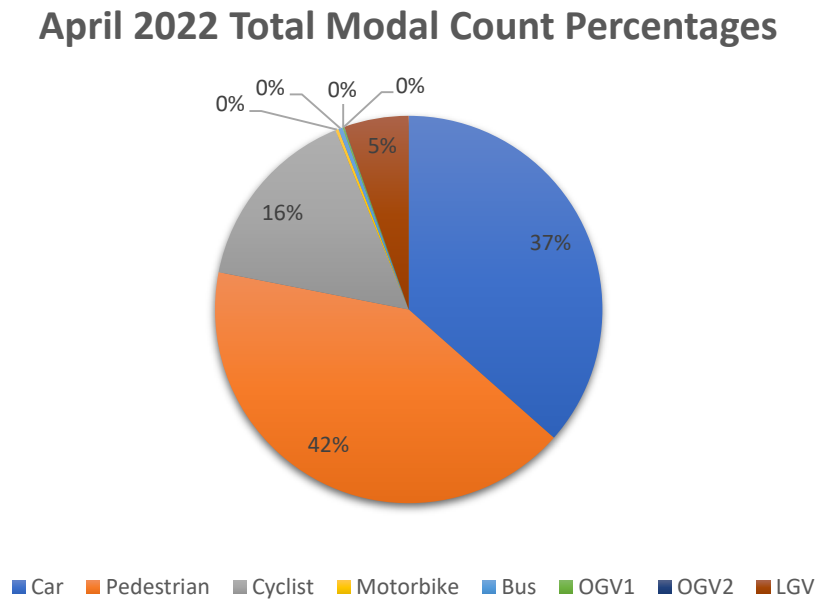
9.3 Following consideration of this report and its contents, the Active Travel Team are seeking approval for technical designs to be produced by consultants on both the Raigmore Interchange and Riverside Way schemes. Following the production of these designs, we are also seeking to commence with the tender process ready for construction of both schemes.

9.4 In consideration of the above, it is recommended that Members note the feedback from the designs, stakeholder consultation and engagement for both schemes and that Members, agree to progress with technical designs and construction pending tender.

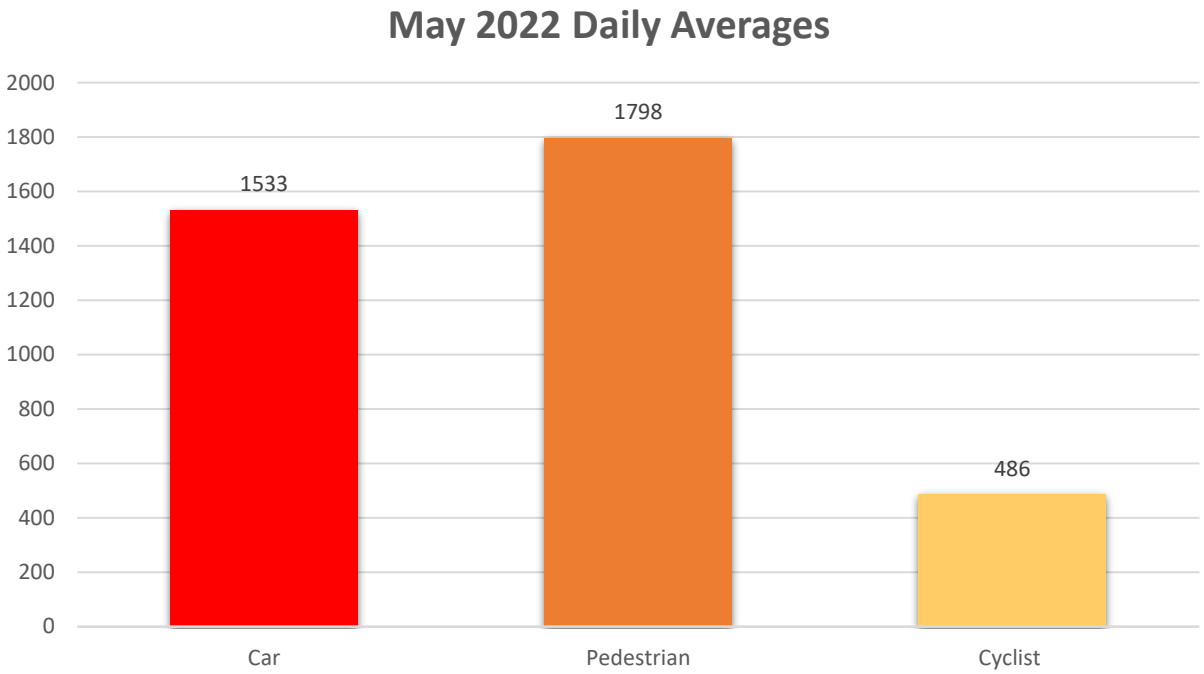
Designation:	Executive Chief Officer Infrastructure, Environment & Economy
Date:	9 November 2022
Authors:	Brendan Dougan, Project Officer (Active Travel)
Background Papers:	Scotland's National Transport Strategy 2 Inner Moray Firth Local Development Plan 2 Highland Council Meeting 9th May 2019 Highland Council Meeting 20th February 2020 Highland Council Meeting 17th February 2022

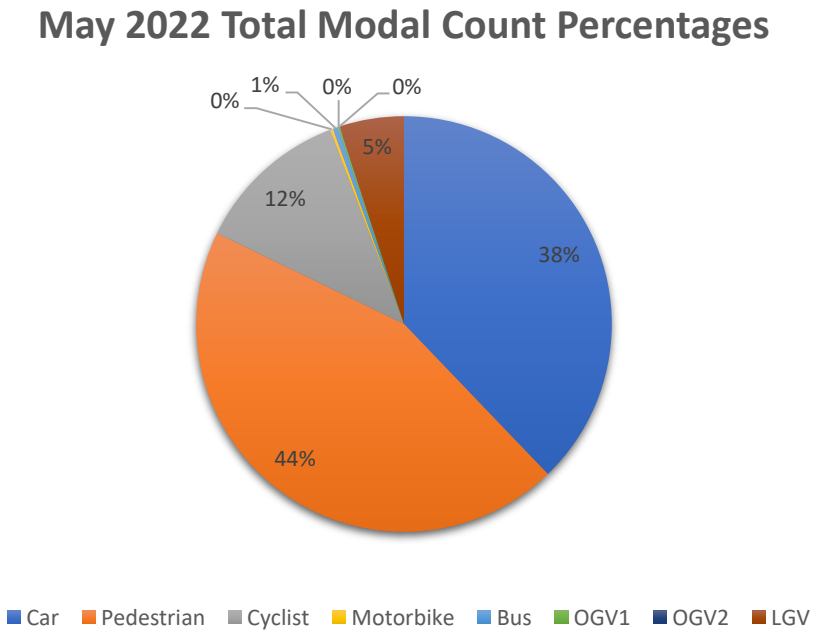
Riverside Way: April Figures





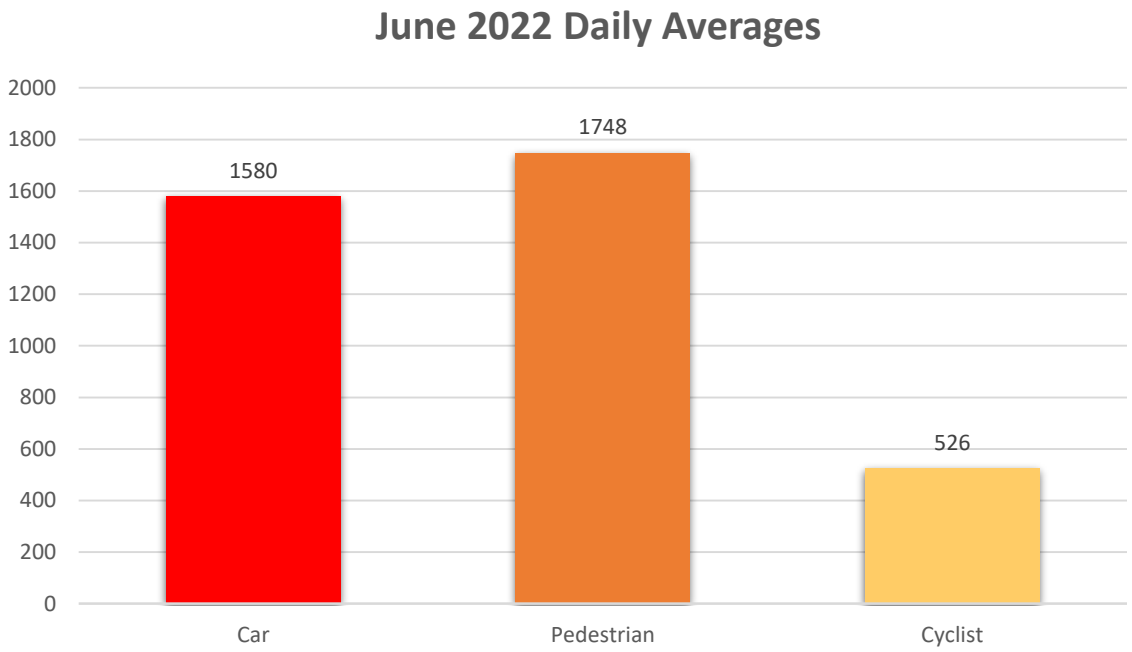
- Greater numbers of people travelling actively (walking, wheeling or cycling) along the route through April compared to motorised use.
- Walking, wheeling, and cycling trips amount to 58% of all journeys in April.
- Average counts per day:
  - 1594 Pedestrians
  - 603 Cyclists
  - 1400 Cars

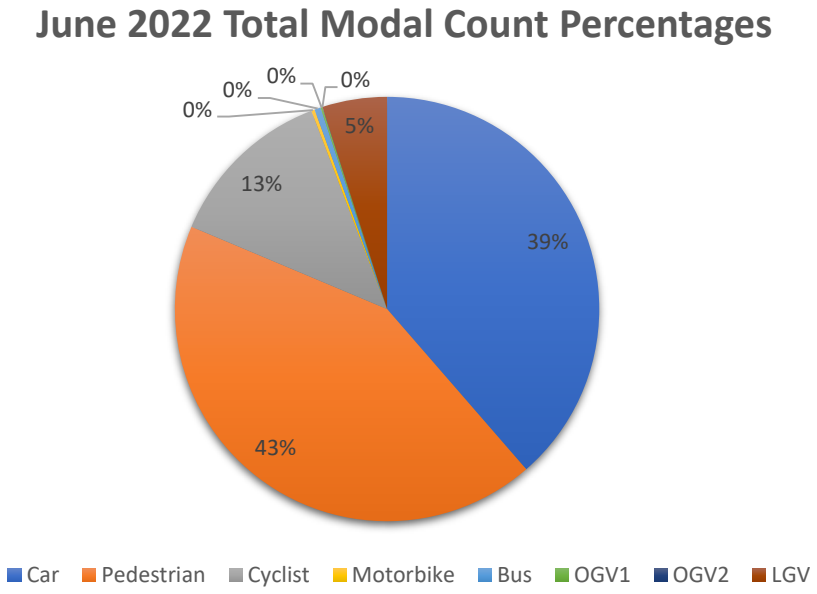




Riverside Way: May Figures

- Greater numbers of people travelling actively (walking, wheeling or cycling) along the route through May compared to motorised use.
- Walking, wheeling, and cycling trips amount to 56% of all journeys in April.
- Average counts per day:
  - 1798 Pedestrians
  - 486 Cyclists
  - 1533 Cars



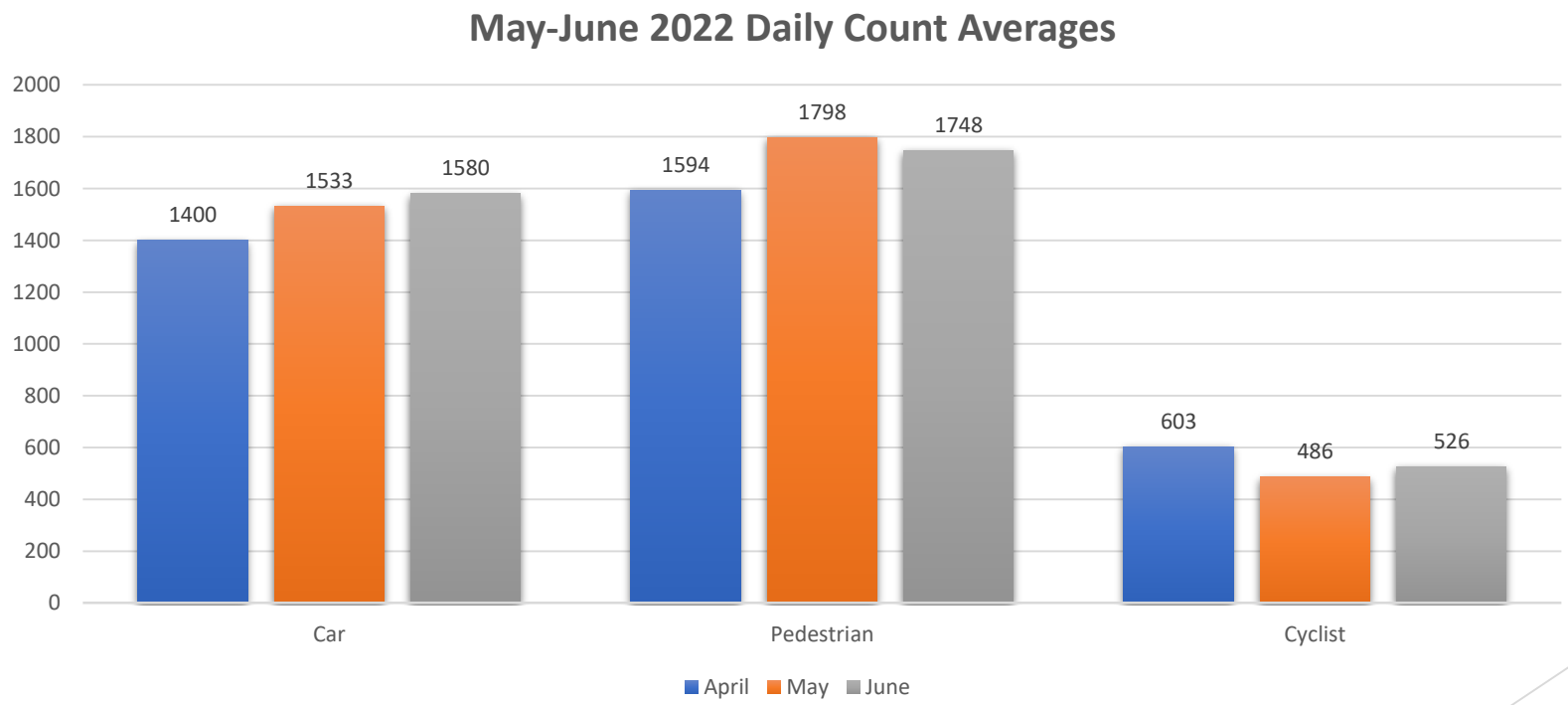


Riverside Way: June Figures

- Greater numbers of people travelling actively (walking, wheeling or cycling) along the route through June compared to motorised use.
- Walking, wheeling, and cycling trips amount to 56% of all journeys in April.
- Average counts per day:
  - 1748 Pedestrians
  - 526 Cyclists
  - 1580 Cars

Riverside Way: Daily Count Averages

- Daily count data from previous slides displayed in a single bar graph.
- Average daily counts from April through June:
  - 1713 pedestrians
  - 538 Cyclists
  - 1503 Cars



A9/A96 Raigmore Interchange

NMU IMPROVEMENT STUDY

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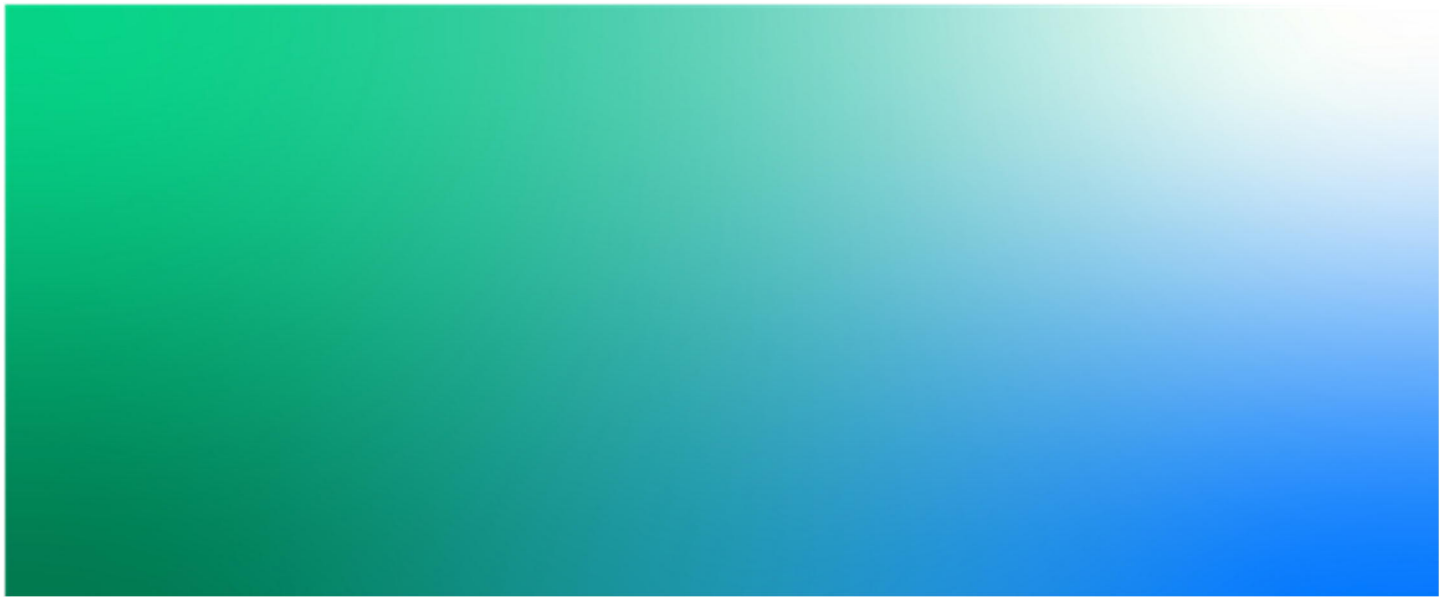
Transport Scotland



A9/A96 Raigmore Interchange NMU Improvement Study

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P00	11/11/21	DRAFT – For Transport Scotland Review	RC	AM	SY	SY
P01	22/11/21	For Information	RC	AM	SY	SY

Contents

Executive Summary

Raigmore Interchange is a grade separated junction located on the A9 trunk road north of the Raigmore Estate, Inverness. There has been concern locally for some time about the level of Non-Motorised User (NMU) provision through the interchange, both in terms of safety and standard of provision.

Jacobs have been instructed by Transport Scotland to investigate potential NMU improvements at the Interchange. Through a process of consultation with The Highland Council and Sustrans, a total of seven potential Intervention Scenarios (IS1, IS2, IS3, IS4, IS4.1, IS5 & IS6) were developed and assessed using a combination of desktop study and traffic sensitivity testing. Interventions were assessed against eight design principles, including both NMU and traffic-based criteria.

Intervention Scenario IS4.1 was found to be the best performing in terms of the assessment scoring applied, with IS 4 and IS6 being the next best performing options. In terms of NMU performance alone, IS6 was the best performing followed by IS4 and IS4.1.

Taking account of feedback obtained during stakeholder workshops held as part of the assessment process, it is recommended that Intervention Scenario 6 be taken forward to detailed design, budget permitting, as the best performing option supported by all project partners.

Intervention Scenario 6 features:

- A new 3m wide NMU route through the roundabout central island, serving both north-south and east-west NMU movements;
- Signal controlled NMU crossings at the Millburn Road eastbound, A96 westbound and A9 northbound approaches to the Interchange roundabout, with associated crossings to the central island; and
- A potential signal controlled NMU crossing of the Millburn Road westbound exit lane.

This recommendation is subject to the following:

- Further work to be carried out at detailed design stage to consider the best use of road space on the southern part of the roundabout circulatory carriageway; and
- Further development of the detailed design for the Millburn Road westbound crossing, including satisfactory completion of a Road Safety Audit.

The estimated scheme cost for IS6 (excluding street lighting) is between £613,500 and £807,000 excl. VAT.

The estimated cost of the street lighting upgrading work identified as likely to be required is between £629, 000 and £828,000 excl. VAT. This work has been costed separately to allow procurement of this work to be considered separately by Transport Scotland.

Potential additional footway improvement works, not included in the assessed Intervention Scenarios, have been identified at two locations which could also be implemented in order to bring all footways at the interchange up to a standard complying with Cycling by Design 2010 recommendations for shared use facilities. These are located at the north west and south west corners of the interchange. The cost of these works is estimated as follows:

- North west corner: £79,000 to £104,000 excl. VAT.
- South west corner: £41,000 to £478,000 excl. VAT)

All of the above estimated costs are at 2020 rates, and include construction, preliminaries, design and site supervision costs and an allowance for optimism bias.

1. Introduction

1.1 Background

1.1.1 Jacobs are commissioned by Transport Scotland to provide multi-disciplinary professional services for the A96 Dualling Inverness to Nairn (including Nairn Bypass) scheme, the A9/A96 Inshes to Smithton scheme and the A9/A82 Longman Junction Improvement Scheme. Through these commissions, Jacobs have developed suitable transport models with which to analyse interventions at Raigmore Interchange.

1.1.2 In 2019, The Highland Council approached Transport Scotland seeking support in modelling a proposed Non-Motorised User (NMU) improvement at Raigmore Interchange. At that time, The Highland Council had been awarded funding through the Scottish Government/Sustrans Community Links PLUS scheme for an NMU safety improvement at the A9 southbound merge slip road of the interchange. Transport Scotland therefore commissioned Jacobs, as part of their work on the A96 Dualling Inverness to Nairn (including Nairn Bypass) commission to investigate the potential traffic implications of the proposed improvement. Through a process of consultation, it was established that a wider intervention, potentially involving full signalisation of the interchange, should be considered. It was also agreed that a wider set of criteria including NMU, traffic and safety performance should be considered in any assessment.

1.2 Location

1.2.1 Raigmore Interchange is a grade separated junction located on the A9 Perth to Inverness trunk road north of the Raigmore Estate, Inverness. It connects the A9 with the A96 Aberdeen to Inverness trunk road and the B865 Millburn Road, one of the main routes into Inverness city centre. The existing dualled A96 and B865 Millburn Road meet below the A9 at a roundabout which includes existing part-time peak signals. The interchange is critical to the efficient operation of the road network in and around Inverness. The location of the interchange is shown in Figure 1.1 below.

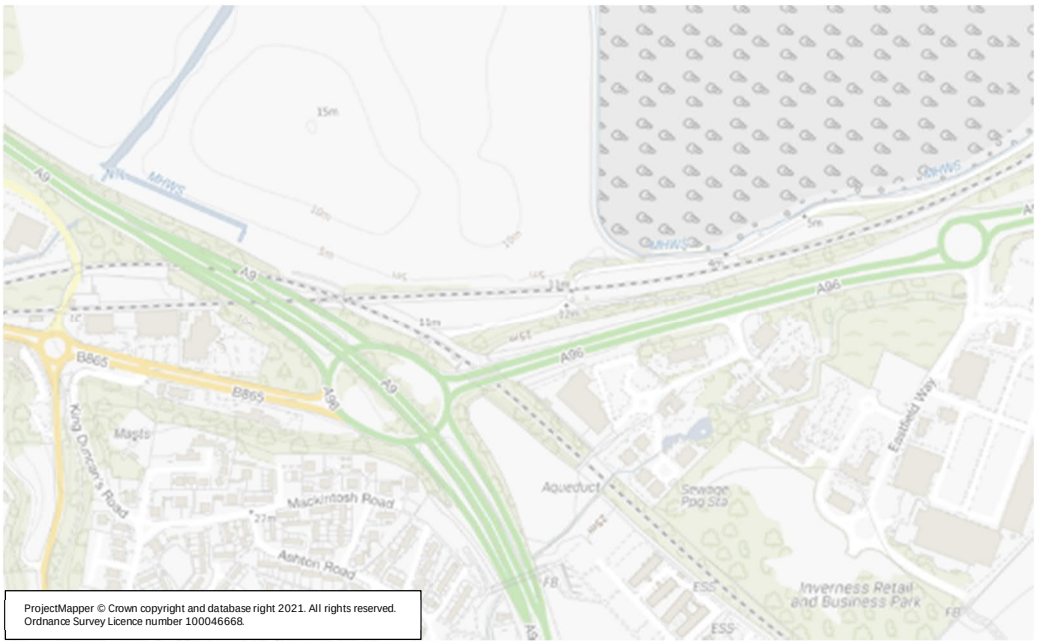

Figure 1.1 Location of Raigmore Interchange, Inverness

1.3 Raigmore Interchange

1.3.1 There has been concern locally for some time about the level of NMU provision through the interchange, both in terms of safety and standard of provision. This is seen as acting as a barrier to encouraging NMU use of the routes that pass through the interchange.

1.3.2 The most significant safety concern has been the NMU crossing of the A9 southbound merge slip road, which is an uncontrolled crossing serving east-west NMU movements.

1.3.3 The existing footways, although used extensively by cyclists, were not designed for use by cyclists and do not meet the desired width standard for cyclists and pedestrians travelling through the interchange.

1.4 National Transport Strategy

1.4.1 The original National Transport Strategy 1 (NTS1) was published in December 2006 to act as an enabler of economic growth and was updated in January 2016. In February 2020, the Cabinet Secretary for Transport, Infrastructure and Connectivity announced a refresh of NTS1 and presented the new National Transport Strategy (NTS2) (Scottish Government 2020).

1.4.2 The Transport Strategy sets a vision for transport in Scotland, it recognises the different needs of cities, towns, remote and rural areas and islands. The Strategy includes 'the whole of the transport system (people and freight) and it considers why we travel and how those trips are made, by including walking, wheeling, cycling, and travelling by bus, train, ferry, car, lorry and aeroplane' (Scottish Government 2020, page 4). It is a Strategy for all, including users travelling to, from and within Scotland.

1.4.3 The NTS2 consists of four interconnected priorities and associated results. These are listed below and included on Page 5 of the NTS2:

- reduces inequalities;
    - Will provide fair access to services we need
    - Will be easy to use for all
    - Will be affordable for all
- takes climate action;
    - Will adapt to the effects of climate change
    - Will help deliver our net zero target
    - Will promote greener, cleaner choices
- helps deliver inclusive economic growth; and
    - Will get us where we need to get to
    - Will be reliable, efficient and high quality
    - Will use beneficial innovation
- improves health and wellbeing.
    - Will be safe and secure for all

- Will enable us to make healthy travel choices
- Will help make our communities great places to live

1.4.4 The Strategy sets out the strategic framework within which future decisions on investment will be made but does not highlight any specific projects, schemes, initiatives or interventions.

1.4.5 The assessment process described in this report has been developed in line with these priorities.

1.5 Community Links PLUS/Places for Everyone

1.5.1 As stated in paragraph 1.1.2, funding for an NMU improvement at Raigmore was originally granted under the Community Links PLUS scheme. This was subsequently renamed as the Places for Everyone scheme. Places for Everyone is a permanent infrastructure fund administered by Sustrans and funded by the Scottish Government through Transport Scotland. It delivers projects which provide better places and spaces for people to live, walk and cycle for everyday journeys.

1.5.2 In 2017, The Highland Council were awarded £6.5M funding under the Places for Everyone scheme for the Inverness City Active Travel Network project (ICATN). This project aims to deliver a comprehensive active travel network across the City of Inverness with the aim of doubling the levels of cycling across the City.

1.5.3 The Highland Council's vision for Inverness is of a vibrant and economically successful city that stimulates more inward investment and attracts and retains people of all ages. An active city fit for the future is at the heart of their vision with walking and cycling on high quality infrastructure as enjoyable, practical everyday transport for more people that promotes health and enlivens streets and public spaces.

1.5.4 Interventions were proposed at the following locations:

- Raigmore Interchange
- Abban Street
- Academy Street
- Millburn Road
- Old Perth Road Roundabout
- West Link Route

1.5.5 The proposals at the Raigmore Interchange included new signals that give pedestrians and cyclists more time to cross and more certainty about where traffic is coming from and a new ramp (The Raigmore Active Travel Link) taking pedestrians and cyclists up to the Raigmore Estate and Golden Bridge. This connection will link the Inverness Campus, site of Inverness College (University of the Highlands and Islands), and a large area of east Inverness to the city centre.

1.5.6 This report relates to the proposals for new signals at Raigmore Interchange. The Raigmore Active Travel Link has been designed and developed as part of the ICATN project and is not covered in this report, other than in relation to any potential implications for the signalisation scheme.

1.6 Road Traffic Collision

1.6.1 On 20 February 2019 a pedestrian was crossing the A9 southbound slip road at the Raigmore Interchange and was knocked down by a car and subsequently died as a result of their injuries. Family and politicians have since campaigned for improvements to be made to the interchange and in May 2019, Transport Scotland confirmed that two new warning signs would be installed near the site of the accident by the end of June 2019. These signs have now been installed by BEAR Scotland and landscaping work to remove vegetation on the A96 slip roads appears to have taken place.

1.7 Stakeholder Consultation

24 January 2019

1.7.1 On 24 January 2019 a stakeholder workshop was convened with representatives from Transport Scotland, BEAR Scotland, The Highland Council and Sustrans. The Raigmore Interchange project was discussed in the context of the adjacent Transport Scotland projects that are in preparation:

- A9 Dualling Perth to Inverness
- A96 Dualling Inverness to Aberdeen
- A9/A96 Inshes to Smithton
- A9/A82 Longman Junction Improvement Scheme

1.7.2 To facilitate the interface with adjacent schemes it was proposed that the Raigmore Interchange project should include the following:

- All A9 slip roads to the point where they meet the neighbouring project boundaries (A9/A82 Longman Junction Improvement Scheme to the north, A9/A96 Inshes to Smithton scheme to the south).
- The A96 Trunk Road up to and including the Seafield Roundabout.
- Millburn Road to the boundary of Places for Everyone Millburn Road intervention as part of the ICATN project.

1.7.3 The following design principles were proposed:

1) Segregate cyclists and walkers from vehicles.
2) Lower traffic speeds (30mph preferred) and explore lane width reduction.
3) Minimise conflict between all users and control this through signalisation.
4) The new design will be at grade.
5) Traffic lane reduction to be explored / modelled.

6) Reducing / removing Millburn Road central reservation to be explored.
7) Potential to widen footpath are investigated.
8) Crossings to follow pedestrian and cyclist desire lines.
9) Signalisation at junction preference over stand-alone crossings.
10) Evaluate (change in) journey times for all users.
11) Consider Sustrans design criteria.

1.7.4 From this it was proposed that two options should be evaluated:

1) NMU travelling around the outside of the Raigmore Interchange roundabout.
2) NMU travelling via the central island of the Raigmore Interchange roundabout.

1.7.5 It was noted that there would be cost implications of increasing the scope of the Raigmore Interchange project. The initial funding award is limited to one crossing of one section of the junction. Full signalisation of the roundabout would be significantly more costly and at that time no funding available for full signalisation.

28 August 2019

1.7.6 Subsequent to the meeting in January 2019, The Highland Council approached Transport Scotland to seek support in taking forward the Raigmore Interchange project, particularly in relation to the traffic modelling necessary to consider the implications of new signals. A meeting was held on 28 August 2019 between Jacobs, Transport Scotland and The Highland Council to discuss. At the meeting, Transport Scotland agreed that Jacobs would carry out traffic modelling work to support the Council, with a further meeting to be held to agree the scope.

19 December 2019

1.7.7 Following the August 2019 meeting, Jacobs prepared a scoping document setting out proposals to carry out the necessary modelling work. The scoping document proposed that an options assessment considering traffic implications, but also wider issues including safety and NMU related criteria should be undertaken. This scoping document was discussed at a meeting between Jacobs, Transport Scotland and The Highland Council on 19 December 2019. Through consultation during and following the meeting, six Intervention Scenarios were identified to be taken forward for assessment. The proposed interventions that were to be taken forward are detailed in full within Section 3.4 (Proposed Intervention Scenarios) of this report.

13 March 2020

1.7.8 Details of the proposed intervention scenarios that had been agreed between Transport Scotland and The Highland Council were shared with Sustrans in December 2019 with Sustrans providing commentary on these in February 2020. A meeting was held between Sustrans, The Highland Council, Transport Scotland and Jacobs on the 13 March 2020 regarding the intervention proposals. At this meeting it was agreed that full signalization would be preferable as it provides the greatest benefit to both NMUs and traffic. Sustrans also confirmed they could not support a solution that did not include a controlled crossing of Millburn Road. They also advised that they would prefer that some of the alternative intervention options proposed in their February 2020 commentary be modelled instead. It was agreed that Jacobs would initially assess the original six intervention scenarios identified in December 2020 and present the findings from the initial modelling work, notwithstanding that some of these options were not viewed as providing an optimum solution by all parties. After the outcomes had been discussed, consideration of additional intervention scenarios to address some of the concerns raised by Sustrans during the meeting could be reviewed and taken forward at that point.

Assessment Workshops

1.7.9 During the course of the options assessment, two further workshops were held on 3 September 2020 and 24 February 2021. Further details of these workshops are included in section 5.7 (Assessment Workshops).

1.8 Purpose of this report

1.8.1 The purpose of this report is to:

- Describe the existing conditions for NMUs at Raigmore Interchange and on the adjacent roads using available data;
- Consider options for improving NMU facilities at Raigmore Interchange in terms of the design principles proposed at the Stakeholder consultation meetings;
- Evaluate and sift improvement options;
- Describe transport modelling undertaken in order to assess the operational performance effect of improvement options on the road network;
- Assess improvement options against a range of NMU and road traffic related criteria; and
- Recommend a preferred option for improving NMU facilities at Raigmore Interchange.

1.8.2 It should be noted that throughout this report, reference is made to Cycling by Design 2010 (Transport Scotland, Revision 1 2011) which was one of the relevant design guidance documents at the time this report was being prepared and options developed and assessed. Close to the time of completion of the report, an updated version of this design guidance, Cycling by Design 2021 (Transport Scotland, 2021) was published. The implications of this updated guidance should be considered at the next stage of scheme development.

2. Existing Conditions

2.1 Existing NMU facilities at Raigmore Interchange

2.1.1 The existing NMU facilities at Raigmore Interchange are shown in Drawing A96PIN-JAC-HGN-XXX-SK-CI-0011 contained in Appendix A (Drawings). There are no dedicated cycling facilities or bridleways through the interchange. Whilst it is known from surveys and anecdotal evidence that both cyclists and pedestrians use the existing footways around the interchange, this is an informal arrangement with no signage on the roundabout to indicate that these are intended for shared use.

2.1.2 There is an existing footway on the south side of Millburn Road. Through the interchange this is between 1.4m and 2.0m and does not meet the desired width of 3m or absolute minimum width of 2m set out in Cycling by Design 2010 for a shared use path for combined flows up to 300 per hour. The width of the footway increases on approach to the signalised crossing of the A9 northbound diverge slip road to 2.4m minimum and widens beyond this point to approximately 3m as it runs along the A9 northbound diverge slip road to the south of the signalised crossing. The southwest quadrant of the interchange is bounded by a concrete retaining wall approximately 2.2m high.

2.1.3 On the north side of Millburn Road, the existing footway is approximately 2.7m, below the desired width of 3m recommended by Cycling by Design 2010; however, greater than the absolute minimum of 2m including a 0.5m separation strip in line with Cycling by Design 2010. As this approaches the Raigmore Interchange entry point it reduces to approximately 1.8m.

2.1.4 On the south side of the A96 trunk road as it approaches the interchange there is a shared use path, approximately 2.0m wide. This does not meet the desirable minimum width for a shared use path as set out in Cycling by Design 2010. It does meet absolute minimum recommended width of 2m although there is no provision of a 0.5m separation strip. This path appears to change to a footway i.e. not intended for cyclists, at the uncontrolled crossing over the A96 entry point to Raigmore Interchange. It continues with the same width between this crossing and the point where it meets the uncontrolled crossing of the A9 southbound merge slip road.

2.1.5 The section of footway between the controlled crossing of the A9 northbound diverge slip road and uncontrolled crossing of the A9 southbound merge slip road varies in width. The section to the east of the controlled crossing of the A9 northbound diverge slip road is restricted by the pedestrian guardrail where it is approximately 1.3m wide. Beneath the structure, the path reduces in width further to its narrowest point at approximately 1.0m, this increases to1.5m on approach to the uncontrolled crossing of the A9 southbound merge. While this does not meet the minimum width of 2m as set out in Cycling by Design 2010, a separation strip of varying width is provided. This section of footway passes under the southern underbridge carrying the A9 trunk road across the Raigmore Interchange roundabout. The headroom clearances passing alongside the structural piers of the underbridge are complaint with the absolute minimum allowance set out in Roads for All Good Practice Guide for Roads (Transport Scotland 2013) and Cycling by Design 2010 where 2.3m is maintained.

2.1.6 There is an existing footway on the A9 northbound merge slip road. On approach to the interchange this is narrow, approximately 2.0m or less and does not meet the desired width or absolute minimum for a shared use path per Cycling by Design 2010. The footway narrows to 1.8m at the Millburn Road entry to the roundabout and narrows further to 1.6m due to the positioning of signage and lighting columns in front of the existing vehicle restraint barrier.

2.1.7 The existing NMU facilities between the A9 northbound merge slip road and the exit to the A96 trunk road is between 1.0m and 2.5m and does not meet the desirable minimum width for shared use of 3.0m across the extent of the footway as set out in Cycling by Design 2010; however, it does meet the absolute minimum of 2m in parts. Furthermore, a separation strip of varying width is provided, although this is not over the full length of the path. There is a part-time controlled crossing of the A9 southbound diverge slip road which operates between the hours of 16:00 and 18:00 with the crossings of the A9 northbound merge slip road and the A96 trunk road entry and exit being uncontrolled.

2.1.8 There is one pedestrian direction sign on the south side of the A96. directing users east toward Smithton and Culloden. No other pedestrian directional signage, or 'pedal cycles and pedestrians only' (diagram 956) signage is included within the interchange.

2.1.9 None of the current uncontrolled crossings include buff tactile paving, the existing drop kerb arrangements require maintenance and are not double transition in line with current best practice. Additionally, the controlled crossing points require maintenance as they are heavily silted and there is a build-up of detritus obscuring the tactile paving particularly at the A9 southbound diverge slip road crossing.

2.1.10 The speed limit on approach to the interchange from the A96 and A9, and on the interchange roundabout has recently been lowered to 30mph. A short section of Millburn Road to the west of the interchange, which was previously subject to a 40mph limit has also been reduced to a 30mph limit. This means there is now a continuous 30mph limit over the full length of Millburn Road between the interchange and the city centre.

2.2 Trip Generators and Attractors

2.2.1 The predominant NMU movement through the interchange is east-west, along a route which connects the city centre with Inverness Retail and Business Park, and onward to the Smithton/Culloden area.

2.2.2 The biggest safety concern has been the crossing of the A9 southbound merge slip road, which is the sole uncontrolled crossing at the interchange for east-west NMU movements on the southern side of the interchange.

2.2.3 There is also a north-south NMU route through the interchange which runs along the A9, from North Kessock towards the Longman Junction, and enters Raigmore Estate just south of the interchange, via an existing stepped ramp adjacent to the A9 northbound diverge slip road. This route includes an uncontrolled crossing of Millburn Road approximately eighty metres west of the interchange. This route also links to the 'Golden Bridge' across the A9, which provides an NMU connection to Inverness Campus. It is noted that the steps on the current ramp mean that it is not currently accessible for all users and cycle users must dismount. However as noted in section 2.6 (Adjacent Developments) work to replace this ramp with a fully accessible ramp was underway at the time of writing this report.

2.2.4 Based on a desktop study of the surrounding areas, the key trip generators and attractors for people walking and cycling through the interchange are summarised in Table 2.1.

Table 2.1: Summary of trip generators and attractors

Land use type	Trip generators and attractors
Local leisure/business locations	▪ Inverness Retail and Business Park

Land use type	Trip generators and attractors
	▪ Stoneyfield Business Park ▪ Beechwood Park ▪ Various Hotels ▪ Howden's Garden Centre
Local schools/educational facilities	▪ Inverness College UHI
Local transport hubs/links	▪ Various off-road shared foot/cycle paths (including on A96 to/from Stoneyfield Business Park and Inverness Retail and Business Park and route via King Duncan's Road/Mackintosh Road over A9 via Golden Bridge to Inverness College UHI and to Stoneyfield Business Park) ▪ On-road cycle route on Harbour Road ▪ On-road marked cycle lane on King Duncan's Road/Mackintosh Road
Neighbouring settlements	▪ Raigmore Estate
Other	▪ Raigmore Hospital

2.3 NMU Barriers

2.3.1 In assessing the existing conditions, considering the key trip generators and attractors, and reflecting on the stakeholder feedback, barriers to walking, cycling and equestrian movements in the area have been identified, as summarised in Table 2.2.

Table 2.2: Summary of barriers to active travel

Barriers	Barrier Description
Existing facilities	▪ Narrow footways do not meet the desired width standard as advised by current guidance i.e. *Roads for All* and *Cycling by Design 2010*.
Safety	▪ The inherent difficulties associated with crossing high-speed roads. ▪ The inherent difficulties associated with cycling on-road, making it unsuitable for all but the most experienced users. ▪ The inherent difficulties associated with navigating roundabout junctions for cycle users cycling on-road.
Quality	▪ The lack of, and poor quality of, facilities around Raigmore Interchange for pedestrians and cycle users, which are not accessible to mobility impaired users and the very young and elderly.
Crossings	▪ The lack of crossing points designed to current *Roads for All* and *Cycling by Design 2010* guidance.
Land use/road network	▪ The barrier effect of the surrounding road network e.g. traffic volumes and speeds.

2.4 Non-Motorised User Counts

2.4.1 No NMU counts have been undertaken for the purposes of this study; however, there have been several NMU surveys on or around the Raigmore Interchange area conducted as part of other recent initiatives in order to understand the NMU flows in the area.

2.4.2 In 2016, as part of work associated with the A96 Dualling Inverness to Nairn (including Nairn Bypass) project, surveys were commissioned by Jacobs, on behalf of Transport Scotland, to provide information on NMU movements within and around the extent of the scheme (Jacobs 2016). Twenty-two locations were chosen at appropriate locations, including core paths, footpaths and existing NMU links and crossing points along the scheme corridor. The surveys were undertaken by specialist survey sub-contractor TRACIS. NMU movements were recorded over a thirteen-hour period between 6am and 7pm on Thursday 21 April 2016 and Saturday 23 April 2016. Three out of the twenty-two survey locations were carried out at the Raigmore Interchange and the following two-way counts were recorded at each site in the tables below.

Table 2.3 Site 20 Approach to Raigmore Junction, Millburn Road

Site 20 Movement Description	Thursday 21 April 2016 (6am – 7pm)				Saturday 23 April 2016 (6am – 7pm)			
	Pedestrians	Pedal Cycle	Equestrian	Total	Pedestrians	Pedal Cycle	Equestrian	Total
Crossing Millburn Road, B865	3	29	0	32	4	6	0	10
Link on Millburn Road, B865, eastbound carriageway footway	4	24	0	28	1	3	0	4
Link on Millburn Road, B865, westbound carriageway footway	94	138	0	232	80	57	0	137

Table 2.4 Site 21 Raigmore Junction, A9 Northbound Merge

Site 21 Movement Description	Thursday 21 April 2016 (6am – 7pm)				Saturday 23 April 2016 (6am – 7pm)			
	Pedestrians	Pedal Cycle	Equestrian	Total	Pedestrians	Pedal Cycle	Equestrian	Total
Crossing A9 northbound merge	5	4	0	9	4	2	0	6

Travel along footpath adjacent to A9 northbound merge	5	43	0	48	0	10	0	10
Travel through northern underbridge of Raigmore Interchange	3	3	0	6	4	2	0	6

Table 2.5 Site 22 Raigmore Junction, A9 Northbound Diverge

Site 22 Movement Description	Thursday 21 April 2016 (6am – 7pm)				Saturday 23 April 2016 (6am – 7pm)			
	Pedestrians	Pedal Cycle	Equestrian	Total	Pedestrians	Pedal Cycle	Equestrian	Total
Crossing A9 northbound diverge	108	130	0	238	79	66	0	145
Footpath link between Millburn Road and controlled crossing on the A9 northbound diverge	92	142	0	234	78	61	0	139
Travel through southern underbridge of Raigmore Interchange	100	105	0	205	79	64	0	143

2.4.3 The summary of results in the tables above shows that there was generally more NMU traffic observed on the Thursday than the Saturday. This is likely due to fewer commuter journeys being undertaken at the weekend. On both days of the study, the greatest number of trips was observed at Site 22 (Raigmore Interchange, A9 northbound diverge slip road), albeit with a reduction in the total trips on the Saturday. No equestrian trips were recorded on either of the survey days. For both modes, the busiest period was between 17:00 and 18:00 on Thursday, with a second, smaller, morning commuter peak period (07:00 to 08:00) recorded.

2.4.4 In 2017, Systra on behalf of Highlands and Island Transport Partnership (HITRANS) prepared the Inverness Active Travel Counts Report (Systra 2017). The report was intended to evaluate the numbers of cyclists and pedestrians at key sites across Inverness, forming a baseline of data for future years. On Friday 7th July 2017 a total of 95 cyclists and 127 pedestrians were recorded crossing the A9 southbound merge slip road. For both modes, the busiest period was between 16:00 and 17:00, with a second, smaller, peak in the morning peak commuter period (08:00 to 09:00) was recorded.

2.4.5 The Highland Council have provided NMU data from the Inverness Millburn Road HITRANS Bike Counter (BC8) which is located on Millburn Road, approximately 750m west from the interchange. Data recorded by the counter is listed in Table 2.6 below.

Table 2.6 Millburn Road HITRANS Bike Counter (BC8) Data

Year	2014	2015	2016	2017	2018	2019 (to 05/12/19)
Count	18,023	72,469	84,668	72,525	88,834	100,406
% Increase on previous year	N/A	302.1	16.8	-14.3	22.5	13.0

2.4.6 The Highland Council has advised that there were lower numbers in 2014 due to the counter being installed part-way through the year (in May) and in 2017 due to the counter experiencing hard-drive issues. This resulted in the counter failing to record data for three months in peak season during 2017. The trend in the data suggests that NMU demand is increasing annually.

2.4.7 Data from an NMU counter on the 'Golden Bridge' over the A9 at Inverness Campus has also been provided by The Highland Council and is shown in Table 2.7. This shows a significant rise in pedestrian and pedal cycle use between 2017 and 2018. It should also be noted that the decrease in 2019 is due to incomplete data for the year.

Table 2.7 University of the Highlands and Islands Inverness Campus 'Golden Bridge Counter'

	People Logger	Bike Logger	People Logger	Bike Logger	People Logger	Bike Logger	People Logger	Bike Logger
	2016	2016	2017	2017	2018	2018	2019 (to September)	2019 (to September)
Totals	53,451	11,207	43,445	13,652	95,317	40,321	78,947	33,381
% Increase on previous year	N/A	N/A	-18.7	21.8	119.4	195.3	-17.2	-17.2

2.5 Existing Infrastructure on Adjoining Roads

B865 Millburn Road

2.5.1 Millburn Road is a dual carriageway and has existing NMU facilities on the north and south sides. In the vicinity of the interchange, there are no shared use signs, which indicates that these NMU facilities are intended for pedestrian use only. On the south side of Millburn Road, from the King Duncan's Road junction westwards, the footway has been widened and improved, with shared use signage erected. This provides a shared use facility connecting the city centre to Raigmore Estate, with onward connection to Raigmore Hospital, Inverness Campus and the east of Inverness. There is a controlled crossing of Millburn Road at the King Duncan's Road junction, approximately 270m west of the interchange which facilitates NMU access to the businesses, restaurants and hotel on either side of the road. There are bus stops with laybys and shelters on both sides of the road. On the south side of the road between the King Duncan's Road junction and Raigmore Interchange, the footway varies in width between 2.5m and 3.5m wide. This meets the desired width of 3m required by Cycling by Design 2010 for a shared use path for combined flows up to 300 per hour in parts; however, primarily sits between desired minimum and absolute minimum, and when accounting for a 0.5m separation strip, will sit closer to absolute minimum. Improvements to this section are being considered as part of the ICATN project – see paragraph 2.6.5 below.

2.5.2 There is a footway on the north side of Millburn Road between the city centre and Raigmore Interchange, approximately 2.7m in width. While it does not meet the desired width of 3m required by Cycling by Design 2010 for a shared use path for combined flows up to 300 per hour; it does meet the absolute minimum of 2m including a 0.5m separation strip. However, as noted in paragraph 2.1.3, this reduces below 2m as the footway enters Raigmore Interchange.

A9 Northbound Merge Slip Road

2.5.3 The current NMU provision on the A9 northbound merge slip road is narrow and does not meet the desired width standard as advised by current guidance. However, there are proposals to widen this facility, as part of the A9 / A82 Longman Junction Improvement scheme, as described in paragraph 2.6.4.

A96 Trunk Road Dual Carriageway

2.5.4 The A96 is a dual carriageway with an existing NMU shared use path on its south side. The existing shared use path is 2m wide and does not meet the desired width of 3m recommended by Cycling by Design 2010 for a shared use path for combined flows up to 300 per hour; it does meet the absolute minimum of 2m. Although when accounting for a 0.5m separation strip, the path width would not be compliant. The route provides access to Stoneyfield Business Park and the Inverness Business and Retail Park.

2.5.5 Improvements to NMU facilities as part of the A96 Dualling Inverness to Nairn (including Nairn Bypass) scheme do not include the section between Raigmore Interchange and the Inverness Retail & Business Park.

A9 Northbound Diverge Slip Road

2.5.6 The A9 northbound diverge slip road has an existing controlled crossing which facilitates the west to east movement around the southern side of the interchange. From this crossing heading south, there is an existing footway running along the west side of the slip road. This footway is 2.75m wide at the controlled crossing and and does not meet the desired width of 3m recommended by Cycling by Design 2010 for a shared use path for combined flows up to 300 per hour; it does meet the absolute minimum of 2m including consideration of a 0.5m separation strip. The NMU facility widens to 3m and terminates approximately 50m south of the controlled crossing point at an existing stepped ramp that

facilitates access to MacIntosh Road/Ashton Road and onward to the 'Golden Bridge' and the Inverness Campus. The Raigmore Active Travel Link as detailed in Section 2.6 (Adjacent Developments) is intended to improve this ramp.

2.6 Adjacent Developments

2.6.1 There are four proposed or potential developments in proximity to Raigmore Interchange which are considered relevant to this study. These are:

- the Raigmore Active Travel Link;
- the A9/A96 Inshes to Smithton scheme;
- the A9/A82 Longman Junction Improvement scheme; and
- Inverness City Active Travel Network (ICATN) project – Millburn Road.

The Raigmore Active Travel Link

2.6.2 As part of the Inverness City Active Travel Network (ICATN), the existing stepped ramp route for pedestrians and cycle users (core path IN 19.16) is proposed to be replaced with a ramp with no steps and a shallower gradient. This will improve the link between Raigmore Interchange and the Golden Bridge and Inverness Campus. An artist impression of the scheme is shown in Figure 2.1 below.

Figure 2.1 The Raigmore Active Travel Link Artist Impression

A9/A96 Inshes to Smithton Scheme

2.6.3 The A9/A96 Inshes to Smithton scheme is being promoted by Transport Scotland and involves provision of a new link road between the Smithton and Inshes areas of Inverness, improving the road network between the A9 and A96 trunk roads. As part of the A9/A96 Inshes to Smithton scheme, there are currently proposals for an enhanced swale and layby to be constructed within the central island of the Raigmore Interchange to the east of the A9. The Intervention Scenarios discussed in this report have been developed in parallel with the design of the swale to avoid clashes between the two designs.

A9/A82 Longman Junction Improvement Scheme

2.6.4 The A9/A82 Longman Junction Improvement Scheme is being promoted by Transport Scotland and involves a strategic A9/A96 Link Road improvement and grade separation of the Longman Interchange. As part of the A9/A82 Longman Junction Improvement Scheme, it is proposed that the footway on the A9 northbound merge slip road will be widened to 3m, to provide a shared use facility. This will taper down to tie in with the existing footway width at the existing uncontrolled crossing of the A9 northbound merge slip road.

Inverness City Active Travel Network (ICATN) project – Millburn Road

2.6.5 In 2017 The Highland Council successfully won funding from Transport Scotland to improve the Active Travel Network across Inverness and encourage walking, wheeling and cycling. This includes The Raigmore Ramp, as discussed in paragraph 2.6.2, which is adjacent to the Raigmore Interchange, but also wider upgrades with the potential for improvements along the length of Millburn Road.

2.6.6 It is understood that the extent and detail of the improvements are still in development. As the Raigmore Interchange NMU improvements moves into detailed design, consultation with The Highland Council will be required to ensure continuity with the potential ICATN upgrades along Millburn Road.

3. Option Generation

3.1 General

3.1.1 The options for improving NMU facilities at Raigmore Interchange have been based on the stakeholder consultations as detailed in Section 1.7 (Stakeholder Consultation) and are fully described in section 3.4 (Proposed Intervention Scenarios) of this report.

3.1.2 The extents of the improvements have been limited to the area outlined in Figure 3.1 below:

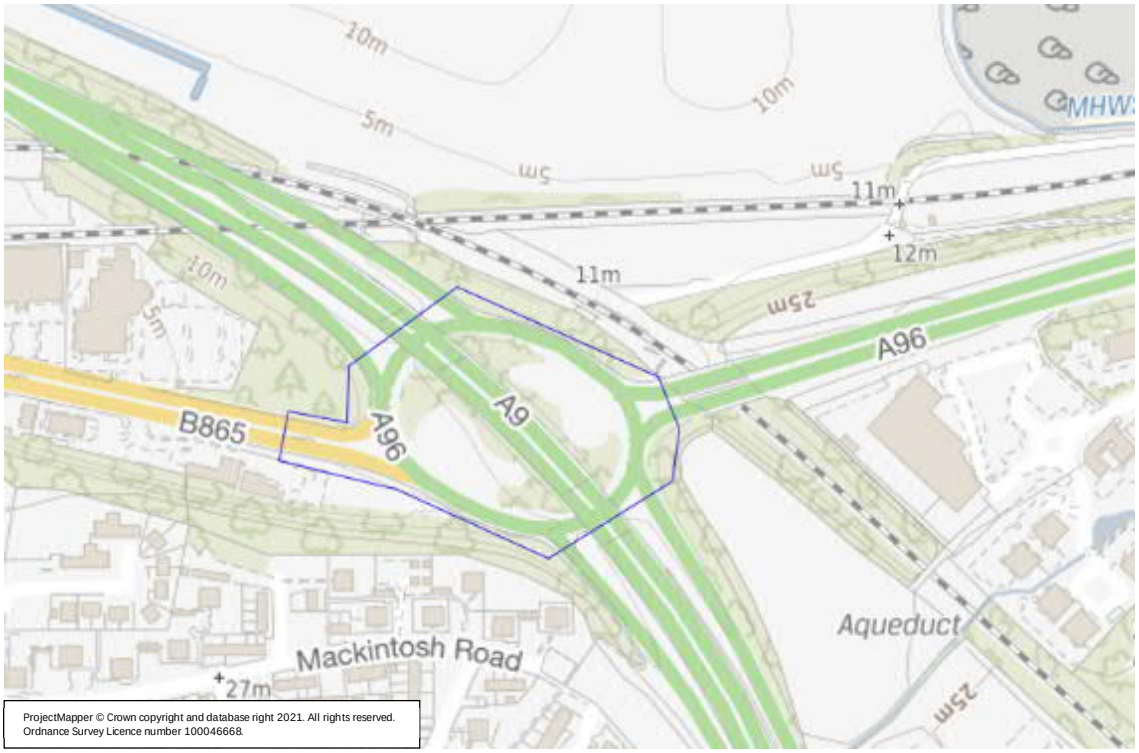

Figure 3.1 Raigmore Interchange Improvement Extents

3.1.3 The options considered offer a range of interventions from localised improvement on the A9 southbound merge slip road through to full signalisation across the interchange and were developed to allow varying scales of intervention to be considered, along with the possibility of a phased approach.

3.1.4 The Intervention Scenarios considered include options involving NMUs travelling around the outside of the Raigmore Interchange and involving NMUs travelling via the central island.

3.1.5 At this early stage, design development is at a high-level in order to allow suitable assessment of each of the Intervention Scenarios. No detailed design has been progressed at this stage.

3.2 Standards & Best Practice

The Interventions have been designed in accordance with the following guidance and best practice:

- CD 143 (DMRB) (formally Advice Note TA 90/05 and Advice Note TA 91/05)
- CD 195 (DMRB)
- Cycling by Design 2010 (Transport Scotland, Revision 1 2011)*

- Roads for All Good Practice Guide for Roads (Transport Scotland, 2013)
- Inclusive Mobility (Department for Transport, 2005)
- Sustrans Design Manual (Sustrans, 2014/2015)
- The Traffic Signs Regulations and General Directions (Department for Transport, 2016)

*All interventions have been designed based on Cycling by Design 2010; however as stated in paragraph 1.8.2, it should be noted that Cycling by Design 2021 has since been published and should be considered at the next stage.

3.3 Core Design Principles

3.3.1 The design options have been developed and assessed based on the following walking and cycling core design principles outlined in Cycling by Design 2010:

- Safety – a route that minimises dangers for walkers and cyclists, and other users, and gives a feeling of security.
- Coherence – a continuous route with a distinct and identifiable NCN character, integrated with local roads and paths.
- Directness – a route that is as direct and quick as possible.
- Comfort – a route that enables a comfortable flow of walking and cycle traffic and is easy to use.
- Attractiveness – a route that complements and enhances its environment in such a way that cycling, wheeling and walking are attractive.

3.4 Proposed Intervention Scenarios

3.4.1 A total of seven Intervention Scenarios (IS) were developed and analysed as part of the assessment. Six of these, Intervention Scenarios 1, 2, 3, 4, 4.1 and 5 were agreed at the consultation which took place between Jacobs, Transport Scotland and The Highland Council in December 2019. A further intervention, Intervention Scenario 6, was identified at a workshop between Jacobs, Transport Scotland, The Highland Council and Sustrans in September 2020.

3.4.2 Each of the Intervention Scenarios is described in the following sections. The traffic modelling and assessment for each of the Intervention Scenarios below and the conclusion drawn from the results are detailed in Sections 4 (Signalisation Sensitivity Tests) and 5 (Intervention Scenario Assessment) of this report. The existing layout was also modelled and assessed for comparison purposes.

Existing Raigmore Interchange layout (See drawing A96PIN-JAC-HGN-XXX-SK-CI-0011 in Appendix A)

3.4.3 Generally, unsignalised roundabout entries with part-time signals at the A9 southbound diverge slip road entry and signalised NMU crossing facility on the A9 northbound diverge slip road. All other NMU crossing points and roundabout entries are uncontrolled.

3.4.4 For the purposes of the assessment, the existing layout at the interchange is treated as the 'Do Minimum' option and used as a baseline for comparison.

Intervention Scenario 1 (IS1) (See drawing A96PIN-JAC-HGN-XXX-SK-CI-0037 in Appendix A)

3.4.5 This intervention scenario retains the features of the existing scenario but with the addition of full-time signals at the A96 entry (on the approach arm and the circulatory carriageway) and a controlled NMU crossing of the A9 southbound merge slip road just south of the roundabout exit point. The on-demand NMU crossing would call an all-red traffic phase on the above traffic signals to enable NMUs to cross the slip road safely. The crossing provision along the existing NMU route between the exit to the A9 northbound merge slip road and the exit to the A96 would remain.

Intervention Scenario 2 (IS2) (See drawing A96PIN-JAC-HGN-XXX-SK-CI-0038 in Appendix A)

3.4.6 This intervention scenario again retains the majority of the features of the existing scenario but with the introduction of full-time signals at the A96 entry and replacement of the existing NMU crossing on the A9 northbound diverge slip road with full-time signals at this entry (with signals on both the approach arm and the circulatory carriageway at both entries). NMU crossings at these locations would create a safe route with signalised crossings from the southwest corner of the interchange across the A9 northbound diverge slip road, across the circulatory carriageway, around the south east perimeter of the central island and back across the circulatory carriageway and the A96 entry to the southeast corner of the interchange. The crossing provision along the existing NMU route between the exit to the A9 northbound merge slip road and the exit to the A96 would remain.

Intervention Scenario 3 (IS3) (See drawing A96PIN-JAC-HGN-XXX-SK-CI-0039 in Appendix A)

3.4.7 Similar to IS1 with full-time signals at the A96 entry and a controlled NMU crossing of the A9 southbound merge slip road. Additionally, the Intervention will include an upgraded, fully compliant NMU path between the A96 entry and A9 northbound diverge slip road, running along the outer verge of the circulatory carriageway. The crossing provision along the existing NMU route between the exit to the A9 northbound merge slip road and the exit to the A96 would remain.

Intervention Scenario 4 (IS4) (See drawing A96PIN-JAC-HGN-XXX-SK-CI-0040 in Appendix A)

3.4.8 Similar to IS2 with the addition of full-time signals at the remaining interchange entries, including NMU crossing facilities at the Millburn Road entry and across the circulating carriageway with an additional length of NMU path in the central island connecting to the NMU crossing provision proposed at the south of the interchange. No signalised crossing provision would be made for the exit to the A9 northbound merge slip road. The existing signalised crossing provision at the entry from the A9 southbound diverge slip road would be removed, along with the existing NMU route between the exit to the A9 northbound merge slip road and the exit to the A96. The removal of this existing NMU facility is based on there being a safer route available via the new NMU facilities described above.

Intervention Scenario 4.1(IS4.1) (See drawing A96PIN-JAC-HGN-XXX-SK-CI-0041 in Appendix A)

3.4.9 Similar to IS4 with the addition of traffic flow improvements on the circulatory carriageway involving the removal of hatching on the circulatory carriageway to provide three traffic lanes around the full circumference of the roundabout.

Intervention Scenario 5 (IS5) (See drawing A96PIN-JAC-HGN-XXX-SK-CI-0042 in Appendix A)

3.4.10 Similar to IS2 with the addition of full-time signals at the remaining interchange entries, including NMU crossing facilities at the Millburn Road entry and a pedestrian demand crossing of the Millburn Road exit. No signalised crossing provision would be made for the exit to the A9 northbound merge slip road. The existing signalised crossing provision at the entry from the A9 southbound diverge slip road would be removed, along with the existing NMU route between the exit to the A9 northbound merge slip road and the exit to the A96.

Intervention Scenario 6 (IS6) (See drawing A96PIN-JAC-HGN-XXX-SK-CI-0043 in Appendix A)

3.4.11 A combination of IS4 and IS5, with full-time signals across the interchange and NMU crossing facilities as per IS4 with the addition of the pedestrian demand crossing of Millburn Road introduced in IS5. Similar to both scenarios, the existing signalised crossing provision at the entry from the A9 southbound diverge slip road would be removed, along with the existing NMU route between the exit to the A9 northbound merge slip road and the exit to the A96.

4. Signalisation Sensitivity Tests

4.1 Traffic Modelling

4.1.1 For each of the seven intervention scenarios, traffic operation through the interchange was modelled using S-Paramics software to understand the potential impact of introducing the proposed signals. The 'Do Minimum' scenario has also been modelled as a comparison.

4.1.2 The traffic modelling was based on the signal layouts as described in Section 3.4 above.

4.2 Non- Motorised User Count Data

4.2.1 For NMU numbers, the count data collected as part of the Jacobs 2016 survey, as discussed in Section 2.4 was used. This included points at Millburn Road (Site 20), the A9 northbound diverge slip road (Site 22) and A9 northbound merge slip road (Site 21). The locations of these survey points can be seen in Figure 4.1. This data has been used to estimate the level of demand present and to predict the level of demand for NMU controlled activated crossings at Raigmore Interchange.

Figure 4.1 NMU User Survey Locations

4.2.2 Predominantly, count data from the A9 northbound diverge slip road (Site 22) has been used to estimate the level of demand in the current layout and IS1 & IS3. IS5 & IS6 has made use of data from Millburn Road (Site 20) also. The data provided by the survey gives a 15-minute breakdown of NMU's crossings. However, the data only offers a total count, it does not account for users crossing in groups. As such, the level of demand has had to be estimated using the total number of NMU's crossing, giving a conservative estimate. Table 4.1 details the crossing frequencies for both site 20 and 22.

Table 4.1 Pedestrian Counts and Crossing Frequencies.

Start Time	End Time	NMU Users Site 22	NMU Frequency (NMU/Minute)	NMU Users Site 20	NMU Frequency (NMU/Minute)
07:00	07:15	4	0.3	0	0.0
07:15	07:30	12	0.8	0	0.0
07:30	07:45	22	1.5	6	0.4
07:45	08:00	18	1.2	6	0.4
08:00	08:15	16	1.1	0	0.0
08:15	08:30	16	1.1	4	0.3
08:30	08:45	14	0.9	2	0.1
08:45	09:00	6	0.4	2	0.1
09:00	09:15	12	0.8	2	0.1
09:15	09:30	6	0.4	2	0.1
09:30	09:45	0	0.0	0	0.0
09:45	10:00	8	0.5	0	0.0
16:00	16:15	8	0.5	2	0.1
16:15	16:30	18	1.2	8	0.5
16:30	16:45	14	0.9	2	0.1
16:45	17:00	12	0.8	2	0.1
17:00	17:15	24	1.6	0	0.0
17:15	17:30	24	1.6	2	0.1
17:30	17:45	0	0.0	0	0.0
17:45	18:00	14	0.9	6	0.4

4.2.3 To determine the level of demand in the existing layout, the count data from each 15-minute segment has been converted into a frequency. Where for example, 15 people have crossed during a 15-minute segment, we can therefore say the crossing has been called every minute. The cycle time for signals at Raigmore has been optimised to 60 seconds. Therefore, any frequency greater than one activation per cycle has been capped.

4.2.4 The crossing frequency has been used to develop a set of activation times which have then been adapted into the S- Paramics plans file. The plans file can be used to modify signal timings, considering loop detectors, time of day and vehicle type. The developed activation times have been used to call a dummy stage or pedestrian stage which sets all traffic signals to red for a set period of time.

4.2.5 Due to the proposed layout of several of the scenarios it has been possible to adopt ‘Walk With’. Effectively, ‘Walk With’ would not require a separate stage to be called by NMU control. Instead, signal times are optimised around pedestrian crossing times. For example, when considering two opposing points on the circulatory and approach arm. The first stream’s green time would be optimised around the second’s crossing time and vice versa.

4.3 LinSig Signal Optimisation

4.3.1 Signal times for Raigmore Interchange have been optimised using LinSig. LinSig uses lane geometries and demand information to calculate the optimal green time for all approaches within a junction. By doing so, it is possible to minimise traffic delay and optimise operational efficiency. As several of the scenarios include the use of 'Walk With', pedestrian crossing times have been calculated and adopted as minimum stage green times within LinSig. In doing so, LinSig can best optimise signal times around the time required for pedestrian crossing times. Proposed crossing locations (Crossings 1-10 or C1-C10) for all scenarios can be seen in Figure 4.2.

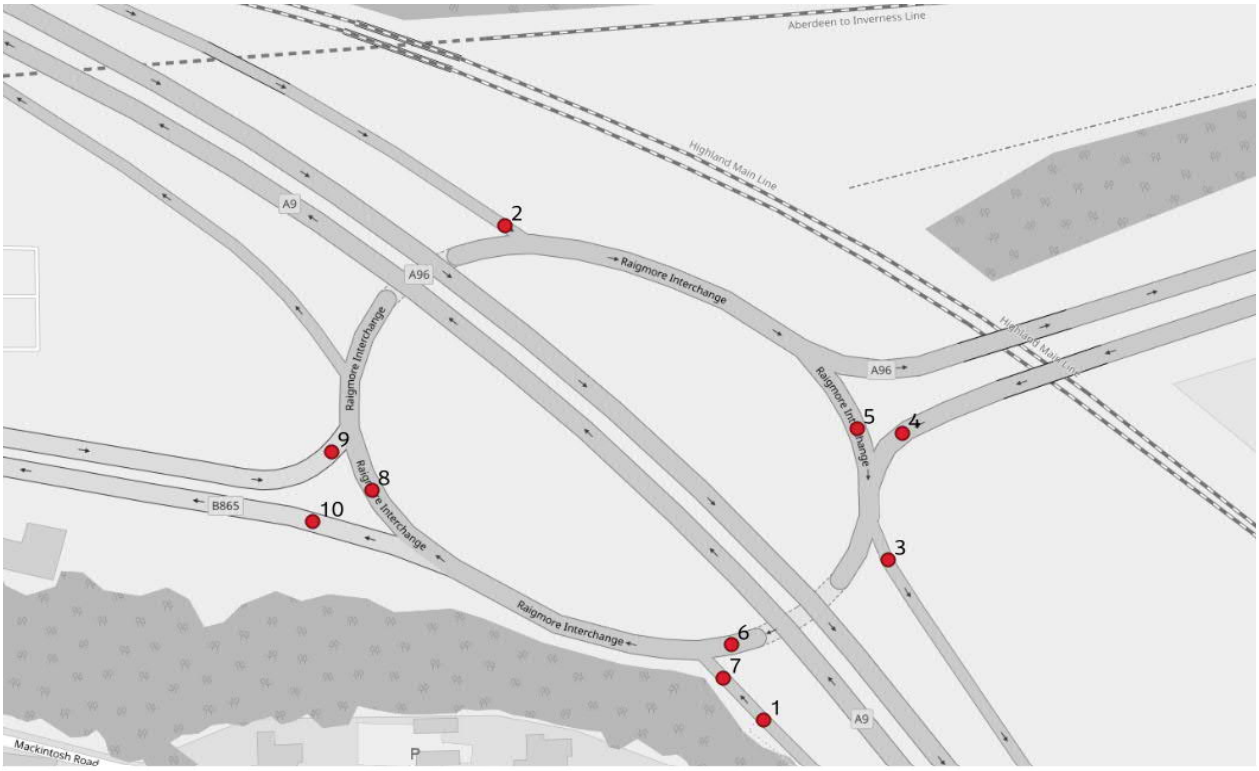

Figure 4.2 NMU Crossing Locations (All Scenarios)

4.3.2 The minimum pedestrian crossing times have been calculated using recommended guidance (Traffic Advisory Leaflet 5/05, Department for Transport 2005). Taking into account the road width, a standard pedestrian walk speed of 1.2m/s and a pedestrian comfort factor of 3 seconds. All crossing times have been calculated with a 5 second minimum intergreen except for C3 and C10 where a larger intergreen time of 8 seconds was required due to the conflicting distances involved (Traffic Advisory Leaflet 5/05, Department for Transport 2006). The calculated pedestrian crossing times can be found in Table 4.2 below.

Table 4.2 Pedestrian Crossing Times

Crossing Location	Pedestrian Crossing Time (Seconds)
C1	13
C2	13
C3	16
C4	15
C5	17
C6	16
C7	13
C8	16
C9	16
C10	14

4.4 S- Paramics Model

4.4.1 All scenarios have been tested under 2024 and 2039 demand year conditions, with the A9/A96 Inshes to Smithton scheme, A96 Dualling Inverness to Nairn (including Nairn bypass) and A9/A82 Longman Junction improvement schemes present. The A9/A96 Inshes to Smithton scheme is forecasted to support increased development in the area which is likely to increase NMU demand at Raigmore. A 30mph speed limit around the interchange has been assumed, in line with the recently introduced limit.

4.5 Vehicle Travel Time

4.5.1 Table 4.3 and Table 4.4 shows the average travel times for vehicles on approach and through the roundabout in both the AM and PM peak periods for 2024 and 2039 respectively. The average travel times have been discerned by one-hour peak periods, taken over five model runs. The routes considered to calculate the average travel time can be seen in Table 4.3.

Table 4.3 Average Journey Times 2024 (Minutes)

AM (08:00-09:00)	'Do Minimum'	IS1 & IS3	IS2	IS4	IS4.1	IS5 & IS6
A9 SB to A96	1.6	1.6	1.6	1.5	1.5	1.5
A9 SB to Millburn Rd	1.9	2.5	2.5	2.4	2.5	2.6
A96 to A9 SB	1.6	5.3	1.4	1.5	1.5	1.5
A96 to Millburn Rd	1.9	7.3	1.8	1.8	1.8	2.0
A96 to A9 NB	2.4	7.9	2.3	2.3	2.4	2.4
A9 NB to Millburn Rd	12.2	6.8	1.9	2.0	1.8	2.2
A9 NB to A96	8.3	3.7	2.4	3.2	3.1	3.3
Millburn Rd to A9 NB	2.8	1.8	1.9	2.0	1.7	1.9
Millburn Rd to A96	2.8	1.7	1.9	1.9	1.7	1.9
Millburn Rd to A9 SB	3.8	2.7	2.7	2.8	2.5	2.7
Total Travel Time	39.2	41.3	20.4	21.4	20.5	22.0
PM (17:00-18:00)	'Do Minimum'	IS1 & IS3	IS2	IS4	IS4.1	IS5 & IS6
A9 SB to A96	1.7	1.7	1.7	1.8	1.8	1.8
A9 SB to Millburn Rd	2.0	2.8	2.5	3.1	2.7	3.2
A96 to A9 SB	1.5	4.0	1.5	1.5	1.5	1.5
A96 to Millburn Rd	1.6	5.2	1.7	1.7	1.8	1.8

A96 to A9 NB	2.2	5.7	2.2	2.6	2.7	2.6
A9 NB to Millburn Rd	9.8	6.9	1.8	1.9	1.9	2.0
A9 NB to A96	10.5	7.5	2.6	2.8	3.0	2.8
Millburn Rd to A9 NB	8.3	7.4	7.3	3.4	1.9	3.2
Millburn Rd to A96	9.0	7.6	7.7	3.3	2.1	3.1
Millburn Rd to A9 SB	10.0	9.0	8.3	3.5	2.4	3.3
Total Travel Time	56.5	57.7	37.4	25.5	21.7	25.4

4.5.2 The results from Table 4.3 suggest that the 'Do Minimum' Scenario, IS1 & IS3 are likely to have the largest negative impact on average travel times. The A96 is expected to be the most severely impacted approach in IS1, suffering longer delays than those previously seen in the 'Do Minimum' Scenario. IS2 is suggested to improve average travel times from the A96 approach as well as A9 Northbound approach; however, average journey times from Millburn Road are expected to remain at similar levels. IS4, IS4.1, IS5 & IS6 provide the greatest benefits in terms of improved average travel times. IS4.1 is expected to make the greatest improvement under 2024 forecasted traffic levels. However, any full signalisation of Raigmore will still provide substantial benefit when compared to the previous scenario.

Table 4.4 Average Journey Times 2039 (Minutes)

AM (08:00-09:00)	'Do Minimum'	IS1 & IS3	IS2	IS4	IS4.1	IS5 & IS6
A9 SB to A96	1.6	1.6	1.6	1.5	1.6	1.5
A9 SB to Millburn Rd	3.5	2.6	2.9	3.0	2.8	3.0
A96 to A9 SB	14.2	9.7	1.6	3.5	2.1	4.0
A96 to Millburn Rd	9.2	8.9	2.2	4.4	2.8	4.9
A96 to A9 NB	7.6	9.6	2.5	4.6	3.2	5.1
A9 NB to Millburn Rd	26.2	9.6	2.6	2.8	2.3	3.1
A9 NB to A96	15.5	6.2	2.7	3.5	3.2	3.7
Millburn Rd to A9 NB	5.5	1.9	4.5	3.5	1.9	3.2
Millburn Rd to A96	5.8	1.9	4.2	3.2	1.8	2.9
Millburn Rd to A9 SB	12.6	4.0	5.4	4.1	2.6	3.9
Total Travel Time	101.8	56.1	30.3	34.2	24.1	35.3
PM (17:00-18:00)	'Do Minimum'	IS1 & IS3	IS2	IS4	IS4.1	IS5 & IS6

A9 SB to A96	5.3	5.1	2.0	4.0	7.3	4.1
A9 SB to Millburn Rd	6.0	6.9	2.8	5.3	7.3	5.6
A96 to A9 SB	16.0	16.6	1.9	5.4	2.7	5.3
A96 to Millburn Rd	8.7	6.5	2.2	6.1	4.1	6.4
A96 to A9 NB	8.3	6.8	2.9	6.9	4.3	6.9
A9 NB to Millburn Rd	11.5	11.3	3.0	4.9	3.3	6.0
A9 NB to A96	14.0	13.6	3.8	6.2	5.8	7.2
Millburn Rd to A9 NB	8.9	8.2	8.3	4.8	3.7	4.8
Millburn Rd to A96	9.1	9.3	8.7	4.9	5.7	4.7
Millburn Rd to A9 SB	20.2	19.0	10.2	4.9	4.2	4.8
Total Travel Time	108.1	103.2	45.9	53.4	48.5	55.9

4.5.3 The results from Table 4.4 suggest that by 2039 the 'Do Minimum' Scenario is likely to operate poorly under the increased levels of traffic expected. IS1 & IS3 are expected to offer minor improvements over that of the existing scenario; however, severe delay is to still be expected. IS2 is again suggested to improve average travel times for both the A96 and A9 Northbound approaches; however, fail to benefit Millburn Road where delay can still be expected. The accumulative travel time from IS4 is expected to be higher than that of IS2. This is most probably due to a more even balance of delay on all approaches under full signalisation. The modelling analysis also suggests that there will be increased delay to the A9 Southbound with IS4.1. Due to the extra capacity, Raigmore Interchange can process greater amounts of traffic in a shorter space of time. This extra capacity forces greater amounts of traffic at the A96 Seafield Roundabout which then begins to queue back towards Raigmore Interchange, increasing delay.

4.5.4 As such, a fully signalised roundabout would offer a more stable solution considering expected future demand.

4.6 Traffic Queue Lengths

4.6.1 Figure 4.3 to Figure 4.6 shown show queue lengths for each of the Raigmore Interchange approaches. Indicative queue lengths have been taken from the S-Paramics model screenshots at what was considered to be the peak time in both the AM and PM peaks (08:30 and 17:30 respectively).

4.6.2 The 'Existing' or 'Do Minimum' Scenario has been included in the queue length diagrams for comparison purposes. This test considered the roundabout remaining in its current form as a priority-controlled roundabout for all approaches other than the A9 Southbound diverge which already has part time signals. This comparator has been presented for both 2024 demands and 2039 demand conditions. However, Raigmore Interchange can be expected to fail under the 2039 demand conditions in which widespread instability and gridlock can be expected. Where there is expected to be no or little queuing, there will be no graphical output for that scenario.

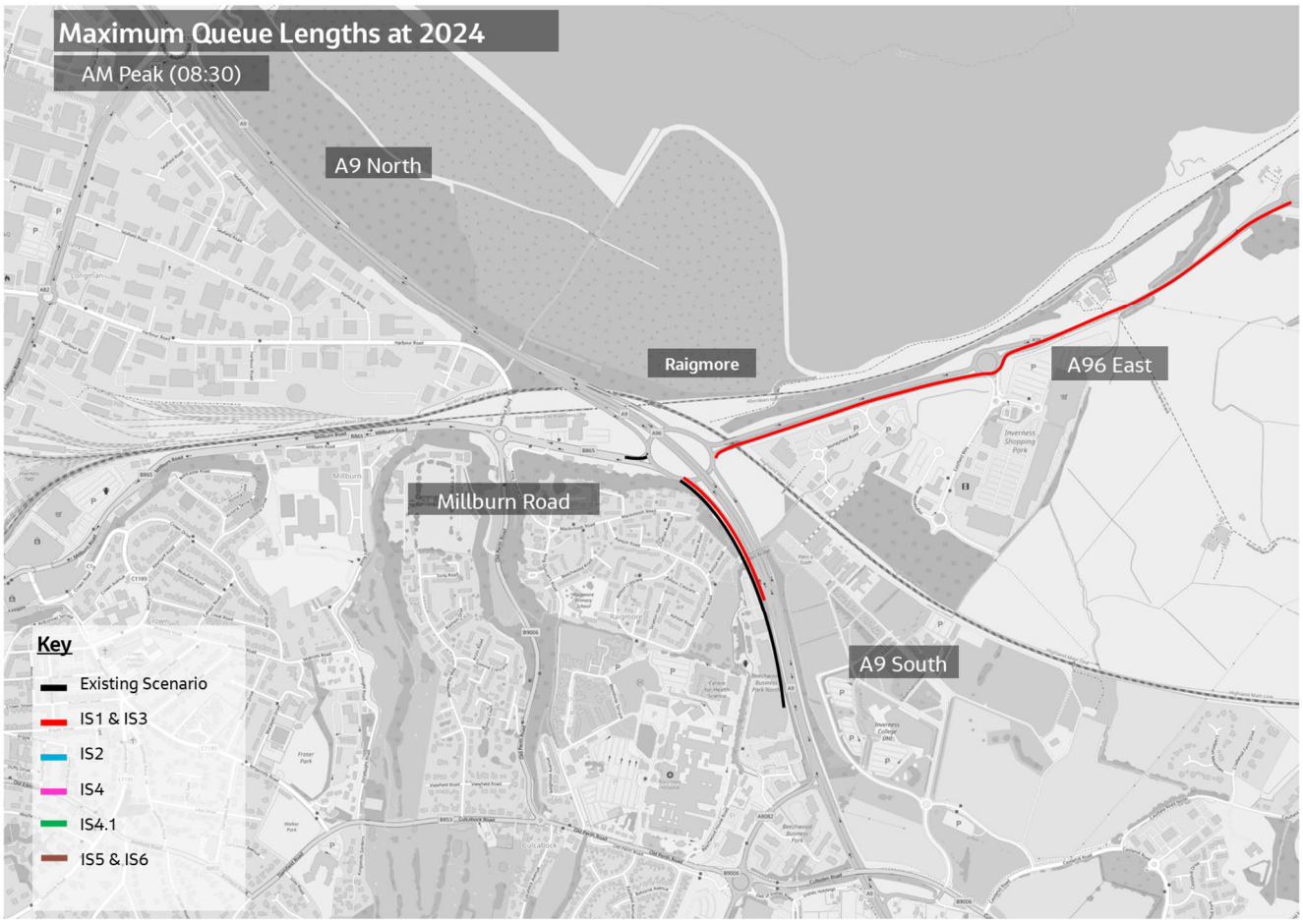

Figure 4.3 Maximum Queue Lengths 2024 AM Peak

4.6.3 It is demonstrated in Figure 4.3 that IS1 & IS3 is likely to impact the A96, with queues expected to reach Smithton Junction under this option. The demand activated pedestrian stage requires green time to be balanced with that of the A96 approach. The Existing NMU demand data suggests that during morning and evening peak, a pedestrian stage will be called once every cycle. This has a detrimental effect on the performance of the A96. Queueing can also be expected on the A9 northbound approach under this option, although when compared to the 'Do Minimum' Scenario not as severe. Queueing is likely present due to the dominant flow from the A96, limiting the availability of gaps to traffic from the A9 northbound to enter. The remaining options are expected to operate satisfactorily in the AM peak under 2024 demand conditions.

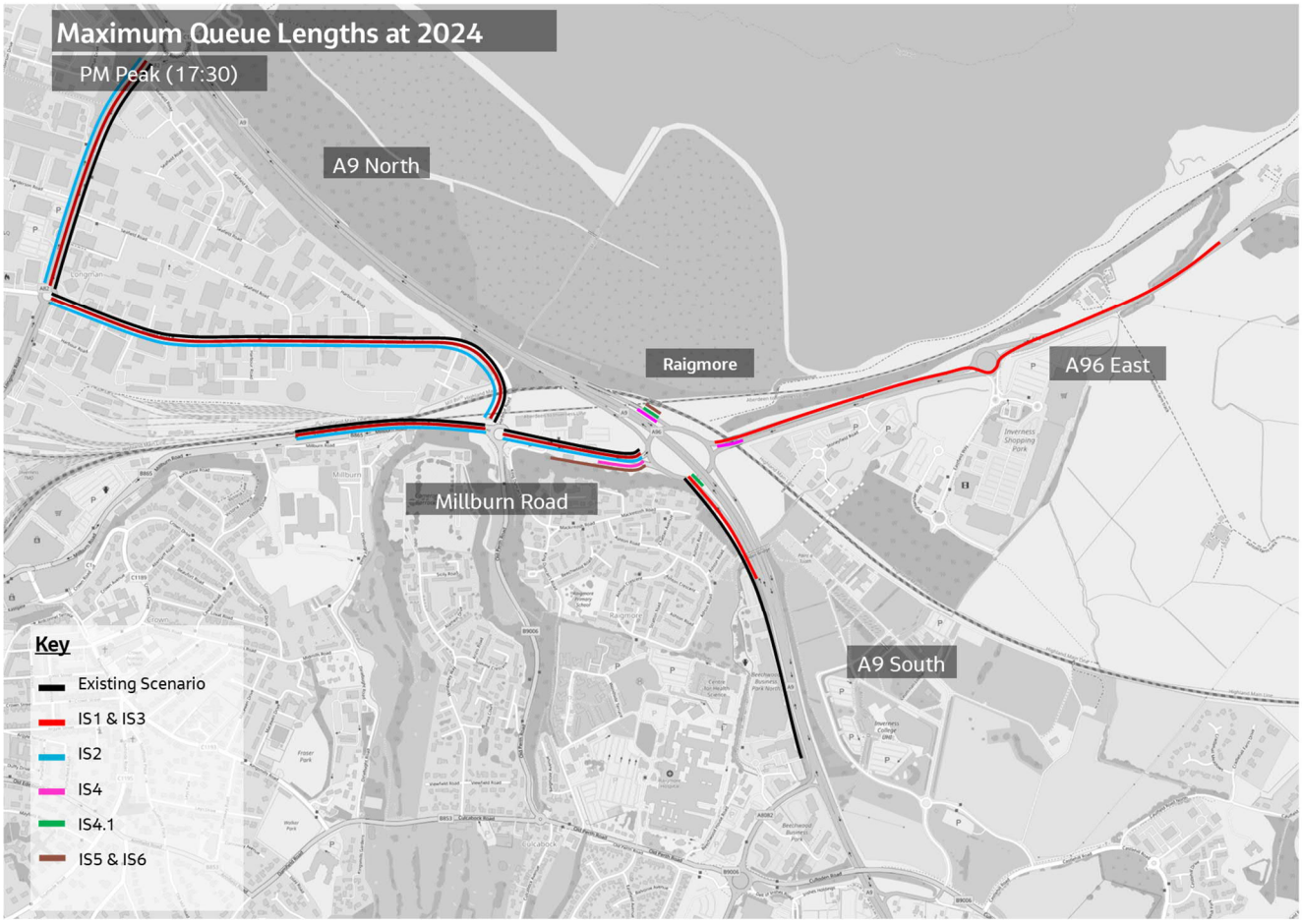

Figure 4.4 Maximum Queue Lengths 2024 PM Peak

4.6.4 Figure 4.4 demonstrates the predicted queues for the 2024 PM peak. Similar to that of Figure 4.3, in IS1 the A96 approach is suggested to queue towards Smithton Junction as well as similar levels of queuing present on the A9 northbound approach. However, under PM peak conditions, Millburn Road approach is expected to also operate poorly under IS1, IS3 and IS2. Under these options Millburn Road is to remain as a priority approach, with the A96 receiving full-time signals and A9 northbound having full time-signals under IS2. Signalisation of the A9 northbound and A96 maximises the amount of traffic passing Millburn Road, decreasing the number of available gaps for traffic to enter the circulating carriageway. This leads to extensive queuing along Millburn Road, Harbour Road and eventually Longman Road.

4.6.5 IS4 is expected to decrease the levels of queuing on Millburn Road under the 2024 demand conditions. Small queues are expected to be present at the A96 and A9 northbound because of much more overall balanced queue lengths at Raigmore Interchange. IS4.1 is expected to benefit queue lengths the most. Marginally longer queues are to be expected on Millburn Road under IS5 & IS6.

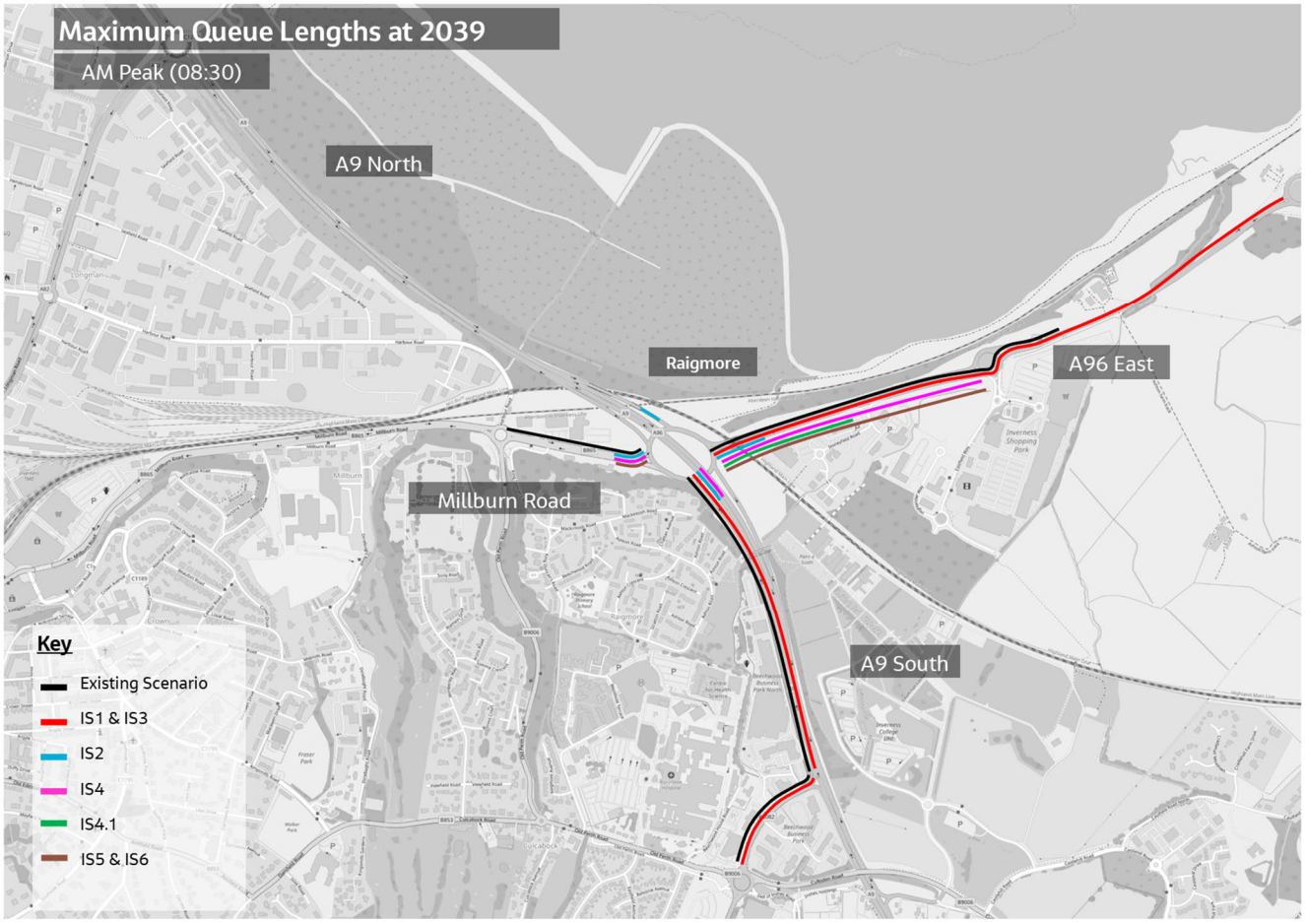

Figure 4.5 Maximum Queue Lengths 2039 AM Peak

4.6.6 Under 2039 demand conditions, as seen in Figure 4.5, longer queues lengths are expected. The 'Do Minimum' Scenario, IS1 & IS3 are suggested by the modelling assessment to have the greatest negative impact. Queues on the A96 under both scenarios are likely to reach past Seafield Roundabout, with the latter IS1 & IS3, expected to reach Smithton junction. Queuing on the A9 northbound approach is also suggested to worsen, with queues reaching Inshes Roundabout. Under IS4, queues on the A96 are expected to decrease, ending just before Seafield Roundabout. IS5 & IS6 demonstrates similar levels of queuing on the A96. IS4.1 is suggested to benefit the A96, with the shortest levels of queuing out of the scenarios tested.

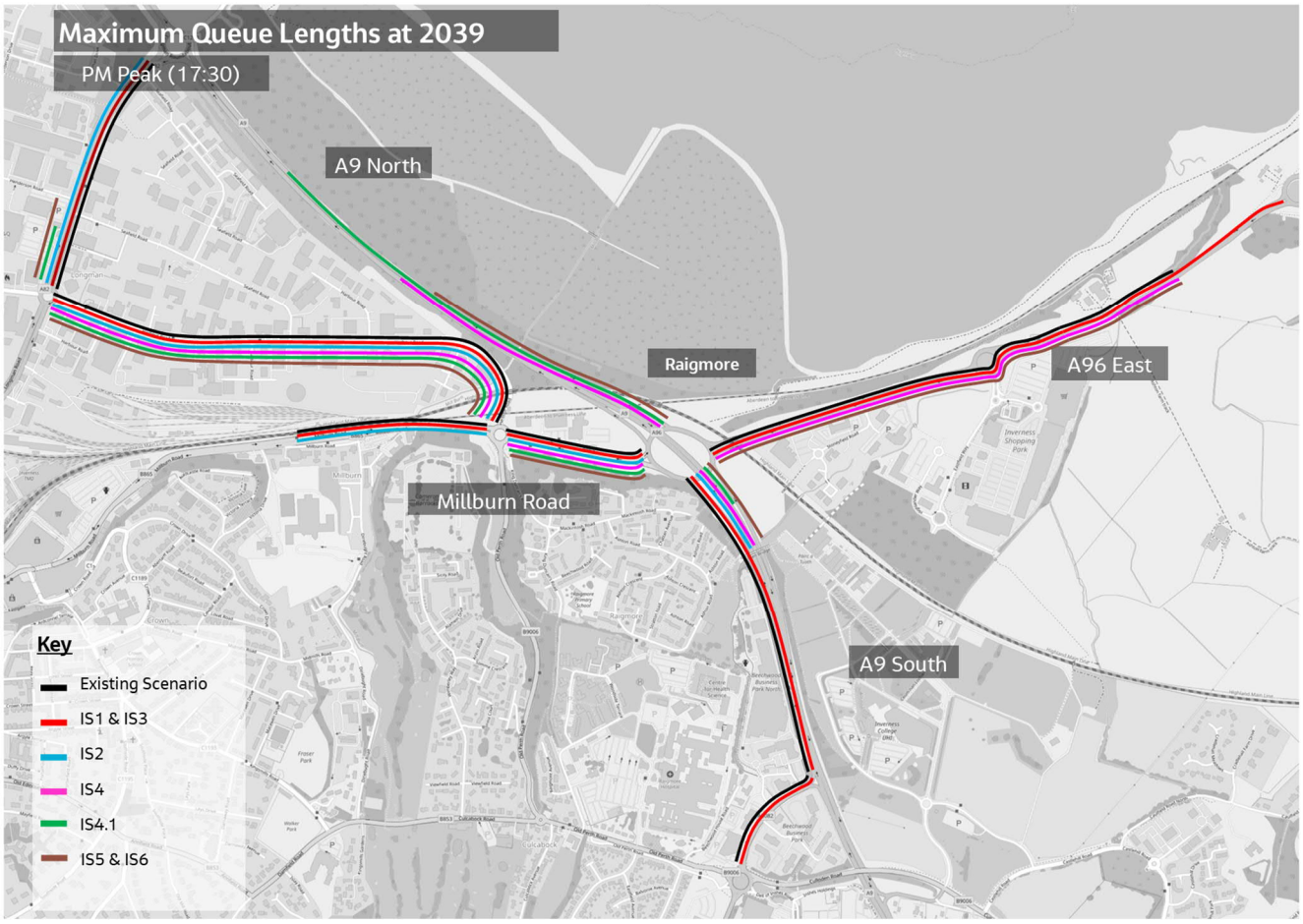

Figure 4.6 Maximum Queue Lengths 2039 PM Peak

4.6.7 Figure 4.6 details the queuing conditions under 2039 PM demand conditions. Extensive queuing is apparent under most options. IS4.1 is suggested to have the most positive impact on the A96 approach, with other scenarios displaying long queue lengths. The A9 northbound approach queue is also suggested to be at its shortest length under this option. Queuing along Millburn Road, Harbour Road and Longman Road are expected under all scenarios. Full signalisation ensures queueing is not present along the entirety of Millburn Road, with queuing mainly apparent along Harbour Road and onto Longman Road. IS4.1 manages queue lengths the most effectively out of all scenarios for the Millburn Road approach. The A9 southbound approach is suggested to be negatively affected under IS4.1. Due to the capacity increases at Raigmore, additional eastbound traffic is reaching the Seafield Roundabout in a shorter space of time. Due to limited capacity at this junction, it is suggested queuing will reach back to Raigmore Interchange. Note that this eastbound queuing is not shown in Figure 4.6. This queuing is most detrimental to the performance of the A9 southbound diverge.

5. Intervention Scenario Assessment

5.1 Intervention Scenario Scoring

5.1.1 To evaluate the merits of each intervention scenario against the 'Do minimum' Scenario, an assessment considering eight different design principles was undertaken and a score assigned based on its performance.

5.1.2 The eight criteria were formed of a combination of NMU and traffic specific principles and included the five Core Design Principles from Cycling by Design 2010, NMU Journey Times, Traffic Safety and Traffic Queue Lengths.

5.1.3 A basic score ranging between 0 and 6 was used; where 0 is major detriment and 6 is major improvement. Therefore, the higher the score the more favourable the option is relative to the design principles considered. Furthermore, given the priority of the scheme is to improve facilities and travel for NMUs, a weighting has been added to the assessment criteria to account for this. While each of the criteria has been individually weighted based on their relative importance, an overall weighting of 60% NMU to 40% traffic has been adopted. Thus, NMU design principles have been afforded greater importance in scoring.

5.1.4 The assessment has been undertaken using a qualitative and quantitative approach. Details on the scoring for the different design principles is outlined in sections 5.3 to 5.55, and the scoring contained in section 5.6 (Scoring Outcomes).

5.2 Assessing Core Design principles

5.2.1 The five Cycling by Design Core Design Principles: NMU Safety, Coherence, Directness, Comfort and Attractiveness, have been assessed and scored on a qualitative basis.

5.2.2 Each of the principles have been reviewed, comparing the various Intervention Scenarios to the 'Do minimum' Scenario. The full benefits and limitations of each intervention have been identified and outlined in Appendix B (Intervention Scenario Assessment Criteria Review).

5.2.3 Summarised below is the assessment outcomes for each principle:

NMU Safety

- IS1 – This has been scored as a minor improvement over 'Do Minimum';
- IS2 - This has been scored as a moderate improvement over 'Do Minimum';
- IS3 - This has been scored as a minor improvement over 'Do Minimum';
- IS4 – This has been scored as a major improvement over 'Do Minimum';
- IS4.1 - This has been scored as a major improvement over 'Do Minimum';
- IS5 – This has been scored as a major improvement over 'Do Minimum';
- IS6 - This has been scored as a major improvement over 'Do Minimum'.

Coherence

- IS1 – This has been scored as a minor improvement over 'Do Minimum';

- IS2 - This has been scored as a moderate improvement over 'Do Minimum';
- IS3 - This has been scored as a moderate improvement over 'Do Minimum';
- IS4 – This has been scored as a major improvement over 'Do Minimum';
- IS4.1 - This has been scored as a major improvement over 'Do Minimum';
- IS5 – This has been scored as a major improvement over 'Do Minimum';
- IS6 - This has been scored as a major improvement over 'Do Minimum'.

Directness

- IS1 – This has been scored as neutral compared to 'Do Minimum';
- IS2 - This has been scored as a minor detriment over 'Do Minimum';
- IS3 - This has been scored as neutral to compared to 'Do Minimum';
- IS4 – This has been scored as a minor detriment over 'Do Minimum';
- IS4.1 - This has been scored as a minor detriment over 'Do Minimum';
- IS5 – This has been scored as neutral to compared to 'Do Minimum';
- IS6 - This has been scored as neutral to compared to 'Do Minimum'.

Comfort

- IS1 – This has been scored as neutral compared to 'Do Minimum';
- IS2 - This has been scored as a minor improvement over 'Do Minimum';
- IS3 - This has been scored as a minor improvement over 'Do Minimum';
- IS4 – This has been scored as a major improvement over 'Do Minimum';
- IS4.1 - This has been scored as a major improvement over 'Do Minimum';
- IS5 – This has been scored as a moderate improvement over 'Do Minimum';
- IS6 - This has been scored as a major improvement over 'Do Minimum'.

Attractiveness

- IS1 – This has been scored as a minor improvement over 'Do Minimum';
- IS2 - This has been scored as a moderate improvement over 'Do Minimum';
- IS3 - This has been scored as a moderate improvement over 'Do Minimum';
- IS4 – This has been scored as a major improvement over 'Do Minimum';
- IS4.1 - This has been scored as a minor improvement over 'Do Minimum';

- IS5 – This has been scored as a moderate improvement over 'Do Minimum';
- IS6 - This has been scored as a major improvement over 'Do Minimum'.

5.3 Assessing NMU Journey times

5.3.1 As part of the traffic modelling, NMU wait times at each of the signalised crossings were calculated. Subsequently, this allowed the estimation of pedestrian journey times through the interchange to understand how the different layouts and crossings times in the various Intervention Scenarios affected NMU journey times compared to the 'Do Minimum' scenario.

5.3.2 Journey times were calculated between four points (A, B, C and D), as shown in Figure 5.1 below and based on the anticipated key NMU movement routes. Points A, B and C are located at points on the north, east and southern arms of the interchange, while Point D is further west on Millburn Road near KFC/Millburn Takeaway and in proximity to the signal controlled crossing over Millburn Road adjacent to King Duncan's Road.

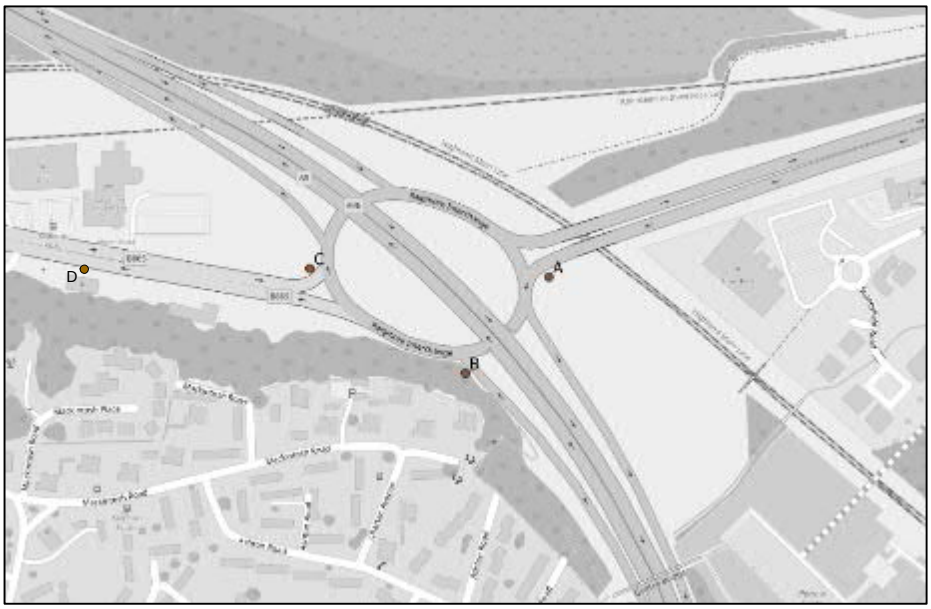

Figure 5.1 NMU journey points

5.3.3 The total time for a journey between two points comprised of two elements, a movement time and a waiting time. Movement time was calculated by distance multiplied by walking speed, where 1.2 m/s (metres per second) was assumed in line with standard practice and used for all scenarios. Waiting times depend on the crossing type and were therefore different for each of the Intervention Scenarios.

5.3.4 As noted above, the wait times at signal controlled crossings, including both 'Walk With' and pedestrian demand, were calculated as part of the traffic modelling undertaken and based on the forecasted traffic flow data.

5.3.5 For each crossing, a best and worst case was determined. A 'Best Case' was based on an NMU arriving at the crossing and having to wait the shortest signal cycle for traffic to be stopped and allow them to cross, while the 'Worst Case' was based on the longest signal cycle. For NMU controlled crossings the wait time has been increased by 60 seconds for the 'Worst Case'. This presumes a pedestrian reaches the NMU controlled crossing at the beginning of a signal cycle. Once called the NMU user will be required to wait for the signal to complete its current cycle before the traffic stage and then NMU demand stage is then activated. Under "walk with" scenarios this has not been included as the pedestrian stage is incorporated in the opposing signals green time.

5.3.6 For the 'Do Minimum', IS1 and IS3, the wait times for the A9 southbound diverge slip road crossing are based on the existing operation.

5.3.7 For uncontrolled crossings, it was not possible to estimate gaps in traffic to allow an NMU to cross. To essentially create a 'Best Case' where it is assumed that the carriageway is clear, a three second cursory wait time was used. This accounted for an NMU stopping to check traffic is clear before proceeding. Given the irregular and variable traffic levels in combination with an individual's perception of risk, a 'Worst Case' cannot be calculated for an uncontrolled crossing. As such, no 'Worst Case' journey times are provided for routes which include an uncontrolled crossing.

5.3.8 Table 5.1 below summarises the best and, where applicable, worst case, journey times for each of the scenarios.

Table 5.1 NMU Journey Times

Scenarios	A - B (Minutes)		A - C (Minutes)		A – D (Minutes)		B - C (Minutes)		C - D (Minutes)	
	Best Case	Worst Case	Best Case	Worst Case	Best Case	Worst Case	Best Case	Worst Case	Best Case	Worst Case
Do Minimum	3.8	-	9.1	-	10.8	-	5.2	-	4.9	-
Scenario 1	4.6	6.4	9.8	-	11.5	13.3	5.2	-	4.9	-
Scenario 2	2.8	4.1	8.0	-	9.7	11	5.2	-	4.9	-
Scenario 3	4.6	6.4	9.8	-	11.5	13.3	5.2	-	4.9	-
Scenario 4	2.8	4.1	5.5	6.8	9.7	11	4.1	5.1	11	12
Scenario 4.1	2.8	4.1	5.5	6.8	9.7	11	4.1	5.1	11	12
Scenario 5	2.8	4.1	7.1	9.5	9.7	11	4.1	5.3	5.3	6.6
Scenario 6	2.8	4.1	5.5	6.8	9.7	11	4.1	5.3*	5.3	6.6

* It has been assumed that it may not be obvious to NMUs whether the inside or outside route for movements B-C will be shorter, unlike A-C and C-D, therefore the 'Worst Case' is based on the longer time from IS5.

5.4 Assessing Traffic Safety

5.4.1 Traffic safety was assessed on a qualitative basis. A high-level road safety review was undertaken for each of the Intervention Scenarios presented with an aim of identifying potential hazards for each scenario. Similar to the Core Design Principles, the full benefits and limitations of each intervention scenario are outlined in Appendix B (Intervention Scenario Assessment Criteria Review).

5.4.2 Summarised below is the assessment outcome for each Intervention Scenario:

- IS1- This has been scored as a minor improvement over 'Do Minimum';
- IS2 - This has been scored as a moderate improvement over 'Do Minimum';
- IS3 - This has been scored as a minor improvement over 'Do Minimum';
- IS4 - This has been scored as a major improvement over 'Do Minimum';
- IS4.1 - This has been scored as a major improvement over 'Do Minimum';
- IS5 - This has been scored as a moderate improvement over 'Do Minimum';
- IS6 - This has been scored as a moderate improvement over 'Do Minimum';

5.5 Assessing Traffic Queue Lengths

5.5.1 Traffic Queue Lengths are discussed earlier in Section 4.6 (Traffic Queue Lengths). Below is a summary of the outcomes found for the different scenarios.

Intervention Scenarios 1 and 3

5.5.2 With the exception of the A9 northbound diverge slip road during the AM and PM peaks in 2024, no betterment is provided with traffic queuing equal to, or worse than 'Do Minimum'. This is most notable on the A96 approach where it reaches back to Smithton junction and is significantly worse than 'Do Minimum' in both AM and PM for 2024 and 2039 at this location. Therefore, these intervention scenarios are considered to result in a major detriment compared to the 'Do Minimum'.

Intervention Scenarios 2

5.5.3 Generally, this intervention scenario performs much better than the 'Do Minimum' with only the PM peaks for 2024 and 2039 on Millburn Road having equal queue lengths. Both the A9 northbound diverge slip road and A96 show minimal or no queuing at the PM peak for 2039 compared to extensive queues for 'Do Minimum'. While significant improvement is noted at certain locations, it is not balanced and at the PM peak there is no betterment for Millburn Road where most traffic will be trying to leave the city. Therefore, this has been scored as a moderate improvement over 'Do Minimum'.

Intervention Scenario 4

5.5.4 For both AM and PM peaks in 2024 and AM in 2039, the queue lengths are a significant improvement on 'Do Minimum'. For the PM peak in 2039 queuing is introduced on the A9 southbound diverge slip road, while the A96 approach matches 'Do Minimum'; however, both Millburn Road and A9 northbound merge slip road are considerably less. Therefore, this has been scored as a moderate improvement over 'Do Minimum'.

Intervention Scenarios 4.1

5.5.5 In this scenario, there is no queuing on the A96 approach compared to the 'Do Minimum'. The improved operational efficiency of the junction from the additional lanes results in minimal queuing on all approaches for the AM and PM peaks in 2024 and AM in 2039. In 2039, queuing is introduced on the A9 southbound diverge slip road; however, there is significant improvement on Millburn Road and A9 northbound diverge slip road, and and no queuing on the A96 approach compared to the 'Do Minimum''. Therefore, this has been scored as a major improvement over 'Do Minimum'.

Intervention Scenarios 5 and 6

5.5.6 For both AM and PM peaks in 2024 and AM in 2039, the queue lengths are a significant improvement on 'Do Minimum'. For the PM peak in 2039 queuing is introduced on the A9 southbound diverge slip road, while the A96 approach matches 'Do Minimum'; however, queues on both Millburn Road and A9 northbound diverge slip road are considerably less. Therefore, this has been scored as a moderate improvement over 'Do Minimum'.

5.6 Scoring outcomes

5.6.1 The scores allocated to the Intervention Scenarios against each of the eight design principles are shown in Table 5.2. From the assessment, IS4.1 was found to have the highest combined weighted score of 570, with IS4 and IS6 following this with scores of 565 and 545, respectively. However, when looking solely at NMU scores, IS6 was first with a score of 345, followed by IS4 with a score of 340, and IS4.1 with a score of 330.

5.6.2 Therefore, from an NMU perspective IS6 is the best performing option. The reason for IS4.1 scoring higher was due to the significant improvements expected for traffic operation which is achieved through the introduction of an additional lane on the circulatory carriageway. This additional lane is on the south east quadrant of the interchange roundabout as it passes under the southern A9 underbridge. In addition, IS6 scored lower on Traffic Safety grounds than IS4 and IS4.1 due to the potential risk associated with the proximity of the signal controlled crossing on Millburn Road westbound carriageway to the exit from the Interchange roundabout.

5.6.3 Three sensitivity tests were carried out where the weighting attributed to the assessment criteria was altered to establish whether this would change the outcome of the highest scoring intervention scenario. The matrices for the sensitivity tests can be found in Appendix C (Sensitivity Testing), and are summarised below:

1. Weighting adjusted to 90% NMUs to10% traffic with no consideration given to Traffic Queue Lengths. Intervention scenarios 4 and 6 returned joint highest scores of 560, with IS6 having the highest NMU score of 510.

2. Weighting adjusted to 90% NMUs to10% traffic, with no consideration given to Traffic Queue Lengths, as above, but with alternative weights against the NMU criteria which were deemed to be more relevant to the interchange. IS4 was highest with a score of 568, closely followed by IS6 with 566. Again, IS6 had the highest NMU score with 516.

3. Weighting adjusted to 75% NMUs to 25% traffic with minor consideration given to Traffic Queue Lengths. Intervention scenarios 4 and 4.1 returned joint highest scores of 570, with IS6 following with 560. Again, IS6 had the highest NMU score with 435.

Table 5.2 Intervention Scenario Options Scoring Matrix

Design Principles Considered	Weighting	Intervention Scenario 1		Intervention Scenario 2		Intervention Scenario 3		Intervention Scenario 4		Intervention Scenario 4.1		Intervention Scenario 5		Intervention Scenario 6	
		Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score
NMU Safety	25	4	100	5	125	4	100	6	150	6	150	6	150	6	150
NMU Coherence	5	4	20	5	25	5	25	6	30	6	30	6	30	6	30
NMU Directness	5	3	15	2	10	3	15	2	10	2	10	3	15	3	15
NMU Comfort	5	3	15	4	20	4	20	6	30	6	30	5	25	6	30
NMU Attractiveness	5	4	20	5	25	5	25	6	30	4	20	5	25	6	30
NMU Journey Times	15	3	45	4	60	3	45	6	90	6	90	5	75	6	90
Traffic Safety	25	4	100	5	125	4	100	6	150	6	150	5	125	5	125
Traffic Queue Lengths	15	1	15	5	75	1	15	5	75	6	90	5	75	5	75
Basic Score		26		35		29		43		42		40		43	
NMU Weighted Score	60	215		265		230		340		330		320		345	
Traffic Weighted Score	40	115		200		115		225		240		200		200	
Combined weighted score	100	330		465		345		565		570		520		545	
0. Major Detriment, 1. Moderate Detriment, 2. Minor Detriment, 3. Neutral, 4. Minor Improvement, 5. Moderate Improvement, 6. Major Improvement															

5.7 Assessment Workshops

5.7.1 During the assessment, two workshops were held with the key stakeholders: Transport Scotland, The Highland Council and Sustrans. The first of these was held on 3rd September 2020 to provide an update on the initial findings from the assessment work carried out to date. The key outcomes from the meeting are listed below:

- Consideration to be given to a combined Intervention Scenario 4 and 5 (referred to as Intervention Scenario 6 (IS6) in this report);
- Consideration to be given to sensitivity testing of the scoring matrix and how this will affect the overall results, see paragraph 5.6.3 above;
- Consideration to be given to scoring of the alternative intervention options put forward by Sustrans in February 2020 to understand how they compare (refer to paragraph 1.7.8); and,
- A further workshop to be held to discuss scoring rationale for each of the Intervention Scenarios and to facilitate further discussions with the aim of identifying a preferred option.

5.7.2 Following the initial workshop, the 'most preferred' and 'least preferred' alternative options put forward by Sustrans in February 2020 were subject to a high level assessment based on the same approach as applied to the seven intervention scenarios described above. It was found that the options generally performed well for NMUs; however, based on the proposed junction layouts, significant impact on traffic flows queue lengths was anticipated. The 'most preferred' alternative option scored 445, placing it above IS1 and IS3 but below the others when compared to the seven intervention scenarios, while the 'least preferred' alternative option scored 475, placing it above IS1, IS2 and IS3. The full assessment, layout schematics and descriptions are contained in Appendix D (Sustrans Options).

5.7.3 A second workshop was held 24th February 2021. At this, the rationale behind the scoring awarded to each of the Intervention Scenarios against the assessment criteria was presented along with the outcome of the high level appraisal of the three alternative Sustrans options. A discussion was held between the attendee stakeholders to identify a preferred scenario.

5.7.4 Despite IS 4.1 scoring highest with a combined weighted score of 570, there was concern from Sustrans and The Highland Council that this option, and the next best performing option, IS4, did not include a direct NMU crossing of the Millburn Road westbound carriageway, resulting in long NMU journeys for North to West movements. The next best performing option is IS6, which does include a crossing of Millburn Road westbound carriageway.

5.7.5 As stated above, IS6 was, overall, scored lower than IS4 and IS4.1 due to its performance against the traffic criteria, both Traffic Safety and Traffic Queue Lengths. In terms of traffic queue lengths, whilst the introduction of an additional lane under IS4.1 improves the operational efficiency of the roundabout Sustrans were concerned about taking forward an option that introduces an additional traffic lane. They argued that any option taken forward should aim to make the space under the bridge structure more attractive, avoid reducing the space available to NMUs, and be designed to encourage adherence to the 30mph limit.

5.7.6 Taking account of the above issues, it was agreed that all parties would support IS6 being taken forward subject to the following:

- Further work to be carried out at detailed design stage to consider the best use of space on the southern part of the roundabout circulatory carriageway. This would include consideration of a cross-section providing an additional traffic lane within the existing carriageway space (as per IS4.1) and a cross-section where the available carriageway space is reduced, to improve the environment for

NMUs (whilst retaining two traffic lanes). This should also consider how any change would assist with reducing vehicle speeds.

- Further development of the detailed design for the Millburn Road westbound crossing, including satisfactory completion of a Road Safety Audit. Subject to a satisfactory design being developed, this would address the potential risk that resulted in IS6 being scored lower than IS4 and IS4.1 on traffic safety grounds.

5.8 Intervention Scenario Preliminary Cost Estimates

5.8.1 A preliminary scheme cost estimate for each of the Intervention Scenarios has been developed. The construction cost has been developed based on the high level headings within the DMRB Volume 4 Bills of Quantities for Highway Works and rates taken from SPON'S Civil Engineering and Highway Works Price Book 2020 and other similar recent projects with measurements taken from the drawings in Appendix A, topographical surveys and available street and aerial photography.

5.8.2 The following percentages have been used in the preparation of the cost estimate:

- Preliminaries – 25%
- Design Costs – 10%
- Site supervision – 5%

5.8.3 Optimism bias has been included in the estimate. Optimism bias is the demonstrated systematic tendency for appraisers to be overly optimistic about key parameters. As such, an uplift of 44% has been included to reflect this early stage of the design development in line with the Treasury publication, The Green Book: appraisal and evaluation in central government, 2020.

5.8.4 The estimated scheme cost for each of the intervention scenarios, inclusive of optimism bias is shown in Table 5.3 below. Indicative costs have been shown within a range based on a lower bound of 5% less than the calculated cost figure (including optimism bias) and an upper bound of 25% greater than the calculated cost figure (including optimism bias). These costs exclude street lighting – refer to paragraph 5.8.9.

Table 5.3 Intervention Scenario Scheme Cost Estimate (2020 rates excl. VAT)

	IS1	IS2	IS3	IS4	IS4.1	IS5	IS6
High +25%	£173,500	£364,500	£266,000	£754,000	£756,500	£675,500	£807,000
Low -5%	£131,500	£277,000	£202,000	£573,000	£575,000	£513,000	£613,500

Cost Estimate Assumptions and Notes

5.8.5 The rates used are standard item rates and do not account for any uplift that may be required for night or weekend working with the exception of Traffic Management, see paragraph 5.8.8 below.

5.8.6 No costs have been assumed for Statutory Undertaker diversions in the estimates above. An initial review of utilities apparatus in the area suggests that work required on these will be minimal. Refer to Section 5.9 (Future Opportunities, Constraints and Uncertainties).

5.8.7 An estimate for landscaping costs has been included for intervention scenarios 4, 4.1 and 6 within the roundabout central island. This has been based on an area of 1200m^2; however, may differ at detailed design depending on the route of the proposed footway and the extent of any desired landscaping.

5.8.8 Traffic Management costs have been estimated based on an anticipated works duration and included in addition to preliminaries. These costs assume that traffic management would be installed/removed at night and that two lanes would be maintained on the interchange and one lane on the slip road as a minimum. The costs have not made allowance for additional equipment or machinery, for example Variable Messaging Signs (VMS) and Impact Protection Vehicles (IPV) that may be required as part of the works. No allowance has been made for Local Authority, Client, Road Operator specific traffic management requests regarding the operation of the road during the works, for example closures or diversion routes.

Cost Estimate for lighting works

5.8.9 An initial review of the existing street lighting on the interchange and approach roads, carried out as part of the cost estimate preparation has identified that it will be necessary to carry out significant replacement works in order to bring the existing lighting up to a suitable standard and allow improvements to be made to NMU lighting provision to take account of the proposed new NMU facilities. Given the potentially significant nature of these works, the lighting works have been costed separately to allow the procurement of this work to be considered separately by Transport Scotland.

5.8.10 For the replacement works including lighting of new NMU facilities, a preliminary cost estimate falling in the range of £629,000 to £828,000(2020 rates excl. VAT) has been calculated, including optimism bias at 44% and other uplift costs outlined in paragraph 5.8.2. This cost is not included in the costs provided in Table 5.3. Similar to the cost estimates for the Intervention Scenarios, this is based on high level design and calculations.

Cost Estimates for additional footway widening works

5.8.11 In addition to the seven intervention scenario options, two locations for potential widening of existing footways have been identified within the 'Improvement Extents Boundary' indicated in Figure 3.1. This work would upgrade these sections of existing footway to comply with Cycling by Design 2010 guidance in terms of widths and separation from the carriageway.

5.8.12 The first is in the north east corner between the proposed Millburn Road eastbound crossing point (which features in Intervention Scenarios 4, 4.1, 5 and 6) and the existing crossing of the A9 northbound merge slip road, to tie into the footway widening works proposed as part of the A9/A82 Longman Junction Improvement Scheme. For this footway widening a preliminary cost estimate falling in the range of £79,000 to £104,000 (2020 rates excl. VAT) has been calculated inclusive of Optimism Bias and other uplift costs outlined in paragraph 5.8.2.

5.8.13 The cost estimate is based on the following key assumptions:

- 3m wide footway with a 0.5m separation strip widening to the back of the verge in line with the desirable minimum requirements for Cycling by Design 2010;
- Earthworks to accommodate widening at the back of the existing verge;
- Removal and replacement of the existing vehicle restraint system;
- Minor ancillary works such as vegetation clearance and sign replacement; and ,
- All works are within Scottish Ministers land. This is based on available information at the time of writing but will need to be confirmed during detailed design, including confirmation of title boundaries.

5.8.14 The cost does not include for the removal or replacement of lighting, or for any works involved in the implementation of the new signal controlled crossing.

5.8.15 The second is the south west corner between the proposed Millburn Road westbound crossing point (which features in Intervention Scenarios 5 and 6), and the proposed A9 northbound diverge slip road crossing where a preliminary cost estimate range of £41,000 to £478,000(2020 rates excl. VAT) has been calculated inclusive of Optimism bias and other uplift costs outlined in paragraph 5.8.2. Due to the presence of an existing retaining wall, a range has been provided to demonstrate the potential upper and lower costs depending on the level of improvement. For the structural elements, an Optimism bias of 63% has been used.

5.8.16 The costs are based on the assumption that the current kerbline would be retained and with improvements undertaken behind this line as opposed to re-allocating carriageway space.

5.8.17 The lower cost estimate is based on the following key assumptions:

- Provision of a 2m wide footway with a 0.5m separation strip in line with the absolute minimum requirements for Cycling by Design 2010;
- Earthworks to accommodate widening at the back of the existing verge where there is a pinchpoint at the vehicle restraint system;
- Removal and replacement of the existing vehicle restraint system; and,
- Minor ancillary works such as vegetation clearance and sign replacement.

5.8.18 The higher cost estimate is based on the following key assumptions:

- Provision of a 3m wide footway with a 0.5m separation strip in line with the desirable minimum requirements for Cycling by Design 2010;
- Demolition of the existing retaining wall and construction of a new wall to accommodate widening at the back of the existing footway;
- Earthworks to accommodate widening at the back of the existing verge where there is a pinchpoint at the vehicle restraint system;
- Removal and replacement of the existing vehicle restraint system; and,
- Minor ancillary works such as vegetation clearance and sign replacement.

5.8.19 Both costs do not include for the removal or replacement of lighting, or for any works involved in the implementation of the new signal controlled crossing.

5.8.20 It has been assumed that all works are within Scottish Ministers land. This is based on available information at the time of writing but will need to be confirmed during detailed design, including confirmation of title boundaries.

5.9 Future Opportunities, Constraints and Uncertainties

Public Utilities

5.9.1 At this stage, no consultations have been held with Statutory Undertakers. The main services identified within the extents of the interchange are based on New Roads and Street Works Act 1991(NRSWA) C2 search information obtained from the A96 Inverness to Nairn (including Nairn Bypass) scheme. The services include, gas (SGN), telecoms (BT) and power (SSE).

5.9.2 From the information available, it is likely that some Intervention Scenarios may interact with the existing services. It is anticipated that the construction of the new footpath will have minimal impact due to depth; however, items such as traffic signal poles, chambers and ducting may require further intervention.

5.9.3 The exact position of each service would need to be determined to understand any potential impacts. Further investigation during the detailed design phase would be required. Figure 5.2 below shows indicative utility locations based on the A96 Dualling Inverness to Nairn (including Nairn Bypass) project mapping,. SGN – Pink, BT – Green and SSE – Purple:

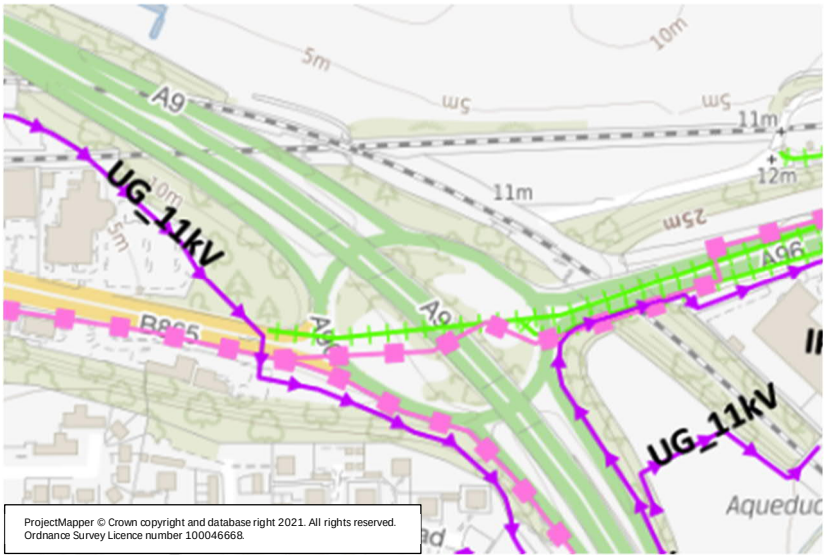

Figure 5.2 A96 Dualling Inverness to Nairn Statutory Undertaker Information

Existing Drainage

5.9.4 Due to the high level design at this stage, a detailed investigation of potential drainage connection points for connection of new drainage has not been carried out as part of this study. Costs have been allocated to allow for additional gullies at low points where new controlled crossings are positioned; however, further review of the drainage, existing positions and possible connection levels will be required at the detailed design stage.

Landscaping

5.9.5 Intervention Scenarios 2, 4, 4.1, 5 and 6 all include the creation of a footpath through the roundabout central island for part of the alignment. Given the space available, the proposals will provide an opportunity to create a more pleasant route for NMUs through the provision of a path enhanced by an appropriate soft landscape design. Furthermore, this will also act as a buffer between NMUs and traffic, with the potential to create an enhanced sense of separation from the road and increased perception of safety for users.

5.9.6 Planting would be likely to incorporate a more defined and structured approach than the existing landscaping present at Raigmore Interchange, potentially using a mixture of native tree species and hedges interspersed with shrubs and amenity grassland. Any proposed planting should conform with the Transport Scotland policy document 'Fitting Landscapes: Securing more sustainable landscapes' and take cognisance of future maintenance requirements. No issues of potential vegetation encroaching on visibility splays have been identified at this early stage; however, consideration of potential effects on sight lines will be required during the development of the detailed design.

5.9.7 It should also be noted that The Highland Council has been investigating opportunities to improve the aesthetic appearance of entrances to, and routes through, Inverness through enhancement of the landscape of infrastructure corridors as part of the strategy framework outlined in 'Approaching Inverness – A Design Guide to Help Improve the Main Approaches to Inverness. The improvements of the NMU route at the Raigmore Interchange could potentially provide an opportunity to incorporate some of the design principles being developed by the local authority into the proposals, which have been put forward in the design guidance included in The Highland Council 'Approaching Inverness – A Design Guide to Help Improve the Main Approaches to Inverness.'

6. Conclusion

6.1 Conclusion

6.1.1 Seven options to improve NMU provision at Raigmore Interchange (IS1, IS2, IS3, IS4, IS4.1, IS5 & IS6) have been assessed against eight design principles, including both NMU and traffic based criteria. A scoring matrix was used to assist in selecting a preferred option. An overall weighting of 60% was applied to NMU criteria and 40% to traffic criteria.

6.1.2 From the assessment, improvement option IS4.1 was found to have the highest combined weighted score of 570, with IS4 and IS6 being the next best performing options with scores of 565 and 545, respectively. Looking solely at NMU scores, IS6 was first with a score of 345, followed by IS4 with a score of 340, and IS4.1 with a score of 330. IS4.1 performed better than both other options in terms of traffic queue lengths, due to the introduction of an additional lane on the roundabout circulatory carriageway as it passes under the southern A9 underbridge. IS4 and IS4.1 both performed better than IS6 on traffic safety grounds due to the potential risk associated with a signal controlled NMU crossing of Millburn Road westbound carriageway, included in IS6. A summary of the assessment scores is provided in Table 6.1.

Table 6.1 Summary of Assessment Scores

Weighted Scores	Weighting	Intervention Scenario 1	Intervention Scenario 2	Intervention Scenario 3	Intervention Scenario 4	Intervention Scenario 4.1	Intervention Scenario 5	Intervention Scenario 6
NMU Score	60	215	265	230	340	330	320	345
Traffic Score	40	115	200	115	225	240	200	200
Combined score	100	330	465	345	565	570	520	545

6.1.3 In stakeholder workshops held during the assessment process, concern was raised that options IS4 and IS4.1 did not include a signal controlled NMU crossing of Millburn Road westbound carriageway. This results in long NMU journeys for North to West movements through the interchange.

6.1.4 In these workshops, concern was also raised about the introduction of an additional lane on the circulatory carriageway, with the view expressed that any option taken forward should aim to make the space under the bridge structure more attractive, avoid reducing the space available to NMUs, and be designed to encourage adherence to the 30mph limit.

6.1.5 Taking account of the above issues, it was agreed that all parties would support IS6 being taken forward subject to the following:

- Further work to be carried out at detailed design stage to consider the best use of space on the southern part of the roundabout circulatory carriageway. This would include consideration of a cross-section providing an additional traffic lane within the existing carriageway space (as per IS4.1) and a cross-section where the available carriageway space is reduced, to improve the environment for NMUs (whilst retaining two traffic lanes). This should also consider how any change would assist with reducing vehicle speeds.

- Further development of the detailed design for the Millburn Road westbound crossing, including satisfactory completion of a Road Safety Audit. Subject to a satisfactory design being developed, this would address the potential traffic safety risk that resulted in IS6 being scored lower than IS4 and IS4.1 on traffic safety grounds.

6.1.6 In terms of cost, the three best performing options are estimated to have scheme costs (excluding street lighting costs) as follows:

- IS4: £573,000 - £754,000
- IS4.1: £575,000 - £756,500
- IS6: £613,500 - £807,000

These costs are at 2020 rates, excluding VAT and include an allowance for optimism bias at 44%. These estimates include construction, preliminaries, design and site supervision costs.

6.1.7 Given that the costs for all three options are relatively similar, it is recommended, budget permitting, that option IS6 be taken forward to detailed design subject to the following:

- Further work to be carried out at detailed design stage to consider the best use of road space on the southern part of the roundabout circulatory carriageway.
- Further development of the detailed design for the Millburn Road westbound crossing, including satisfactory completion of a Road Safety Audit.

6.1.8 As part of the assessment process, it has been identified that the existing street lighting of the interchange is likely to need full replacement in order to bring it up to standard, as part of any NMU improvement. This work has been costed separately to allow procurement of this work to be considered separately by Transport Scotland. The cost of the lighting replacement works, including lighting of new NMU facilities, is estimated to be between £629,000 and £828,000 (2020 rates excl. VAT). This includes construction, preliminaries, design and site supervision costs and optimism bias at 44%.

6.1.9 In addition to the works included in the assessed Intervention Scenarios, two further locations for potential widening of existing footways within the scheme boundary, in order to bring all footways at the interchange up to a standard complying with Cycling by Design 2010 recommendations for shared use facilities. These are located at the north west and south west corners of the interchange. The cost of these works is estimated as follows:

- North west corner: £79,000 to £104,000 (2020 rates excl. VAT)
- South west corner: £41,000 to £478,000(2020 rates excl. VAT)

The large range at the south west corner is due to the range of improvement options available depending on whether the footway is upgraded to meet absolute or desirable minimum standards. These costs include construction, preliminaries, design and site supervision costs and optimism bias at 44% (other than for structural elements where an Optimism bias of 63% has been used).

6.1.10 As part of the preparation of the options assessment, a number of issues have been identified that will require further consideration at detailed design stage, in addition to those mentioned in the preceding paragraphs. These include:

- Design guidance – interventions have been designed based on Cycling by Design 2010 (Revision 1 2011). An updated version of this guidance, Cycling by Design 2021 (Transport Scotland, 2021) has since been published and the implications of this updated guidance should be considered at the next stage of scheme development;
- Adjacent schemes – integration with schemes proposed/under construction adjacent to the interchange including the Raigmore Active Travel Link, the A9/A96 Inshes to Smithton scheme, the

A9/A82 Longman Junction Improvement scheme and potential improvements on Millburn Road as part of the Inverness City Active Travel Network (ICATN) project to be taken into account;

- Utilities – further investigation required to confirm exact location of utilities and potential clashes with items such as traffic signal foundations and chambers;
- Drainage – further investigation required to confirm suitable connection points for new drainage – e.g. new gullies; and
- Landscaping – opportunities to enhance the attractiveness of the environment for NMU's through appropriate soft landscape design to be explored, particularly in the roundabout central island. This should take into account the design guidance included in The Highland Council's 'Approaching Inverness – A Design Guide to Help Improve the Main Approaches to Inverness.'

7. References

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Standard for Highways (2021a). Design Manual for Roads and Bridges – CD 195 - Designing for cycle traffic.

Appendix A. Drawings

List of related drawings:

- A96PIN-JAC-HGN-XXX-SK-CI-0011 – Specimen Design Raigmore Interchange Existing Conditions
- A96PIN-JAC-HGN-XXX-SK-CI-0037 – Raigmore Interchange NMU Improvement Study Intervention Scenario 1
- A96PIN-JAC-HGN-XXX-SK-CI-0038– Raigmore Interchange NMU Improvement Study Intervention Scenario 2
- A96PIN-JAC-HGN-XXX-SK-CI-0039– Raigmore Interchange NMU Improvement Study Intervention Scenario 3
- A96PIN-JAC-HGN-XXX-SK-CI-0040– Raigmore Interchange NMU Improvement Study Intervention Scenario 4
- A96PIN-JAC-HGN-XXX-SK-CI-0041– Raigmore Interchange NMU Improvement Study Intervention Scenario 4.1
- A96PIN-JAC-HGN-XXX-SK-CI-0042– Raigmore Interchange NMU Improvement Study Intervention Scenario 5
- A96PIN-JAC-HGN-XXX-SK-CI-0043– Raigmore Interchange NMU Improvement Study Intervention Scenario 6

Appendix B. Intervention Scenario Assessment Criteria Review

B.1 Intervention Scenario 1

B.1.1 NMU Safety

Benefits:

- Safety improvement by providing controlled crossing to the A9 southbound merge slip road, the busiest of the currently uncontrolled crossings, with recognized safety concerns;

Limitations:

- Improvements limited only to the southeast corner providing no benefit to the remainder of the interchange;
- Uncontrolled northern route remains;
- Potential for pedestrians to cross without 'green man' due to wait times in the signal cycle as it is pedestrian controlled.
- No new NMU facilities improving on existing;
- Uncommon layout signal layout, potential for vehicles to overshoot and not realise second stop line.

Summary:

- Improves the safety through the controlled crossing, but these are limited to one area of the interchange. Therefore, this has been scored a minor improvement over 'Do Minimum'.

B.1.2 Coherence

Benefits:

- Introduction of a controlled crossing creates a more continuous route for anyone travelling to/from the east;
- No variation to existing route making for easy navigation;

Limitations:

- Limited to the A9 southbound merge slip road;
- No improvements to the existing infrastructure around the interchange which varies in width, quality, use of tactiles and crossing type;
- Future growth potentially stifled due to existing infrastructure;

Summary:

- Creates limited improvement on the 'Do Minimum' scenario at the A9 southbound merge slip road, but does not provide any further improvements to coherence across the remainder of the interchange. Therefore, this has scored a minor improvement over 'Do Minimum'.

B.1.3 Directness

Benefits:

- Follows the same as the existing route;

Limitations:

- None of note;

Summary:

- No improvement on the 'Do Minimum' scenario as it follows the same route.

B.1.4 Comfort

Benefits:

- Minimal over 'Do Minimum' scenario;

Limitations:

- None of note;

Summary:

- No real improvements on the 'Do Minimum' scenario as it is effectively the same with regard to comfort.

B.1.5 Attractiveness

Benefits:

- The introduction of a controlled crossing at the A9 southbound merge slip road will likely attract some users who may have been hesitant or unwilling to negotiate this point previously.

Limitations:

- The increase in attractiveness is likely to be restricted due to the limited extent of the intervention, particularly as a result of the nature of the existing infrastructure.

B.1.6 Traffic Safety

Benefits:

- Introduces traffic signals on the A96 approach and adjacent section of the circulating carriageway allowing controlled, safer, entry to the interchange from the A96;
- Will provide some limited benefit to the A9 northbound diverge slip road.

Limitations:

- Safety improvements are limited to the southeast corner;

- Traffic signals and secondary stop line will also be installed at the crossing point which may be unexpected by many drivers and could lead to emergency breaking and potentially rear end shunts;
- Lane two of the circulatory carriageway on approach to the A96 entry is a straight through and left. Stacking traffic at the lights may result in drivers pulling unexpectedly into lane 1 to turn left onto A96 given that in advance of this point there is no traffic control outwith peak hours .

Summary:

- There will be some improvement through the controlled entry to the circulatory carriageway. However, the unusual layout of the secondary stop line at the crossing may cause surprise to drivers resulting in an increase in rear end shunts and emergency breaking. Therefore, this has scored a minor improvement over 'Do Minimum'.

B.2 Intervention Scenario 2

B.2.1 NMU Safety

Benefits:

- Safety improvement by introducing controlled crossings at A96 entry and upgraded facility on A9 northbound diverge slip road;
- 'Walk with' reduces waiting times and improving continuity making it less likely for pedestrians to errantly cross compared to pedestrian demand signal crossings;
- New NMU infrastructure and separation strip moves pedestrians away from the carriageway edge and reduces likelihood of NMU conflicts.

Limitations:

- Introduces two additional carriageway crossings;
- Limited to the southern half of the interchange;
- Uncontrolled northern route remains.

Summary:

- The combination of a new controlled crossing near the A9 southbound merge slip road, 'walk with' crossings being used, thus less likelihood of errant crossing, and a new shared use path and set back from the carriageway provide improvements over 'Do minimum'; however, this is still limited to the southern half of the interchange and no mitigation is provided for the uncontrolled northern route. Therefore, this has been scored a moderate improvement over 'Do Minimum'.

B.2.2 Coherence

Benefits:

- 'Walk with' crossings provide a more continuous route through reduced waiting times;
- New shared use path designed to current standards and will comprise of high-quality materials for those traveling to/from the east;

- New path designed to accommodate future growth in NMU numbers;
- New signage will be used to assist in navigation of interchange.

Limitations:

- Limited to the southern half of the interchange;
- Lengths of the varied existing infrastructure remain;
- Slightly more complex navigation required.

Summary:

- The new 3m NMU path will provide a significant improvement over the existing path, (which narrows to 1m at points), on the southern side of the interchange helping to accommodate the anticipated future growth in numbers. While the scenario provides links to the same points as the 'Do Minimum' scenario, the benefit achieved by the 'Walk with' crossings allows minimum waiting and more continuous travel along the route compared to the potentially longer start/stop motion of an uncontrolled crossings or pedestrian demand crossing. Therefore, this has scored a moderate improvement over 'Do Minimum'.

B.2.3 Directness

Benefits:

- None of note.

Limitations:

- Layout is less direct than the existing east-west.

Summary:

- While approximately the same length, the proposed path goes into the roundabout central island and does not follow the obvious pedestrian desire line. Therefore, this has been scored as a minor detriment compared to 'Do Minimum'.

B.2.4 Comfort

Benefits:

- New path to be laid in the roundabout central island which will be designed with suitable longitudinal and crossfall gradients to aid in drainage and utilise high quality pavement materials;
- Path width is based on desirable dimensions in the current design guidance which will accommodate the anticipated growth ensuring suitable room for free travel;
- 0.5m set back from the carriageway helping to minimise impacts from spray and traffic as well as kerb shyness so full width of path can be used confidently.

Limitations:

- Limited to only the southern half of the interchange;

- Extensive lengths of the existing infrastructure remain;
- The movement across the additional crossings may not be comfortable for all users, for example, the time available for crossing the carriageway.

Summary:

- The new path does provide good improvements over the existing situation, particularly the narrow stretch of path beneath the structure; however, this is limited to the southern half of the interchange with no proposed improvements across the northern half. Therefore, this has been scored a minor improvement over 'Do Minimum'.

B.2.5 Attractiveness

Benefits:

- The new signals allow for safe crossing which will likely attract some users who may have been hesitant or unwilling to negotiate this point previously;
- New path will provide greater room for travelling and allow NMUs to pass each other, particularly those with limited mobility and cycles which the existing path does not comfortably accommodate;
- The path will also make the route more visually appealing due to newer materials.

Limitations:

- No increase in attractiveness for those travelling north-south;
- There is no improvement to the south western path which connects the north and south sides of the junction. The narrow path may lead to close passing of NMUs, particularly if numbers increase, which may put some people off while the high nature of the retaining wall and pedestrian guardrail are also not particularly attractive.

Summary:

- The improvement to both the available space and the aesthetic of the new path as well as safe crossings will help make this a more attractive route compared to the existing path. However, there is no notable improvement to the north-south route. Therefore, this has been scored as a moderate improvement over 'Do Minimum'.

B.2.6 Traffic Safety

Benefits:

- Introduces controlled entry into the circulating carriageway for the A9 northbound diverge slip road and A96 approach while also regulating the circulatory carriageway traffic;
- Will provide benefit to the Millburn Road entry allowing drivers to anticipate oncoming traffic easier.

Limitations:

- Controlled improvements are limited to the southern half of the interchange;

Summary:

- The full time signals on the southern half of the interchange will provide some improvement as well as having a positive impact on Millburn Road entry; however, it is limited. Therefore, this has scored a moderate improvement over 'Do Minimum.

B.3 Intervention Scenario 3

B.3.1 NMU Safety

Benefits:

- Safety improvement by providing controlled crossing on the A9 southbound merge slip road, the busiest of the currently uncontrolled crossings, with recognized safety concerns;
- New NMU infrastructure and separation strip moves pedestrians away from the carriageway edge and reduces likelihood of NMU conflicts.

Limitations:

- Improvements limited only to the south to southeast corner with no benefit to the remainder of the interchange;
- Uncontrolled northern route remains;
- Potential for pedestrians to cross without 'green man' due to wait times in the signal cycle as it is pedestrian controlled;
- Uncommon layout signal layout, potential vehicles to overshoot and not realise second stop line.

Summary:

- Improves the safety through the controlled crossing, but these are limited to one area of the interchange. While improved NMU infrastructure is provided, the benefits are not viewed as outweighing the inherent risks in the signal layout. Therefore, this has scored a minor improvement over 'Do Minimum'.

B.3.2 Coherence

Benefits:

- New shared use path designed to current standards and will comprise of high-quality materials for those traveling to/from the east;
- New path designed to accommodate future growth in NMU numbers;
- Introduction of a controlled crossing creates a more continuous route for anyone travelling to/from the east;
- No variation to existing route making for easy navigation.

Limitations:

- Limited to the southern half of the interchange;
- Lengths of the varied existing infrastructure remain.

Summary:

- The new 3m NMU path will provide a significant improvement over the existing path, (which narrows to 1m at points), on the southern side of the interchange helping to accommodate the anticipated future growth in numbers. Following the existing pedestrian route, results in easy navigation and no change to travel. Therefore, this has scored a moderate improvement over 'Do Minimum'.

B.3.3 Directness

Benefits:

- Follows the same as the existing route;

Limitations:

- None of note;

Summary:

- No improvement on the 'Do Minimum' scenario as it follows the same route.

B.3.4 Comfort

Benefits:

- Upgraded path along the south side which will be designed with suitable longitudinal and crossfall gradients to aid in drainage and utilise high quality pavement materials;
- Path width is based on desirable dimensions in the current design guidance which will accommodate the anticipated growth ensuring suitable room for free travel;
- 0.5m set back from the carriageway helping to minimise impacts from spray and traffic as well as kerb shyness so full width of path can be used confidently.

Limitations:

- Limited to only the southern half of the interchange;
- Extensive lengths of the existing infrastructure remain;
- A length of low retaining wall would be required east of the A9 southbound merge slip road crossing, adjacent to the back of the footway. This could minimise the usable space due handlebar clip and natural desire to travel offset from a delineator.

Summary:

- The new path does provide good improvements over the existing situation, particularly the narrow stretch of path beneath the structure; however, this is limited to the southern half of the interchange. The retaining wall creates a potential for edge shyness and therefore may limit the usable width of the path. Therefore, this has scored as a minor improvement over 'Do Minimum'.

B.3.5 Attractiveness

Benefits:

- The new signals allow for safe crossing which will likely attract some users who may have been hesitant or unwilling to negotiate this point previously;
- New path will provide greater room for travelling and allow NMUs to pass each other, particularly those with limited mobility and cycles which the existing path does not comfortably accommodate;
- The path will also make the route more visually appealing due to newer materials.

Limitations:

- No increase in attractiveness for those travelling north-south;
- There is no improvement to the south western path which connects the north and south sides of the junction. The narrow path may lead to close passing of NMUs, particularly if numbers increase, which may put some people off while the high nature of the retaining wall and pedestrian guardrail are also not particularly attractive.

Summary:

- The improvement to both the available space and the aesthetic of the new path as well as safe crossings will help make this a more attractive route compared to the existing path. However, there is no notable improvement to the north-south route and users still need to use the south western path. Therefore, this has been scored as a moderate improvement over 'Do Minimum'.

B.3.6 Traffic Safety

Summary:

- As per IS1 from a traffic safety perspective

B.4 Intervention Scenario 4

B.4.1 NMU Safety

Benefits:

- Full signalisation allows for safe crossing on any route of travel across the junction;
- 'Walk with' reduces waiting times and improving continuity making it less likely for pedestrians to errantly cross compared to pedestrian demand signal crossings;
- New NMU infrastructure and separation strip moves pedestrians away from the carriageway edge and reduces likelihood of NMU conflicts;
- Removal of the northern uncontrolled route;
- Removal of the Millburn Road uncontrolled crossing.

Limitations:

- Introduces two additional carriageway crossings.

Summary:

- Full signalisation along with the removal of the two uncontrolled routes provide significant NMU safety improvement over the 'Do Minimum' scenario. The new NMU infrastructure across the interchange should help reduce NMU conflict if numbers increase. Therefore, this has been scored as a major improvement over 'Do Minimum'.

B.4.2 Coherence

Benefits:

- Full signalisation across the interchange providing greater continuity between the links;
- Extensive new shared use path designed to current standards and will comprise of high-quality materials for both north-south and east-west routes;
- New path designed to accommodate future growth in NMU numbers;
- New signage will be used to assist in navigation of interchange;
- Removal of the existing northern route helps guide people through a single route.

Limitations:

- Slightly more complex navigation required due to uncommon layout.

Summary:

- Creates significant improvements over 'Do Minimum' through the extensive introduction of new paths and toucan crossings linking the various routes through the interchange and accommodating for potential future growth. The removal of the northern route helps steer NMUs through one route as opposed to two, improving continuity junction wide. As all NMU moments are via new infrastructure, continuity across the interchange is ensured compared to the 'Do Minimum' scenario which is varied. Therefore, this has been scored as a major improvement over 'Do Minimum'.

B.4.3 Directness

Benefits:

- Shorter distance on the north-south route.

Limitations:

- Layout is less direct than the existing east-west;
- Route from north to west is less direct than existing although this has limited usage.

Summary:

- On the southern side of the interchange, the proposed path goes into the roundabout central island and does not follow the obvious pedestrian desire line around the outside. However, for a north-south movement, the route is approximately 53m shorter due to the uncontrolled crossing on Millburn road being almost 70m from the junction, although this still does not follow the obvious desire line. Therefore, this has been scored as a minor detriment compared to 'Do Minimum'.
- Removal of the existing northern route has not been viewed as positive or negative for directness.

B.4.4 Comfort

Benefits:

- Extensive new path designed to desirable widths with suitable longitudinal and cross fall gradients;
- Minimum 0.5m offset from carriageway and up to 4.5m on the north-south stretch, minimising impacts of traffic on NMUs;
- For the majority of routes across the interchange, NMUs will travel on the new infrastructure minimising use of existing facilities.

Limitations:

- A small retaining feature may be required in the N-S stretch of path, adjacent to the back of the footway. This could minimise the usable space due handlebar clip and natural desire to travel offset from a vertical delineator;
- The movement across the additional crossings may not be comfortable for all users, for example, the time available for crossing the carriageway.

Summary:

- The extensive new infrastructure will help improve the comfort of users quite considerably compared to the existing situation, particularly given that the majority of journeys through the interchange will now utilise it as well as a substantial setback from the carriageway for the north-south route. Despite there potentially being limitations from the retaining feature, it is expected to be possible to provide suitable offset between the wall and path. Therefore, this has been scored a major improvement over 'Do Minimum'.

B.4.5 Attractiveness

Benefits:

- Fully signalised and removal of the uncontrolled crossings will make this more attractive;
- Extensive lengths of new path will provide greater room for travelling and allow NMUs to pass each other, particularly those with limited mobility and cycles;
- The path will also make the route more visually appealing due to newer materials;
- There is opportunity to integrate the north-south route within the landscaping in the roundabout central island making the route more appealing.

Limitations:

- None of note.

Summary:

- The extensive length of new path and crossings will significantly improve the attractiveness both visually and from a feeling of space, for all directions of travel as the majority of users will pass through the new infrastructure. Due to the extensive space available in the gyratory, there is opportunity to integrate the route within the landscaping. Therefore, this has been scored a major improvement over 'Do Minimum'.

B.4.6 Traffic Safety

Benefits:

- Full signalisation helps controls traffic flows and manages vehicles entering and traveling around the circulating carriageway which in turn should lead to improvements in safety through reduced likelihood of incidents occurring;
- Affords drivers dedicated time for entering the interchange leading to less driver frustration and less likely to take risks;
- Removes the part-time signals and replaces with full-time.

Limitations:

- None of note.

Summary:

- The full signalisation significantly improves the management of traffic across the interchange and as a result improves safety. Therefore, this has been scored a major improvement over 'Do Minimum'.

B.5 Intervention Scenario 4.1

B.5.1 NMU Safety

Benefits:

- Full signalisation allows for safe crossing on any route of travel across the junction;
- 'Walk with' reduces waiting times and improving continuity making it less likely for pedestrians to errantly cross compared to pedestrian demand signal crossings;
- New NMU infrastructure and separation strip moves pedestrians away from the carriageway edge and reduces likelihood of NMU conflicts;
- Removal of the northern uncontrolled route;
- Removal of the Millburn Road uncontrolled crossing.

Limitations:

- Introduces two additional carriageway crossings (on both east-west and north-south);
- Additional traffic lane at crossing points does increase risk of NMU/vehicle conflict.

Summary:

- Full signalisation along with the removal of the two uncontrolled routes provide significant NMU safety improvement over the 'Do Minimum' scenario. The new NMU infrastructure across the interchange should help reduce NMU conflict if numbers increase. The additional traffic lane is acknowledged to increase the risk; however, this is anticipated to be marginal due to the common use of this layout and controlled crossings in general. Therefore, this has scored a major improvement over 'Do Minimum'.

B.5.2 Coherence

Benefits:

- Full signalisation across the interchange providing greater continuity between the links;
- Extensive new shared use path designed to current standards and will comprise of high-quality materials for both north-south and east-west routes;
- New path designed to accommodate future growth in NMU numbers;
- New signage will be used to assist in navigation of interchange;
- Removal of the existing northern route helps guide people through a single route.

Limitations:

- Slightly more complex navigation required due to uncommon layout.

Summary:

- Creates significant improvements over 'Do Minimum' through the extensive introduction of new paths and toucan crossings linking the various routes through the interchange and accommodating for potential future growth. The removal of the northern route helps steer NMUs through one route as opposed to two, improving continuity junction wide. As all NMU moments are via new infrastructure, continuity across the interchange is ensured compared to the 'Do Minimum' scenario which is varied. Therefore, this has scored a major improvement over 'Do Minimum'.

B.5.3 Directness

Benefits:

- Shorter distance on the north-south route.

Limitations:

- Layout is less direct than the existing east-west;
- Route from north to west is less direct than existing although this has limited usage.

Summary:

- On the southern side of the interchange, the proposed path goes into the roundabout central island and does not follow the obvious pedestrian desire line around the outside. However, for a north-south movement, the route is approximately 53m shorter due to the uncontrolled crossing on Millburn road being almost 70m from the junction, although this still does not follow the obvious desire line. Therefore, this has been scored as a minor detriment compared to 'Do Minimum'.
- Removal of the existing northern route has not been viewed as positive or negative for directness.

B.5.4 Comfort

Benefits:

- Extensive new path designed to desirable widths with suitable longitudinal and cross fall gradients;
- Minimum 0.5m offset from carriageway and up to 4.5m on the north-south stretch, minimising impacts of traffic on NMUs;
- For the majority of routes across the interchange, NMUs will travel on the new infrastructure minimising use of existing facilities.

Limitations:

- A length of small gabion wall in the N-S stretch of path sits adjacent to the back of the footway, this could minimise the usable space due to handlebar clip and natural desire to travel offset from a vertical delineator
- The movement across the additional crossings may not be comfortable for all users, for example, the time available for crossing the carriageway.

Summary:

- The extensive new infrastructure will help improve the comfort of users quite considerably compared to the existing situation, particularly given that the majority of journeys through the interchange will now utilise it as well as a substantial setback from the carriageway for the north-south route. Despite there potentially being limitations from the retaining feature, it is expected to be possible to provide suitable offset between the wall and path. Therefore, this has been scored a major improvement over 'Do Minimum'.

B.5.5 Attractiveness

Benefits:

- Fully signalised and removal of the uncontrolled crossings will make this more attractive;
- Extensive lengths of new path will provide greater room for travelling and allow NMUs to pass each other, particularly those with limited mobility and cycles;
- The path will also make the route more visually appealing due to newer materials;
- There is opportunity to integrate the north-south route within the landscaping in the roundabout central island making the route more appealing.

Limitations:

- The introduction of additional traffic through the junction may increase fumes and noise which would reduce attractiveness for users.

Summary:

- The extensive length of new path and crossings will significantly improve the attractiveness both visually and from a feeling of space, for all directions of travel as the majority of users will pass through the new infrastructure. Due to the extensive space available in the roundabout central island, there is opportunity to integrate the route within the landscaping. However, through the introduction of a third traffic lane at all crossing points, this may lead to increased noise and reduced air quality which would make the overall scenario less attractive. While there is a considerable improvement due to the new infrastructure,

the negative impact from the additional traffic cannot be discounted. Therefore, it has been scored as a minor improvement over 'Do Minimum'.

B.5.6 Traffic Safety

Benefits:

- Full signalisation helps controls traffic flows and manages vehicles entering and travelling around the circulating carriageway which in turn should lead to improvements in safety through reduced likelihood of incidents occurring;
- Affords drivers dedicated time for entering the interchange leading to less driver frustration and less likely to take risks;
- Removes the part-time signals and replaces with full-time.

Limitations:

- Potential increased risk due to additional vehicles on the roundabout at any given time with IS4.1, but this is considered low.

Summary:

- The full signalisation significantly improves the management of traffic across the interchange and as a result improves safety. While the additional vehicles with IS4.1 may increase risk, the layout is commonly used across the UK at junctions with greater traffic volumes and this is not being viewed as substantial enough to reduce the score. Therefore, both IS4 & IS4.1 are scored as a major improvement over 'Do Minimum'.

B.6 Intervention Scenario 5

B.6.1 NMU Safety

Benefits:

- Full signalisation allows for safe crossing on any direction of travel across the junction;
- 'Walk with' for majority of crossings reduces waiting times and improves continuity making it less likely for pedestrians to errantly cross;
- New NMU infrastructure and separation strip moves pedestrians away from the carriageway edge and reduces likelihood of NMU conflicts on southern side.
- Removal of the northern uncontrolled route;
- Removal of the Millburn Road uncontrolled crossing.

Limitations:

- Introduces two additional carriageway crossings (east-west only);
- Longer waiting times for the pedestrian demand called signal on Millburn westbound may lead to errant crossing.

Summary:

- The benefits of the new NMU infrastructure and the 'walk with' are generally limited to the southern side of the junction; however, the full signalisation provides safe crossing for all travel directions giving it a significant improvement over the 'Do Minimum' scenario and outweighs the limitations. Therefore, this has scored a major improvement over 'Do Minimum'.

B.6.2 Coherence

Benefits:

- Full signalisation across the interchange providing greater continuity between the links;
- New shared use path designed to current standards and will comprise of high-quality materials for those traveling to/from the east;
- New path designed to accommodate future growth in NMU numbers;
- New signage will be used to assist in navigation of interchange;
- Removal of the existing northern route helps guide people through a single route.

Limitations:

- Utilises the existing path which varies between 1.4m and 3.2m on the southwestern side of the interchange, below current design standards.

Summary:

- Creates significant improvements over 'Do Minimum' through the introduction of new paths and toucan crossings and accommodating for potential future growth on the southern side of the interchange. The direct crossing over Millburn Road, provides improved continuity compared to the existing uncontrolled crossing in the 'Do Minimum' scenario. The removal of the northern route helps steer NMUs through one route as opposed to two, improving continuity junction wide. However, the route on the southwestern side of the interchange utilises the existing path which is below current standards and may impact on future use. Therefore, this has scored a major improvement over 'Do Minimum'.

B.6.3 Directness

Benefits:

- Follows the obvious desire line across Millburn Road more closely;
- Shorter distance on the north-south route.

Limitations:

- Layout is less direct than the existing east-west.

Summary:

- While this layout does provide a more direct and shorter route across Millburn Road, on the southern side the proposed path goes into the central reserve and does not follow the desire line. Therefore, this has been scored as a neutral compared to 'Do Minimum' as these two factors balance each other out.

- Removal of the existing northern route has not been viewed as positive or negative for directness.

B.6.4 Comfort

Benefits:

- New path designed to desirable widths with suitable longitudinal and cross fall gradients;
- 0.5m set back from the carriageway helping to minimise impacts from spray and traffic as well as kerb shyness so full width of path can be used confidently;
- Improved crossing width over Millburn Road.

Limitations:

- Limited to only the southern half of the interchange other than the Millburn Road crossing point. Users still need to use the existing south west path when making movements in all routes of travel;
- The movement across the additional crossings may not be comfortable for all users.

Summary:

- The new path does provide good improvement over the existing situation on the southern side as well as some improvement over the existing uncontrolled crossing at Millburn Road as more space will be provided. However, for all movements through the interchange, users will need to use the existing path on the south western side. This varies in width between 1.4m and 3.2m and has no separation strip. Furthermore, there is a tall retaining wall and stretches of guardrail which could further restrict the comfort of users. While the new infrastructure does provide significant improvement over the existing situation, this is limited by the existing southwest path which could become less comfortable to use in future if user numbers grow as anticipated. Therefore, it has been scored a moderate improvement over 'Do Minimum'.

B.6.5 Attractiveness

Benefits:

- Fully signalised and removal of the uncontrolled crossings will make this more attractive;
- New path will provide greater room for travelling and allow NMUs to pass each other, particularly those with limited mobility and cycles;
- The path will also make the route more visually appealing due to newer materials.

Limitations:

- There is no improvement to the south western path which connects the north and south sides of the junction. The narrow path may lead to close passing of NMUs, particularly if numbers increase, which may put some people off while the high nature of the retaining wall and pedestrian guardrail are also not particularly attractive.

Summary:

- The improvement to both the available space and the aesthetic of the new path as well as safe crossings at the A96 and A9 northbound diverge entries and at Millburn Road will help make this a more attractive

route compared to the existing path. However, the south western path will remain the connecting link between the north and south of the interchange with no improvements to the existing constraints, limiting the potential attractiveness particularly if NMU numbers increase as anticipated. Therefore, it has been scored as a moderate improvement over 'Do Minimum'.

B.6.6 Traffic Safety

Benefits:

- Full signalisation helps control traffic flows and manages vehicles entering and travelling around the circulating carriageway which in turn should lead to improvements in safety through reduced likelihood of incidents occurring;
- Affords drivers dedicated time for entering the interchange leading to less driver frustration and less likely to take risks;
- Removes the part-time signals and replaces with full-time.

Limitations:

- The addition of the pedestrian demand crossing over Millburn Road westbound may lead to vehicles stacking back on to the circulating carriageway, potentially increasing the likelihood of rear end shunts.

Summary:

- The full signalisation significantly improves the management of traffic across the interchange and as a result improves safety. However, the pedestrian demand signals on Millburn Road westbound may increase likelihood of rear end shunts. Therefore, this has been scored a moderate improvement over 'Do Minimum'.

B.7 Intervention Scenario 6

B.7.1 NMU Safety

Benefits:

- Full signalisation allows for safe crossing on any direction of travel across the junction;
- 'Walk with' for majority of crossings reduces waiting times and improves continuity making it less likely for pedestrians to errantly cross;
- New NMU infrastructure and separation strip moves pedestrians away from the carriageway edge and reduces likelihood of NMU conflicts on southern side.
- Removal of the northern uncontrolled route;
- Removal of the Millburn Road uncontrolled crossing.

Limitations:

- Introduces two additional carriageway crossings for both east-west and north-south movements;
- Longer waiting times for the pedestrian demand called signal on Millburn westbound may lead to errant crossing.

Summary:

- Full signalisation along with the removal of the two uncontrolled routes provides safe crossing for all travel directions giving it a significant improvement over the 'Do Minimum' scenario and outweighs the limitations. Therefore, this has been scored as a major improvement over 'Do Minimum'.

B.7.2 Coherence

Benefits:

- Full signalisation across the interchange providing greater continuity between the links;
- New shared use path designed to current standards and will comprise of high-quality facilities for both north-south and east-west routes;
- New path designed to accommodate future growth in NMU numbers;
- New signage will be used to assist in navigation of interchange;
- Removal of the existing northern route helps guide people through a single route.

Limitations:

- Due to the pedestrian demand crossing on Millburn Road, a proportion of NMUs travelling north-south will likely use the existing path on the south west side of the interchange which varies from 1.4m to 3.2m, below current design standards.

Summary:

- Creates significant improvements over 'Do Minimum' through the introduction of new paths and toucan crossings and accommodating for potential future growth on the southern side of the interchange. The direct crossing over Millburn Road, provides improved continuity compared to the existing uncontrolled crossing in the 'Do Minimum' scenario for north-south movements. The removal of the northern route helps steer NMUs through one route as opposed to two, improving continuity junction wide. The south west path remains below standard and may be frequently used; however, it is viewed that the benefits outweigh this limitation. Therefore, this has scored a major improvement over 'Do Minimum'.

B.7.3 Directness

Benefits:

- Follows the obvious desire line across Millburn Road more closely;
- Shorter distance on the north-south route compared to the Do Minimum.

Limitations:

- Layout is less direct than the existing east-west.

Summary:

- This layout does provide a more direct and shorter route across Millburn Road. On the southern side the proposed path goes into the central reserve and does not follow the desire line. However, for those travelling from north to east, the path in the roundabout central island is more direct than the existing

arrangement. Therefore, this has been scored as a neutral compared to 'Do Minimum' as these factors balance each other out.

- Removal of the existing northern route has not been viewed as positive or negative for directness.

B.7.4 Comfort

Benefits:

- New path designed to desirable widths with suitable longitudinal and cross fall gradients;
- 0.5m set back from the carriageway helping to minimise impacts from spray and traffic as well as kerb shyness so full width of path can be used confidently;
- For the majority of routes across the interchange, NMUs will travel on the new infrastructure minimising use of existing facilities while an improved crossing width over Millburn Road has been provided.

Limitations:

- A small retaining feature may be required in the north to south stretch of path, adjacent to the back of the footway. This could minimise the usable space due handlebar clip and natural desire to travel offset from a vertical delineator;
- Users who opt to use the existing path on the south west side of the interchange may experience less comfort due to the narrower existing path at this location;
- The movement across the additional crossings may not be comfortable for all users, for example, the time available for crossing the carriageway).

Summary:

- The extensive new infrastructure will help improve the comfort of users quite considerably compared to the existing situation, particularly given that the majority of journeys through the interchange will now utilise it. There is also a substantial setback from the carriageway for the north-south route. Despite there potentially being limitations from the retaining feature, it is expected to be possible to provide suitable offset between the wall and path. Some improvement over the existing uncontrolled crossing at Millburn Road is also expected as more space will be provided. Despite the limitations of the existing path, the improvements provided as part of this intervention scenario outweigh this. Therefore, it has been scored a major improvement over 'Do Minimum'.

B.7.5 Attractiveness

Benefits:

- Fully signalised and removal of the uncontrolled crossings will make this more attractive;
- Extensive lengths of new path will provide greater room for travelling and allow NMUs to pass each other, particularly those with limited mobility and cycles;
- The new paths will also make the route more visually appealing due to newer materials;
- There is opportunity to integrate the north-south route within the landscaping in the roundabout central island making the route more appealing.

Limitations:

- There is no improvement to the south western path which connects the north and south sides of the junction. The narrow path may lead to close passing of NMUs, particularly if numbers increase, which may put some people off while the high nature of the retaining wall and pedestrian guardrail are also not particularly attractive. However, with the addition of the path in the roundabout central island, there is an alternative route that users may take.

Summary:

- There is an improvement created through the aesthetic of the new path as well as safe crossings and from a feeling of space, for all directions of travel as the majority of users will pass through the new infrastructure. Due to the extensive space available in the roundabout central island, there is opportunity to integrate the route within the landscaping. Furthermore, the safe crossing over Millburn Road will help make this a more attractive route compared to the existing path. Therefore, it has scored a major improvement over 'Do Minimum'.

B.7.6 Traffic Safety

Benefits:

- Full signalisation helps control traffic flows and manages vehicles entering and travelling around the circulating carriageway which in turn should lead to improvements in safety through reduced likelihood of incidents occurring;

- Affords drivers dedicated time for entering the interchange leading to less driver frustration and less likely to take risks;

- Removes the part-time signals and replaces with full-time.

Limitations:

- The addition of the pedestrian demand crossing over Millburn Road westbound may lead to vehicles stacking back on to the circulating carriageway, potentially increasing the likelihood of rear end shunts.

Summary:

- The full signalisation significantly improves the management of traffic across the interchange and as a result improves safety. However, the pedestrian demand signals on Millburn Road westbound may increase likelihood of rear end shunts. Therefore, this has been scored a moderate improvement over 'Do Minimum'.

Appendix C. Sensitivity Testing

Table C.1 90% NMU to 10% Traffic

Design Principles Considered	Weighting	Intervention Scenario 1		Intervention Scenario 2		Intervention Scenario 3		Intervention Scenario 4		Intervention Scenario 4.1		Intervention Scenario 5		Intervention Scenario 6	
		Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score
NMU Safety	30	4	120	5	150	4	120	6	180	6	180	6	180	6	180
NMU Coherence	10	4	40	5	50	5	50	6	60	6	60	6	60	6	60
NMU Directness	10	3	30	2	20	3	30	2	20	2	20	3	30	3	30
NMU Comfort	10	3	30	4	40	4	40	6	60	6	60	5	50	6	60
NMU Attractiveness	10	4	40	5	50	5	50	6	60	4	40	5	50	6	60
NMU Journey Times	20	3	60	4	80	3	60	6	120	6	120	5	100	6	120
Traffic Safety	10	4	40	5	50	4	40	6	60	6	60	5	50	5	50
Traffic Queue Lengths	Not counted in weighted scores	1	N/A	5	N/A	1	N/A	5	N/A	6	N/A	5	N/A	5	N/A
Basic Score		26		35		29		43		42		40		43	
NMU Weighted Score	90	320		390		350		500		480		470		510	
Traffic Weighted Score	10	40		50		40		60		60		50		50	
Combined weighted score	100	360		440		390		560		540		520		560	

0. Major Detriment, 1. Moderate Detriment, 2. Minor Detriment, 3. Neutral, 4. Minor Improvement, 5. Moderate Improvement, 6. Major Improvement

Table C.2 90% NMU to 10% Traffic (alternative weighting)

Design Principles Considered	Weighting	Intervention Scenario 1		Intervention Scenario 2		Intervention Scenario 3		Intervention Scenario 4		Intervention Scenario 4.1		Intervention Scenario 5		Intervention Scenario 6	
		Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score
NMU Safety	35	4	140	5	175	4	140	6	210	6	210	6	210	6	210
NMU Coherence	8	4	32	5	40	5	40	6	48	6	48	6	48	6	48
NMU Directness	8	3	24	2	16	3	24	2	16	2	16	3	24	3	24
NMU Comfort	6	3	18	4	24	4	24	6	36	6	36	5	30	6	36
NMU Attractiveness	5	4	20	5	25	5	25	6	30	4	20	5	25	6	30
NMU Journey Times	28	3	84	4	112	3	84	6	168	6	168	5	140	6	168
Traffic Safety	10	4	40	5	50	4	40	6	60	6	60	5	50	5	50
Traffic Queue Lengths	Not counted in weighted scores	1	N/A	5	N/A	1	N/A	5	N/A	6	N/A	5	N/A	5	N/A
Basic Score		26		35		29		43		42		40		43	
NMU Weighted Score	90	318		392		337		508		498		477		516	
Traffic Weighted Score	10	40		50		40		60		60		50		50	
Combined weighted score	100	358		442		377		568		558		527		566	
0. Major Detriment, 1. Moderate Detriment, 2. Minor Detriment, 3. Neutral, 4. Minor Improvement, 5. Moderate Improvement, 6. Major Improvement															

Table C.3 75% NMU to 25% Traffic

Design Principles Considered	Weighting	Intervention Scenario 1		Intervention Scenario 2		Intervention Scenario 3		Intervention Scenario 4		Intervention Scenario 4.1		Intervention Scenario 5		Intervention Scenario 6	
		Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score	Basic Score	Weighted Score
NMU Safety	30	4	120	5	150	4	120	6	180	6	180	6	180	6	180
NMU Coherence	5	4	20	5	25	5	25	6	30	6	30	6	30	6	30
NMU Directness	5	3	15	2	10	3	15	2	10	2	10	3	15	3	15
NMU Comfort	5	3	15	4	20	4	20	6	30	6	30	5	25	6	30
NMU Attractiveness	5	4	20	5	25	5	25	6	30	4	20	5	25	6	30
NMU Journey Times	25	3	75	4	100	3	75	6	150	6	150	5	125	6	150
Traffic Safety	15	4	60	5	75	4	60	6	90	6	90	5	75	5	75
Traffic Queue Lengths	10	1	10	5	50	1	10	5	50	6	60	5	50	5	50
Basic Score		26		35		29		43		42		40		43	
NMU Weighted Score	75	265		330		280		430		420		400		435	
Traffic Weighted Score	25	70		125		70		140		150		125		125	
Combined weighted score	100	335		455		350		570		570		525		560	

0. Major Detriment, 1. Moderate Detriment, 2. Minor Detriment, 3. Neutral, 4. Minor Improvement, 5. Moderate Improvement, 6. Major Improvement

Appendix D. Sustrans Options

D.1.1 Layouts

Sustrans most preferred option, 'Scenario A', followed the layout in Figure D.1 below. NMUs are retained on the outside of the roundabout with crossings over Millburn Road, the A9 northbound diverge slip road and A9 southbound merge slip road, indicated in red. It is also proposed to remove a lane on the southwest corner of the roundabout and Millburn Road westbound, indicated in grey, and widen the path on the southern side of the roundabout into the existing hatching, shown in green. It is assumed that the interchange would be fully signalised.

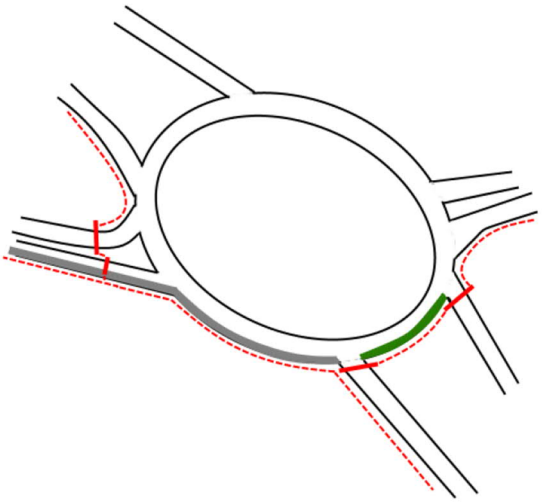


Figure D.1 – Sustrans most preferred layout

Sustrans least preferred option, 'Scenario I', followed the layout in Figure D.2 below. NMUs use the inside of the roundabout with single stage crossings over the carriageway at the northwest and southeast corners and a two stage crossing at the southwest corner indicated in red. Unlike above, no lane reductions or widening of paths are proposed. It is assumed that the interchange would be fully signalised. Grey and green colouring in Figure D.2 should be ignored.

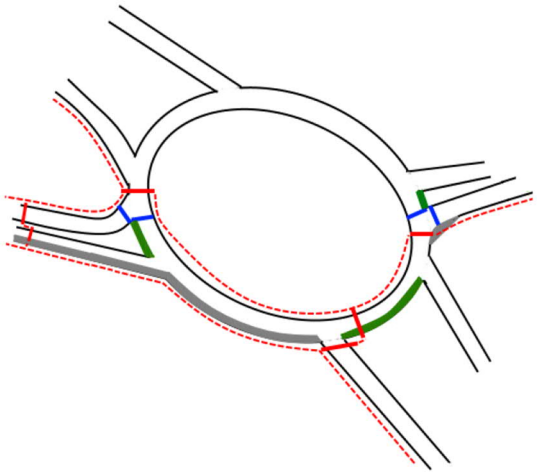


Figure D.2 – Sustrans least preferred layout

D.1.2 Sustrans Most Preferred Option Performance

Benefits:

- Significant NMU safety benefits due to fully controlled crossings;
- The removal of the traffic lane and hatching will allow for paths to be extended providing significant improvement in comfort, coherence and attractiveness;
- The layout moves the north-south crossing closer to the roundabout entry, compared to the existing uncontrolled crossing, slightly improving the directness;
- It has been assumed that the layout will be fully signalised, thus a similar traffic safety scoring to IS5 of moderate improvement would be awarded due to the Millburn Road Crossing. It is assumed the Millburn Road approach crossing would be moved closer to the roundabout give way line to avoid two crossings in close proximity on the eastbound carriageway;

Limitations:

- From the traffic modelling analysis of IS 1 to 5 it can be concluded that the removal of the lane between A9 northbound diverge slip road and Millburn road in combination with pedestrian demand crossings will have a major detriment to queue lengths in the long term;
- The majority of crossings will be pedestrian demand rather than 'walk with' which will likely lead to increased NMU Journey times.

Summary:

- This layout would provide benefits on the 'Do Minimum' scenario for NMU design principles (Safety, Coherence, Directness, Comfort and Attractiveness) as well as considerable improvements for Traffic Safety; however, the removal of the lane will have extensive repercussions on traffic queue lengths and the use of pedestrian demand crossings will increase NMU journey times.

D.1.3 Sustrans Least Preferred Option Performance

Benefits:

- As demonstrated for IS4 and IS4.1, the use of the central path will provide significant improvement in comfort, coherence and attractiveness;
- Assumed to be fully signalised, no unexpected traffic safety risks are introduced and thus will provide a major improvement over the 'Do Minimum' scenario.

Limitations:

- Similar to IS4 and IS4.1, the central path will create a minor detriment in directness;
- The crossings directly across the circulatory carriageway at the northwest and southeast corners will be pedestrian demand thus longer wait times and longer NMU journey times;
- Due to the pedestrian demand crossings, traffic queues are anticipated to worsen, not dissimilar to IS1.

Summary:

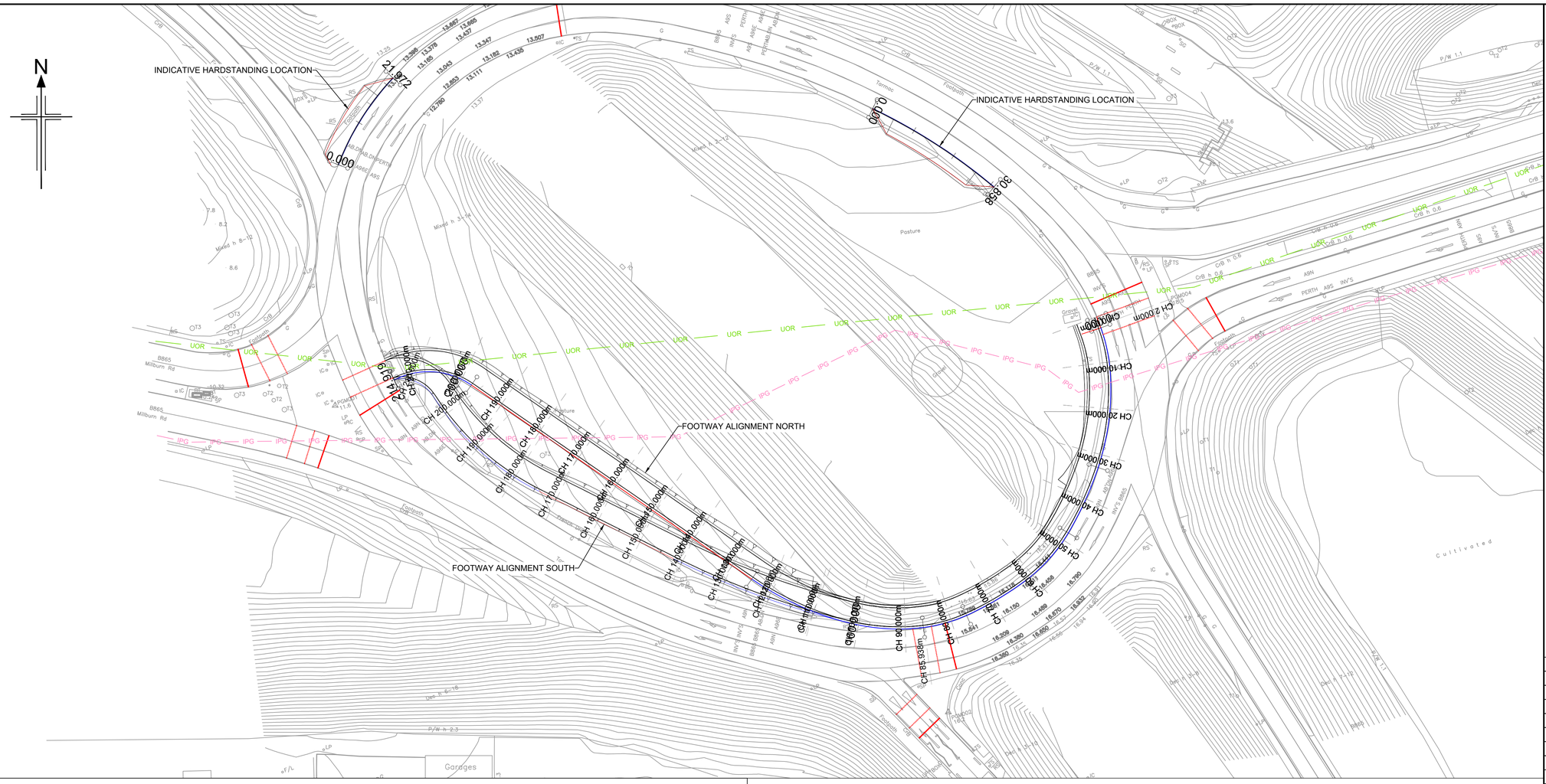
- Similar to the most preferred option, this layout would provide significant benefits on the 'Do Minimum' scenario for NMU design principles (Safety, Coherence, Comfort and Attractiveness) as well as considerably improvements for Traffic Safety. However, there would be some detriment to directness. Furthermore, the pedestrian demand crossings both on the circulating carriageway in the northwest and A96 approach in the southeast will have significant impact on queuing and efficiency of the interchange likely causing major detriment. As with the other scenarios, the pedestrian demand crossing also increases wait times and as a result increases NMU journey times.

D.1.4 Assessment

Table D.1 below contains the scores for each of the criteria the options were assessed against. As the Sustrans options were not subject to traffic modelling, NMU Journey Times and Traffic Queue Lengths were scored qualitatively, similar to the other criteria, based on the anticipated performance based on the modelling for the other Intervention Scenarios.

Table D.1 Sustrans options assessment

Design Principles Considered	Weighting	Sustrans most preferred option		Sustrans least preferred option	
		Basic Score	Weighted Score	Basic Score	Weighted Score
NMU Safety	25	6	150	6	150
NMU Coherence	5	6	30	6	30
NMU Directness	5	4	20	2	10
NMU Comfort	5	6	30	6	30
NMU Attractiveness	5	6	30	6	30
NMU Journey Times	15	4	60	4	60
Traffic Safety	25	5	125	6	150
Traffic Queue Lengths	15	0	0	1	15
Basic Score		37		37	
NMU Weighted Score	60	320		310	
Traffic Weighted Score	40	125		165	
Combined weighted score	100	445		475	
0. Major Detriment, 1. Moderate Detriment, 2. Minor Detriment, 3. Neutral, 4. Minor Improvement, 5. Moderate Improvement, 6. Major Improvement					

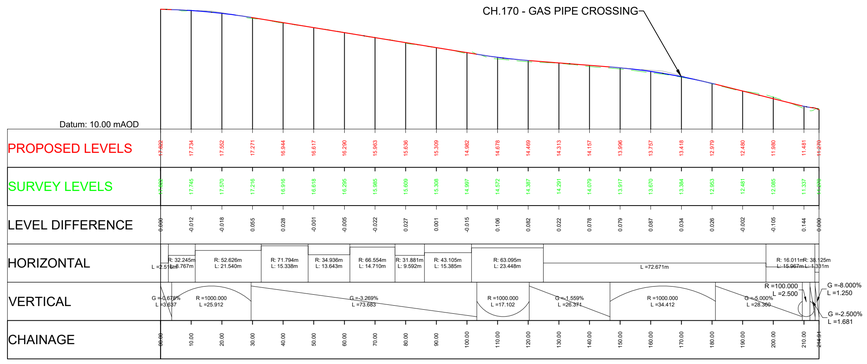


NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
2. THIS DRAWING IS FOR INFORMATION ONLY.
3. UTILITIES SHOWN ARE LIMITED TO THOSE WHICH INTERACT WITH THE CENTRAL PATH. THE LOCATIONS ARE BASED ON C2 INFORMATION AND THEREFORE INDICATIVE. ACTUAL LOCATIONS MAY DIFFER.

KEY:

- INDICATIVE PEDESTRIAN CROSSING LOCATIONS
- UOR — BT UNDERGROUND CABLE
- IPG — INTERMEDIATE PRESSURE GAS MAINS



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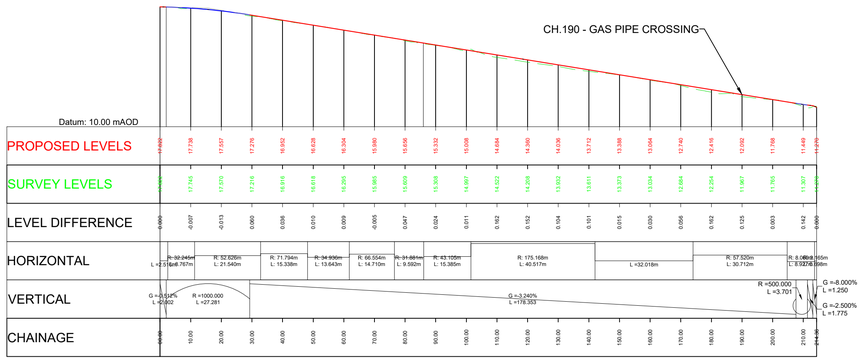

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SCALE: H 1:500,V 1:100. DATUM: 10.000

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
0	04/07/22	FOR INFORMATION	JM	RC	RC	CS

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95 Bothwell St, Glasgow, G2 7HX
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www.jacobs.com

Client

The Highland Council
Comhairle na Gàidhealtachd

Project

A9/A96 RAIGMORE INTERCHANGE NMU IMPROVEMENTS

Drawing title

DRAFT PLAN, PROFILE AND CROSS SECTIONS SHEET 1 OF 3

Drawing status	FOR INFORMATION
Scale	1:500 @ A1 — DO NOT SCALE
Jacobs No.	B2340241
Drawing number	B2340241-JAC-HGN-SK-0001
Rev	0

EXISTING JUNCTION AND CROSSING ALIGNMENT CHANGED TO A RAISED TABLE TO PROVIDE PROTECTION AND AND PROMOTE PRIORITY TO ACTIVE TRAVEL USERS.

FOOTWAY WIDENED THROUGHOUT PROJECT EXTENTS TO A MINIMUM OF 1.8m TO COMPLY WITH THE REQUIREMENTS OF THE EQUALITY ACT IN LINE WITH THE GUIDANCE PROVIDED WITHIN THE ROADS FOR ALL GUIDE.
.

STEPPED CONTRAFLOW CYCLE WAY PROVIDED TO A WIDTH OF 2m THROUGHOUT PROJECT EXTENTS.

SPEED CUSHIONS AND BUILD-OUTS/ISLANDS PROVIDED APPROXIMATELY EVERY 70M THROUGHOUT PROJECT EXTENTS.

Key:	
	Footway / Splitter Island
	Carriageway
	Raised Table
	Shared Use Surfacing
	Segregated Cycle Route
	Planting
	Uncontrolled Crossing Tactile Paving
	Crossing Tactile Paving
	Speed Cushion
	Proposed Half Battered Kerb
	Proposed Splay Kerb
	Proposed Transition Kerb
	Proposed Dropped Kerb
	Edging Kerb
	Existing / Proposed Tree
	Sign & Post

RESIDUAL HAZARDS IDENTIFIED

ITEM	DESCRIPTION
1	REFER TO SAFETY IN DESIGN - DESIGNER'S RESIDUAL HAZARDS REGISTER FOR HAZARDS IN RELATION TO THESE WORKS

Issue Status: DETAILED DESIGN

Scale
0 2.5 5 10 20m

Original Size (A1) 1:250 @ A1 1:500 @ A3

AECOM

PROJECT

THE RIVERSIDE WAY - STRATEGIC ACTIVE TRAVEL CORRIDOR

CLIENT

The Highland Council
Comhairle na Gàidhealtachd

CONSULTANT

AECOM
Aurora
120 Bothwell St
GLASGOW, G2 7JS
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www.aecom.com

NOTES

1. ALL WORKS TO BE EXECUTED IN ACCORDANCE WITH THE SPECIFICATION FOR HIGHWAY WORKS - THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, DESIGN MANUAL FOR ROADS AND BRIDGES, TRAFFIC SIGNS MANUAL AND LOCAL COUNCIL GUIDELINES.
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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2022-09-06	REVISED ROAD MARKINGS

KEY PLAN

PROJECT NUMBER

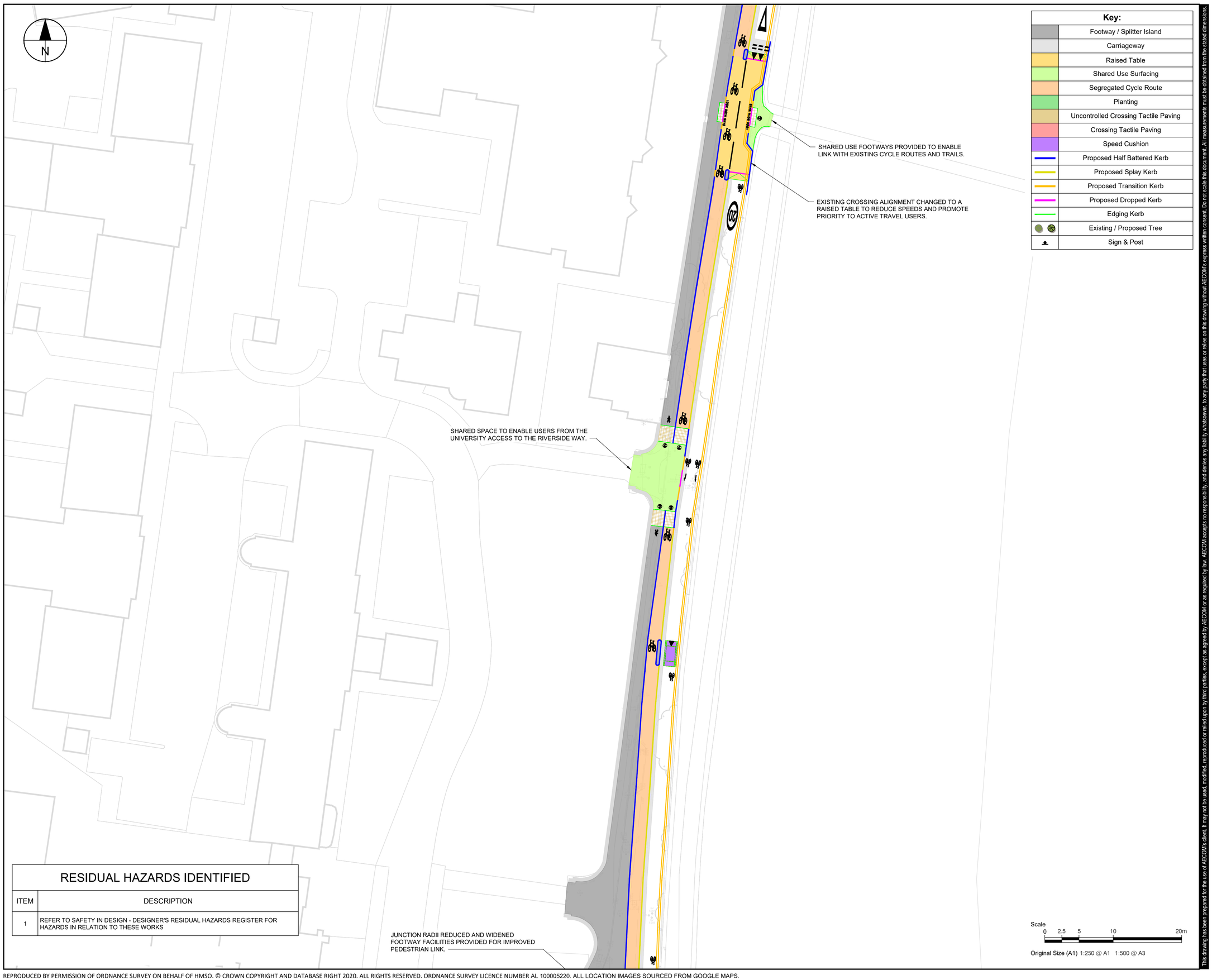
60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 1 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-001



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A	2022-09-06	REVISED ROAD MARKINGS

KEY PLAN

PROJECT NUMBER

60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 2 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-002

ISO A1 594mm x 841mm

Project Management Initials: Designer: SPC Checked: PL Approved: DM

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Last saved by: STEPHEN CLYNE Last Plotted: 2022-09-08

N

Issue Status: DEVELOPED DESIGN

JUNCTION RADII REDUCED AND WIDENED FOOTWAY FACILITIES PROVIDED FOR IMPROVED PEDESTRIAN LINK.

NO ENTRY

TURN RIGHT

20

MANDATORY CONTRAFLOW CYCLE WAY PROVIDED TO A WIDTH OF 2m AT THIS LOCATION DUE TO PROXIMITY TO JUNCTION TO HOSPITAL.

JUNCTION RADII REDUCED AND WIDENED FOOTWAY FACILITIES PROVIDED FOR IMPROVED PEDESTRIAN LINK.

NO ENTRY

JUNCTION ALIGNMENT CHANGED FROM EXISTING MINI-ROUNDABOUT TO T-JUNCTION TO REDUCE SPEEDS AND PROMOTE PRIORITY TO ACTIVE TRAVEL USERS.

20

Key:	
	Footway / Splitter Island
	Carriageway
	Raised Table
	Shared Use Surfacing
	Segregated Cycle Route
	Planting
	Uncontrolled Crossing Tactile Paving
	Crossing Tactile Paving
	Speed Cushion
	Proposed Half Battered Kerb
	Proposed Splay Kerb
	Proposed Transition Kerb
	Proposed Dropped Kerb
	Edging Kerb
	Existing / Proposed Tree

RESIDUAL HAZARDS IDENTIFIED

ITEM	DESCRIPTION
1	REFER TO SAFETY IN DESIGN - DESIGNER'S RESIDUAL HAZARDS REGISTER FOR HAZARDS IN RELATION TO THESE WORKS

Scale
0 2.5 5 10 20m

Original Size (A1) 1:250 @ A1 1:500 @ A3

AECOM

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60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 3 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-003

ISO A1 594mm x 841mm

Project Management Initials: Designer: SPC Checked: PL Approved: DM

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Last saved by: STEPHEN CLYNE Last Plotted: 2022-09-08

N

Issue Status: DEVELOPED DESIGN

NO ENTRY

NEW PEDESTRIAN CROSSING TO CURRENT LEGAL REQUIREMENTS OF THE EQUALITY ACT 2010, IN LINE WITH THE GUIDANCE PROVIDED WITHIN THE ROADS FOR ALL GUIDE AND TO PROVIDE CONSISTENCY THROUGHOUT THE SCHEME EXTENTS AND PROVIDE ACCESS TO PITCHES.

NO ENTRY

Key:	
	Footway / Splitter Island
	Carriageway
	Raised Table
	Shared Use Surfacing
	Segregated Cycle Route
	Planting
	Uncontrolled Crossing Tactile Paving
	Crossing Tactile Paving
	Speed Cushion
	Proposed Half Battered Kerb
	Proposed Splay Kerb
	Proposed Transition Kerb
	Proposed Dropped Kerb
	Edging Kerb
	Existing / Proposed Tree
	Sign & Post

RESIDUAL HAZARDS IDENTIFIED

ITEM	DESCRIPTION
1	REFER TO SAFETY IN DESIGN - DESIGNER'S RESIDUAL HAZARDS REGISTER FOR HAZARDS IN RELATION TO THESE WORKS

Scale
0 2.5 5 10 20m

Original Size (A1) 1:250 @ A1 1:500 @ A3

AECOM

PROJECT

THE RIVERSIDE WAY - STRATEGIC ACTIVE TRAVEL CORRIDOR

CLIENT

The Highland Council
Comhairle na Gàidhealtachd

CONSULTANT

AECOM
Aurora
120 Bothwell St
GLASGOW, G2 7JS
+44 (0) 141 248 0300 tel
www.aecom.com

NOTES

1. ALL WORKS TO BE EXECUTED IN ACCORDANCE WITH THE SPECIFICATION FOR HIGHWAY WORKS - THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, DESIGN MANUAL FOR ROADS AND BRIDGES, TRAFFIC SIGNS MANUAL AND LOCAL COUNCIL GUIDELINES.
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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2022-09-06	REVISED ROAD MARKINGS

KEY PLAN

PROJECT NUMBER

60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 4 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-004

N

Issue Status: DEVELOPED DESIGN

2 No. NEW DISABLED PARKING FACILITIES COMPLYING WITH THE REQUIREMENTS OF THE EQUALITY ACT, IN LINE WITH THE GUIDANCE PROVIDED WITHIN THE ROADS FOR ALL GUIDE FOR DISABLED ROAD USERS.

PROVISION OF CYCLE PARKING FACILITIES

DROPPED KERB PROVIDED ALONG DISABLED BAYS AND FOOTPATH WIDENED TO 4m TO MAXIMISE EFFECTIVE WIDTH AROUND EV CHARGING POINTS

INFRASTRUCTURE FOR EV CHARGING TO BE PROVIDED FOR FUTURE PROVISION.

NEW PEDESTRIAN CROSSING TO CURRENT LEGAL REQUIREMENTS OF THE EQUALITY ACT 2010, IN LINE WITH THE GUIDANCE PROVIDED WITHIN THE ROADS FOR ALL GUIDE AND TO PROVIDE CONSISTENCY THROUGHOUT THE SCHEME EXTENTS AND PROVIDE ACCESS TO PITCHES.

PROVISION OF CYCLE REPAIR FACILITIES

3NO. NEW PARKING FACILITIES COMPLYING WITH THE REQUIREMENTS OF THE EQUALITY ACT, IN LINE WITH THE GUIDANCE PROVIDED WITHIN THE ROADS FOR ALL GUIDE FOR DISABLED ROAD USERS.

BUILD-OUT TO TO PROVIDE FACILITIES FOR PAY & DISPLAY METERS.

Key:	
	Footway / Splitter Island
	Carriageway
	Raised Table
	Shared Use Surfacing
	Segregated Cycle Route
	Planting
	Uncontrolled Crossing Tactile Paving
	Crossing Tactile Paving
	Speed Cushion
	Proposed Half Battered Kerb
	Proposed Splay Kerb
	Proposed Transition Kerb
	Proposed Dropped Kerb
	Edging Kerb
	Existing / Proposed Tree
	Sign & Post

RESIDUAL HAZARDS IDENTIFIED

ITEM	DESCRIPTION
1	REFER TO SAFETY IN DESIGN - DESIGNER'S RESIDUAL HAZARDS REGISTER FOR HAZARDS IN RELATION TO THESE WORKS

Scale
0 2.5 5 10 20m

Original Size (A1) 1:250 @ A1 1:500 @ A3

AECOM

PROJECT

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CLIENT

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CONSULTANT

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
C	2022-09-08	REVISED GENERAL ARRANGEMENT
B	2022-09-06	REVISED ROAD MARKINGS
A	2022-08-19	REVISED GENERAL ARRANGEMENT

KEY PLAN

PROJECT NUMBER

60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 5 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-005

ISO A1 594mm x 841mm

Approved: DM

Checked: PL

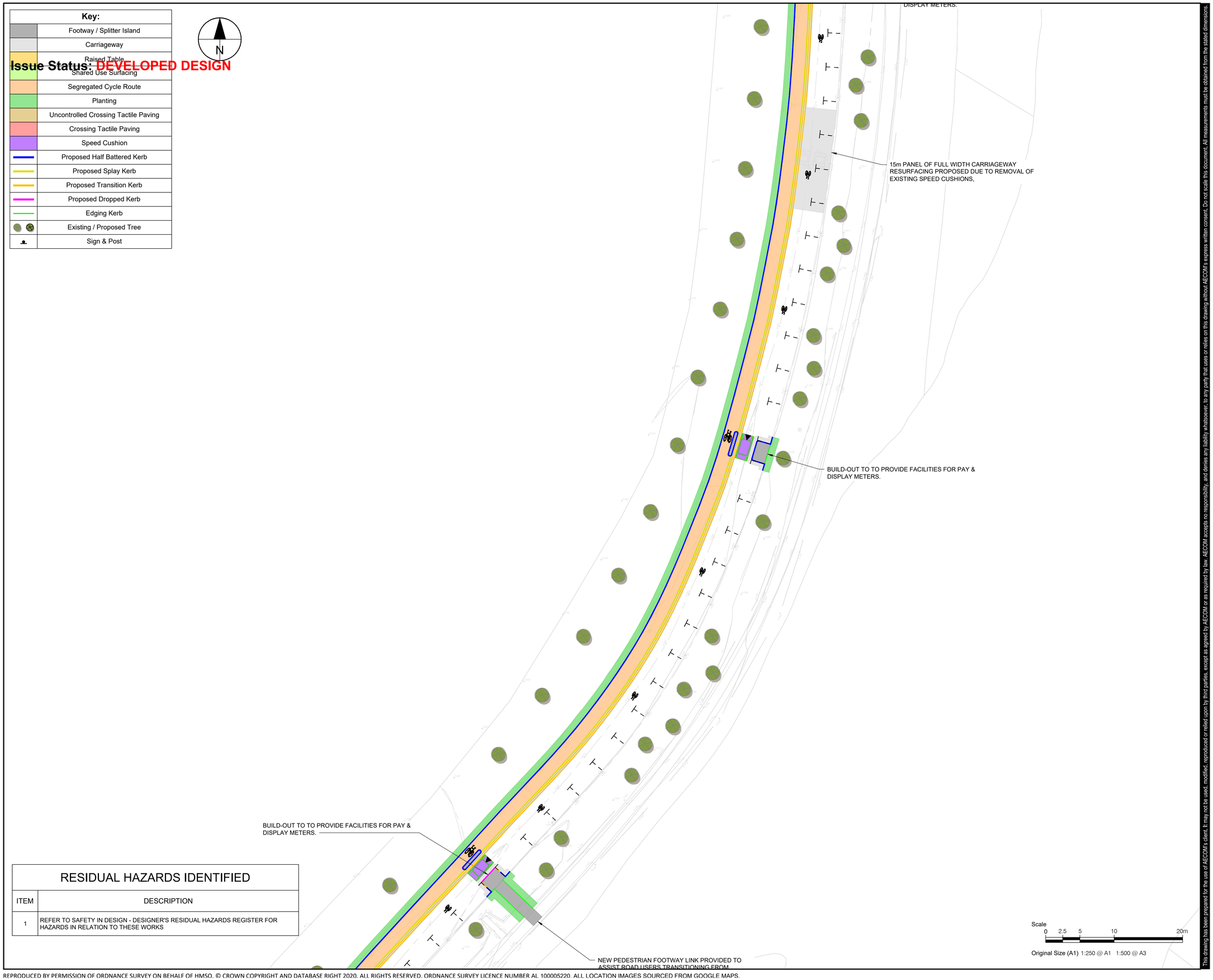
Designer: SPC

Project Management Initials:

Key:	
	Footway / Splitter Island
	Carriageway
	Raised Table Shared Use Surfacing
	Segregated Cycle Route
	Planting
	Uncontrolled Crossing Tactile Paving
	Crossing Tactile Paving
	Speed Cushion
	Proposed Half Battered Kerb
	Proposed Splay Kerb
	Proposed Transition Kerb
	Proposed Dropped Kerb
	Edging Kerb
	Existing / Proposed Tree
	Sign & Post

N

Issue Status: DEVELOPED DESIGN



Scale
0 2.5 5 10 20m

Original Size (A1) 1:250 @ A1 1:500 @ A3

RESIDUAL HAZARDS IDENTIFIED

ITEM	DESCRIPTION
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Filename: L:\DCS\PROJECTS\CI\60684495_SXL2_THC_RIVERSIDE\900_CAD_GIS\910_CAD\910-20-SHEETS\60684495-SHT-CON-DD-0105-P1-001-011 GENERAL ARRANGEMENT.DWG
Last saved by: STEPHEN.CLYNE Last Plotted: 2022-09-08

AECOM

PROJECT

THE RIVERSIDE WAY - STRATEGIC ACTIVE TRAVEL CORRIDOR

CLIENT

The Highland Council
Comhairle na Gàidhealtachd

CONSULTANT

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Aurora
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GLASGOW, G2 7JS
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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2022-09-06	REVISED ROAD MARKINGS

KEY PLAN

PROJECT NUMBER

60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 6 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-006

ISO A1 594mm x 841mm

Approved: DM

Checked: PL

Designer: SPC

Project Management Initials:

Key:	
	Footway / Splitter Island
	Carriageway
	Raised Table Shared Use Surfacing
	Segregated Cycle Route
	Planting
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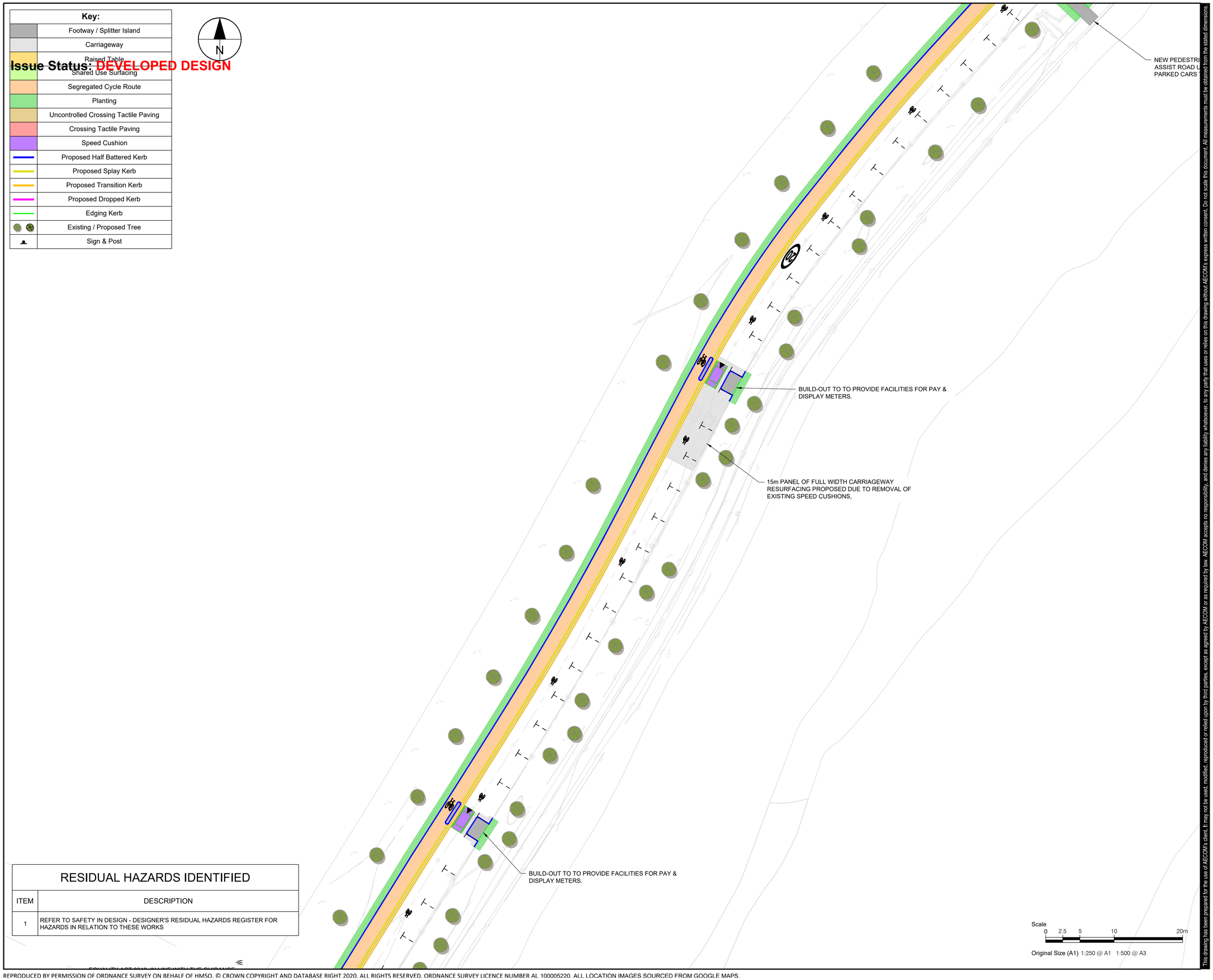
	Proposed Splay Kerb
	Proposed Transition Kerb
	Proposed Dropped Kerb
	Edging Kerb
	Existing / Proposed Tree
	Sign & Post

N

Issue Status: DEVELOPED DESIGN



RESIDUAL HAZARDS IDENTIFIED	
ITEM	DESCRIPTION
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Scale
0 2.5 5 10 20m

Original Size (A1) 1:250 @ A1 1:500 @ A3

AECOM

PROJECT

THE RIVERSIDE WAY - STRATEGIC ACTIVE TRAVEL CORRIDOR

CLIENT

The Highland Council
Comhairle na Gàidhealtachd

CONSULTANT

AECOM
Aurora
120 Bothwell St
GLASGOW, G2 7JS
+44 (0) 141 248 0300 tel
www.aecom.com

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2022-09-06	REVISED ROAD MARKINGS

KEY PLAN

PROJECT NUMBER

60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 7 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-007

Filename: L:\DCS\PROJECTS\CH\60684495_SXL2_THC_RIVERSIDE\900_CAD_GIS\910_CAD\910-20-SHEETS\60684495-SHT-CON-DD-0105-P1-001-011 GENERAL ARRANGEMENT.DWG
Last saved by: STEPHEN.CLYNE Last Plotted: 2022-09-08

ISO A1 594mm x 841mm

Approved: DM

Checked: PL

Designer: SPC

Project Management Initials:

Key:	
	Footway / Splitter Island
	Carriageway
	Raised Table Shared Use Surfacing
	Segregated Cycle Route
	Planting
	Uncontrolled Crossing Tactile Paving
	Crossing Tactile Paving
	Speed Cushion
	Proposed Half Battered Kerb
	Proposed Splay Kerb
	Proposed Transition Kerb
	Proposed Dropped Kerb
	Edging Kerb
	Existing / Proposed Tree
	Sign & Post

N

Issue Status: DEVELOPED DESIGN

EXISTING PEDESTRIAN CROSSING IMPROVED TO BRING TO CURRENT LEGAL REQUIREMENTS OF THE EQUALITY ACT 2010, IN LINE WITH THE GUIDANCE PROVIDED WITHIN THE ROADS FOR ALL GUIDE AND TO PROVIDE CONSISTENCY THROUGHOUT THE SCHEME EXTENTS AND PROVIDE ACCESS TO PITCHES.

BUILD-OUT TO TO PROVIDE FACILITIES FOR PAY & DISPLAY METERS.

BUILD-OUT TO TO PROVIDE FACILITIES FOR PAY & DISPLAY METERS.

RESIDUAL HAZARDS IDENTIFIED	
ITEM	DESCRIPTION
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Scale
0 2.5 5 10 20m

Original Size (A1) 1:250 @ A1 1:500 @ A3

AECOM

PROJECT

THE RIVERSIDE WAY - STRATEGIC ACTIVE TRAVEL CORRIDOR

CLIENT

The Highland Council
Comhairle na Gàidhealtachd

CONSULTANT

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120 Bothwell St
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+44 (0) 141 248 0300 tel
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ISSUE/REVISION

A	2022-09-06	REVISED ROAD MARKINGS
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 8 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-008

Filename: L:\DCS\PROJECTS\CI\60684495_SXL2_THC_RIVERSIDE\900_CAD_GIS\910_CAD\910-20-SHEETS\60684495-SHT-CON-DD-0105-P1-001-011 GENERAL ARRANGEMENT.DWG
Last saved by: STEPHEN.CLYNE Last Plotted: 2022-09-08

ISO A1 594mm x 841mm

Approved: DM

Checked: PL

Designer: SPC

Project Management Initials:

Key:	
	Footway / Splitter Island
	Carriageway
	Raised Table, Shared Use Surfacing
	Segregated Cycle Route
	Planting
	Uncontrolled Crossing Tactile Paving
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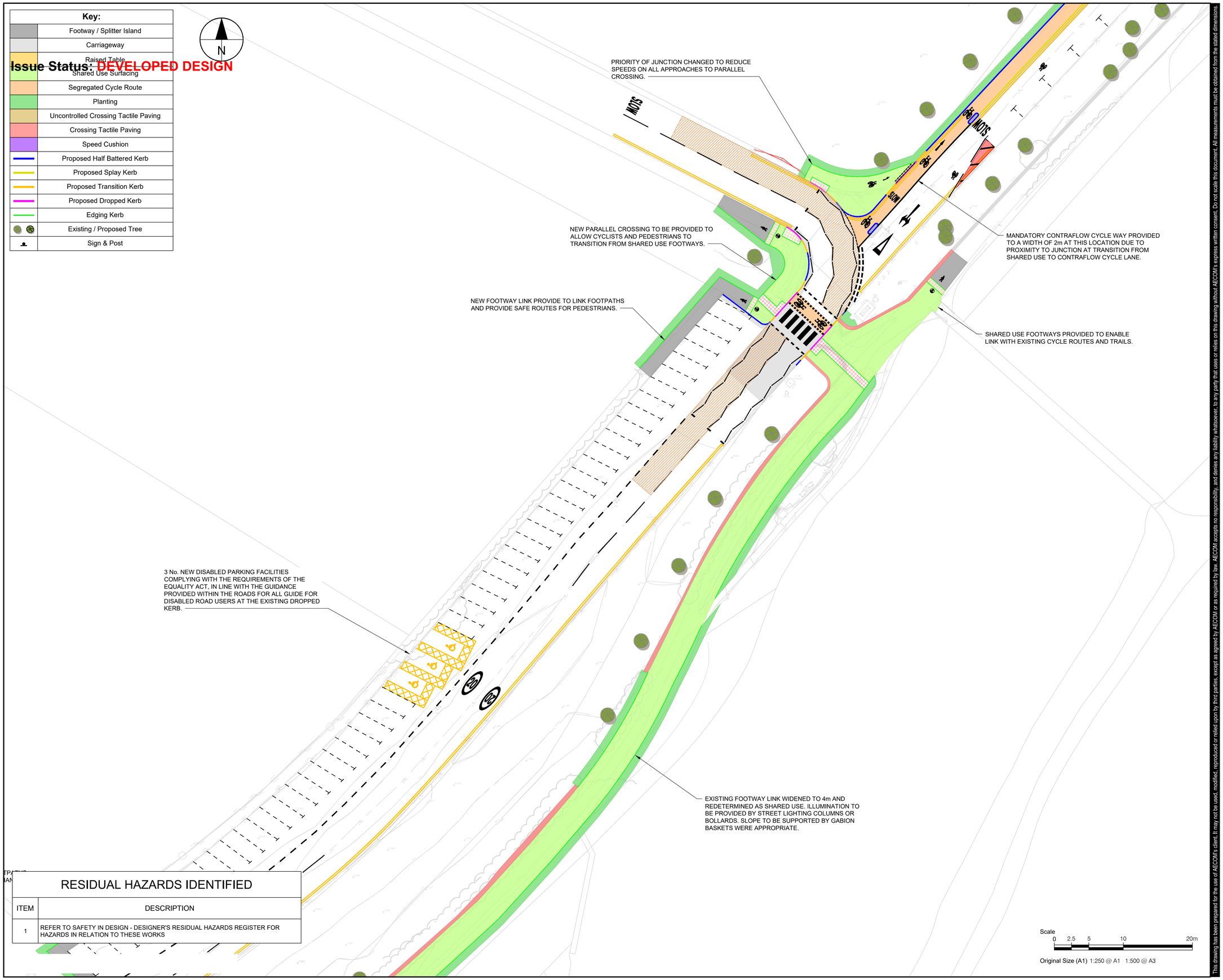
	Proposed Splay Kerb
	Proposed Transition Kerb
	Proposed Dropped Kerb
	Edging Kerb
	Existing / Proposed Tree
	Sign & Post

Issue Status: DEVELOPED DESIGN

N



RESIDUAL HAZARDS IDENTIFIED

ITEM	DESCRIPTION
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Scale
0 2.5 5 10 20m

Original Size (A1) 1:250 @ A1 1:500 @ A3

Filename: L:\DCS\PROJECTS\CI\60684495_SXL2_THC_RIVERSIDE\900_CAD_GIS\910_CAD\910-20-SHEETS\60684495-SHT-CON-DD-0105-P1-001-011 GENERAL ARRANGEMENT.DWG
Last saved by: STEPHEN.CLYNE Last Plotted: 2022-09-08

AECOM

PROJECT

THE RIVERSIDE WAY - STRATEGIC ACTIVE TRAVEL CORRIDOR

CLIENT

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Comhairle na Gàidhealtachd

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2022-09-06	REVISED ROAD MARKINGS

KEY PLAN

PROJECT NUMBER

60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 9 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-009

ISO A1 594mm x 841mm

Approved: DM

Checked: PL

Designer: SPC

Project Management Initials:

Key:	
	Footway / Splitter Island
	Carriageway
	Raised Table
	Shared Use Surfacing
	Segregated Cycle Route
	Planting
	Uncontrolled Crossing Tactile Paving
	Crossing Tactile Paving
	Speed Cushion
	Proposed Half Battered Kerb
	Proposed Splay Kerb
	Proposed Transition Kerb
	Proposed Dropped Kerb
	Edging Kerb
	Existing / Proposed Tree
	Sign & Post

Issue Status: DEVELOPED DESIGN

N

NEW FOOTWAY LINK PROVIDE TO LINK FOOTPATHS AND PROVIDE SAFE ROUTES FOR PEDESTRIANS.

A835

SHARED USE FOOTWAYS PROVIDED TO ENABLE LINK WITH EXISTING CYCLE ROUTES AND TRAILS.

NEW FOOTWAY LINK PROVIDE TO LINK FOOTPATHS AND PROVIDE SAFE ROUTES FOR PEDESTRIANS.

RESIDUAL HAZARDS IDENTIFIED

ITEM	DESCRIPTION
1	REFER TO SAFETY IN DESIGN - DESIGNER'S RESIDUAL HAZARDS REGISTER FOR HAZARDS IN RELATION TO THESE WORKS

Scale
0 2.5 5 10 20m

Original Size (A1) 1:250 @ A1 1:500 @ A3

Filename: L:\DCS\PROJECTS\CI\60684495_SXL2_THC_RIVERSIDE\900_CAD_GIS\910_CAD\910-20-SHEETS\60684495-SHT-CON-DD-0105-P1-001-011 GENERAL ARRANGEMENT.DWG
Last saved by: STEPHEN.CLYNE Last Plotted: 2022-09-08

AECOM

PROJECT

THE RIVERSIDE WAY - STRATEGIC ACTIVE TRAVEL CORRIDOR

CLIENT

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2022-09-06	REVISED ROAD MARKINGS

KEY PLAN

PROJECT NUMBER

60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 10 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-010

ISO A1 594mm x 841mm

Approved: DM

Checked: PL

Designer: SPC

Project Management Initials:

Key:	
	Footway / Splitter Island
	Carriageway
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	Segregated Cycle Route
	Planting
	Uncontrolled Crossing Tactile Paving
	Crossing Tactile Paving
	Speed Cushion
	Proposed Half Battered Kerb
	Proposed Splay Kerb
	Proposed Transition Kerb
	Proposed Dropped Kerb
	Edging Kerb
	Existing / Proposed Tree
	Sign & Post

N

Issue Status: DEVELOPED DESIGN

EXISTING FOOTWAY LINK WIDENED TO 4m AND REDETERMINED AS SHARED USE. ILLUMINATION TO BE PROVIDED BY STREET LIGHTING COLUMNS OR BOLLARDS.

IMPROVED CROSSING FACILITIES PROVIDED ENABLING A LINK ALONG VARIOUS ROUTES IN THE LOCAL AREA.

RESIDUAL HAZARDS IDENTIFIED	
ITEM	DESCRIPTION
1	REFER TO SAFETY IN DESIGN - DESIGNER'S RESIDUAL HAZARDS REGISTER FOR HAZARDS IN RELATION TO THESE WORKS

Issue Status: DEVELOPED DESIGN

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www.aecom.com

NOTES

1. ALL WORKS TO BE EXECUTED IN ACCORDANCE WITH THE SPECIFICATION FOR HIGHWAY WORKS - THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, DESIGN MANUAL FOR ROADS AND BRIDGES, TRAFFIC SIGNS MANUAL AND LOCAL COUNCIL GUIDELINES.
2. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE. ALL LEVELS ARE IN METRES AND RELATE TO ORDNANCE DATUM.
3. DO NOT SCALE FROM ANY DRAWING. WORK TO FIGURED DIMENSIONS ONLY. ANY DISCREPANCIES IN DIMENSION ARE TO BE REFERRED TO THE DESIGNER BEFORE WORK IS PUT TO HAND.
4. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO PREPARING ANY WORKING DRAWINGS OR COMMENCING ON SITE.
5. ALL WORKS BY THE CONTRACTOR MUST BE CARRIED OUT IN SUCH A WAY THAT ALL REQUIREMENTS UNDER THE HEALTH AND SAFETY AT WORK ACT ARE SATISFIED.
6. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE STATUTORY AUTHORITIES AND CONSTRUCTION DESIGN AND MANAGEMENT REGULATIONS.
7. DRAWING BASE RECEIVED FROM OTHERS, SURVEY CARRIED OUT BY OTHERS. AECOM CANNOT GUARANTEE THEIR ACCURACY. CONTRACTOR TO SATISFY THEMSELVES AS TO THE ACCURACY OF SUCH INFORMATION.

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2022-09-06	REVISED ROAD MARKINGS

KEY PLAN

PROJECT NUMBER

60684495

SHEET TITLE

The Riverside Way, Inverness
General Arrangement
Sheet 11 of 11

SHEET NUMBER

60684495-SHT-CON-DD-0105-P1-011

Filename: L:\DCS\PROJECTS\CI\60684495_SXL2_THC_RIVERSIDE\900_CAD_GIS\910_CAD\910-20-SHEETS\60684495-SHT-CON-DD-0105-P1-001-011 GENERAL ARRANGEMENT.DWG
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