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A96 DUALLING
EAST OF HUNTLY TO ABERDEEN

A96 Dualling

East of Huntly to Aberdeen scheme

A96 Online Dualling at Inverurie
Supplementary Study

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A96 Dualling East of Huntly to Aberdeen

A96 Online Dualling at Inverurie Supplementary Study

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1 Introduction

1.1 Background

The A96 Dualling East of Huntly to Aberdeen project is currently progressing through the Design Manual for Roads and Bridges (DMRB) Stage 2 appraisal process which will lead to the identification of an emerging preferred option for dualling of the route.

During DMRB Stage 2, options considered for dualling at Inverurie have included several bypasses to the north and south of Inverurie and online dualling of the A96 through Inverurie. Online dualling was sifted out as one of the poorer performing route options as part of the First Fix Appraisal in July 2018.

Route options for dualling the A96 between East of Huntly and Kintore were presented at public engagement events in October 2018 and May 2019. Online dualling through Inverurie was first shown as a deselected option at the October 2018 event indicating that it was not being considered further as part of the DMRB Stage 2 assessment. Following each engagement event, feedback was received with several common themes apparent, including some support for online dualling through Inverurie.

This supplementary report summarises the work undertaken previously on online dualling through Inverurie during DMRB Stage 2 and additionally presents the findings of supplementary design and assessment undertaken following the May 2019 Route options design update public drop-in sessions.

1.2 Consideration of Online Dualling through Inverurie during DMRB Stage 2

1.2.1 Corridor Options

The initial Corridor Options phase for development of the Stage 2 design included an online dualling Corridor Option through Inverurie (Corridor Option OLI – Online Inverurie). Corridor Options were appraised against Programme and scheme objectives and while the assessment noted the challenging nature of online widening, it was concluded that online dualling through Inverurie should progress to First Fix Alignment development. Details of the Corridor Options assessment can be found at the following link:

https://www.transport.gov.scot/publication/dmrb-stage-2-early-sifting-reports-east-of-huntly-to-aberdeen-a96-dualling/

1.2.2 First Fix Alignment and Sifting

First Fix Alignments were developed within the Corridor Options taken forward from the Corridor Options Assessment. They did not form end-to-end options at this stage nor were junctions included. The First Fix Alignments were appraised in relation to engineering, environmental and traffic performance against the scheme objectives to identify better performing options within the Corridor Options that would be taken forward to form end-to-end alignments.

The First Fix appraisal of online dualling through Inverurie identified major adverse impacts including the existing road boundary being of insufficient width to accommodate the full dual carriageway cross-section with property constraints immediately adjacent to each side of the existing road, particularly around the Blackhall Road area. Online

dualling through Inverurie was considered to have significant effects on people and communities due to the proximity to properties, businesses and community facilities and was expected to have significant visual impacts on a large number of receptors. Adverse impacts were also anticipated in relation to noise and air quality due to the proximity of the widened road to a large number of receptors. Further major adverse impacts were anticipated should online dualling through Inverurie be progressed as junctions would be required to maintain adequate access to and from Inverurie.

The First Fix Workshop held in April 2018 concluded that no First Fix Alignment from the OLI Corridor Option should progress to the Second Fix design development phase. It was however recommended that additional work should be undertaken to test the feasibility of an online option through Inverurie, including the impacts of a grade separated junction (GSJ) at Blackhall Road, to confirm the decision. It was recommended as part of this additional work that traffic modelling should be carried out using available traffic models to assess the need for and impact of junction options on traffic behaviour.

Details of the First Fix Options assessment can be found at the following link:

https://www.transport.gov.scot/publication/dmrb-stage-2-early-sifting-reports-east-of-huntly-to-aberdeen-a96-dualling/

1.2.3 Online Dualling at Inverurie - Feasibility and Appraisal Report

The purpose of this report was to provide more detail on the issues associated with dualling the existing A96 online at Inverurie, incorporating grade separated junctions where required. This appraisal included undertaking traffic modelling which had been considered qualitatively at the First Fix phase.

The further engineering and traffic work found that although online dualling through Inverurie had potential to positively contribute to some of the A96 East of Huntly to Aberdeen scheme objectives, it performed poorly from an environment and engineering perspective.

The engineering appraisal confirmed that the existing A96 through Inverurie is constrained on both sides due to the proximity of residential and commercial properties. Generally, the existing landscaping and screening bunds would need to be removed to accommodate a new dual carriageway with some sections requiring retaining structures to prevent encroachment of earthworks into adjoining properties.

At the narrowest point east of Blackhall Roundabout, the available width between trunk road boundary fence lines is 21m with private properties located immediately behind these boundaries. The cross-section width considered for online dualling assuming a straight and level alignment with no earthworks is 26.1m. Therefore, any widening at this location even with retaining structures would encroach and permanently impact on the accessibility to properties to the south of the A96 and/or rear garden areas of the properties located to the north.

Furthermore, the grade separation of the existing Blackhall Roundabout and its associated slip roads would have an even greater impact on these private properties than the dual carriageway cross-section, noting that additional land would be required at the junction location leading to further encroachment on the surrounding commercial and residential properties.

The environmental appraisal confirmed that the dualling of the existing route would likely have significant effects on People and Communities due to the proximity to existing properties, businesses and community facilities. Significant Noise and Vibration, Air Quality and Landscape and Visual impacts were also anticipated on a large number of receptors within close proximity to the A96, particularly for those properties bounding the existing A96.

The outcome of the traffic appraisal indicated that there would be no real benefits to local traffic within Inverurie with all traffic continuing to pass through the town to join the trunk road. Furthermore, traffic effects within the town would likely be exacerbated with the new and proposed development traffic on the north side of Inverurie travelling towards the new A96. The traffic assessment also indicated that for the standard of dualling being considered, full grade separation with slip roads would be required at Blackhall Roundabout, to avoid severe congestion on the surrounding road network.

Based on the above, the decision was confirmed to de-select an online dual carriageway upgrade of the A96 at Inverurie from the DMRB Stage 2 Scheme Assessment process. Details of the feasibility of online dualling at Inverurie can be found in the report at the following link:

https://www.transport.gov.scot/media/44577/online-at-inverurie-dualling-feasibility-and-appraisal-east-of-huntly-to-aberdeen-a96-dualling.pdf

1.3 Feedback

Three public engagement events have been held since the start of this commission in July 2017 namely:

- Meet the Team Events – November 2017;
- Initial Route Options Public Exhibitions – October 2018; and
- Route Options Design Update Public Drop-in Sessions – May 2019.

Deselected options, including online dualling at Inverurie, were first shown at the October 2018 public exhibition. Following the exhibition, feedback was received suggesting online dualling through Inverurie should be re-considered. As a result, additional information on the challenges associated with online dualling through Inverurie was presented at the May 2019 Route options design update public drop-in sessions. Following the drop-in session, further feedback was received suggesting that online dualling through Inverurie should be included in the full DMRB Stage 2 assessment. Additionally, given the constraints to dualling, feedback suggested consideration should be given to reduced standards through not grade separating Blackhall Roundabout and narrower cross-section widths.

Materials presented at the May 2019 Route options design update public drop in sessions can be found at:

https://www.transport.gov.scot/publication/exhibition-materials-may-2019-east-of-huntly-to-aberdeen-a96-dualling/

1.4 Purpose of this Report

As part of the consideration of feedback following the public drop-in sessions in May 2019, supplementary design development and assessment has been undertaken of online dualling through Inverurie. This report outlines the supplementary work

undertaken as well as considering to what extent reductions in the standard of road provided would lessen the challenges and impacts associated with online dualling through Inverurie and how this would accord with the scheme objectives.

2 Approach

Previous work considered a First Fix alignment corridor without junctions although the feasibility study referred to in Section 1.2.3 considered space required for the junction footprint. This identified constraints and outlined the extents of the main engineering features required. For this report, supplementary design of dual carriageway layouts, including junction configurations, has been undertaken.

Online dualling at Inverurie would be required to meet the objectives of the scheme and would be required to form an end-to-end route from East of Huntly to Aberdeen. The extent considered in this supplementary design development is from the Orange route option west of Inverurie at Drimmies to the existing A96 dual carriageway at Thainstone, as shown in Figure 1.

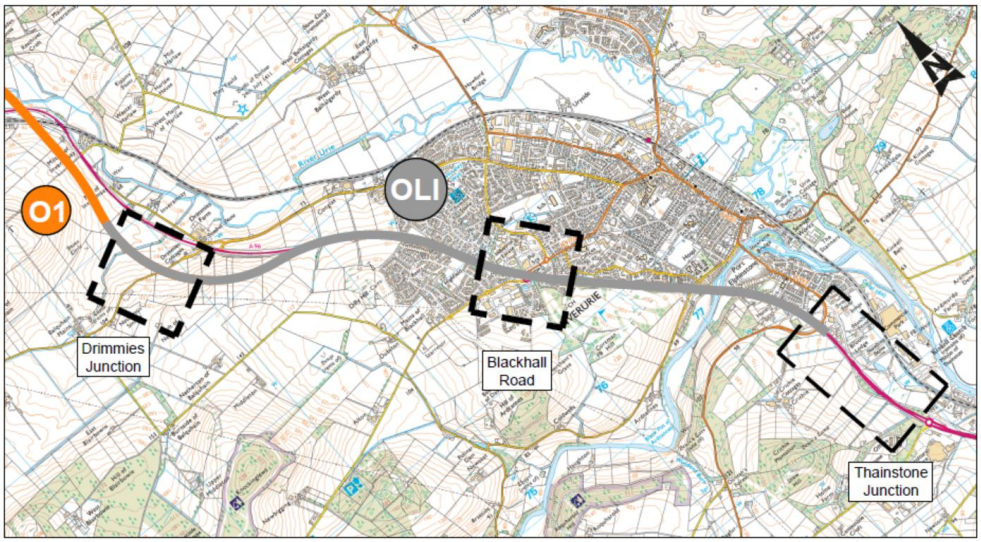

Figure 1: Online Dualling at Inverurie Supplementary Design Extents

For the purposes of this report, the A96 is considered to run west to east from Inverness to Aberdeen. Directions used within descriptions in the report adopt this convention accordingly with items adjacent to the eastbound carriageway being described as north of the A96 and adjacent to the westbound carriageway being described as to the south.

This supplementary assessment has considered the level of impact using a seven point scale as shown in Table 1, in accordance with the Scottish Transport Appraisal Guidance (STAG Technical Database Section 5 and WebTAG Transport Appraisal Process para 2.10.9). Beneficial and adverse impacts are considered but to focus on key issues, the report largely discusses major and moderate impacts.

The supplementary assessment has been undertaken for engineering, environment and traffic disciplines with reference to the scheme objectives, replicated in Table 2 for ease of reference. The development and layout of the designs and subsequent assessments are covered in the following sections:

- Section 3 - D2APc (GSJ) dual carriageway with Grade Separated Junctions (GSJ);
- Section 4 - D2APb (At-Grade) dual carriageway with an at-grade roundabout at Blackhall Road; and

- Section 5 - Considers the potential for further reductions in standards.

Table 1: Seven Point Scale

Major beneficial
Moderate beneficial
Minor beneficial
Neutral
Minor adverse
Moderate adverse
Major adverse

Table 2: Scheme Objectives

Scheme Objective	Scheme Sub-objective
1: To improve the operation of the A96 and inter-urban connectivity through:	1.1: Reduced journey times
	1.2: Improved journey time reliability
	1.3: Increased overtaking opportunities
	1.4: Improved efficiency of freight movements along the transport corridor
	1.5: Reduced conflicts between local traffic and strategic journeys
	1.6 Improved network resilience
2: To improve safety for motorised and non-motorised users (NMUs) through:	2.1: Reduced accident rates and severity
	2.2: Reduced driver stress
	2.3: Reduced potential conflicts between motorised and NMUs
3: To provide opportunities to grow the regional economies on the corridor through:	3.1: Improved access to the wider strategic transport network
	3.2: Enhanced access to jobs and services
4: To facilitate active travel in the corridor	
5: To facilitate integration with public transport facilities	
6: To avoid significant environmental impacts and where this is not possible, to minimise the environmental effect on:	6.1: The communities and people in the corridor
	6.2: Natural and cultural heritage assets

3 Online Dualling with Grade Separated Junctions

3.1 Online Dualling/Widening Consideration

The aim of the A96 Dualling Programme is to deliver a high-quality dual carriageway linking Inverness and Aberdeen. This is reflected in the A96 Dualling East of Huntly to Aberdeen scheme brief which specifies that the scheme should be a DMRB Category 7A All Purpose dual carriageway, wherever possible. Since the scheme brief was prepared, the DMRB has been updated and Category 7A is now referred to as D2APc. The new DMRB terminology is used in this report.

The requirements in terms of access and junction treatments for a D2APc (GSJ) road are outlined in DMRB (Volume 6, Section 1, Part 1, CD109 Highway link design, Table A.2) and are reproduced below in Table 3, for ease of reference. For a D2APc (GSJ) dual carriageway, at-grade road connections are not permitted therefore grade-separated junctions are required.

Table 3: D2APc (GSJ) DMRB (CD 109) Requirements

Type of road	Edge treatment	Access treatment	Minor road treatment	Major junction treatment
D2APc (GSJ)	Nearside - hard strip. Offside - hard strip.	No access except isolated existing access with left turns only. Clearway	No minor junctions at-grade. No gaps in the central reserve.	Full grade separation.

The supplementary D2APc (GSJ) layout has been designed in accordance with the DMRB, in particular the following technical guidance and design standards as applicable:

- Volume 6, Section 1, Part 1, CD109 Highway link design;
- Volume 6, Section 1, Part 2, CD127 Cross-sections and headrooms; and
- Volume 6, Section 2, Part 1, CD122 Geometric design of grade separated junctions.

The mainline alignment has been designed to a 120A kph Design Speed in accordance with CD109 Highway link design.

To comply with the CD109 requirement for hard strips, the following rural D2AP cross-section has been adopted for the mainline design in accordance with DMRB (Volume 6, Section 1, Part 2, CD127 Cross-sections and headrooms):

- 7.3m carriageways;
- 1.0m hard strip on both sides of each carriageway;
- 2.5m central reserve; and
- 2.5m verges.

This provides a minimum dual carriageway cross-section of 26.1m wide excluding space for earthworks or retaining walls. The actual width required online through Inverurie would vary along its length as there are many components of a road provided for specific purposes and each involves several interrelated design decisions. Features required that have influenced the design are as follows:

- level differences between proposed carriageway and adjoining land with resulting earthworks or retaining walls;
- widening of verge and/or central reserve for visibility to provide the required Stopping Sight Distance;
- width to accommodate road drainage systems, vehicle road restraint systems, lighting columns and road traffic signs;
- accommodation of utility apparatus currently located within the existing A96 road corridor;
- other features that may be identified during further design stages and may lead to a further increase in cross-section such as ducting provision for enhanced digital connectivity and ITS equipment including CCTV, Variable Message Signs and their associated maintenance hard standing/access;
- landscaping and/or noise mitigation requirements; and
- access space for inspection and maintenance activities.

The basic premise adopted in the supplementary design is to widen to the immediate south side of the existing A96, adding a new two-lane carriageway to carry the westbound traffic, with the existing A96 used by eastbound traffic. The benefits of doing so are:

- it maximises the use of the existing asset by re-using the existing A96 as the new eastbound carriageway;
- it minimises the impact on properties given most are situated to the north of the existing road; and
- it would help to minimise the impact on traffic by offsetting works to one side, although it would still require significant construction operations close to live traffic.

Within the extents of Drimmies to Thainstone, the areas where re-using the existing A96 as the new eastbound carriageway are not possible are the tie in at Drimmies (where the alignment would be offline to tie into the Orange route option) and on the approaches to and through Blackhall Road junction (where the mainline dual carriageway would be elevated over the junction). Elsewhere, the above design premise would be able to be adopted although retaining walls would be necessary at pinch points to minimise the impact on properties. Part of a garden of one property at Old Kemnay Road would be affected by an access realignment required to accommodate the dual carriageway widening. Online dualling would also encroach into Inverurie Golf Club affecting one of the teeing areas. There are further property impacts at the junction areas discussed in Section 3.2.

3.2 D2APc (GSJ) Junction Configurations

Within this supplementary design development, consideration has been given to junction configurations comprising a D2APc (GSJ) dual carriageway with grade separated junctions at Drimmies, Blackhall Road (as presented at the May 2019 Route options design update public drop-in sessions) and at Thainstone.

3.2.1 Drimmies Junction

Online dualling at Inverurie would tie into the Orange route option at Drimmies. The grade separated junction at Drimmies remains largely as presented under the Orange route option at the May 2019 Route options design update public drop-in sessions, the only difference being a marginal realignment of the slip roads to tie into the online dualling layout rather than the Orange route option.

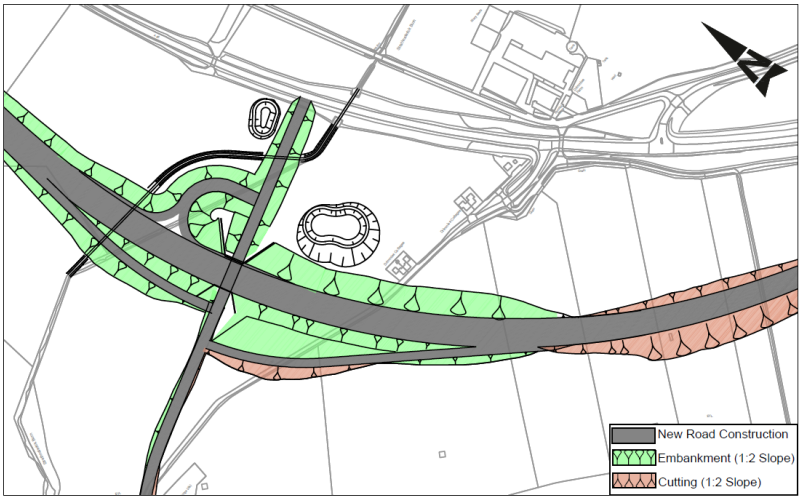

Figure 2: Drimmies Junction

3.2.2 Blackhall Road Junction

Traffic modelling undertaken for the Online at Inverurie Feasibility and Appraisal study confirmed that a junction on the A96 at Blackhall Road would be required to avoid severe congestion on the surrounding road network. Challenges associated with the development of a grade separated junction at Blackhall Road were discussed within the study and a layout was presented at the May 2019 Route options design update public drop-in sessions.

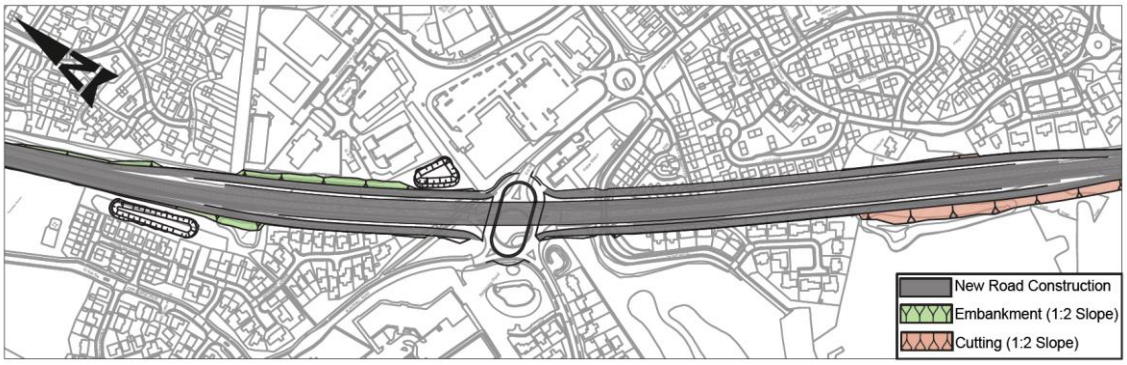

Figure 3: Blackhall Road Grade Separated Junction

The design presented showed a gyratory layout at existing levels for Blackhall Roundabout which would necessitate enlargement of the roundabout. The mainline dual carriageway would be grade separated around 8m above the roundabout. Slip roads providing access between the roundabout and the mainline would be provided, these being constructed at the same level as the existing A96 allowing traffic to be diverted onto the slip roads/widened roundabout prior to construction of the mainline overhead. Further detail of construction sequencing is provided in Section 3.4.6 of this report.

The physical space needed to accommodate the slip roads and mainline, including retaining walls instead of earthworks to minimise the footprint, is approximately 55m excluding construction space, as shown on drawing A96PEA-AMAR-HGN-SWI-SK-CH-335038 contained in Appendix A. With only 21m at its narrowest and 24m typically being available between road boundaries to the east side of Blackhall Roundabout, property acquisition and demolition would be required. Despite greater width between road boundaries being available to the west of Blackhall Roundabout, property demolition would also be required. The acquisition and assumed demolition of a total of 40 residential properties plus the acquisition of parts of the gardens of a further 10 properties, would be required to accommodate a grade separated junction at Blackhall Road. Acquisition of land from five non-residential properties around the Blackhall Road area would also be required including from Morrisons and Police Scotland.

3.2.3 Inverurie Roundabout/Thainstone Junction

Inverurie Roundabout at Port Elphinstone is the main access to and from Inverurie east of the River Don. The proximity of the Inverurie and Thainstone roundabouts to each other are such that there would be insufficient distance to grade separate each roundabout at their existing locations as the slip roads would overlap. There are also several constraints at each, including a cemetery immediately to the north-west of Inverurie Roundabout and several residential and commercial properties adjacent to each roundabout.

A combined grade separated junction located between the existing roundabouts has therefore been developed as part of the supplementary design. Links to the B993 Kemnay Road, Thainstone, Kirkwood Commercial Park and to Inverurie via Mill Road would be provided to maintain access. The combined length of these access roads would be approximately 4km. Mill Road would become the most easterly link to/from Inverurie and may require upgrading works to accommodate predicted traffic flows.

Figure 4: Thainstone Junction

Given the number of links in addition to the slip roads tying into the junction, a large gyratory layout is envisaged. The gyratory and approach slip/link roads would be elevated on embankment up to 8m above the existing A96. Maintaining the A96 at existing levels would facilitate construction by allowing the slip/link roads to be constructed offline to the side of the existing A96, minimising disruption to traffic. Further consideration of construction issues associated with online dualling through Inverurie is provide in Section 3.4.6 of this report.

3.3 Description of D2APc (GSJ) Online Dualling

The resulting layout developed for a D2APc (GSJ) dual carriageway between Drimmies and the existing A96 dual carriageway at Kintore (incorporating grade separated junctions at Drimmies, Blackhall Road and Thainstone) is shown on the following drawings, which can be found in Appendix A:

- A96PEA-AMAR-HGN-SWI-DR-CH-335062 – Sheet 1 of 3
- A96PEA-AMAR-HGN-SWI-DR-CH-335070 – Sheet 2 of 3
- A96PEA-AMAR-HGN-SWI-DR-CH-335064 – Sheet 3 of 3

These show offline dual carriageway construction from Drimmies to around chainage (ch) 2000 where the alignment converges with the existing A96. For the following 1km between ch2000 and ch3000, the existing A96 could be retained as the new eastbound carriageway with a new westbound carriageway constructed alongside. It is anticipated the existing A96 would require upgrade works to achieve the required design life to form part of the new dual carriageway and to comply with current technical standards.

A new all direction grade separated junction would be constructed at Blackhall Road comprising an elevated mainline above a roundabout in the same location as the existing Blackhall Roundabout. The junction configuration is such that the existing A96 could not be re-used between ch3000 and ch4750 and full construction of a new dual carriageway and junction would be required.

From ch4750, a new westbound carriageway is shown to the south of the existing A96 with the existing road forming the new eastbound carriageway. A new bridge over the River Don would be required to the south of the existing crossing to carry the new westbound carriageway, with the existing bridge retained to carry the new eastbound carriageway. The new bridge would be adjacent to but separate from the existing bridge, with its own foundations and supports.

The new westbound carriageway would continue on the south side of the existing A96 to Inverurie Roundabout, which would be removed. The new works would tie into the existing dual carriageway east of Inverurie Roundabout.

A new grade separated junction would be formed approximately 400m west of the existing Thainstone Roundabout, which would require to be removed. The new junction would comprise of a large gyratory roundabout elevated above the existing A96. Several local roads would require realigning or extending to connect to the new junction.

In summary, between Drimmies and Thainstone (a distance of 7.5km) a D2APc (GSJ) dual carriageway online at Inverurie could be constructed using the existing A96 as the eastbound carriageway for 2.4km and utilising the existing dualled section east of Inverurie Roundabout for approximately 1.2km. The existing road and structures would require assessing to determine any works required to provide the necessary design life. Retaining walls would also be required at pinch points along these sections and an additional single carriageway width bridge would be required over the River Don. For 1.75km around Blackhall Road, full new construction of a dual carriageway and construction of a grade separated junction would affect 40 residential properties with assumed demolition and with part of the gardens of a further 11 properties requiring acquisition (10 at Blackhall Road area and one at Old Kemnay Road). Acquisition of land from six non-residential properties would also be required including from Morrisons and Police Scotland at the Blackhall Road and further east from Inverurie Golf Club affecting one of the teeing areas.

3.4 D2APc (GSJ) Engineering Assessment

3.4.1 Road Layout

The D2APc (GSJ) supplementary design is fully compliant with design standards and the scheme brief for provision of a high-quality dual carriageway. The requirement for property demolition to achieve a D2APc (GSJ) layout is considered within the People and Communities section of the Environmental Assessment (Section 3.5).

3.4.2 Structures

The following structures would be required as shown on drawings A96PEA-AMAR-HGN-SWI-DR-CH-335062, 335070 and 335064 in Appendix A and summarised in Table 4:

Table 4: D2APc (GSJ) Layout - Structures

Structure Ref	Approx. chainages	Structures
C1	440	New underpass at Drimmies Junction to carry the A96 over the realigned sideroad.

Structure Ref	Approx. chainages	Structures
C2	2290	Approximately 12m extension to existing agricultural underpass for the new westbound carriageway widening.
C3	2650 to 3015	365m of new retaining wall to westbound carriageway, 2m to 4.5m in height for retention of amenity ground and private gardens.
C4	3310 to 3420	Eastbound off slip outer retaining wall adjacent to residential property, 110m long and 2.3m to 2.8m in height for retention of the A96 above.
C5a&b	3400 to 3710	Retaining walls 310m and 260m long between mainline and slip roads for east and westbound directions, 0.5m to 8m high retaining mainline above slip roads.
C6	3445 to 3595	150m long retaining wall to outside of westbound on-slip, 1m to 3.2m in height retaining gardens of residential properties above westbound on slip. Requires demolition of residential properties.
C7	3640 to 3700	Existing pedestrian underpass (approximately 22m long) at Blackhall Roundabout to be extended under widened A96, resulting in an underpass approximately 80m long. Potential alternative of at-grade crossings around the roundabout may be possible because of a reduction in traffic using the roundabout and may be more desirable than a long underpass, although this would result in more conflicts between traffic and NMUs.
C8	3705 to 3720	A96 underbridge over enlarged Blackhall Roundabout (western side).
C9a&b	3715 to 3760	40m and 45m long retaining walls between Blackhall Junction underbridges supporting mainline above roundabout approximately 8m in height.
C10	3760 to 3775	A96 underbridge over enlarged Blackhall Roundabout (eastern side).
C11	3760 to 3840	80m long retaining wall to the exit arm from the roundabout towards A96 eastbound, 1.5m to 4m in height. Retains slip road above Police Scotland site. Partial demolition of Police Scotland building may be required as a minimum.

Structure Ref	Approx. chainages	Structures
C12	3845	Existing vehicle underpass (approximately 16m long) accessing Inverurie Golf Club and Davah Wood to be extended under widened A96 to approximately 53m long.
C13a&b	3770 to 4330	550m and 560m long retaining walls between mainline and slip roads east of Blackhall Roundabout. Height 0.5m to 8m, retaining mainline above slip roads.
C14	3850 to 4130	280m long retaining wall to outside of the eastbound on slip, 0.5m to 4.8m in height retaining slip road above Aquhorthies Circle and Golf Park. Requires demolition of residential properties.
C15	3900 to 4150	250m long retaining wall to outside of the westbound off slip, 0.5m to 3m in height retaining Davah Wood area above westbound off slip. Requires demolition of residential properties.
C16	4285 to 4475	190m long retaining wall to outside of eastbound on slip, 1m to 2m in height retaining gardens of Old Course Avenue above eastbound on slip.
C17	5090	Upperboat Bridge carrying St James's Place above the A96 has insufficient span lengths to accommodate a dualled A96 and would require replacing with a new overbridge. Closure of the A96 would be required for demolition of the existing bridge and for some construction activities on the new bridge.
C18	5225 to 5390	River Don crossing – a new structure separate and to the south of the existing River Don bridge would be constructed to carry the new westbound carriageway. It is anticipated that the existing bridge would be retained to carry the eastbound carriageway, although it may need upgrades to achieve the required design life.
C19	5550	Potential new footbridge required to close existing at-grade NMU crossing at Old Kemnay Road as at-grade crossing of the new dual carriageway would not be permitted.
C20	5730 to 5975	245m long retaining wall required to westbound carriageway, approximately 2m to 6m in height to retain grounds at Ardennan House above the A96.

Structure Ref	Approx. chainages	Structures
C21	5980	Potential new footbridge required to close existing at-grade NMU crossing at Kemnay Road as at-grade crossing of the new dual carriageway would not be permitted.
C22	6970	New overbridge to carry the Thainstone Junction gyratory carriageway (west side) over the A96.
C23	7020	New overbridge to carry the Thainstone Junction gyratory carriageway (east side) over the A96.

A significant number of structures are required along an online corridor. A second bridge over the River Don is the most significant structure requiring construction above the River Don and flood plain. It is anticipated that the existing bridge would be retained to carry the eastbound carriageway and the new bridge constructed to carry only the new westbound carriageway, adjacent to the existing. Re-using the existing bridge would result in a reduction in the new construction work required to achieve a dual carriageway over the River Don, although upgrade works may be required to the existing structure to provide the required design life. The length of the new River Don bridge would likely be greater than the existing to avoid approach embankment in the flood plain, although it is likely bridge piers in the flood plain will be required and flood compensatory storage may be necessary.

Upperboat Bridge carrying St James's Place over the A96 would require demolition and replacement. While the replacement bridge is not anticipated to be significantly large or structurally complex, the demolition of the existing bridge and construction of the new above live traffic would add to the complexity and impacts. Similarly, there are several underpasses below the A96 that while not structurally complex, works to lengthen the underpasses would be complicated by the online nature of construction and will require both local and trunk road closures during construction.

There is the potential need for two new overbridges to maintain NMU links along Old Kemnay Road and Kemnay Road to and from Inverurie to mitigate for an increase in severance resulting from online dualling. It is understood that Aberdeenshire Council have promoted stopping up orders for these links, although they remain open currently as at-grade crossings of the existing A96 single carriageway. At-grade NMU crossings would not be permitted on a D2APc (GSJ) dual carriageway and stopping up measures would need to be implemented. An alternative grade separated route currently exists for Old Kemnay Road, although it is significantly longer than the existing at-grade crossing and is routed through the River Don flood plain. There is no existing alternative provision for the Kemnay Road crossing.

Substantial lengths of retaining walls totalling approximately 3.4km are required at pinch points to avoid further encroachment of earthworks into residential and commercial properties. Depending on the final extent of land acquisition associated with the properties, it could be possible in some locations to utilise earthwork slopes instead of retaining walls. Retaining walls have been shown at this stage however, demonstrating

that even with retention and minimised footprint, it would not be possible to avoid residential property acquisition and demolition.

Online construction would increase the cost, complexity and construction duration of such structures. Further consideration of these aspects and phasing of the works is given in Section 3.4.6 of this report.

3.4.3 Geotechnical Engineering

At the location of the second River Don Bridge, surface geology is indicated to be comprised of alluvial soils. The extent and thickness of this material is unknown at this stage and is assessed as having a major adverse impact in relation to geotechnical engineering.

Within the remainder of the alignment, there is a varying height embankment of 10m or higher around Drimmies upon glacial till and alluvium for approximately 550m and approximately 450m of alignment to the east of Drimmies formed from cuttings within shallow rock, both of which are considered to be moderately adverse. The remainder of the earthworks is not considered to be unduly significant.

There would be benefits from the supplementary design layout in that for around 2.4km, re-use of the existing road means earthworks operations would only be needed to form the new westbound dual carriageway. A further 1.2km of existing dual carriageway retained east of Inverurie Roundabout at Port Elphinstone would also require only limited earthworks although earthworks operations in general in this area would still be required to form the new junction at Thainstone.

Retaining walls would require construction in constrained sites which would increase the complexity of the geotechnical engineering. In relation to the impact, this is considered within the Health and Safety Considerations element in Section 3.4.6 of this report.

3.4.4 Utilities

Diversion of utilities has been identified where construction works would coincide with existing utility apparatus. The alignment interfaces with the following utility apparatus which are considered to represent major or moderate construction constraints to online dualling, as shown on drawings A96PEA-AMAR-VUT-SWI-DR-CU-335001, 335010 and 335003 in Appendix A:

- National Grid Gas High Pressure Pipeline 1050mm diameter
- Scottish Water 300mm and 250mm diameter water mains

A diversion/replacement of a section of the National Grid High Pressure Gas Pipeline would be required west of Inverurie. This would be complex works and would represent a significant programme constraint and risk.

300mm diameter and 250mm diameter water mains run alongside the existing A96, beneath the online dualling alignment, for approximately 4.3km. These would require diversion which would be onerous given the length and diameter of the mains, the proximity of live traffic and coordination with construction of retaining walls and other construction works within the corridor.

Other utilities are present along the corridor and diversions would be required, however these are considered to represent a lesser constraint.

3.4.5 Hydrology and Drainage

3.4.5.1 Hydrology, including Flooding

The alignment crosses nine watercourses including the River Don. Two watercourse diversions are considered necessary, Strathnaterick Burn near to Drimmies Junction and a small watercourse between the existing Inverurie and Thainstone Roundabouts.

The major impact on watercourses is the crossing of the River Don and its flood plain. The positioning of bridge piers within the flood plain may require compensatory flood storage to be provided to ensure that flood risk from this is mitigated. It is assumed that earthworks necessary to accommodate the bridge abutments would not be permitted within the flood plain, resulting in a bridge approximately 100m longer than the existing River Don crossing being required.

3.4.5.2 Highway Drainage

The existing A96 does not include attenuation or road drainage treatment measures to current standards, which the new dual carriageway would require. An appraisal of the potential drainage attenuation and outfall locations has been undertaken as part of the supplementary design given that the corridor is constrained in nature and additional space for attenuation and treatment may not be readily available.

The supplementary highway drainage design provides attenuation of surface water flows to mitigate the effects of surface water flooding and treatment of road surface drainage, to satisfy water quality criteria before release into the water environment.

Road drainage runoff would be attenuated by the provision of attenuation basins, where water is stored temporarily and released back into the water environment at a controlled rate. Treatment of surface water would be provided, in part, via the attenuation basins as part of the Sustainable Drainage System (SuDS) treatment train in line with the requirements of SEPA and the local authority.

Potential locations for attenuation basins for online dualling are shown on drawings A96PEA-AMAR-HGN-SWI-DR-CH-335062, 335070 and 335064 in Appendix A. These have been positioned considering alignment low points, local topography, existing flood plains and potential outfall locations to watercourses. In line with standard practice, separate basins are provided for adjacent or connecting roads under the separate responsibilities of Aberdeenshire Council and Transport Scotland.

A major adverse impact has been identified to the west of Blackhall Roundabout, where the alignment low point coincides with a constrained section of available highway boundary. There is a potential adjacent area of vacant land available for an attenuation/treatment basin, however it would result in the loss of vegetation and screening of the road. This location is further complicated by the presence of the existing pedestrian underpass.

In the vicinity of Upperboat Bridge and the River Don Crossing, the provision of basins is constrained by topography and the extent of functional flood plain of the River Don. It is considered that a D2APc (GSJ) layout would require two basins in the vicinity of St James's Place (Upperboat Bridge).

A further major adverse impact has been identified in the vicinity of the River Don crossing. The existing alignment sag point is too low to provide a viable basin location outside the functional floodplain, leaving approximately 400m of road between ch5100 to ch5500 without a readily achievable attenuation and treatment solution.

As online dualling would seek to re-use the existing River Don bridge, there is no scope to amend the road level sufficiently on the eastbound carriageway to address this issue. A new bridge carrying the new westbound carriageway could be constructed at a higher level with resulting structural, earthworks and land acquisition issues however it would not address the issue for the eastbound carriageway using the existing road. Separate and potentially non-standard measures to treat and attenuate the road run-off in the area constrained by the existing road level would need agreement with SEPA and Aberdeenshire Council, statutory consultees for the scheme.

For the section of road east of the River Don from ch5500, there is limited suitable land outside of the flood plain to provide treatment and attenuation of surface water flows because of the extent of the flood plain and steep ground. The outline drainage layout identifies a potential location for an attenuation basin approximately 500m south of the road, which would require long outfall pipes and extended land acquisition.

In addition to challenges associated with permanent outfall attenuation and treatment, there is a requirement for treatment of run-off during construction activities. Best practice would be to provide temporary settlement ponds separate to those provided for the permanent layout. Finding suitable locations within online dualling through Inverurie would be challenging given the constrained nature of the corridor.

In summary, there are major impacts of online dualling in relation to the provision of road drainage to current standards as a result of utilising the existing alignment and the constrained nature of the corridor. This would potentially require non-standard provision and would require the agreement of statutory bodies responsible for the water environment. There would also likely be additional challenges associated with providing land for treatment of run-off during construction.

3.4.6 Health & Safety Considerations

The Construction (Design and Management) Regulations 2015 (CDM) place a statutory obligation on Designers to eliminate, so far as reasonably practical, foreseeable risks to the health and safety of any person. As a general principle, construction online within a constrained corridor with live traffic is more complex and introduces hazards/risks that would not be so prevalent with comparable construction in an offline setting. Online construction activities have the potential to increase risks for both those involved in construction and the travelling public.

3.4.6.1 Live Traffic

Online dualling construction works would require narrow traffic lanes on the existing A96 and implementation of a 40mph speed limit during construction. This has the potential to cause delays and rat-running, whereas offline construction would leave the existing A96 to operate largely as existing with minimal interaction except at crossings/tie ins.

Where construction space is limited by live traffic, construction programmes are generally extended, potentially increasing the risks associated with working in a congested site adjacent to a live road for longer periods. It is more complex, more costly and takes a longer time to construct works in proximity of live traffic. This is magnified where there are also multiple construction activities in one location, such as utility diversions and new structures which is the case for online dualling through Inverurie.

To maintain traffic flows and provide sufficient working space for construction, two narrow lanes would be required during most of the construction period. Time limited full closures of the A96 at Inverurie, overnight and the potential for weekend closures, would be

needed for individual engineering activities such as the demolition of Upperboat Bridge and lifting of beams for new bridges across the A96. During closure periods, the strategic diversion would be via the A947/A920 with local diversion through Inverurie.

3.4.6.2 Construction and Maintenance Space

Sufficient working space between the physical footprint of the road layout and the land boundary is required for safe access for both construction and future maintenance. This distance would be determined following a detailed risk assessment of the space needed. The space between the layout footprint and road boundary provides:

- working areas for construction plant movements and operations, plus access for construction personnel between the site boundary and the layout footprint;
- it allows for future access for maintenance along the scheme without the need for working outside the road boundary in third party land. It also provides space at the top/bottom of slopes or walls from which maintenance plant and operatives can work, helping to avoid hazards such as working from a live carriageway and at steep angles on earthwork slopes;
- it provides space for the installation and maintenance of cut-off drainage to intercept surface water run-off, such drainage being essential to prevent run-off from the scheme entering third party land or to prevent run-off undermining earthwork slopes, where adjacent land falls towards the scheme.

For the purposes of this report, a typical 3m minimum offset has been adopted between the edge of the earthworks footprint and the boundary fence. In the case of online dualling through Inverurie, the construction and maintenance space would provide for construction vehicle movements between the layout footprint and adjacent residential gardens. A greater offset for such construction vehicle movements may therefore be required. Likewise, a greater offset may be required for construction of retaining walls where increased plant movements could be expected. Notwithstanding, the drawings have been developed to show a 3m construction and maintenance strip to demonstrate the impact of the minimum width.

While the offset from the layout footprint to the road boundary will assist with future maintenance, online dualling is considered to perform poorly in relation to improved network resilience (Scheme Objective 1.6) by concentrating strategic and local traffic in the same corridor. It also removes the redundancy offered by the existing A96 through Inverurie, for example for diversions during a road traffic incident or during a significant reduction in network capacity due to major planned maintenance.

3.4.6.3 Phasing

To assess the feasibility of online dualling through Inverurie, indicative construction phasing has been considered for a section of widening where a new westbound carriageway would be constructed adjacent to the existing A96 and for the area at the pinch point around Aquhorthies Circle/Davah Wood, east of Blackhall Roundabout.

Drawing A96PEA-AMAR-HGN-SWI-SK-CH-335049 in Appendix A illustrates indicative phasing for construction of a new westbound carriageway alongside the existing A96. The tightest space restrictions would be during excavation works where traffic would be moved northwards into narrow lanes to maximise the space available for earthwork widening operations to the south. Sufficient space should be available for the construction operations and once excavation is complete, more space is available for

subsequent works. For clarity the cross-sections do not show all works required such as drainage installation or utility diversions which would be undertaken within the phase appropriate to the area of working.

Drawing A96PEA-AMAR-HGN-SWI-SK-CH-335051 in Appendix A illustrates indicative phasing for construction of the dualling and grade separated junction at the Aquhorthies Circle/Davah Wood pinch point to the east of Blackhall Roundabout. While the operations involve more complex construction including construction of retaining walls, bridges and extending Davah Wood underpass, the need to acquire land for a 50m+ corridor means that there is significant working space available following demolition of the properties.

It is anticipated that construction would initially focus on demolition and clearing of space to construct the new slip roads at the same level as the existing A96 to facilitate moving the traffic outwards to then allow construction of the dual carriageway over Blackhall Roundabout.

The indicative phasing drawings demonstrate that although the available construction space is limited until site clearance and earthworks widening have been substantially progressed, it is feasible to construct an online grade separated dual carriageway through Inverurie while maintaining two lanes of traffic, albeit in narrow lanes and that time limited closures for specific operations would be required.

In addition to the general earthworks/retaining wall and roadworks construction within the online corridor shown, other significant activities would be specific to online dualling through Inverurie such as utility diversions and structural works.

3.4.6.4 Utility Diversions

It would be necessary to divert approximately 4.3km of 300mm diameter and 250mm diameter water mains. These pipes currently run in parallel along the southern side of the existing A96 corridor from western Inverurie across the River Don Bridge to the Thainstone area. The complexity and duration of the diversion works would be increased due to the need for retaining wall works and the presence of live traffic. The working space during site clearance and earthworks phases would be directly above these services. Diversions would not readily be feasible until the widened earthworks and retaining walls were complete resulting in increased potential for damage to the existing pipes during the works. Agreement of protection measures would be required with Scottish Water.

Similarly, a significant quantity of utilities are routed north-south through Blackhall Roundabout. Diversion of these utilities to facilitate construction of new retaining walls and bridges would be time consuming and disruptive. Temporary traffic management would be required for an extended period, increasing the risk of exposure of construction activities to traffic and vice versa and to increased traffic and programme delays.

3.4.6.5 Upperboat Bridge

It would be necessary to demolish the existing structure and construct a replacement road bridge. The bridge carries St James's Place over the existing A96 but is not long enough to accommodate a widened carriageway. A closure (or number of closures) of the existing A96 would be required to demolish the existing structure and to place the deck structure of a replacement bridge. It is likely that these closures would be time limited to overnight and potentially weekend closures.

Closure of St James's Place for a lengthy time period may be required following demolition of the existing bridge until the new bridge is constructed, unless the new bridge can be constructed off the line of St James's Place, adjacent to the existing structure. If the existing bridge cannot be maintained until the new bridge is completed, vehicular traffic would likely divert via the C116 and Blackhall Road to access Inverurie, which would be a three mile diversion. It may however be necessary to construct a temporary footbridge over the existing A96 to prevent severance for residents and maintain utility supplies during the construction period.

Phasing of any closures for construction activities at Blackhall Road junction would need considered and would be unlikely to be permitted concurrently with St James's Place closure if Blackhall Road is used as a diversion route. It is however envisaged that any closures around Blackhall Road junction would be time-limited and therefore phasing considerations are unlikely to significantly affect the overall programme.

3.4.6.6 River Don Crossing

Hazards associated with construction above the river and within the flood plain would be unavoidable for any such crossing but the need for a single River Don crossing would be a benefit of online dualling in terms of construction complexity and programme. Re-use of the existing bridge would be expected to involve greater maintenance and potential interventions sooner than might otherwise be the case. Overall, works associated with this crossing would be reduced through requiring the new bridge to accommodate the westbound carriageway only.

3.4.6.7 Existing Underpasses

Three extensions to existing underpasses would be required. It is impractical to anticipate that the existing underpasses could be constructed while keeping the roads/NMU routes open at all times and therefore alternative arrangements would be required for significant periods.

An alternative route via public roads would likely be required for extension of the agricultural underpass to the west of Inverurie (around ch2290).

The pedestrian underpass west of Blackhall Roundabout would require to be extended. This would necessitate closure of the route and realignment of the approach paths to achieve compliant gradients and sightlines. Non-motorised users would need to be provided with an alternative route during these works, which would likely comprise at-grade crossings through temporary traffic management at Blackhall Roundabout. Ultimately it may be desirable to provide a permanent at-grade route rather than an extended underpass given that the resultant underpass would be approximately 80m long. This would however result in more conflicts between traffic and NMUs.

The vehicle and NMU underpass at Davah Wood would need to be closed during construction to extend the structure and realign the approach roads. To maintain access to residential properties, a temporary access would need to be formed, likely directly from Davah Wood to Corsemanhill Drive or a new underpass could potentially be constructed offline, which could allow the existing underpass to remain open during construction.

3.4.7 Engineering Summary

The provision of an online D2APc (GSJ) road through Inverurie would require the acquisition and assumed demolition of 40 residential properties and garden area from a

further 11 properties. Land acquisition from a further six non-residential properties would be required including Morrisons, Police Scotland and Inverurie Golf Club, affecting one of the teeing areas.

Utilising the existing A96 would be possible for 3.6km (out of the 7.5km length from Drimmies to Thainstone) which would reduce the earthworks required in the corridor, as only widening to form a new carriageway alongside the existing would be necessary rather than construction of a full new dual carriageway. Significant numbers of retaining walls would however be required in lieu of earthworks at pinch points, a total of approximately 3.4km in length if using retaining walls to minimise the earthwork footprint.

There would be savings in the works associated with the River Don crossing as it is anticipated the existing bridge would be utilised for the eastbound carriageway with a new bridge constructed alongside to carry the westbound carriageway. Re-using the existing bridge would result in a reduction in the new construction work required to achieve a dual carriageway over the River Don however there may be improvements required to the existing structure to provide the required design life.

Major utility impacts exist within the corridor including 4.3km diversions of 300mm and 250mm diameter water mains and a crossing of a 1050mm diameter National Grid gas high pressure pipeline. The provision of suitable attenuation and treatment of road drainage involves significant challenges given the constrained nature of the corridor. Around the River Don, re-use of the existing alignment and River Don bridge gives rise to challenges around the potential need to agree non-standard treatment of road drainage with statutory bodies.

There are major challenges with regards to construction of the permanent works within a constrained corridor adjacent to live traffic and significant utilities. Limited closures of the A96 would be required, for example during the demolition of Upperboat Bridge.

Online dualling is considered to perform poorly in relation to Scheme Objective 1.6 for improved network resilience by concentrating strategic and local traffic in the same corridor and removing the flexibility offered by the existing A96 through Inverurie for diversions.

3.5 D2APc (GSJ) Environmental Assessment

The environmental assessment is split into specialist topics and provides a measure of how online dualling at Inverurie would align with Scheme Objective 6 to avoid significant environmental impacts and where this is not possible, to minimise the environmental effect. Key environmental constraints at Inverurie are shown on drawing A96PEA-AMAR-EGN-SWI-MP-LX-002001 contained in Appendix A.

This assessment has been undertaken in accordance with DMRB Volume 11, Environmental Assessment and DMRB Interim Advice Note 125/15, Environmental Assessment Update. New DMRB guidance has recently been published for Environmental Assessment, LA 104 Environmental assessment and monitoring, during this supplementary design and assessment process. A review of all discipline topics has been undertaken and the outcome of each assessment would not change following the updated guidance.

3.5.1 Air Quality

Online dualling increases the size of the road with the effects of the alignment covering a commensurate larger area than the existing road. This involves the widened road

passing south of Inverurie and north of Highfield, with both areas having a density of >20 people per km^2 (ppl/$km^{2)}$. The new Thainstone Junction also results in side roads, including the main route east of the River Don to/from Inverurie, passing through more of the Port Elphinstone Local Development Plan (LDP) settlement area.

An assessment of the permanent impact of upgrading the online alignment was undertaken using guidance detailed in DMRB HA 207/07 and the seven-point scale referred to in Section 2. This identified a potential major adverse impact where receptors are present within 50m of the alignment and a potential moderate adverse impact where receptors are present within 200m of the alignment.

GIS mapping was used to identify receptors within 50m and within 200m of the online dual carriageway centreline. Receptors were identified using the AddressBase Plus database. Measurements were taken from the online alignment centreline. The assessment identified that there are 174 sensitive receptors (e.g. residential, medical, schools, care homes etc) within 50m of the online centreline and 1,346 sensitive receptors within 200m of the alignment. The receptors are shown on drawing A96PEA-AMAR-EAQ-SWI-MP-LA-002001 in Appendix A.

The results of the DMRB HA 207/07 assessment therefore identified a high number of receptors in a high-density area with the impact classed as major adverse for much of the distance between ch2650 and ch7550, where the A96 is currently located within the residential area of Inverurie. Outwith the built-up area, the Air Quality assessment assessed impacts as neutral given the reduced density of receptors and lower background concentrations in the rural setting, where absolute concentrations will be lower than those in the Inverurie urban area.

A further qualitative assessment was also undertaken to recognise the context of online dualling and the presence of the existing A96. This followed the DMRB IAN 174/13 guidance which considers the magnitude of change in air quality based on traffic flows. To assess the range of possible predicted traffic flows for online dualling at Inverurie, traffic flows were determined for all end-to-end route combinations as different route option connections give rise to different traffic flows. Traffic modelling was undertaken linking online dualling at Inverurie to the portion of the Orange route option from Drimmies to Pitcaple with further connections onto each of the Brown or Pink and Cyan or Red route options. This modelling was undertaken for 2030 (the assumed year of opening) and 2045 (15 years after opening).

The assessment determined that online dualling with grade separated junctions has the potential to give rise to major/moderate adverse changes in air quality at receptors located within 25m of the alignment centreline and also to give rise to some moderate adverse changes at those within 25m to 50m. It should be noted however that for the D2APc (GSJ) layout, properties within 25m of the centreline would require demolition.

The results of the assessment are shown in Appendix B Tables B1 and B2 for each of the end-to-end combinations, which identified that the major adverse changes in air quality were typically associated with those properties within 25m of the online dualling centreline and moderate adverse impacts typically affecting properties at a distance of 25m to 50m. There are no sensitive receptors within 25m due to demolition of properties and 110 No. within 25m to 50m of the road centreline.

Online dualling would not realise the opportunity for reduction in pollution which would benefit a high number of receptors within the urban area of Inverurie if traffic levels were lower. It should also be noted that while changes in air quality are predicted, no exceedance of UK air quality objective thresholds are anticipated.

In summary, two methods of assessment have considered the effects on air quality for online dualling with grade separated junctions. The first (DMRB HA 207/07) identified that within Inverurie, online dualling is predicted to generate a major adverse impact as a result of the number of receptors. The second method (DMRB IAN 174/13) was undertaken to recognise the context of upgrading an existing road by considering the magnitude of change based on predicted traffic flows which determined moderate adverse changes in air quality would be experienced at properties within 50m of the alignment centreline.

3.5.2 Noise and Vibration

A qualitative assessment was undertaken considering the number of receptors within the proximity of the online dualling. Potential major adverse impacts were considered to relate to where receptors are present within 50m of the road and a potential moderate adverse impact where receptors are present within 50m to 100m of the alignment. A minor adverse impact was identified where receptors are present within 100m to 300m of the alignment. GIS was used to identify receptors within 300m of the online dual dualling centreline with receptors identified using the AddressBase Plus database.

Measurements (i.e., 50m, 100m and 300m buffers) were taken from the online dualling centreline showing approximately 1750 residential receptors within a 300m buffer of the online dualling. The receptors are shown on drawing A96PEA-AMAR-ENV-SWI-MP-LN-002001 in Appendix A.

In recognition of the presence of the existing road, additional complementary assessment utilised information on the change in traffic flows in 18hr Annual Average Weekday Traffic (AAWT) form, average speed and percentage of heavy vehicles. The change in noise exposure was calculated using the Calculation of Road Traffic Noise, Basic Noise Level (BNL) following DMRB HD 213/11 guidance for predicted traffic noise levels at a standard reference distance of 10m from the edge of the carriageway.

The calculation results and change in noise levels are tabulated in Appendix C Table C1. These show that D2APc (GSJ) online dualling has the potential to give rise to moderate adverse impacts in the short-term (opening year) and to minor/moderate adverse impacts in the long-term (15 years after the scheme opening).

3.5.3 People and Communities

The major impact on People and Communities for online D2APc (GSJ) dualling is the need to acquire and demolish residential property. Widening the A96 would require the acquisition and assumed demolition of 40 residential properties plus part of the gardens of a further 11 properties and also affects a community receptor, the police station at Blackhall Roundabout. Widening of Blackhall Road between the A96 and Burghmuir Drive (Morrisons) would also encroach into the Police Scotland car park area.

An aspiration to avoid demolition comes from the East of Huntly to Aberdeen scheme objective to avoid or minimise the impacts on People and Communities as part of Scheme Objective 6: “To avoid significant environmental impacts and, where this is not possible, to minimise the environmental effect on: - The communities and people in the

corridor". In addition, the Tier 2 Strategic Environmental Assessment (SEA)[1] also gave guidance on avoiding impacts on properties as follows:

- SEA criteria for Population and Human Health, outlined that the approach to improvement strategy option constraint analysis and impact assessment was to consider the "use of population extent (key centres/population areas) and density study areas to provide an indication of relative sensitivity to amenity effects from new roads and for increased risk of loss of or demolition of property".
- Detailed Assessment Findings – Inverurie B Inner: "The number of population centres and population density within this option is high and it is predicted that it will be difficult to avoid completely through route alignment due to the presence of the built-up area of Inverurie". The assessment stated that "the risk of effects on population and human health for this option was 'major adverse' due to potential effects on a high number of properties, which may not be avoidable".
- The 'option specific mitigation' stated that the "principle of avoidance should be adopted for key constraints including properties and designated areas identified in the option boundary. Where this is not possible more detailed environmental assessment as part of the DMRB process will inform future route alignment studies and project specific mitigation".
- Section 8.2, Mitigation, Population and Human Health stated "future road alignments to minimise need for property demolition and land take".

There is therefore an aspiration within the SEA to avoid the requirement for property demolition, although it does not rule out online options or demolition.

The DMRB Stage 2 option selection process for East of Huntly to Aberdeen has been developed taking account of identified significant constraints and groups of serious constraints. One of the significant High Impact Areas (HIA) constraints was the existing and proposed settlement boundaries and areas through Aberdeenshire Council (LDP) allocations, including but not limited to industrial/commercial/employment allocations and residential allocations, protected areas/reserved land. This was considered an HIA constraint because there would be an adverse impact upon local communities and proposed development areas.

At a strategic level, and from a project-specific basis, the need for property demolition has been considered undesirable with achieving Scheme Objective 6 to minimise impact on the environment including People and Communities. The need for property demolition is therefore considered a notable and significant impact. It is also considered that it is an impact that could otherwise be avoided and is unique to online dualling, unlike the requirement to acquire agricultural land for the scheme. Online dualling is therefore considered to perform poorly against Scheme Objective 6.1 to minimise the environmental effect on communities and people.

Between ch3450 and ch3600 there are major adverse impacts on private buildings and gardens affected and between ch3750 and ch4050 there are direct impacts upon the Police Scotland building and private buildings. There are major adverse impacts between ch4150 and ch5100 in relation to the loss of land from the golf course (a community facility) and there are major adverse impacts between ch3100 and ch3250 due to land

[1] www.transport.gov.scot/publication/tier-2-sea-environmental-report-a96-dualling-inverness-to-aberdeen/ and https://www.transport.gov.scot/media/39271/a96-tier-2-sea-environmental-report.pdf

take from a further community facility, John Sorrie Drive playing fields. The loss of land at the golf course would largely affect landscape screening but the widening would encroach onto and affect one of the teeing areas.

Elsewhere within the People and Communities assessment, moderate adverse impacts arise where there is a direct loss of Prime Agricultural Land (Class 3.1 or above) which occurs between ch0 to ch600 and between ch5350 and ch5500.

Between ch5350 and ch5500, moderate adverse impacts also arise due to impacts on the Core Path at Old Kemnay Road (Kemnay – Inverurie, reference 408.05) and Public Right of Way (GG55). Existing NMU routes that are currently grade separated such as that immediately west of Blackhall Roundabout would be affected by the widening, particularly during construction. Additional grade separated NMU routes at Old Kemnay Road and Kemnay Road may be required. It is understood Aberdeenshire Council have promoted stopping-up orders for these routes, however the crossings currently remain open. Closure would be required for online dualling resulting in an impact and long diversion routes or the need for new footbridges.

3.5.4 Landscape and Visual

Due to the density and location of residents in close proximity to the alignment between ch3150 to ch4900, there would be major adverse effects on existing landscape character and visual effects on receptors as a result of the road widening and the introduction of an elevated grade separated junction and retaining walls. There would also be a major adverse effect due to the new bridge crossing of the River Don (ch5200 to 5400). The new junction at Thainstone (ch6750 to ch7450) is significant in size and represents a major adverse landscape impact and visual effect on adjacent receptors. Elevated access roads are introduced in this location as new additional features.

There would be moderate adverse effects on visual receptors due to the introduction of the widened alignment and structures adjacent to residents. Removal of existing mature trees, plantation woodland and hedges located between the existing carriageway and residential properties also leaves the road exposed to visual receptors, with little potential for replacement landscape planting mitigation as part of the scheme.

Overall, most of the online alignment is considered to have moderate adverse impacts in relation to the Landscape and Visual assessment.

3.5.5 Policies and Plans

There are several locations where online dualling is assessed as having major adverse impacts, as it is within the Inverurie and Port Elphinstone Local Development Plan (LDP) settlement boundary between ch2650 and ch7700.

Major adverse impacts arise due to:

- Intersects land allocated as Green Network, ch2650 to ch7650, defined as ‘connected areas of green space and habitats such as parks, paths and woodlands (green networks) within and on the edge of our villages and towns’;
- Adjoining allocated housing land in Local Plan 2017, ch3400 to ch3600 and ch5300 to ch5450;
- Intercepts an application for the reinforcement of a 400kV Overhead Line, between ch3550 and ch3750, the overhead line being to the west of Inverurie, but the planning application boundary includes the construction access routes;

- Proximity to a consented dwelling house application (APP/2014/3086), ch3750 to ch3800;
- Proximity to allocated housing land in Local Plan 2017, ch3850 to ch4150;
- Proximity to protected recreational land, ch4150 to ch5000;
- Intersects a major mixed-use development including 737 houses (APP/2013/0267), ch5300 to ch5500;
- Alignment is adjacent to employment uses in the 2017 LDP (BUS10) ch6550 to ch7000 and (BUS6) ch7150 to ch7400;
- Intersects with land consented for a Sunday market (APP/2017/2192), ch7400 to ch7650 at Thainstone Mart; and
- Intersects existing employment land (BUS9) of the adopted LDP 2017, ch7400 to ch7750.

Moderate adverse impacts arise due to:

- Proximity to major consented housing development (APP/2017/3188), ch2200 to ch2650;
- Within 50m of land allocated in the 2017 LDP for housing (OP1), ch2500 to ch2650; and
- Proximity to three consented dwelling houses (APP/2015/1968), ch7700 to ch7750.

3.5.6 Cultural Heritage

There are major adverse impacts on cultural heritage receptors. There are direct effects on the Thainstone House Non-Inventory Designed Landscape (NIDL), a direct effect on the Category B Listed Building of Thainstone North Lodge (LB9153), and an impact on the setting of the same building. The major adverse impacts are between ch7200 and ch7450 at Thainstone. There are also setting impacts upon Balquhain Castle and Balquhain stone circle (SM3961), assessed as being major adverse, at the very western extent of the alignment, ch0 to ch250.

Moderate adverse impacts arise between ch6500 and ch6800 due to the impact on the setting of Bruce's Camp Hillfort (Scheduled Monument (SM)12523) and the impact on the setting of Broomend henge standing stones and symbol stone (SM18).

3.5.7 Water Environment

Between ch5200 and ch5450, there is a crossing of the River Don (medium-sized waterbody) and its floodplain which from a Road Drainage and Water Environment perspective, online dualling is assessed as having a moderate adverse impact.

3.5.8 Geology and Soils

It is considered that there are no major adverse impacts on geology and soils associated with online dualling. The mainline and the side road layout between ch6650 and ch7150 impact on soil and gravel resource and areas of potential contamination (landfill, artificial ground and a historical pit). This is considered a moderate adverse impact.

3.5.9 Materials

The materials assessment considers potential impacts and effects on material resources and the generation of waste. The use of materials is assessed as moderate adverse as both primary and imported materials are likely to be used in conjunction with recycled or site won material. There would be a saving in earthworks materials needed through re-use of the existing A96 as one of the carriageways of a dualling scheme, although this can only be achieved for approximately 3.6km and will be offset by the materials required for retaining walls at pinch points.

Waste generation is assessed as minor adverse as waste arisings from the scheme will be predominantly re-used onsite, on another section of the scheme or sent to recycling/composting facilities, minimising waste going to landfill. There are however significant land constraints within the online corridor through Inverurie which would limit re-use within the immediate vicinity.

3.5.10 Ecology

The crossing of the River Don between ch5250 and ch5350 is assessed as a moderate adverse impact due to the disturbance that would be caused to riparian habitats and species.

3.5.11 Agricultural, Forestry and Sporting Interests

A qualitative assessment has been undertaken to assess the agricultural, forestry and sporting impact of online D2APc (GSJ) dualling at Inverurie. The majority of the road does not pass through agricultural land but through land classed as urban or land that is not being used for agricultural purposes.

The number of individual agricultural land interests impacted by D2APc (GSJ) online dualling is expected to be small.

Thainstone Mart and other agricultural industries are located at the eastern extent of online alignment at ch7500 and this junction is regularly used by agricultural vehicles.

At the western and eastern extents of the D2APc (GSJ) online dualling, there are some agricultural land interests and fields. The Land Capability for Agriculture in Scotland Classifications categorises the land as being a mix of Classes 3.1, 3.2 or 4.2. There will be a direct loss of prime agricultural land (Class 3.1) between ch0 to ch750 and between ch5350 and ch5500, however the majority of the land required for online dualling is classed as non-prime agricultural land.

Between ch0 and ch2500 fields will be severed and some isolation of land may occur. This combined with the prime agricultural land present could have a moderate adverse impact on agricultural land interests in this area.

Between ch6000 and ch8000 some field boundaries will be lost but the remainder and majority of fields will be left intact. There are some woodland features in this area and some small areas may be lost. The new crossing of the River Don between ch5250 and ch5350 could impact fishing access while under construction but access should be similar to the existing structure once operational.

Overall, D2APc (GSJ) online dualling at Inverurie is expected to have a minor adverse impact.

3.5.12 Climate Change

Climate change is assessed across two aspects:

- Impacts of the project on climate, i.e. greenhouse gas (GHG) emissions; and
- Vulnerability of the project to climate change.

In relation to the emission of GHG, it should be understood that all construction and upgrade works results in the emission of GHGs, which arise during construction (from the extraction and manufacture of materials, and from construction processes) and in operation (through maintaining the asset, but also from road user vehicle emissions). In general, the scale of construction emissions from a roads project is primarily driven by the physical scale of the project – although some activities (such as construction of structures) result in greater overall emissions for a given length of road.

On this basis, the online dualling with grade separated junctions would result in emissions arising from construction. In themselves these are considered unlikely to be 'significant', based on the rationale that significance of emissions is considered in the context of overall national emissions, and the low risk that the project will compromise the ability of the Government to meet current legally binding carbon targets.

Construction emissions are likely to be outweighed by the user operational emissions, which arise from the use of motor vehicles. The aggregate emissions from vehicles are a product of total vehicle travel distances, queuing and congestion, and vehicle speed patterns. In the absence of significant congestion challenges, the overall route length is the primary factor in the scale of user emissions. Online dualling through Inverurie offers a direct route along the A96 corridor, although it is not significantly shorter than all of the route options under consideration. However, the emissions from motor vehicles would not be expected to be of a scale which compromises the ability of the Government to meet carbon targets (although much of the eventual impact depends on wider national strategy encouraging uptake of low emissions vehicles).

The other elements of operational emissions relate to the emissions arising from maintenance of road assets. It is likely that online dualling would result in smaller aggregate emissions than an option which resulted in a separate trunk road and local road, on the basis that only a single road would require maintenance and upkeep.

With regards to the vulnerability of the road to climate change, it is noted that the online dualling route has issues relating to drainage as set out in Section 3.4.5. With regards to wider vulnerability to extreme weather and a changing climate however, it is not expected that there will be significant vulnerabilities.

3.5.13 Human Health

The health assessment uses the conclusions from other topics (e.g. noise, air quality, landscape and visual) to inform the magnitude of impact on health determinants. Major impacts are generally assessed as high magnitude with moderate and minor impacts assessed as medium and low magnitude respectively. This is combined with the population sensitivity, which is a combination of population exposure and vulnerability, to determine the overall significance as either major, moderate or minor health effects.

The Air Quality assessment identifies major adverse changes in air quality associated with properties within 25m of the online dualling centreline and moderate adverse impacts typically affecting properties at a distance of 25m to 50m. There are no sensitive receptors within 25m due to demolition of properties and 110 No. within 25m to 50m of

the road centreline. A moderate to high magnitude impact combined with medium sensitivity resulting from the numbers affected and existing high rates of asthma hospitalisations in the Inverurie north and south areas compared with the surrounding data zones of Barrahill and Durno-Chapel of Garioch are assessed to result in a moderate to major adverse effect on health.

The Noise assessment concludes that online dualling has the potential to give rise to moderate adverse impacts in the short-term (opening year) and to minor/moderate adverse impacts in the long-term (15 years after the scheme opening). Low-medium magnitude noise impacts affecting a large number of people (approximately 1750 residential receptors within a 300m buffer of the online dualling) is assessed to result in moderate to major adverse health effects depending on proximity to the centreline.

Widening the A96 would require the acquisition and assumed demolition of 40 residential properties plus part of the gardens of a further 11 properties. The People and Communities assessment identifies this as having a major impact. It also identifies major adverse impacts between ch4150 and ch5100 in relation to the loss of land from the golf course (a community facility) and major adverse impacts between ch3100 and ch3250 due to land take from a further community facility, John Sorrie Drive playing fields. The magnitude of impact is considered to be high, but the sensitivity is assessed as medium as the numbers affected are relatively low. The significance of health effects is assessed to be major adverse given the magnitude of impact.

The Landscape and Visual assessment identifies that there would be major adverse effects on existing landscape character and visual effects on receptors as a result of the road widening and the introduction of an elevated grade separated junction and retaining walls, due to the density and location of residents in close proximity to the alignment between ch3150 to ch4900. Sensitivity is assessed to be medium to high due to the number of receptors in close proximity. This is assessed to result in major adverse effects on health.

Between ch2650 and ch7700 online dualling is identified as being within the Inverurie and Port Elphinstone LDP settlement boundary. This has the potential to introduce additional residential receptors that would potentially experience adverse impacts in relation to noise, air quality, and visual impacts and their associated effects on health.

It is also noted that widening the A96 to dual carriageway through Inverurie would limit the space available for potentially providing segregated NMU routes along the existing corridor parallel to the existing A96, particularly between Blackhall and Inverurie roundabouts; limiting the opportunities for beneficial effects on health arising from increased opportunities for active travel.

Overall, major adverse effects on human health would be expected with D2APc (GSJ) online dualling at Inverurie.

3.5.14 Environmental Summary

For online dualling there are a minimum of four major adverse impacts through most of Inverurie between ch3100 and ch5050. This rises to five simultaneous major adverse impacts for Human Health, People and Communities, Air Quality, Landscape and Visual and Policies and Plans between ch3150 to ch3250, ch3450 to ch3600, ch3800 to ch4050 and ch4350 to ch4900. There are also five simultaneous major adverse impacts for Human Health, Cultural Heritage, Air Quality, Landscape and Visual and Policies and Plans between ch7350 and ch7450. In total, there is 1.15km of the layout where there

are five simultaneous major adverse impacts and a further kilometre where four major adverse impacts coincide.

The requirement for property acquisition is an impact unique to online dualling through Inverurie and in the case of D2APc (GSJ) dualling, a large number of properties would be directly affected requiring the acquisition and assumed demolition of 40 residential properties and part of the gardens of a further 11. For Landscape and Visual, Air Quality and Noise and Vibration, major/moderate adverse impacts on a large number of receptors are predicted despite the presence of the existing A96.

Online dualling is therefore considered to perform poorly against Scheme Objective 6 to minimise the environmental effect of the layout, including performing particularly poorly against Scheme Objective 6.1 relating to People and Communities.

3.6 D2APc (GSJ) Traffic Assessment

Traffic modelling has been undertaken for the assessment based upon the A96 Corridor Road Assignment Model (CRAM), which is a SATURN model of the network constructed for use on the A96 Dualling Programme. It should be noted that the traffic model can only be run for end-to-end schemes, therefore the results of the modelling used in this assessment capture the total route benefits between the east of Huntly and Kintore.

The results are therefore not necessarily direct measures of the benefits of only online dualling at Inverurie. In some instances, it has been possible to ascertain values for online dualling at Inverurie, which is described in the commentary below to highlight the relevance to online dualling, but it has not been possible to do so for all measures.

The traffic assessment is also carried out comparing dualling schemes with a Do-Minimum scenario, which does not include dualling of the A96, although it does include other network improvements such as at Haudagain Roundabout in Aberdeen. The difference in performance is therefore being measured by comparing the performance of the existing A96 single carriageway road with a dual carriageway.

The assessment of the traffic performance is presented in Appendix D and generally shows that online dualling at Inverurie performs well against the scheme objectives, although as noted above this is as part of an end-to-end dualling scheme. Most of the benefit derives from upgrading the A96 from a single carriageway to dual which will achieve many of the scheme objectives such as reduced journey times, improved journey time reliability and increased overtaking opportunities through the inherent benefits provided by a higher standard of road geometry, improved junction configurations and higher speed limit.

These overall benefits of end-to-end dualling dilute local impacts. Commentary is therefore provided below to highlight specific characteristics of online dualling at Inverurie in relation to performance against scheme objectives.

3.6.1 Traffic Operation

Journey time savings (Scheme Objective 1.1) has been assessed as a major economic benefit however most of the benefit derives from the dualling and junction upgrades rather than being intrinsically linked to online dualling at Inverurie.

For Scheme Objective 1.5 (reducing conflict between strategic and local traffic), online dualling is considered to perform poorly against this objective. All traffic, both local and strategic including HGVs, would travel along the dual carriageway through Inverurie

passing between the communities on the northern and southern sides of the A96. In terms of the metric tabulated in Appendix D for this scheme objective, the concentration of local and strategic traffic in the same corridor is assessed as limiting the performance to a moderate benefit.

The dominant movement in the PM peak at Blackhall Road junction is the right turn from the A96 westbound into Inverurie. During the PM peak traffic modelling predicts that the westbound offslip would be nearing capacity.

Aberdeenshire Council's future LDP allocations may be influenced by the preferred route for the A96 dualling. The GSJ arrangement would have greater capacity compared to the existing roundabout and would therefore create the opportunity for additional future development on the south side of the A96 if so required.

3.6.2 Safety

The existing Blackhall Roundabout is an accident cluster site with one serious and four slight accidents occurring at the junction between 2014 and 2018. Providing a GSJ at Blackhall Road is consistent with the treatments of new junctions throughout the A96 dualling scheme. GSJs generally exhibit lower accident rates compared to at-grade junctions as the reduced complexity of traffic movements through the junction reduces the risk of accidents. However, the severity rate at GSJs tends to be higher than other junctions due to their higher traffic speeds.

The COBALT accident modelling tool used in the assessment predicts that with the GSJ in place, dualling the A96 between East of Huntly and Kintore would generate a net reduction in accidents occurring in the end-to-end scheme's area of influence by nearly 30 personal injury accidents per year.

Under the GSJ arrangement, NMUs could utilise a lengthened underpass to cross beneath the A96 at Blackhall. To accommodate the D2APc (GSJ) arrangement, the underpass would need to be extended and the footpath realigned and re-graded, making it a less attractive route for NMUs. Consequently, some NMUs may consider the roundabout beneath the elevated A96 as a more direct and attractive route, utilising the deflection islands as un-controlled at-grade crossing points. The risk of a vehicle entering or exiting the roundabout coming into conflict with NMUs crossing the junction is not taken account of in the COBALT accident analysis software. Alternatively, signalised NMU crossing facilities could be provided on the roundabout. This would however create additional delay at this junction, reducing the benefits associated with end-to-end journey time savings. Increasing the length of the underpass or inducing more conflicts between traffic and NMUs would be a consequence of online dualling, neither of which is desirable.

3.6.3 Active Travel

Widening the A96 to dual carriageway through Inverurie would limit the space available for potentially providing segregated NMU routes along the existing corridor parallel to the existing A96, particularly between Blackhall and Inverurie roundabouts. The corridor is constrained by adjacent properties which are subject to major adverse impacts and further widening for NMU provision would present further challenges and would exacerbate impacts.

In addition, online dualling intersects existing NMU routes where they cross the A96 at Old Kemnay Road and Kemnay Road. It has been assumed that grade-separated NMU

facilities would be provided at these locations, although they may not be as direct or attractive as the existing A96 at-grade crossings.

While the end-to-end assessment shows improvements against Scheme Objective 2.3 (Reduced potential conflicts between motorised and NMUs) and Scheme Objective 4 (Facilitate active travel in the corridor), online dualling along the constrained A96 corridor through Inverurie is considered challenging and offers few opportunities for NMU provision and is therefore considered to perform poorly against Scheme Objectives 2.3 and 4.

3.6.4 Accessibility and Economy

With online dualling at Inverurie, traffic between Kemnay and Inverurie would be required to use a longer route as Inverurie Roundabout is stopped up and traffic must divert via a new Thainstone Junction, which would add approximately 1.5km to journeys. Traffic travelling eastwards from Thainstone Business Park/Mart towards Aberdeen would also experience a similar increase in journey length as they would no longer have direct access from the A96 at Thainstone Roundabout.

The new Thainstone GSJ does however offer direct access to the proposed Crichie development site. The site is situated to the south of the existing A96 and is a mixed use residential, business and industrial allocation with over 700 new homes, community facilities, a primary school and 23 ha of employment land. However, as with the developments on the southern side of Blackhall Junction, the online dualling fails to reduce severance between Inverurie town centre and people living and working in Crichie with local and strategic traffic passing between the two communities when the dualling is complete.

Overall therefore, online dualling at Inverurie is considered to perform poorly in relation to Scheme Objective 3 to provide opportunities to grow the regional economy.

3.6.5 D2APc (GSJ) Traffic Assessment Summary

While the traffic assessment shows online dualling performs well against the majority of the scheme objectives, it is the upgrade of the road from single to dual carriageway from which most of these benefits derive. Online dualling is considered to perform poorly in relation to:

- Scheme Objective 1.5 - separating local and strategic traffic as all traffic uses the same corridor;
- Scheme Objective 2.3 and Scheme Objective 4 - relating to NMU/active travel as it offers less opportunity for NMU provision and has potential issues with additional NMU conflicts and changes to NMU routes including longer underpasses;
- Scheme Objective 3 - providing opportunities to grow the regional economy through increased traffic within the same corridor leading to greater severance between the centre of Inverurie and future developments.

3.7 D2APc (GSJ) Overall Summary

The provision of an online D2APc (GSJ) road at Inverurie requires the acquisition and assumed demolition of 40 residential properties and land from gardens of 11 further properties. Acquisition of land from six non-residential properties would also be required

including from Morrisons, Police Scotland and Inverurie Golf Club affecting one of the teeing areas.

Online dualling would result in a saving on earthworks operations through utilisation of the existing A96. Approximately 3.6km of the existing A96 could be re-used (out of a distance of 7.5km between Drimmies and Thainstone) although significant numbers of retaining walls would be required in lieu of earthworks at pinch points, a total of approximately 3.4km in length if using retaining walls to minimise the earthwork footprint.

Utilising the existing River Don bridge reduces works associated with the crossing through requiring only a new single carriageway width bridge to be constructed to carry westbound traffic. It does however present challenges in achieving treatment and attenuation of road drainage, which would require agreement with SEPA and Aberdeenshire Council. Major utility impacts exist within the corridor including 4.3km diversions of 300mm and 250mm diameter water mains which add to the increased construction and programme risk associated with construction within a constrained corridor adjacent to live traffic.

In relation to environmental impacts, there are five simultaneous major adverse impacts for People and Communities, Air Quality, Landscape and Visual, Human Health and Policies and Plans within the built-up area of Inverurie which would affect a large number of receptors despite the presence of the existing road.

The requirement for property acquisition and demolition is an impact unique to online dualling and in the case of D2APc (GSJ) dualling through Inverurie, a large number of properties would be directly affected.

While the traffic assessment shows online dualling performs well against most scheme objectives, it is the upgrade of the road from single to dual carriageway from which most of these benefits derive.

In relation to scheme objectives, online dualling is considered to perform poorly against:

- Scheme Objective 1.5 separating local and strategic traffic as all traffic is concentrated in the same corridor;
- Scheme Objective 1.6 to improve network resilience as it removes the option of using the existing A96 as a diversion route;
- Scheme Objectives 2.3 and 4 relating to NMU/active travel as it offers little opportunity for NMU provision in the corridor and presents issues with additional NMU conflicts and changes to NMU routes including longer underpasses;
- Scheme Objective 3 providing opportunities to grow the regional economy as traffic is concentrated along the existing corridor leading to greater severance between the centre of Inverurie and future developments;
- Scheme Objective 6 to minimise the environmental effect of the scheme as a result of major adverse impacts on a large number of receptors, including performing particularly poorly against Scheme Objective 6.1 relating to People and Communities given the requirement for property acquisition and demolition.

4 D2APb (At-Grade) Blackhall Road Junction

4.1 Road Layout Provision

As outlined in Section 1.4 and as part of the consideration of feedback following the public drop-in sessions in May 2019, supplementary design development and assessment has been undertaken of online dualling at Inverurie. This section considers to what extent reductions in the standard of road provided would lessen the challenges and impacts associated with online dualling at Inverurie and how this would accord with the scheme objectives.

As detailed in Section 3 of this report, the aim of the A96 Dualling Programme is to deliver a high-quality dual carriageway, from which a reduction in standard to include an at-grade junction would be a deviation. The primary area of constraint to D2APc (GSJ) online dualling at Inverurie is around Blackhall Road junction. Options for an at-grade junction at Blackhall Road have therefore been considered as part of this supplementary design development.

An at-grade junction at Blackhall Road would not be in accordance with the requirements of a D2APc (GSJ) road and would be classified as a D2APb layout, the requirements for which are given in Table 5. Prior to the recent DMRB amendments referred to in Section 3.1, a D2APb layout was referred to as Category 6. This report uses the new DMRB terminology. Cross-section requirements for D2APb (At-Grade) remain the same as the D2APc (GSJ) layout.

Table 5: D2APb (At-Grade) DMRB (CD 109) Requirements

Type of road	Edge treatment	Access treatment	Minor road treatment	Major junction treatment
D2APb (At-Grade)	Nearside - hard strip. Offside - hard strip.	Minimise number of direct accesses to avoid standing vehicles and concentrate turning movements.	No minor junctions at-grade. No gaps in the central reserve	At-grade roundabouts. Full grade separation.

4.2 D2APb (At-Grade) Junction Configuration

Traffic modelling and geometric design requirements were used to confirm the viability and requirements of an at-grade junction at Blackhall Road which found that enlargement and signalisation of the roundabout would be required to accommodate predicted traffic flows. Traffic modelling confirmed the following requirements for the junction:

- Blackhall Road junction requires to be a signalised roundabout with all approaches and circulatory carriageway under traffic control as predicted traffic flow patterns could not be accommodated without signalisation;

- a three-lane circulatory carriageway on the roundabout would be required, which can be accommodated within much of the existing paved width although the roundabout requires enlarging to accept the wider A96 dual carriageway entries and exits;
- dual two-lane approaches on the A96 East and A96 West require flaring to three lanes on the approach to the stop lines;
- as per the existing layout, the right turn from the A96 East to Inverurie requires two lanes on approach, around the circulatory carriageway and on exit into Inverurie;
- the left turn from Inverurie to the A96 East requires two lanes on Blackhall Road between the Burghmuir Drive (Morrisons) roundabout and Blackhall Roundabout. This is currently a single lane approach and would require widening of Blackhall Road between the two roundabouts which would encroach into the Police Scotland car park area.

Incorporating an at-grade signalised roundabout on a dual carriageway would require a speed limit to comply with Design Standards (DMRB Design Standard CD 116, Paragraph 4.1) as signal-controlled roundabouts are not permitted on 70mph roads. For a D2APb (At-Grade) layout which includes 1m hard strips, it is envisaged a 60mph speed limit would be imposed for around a kilometre on the approaches to the roundabout.

Blackhall Roundabout would require enlarging to accommodate the increased road widths connecting into the roundabout and to ensure geometric design requirements would be achieved, particularly with regard to entry deflection. This requires roundabout approach arms to be positioned such that the central roundabout island presents a physical constraint to be negotiated to encourage lower vehicle speeds. Conversely, the exit arm is normally pushed closer to the edge rather than centre of the roundabout, which facilitates vehicles leaving the roundabout. While some alignment flexibility exists further back from the roundabout, the entry approach from the A96 West would therefore ideally be pushed towards the south (Westburn Avenue) and the A96 East approach would ideally be pushed to the north towards Police Scotland.

A retaining wall has been incorporated in the D2APb (At-Grade) supplementary design to allow the A96 to the west of the roundabout to be pushed as far to the south as possible without encroaching into the properties at Westburn Avenue. Under this scenario, enlargement of the roundabout towards the northwest corner (at Morrisons) is required to accommodate the A96 West arm. It does however permit the south side of the roundabout to remain largely as existing, facilitating construction.

To the east of Blackhall Road, the Aquhorthies Circle/Davah Wood constraint is approximately 105m in length however it influences a longer section of carriageway given the need to shift the alignment to form a safe connection to Blackhall Roundabout. The A96 East would ideally be widened towards the Police Scotland building and Aquhorthies Circle for roundabout entry deflection requirements as described above.

With a retaining wall placed adjacent to the existing boundary at Davah Wood, the D2APb (At-Grade) dual carriageway footprint, plus construction and maintenance space, encroaches into the gardens at Aquhorthies Circle. Where there is no clash with buildings minimal existing garden would remain as shown on drawing A96PEA-AMAR-HGN-SWI-SK-CH-335055 in Appendix A.

Nine properties at Aquhorthies Circle would need to be acquired with assumed demolition for this D2APb (At-Grade) layout. Parts of gardens of a further nine properties at Aquhorthies Circle would be required (plus a further property near Old Kemnay Road as discussed in Section 3.1) meaning a total of parts of 10 gardens would be required for this D2APb (At-Grade) layout.

While the A96 East would ideally be pushed to the north to facilitate connection to the roundabout as discussed above, some alignment flexibility exists further back from the roundabout such that it would be possible to widen to the south (Davah Wood) side with an alignment to standard. While this would lessen the impact on Aquhorthies Circle, parts of the gardens at Aquhorthies Circle would still be required to enable the connection to the roundabout. Properties at Davah Wood would require acquisition given their access road would be removed, as shown on drawing A96PEA-AMAR-HGN-SWI-SK-CH-335055 in Appendix A. For widening to the Davah Wood side, a minimum of four properties would require acquisition and parts of gardens from a further 11 properties at Blackhall Road would be required (12 in total including part of a garden at Old Kemnay Road).

4.3 Description of D2APb (At-Grade) Dualling

A D2APb (At-Grade) online dualling layout at Inverurie incorporating an at-grade signal-controlled roundabout at Blackhall Road has been developed as part of this supplementary study to determine the extent to which a reduced standard would lessen the impacts.

At Thainstone and Inverurie Roundabouts, it is considered a grade separated junction would be provided under any online dualling layout as no property demolition would be required. This would accord with the scheme brief for a D2APc (Category 7A) dual carriageway, where possible as part of providing a high-quality dual carriageway between Inverness and Aberdeen and in recognition that it would be the closest junction to access Inverurie to and from Aberdeen.

The D2APb (At-Grade) supplementary design differs from the D2APc (GSJ) layout between ch3000 and ch4750 around Blackhall Road. The constraints and impacts outwith these chainages remain as described in Section 3 of this report.

The D2APb (At-Grade) layout is shown on the following drawings in Appendix A:

- A96PEA-AMAR-HGN-SWI-DR-CH-335062 – Sheet 1 of 3
- A96PEA-AMAR-HGN-SWI-DR-CH-335071 – Sheet 2 of 3
- A96PEA-AMAR-HGN-SWI-DR-CH-335064 – Sheet 3 of 3

The westbound carriageway would be situated to the south of the existing A96 until Blackhall Roundabout. Blackhall Roundabout would require to be enlarged to facilitate connections to the widened carriageways for the A96 East and A96 West and Blackhall Road exiting Inverurie. East of Blackhall Roundabout, the new carriageway is shown aligned between the constraint of Aquhorthies Circle/Davah Wood for approximately 600m, until the widening reverts to the south side of the corridor. From approximately ch4350, the new carriageway would be to the south of the existing A96 and meets the second River Don Bridge described in Section 3.

Blackhall Roundabout developed as part of the supplementary design would be enlarged to the north to accommodate the dual carriageway entry arms leaving much of the roundabout as existing, which would facilitate construction. Blackhall Road leaving

Inverurie would require widening to two lanes between the A96 and Burghmuir Drive, widening of which would encroach into the Police Scotland car park area. The roundabout would require to be signalised and would require a 60mph speed limit to be introduced on the A96 dual carriageway to comply with design standards.

The layout developed incorporates retaining walls to minimise the need for property acquisition, for example around Westburn Avenue and Davah Wood. Even with retaining walls however, property acquisition would be required at the Aquhorthies Circle/Davah Wood constraint. With an at-grade signalised roundabout in lieu of a grade separated junction at Blackhall Road, property acquisition is not avoided with between four and nine properties requiring acquisition with assumed demolition depending to which side the road is widened at Aquhorthies Circle/Davah Wood and up to a further 12 properties requiring acquisition of parts of their gardens.

4.4 D2APb (At-Grade) Engineering Assessment

4.4.1 Road Layout

In relation to road layout, D2APb (At-Grade) dualling is considered to have a major adverse impact as the incorporation of the at-grade signalised roundabout at Blackhall Road would be a reduction in standard from full grade separation. Grade separation of junctions where possible is envisaged within the A96 Dualling Programme junction strategy to provide a consistent high standard dual carriageway. Provision of an at-grade signalised roundabout at Blackhall Road would not be in line with this strategy and could be the only or first at-grade roundabout after long stretches of high-quality D2APc grade separated dual carriageway.

As with the D2APc (GSJ) layout, property demolition is required, which is considered under the People and Communities topic of the Environmental Assessment (Section 4.5.4).

4.4.2 Structures

Several of the same structures as the D2APc (GSJ) layout are required for the D2APb (At-Grade) layout (references C1 to C3 and C17 to C23 in Table 4). The structures required to form the D2APb (At-Grade) road corridor between ch3000 and ch4750 are set out in Table 6 below:

Table 6: D2APb (At-Grade) Layout - Structures

Structure Ref	Approx chainages	Structures
B1	3530 to 3590	60m long retaining wall to the rear of Westburn Avenue. Retained height 2m.
B2	3640 to 3700	Existing pedestrian underpass (approximately 22m long) west of Blackhall Roundabout to be extended under the widened A96 to approximately 40m long. Potential alternative of footbridge.

Structure Ref	Approx chainages	Structures
B3	3840 to 3850	Existing vehicle underpass (approximately 16m long) accessing Golf Course and Davah Wood to be extended to approximately 28m long.
B4 or B6	3870 to 4170 or 3870 to 4160	New retaining wall to retain existing ground (Davah Wood) above westbound carriageway. Retained height 2m to 2.5m. Length 290m or 300m depending to which side the road is widened.
B5 or B7	3865 to 4130 or 3865 to 3985	New retaining wall to retain eastbound carriageway above Aquhorthies Circle. Retained height 0.5m to 2.5m. Length 120m or 265m depending to which side the road is widened.

4.4.3 Geotechnical Engineering

The impacts associated with geotechnical engineering around the River Don and Drimmies described in Section 3.4.3 remain under this layout. While significant numbers of retaining walls also remain a requirement, there would be an improvement through a reduction in total length of retaining wall needed. Up to approximately 0.9km of retaining wall would be required for the D2APb (At-Grade) layout compared to approximately 3.4km for the D2APc (GSJ) layout. Construction of these adjacent to live traffic and properties would remain more complex than within a greenfield area, however there would be fewer in number and extent compared to the D2APc (GSJ) layout.

4.4.4 Utilities

The D2APb (At-Grade) signalised roundabout layout at Blackhall Road offers no reduction in impact on utilities as shown on drawing A96PEA-AMAR-VUT-SWI-DR-CU-335011 in Appendix A and described in Section 3.4.4. The impact remains major adverse through requiring extensive diversion of water mains for 4.3km and crossing a 1050mm diameter high pressure gas pipeline.

4.4.5 Hydrology and Drainage

Crossings of nine watercourses as described in Section 3.4.5.1 remains a requirement of the D2APb (At-Grade) layout. There is also the same major impact on the River Don and its flood plain as under the D2APc (GSJ) layout, arising from the positioning of bridge piers in the flood plain, which may require compensatory flood storage.

4.4.5.1 Highway Drainage

The D2APc (GSJ) arrangement features larger areas of carriageway than the D2APb (At-Grade) layout. Consequently, smaller basin provision would be required on the D2APb (At-Grade) layout. The reduction in basin capacity required is approximately a 16% reduction in volume.

The reduction in basin capacity under the D2APb (At-Grade) layout serves to simplify the basin arrangement in the vicinity of St James's Place (Upperboat Bridge) compared to the D2APc (GSJ) arrangement with only one basin required that would likely be able to be accommodated adjacent to the road.

The issue remains however regarding statutory compliance and the provision of attenuation/treatment for the re-use of the existing road in the vicinity of the River Don crossing as described in Section 3.4.5.2. The location of the basin that could be accommodated in this area also remains significantly remote from the A96 at around 500m south of the road.

4.4.6 Health and Safety Considerations

The majority of the items identified for the D2APc (GSJ) arrangement in relation to health and safety/CDM Regulations apply to the D2APb (At-Grade) layout. The primary difference is less complex construction through removal of retaining walls and bridges at the Blackhall Road area.

4.4.6.1 Live Traffic

The removal of retaining walls for the D2APb (At-Grade) layout compared to the D2APc (GSJ) layout would help to simplify construction activities, however issues with working in close proximity of live traffic would remain. Narrow traffic lanes on the existing A96 and likely implementation of a 40mph speed limit would remain a requirement as would time limited overnight or weekend closures of the A96 for activities such as demolition of Upperboat Bridge and lifting of beams for new bridge construction.

4.4.6.2 Construction and Maintenance Space

Working space between the earthwork footprint and the boundary fence for safe access for both construction and future maintenance is required regardless of the road layout adopted. While an increase in this space adjacent to gardens and to retaining walls would be desirable, the drawings for the D2APb (At-Grade) layout have been developed to show a 3m construction and maintenance strip to demonstrate the impact of a minimum provision.

D2APb (At-Grade) online dualling at Inverurie with a roundabout at Blackhall Road is considered to perform poorly in relation to improved network resilience (Scheme Objective 1.6) by concentrating strategic and local traffic in the same corridor. Furthermore, the D2APb (At-Grade) layout would increase the mixing of strategic and local traffic compared to the D2APc (GSJ) layout through the use of an at-grade rather than grade separated junction at Blackhall Road.

As with the D2APc (GSJ) layout, improved network resilience would not be realised as online dualling removes the redundancy offered by the existing A96 through Inverurie, for example for diversions during a road traffic incident or during a significant reduction in network capacity due to major planned maintenance.

4.4.6.3 Phasing

Indicative phasing drawings A96PEA-AMAR-HGN-SWI-SK-CH-335050 and A96PEA-AMAR-HGN-SWI-SK-CH-335077 in Appendix A illustrate a similar proposal for construction phasing to that for the D2APc (GSJ) layout. Traffic would be confined to narrow lanes to open construction space adjacent to the existing carriageway for widening of the earthworks during Phase 1, shown in this example northwards towards Aquhorthies Circle.

While the issues of extended construction operations and increased safety risk from online construction remain, consideration of an indicative phasing proposal indicates that there should be no insurmountable impediment to construction online while maintaining traffic flows, albeit within narrow lanes.

4.4.6.4 Utility Diversions

The complexity of works associated with the 4.3km diversion of 300mm and 250mm diameter water mains would be improved compared to the D2APc (GSJ) layout through the reduction in retaining wall construction in the same corridor. These would however remain complex due to the length of diversion and the need to work directly above the existing mains during site clearance and earthworks operations, for which protection measures would need agreement with Scottish Water.

4.4.6.5 Upperboat Bridge

The demolition of Upperboat Bridge described in Section 3.4.6.5 to accommodate the widened dual carriageway would remain a requirement for the D2APb (At-Grade) layout as does the potential for long duration closures and lengthy diversion routes.

4.4.6.6 River Don Crossing

Hazards associated with construction above the river and within the flood plain would remain but as with the D2APc (GSJ) layout, the need for a single River Don crossing to carry the new westbound carriageway only would be a benefit of online dualling in terms of construction complexity and programme.

4.4.6.7 Existing Underpasses

Extensions to three underpasses described in Section 3.4.6.7 would remain a requirement for the D2APb (At-Grade) layout. The length of the extensions to the existing pedestrian underpass and Davah Wood underpass at Blackhall would be reduced compared to the D2APc (GSJ) layout, although they would still necessitate a significant period to complete during which times closures and alternative access would be required.

4.4.7 Engineering Summary

The majority of the impacts identified for the D2APc (GSJ) arrangement apply to the D2APb (At-Grade) roundabout layout, including major issues with utilities diversions, potential statutory compliance challenges regarding road drainage treatment/attenuation around the River Don area and hazard minimisation under CDM regulations. While a reduced number of residential properties would need to be acquired under the D2APb (At-Grade) layout, the requirement for property demolition would not be avoided. Significant lengths of retaining wall would be required although it would represent a

reduction to a total of up to approximately 0.9km compared to 3.4km for the D2APc (GSJ) layout.

From an engineering perspective, there are limited benefits in the provision of an at-grade signalised roundabout at Blackhall Road for which a reduction in the standard of road provided and the introduction of a speed limit are considered additional major adverse impacts compared to the D2APc (GSJ) layout. It would also not be in line with the overall strategy of providing a consistent, high-quality dual carriageway as an outcome of the A96 dualling programme.

4.5 D2APb (At-Grade) Environmental Assessment

The results of the environmental assessment for the D2APb (At-Grade) layout are summarised below highlighting the key differences between the D2APb (At-Grade) and the D2APc (GSJ) layouts between ch3000 and ch4750. The assessment between ch0 and ch3000, and ch4800 to ch8000 is unchanged as these do not relate to the Blackhall Road area.

4.5.1 Air Quality

Using guidance detailed in DMRB HA 207/07 to determine the permanent impact of upgrading the online alignment, it is predicted that the impacts would be major adverse for the built-up area of Inverurie. The impact would be neutral for the sections of the layout east and west of Inverurie/Port Elphinstone, primarily based upon the density of receptors. There is no material change in this assessment between the D2APc (GSJ) arrangement and D2APb (At-Grade) layout as it is based on 50m to 200m buffers from the mainline centreline, which does not change significantly between the layouts.

The results of the DMRB IAN 174/13 Magnitude of Change, which considers the magnitude of change in air quality based on traffic flows, are included in Appendix B Tables B3 and B4. These show that online dualling with an at-grade signalised roundabout at Blackhall Road has the potential to give rise to major adverse and moderate adverse changes in air quality at sensitive receptor locations, depending on the design year and route options considered. There are six sensitive receptors within 25m of the centreline (excluding those demolished to accommodate the D2APb (At-Grade) layout).

The D2APb (At-Grade) layout compared to the D2APc (GSJ) arrangement shows a reduction from major adverse to moderate adverse changes in air quality for most of the route option combinations for those receptors within 25m of the online dualling centreline, although major adverse changes in air quality are predicted for one of the route option combinations.

The D2APb (At-Grade) signalised roundabout layout therefore shows an improvement over the D2APc (GSJ) arrangement largely as a result of the smaller footprint and less elevated nature of the GSJ layout. However, it remains as having major to moderate adverse impacts in terms of air quality on a large number of receptors and major to moderate adverse changes in air quality when considering the presence of the existing road and predicted change in traffic flows.

4.5.2 Noise and Vibration

A qualitative assessment undertaken in relation to the number of receptors within the proximity of the online dualling identified that there were approximately 1750 residential receptors within 300m of the layout. The buffer was based upon the road centreline and

therefore there is no material change in the numbers compared to the D2APc (GSJ) layout as the centreline does not change significantly between the layouts.

A quantitative assessment was completed using traffic data generated from traffic modelling. The results of this assessment are shown in Appendix C Table C2 showing the Basic Noise Levels (BNL) following DMRB HD 213/11 guidance, i.e. predicted traffic noise levels at a standard reference distance of 10m from the edge of carriageway.

Online dualling with an at-grade signalised Blackhall Roundabout has the potential to give rise to moderate adverse impacts in the short-term (i.e. opening) and to minor adverse impacts in the long-term (i.e. 15 years following opening, as per DMRB criteria), when using the traffic data. While predicted change in BNL shows smaller values for the D2APb (At-Grade) layout compared to the D2APc (GSJ) arrangement, the difference is insufficient to alter the magnitude of change assessed.

It should be noted that the assessment undertaken is based on the methodologies listed and does not consider the introduction of transverse bar markings and/or high friction surfacing which would increase road traffic noise. Such measures are likely to be required, for example as an outcome of a road safety audit as mitigation for the inclusion of a signalised roundabout on an otherwise D2APc (GSJ) dual carriageway.

4.5.3 People and Communities

The major impact on People and Communities for online dualling is the need to acquire and demolish residential property and to acquire parts of gardens. The D2APb (At-Grade) roundabout layout reduces the number of properties to be acquired with assumed demolition to between four and nine depending to which side of the existing A96 the road is widened, plus parts of gardens of up to a further 12 properties (including the part of the garden at Old Kemnay Road referred to in Section 3.1). This is therefore an improvement compared to the D2APc (GSJ) layout but the need for residential property acquisition and demolition means that this remains a major adverse impact. Widening of Blackhall Road between the A96 and Burghmuir Drive (Morrisons) would encroach into the Police Scotland car park area.

4.5.4 Landscape and Visual

In comparison to the D2APc (GSJ) layout, the Landscape and Visual assessment of the D2APb (At-Grade) arrangement identified reduced adverse impacts between ch3150 and ch4750, these being moderate adverse rather than major adverse impacts. The lower impact results from the mainline under the D2APb (At-Grade) layout which would no longer be elevated compared to the D2APc (GSJ) arrangement. Moderate adverse impacts arise however as a result of carriageway widening and the visual receptors affected. There is a moderate loss of woodland/trees/hedges and limited potential for landscape planting mitigation.

4.5.5 Policies and Plans

The majority of the impacts identified in Section 3.5.5 relating to Policies and Plans remain as the land take is within the Inverurie and Port Elphinstone Settlement Area, designated within the LDP. In comparison to the D2APc (GSJ) layout at Blackhall Road, impacts are downgraded from major adverse to moderate adverse impact at this location. All other major adverse impacts remain for the D2APb (At-Grade) layout.

4.5.6 Cultural Heritage

There is no change to the assessment for this topic between the D2APc (GSJ) and D2APb (At-Grade) layouts as all impacts (three major and two moderate) were identified outwith the Blackhall Road area.

4.5.7 Water Environment

No major or moderate impacts were identified around the Blackhall Road area for the D2APc (GSJ) layout, therefore there is no change to the assessment which identified a moderate adverse impact around the River Don.

4.5.8 Geology and Soils

There is no change to the assessment between the D2APc (GSJ) and D2APb (At-Grade) layouts for this topic, with a moderate adverse impact identified between ch6650 and ch7150 on soil and gravel resource and areas of potential contamination (landfill, artificial ground and a historical pit) which are outwith the Blackhall Road area.

4.5.9 Materials

There would be a reduction in materials associated with the smaller junction size at Blackhall Road between the D2APc (GSJ) and D2APb (At-Grade) layouts. This is not considered to change the overall assessment given the relatively localised extents compared to the scheme length. The D2APb (At-Grade) layout is therefore assessed as resulting in a moderate adverse impact on materials resources and minor adverse for waste generation.

4.5.10 Ecology

The moderate adverse impact identified for the D2APc (GSJ) layout remains around the crossing of the River Don between ch5250 and ch5350, due to the disturbance that would be caused to riparian habitats and species.

4.5.11 Agricultural, Forestry and Sporting Interests

There is no change to the assessment for this topic between the D2APc (GSJ) and D2APb (At-Grade) layouts as all agricultural impacts are outwith the Blackhall Road area.

4.5.12 Climate Change

The D2APb (At-Grade) layout would be expected to result in marginally lower construction emissions than the D2APc (GSJ) layout. However, the scale of this difference in emissions would be minor and, as noted for D2APc (GSJ) layout, construction emissions are likely to be outweighed by the user operational emissions arising from the use of motor vehicles. Overall, emissions from road vehicles would not be expected to be of a scale which compromises the ability of the Government to meet carbon targets (dependent upon wider national strategy regarding the uptake of low emissions vehicles).

It is not expected that there would be any difference in vulnerability to climate change between the D2APb (At-Grade) and D2APc (GSJ) layouts.

4.5.13 Human Health

The air quality assessment for the D2APb (At-Grade) layout identifies that impacts on air quality remain as moderate – major adverse. Therefore, the assessment of health effects remains moderate to major adverse as per the D2APc (GSJ) arrangement.

The Noise assessment concludes that noise impacts remain the same as for the D2APc (GSJ) arrangement. Therefore, the health effects remain as moderate to major adverse, depending on proximity to the centreline.

The People and Communities assessment concludes that the D2APb (At-Grade) option reduces the number of properties acquired for demolition which is an improvement compared to the D2APc (GSJ) layout. However, the impacts are still assessed as major adverse and the assessment of health effects therefore also remains as major adverse.

The Landscape and Visual assessment identifies that the D2APb (At-Grade) arrangement would reduce impacts to moderate adverse due to the layout no longer being elevated. Moderate adverse impacts still arise however as a result of carriageway widening and the visual receptors affected. Sensitivity is assessed to be medium to high due to the number of receptors in close proximity. This is assessed to result in moderate adverse effects on health.

Overall, major adverse effects on human health remains a feature of dualling through Inverurie at D2APb (At-Grade) standard.

4.5.14 Environmental Summary

Between ch3000 and ch4750, which is the extent of the D2APb (At-Grade) Blackhall Roundabout layout, there is approximately 700m where there are four simultaneous major adverse impacts for People and Communities, Air Quality, Human Health and Policies and Plans.

From the environmental assessment, the benefits of a D2APb (At-Grade) roundabout at Blackhall Road compared to the D2APc (GSJ) layout are:

- The effects on Air Quality are improved but remain as having major to moderate adverse impacts on a large number of receptors, when considering the presence of the existing road and predicted changes in traffic flows;
- For Noise and Vibration, the assessment predicts smaller Basic Noise Level values for the D2APb (At-Grade) layout compared to the D2APc (GSJ) arrangement, resulting in moderate short-term and minor long-term adverse impacts;
- The Landscape and Visual impacts reduce from major adverse around the Blackhall Road area as a result of removing the elevated section of the D2APc (GSJ) layout, although they are still considered moderate adverse as a result of carriageway widening and loss of landscape screening;
- The D2APb (At-Grade) layout reduces the number of properties to be acquired compared to the D2APc (GSJ) arrangement but given acquisition and demolition remains a requirement, it is considered that it performs poorly against Scheme Objective 6.1 to minimise the environmental effect on communities and people;
- Other aspects of the assessment remain largely the same as the D2APc (GSJ) layout and the same for the extents outwith the Blackhall Road area.

D2APb (At-Grade) online dualling with the inclusion of a roundabout at Blackhall Road is considered to remain poorly performing against Scheme Objective 6 to minimise the environmental effect of the scheme, including performing particularly poorly against Scheme Objective 6.1 relating to People and Communities.

4.6 D2APb (At-Grade) Traffic Assessment

The assessment table for the D2APb (At-Grade) layout is shown in Appendix D and as with the D2APc (GSJ) arrangement it generally shows beneficial and several major beneficial impacts against the scheme objectives. This is largely a result of the end-to-end nature of the modelling and comparison of dualling to the Do-Minimum situation with a single carriageway A96.

4.6.1 Traffic Operation

Journey time savings (Scheme Objective 1.1) has been assessed as a major economic benefit. As with the D2APc (GSJ) layout, most of the benefit derives from the dualling and junction upgrades rather than being intrinsically linked to online dualling through Inverurie. Delays associated with the at-grade signalised roundabout at Blackhall can result in around 30 seconds less journey time savings than the D2APc (GSJ) arrangement.

Under the D2APb (At-Grade) arrangement, the signalised roundabout limits the length over which overtaking can occur as vehicles are slowing and getting into lane on the approaches to and through the signalised roundabout. The D2APb (At-Grade) therefore offers less overtaking opportunities (Scheme Objective 1.3) than a D2APc (GSJ) arrangement.

For Scheme Objective 1.5 (reducing conflict between strategic and local traffic) all local and strategic traffic must pass through a signalised Blackhall Roundabout and this therefore inhibits its performance to a minor benefit compared to the existing roundabout.

Aberdeenshire Council's future LDP allocations may be influenced by the preferred route for the A96 dualling. There is development potential for land to the south of the existing A96 which will be less attractive through inclusion of an at-grade signalised roundabout with little spare capacity. The traffic signal timings on Blackhall Roundabout under the D2APb (At-Grade) layout have been optimised using LinSig traffic signal design software. This has minimised the green time on the southern arms of the signalised roundabout and maximised it on the A96 and the Inverurie arms to accommodate the dominant flows. Increasing the green time allocated to arms from the south of the signalised roundabout for potential future development would result in the junction becoming more congested. This would have a negative impact and increase traffic delays on the Inverurie arm of the signalised roundabout.

4.6.2 Safety

The existing Blackhall Roundabout is an accident cluster site with four slight personal injury accidents located at the junction. The serious accident rate on the existing A96 between Blackhall and Inverurie roundabouts is higher than the national average and the accident rate for all injury accidents and serious accidents is also higher than the regional average.

Providing an at-grade signalised roundabout is not consistent with the treatments of other proposed junctions throughout the A96 dualling scheme. Drivers who are unfamiliar with the area may not be expecting to encounter a signalised roundabout on this upgraded

dual carriageway and may therefore approach the junction at excessive speeds, increasing the potential for accidents associated with late braking, shunts and stop line overruns. Signalised roundabouts generally present higher accident rates compared to grade-separated junctions, albeit with lower severities. To reduce the risk of accidents occurring at this D2APb (At-Grade) junction, advance signing will be needed and speed reduction measures are likely to be required to increase awareness of the junction and reduce the potential for inappropriate approach speeds, particularly as the speed limit at and on approach to the roundabout is required to be lower than the general 70mph limit along the rest of the route.

The COBALT accident analysis software predicts that the D2APb (At-Grade) is comparable with the D2APc (GSJ), generating a reduction of nearly 30 personal injury accidents per year. However, the software is not sufficiently detailed to differentiate accident rates at individual junctions. In practice however, GSJs are a higher standard of junction as they reduce vehicle conflicts. The D2APb (At-Grade) layout is therefore considered to perform more poorly than a D2APc (GSJ) against Scheme Objective 2.1 to reduced accident rates and severity.

As with the D2APc (GSJ) layout, the pedestrian underpass at Blackhall Roundabout would need to be extended and the footpath realigned and re-graded to accommodate the D2APb (At-Grade) arrangement, albeit the length of underpass extension would be reduced. It would nevertheless be longer than the existing underpass and therefore a less attractive route for NMUs. Consequently, some NMUs may consider the signalised roundabout as a more direct and attractive route, utilising the traffic signals to cross in front of the stop lines. The exit arms of the roundabout however are not signalised and the risk of a vehicle coming into conflict with NMUs crossing on the exit from the junction is not taken account of in the COBALT accident analysis software. There is insufficient spare capacity in the signal timings to introduce at-grade signal controlled NMU crossings at the roundabout and the lack of desirable NMU crossing facilities may discourage active travel in this area.

4.6.3 Active Travel

As with the D2APc (GSJ) layout, widening the A96 to provide a D2APb (At-Grade) dual carriageway at Inverurie, would limit the space available for potentially providing segregated NMU routes parallel to the existing A96 between Blackhall and Inverurie roundabouts.

There would also be the same interaction as the D2APc (GSJ) layout with existing NMU routes at Old Kemnay Road, Kemnay Road and Thainstone junction. Whilst it is assumed that grade-separated NMU facilities would be provided at these locations, they may not be as direct or attractive as the existing A96 at-grade crossings.

While the end-to-end assessment shows improvements against Scheme Objective 2.3 (Reduced potential conflicts between motorised and NMUs) and Scheme Objective 4 (Facilitate active travel in the corridor), online dualling along the constrained A96 corridor through Inverurie is considered challenging and offers few opportunities for NMU provision and is therefore considered to perform poorly against Scheme Objectives 2.3 and 4.

4.6.4 Accessibility and Economy

Under both D2APc (GSJ) and D2APb (At-Grade) online dualling, Inverurie Roundabout is stopped up meaning traffic travelling between Kemnay and Inverurie or from Thainstone Business Park/Mart to Aberdeen is required to travel an additional 1.5km.

Likewise D2APb (At-Grade) dualling options fail to reduce severance between Inverurie town centre and people living and working in Crichie to the south of the A96 with both strategic and local traffic passing between the two communities. The at-grade signalised roundabout at Blackhall Road also limits the opportunity for future development to the south of Inverurie.

D2APb (At-Grade) online dualling at Inverurie is therefore considered to perform poorly in relation to Scheme Objective 3, providing opportunities to grow the regional economy.

4.6.5 D2APb (At-Grade) Traffic Assessment Summary

The D2APb (At-Grade) layout performs similarly to the D2APc (GSJ) arrangement regarding Scheme Objectives 2.3 & 4 as it offers little opportunity for NMU provision. For other scheme objectives, the differences in performance between the GSJ layout and at-grade signalisation at Blackhall Road have been identified as:

- Journey time savings (Scheme Objective 1.1) on the A96 through Inverurie are slightly lower than the D2APc (GSJ) layout as a result of the signalised roundabout at Blackhall Road through which all traffic needs to pass, although dualling continues to offer an overall major benefit compared to the Do-Minimum scenario;
- The COBALT Link and Junction Combined accident assessment used for the A96 dualling scheme is not sufficiently detailed to differentiate accident rates at individual junctions. There is a lower potential for accidents to occur at a GSJ than a signalised roundabout and therefore it is considered that the D2APb (At-Grade) layout performs more poorly than the D2APc (GSJ) against Scheme Objective 2.1 to reduce accident rates and severity and Scheme Objective 2.2 to reduced driver stress;
- Improvements to overtaking (Scheme Objective 1.3) on the approaches to the signalised roundabout is limited by vehicles having to get into the correct lane and slow down to negotiate the junction;
- For Scheme Objective 1.5 reducing conflict between strategic and local traffic, online dualling limits the end-to-end performance as a moderate benefit for D2APc (GSJ) because all traffic uses the same corridor. For D2APb (At-Grade), there is a further reduction to minor benefit as strategic traffic would no longer be grade separated at Blackhall Roundabout;
- There is development potential for land to the south of the existing A96 which could be less attractive through inclusion of an at-grade signalised roundabout with little spare capacity. The D2APc (GSJ) online dualling was considered to perform poorly against Scheme Objective 3 to provide opportunities to grow the regional economies. It is considered the D2APb (At-Grade) roundabout would represent a further reduction in performance against this objective.

4.7 Overall D2APb (At-Grade) Summary

The majority of the impacts identified for the D2APc (GSJ) arrangement apply to the D2APb (At-Grade) roundabout layout including major issues with utilities diversions, issues regarding road drainage treatment/attenuation around the River Don area and hazard minimisation under CDM regulations, although there would be a reduction in the extent of retaining walls required. Overall, the complexity of construction remains an issue for an at-grade signalised roundabout at Blackhall Road.

It would also require a reduction in the standard of road provided including junction signalisation and the introduction of a speed limit compared to D2APc (GSJ) dualling, which are considered additional major adverse impacts. It would also not be in line with the overall strategy of providing a consistent, high-quality dual carriageway as an outcome of the A96 dualling programme.

A D2APb (At-Grade) roundabout at Blackhall Road would reduce the Landscape and Visual impacts from major adverse although overall there are still considered to be moderate adverse impacts as a result of carriageway widening and loss of screening. A further benefit of the D2APb (At-Grade) layout is the reduction in the number of properties to be acquired but given acquisition and demolition remains a requirement, it is still considered that it performs poorly against Scheme Objective 6.1 to minimise the environmental effect on communities and people. Overall, a D2APb (At-Grade) layout is considered to perform poorly against Scheme Objective 6 to avoid or reduce the environmental impact.

From a traffic perspective, a change to a D2APb (At-Grade) roundabout at Blackhall Road compared to a D2APc (GSJ) layout results in more interaction between strategic and local traffic as all traffic has to negotiate the signalised roundabout; reduced journey time improvement due to delays at the signalised roundabout; lower safety performance due to a reduction in the standard provided; and increased delays and reduced performance in relation to economy as there is less capacity at the junction for future development to the south of Inverurie.

In relation to scheme objectives, D2APb (At-Grade) online dualling is considered to perform poorly against:

- Scheme Objective 1.5 to separate local and strategic traffic with the at-grade junction layout having a poorer performance than the GSJ as a result of the need for all traffic to interact at a signalised Blackhall Roundabout;
- Scheme Objective 1.6 to improve network resilience as it removes the opportunity to use the existing A96 as a diversion route;
- Scheme Objectives 2.3 and 4 relating to NMU/active travel as it offers little opportunity for NMU provision and has potential issues with NMU conflicts and changes to NMU routes including longer underpasses;
- Scheme Objective 3 to provide opportunities to grow the regional economy with the at-grade junction layout having a poorer performance than the GSJ as a result of offering less capacity for future development;
- Scheme Objective 6 to minimise the environmental effect of the scheme as a result of major adverse impacts on a large number of receptors. Compared to the D2APc (GSJ) layout, there would be a reduction in the number of properties to be acquired and reduced Landscape and Visual impacts. Overall environmentally, major adverse impacts remain including performing particularly poorly against Scheme Objective 6.1 relating to People and Communities as property acquisition and demolition remains a requirement for a D2APb (At-Grade) layout.

5 Consideration of Dual Carriageway Cross-Section

5.1 Road Layout Provision

Both D2APc (GSJ) and D2APb (At-Grade) layouts comprise a cross-section with 1m hard strips, generally referred to as a rural cross-section. Prior to the recent DMRB update referred to in Section 3.1, rural dual carriageways without hard strips were classified as Category 5 dual carriageways. Removal of hard strips on rural dual carriageways is no longer permitted in the updated DMRB (CD 109 Table A.2). Removal of hard strips on lower standard dual carriageways, generally referred to as urban dual carriageways, is however permitted along with a reduction in the central reserve width. Removal of hard strips would be deemed to constitute a D2UAP road (to DMRB CD 127) which can have at-grade or grade separated junctions.

An urban dual carriageway is defined as having a speed limit of 60mph or less. It is also defined as a road within a built-up area, the characteristics of which are influenced by the urban fabric and site-specific requirements. While the existing A96 is adjacent to the urban area of Inverurie, there is limited direct interaction between properties and the existing road due to earthworks and screening. The existing A96 also does not display features of roads in a built-up area, having limited direct access and the provision of hard strips that are associated with a rural road cross-section. The existing A96 is therefore not urban in nature but nevertheless, reductions to urban standards have been considered in this study for completeness to determine if these might lessen the challenges and impacts of dualling the existing A96 through Inverurie.

Design Standards also previously permitted a reduction in lane widths on new dual carriageways (DMRB TD9 paragraph 3.14) which would have reduced the mainline carriageways from 7.3m wide to 7.0m, saving a further 0.6m across both carriageways. This reduction in lane widths is no longer permitted under the updated DMRB and is therefore not considered.

Verge widths would need to accommodate drainage and with no hard strips adjacent to the running lanes, surface water flow path widths adjacent to the kerb would need to be kept to a minimum, likely requiring kerb drainage channels with access units and separate filter drains for subsurface drainage. A 2.5m verge is therefore considered the minimum appropriate to allow for drainage and associated other infrastructure such as road restraint system foundations, signage and ducting and lighting which would be required for the signalised roundabout and approaches. It also provides limited space for broken down vehicles to partly edge off the running carriageway given the absence of hard strips.

The cross-section for a D2UAP road at a minimum would therefore be, a mainline carriageway of:

- 7.3 m carriageways;
- 1.8 m central reserve;
- 2.5 m near side verges;

and for slip roads:

- 2.0m near side verge;

- 3.3m hard shoulder;
- 3.7m carriageway;
- 0.3m offside hard strip;
- 1m offside verge.

Where retaining walls are necessary, these are assumed to be 1m thick including facings, in addition to the dimensions of the road corridor identified above.

5.2 D2UAP (GSJ) Layout

The minimum width required for a D2UAP (GSJ) layout is 46m, inclusive of necessary retaining walls but excluding any construction/maintenance strip. This is similar to that considered during the earlier Online Dualling Feasibility and Appraisal Study referred to in Section 1.2.3, which recognised that in a constrained environment it is likely that reductions from a full rural cross-section would potentially be incorporated. Inclusion of an assumed minimum 3m construction and maintenance space would require an overall footprint of at least 52m.

To the east of Blackhall Road, the road corridor is 21m wide at the narrowest point and typically 24m between existing fence lines. The houses of Davah Wood and Aquhorthies Circle are approximately 43m apart, measured between the buildings with the local service road accessing the properties at Davah Wood located within this space. There is therefore insufficient space to accommodate a D2UAP (GSJ) layout at Blackhall Road without property acquisition and demolition even when considering a reduced cross-section. The reduction in width of a D2UAP (GSJ) layout compared to a D2APc (GSJ) arrangement results in 25 residential properties to be acquired with assumed demolition plus the acquisition of parts of gardens from a further 24 properties. A D2UAP (GSJ) layout is shown on drawing A96PEA-AMAR-HGN-SWI-SK-CH-335056 in Appendix A.

It is envisaged that reductions in cross-section would occur locally around the Blackhall Road area and that outwith the vicinity of the junction, the D2APc (GSJ) rural cross-section would be adopted. Abrupt changes in cross-section would need to be avoided to aid driver perception of the road layout and a suitable place for change from rural to urban cross-section would be to transition over the slip road taper/nose areas. The speed limit and urban cross-section would therefore likely be applied between the back of the hatched nosing areas and would occur over a relatively short length of around 800m, although this could give rise to lack of compliance and enforcement issues resulting in speeding and reduced safety on this narrow width section.

From an engineering perspective, the D2UAP (GSJ) layout represents a lower standard of road, requiring a lower speed limit than the D2APc (GSJ) layout and with more constrained construction and maintenance space. Therefore, such a layout is considered to be poorer performing with most of the issues associated with online dualling remaining:

- Road Layout – The removal of hard strips and narrower cross-section would reduce the level of service provided and reduce driver comfort by vehicles being required to run closer to the edge of the carriageway. It would also remove road space on both the nearside and offside for errant vehicles or drivers taking evasive action. There would be less space for broken down vehicles to edge off the running lanes and less space to accommodate surface water runoff that would need taken into account in the design of the drainage system. The D2AUP

(GSJ) layout is however fully compliant with design standards for a lower standard of road but would not be in line with the scheme brief for provision of a high-quality dual carriageway as a result of the use of the narrower urban cross-section width.

- Structures – the limited reduction in width of the D2UAP (GSJ) layout would have a marginal effect on the structures required. All structures associated with the D2APc (GSJ) layout referred to in Table 4 would remain a requirement including a substantial length of retaining walls.
- Geotechnical – the relatively short length of narrowed cross-section around Blackhall Road has little effect on geotechnical aspects compared to the D2APc (GSJ) layout. The impacts associated with geotechnical engineering around the River Don and Drimmies remain as does the requirement for approximately 3.4km of retaining walls.
- Utilities – there would be no saving in utility impacts resulting from the reduction in standard compared to the D2APc (GSJ) layout. Diversion of the 1050mm diameter National Grid High Pressure pipeline and 4.3km diversion of twin water mains would remain a requirement.
- Hydrology and Drainage – the limited reduction in width of the D2UAP (GSJ) layout would result in no significant difference in hydrology and drainage impacts compared to the D2APc (GSJ) layout. Nine watercourse crossings including of the River Don and its flood plain would remain a requirement. Major impacts would also remain in relation to the provision of road drainage to current standards within the constrained corridor and would require agreement with statutory bodies. The inclusion of a kerb drainage system as a result of removal of hard strips would remove a level of treatment required on the drainage system for water quality purposes and would need to be compensated elsewhere within the network prior to discharging to a watercourse.
- Health and Safety Considerations – the reduction in road width would increase the challenges with regards to construction of the permanent works within a constrained corridor adjacent to live traffic. The reduction in property acquisition compared to a D2APc (GSJ) layout would mean less land take would be available for construction and maintenance, although consideration of potential phasing indicates that construction of a D2UAP (GSJ) would be feasible as shown on Drawing A96PEA-AMAR-HGN-SWI-SK-CH-335069.
- Online dualling to D2UAP (GSJ) is considered to perform poorly in relation to Scheme Objective 1.6 for improved network resilience by concentrating strategic and local traffic in the same corridor and removing the redundancy offered by the existing A96 for diversions during incidents or future planned maintenance.

From an environmental perspective, the small decrease in cross-section width through Blackhall Junction is not considered to offer any significant mitigation of the impacts identified for the D2APc (GSJ) layout. The impacts for the D2UAP (GSJ) layout therefore remain as:

- Air Quality – major adverse impacts are predicted as result of the number of receptors in close proximity to online dualling. No significant difference in traffic flows is anticipated between the D2APc (GSJ) and D2UAP (GSJ) layouts and therefore moderate adverse changes in Air Quality for properties within 50m of the alignment centreline would remain predicted.

- Noise and Vibration – as the alignment centreline remains consistent, a large number of receptors remain identified within the vicinity of online dualling. The Basic Noise Level assessment based on traffic flows that are not significantly different to those for the D2APc (GSJ) layout mean impacts are anticipated to remain as moderate adverse in the short-term (opening year) and moderate/minor adverse in the long-term (15 years after the scheme opening).
- People and Communities – major and moderate adverse impacts on NMU routes, agricultural land and community facilities such as Police Scotland and Inverurie Golf Club remain a feature of the D2UAP (GSJ) layout. The major impact remains the acquisition and demolition of properties, which is considered notable and unique to online dualling. The D2UAP (GSJ) layout requires 25 residential properties to be acquired with assumed demolition and parts of gardens of a further 24 properties to be acquired.
- Landscape and Visual – most of the online alignment is considered to have moderate adverse impacts in relation to the Landscape and Visual assessment due to the introduction of the widened alignment and structures adjacent to residents. Removal of existing mature trees, plantation woodland and hedges located between the existing carriageway and residential properties also leaves the road exposed to visual receptors, with little potential for landscape planting mitigation as part of the scheme. The reduction in cross-section width through the Blackhall Road area is not considered to result in a significant reduction in impact as there remains substantial widening required compared to the existing layout.
- Policies and Plans – the small decrease in road width is not considered to alter the impacts compared to the D2APc (GSJ) layout. There therefore remain ten locations where online dualling is assessed as having major adverse impacts and a further three with moderate adverse impact.
- Cultural Heritage – major adverse impacts remain between ch0 to ch250, ch7200 to ch7450 and moderate adverse impacts between ch6500 to ch6800.
- Water Environment – the crossing of the River Don and its flood plain remains as a moderate adverse impact.
- Geology and Soils – between ch6650 and ch7150, a moderate adverse impact remains on a soil and gravel resource and areas of potential contamination.
- Materials – the small decrease in road width is not considered to alter the impacts compared to the D2APc (GSJ) layout. The impact on material resources remains as moderate adverse and as minor adverse in relation to waste generation.
- Ecology – the crossing of the River Don between ch5250 and ch5350 is assessed as a moderate adverse impact.
- Agricultural, Forestry and Sporting Interests – Loss of some agricultural land and field severance remain a feature of the D2UAP (GSJ) layout but overall, the impact remains minor adverse.
- Climate Change – As construction emissions are likely to be outweighed by the user operational emissions and there is no significant difference in traffic flows between the D2APc (GSJ) and D2UAP (GSJ) layout, no change in impact is expected. Overall, emissions from road vehicles would not be expected to be of

a scale which compromises the ability of the Government to meet carbon targets (dependent upon wider national strategy regarding the uptake of low emissions vehicles).

- Human Health – the human health assessment uses the results from other environmental topics eg noise, air quality, landscape and visual. These are unchanged between the D2APc (GSJ) and D2UAP (GSJ) layouts and therefore the assessment of the effects on human health remains major adverse.
- From an environmental perspective online dualling to D2UAP (GSJ) standard is considered to perform poorly against Scheme Objective 6 to minimise the environmental effect of the layout, including performing particularly poorly against Scheme Objective 6.1 relating to People and Communities.

In terms of traffic, it is not considered that there would be significant differences between the D2APc (GSJ) and D2UAP (GSJ) layouts. Specific characteristics of D2UAP (GSJ) online dualling at Inverurie are:

- Traffic Operation - there would be less journey time savings than the D2APc (GSJ) layout due to speed restrictions. Grade separating the junctions would improve reserve capacity compared to the existing roundabout however online dualling would continue to concentrate local and strategic traffic in the same corridor.
- Safety – there would be a reduced level of safety through removal of hard strips. Issues regarding increasing the length of the NMU underpasses or inducing more conflicts between traffic and NMUs would remain.
- Active Travel – Provision of NMU facilities along the corridor would remain challenging and may not be appropriate for the setting of an urban dual carriageway.
- Accessibility and Economy – Increased travel distances between Inverurie and Kemnay/Thainstone Mart would remain as would severance between Inverurie town centre and people living and working in Crichie south of the A96.

5.3 D2UAP (At-Grade) Layout

A reduced back of verge to back of verge width of 29.4m would be required for a D2UAP (At-Grade) footprint including an assumed 3m minimum construction and maintenance space. Although increased space between the road footprint and boundary is likely to be desirable adjacent to gardens and behind retaining walls, layouts have been developed based upon a 3m minimum construction and maintenance space to demonstrate the impact of the assumed minimum width required.

The narrow D2UAP (At-Grade) cross-section would be implemented through the pinch point at Davah Wood/Aquhorthies Circle. While the length of the constraint between the properties is approximately 105m, abrupt changes in cross-section should be avoided and therefore the reduced cross-section would run from Blackhall Roundabout past the Davah Wood/Aquhorthies Circle constraint for approximately 400m.

A further reduction in speed limit may be appropriate as the D2APb (At-Grade) dual carriageway cross-section with hard strips would be subject to a 60mph speed limit as discussed in Section 4.1 to comply with design standards. Likewise, a D2UAP (GSJ) layout would be subject to a 60mph speed limit. A D2UAP (At-Grade) layout would be a

lower standard of provision with a consequent reduction in safety and could potentially merit a further reduction in speed limit to 50mph.

The D2UAP (At-Grade) layout could be achieved by positioning the road footprint towards the existing highway boundary at Davah Wood. The outside edge of the 3m minimum construction and maintenance space would be positioned to coincide with the existing boundary to allow construction, operation and future maintenance to be delivered from within the road boundary. With only 21m between the existing highway boundary, this would result in the opposite side encroaching into the properties at Aquhorthies Circle, as shown on Drawings A96PEA-AMAR-HGN-SWI-DR-CH-335074 and A96PEA-AMAR-HGN-SWI-SK-CH-335073.

In this scenario, keeping the existing Davah Wood boundary and widening towards Aquhorthies Circle, the land to be acquired for the scheme would require the acquisition of seven properties with some potential demolition. In addition, part of the garden of the property at Old Kemnay Road referred to in Section 3.1 would need to be acquired.

Alternatively, the existing boundary at Aquhorthies Circle could be maintained and the road widened towards Davah Wood. While this would not clash with the houses at Davah Wood, the access road to the properties would be affected as shown on Drawing A96PEA-AMAR-HGN-SWI-SK-CH-335074. As vehicular access to four of the houses would no longer be provided, under this scenario all four properties would be acquired as well as acquisition of parts of a further four gardens (including part of the garden of the property at Old Kemnay Road).

To accommodate a D2UAP (At-Grade) layout at Blackhall Road, the acquisition and potential demolition of between four and seven residential properties, depending to which side of the existing A96 is widened, would be required as would acquisition of parts of gardens of up to a further four properties. The widening would also encroach into Police Scotland ground affecting the car park area and Inverurie Golf Club affecting one of the teeing areas.

From an engineering perspective, the D2UAP (At-Grade) layout represents a lower standard of road, requiring a lower speed limit and with more constrained construction and maintenance space than the D2APb (At-Grade) layout. Therefore, such a layout is considered to be poorer performing with most of the issues associated with online dualling remaining:

- Road Layout – The removal of hard strips and narrower cross-section would reduce the level of service provided and reduce driver comfort. There would also be a loss of road width for errant vehicles or drivers taking evasive action and less space for vehicles to edge off the running lanes in the event of breakdown. The D2AUP (At-Grade) layout is however fully compliant with design standards for a lower standard of road but would not be in line with the scheme brief for provision of a high-quality dual carriageway as a result of the use of the narrower urban cross-section width and provision of a roundabout at Blackhall Road.
- Structures – the limited reduction in width of the D2UAP (At-Grade) layout would have a marginal effect on the structures required compared to the D2APb (At-Grade) layout. All structures referred to in Section 4.4.2 would remain a requirement.
- Geotechnical – The impacts associated with geotechnical engineering around the River Don and Drimmies remain as does the requirement for approximately 0.9km of retaining walls.

- Utilities – there would be no saving in utility impacts resulting from the reduction in standard. Diversion of the 1050mm diameter National Grid High Pressure pipeline and 4.3km diversion of twin water mains would remain a requirement.
- Hydrology and Drainage – Nine watercourse crossings including of the River Don and its flood plain would remain a requirement. Major impacts would also remain in relation to the provision of road drainage to current standards within the constrained corridor and would require agreement with statutory bodies. Provision of kerb drainage units, arising from the removal of the hard strips, would result in less treatment of road-run-off that would need to be mitigated elsewhere within the drainage system.
- Health and Safety Considerations – the reduction in road width would increase the challenges with regards to construction of the permanent works within a constrained corridor adjacent to live traffic. The reduction in land available as a result of less property acquisition would partially offset the benefits from the reduction in the cross-section width, although consideration of potential phasing indicates that construction of a D2UAP (At-Grade) would be feasible as shown on Drawings A96PEA-AMAR-HGN-SWI-SK-CH-335071 and A96PEA-AMAR-HGN-SWI-SK-CH-335072.
- Online dualling to D2UAP (At-Grade) is considered to perform poorly in relation to Scheme Objective 1.6 for improved network resilience by concentrating strategic and local traffic in the same corridor, through mixing of traffic at the at-grade signalised roundabout and by removing the redundancy the existing A96 offers for diversions during incidents or future planned maintenance.

From an environmental perspective, there are not anticipated to be any significant changes between the D2UAP (At-Grade) and D2APb (At-Grade) layouts which include:

- major adverse impacts on Noise and Vibration and Air Quality due to the proximity to a large number of receptors. There are not anticipated to be any significant changes in traffic flows between the D2APb (At-Grade) and D2UAP (At-Grade) layouts. The assessment based on traffic flows for Air Quality would therefore result in major to moderate adverse impacts. Likewise, moderate short-term and minor long-term adverse Noise and Vibration impacts would remain.
- for the People and Communities assessment, property acquisition and potential demolition of residential properties would be a requirement and therefore major adverse impacts would remain for the D2AUP (At-Grade) layout.
- the reduction in width is not considered to change the Landscape and Visual assessment with moderate adverse impacts resulting from carriageway widening and loss of landscape screening.
- the human health assessment uses the results from other environmental topics eg noise, air quality, landscape and visual. These are unchanged between the D2APb (At-Grade) and D2UAP (At-Grade) layouts and therefore the assessment of the effects on human health remains major adverse.
- other aspects of the environmental assessment remain largely the same under all online dualling scenarios as these predominantly occur outwith the Blackhall Road area. Online dualling with the inclusion of a roundabout at Blackhall Road and narrowed cross-section is considered to remain poorly performing against Scheme Objective 6 to minimise the environmental effect of the scheme,

including performing particularly poorly against Scheme Objective 6.1 relating to People and Communities.

In terms of traffic impacts, it is not considered that there would be significant differences between D2APb (At-Grade) and D2UAP (At-Grade) layouts. Specific characteristics of D2UAP (At-Grade) online dualling at Inverurie are:

- Traffic Operation – there would be less journey time savings than a grade separated arrangement due to speed restrictions and from the inclusion of a roundabout at Blackhall Road. Local and strategic traffic would remain concentrated in the same corridor with all traffic mixing at a signalised Blackhall Roundabout.
- Safety – there would be a reduced level of safety of the road compared to a D2APc (GSJ) arrangement resulting from the narrower cross-section in addition to the greater potential for accidents as a result of the inclusion of a roundabout at Blackhall Road. Issues as described in Section 4.6.2 would remain regarding increasing the length of the NMU underpasses or inducing more conflicts between traffic and NMUs.
- Active Travel – Challenges associated with the provision of NMU facilities as described in Section 4.6.3 would remain and potentially be increased given less land would be acquired.
- Accessibility and Economy – Increased travel distances between Inverurie and Kemnay/Thainstone Mart would remain as would severance between Inverurie town centre and people living and working in Crichie south of the A96.

5.4 D2UAP Overall Summary

A reduction in cross-section width through the removal of hard strips to a D2UAP dual carriageway for both a grade separated layout and an at-grade signalised roundabout at Blackhall Road would not be in line with the overall strategy of providing a consistent, high-quality dual carriageway as an outcome of the A96 dualling programme. The removal of the hard strips and narrower cross-section would reduce the level of service provided and reduce driver comfort. There would also be a loss of road width for errant vehicles or drivers taking evasive action and less space for vehicles to edge off the running lanes in the event of breakdown.

While the narrower cross-section would result in less property acquisition and demolition than providing a D2AP cross-section with hard strips, it would remain a requirement for both scenarios. Indeed, all layouts for online dualling at Inverurie would result in property acquisition with some potential demolition.

There would be few changes to other predicted impacts of a D2UAP (GSJ) arrangement compared to a D2APc (GSJ) layout. Similarly, there would be little change to predicted impacts for a D2UAP (At-Grade) arrangement compared to a D2APb (At-Grade) layout. The D2UAP layouts would represent a further reduction in standards compared to providing a grade separated junction with poor performance against:

- Scheme Objective 1.5 separating local and strategic traffic;
- Scheme Objective 1.6 to improve network resilience as it removes the option of using the existing A96 as a diversion route;

- Scheme Objectives 2.3 and 4 relating to NMU/active travel as it offers little opportunity for NMU provision and has potential issues with additional NMU conflicts and changes to NMU routes including longer underpasses;
- Scheme Objective 3 providing opportunities to grow the regional economy through concentrating increased traffic along the existing corridor leading to greater severance between the centre of Inverurie and future developments;
- Scheme Objective 6 to minimise the environmental effect of the scheme as a result of major adverse impacts on a large number of receptors, including performing particularly poorly against Scheme Objective 6.1 relating to People and Communities given the requirement for property acquisition and demolition.

6 Cost and Programme Considerations

6.1 Costs

Online dualling at Inverurie may offer cost savings compared to full new offline construction, with progressively more savings as the standard of provision is lowered, although the economic benefits of the scheme in those instances would also reduce.

Some saving may be anticipated as a result of the length of online dualling, although the alignment through Inverurie is only 200m or so shorter than the proposed Orange route option, therefore the reduction in length does not offer any intrinsically significant saving in this regard.

The main cost savings would arise from re-use of the existing A96 where possible, in the case of the developed layouts as the new eastbound carriageway. This can be achieved over approximately 3.6km, which in the context of the East of Huntly to Aberdeen scheme, is around 10% of the length of the end-to-end alignments. Works would however be required to construct the additional carriageway alongside the existing which would offset the saving of re-using the existing road. This gives a measure of the degree to which online dualling at Inverurie might influence costs, although actual savings would be linked to the reduction in construction works and associated costs.

It is anticipated that the existing A96 forming the eastbound carriageway would be subject to pavement reconstruction and renewal of drainage and other finishes to comply with current standards and in recognition that much of the current infrastructure would otherwise be life-expired by 2030, requiring intervention particularly if the road is to continue to function as the main trunk road carrying strategic, local and HGV traffic.

The re-use of the existing A96 would however offer savings in earthwork quantities, requiring only excavation/filling for the new westbound carriageway. While only around half the earthworks construction would be needed, the earthworks savings would not constitute a 50% reduction in cost as retaining the existing A96 as the eastbound carriageway is achieved for approximately 3.6km out of the 7.5km distance between Drimmies and Thainstone. Further cost savings would be offset by substantial lengths of retaining walls at pinch points amounting to approximately 3.4km in total for a GSJ layout.

Less land would also need to be acquired as a result of re-using the existing road although savings in the area of agricultural land needed for an offline dual carriageway would be offset by the higher costs associated with property acquisition.

Savings for the River Don crossing would be realised given only a single structure would be required to carry the new westbound carriageway.

There would be additional costs from online dualling such as significant utility diversions (primarily two 4.3km water main diversions) associated with the online upgrade which would not be required for an offline route with less utility interaction. More extensive traffic management and construction prolongation for working in a constrained corridor with live traffic would also add to the cost.

The overall cost saving for D2APc (GSJ) online dualling at Inverurie is estimated to be in the region of 5% in the context of the cost of an end-to-end scheme. Removing the requirement for works associated with grade separation at Blackhall Road for a D2APb (At-Grade) layout would offer more savings primarily through a reduction in structures, earthworks and pavement costs. It is considered that further savings amounting to an

approximate total of 10% of overall end-to-end scheme costs may be achieved, although given the difference in standards and junction provision this is not a wholly like-for-like comparison.

Additional delays to traffic would reduce the performance and economic benefits of a D2APb (At-Grade) layout. Traffic modelling has indicated that the reduction in benefits would be of a magnitude such that a reduction in costs associated with a lower standard of provision would result in a similar Benefit/Cost Ratio (BCR) as full grade separated provision. Accepting a lower standard of road would therefore result in no significant difference in economic performance to offset the reduced correlation with the scheme objectives.

Given the potential level of savings anticipated, substantial investment would still be required to provide online dualling through Inverurie even including a signalised at-grade junction at Blackhall Road. This investment would fall short of realising the aspiration for a consistent, high-quality dual carriageway between Inverness and Aberdeen on one of the busiest sections of the A96.

Savings for a D2UAP (GSJ) layout would be as a result of a slightly reduced width, still requiring property acquisition and demolition. Savings associated with the reduced width would be marginal as would the reduction in land costs which generally form a small proportion of overall scheme costs.

Overall, online dualling at Inverurie would be expected to offer a small cost saving for a D2APc (GSJ) layout while a reduction to D2APb (At-Grade) with an at-grade junction at Blackhall Road would offer no significant economic difference from the lower standard provision. This would also be the case for D2UAP grade separated and at-grade layouts.

6.2 Programme

In relation to delivery of a dualling scheme, whichever preferred option is selected, the same process would be required:

- Completion of DMRB Stage 2 to identify the preferred option;
- Undertake DMRB Stage 3 design and assessment to develop the preferred route, leading to publication of the draft scheme Orders and Environmental Impact Assessment Report;
- Completion of statutory processes including a potential Public Local Inquiry (PLI) if required;
- Procurement; and
- Construction

Online dualling at Inverurie would not shorten either the completion of DMRB Stage 2 or the Stage 3 timescale. Indeed, this supplementary study is additional to the DMRB Stage 2 assessment work being undertaken on the remaining route options but is considered necessary given the importance of addressing feedback appropriately.

DMRB Stage 3 will require site investigations (topographical, geotechnical and environmental surveys) plus further community engagement including with those directly affected by the preferred option, the timescale of which would not be significantly affected by incorporating a relatively short length of existing carriageway. In relation to potential

objection resolution and PLI, there is the potential for an increased timescale given the larger number of receptors in the vicinity of online dualling at Inverurie.

Online construction would typically be prolonged in comparison to comparable offline construction given the more constrained nature of an online corridor and the need to maintain traffic flows. While there would be some savings in timescales associated with a reduction in the works required, principally earthworks construction and the smaller River Don crossing, any such saving is not considered to be substantial as it would at least be partially offset by the increased phasing required for online construction. Major utility diversions required for online dualling, primarily 4.3km of twin water main diversion, would also be a significant programme risk during construction.

In relation to programme therefore, no significant savings on the overall programme are anticipated given the relatively modest construction savings which could only be realised towards the end of a design, assessment and statutory objection/procurement process that cannot readily be shortened.

7 Summary and Conclusions

7.1 Summary of Supplementary Study

Following public feedback, a supplementary study into the use of varying standards for online dualling at Inverurie has been undertaken to determine the impacts and performance in relation to the scheme objectives, including to what extent reductions in standard would lessen the impacts and challenges.

A D2APc (GSJ) dual carriageway with full grade separation in line with the scheme brief and aspiration for a high-quality dual carriageway has been considered. A D2APb (At-Grade) layout incorporating an at-grade signal-controlled roundabout at Blackhall Road has also been considered, which to comply with design standards would require a 60mph speed limit.

Further reductions in the cross-section provision through removal of hard strips and narrower central reserve to urban D2UAP standard has also been considered for both grade separation at Blackhall Road and an at-grade signalised Blackhall Roundabout.

The results of the study are summarised in Appendix E.

7.2 D2APc (GSJ) Dual Carriageway Layout

The layout would require the acquisition and assumed demolition of 40 residential properties plus acquisition of parts of the gardens from a further 11 properties to accommodate a D2APc (GSJ) online dual carriageway at Inverurie. The requirement for property acquisition and demolition is considered a notable impact unique to online dualling.

Online dualling with re-use of the existing A96 would result in benefits primarily in earthworks operations by limiting earthworks widening to that required to add a single carriageway, rather than the earthworks operations required to provide full new dual carriageway width. The arrangement of adding a new carriageway alongside the existing could be achieved for approximately 3.6km (out of a total section length of 7.5km considered between Drimmies and Thainstone). The savings in earthwork operations would be partially offset by the need for substantial lengths of retaining walls at pinch points along the corridor, a total of approximately 3.4km in length.

Savings in works associated with the River Don crossing would also be achieved as it is anticipated that the existing bridge would be retained to carry the eastbound carriageway and that a new bridge would need to be constructed to carry only the new westbound carriageway.

Overall, the benefits of reduced construction activities have been estimated to translate to a cost saving in the region of 5% in the context of the overall cost of an end-to-end scheme.

Construction operations would be required in a constrained corridor adjacent to live traffic. There would also be major utility impacts within the corridor including 4.3km diversions of 300mm and 250mm diameter water mains. The re-use of the existing River Don bridge presents challenges in achieving treatment and attenuation of road drainage, which would require agreement with SEPA and Aberdeenshire Council.

In relation to environmental impacts, there are five simultaneous major adverse impacts for People and Communities, Air Quality, Landscape and Visual, Human Health and

Policies and Plans within the built-up area of Inverurie which would affect a large number of receptors despite the presence of the existing road.

While the traffic assessment shows online dualling performs well against most of the scheme objectives, it is the upgrade of the road from single to dual carriageway from which most of these benefits are derived.

In relation to scheme objectives, online dualling is considered to perform poorly against:

- Scheme Objective 1.5 separating local and strategic traffic as a result of concentrating traffic in the same corridor;
- Scheme Objective 1.6 to improve network resilience as it removes the opportunity to use the existing A96 as a diversion route;
- Scheme Objectives 2.3 and 4 relating to NMU/active travel as it offers little opportunity for NMU provision in the corridor and presents issues with additional NMU conflicts and changes to NMU routes including longer underpasses;
- Scheme Objective 3 providing opportunities to grow the regional economy as traffic is concentrated along the existing corridor leading to greater severance between the centre of Inverurie and future developments;
- Scheme Objective 6 to minimise the environmental effect of the scheme as a result of major adverse impacts on a large number of receptors, including performing particularly poorly against Scheme Objective 6.1 relating to People and Communities given the requirement for property acquisition and demolition.

7.3 D2APb (At-Grade) Dual Carriageway Layout

From an engineering perspective, there are limited benefits in the provision of an at-grade junction at Blackhall Road. Compared to a D2APc (GSJ) layout, there would be a reduction in the standard of junction provided and the introduction of a speed limit. These are considered as additional major adverse impacts that would not be in line with the overall strategy of providing a consistent, high-quality dual carriageway as an outcome of the A96 dualling programme. While there would be savings in earthworks operations including reduced lengths of retaining walls and the savings associated with the River Don Crossing, major impacts would remain in relation to construction within a constrained corridor leading to challenges for drainage provision to current standard and the requirement for substantial utility diversions.

Environmentally, a D2APb (At-Grade) junction compared to a D2APc (GSJ) at Blackhall Road would reduce the Landscape and Visual impacts and reduce the number of residential properties to be acquired with assumed demolition to between four and nine, plus acquisition required of parts of the gardens of up to a further 12 properties. Demolition therefore remains a requirement and a major adverse impact. Other environmental impacts associated with online dualling are not considered to be improved significantly with four simultaneous major adverse impacts for People and Communities, Air Quality, Human Health and Policies and Plans.

From a traffic perspective, a change to a D2APb (At-Grade) roundabout at Blackhall Road results in more interaction between strategic and local traffic compared to a D2APc (GSJ) layout. There would also be reduced journey time improvement due to the signalised roundabout, lower safety performance due to a reduction in the standard provided and reduced performance in relation to economy as there is less capacity at the junction for future development to the south of Inverurie.

In relation to costs, removing the requirement for works associated with grade separation at Blackhall Road would be expected to offer savings totalling in the region of 10% of an overall end-to-end scheme cost. However, additional delays to traffic would reduce the performance and economic benefits. Accepting a lower standard of road would therefore not result in any significant difference in economic performance to offset the reduced correlation with the scheme objectives.

Overall, an at-grade signalised roundabout at Blackhall Road is not considered to offer a sufficient reduction in impacts compared to a grade separated layout to offset the decrease in performance and safety resulting from the lower standard provided. As with the D2APc (GSJ) layout, the D2APb (At-Grade) layout performs poorly against Scheme Objectives 1.5, 1.6, 2.3, 3, 4 and 6.

7.4 D2UAP (GSJ & At-Grade) Layouts

A further reduction in standard to D2UAP (GSJ), which incorporates a reduced cross-section through removal of hard strips and narrower central reserve, has also been considered. While property impacts would be reduced compared to a D2APc (GSJ), acquisition and assumed demolition of 25 residential properties would be required as would acquisition of parts of a further 24 gardens. Such a layout is considered to offer little saving compared to a D2APc (GSJ) dual carriageway while retaining the impacts and reduction in performance against scheme objectives, at a lower standard of provision.

A D2UAP (At-Grade) layout reduces the footprint of the dual carriageway by removal of grade separation at Blackhall Road and narrowing of the cross-section. Even with this reduction in standard and with a 3m minimum construction and maintenance space, acquisition and potential demolition of between four and seven properties is required along with acquisition of parts of gardens from up to a further four properties. The lower standard D2UAP (At-Grade) dualling is not considered to offer significant reductions in impacts compared to the D2APb (At-Grade) layout and therefore results in a comparable reduction in performance against scheme objectives.

7.5 Conclusion

Online dualling at Inverurie is considered to perform poorly against the scheme objectives and to have impacts on a large number of receptors including the need for residential property acquisition and demolition. It is considered that the impacts cannot be offset sufficiently through reducing standards from that detailed in the scheme brief for the provision of a consistent, high-quality dual carriageway as an outcome of the A96 Dualling Programme.