Appendix A - TN46 Public Transport Review

Technical Note

Project:	**A720 Sheriffhall Roundabout**	Job No:	**60572241**
Subject:	**TN46 – Public Transport Review**		
Prepared by:	**AR**	Date:	**13/10/2020**
Checked by:	**JI**	Date:	**27/10/2020**
Approved by:	**RH**	Date:	**13/11/2020**

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1. Introduction

1.1 Scheme Background

The A720 Sheriffhall Roundabout scheme (hereafter referred to as the Proposed Scheme) will upgrade the Sheriffhall Roundabout to a grade separated junction:

- A720 City of Edinburgh Bypass to be realigned over a length of 1.6km.
- Sheriffhall Roundabout to be enlarged to become a 8-arm roundabout.
- All side roads to be realigned to tie into the enlarged roundabout.
- Grade separated routes for Non-Motorised Users (NMU) to be provided to allow safe crossing of the junction.

The Proposed Scheme has undergone Design Manual for Roads and Bridges (DMRB) Scheme Assessment Stages 1, 2 and 3. Following completion of the DMRB Stage 3 Scheme Assessment, Draft (Road and Compulsory Purchase) Orders and Environmental Statement (ES) were published in December 2019. Public Exhibitions were held in December following the publication of the ES and draft Orders. A substantial number of representations were received, including objections; the statutory process is ongoing.

The Proposed Scheme plan layout is shown in drawing 60572241-ACM-HGN-SW_RB_000_Z-SK-CH-0004 included in Appendix A.

1.2 Purpose of Review

Following the representations (including objections) received, and the Edinburgh and South-East Scotland City Region Deal (ESESCRD) meeting attended by Transport Scotland in February 2020, it was agreed that:

- The Proposed Scheme would be reviewed to see whether further improvements to active travel and public transport facilities would be feasible, whilst not creating additional impacts for local landowners, residents and businesses.
- A technical stakeholder workshop would be held to discuss the findings of the review, with technical officers from all local authority City Region Deal partners in attendance.

2. Existing Conditions and Current Design

2.1 Existing Bus Services

The Sheriffhall Park & Ride and 14 bus stops are located within the immediate 500m vicinity of the scheme. Two bus stops are located within the scheme extents, both on the A7 North: one on the northbound lane near Summerside and one on the southbound near Campend.

Bus services covering this area are summarised in Table 2.1 and the existing bus facility within 500m of the scheme are shown in Image 2.1.

Table 2.1 - Existing bus services

Operator	Service Number	Service Route
Lothian Buses	3	Clovenstone - Mayfield
	29	Silverknowes - Gorebridge
	33	Wester Hailes – Sheriffhall Park & Ride
	X33	Edinburgh – Newtongrange
	48	Gorebridge – Royal Infirmary
	49	Rosewell – Fort Kinnaird
Borders Buses	51/52	Jedburgh to Edinburgh via St Boswelss, Earlston, Lauder, Oxton, Pathhead
	95A, X95	Edinburgh to Carlisle via Newtongrange, Galashiels, Selkirk, Hawick, Langholm
Lothian Buses	R3	Dalkeith, Danderhall, Newton Village, Millerhill, ASDA (The Jewel)

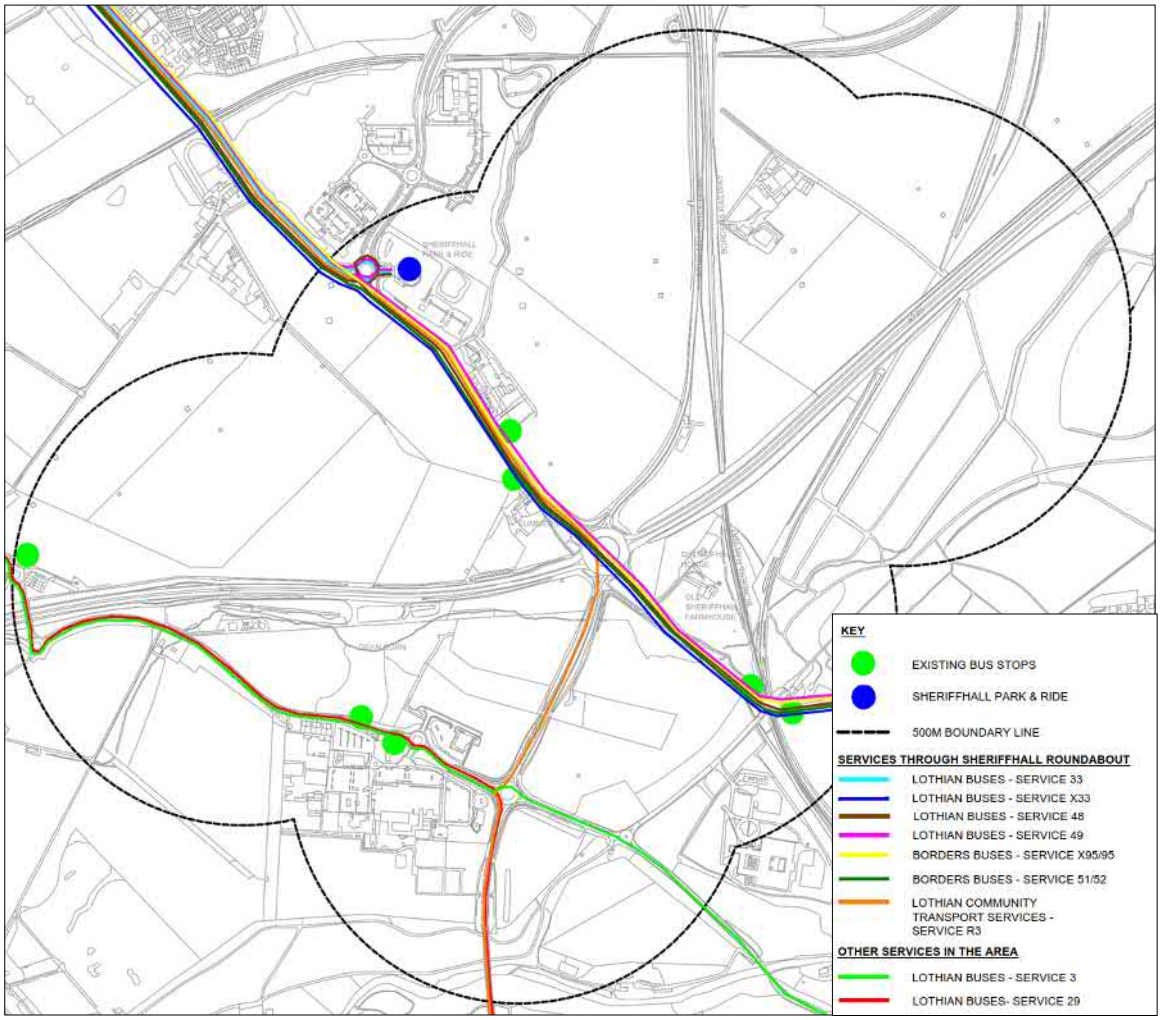


Image 2.1 - Existing bus facilities

In addition to Sheriffhall Park & Ride, there are two other park and ride facilities within 5km of the scheme. Newcraighall Park & Ride is located 3.7km north of Sheriffhall Roundabout and Straiton Park & Ride is located 4.9km west of Sheriffhall. The existing Park & Ride facilities within 5km of the scheme are shown in Image 2.2.

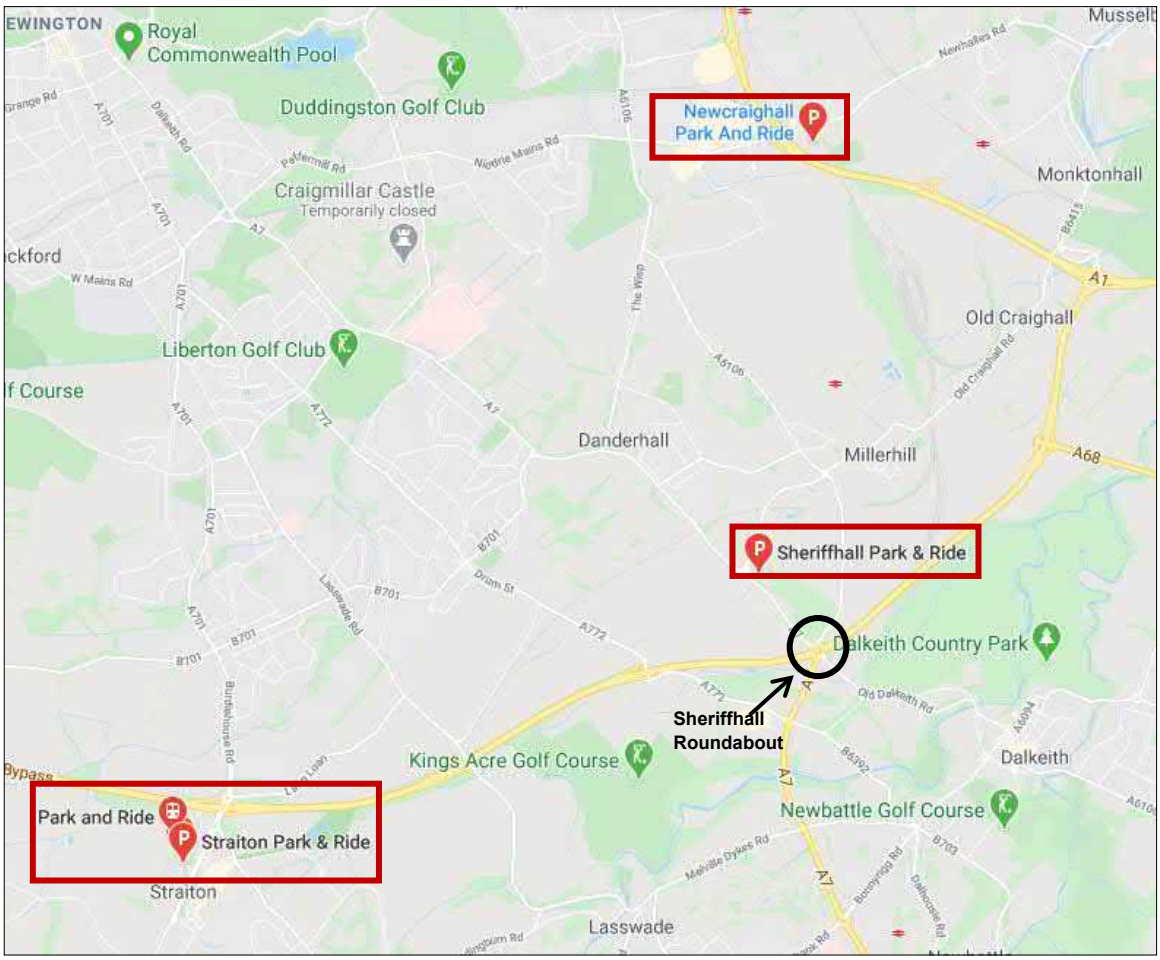


Image 2.2 - Existing Park & Ride Facilities

2.2 Rail Services

ScotRail (operated by Abellio) currently provide passenger services on the Borders Railway line between Edinburgh (Waverley) and Tweedbank in the Scottish Borders. Monday to Saturday services are half-hourly in each direction until 20:00, with an hourly service provided after 20:00 and on Sundays. The route alignment between Millerhill and Eskbank passes below the A720 Edinburgh City Bypass to the east of Sheriffhall Roundabout. Borders Railway stations within the 5km study area are located at Newtongrange, Eskbank, Shawfair, Newcraighall and Brunstane.

Scotrail also provide passenger services on the North Berwick Railway line between Edinburgh (Waverly) and North Berwick. Monday to Friday services are hourly with an additional half-hourly service over peak hours. A half-hourly service operates on Saturdays and an hourly service on Sundays. Musselburgh Railway Station is located within the 5km study area on the North Berwick line.

The existing railway services and stations are shown in Image 2.3.

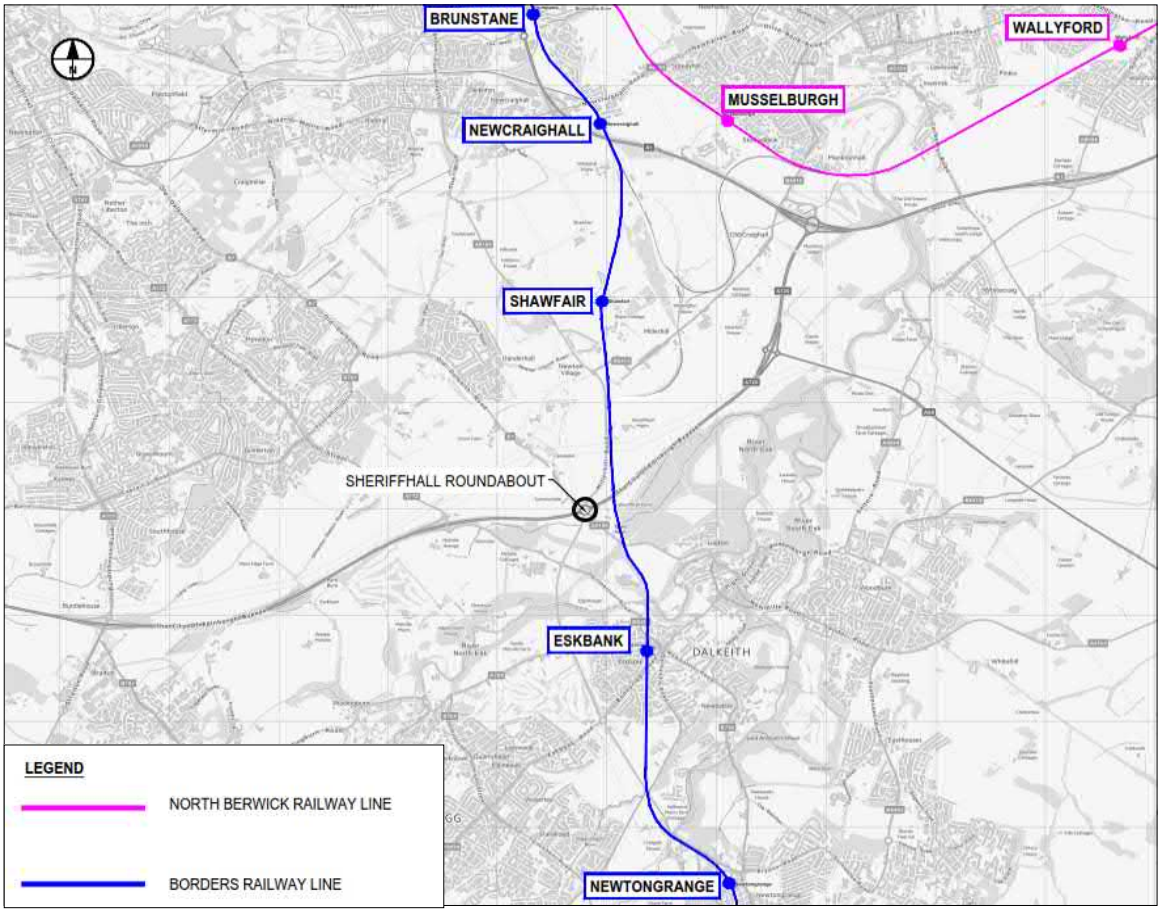


Image 2.3 - Existing Rail Services and Stations

2.3 Effect of the Proposed Scheme on Public Transport

2.3.1 Effects on public transport facilities

The Proposed Scheme does not have any direct impact on rail facilities as there are no stations in the immediate vicinity of the Proposed Scheme and the proposed A720 bridges pass over the existing railway line without requiring realignment of the railway.

The Proposed Scheme does not have any impact on Park & Ride facilities and does not include any dedicated bus lanes, as per existing provision, or additional bus stops.

The realignment of the A7 North will require the relocation of an existing bus stop located on the northbound lane near Summerside. The existing bus stop does not include a bus layby and conflicts with the on-road cycling lane adjacent to the A7 North northbound lane. The bus stop will be relocated approximately 110m north of its current location and a bus layby will be provided. The new location, as shown on Image 2.4, has been identified to be as close as possible to Summerside, whilst still maintaining a like-for-like distance, as per existing arrangement, of approx. 150m from the enlarged roundabout.

The existing bus stop on the A7 North southbound lane will be retained at its current location.

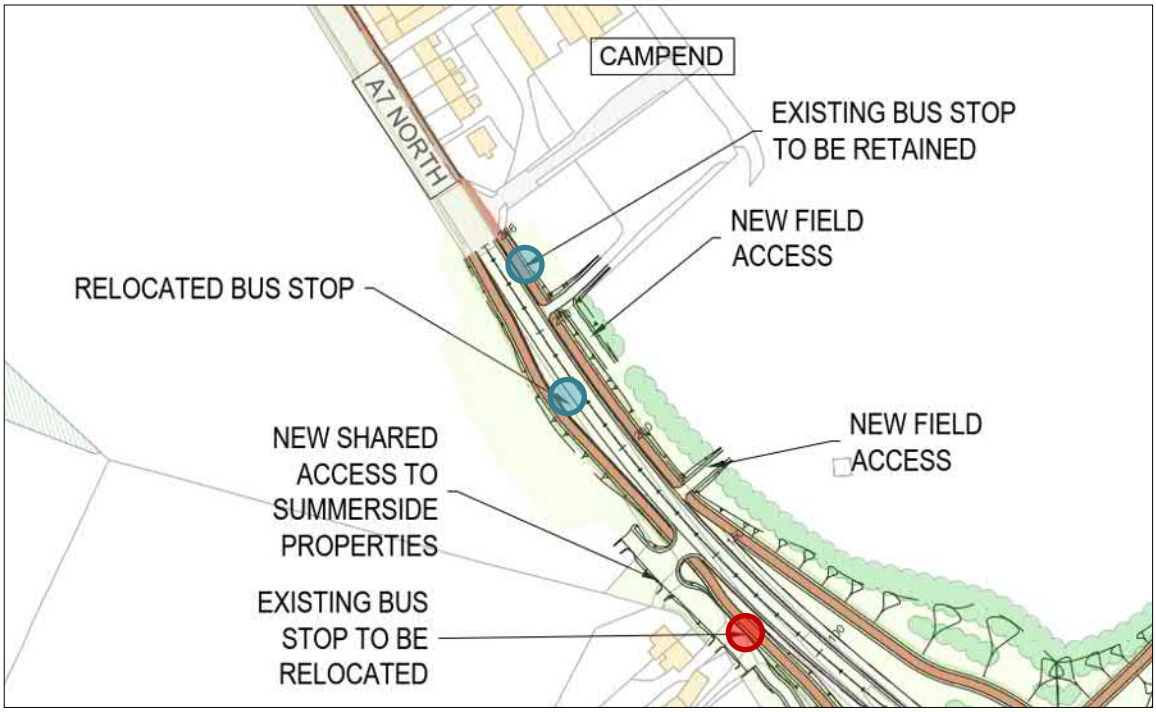


Image 2.4 - Relocated and retained bus stops on the A7 North

2.3.2 Effects on bus journey times

An assessment of the operational benefits of the Proposed Scheme was undertaken as part of the scheme development and assessment process. This involved detailed data collection surveys to define baseline conditions and the development and application of various computer models to assess the operational performance of the Proposed Scheme. In the case of the A720 Sheriffhall Roundabout, the operational assessment involved the development of a Paramics micro-simulation traffic model.

The programme of data collection surveys was undertaken within the study area to assist in establishing current traffic volumes and vehicle proportions at key locations, to quantify variations

in hourly and daily traffic demand, to establish the levels of congestion and delays experienced by road users, and to estimate current vehicle speeds and journey times in the study area. Through the collection and analysis of this information, the prevailing traffic demand and operating conditions within the study area were established.

To provide an indication of recent traffic growth at Sheriffhall Roundabout, 59,000 vehicles were recorded passing through the junction in October 2014 and 57,700 vehicles were recorded passing through the junction in October 2013. It should be noted that the changes in local trip patterns are likely to have been influenced by the temporary closure of the A6106 (North) of Sheriffhall Roundabout during the October 2014 surveys.

The changes in traffic flows along the A720 and on the roads around Sheriffhall Roundabout are shown in Image 2.5.

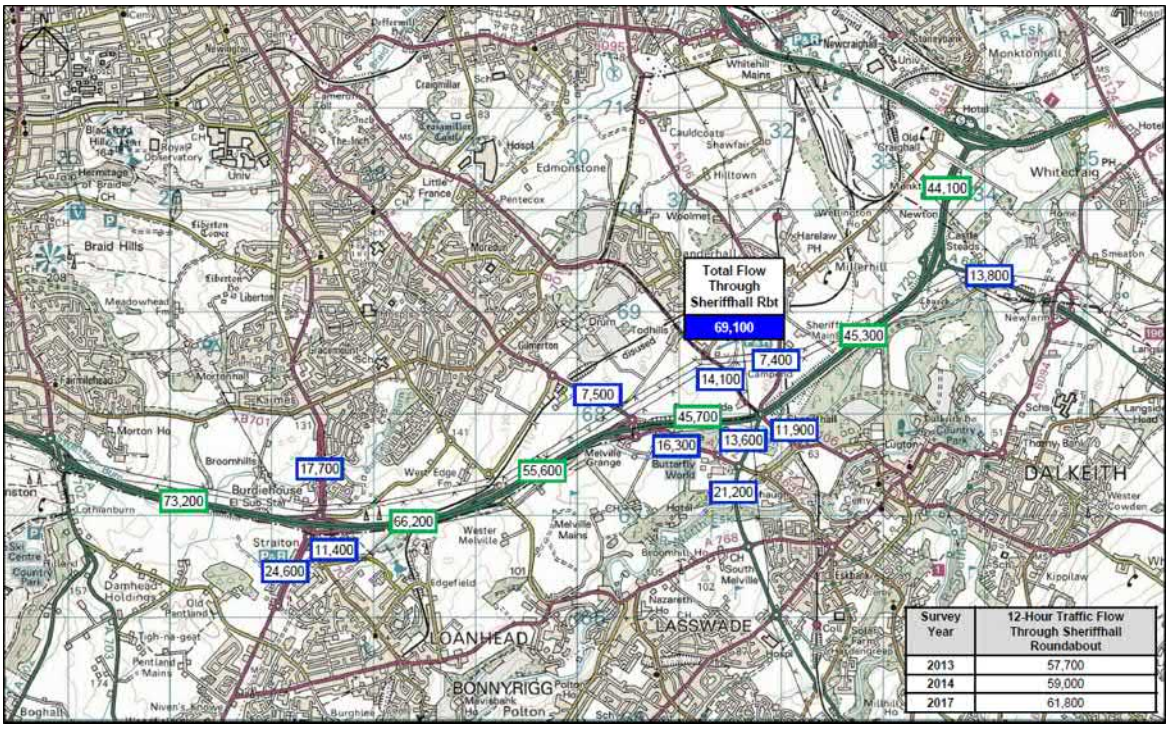


Image 2.5 - A720 / Sheriffhall Roundabout 2017 14-Hour Observed Traffic Flows

As part of the DMRB Stage 3 assessment, the scheduled bus services which pass through Sheriffhall Roundabout were examined to determine the number of buses and frequency of bus services which pass through Sheriffhall Roundabout during a typical weekday between 06:00 and 20:00 hours.

The Manual Classified Counts undertaken during the May 2017 data collection programme included all passenger service vehicles (PSV) movements recorded on the approach roads at Sheriffhall Roundabout.

A summary of the 14-hour PSV turning movements observed at Sheriffhall Roundabout recorded during the surveys is shown in Table 2.2.

Table 2.5 - Observed PSV Turning Movements

Approach T&E Table Road	A7 (N)	A6106 (N)	A720 (E)	A6106 (S)	A7 (S)	A720 (W)	Total
A7 (N)	0	0	12	**124**	15	3	**154**
A6106 (N)	0	0	0	4	2	2	**8**
A720 (E)	6	0	0	3	13	**77**	**99**
A6106 (S)	**120**	0	5	0	0	17	**142**
A7 (S)	14	2	15	1	0	2	**34**
A720 (W)	6	1	**89**	17	1	0	**114**
Total	**146**	**3**	**121**	**149**	**31**	**101**	**551**

Examination of the PSV turning movements observed at Sheriffhall Roundabout indicates that the main PSV movement travelling through Sheriffhall Roundabout is between the A7(N) and the A6106(S) in both directions. In a northbound direction between the A6106(S) and the A7(N), 120 PSVs were recorded travelling through Sheriffhall Roundabout during the 14-hour survey. In the reverse southbound direction 124 PSVs were recorded travelling between the A7(N) and A6106(S) through Sheriffhall Roundabout.

Examination of the above data indicates that the A7(N) and A6106 (S) approaches carry the highest volume of PSVs through Sheriffhall Roundabout between 06:00 and 20:00 hours, with 154 PSVs recorded on the A7(N) approach road and 142 PSVs recorded on the A6106(S) approach road.

The hourly flow profile of PSV movements across all approach roads at Sheriffhall Roundabout are shown in Image 2.6.

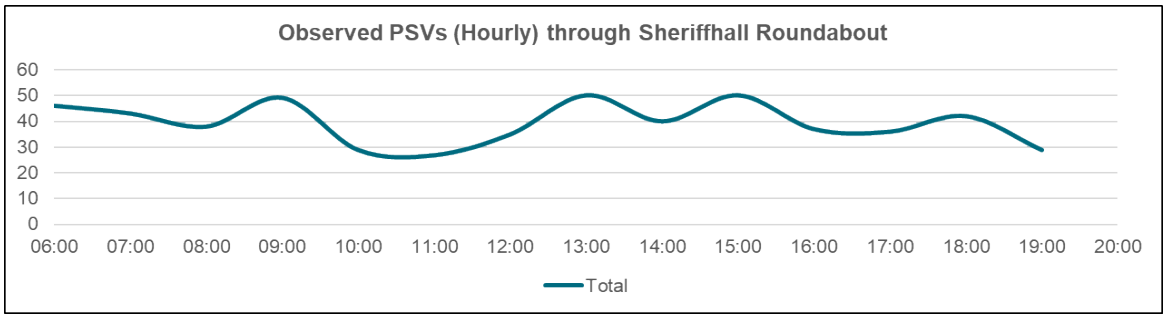


Image 2.6 - Hourly Flow Profile of PSV Movements at Sheriffhall Roundabout

The AM peak hour PSV total flow on all approach roads at Sheriffhall Roundabout was observed between 09:00 and 10:00 hours with 49 PSVs recorded. The PM peak hour PSV movement at Sheriffhall Roundabout was observed between 13:00 and 14:00 hours and between 15:00 and 16:00 hours with 50 PSVs recorded.

The following bus services were identified as travelling through Sheriffhall Roundabout between the A6106 to the south of Sheriffhall Roundabout and the A7 to the north of Sheriffhall Roundabout during a typical weekday service:

- Lothian Buses – Service X33;
- Lothian Buses – Service 48;
- Lothian Buses – Service 49;
- Border Buses – Service 51/52; and
- Border Buses – Service X95.

The location of the main local routes that travel through Sheriffhall Roundabout are shown in Image 2.7.

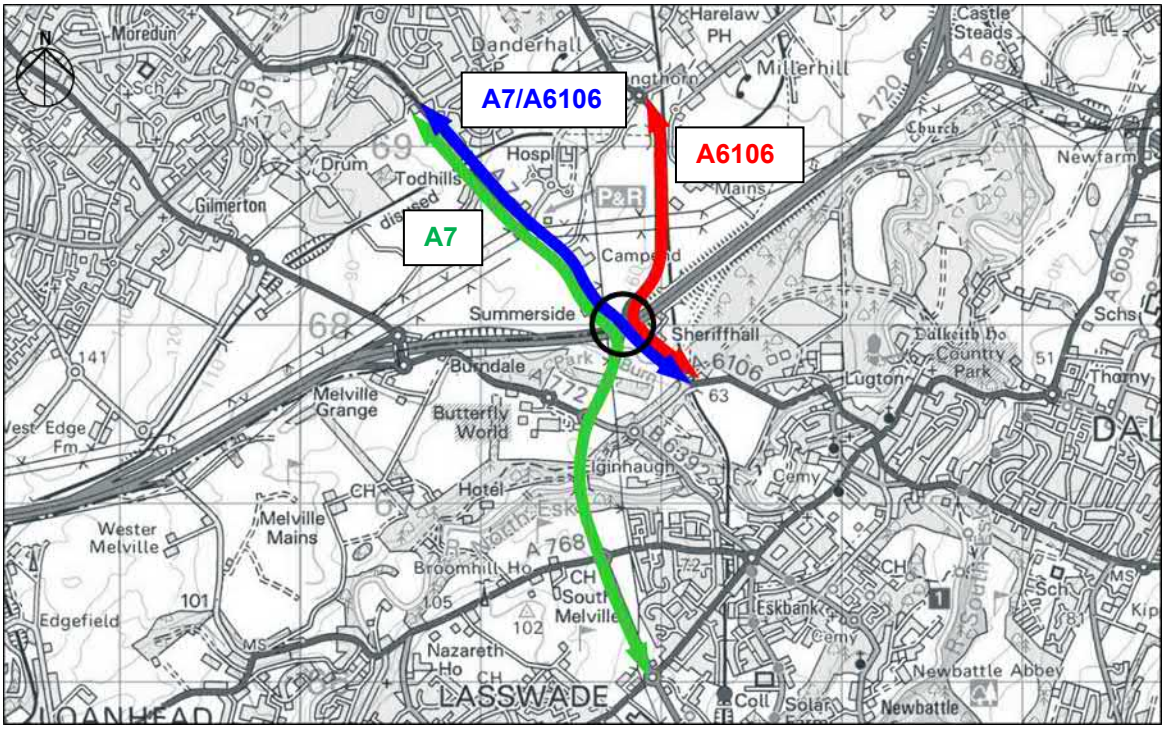


Image 2.7 - Main Local Routes through Sheriffhall Roundabout

As noted earlier in this Technical Note, examination of the PSV turning movements observed at Sheriffhall Roundabout indicates that the main PSV movement travelling through Sheriffhall Roundabout is between the A7(N) and the A6106(S) in both directions.

The operational and economic assessment of the Proposed Scheme has required the development and application a Paramics micro-simulation traffic model. To provide an indication of the travel times for PSVs travelling on these routes, data has been extracted from the Base and Design Paramics models for the assumed 2024 year of opening year.

A7 Route

A comparison of the 14-hour journey speeds and times on the A7 route from the Base and Design models in the assumed 2024 Opening Year is shown in Table 2.3.

Table 2.6 - Journey Time Savings due to Proposed Scheme (A7 Route)

Time Period	Direction	Base 2024 Speed (mph)	Design 2024GS Speed (mph)	Speed Diff. (mph)	Base 2024 Time (mins)	Design 2024GS Time (mins)	Time Diff. (mins)	Time Diff. (%)
Total (14-Hour)	N/b	16	23	+7	8.8	6.2	-2.7	-30%
Total (14-Hour)	S/b	20	26	+6	7.3	5.6	-1.7	-23%

Note: The above results are based on the averages of 15 simulation runs over a 4km section of the A7.

The above results indicate that average journey times on the A7 during the 14-hour average weekday period would decrease by 30% (2.7mins) and 23% (1.7mins) in the northbound and southbound directions respectively.

Comparison between the Base and Design models indicates that significant times savings could be realised during peak periods with corresponding improvements in journey time reliability for all road traffic including buses on the A7 northbound route.

Analysis of operating conditions throughout the day on the A7 northbound route indicates that journey time savings would generally range from 2 minutes to 5 minutes during the PM period, with a maximum time saving of 6.5 minutes which occurs during the PM peak at 18:00 hours.

This information is presented in Image 2.8 below.

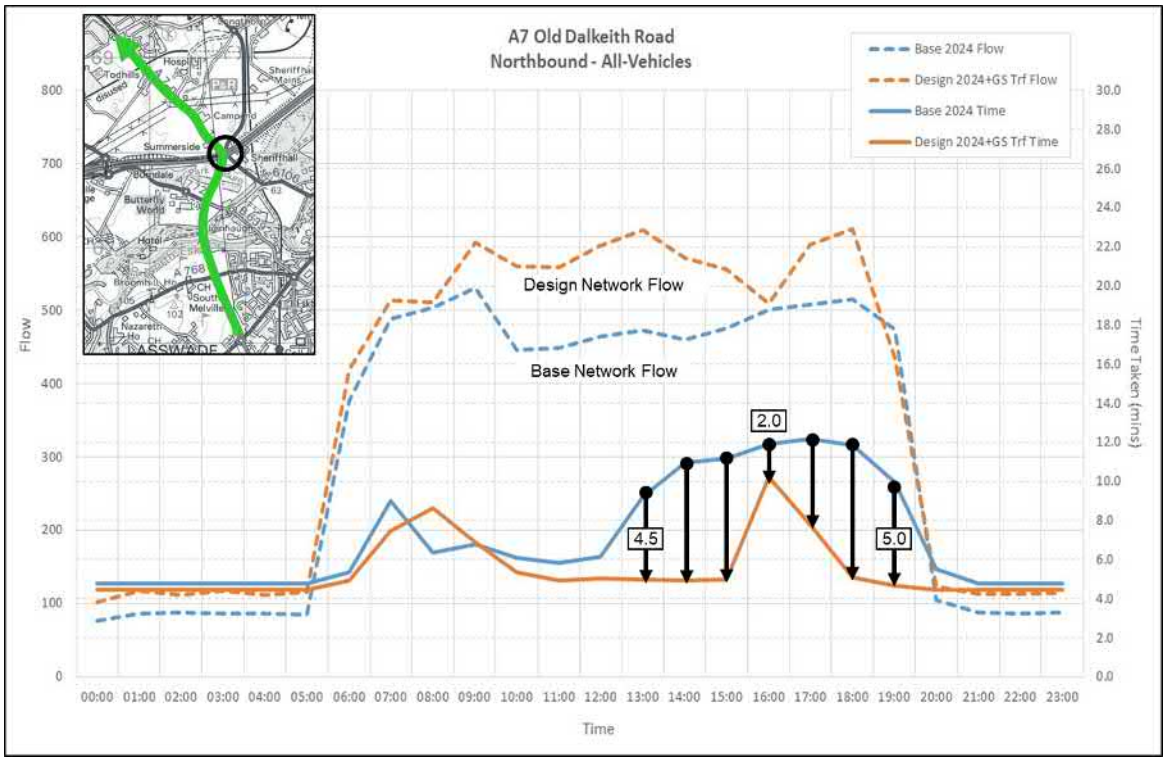


Image 2.8 - A7 N/b Hourly Traffic Flows and Journey Times – Base and Design Networks

Comparison between the Base and Design models indicates that significant times savings could be realised during peak periods with corresponding improvements in journey time reliability for all road traffic including buses on the A7 southbound route.

Analysis of operating conditions throughout the day on the A7 southbound route indicates that journey time savings would be approximately 4 minutes during the PM period. There is a maximum time saving of approximately 5 minutes, which occurs during the PM peak at 15:00 hours.

This information is presented in Image 2.9 below.

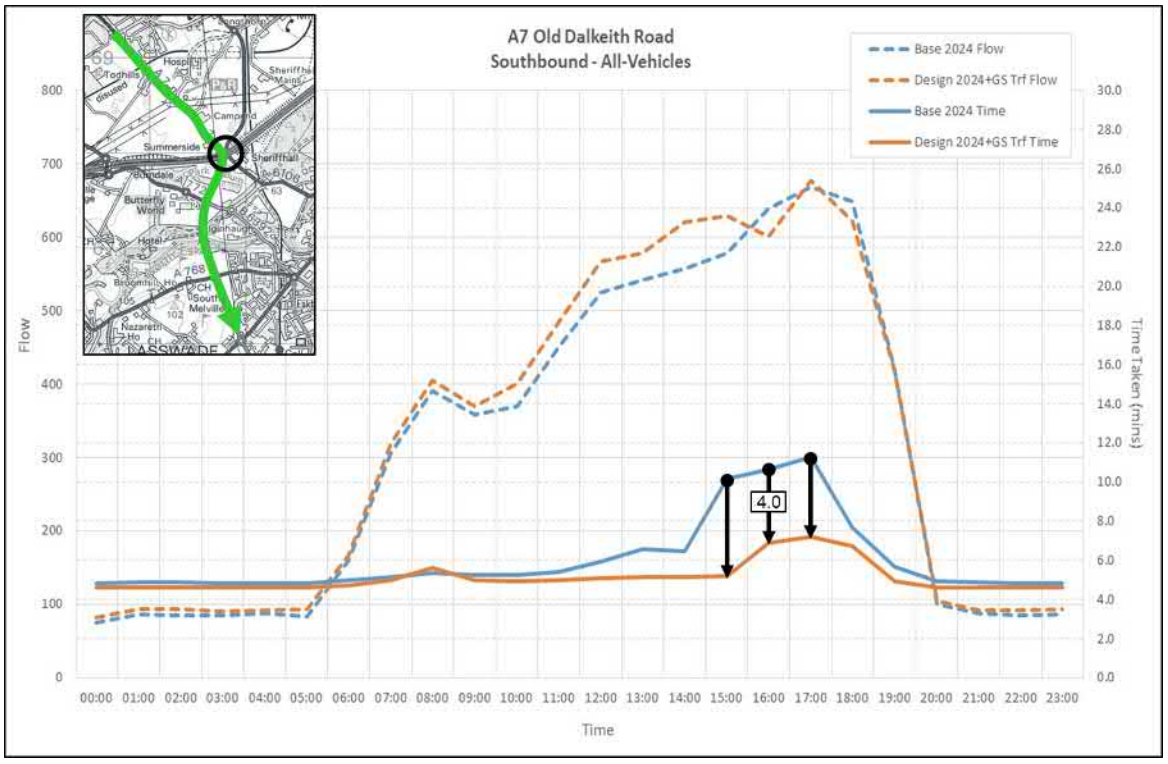


Image 2.9 - A7 S/b Hourly Traffic Flows and Journey Times – Base and Design Networks

Overall, the Proposed Scheme would reduce journey times for all A7 northbound and southbound road traffic including buses passing through the junction.

A6106 Route

A comparison of the 14-hour journey speeds and times on the A6106 from the Base and Design models in the assumed 2024 Opening Year is shown in Table 2.4.

Table 2.7 - Journey Time Savings due to Proposed Scheme (A6106 Route)

Time Period	Direction	Base 2024 Speed (mph)	Design 2024GS Speed (mph)	Speed Diff. (mph)	Base 2024 Time (mins)	Design 2024GS Time (mins)	Time Diff. (mins)	Time Diff. (%)
Total (14-Hour)	N/b	26	28	+2	2.8	2.6	-0.2	-8%
Total (14-Hour)	S/b	7	26	+19	9.7	2.7	-7.0	-72%

Note: The above results are based on the averages of 15 simulation runs over a 2km section of the A6106.

The average journey times on the A6106 during the 14-Hour average weekday period would decrease by 8% (0.2mins) and 72% (7.0mins) in the northbound and southbound directions respectively.

Comparison between the Base and Design models indicates that journey times are reasonably consistent during the day for all road traffic including buses on the A6106 northbound route.

This information is presented in Image 2.10 below.

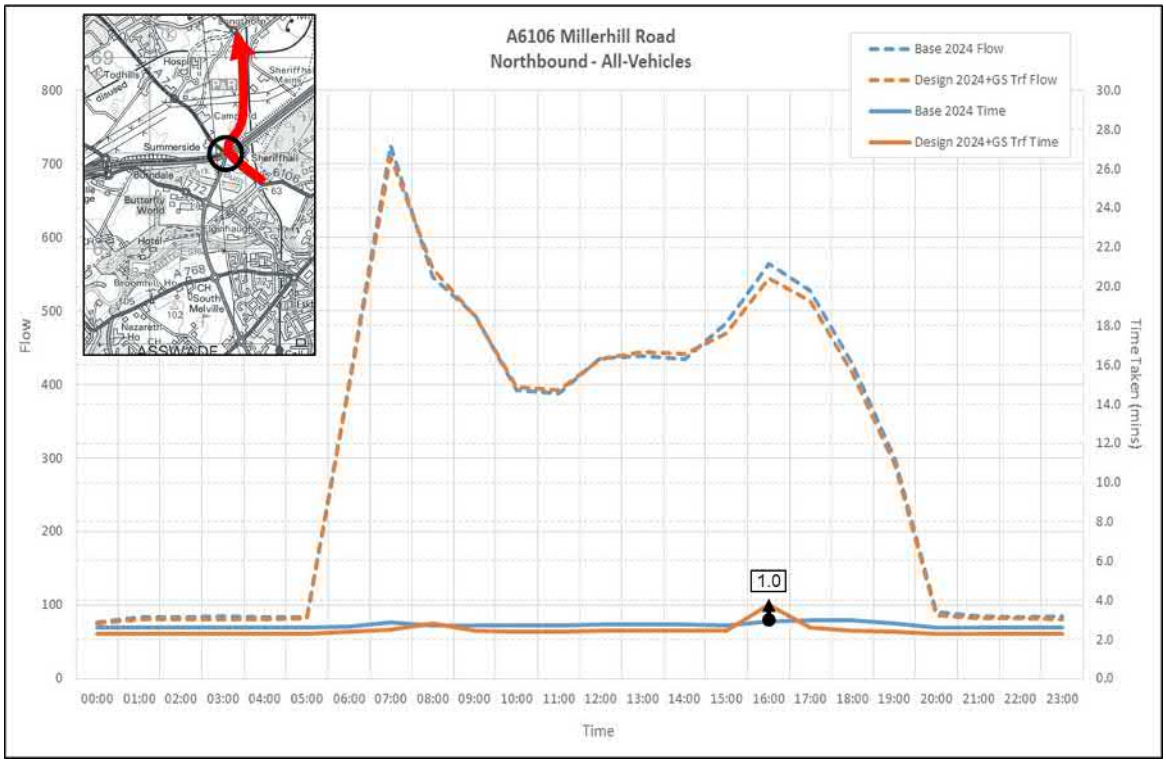


Image 2.10 - A6106 N/b Hourly Traffic Flows and Journey Times – Base and Design Networks

Comparison between the Base and Design models indicates that significant times savings could be realised during peak periods with corresponding improvements in journey time reliability for all road traffic including buses on the A6106 southbound route.

Analysis of operating conditions throughout the day on the A6106 southbound route indicates that journey time savings would range from 9 minutes to 26.5 minutes during the PM period, with a maximum time saving which occurs during the PM peak at 18:00 hours.

This information is presented in Image 2.11 below.

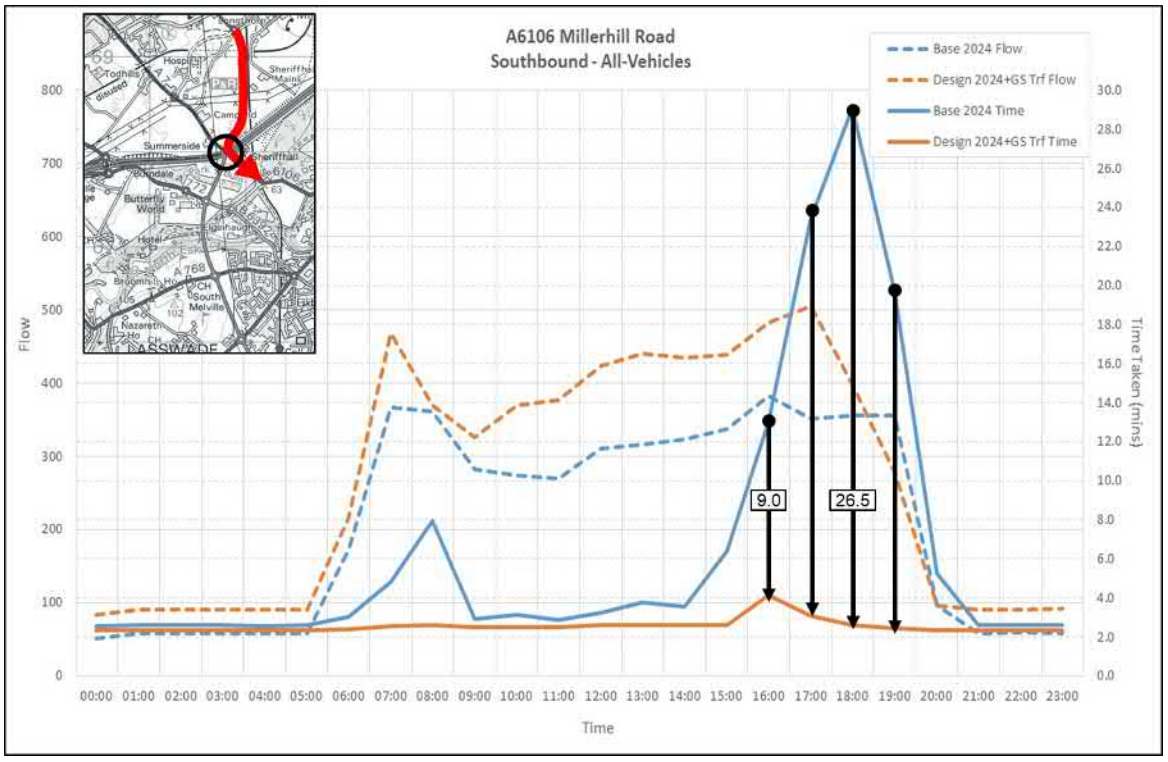


Image 2.11 - A6106 S/b Hourly Traffic Flows and Journey Times – Base and Design Networks

Overall, the proposed scheme would reduce journey times for all A6106 southbound road traffic, including buses, passing through the junction but with only a small change to northbound traffic which does not experience the same level of variation in journey times.

A6106(S) / A7(N) Route

Comparison between the Base and Design models indicates that journey times are reasonably consistent during the day for all road traffic including buses on the A6106(S) to A7(N) northbound route.

This information is presented in Image 2.12 below.

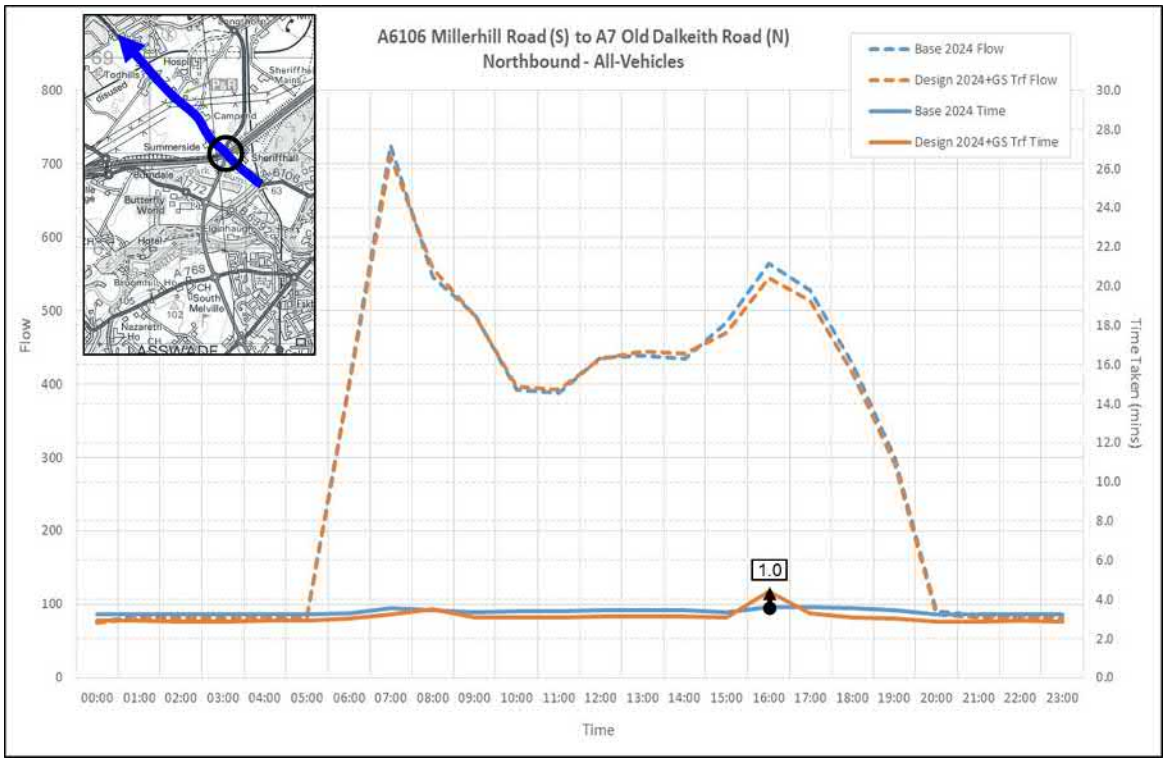


Image 2.12 - A6106(S) to A7(N) Hourly Traffic Flows and Journey Times – Base and Design Networks

Comparison between the Base and Design models indicates that significant times savings could be realised during peak periods with corresponding improvements in journey time reliability for all road traffic including buses on the A7(N) to A6106(S) southbound route.

Analysis of operating conditions throughout the day on the southbound route indicates that journey time savings would range from 3.5 minutes to 5 minutes during the PM period, with a maximum time saving which occurs during the PM peak at 15:00 hours.

This information is presented in Image 2.13 below.

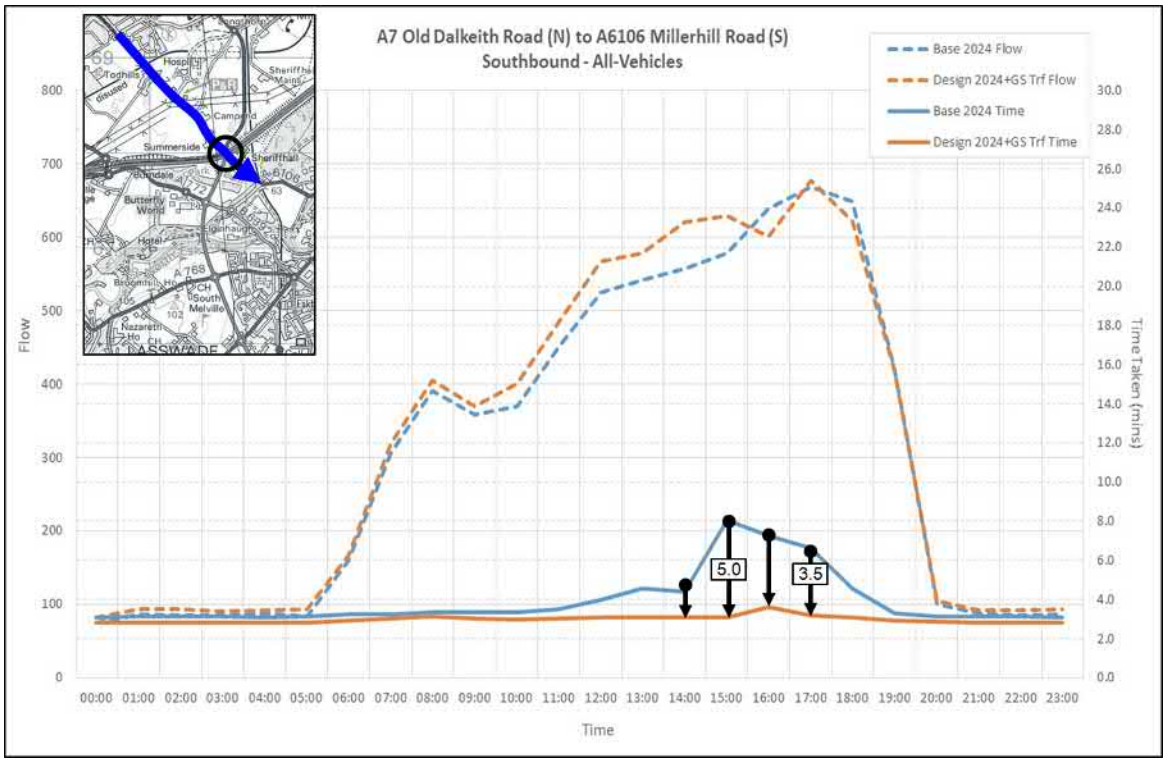


Image 2.13 - A7(N) to A6106(S) Hourly Traffic Flows and Journey Times – Base and Design Networks

Overall, the proposed scheme would reduce journey times for all A6106(S) to A7(N) road traffic, including buses, passing through the junction but with only a small change to northbound traffic which does not experience the same level of variation in journey times.

3. Scheme Objectives and Opportunities

3.1 Design Objectives

The following Scheme Objectives were agreed for the development and assessment of the scheme to address the main issues affecting Sheriffhall Roundabout, and were used throughout the scheme assessment process.

A. Improve the movement of traffic on the A720 between Gilmerton and Old Craighall by providing grade-separation of the A720 at the existing Sheriffhall Roundabout;

B. Reduce the conflict between strategic and local traffic;

C. Minimise traffic impact of local proposed developments in Midlothian, East Lothian and City of Edinburgh on the A720 between Gilmerton Junction and Old Craighall Junction and approach roads;

D. Improve road safety for all users on the A720 and approach roads between Gilmerton Junction and Dalkeith Northern Bypass;

E. Minimise intrusion of the new works on the natural environment, cultural heritage and people whilst enhancing the local environment where opportunities arise;

F. Facilitate integration for different modes of transport along and across the A720 corridor between Gilmerton Junction and the Dalkeith Northern Bypass; and

G. Reduce severance by improving accessibility across the A720 for all users.

Out of the objectives listed above, the following are relevant to public transport:

D. Improve road safety for all users on the A720 and approach roads;

E. Minimise intrusion of the new works on the natural environment, cultural heritage and people whilst enhancing the local environment where opportunities arise;

F. Facilitate integration for different modes of transport along and across the A720 corridor; and

G. Reduce severance by improving accessibility across the A720 for all users.

4. Bus Priority Options

As part of the Public Transport review undertaken, a number of potential measures have been considered for the implementation of bus priority into the Proposed Scheme. Details of the options considered for implementation and the relevant assessment work undertaken as part of this review are given in the following sections.

4.1 Bus Priority Standards and Guidelines

Bus priority can be implemented in a number of ways on existing and new road networks. The methodology will normally depend on each specific case in relation to the nature of the scheme, level of demand and local opportunities/constraints. Guidelines and best practice on this subject will depend on these criteria, as well as on specific requirements/policies as advised by the local authorities, Midlothian Council (MLC) and City of Edinburgh Council (CEC).

In order to develop potential options for the implementation of bus priority for Sheriffhall, the following guidelines and industry best practice guidance have been used.

- Edinburgh Street Design Guidance: Part C - Detailed Design Manual – PT3 (CEC)
- Network Management Notes – Bus Priority (The Chartered Institution of Highways & Transportation – CIHT).
- National Roads Development Guide (Society of Chief Officers of Transportation in Scotland – SCOTS)
- Local Transport Note 1-97 'Keeping Buses Moving' (Department for Transport – DfT)

MLC have advised they do not have specific design standards for the provision of bus priority and that they follow national guidelines and best practice. The standards listed above have therefore been considered relevant to the Sheriffhall scheme.

Part C of the Edinburgh Street Design Guidance (Detailed Design Manual) defines bus priority measures as a key policy for the CEC to ensure that bus travel is as convenient, rapid and reliable as possible. Bus priority measures should therefore be the default option whenever there is a benefit to bus journey times and/or reliability.

CEC identifies the following main options for the provision of bus priority:

- Bus lanes.
- Bus-only streets and bus-ways
- Signal priority and Traffic management/calming

CEC Detailed Design Manual also recommends considering bus priority measures in conjunction with provision for pedestrians and cyclists, and/or as part of an urban traffic strategy, such as parking reviews. However, given that the Sheriffhall scheme includes provision of dedicated NMU facilities network and no parking, this would not apply to the implementation of bus priority for Sheriffhall Roundabout.

The CIHT Network Management Notes on bus priority state similar reasons for considering bus priority in existing and new schemes, also emphasising that bus priority is *'most successful if it is adopted along complete route corridors and accompanied by high vehicle and operational standards (eg, low emission, low floor buses and drivers specially trained in customer care) and high profile marketing'*. The bus priority options mentioned in the Network Management Notes can also be summarised as:

- Full or part-time bus lanes.
- Bus-only roads, bus-ways and bus gates

- Traffic signal controlled bus priority

Similarly to CEC and CIHT guidance, Local Transport Note 1-97 'Keeping Buses Moving' also highlights the importance of *'measures to encourage provision of more sustainable, environmentally friendly, forms of transport, including the development of more attractive public transport services'*, and considers similar bus priority measures to those listed above.

The provision of dedicated bus facilities as a way to encourage the use of public transport is also considered in the National Roads Development Guide, which states Scottish policy is *'to enable bus to provide an effective alternative to the car by improving reliability, average bus speed and encouraging improvements to the quality of services and infrastructure'.*

Further details on the recommended bus priority options included in the standards and guidelines considered for this review are given in the following sections.

4.1.1 a) Bus lanes

Dedicated bus lanes allow bus services to bypass traffic congestion. Dedicated bus lanes can be permanently restricted to bus-only use, but restrictions typically apply during peak hours only. In Edinburgh, most bus lanes operate Monday to Friday at 07:30-09:30 and 16:00-18:30, but these times are currently under review and subject to change. Peak hour restrictions should be enforced to ensure appropriate usage of the bus lane.

CEC guidance specifies the desirable width of a bus lane is 4.5m to allow for the provision of a mandatory or advisory 1.5m cycle lane. Narrower lanes (3.25m) are allowed, up to an absolute minimum of 3m, providing buses are not expected to pass each other. Given that buses are not expected to pass each other on the approach to the roundabout, and that the Proposed Scheme includes dedicated NMU facilities, a dedicated 3m wide bus lane is considered most appropriate for the Sheriffhall scheme. This is also in line with the minimum width recommended by the National Roads Development Guide and LTN 1-97.

CIHT guidance specifies that, in order for bus lanes to work effectively, they need to be properly enforced to prevent other vehicles from driving or parking in the bus lanes. Methodologies listed in the Guidance Notes to discourage misuse include colour differentiation of road surface, textural differentiation (e.g. rough surfacing material, such as cobble stones, outside the bus's 'trackway', to discourage violation), and partial or full segregation. Enforcement cameras can also be used in conjunction with other measures, especially when segregation is not feasible (e.g. when bus lanes operate only part time).

CIHT, CEC and LTN 1-97 guidance also identify contra-flow bus lanes as a way to avoid unnecessary diversions for buses and maintain an efficient route. Contra-flow bus lanes would run on the opposite direction to general traffic on a one-way road and should always be wide enough to allow use by cyclists, who should also be permitted to use the bus lanes. CEC design guidance specifies that a desirable minimum width of 4.5m is recommended, whereas LTN 1-97 states a preferred minimum of 4m and an absolute minimum of 3m.

Based on the guidance detailed above, the following sub-options have been identified for the Sheriffhall Roundabout scheme.

i. provision of a dedicated additional bus lane adjacent to the currently proposed carriageway

ii. reallocation of carriageway space to buses with no changes to the current design.

iii. Extension of entry flares to provide longer Lane 1 and Lane 2 on the approach to the roundabout, so that Lane 1 can be reallocated to exclusive use of buses.

iv. Long extension of Lane 1 and reallocation to exclusive use of buses.

Due to the absence of one-way roads within the Proposed Scheme, the implementation of bus priority with contra-flow lanes is not applicable for the Sheriffhall scheme, and has therefore been

discounted. Further details on the sub-options listed above and their application to the Sheriffhall Roundabout scheme are given in Section 5.

4.1.2 b) Bus-only streets, bus-ways and bus gates

Improved bus journey times and route permeability can be achieved by limiting or removing the interaction of buses with other vehicular traffic. This can be achieved by physically segregating bus routes with the implementation of appropriate infrastructure ('bus-ways'), or by allocating an entire road/street to the exclusive use of buses ('bus-only streets'). Other users, including taxis, cycles and emergency vehicles, can also be granted use of unguided busways and bus only streets.

The CIHT Guidance also identifies bus gates as another form of bus-way that can be implemented to improve bus journey times and reliability. These are short links closed to other traffic, so that a bus can travel directly to and across an area not open to general through traffic. Bus gates can be implemented simply by using appropriate signs or involve the provision of physical measures (e.g. traffic signals, barriers, rising bollards, etc.).

As the approaches to the roundabout cannot be entirely allocated to buses and physical segregation of bus routes cannot be fully achieved through the junction, bus-ways, bus-only streets and bus gates are not considered to be feasible options for bus priority for Sheriffhall Roundabout, and therefore this option has been discounted

4.1.3 c) Signal priority and Traffic management/calming

Signal priority for buses should be implemented on a case-by-case basis as the default option when this can help reduce journey times and delays, but it is normally more effective as part of a wider strategy involving multiple junctions on a bus route. There are several signal priority options that can be considered:

- Signal timings/Passive Priority
- Selected Vehicle Detection (SVD)/Active priority
- Queue holding
- Gap generation
- Virtual bus lanes

CEC Design Guidance requires any new signalised junction to be assessed in terms of impacts on bus routes. If any detrimental impact on bus services is identified, one of the above options is required to be implemented to mitigate this impact.

Bus priority can also be achieved by allowing buses to access quicker routes (e.g. being allowed to make otherwise banned movements) or being prioritised by selective signals.

Based on the guidance detailed above, the following sub-options have been identified for the Sheriffhall Roundabout scheme:

i. Passive priority

ii. Selected Vehicle Detection (SVD)/Active priority

Further details on the various signal priority options available are discussed below.

i) Passive priority

If no detection of buses is implemented and signal timings are not adjusted dynamically on demand, the signal priority system is considered 'passive'. Passive systems can offer some form of

prioritisation, but the lack of flexibility and on-demand adjustments make them less effective than 'active' systems..

Simpler passive priority systems are set on pre-determined signal timings based on historic traffic flows (eg, the traffic modelling and signal optimiser software TRANSYT). If one of the routes is known to have significant bus flows, a more sophisticated version of these systems (BUS TRANSYT) can be used to bias signal phasing in favour of roads with heavy bus flows.

There are other forms of passive priority that would allow control of general traffic flows so that buses are not delayed in traffic queues:

- Queue holding. This technique is also known as traffic metering, or 'gating'. This priority method holds excess traffic at locations where it can be 'stored', and only released into a potentially congested downstream bottleneck at a level which can be accommodated under free–flow conditions.
- Gap generation. A loop buried at the head of a bus layby would detect a bus needing to pull out and activate a red phase for traffic on approach to the layby. This would allow the bus to rejoin the carriageway without delays.
- Virtual bus lanes. Queue holding or gap generation techniques can be used to allow a bus to bypass a queue of traffic ahead of traffic lights. For example, pre-signals could hold general traffic travelling on either direction so that a free-flow corridor is created for a bus to overtake the downstream queue and use the lane on the opposite direction as a temporary ('virtual') lane to move in front of the queue at the junction.

Due to the absence of bus stops on the immediate approaches to the roundabout, and to the operational difficulties associated with the implementation of other traffic management measures on the approach to a roundabout, signal priority with pre-determined signal timings is considered to be the only applicable passive priority measure.

ii) Selected Vehicle Detection (SVD)/Active priority

Active priority provision would allow a traffic signal system to adjust when specific circumstances apply, such as when a delayed bus approaches the junction. These intelligent transport systems require vehicle detection and identification (Selective Vehicle Detection – SVD), as well as IT equipment to be installed to analyse data and control the traffic signal systems. Each bus would also need to be fitted with an electronic device, such as a transponder, which enables the bus to be identified, its position and status to be logged and traffic signals to be adjusted accordingly to allow prioritised passage through the junction.

Many towns and cities increasingly use active priority systems to prioritise bus services at signalised junctions. The fully traffic flow responsive system SCOOT (Split Cycle Offset Optimisation Technique) is a popular example of dynamic signal timing system implemented in place of former fixed cycle traffic signal strategies. A more recent version of SCOOT also includes an interactive facility to give dynamic priority to buses, which is activated by bus detectors located upstream of each signal-controlled junction.

Priority is given to buses by extension to or early recall of the green phase and by reducing green time for other traffic. The system is also normally designed so that delays and restrictions to other traffic are minimised, for a given level of bus priority.

4.2 Sheriffhall Bus Priority Design Options

Based on the guidance notes summarised above, the following can be considered as bus priority measures:

a) Bus lanes

i. dedicated bus lanes,

ii. reallocation of carriageway space for buses

iii. extension of roundabout entry flares, and

iv. long extension of Lane 1

b) Bus only streets, bus-ways and gates

c) Signal Priority and Traffic Management / Calming

i. Passive Provision, including queue holding, gap generation and virtual bus lanes, and full signalisation of the roundabout with fixed prioritisation of bus routes.

ii. Selective Vehicle Detection / Active Priority

Due to the reasons detailed in Section 4.1.3, bus priority measures listed at point b) above have been discounted. Therefore a total of six options have been considered as appropriate for consideration for bus prioritisation measures on the Sheriffhall scheme.

Option 1 - providing additional approach lane and entry (ref. a) i.)

Option 2 - reallocation of carriageway space to buses (ref. a) ii.)

Option 3 - extension of roundabout entry flares (ref. a) iii.)

Option 4 - long extension of Lane 1 (ref. a) iv.)

Option 5 - full signalisation of the roundabout with passive priority (ref. c) i.)

Option 6 - full signalisation of the roundabout with active priority (ref. c) ii.)

These options will be considered in addition to the design proposed for the Sheriffhall Roundabout scheme as presented in the published draft Orders (Road and CPO) and Environmental Statement.

The design application is considered further and discussed for each option in the following sections.

4.3 Option 1 – Providing Additional Approach Lane and Entry

4.3.1 Design Application

Provision of a dedicated additional lane for buses can be considered among the potential options for bus prioritisation. Although additional lanes could be provided adjacent to the nearside lane of each approach (without the need to amend the geometry or length of the lanes included in the Proposed Scheme). A dedicated additional bus lane would also require carriageway widening at its' junction with the roundabout to provide a fourth bus lane at the roundabout stop/give-way line. An initial assessment has shown that this would not be feasible without major changes to the geometry of the junction.

Due to the close proximity of each roundabout entry to the following exit, there is insufficient space within the current design for a fourth nearside lane to be added. Narrowing the splitter islands would help to accommodate a fourth lane, but would require the realignment of the approach lanes and involve relaxing the current geometry and deflection standards. CD 116 'Geometric design of roundabouts' also states (par. 2.5) that signalised roundabouts shall be designed following the same requirements as normal roundabouts, therefore the same geometry requirements would apply even if Option 1 was implemented in combination with Option 5 or 6. In these circumstances, narrowing the splitter island would also reduce the queuing capacity on the circulatory carriageway at signals, if all approaches are signalised.

The introduction of a fourth lane on the approach to the roundabout would also require an additional lane on the circulatory carriageway, therefore resulting in a significant increase of the size of the

roundabout and, consequently, a redesign of the entire junction and additional land take. The approach roads would also need to be realigned to maintain compliance with standards.

An indicative sketch for Option 1 is given in drawing 60572241-ACM-HGN-SW_RB_000_Z-SK-CH-0100 included in Appendix A.

4.3.2 Initial Design Assessment

Although the provision of an additional long lane dedicated to buses would be beneficial and would not impact on capacity for general traffic, Option 1 would have a severe impact on the scheme layout. It would require a full redesign and reassessment of the junction, as well as increased environmental impact, footprint and cost, and the republication of the Environmental Statement, CPO and Road Orders.

Due to the reasons detailed above, Option 1 has been discounted.

4.4 Option 2 – Reallocation of Carriageway Space to Buses

4.4.1 Design Application

Part of the currently proposed carriageway space could be reallocated to provide a dedicated lane for buses. Since all approaches to Sheriffhall Roundabout include a single lane in each direction, this could only be achieved on the immediate approach to the roundabout where the entry flare provides two additional lanes.

Lanes 1 and 2 availability has been assessed for each side road and approximate lengths are summarised in Table 4.1. It should be noted that each lane has only been measured considering the length over which the flare provides a full minimum additional width of 3m. An indicative plan layout for Option 2 is shown in drawing 60572241-ACM-HGN-SW_RB_000_Z-SK-CH-0200 included in Appendix A.

Table 4.1 - Current lane provision on approach to the roundabout

Road	Lane 1 (approx.) Length [m]	Lane 2 (approx.) Length [m]
A7 North	16	34
A7 South	8	31
A6106 North (Millerhill Road)	8	29
A6106 South (Old Dalkeith Road)	28	133

Allocating Lane 1 for exclusive use of buses on the A7 North, A7 South and A6106 North is considered not to provide significant journey time benefits as its length would not be adequate for a bus to bypass any queues of general traffic. Assigning one of the three approach lanes to buses without lengthening them would also reduce capacity for general traffic.

The proposed cross section for the realigned A6106 South does not include hard strips and widens to include two northbound lanes, matching the existing provision. Throughout its length (133m) it therefore provides sufficient width for at least two 3m-wide lanes, widening to three over the final 28m on the approach to the roundabout. However, assigning Lane 1 to buses would be insufficient to allow buses to bypass queues on Lane 2 if these are over 28m long, and would reduce the road's overall capacity for general traffic.

4.4.2 Initial Design Assessment

Reallocation of carriageway space without any specific changes to the road geometry currently included in the Proposed Scheme is not considered sufficiently effective on its own for bus prioritisation as the reallocated space would be insufficient. Initial operational considerations also found Option 2 may have a negative impact on bus journey times due to the short length of bus lanes and the reduction of junction capacity.

Due to the reasons detailed above, Option 2 has been discounted.

4.5 Option 3 – Extension of Roundabout Entry Flares

4.5.1 Design Application

Reallocation of carriageway space to accommodate buses, as detailed for Option 2, would be more effective if longer approach lanes are provided to minimise impacts on capacity. Therefore, Option 3 lengthens the entry flare on each approach, providing longer Lanes 1 and 2. This would help to avoid buses getting held up behind general traffic, unable to use the dedicated lane and reach the front of the queue. Lengthening entry flares would also help general traffic by increasing the capacity of Lane 2, partly compensating for the lost capacity of Lane 1 reallocated for exclusive bus use.

A preliminary assessment has been undertaken for each side road approach to determine the feasibility of extending the entry flares and any implications, such as impact on adjacent land and/or on other elements of the scheme e.g. earthworks, visibility, etc.

An indicative potential plan layout for Option 3 is shown in drawing 60572241-ACM-HGN-SW_RB_000_Z-SK-CH-0300 included in Appendix A, and each approach is discussed in turn below

A7 North

A preliminary realignment of the entry flare for the A7 North shows Lane 1 and 2 can be extended by 6m and 15m to 22m and 49m respectively. This could be achieved by widening the carriageway and can be accommodated by the proposed verge.

A traffic assessment would be required to determine the actual benefits of these changes, or whether further lengthening of Lane 1 would be required to maximise effectiveness for bus priority. A detailed geometric and visibility assessment would also be required to confirm feasibility and compliance with design standards, and if any geometric Departures or Relaxation from Standard would be required.

Should the assessment identify the need of a longer lane, and/or further verge widening to maintain compliance with visibility requirements on the approach to the roundabout, this would likely result in a slight steepening of the adjacent slope. However, there would be no land implications as this would fall within the area already included in the CPO.

A7 South

The entry flare on the A7 South can be extended to lengthen Lane 1 and 2 by 13m and 15m to 21m and 46m respectively. This could be achieved by widening the carriageway and can be accommodated by the proposed verge.

As with the A7 North, a traffic assessment would be required to quantify the benefits of these changes and a geometric and visibility assessment would also be required to confirm feasibility and compliance with standards. However, due to the close proximity of NMU routes the feasibility of further lane extensions is more limited, when compared to the A7 North.

Should the assessment identify the need of further verge widening to maintain compliance with visibility requirements on the approach to the roundabout, this would likely result in a slight steepening of the adjacent slope. However, there would be no land implications as this would fall within the area already included in the CPO.

A6106 North (Millerhill Road)

An initial assessment of the horizontal geometry has shown both Lane 1 and 2 on the approach to the roundabout can be extended by approximately 8m to a total length of 16m and 37m respectively. A traffic assessment would be required to determine whether this would be enough to allow a bus to bypass any queues without impacting on operational capacity.

Should this extension be insufficient there is scope to further extend the lanes, as an additional carriageway widening could be accommodated by the proposed verge, subject to geometric assessment to determine whether any Departures or Relaxations from Standards are needed.

It should be noted that any changes to the geometry would need to be fully designed and assessed properly to ensure compliance with standards. Any relaxation of current geometry and visibility standards would need to be discussed and agreed with the relevant Local Authority.

A6106 South (Old Dalkeith Road)

The proposed cross section for the A6106 South includes two northbound lanes for its entire length, and widens further to three lanes over the last 28m on the approach to the roundabout. If Lane 1 is reassigned to the exclusive use of buses, the extension of the entry flare could provide a further 18m (approx.) to minimise any impact on current capacity.

As noted for the other approaches, a traffic assessment would be required to determine the benefits of these changes, or whether Lane 1 needs to be lengthened further to avoid any impact on capacity.

Any carriageway widening for this option would increase the footprint of the road as the verge, as included in the Proposed Scheme, is 2.5m wide on the inside (west) of the road, therefore cannot be narrowed further. However, the increased footprint would not have any implications on land or other elements of the design as it can be accommodated within the current CPO extents and the adjacent Sustainable Drainage System (SuDS) pond is approximately 7m away from the road earthworks.

4.5.2 Initial Design Assessment

The roundabout approach lanes can be lengthened on all approaches by extending the entry flares, as detailed above and summarised in Table 4.2 below.

Table 4.2 - Potential lane provision for Option 3

Road	Lane 1 (approx.) Length [m][1]	Lane 2 (approx.) Length [m][1]
A7 North	22 (+6)	49 (+15)
A7 South	21 (+13)	46 (+15)
A6106 North (Millerhill Road)	16 (+8)	37 (+8)

[1] Figures within brackets indicate the difference (increase) in length compared to the Proposed Scheme

A6106 South (Old Dalkeith Road)	46 (+18)	133 (-)

Although the extension of flares would result in longer bus lanes when compared to Option 2, the benefits associated with Option 3 are still considered to be negligible due to the reduced junction capacity and the relatively short length of the extended Lane 1. Due to the changes to junction capacity and road geometry, Option 3 is likely to have a potential minor impact on landscape, noise and air quality, and present operational challenges due to conflicting movements between buses and general traffic.

Due to the reasons detailed above, Option 3 has been discounted.

4.6 Option 4 – Long Extension of Lane 1

4.6.1 Design Application

As detailed for Option 3, reallocation of carriageway space to accommodate buses would be more effective if Lanes 1 and 2 are lengthened to minimise impacts on capacity. Option 4 aims to maximise the extension of Lane 1 to an overall length of approximately 100m, wherever possible. This would help to avoid buses overcome any queues, but also assist general vehicle traffic by increasing the capacity of Lane 2. Due to its length, the final section of the bus lane can be reallocated to all traffic to minimise impact on junction capacity

A preliminary assessment has been undertaken for each side road to determine the feasibility of extending Lanes 1 and 2 (impact on adjacent land and/or on other elements of the scheme e.g. earthworks, visibility, etc.). A summary of this assessment is given in the following sections for each road and an indicative potential plan layout for Option 4 is shown in drawing 60572241-ACM-HGN-SW_RB_000_Z-SK-CH-0400 included in Appendix A.

A7 North

A preliminary assessment for the A7 North shows the extension of Lane 1 and 2 would be feasible by widening the carriageway using the space available between the road and the NMU route on the east side. The carriageway widening can be partly accommodated within the proposed verge, with some localised verge widening required in places where the carriageway widening would make it too narrow, to ensure compliance with standards.

A traffic assessment would be required to determine the actual benefits of these changes. A detailed geometric and visibility assessment would also be required to confirm feasibility and compliance with standards, and if any geometric Departures or Relaxation from Standard would be required.

However, the geometric changes to the scheme would likely result in a steepening of the adjacent slope. However, there would be no land implications as this would fall within the area already included in the CPO.

A7 South

The extension of Lane 1 and 2 on the A7 South would also be feasible, however due to the close proximity of the NMU route on the west side the overall achievable length for Lane 1 is less than 100m (approx. 72m). The extension of Lane 1 and 2 could be achieved by widening the carriageway and can be partly accommodated within the proposed verge, with some localised verge widening where the carriageway widening would make it too narrow, to ensure compliance with standards.

As with the A7 North, a traffic assessment would be required to quantify the benefits of these changes and a geometric and visibility assessment would also be required to confirm feasibility and compliance with standards. However, due to the close proximity of NMU routes the feasibility of further lane extensions is more limited, when compared to the A7 North.

Whilst there may be scope to extend the lanes further, if a traffic assessment confirms the need of significantly longer lanes the NMU route located west of the road would likely need to be realigned. If this is the case, the NMU route realignment could be accommodated within the current CPO, but the draft Road Orders would need to be amended accordingly and re-published. Furthermore, if localised verge widening is required for compliance with visibility requirements on the approach to the roundabout, this would likely result in a steepening of the adjacent slope.

A6106 North (Millerhill Road)

An initial assessment has shown the carriageway can be widened to extend both Lane 1 and 2 on the approach to the roundabout, however a traffic assessment would be needed to determine the benefits of these changes.

There is scope to further extend the lanes, as an additional carriageway widening could be accommodated within the proposed verge, subject to geometric assessment to determine whether any Departures or Relaxations from Standards are needed.

It should be noted that any changes to the geometry would need to be fully designed and assessed to ensure compliance with standards. Any relaxation of current geometry and visibility standards would need to be discussed and agreed with the relevant Local Authority. Should the SuDS pond require relocation, any realignment of the relevant access road would require republication of the draft Road Orders.

A6106 South (Old Dalkeith Road)

The proposed cross section for the A6106 South already includes two northbound lanes for its entire length, and widens further to three lanes over the last 28m on the approach to the roundabout. An initial assessment has shown the carriageway can be widened to three lanes over a longer length, however as mentioned for the other approaches, a traffic and geometric assessment would be required to determine the benefits of these changes and their feasibility in compliance with standards.

As the verge is 2.5m wide on the west side and cannot be narrowed further to maintain compliance with standards, any carriageway widening would increase the footprint of the road. However, this would not have any implications on land or other elements of the design as the widening could be accommodated within the current CPO extents and within the space available between the road and the SuDS pond access road.

4.6.2 Initial Design Assessment

Lanes 1 and 2 can be lengthened on all side roads as detailed above and summarised in Table 4.3.

Table 4.3 - Potential lane provision for Option 4

Road	Lane 1 (approx.) Length [m]	Lane 2 (approx.) Length [m]
A7 North	108	34
A7 South	72	40

Road	Lane 1 (approx.) Length [m]	Lane 2 (approx.) Length [m]
A6106 North (Millerhill Road)	110	34
A6106 South (Old Dalkeith Road)	102	133

The provision of dedicated infrastructure may help increase public transport attractiveness and reduce bus journey times as a long bus lane would help buses overcome any queues. Due to the longer bus lanes provided in Option 4, when compared to other options, the final section of the bus lane can be reallocated to all traffic to minimise impact on junction capacity.

However, despite the benefits, Option 4 still presents operational challenges as the conflicting movements between buses and general traffic identified for other bus lane options are also likely to still occur if no signalisation or bus advance area is provided. Some initial operational considerations are detailed in the next section. Due to the changes to junction capacity and road geometry, this option might also have a potential minor impact on landscape, noise and air quality.

4.6.3 Initial Operational Considerations

The operational assessment of the Proposed Scheme has required the development and application of various computer models including a Paramics micro-simulation traffic model which simulates the interaction between individual vehicles in the traffic stream within the modelled network during short time segments.

As noted above, the results from the simulation models indicate that the Proposed Scheme will significantly improve operating conditions at the roundabout by grade-separating the junction to remove the conflicts between strategic and local traffic movements. This arrangement would allow A720 through-traffic, which accounts for 48% of all traffic at Sheriffhall Roundabout, to pass over the junction.

Illustrations of forecasted traffic queues at Sheriffhall Roundabout during the PM peak period in the assumed 2024 year of opening, based on the existing junction layout and the Proposed Scheme layout, are shown in Image 4.1 below.

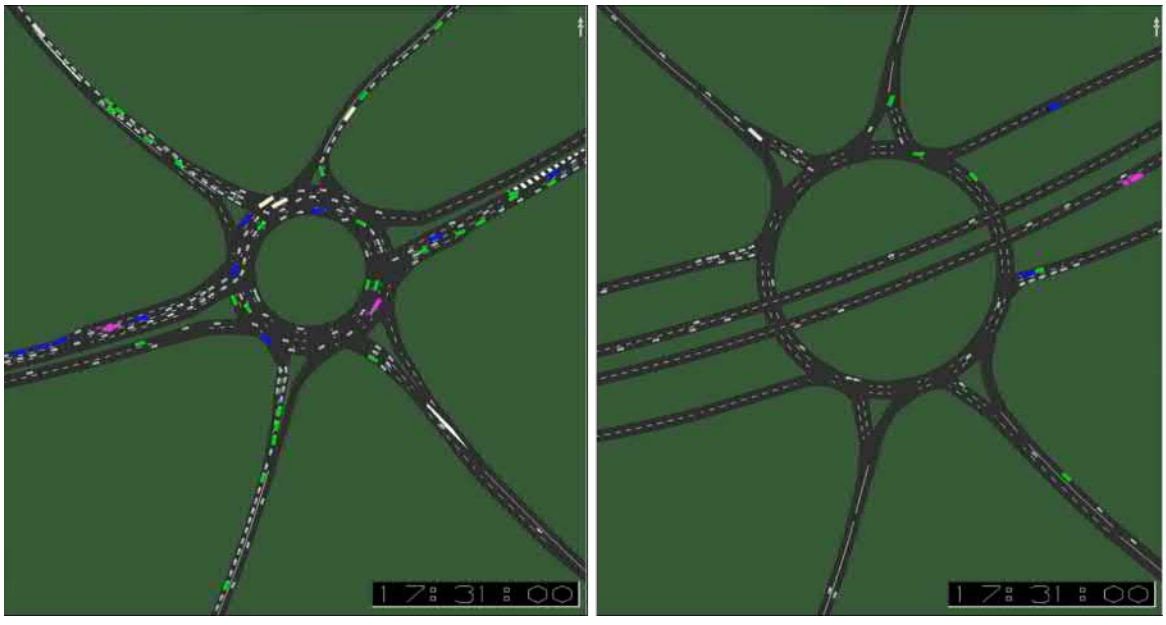


Image 4.1 - Comparison of Paramics Base and Design models in 2024 Opening Year

The Paramics models developed for the operational assessment of the Proposed Scheme were used to provide information for an initial consideration of Option 4 of the public transport improvement options based on the A6106(S) and A7(N) approaches as these are the primary bus service routes through the existing Sheriffhall Roundabout.

Designation of Approach Lane 1 for Buses Only

Although an extension of lane 1 on the A6106(S) approach from 28m to 102m would increase queueing capacity on the approach to the roundabout, designation of this lane for buses only would reduce the capacity for all other vehicle types from 3 lanes to 2 lanes at the roundabout entry.

Although allocating lane 1 for use of buses only would allow buses to use this lane to pass queueing traffic over a distance of approximately 102m, the Paramics model indicates that only short queues would form on the local road approaches for the majority of the day and consequently a bus only lane would not provide any significant benefit beyond that already provided by the proposed lane arrangement where all three lanes are available to all vehicle types.

However, the results from the Paramics model indicate that should significant congestion occur on the A720 westbound carriageway downstream of Sheriffhall Roundabout, the resulting traffic queue could extend back to the circulatory carriageway of the Proposed Scheme and limit access to the roundabout from the various approach roads.

Under this scenario, queue lengths on the A6106(S) would increase quickly and the reduction in entry capacity for general traffic that is excluded from the bus lane could rapidly extend queue lengths beyond the 102m length of bus lane. As a consequence, buses would be unable to access the designated bus only lane and would be held behind the general queue of traffic.

A similar situation would exist on the A7(N) approach, although in this case the maximum length of the designated bus lane would be 108m.

Approach Lane 1 Vehicle Paths through the Proposed Roundabout

The primary route through the existing Sheriffhall Roundabout used by current bus services is between the A7(N) and A6106(S).

Designation of approach lane 1 as a bus only lane would create a conflict between buses in lane 1 and vehicles on the circulatory carriageway due to the 2-lane exit configuration required for the A720 merge slips.

For example, vehicles entering the proposed roundabout from lane 1 on the A6106(S) would be required to exit at the A7(S) or on lane 1 of the A720(W) on-slip. If lane 1 of the A6106(S) were designated as a bus lane, all buses in this lane would also be required to exit at the A7(S) or on lane 1 of the A720(W) on-slip as opposed to the A7(N) which is the primary bus service route. If buses were to continue on lane 1 of the circulatory carriageway there would be a conflict with vehicles exiting the roundabout on to lane 2 of the A720(W) on-slip, as shown in Images 4.2 and 4.3 below.

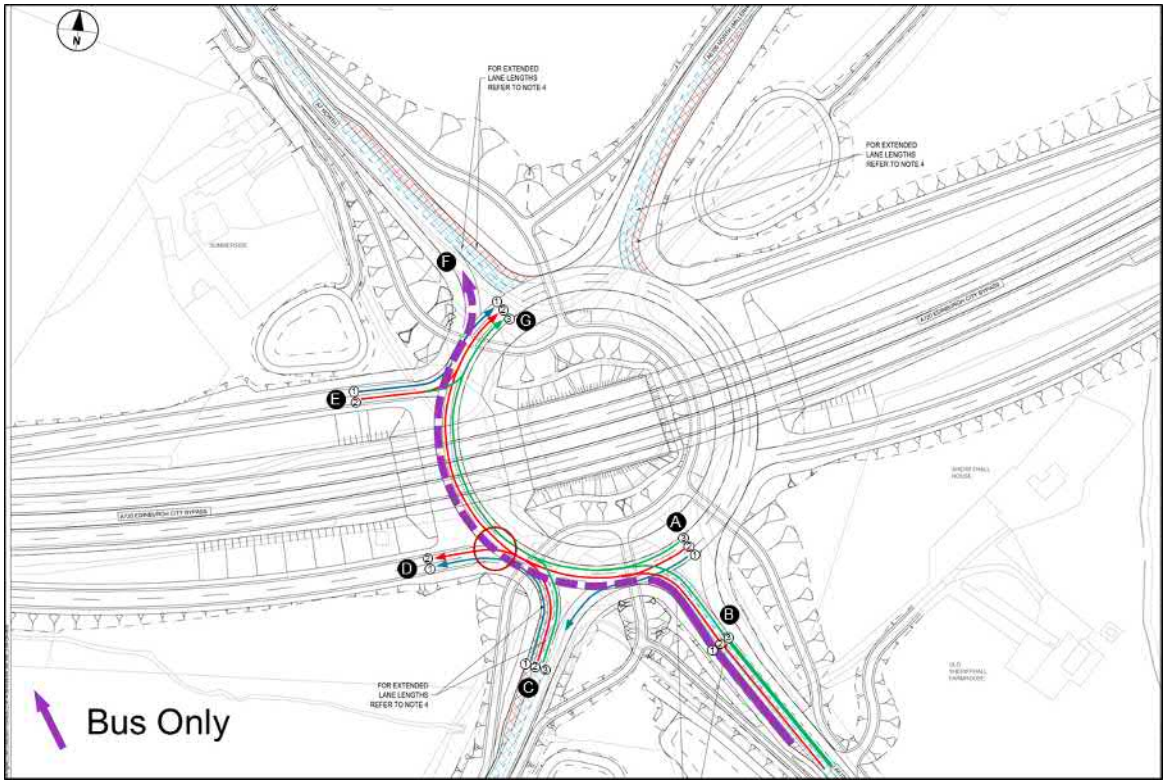


Image 4.2 - Vehicle Paths for A6106(S) Bus Only Lane 1 Approach

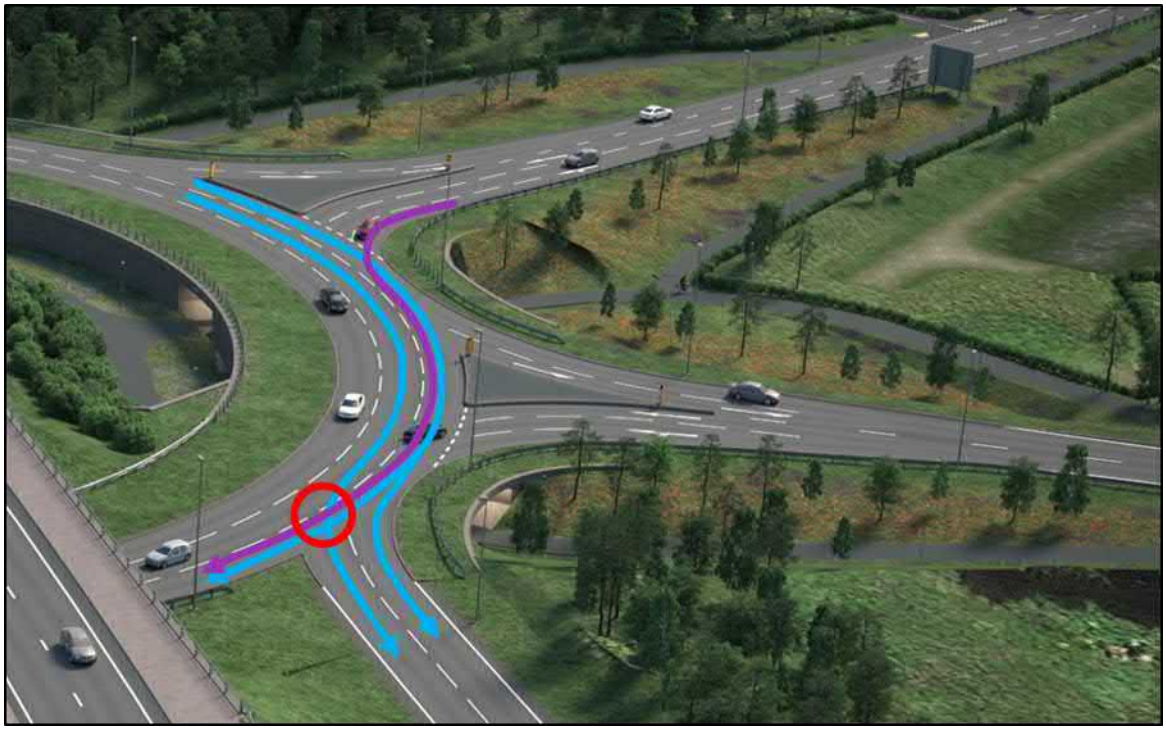


Image 4.3 - Conflicting Paths for A6106(S) Bus Only Lane 1 Approach

Similar to the A6106(S) approach, vehicles entering the proposed roundabout from lane 1 on the A7(N) would be required to exit at the A6106(N) or on lane 1 of the A720(E) on-slip. If lane 1 of the A7(N)) were designated as a bus lane, all buses in this lane would also be required to exit at the A6106(N) or on lane 1 of the A720(E) on-slip as opposed to the A6106(S) which is the primary bus service route.

Approach Lane 2 Vehicle Paths through the Proposed Roundabout

On the Proposed Scheme, buses would be required to enter the roundabout on lane 2 to follow the paths between the A6106(S) and the A7(N), as shown in Images 4.4 and 4.5 below.

Although the designation of lane 2 for buses only would address the conflicting vehicle paths discussed above, the length of carriageway available to accommodate the bus only lane on the A7(N) approach is too short at 34m to create an effective bus only facility.

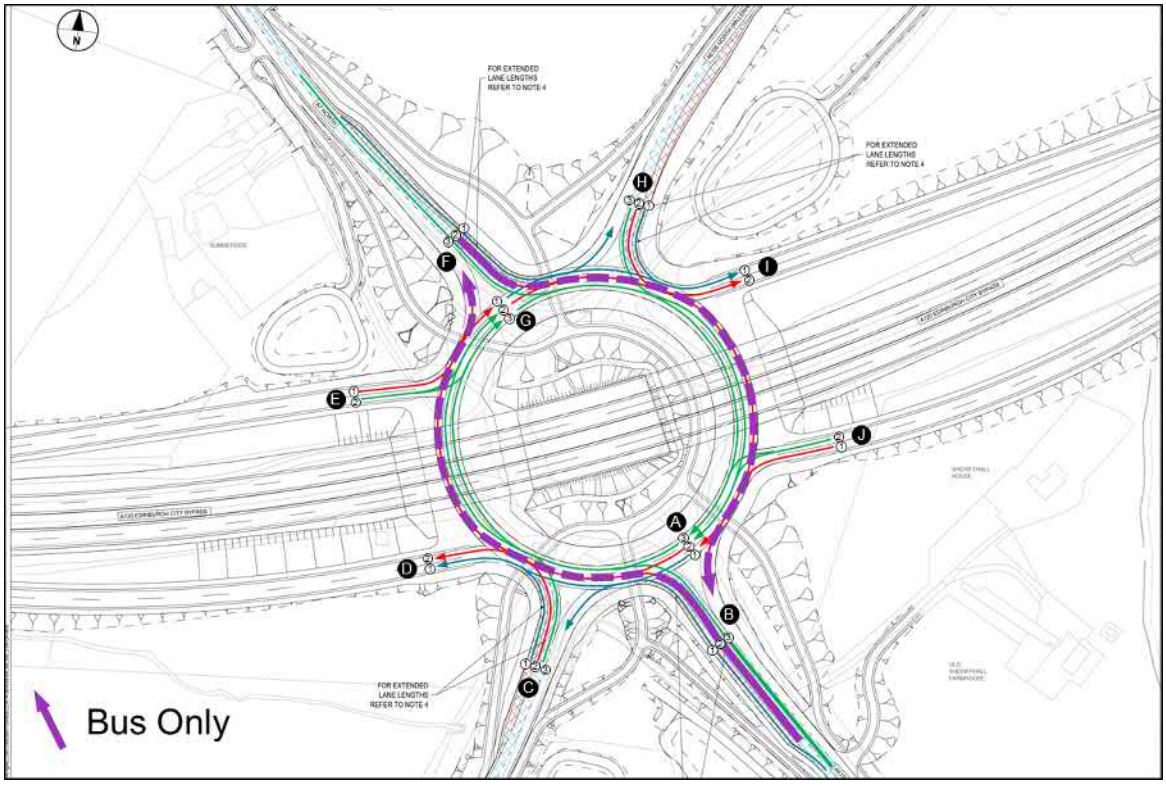


Image 4.4 - Vehicle Paths for A6106(S) and A7(N) Bus Only Lane 2 Approaches

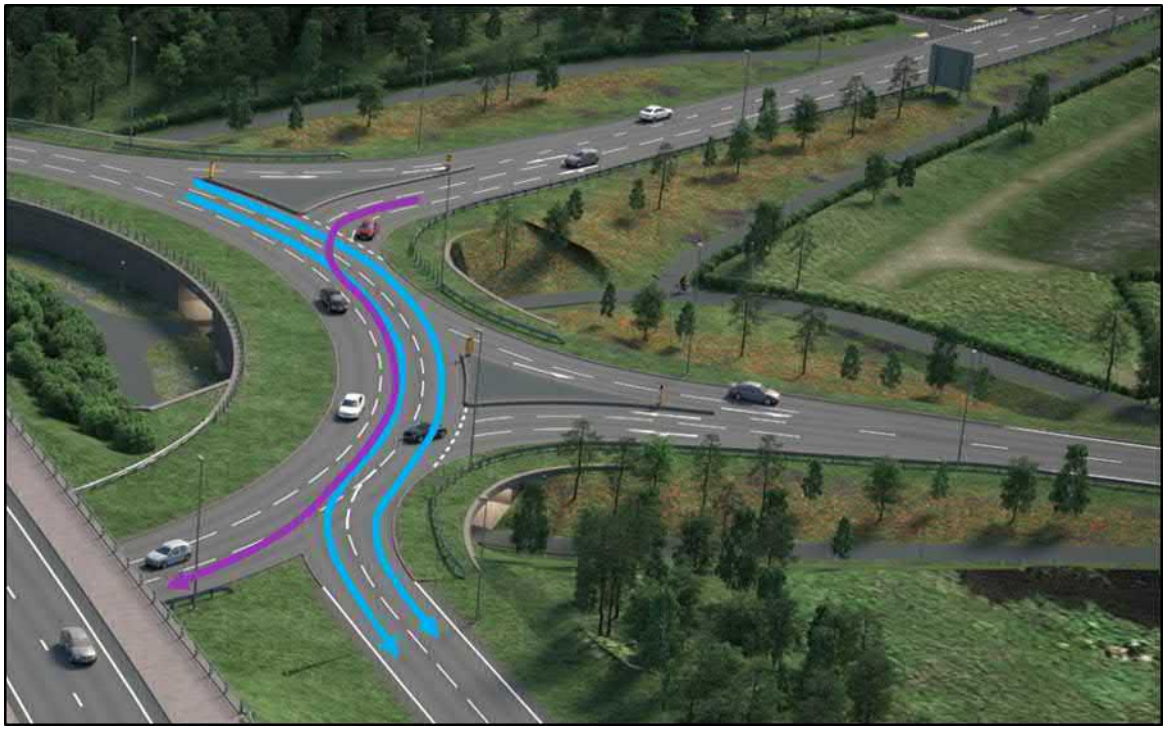


Image 4.5 - Vehicle Path for A6106(S) Bus Only Lane 2 Approach

4.7 Option 5 – Full Traffic Signalisation with Passive Priority

4.7.1 Design Application

The Sheriffhall scheme design includes partial signalisation of the roundabout with traffic lights provided at its junction with the diverge slip roads. Option 5 would provide traffic signals at all approaches to the roundabout.

As detailed in Section 4.1, prioritisation could be provided by using either passive or active systems. Passive priority would require the identification of main bus routes and service schedules, so that signal phasing is designed accordingly.

An indicative potential plan layout for Option 5 is shown in drawing 60572241-ACM-HGN-SW_RB_000_Z-SK-CH-0500 included in Appendix A.

4.7.2 Initial Design Assessment

Passive signal priority would help improve bus journey times and would not require any changes to the Proposed Scheme geometry. However this would not provide any dynamic on-demand adjustment and any future change or addition to bus services would require a reassessment of bus priority routes and timing. Option 5 would benefit from being part of a wider bus priority strategy to ensure efficiency.

Furthermore, the traffic assessment undertaken for the Proposed Scheme indicates that traffic signals are not required on the local road approaches to the roundabout based on predicted levels of demand, therefore the provision of traffic signals where they are not needed might worsen the operational conditions of the roundabout.

Due to the reasons detailed above, Option 5 has been discounted.

4.8 Option 6 – Full Traffic Signalisation with Active Priority

4.8.1 Design Application

Full signalisation with active priority would more effectively provide priority to buses, especially when using a SVD system paired with a traffic signal controller (such as SCOOT), so that signal phasing is adjusted when the system detects a bus is approaching the junction.

Active priority would not normally be given to all buses, but just to delayed services to help them reduce or cancel their delay. Prioritising services that are on time should be avoided as this would make buses arrive early at their stops, with the risk of passengers missing their bus.

An indicative potential plan layout for Option 6 is shown in drawing 60572241-ACM-HGN-SW_RB_000_Z-SK-CH-0500 included in Appendix A.

4.8.2 Initial Design Assessment

Option 6 would have the same high deliverability as Option 5 due to no changes to the Proposed Scheme geometry, but it would be more effective for bus priority due to the dynamic and targeted adjustments to signal phases. However, Option 6 also requires the installation of specific equipment on buses and, as detailed for Option 5, it needs to be part of a wider bus priority strategy to ensure efficiency.

4.8.3 Initial Operational Considerations

As detailed for Option 5, the traffic assessment undertaken for the Proposed Scheme indicates that traffic signals are not required on the local road approaches to the roundabout based on predicted levels of demand, therefore the provision of traffic signals where they are not needed is considered to worsen the operational conditions of the roundabout.

The Proposed Scheme has been futureproofed with the provision of ducting throughout the junction. This would facilitate the implementation of any signal priority measure at a later date if deemed necessary and beneficial in future, and as part of a longer term and wider strategy.

4.9 Conclusions

As the DMRB Stage 3 traffic assessment has demonstrated, and as detailed in Section 2.3, the Proposed Scheme is expected to deliver significant benefits to local traffic (including bus services) due to the improved traffic conditions on local roads resulting from the separation between strategic and local traffic that grade separation of Sheriffhall will provide.

Out of a total of six bus priority options developed as part of this review, four options (1, 2, 3 and 5) have been discounted due to negligible benefits to buses, impacts on general traffic and/or deliverability issues. Options 4 and 6 are potentially beneficial to bus journey times and reliability, but benefits are considered to be marginal when compared to the benefits the Proposed Scheme already offers. These bus priority measures, especially if considered in isolation, also introduce operational challenges or conflicts for general traffic.

The Proposed Scheme has been futureproofed with the provision of ducting throughout the junction. This would facilitate the implementation of Option 6 at a later date if deemed necessary and beneficial in future, and as part of a longer term and wider strategy.

5. Tram Feasibility

5.1 Introduction

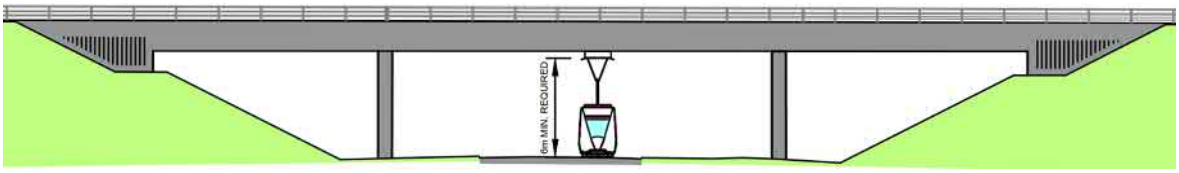
ESESCRD Partner the City of Edinburgh Council (CEC) have advised that their future public transport plans might include the extension of the tram line from Edinburgh to Dalkeith, potentially along the A7 and through Sheriffhall Roundabout.

CEC response to the publication of draft Orders for the Proposed Scheme enquired whether the current design for the grade separation of Sheriffhall Roundabout would be able to accommodate this tram extension in the future. An initial feasibility assessment for the potential tram extension, in relation to the current proposals for Sheriffhall Roundabout, has therefore been undertaken and is summarised below.

5.2 Future Implementation of Tram Facilities

There are no specific design plans for the tramline extension at present, but if a future extension to the tram line needs a separate infrastructure, it is considered unlikely this could be accommodated within the extents of the current Sheriffhall Roundabout scheme CPO. However, CEC advised any extension might instead use one of the lanes provided within the current scheme, therefore an initial feasibility assessment has been undertaken to ensure the proposed scheme would not preclude or represent a barrier to the tram extension plans, especially in relation to the available headroom at the structures.

The required headroom under structures typically depends on the specific tramway systems, but a vertical clearance of approximately 6m to the overhead cables is generally advised. This is based on experience on similar schemes in the UK and Ireland, and on industry guidelines and best practice such as “Tramway Principles and Guidance” published by UK Tram in January 2018.



In accordance with the Structures section of the Employer’s Requirements, which form part of the contact documents for the Proposed Scheme, the main structures included in have been designed to provide a minimum 6.45m clearance over the roundabout, as defined for a High Load Route in DMRB TD 27 (now CD 127) ‘Cross-sections and Headrooms’. Based on guidelines mentioned above, the proposed scheme should therefore provide sufficient headroom for any future tramline extensions through the roundabout.

Notwithstanding the headroom requirements, it is acknowledged that technology advancements may allow for alternative power sources to be utilised.

5.3 Conclusions

Further consultation with CEC and a full assessment will need to be undertaken once design plans for the proposed tramway extension are developed and made available, but an initial assessment of the available headroom at structures shows the proposed scheme would not be a barrier to the tramway extension aspirations.

6. Public Transport Review Summary

As noted by CEC, the Sheriffhall Roundabout scheme offers an opportunity to provide improvements to infrastructure enabling better bus services and thus helping to promote modal shift and greener transport choices. This review has been undertaken to determine whether further improvements to bus facilities would be feasible and beneficial, whilst not creating additional impacts for local landowners, residents and businesses.

The Proposed Scheme does not have any direct impact on rail facilities as there are no stations in the immediate vicinity of the scheme and the realigned A720 bridges over the existing railway line without requiring its realignment. The Proposed Scheme does not have any impact on Park & Ride facilities either and does not include any dedicated bus lanes, as per existing provision, or additional bus stops.

The Proposed Scheme is expected to deliver significant benefits to local traffic (including bus services) due to the improved traffic conditions on local roads resulting from the separation between strategic and local traffic.

A total of 6 bus priority options have been developed and assessed as part of this review to determine whether there was an opportunity to improve provision for public transport within the scheme, whilst not creating additional impacts for local landowners, residents and businesses. Several Options (1, 2, 3 and 5) have been discounted due to negligible benefits to buses, impacts on general traffic and/or deliverability issues.

Options 4 and 6 are potentially beneficial to bus journey times and reliability, but benefits are considered to be marginal when compared to the benefits the Proposed Scheme already offers. These bus priority measures, especially if considered in isolation, also introduce operational challenges or conflicts for general traffic.

The Proposed Scheme has been futureproofed with the provision of ducting to accommodate future traffic signals throughout the junction. This would facilitate the implementation of Option 6 at a later date if deemed necessary and beneficial in the future as part of a longer term and wider strategy.

In relation to CEC aspiration to extend the tram line to Dalkeith through Sheriffhall, this review has considered the available headroom at structures and confirmed the Proposed Scheme would not be a constraint to CEC's tramway extension aspirations. However, a full assessment and further consultation with CEC and MLC would be required once design plans for the proposed tramway extension are developed and made available.

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Appendix A - Public Transport Review Drawings

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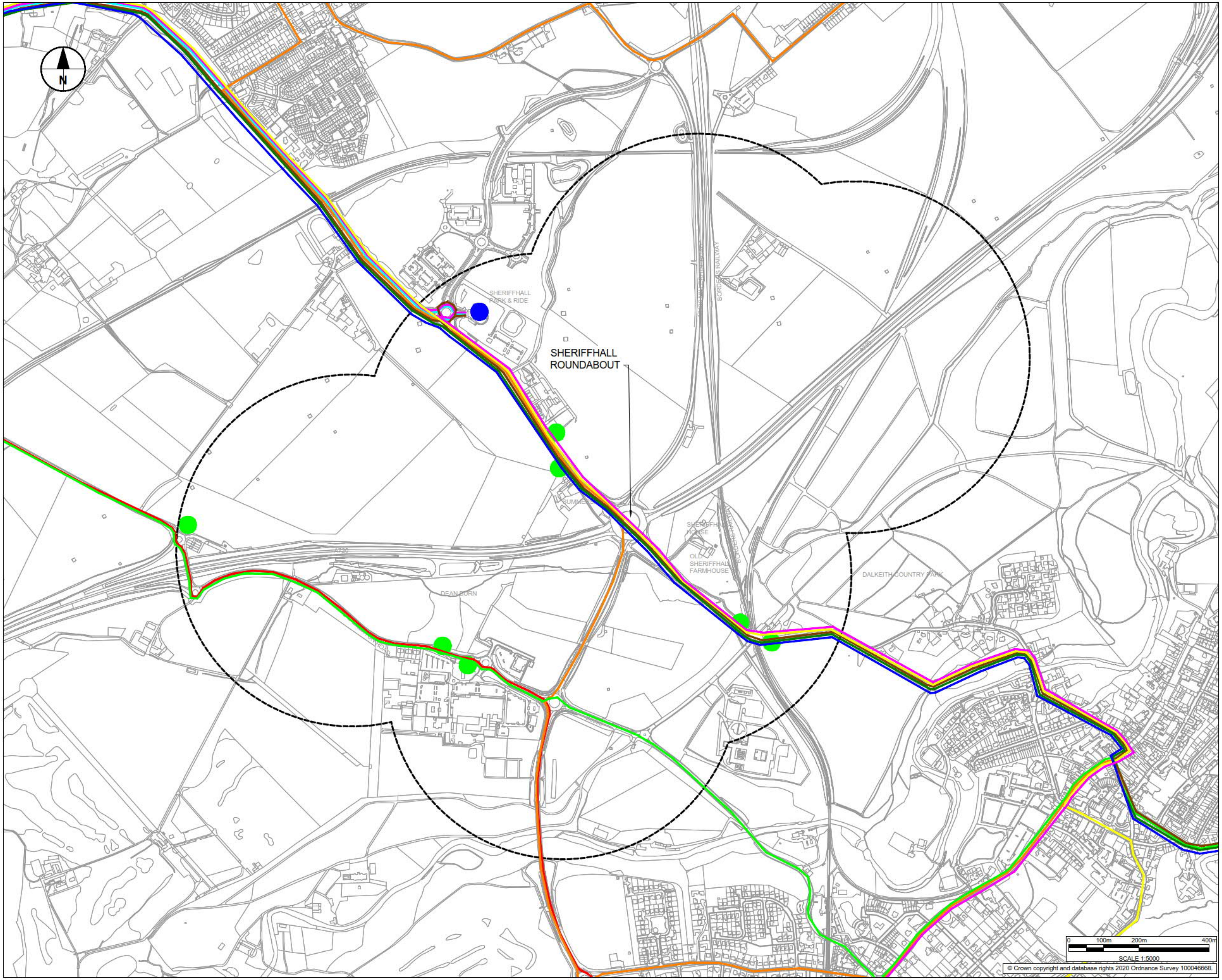

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KEY

- EXISTING BUS STOPS
- SHERIFFHALL PARK & RIDE
- 500M WCHAR STUDY AREA BOUNDARY

SERVICES THROUGH SHERIFFHALL ROUNDABOUT

- LOTHIAN BUSES - SERVICE 33
- LOTHIAN BUSES - SERVICE X33
- LOTHIAN BUSES - SERVICE 48
- LOTHIAN BUSES - SERVICE 49
- BORDERS BUSES - SERVICE X95/95
- BORDERS BUSES - SERVICE 51/52
- LOTHIAN COMMUNITY TRANSPORT SERVICES - SERVICE R3

OTHER SERVICES IN THE AREA

- LOTHIAN BUSES - SERVICE 3
- LOTHIAN BUSES- SERVICE 29

Revision Details	By / Check	Date	Suffix
FIRST ISSUE	CM / RH	25/11/20	P01
MINOR CHANGES TO ANNOTATIONS	HH / RH	04/12/20	P02
Issued for Technical Note 46	HH / RH	14/12/20	A01

Purpose of issue

FOR INFORMATION

Client

TRANSPORT SCOTLAND

Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

PUBLIC TRANSPORT REVIEW EXISTING BUS SERVICES

Designed	Drawn	Checked	Approved	Date
AR	HH	JI	RH	04/12/20

Internal Project No.: 60572241

Suitability: A1

Scale @ A1

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Drawing Number

Project No	Originator	Volume	Rev
60572241	-ACM	-HGN-	A01

Location	Type	Role	Number
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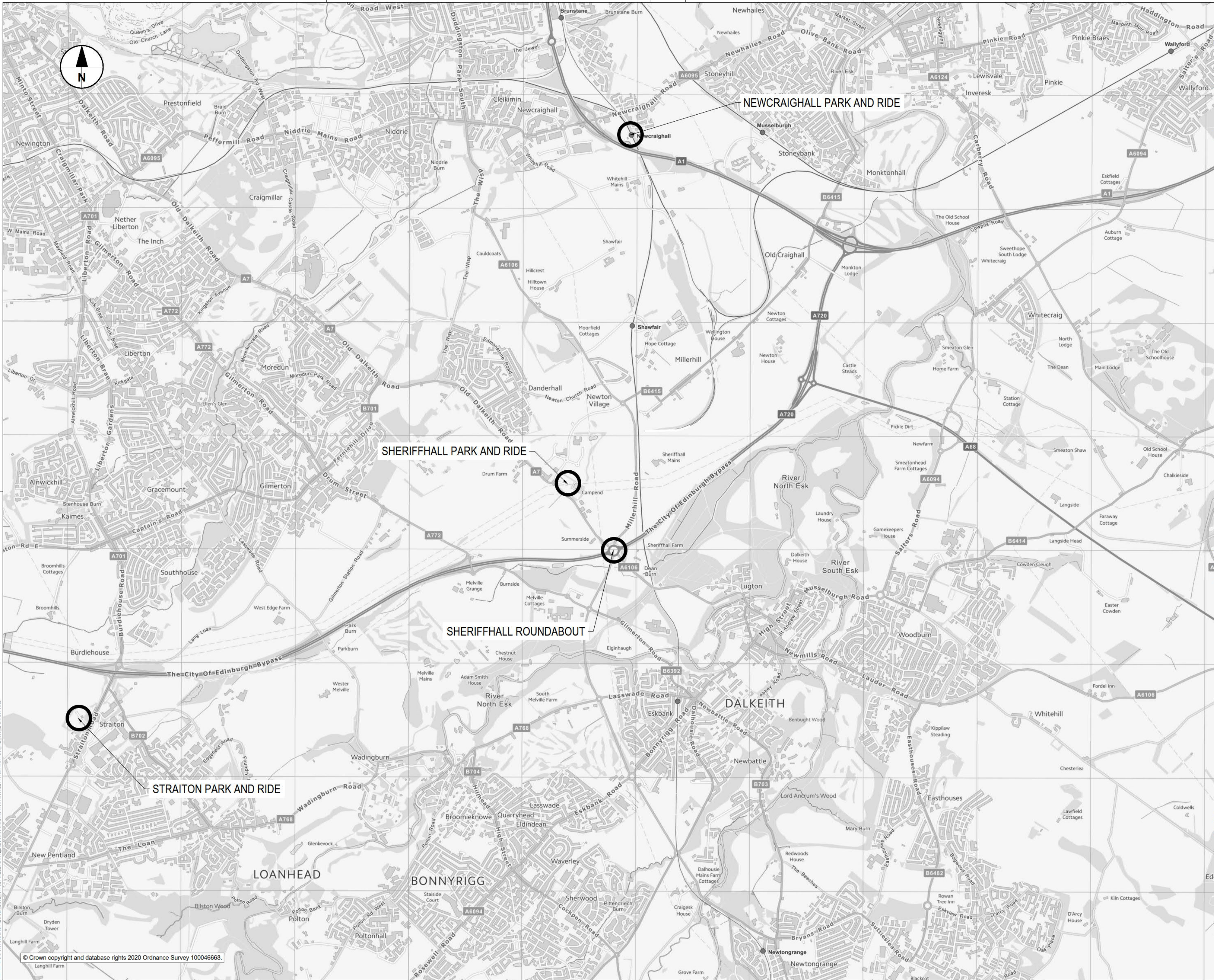

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Purpose of issue

FOR INFORMATION

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TRANSPORT SCOTLAND
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Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

PUBLIC TRANSPORT REVIEW
EXISTING PARK & RIDE FACILITIES

Designed	Drawn	Checked	Approved	Date
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Rev
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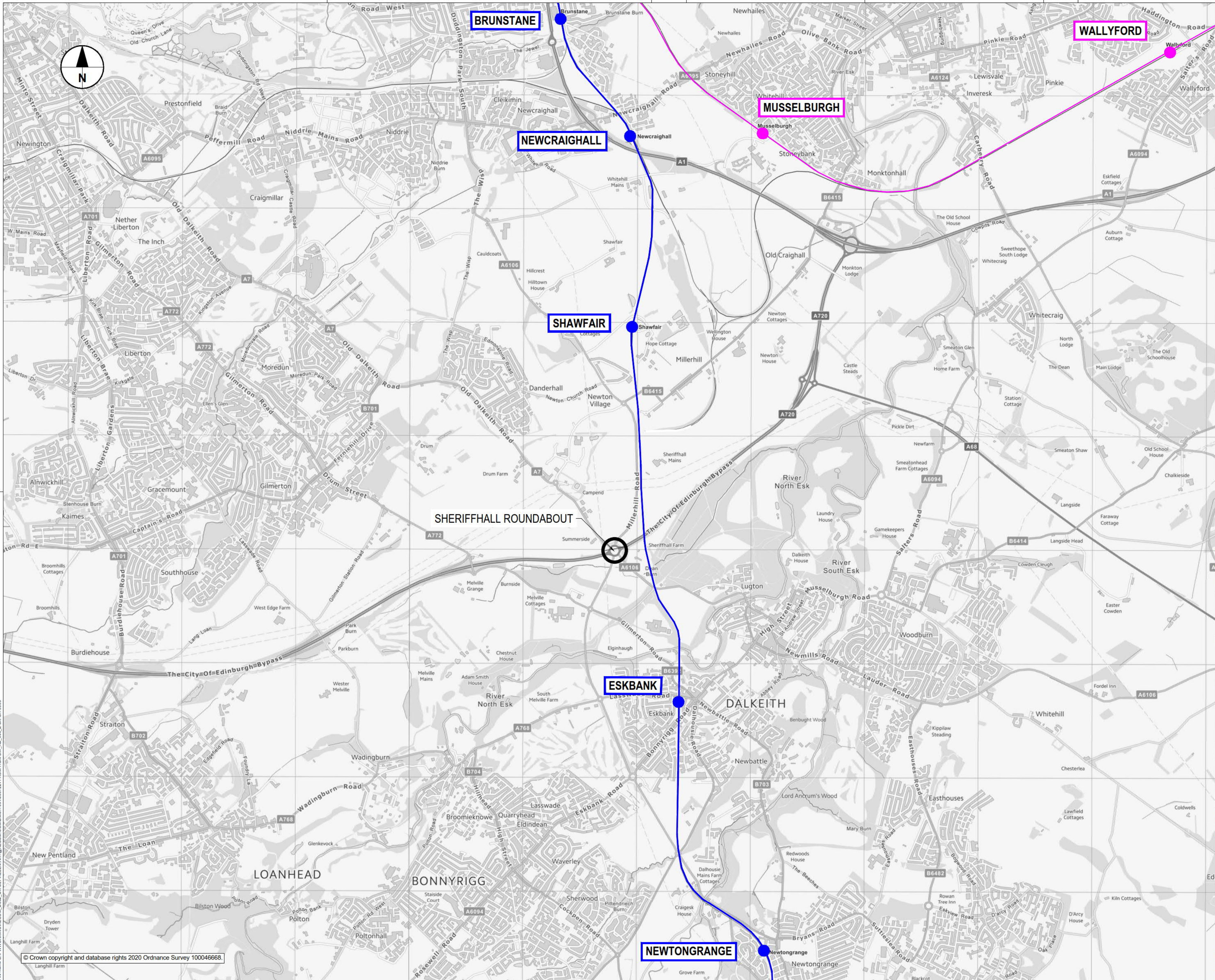

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LEGEND

- NORTH BERWICK RAILWAY LINE
- NORTH BERWICK RAILWAY STATION
- BORDERS RAILWAY LINE
- BORDERS RAILWAY STATION

Revision Details	By / Check	Date	Suffix
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MINOR CHANGES TO ANNOTATIONS	HH / RH	04/12/20	P02
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A720 SHERIFFHALL ROUNDABOUT

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PUBLIC TRANSPORT REVIEW EXISTING RAIL SERVICES

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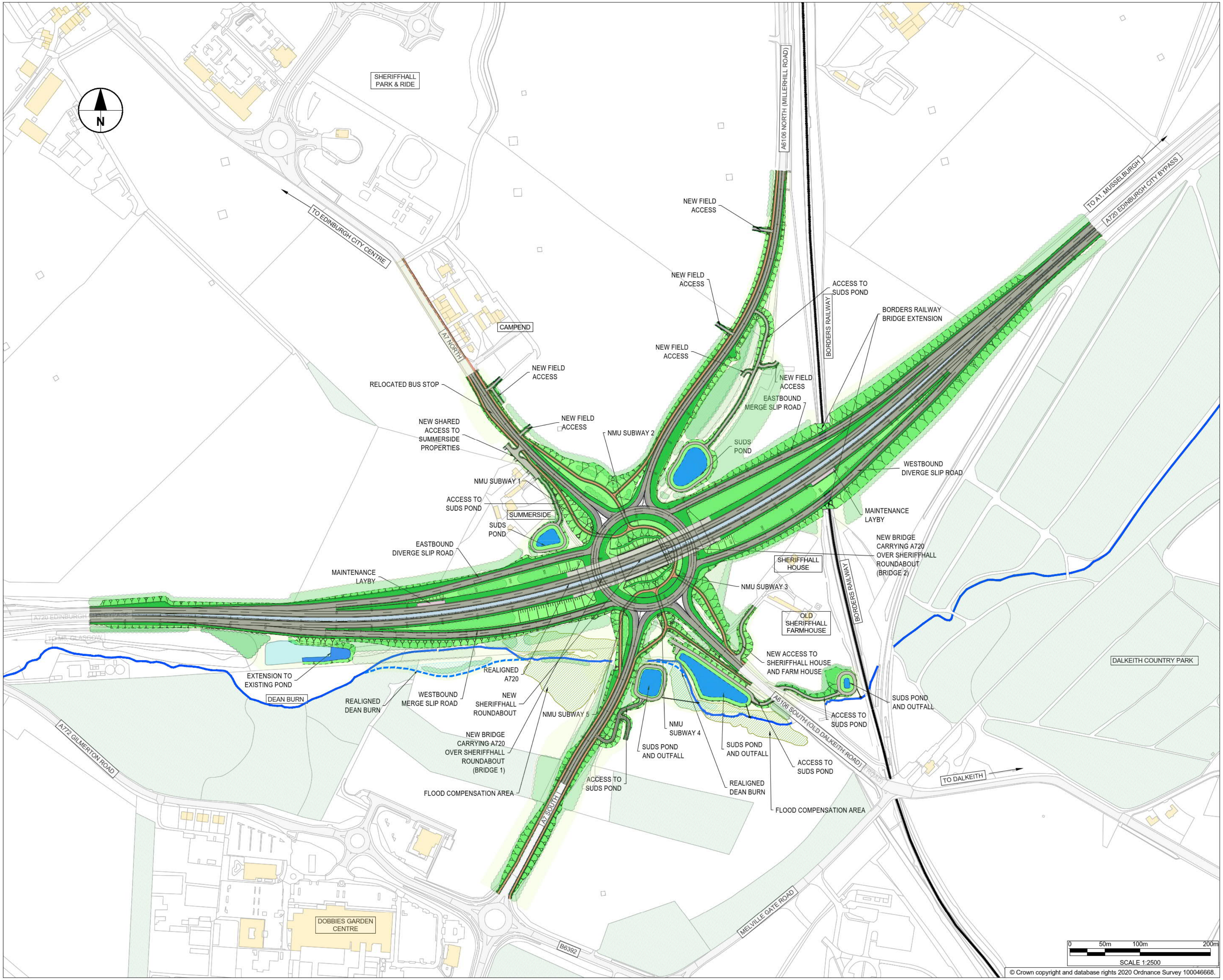
Rev A01



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KEY

- PROPOSED CARRIAGEWAY
- PROPOSED NON MOTORISED USER ROUTES (NMU)
- EARTHWORKS
- ACCOMMODATION WORKS (INDICATIVE)
- VERGES
- PROPOSED SUDS PONDS
- DEAN BURN REALIGNMENT (INDICATIVE)
- EXISTING DEAN BURN
- PROPOSED FLOOD COMPENSATION AREA

Revision Details	By / Check	Date	Suffix
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Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

PROPOSED SCHEME PLAN LAYOUT

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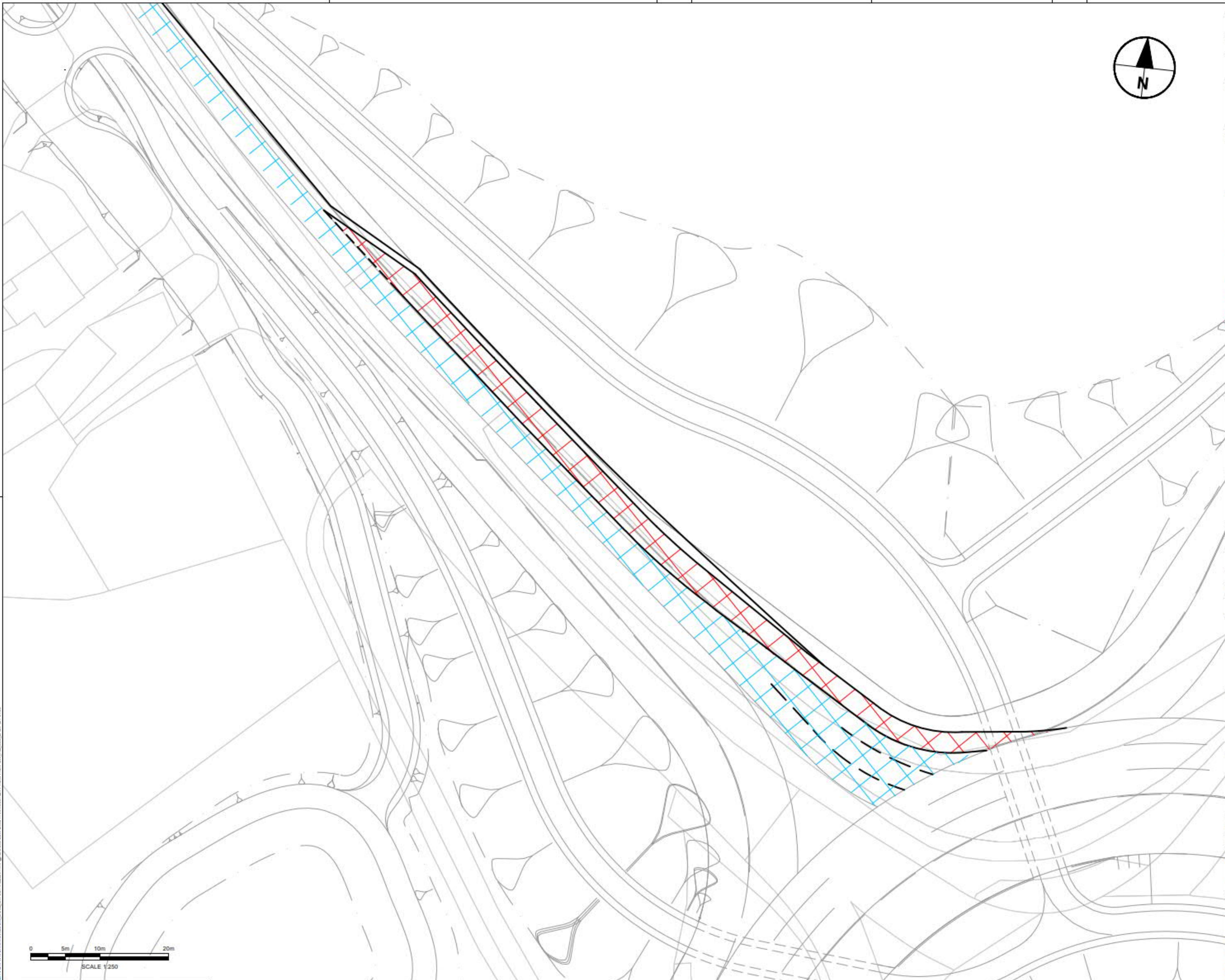
Rev: A01



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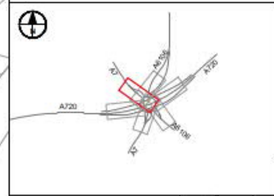
LEGEND

CARRIAGEWAY SPACE ALLOCATED TO GENERAL TRAFFIC

CARRIAGEWAY SPACE ALLOCATED TO BUSES



Revision Details	By / Check	Date	Suffix
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Issued for Technical Note 46	CM / RH	14/12/20	A01

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Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

BUS PRIORITISATION OPTION 1 ADDITONAL APPROACH LANE & ENTRY

Designed	Drawn	Checked	Approved	Date
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Internal Project No.	Suitability
60572241	A1
Scale @ A1	**Zone**
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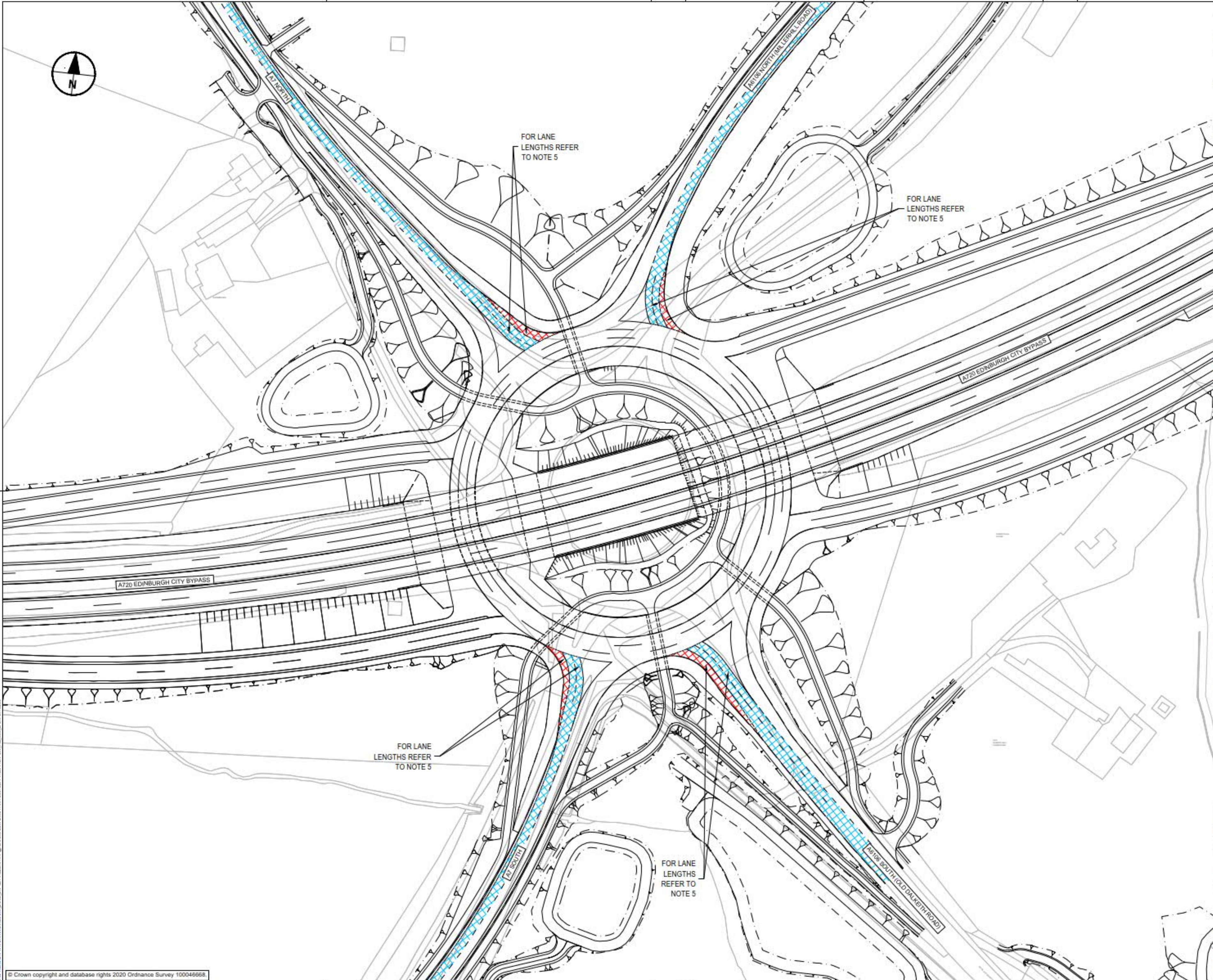

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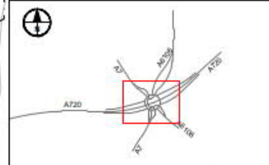
5. LANE LENGTHS.

Road	Lane 1 (Approx.) Length (m)	Lane 2 (Approx.) Length (m)
A7 North	16	34
A7 South	8	31
A6106 North	8	29
A6106 South	28	133

LEGEND

CARRIAGEWAY SPACE ALLOCATED TO GENERAL TRAFFIC

CARRIAGEWAY SPACE ALLOCATED TO BUSES



Revision Details	By / Check	Date	Suffix
FIRST ISSUE	CM / RH	25/11/20	P01
Issued for Technical Note 46	CM / RH	14/12/20	A01

Purpose of issue

FOR INFORMATION

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TRANSPORT SCOTLAND

Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

BUS PRIORITISATION OPTION 2 REALLOCATION OF CARRIAGEWAY SPACE

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Internal Project No. 60572241	Suitability A1
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Location | Type | Role | Number

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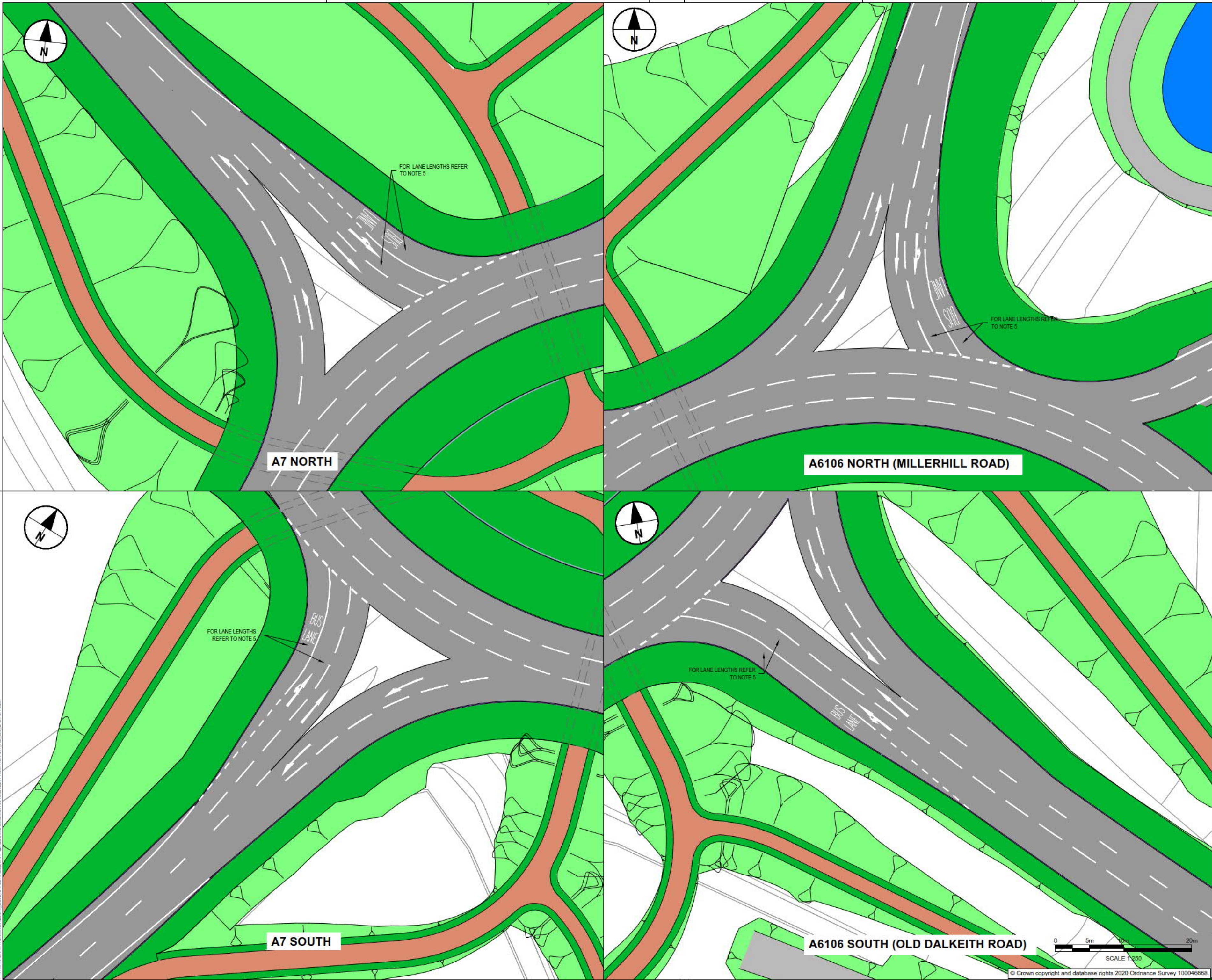

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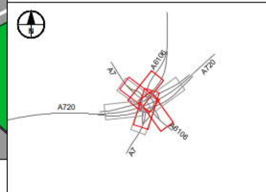
5. LANE LENGTHS.

Road	Lane 1 (Approx.) Length (m)	Lane 2 (Approx.) Length (m)
A7 North	16	34
A7 South	8	31
A6106 North	8	29
A6106 South	28	133



Revision Details	By / Check	Date	Suffix
FIRST ISSUE	CM / RH	25/11/20	P01
Issued for Technical Note 46	CM / RH	14/12/20	A01

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TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

BUS PRIORITISATION OPTION 2 INDICATIVE ROAD MARKING LAYOUT

Designed	Drawn	Checked	Approved	Date
AR	CM	JI	RH	25/11/20

Internal Project No.: 60572241
Suitability: A1
Scale @ A1
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Rev: A01

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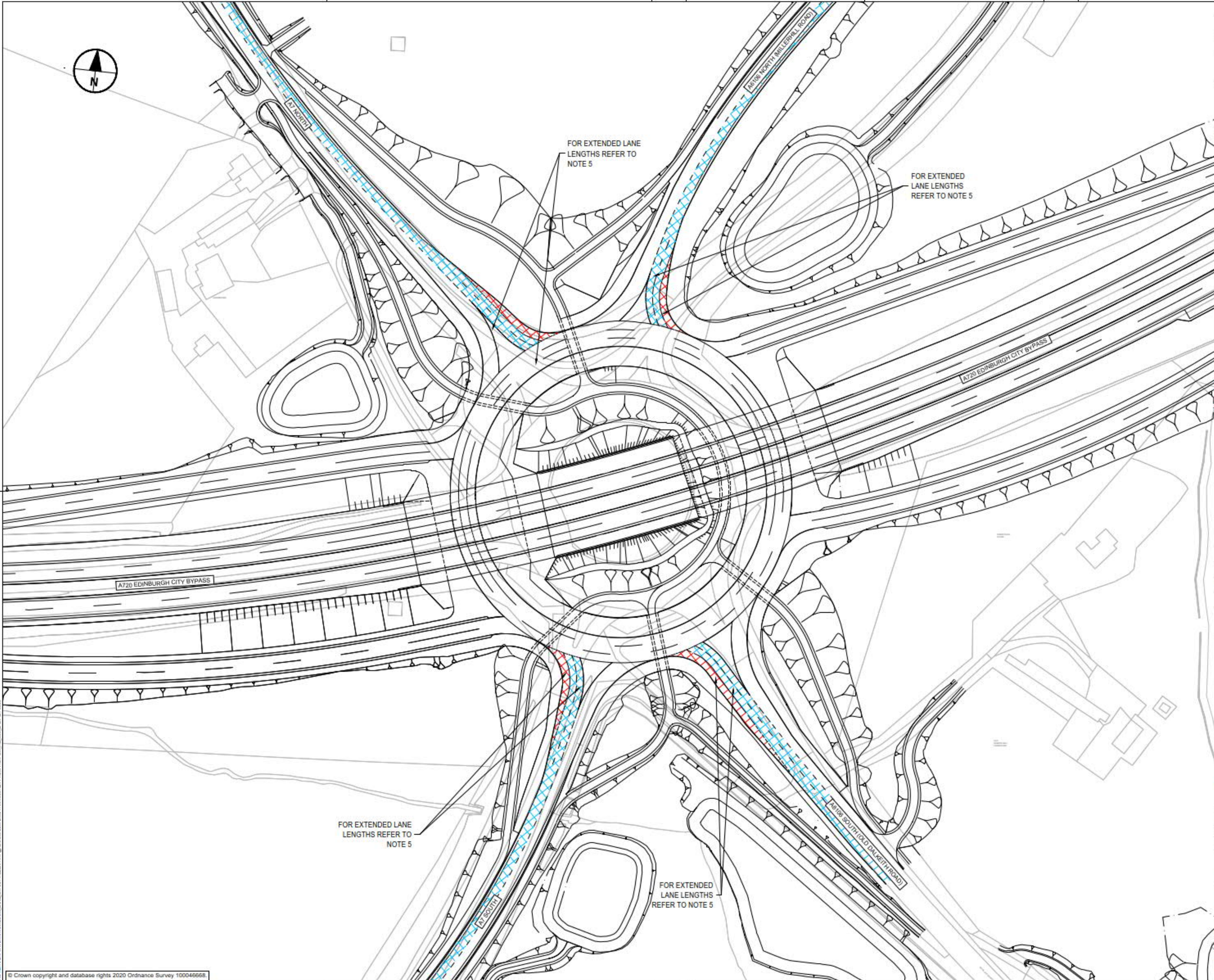

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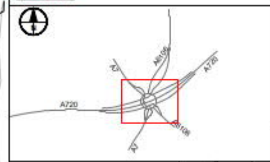
5. EXTENDED LANE LENGTHS. (FIGURES WITHIN BRACKETS INDICATE THE DIFFERENCE IN LENGTH COMPARED TO THE PROPOSED SCHEME)

Road	Lane 1 (approx.) Length (m)	Lane 2 (approx.) Length (m)
A7 North	22 (+6)	49 (+15)
A7 South	21 (+13)	46 (+15)
A6106 North	16 (+8)	37 (+8)
A6106 South	46 (+18)	133 (-)

LEGEND

CARRIAGEWAY SPACE ALLOCATED TO GENERAL TRAFFIC

CARRIAGEWAY SPACE ALLOCATED TO BUSES



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FIRST ISSUE	CM / RH	25/11/20	P01
Issued for Technical Note 46	CM / RH	14/12/20	A01

Purpose of issue

FOR INFORMATION

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TRANSPORT SCOTLAND

Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

BUS PRIORITISATION OPTION 3 EXTENDED ENTRY FLARES

Designed	Drawn	Checked	Approved	Date
AR	CM	JI	RH	25/11/20

Internal Project No. 60572241 | Suitability A1

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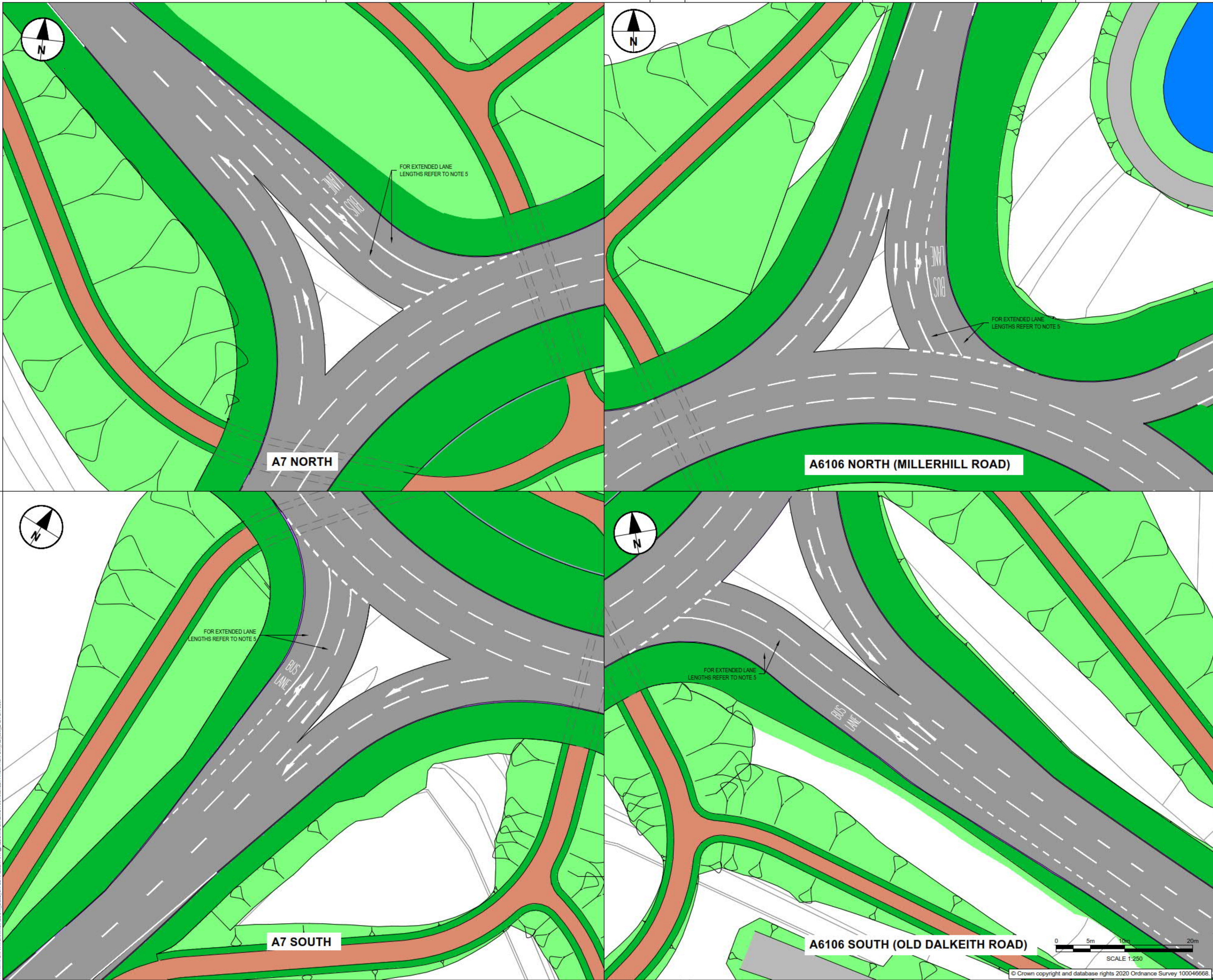
Drawing Number (Project No. – Originator – Volume – Location – Type – Role – Number): 60572241 -ACM -HGN- SW_RB_000_Z -SK -CH-0300

Rev: A01



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

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CONSTRUCTION

NOT FOR CONSTRUCTION

MAINTENANCE / OPERATION / DECOMMISSIONING / DEMOLITION

NOTES

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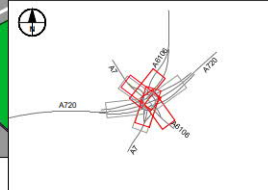
4. THE AMENDED ROAD LAYOUT SHOWN IN THIS DRAWING IS INDICATIVE AND SUBJECT TO CHANGE
5. EXTENDED LANE LENGTHS (FIGURES WITHIN BRACKETS INDICATE THE DIFFERENCE IN LENGTH COMPARED TO THE PROPOSED SCHEME)

Road	Lane 1 (approx.) Length(m)	Lane 2 (approx.) Length(m)
A7 North	22 (+6)	49 (+15)
A7 South	21 (+13)	46 (+15)
A6106 North	16 (+8)	37 (+8)
A6106 South	46 (+18)	133 (-)



Revision Details	By / Check	Date	Suffix
FIRST ISSUE	CM / RH	25/11/20	P01
Issued for Technical Note 46	CM / RH	14/12/20	A01

Purpose of issue

FOR INFORMATION

Client

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

BUS PRIORITISATION OPTION 3 INDICATIVE ROAD MARKING LAYOUT

Designed	Drawn	Checked	Approved	Date
AR	CM	JI	RH	25/11/20

Internal Project No.	Suitability
60572241	A1
Scale @ A1	Zone
	-

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Drawing Number
Project No. | Originator | Volume
60572241 -ACM -HGN - SW_RB_000_Z -SK -CH-0301
Location | Type | Role | Number

Rev
A01

Plot Time:
Plot Date: 15 December 2020 10:12:29
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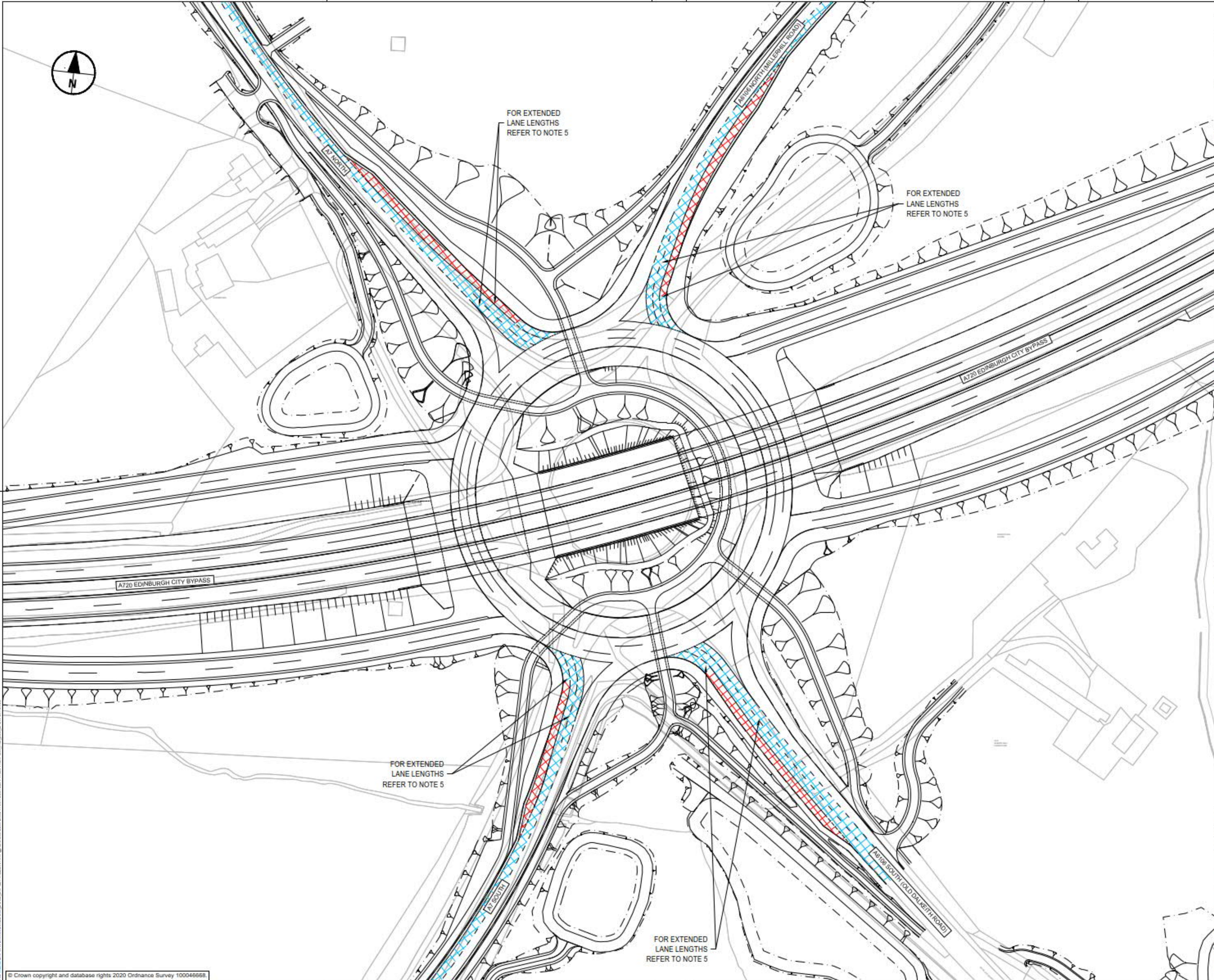

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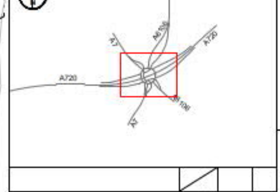
5. EXTENDED LANE LENGTHS.

Road	Lane 1 (approx.) Length (m)	Lane 2 (approx.) Length (m)
A7 North	108	34
A7 South	72	40
A6106 North	110	34
A6106 South	102	133

LEGEND

CARRIAGEWAY SPACE ALLOCATED TO GENERAL TRAFFIC

CARRIAGEWAY SPACE ALLOCATED TO BUSES



Revision Details	By / Check	Date	Suffix
FIRST ISSUE	CM / RH	25/11/20	P01
Issued for Technical Note 46	CM / RH	14/12/20	A01

Purpose of issue

FOR INFORMATION

Client

TRANSPORT SCOTLAND

Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

BUS PRIORISTISATION OPTION 4 EXTENSION OF LANE 1

Designed	Drawn	Checked	Approved	Date
AR	CM	JI	RH	25/11/20

Internal Project No.	Suitability
60572241	A1
Scale @ A1: 1:750	Zone: -

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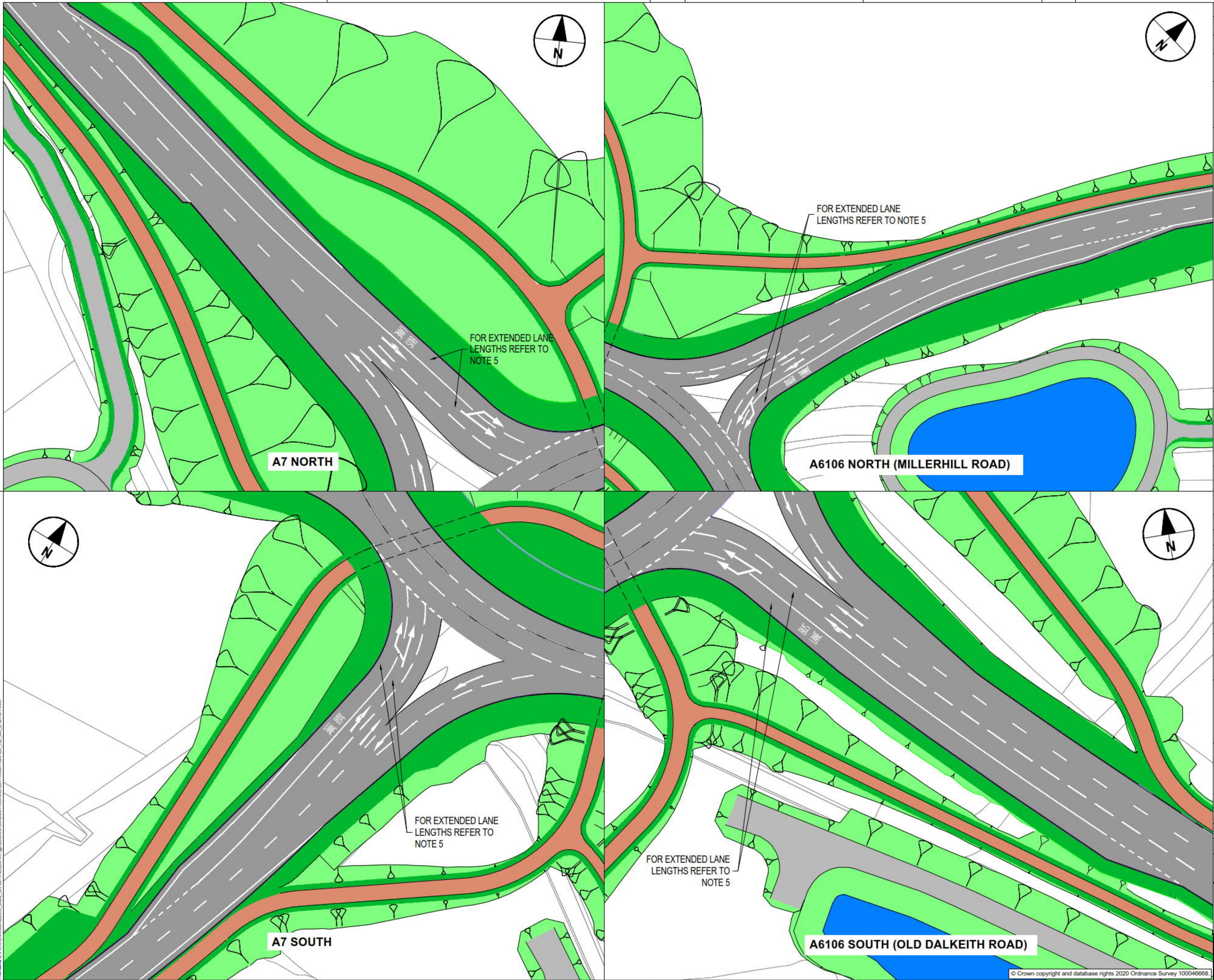
60572241 -ACM -HGN- SW_RB_000_Z -SK -CH-0400

Rev: A01



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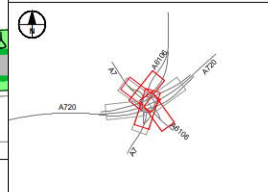
Road	Lane 1 (approx.) Length (m)	Lane 2 (approx.) Length (m)
A7 North	108	34
A7 South	72	40
A6106 North	110	34
A6106 South	102	133



Revision Details	By / Check	Date	Suffix
FIRST ISSUE	CM / RH	25/11/20	P01
Issued for Technical Note 46	CM / RH	14/12/20	A01

Purpose of issue

FOR INFORMATION

Client

TRANSPORT SCOTLAND

Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

BUS PRIORITISATION OPTION 4 INDICATIVE ROAD MARKING LAYOUT

Designed	Drawn	Checked	Approved	Date
AR	CM	JI	RH	25/11/20

Internal Project No. 60572241 | Suitability A1

Scale @ A1 NTS | Zone -

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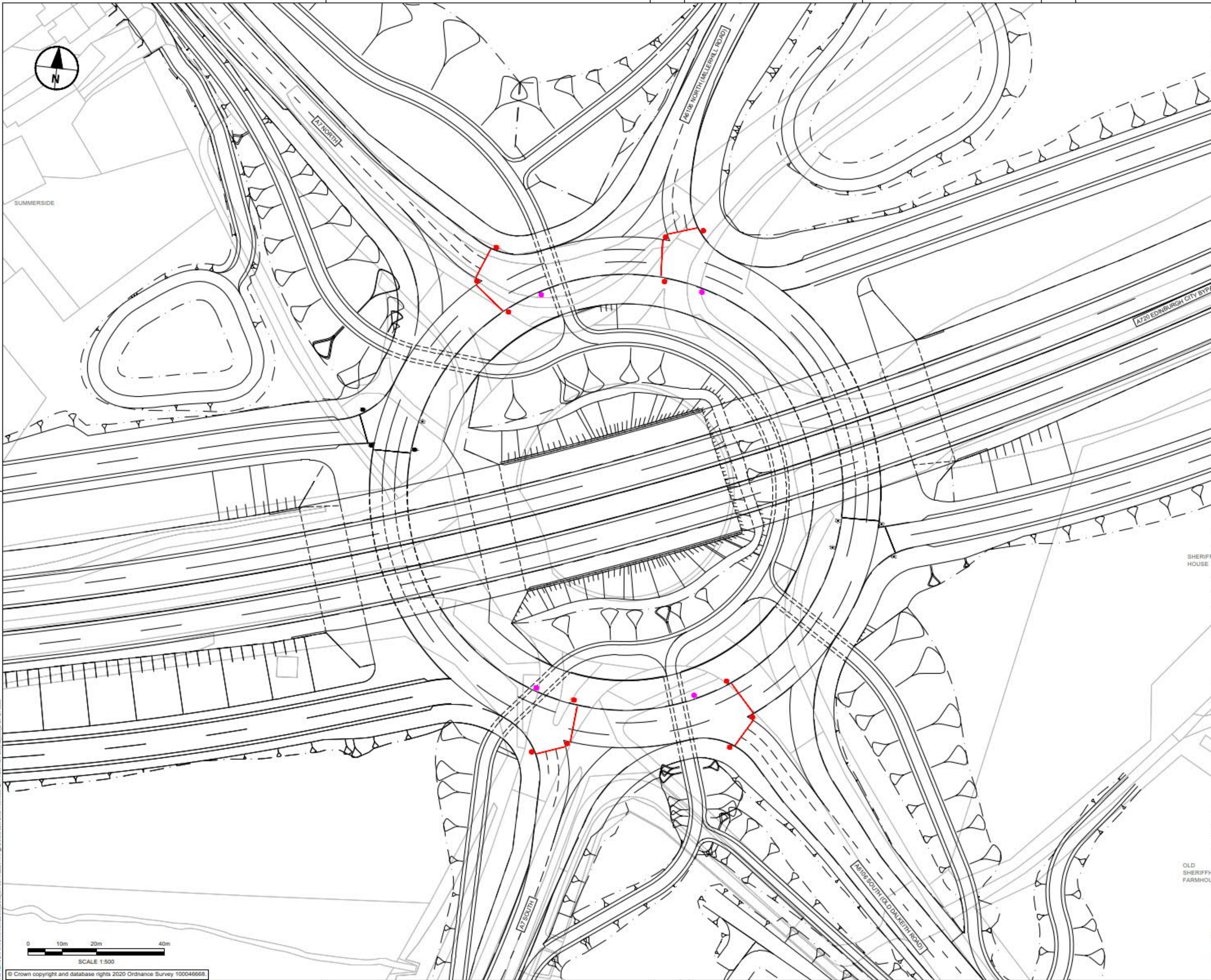
Drawing Number (Project No. | Originator | Volume | Location | Type | Role | Number)

60572241 -ACM -HGN - SW_RB_000_Z -SK -CH-0401

Rev A01



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6. THE FULL SIGNALISATION PLAN LAYOUT SHOWN IN THIS DRAWING APPLIES TO BOTH OPTIONS 5 (PASSIVE PRIORITY SYSTEMS) AND 6 (ACTIVE PRIORITY SYSTEMS), HOWEVER IT SHOULD BE NOTED ACTIVE PRIORITY SYSTEMS FOR OPTION 6 MIGHT REQUIRE ADDITIONAL EQUIPMENT.

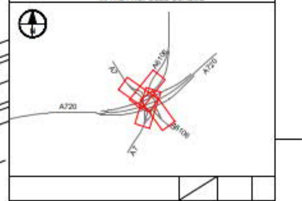
LEGEND

PRIMARY TRAFFIC LIGHTS

SECONDARY TRAFFIC LIGHTS

STOP LINE

TRAFFIC SIGNALS INCLUDED IN THE PROPOSED SCHEME



Revision Details	By / Check	Date	Suffix
FIRST ISSUE	CM / RH	25/11/20	P01
Issued for Technical Note 46	CM / RH	14/12/20	A01

Purpose of issue

FOR INFORMATION

Client

TRANSPORT SCOTLAND

Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

BUS PRIORITISATION OPTIONS 5 & 6 FULL SIGNALISATION

Designed	Drawn	Checked	Approved	Date
AR	CM	JI	RH	25/11/20

Internal Project No. 60572241	Suitability A1
Scale @ A1 1:500	Zone -

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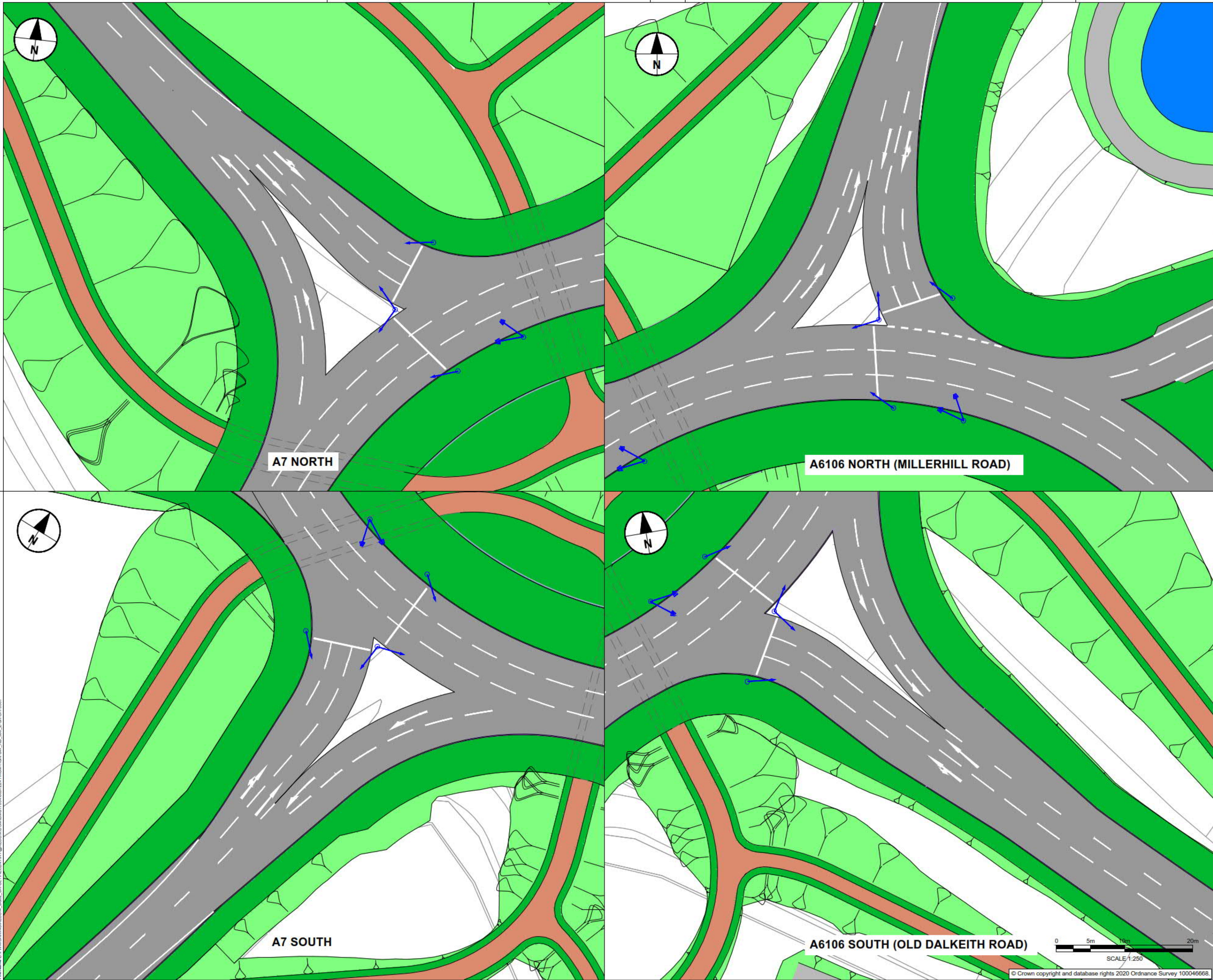
Drawing Number (Project No. | Originator | Volume | Location | Type | Role | Number)

60572241 -ACM -HGN- SW_RB_000_Z -SK -CH-0500

Rev A01



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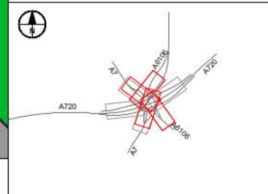
LEGEND

- INDICATIVE ORIENTATION OF TRAFFIC LIGHTS
- INDICATIVE ORIENTATION OF SECONDARY TRAFFIC LIGHTS
- INDICATIVE SIGNAL LOCATION



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Purpose of issue

FOR INFORMATION

Client

TRANSPORT SCOTLAND

Project Title

A720 SHERIFFHALL ROUNDABOUT

Drawing Title

BUS PRIORITISATION OPTION 5 & 6 INDICATIVE ROAD MARKING LAYOUT

Designed	Drawn	Checked	Approved	Date
AR	CM	JI	RH	25/11/20

Internal Project No.	Suitability
60572241	A1
Scale @ A1	Zone
	-

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Rev: A01