

Buchan Sustainable Transport Study

Preliminary Options Appraisal Report

Campaign for North East Rail and Aberdeen & Grampian
Chamber of Commerce

AECOM in partnership with Stantec UK Limited

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Quality information

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1. Introduction

Background and Purpose of the Study

The Campaign for North East Rail (CNER), in partnership with Aberdeen and Grampian Chamber of Commerce (AGCC) commissioned AECOM, in partnership with Stantec, to undertake an appraisal of the strategic transport links between Dyce, Ellon, Fraserburgh and Peterhead in north east Aberdeenshire in line with Scottish Transport Appraisal Guidance (STAG). Grant funding was awarded through Phase 1 of the Scottish Government’s Just Transition Fund.

Several previous studies have considered options for improvements in the study area, including:

- **Fraserburgh and Peterhead to Aberdeen Strategic Transport Study Pre and Part 1 STAG Appraisal¹** (2014 - 2016) – this multi-modal study identified and appraised options for improving strategic transport connections between Fraserburgh, Peterhead and Aberdeen. The final report ultimately presented two option packages: a ‘Road and Bus Option Package’ and a ‘Rail and Bus Option’ Package
- **Fraserburgh and Peterhead to Aberdeen Strategic Transport Study: STAG Part 1 Plus Road and Rail Studies** (2017) – following the completion of the study above, separate road-based and rail-based studies further defined the respective Road and Rail Option Packages in preparation for a STAG Part 2 Appraisal and each included a review of the supporting data from the STAG Part 1, additional new data analysis, and a STAG appraisal of the Option Package

Since those studies were completed, there have been wider changes that have affected travel in the area, including the opening of the Aberdeen Western Peripheral Route (AWPR) and Balmedie-Tipperty (B-T) Dualling in 2019; new housing and employment land allocated within the Aberdeenshire Local Development Plan (LDP); and significant changes in the policy landscape.

Study Area

The study is being delivered in parallel with the A90(N) / A952 study, which is also an appraisal of transport accessibility and connectivity on the strategic transport links to and from Fraserburgh and Peterhead.

The A90(N) / A952 appraisal is being taken forward by Nestrans, the statutory Regional Transport Partnership for North East Scotland, covers a similar study area to this commission (see Figure 1-1) and is focussed on short-to-medium term improvement options. This study is examining the potential of longer-term improvement options.

There is, however, significant overlap between both studies, particularly at the Case for Change Stage. Therefore, to deliver efficiencies, relevant outputs from the data analysis have been shared and some aspects of the public and stakeholder engagement programme have been delivered jointly.

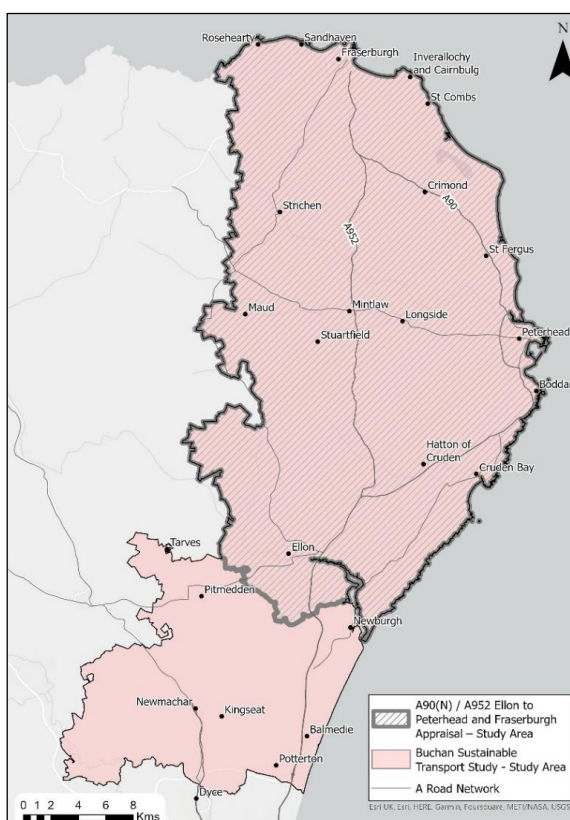


Figure 1-1: Study Area

¹ Now referred to as the Initial Appraisal: Case for Change and Preliminary Options Appraisal

Purpose of the Report

The purpose of this report is to detail the analysis and findings from the Preliminary Options Appraisal stage of the study. This is the third stage of the Transport Appraisal in line with STAG guidance and is a preliminary appraisal of options that could address the evidenced problems and help realise the opportunities across the study area.

The study has also undertaken an economic value for money assessment of the rail options and produced a series of high-level benefit to cost ratios (BCRs), which is additional to requirements at preliminary options appraisal. This economic value for money assessment differs from an overall value for money assessment, which would be required at Detailed Options Appraisal stage and cover all modes, such that only the quantified and monetised impacts of the rail options have been included.

Initial Appraisal: Case for Change

The Case for Change report was completed in March 2024. That report documented the first stage of the study, which involved identifying evidenced transport problems and opportunities in the study area and setting Transport Planning Objectives (TPOs) to reflect the changes sought to address these problems and opportunities.

The Structure of the Report

The remainder of this report is structured as follows:

- Chapter 2: describes the methodology that has been applied in carrying out the Preliminary Options Appraisal
- Chapter 3: sets out the option generation, sifting and development process and identifies the options that are recommended for consideration at this stage of appraisal
- Chapter 4: details the appraisal findings, including the performance of the options against the TPOs; the appraisal of the impacts against the five STAG criteria; how each option 'fits' within the wider policy context; and the Feasibility, Affordability and Public Acceptability of each option
- Chapter 5: outlines the recommendations, including the options recommended to be taken forward to the Detailed Options Appraisal stage

A number of appendices that document the technical work undertaken to support the assessment of rail options are provided as follows: **Appendix A: Rail Engineering Feasibility Technical Note**, **Appendix B: Rail Scheme Appraisal Technical Note** and **Appendix C: Freight Technical Note**.

2. Methodology

Scottish Transport Appraisal Guidance

The **Preliminary Options Appraisal** stage of the Buchan Sustainable Transport Study has been undertaken having due regard to Scottish Transport Appraisal Guidance (STAG). The STAG process is split into five parts as shown in Figure 2-1.

The Preliminary Options Appraisal forms the third part of the overall process: Initial Appraisal: Case for Change; Option Generation and Development; Preliminary Options Appraisal; Detailed Options Appraisal; and Monitoring and Evaluation Plan.

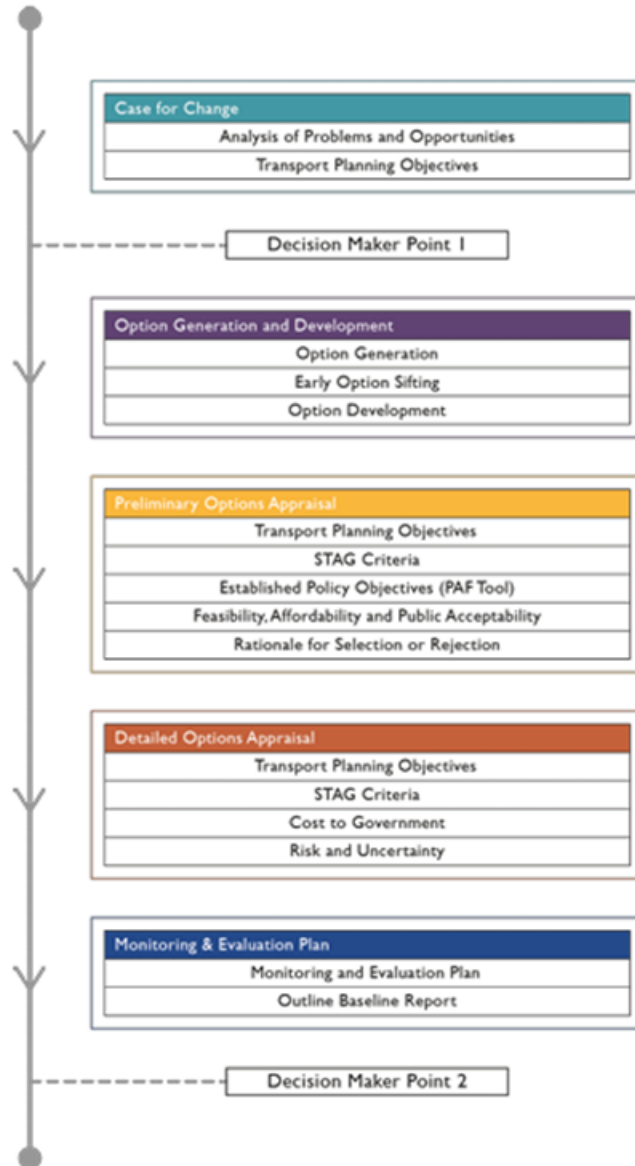
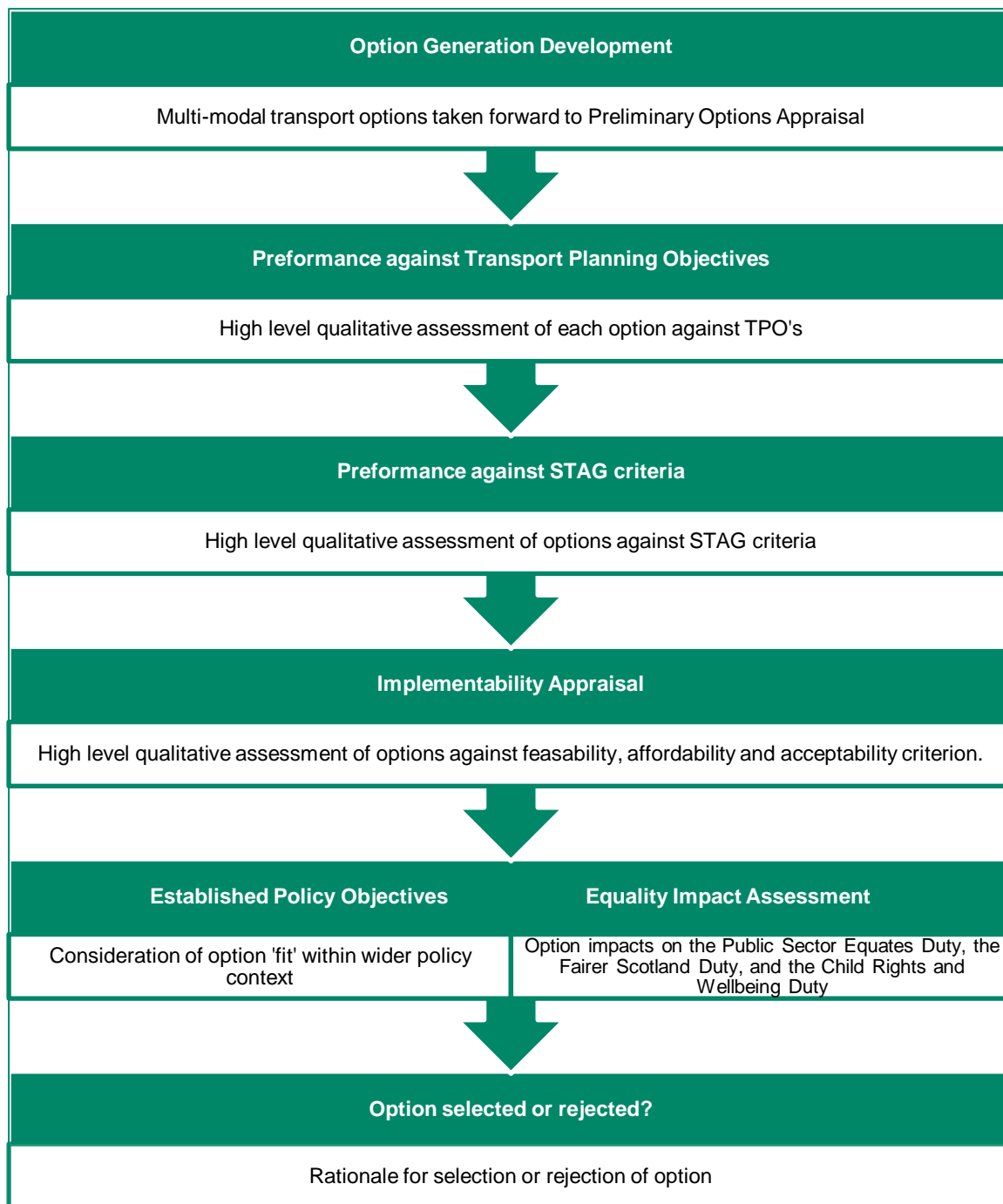


Figure 2-1: STAG Process

Approach to Preliminary Options Appraisal

The Preliminary Options Appraisal is a qualitative assessment; however, it draws on quantitative information where available. It has been undertaken using the following approach.



Option Generation and Development has taken place before completing the appraisal. The appraisal considers the performance of each option against the **TPOs**, the five **STAG criteria**, and an initial assessment against **Feasibility, Affordability and Public Acceptability**. It also considers the 'fit' of each option with relevant established **Policy Directives, Plans and Strategies** and key measures contained within the **Equality Act 2010**.

Further details of the approach are described below.

Option Generation and Development

The overall aim of option generation is to identify a set of transport options that could potentially deliver the Transport Planning Objectives (TPOs) and, consequently, address the evidenced problems and help realise potential opportunities. The process was unconstrained and fully reflected the range of options available in the study area. Details are provided in Chapter 3.

Transport Planning Objectives

Five TPOs were developed during the Initial Appraisal: Case for Change stage of the study, as listed below, reflecting the changes sought to address the evidenced problems and realise the opportunities. It should be noted that there is no weighting or hierarchy applied to the TPOs and the numbering system is used for presentation and reference purposes only.

- **TPO 1:** Reduce the number of people killed or seriously injured on the A90/A952 by 75% from the period 2014-19 (12 and 59 respectively) to the period 2037-41
- **TPO 2:** Reduce weekday AM and PM peak road-based journey time variation to the level seen in the inter-peak across the A90 and A952 from Fraserburgh to south of the Ellon south roundabout by 2037
- **TPO 3:** Increase the labour force who can access Peterhead and Fraserburgh town centres within 75 minutes by at least 65% by 2037
- **TPO 4:** Increase the average number of job opportunities available to Peterhead and Fraserburgh residents within 75 minutes by at least 40% by 2037
- **TPO 5:** The study area's transport networks should enable a sustainable and just transition away from oil and gas for current industries, and support key strategic industrial and other developments in new sectors

These TPOs play a pivotal role in the appraisal process by specifying the changes sought to address the evidenced problems and therefore provide a means to measure the performance of the options in terms of addressing the problems in the study area.

STAG Criteria

The appraisal of the impacts of the options against the five STAG criteria and sub-criteria includes:

Environment

- Biodiversity and Habitats
- Geology and Soils
- Land Use (including Agriculture and Forestry)
- Water, Drainage and Flooding
- Air Quality
- Historic Environment
- Landscape
- Noise and Vibration

Climate Change

- Greenhouse Gas Emissions
- Vulnerability to the Effects of Climate Change
- Potential to Adapt to the Effects of Climate Change

Health, Safety and Wellbeing

- Accidents
- Security
- Health Outcomes
- Access to Health and Wellbeing Infrastructure
- Visual Amenity

Economy

- Transport Economic Efficiency (TEE) covers the benefits ordinarily captured by standard cost-benefit analysis – including traffic volumes, journey times, driver frustration or travel time reliability
- Wider Economic Impacts (WEIs) refer to any economic impacts which are additional to transport user benefits

Equality and Accessibility

- Public Transport Network Coverage
- Active Travel Network Coverage
- Comparative Access by People Group
- Comparative Access by Geographic Location
- Affordability

As set out in STAG, a seven-point scale assessment has been undertaken to assess each option against the TPOs and STAG criteria. This considers the relative size and scale of the likely impacts, in qualitative terms.

- **Major benefit (+3):** these are benefits or positive impacts which, depending on the scale of benefit or severity of impact, the practitioner feels should be a principal consideration when assessing an option's eligibility for funding
- **Moderate benefit (+2):** the option is anticipated to have only a moderate benefit or positive impact. Moderate benefits and impacts are those which taken in isolation may not determine an option's eligibility for funding but taken together do so
- **Minor benefit (+1):** the option is anticipated to have only a small benefit or positive impact. Small benefits or impacts are those which are worth noting, but the practitioner believes are not likely to contribute materially to determining whether an option is funded or otherwise
- **Neutral (-):** the option is anticipated to have no or negligible benefit or negative impact
- **Small minor cost or negative impact (-1):** the option is anticipated to have only a small cost or negative impact. Minor costs/negative impacts are those which taken in isolation may not determine an option's eligibility for funding but taken together could do so
- **Moderate cost or negative impact (-2):** the option is anticipated to have only a moderate cost or negative impact. Moderate costs/negative impacts are those which taken in isolation may not determine an option's eligibility for funding but taken together could do so
- **Major cost or negative impact (-3):** these are costs or negative impacts which, depending on the scale of cost or severity of impact, the practitioner should take into consideration when assessing an option's eligibility for funding

Feasibility, Affordability and Public Acceptability

An implementability appraisal covering Feasibility, Affordability and Public Acceptability criteria has been undertaken for each option. The criteria are described in Table 2-1.

Table 2-1: Feasibility, Affordability and Public Acceptability criteria

Criteria	Description
Feasibility	A preliminary assessment of the feasibility of construction or implementation and operation (if relevant) of an option and the status of its technology [e.g. proven, prototype, in development etc.] as well as any cost, timescale or deliverability risks associated with the construction or operation of the option, including consideration of the need for any departure from design standards that may be required
Affordability	The scale of the financing burden on the promoting authority and other possible funding organisations and the risks associated with these should be considered together with the level of risk associated with an option's ongoing operating or maintenance costs and its likely operating revenues (if applicable)
Public Acceptability	The likely public response at the Preliminary Options Appraisal stage

Each criterion has been scored against three levels: minor, moderate, or major considerations (or low, medium, or high risk). By 'consideration' it is meant that there could be risks associated with each option recommended for further appraisal work that will require a certain level of investigation at that time.

Established Policy Objectives

There are many policies and strategies which could have an influence over the future local and strategic development of the study area and the North East region in terms of employment, housing, and infrastructure. It is therefore important to consider the 'fit' of each option within the wider relevant policy context. As such, an assessment has been undertaken to establish whether the options align with and contribute to the aims of transport and wider (non-transport) government policies and national transport objectives.

For the purposes of this study, the following strategies and policies have been considered with assessment outcomes presented in Chapter 4:

- National Transport Strategy 2
- Nestrans' Regional Transport Strategy 2040
- North East of Scotland Regional Economic Strategy 2035
- Scotland's Just Transition Objectives

Equality Impact Assessment

The Public Sector Equality Duties require public bodies to promote race, disability, and gender equality. As part of this requirement public bodies should take due consideration of the impact of their policies and practices on race, disability, and gender issues through the undertaking of an Equality Impact Assessment. It is also good practice for account to be taken of age, sexual orientation, and faith.

The appraisal has considered the impacts of each option against the following key measures contained within the Equality Act 2010 and is discussed further in Chapter 4:

- Public Sector Equalities Duty – the duty ensures that all public bodies play their part in making society fairer by tackling discrimination and providing equality of opportunity for all.
- Fairer Scotland Duty – the duty helps public bodies to actively consider how they can reduce inequalities of outcome caused by socio-economic disadvantage, when making strategic decisions.
- Child Rights and Wellbeing Duty – the duty allows for an assessment of the barriers children and young people face when accessing transport, including socio-economic background, geographical location, and accessibility and safety of transport.

Risk and Uncertainty

Sensitivity testing of the options has been undertaken to determine the relative effects of various parameters on the outcome of the scheme appraisal and optimism bias has been included in the costs. Details on assumptions are set out in Appendix B.

3. Option Generation & Development

This chapter sets out details of the option generation, initial sifting, and development process. The overall aim is to identify a set of transport options that could potentially deliver the TPOs and, consequently, address the evidenced problems and help realise the opportunities.

Given the significant overlap between this study and the A90(N) / A952 study, it has been necessary to coordinate the initial stages of option generation and consideration has been given to both short-to-medium term options and longer-term options.

Option Generation

Option Generation – identifying an initial long list of transport options, guided by the Sustainable Travel and Investment Hierarchies as described in the National Transport Strategy 2², which are not unreasonably constrained at this stage of the appraisal process

The initial long list of options has been generated via:

- The TPOs set for this study
- Consideration of previous studies, including the Fraserburgh and Peterhead to Aberdeen Strategic Transport Study Pre and Part 1 Appraisal (2014 - 2016) and Fraserburgh and Peterhead to Aberdeen Strategic Transport Study: STAG Part 1 Plus Road and Rail Studies (2017)
- Consideration of constraints identified as part of the Initial Appraisal: Case for Change
- Feedback from stakeholder and public engagement activities undertaken as part of the Initial Appraisal: Case for Change
- Suggestions from the Project Working Groups (AGCC/CNER and Nestrans), including CNER proposals

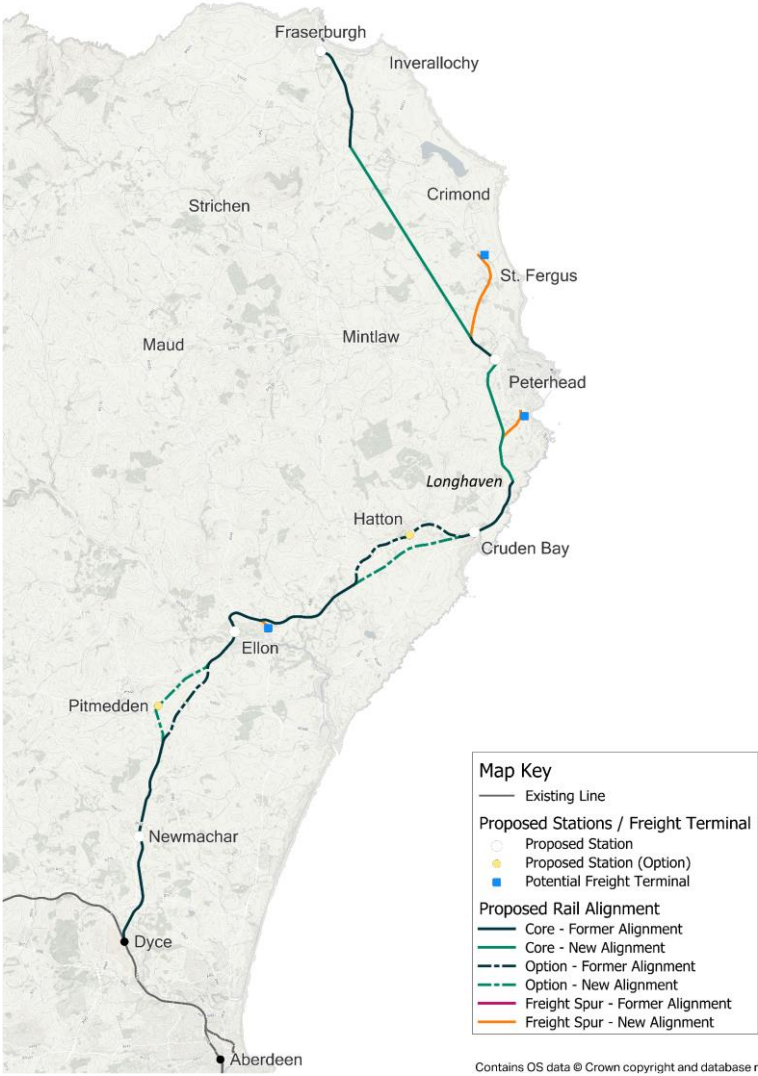
The initial long list of options is shown in Table 3-1.

It is important to note that the schematics shown depict high level routes and alignments and are for illustrative purposes only at this stage - decisions on any preferred routes or alignments would be subject to more detailed assessment at future stages of study.

² [View the National Transport Strategy 2](#)

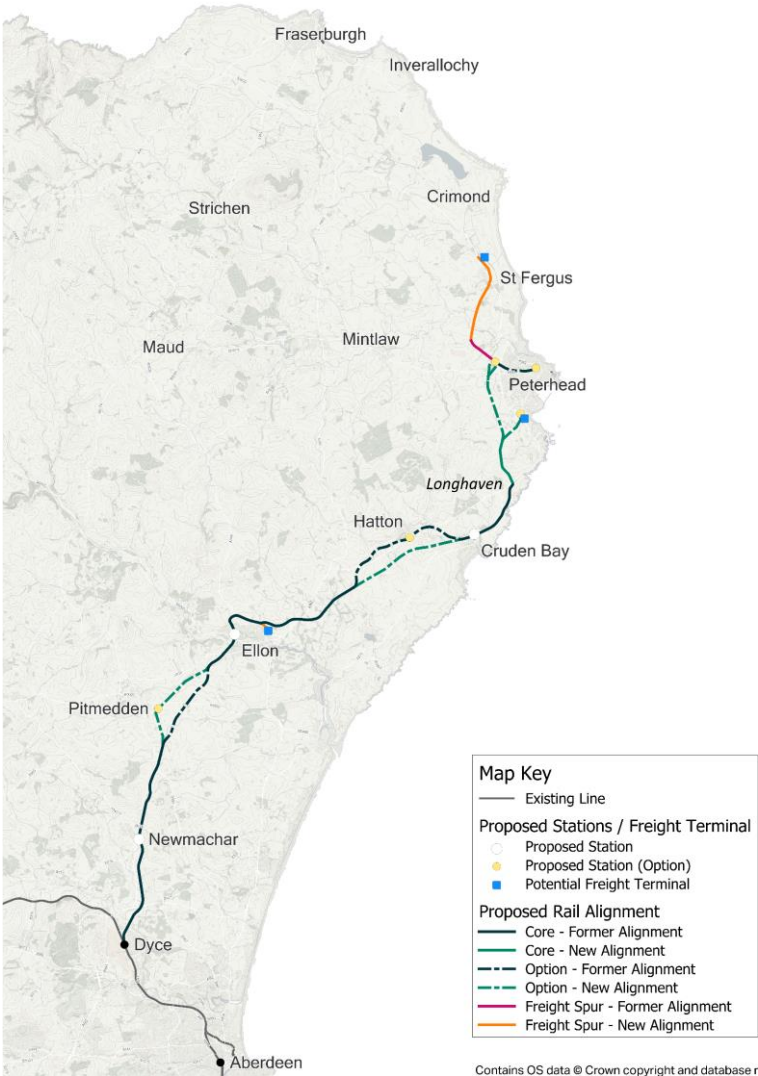
Table 3-1: Initial Long List of Multi-modal Options


Option Ref.	Type	Title	Details	Indicative alignments
A1	Public Transport	New passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead, Crimond and Inverallochy	<ul style="list-style-type: none"> ■ Use of old railway alignments between Dyce and Cruden Bay ■ New railway alignment required between Longhaven and Fraserburgh, also serving local communities north of Peterhead ■ Option for route to serve Hatton (via old alignment) or more direct route via Cruden Bay only ■ Option for route to serve Pitmedden or to remain on more direct route to Ellon via old alignment ■ Potential freight terminals at Ellon, Peterhead and/or St Fergus ■ Active travel provision will be protected 	<p>Map Key</p> <ul style="list-style-type: none"> — Existing Line Proposed Stations / Freight Terminal <ul style="list-style-type: none"> ○ Proposed Station ● Proposed Station (Option) ■ Potential Freight Terminal Proposed Rail Alignment <ul style="list-style-type: none"> — Core - Former Alignment — Core - New Alignment - - - Option - Former Alignment - - - Option - New Alignment — Freight Spur - Former Alignment — Freight Spur - New Alignment <p>Contains OS data © Crown copyright and database right 2023</p>

Option Ref.	Type	Title	Details	Indicative alignments
A2	Public Transport	New passenger and freight rail line between Aberdeen and Peterhead via Fraserburgh (no intermediate stations north of Peterhead)	<ul style="list-style-type: none"> Same alignment between Dyce and Peterhead as per option A1 but new railway alignment between Longhaven and Fraserburgh shorter and more direct than for Option A1 and with no intermediate stations north of Peterhead Active travel provision will be protected 	 <p>The map shows the rail corridor from Aberdeen in the south to Fraserburgh in the north. Key locations marked include Aberdeen, Dyce, Newmachar, Pitmedden, Ellon, Hatton, Cruden Bay, Longhaven, Peterhead, St. Fergus, Crimond, Inverallochy, Strichen, Maud, and Mintlaw. The proposed rail alignments are color-coded: dark green for Core - Former Alignment, light green for Core - New Alignment, dashed dark green for Option - Former Alignment, dashed light green for Option - New Alignment, purple for Freight Spur - Former Alignment, and orange for Freight Spur - New Alignment. Potential freight terminals are marked with blue squares at St. Fergus and Peterhead. Proposed stations are marked with white circles (new) and yellow circles (option) at Pitmedden and Hatton.</p> <p>Map Key</p> <ul style="list-style-type: none"> Existing Line Proposed Stations / Freight Terminal <ul style="list-style-type: none"> Proposed Station Proposed Station (Option) Potential Freight Terminal Proposed Rail Alignment <ul style="list-style-type: none"> Core - Former Alignment Core - New Alignment Option - Former Alignment Option - New Alignment Freight Spur - Former Alignment Freight Spur - New Alignment <p>Contains OS data © Crown copyright and database right 2023</p>

Option Ref.	Type	Title	Details	Indicative alignments
B1	Public Transport	New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Maud	<ul style="list-style-type: none"> ■ Route splits into two at Ellon serving Fraserburgh and Peterhead separately ■ Route to Fraserburgh using old alignment, calling at Maud and Strichen ■ Route to Peterhead using same alignment as Options A1/A2, although options for a different station location serving Peterhead ■ Option for route to serve Hatton (via old alignment) or more direct route via Cruden Bay only ■ Option for route to serve Pitmedden or to remain on more direct route to Ellon via old alignment ■ Potential freight terminals at Ellon, Peterhead and/or St Fergus ■ Active travel provision will be protected 	<p>Map Key</p> <ul style="list-style-type: none"> — Existing Line Proposed Stations / Freight Terminal <ul style="list-style-type: none"> ○ Proposed Station ● Proposed Station (Option) ■ Potential Freight Terminal Proposed Rail Alignment <ul style="list-style-type: none"> — Core - Former Alignment — Core - New Alignment - - - Option - Former Alignment - - - Option - New Alignment - - - Freight Spur - Former Alignment - - - Freight Spur - New Alignment <p><small>Contains OS data © Crown copyright and database right 2023</small></p>

Option Ref.	Type	Title	Details	Indicative alignments
B2	Public Transport	New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Mintlaw	<ul style="list-style-type: none"> ■ Route splits into two at Ellon serving Fraserburgh and Peterhead separately ■ Route to Fraserburgh using part old alignment and part new railway alignment via Mintlaw, offering shorter, more direct route than Option B1 ■ Route to Peterhead using same alignment as Options A1/A2/B1, with options for a different station location serving Peterhead ■ Option for route to serve Hatton (via old alignment) or more direct route via Cruden Bay only ■ Option for route to serve Pitmedden or to remain on more direct route to Ellon via old alignment ■ Potential freight terminals at Ellon, Peterhead and/or St Fergus ■ Active travel provision will be protected 	<p>Map Key</p> <ul style="list-style-type: none"> — Existing Line Proposed Stations / Freight Terminal <ul style="list-style-type: none"> ○ Proposed Station ● Proposed Station (Option) ■ Potential Freight Terminal Proposed Rail Alignment <ul style="list-style-type: none"> — Core - Former Alignment — Core - New Alignment - - - Option - Former Alignment - - - Option - New Alignment — Freight Spur - Former Alignment — Freight Spur - New Alignment <p><small>Contains OS data © Crown copyright and database right 2023</small></p>

Option Ref.	Type	Title	Details	Indicative alignments
C	Public Transport	New passenger and freight rail line between Aberdeen and Peterhead only	<ul style="list-style-type: none"> ■ No rail service to Fraserburgh ■ Route to Peterhead using same alignment as Options A1/A2/B1/B2, with options for a different station location serving Peterhead ■ Option for route to serve Hatton (via old alignment) or more direct route via Cruden Bay only ■ Option for route to serve Pitmedden or to remain on more direct route to Ellon via old alignment ■ Potential freight terminals at Ellon, Peterhead and/or St Fergus ■ Active travel provision will be protected 	 <p>Map Key</p> <ul style="list-style-type: none"> — Existing Line Proposed Stations / Freight Terminal <ul style="list-style-type: none"> ○ Proposed Station ● Proposed Station (Option) ■ Potential Freight Terminal Proposed Rail Alignment <ul style="list-style-type: none"> — Core - Former Alignment — Core - New Alignment - - - Option - Former Alignment - - - Option - New Alignment — Freight Spur - Former Alignment — Freight Spur - New Alignment <p>Contains OS data © Crown copyright and database right 2023</p>

Option Ref.	Type	Title	Details	Indicative alignments
D	Public Transport	New railway alignment between Aberdeen and Peterhead/Fraserburgh via the Bridge of Don, including options for light rail or tram	<ul style="list-style-type: none"> ▪ Rail services would be direct to Aberdeen, not requiring interchange at Dyce ▪ Potential for new rail stations at e.g. Bridge of Don, Blackdog, Balmedie, Ellon, Hatton, Peterhead, St. Fergus (if continuous route), Mintlaw (if branch line) and Fraserburgh ▪ Option raised in previous study and noted in stakeholder drop-in event. ▪ Potential of using Light Rail or Tram as an alternative to heavy rail also noted 	 <p>The map displays a proposed railway route (thick black line) connecting Aberdeen to Fraserburgh. The route starts at Aberdeen, goes north through Dyce, Ellon, Hatton of Cruden, and Toll of Birness. It then branches east towards Peterhead, passing through Boddam and St. Fergus, before heading north to Fraserburgh. Other stations shown include Maud, Mintlaw, Stuartfield, Longside, Crimond, and Cortes Junction. Existing railway lines are shown as thin grey lines, and existing stations are marked with black dots. A map key in the bottom right corner defines the symbols used.</p> <p>Map Key</p> <ul style="list-style-type: none"> — Proposed Option — Existing Line • Existing Railway Station <p>Contains OS data © Crown copyright and database right 2023</p>

Option Ref.	Type	Title	Details	Indicative alignments
RD1	Road	A90 / B9005 Junction improvements	Improvements to Ellon South Roundabout (A90 / B9005)	
RD2	Road	A90 / A948 Junction improvements	Improvements to Ellon North Roundabout (A90 / A948)	
RD3	Road	A90 / A952 Junction improvements	Improvements to the Toll of Birness Junction	
RD4	Road	A90 / A952 Junction improvements	Improvements to Cortes Junction	
RD5	Road	A90 Dualling	A90 Ellon Bypass Dualling	
RD6	Road	A90 Dualling	A90 Ellon to the Toll of Birness Dualling	
RD7	Road	A90 Dualling	A90 Toll of Birness to Peterhead Dualling	
RD8	Road	A952 Dualling	A952 Toll of Birness to Fraserburgh Dualling	
RD9	Road	A90 / A952 capacity enhancement and safety measures	Targeted improvements on the A90 and A952, including overtaking lanes and junction improvements	

Following option generation, a meeting was held with both project working groups to determine which options should be appraised as part of this study and which should be appraised as part of the A90(N) / A952 study. It was agreed that the following options fell into the category as ‘longer-term’ and therefore should be appraised as part of this study:

- Option A1 (Public Transport): New passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead, Crimond and Inverallochy
- Option A2 (Public Transport): New passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead (no intermediate stations north of Peterhead)
- Option B1 (Public Transport): New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Maud
- Option B2 (Public Transport): New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Mintlaw
- Option C (Public Transport): New passenger and freight rail line between Aberdeen and Peterhead only
- Option D (Public Transport): New railway alignment between Aberdeen and Peterhead/Fraserburgh via the Bridge of Don, including options for light rail or tram
- Option RD5 (Road): A90 Ellon Bypass Dualling
- Option RD6 (Road): A90 Ellon to the Toll of Birness Dualling
- Option RD7 (Road): A90 Toll of Birness to Peterhead Dualling
- Option RD8 (Road): A952 Toll of Birness to Fraserburgh Dualling

Initial Option Sifting

Option Sifting – sifting out of options from the initial long list to retain a reasonable number of multi-modal transport options for development

The initial sifting out of options approach sought to reject options that are unlikely to be delivered due to technical and/or deliverability challenges, affordability, and wider established policy objectives. It was recognised that, in some cases, there is limited quantifiable information available and therefore the approach also sought to avoid rejecting any options too early without the necessary supporting evidence to do so.

Table 3-2: Rationale for Option Rejection

Option Ref.	Title	Rationale for Option Rejection
A1	New passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead, Crimond and Inverallochy	<p>Option A1 journey time between Fraserburgh and Aberdeen is estimated to be approximately 70 minutes, which is much less competitive relative to car or bus travel when compared to the journey times associated with the other proposed rail options, which are estimated to range between 54 and 62 minutes. The catchment populations of three proposed stations north of Peterhead are very small, i.e. St Fergus (1,050), Crimond (1,430) and Inverallochy (2,610). Option A1 would be a significantly more costly option for travel between Peterhead and Fraserburgh, and would include:</p> <ul style="list-style-type: none"> ▪ design and construction costs for three additional stations ▪ require 25 new bridge structures, including three crossings of the A90, whereas Option A2 would require 22 new bridge crossings and one crossing of the A90 ▪ Option A1 is two miles longer than Option A2 between Peterhead and Fraserburgh and would involve a considerably higher proportion of new build as opposed to re-purposing an old alignment/cycle track. Option A1 would require 14 miles of new track and 1.5 miles of re-purposed cycle track compared to Option A2, which would require 8.7 miles of new track and 4.8 miles of re-purposed cycle track

Option Ref.	Title	Rationale for Option Rejection
D	New railway alignment between Aberdeen and Peterhead/Fraserburgh via the Bridge of Don, including options for light rail or tram	Option D could generate benefits for communities and businesses in the study area, in relation to improving accessibility to Aberdeen and beyond for employment, further education, healthcare and social activities. However, this option would entail additional works and additional costs associated with a new rail alignment through a constrained urban network with significant land constraints where no rail line has previously existed; accordingly, this option is unlikely to perform significantly better or offer significantly more operational benefits than the alternative rail options interchanging at Dyce. The options for light rail or tram would not provide the opportunity for a non-road-based freight alternative to serve the North East of Scotland.
RD8	A952 Toll of Birness to Fraserburgh Dualling	Option RD8 would improve safety and journey times along the A952 by providing a higher standard of road to the existing single carriageway. This would be a high-cost option relative to the other dualling options and may not meet the TPOs in a cost-effective manner. Shorter-term road-based improvements proposed for the route as part of the A90/A952 STAG study could also address the identified problems on this route in a more cost-effective manner. This option does not align well with the Sustainable Travel and Investment Hierarchies, whereby active and sustainable travel options and those which reduce the need to travel unsustainably will be prioritised above other options. Option RD8 does not support Scottish Government's promotion of efficient and sustainable freight transport for the movement of goods, particularly the shift from road to rail.

Additional to the above, for the rail options, specific consideration has been given to potential variants in terms of station locations, notably in Peterhead where options exist around Peterhead South, Peterhead West, Peterhead Central and Peterhead East. Due to engineering constraints, Peterhead East has been discounted from further consideration. Further information on the specific rail variants discounted as part of the study is provided within supporting Technical Notes in Appendix A and Appendix B.

Recommended Multi-Modal Options for Appraisal

The list of recommended options for Preliminary Options Appraisal is shown in Table 3-3. For the purposes of this appraisal, Options RD5, RD6 and RD7 have been grouped together and renamed Option RD10.

It should be noted that no weighting or hierarchy is applied to the naming of the options – the numbering system is used for presentation and reference purposes only.

Table 3-3: Recommended Options for Preliminary Options Appraisal

Option Ref.	Type	Title
A2	Public Transport	New passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead (no intermediate stations north of Peterhead)
B1	Public Transport	New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Maud
B2	Public Transport	New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Mintlaw
C	Public Transport	New passenger and freight rail line between Aberdeen and Peterhead only
RD10	Road	A90 Ellon to Peterhead Dualling

4. Preliminary Options Appraisal

Introduction

Findings from the Preliminary Options Appraisal for each option is provided below. The appraisal has considered:

- The performance of options against the TPOs
- The impact of the options against the five STAG criteria [i.e. Environment; Climate Change; Health, Safety and Wellbeing; Economy; and Equality and Accessibility]
- An implementability appraisal of options covering feasibility [i.e. technical and deliverability risks], affordability [i.e. financial risks and costs] and public acceptability criteria

In line with STAG guidance, the preliminary options appraisal has largely been completed based on qualitative assessment of the respective options. However, the economic appraisal has been informed by initial demand forecasting and modelling work, which would normally be completed during the Detailed Appraisal stage.

Further details on the approach to the economic appraisal is presented in Appendix B.

The STAG seven-point assessment scale, shown below, has been used to assess each option against the TPOs and STAG criteria. This considers the relative size and scale of the likely impacts (benefits / dis-benefits), in qualitative terms.

+3	+2	+1	0	-1	-2	-3
Major benefit	Moderate benefit	Minor benefit	Neutral (no benefit or impact)	Small minor cost or negative impact	Moderate cost or negative impact	Major cost or negative impacts

Appraisal Findings

Findings from the preliminary options appraisal are set out below.

Option A2		
Type of Option: Public Transport		
Title: New passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead (no intermediate stations north of Peterhead)		
Transport Planning Objectives		
Objective	Performance against TPO	Score
TPO 1: Reduce the number of people killed or seriously injured on the A90/A952 during the period 2014-19 (12 and 59 respectively) by 75% by the period 2037-2041	This option would be anticipated to generate mode shift from road to public transport, which could have a positive impact in terms of reducing road traffic volumes, particularly longer distance road traffic. As a result, this option could reduce the number of personal injury collisions on the A90 and A952, resulting from a reduction in the number of motor vehicles on the road network from drivers switching from car travel to rail. Overall, the option would be anticipated to have a moderate positive impact against this objective.	+2
TPO 2: Reduce weekday AM and PM peak road-based journey time variation to the level seen in the inter-peak across the A90 and A952 from Fraserburgh to south of the Ellon south roundabout by 2037	This option could generate mode shift and have a moderate, positive impact on road traffic volumes and therefore improve the consistency and reliability of day-to-day journeys along the A90 and A952 for private motorists, business travel and transfer of goods.	+2
TPO 3: Increase the labour force who can access Peterhead and Fraserburgh town centres within 75 minutes by at least 65% by 2037	This option would improve public transport connections and journey times across the study area, notably Peterhead and Fraserburgh, and would provide major accessibility benefits to both towns for employment, further education, healthcare, and social activities. Through enhancing public transport journey times to Peterhead and Fraserburgh from destinations south, including Aberdeen, this option would increase the labour force that can access these towns within 75 minutes.	+3
TPO 4: Increase the average number of job opportunities available to Peterhead and Fraserburgh residents within 75 minutes by at least 40% by 2037	By enhancing public transport connections and journey times across the study area, particularly from Peterhead and Fraserburgh to Aberdeen, this option would increase the number of job opportunities available to residents which are accessible within 75 minutes by public transport.	+3
TPO 5: The study area's transport networks should enable a sustainable and just transition away from oil and gas for current industries, and support key strategic industrial and other developments in new sectors	This option has the potential to have a major positive impact against this objective by introducing a step-change in public transport provision in the north east of Aberdeenshire. A reintroduced rail network serving Peterhead and Fraserburgh would be expected to encourage modal switch from private ICE vehicles to rail. Increasing the accessibility of the area via rail would strengthen the local economy for business by improving the efficiency of the transport network for both people and freight, increase skilled labour market supply which can in turn help to retain existing and attract new business to the region. This	+3

	<p>includes jobs in key strategic developments such as renewables, and CCUS at St Fergus. The railway itself would support the creation of green jobs directly through employment during its construction and in the construction of associated facilities such as stations and terminals as well as associated development such as housing, and adjacent industrial development which could be directly linked to the railway.</p> <p>By enabling the trunk haul of the transport of goods by rail freight rather than road, this option would also support Just Transition, with engagement with major industries in the region highlighting the potential for goods and products, including CO₂, to be transported more sustainably and more cost effectively for those movements to / from and beyond the Central Belt.</p>	
STAG Criteria		
Criterion		
	Performance against STAG Criterion	Score
Environment:		-3
Environment	<p>The implementation of a new passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead is anticipated to have a moderate negative impact on the Environment Criterion. While the reuse of old railway alignments is proposed between Dyce and Longhaven, the option would also require new railway alignment between Longhaven and Fraserburgh. Both elements would require significant construction, to varying degrees, in areas of existing greenspace and/or farmland, resulting in potential detrimental impacts on biodiversity and habitats; geology and soils; land use; water, drainage and flooding; and landscape. The construction of new stations/freight terminals would have lesser potential impacts on these sub-criteria.</p> <p>However, the implementation of the new rail line also has potential to encourage a modal shift to public transport, which could have beneficial impacts on air quality and noise and vibration within the study area. Active travel provision would also be protected through the implementation of this option. Further option development work is required to understand the full extent of environmental impacts and subsequent opportunities for mitigation.</p>	-3
Climate Change:		+1
Greenhouse Gas Emissions	<p>The implementation of a new passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead is anticipated to have a minor positive impact on the greenhouse gas emissions sub-criterion. During the construction phase, greenhouse gas emissions would occur due to construction activities required to deliver the infrastructure. However, in the longer term, there is potential for this option to encourage a modal shift to public transport and away from private car use, thereby reducing CO₂ emissions within the study area</p>	+1

	compared to the baseline scenario. Any reductions in greenhouse gas emissions resulting from the implementation of this option would however be dependent on the level of modal shift achieved. Removal of HGV mileage associated with the transfer of goods via rail freight under this option would also positively contribute towards this criterion.	
Vulnerability to the Effects of Climate Change	The implementation of a new passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead could be vulnerable to the effects of climate change. Infrastructure constructed as part of this option, e.g. paved surfaces could be impacted by surface water flooding during periods of heavy rainfall. Similarly, an increase in the magnitude and frequency of storm events and heavy rainfall could lead to an increase in fallen trees and other foliage on the new rail line, resulting in significant damage and delays. The overall impact is therefore anticipated to be minor negative against this sub-criterion.	-1
Potential to Adapt to the Effects of Climate Change	The implementation of a new passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead would be designed in such a way to adapt to the potential effects of climate change, and designed in accordance with relevant planning, design, engineering practice and codes. Several mitigation and adaptation measures would be considered at later design development stages to address potential risks. The overall impact is therefore anticipated to be minor positive against this sub-criterion.	+1
Health, Safety and Wellbeing:		+2
Accidents	This option could generate mode shift and have a moderate, positive impact on road traffic volumes, particularly longer distance road traffic. Consequently, this option could reduce the number of personal injury collisions on the A90 and A952, resulting from the reduction in the number of motor vehicles on the road network from drivers switching from car travel to public transport.	+2
Security	New stations associated with this option would be designed to meet modern design standards regarding security and personal safety e.g. lighting, CCTV, accessibility requirements, thereby reducing concerns around personal security, particularly amongst vulnerable users.	+1
Access to Health and Wellbeing Infrastructure	This option would provide a new, and faster, mode of public transport access from settlements in the region to hospitals in Aberdeen to access specialists, tests, and maternity services. Although the measures included in this option do not directly improve links to the healthcare facilities that comprise Aberdeen Royal Infirmary, the measures would improve indirect access through improved public transport provision via the city centre. Due to the longer distance nature of rail journeys, access to GP surgeries and other local care is unlikely to be affected.	+1
Visual Amenity	This option would be expected to have a minor negative impact on the Visual Amenity sub-criterion associated with the visibility of the new rail line disturbing rural landscapes.	-1

Economy:		+2
Economic Efficiency of the Transport System (TEE)	<p>The STAG economic appraisal demonstrated the scheme generates positive impacts mainly in user time savings and external benefits deriving from mode shift from car to rail. Scheme present value of benefits (2010 prices) sit in the range £300m-£430m (passenger) depending on service frequency. This is the only rail option that would provide direct rail connectivity between the towns of Fraserburgh and Peterhead (which is the largest flow to/from Fraserburgh) and alongside Option C is the only rail option that provides the opportunity to operate two trains per hour between Peterhead and Aberdeen.</p> <p>Freight terminals at Peterhead and Ellon could generate significant further benefits through transferring the movement of goods from road to rail to/from North East Aberdeenshire, particularly to/from locations in the Central Belt and further south to the Midlands in England. It has been estimated that there is an opportunity to generate up to circa £500m in additional freight-related benefits through removing lorry-km from the Scottish and English road network. This option could also open the opportunity for a freight terminal at Fraserburgh. Further details are provided in the Rail Scheme Appraisal Technical Note provided in Appendix B.</p>	+2
Wider Economic Impacts / Benefits	This option is expected to bring a range of wider economic benefits associated with the provision of a new public transport mode and increased connectivity, including agglomeration economies, increased competition because of better transport, and wider benefits arising from improved labour supply.	+2
Equality and Accessibility:		+2
Public Transport Network Coverage	This option would have a major positive impact on public transport network coverage in the study area by introducing a new mode of public transport for longer distance journeys and improving public transport journey times for direct rail journeys and multi-modal public transport journeys involving rail – increasing the effective public transport “catchment” around stations on the line.	+3
Active Travel Network Coverage	This option is not anticipated to impact active travel network coverage in the study area. Where the railway is reinstated on the Formartine and Buchan Cycleway, a suitable alternative route will be provided.	0
Comparative Access by People Group	This option would have a moderate positive impact on comparative access by people group. Rail is one of the most accessible forms of transport for all users (children, older people, and people with mobility impairments). Furthermore, with increased opportunities to access a new form of transport, this could benefit those in more restricted user groups, for example those without access to, or who wish not to choose the private car to travel.	+2
Comparative Access by Geographic Location	This option would have a moderate positive impact on comparative access by geographic location, providing a new mode choice to settlements served (including Fraserburgh).	+2

Affordability	This option would have a minor positive impact on affordability by reducing forced car ownership and reliance on taxis for people without access to a car.	+1
Implementability Appraisal		
Feasibility:	<p>Based on the engineering feasibility assessment, the introduction of a rail route which would connect Peterhead and Fraserburgh to the existing rail network at Dyce is considered to be technically feasible. However, each option would present various technical challenges. A significant portion of the proposed route considered in this option utilises former railway alignment, although a considerable proportion of the section between Peterhead and Fraserburgh would be new build. There are several existing structures which could potentially be utilised for a new railway. However, the suitability of these existing structures would need to be assessed further at a later stage to determine if they are structurally and geometrically suitable for modern railway loading and required clearances. However, as this option only utilises sections of the current active travel route between Dyce and Ellon, it would minimise the extent of cycleway to be maintained along the route.</p> <p>Within Scotland, there is strong, recent experience in the construction of new railway projects, such as Borders Rail and Levenmouth, with the knowledge and expertise developed through such projects aiding the deliverability of this option.</p> <p>Further details are provided in Appendix A.</p>	Medium - High Risk
Affordability:	This option is anticipated to have significant capital costs with a high level of risk due to uncertainty surrounding land acquisition costs, ground conditions, topography, existing structures, utilities, environmental considerations and other exclusions, noting the preliminary stage of assessment. It is likely that ongoing subsidy would be required to operate the service, although this is not uncommon for a rail service operating in rural Scotland.	High Risk
Public Acceptability:	There is expected to be general support for this option due to expected connectivity benefits and economic benefits associated with regeneration and increased attractiveness of the study area as a place to live and work. There may be some opposition from land owners and local residents associated with the construction of the rail line. Overall, the public acceptability risk is considered to be low.	Low Risk

Option B1		
Type of Option: Public Transport		
Title: New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Maud		
Transport Planning Objectives		
Objective	Performance against TPO	Score
TPO 1: Reduce the number of people killed or seriously injured on the A90/A952 during the period 2014-19 (12 and 59 respectively) by 75% by the period 2037-2041	This option could generate additional mode shift and have a moderate, positive impact on road traffic volumes, particularly longer distance road traffic. Consequently, this option could reduce the number of personal injury collisions on the A90 and A952, resulting from the reduction in the number of motor vehicles on the road network from drivers switching from car travel to public transport.	+2
TPO 2: Reduce weekday AM and PM peak road-based journey time variation to the level seen in the inter-peak across the A90 and A952 from Fraserburgh to south of the Ellon south roundabout by 2037	This option could generate mode shift and have a moderate, positive impact on road traffic volumes and therefore improve the consistency and reliability of day-to-day journeys along the A90 and A952 for private motorists, business travel and transfer of goods.	+2
TPO 3: Increase the labour force who can access Peterhead and Fraserburgh town centres within 75 minutes by at least 65% by 2037	This option would improve public transport connections and journey times across the study area, notably Peterhead and Fraserburgh, and would provide major accessibility benefits to both towns for employment, further education, healthcare, and social activities. Through enhancing public transport journey times to Peterhead and Fraserburgh from destinations south, including Aberdeen, this option would increase the labour force that can access these towns within 75 minutes.	+3
TPO 4: Increase the average number of job opportunities available to Peterhead and Fraserburgh residents within 75 minutes by at least 40% by 2037	By enhancing public transport connections and journey times across the study area, particularly from Peterhead and Fraserburgh to Aberdeen, this option would increase the number of job opportunities available to residents which are accessible within 75 minutes by public transport.	+3
TPO 5: The study area's transport networks should enable a sustainable and just transition away from oil and gas for current industries, and support key strategic industrial and other developments in new sectors	This option has the potential to have a major positive impact against this objective by introducing a step-change in public transport provision in the north east of Aberdeenshire. A reintroduced rail network serving Peterhead and Fraserburgh would be expected to encourage modal switch from private ICE vehicles to rail. Increasing the accessibility of the area via rail would strengthen the local economy for business by improving the efficiency of the transport network for both people and freight, increase skilled labour market supply which can in turn help to retain existing and attract new business to the region. This includes jobs in key strategic developments such as renewables, and CCUS at St Fergus. The railway itself would support the creation of green jobs directly through employment during its	+3

	<p>construction and in the construction of associated facilities such as stations and terminals as well as associated development such as housing, and adjacent industrial development which could be directly linked to the railway.</p> <p>By enabling the trunk haul of the transport of goods by rail freight rather than road, this option would also support Just Transition, with engagement with major industries in the region highlighting the potential for goods and products, including CO₂, to be transported more sustainably and more cost effectively for those movements to / from and beyond the Central Belt.</p>	
STAG Criteria		
Criterion		
	Performance against STAG Criterion	Score
Environment:		-3
Environment	<p>The implementation of a new passenger and freight rail line between Aberdeen and Peterhead with Fraserburgh branch from Ellon via Maud is anticipated to have a major negative impact on the Environment Criterion. While the reuse of old railway alignments is proposed, the option would require significant construction to facilitate the two rail branches, in addition to proposed stations and freight terminals at Ellon, Peterhead and/or St Fergus. As all these components are located within or adjacent to existing areas of greenspace and/or farmland, construction in these areas would likely result in potential detrimental impacts on biodiversity and habitats; geology and soils; land use; water, drainage, and flooding; and landscape. Of the two potential rail station locations at Peterhead, it is considered that the western location would have a lesser potential impact on the environment criterion than the central location which would require construction works within the settlement.</p> <p>However, the implementation of this option also has potential to encourage a modal shift to public transport, which could have beneficial impacts on air quality and noise and vibration within the study area. Active travel provision would also be protected through the implementation of this option.</p> <p>Further option development work is required to understand the full extent of environmental impacts and subsequent opportunities for mitigation.</p>	-3
Climate Change:		+1
Greenhouse Gas Emissions	<p>The implementation of a new passenger and freight rail line between Aberdeen and Peterhead with Fraserburgh branch from Ellon via Maud is anticipated to have a minor positive impact on the greenhouse gas emissions sub-criterion. During the construction phase, greenhouse gas emissions would occur due to construction activities required to deliver the infrastructure. However, in the longer term, there is potential for</p>	+1

	<p>this option to encourage a modal shift to public transport and away from private car use, thereby reducing CO₂ emissions within the study area compared to the baseline scenario. Reductions in greenhouse gas emissions resulting from the implementation of this option would however be dependent on the level of modal shift achieved. Removal of HGV mileage associated with the transfer of goods via rail freight under this option would also positively contribute towards this criterion.</p>	
Vulnerability to the Effects of Climate Change	<p>The implementation of a new passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead could be vulnerable to the effects of climate change. Infrastructure constructed as part of this option, e.g. paved surfaces could be impacted by surface water flooding during periods of heavy rainfall. Similarly, an increase in the magnitude and frequency of storm events and heavy rainfall could lead to an increase in fallen trees and other foliage on the new rail line, resulting in significant damage and delays. The overall impact is therefore anticipated to be minor negative against this sub-criterion.</p>	-1
Potential to Adapt to the Effects of Climate Change	<p>The implementation of a new passenger and freight rail line between Aberdeen and Peterhead with Fraserburgh branch from Ellon via Maud would be designed in such a way to adapt to the potential effects of climate change, and designed in accordance with relevant planning, design, engineering practice and codes. Several mitigation and adaptation measures would be considered at later design development stages to address potential risks. The overall impact is therefore anticipated to be minor positive against this sub-criterion.</p>	+1
Health, Safety and Wellbeing:		+2
Accidents	<p>This option could generate mode shift and have a moderate, positive impact on road traffic volumes, particularly longer distance road traffic. Consequently, this option could reduce the number of personal injury collisions on the A90 and A952, resulting from the reduction in the number of motor vehicles on the road network from drivers switching from car travel to public transport.</p>	+2
Security	<p>New stations associated with this option would be designed to meet modern design standards regarding security and personal safety e.g. lighting, CCTV, accessibility requirements, thereby reducing concerns around personal security, particularly amongst vulnerable users.</p>	+1
Access to Health and Wellbeing Infrastructure	<p>This option would provide a new, and faster, mode of public transport access from settlements in the region to hospitals in Aberdeen to access specialists, tests, and maternity services. Although the measures included in this option do not directly improve links to the healthcare facilities that comprise Aberdeen Royal Infirmary, the measures would improve indirect access through improved public transport provision via the city centre. Due to the longer distance nature of rail journeys, access to GP surgeries and other local care is unlikely to be affected.</p>	+1

Visual Amenity	This option would be expected to have a minor negative impact on the Visual Amenity sub-criterion associated with the visibility of the new rail line disturbing rural landscapes.	-1
Economy:		+2
Economic Efficiency of the Transport System (TEE)	<p>The STAG economic appraisal demonstrated the scheme generates positive impacts mainly in user time savings and external benefits deriving from mode shift from car to rail. Scheme present value of benefits (2010 prices) sit in the range £340m-£410m (passenger) depending on service frequency. This rail option would not serve the Fraserburgh-Peterhead market but does open a rail offer to communities such as Maud and Strichen.</p> <p>Freight terminals at Peterhead and Ellon could generate significant further benefits through transferring the movement of goods from road to rail to/from North East Aberdeenshire, particularly to/from locations in the Central Belt and further south to the Midlands in England. It has been estimated that there is an opportunity to generate up to circa £500m in additional freight-related benefits through removing lorry-km from the Scottish and English road network. This option could also open the opportunity for a freight terminal at Fraserburgh. Further details are provided in the Rail Scheme Appraisal Technical Note provided in Appendix B.</p>	+2
Wider Economic Impacts / Benefits	This option is expected to bring a range of wider economic benefits associated with the provision of a new public transport mode and increased connectivity, including agglomeration economies, increased competition because of better transport, and wider benefits arising from improved labour supply.	+2
Equality and Accessibility:		+2
Public Transport Network Coverage	This option would have a major positive impact on public transport network coverage in the study area by introducing a new mode of public transport for longer distance journeys and improving public transport journey times for direct rail journeys and multi-modal public transport journeys involving rail – increasing the effective public transport “catchment” around stations on the line.	+3
Active Travel Network Coverage	This option is not anticipated to impact active travel network coverage in the study area. Where the railway is reinstated on the Formartine and Buchan Cycleway, a suitable alternative route will be provided.	0
Comparative Access by People Group	This option would have a moderate positive impact on comparative access by people group. Rail is one of the most accessible forms of transport for all users (children, older people, and people with mobility impairments). Furthermore, with increased opportunities to access a new form of transport, this could benefit those in more restricted user groups, for example those without access to, or who wish not to choose the private car to travel.	+2
Comparative Access by Geographic Location	This option would have a moderate positive impact on comparative access by geographic location, providing a new mode choice to settlements served, including Fraserburgh, Maud and Strichen.	+2

Affordability	This option would have a minor positive impact on affordability by reducing forced car ownership and reliance on taxis for people without access to a car.	+1
Implementability Appraisal		
Feasibility:	<p>Based on the engineering feasibility assessment, the introduction of a rail route which would connect Peterhead and Fraserburgh to the existing rail network at Dyce is considered to be technically feasible. However, each option would present various technical challenges. The majority of the proposed route considered in this option utilises former railway alignment (Option B1 uses proportionally more former rail alignment than any of the other options that reach Fraserburgh), with many existing structures which could potentially be utilised for a new railway. However, the suitability of these existing structures would need to be assessed further at a later stage to determine if they are structurally and geometrically suitable for modern railway loading and required clearances. There would also be the challenge of maintaining the existing cycleway as the majority of the route in this option utilises the Formartine and Buchan Way.</p> <p>Within Scotland, there is strong, recent experience in the construction of new railway projects, such as Borders Rail and Levenmouth, with the knowledge and expertise developed through such projects aiding the deliverability of this option.</p> <p>Further details are provided in Appendix A.</p>	Medium Risk
Affordability:	This option is anticipated to have significant capital costs, with a high level of risk due to uncertainty surrounding land acquisition costs, ground conditions, topography, existing structures, utilities, environmental considerations and other exclusions, noting the preliminary stage of assessment. It is likely that ongoing subsidy would be required to operate the service, although this is not uncommon for a service operating in rural Scotland.	High Risk
Public Acceptability:	There is expected to be general support for this option due to expected connectivity benefits and economic benefits associated with regeneration and increased attractiveness of the study area as a place to live and work. There may be some opposition from land owners and local residents associated with the construction of the rail line. Overall, the public acceptability risk is considered to be low.	Low Risk

Option B2		
Type of Option: Public Transport		
Title: New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Mintlaw		
Transport Planning Objectives		
Objective	Performance against TPO	Score
TPO 1: Reduce the number of people killed or seriously injured on the A90/A952 during the period 2014-19 (12 and 59 respectively) by 75% by the period 2037-2041	This option could generate additional mode shift and have a moderate, positive impact on road traffic volumes, particularly longer distance road traffic. Consequently, this option could reduce the number of personal injury collisions on the A90 and A952, resulting from the reduction in the number of motor vehicles on the road network from drivers switching from car travel to public transport.	+2
TPO 2: Reduce weekday AM and PM peak road-based journey time variation to the level seen in the inter-peak across the A90 and A952 from Fraserburgh to south of the Ellon south roundabout by 2037	This option could generate mode shift and have a moderate, positive impact on road traffic volumes and therefore improve the consistency and reliability of day-to-day journeys along the A90 and A952 for private motorists, business travel and transfer of goods.	+2
TPO 3: Increase the labour force who can access Peterhead and Fraserburgh town centres within 75 minutes by at least 65% by 2037	This option would improve public transport connections and journey times across the study area, notably Peterhead and Fraserburgh, and would provide major accessibility benefits to both towns for employment, further education, healthcare, and social activities. Through enhancing public transport journey times to Peterhead and Fraserburgh from destinations south, including Aberdeen, this option would increase the labour force that can access these towns within 75 minutes.	+3
TPO 4: Increase the average number of job opportunities available to Peterhead and Fraserburgh residents within 75 minutes by at least 40% by 2037	By enhancing public transport connections and journey times across the study area, particularly from Peterhead and Fraserburgh to Aberdeen, this option would increase the number of job opportunities available to residents which are accessible within 75 minutes by public transport.	+3
TPO 5: The study area's transport networks should enable a sustainable and just transition away from oil and gas for current industries, and support key strategic industrial and other developments in new sectors	This option has the potential to have a major positive impact against this objective by introducing a step-change in public transport provision in the north east of Aberdeenshire. A reintroduced rail network serving Peterhead and Fraserburgh would be expected to encourage modal switch from private ICE vehicles to rail. Increasing the accessibility of the area via rail would strengthen the local economy for business by improving the efficiency of the transport network for both people and freight, increase skilled labour market supply which can in turn help to retain existing and attract new business to the region. This includes jobs in key strategic developments such as renewables, and CCUS at St Fergus. The railway itself would support the creation of green jobs directly through employment during its	+3

	<p>construction and in the construction of associated facilities such as stations and terminals as well as associated development such as housing, and adjacent industrial development which could be directly linked to the railway.</p> <p>By enabling the trunk haul of the transport of goods by rail freight rather than road, this option would also support Just Transition, with engagement with major industries in the region highlighting the potential for goods and products, including CO₂, to be transported more sustainably and more cost effectively for those movements to / from and beyond the Central Belt.</p>	
STAG Criteria		
Criterion		
	Performance against STAG Criterion	Score
Environment:		-3
Environment	<p>The implementation of a new passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Mintlaw is anticipated to have a major negative impact on the Environment Criterion. While the reuse of old railway alignments is proposed, the option would require significant construction to facilitate the two rail branches, in addition to a partly new railway alignment via Mintlaw, and proposed stations and freight terminals at Ellon, Peterhead and/or St Fergus. All these components are located within or adjacent to existing areas of greenspace and/or farmland, and construction in these areas would likely result in potential detrimental impacts on biodiversity and habitats; geology and soils; land use; water, drainage, and flooding; and landscape. Of the two potential rail station locations at Peterhead, it is considered that the western location would have a lesser potential impact on the environment criterion than the central location which would require construction works within the settlement.</p> <p>However, the implementation of this option also has potential to encourage a modal shift to public transport, which could have beneficial impacts on air quality and noise and vibration within the study area. Active travel provision would also be protected through the implementation of this option.</p> <p>Further option development work is required to understand the full extent of environmental impacts and subsequent opportunities for mitigation.</p>	-3
Climate Change:		+1
Greenhouse Gas Emissions	<p>The implementation of a new passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Mintlaw is anticipated to have a minor positive impact on the greenhouse gas emissions sub-criterion. During the construction phase, greenhouse gas emissions would occur due to construction activities required to deliver the infrastructure. However, in the longer term, there is potential for</p>	+1

	<p>this option to encourage a modal shift to public transport and away from private car use, thereby reducing CO₂ emissions within the study area compared to the baseline scenario. Any reductions in greenhouse gas emissions resulting from the implementation of this option would however be dependent on the level of modal shift achieved. Removal of HGV mileage associated with the transfer of goods via rail freight under this option would also positively contribute towards this criterion.</p>	
Vulnerability to the Effects of Climate Change	<p>The implementation of a new passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead could be vulnerable to the effects of climate change. Infrastructure constructed as part of this option, e.g. paved surfaces could be impacted by surface water flooding during periods of heavy rainfall. Similarly, an increase in the magnitude and frequency of storm events and heavy rainfall could lead to an increase in fallen trees and other foliage on the new rail line, resulting in significant damage and delays. The overall impact is therefore anticipated to be minor negative against this sub-criterion.</p>	-1
Potential to Adapt to the Effects of Climate Change	<p>The implementation of a new passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Mintlaw would be designed in such a way to adapt to the potential effects of climate change, and designed in accordance with relevant planning, design, engineering practice and codes. Several mitigation and adaptation measures would be considered at later design development stages to address potential risks. The overall impact is therefore anticipated to be minor positive against this sub-criterion.</p>	+1
Health, Safety and Wellbeing:		+2
Accidents	<p>This option could generate mode shift and have a moderate, positive impact on road traffic volumes, particularly longer distance road traffic. Consequently, this option could reduce the number of personal injury collisions on the A90 and A952, resulting from the reduction in the number of motor vehicles on the road network from drivers switching from car travel to public transport.</p>	+2
Security	<p>New stations associated with this option would be designed to meet modern design standards regarding security and personal safety e.g. lighting, CCTV, accessibility requirements, thereby reducing concerns around personal security, particularly amongst vulnerable users.</p>	+1
Access to Health and Wellbeing Infrastructure	<p>This option would provide a new, and faster, mode of public transport access from settlements in the region to hospitals in Aberdeen to access specialists, tests, and maternity services. Although the measures included in this option do not directly improve links to the healthcare facilities that comprise Aberdeen Royal Infirmary, the measures would improve indirect access through improved public transport provision via the city centre. Due to the longer distance nature of rail journeys, access to GP surgeries and other local care is unlikely to be affected.</p>	+1

Visual Amenity	This option would be expected to have a minor negative impact on the Visual Amenity sub-criterion associated with the visibility of the new rail line disturbing rural landscapes.	-1
Economy:		+2
Economic Efficiency of the Transport System (TEE)	<p>The STAG economic appraisal demonstrated the scheme generates positive impacts mainly in user time savings and external benefits deriving from mode shift from car to rail. Scheme present value of benefits (2010 prices) sit in the range £340m-£400m (passenger) depending on service frequency. This rail option would not serve the Fraserburgh-Peterhead market but does open a rail offer to communities such as Mintlaw. This option would provide the fastest journey time by rail between Fraserburgh and Aberdeen.</p> <p>Freight terminals at Peterhead and Ellon could generate significant further benefits through transferring the movement of goods from road to rail to/from North East Aberdeenshire, particularly to/from locations in the Central Belt and further south to the Midlands in England. It has been estimated that there is an opportunity to generate up to circa £500m in additional freight-related benefits through removing lorry-km from the Scottish and English road network. This option could also open the opportunity for a freight terminal at Fraserburgh. Further details are provided in the Rail Scheme Appraisal Technical Note provided in Appendix B.</p>	+2
Wider Economic Impacts / Benefits	This option is expected to bring a range of wider economic benefits associated with the provision of a new public transport mode and increased connectivity, including agglomeration economies, increased competition because of better transport, and wider benefits arising from improved labour supply.	+2
Equality and Accessibility:		+2
Public Transport Network Coverage	This option would have a major positive impact on public transport network coverage in the study area by introducing a new mode of public transport for longer distance journeys and improving public transport journey times for direct rail journeys and multi-modal public transport journeys involving rail – increasing the effective public transport “catchment” around stations on the line.	+3
Active Travel Network Coverage	This option is not anticipated to impact active travel network coverage in the study area. Where the railway is reinstated on the Formartine and Buchan Cycleway, a suitable alternative route will be provided.	0
Comparative Access by People Group	This option would have a moderate positive impact on comparative access by people group. Rail is one of the most accessible forms of transport for all users (children, older people, and people with mobility impairments). Furthermore, with increased opportunities to access a new form of transport, this could benefit those in more restricted user groups, for example those without access to, or who wish not to choose the private car to travel.	+2
Comparative Access by Geographic Location	This option would have a moderate positive impact on comparative access by geographic location, providing a new mode choice to settlements served (including Fraserburgh and Mintlaw).	+2

Affordability	This option would have a minor positive impact on affordability by reducing forced car ownership and reliance on taxis for people without access to a car.	+1
Implementability Appraisal		
Feasibility:	<p>Based on the engineering feasibility assessment, the introduction of a rail route which would connect Peterhead and Fraserburgh to the existing rail network at Dyce is considered to be technically feasible. However, each option would present various technical challenges. Whilst south of Ellon and towards Peterhead the proposed route would mostly utilise former rail alignment, north of Ellon towards Fraserburgh a substantial part of the proposed route would constitute new build through Mintlaw. There are several existing structures which could potentially be utilised for a new railway. However, the suitability of these existing structures would need to be assessed further at a later stage to determine if they are structurally and geometrically suitable for modern railway loading and required clearances. This option would also require the greatest number of new bridge structures.</p> <p>Within Scotland, there is strong, recent experience in the construction of new railway projects, such as Borders Rail and Levenmouth, with the knowledge and expertise developed through such projects aiding the deliverability of this option.</p> <p>Further details are provided in Appendix A.</p>	Medium - High Risk
Affordability:	This option is anticipated to have significant capital costs, with a high level of risk due to uncertainty surrounding land acquisition costs, ground conditions, topography, existing structures, utilities, environmental considerations and other exclusions, noting the preliminary stage of assessment. It is likely that ongoing subsidy would be required to operate the service, although this is not uncommon for a service operating in rural Scotland.	High Risk
Public Acceptability:	There is expected to be general support for this option due to expected connectivity benefits and economic benefits associated with regeneration and increased attractiveness of the study area as a place to live and work. There may be some opposition from land owners and local residents associated with the construction of the rail line. Overall, the public acceptability risk is considered to be low.	Low Risk

Option C		
Type of Option: Public Transport		
Title: New passenger and freight rail line between Aberdeen and Peterhead only		
Transport Planning Objectives		
Objective	Performance against TPO	Score
TPO 1: Reduce the number of people killed or seriously injured on the A90/A952 during the period 2014-19 (12 and 59 respectively) by 75% by the period 2037-2041	This option could generate additional mode shift and have a moderate, positive impact on road traffic volumes, particularly longer distance road traffic. Consequently, this option could reduce the number of personal injury collisions on the A90 and A952, resulting from the reduction in the number of motor vehicles on the road network from drivers switching from car travel to public transport.	+2
TPO 2: Reduce weekday AM and PM peak road-based journey time variation to the level seen in the inter-peak across the A90 and A952 from Fraserburgh to south of the Ellon south roundabout by 2037	This option could generate mode shift and have a moderate, positive impact on road traffic volumes and therefore improve the consistency and reliability of day-to-day journeys along the A90 and A952 for private motorists, business travel and transfer of goods.	+2
TPO 3: Increase the labour force who can access Peterhead and Fraserburgh town centres within 75 minutes by at least 65% by 2037	This option would improve public transport connections and journey times across the study area, notably Peterhead, and would provide accessibility benefits to Peterhead for employment, further education, healthcare, and social activities. Through enhancing public transport journey times to Peterhead from destinations south, including Aberdeen, this option would be anticipated to increase the labour force that can access the town within 75 minutes.	+2
TPO 4: Increase the average number of job opportunities available to Peterhead and Fraserburgh residents within 75 minutes by at least 40% by 2037	By enhancing public transport connections and journey times across the study area, particularly from Peterhead to Aberdeen, this option would increase the number of job opportunities available to residents which are accessible within 75 minutes by public transport.	+2
TPO 5: The study area's transport networks should enable a sustainable and just transition away from oil and gas for current industries, and support key strategic industrial and other developments in new sectors	This option has the potential to have a major positive impact against this objective by introducing a step-change in public transport provision in the north east of Aberdeenshire. A reintroduced rail network serving Peterhead would be expected to encourage modal switch from private ICE vehicles to rail. Increasing the accessibility of the area via rail would strengthen the local economy for business by improving the efficiency of the transport network for both people and freight, increase skilled labour market supply which can in turn help to retain existing and attract new business to the region. This includes jobs in key strategic developments such as renewables, and CCUS at St Fergus. The railway itself would support the creation of green jobs directly through employment during its	+3

	<p>construction and in the construction of associated facilities such as stations and terminals as well as associated development such as housing, and adjacent industrial development which could be directly linked to the railway.</p> <p>By enabling the trunk haul of the transport of goods by rail freight rather than road, this option would also support Just Transition, with engagement with major industries in the region highlighting the potential for goods and products, including CO₂, to be transported more sustainably and more cost effectively for those movements to / from and beyond the Central Belt.</p>	
STAG Criteria		
Criterion		
	Performance against STAG Criterion	Score
Environment:		-2
Environment	<p>The implementation of a new passenger and freight rail line between Aberdeen and Peterhead is anticipated to have a moderate negative impact on the Environment Criterion. While the reuse of old railway alignments is proposed, significant construction would be required in areas of existing greenspace and/or farmland to facilitate the new rail line and freight terminals/stations at Ellon, Peterhead and/or St Fergus, resulting in potential detrimental impacts on biodiversity and habitats; geology and soils; land use; water, drainage, and flooding; and landscape. Of the two potential rail station locations at Peterhead, it is considered that the western location would have a lesser potential impact on the environment criterion than the central location which would require construction works within the settlement.</p> <p>However, the implementation of the new rail line also has potential to encourage a modal shift to public transport, which could have beneficial impacts on air quality and noise and vibration within the study area. Active travel provision would also be protected through the implementation of this option.</p> <p>Further option development work is required to understand the full extent of environmental impacts and subsequent opportunities for mitigation.</p>	-2
Climate Change:		+1
Greenhouse Gas Emissions	<p>The implementation of a new passenger and freight rail line between Aberdeen and Peterhead is anticipated to have a minor positive impact on the greenhouse gas emissions sub-criterion. During the construction phase, greenhouse gas emissions would occur due to construction activities required to deliver the infrastructure. However, in the longer term, there is potential for this option to encourage a modal shift to public transport and away from private car use, thereby reducing CO₂ emissions within the study area compared to the baseline scenario. Any reductions in greenhouse gas emissions resulting from the implementation of this option would</p>	+1

	however be dependent on the level of modal shift achieved. Removal of HGV mileage associated with the transfer of goods via rail freight under this option would also positively contribute towards this criterion.	
Vulnerability to the Effects of Climate Change	The implementation of a new passenger and freight rail line between Aberdeen and Peterhead could be vulnerable to the effects of climate change. Infrastructure constructed as part of this option, e.g. paved surfaces could be impacted by surface water flooding during periods of heavy rainfall. Similarly, an increase in the magnitude and frequency of storm events and heavy rainfall could lead to an increase in fallen trees and other foliage on the new rail line, resulting in significant damage and delays. The overall impact is therefore anticipated to be minor negative against this sub-criterion.	-1
Potential to Adapt to the Effects of Climate Change	The implementation of a new passenger and freight rail line between Aberdeen and Peterhead would be designed in such a way to adapt to the potential effects of climate change, and designed in accordance with relevant planning, design, engineering practice and codes. Several mitigation and adaptation measures would be considered at later design development stages to address potential risks. The overall impact is therefore anticipated to be minor positive against this sub-criterion.	+1
Health, Safety and Wellbeing:		+2
Accidents	This option could generate mode shift and have a moderate, positive impact on road traffic volumes, particularly longer distance road traffic. Consequently, this option could reduce the number of personal injury collisions on the A90 and A952, resulting from the reduction in the number of motor vehicles on the road network from drivers switching from car travel to public transport.	+2
Security	New stations associated with this option would be designed to meet modern design standards regarding security and personal safety e.g. lighting, CCTV, accessibility requirements, thereby reducing concerns around personal security, particularly amongst vulnerable users.	+1
Access to Health and Wellbeing Infrastructure	This option would provide a new, and faster, mode of public transport access from settlements in the region to hospitals in Aberdeen to access specialists, tests, and maternity services. Although the measures included in this option do not directly improve links to the healthcare facilities that comprise Aberdeen Royal Infirmary, the measures would improve indirect access through improved public transport provision via the city centre. Due to the longer distance nature of rail journeys, access to GP surgeries and other local care is unlikely to be affected.	+1
Visual Amenity	This option would be expected to have a minor negative impact on the Visual Amenity sub-criterion associated with the visibility of the new rail line disturbing rural landscapes.	-1
Economy:		+2

Economic Efficiency of the Transport System (TEE)	<p>The STAG economic appraisal demonstrated the scheme generates positive impacts mainly in user time savings and external benefits deriving from mode shift from car to rail. Scheme present value of benefits (2010 prices) sit in the range £270m-£380m (passenger) depending on service frequency. Alongside Option A2 this is the only rail option that provides the opportunity to operate two trains per hour between Peterhead and Aberdeen. This option does not serve Fraserburgh directly.</p> <p>Freight terminals at Peterhead and Ellon could generate significant further benefits through transferring the movement of goods from road to rail to/from North East Aberdeenshire, particularly to/from locations in the Central Belt and further south to the Midlands in England. It has been estimated that there is an opportunity to generate up to circa £500m in additional freight-related benefits through removing lorry-km from the Scottish and English road network.</p> <p>Further details are provided in the Rail Scheme Appraisal Technical Note provided in Appendix B.</p>	+2
Wider Economic Impacts / Benefits	This option is expected to bring a range of wider economic benefits associated with the provision of a new public transport mode and increased connectivity, including agglomeration economies, increased competition because of better transport, and wider benefits arising from improved labour supply.	+2
Equality and Accessibility:		+2
Public Transport Network Coverage	This option would have a moderate positive impact on public transport network coverage in the study area (excluding Fraserburgh) by introducing a new mode of public transport for longer distance journeys and improving public transport journey times for direct rail journeys and multi-modal public transport journeys involving rail – increasing the effective public transport “catchment” around stations on the line.	+2
Active Travel Network Coverage	This option is not anticipated to impact active travel network coverage in the study area. Where the railway is reinstated on the Formartine and Buchan Cycleway, a suitable alternative route will be provided.	0
Comparative Access by People Group	This option would have a moderate positive impact on comparative access by people group. Rail is one of the most accessible forms of transport for all users (children, older people, and people with mobility impairments). Furthermore, with increased opportunities to access a new form of transport, this could benefit those in more restricted user groups, for example those without access to, or who wish not to choose the private car to travel.	+2
Comparative Access by Geographic Location	This option would have a minor positive impact on comparative access by geographic location, providing a new mode choice to settlements served.	+1
Affordability	This option would have a minor positive impact on affordability by reducing forced car ownership and reliance on taxis for people without access to a car.	+1
Implementability Appraisal		

<p>Feasibility:</p>	<p>Based on the engineering feasibility assessment, the introduction of a rail route which would connect Peterhead to the existing rail network at Dyce is considered to be technically feasible. However, each option would present various technical challenges. With Option C, the majority of the proposed route utilises former railway alignment. However, as this option only utilises sections of the current active travel route between Dyce and Ellon, it would minimise the extent of cycleway to be maintained along the route. As the route considered in this option does not include a route to Fraserburgh, it would have the lowest requirements in terms of new infrastructure.</p> <p>Within Scotland, there is strong, recent experience in the construction of new railway projects, such as Borders Rail and Levenmouth, with the knowledge and expertise developed through such projects aiding the deliverability of this option.</p> <p>Further details are provided in Appendix A.</p>	<p>Medium Risk</p>
<p>Affordability:</p>	<p>This option is anticipated to have significant capital costs, with a high level of risk due to uncertainty surrounding land acquisition costs, ground conditions, topography, existing structures, utilities, environmental considerations and other exclusions, noting the preliminary stage of assessment. It is likely that ongoing subsidy would be required to operate the service, although this is not uncommon for a service operating in rural Scotland.</p>	<p>High Risk</p>
<p>Public Acceptability:</p>	<p>There is expected to be general support for this option due to expected connectivity benefits and economic benefits associated with regeneration and increased attractiveness of the study area as a place to live and work. There may be some opposition from land owners and local residents associated with the construction of the rail line, while acceptability may be lower than the other rail options given this option would not directly serve Fraserburgh. Overall, the public acceptability risk is considered to be low.</p>	<p>Low Risk</p>

Option RD10		
Type of Option: Road		
Title: A90 Ellon to Peterhead Dualling		
Transport Planning Objectives		
Objective	Performance against TPO	Score
TPO 1: Reduce the number of people killed or seriously injured on the A90/A952 during the period 2014-19 (12 and 59 respectively) by 75% by the period 2037-2041	This option would reduce driver frustration and potentially risky overtaking behaviours associated with platooning and slow-moving vehicles. However, the increase in capacity could contribute to an increase in road traffic which may offset the benefit to some extent.	+2
TPO 2: Reduce weekday AM and PM peak road-based journey time variation to the level seen in the inter-peak across the A90 and A952 from Fraserburgh to south of the Ellon south roundabout by 2037	This option would reduce journey time variation associated with platooning and slow moving vehicles and would reduce the risk of the road having to close completely in the event of an incident or to enable maintenance works.	+2
TPO 3: Increase the labour force who can access Peterhead and Fraserburgh town centres within 75 minutes by at least 65% by 2037	This option would reduce delays associated with platooning and slow-moving vehicles, thus reducing average journey times along the route. This would increase the labour force who can access Peterhead and Fraserburgh town centres within 75 minutes.	+1
TPO 4: Increase the average number of job opportunities available to Peterhead and Fraserburgh residents within 75 minutes by at least 40% by 2037	This option would reduce delays associated with platooning and slow-moving vehicles, thus reducing average journey times along the route. This would increase the average number of job opportunities available to residents in Peterhead and Fraserburgh within 75 minutes.	+1
TPO 5: The study area's transport networks should enable a sustainable and just transition away from oil and gas for current industries, and support key strategic industrial and other developments in new sectors	This option is expected to have a minor positive impact against this objective by improving road journey times and reducing variability between Ellon and Peterhead. This would strengthen the local economy for business by improving the efficiency of the transport network for both people and freight, increase skilled labour market supply which can, in turn, help to retain existing and attract new business to the region. This includes jobs in key strategic developments such as renewables and CCUS at St Fergus.	+1
STAG Criteria		
Criterion		
	Performance against STAG Criterion	Score

Environment:		-2
Environment	<p>Overall, dualling the A90 between Ellon and Peterhead is anticipated to have a moderate negative impact on the Environment Criterion. This option would require significant construction to widen the existing A90 corridor in surrounding areas of greenspace and/or farmland, resulting in potential detrimental impacts on biodiversity and habitats; geology and soils; land use; and water, drainage, and flooding. While there is also potential for detrimental impacts on landscape, given the presence of the existing road infrastructure in this location, the overall impact on this sub-criterion is not anticipated to be significant.</p> <p>In the short term, the dualling of the A90 between Ellon and Peterhead could have potential negative impacts on air quality and noise and vibration arising from construction activities. In the longer-term, potential increases in road traffic due to increased capacity along this section of the A90 could lead to potential negative impacts on local air quality and noise and vibration for surrounding receptors.</p> <p>Further option development work is required to understand the full extent of environmental impacts and subsequent opportunities for mitigation.</p>	-2
Climate Change:		-1
Greenhouse Gas Emissions	<p>The dualling the A90 between Ellon and Peterhead is anticipated to have a minor negative impact on the greenhouse gas emissions sub-criterion. During the construction phase, greenhouse gas emissions would occur due to construction activities required to deliver the infrastructure. In the longer term, there is potential for this option to lead to increased greenhouse gas emissions due to potential increases in road traffic resulting from increased capacity along this section of the A90.</p>	-1
Vulnerability to the Effects of Climate Change	<p>The dualling of the A90 between Ellon and Peterhead could be vulnerable to the effects of climate change. With increasing summer temperatures, there is an increased risk of thermal expansion and movement of paved surfaces, potentially resulting in deformation and cracking. Additional paved surfaces could also be impacted by surface water flooding during periods of heavy rainfall. Similarly, an increase in the magnitude and frequency of storm events and heavy rainfall could lead to an increase in fallen trees and other foliage on the A90 route, resulting in significant damage and delays. The overall impact is therefore anticipated to be minor negative against this sub-criterion.</p>	-1
Potential to Adapt to the Effects of Climate Change	<p>The dualling of the A90 between Ellon and Peterhead would be designed in such a way to adapt to the potential effects of climate change, and designed in accordance with relevant planning, design, engineering practice and codes. Several mitigation and adaptation measures would be considered at later design development stages to address potential risks. The overall impact is therefore anticipated to be minor positive against this sub-criterion.</p>	+1

Health, Safety and Wellbeing:		+2
Accidents	This option would reduce driver frustration and potentially risky overtaking behaviours associated with platooning and slow-moving vehicles. Consequently, this option could reduce the number of personal injury collisions on the A90. However, the increase in capacity could contribute to an increase in road traffic which may offset the benefit to some extent.	+2
Security	This option would not be anticipated to have any impact on security.	0
Access to Health and Wellbeing Infrastructure	This option would provide more reliable road access from settlements in the region to hospitals in Aberdeen to access specialists, tests, and maternity services. Safer continuous overtaking opportunities would allow faster ambulance journey times in an emergency. Due to the longer distance nature of typical journeys via the A90, access to GP surgeries and other local care is unlikely to be affected.	+1
Visual Amenity	There is expected to be a minor negative visual amenity impact associated with the widening of the carriageway to enable dualling disturbing rural landscapes, particularly if any major realignment or offline dualling is required.	-1
Economy:		+1
Economic Efficiency of the Transport System (TEE)	This option is expected to have a minor positive impact against this objective by improving road journey times and reducing variability between Ellon and Peterhead.	+1
Wider Economic Impacts / Benefits	This option is expected to bring some wider economic benefits associated with more reliable journey times, including agglomeration economies, increased competition because of better transport, and wider benefits arising from improved labour supply.	+2
Equality and Accessibility:		0
Public Transport Network Coverage	This option would not be anticipated to have any impact on public transport network coverage.	0
Active Travel Network Coverage	This option would not be anticipated to have any impact on active travel network coverage.	0
Comparative Access by People Group	This option would not be anticipated to have any impact on comparative access by people group.	0
Comparative Access by Geographic Location	This option would have a minor positive impact on comparative access by geographic location, providing more reliable connectivity between settlements in the study area.	+1
Affordability	This option would not be anticipated to have any impact on affordability of transport.	0

Implementability Appraisal		
Feasibility:	This option is anticipated to have a moderate level of feasibility risk. Although the option would be likely to largely follow the existing carriageway, there may still be uncertainty surrounding existing structures, ground conditions and land acquisition, particularly if offline dualling is required in places. Construction feasibility is proven, with recent experience developed locally following construction of the AWPR-BT which this option would link to.	Medium Risk
Affordability:	This option is anticipated to have significant capital costs with a high level of risk. Although the option would likely follow the existing carriageway, there may still be uncertainty surrounding existing structures, ground conditions and land acquisition.	High Risk
Public Acceptability:	There is expected to be general support for this option due to expected reliability and resilience benefits. There may be some opposition from environmental groups due to the potential increase in road traffic associated with higher capacity. Overall, the public acceptability risk is considered to be low.	Low Risk

Appraisal Summary

Option	A2	B1	B2	C	RD10
Transport Planning Objectives					
TPO 1: Reduce the number of people killed or seriously injured on the A90/A952 during the period 2014-19 (12 and 59 respectively) by 75% by the period 2037-2041	2	2	2	2	2
TPO 2: Reduce weekday AM and PM peak road-based journey time variation to the level seen in the inter-peak across the A90 and A952 from Fraserburgh to south of the Ellon south roundabout by 2037	2	2	2	2	2
TPO 3: Increase the labour force who can access Peterhead and Fraserburgh town centres within 75 minutes by at least 65% by 2037	3	3	3	2	1
TPO 4: Increase the average number of job opportunities available to Peterhead and Fraserburgh residents within 75 minutes by at least 40% by 2037	3	3	3	2	1
TPO 5: The study area's transport networks should enable a sustainable and just transition away from oil and gas for current industries, and support key strategic industrial and other developments in new sectors	3	3	3	3	1
STAG Criteria					
Environment:	-3	-3	-3	-2	-2
Climate Change:	1	1	1	1	-1
<i>Greenhouse Gas Emissions</i>	1	1	1	1	-1
<i>Vulnerability to the Effects of Climate Change</i>	-1	-1	-1	-1	-1
<i>Potential to Adapt to the Effects of Climate Change</i>	1	1	1	1	1
Health, Safety and Wellbeing:	2	2	2	2	2
<i>Accidents</i>	2	2	2	2	2
<i>Security</i>	1	1	1	1	0
<i>Access to Health and Wellbeing Infrastructure</i>	1	1	1	1	1
<i>Visual Amenities</i>	-1	-1	-1	-1	-1
Economy:	2	2	2	2	1
<i>Economic Efficiency of the Transport System (TEE)</i>	2	2	2	2	1
<i>Wider Economic Impacts / Benefits</i>	2	2	2	2	2
Equality and Accessibility:	2	2	2	2	0
<i>Public Transport Network Coverage</i>	3	3	3	2	0
<i>Active Travel Network Coverage</i>	0	0	0	0	0
<i>Comparative Access by People Group</i>	2	2	2	2	0
<i>Comparative Access by Geographic Location</i>	2	2	2	1	1
<i>Affordability</i>	1	1	1	1	0
Deliverability Criteria					
Feasibility:	Medium - High Risk	Medium Risk	Medium - High Risk	Medium Risk	Medium Risk
Affordability:	High Risk	High Risk	High Risk	High Risk	High Risk
Public Acceptability:	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk

Each of option would be expected to positively contribute to the TPOs, although Options A2, B1 and B2 perform better against TPO 3 and 4 than Option C, given that these options would enhance connectivity to Fraserburgh. Option RD10 does not perform as strongly against TPOs 3,4 and 5 since it relates improving journey time and reliability on the existing route and does not provide the same step-change in connectivity as the rail options.

Regarding the STAG criteria, all options would be anticipated to provide benefits against the Health, Safety and Wellbeing criteria. All options perform negatively against the Environment criterion, associated with the introduction of significant new rail infrastructure through predominantly rural landscapes. Otherwise, the rail options generally perform positively against the STAG criteria, with minor benefits against Climate Change, and moderate benefits against Economy, and Equality and Accessibility. Option RD10 has a minor negative impact against Climate Change; a minor benefit against Economy; and performs neutrally against Equality and Accessibility, since it only benefits road users of the A90 between Ellon and Peterhead.

Feasibility risks are anticipated to be Medium to High Risk for Options A2 and B2, and Medium Risk for Options B1, C and RD10, due to uncertainties relating to groundworks and existing structures, noting that Option C only requires feasibility of a route to Peterhead, while Options B1 and RD10 will largely follow the previous/existing alignments respectively (although there may still be uncertainty surrounding existing structures). Note that recent skills and experience built locally from construction of the AWPR-BT and rail infrastructure work in the Scottish Borders and Levenmouth could support the deliverability of options.

All options are considered to have significant affordability risks due to the high capital costs. There is uncertainty surrounding specifics such as land acquisition costs, groundworks, topography, existing structures, utilities, environmental considerations, and other exclusions.

Options A2, B1, B2 and C are expected to have significant public support in terms of them enhancing connectivity, supporting regeneration in Peterhead and Fraserburgh, and increasing the overall attractiveness of the study area as a place to live and work. However, these options may have some opposition from land owners and environmental groups. Option RD10 is expected to have an element of public support due to its anticipated journey time reliability and road network resilience benefits. It may, however, have some opposition from environmental groups due to the potential increase in road traffic associated with higher capacity.

Options Contribution to Relevant Wider Policy Context

This section outlines how each of the options align with and may contribute to the aims of transport and wider (non-transport) government policies and national transport objectives.

For the purposes of this study, the following strategies and policies have been considered:

- National Transport Strategy 2
- Nestrans' Regional Transport Strategy 2040
- North East of Scotland Regional Economic Strategy 2035
- Scotland's Just Transition Objectives

Given the scope of the rail options and scale of the assessment, there is no major difference in terms of how each rail option would perform against the established policy objectives. Therefore, for the purposes of this assessment, the rail options have been considered as one overall rail option.

Option	National Transport Strategy 2			
	Reduces inequalities	Takes climate action	Helps deliver inclusive economic growth	Improves our health and wellbeing
A2: Fraserburgh via Peterhead & St Fergus	✓	✓	✓	✓
B1: Peterhead & St Fergus + Fraserburgh via Maud	✓	✓	✓	✓
B2: Peterhead & St Fergus + Fraserburgh via Mintlaw	✓	✓	✓	✓
C: Peterhead & St Fergus only	✓	✓	✓	✓
RD10: A90 Ellon to Peterhead Dualling			✓	

Option	Regional Transport Strategy 2040					
	Improved journey efficiencies to enhance connectivity	Reduced carbon emissions to support net-zero	Accessibility for all	A step change in public transport and active travel enabling 50:50 mode split	Air quality that is cleaner than WHO standards for emissions from transport	Zero fatalities on the road network
A2: Fraserburgh via Peterhead & St Fergus	✓	✓	✓	✓		✓
B1: Peterhead & St Fergus + Fraserburgh via Maud	✓	✓	✓	✓		✓
B2: Peterhead & St Fergus + Fraserburgh via Mintlaw	✓	✓	✓	✓		✓
C: Peterhead & St Fergus only	✓	✓	✓	✓		✓
RD10: A90 Ellon to Peterhead Dualling	✓					✓

Option	Regional Economic Strategy				
	To establish the North East as a pioneer of the energy transition	Maintain and increase regional GVA from region's growth sectors	Maintain a healthy, sustainable, working age population through increasing economic participation rates	Become a Real Living Wage region	Protect and enhance the natural capital
A2: Fraserburgh via Peterhead & St Fergus	✓	✓	✓		
B1: Peterhead & St Fergus + Fraserburgh via Maud	✓	✓	✓		
B2: Peterhead & St Fergus + Fraserburgh via Mintlaw	✓	✓	✓		
C: Peterhead & St Fergus only	✓	✓	✓		
RD10: A90 Ellon to Peterhead Dualling		✓	✓		

Option	Just Transition							
	Decarbonisation and Efficiencies	Citizens, Communities and Place	Jobs, Skills, and Education	Fair Distribution of Costs and Benefits	Business and Economy	Adaptation and Resilience	Environmental Protection and Restoration	Equality and Human Rights Implementation
A2: Fraserburgh via Peterhead & St Fergus	✓	✓	✓	✓	✓	✓	✓	✓
B1: Peterhead & St Fergus + Fraserburgh via Maud	✓	✓	✓	✓	✓	✓	✓	✓
B2: Peterhead & St Fergus + Fraserburgh via Mintlaw	✓	✓	✓	✓	✓	✓	✓	✓
C: Peterhead & St Fergus only	✓	✓	✓	✓	✓	✓	✓	✓
RD10: A90 Ellon to Peterhead Dualling			✓		✓			

Options A2, B1, B2 and C (Rail)

- In terms of alignment with policy, this option is considered to support most objectives set out in NTS2, RTS and the Regional Economic Strategy. It would provide a new passenger and freight rail line between Aberdeen, Ellon and Fraserburgh via Peterhead and St Fergus, which would support improved journey times by public transport and thereby align with policy objectives around inclusive economic growth and improved journey efficiencies
- This option could also encourage modal shift to public transport, which would support the 'Takes Climate Action' objective within the NTS2 by promoting greener, cleaner travel choices and the 'Step change in public transport and active travel enabling a 50:50 mode split' objective within the RTS. Furthermore, this option would support the 'Accessibility for all' objective in the RTS through improving geographic accessibility and new rail stations would be designed in accordance with physical accessibility standards, thereby supporting this objective further. A modal shift to public transport is also likely to provide safety benefits and contribute towards policy objectives focused on safety and health and wellbeing
- This option is also considered to support the NTS2 'Reducing inequalities' policy objective as improving the efficiency and reliability of the public transport network could support the stimulation of new development in the Buchan region. This, in turn, could support increased employment opportunities and contribute towards reducing inequalities. This option would also reduce inequalities by providing those without access to a private vehicle a means of accessing employment opportunities and other services
- This option would be expected to positively contribute to most of the Just Transition Fund objectives, particularly around 'decarbonisation and efficiencies.' Notably, the option would support modal shift from road freight to rail, reducing carbon emissions while increasing the efficiency of goods movements to and from the region. A reintroduced low carbon rail network serving Peterhead and Fraserburgh would be expected to encourage modal shift from private car to rail. By improving the accessibility of the Buchan region through the introduction of rail, this option would positively contribute to regeneration and economic development of the region, retaining and supporting skilled labour which will be key to supporting a Just Transition

Option RD10: A90 Ellon to Peterhead Dualling

- In terms of alignment with policy, this option is considered to support several objectives set out in NTS2, RTS and the Regional Economic Strategy. This option would provide a dual carriageway between Ellon and Peterhead, which would support improved journey times and thereby align with policy objectives around economic growth and improved journey efficiencies. Improvements to the reliability of the road network could also support the stimulation of new development in the Buchan region which, in turn, could support increased employment opportunities and contribute towards reduced inequalities
- This option is also considered to support policy objectives around improving safety on the road network. Dual carriageway provision would allow traffic to move more freely and allow for safer overtaking manoeuvres, thereby reducing the risk of collisions
- However, given the focus on road building, this option is not considered to align well with policy around taking climate action. It would sit at the bottom of the Sustainable Modal Hierarchy, which prioritises measures that promote low carbon, sustainable transport modes ahead of private vehicle use

Equality Impact Assessment

This section outlines the estimated impacts of each option on key measures contained within the Equality Act 2010, including the Public Sector Equalities Duty, the Fairer Scotland Duty, and the Child Rights and Wellbeing Duty.

The **Public Sector Equalities Duty** is outlined in Section 149 of the Equality Act 2010, and requires public bodies in exercise of its functions to have due regard to the following protected characteristics:

- Age
- Disability
- Gender Reassignment
- Pregnancy and Maternity
- Race

- Religion or Belief
- Sex and Sexual Orientation

The **Fairer Scotland Duty** is set out in Part 1 of the Equality Act 2010 and places a legal responsibility on particular public bodies in Scotland to actively consider how they can reduce inequalities caused by socio-economic disadvantage. Socio-economic disadvantage can be described as:

- Persons of low or no wealth
- Persons with low income
- Persons from a deprived area
- Persons with a poor socio-economic background
- Persons with material deprivation

The **Child Rights and Wellbeing Duty** assesses the barriers children and young people face when accessing transport. These can include:

- Socio-economic background
- Geographical location
- Accessibility and safety of transport

Equalities Assessment

The estimated impacts of each option on those key measures contained within the Equality Act 2010 are shown in Table 4-1.

Table 4-1: Option Impacts on Key Measures within Equality Act 2010

Option Ref.	Type	Title	Public Sector Equalities Duty	Fairer Scotland Duty	Child Rights and Wellbeing Duty
A2	Public Transport	New passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead (no intermediate stations north of Peterhead)	This option would result in a positive impact as rail is one of the most accessible forms of transport for all users (children, older people, and people with mobility impairments).	The reintroduction of rail would provide a new, alternative public transport mode for residents in the study area, including Fraserburgh and Peterhead which contain all nine of the most deprived datazones in Aberdeenshire.	Children and young people tend to be more reliant on public transport services, so are more likely to benefit from rail improvements. Accordingly, this option would be anticipated to have a positive impact.
B1	Public Transport	New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Maud	This option would result in a positive impact as rail is one of the most accessible forms of transport for all users (children, older people, and people with mobility impairments).	The reintroduction of rail would provide a new, alternative public transport mode for residents in the study area, including Fraserburgh and Peterhead which contain all nine of the most deprived datazones in Aberdeenshire.	Children and young people tend to be more reliant on public transport services, so are more likely to benefit from rail improvements. Accordingly, this option would be anticipated to have a positive impact.
B2	Public Transport	New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Mintlaw	This option would result in a positive impact as rail is one of the most accessible forms of transport for all users (children, older people, and people with mobility impairments).	The reintroduction of rail would provide a new, alternative public transport mode for residents in the study area, including Fraserburgh and Peterhead which contain all nine of the most deprived datazones in Aberdeenshire.	Children and young people tend to be more reliant on public transport services, so are more likely to benefit from rail improvements. Accordingly, this option would be anticipated to have a positive impact.
C	Public Transport	New passenger and freight rail line between Aberdeen and Peterhead only	This option would result in a positive impact as rail is one of the most accessible forms of transport for all users (children, older people, and people with mobility impairments).	The reintroduction of rail would provide a new, alternative public transport mode for residents in the study area, including Peterhead which contains four of the nine most deprived datazones in Aberdeenshire.	Children and young people tend to be more reliant on public transport services, so are more likely to benefit from rail improvements. Accordingly, this option would be anticipated to have a positive impact.
RD10	Road	A90 Ellon to Peterhead Dualling	This option would be anticipated to result in a disproportionate benefit to those with access to a private car and as such could increase inequalities associated with protected characteristics.	This option would improve journey time reliability by road for residents in the study area, including in Peterhead, which contains four of the nine most deprived datazones in Aberdeenshire.	The impact of this option on young people is anticipated to be limited.

Risk and Uncertainty

Sensitivity testing of the options has been undertaken to determine the relative effects of various parameters on the outcome of the scheme appraisal and optimism bias has been included in the costs. Details on assumptions are set out in Appendix B.

5. Summary and Next Steps

Introduction

The Preliminary Options Appraisal has assessed five transport options that have been identified for the Buchan Sustainable Transport Study. In line with STAG, it has considered the performance of each option against the TPOs, STAG Criteria, and an initial assessment against Feasibility, Affordability and Public Acceptability. It has also considered the 'fit' of each option in light of relevant Established Policy Objectives and key measures contained within the Equality Act 2010.

The options are:

- Option A2: New passenger and freight rail line between Aberdeen and Fraserburgh via Peterhead (no intermediate stations north of Peterhead)
- Option B1: New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Maud
- Option B2: New passenger and freight rail line between Aberdeen and Peterhead, with Fraserburgh branch from Ellon via Mintlaw
- Option C: New passenger and freight rail line between Aberdeen and Peterhead only
- Option RD10: A90 Ellon to Peterhead Dualling

Preliminary Options Appraisal Outcomes

Table 5-1: Preliminary Options Appraisal Outcomes

Option	A2	B1	B2	C	RD10
Transport Planning Objectives					
TPO 1: Reduce the number of people killed or seriously injured on the A90/A952 during the period 2014-19 (12 and 59 respectively) by 75% by the period 2037-2041	2	2	2	2	2
TPO 2: Reduce weekday AM and PM peak road-based journey time variation to the level seen in the inter-peak across the A90 and A952 from Fraserburgh to south of the Ellon south roundabout by 2037	2	2	2	2	2
TPO 3: Increase the labour force who can access Peterhead and Fraserburgh town centres within 75 minutes by at least 65% by 2037	3	3	3	2	1
TPO 4: Increase the average number of job opportunities available to Peterhead and Fraserburgh residents within 75 minutes by at least 40% by 2037	3	3	3	2	1
TPO 5: The study area's transport networks should enable a sustainable and just transition away from oil and gas for current industries, and support key strategic industrial and other developments in new sectors	3	3	3	3	1
STAG Criteria					
Environment:	-3	-3	-3	-2	-2
Climate Change:	1	1	1	1	-1
Health, Safety and Wellbeing:	2	2	2	2	2
Economy:	2	2	2	2	1
Equality and Accessibility:	2	2	2	2	0
Deliverability Criteria					
Feasibility:	Medium - High Risk	Medium Risk	Medium - High Risk	Medium Risk	Medium Risk
Affordability:	High Risk	High Risk	High Risk	High Risk	High Risk
Public Acceptability:	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk

Each option would be expected to positively contribute to the TPOs, although Options A2, B1 and B2 perform better against TPO 3 and 4 than Option C, given that these options would enhance connectivity to Fraserburgh. Option RD10 does not perform as positively against TPOs 3, 4 and 5 since it relates to improving journey times and reliability to the existing route and does not provide the same step-change in connectivity as the rail options.

Regarding the STAG criteria, each of the options have been assessed as having a negative impact against the Environment criterion, associated with the construction of significant new rail infrastructure through predominantly rural landscapes. Otherwise, the rail options generally perform positively against the STAG criteria, with minor benefits against Climate Change, and moderate benefits against Economy, and Equality and Accessibility. The performance against some of the Equality and Accessibility sub-criteria for Option C is slightly reduced given that this option does not connect to Fraserburgh. Option RD10 has a minor negative impact against Climate Change; a minor benefit against Economy; and performs neutrally against Equality and Accessibility, since it only benefits road users of the A90 between Ellon and Peterhead.

In terms of deliverability, feasibility risks are anticipated to be Medium to High for Options A2 and B2, and Medium Risk for Options B1, C and RD10, due to similar uncertainties to those identified for Affordability such as groundworks and existing structures, noting that Option B1 uses a significant proportion of the former rail alignment, Option C only requires feasibility of a route to Peterhead, while with Option RD10 dualling would likely involve a widening of the existing A90 trunk road. All options are considered to have significant affordability risks due to the high capital costs, with uncertainty surrounding specifics such as groundworks and existing structures. All options are expected to benefit from public support, although there would likely be risks associated with land acquisition and environmental concerns.

The economic appraisal suggests that the best performing rail option is Option C serving Peterhead only. The incremental costs associated with extending the scheme to Fraserburgh (either via Peterhead or via Ellon) significantly outweigh the incremental benefits of doing so. The appraisal indicates that providing a Peterhead only rail service has the potential to capture approximately 90% of the rail demand being forecast for the full scheme (i.e. also serving Fraserburgh). This option also retains the ability to provide freight facilities at both Peterhead and Ellon, which have been identified as offering the greatest opportunity to move goods traffic from road to rail in the region.

Should there be a desire for the rail scheme to reach Fraserburgh, then the outcomes from the economic appraisal suggest that this should be considered via Peterhead (Option A2) as the incremental cost of extending to Fraserburgh is less than extending from Ellon. Extending from Peterhead also allows the scheme to access the Fraserburgh-Peterhead market (the largest flow to/from Fraserburgh) and continues to allow the opportunity to consider two trains per hour between Peterhead and Aberdeen, which is not possible between Fraserburgh and Aberdeen via Ellon. Furthermore, adopting the alignment under Option A2 would make it easier to serve a potential freight terminal at St Fergus.

Rail Options B1 and B2, in economic appraisal terms, do not perform as well as either Option C or Option A2. However, for the reasons outlined in the 'Next Steps' section below, there is merit in retaining Option B1 at this stage in the scheme development process. Option B2 does not offer any significant advantage over Option B1, in economic appraisal terms, and is therefore rejected at this stage.

It is also recommended that Option RD10: A90 Ellon to Peterhead Dualling is rejected at this stage of the study. This option does not contribute as positively to the TPOs or STAG criteria as the other options. Road dualling does not align well with the Sustainable Travel and Investment Hierarchies, whereby active and sustainable travel options and those which reduce the need to travel unsustainably should be prioritised above other options, and it does not support Scottish Government's promotion of efficient and sustainable freight transport for the movement of goods, particularly the shift from road to rail. Shorter-term road-based improvements proposed for the route as part of the parallel A90(N) / A952 STAG study could also address the identified problems, including safety and journey time reliability, in a more cost-effective manner.

Next Steps: Detailed Options Appraisal

The purpose of the Detailed Options Appraisal is to undertake a detailed quantitative appraisal of the options taken forward from the Preliminary Options Appraisal. This includes a detailed appraisal of:

- The performance of options against SMART Transport Planning Objectives (TPOs)
- The impact of the options against the five STAG criteria (i.e. Environment; Climate Change; Health, Safety and Wellbeing; Economy; and Equality and Accessibility)

- Cost to Government
- Risk and Uncertainty

The potential feasibility, affordability and public acceptability risks associated with delivery of each option will also be investigated during this next and final stage of the study. A Monitoring and Evaluation plan will also be developed which will outline how the outcomes of the implemented option will be monitored and evaluated.

The economic appraisal undertaken to inform this study, as set out in Appendix B, has provided an early indication of the likely challenges that the scheme will face in relation to demonstrating value for money. It must be acknowledged, however, that the BCR is just one indicator of value for money in the wider context of achieving the objectives set for the scheme. Through detailed sensitivity testing, the appraisal has also identified where further refinement of the scheme specification will contribute to improving the overall value for money of the scheme. Examples include optimising the location of a station serving Peterhead and continuing to adopt the latest assumptions associated with improvements in rolling stock technology.

A key challenge moving into the next stage of scheme development will be providing more robust capital cost estimates, including providing greater transparency between the costs of converting old railway alignment and a completely new build. The recommendation is that rail options A2 and C are retained for further development, and both involve, to different degrees, a combination of new build and old railway alignment conversion. For Option A2 particular, it is acknowledged that to extend a railway to Fraserburgh via Peterhead would involve considerable new build (as opposed to converting an old railway alignment) north of Peterhead. Therefore, Option B1 is also recommended for further development as an alternative means of directly serving Fraserburgh using predominantly old railway alignment³. As the costing exercise is refined and developed, it would therefore be expected that a more detailed picture comparing the relative merits of adopting new build versus using existing alignments can be developed.

Furthermore, given the wide range of demand projections generated to forecast rail freight potential in the region – understandable given the longer delivery timeframe (2037) and uncertainty over CO2 reduction pathways in different industrial sectors – there would be merit in undertaking further demand assessment to understand the potential rail freight market size, including that of the non-pipeline transport market from Scottish emitters to St Fergus.

³ Option B2 north of Ellon is predominantly new build and therefore does not offer an alternative to Option A2, which is also predominantly new build north of Peterhead, in the sense of offering a fundamentally alternative deliverability scenario.

Appendix A : Rail Engineering Feasibility Technical Note

Buchan Sustainable Transport Study

Engineering Feasibility Technical Note

Campaign for North East Rail
Aberdeen and Grampian Chamber of Commerce

April 2024

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1. Introduction

1.1 Overview

This report outlines the findings from an assessment into the engineering feasibility of connecting Peterhead and Fraserburgh to the existing rail network. This would include reinstatement of significant sections of historic rail routes which previously connected to the Aberdeen to Inverness line at Dyce Junction. The historic rail routes which are considered in this study are the Formartine and Buchan Way which is currently utilised as an active travel route, and the disused Boddam branch. These historic routes were predominantly single-track railways, and the layout of these routes are highlighted in Figure 1.1. The routes from Dyce to Fraserburgh and Maud Junction to Peterhead make up the current Formartine and Buchan Way active travel route, and the section from Ellon to Boddam denotes the historic Boddam branch route.



Figure 1.1: Historic Rail Routes (CNER, 2023)

Various options have been considered to reconnect Fraserburgh and Peterhead to the rail network, all of which include reinstatement of sections of these historic routes. Each of these options include the reintroduction of rail services between Dyce and Peterhead.

Option A - proposes a route from Dyce to Peterhead which continues to Fraserburgh.

Option B - proposes that the route branches at Ellon with one route leading towards Fraserburgh and the other towards Peterhead.

Option C - proposes that the route runs from Ellon to a 'park and ride' station at Peterhead, with no route to Fraserburgh. However, this option will only be considered if the first two options are deemed not to be feasible.

There are also various alternatives to sections of the route within these three overarching options, such as optional additional stations along the route. Figures 1.2, 1.3 and 1.4 denote the proposed routes for Options A, B and C, respectively. For route sections shown in orange a single alignment option is being considered. Blue sections indicate where more than one route option is available with the selection of preferred option subject to further study to assess the benefits of each.

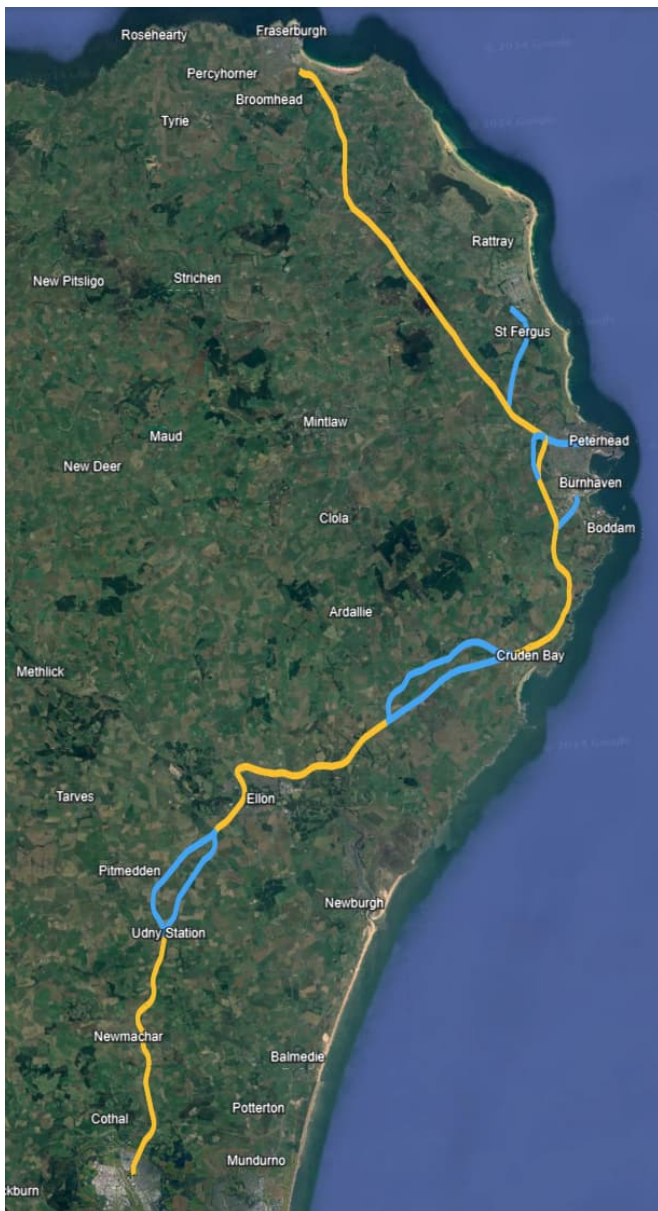


Figure 1.2: Option A proposed route



Figure 1.3: Option B proposed route

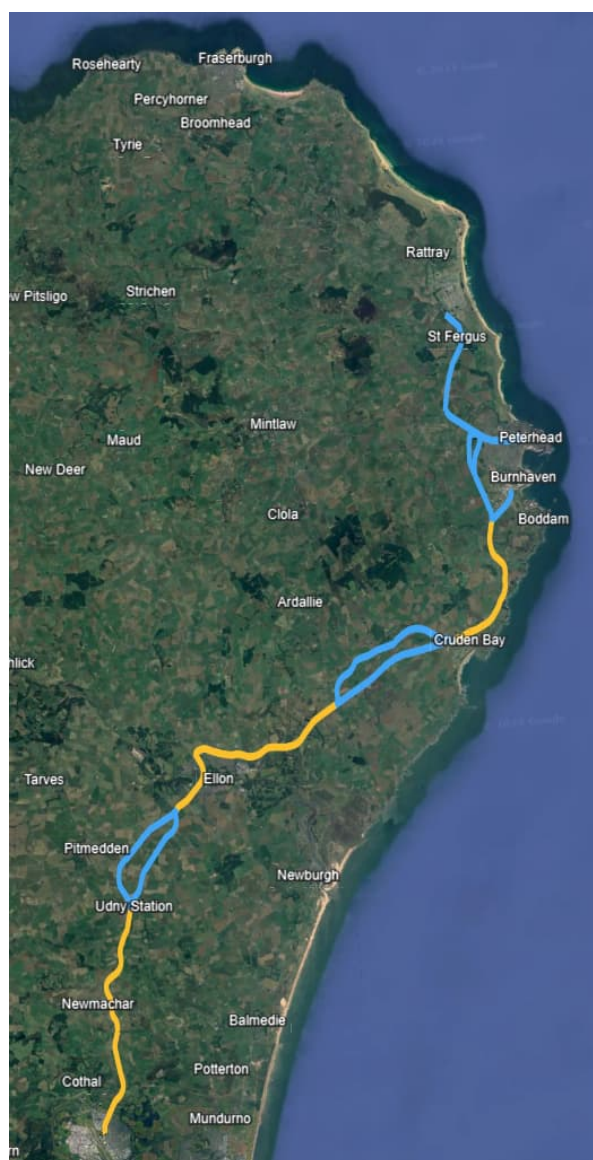


Figure 1.4: Option C proposed route

The alignment for all proposed options is single track with a target design line speed of 75mph. There is also the requirement for passing loops to increase the operational flexibility of the route. It is assumed that by the time this proposal would reach construction stage, battery operated trains would be in use in the UK. Therefore, it is assumed that OLE would only be required in sections of the route where train batteries would need to be recharged. It is also assumed that where the route utilises sections of the Formartine and Buchan Way, there would be the requirement to maintain the existing active travel route for the length of the works.

The Buchan line from Maud Junction to Peterhead closed in 1970, and the line from Dyce to Fraserburgh closed in 1979. The former Buchan line was then converted for use as an active travel route named the Formartine and Buchan Way. Much of the former railway infrastructure remains including underbridges, overbridges, station platforms and various buildings, which are in varying states of disrepair. Where the routes make use of the former rail corridors, the existing infrastructure will need to be assessed for suitability to support a modern passenger railway compliant to current standards and strengthened, modified or replaced as required.

A site walkthrough on the Formartine and Buchan Way between Dyce and Ellon was carried out for a previous AECOM study in February 2017 (*Fraserburgh and Peterhead to Aberdeen Strategic Transport Study (FPASTS) – Ellon Rail Study*) to identify site constraints and possible works required to enable reinstatement of this section of former rail route. A further site walkover between Ellon and Fraserburgh was carried out in November 2023 to assess the remaining stretch of former route between Dyce and Fraserburgh.

The former Boddam branch was closed in 1948, and unlike the Formartine and Buchan Way, this line was not preserved as an active travel route. There is still existing infrastructure along the route such as overbridges, embankments, and cuttings. Most of the underbridges along the route have been demolished including Cruden Bay Viaduct. However, in many cases abutment walls or piers remain. As this former rail route has not been preserved, it was not possible to carry out a site walkthrough and publicly available mapping and aerial imagery has been used to assess the route in this study. As noted above, the existing infrastructure will need to be assessed for suitability to support a modern passenger railway compliant to current standards and strengthened, modified or replaced as required.

Refer to the drawings in Appendix A for details on the existing and proposed infrastructure for all route options.

Appendix B includes route options which were initially considered as part of this study but have since been discounted for various reasons.

2. Route Analysis – Dyce to Ellon

The proposed route from Dyce to Ellon is the same for all three options covered in this report. The majority of this route follows the alignment of the historic Buchan line which is currently used as an active travel route known as the Formartine and Buchan Way. However, there is a diversion from the historic route where a new station is proposed at Newmachar and compliance with current standards

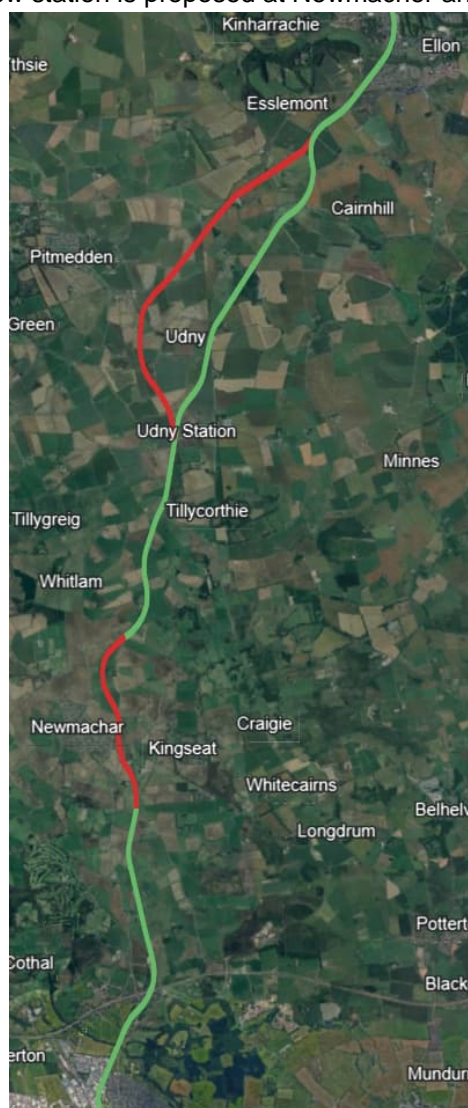


Figure 2.1: Dyce to Ellon Route Options

requires amendments to the track curvature through stations. There is also another potential diversion to an optional new station southeast of Pitmedden.

Figure 2.1 highlights the route options between Dyce and Ellon. The green sections identify the former Formartine and Buchan Way routes. The red sections are areas that are not historic rail routes and a new rail corridor would be required

Refer to drawings 60716023-AEC-DRG-ECV-000001 to 60716023-AEC-DRG-ECV-000005 in Appendix A for further information on existing and proposed infrastructure along this route.

2.1 Existing Infrastructure

2.1.1 Bridges

The following summary provides a breakdown of structure types along the Formartine and Buchan Way from Dyce to Ellon:

- Masonry arch underbridges – 6 No.
- Concrete underbridges – 3 No.
- Metallic underbridges – 9 No.
- Masonry arch overbridges – 8 No.
- Concrete overbridges – 2 No.
- Metallic overbridges – 4 No.

Additionally, there are 4 No. more significant underbridge structures on this section of the route:

- Masonry viaduct crossing River Don
- New steel structure crossing Dyce Drive
- New steel structure crossing A947
- Masonry viaduct crossing River Ythan

These existing structures will not have been subject to regular maintenance or assessed for rail traffic since the closure of the route in 1979. They have also not been subject to railway live loading since closure of the line.

2.1.2 Stations

There are remains of historic stations along the Formartine and Buchan Way from Dyce to Ellon. Historic Station locations where remnants of platforms remain are as follows:

- Parkhill Station
- Newmacher Station
- Udney Station
- Logierieve Station
- Esslemont Station
- Ellon Station

Removal of the existing station platforms will be required to prevent any potential clearance issues.

2.1.3 Road Crossings

The historic route intersects with classified and unclassified road carriages at 4 No. locations along the Formartine and Buchan Way between Dyce and Ellon. There is a road intersection which has been identified as a former railway level crossing at Tillycorthie, just south of Udney Station.

There are also various field to field crossings along the Formartine and Buchan Way.

2.1.4 Earthworks and Boundary

The existing railway corridor, outside of the station areas, is relatively consistent along the Formartine and Buchan Way from Dyce to Ellon. There are localised areas along the route where the railway corridor has been reduced through acquisition of adjacent land. Where historic platforms are still present, there are instances where residential properties have been constructed on one or both station platforms. The earthworks along the route appear unchanged since closure of the railway corridor, with a variety of steep and shallow embankments and cuttings present. Local rock cuttings were also identified along the route.

2.1.5 Track

The historic track components along the Formartine and Buchan Way have been removed since the closure of the route. However, it is clear from record information that the historic Buchan route was connected to the current operational railway south of Dyce Station. The historic route was largely single track and followed the alignment of the existing solum. Ground investigation would be required to determine if the track bed is still present.

The gradient of the historic track bed is shown in record information. The track gradient fell at approximately 1 in 85 from Dyce to the former Parkhill Station site, before rising sharply at a gradient of approximately 1 in 80 (worst case 1 in 75) to a high point north of the former Newmacher Station site. The track then fell at a similar gradient through former station sites at Udney, Logierieve and Esslemont, to reach a low point at the former Ellon Station site. The gradients of the historic route are not compliant with current railway standards, particularly through station locations.

2.1.6 Other Infrastructure

There are various timber and masonry buildings present along the former railway corridor. There are also instances of disused masonry abutment walls along the former rail route, indicating that old railway bridge decks have been removed in some cases.

2.2 Proposed Infrastructure

2.2.1 Tie-in to Existing Network

The proposed tie-in to the existing operational rail network at Dyce Station was analysed in a previous AECOM study which investigated the feasibility of reconnecting the section of the Formartine and Buchan Way from Dyce to Ellon to the current rail network.

Historically, the former Buchan line tied into the south of the current Dyce Station platforms. Therefore, to connect the new rail route to the existing network in the same way, demolition and reconstruction of the platforms would be required. A new island platform and footbridge would be required to allow access to the new platform. A new switches and crossings turnout from the existing route would also be required to allow access to the new route south of Dyce Station.

Alternatively, the route could tie-in to the existing rail network north of Dyce Station. However, during the previous Dyce to Ellon study, a tie-in to the South of the station was deemed to be the most feasible option at this stage due to issues with limited availability of space to the north of the station.

2.2.2 Stations

Newmacher & Kingseat Station



Figure 2.2: Proposed Indicative Alignment at Newmacher

The previous AECOM study also recommended a diversion from the historic route at Newmacher. The historic Newmacher Station was situated on a curve which would not conform to current design standards for new stations.

The green route in Figure 2.2 denotes the historic Formartine and Buchan Way route and the red route denotes the proposed indicative alignment through this section. The proposed alignment is still curved slightly to reduce the extent of earthworks required to achieve compliant gradients, whilst keeping the curvature above the minimum radius for 75mph line speeds. This will also allow for a straight section through the proposed station location whilst ensuring no clashes with the adjacent planned housing development highlighted in Figure 2.2.

Pitmedden



Figure 2.3: Proposed Indicative Pitmedden Alignment Options

There is an optional station proposed southeast of Pitmedden. This station is on an optional alignment which branches off from the historic Formartine and Buchan Way to a new station to serve Pitmedden. The alternative option is to continue along the historic route through this section, with no station at Pitmedden. The green route in Figure 2.3 denotes the historic Formartine and Buchan Way route option and the red route denotes the indicative route option via Pitmedden Station.

Ellon

It is proposed to locate the station at Ellon at the approximate location of the historic Ellon Station. However, this would require the existing station platforms to be demolished and reconstructed. Therefore, it is proposed that the new station is constructed north of the former station around a masonry building ruin to prevent the need for significant land take and demolition. Earthworks will also be required to achieve a compliant gradient through the station as the existing route gradients through this area would not conform to current railway standards. The proposed location of the new Ellon Station is shown in Figure 2.4.



Figure 2.4: Proposed Ellon Station Location

2.2.3 Bridges

New bridges are proposed where the proposed route intersects with a road or watercourse. Between Dyce and Ellon there are 16 No. crossings which would require a new bridge structure, assuming the railway branches off from the historic route at Udney and is routed via a new station at Pitmedden. Alternatively, if the route were to continue along the historic alignment from Udney to Ellon, this would reduce the number of new bridges required between Dyce and Ellon to 12 No. structures.

2.2.4 Track

There will be approximately 7.5 miles of track required along the existing alignment between Dyce and Ellon, assuming the railway branches off from the historic route at Udney and is routed via a new station at Pitmedden. There would also be approximately 6 miles of track on new alignment required due to diversions from the historic route at Newmacher and Pitmedden.

Alternatively, if the route were to continue along the historic alignment from Udney to Ellon with no diversion Pitmedden, this would reduce the length of track required on new alignment. This would result in approximately 11.5 miles of track on existing alignment and approximately 2 miles of track on new alignment.

3.Route Analysis – Ellon to Peterhead

The proposed route from Ellon to Peterhead is the same for all three options covered in this report. This route utilises sections of the historic Boddam Branch, as well as sections of proposed new alignment. Figure 3.1 highlights the route options between Ellon and Peterhead. The green sections of route denote existing alignment and the red sections of route denote new alignment.

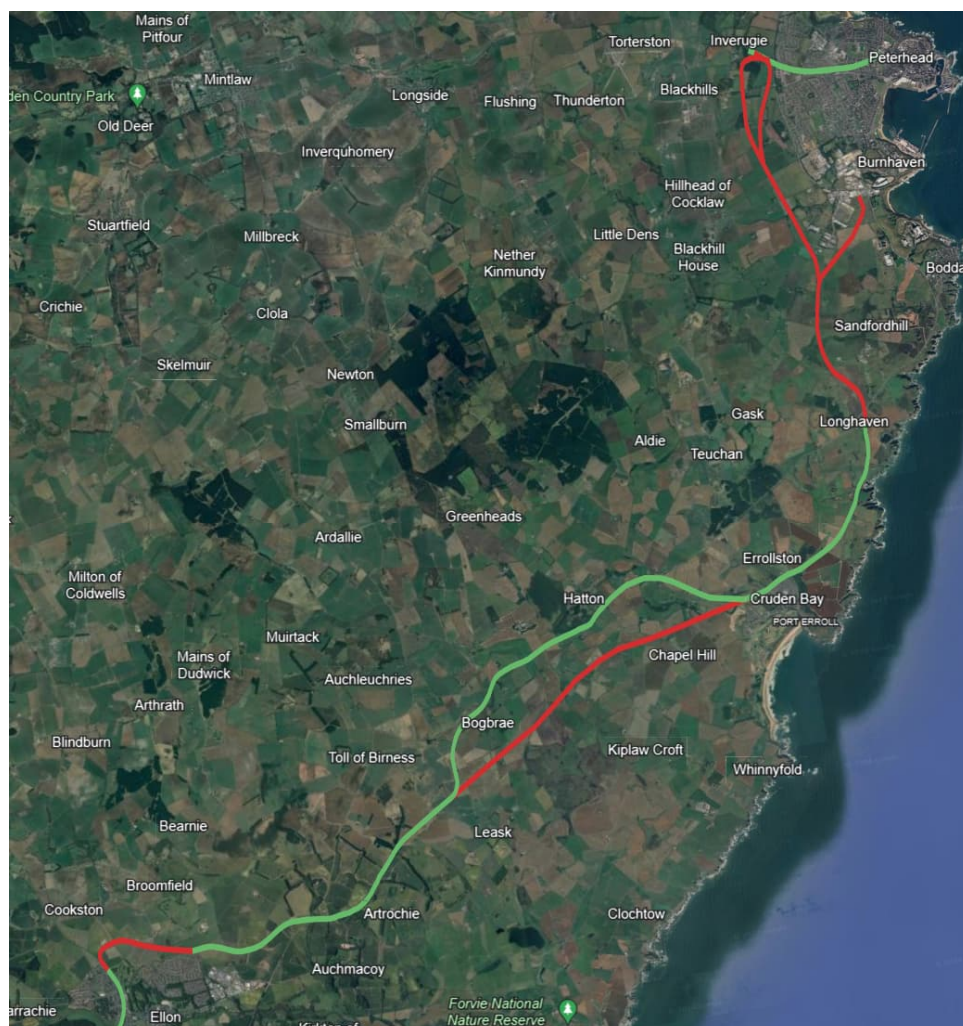


Figure 3.1: Ellon to Peterhead Proposed Route options

There are three potential Peterhead Station sites considered in this study which are shown in Figure 3.2. One possible station location is south of Peterhead, another option is a station located west of Peterhead and the final option is the site of the historic Peterhead Station in the town centre.



Figure 3.2: Peterhead Station Location Options

Refer to drawings 60716023-AEC-DRG-ECV-000006 to 60716023-AEC-DRG-ECV-000013 in Appendix A for further information on existing and proposed infrastructure along this route.

3.1 Existing Infrastructure

3.1.1 Bridges

There are 2 No. overbridges between Ellon and Bograe on the section of the historic Boddam branch utilised by the route options between Ellon and Peterhead.

There are 2 No. overbridges through Peterhead on the section of the historic Formartine and Buchan Way utilised by the route options between Ellon and Peterhead.

These existing structures will not have been subject to regular maintenance or assessed for rail traffic since the closure of the historic routes. They have also not been subject to railway live loading since closure of the line.

3.1.2 Stations

There are no existing stations between Ellon and Peterhead.

3.1.3 Road Crossings

The section of the historic Boddam branch utilised by the options in this proposal intersects classified and unclassified roads at 18 No. locations, including 3 No. A90 crossings.

The section of the Formartine and Buchan Way which would be utilised, provided that the historic Peterhead Station site in the town centre is selected, intersects with classified and unclassified roads at a further 5 No. locations, including 1 No. A90 crossing. It also intersects with 1 No. pedestrian crossing.

3.1.4 Earthworks and Boundary

The condition and presence of boundary fence along the old Boddam branch route could not be confirmed as this line was not preserved after closure in 1948. A site walkover could not be undertaken as this route is disused with some sections being completely removed, particularly where the route crossed the A90 and A975. Several sections which remain are fenced off to prohibit access,

with other sections overgrown with vegetation. However, most of the route is still visible, and the earthworks appear largely unchanged since closure of the railway corridor, with several cuttings and embankments evident.

3.1.5 Track

The track components along the historic Boddam Branch have been removed since the closure of the route. The route was largely single track and followed the alignment of the existing solum. Ground investigation would be required to determine if the track bed is still present.

The gradient of the historic track bed is unknown due to lack of access to record information. The gradients of the historic route would need to be assessed at a later stage to ensure they are compliant with current railway standards. If the gradients of the route are not suitable for a modern rail route, earthworks would need to be carried out to bring the gradients into compliance.

3.1.6 Other Infrastructure

There are instances of disused masonry abutment walls along the former rail route, indicating that old railway bridge decks have been removed in some cases.

3.2 Proposed Infrastructure

3.2.1 Ellon to Stirling Hill Bypass

This section of route between Ellon and Peterhead runs from Ellon Junction to a section of proposed new alignment referred to as the Stirling Hill Bypass. This bypass runs from the point the route leaves the historic alignment at Longhaven, heading to a point north of Sandfordhill where the route then branches off towards the optional Peterhead Station sites (Figure 3.3).



Figure 3.3: Stirling Hill Bypass Indicative Route

Bridges

New bridges are proposed where the proposed route intersects with a road or watercourse. Between Ellon and the Stirling Hill bypass there are 24 No. crossings which would require a new bridge structure to be constructed, assuming the railway continues along the historic Boddam route via a new station at Hatton.

Alternatively, if the route were to branch off from the historic alignment at Bogbrae on a more direct route to Cruden Bay, this would reduce the number of new bridges required between Ellon and the Stirling Hill Bypass to 22 No. structures, avoiding 2 No. additional A90 crossings.

Track

Use of the historic alignment of the Boddam branch heading out of Ellon (Ellon Junction) is not possible as residential properties have been constructed on this section of the route since closure of the line. Therefore, a new Ellon Junction alignment is proposed which curves round north of the historic alignment before joining the historic route further east. The alignment options for this junction were restricted due to the golf course to the south of the route and industrial buildings north of the route (Figure 3.4). Therefore, the route curves round through fields between these assets which limits the achievable curvature of the route. The route curves at a 200m radius bend which is the minimum allowable curvature for a passenger line at maximum cant of 150mm. This would restrict the speed through this junction to 40mph.



Figure 3.4: Ellon Junction Indicative Alignment

There are two potential route options proposed between Bogbrae and Cruden Bay. The first option continues along the historic branch via a new station at Hatton. An alternative option is to branch off from the historic alignment at Bogbrae, taking a more direct route, before rejoining the historic route on approach to Cruden Bay.

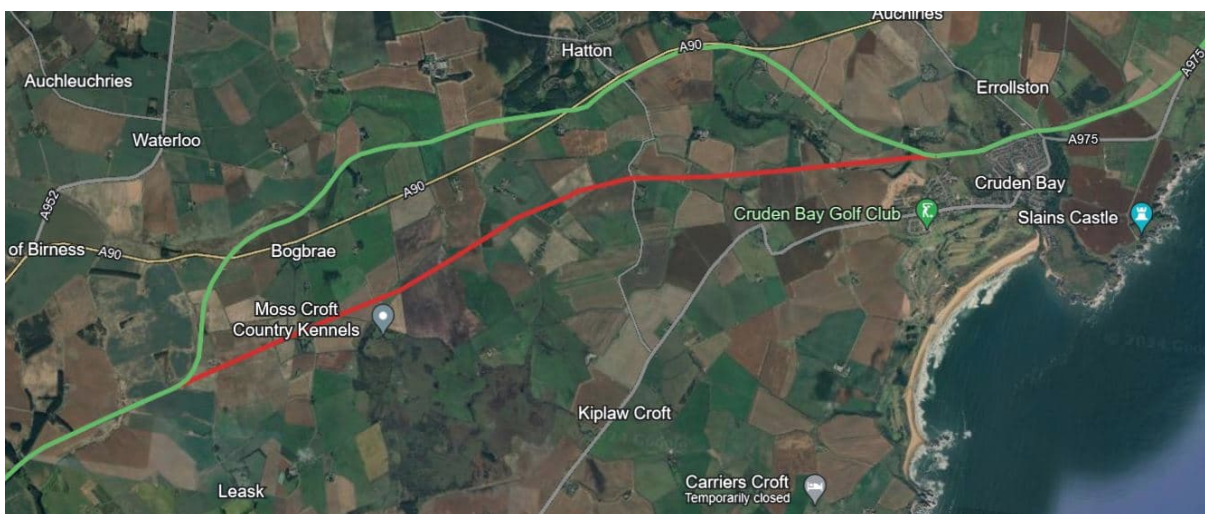


Figure 3.5: Indicative Bogbrae to Cruden Bay route options

The green route shown in Figure 3.5 denotes the historic Boddam Branch route which would allow for a station at Hatton. However, due to the curvature of the historic route at Bogbrae, the speed limit would be restricted to 55mph through Bogbrae which is below the target line speed of 75mph. This route also crosses the A90 twice, once at Bogbrae and again on approach to Hatton. The red route shown in Figure 3.5 denotes an indicative more direct route to Cruden Bay which would avoid 2 No. A90 crossings and allow for a line speed of 75mph to be maintained between Bogbrae and Cruden Bay.

The historic Boddam Branch did not go as far as Peterhead, therefore, at Longhaven the route branches off from the historic alignment, heading North towards Peterhead.

There will be approximately 12 miles of track required along the existing alignment between Ellon and the Stirling Hill Bypass, assuming the railway continues along the historic Boddam route via a new station at Hatton. There would also be approximately 3.5 miles of track on new alignment required due to the proposed alignment at Ellon Junction and the Stirling Hill Bypass.

Alternatively, if the route were to branch off from the historic alignment at Bogbrae on a more direct route to Cruden Bay, this would reduce the total length of track required but would increase the length of track required on new alignment. This would result in approximately 7 miles of track on existing alignment and approximately 7.5 miles of track on new alignment.

Stations

There are 2 No. proposed stations between Ellon Junction and the Stirling Hill Bypass. There is a proposed station at Cuden Bay and a proposed optional Station at Hatton, which is dependent on which alignment option is selected between Bogbrae and Cruden Bay.

3.2.2 Peterhead Station (South) Option

The first option for Peterhead Station is located south of Peterhead. This option would require the shortest length of track and reduce the amount of new infrastructure required to reach Peterhead Station if the route was to branch at Ellon (Option B).

Bridges

New bridges are proposed where the proposed route intersects with a road or watercourse. Between the Stirling Hill Bypass and this option for Peterhead Station location (south of Peterhead), there are 2 No. road crossings which would require new bridge structures to be constructed.

Track

There would be approximately 1.5 miles of track on new alignment required between the Stirling Hill bypass and this Peterhead Station option.

3.2.3 Peterhead Station (West) Option

The second option for Peterhead Station is a location west of Peterhead which ties in to the existing Formartine and Buchan Way. This would be the preferred option for Peterhead Station if the route was to run from Peterhead to Fraserburgh (Option A).

Bridges

New bridges are proposed where the route intersects with a road or watercourse. Between the Stirling Hill Bypass and this option for Peterhead Station location (west of Peterhead), there are 5 No. road crossings (including 1 No. A950 crossing) which would require new bridge structures.

Track

There would be approximately 3 miles of track on new alignment and approximately 0.5 miles of track on existing alignment required between the Stirling Hill bypass and this Peterhead Station option, located west of Peterhead.

Due to the radius of the curve required to curve round and tie-in to the existing alignment of the Formartine and Buchan Way at the proposed Station location (Figure 3.6), the line speed round this bend on approach to the station would be reduced to 40mph. The green route in Figure 3.6 denotes the Formartine and Buchan Way and the red route denotes the indicative new alignment on approach to the station.

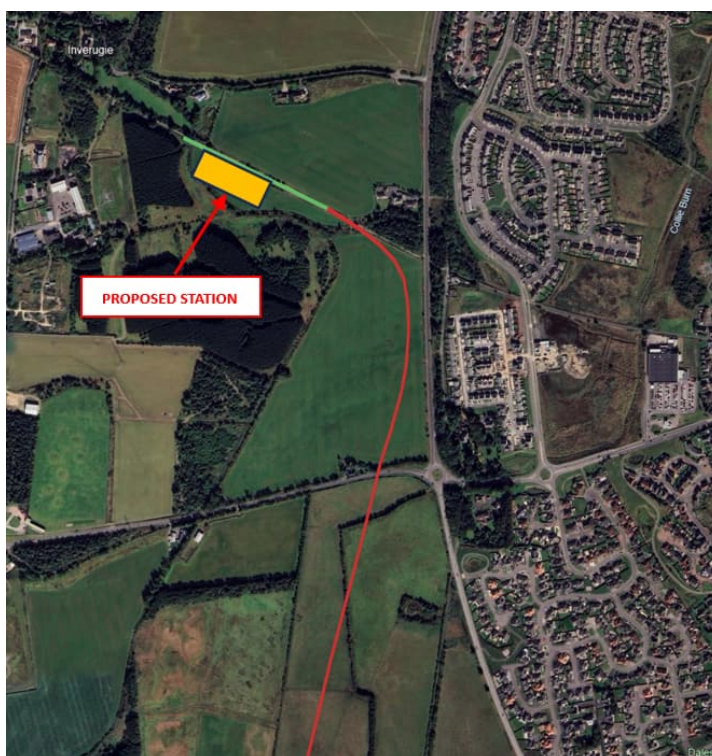


Figure 3.6: Peterhead Station Option (West) approach

3.2.4 Historic Peterhead Station Option

The final Peterhead Station option considered in this report is the site of the historic station. This option would allow for the most central station location and utilises a section of the Formartine and Buchan Way through the town centre.

Bridges

For the historic Peterhead Station site option, 6 No. new bridges would be required in addition to those outlined in Section 3.2.3. This includes the need for construction of a bridge where the route crosses the A90 just west of Peterhead.

Track

There would be approximately 1.5 miles of track on existing alignment and 3 miles of track on new alignment required between the Stirling Hill Bypass and the historic Peterhead Station site.

Due to the radius of the curve required to curve round and tie-in to the existing alignment of the Formartine and Buchan Way west of Peterhead (Figure 3.7), the line speed round this bend on approach to the tie in point of the historic route would be reduced to 40mph. The green route in Figure 3.7 denotes the Formartine and Buchan Way and the red route denotes the indicative new alignment to tie-in to the historic route.



Figure 3.7: Historic Peterhead Station Option

4.Route Analysis – Peterhead to Fraserburgh

The route from Peterhead to Fraserburgh has been considered as part of Option A. If this option is selected, the Peterhead Station location to the west of Peterhead would likely be the preferred option. The route from Peterhead to Fraserburgh utilises sections of the historic Formartine and Buchan Way alignment as it leaves Peterhead Station and between Lonmay and Fraserburgh. The remainder of the proposed route, between Torterston and Lonmay is on new alignment. Figure 4.1 highlights the route options between Peterhead and Fraserburgh. The green sections identify the former railway route. The red sections are areas that are not historic rail routes, and a new rail corridor would be required.



Figure 4.1: Peterhead to Fraserburgh Route Options

Refer to drawing 60716023-AEC-DRG-ECV-000015 in Appendix A for further information on existing and proposed infrastructure along this route.

4.1 Existing Infrastructure

4.1.1 Bridges

The following summary provides a breakdown of existing structures along the section of the historic Formartine and Buchan Way which would be utilised between Peterhead and Fraserburgh provided that the Peterhead Station site west of Peterhead is selected.

- 1 No. masonry overbridge at Inverugie
- Metallic overbridge – 2 No.
- Metallic underbridge – 4 No.

These existing structures will not have been subject to regular maintenance or assessed for rail traffic since the closure of the route. They have also not been subject to railway live loading since closure of the line.

4.1.2 Stations

There are no existing stations between Peterhead and Fraserburgh.

4.1.3 Road Crossings

The historic sections utilised by this route intersect with roads at 5 No. locations along the route.

4.1.4 Earthworks and Boundary

The existing railway corridor is relatively consistent along the Formartine and Buchan Way from Peterhead to Fraserburgh. There are localised areas along the route where the railway corridor has been reduced through acquisition of adjacent land. The earthworks along the route appear unchanged since closure of the railway corridor, with a variety of steep and shallow embankments and cuttings present. Local rock cuttings were also identified along the route.

4.1.5 Track

The historic track components along the Formartine and Buchan Way have been removed since the closure of the route. The historic route was largely single track and followed the alignment of the existing solum. Ground investigation would be required to determine if the track bed is still present.

The proposed route between Peterhead and Fraserburgh uses a small section of the Formartine and Buchan Way through Inverugie. The gradient of the historic track bed is shown in record information. The track rose from Longside through the former Newseat Halt Station site (worst case 1 in 100 rise) before falling through the former Inverugie Station site towards the historic Peterhead Station site (worst case 1 in 100 fall). The proposed route also uses a section of the Formartine and Buchan Way from Lonmay to Fraserburgh. The gradient of the track fell from Lonmay through the historic Rathen Station (worst case 1 in 80 fall) before levelling out on approach to the former Philorth Halt Station. The track remained relatively level towards the historic Fraserburgh Station site. The gradients of the historic route are not compliant with current railway standards, particularly through station locations.

4.1.6 Other Infrastructure

There are various timber and masonry buildings present along the former railway corridor. There are also instances of disused masonry abutment walls along the former rail route, indicating that old railway bridge decks have been removed in some cases.

4.2 Proposed Infrastructure

4.2.1 Bridges

New bridges are proposed where the proposed route intersects with a road or watercourse. Between Peterhead and Fraserburgh there are 22 No. crossings (including 1 No. A90 crossing & 1 No. crossing of the River Ugie) which would require new bridge structures to be constructed.

4.2.2 Track

There will be approximately 8.5 miles of track on new alignment and approximately 5 miles of track on existing alignment required between Peterhead and Fraserburgh.

4.2.3 Stations

There is 1 No. station proposed at Fraserburgh.

5.Route Analysis – Ellon to Fraserburgh

The route between Ellon and Fraserburgh has been considered as part of Option B. There are two potential route options between Ellon and Fraserburgh. The first option is to utilise the entire length of the existing alignment along the Formartine and Buchan Way between Ellon and Fraserburgh. An alternative option is to utilise sections of the Formartine and Buchan Way south of Mill or Elrick and north of Lonmay. The remainder of the route would be on new alignment via a new station at Mintlaw.

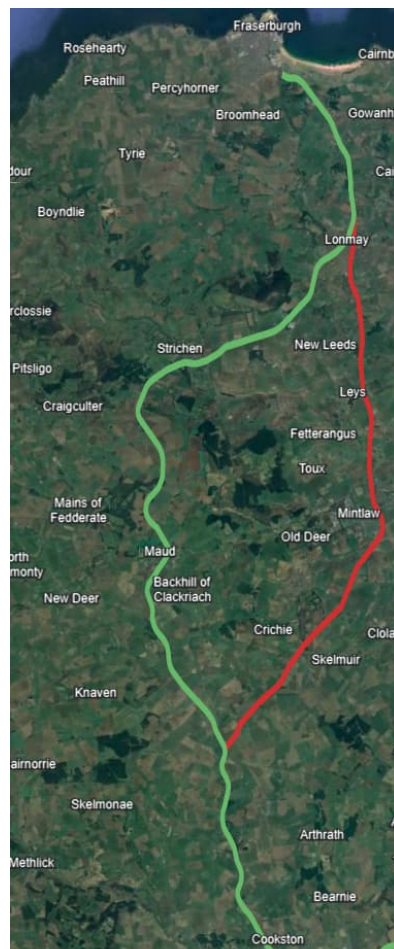


Figure 5.1: Ellon to Fraserburgh Route Options

Figure 5.1 highlights the route options between Ellon and Fraserburgh. The green sections identify the former rail routes. The red sections are areas that are not historic rail routes where a new rail corridor would be required.

Refer to drawings 60716023-AEC-DRG-ECV-000016 & 60716023-AEC-DRG-ECV-000017 in Appendix A for further information on existing and proposed infrastructure along this route.

5.1 Existing Route (F&B Way)

5.1.1 Existing Infrastructure

Bridges

The following summary provides a breakdown of structure types along the Formartine and Buchan Way from Ellon to Fraserburgh:

- Concrete underbridges – 3 No.
- Metallic underbridges – 19 No.
- Masonry arch overbridge – 3 No.
- Concrete overbridge – 1 No.
- Metallic overbridge – 23 No.

Additionally, there are 5 No. more significant underbridge structures on this section of the route:

- Metallic underbridge over North Ugie Water – 1 No.
- Metallic underbridge over South Ugie Water – 1 No.
- Metallic underbridges near Auchnagatt replaced December 2023 – 3 No.

These existing structures will not have been subject to regular maintenance or assessed for rail traffic since the closure of the route in 1979. They have also not been subject to railway live loading since closure of the line.

Stations

Remnants of the historic station platforms remain at the site of the historic Maud Station on the Formartine and Buchan Way between Ellon and Fraserburgh. Removal of the existing station platforms will be required to prevent any potential clearance issues.

Road Crossings

The historic route intersects with classified and unclassified roads at 17 No. locations along the Formartine and Buchan Way between Ellon and Fraserburgh, including 1 No. A90 crossing just North of Lonmay.

There are also various field to field crossings along the Formartine and Buchan Way.

Earthworks and Boundary

The existing railway corridor is relatively consistent along the Formartine and Buchan Way from Ellon to Fraserburgh. There are localised areas along the route where the railway corridor has been reduced through acquisition of adjacent land. The earthworks along the route appear unchanged since closure of the railway corridor, with a variety of steep and shallow embankments and cuttings present. Local rock cuttings were also identified along the route.

Track

The historic track components along the Formartine and Buchan Way have been removed since the closure of the route. The historic route was largely single track and followed the alignment of the existing solum. Ground investigation would be required to determine if the track bed is still present.

The gradient of the historic track is shown in record information. The track rose at a gradient of approximately 1 in 75 out of Ellon, before falling to a low point at the former Arnage Station site (worst case 1 in 80 fall). The track then rose at a gradient of approximately 1 in 150 (worst case 1 in 120) through the former Auchnagatt Station before falling at a gradient of approximately 1 in 100 through the former Maud Station site. The route then rose through the former Brucklay Station site (worst case 1 in 70 rise), before falling at a gradient of approximately 1 in 60 to a low point at the former Strichen station. The track then rose to a high point at the former Mormond Halt Station (worst case 1 in 66 rise) before falling through former station sites at Lonmay and Rathen (worst case 1 in 70 fall). The track then levelled out on approach to the former Philorth Halt Station, remaining relatively level towards the historic Fraserburgh Station site. The gradients of the historic route are not compliant with current railway standards, particularly through station locations.

Other Infrastructure

There are various timber and masonry buildings present along the former railway corridor. There are also instances of disused masonry abutment walls along the former rail route, indicating that old railway bridge decks have been removed in some cases.

5.1.2 Proposed Infrastructure

Bridges

New bridges are proposed where the proposed route intersects with a road or watercourse. Between Peterhead and Fraserburgh there are 17 No. crossings (including 1 No. A90 crossing) which would require new bridge structures to be constructed along the Formartine and Buchan Way between Ellon and Fraserburgh.

Track

There would be approximately 26.5 miles of track on existing alignment required between Ellon and Fraserburgh. There are 5 No. curves along this route which will restrict the line speed to below the target speed of 75mph. The curves where speed will need to be reduced and corresponding maximum speeds are shown in Figure 5.2. The green route in Figure 5.2 denotes the Formartine and Buchan Way.

Stations

There are 3 No. stations proposed along the historic route option between Ellon and Fraserburgh. These stations are proposed at Maud, Strichen and Fraserburgh.



Figure 5.2: Speed restrictions along Formartine and Buchan Way from Ellon to Peterhead

5.2 New Route (via Mintlaw)

5.2.1 Existing Infrastructure

Bridges

The following summary provides a breakdown of structure types along the Formartine and Buchan Way from Ellon to Fraserburgh which would be utilised by this option:

- Metallic underbridges – 5 No.
- Masonry arch overbridge – 2 No.
- Metallic overbridge – 7 No.

These existing structures will not have been subject to regular maintenance or assessed for rail traffic since the closure of the route in 1979. They have also not been subject to railway live loading since closure of the line.

Stations

There are no existing stations along this route from Ellon to Fraserburgh.

Road Crossings

The historic sections of this route intersect with classified and unclassified roads at 6 No. locations between Ellon and Fraserburgh.

There are also various field to field crossings along the Formartine and Buchan Way.

Earthworks and Boundary

The existing railway corridor is relatively consistent along the Formartine and Buchan Way from Ellon to Fraserburgh. There are localised areas along the route where the railway corridor has been reduced through acquisition of adjacent land. The earthworks along the route appear unchanged since closure of the railway corridor, with a variety of steep and shallow embankments and cuttings present. Local rock cuttings were also identified along the route.

Track

Refer to the 'Track' section in Section 5.1.1 of this report for historic track information for the Formartine and Buchan Way between Ellon and Fraserburgh.

Other Infrastructure

Refer to the 'Other Infrastructure' section in Section 5.1.1 of this report for information on additional existing infrastructure along the Formartine and Buchan Way between Ellon and Fraserburgh.

5.2.2 Proposed Infrastructure

Bridges

New bridges are proposed where the proposed route intersects a road or watercourse. Between Peterhead and Fraserburgh there are 26 No. crossings (including 1 No. A90 crossing) which would require new bridge structures to be constructed.

Track

There would be approximately 10 miles of track on existing alignment and approximately 14.5 miles of track on new alignment required along this proposed alignment between Ellon and Fraserburgh.

There are 2 No. curves on the Formartine and Buchan Way on this proposed route from Ellon to Fraserburgh which will restrict the line speed below the target speed of 75mph. The curves where speed will need to be reduced and corresponding maximum speeds are shown in Figure 5.2 in Section 5.1.2. The green route in Figure 5.2 denotes the Formartine and Buchan Way and the curves which will affect this route option are the two southern most curves highlighted in Figure 5.2.

Stations

There are 2 No. Stations proposed along this route alignment option between Ellon and Fraserburgh. These stations are proposed at Mintlaw and Fraserburgh.

6. Additional Proposed Works

6.1 Bridges

6.1.1 Structure Capacity

The existing underbridge structures on the Formartine and Buchan Way and the historic Boddam Branch will require a full structural assessment to NR/GN/CIV/025 – *Structural Assessment of Underbridges* to ensure that the current capacity of the structures exceeds the proposed Route Availability (RA) of the line. The metallic underbridges identified along the route are likely to require significant strengthening or replacement. Existing masonry arch underbridges and precast concrete underbridges are more likely to conform to modern railway standards in terms of loading capacity and minor repairs may be all that is required. However, this can only be verified through full structural assessment of these underbridges.

Where it is identified through structural assessment that full superstructure replacement is required, the bridge foundations would require assessment to determine if they can withstand the additional dead load from the superstructure.

There are several structures which have been constructed or replaced along the Formartine and Buchan Way since the closure of the historic Buchan line. There are 2 No. modern steel underbridges crossing Dyce Drive and the A947 which were constructed after closure of the railway. There are also 2 No. metallic underbridges south of Auchnagatt, and 1 No. metallic underbridge north of Auchnagatt which were replaced in 2023. As these structures are located on an existing active travel route, it is likely that they have been designed for pedestrian / cycleway loading only. Therefore, these structures will likely not be suitable for railway use and will need to be replaced. The bridge foundations for these structures would also need to be assessed to determine if they are suitable for railway use.

6.1.2 Structure Clearance

The historic routes were single track and therefore, existing infrastructure along these routes was initially constructed to accommodate this. However, these structures will require assessment to ensure they meet the minimum clearance requirements for modern day railway standards.

Horizontal Clearance

Current railway standards dictate that a cess walkway should be provided on either side of the track on an underbridge where deemed reasonably practicable. For line speeds of less than 100mph, this would require a minimum distance of 1.25m horizontal clearance from the running edge to the edge of the walkway and an additional horizontal distance provided for a walkway. Current standards dictate that the required width of walkway should not be below the minimum required for whole body access for horizontal body movement in an upright posture. The width of walkway required would be dependent on a number of factors, but it is likely to be in the order of 800mm in this scenario. The minimum required clearances also increase dependent on the curvature of the track.

During the site walkthrough, structure widths between parapets of as low as 3m were observed. Therefore, in this case, the minimum clearances required to provide a continuous position of safety along the length of the structure would not be achievable if the existing structure was left in place. Assuming Network Rail agreement, local limited clearances could be provided on the basis that a position of safety is provided at both ends of the structure. However, large structures such as viaducts would require a continuous position of safety along the length of the structure. If this is not possible due to the width of the existing deck, a walkway could be cantilevered off the side of the structure, subject to assessment of the existing bridge. If this is not a viable option, a new, wider structure may be required.

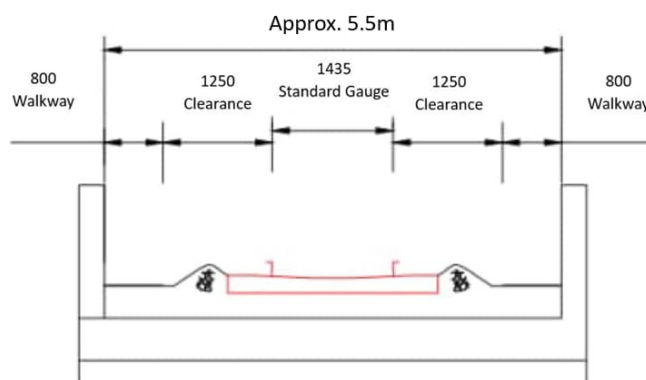


Figure 6.1: Full clearance and walkway on both sides

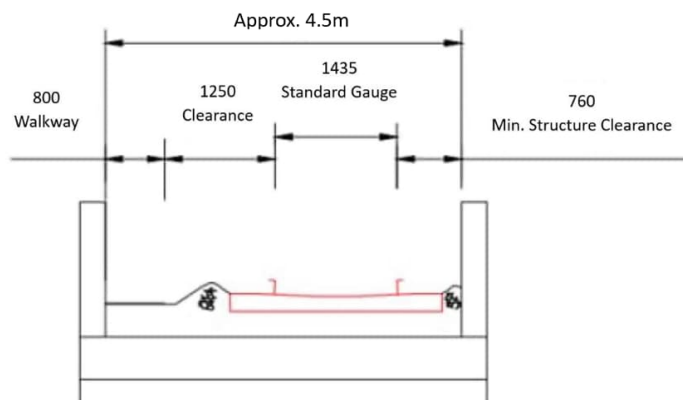


Figure 6.2 Full clearance and walkway on one side and minimum clearance on other side

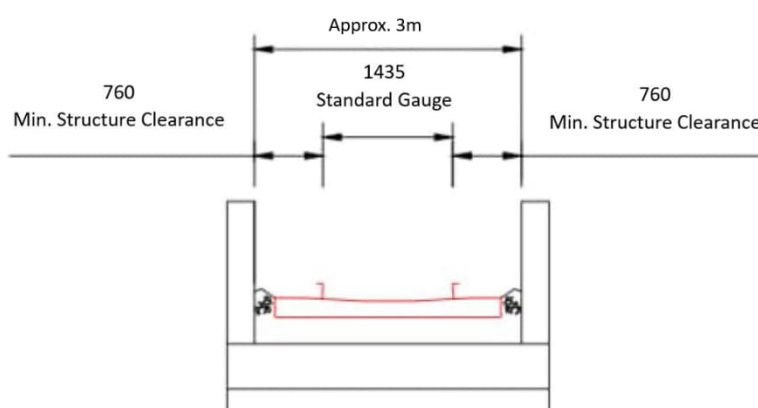


Figure 6.3: Minimum clearance on both sides

Figure 6.1 shows a section through a structure with the preferred clearance values for new rail routes. Figure 6.2 shows the next most desirable option where the situation shown in Figure 6.1 is not viable, and Figure 6.3 shows the least desirable option in terms of absolute minimum structure clearances. To achieve the preferred scenario shown in Figure 6.1, bridge replacements would likely be necessary in many cases, and this may also require additional land purchase.

Vertical Clearance

Existing overbridges would also require assessment to ensure that there is suitable gauge clearance for trains along the route. Any overbridges where gauging issues are identified would require raising the soffit level of the bridge or lowering the track through the structure. Raising the soffit level would require replacing the bridge deck and possible re-alignment of the above carriageway. Ground investigation would be required and detailed track design would have to be undertaken to determine if track lowering would be a suitable option.

The gauge clearances for existing overbridges throughout the route is not known at this stage and would have to be determined at a later stage. However, there is 1 No. modern concrete overbridge located between Maud and Strichen on the Formartine and Buchan Way which was encountered during the site walkover, which has a soffit level of approximately 2.7m above ground level. This bridge will require modification to meet suitable gauge clearances.

6.1.3 Reinstatement of Active Travel Route

As the Formartine and Buchan Way is currently used as an active travel route, there will likely be a requirement to maintain this route alongside the railway. However, this would result in an increased number of structures requiring modification or renewal and could also result in the need for additional

land purchase. To allow for an active travel route alongside the railway, the minimum required structure clearances would increase, as shown in Figures 6.4 and 6.5. As discussed previously, the minimum clearances would increase dependant on curvature of the track. Boundary measures would also be required between the active travel route and the railway in the form of fencing.

At overline structures there may not be enough space to fit the railway and active travel route side by side. Therefore, the active travel route may have to be diverted up and over the bridge at these locations. At large structures such as viaducts, an independent structure may be required to support the active travel route where the bridge deck is not wide enough to accommodate both.

6.2 Railway Systems

For all options considered in this report, various type of railway equipment will be required to operate the new railway. This would include mechanical and electrical (M&E) equipment, telecoms equipment and signalling equipment.

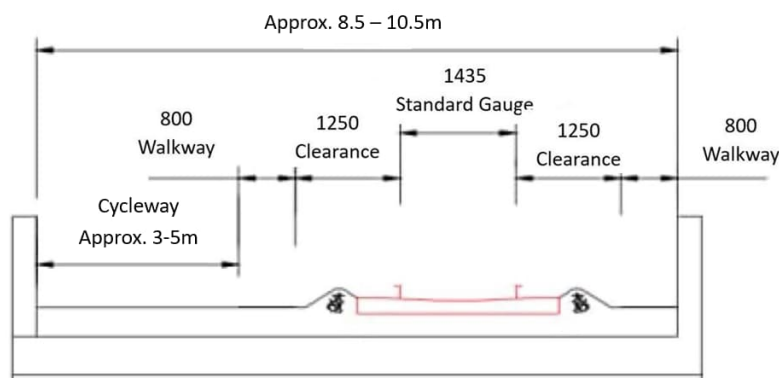


Figure 6.4: Full clearance and walkway on both sides of track with cycleway

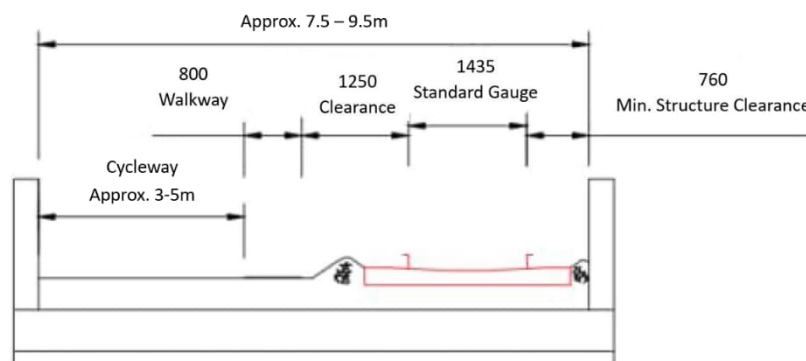


Figure 6.5: Full clearance and walkway on one side and minimum clearance on other side including cycleway

6.3 OLE

Overhead line equipment (OLE) would be required to operate the new railway. Assuming by the time of construction of this rail route, battery operated trains will be in use in Scotland, the requirement for OLE infrastructure has been determined for all route options. The OLE requirements for all route options are shown in Figure 6.6. The OLE requirements for the route options have been determined

based on battery charge / discharge assumptions provided by Scotland's Railway. This proposal assumes a maximum range of 30 miles for battery operated trains.

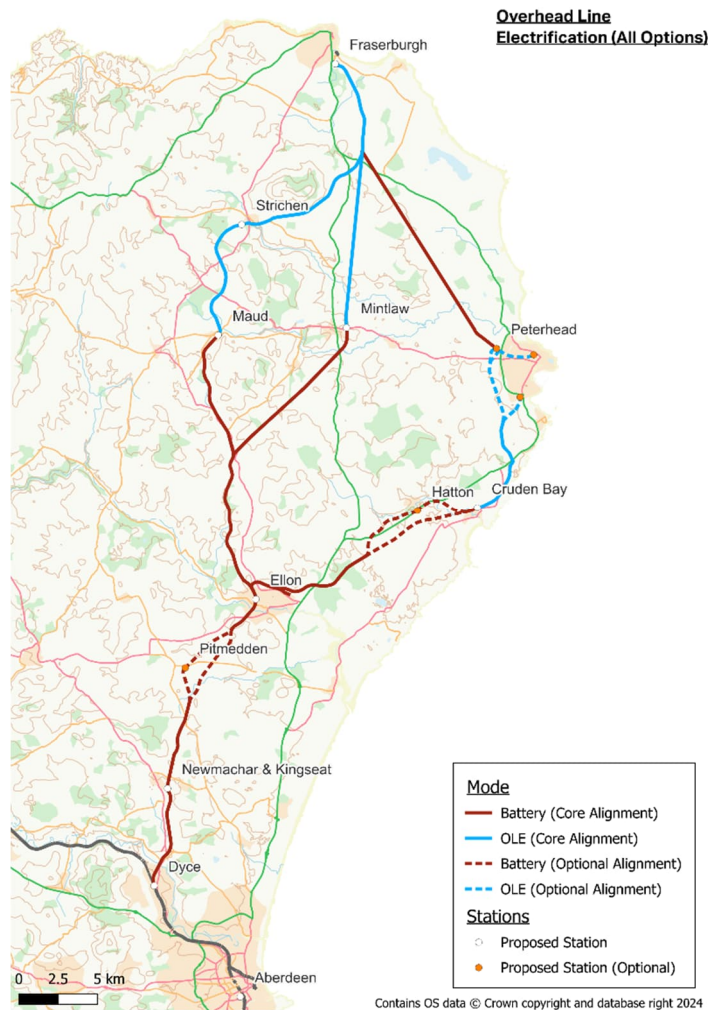


Figure 6.6: OLE requirements for all route options

Table 6.1 shows the approximate length of track which would require OLE infrastructure for the proposed route options.

Table 6.1: OLE Requirements

Section	Approximate Distance (miles)
Cruden Bay to Peterhead	8.5
Maud to Fraserburgh	15.5
Mintlaw to Fraserburgh	11
Lonmay to Fraserburgh	5

6.4 Earthworks and Boundary

The average width of the active travel route along the Formartine and Buchan Way is approximately 2.5m. Due to the required walkway clearances shown in Figures 6.1 to 6.3, the railway solum would have to be widened to accommodate the track and cess walkway widths. To maintain a suitable gradient of earthworks required, the extent of the earthworks will likely fall outside the existing boundary fence in several locations. Where passing loops are required, the railway solum would need to be increased by approximately a further 3.5m to accommodate the additional track.

Where earthworks extend beyond the existing boundary fence, additional land purchase would also be required. Where this is not possible/feasible, an alternative option would be to install retaining

structures to maintain the existing boundary. Note that this would not be an option in locations where the solum must be extended beyond the existing boundary due to required clearances / passing loops. A Value Engineering assessment would also have to be conducted to compare the cost of earthworks plus required land purchase against the cost of installing retaining structures to determine the most appropriate solution.

The actual footprint of the railway solum would be determined at a later stage through detailed design. This would take into account additional works/assets such as cable troughing, drainage and lineside ancillary civils equipment.

Maintaining the active travel route along the Formartine and Buchan Way is also a key factor in the width of the solum required. If the active travel route was to run alongside the track as shown in Figures 6.4 and 6.5, this would increase the solum width and corresponding earthworks. An alternative option could be to provide an alternative route for the existing active travel route out with the existing solum which may reduce the extent of earthworks, land purchase and structure modifications required. An assessment of potential options for the active travel route would have to be undertaken at detailed design stage to determine the most suitable approach.

6.5 Access and Fencing

Suitable boundary fencing would need to be provided to prevent public trespassing onto the railway solum. The type of fencing required would be determined at the design stage and may require vehicle collision protection in areas where this is considered to be an issue.

Access requirements would also need to be considered to allow safe access for maintenance staff to railway assets. Access point locations would have to be identified which would prevent maintenance staff from having to cross track to access lineside assets. Where trains change lines or route at switches and crossings (S&C) locations, vehicle access would be required and would need to be considered.

As mentioned in Section 6.1.3, boundary measures would need to be considered between the active travel route and the railway. Fencing would be required to separate the active travel route from the track to prevent pedestrians and cyclists from entering the railway solum.

6.6 Passing Loops

Passing loop locations have been assessed for all route options based on a high level rail planning analysis to understand how services could operate on the route given potential service frequencies and the potential for train path conflicts. Figure 6.7 shows the locations and types of passing loops required for all route options. Dynamic passing loops must be long enough to allow trains running in opposite directions to pass each other. The length of dynamic passing loops proposed in this study are assumed to be between 3km and 5km. There are also passing loops provided at various stations along the route. Where passing loops are proposed at stations, it is assumed that the station will have 2 No. platforms with the passing loop extending out beyond both sides of the station. The length of passing loops proposed at stations along the route are assumed to be between approximately 0.6km – 1km.

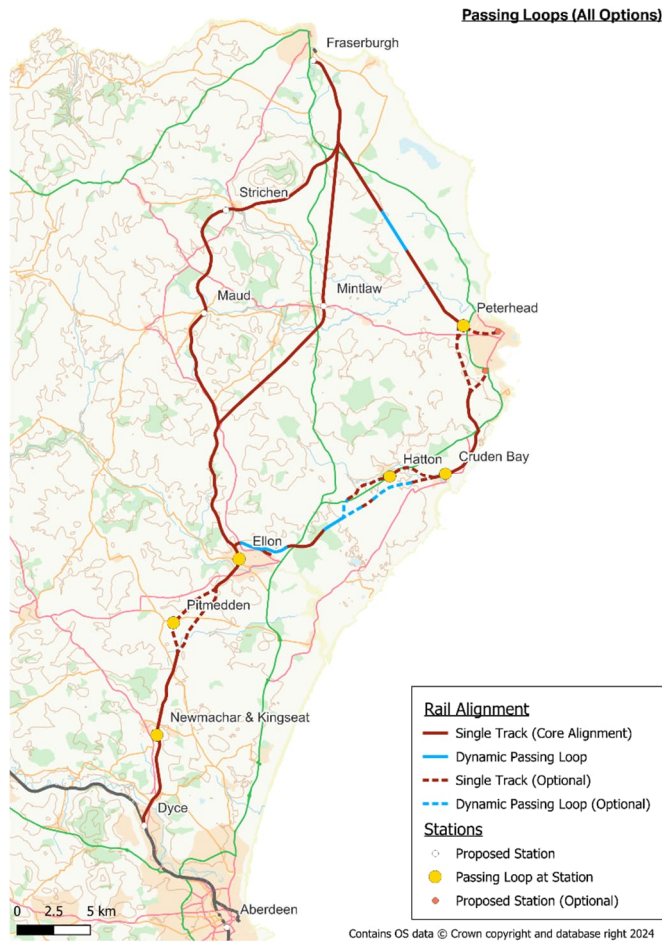


Figure 6.7: Proposed Passing Loop locations for all route options.

6.7 Freight Terminals

The freight terminal locations considered by this study are at Ellon, Peterhead/ St Fergus and Fraserburgh.

Ellon

The proposed freight terminal at Ellon would be a small category terminal.

Peterhead / St Fergus

It is proposed to have a freight terminal at either Peterhead or St Fergus. The main demand for use of the terminal is currently for the transport of carbon dioxide from St Fergus. This is proposed as a medium category terminal.

The terminal would be located on the bypass line at Peterhead if a Peterhead location is preferred. If St Fergus is selected as the preferred location, there would be some additional infrastructure requirements to connect this terminal to the proposed rail route. The infrastructure requirements for the St Fergus terminal location are provided in drawing 60716023-AEC-DRG-ECV-000014 in Appendix A. A terminal at St Fergus would require approximately 3.5 miles of additional track branching off from the passenger route near Peterhead and would utilise approximately 1 mile of the historic Formartine and Buchan Way alignment. There is 1 No. existing overbridge on this historic section of route. It would also require 7 No. new bridge structures at crossings (including 1 No. A90 crossing and 1 No. crossing of the River Ugie).

Fraserburgh

The proposed freight terminal at Fraserburgh would be a small category terminal and has been identified as currently being the lowest priority of the potential freight sites.

6.8 Dyce to Aberdeen

The works which would be required on the existing network between Dyce and Aberdeen, due to the works proposed in this study, were assessed as part of the previous AECOM study in 2017. These proposed works have not been covered in this report given the understanding from Scotland's Railways that any required works on this section of track, and at Aberdeen Station, associated with connecting Peterhead and Fraserburgh to the existing rail network need not be explored as part of this study.

7. Summary

The findings from this engineering feasibility study indicate that connecting Peterhead and Fraserburgh to the existing rail network would involve the following major works:

- The design and construction of several new bridge structures at crossings (including major road and watercourse crossings).
- Structural assessment of any existing underbridge structures along the rail route to determine their suitability for railway loading.
- Extension or replacement of any existing underbridge structures to accommodate required clearances for cess walkways and an active travel route where necessary.
- Gauging analysis of any existing overbridges along the route to assess suitability for rail traffic. Dependant on results of this analysis, bridge replacement or track lowering may be required.
- Design and construction of new railway stations along the route. The number and location of stations is dependent on which route options are selected.
- Design and construction of new freight terminals. The number and location of terminals is dependent on which route options are selected.
- Modification to the existing station at Dyce to allow tie-in to the existing rail network.
- Design and construction of new track and associated earthworks. Length of track required depends on which route options are selected.
- Land purchase for sections of new alignment or where the existing solum must be widened to accommodate required clearances / active travel route / passing loops.
- Design and installation of required railway systems equipment including M&E, telecoms and signalling to allow operation of the new rail route.
- Design and installation of OLE equipment where required.
- Design and installation of required fencing and access points along the route.
- Ground investigation works to inform the design.

Tables 7.1, 7.2 and 7.3 summarise the infrastructure requirements for Options A, B and C, respectively. The summary tables all assume that the route passes through a new station at Pitmedden and follows a new alignment on approach to Cruden Bay (no station at Hatton). The Peterhead Station location option to the west of Peterhead is the assumed station location for all options in the summary tables.

Table 7.1: Summary of Infrastructure Requirements for Option A

Option A		
Infrastructure Type	Unit	Notes
Existing underbridges	16 No.	Refer to the drawings in Appendix A for location of existing structures.
Existing Overbridges	11 No.	Refer to the drawings in Appendix A for location of existing structures.
Existing Culverts	1 No.	Refer to the drawings in Appendix A for location of existing structures.
Proposed Bridges	66 No.	Refer to the drawings in Appendix A for location of proposed structures.
Proposed Stations	6 No.	Refer to the drawings in Appendix A for location of proposed stations.
Track (former railway alignment)	20 miles	Refer to the drawings in Appendix A for alignment details.
Track (new rail corridor)	25.5 miles	Refer to the drawings in Appendix A for alignment details.
Passing Loops	4 No. dynamic loops 5 No. station loops	Refer to Section 6.6 for passing loop lengths and location.
OLE	13.5 miles	Refer to Section 6.3 for further information on OLE Requirements.
Displaced Cycleway	13 miles	Refer to the drawings in Appendix A for alignment of existing cycleway.

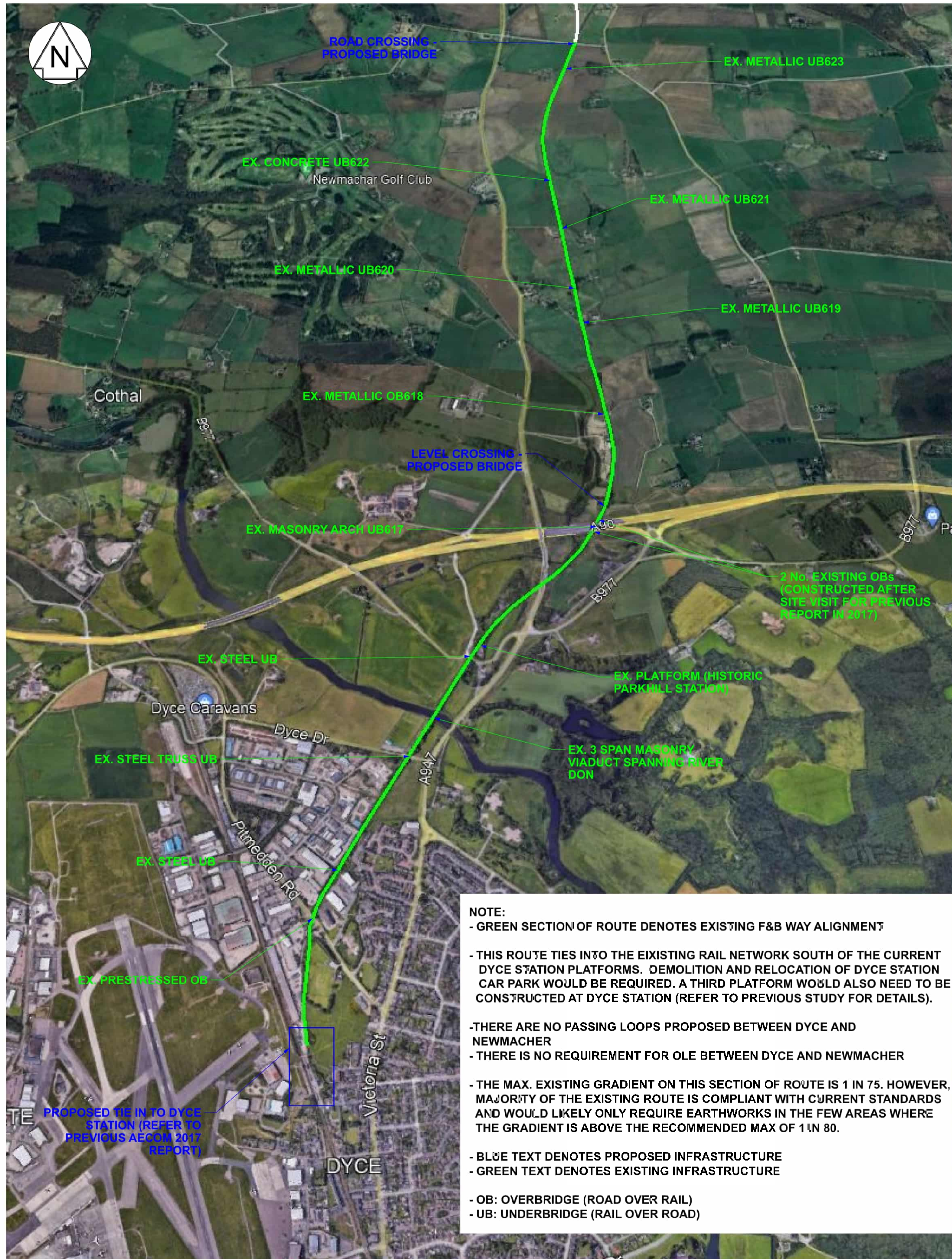
Table 7.2: Summary of Infrastructure Requirements for Option B

Option B			
Infrastructure Type	Unit		Notes
	Option B.1 – Fraserburgh via Maud & Strichen	Option B.2 – Fraserburgh via Mintlaw	
Existing underbridges	38 No.	17 No.	Refer to the drawings in Appendix A for location of existing structures.
Existing Overbridges	32 No.	18 No.	Refer to the drawings in Appendix A for location of existing structures.
Existing Culverts	13 No.	4 No.	Refer to the drawings in Appendix A for location of existing structures.
Proposed Bridges	62 No.	71 No.	Refer to the drawings in Appendix A for location of proposed structures.
Proposed Stations	8 No.	7 No.	Refer to the drawings in Appendix A for location of proposed stations.
Track (former railway alignment)	41.5 miles	25 miles	Refer to the drawings in Appendix A for alignment details.
Track (new rail corridor)	17 miles	31.5 miles	Refer to the drawings in Appendix A for alignment details.
Passing Loops	3 No. dynamic loops 5 No. station loops	3 No. dynamic loops 5 No. station loops	Refer to Section 6.6 for passing loop lengths and location.
OLE	24 miles	19.5 miles	Refer to Section 6.3 for further information on OLE Requirements.
Displaced Cycleway	34.5 miles	18 miles	Refer to the drawings in Appendix A for alignment of existing cycleway.

Table 7.3: Summary of Infrastructure Requirements for Option C

Option C		
Infrastructure Type	Unit	Notes
Existing underbridges	12 No.	Refer to the drawings in Appendix A for location of existing structures.
Existing Overbridges	9 No.	Refer to the drawings in Appendix A for location of existing structures.
Existing Culverts	1 No.	Refer to the drawings in Appendix A for location of existing structures.
Proposed Bridges	45 No.	Refer to the drawings in Appendix A for location of proposed structures.
Proposed Stations	5 No.	Refer to the drawings in Appendix A for location of proposed stations.
Track (former railway alignment)	15 miles	Refer to the drawings in Appendix A for alignment details.
Track (new rail corridor)	17 miles	Refer to the drawings in Appendix A for alignment details.
Passing Loops	3 No. dynamic loops 5 No. station loops	Refer to Section 6.6 for passing loop lengths and location.
OLE	8.5 miles	Refer to Section 6.3 for further information on OLE Requirements.
Displaced Cycleway	8 miles	Refer to the drawings in Appendix A for alignment of existing cycleway.

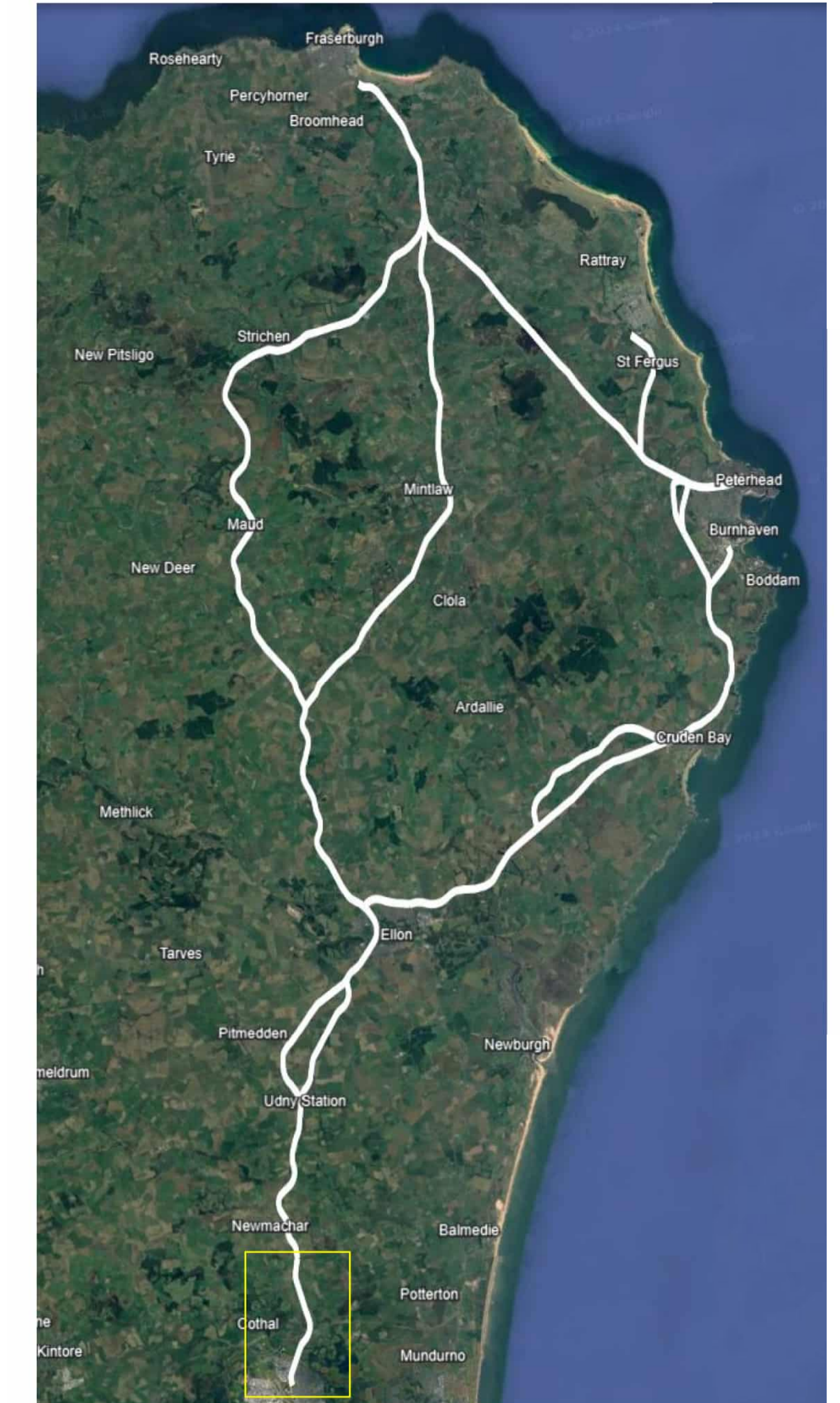
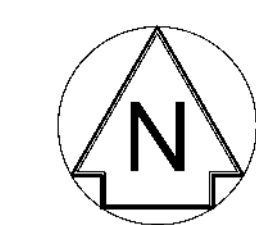
Appendix A – Route Wide Drawings



PLAN ON ROUTE
NTS

NOTE:

- GREEN SECTION OF ROUTE DENOTES EXISTING F&B WAY ALIGNMENT
- THIS ROUTE TIES INTO THE EXISTING RAIL NETWORK SOUTH OF THE CURRENT DYCE STATION PLATFORMS. DEMOLITION AND RELOCATION OF DYCE STATION CAR PARK WOULD BE REQUIRED. A THIRD PLATFORM WOULD ALSO NEED TO BE CONSTRUCTED AT DYCE STATION (REFER TO PREVIOUS STUDY FOR DETAILS).
- THERE ARE NO PASSING LOOPS PROPOSED BETWEEN DYCE AND NEWMACHER
- THERE IS NO REQUIREMENT FOR OLE BETWEEN DYCE AND NEWMACHER
- THE MAX. EXISTING GRADIENT ON THIS SECTION OF ROUTE IS 1 IN 75. HOWEVER, MAJORITY OF THE EXISTING ROUTE IS COMPLIANT WITH CURRENT STANDARDS AND WOULD LIKELY ONLY REQUIRE EARTHWORKS IN THE FEW AREAS WHERE THE GRADIENT IS ABOVE THE RECOMMENDED MAX OF 1 IN 80.
- BLUE TEXT DENOTES PROPOSED INFRASTRUCTURE
- GREEN TEXT DENOTES EXISTING INFRASTRUCTURE
- OB: OVERBRIDGE (ROAD OVER RAIL)
- UB: UNDERBRIDGE (RAIL OVER ROAD)



LOCATION PLAN
NTS

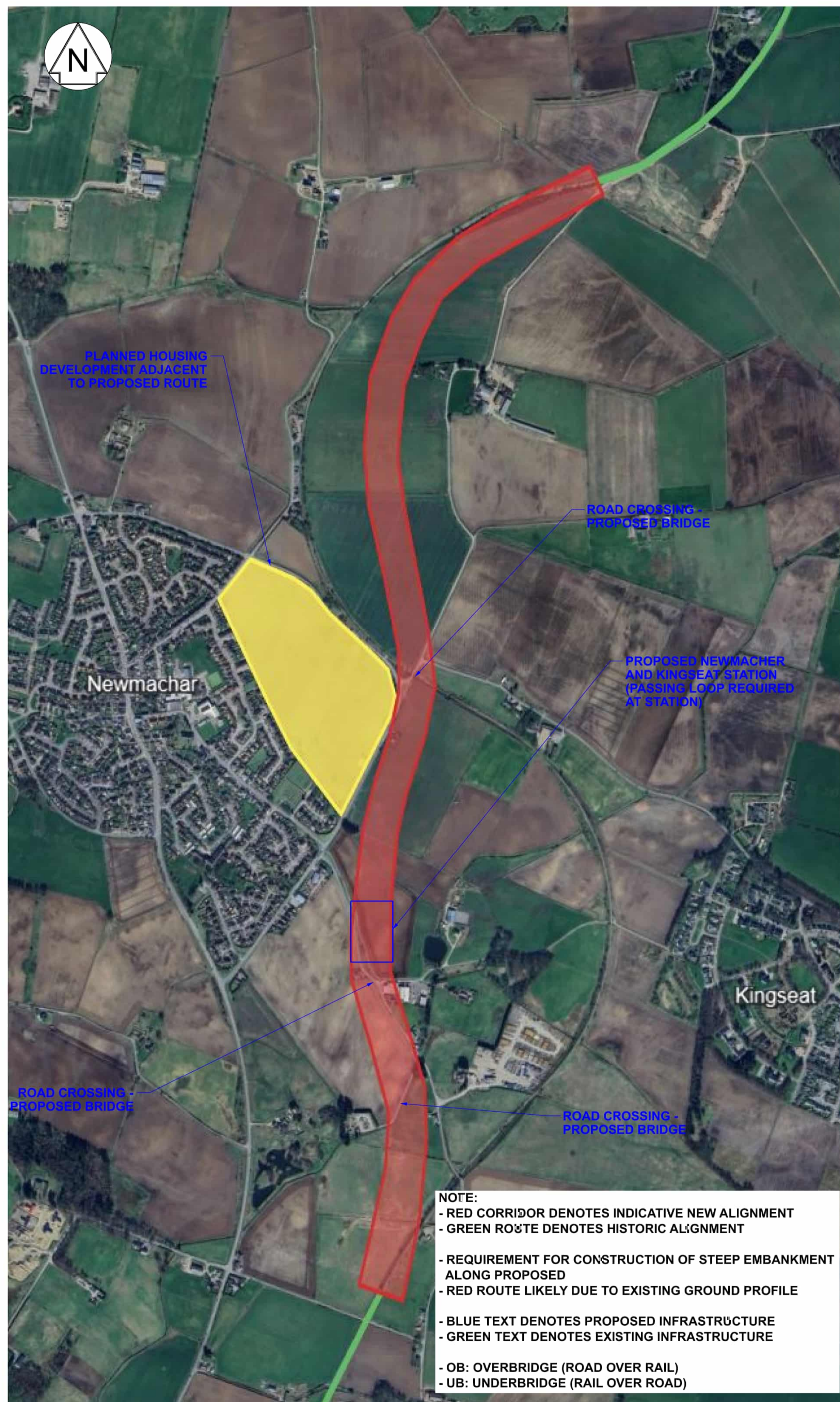
SUMMARY OF INFRASTRUCTURE:

EXISTING

- HISTORIC PARKHILL STATION PLATFORM
- 7 No. METALLIC UNDERBRIDGES
- 1 No. METALLIC OVERBRIDGES
- 1 No. MASONRY ARCH UNDERBRIDGE
- 1 No. MASONRY VIADUCT SPANNING RIVER DON (3 SPAN)
- 1 No. PRESTRESSED CONCRETE OVERBRIDGE
- 1 No. CONCRETE UNDERBRIDGE
- 2 No. OVERBRIDGES WHICH WERE UNDER CONSTRUCTION DURING 2017 SITE VISIT

PROPOSED

- 2 No. BRIDGE STRUCTURES
- APPROX. 3.5 MILES OF TRACK ON EXISTING ALIGNMENT
- APPROX. 3.5 MILES OF ACTIVE TRAVEL ROUTE TO BE MAINTAINED ALONGSIDE TRACK



PLAN ON ROUTE
NTS

SUMMARY OF INFRASTRUCTURE:

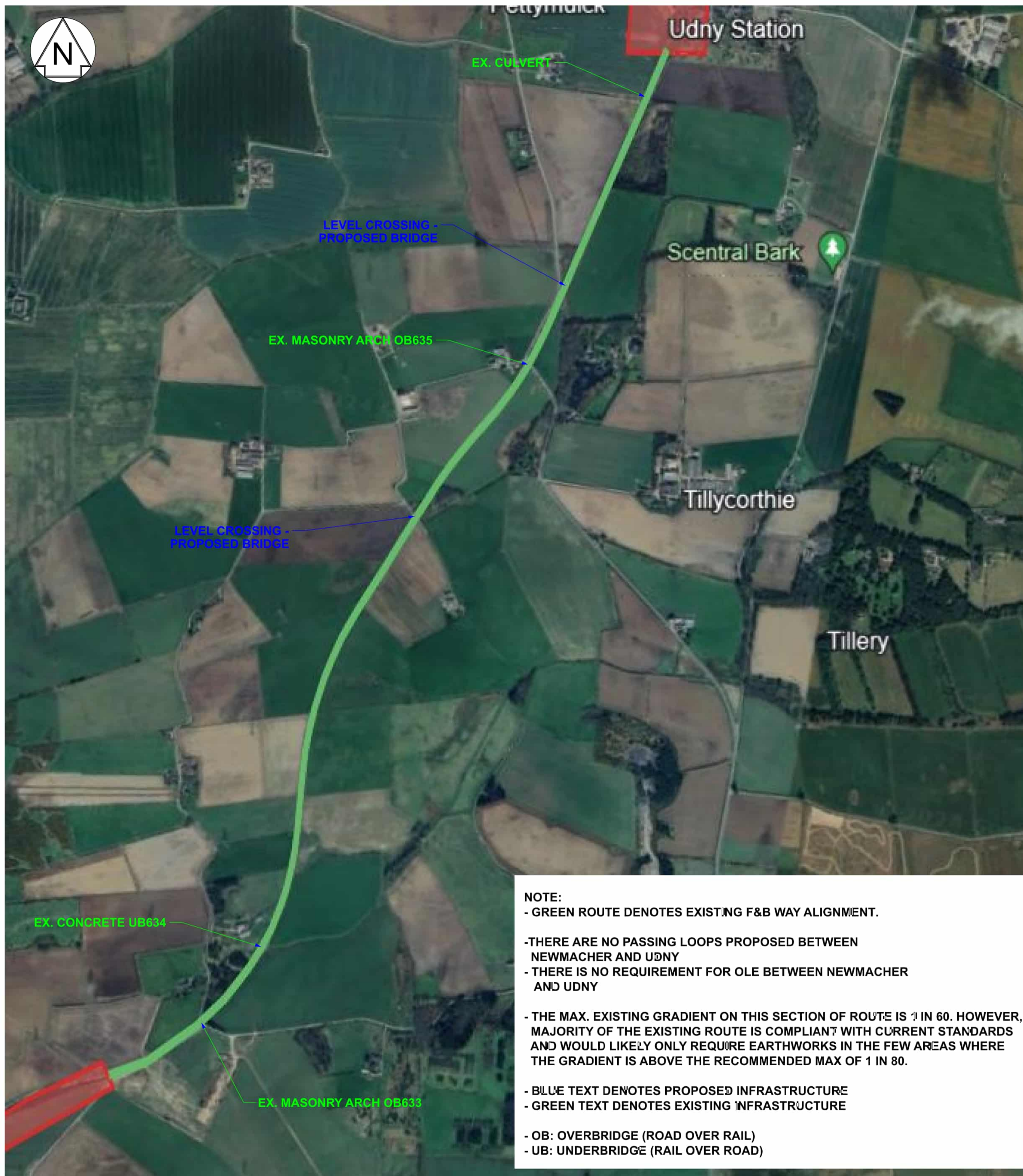
EXISTING
N/A

PROPOSED

- 1 No. STATION (NEWMACHER & KINGSEAT) WITH PASSING LOOP
- 3 No. BRIDGE STRUCTURES
- APPROX. 2 MILES OF TRACK ON NEW ALIGNMENT



LOCATION PLAN
NTS



NOTE:

- GREEN ROUTE DENOTES EXISTING F&B WAY ALIGNMENT.
- THERE ARE NO PASSING LOOPS PROPOSED BETWEEN NEWMACHER AND UDNY
- THERE IS NO REQUIREMENT FOR OLE BETWEEN NEWMACHER AND UDNY
- THE MAX. EXISTING GRADIENT ON THIS SECTION OF ROUTE IS 1 IN 60. HOWEVER, MAJORITY OF THE EXISTING ROUTE IS COMPLIANT WITH CURRENT STANDARDS AND WOULD LIKELY ONLY REQUIRE EARTHWORKS IN THE FEW AREAS WHERE THE GRADIENT IS ABOVE THE RECOMMENDED MAX OF 1 IN 80.
- BLUE TEXT DENOTES PROPOSED INFRASTRUCTURE
- GREEN TEXT DENOTES EXISTING INFRASTRUCTURE
- OB: OVERBRIDGE (ROAD OVER RAIL)
- UB: UNDERBRIDGE (RAIL OVER ROAD)

PLAN ON ROUTE
NTS



LOCATION PLAN
NTS

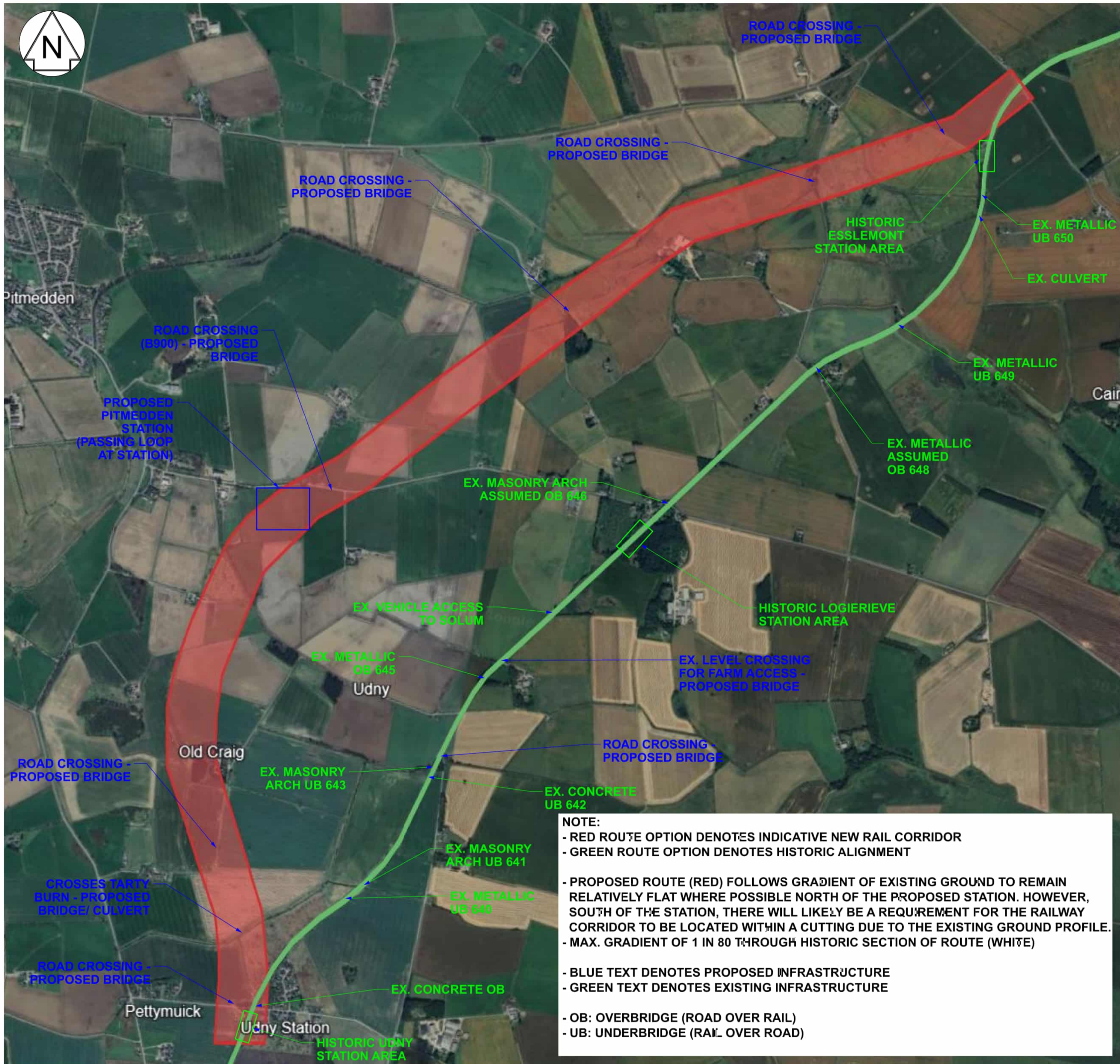
SUMMARY OF INFRASTRUCTURE:

EXISTING

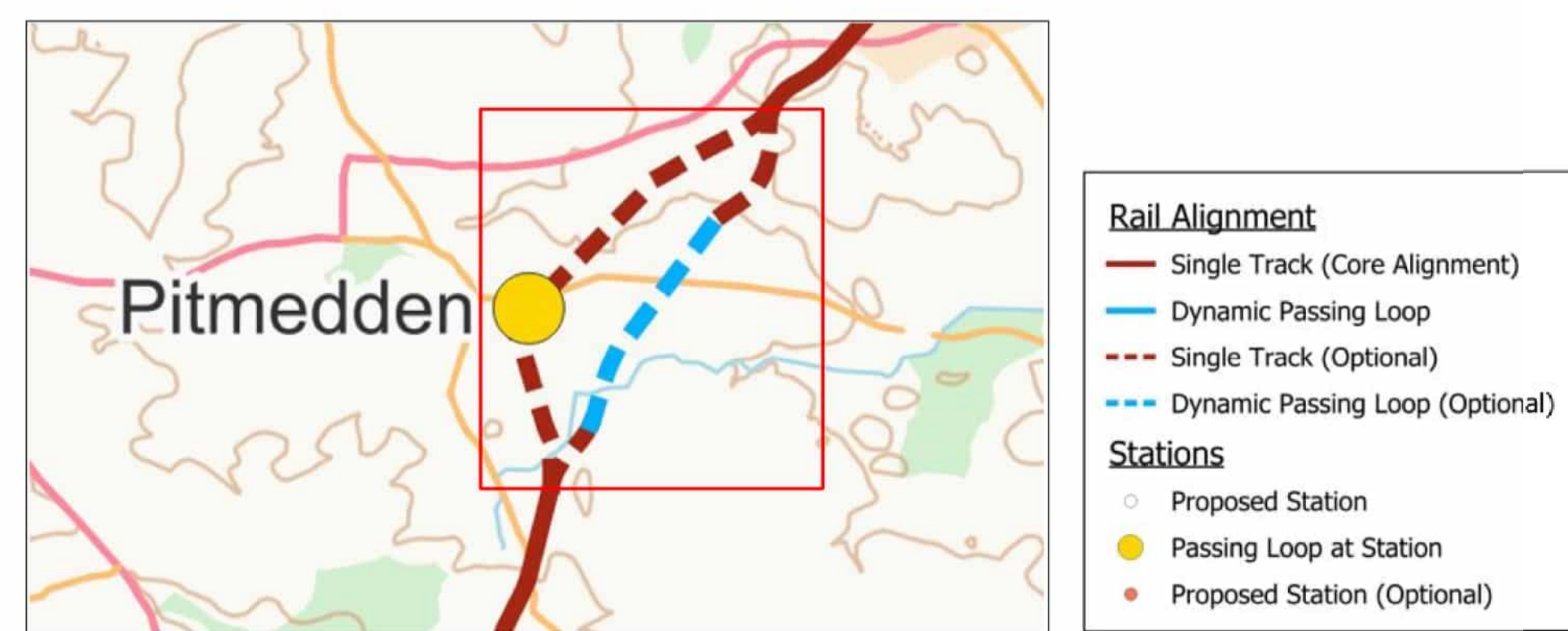
- 1 No. CONCRETE UNDERBRIDGES
- 2 No. MASONRY ARCH OVERBRIDGES
- 1 No. CULVERTS

PROPOSED

- 2 No. BRIDGE STRUCTURES
- APPROX. 2 MILES OF TRACK ON EXISTING ALIGNMENT
- APPROX. 2 MILES OF ACTIVE TRAVEL ROUTE TO BE MAINTAINED ALONGSIDE TRACK



PLAN ON ROUTE
NTS



PLAN SHOWING PASSING LOOP LOCATIONS
NTS

SUMMARY OF INFRASTRUCTURE FOR EACH OPTION:

OPTION 1: NEW ALIGNMENT (VIA PITMEDDEN)

EXISTING
N/A

PROPOSED

- 7 No. BRIDGE STRUCTURES
- 1 No. STATION (PITMEDDEN)
- PASSING LOOP AT STATION
- APPROX. 4 MILES OF TRACK ON NEW ALIGNMENT

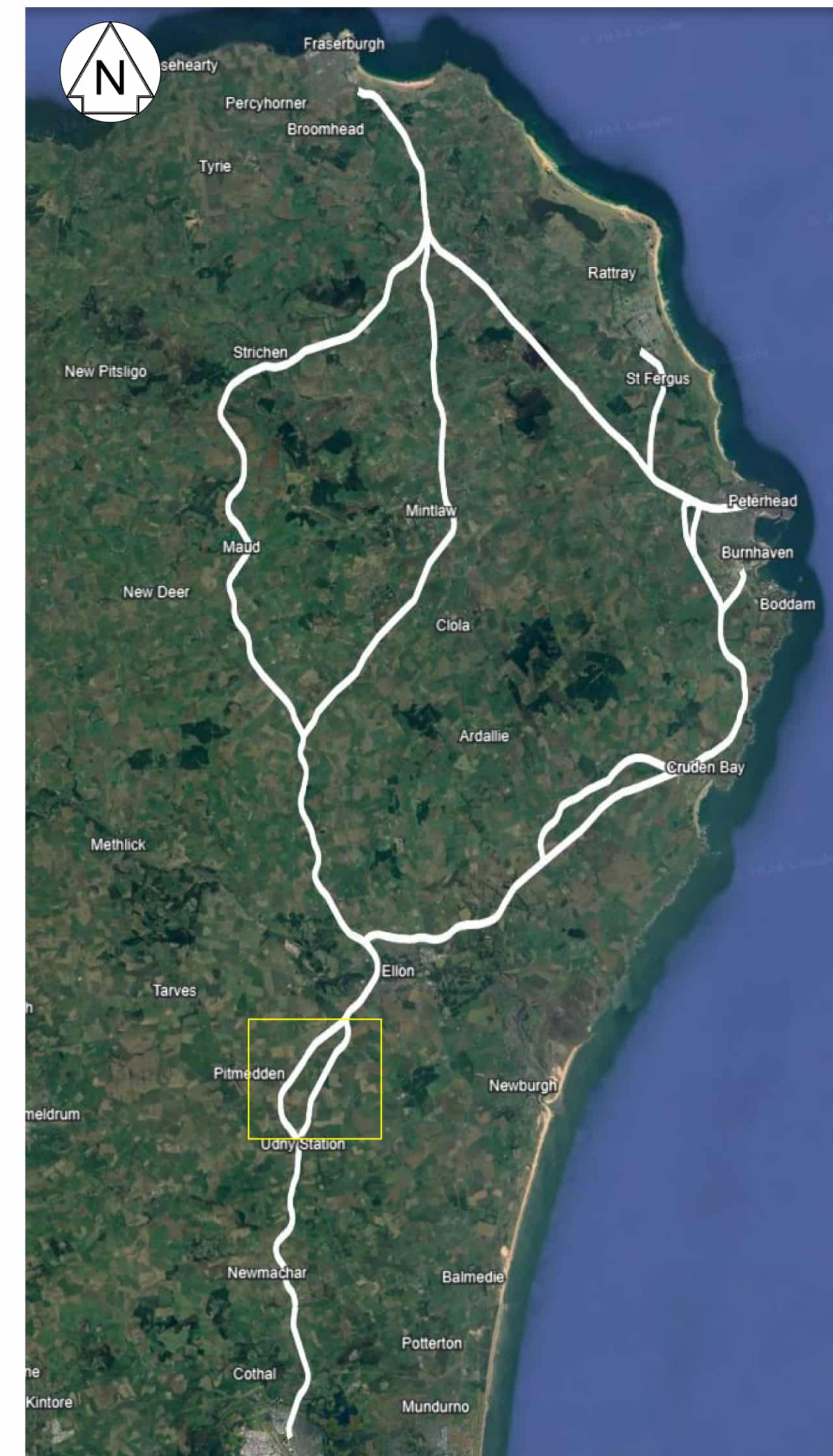
OPTION 2: HISTORIC ALIGNMENT

EXISTING

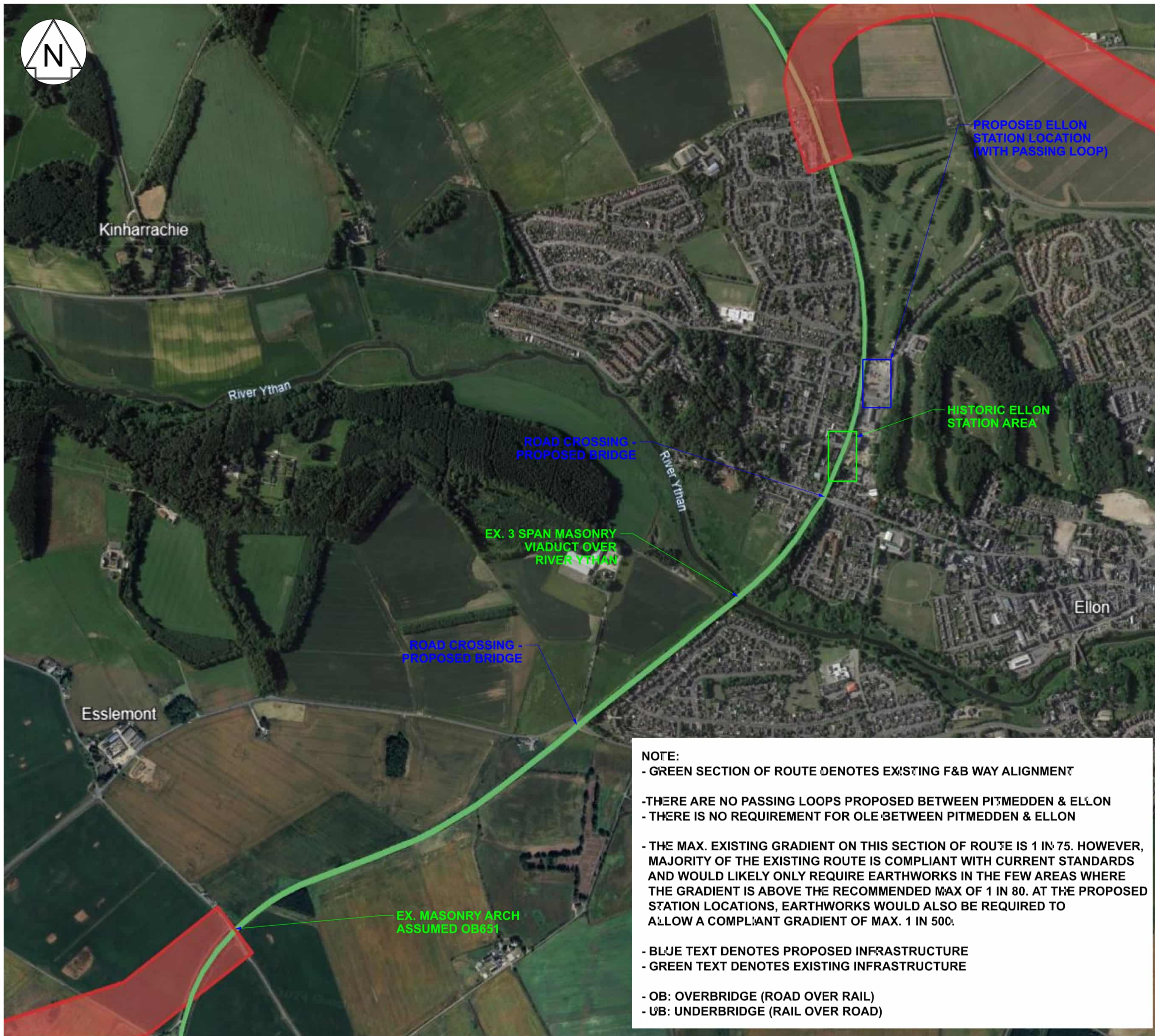
- 1 No. DYNAMIC PASSING LOOP
- HISTORIC UDNY STATION AREA TO BE DEMOLISHED
- HISTORIC LOGIERIEVE STATION AREA TO BE DEMOLISHED
- HISTORIC ESLEMONT STATION AREA TO BE DEMOLISHED
- 1 No. MASONRY ARCH OVERBRIDGE
- 1 No. CONCRETE OVERBRIDGE
- 2 No. METALLIC OVERBRIDGES
- 3 No. METALLIC UNDERBRIDGES
- 1 No. CONCRETE UNDERBRIDGE
- 2 No. MASONRY ARCH UNDERBRIDGES
- 1 No. VEHICLE ACCESS TO SOLUM TO BE REMOVED/BLOCKED OFF
- 1 No. CULVERT

PROPOSED

- 3 No. BRIDGE STRUCTURES
- APPROX. 3.5 MILES OF TRACK ON EXISTING ALIGNMENT
- APPROX. 3.5 MILES OF ACTIVE TRAVEL ROUTE TO BE MAINTAINED ALONGSIDE RAILWAY CORRIDOR



LOCATION PLAN
NTS



PLAN ON ROUTE
NTS

NOTE:

- GREEN SECTION OF ROUTE DENOTES EXISTING F&B WAY ALIGNMENT
- THERE ARE NO PASSING LOOPS PROPOSED BETWEEN PITMEDDEN & ELLON
- THERE IS NO REQUIREMENT FOR OLE BETWEEN PITMEDDEN & ELLON
- THE MAX. EXISTING GRADIENT ON THIS SECTION OF ROUTE IS 1 IN 75. HOWEVER, MAJORITY OF THE EXISTING ROUTE IS COMPLIANT WITH CURRENT STANDARDS AND WOULD LIKELY ONLY REQUIRE EARTHWORKS IN THE FEW AREAS WHERE THE GRADIENT IS ABOVE THE RECOMMENDED MAX OF 1 IN 80. AT THE PROPOSED STATION LOCATIONS, EARTHWORKS WOULD ALSO BE REQUIRED TO ALLOW A COMPLIANT GRADIENT OF MAX. 1 IN 500.
- BLUE TEXT DENOTES PROPOSED INFRASTRUCTURE
- GREEN TEXT DENOTES EXISTING INFRASTRUCTURE
- OB: OVERBRIDGE (ROAD OVER RAIL)
- UB: UNDERBRIDGE (RAIL OVER ROAD)

SUMMARY OF INFRASTRUCTURE:

EXISTING

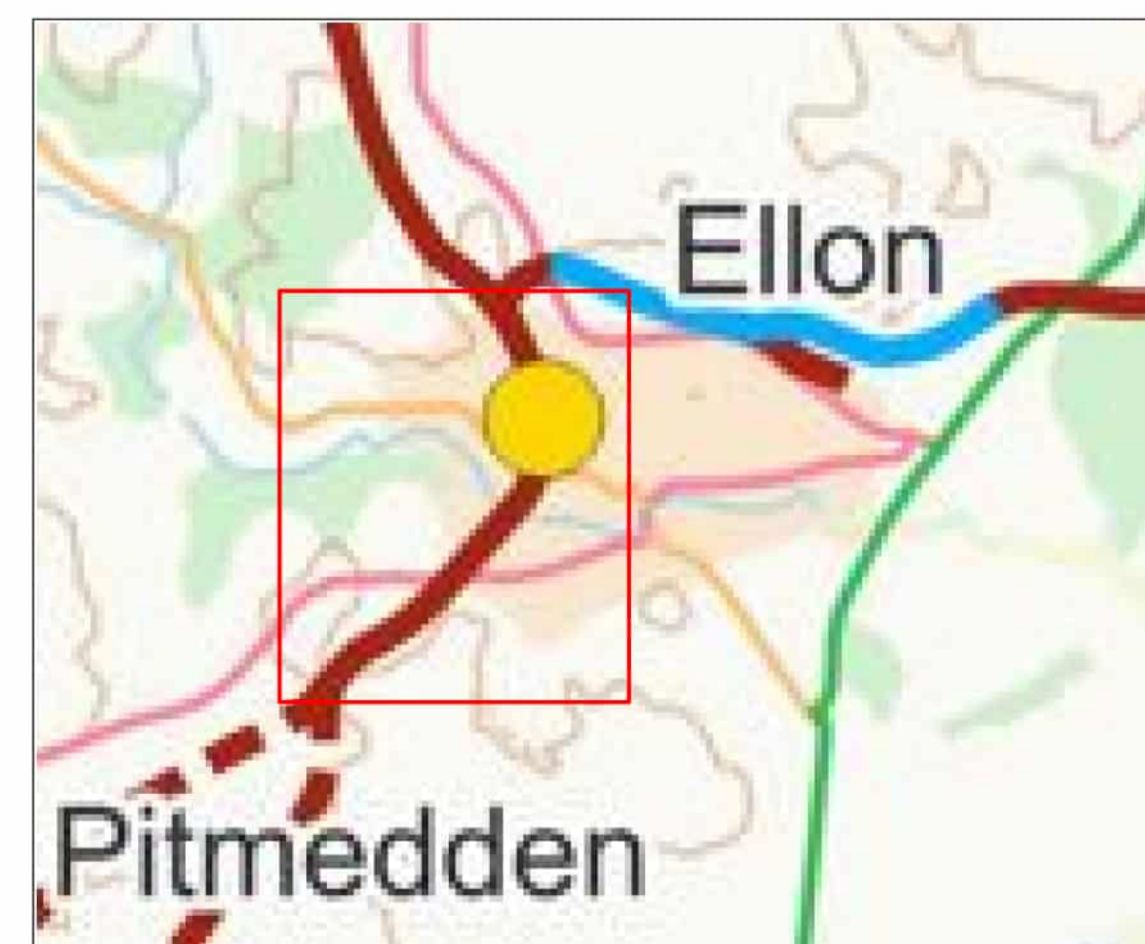
- 1 No. MASONRY ARCH OVERBRIDGE
- HISTORIC ELLON STATION AREA
- 1 No. MASONRY VIADUCT OVER RIVER YTHAN (3 SPAN)

PROPOSED

- 2 No. BRIDGE STRUCTURES
- 1 No. STATION (ELLON) WITH PASSING LOOP
- APPROX. 2 MILES OF TRACK ON EXISTING ALIGNMENT
- APPROX. 2 MILES OF ACTIVE TRAVEL ROUTE TO BE MAINTAINED ALONGSIDE TRACK



LOCATION PLAN
NTS



PLAN SHOWING LOCATION OF PASSING LOOPS
NTS

Rail Alignment

- Single Track (Core Alignment)
- Dynamic Passing Loop
- - - Single Track (Optional)
- - - Dynamic Passing Loop (Optional)

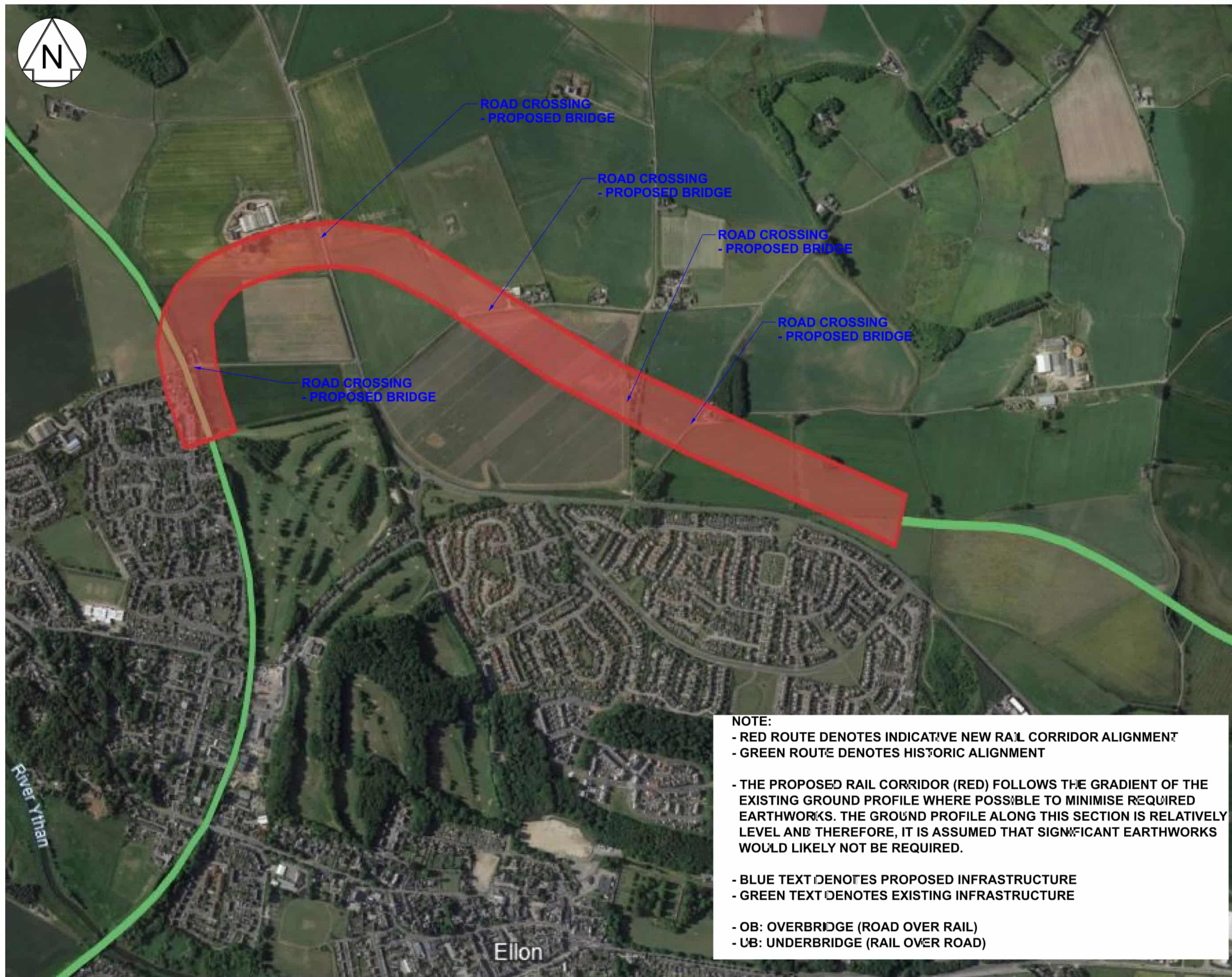
Stations

- Proposed Station
- Passing Loop at Station
- Proposed Station (Optional)

SUMMARY OF INFRASTRUCTURE:

EXISTING
N/A

PROPOSED
- 5 No. BRIDGE STRUCTURES
- APPROX. 1.5 MILES OF TRACK ON NEW ALIGNMENT



PLAN ON ROUTE
NTS

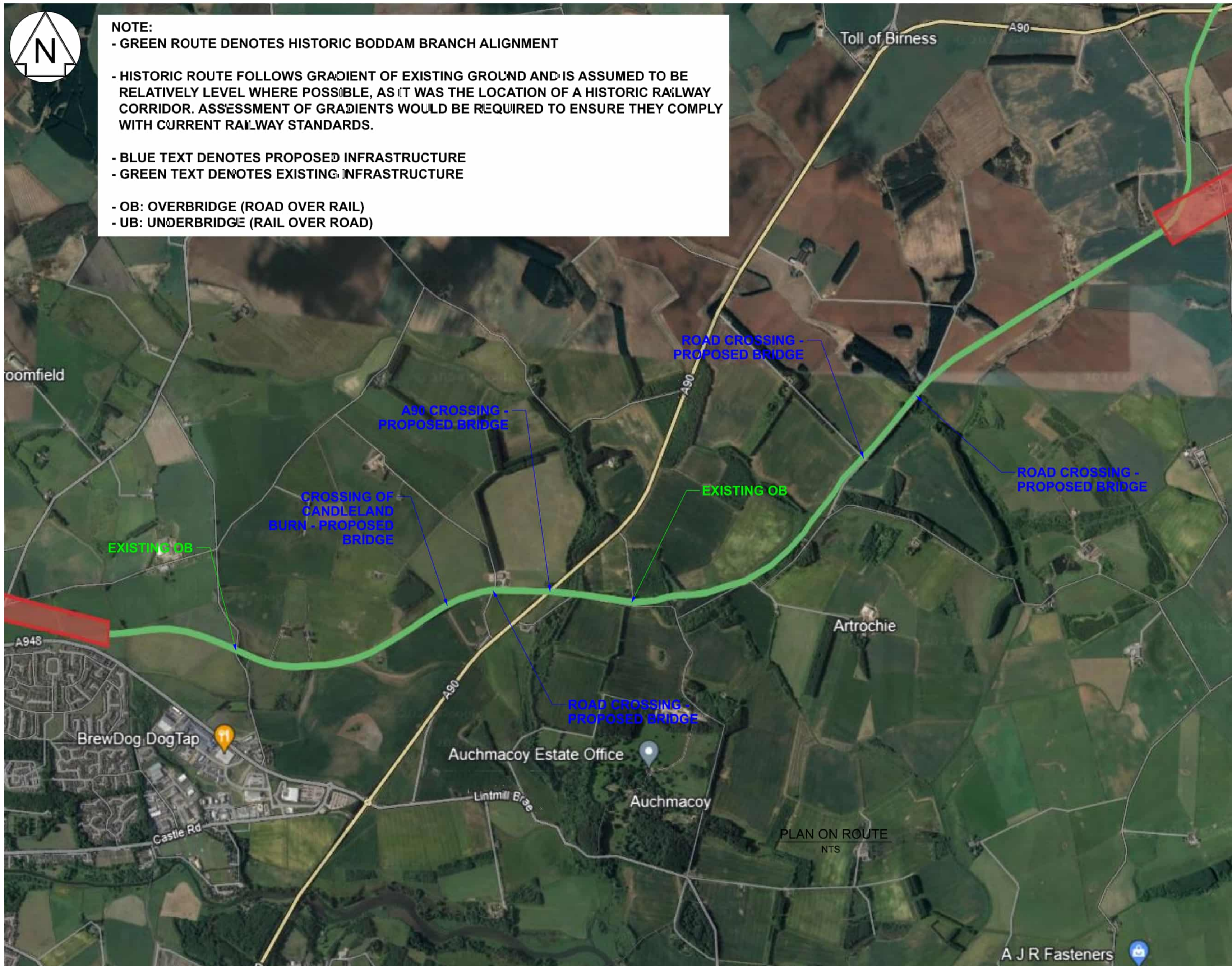


LOCATION PLAN
NTS



NOTE:

- GREEN ROUTE DENOTES HISTORIC BODDAM BRANCH ALIGNMENT
- HISTORIC ROUTE FOLLOWS GRADIENT OF EXISTING GROUND AND IS ASSUMED TO BE RELATIVELY LEVEL WHERE POSSIBLE, AS IT WAS THE LOCATION OF A HISTORIC RAILWAY CORRIDOR. ASSESSMENT OF GRADIENTS WOULD BE REQUIRED TO ENSURE THEY COMPLY WITH CURRENT RAILWAY STANDARDS.
- BLUE TEXT DENOTES PROPOSED INFRASTRUCTURE
- GREEN TEXT DENOTES EXISTING INFRASTRUCTURE
- OB: OVERBRIDGE (ROAD OVER RAIL)
- UB: UNDERBRIDGE (RAIL OVER ROAD)



SUMMARY OF INFRASTRUCTURE:

EXISTING

- 2 No. OVERBRIDGES

PROPOSED

- 5 No. BRIDGE STRUCTURES (INCLUDING 1 No. A90 CROSSING)
- APPROX. 4 MILES OF TRACK ON EXISTING ALIGNMENT



LOCATION PLAN
NTS



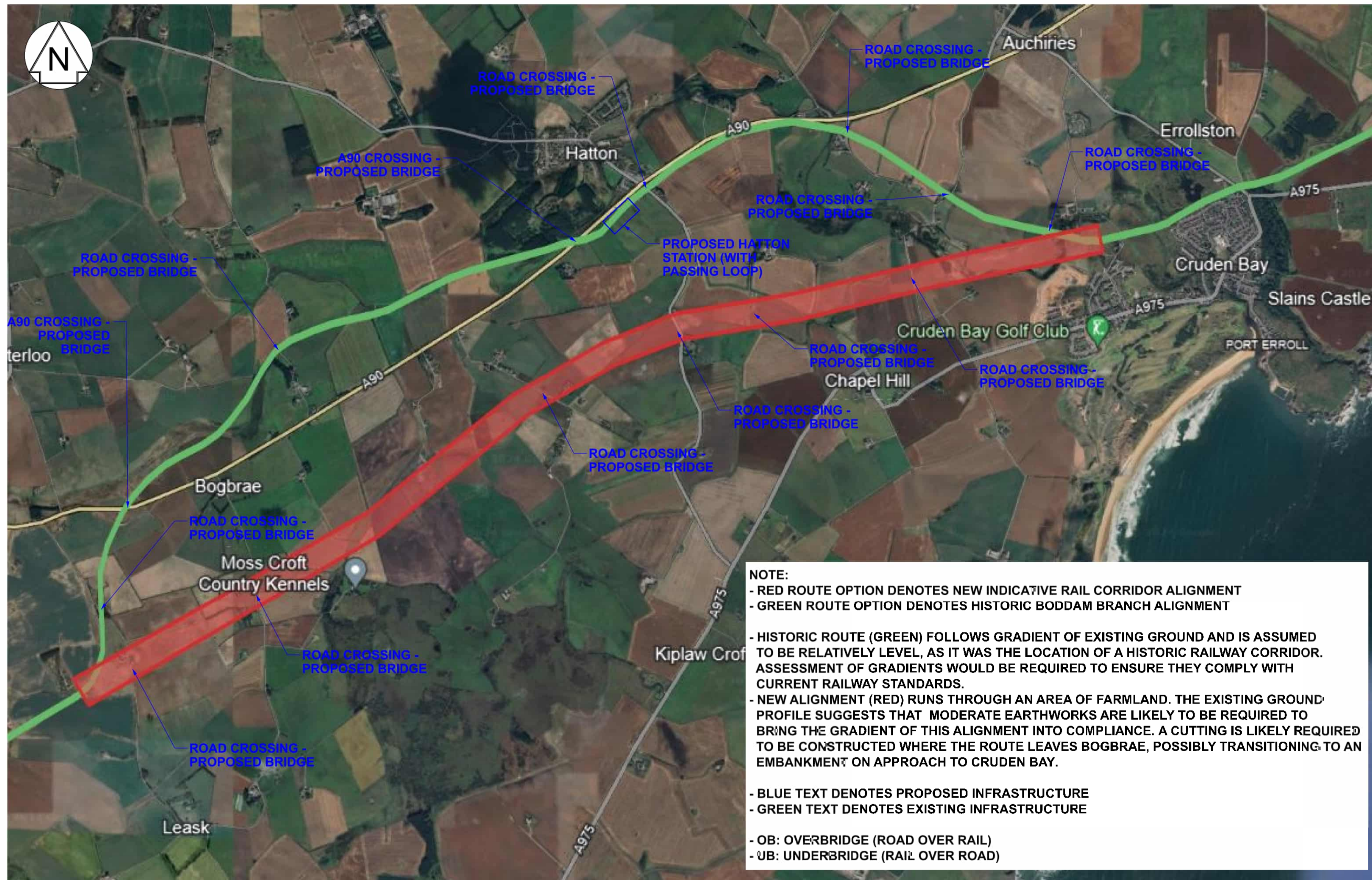
PLAN SHOWING LOCATION OF PASSING LOOPS
NTS

Rail Alignment

- Single Track (Core Alignment)
- Dynamic Passing Loop
- - - Single Track (Optional)
- - - Dynamic Passing Loop (Optional)

Stations

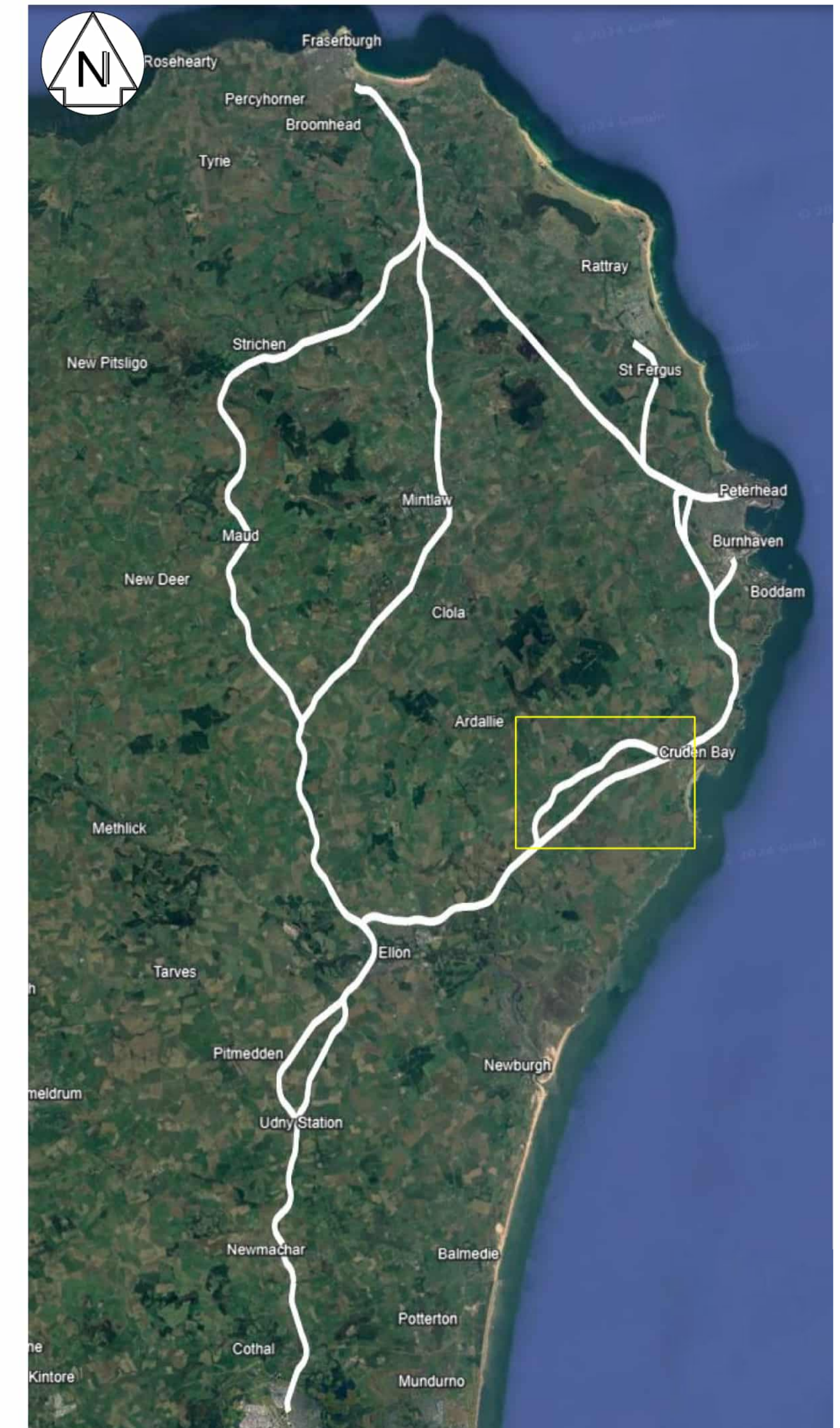
- Proposed Station
- Passing Loop at Station
- Proposed Station (Optional)



NOTE:

- RED ROUTE OPTION DENOTES NEW INDICATIVE RAIL CORRIDOR ALIGNMENT
- GREEN ROUTE OPTION DENOTES HISTORIC BODDAM BRANCH ALIGNMENT
- HISTORIC ROUTE (GREEN) FOLLOWS GRADIENT OF EXISTING GROUND AND IS ASSUMED TO BE RELATIVELY LEVEL, AS IT WAS THE LOCATION OF A HISTORIC RAILWAY CORRIDOR. ASSESSMENT OF GRADIENTS WOULD BE REQUIRED TO ENSURE THEY COMPLY WITH CURRENT RAILWAY STANDARDS.
- NEW ALIGNMENT (RED) RUNS THROUGH AN AREA OF FARMLAND. THE EXISTING GROUND PROFILE SUGGESTS THAT MODERATE EARTHWORKS ARE LIKELY TO BE REQUIRED TO BRING THE GRADIENT OF THIS ALIGNMENT INTO COMPLIANCE. A CUTTING IS LIKELY REQUIRED TO BE CONSTRUCTED WHERE THE ROUTE LEAVES BOGBRAE, POSSIBLY TRANSITIONING TO AN EMBANKMENT ON APPROACH TO CRUDEN BAY.
- BLUE TEXT DENOTES PROPOSED INFRASTRUCTURE
- GREEN TEXT DENOTES EXISTING INFRASTRUCTURE
- OB: OVERBRIDGE (ROAD OVER RAIL)
- UB: UNDERBRIDGE (RAIL OVER ROAD)

PLAN ON ROUTE
NTS



LOCATION PLAN
NTS

SUMMARY OF INFRASTRUCTURE FOR EACH OPTION:

OPTION 1: NEW ALIGNMENT (DIRECT)

EXISTING
N/A

PROPOSED

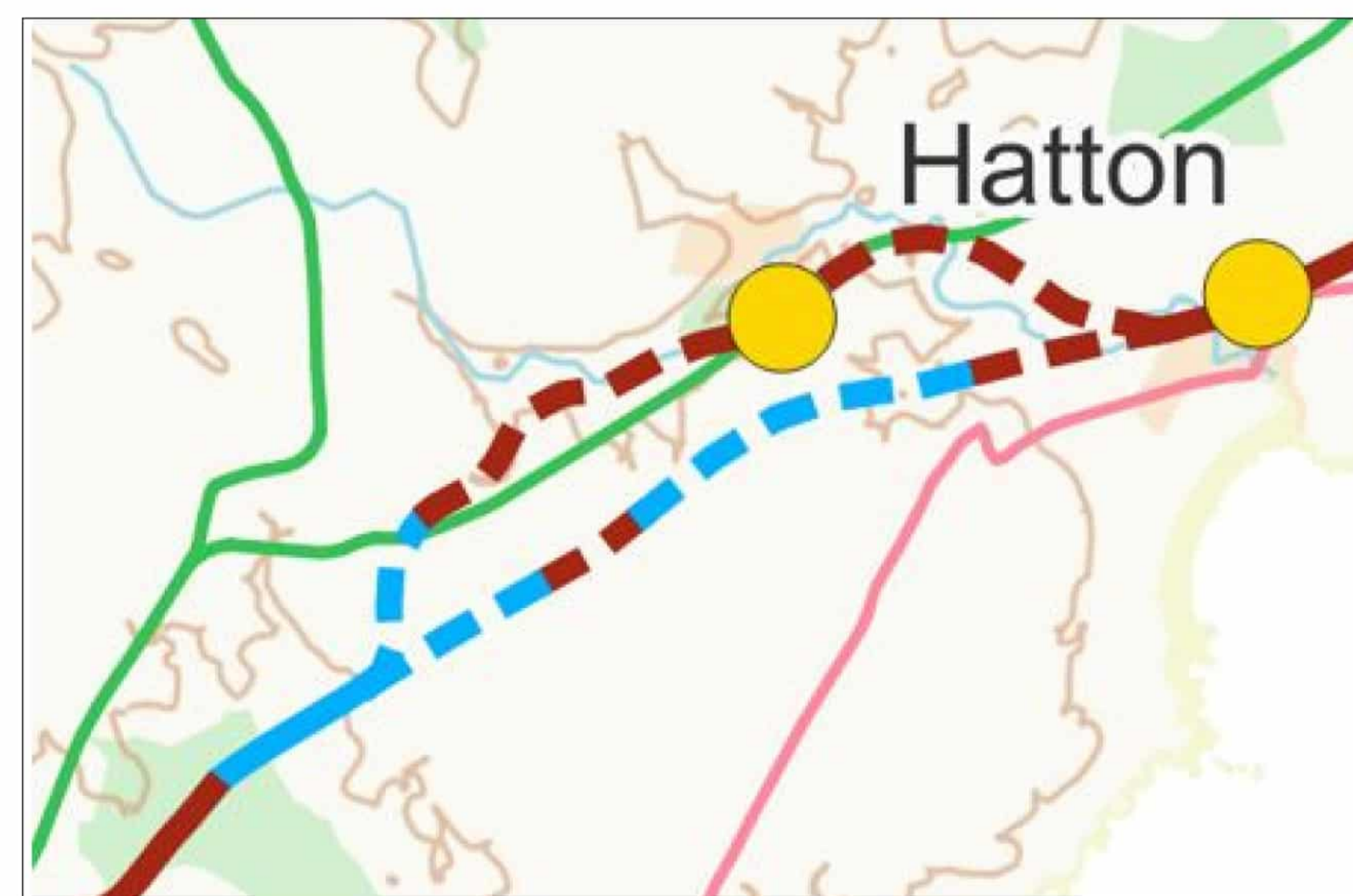
- 6 No. BRIDGE STRUCTURES
- APPROX. 4.5 MILES OF TRACK ON NEW ALIGNMENT

OPTION 2: HISTORIC ALIGNMENT (VIA HATTON)

EXISTING
N/A

PROPOSED

- 8 No. BRIDGE STRUCTURES (INCLUDES 2 No. A90 CROSSINGS)
- 1 No. STATION (HATTON)
- 1 No. PASSING LOOP AT STATION
- APPROX. 5 MILES OF TRACK ON EXISTING ALIGNMENT



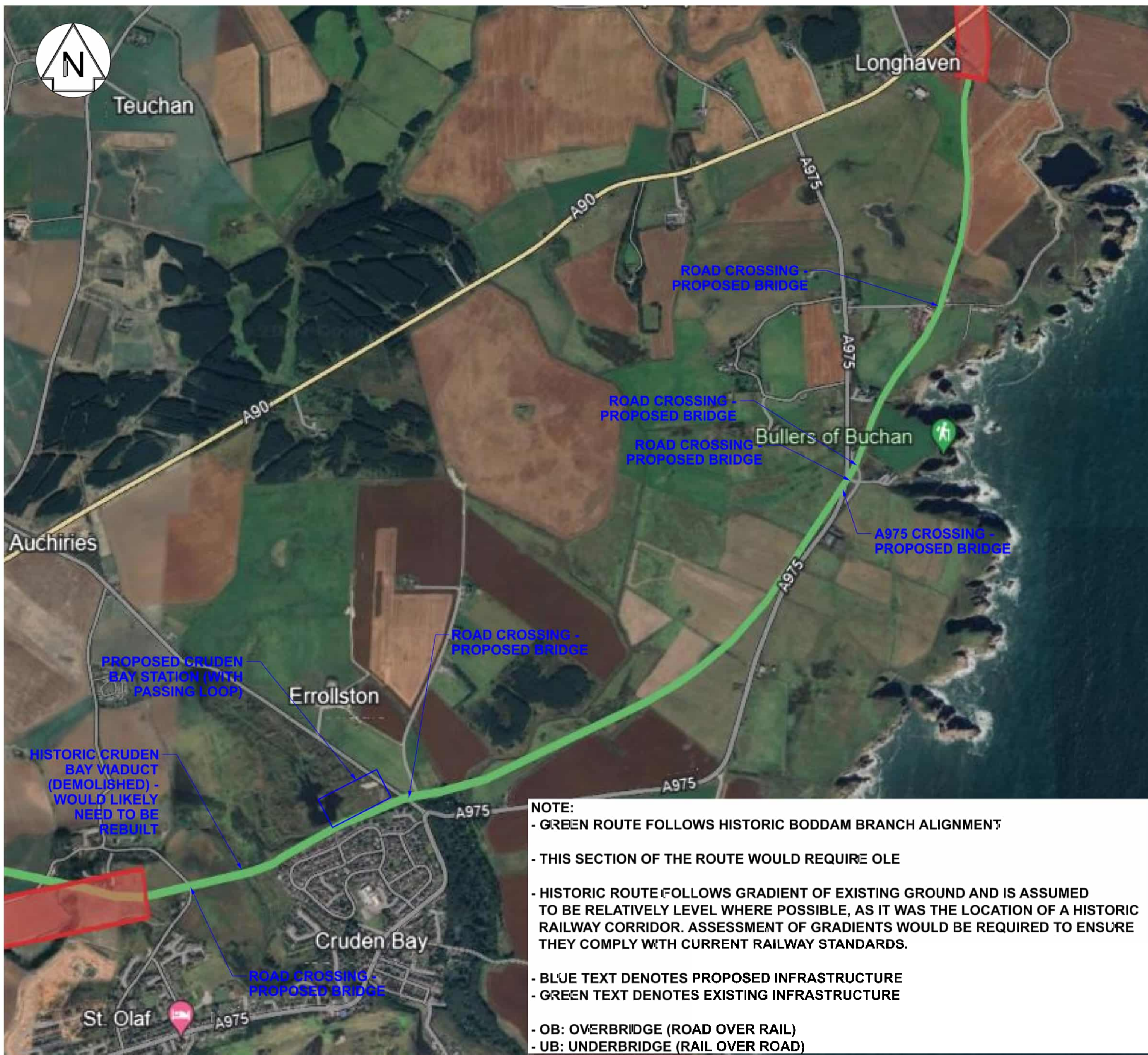
PLAN SHOWING LOCATION OF PASSING LOOPS
NTS

Rail Alignment

- Single Track (Core Alignment)
- Dynamic Passing Loop
- - - Single Track (Optional)
- - - Dynamic Passing Loop (Optional)

Stations

- Proposed Station
- Passing Loop at Station
- Proposed Station (Optional)



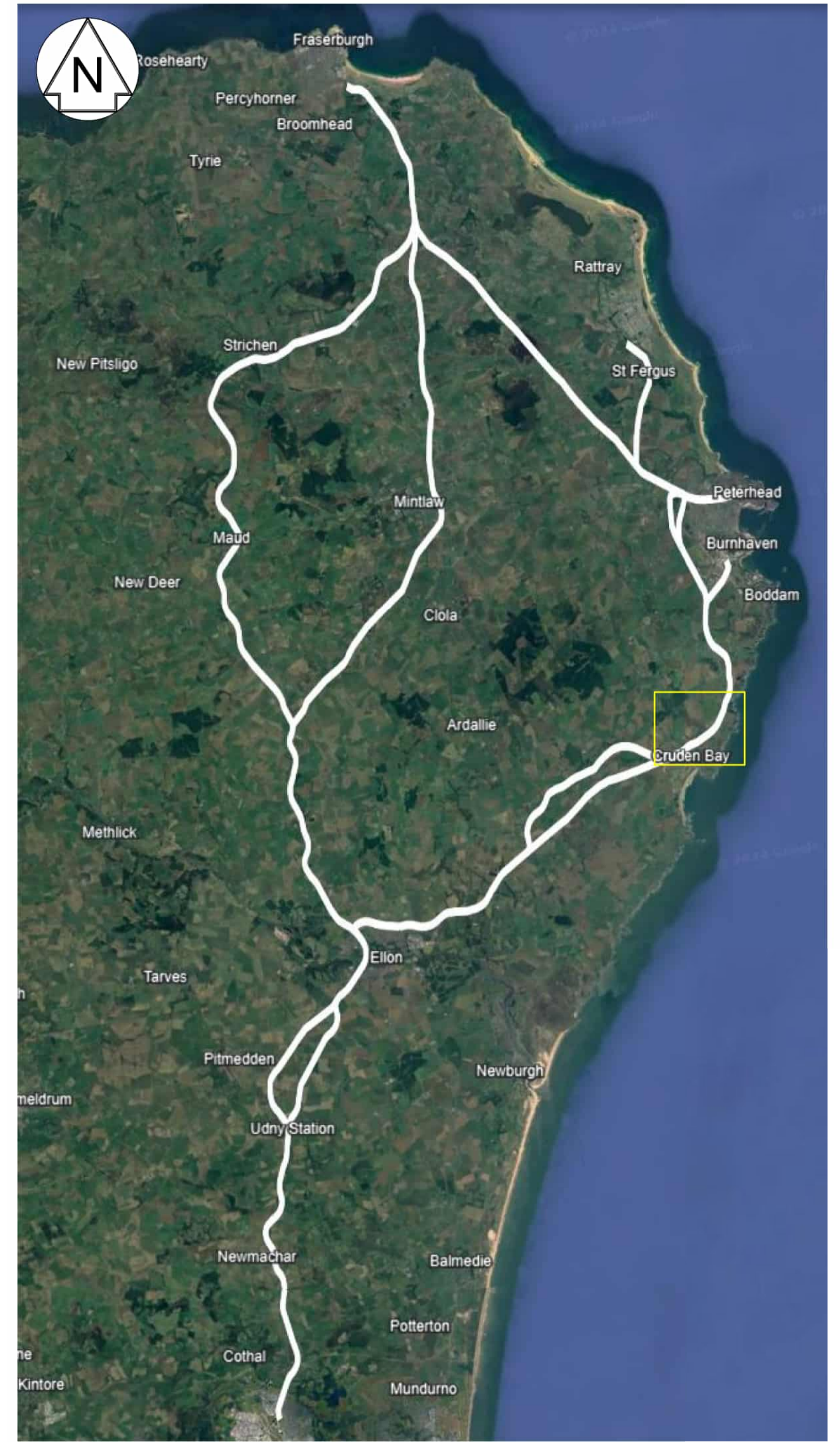
PLAN ON ROUTE
NTS

SUMMARY OF INFRASTRUCTURE:

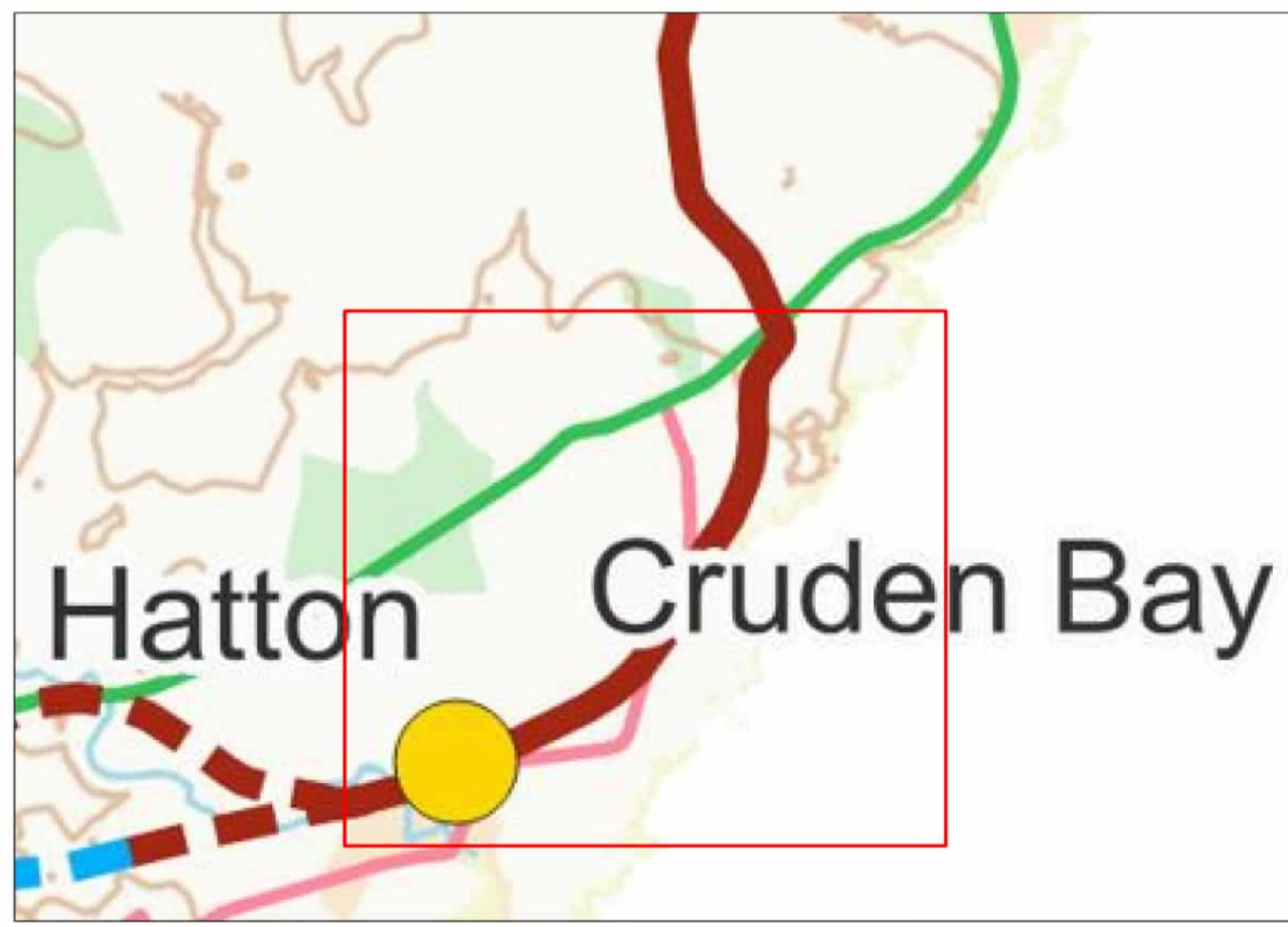
EXISTING
N/A

PROPOSED

- 6 No. BRIDGE STRUCTURES (INCLUDING 1 No. A975 CROSSING)
- 1 No. STATION (CRUDEN BAY) WITH PASSING LOOP
- APPROX. 3 MILES OF TRACK ON EXISTING ALIGNMENT
- OLE INFRASTRUCTURE FOR APPROX. 3 MILES OF TRACK



LOCATION PLAN
NTS



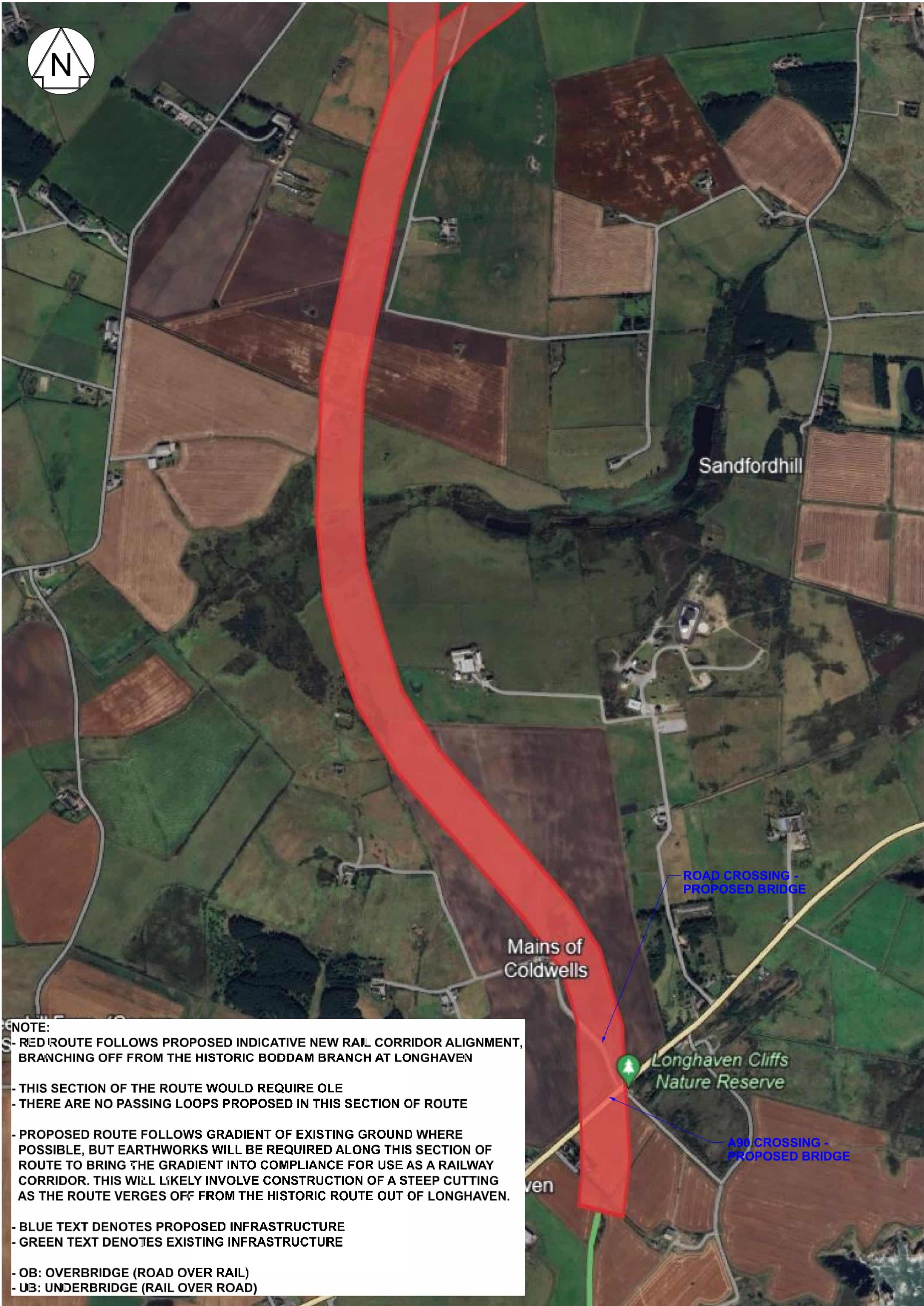
PLAN SHOWING LOCATION OF PASSING LOOPS
NTS

Rail Alignment

- Single Track (Core Alignment)
- Dynamic Passing Loop
- - - Single Track (Optional)
- - - Dynamic Passing Loop (Optional)

Stations

- Proposed Station
- Passing Loop at Station
- Proposed Station (Optional)



NOTE:

- RED ROUTE FOLLOWS PROPOSED INDICATIVE NEW RAIL CORRIDOR ALIGNMENT, BRANCHING OFF FROM THE HISTORIC BODDAM BRANCH AT LONGHAVEN
- THIS SECTION OF THE ROUTE WOULD REQUIRE OLE
- THERE ARE NO PASSING LOOPS PROPOSED IN THIS SECTION OF ROUTE
- PROPOSED ROUTE FOLLOWS GRADIENT OF EXISTING GROUND WHERE POSSIBLE, BUT EARTHWORKS WILL BE REQUIRED ALONG THIS SECTION OF ROUTE TO BRING THE GRADIENT INTO COMPLIANCE FOR USE AS A RAILWAY CORRIDOR. THIS WILL LIKELY INVOLVE CONSTRUCTION OF A STEEP CUTTING AS THE ROUTE VERGES OFF FROM THE HISTORIC ROUTE OUT OF LONGHAVEN.
- BLUE TEXT DENOTES PROPOSED INFRASTRUCTURE
- GREEN TEXT DENOTES EXISTING INFRASTRUCTURE
- OB: OVERBRIDGE (ROAD OVER RAIL)
- UB: UNDERBRIDGE (RAIL OVER ROAD)

PLAN ON ROUTE
NTS

SUMMARY OF INFRASTRUCTURE:

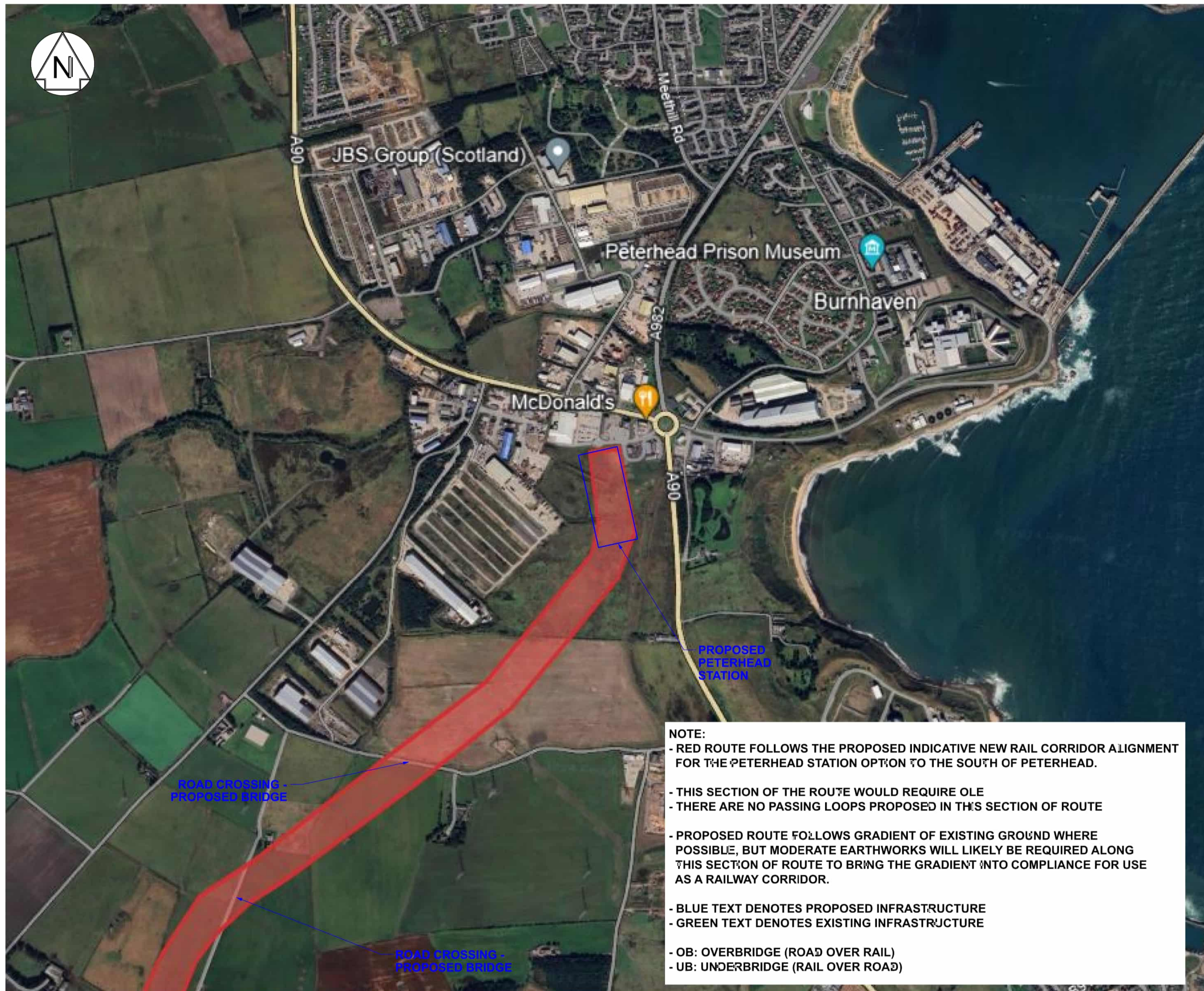
EXISTING
N/A

PROPOSED

- 2 No. BRIDGE STRUCTURES (INCLUDES 1 No. A90 CROSSING)
- APPROX. 2 MILES OF TRACK ON NEW ALIGNMENT
- OLE INFRASTRUCTURE FOR APPROX. 2 MILES OF TRACK



LOCATION PLAN
NTS



PLAN ON ROUTE
NTS



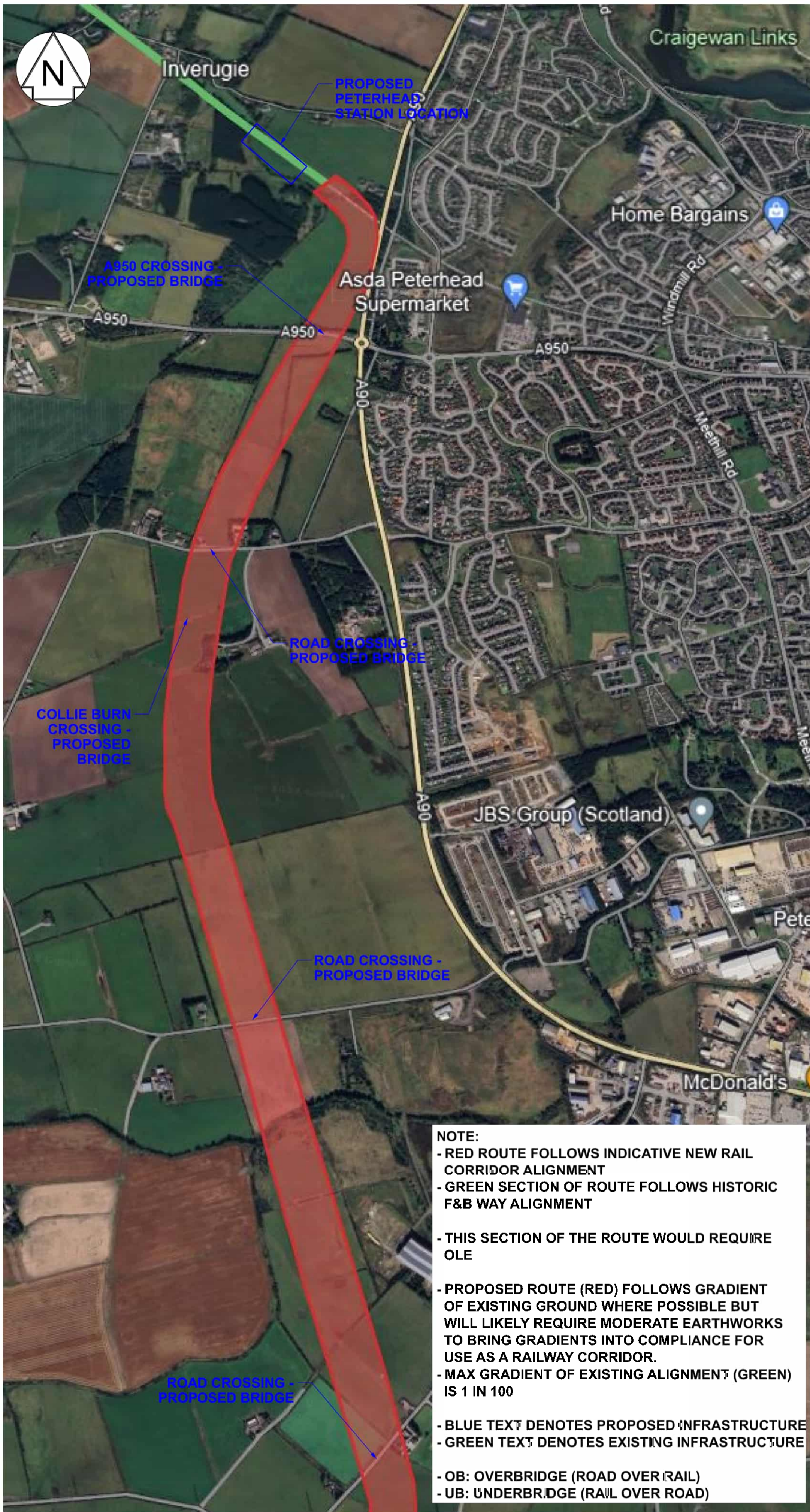
LOCATION PLAN
NTS

SUMMARY OF INFRASTRUCTURE:

EXISTING
N/A

PROPOSED

- 2 No. BRIDGE STRUCTURES
- 1 No. STATION (PETERHEAD)
- APPROX. 1.5 MILES OF TRACK ON NEW ALIGNMENT
- OLE INFRASTRUCTURE FOR APPROX. 1.5 MILES OF TRACK



PLAN ON ROUTE
NTS

SUMMARY OF INFRASTRUCTURE:

EXISTING
N/A

PROPOSED

- 5 No. BRIDGE STRUCTURES (INCLUDES 1 No. A950 CROSSING)
- 1 No. STATION (PETERHEAD) WITH PASSING LOOP
- APPROX. 3 MILES OF TRACK ON NEW ALIGNMENT
- APPROX. 0.5 MILES OF TRACK ON EXISTING ALIGNMENT
- APPROX 0.5 MILES OF ACTIVE TRAVEL ROUTE TO BE MAINTAINED ALONGSIDE TRACK
- OLE INFRASTRUCTURE FOR APPROX. 3.5 MILES OF TRACK

Rail Alignment

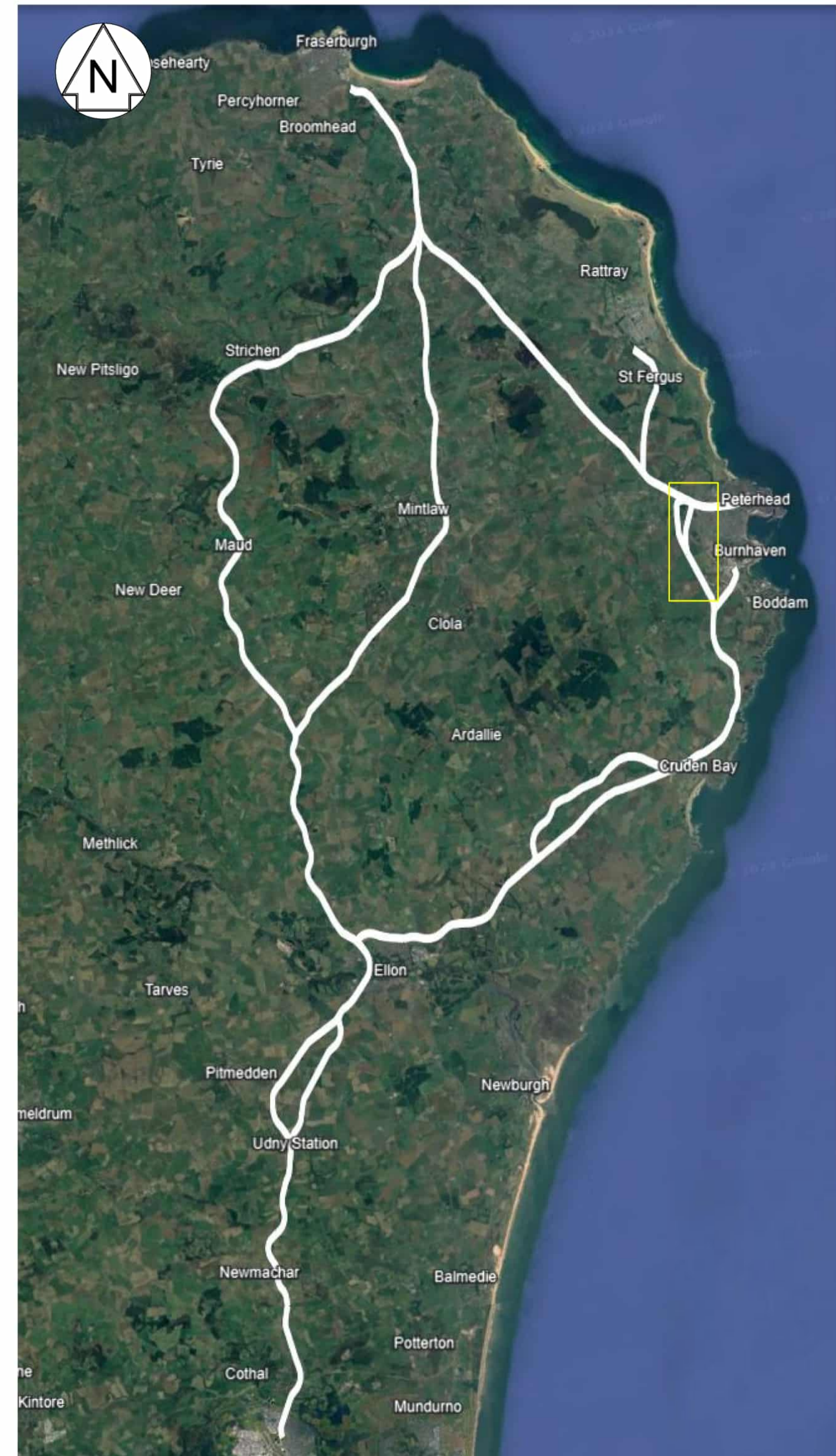
- Single Track (Core Alignment)
- Dynamic Passing Loop
- - - Single Track (Optional)
- - - Dynamic Passing Loop (Optional)

Stations

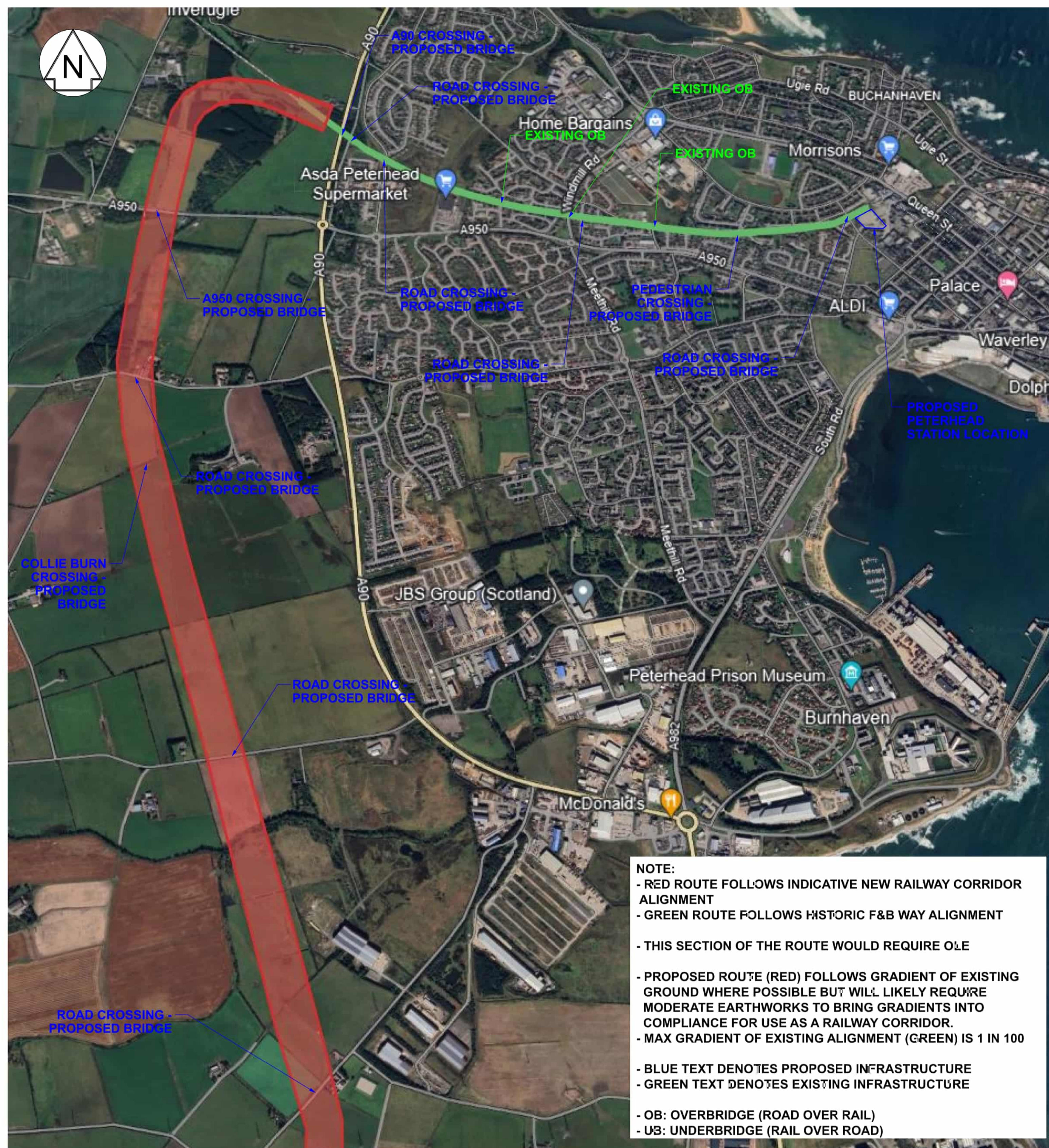
- Proposed Station
- Passing Loop at Station
- Proposed Station (Optional)



PLAN SHOWING LOCATION OF PASSING LOOPS
NTS



LOCATION PLAN
NTS



PLAN ON ROUTE
NTS

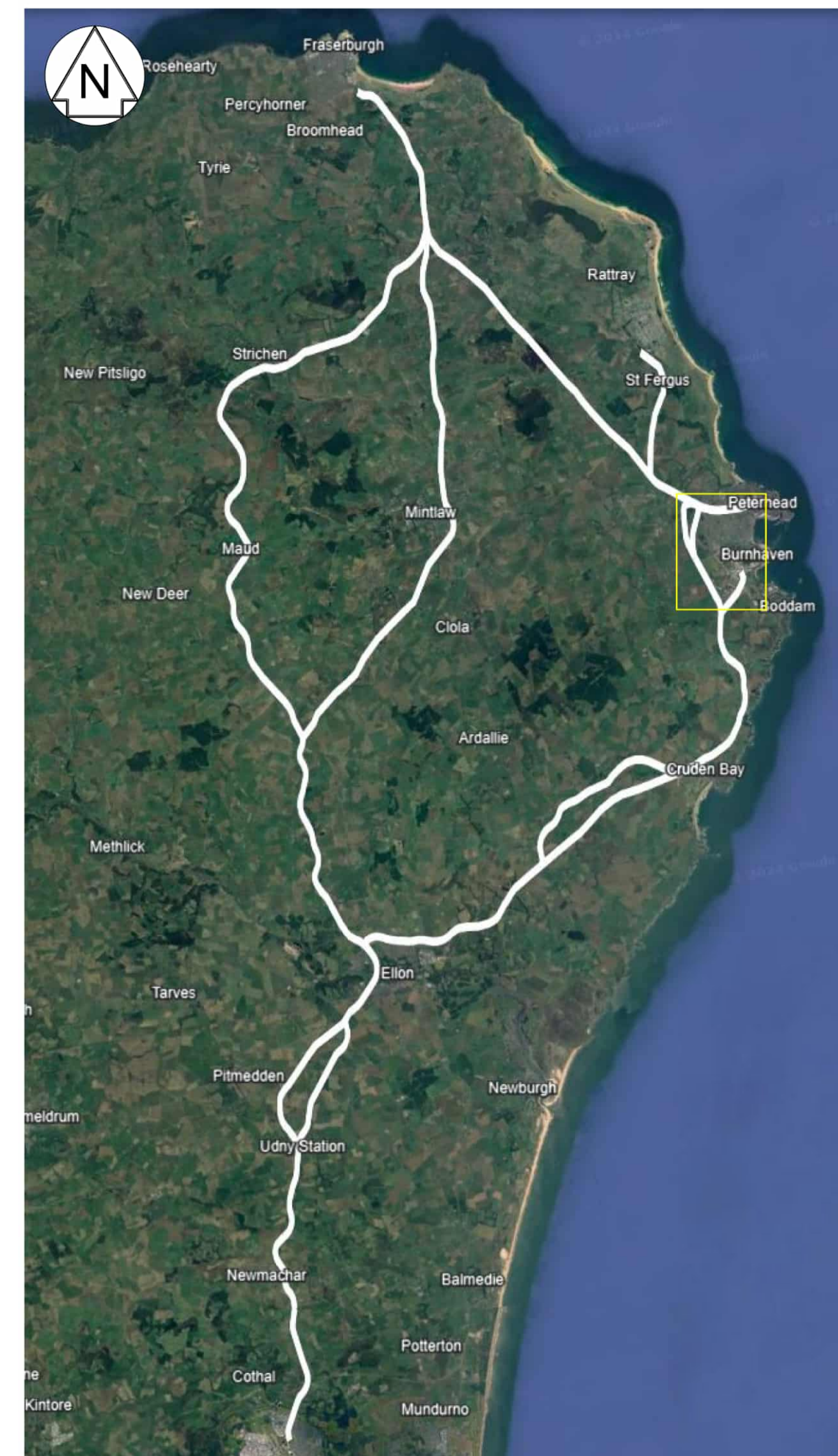
SUMMARY OF INFRASTRUCTURE:

EXISTING

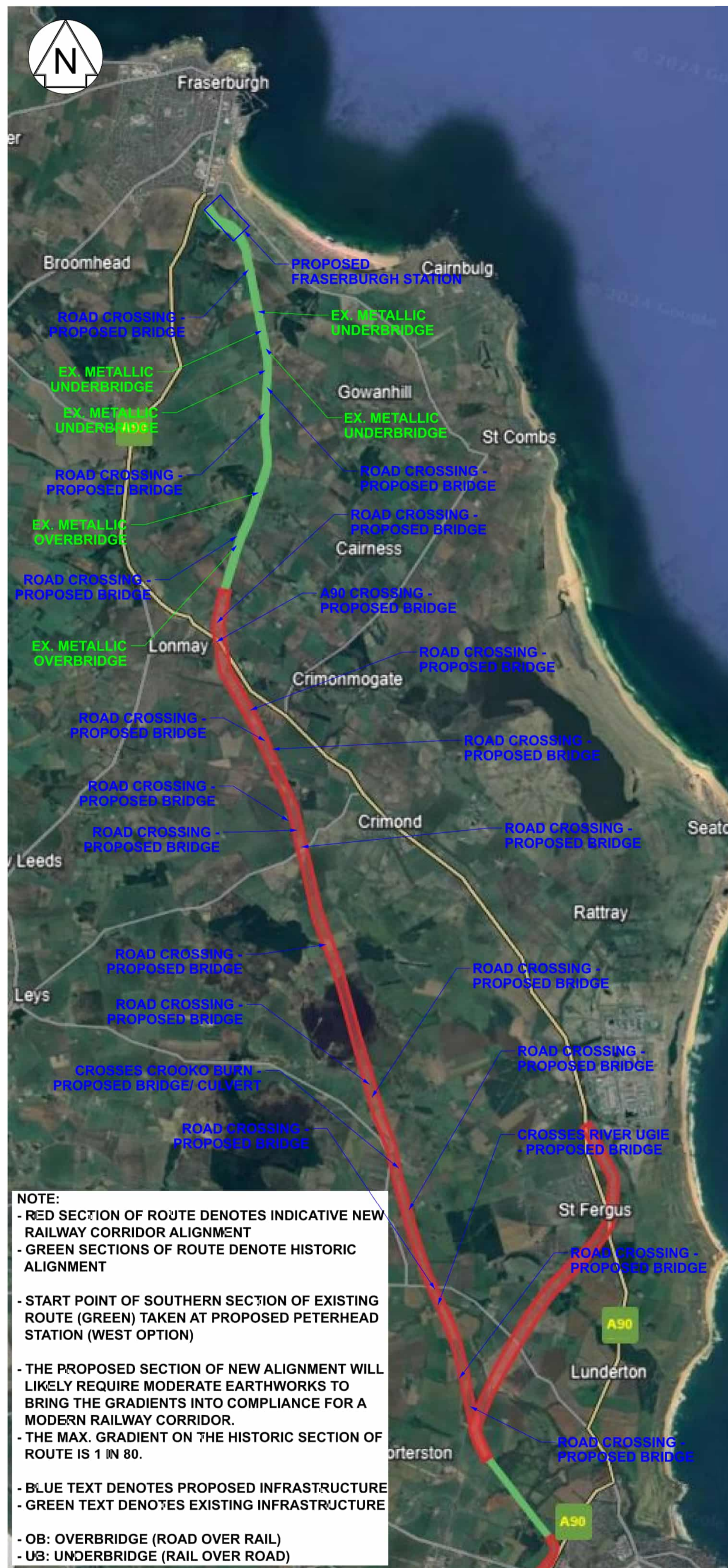
- 3 No. OVERBRIDGES

PROPOSED

- 11 No. BRIDGE STRUCTURES (INCLUDES 1 No. A950 CROSSING, 1 No. A90 CROSSING & 1 No. PEDESTRIAN CROSSING)
- 1 No. STATION (PETERHEAD)
- APPROX. 1.5 MILES OF TRACK ON EXISTING ALIGNMENT
- APPROX. 3 MILES OF TRACK ON NEW ALIGNMENT
- APPROX. 1.5 MILES OF ACTIVE TRAVEL ROUTE TO BE MAINTAINED ALONGSIDE TRACK
- O&E INFRASTRUCTURE FOR APPROX. 4.5 MILES OF TRACK



LOCATION PLAN
NTS



NOTE:

- RED SECTION OF ROUTE DENOTES INDICATIVE NEW RAILWAY CORRIDOR ALIGNMENT
- GREEN SECTIONS OF ROUTE DENOTE HISTORIC ALIGNMENT
- START POINT OF SOUTHERN SECTION OF EXISTING ROUTE (GREEN) TAKEN AT PROPOSED PETERHEAD STATION (WEST OPTION)
- THE PROPOSED SECTION OF NEW ALIGNMENT WILL LIKELY REQUIRE MODERATE EARTHWORKS TO BRING THE GRADIENTS INTO COMPLIANCE FOR A MODERN RAILWAY CORRIDOR.
- THE MAX. GRADIENT ON THE HISTORIC SECTION OF ROUTE IS 1 IN 80.
- BLUE TEXT DENOTES PROPOSED INFRASTRUCTURE
- GREEN TEXT DENOTES EXISTING INFRASTRUCTURE
- OB: OVERBRIDGE (ROAD OVER RAIL)
- UB: UNDERBRIDGE (RAIL OVER ROAD)

PLAN ON ROUTE
NTS

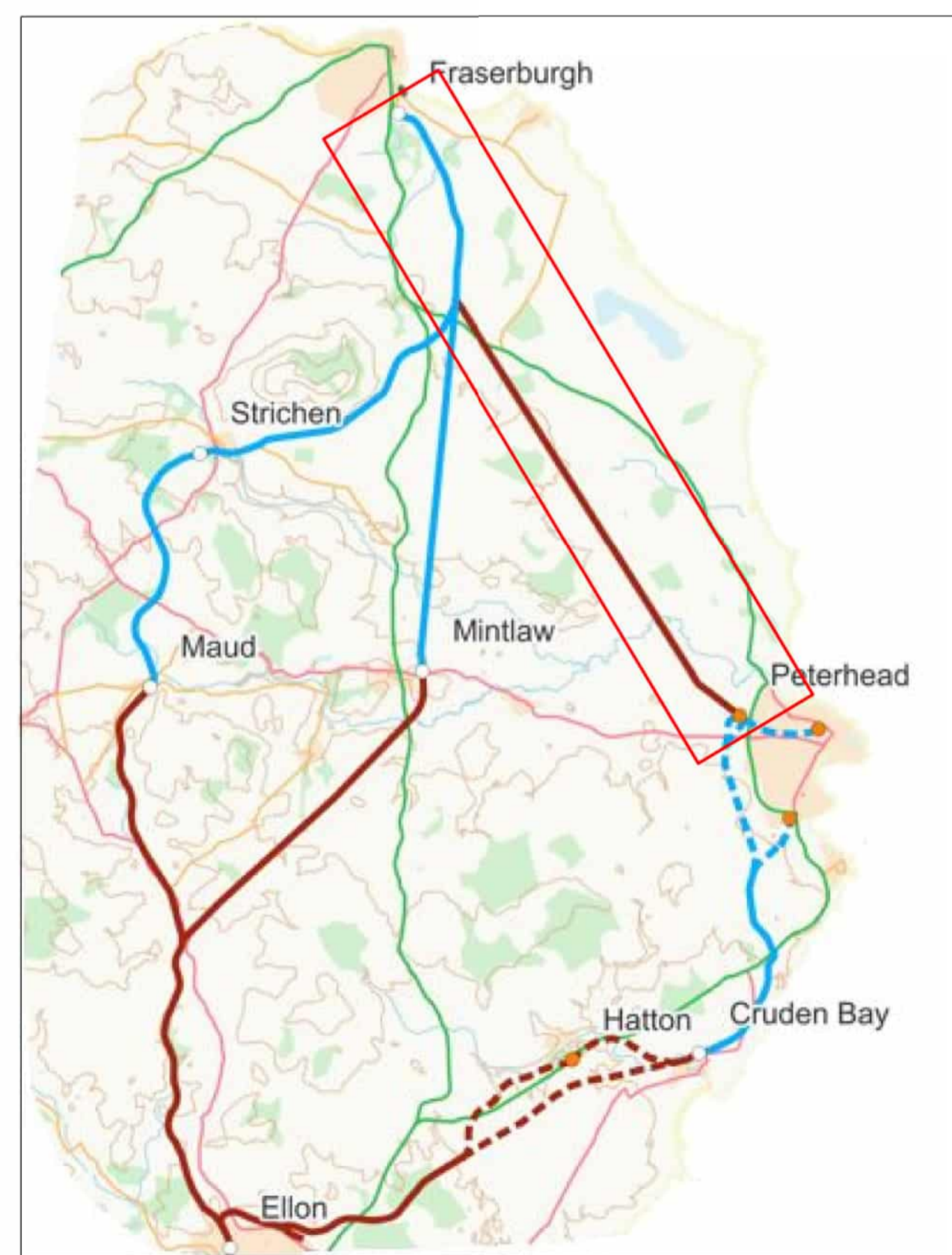
SUMMARY OF INFRASTRUCTURE:

EXISTING

- 4 No. UNDERBRIDGES
- 2 No. OVERBRIDGES

PROPOSED

- 21 No. BRIDGE STRUCTURES (INCLUDES 1 No. A90 CROSSING & 1 No. CROSSING OF RIVER UGIE)
- 1 No. STATION (FRASERBURGH)
- APPROX. 8.5 MILES OF TRACK ON NEW ALIGNMENT (RED SECTION)
- APPROX. 5 MILES OF TRACK ON EXISTING ALIGNMENT (GREEN SECTIONS)
- APPROX. 5 MILES OF ACTIVE TRAVEL ROUTE TO BE MAINTAINED
- APPROX. 5 MILES OF OLE INFRASTRUCTURE REQUIRED BETWEEN LONMAY AND FRASERBURGH



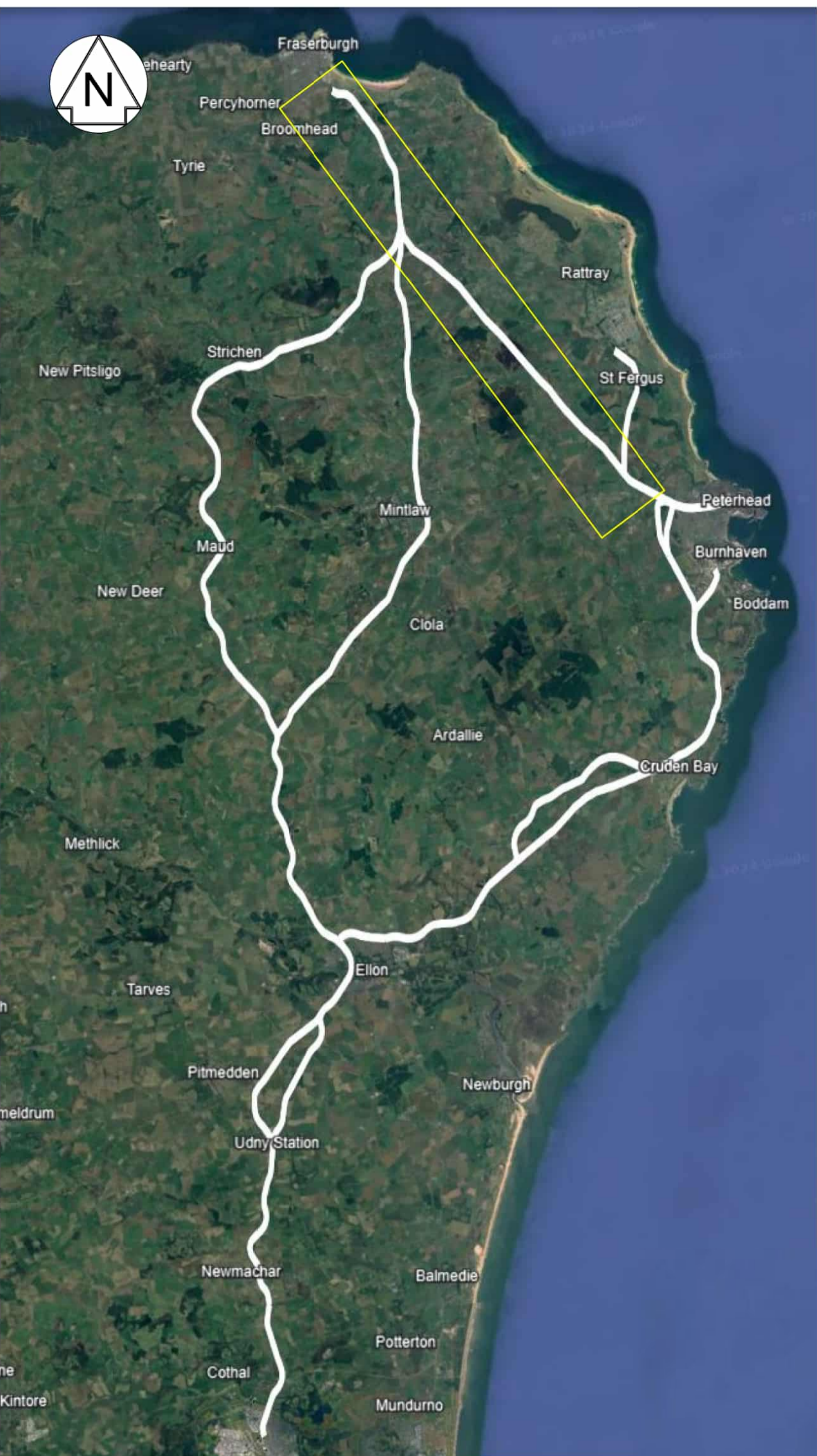
OLE REQUIREMENTS
NTS

Mode

- Battery (Core Alignment)
- OLE (Core Alignment)
- - - Battery (Optional Alignment)
- - - OLE (Optional Alignment)

Stations

- Proposed Station
- Proposed Station (Optional)



LOCATION PLAN
NTS



PLAN ON ROUTE
NTS

NOTE:

- GREEN ROUTE DENOTES HISTORIC ALIGNMENT (F&B WAY)
- THERE ARE NO PASSING LOOPS PROPOSED BETWEEN ELLON AND FRASERBURGH
- THE MAX. GRADIENT ON THE HISTORIC SECTION OF ROUTE IS 1 IN 60. HOWEVER, MAJORITY OF THE EXISTING ROUTE IS COMPLIANT WITH CURRENT STANDARDS AND WOULD LIKELY ONLY REQUIRE EARTHWORKS IN THE FEW AREAS WHERE THE GRADIENT IS ABOVE THE RECOMMENDED MAX OF 1 IN 80. AT THE PROPOSED STATION LOCATIONS, EARTHWORKS WOULD ALSO LIKELY BE REQUIRED TO ALLOW A COMPLIANT GRADIENT OF MAX. 1 IN 500.
- BLUE TEXT DENOTES PROPOSED INFRASTRUCTURE
- GREEN TEXT DENOTES EXISTING INFRASTRUCTURE
- OB: OVERBRIDGE (ROAD OVER RAIL)
- UB: UNDERBRIDGE (RAIL OVER ROAD)

SUMMARY OF INFRASTRUCTURE:

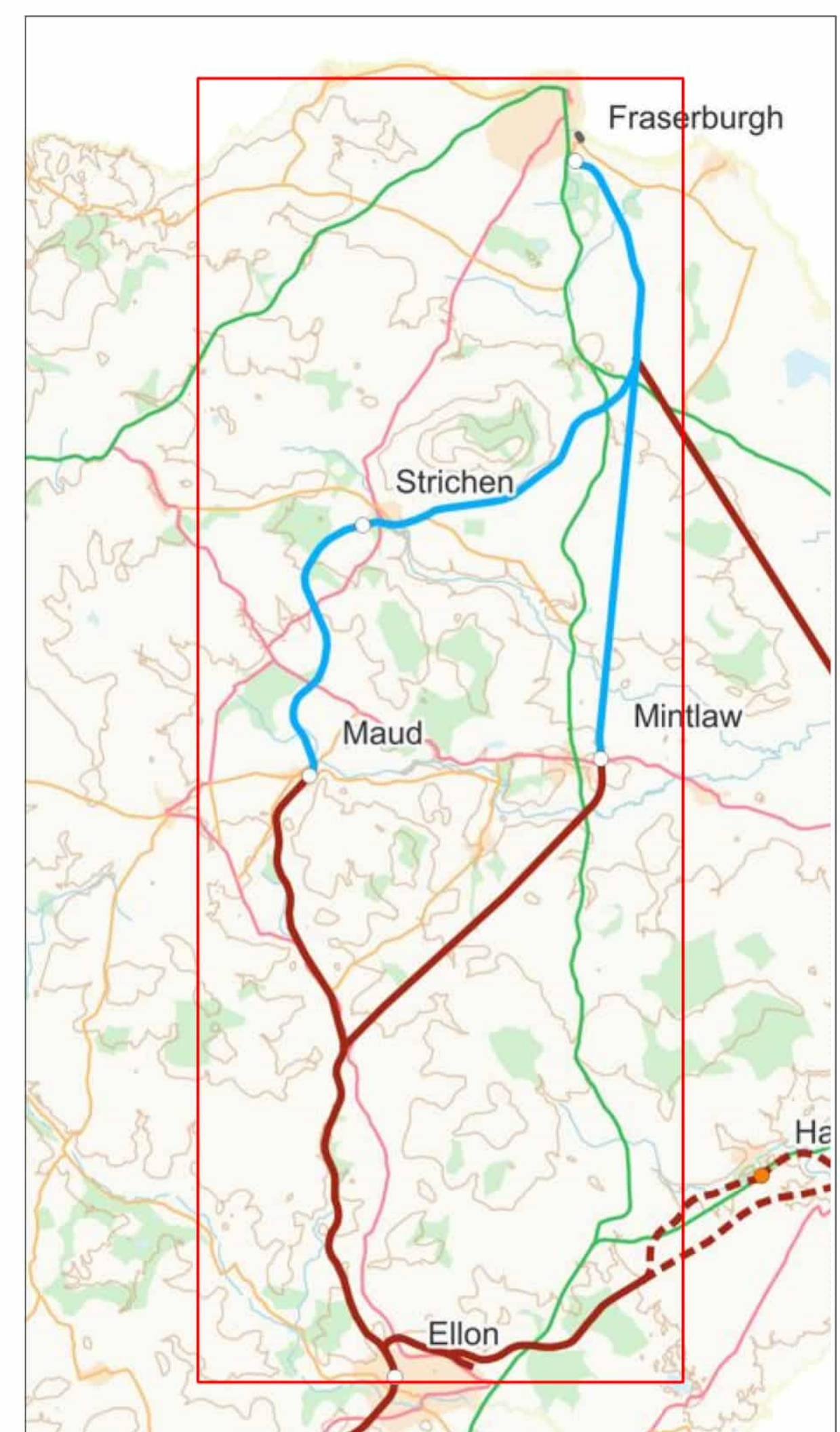
EXISTING ALIGNMENT (F&B WAY)

EXISTING

- 23 No. METALLIC UNDERBRIDGES
- 19 No. METALLIC OVERBRIDGES
- HISTORIC MAUD STATION PLATFORM
- 3 No. MASONRY ARCH OVERBRIDGES
- 3 No. CONCRETE UNDERBRIDGES
- 1 No. CONCRETE OVERBRIDGE (SOFFIT APPROX. 2.7m ABOVE GROUND LEVEL)
- 12 No. CULVERTS

PROPOSED

- 17 No. BRIDGE STRUCTURES (INCLUDES 1 No. A90 CROSSING)
- 3 No. STATIONS (MAUD, STRICHEN & FRASERBURGH)
- APPROX. 26.5 MILES OF TRACK ON EXISTING ALIGNMENT (GREEN SECTION)
- APPROX. 26.5 MILES OF ACTIVE TRAVEL ROUTE TO BE MAINTAINED ALONGSIDE TRACK
- OLE FOR APPROX. 15.5 MILES OF TRACK



PLAN ON OLE LOCATIONS
NTS



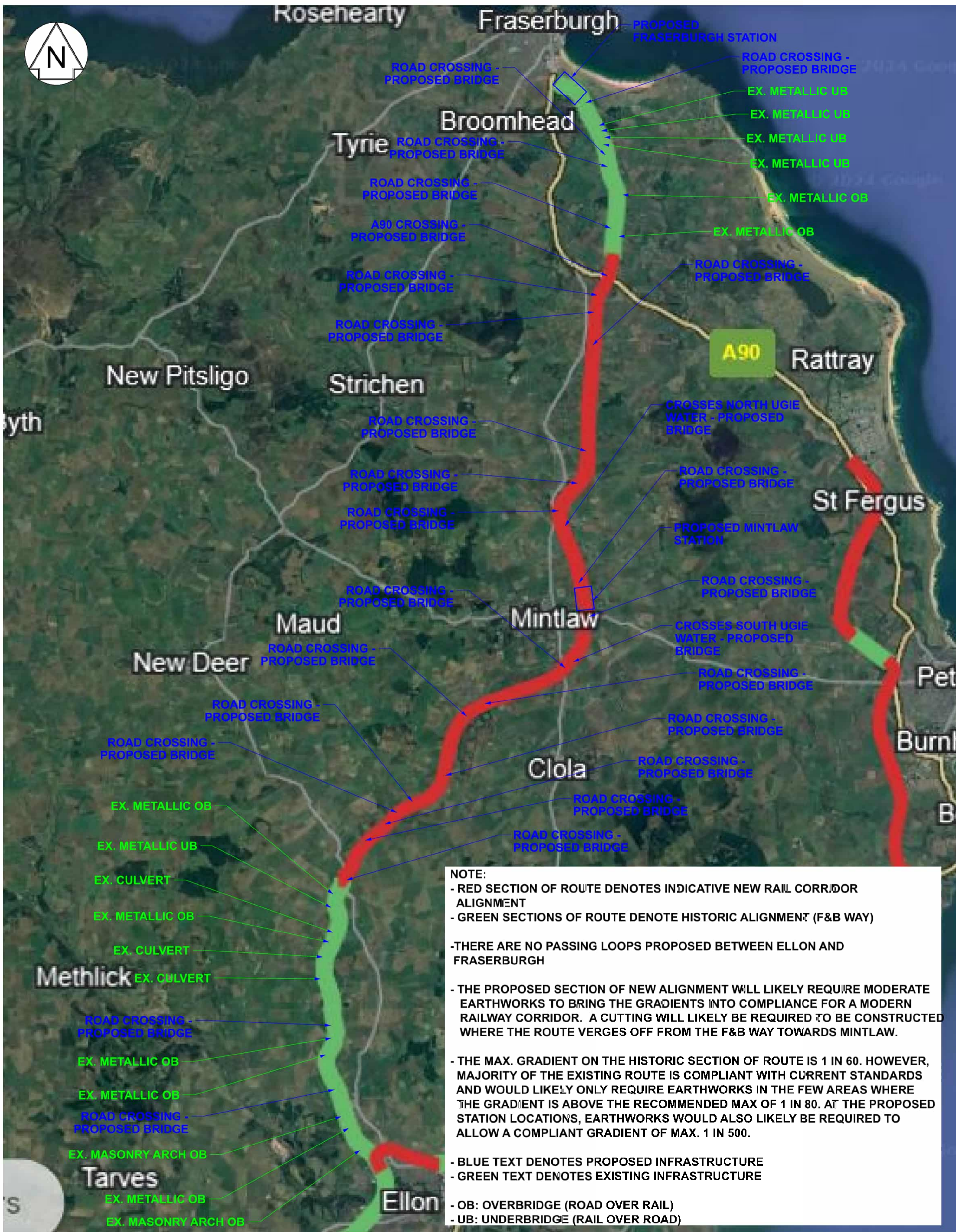
LOCATION PLAN
NTS

Mode

- Battery (Core Alignment)
- OLE (Core Alignment)
- - - Battery (Optional Alignment)
- - - OLE (Optional Alignment)

Stations

- Proposed Station
- Proposed Station (Optional)



NOTE:

- RED SECTION OF ROUTE DENOTES INDICATIVE NEW RAIL CORRIDOR ALIGNMENT
- GREEN SECTIONS OF ROUTE DENOTE HISTORIC ALIGNMENT (F&B WAY)
- THERE ARE NO PASSING LOOPS PROPOSED BETWEEN ELLON AND FRASERBURGH
- THE PROPOSED SECTION OF NEW ALIGNMENT WILL LIKELY REQUIRE MODERATE EARTHWORKS TO BRING THE GRADIENTS INTO COMPLIANCE FOR A MODERN RAILWAY CORRIDOR. A CUTTING WILL LIKELY BE REQUIRED TO BE CONSTRUCTED WHERE THE ROUTE VERGES OFF FROM THE F&B WAY TOWARDS MINTLAW.
- THE MAX. GRADIENT ON THE HISTORIC SECTION OF ROUTE IS 1 IN 60. HOWEVER, MAJORITY OF THE EXISTING ROUTE IS COMPLIANT WITH CURRENT STANDARDS AND WOULD LIKELY ONLY REQUIRE EARTHWORKS IN THE FEW AREAS WHERE THE GRADIENT IS ABOVE THE RECOMMENDED MAX OF 1 IN 80. AT THE PROPOSED STATION LOCATIONS, EARTHWORKS WOULD ALSO LIKELY BE REQUIRED TO ALLOW A COMPLIANT GRADIENT OF MAX. 1 IN 500.
- BLUE TEXT DENOTES PROPOSED INFRASTRUCTURE
- GREEN TEXT DENOTES EXISTING INFRASTRUCTURE
- OB: OVERBRIDGE (ROAD OVER RAIL)
- UB: UNDERBRIDGE (RAIL OVER ROAD)

PLAN ON ROUTE
NTS

SUMMARY OF INFRASTRUCTURE:

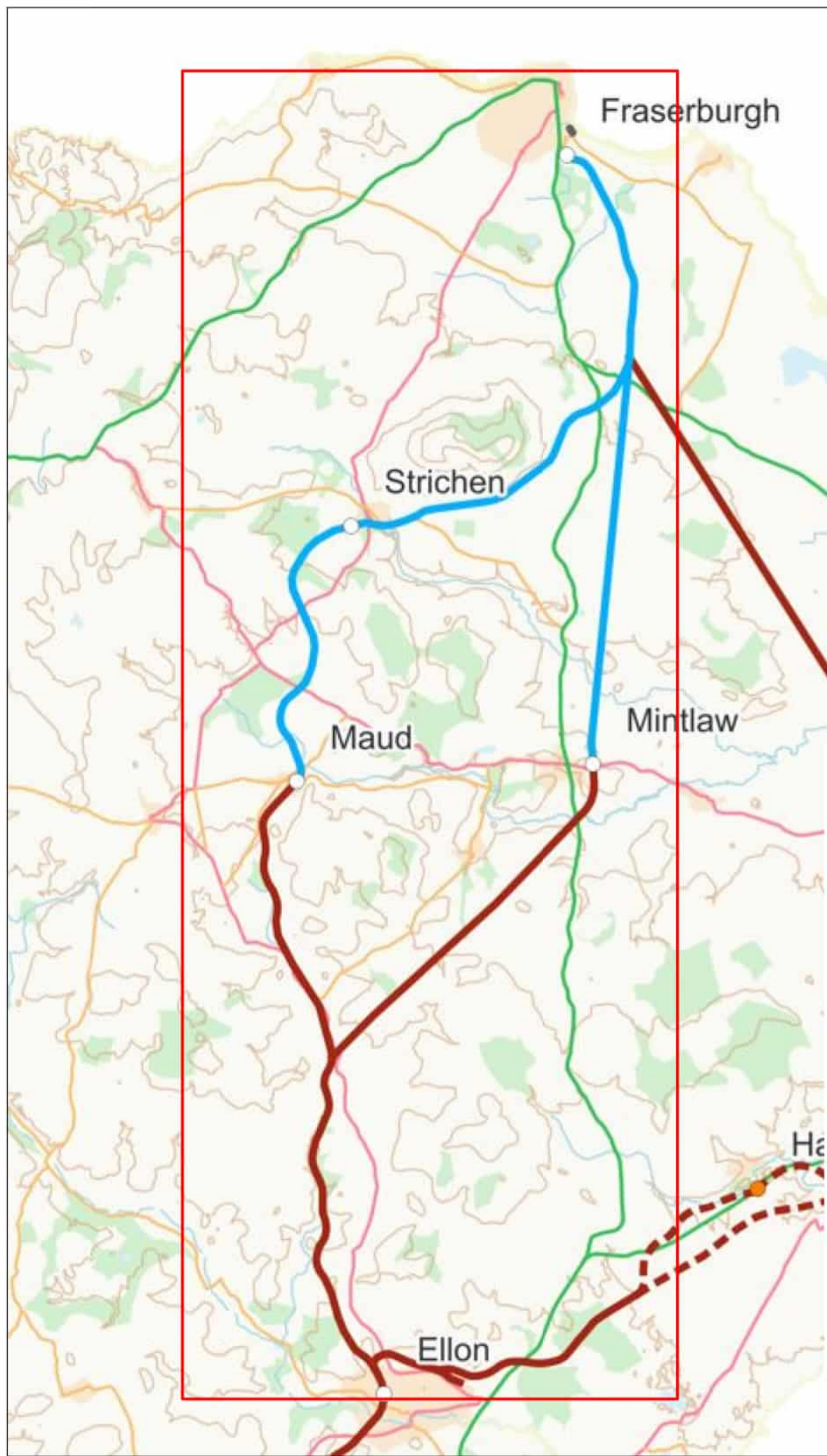
NEW ALIGNMENT (INCLUDES SECTIONS OF F&B WAY)

EXISTING

- 7 No. METALLIC OVERBRIDGES
- 5 No. METALLIC UNDERBRIDGES
- 2 No. MASONRY ARCH OVERBRIDGES
- 3 No. CULVERTS

PROPOSED

- 26 No. BRIDGE STRUCTURES (INCLUDES 1 No. A90 CROSSING)
- 2 No. STATIONS (MINTLAW & FRASERBURGH)
- APPROX. 14.5 MILES OF TRACK ON NEW ALIGNMENT (RED SECTION)
- APPROX. 10 MILES OF TRACK ON EXISTING ALIGNMENT (GREEN SECTIONS)
- APPROX. 10 MILES OF ACTIVE TRAVEL ROUTE TO BE MAINTAINED ALONGSIDE TRACK
- OLE FOR APPROX. 11 MILES OF TRACK



PLAN ON OLE LOCATIONS
NTS



LOCATION PLAN
NTS

Mode

- Battery (Core Alignment)
- OLE (Core Alignment)
- - - Battery (Optional Alignment)
- - - OLE (Optional Alignment)

Stations

- Proposed Station
- Proposed Station (Optional)

Appendix B – Rejected Options

B.1 Additional Peterhead Station Option

There was a fourth option which was initially considered for the proposed Peterhead Station location. This option proposed a station location which would follow an alignment behind HMP & YOI Grampian.

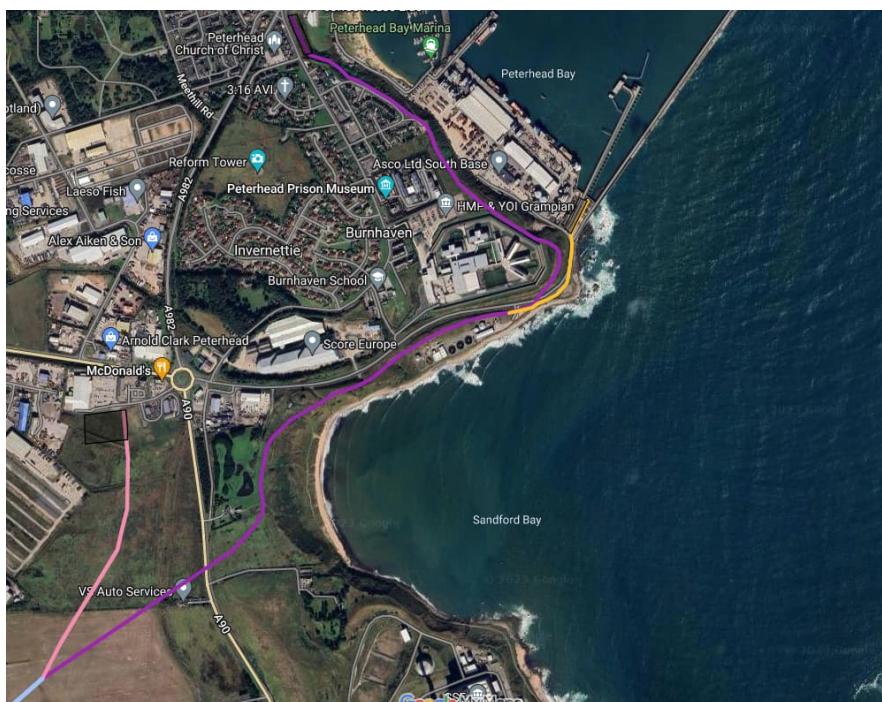


Figure B.1: Additional Peterhead Station Option

Figure B.1 shows an indicative alignment (purple) for this station option at Peterhead. However, this option was rejected in the initial stages of this study for various reasons. The minimum allowable curvature for a passenger line would not be achievable along this alignment without demolishing the adjacent HMP & YOI Grampian buildings. The existing ground profile along this alignment would also require extensive earthworks and potentially a new viaduct structure to bring the gradients into compliance for a modern rail route. The proposed station location site is also limited due to surrounding infrastructure which could result in limitations on the station design and potentially rule it out at the design stage if there is not sufficient space available for facilities such as station parking or accessible facilities such as a station footbridge and lifts.

B.2 Peterhead to Fraserburgh (Village Route)

There was initially an alternative route considered between Peterhead and Fraserburgh. This route proposed additional stations between Peterhead and Fraserburgh, at Crimmond and Inverallochy.

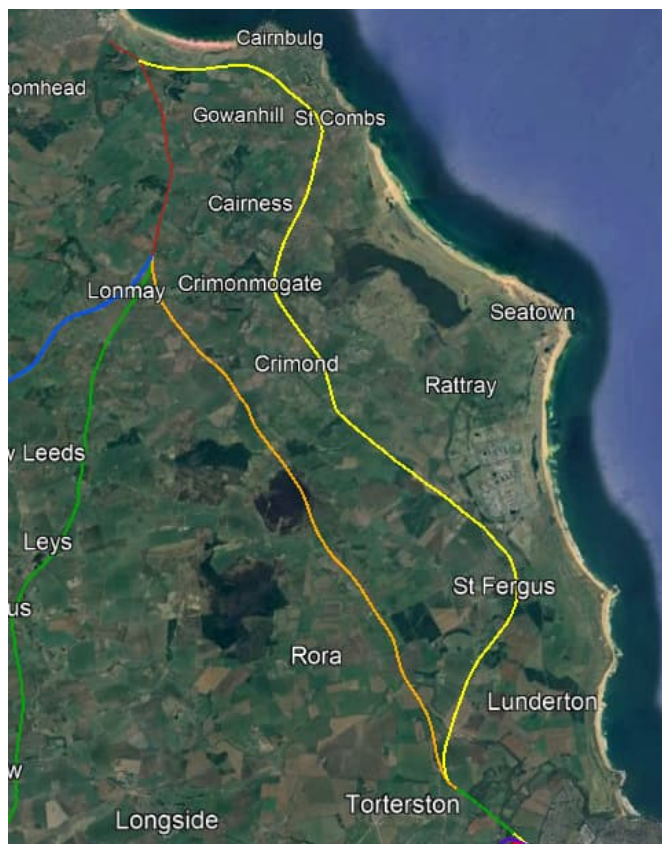


Figure B.2: Peterhead to Fraserburgh (Village Route Option)

The indicative yellow alignment shown in Figure B.2 denotes the additional village route option between Peterhead and Fraserburgh. During the initial stages of this study, it was determined that this option between Peterhead and Fraserburgh should be discounted due to uncompetitive journey times and cost implications. Route analysis was carried out which concluded that this option would be significantly more costly as it would result in the requirement for a greater amount of new infrastructure, such as bridge structures and additional stations, when compared to the more direct route between Peterhead and Fraserburgh considered in this study.

Appendix B : Rail Scheme Appraisal Technical Note

Buchan Sustainable Transport Study

Rail Scheme Appraisal Technical Note

Campaign for North East Rail
Aberdeen and Grampian Chamber of Commerce

May 2024

Quality information

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V1.2	10/05/2024	Incorporating client feedback	30/04/2024	RF	Associate Director

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1 Introduction

1.1 Overview

- 1.1.1 Following the award of Scottish Government Just Transition funding, AECOM have been commissioned by the Campaign for North East Rail (CNER), in partnership with Aberdeen and Grampian Chamber of Commerce (AGCC), to investigate the potential for re-introducing a rail service in the former Formartine and Buchan railway, connecting Aberdeen and Dyce to Ellon, Peterhead and Fraserburgh, using the former Boddam Branch, not assessed in previous work. CNER has produced an extensive body of work setting out proposals for a new rail service, highlighting changing circumstances that can potentially strengthen the case for rail, and successfully securing support for the proposal from a wide range of stakeholders.
- 1.1.2 Previous studies include the Fraserburgh & Peterhead to Aberdeen Strategic Transport Study (FPASTS) Pre-Appraisal Study and STAG Part 1 Appraisal study and the STAG Part 1 Plus Ellon Rail Study which specifically examined the feasibility of a rail extension from Dyce to Ellon.
- 1.1.3 The commission's main aim is to review, build upon and renew the evidence base developed in previous studies and examine the CNER proposals in greater detail, all in an evidence-based manner as facilitated by the STAG framework. As part of this commission, a more specific rail scheme appraisal to generate an outline of the potential value for money of the scheme was requested. This work involved service option specification (incorporating both passenger and freight), operational feasibility, engineering feasibility, demand forecasting and outline STAG scheme appraisal. This Technical Note sets out this element of the work undertaken, and is presented as an appendix to the Preliminary Options Appraisal Report.

1.2 Rail Passenger and Freight

- 1.2.1 Built in the late 19th and early 20th centuries, the Formartine and Buchan railway served as a vital link connecting the fishing ports of Fraserburgh and Peterhead to Aberdeen. Spanning 57 miles, the railway split at Maud from Aberdeen towards both Fraserburgh and Peterhead. It provided stops at 25 stations along its route including at Fraserburgh, Peterhead, Strichen, Maud, Mintlaw, Ellon and Newmachar. Following recommendation of the Beeching Report the passenger service was closed in 1966. Nonetheless, the line continued to be used for freight transportation for the subsequent two decades. The line was then lifted, and the long-distance foot and cycle path known as the Formartine and Buchan Way was established in the early 1990s.
- 1.2.2 At present, access to Aberdeen for communities north of Aberdeen is primarily served by the A90 trunk road, with drivers from Fraserburgh usually taking advantage of the more direct A952 via Mintlaw which merges into the A90 north of Ellon. The Aberdeen Western Periphery Route (AWPR) and the Balmedie to Tipperty (now) dual carriageway has significantly improved car journey times. For example, since its full opening in early 2019 journey times between Ellon and Aberdeen city centre reduced from circa 40 minutes down to 25, more than a one-third decrease from the previous car journey time.
- 1.2.3 In terms of public transport, Stagecoach is the main bus operator serving North Aberdeenshire, despite limited regional connectivity. The bus Park & Ride site in Ellon is located adjacent to the A90 which makes it accessible for commuters from locations north of Aberdeen such as Mintlaw, Fraserburgh and Peterhead. Opened in 2000, the facility provides 300 parking spaces with services operating at the site to/from Aberdeen, Peterhead, Fraserburgh, Inverurie, Dyce and Aberdeen Airport. Specifically, the 'Buchan Xpress' operated by Stagecoach offers a typical journey time of 43 minutes to Aberdeen from Ellon (source: 2023 Stagecoach X60/61/X63 timetable).

- 1.2.4 The Formartine and Buchan Way provides a continuous off-road cycle path between Aberdeen and Ellon/Fraserburgh and Peterhead (via Maud) and whilst it is understood to be used by commuters, principally it is used as a recreational route, with the Sustrans National Cycle Network Route 1 and the North Sea Cycle Route routing along the trail for significant parts. While the facility provides an excellent facility for active travel, evidence suggests that active travel in Aberdeenshire tends to be poor due to large distances between towns and villages, with very few exceptions to the rule. Reintroducing the railway along the former route would require replacement of the existing cycle path with an equivalent facility in the vicinity of the rail line.
- 1.2.5 Several industries are located in northeast Aberdeenshire and would potentially benefit from rail connections to the wider UK rail network and freight terminals. Freight terminals at key locations in the area (potentially Ellon, Peterhead/St Fergus and/or Fraserburgh) would open the opportunity to decarbonise transport by removing shipments of goods from the region by road into rail thus supporting the goal for Net-Zero whilst improving competition in Scotland's Supply Chain by solving local freight transport issues. The study collated evidence from local stakeholders through an extensive specific freight tailored consultation, which in turn informed the specification of freight scenarios (potential number of freight services) by terminal that could then be used to estimate potential freight benefits to be captured by this scheme appraisal.

1.3 Report Contents and Structure

- 1.3.1 This report starts by outlining the development of the rail scheme options, based on the original CNER options as presented on their website, assessed as part of the study in Chapter 2. It summarises the reasoning for the early sifting out of some of the options to be assessed, and how the central case options were developed.
- 1.3.2 Chapter 3 provides a brief overview of the rail operational analysis that informed the identification of infrastructure requirements that, in turn, informed the estimation of scheme costs (see separate Engineering Feasibility Technical Note). Capital costs informing the study are benchmarked in this section of the report. Rail operating costs that later inform the STAG economic appraisal are also summarised in this section.
- 1.3.3 The focus in Chapter 4 is the development of the demand forecasting model, detailing the model structure, baseline data and validation of forecasts against the observed demand matrix. This chapter also covers the determination of growth factors and uplifts applied to the demand forecasting model outputs, to capture growth into future years of operation of the scheme.
- 1.3.4 Chapter 6 provides an overview of the Appraisal model, summarising the core assumptions, parameters and outlining the methodology applied to estimate each of its appraisal elements.
- 1.3.5 Finally Chapter 7 presents all key appraisal outputs and discusses the robustness of the appraisal results by way of sensitivity and switching values testing, in-line with appraisal guidance.

2 Option Development

2.1 Introduction

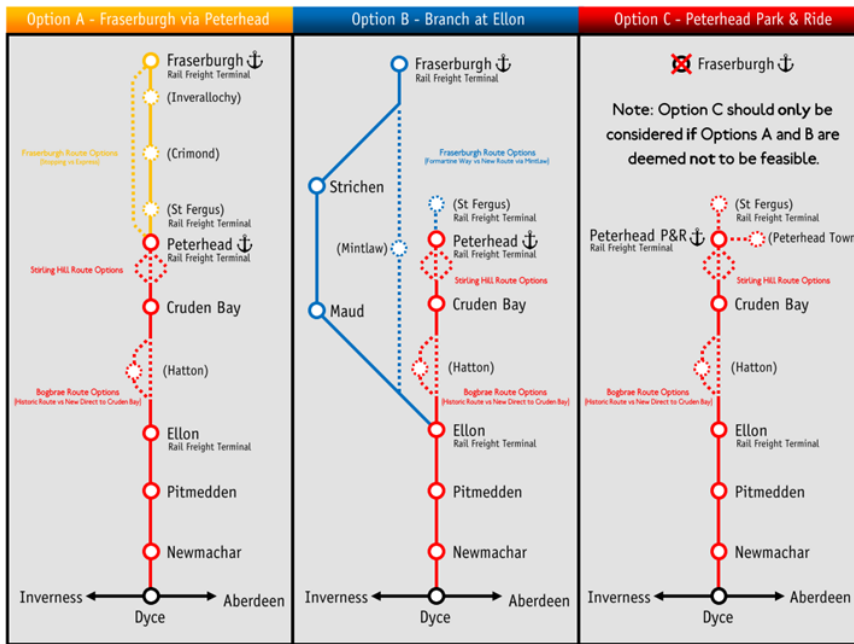
- 2.1.1 Five separate rail alignment combinations originally identified by CNER formed the basis for reinstatement of a rail service north of Dyce, each with several potential permutations of service frequencies and station calls. In order to determine a list of options to be taken forward for appraisal, each potential rail alignment combination was looked at independently, identifying potential constraints and justifications for early sifting.
- 2.1.2 Adopting technical standards agreed with the client group and the rail industry (Scotland's Railway – Network Rail & Scotrail) at inception stage, runtime simulations were used to estimate station-to-station journey times by corridor. Informed by this, train-graphs were then developed to identify the minimum infrastructure requirements needed to operate specific service frequency variants.
- 2.1.3 The development of the options also took into consideration the accommodation of freight services, based on the initial market soundings undertaken to inform this study.
- 2.1.4 The options presented in this chapter have undergone a process of development and refinement, guided by engineering and operational feasibility assessments. These evaluations, outlined in subsequent chapters, provide detailed insights into the practicality and viability of each option, considering factors such as capacity, reliability, and journey times.

2.2 Route Alignment Options

Source and Sifting of Alignment Options

- 2.2.1 The interactive map on CNER's website and the Buchan Railway Study Framework (CNER, 2023) outlined five main route alignments, grouped under three main headings as presented in Table 1. The schematic diagram set out in Figure 1 presents the proposed corridor alignments in North Aberdeenshire.

Figure 1 CNER route alignments (source: CNER website)



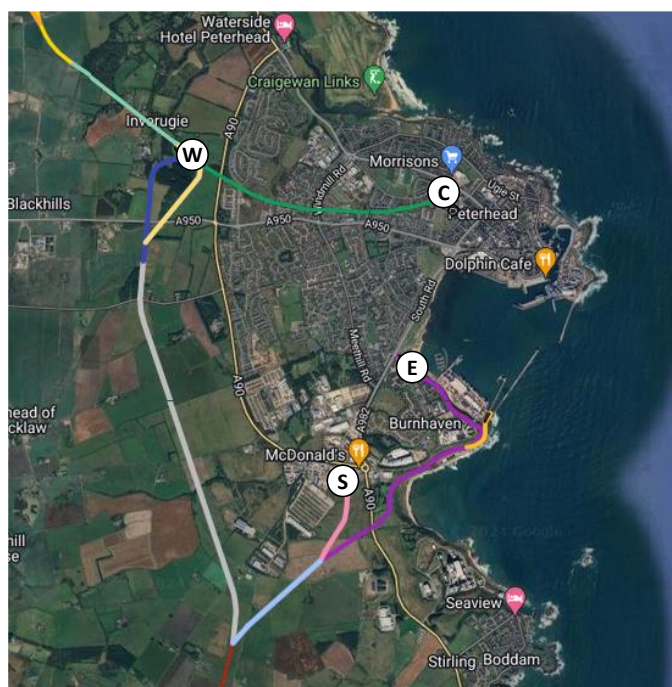
2.2.2 All five alignments are proposed to call at the same stations between Dyce and Peterhead, namely at Newmachar & Kingseat, Ellon and Cruden Bay. Pitmedden was also proposed as a potential station call, diverting from the original route alignment to serve the town's catchment. Two alternative routes to connect Ellon and Cruden Bay were considered, with the longer option routing via the former Boddam Branch with a station call at Hatton or a new more direct route that by-passes Hatton.

Table 1 Description of CNER's initial route alignments

Option A – Fraserburgh via Peterhead		
1	Stopping	via St Fergus, Crimond and Inverallochy
2	Express	
Option B – Branch at Ellon		
1	Formartine Way	via Maud and Strichen
2	New Route	via Mintlaw
Option C – Peterhead Only		
1	Peterhead	

2.2.3 In addition to the five core route alignments there were a number of different locations proposed by CNER for a station to serve Peterhead. A total of four potential station sites were identified as illustrated in Figure 2.

Figure 2 Potential locations for a station serving Peterhead (source: CNER website)



Note: Peterhead Central (C); Peterhead West (W); Peterhead East (E) and Peterhead South (S). Contains Google Maps data.

Early Sifting of Alignment Options

2.2.4 Following initial engineering and operational feasibility it was possible to reduce the list of rail options to consider through an early sifting exercise. This early examination of all the alignment variations in-play identified those where it was considered that it would not be feasible to construct or where better alternatives (in terms of cost and/or demand impact) would exist.

Alignment A1 (Fraserburgh to Peterhead and Aberdeen via St Fergus, Crimond and Inverallochy)

- 2.2.5 Alignment A1 routes via Peterhead to Fraserburgh, with additional stations serving St Fergus, Crimond & Inverallochy.
- 2.2.6 The emerging journey times for Alignment A1 between Fraserburgh & Aberdeen were estimated to be c68 mins, assuming a 75 mph max line speed. This was considered to be a much less competitive proposition versus car or bus when compared to what the other proposed options (including Option A2 via Peterhead) might be able to offer, which are closer to 53-61 mins.
- 2.2.7 The catchment populations for the three proposed stations are very small (St Fergus: 1,050, Crimond: 1,430 and Inverallochy: 2,610 (source: Census & TEMPro data)).
- 2.2.8 It was considered that Alignment A1 will be a significantly more costly way of getting from Peterhead to Fraserburgh, based on the following evidence:
- It would incur the additional cost of design/construction of three extra stations;
 - It would require 25 new bridge structures (including 3 A90 crossings), whereas Alignment A2 would require 22 new bridge crossings (and only crosses the A90 once);
 - Between Peterhead and Fraserburgh, A1 is 2 miles longer than A2 and involves a considerably higher proportion of new build (as opposed to re-purposing an old alignment/cycle track). A1 would require 14 miles of new track & 1.5 miles of re-purposed cycle track (compared to A2, which would require 8.7 miles of new track & 4.8 miles of re-purposed cycle track).
- 2.2.9 On the basis of the above, Alignment A1 was sifted out and excluded from the economic appraisal.

Peterhead East Station

- 2.2.10 Peterhead East station was proposed at a location close to the Lido and Marina adjacent to South Road. Rail access to this station would be via an alignment that went around the prison on the east side close the South Bay Harbour.
- 2.2.11 On the basis of the following initial observations, it was considered that a station at this location could be sifted out:
- The minimum curve allowable on a passenger line is a 200m radius. This would not be achievable for this option without demolishing the adjacent Peterhead Prison buildings.
 - The existing ground profile/ gradients along this route would require extensive earthworks and potentially a viaduct structure to bring the gradients into compliance for a modern railway. Current design standards state a recommended maximum gradient of 1 in 80 for rail routes and a maximum of 1 in 500 where there is a station.
 - The proposed station location is also tight for space due to the surrounding existing infrastructure. This would put limitations on the station design and potentially rule it out as an option at the design stage if there is not sufficient space to include facilities such as station parking or allow for accessible facilities such as station footbridge/lifts.
 - Very slow train speeds would be necessary and would therefore impact on journey times, for marginal benefit in terms of station catchment.

Service Frequency Option Development

- 2.2.12 For each alignment option a number of different service frequency options were available to consider. These were developed in 0.5tph (trains per hour) increments, with a minimum of 1tph serving Peterhead and assuming that no more than 2tph would be able to operate south of Ellon and onto the existing rail infrastructure via Dyce to/from Aberdeen. As such, five alternative service frequency options have been developed for Alignment A2, whilst for each of the other potential alignments two alternative service frequency options were identified, as shown in Table 2.

Table 2 Service frequency options

Option	Peterhead-Aberdeen Service tph	Fraserburgh-Aberdeen Service tph	Between Dyce and Aberdeen tph
Alignment A2			
A2-1	-	1	+1
A2-2	-	2	+2
A2-3	0.5	0.5	+1
A2-4	1	0.5	+1.5
A2-5	1	1	+2
Alignment B1			
B1-1	1	0.5	+1.5
B1-2	1	1	+2
Alignment B2			
B2-1	1	0.5	+1.5
B2-2	1	1	+2
Alignment C			
C1	1	n/a	+1
C2	2	n/a	+2

Defining the Core Scheme Alignment

Pitmedden / Hatton

- 2.2.13 Within each of the alignment/timetable variants identified above, further thought was given to whether the core scheme should consider a rail station serving Pitmedden (which would require a deviation from the original alignment and was not considered in previous work) and whether the scheme should consider a rail station serving Hatton (located on the former (less direct) Boddam branch alignment).
- 2.2.14 In order to serve Pitmedden CNER proposed a new alignment to the west of the original rail alignment (further details of this alignment are contained in the accompanying Engineering Feasibility Technical Note). Some initial demand analysis was undertaken to determine what the net impact of this alternative alignment might be (compared to not serving Pitmedden, which would result in slightly quicker journey times to/from Aberdeen for passengers north of Pitmedden). Using Option A2 with 2 tph it was determined that serving Pitmedden (as opposed to bypassing Pitmedden) generated a further net 160,000 journeys per annum. On that basis, it was considered worthwhile including Pitmedden in the core scheme alignment. A sensitivity test has been undertaken to demonstrate the impact on the scheme appraisal of not serving Pitmedden.
- 2.2.15 The original Boddam branch alignment served the community of Hatton, between Ellon and Cruden Bay. CNER proposed an alternative more direct alignment that avoided Hatton and reduced the number of crossings of the A90 (further details of this alignment are contained in the accompanying Engineering Feasibility Technical Note). Some initial demand analysis was undertaken to determine what the net impact of this alternative alignment might be (compared to serving Hatton, which would result in slower journey times to/from Aberdeen for passengers north of Hatton). Using Option A2 with 2 tph it was determined that serving Hatton (as opposed to bypassing Hatton) only generated a further net 55,000 journeys per annum. On that basis, and given the likely additional costs associated with serving Hatton, it was considered worthwhile to adopt the more direct alignment bypassing Hatton in the core scheme alignment.

It is also worth noting that Hatton is located relatively close to Cruden Bay where a new station would be introduced as part of the core scheme. A sensitivity test has been undertaken to demonstrate the impact on the scheme appraisal of serving Hatton.

Peterhead Station Location

2.2.16 CNER originally proposed four alternative potential station locations for a station in Peterhead, as described in Table 3. As discussed above, the 'East' station location was sifted out on the basis of a number of technical and operational challenges.

Table 3 CNER's proposed Peterhead station locations

Designation	Description
Option 1 (South)	Located on the southern edge of Peterhead off the A90 and near the retail park. Lower cost option as requires less new railway north of Cruden Bay. However, located circa 3km from the centre of Peterhead.
Option 2 (East)	Located on the southern edge of the Peterhead Bay, close to the Marina and Lido. Sifted out due to technical and operational challenges.
Option 3 (West)	Located on the western outskirts of Peterhead by the A90 and A950, where the original rail alignment (from Maud) crosses the A90. Enables through rail services to/from Fraserburgh/St Fergus, so default station location for alignment option A2. Requires more new rail infrastructure than the 'South' option north of Cruden Bay. Located circa 3km from the centre of Peterhead, but close to new development proposals and better located to serve the wider Peterhead area.
Option 4 (Central)	Historic site of Peterhead railway station, in the centre of Peterhead. Currently site of Peterhead Academy but we are advised that this is relocating. Would utilise the original alignment to access the site. Likely to incur the highest capital costs of the four station options, but best placed to serve central Peterhead (although worth noting that there would be some potential local traffic impact associated with access to the station).

2.2.17 Our initial demand analysis suggested the difference in demand generated by the South and West station locations is marginal (+0.5% for the southern location) due to similar access times from zones north of Peterhead to each of these locations (the rail journey time from the South location is estimated to be 1.5 minutes faster than from the Option 3 West location).

2.2.18 Despite having the highest end-to-end rail journey time compared to the other station options (+3.5 / +2.0 minutes compared to the South/West station locations), the Central station location generates the highest demand forecast figure (+6% compared to the South station location) which reflects its ease of access for the local population and for passengers travelling to Peterhead (due to a smaller egress time). However, this option would incur the highest cost compared to the other station options.

2.2.19 On the basis of the above, it was therefore decided to assume that the 'West' station location would be the default location for a station serving Peterhead in the core scheme appraisal. It is the only viable station location for alignment option A2 and generates similar demand impacts to the South station location. Whilst the Central station location generates slightly more demand it would come at a price. For the appraisal it also benefits from assuming the same location for comparison purposes. Sensitivity tests assuming the South and Central station locations have been included so that the overall economic impacts can be compared.

2.2.20 Figure 3 to Figure 6 below, therefore present each of the core scheme alignments that were taken forward to economic appraisal.

Figure 3 Alignment A2

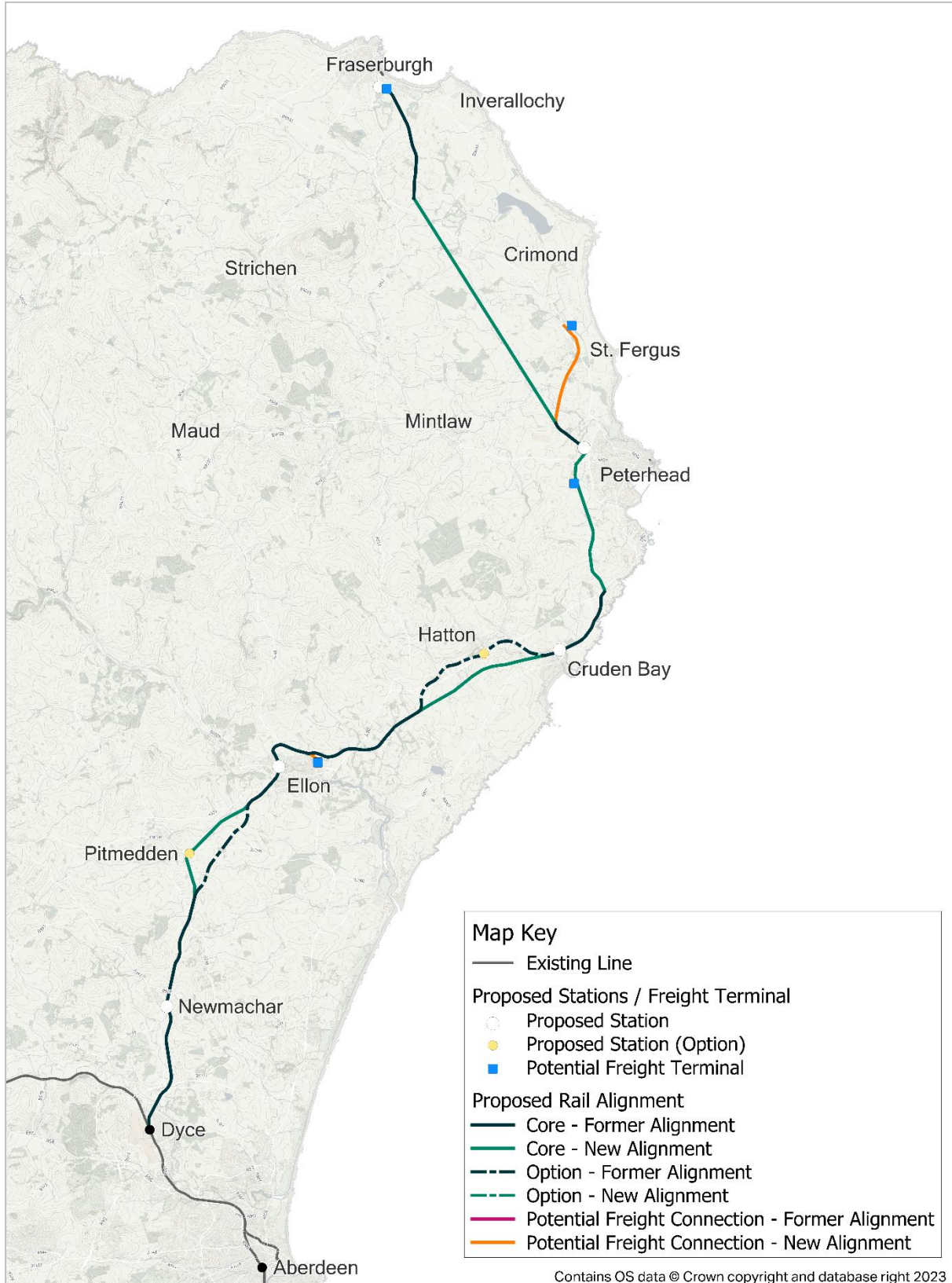


Figure 4 Alignment B1

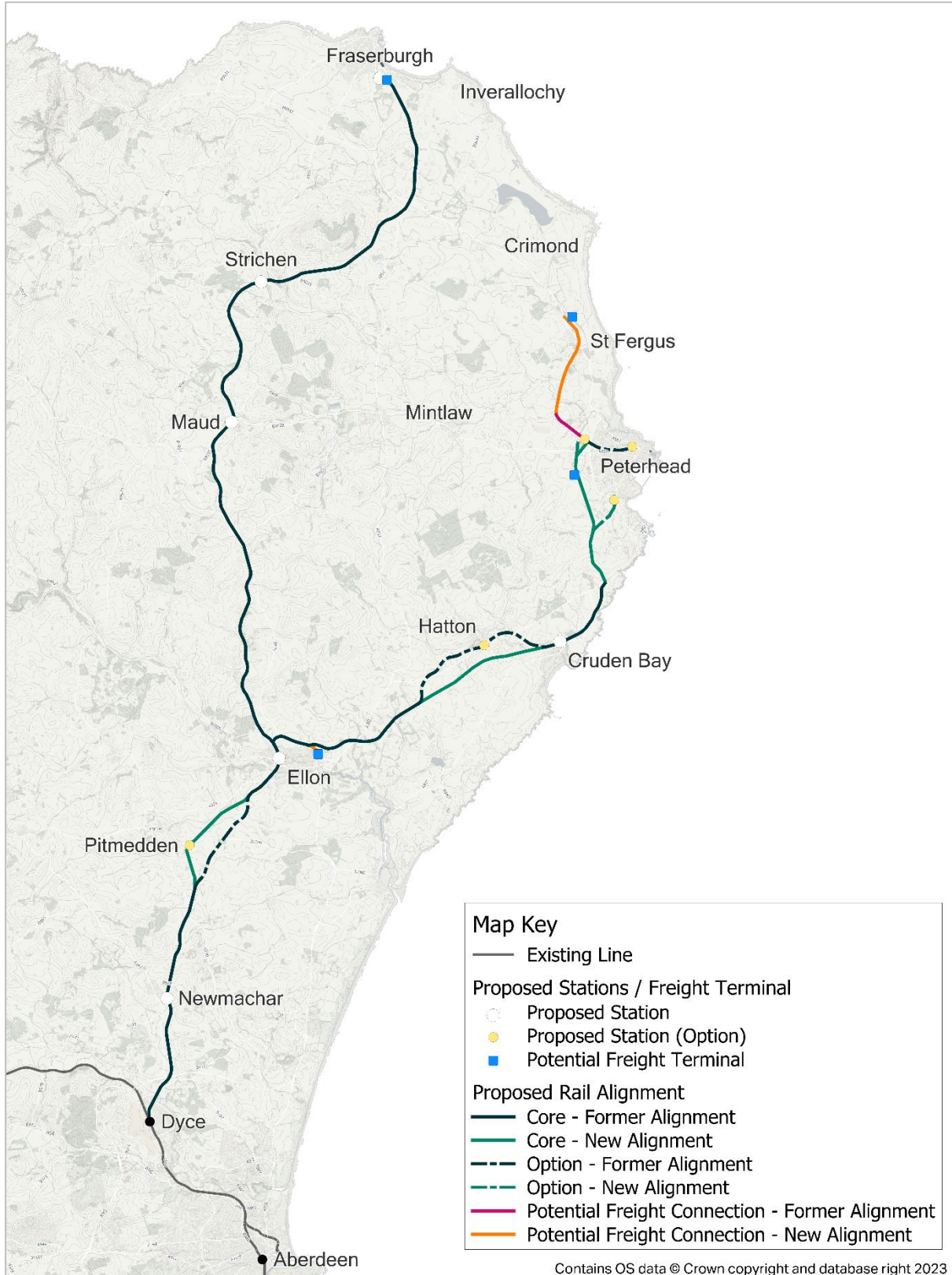


Figure 5 Alignment B2

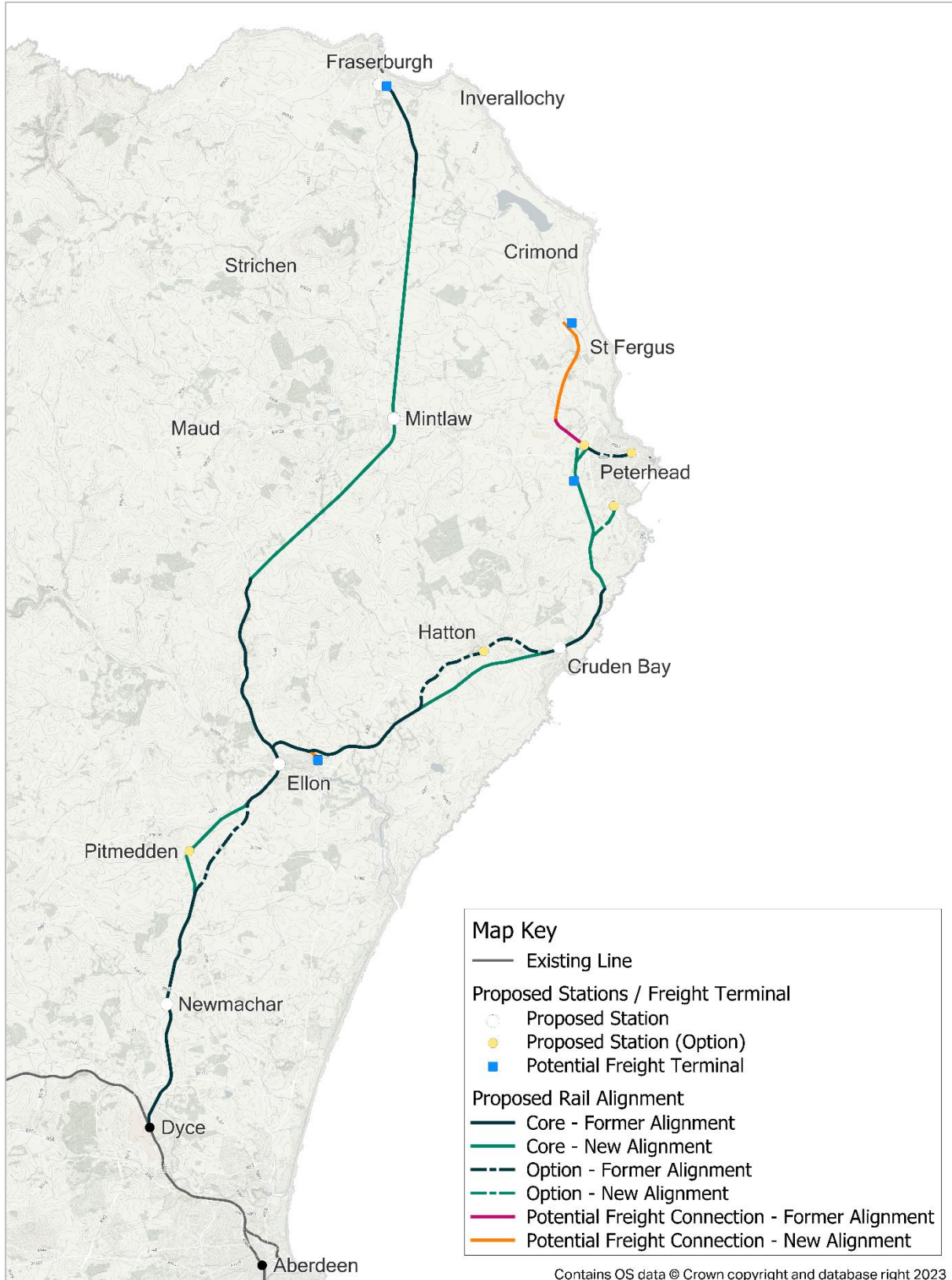
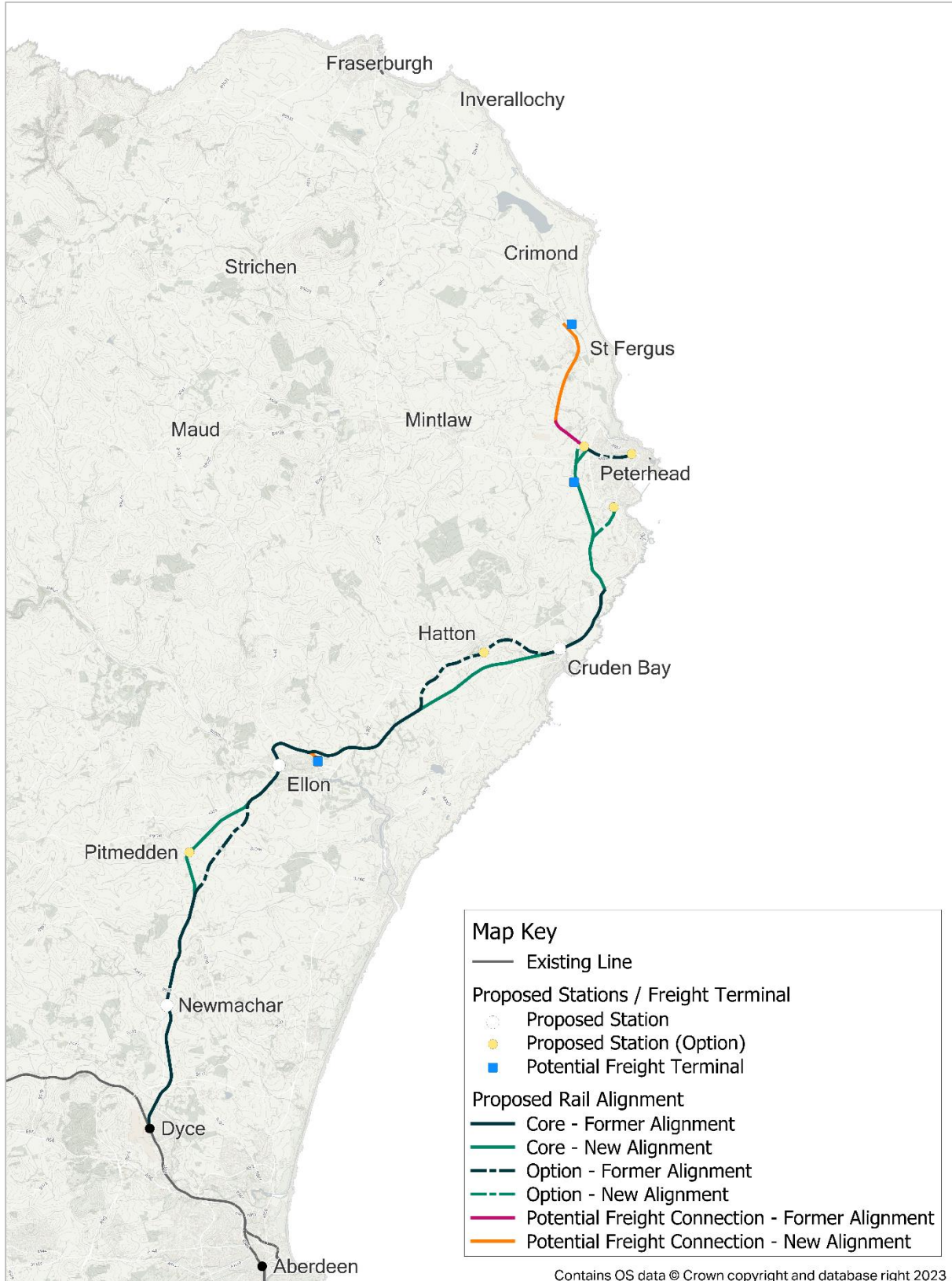


Figure 6 Alignment C



2.3 Option Development - Passenger

Operational Analysis

Scope of Analysis

- 2.3.1 To develop the options for costing, modelling and appraisal purposes, an assessment of rail operations for each option has been undertaken. The operational analysis was based on a 'standard hour' of a working timetable that is compliant with Scotland's Railway operational planning rules. The aim was to show that the proposed rail services can be accommodated in a way that is operationally robust and compliant with planning rules, or if this is not possible, to identify what additional infrastructure may be needed to achieve this. The standard hour represents the normal weekday, off-peak service pattern.
- 2.3.2 The outputs from the standard hour timetable analysis have fed through to the development of capital costs (infrastructure requirements), operating costs (rolling stock and train crew requirements) and demand (journey times); as discussed in subsequent sections of this report.
- 2.3.3 Operational planning and creation of working timetables is a complex and time-consuming process that requires many data inputs including point to point running times, planning headways, junction margins, station planning rules and so on. The interdependency of various elements of the rail network means that full validation of a timetable requires a wide area to be considered and this requires significant resource. To keep the scope manageable and appropriate to a study of this scale only a 'standard hour' has been created, and the area of validation limited to the new rail alignment north of Dyce, following agreement with Scotland's Railway.

Assumptions

- 2.3.4 The standard hour operation that has been modelled has been based on several critical assumptions such as sectional running times on the new infrastructure, the signalling headway and location of passing loops. The source of data inputs to the standard hour are set out in Table 4. These were confirmed with Scotland's Railway prior to modelling.

Table 4 Key assumptions for Operational Analysis

Designation	Assumption
Train service specification	<ul style="list-style-type: none"> From option specification stage of the study (see Table 2).
Rolling Stock	<ul style="list-style-type: none"> New Battery Electric Multiple Unit (BEMU) in line with the Rail Services Decarbonisation Action Plan strategy. Assumed 30-mile range with a 10% to 15% minimum 'floor' of charge held.
Maximum line speed	<ul style="list-style-type: none"> 75mph maximum line speed
Electrification	<ul style="list-style-type: none"> Associated with requirement for battery re-charging. Discontinuous electrification where required in line with battery range assumptions. Electrification between Aberdeen and Dyce would be in place by opening year.
Sectional running times	<ul style="list-style-type: none"> AECOM calculation using in-house run-time estimation tool (ARTEM), based on route alignment distances and class 170 performance characteristics (used as proxy for BEMU). No vertical gradients have been considered at this stage. Line speed reductions where identified (see separate Engineering Feasibility Technical Note).

Planning rules	<ul style="list-style-type: none"> ▪ AECOM assumption with reference to existing planning rules on comparable parts of the rail network (namely pathing allowances on Inverness-Aberdeen line). ▪ Consideration of single-track section north of Aberdeen station. ▪ Platform capacity at Aberdeen not considered (assumed a future platform 8 would be sufficient to accommodate additional (up to 2tph). ▪ Station dwell times of minimum 30 seconds at each station, except Ellon, Peterhead and Fraserburgh (minimum 1 minute). ▪ Pathing allowance of 1 minute approaching Dyce junction; 1 minute approaching Ellon junction (Corridor B); additional 1 minute margins added near passing loop locations. ▪ Minimum margin of 3 minutes at station passing loops. ▪ Minimum turnaround time at terminus station of 5 minutes (DMU). For BEMU minimum turnaround time dictated by charging time required to re-charge – dictating number of units required.
Freight	<ul style="list-style-type: none"> ▪ Class 4 freight trains (max 75mph). This would allow a freight train to be able to run in the path of a passenger train.

2.3.5 Table 5 summarises the estimated output running times by route section. These outputs were used to generate timetables to inform the demand forecasting model. The slight variations in running times reflects the differing operational requirements associated with operating different service frequencies (e.g. passing loops in different locations, allowances for passing trains, etc).

Table 5 Running Times by Route Section

Route Section	Running Times by Route Section (minutes)
Fraserburgh to Strichen	10
Strichen to Maud	6
Maud to Ellon	11
Fraserburgh to Mintlaw	11
Mintlaw to Ellon	12
Fraserburgh to Peterhead	12
Peterhead to Cruden Bay	8-10
Cruden Bay to Ellon	11-13
Ellon to Pitmedden	6-9
Pitmedden to Newmachar	6-7
Newmachar to Dyce	5-7
Dyce to Aberdeen	9-10

Infrastructure Requirements

2.3.6 The operational assessment adopted an approach that attempted to achieve a reasonable balance between infrastructure provision (i.e. cost) required, whilst minimising journey time penalties to passengers. As the Formartine and Buchan railway was originally constructed to a single-track solum, the same configuration was assumed for the scheme.

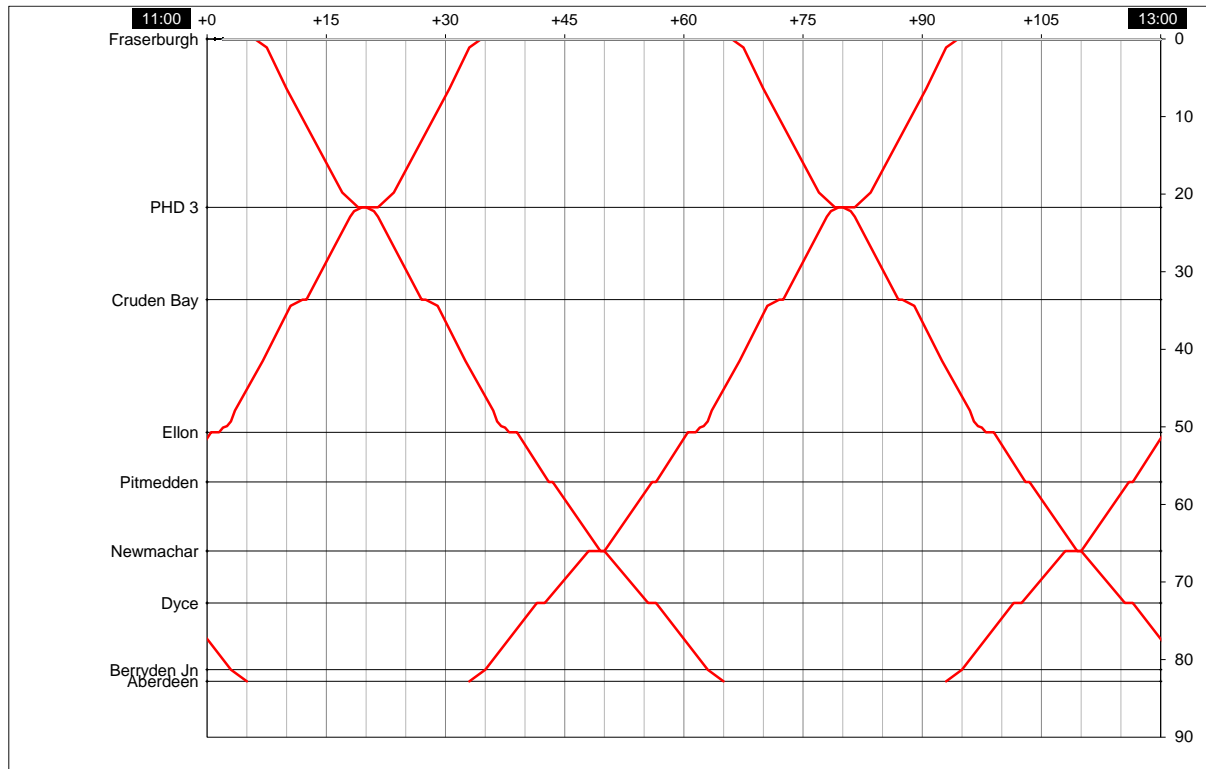
2.3.7 Where possible, stations were used as the preferred location for constructing passing loops to enable the crossing of services travelling in opposite directions. Where this was not achievable, then a dynamic loop was identified, but acknowledging that these would be more expensive than providing a passing loop at a station (due to their greater distances involved). Standard passing loops in non-station locations were ruled out on the basis that they would place an undesirable operational constraint with regard to the robustness of the timetable.

Table 6 Estimated passing loop location requirements by option

Option	Strichen	Maud	Mintlaw	Fraserb'rg'h	Peterhead	Cruden Bay	Ellon	Pitmedden	Newmachar
Alignment A2									
1					Station				Station
2					Station	Dynamic			Station
3					Station				Station
4					Station	Station	Station		Station
5				Dynamic		Dynamic		Station	
Alignment B1									
1							Station		Station
2							Station		Station
Alignment B2									
1							Station		Station
2							Station		Station
Alignment C									
1							Station		
2						Dynamic		Station	

2.3.8 Figure 7 provides an example of how an hourly service via Peterhead through to Fraserburgh would be timed, with trains running in opposite directions crossing each other at the station passing loops at Peterhead and Newmachar.

Figure 7 Example of a train-graph produced (A2-1)



2.4 Option Development - Freight

- 2.4.1 For the purpose of appraising freight benefits, a scenario-based approach was chosen to reflect the variation in intermodal and bulk (carbon dioxide) freight demand based on information provided from stakeholders during the consultation exercise (please refer to the separate Freight Technical Note Appendix that accompanies the Preliminary Options Appraisal report). The number of lorry movements that could be removed from the road network was based on a view on the proportion of potential modal shift induced by each proposed terminal location.
- 2.4.2 For each potential freight terminal location, three sets of 'mode shift' scenarios were defined: low, medium, and high. These were set out based on the stakeholders view of future demand from their business plans combined with an AECOM view on additional third-party traffic which could be attracted to rail. Table 7 indicates the average number of trains per day assumed in each scenario.
- 2.4.3 Section 6.1 – Freight later in this note details how the resulting equivalent net lorry-km removed from the road network were estimated based on the figures presented in the table below. For further details, please also refer to the 'Freight Technical Appendix' Note.

Table 7 Freight options for appraisal: average trains per day (one direction)

Freight terminal	Low Scenario		Medium Scenario		High Scenario	
	Intermodal	CO ₂	Intermodal	CO ₂	Intermodal	CO ₂
Fraserburgh	0.2	n/a	0.3	n/a	0.3	n/a
Peterhead / St Fergus	0.3	1.0	0.6	3.0	1.0	5.0
Ellon	0.5	n/a	1.3	n/a	1.5	n/a

3 Scheme Costs

3.1 Capital Costs

- 3.1.1 High-level scheme capital cost estimates for each of the options were developed by applying standard unit cost rates to quantities identified by the engineering exercise. Further details of the engineering feasibility, including outline alignment drawings, can be found in the Engineering Feasibility Technical Note, which is a separate appendix to the Preliminary Options Appraisal report.
- 3.1.2 Table 8 summarises the key infrastructure elements costed as part of this exercise. It is important to acknowledge that the development of the costs for each option has been undertaken at a high-level using cost rates that reflect current typical costs across the main infrastructure elements. A number of assumptions and exclusions have been identified in developing these costs.

Table 8 Identification of the key rail infrastructure cost variables considered

Variable	Description / Assumptions
Track and systems	Cost rate per single-track kilometre, including groundworks, ballast, placement of rails and signalling infrastructure.
Bridges and structures	Cost allowance for additional bridges and structures required.
Passing loops	Cost allowance for each station loop and dynamic passing loop.
OLE infrastructure	Cost for provision of infrastructure required to re-charge battery trains under wires.
Link to Dyce-Aberdeen	Relocation of car park and additional platform at Dyce, including turnouts and crossover onto existing line
Active travel route infrastructure	Cost of removing/building an active travel route alignment parallel to the rail alignment where the scheme impacts on the existing facilities. Assumes 2m wide cycleway.
Passenger stations	Cost of new single / double-platform station inclusive of car park. Terminal stations assumed to be double-platformed due to capacity requirements for re-charging trains at station. Passing loop stations also assumed as double-platformed. All others single platform.
Freight terminals	Cost allowance for a new rail freight terminal alongside new track, including connection to single track line.

- 3.1.3 Table 9 presents the capital costs associated with each option. These costs include both the direct and indirect costs, including items such as project management costs, design fees, etc. They do not include any allowances for land costs, inflation or risk¹. Costs associated with freight terminals are also excluded from Table 9. A value of £5m per freight terminal has been assumed for the purposes of informing this analysis², plus any costs associated with additional rail alignment that might be necessary to access the terminal (in practice this only applies to the potential site at St Fergus).

¹ Noting that economic appraisal guidance prescribes standard factors for the treatment of infrastructure-related inflation and optimism bias (that replaces risk costs).

² Noting that this will have an optimism bias factor applied to it in the appraisal.

3.1.4 The capital cost of re-introducing a railway to Peterhead via Ellon is estimated as being circa £1bn. It is then estimated to cost a further circa £450m to extend the railway from Peterhead to Fraserburgh. If the extension to Fraserburgh is constructed from Ellon instead, then this is estimated to cost up to circa £750m with some variation depending on whether this is routed via Maud or Mintlaw.

Table 9 Capital costs by option (£m, 2024 prices)

	A2					B1		B2		C	
	1	2	3	4	5	1	2	1	2	1	2
Track & Systems	979	979	979	979	979	1,259	1,259	1,218	1,218	685	685
Bridges	375	375	375	375	375	335	335	380	380	245	245
Pass. Loops	12	27	12	24	36	12	12	12	12	6	21
OLE	10	10	10	10	10	31	31	25	25	10	10
Dyce	5	5	5	5	5	5	5	5	5	5	5
Active Travel	24	24	24	24	24	66	66	34	34	15	15
Stations	24	24	24	28	22	32	32	29	29	19	19
Total (£bn)	1.43	1.44	1.43	1.45	1.45	1.74	1.74	1.70	1.70	0.99	1.00

Benchmarking Capital Costs

- 3.1.5 Reviewing comparator project costs is not easy for this type of project since there have been very few comparable projects being built or planned. Benchmarking can be misleading, leading to false confidence as easily as it can lead to unnecessary concern, for a number of reasons. Factors such as fundamental differences in scheme scope (e.g. line speed, service frequency), access or ground conditions and/or the level of design at which the cost estimate has been made make it hard to make like-for-like comparisons of the costs. Furthermore, headline costing figures can be opaque as to what they do and do not include (e.g. may or may not include design, planning, client costs, risk, etc), making it difficult to make like-for-like comparisons. As such, cost comparison or 'benchmarking' of capital costs between different rail schemes should be considered in this context, acknowledging costs can also reflect different scales of detail ranging from high level estimates compared to actual outturn costs.
- 3.1.6 Nevertheless, in the context of the warnings above, a comparison of costs per single track km for this scheme have been compared with three other projects, two of which are of a similar distance and across open country (Borders Railway and East West Rail) whereas the other is a recent re-opening in Scotland (Levenmouth).
- 3.1.7 The estimated Buchan capital costs have been divided by the distance covered to estimate a high-level cost per kilometre. The costs shown for the Buchan scheme in Table 10 exclude active travel and OLE costs to make them align more closely to the other comparable schemes. They also do not include the costs associated with providing a rail freight terminal. All distances have broadly been converted to 'single-track' length, acknowledging that some sections on both Borders Railway and Buchan schemes are double tracked (passing loops). Costs have been uplifted to 2024 prices by applying the GDP deflator.
- 3.1.8 It should also be noted that there are some significant differences in the specification and scope of some of these comparator schemes. The Levenmouth scheme covers a short section of route upgrade on an existing (disused) rail corridor and is mostly double track with two new stations. The East West Rail project is anticipated to be on a much larger scale with double-track, larger stations and a greater level of interaction with existing rail infrastructure.

Table 10 Benchmarking of capital costs per single track-km (2024 prices)

	Levenmouth ¹	Borders Railway	Buchan (A2)	Buchan (B)	Buchan (C)	East West Rail ²
All in delivery cost (£m)	116	653	1,400-1,420	1,580	960-975	3,678
Route length (km)	19*	50	72	87-90	51	107*
All-in cost (£m/single track-km)	6	13	19-20	18-19	19	34

* Route length doubled to account for double track

¹ Source: <https://scotlandsrailway.com/projects/levenmouth-reconnected-raillink>

² Central Section, Route E. Source: <http://eastwestrail.co.uk/library/howmuchdoesitcosttobuildarailway>

3.1.9 At this early stage of scheme development, the Buchan corridor costs informing this appraisal could be considered to align in broad terms with the Borders Railway costs once consideration is given to the greater proportion of new alignment (as opposed to use of old alignments) required in the Buchan corridor³, the more constrained use of a single-track solum and the more recent consideration of construction cost inflation is taken into account. It might also be the case that the legacy track bed for Borders Railway was in sufficiently good condition as to minimise track formation costs compared to what might be the position on the Buchan line. In comparison with East West Rail, the Buchan Line may be expected to be significantly cheaper given the specification for faster, more frequent and longer trains on East West Rail.

3.2 Service Mobilisation Costs

- 3.2.1 Service mobilisation costs are one-off incremental costs incurred by the service operator in the period prior to the commencement of passenger services, and include items such as rolling stock mobilisation, driver recruitment and training, route learning, new uniforms and conductor ticket machines.
- 3.2.2 Mobilisation costs have been estimated based on costs derived from the previous Ellon study, updated to 2024 prices with the GDP deflator. Mobilisation costs vary by option based on the number of traincrew diagrams required to operate the service, reflecting the fact that the majority of these costs relate to staff training and equipment. Costs therefore range between £2m and £5m as illustrated in the table below.

Table 11 Mobilisation costs by option (£m, 2024 prices)

A2					B1		B2		C	
1	2	3	4	5	1	2	1	2	1	2
3.1	5.0	3.1	3.1	5.0	3.8	4.4	3.8	4.4	1.9	3.8

3.3 Renewals and Replacement Costs

- 3.3.1 An allowance has been made for ongoing renewals and replacement costs throughout the duration of the 60-year appraisal period. Reflecting the fact that this is an early-stage feasibility study, a set of profiled and itemised costs has not been produced. Instead, these costs have been determined as a proportion of the original capital cost.
- 3.3.2 Evidence from other schemes suggests that a rate of 2% of the base rail infrastructure construction cost per annum is sufficient to cover renewals and replacement costs (this being a typical value for renewals and replacement averaged out over the 60-year appraisal period). As the scheme is progressed towards further stages of development these costs will need to be reviewed based on a more detailed renewals and replacement cost estimate.

³ The core alignment options A, B2 and C contain between 50% and 60% new alignment, core alignment option B1 circa 30%.

3.3.3 In this case, there is a considerable amount of 'new' rail infrastructure that will need to be renewed. Table 12 indicates the allowance considered for each option, per annum⁴.

Table 12 Annual renewals and replacement costs by option (£m, 2024 prices)

A2					B1		B2		C	
1	2	3	4	5	1	2	1	2	1	2
20.2	20.4	20.2	20.4	20.5	24.0	24.0	24.0	24.0	13.9	14.1

3.4 Operating Costs

Operating Costs - Passenger

3.4.1 Scotland's Railway provided indicative unit cost rates that informed the estimation of ongoing service operating costs to operate a Buchan line passenger service. An annualisation factor of 331 was considered to convert from daily to annual mileage for the estimation of annual operating costs (assuming Sundays and Bank Holidays will have half the services of a regular weekday).

3.4.2 Table 13 summarises each operating cost element considered for appraisal in this study. All unit costs have been provided by/agreed with Scotland's Railway. These are not presented in the table as they remain commercially sensitive.

Table 13 Operating Costs considered in the Appraisal

Cost item	Description / Assumptions
Rolling stock lease costs	Capital lease costs. Cost based on number of units to lease, including 1 maintenance spare for every 10 (or fewer) units.
Rolling stock maintenance costs	Maintenance and cleaning costs per vehicle-mile.
Rolling stock energy costs	Average cost of energy consumed per vehicle-mile (electric current for traction (EC4T) used as proxy for battery-charging assuming same rate of energy required to re-charge energy spent whilst operating on battery).
Rolling stock running costs	Variable costs including Vehicle Usage Charge and Electrification Asset User Charge.
Staff costs	Scotland's Railway provided information on ratios to assume, as follows: - number of traincrew per rolling stock diagram - number of train-care staff per additional vehicles added to fleet - number of driver managers per additional drivers
Station costs	Typical station operating costs associated with a one- or a two-platform unstaffed station. Costs include long term charge, cleaning, CCTV, ticket vending machines (TVM) and customer information systems (CIS), utility costs, winterisation, Wi-Fi and insurance for station and car parks. Cost based on examples provided by Scotland's Railway.

3.4.3 Table 14 provides a breakdown of key data by option informing the estimation of net operating costs for appraisal, including the number of trains required to operate each timetable option, total train/vehicle-kilometrage by route/timetable option and the number and size of stations defined for each option. By applying the appropriate unit cost rates, operating costs have been estimated and summed by cost item (each of these is treated differently within the scheme appraisal in line with appraisal guidance).

⁴ These values for renewals do not include the renewals costs associated with station buildings and platforms. This is because it is assumed that the Long Term Charge, which is part of the operating costs for the scheme, captures the renewals costs associated with stations.

Table 14 Operational Input Data that informs the Operating Costs in the Appraisal

Option	No. BEMU Units Required*	Train-km p.a.	Veh-km p.a.	Veh-km (OHLE) p.a.	1-platform stations	2-platform stations
Alignment A2						
1	5	0.88	3.51	2.36	3	3
2	8	1.76	7.02	4.72	3	3
3	5	0.76	3.05	2.06	3	3
4	5	1.09	4.35	2.94	1	5
5	8	1.53	6.10	4.12	4	2
Alignment B1						
1	6	1.05	4.19	3.01	4	4
2	7	1.45	5.78	4.03	4	4
Alignment B2						
1	6	1.03	4.12	2.93	3	4
2	7	1.41	5.65	4.11	3	4
Alignment C						
1	3	0.65	2.59	0.93	3	2
2	6	1.30	5.18	1.87	3	2

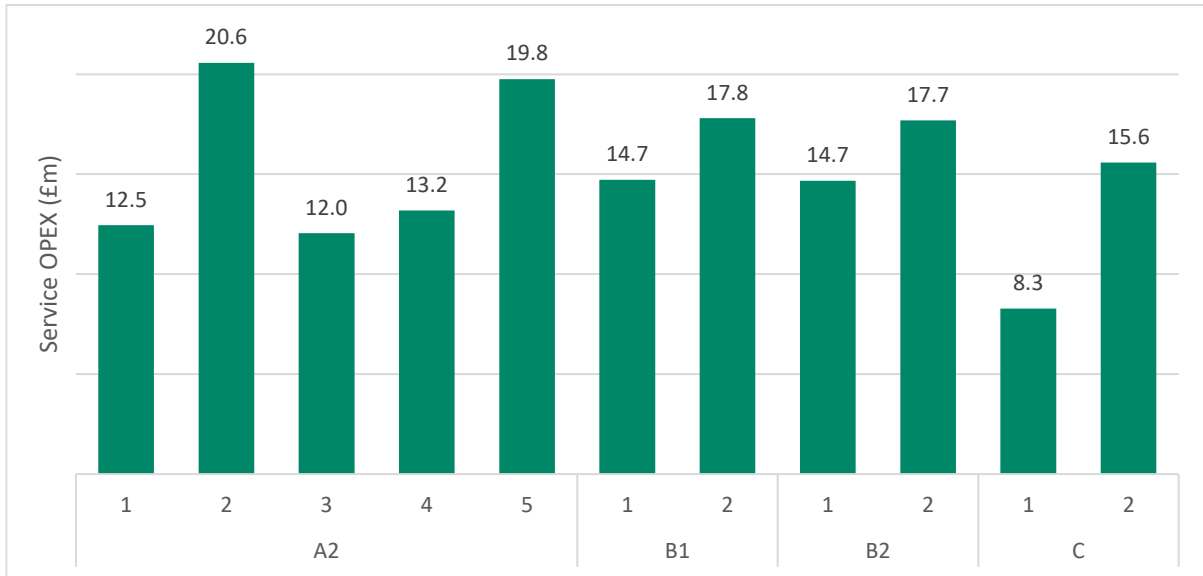
* excluding spare units. Assumption of 1 spare unit for every 10 units (i.e. +1 in all options)

3.4.4 A summary of annual operating costs at nominal 2024 prices is presented in Table 15. Figure 8 compares the total train-related operating costs (excluding station costs) where it becomes clear that operating 2tph through to Fraserburgh (Option A2-2) is the most expensive option, mostly due to the number of trainsets required to operate the timetable and the total incremental mileage associated with that option.

Table 15 Estimation of Annual Operating Costs (£m, 2024 prices)

Option	Leasing	Maintenance	Fuel/Energy	Running	Staff	Total	Station
Alignment A2							
1	5.62	2.12	0.72	0.27	3.73	12.45	0.66
2	8.42	4.23	1.44	0.54	5.94	20.58	0.66
3	5.62	1.84	0.63	0.23	3.73	12.05	0.66
4	5.62	2.62	0.89	0.33	3.73	13.19	0.75
5	8.42	3.68	1.25	0.47	5.94	19.76	0.61
Alignment B1							
1	6.55	2.52	0.86	0.32	4.47	14.73	0.88
2	7.49	3.49	1.19	0.45	5.21	17.81	0.88
Alignment B2							
1	6.55	2.48	0.84	0.32	4.47	14.67	0.79
2	7.49	3.40	1.16	0.44	5.21	17.69	0.79
Alignment C							
1	3.74	1.56	0.53	0.19	2.26	8.28	0.53
2	6.55	3.12	1.06	0.38	4.47	15.58	0.53

Figure 8 Comparison of estimated total annual service operating costs (£m, 2024 prices)



Note: Excluding station operating costs

Operating Costs - Freight

3.4.5 Freight operating costs have not been developed to inform this scheme appraisal. It is assumed for appraisal purposes that any freight operating costs would be covered by the freight income (revenue) and therefore the net outcome on the appraisal would be neutral (zero).

Benchmarking

3.4.6 The train service operating costs have been divided by the total annual vehicle miles covered by rolling stock in each option. Costs per vehicle-mile are estimated to range between £4.7 and £6.4 per vehicle-mile (in 2024 prices). The variation across the options reflects how efficiently the timetable can be operated by the number of train diagrams. Comparing these values to previous studies, these estimates fall within the expected range of cost per vehicle-mile at around the £5/vehicle-mile mark.

Figure 9 Comparison of estimated operating cost per vehicle-mile (2024 prices)



4 Demand Model Development & Results

4.1 Overview

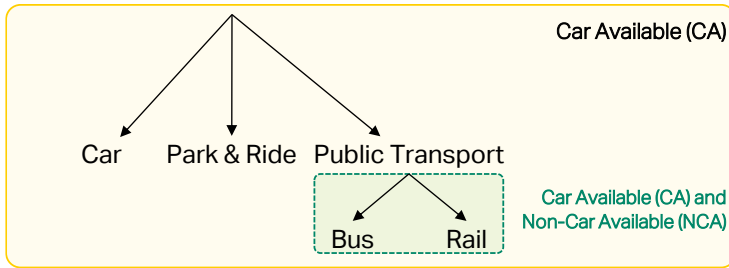
- 4.1.1 This section outlines the demand forecasting methodology adopted to inform this study. Building from previous studies looking at introducing passenger rail services in the area, a bespoke spreadsheet-based mode-choice model was developed to estimate the potential level of rail demand that could be generated by the proposed rail options in the Buchan corridor. This approach aligns with the Passenger Demand Forecasting Handbook (PDFH) and ensures good practice is adopted, in that the forecasts are generated 'bottom-up' with built-in sense-checks and formal validation processes at key stages of the development of the demand forecasting model.
- 4.1.2 The mode-choice model enables the representation of trip decision-making in the study corridor, with the impacts of longer distance movements represented by the application of an appropriate demand uplift factor based on observed levels of rail demand on the Inverurie rail corridor into Aberdeen.
- 4.1.3 Key stages of the demand forecasting exercise included defining the model structure and zoning system (based on the most recent update of the Aberdeen Sub Area Model - ASAM19), calculating the demand and revenue impacts of new rail services in the base forecasting year (2019), forecasting demand and revenue impacts for future years (based on the UK rail industry exogenous growth database⁵), and providing an indicative impact of demand on the Dyce to Aberdeen flow due to enhanced service offer.

4.2 Model Structure

- 4.2.1 The demand forecasting model developed for this study uses a nested logit mode-choice structure to represent the available travel choices for each origin-destination flow. The mode-choice model aggregates the observed demand by all modes (sourced from the ASAM19 model baseline matrices) and estimates mode shares based on the generalised cost of the journey by each available transport mode.
- 4.2.2 Generalised costs for each mode are calculated by weighting the in-vehicle time, out of vehicle time, cost (e.g. public transport fares or car costs) and interchange penalties. In addition, a mode constant is also defined to represent the preference for a particular mode. This mode constant captures the preference for each of the modes modelled, all things being equal between them. Stated preference surveys have evidenced that public transport passengers tend to demonstrate a preference for travelling by rail over travelling by bus. As such, if the fare and journey time of a public transport trip by bus and rail are equal for a given flow, a larger share of passengers travelling by rail is observed.
- 4.2.3 The transport model has four segments representing the AM peak and interpeak periods and car availability (CA – car available, and NCA – non-car available). Figure 10 illustrates the model structure comprising two tiers of mode choice. The upper tier allocates journeys between car, park and ride or public transport, whilst the lower tier determines the mode used by public transport users. Car available journeys can in principle use any mode, whilst non-car available journeys are restricted to public transport travel options, as shown in the diagram.

⁵ EDGE – Exogenous Demand Growth Estimator. Rail demand drivers considered include employment, population and GDP forecasts at the relevant Local Authority level.

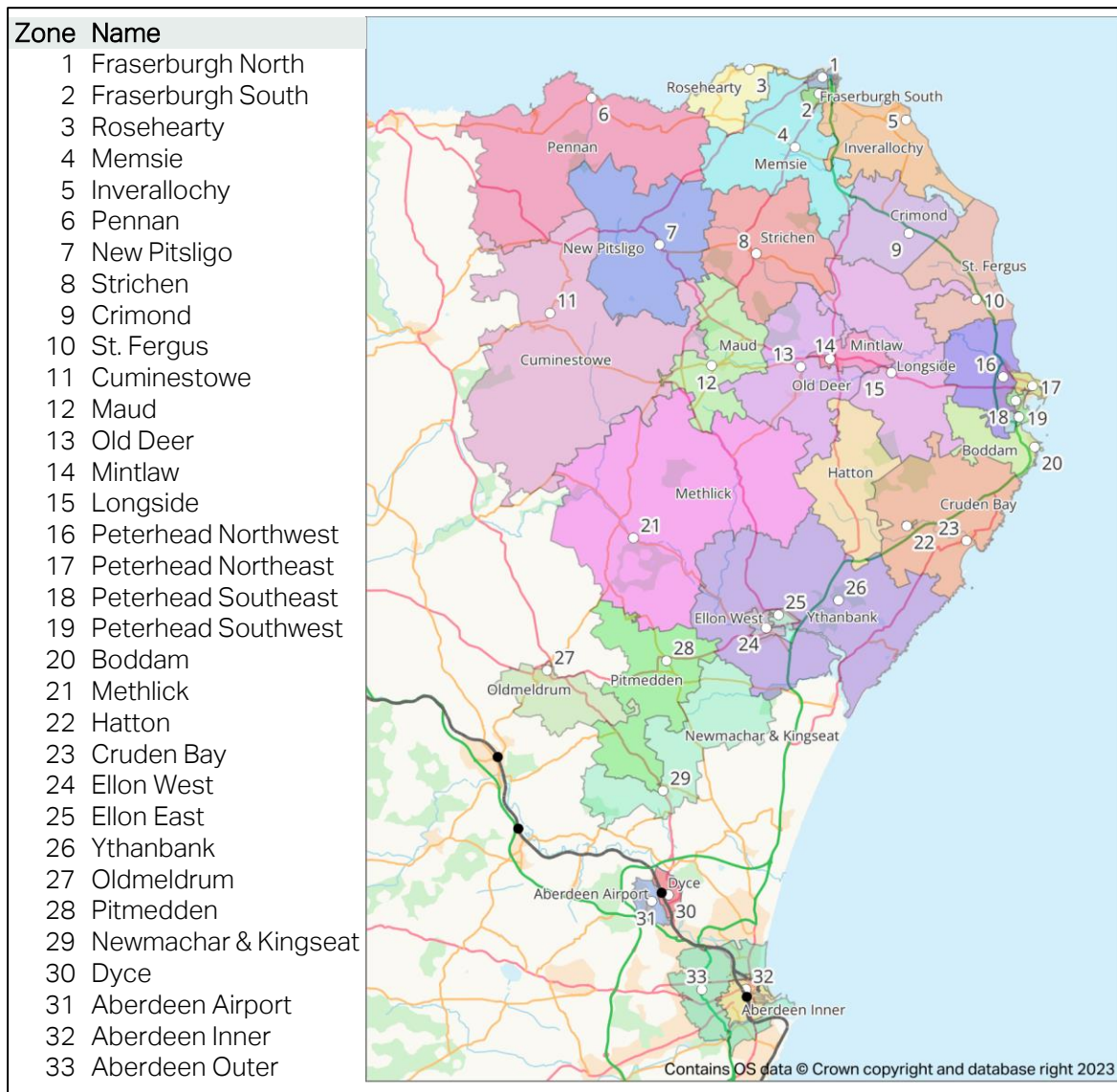
Figure 10 Nested model structure



Model Zoning System

4.2.4 The adopted mode choice model zoning system is presented in Figure 11 and it derives from the ASAM19 zoning system, with some aggregation of model zones where this was deemed appropriate. Closer to the proposed corridor stations, the model presents greater disaggregation than further away from the proposed scheme. This allows the model to consider ‘walk-in’ station catchments that will typically have higher rail trip rates as passengers face lower costs and times to access the station compared to more distant zones. The disaggregation of zones in the Peterhead area also allowed for different station locations to be tested in the appraisal.

Figure 11 Mode-Choice Model zoning system



Model Parameters

- 4.2.5 Base model parameters for this study were imported from similar bespoke mode-choice models developed by AECOM to study rail schemes elsewhere in the UK, including the Northumberland Line scheme. Prior to undertaking the calibration and validation stages, the cost parameters were updated to reflect the 2019 value of times from TAG.
- 4.2.6 Information sourced from the ASAM19 Model Development Report⁶ was used to determine demand uplift factors to capture non-modelled daily demand. Further demand uplifts to capture induced and long-distance trips are also applied to the forecasts (discussed further in Section 4.6).

4.3 Base Demand

- 4.3.1 The base demand matrices for the mode-choice model were supplied by SYSTRA from the ASAM19 multi-modal model (2019 demand figures). These cover the modelled study area and includes demand matrices by time period for the modes defined in the baseline scenario (car, bus and park and ride). ASAM19 trip matrices were aggregated to match the adopted model zoning system.
- 4.3.2 Table 16 presents the hourly trips by period based on the ASAM19 demand matrices for all relevant study flows combined. The table demonstrates the dominance of the use of car within the study corridor, with car travel accounting for over 90% of the mode share. Partially this reflects the limited public transport available in the corridor and the sparse population distribution across the study area. This figure aligns with evidence found in existing studies that indicate bus mode share levels of circa 5% in Aberdeenshire⁷.

Table 16 Base demand sourced from the ASAM19 model (baseline relevant flows)

Mode	AM Peak (hourly)	Mode Share (%)	Interpeak (hourly)	Mode Share (%)
Car	3,690	92%	3,357	95%
Bus	241	6%	138	4%
Park and Ride	74	2%	35	1%
Total	4,006	100%	3,530	100%

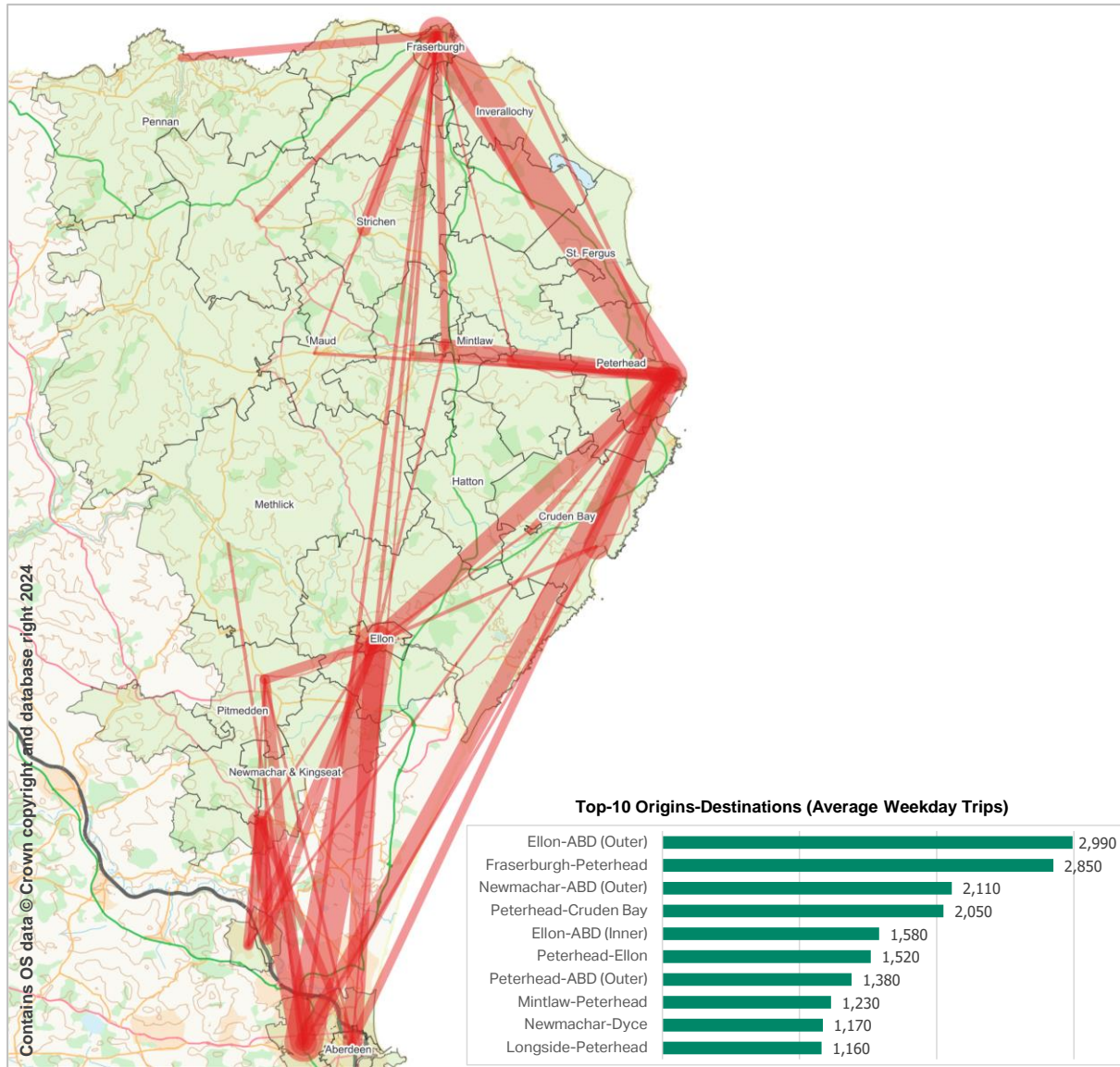
Source: ASAM19 Model

- 4.3.3 Figure 12 provides an illustration of key desire lines based on the baseline model demand matrices. The thicker the line, the more observed trips (all modes combined). The figure focuses on origin-destination flows that generate more than 300 trips on an average weekday (10% of the top flow, Ellon to/from Outer Aberdeen). Flows that will not be impacted by the proposed rail scheme have also been excluded from the analysis.
- 4.3.4 The relatively strong flows between Ellon/Newmachar and Aberdeen are noted, as well as key flows between Peterhead and Ellon and between Peterhead and Aberdeen. However, it is equally noticeable that there is relatively little demand travelling between Fraserburgh and Aberdeen. Fraserburgh's key interaction within the study area is with Peterhead.

⁶ ASAM19 Model Development Draft Report (v1.1) (2022) SYSTRA/Nestrans.

⁷ [Assessing the State of the Bus Network in Aberdeen and Aberdeenshire](#) (2019) North East Bus Alliance.

Figure 12 Average weekday demand in study corridor (baseline relevant flows)



4.4 Base Times & Costs

4.4.1 Time and cost data for the baseline model has been collated from a number of sources, as listed in Table 17.

Table 17 Sources of Base Times and Costs

Variable	Source
Car	
Access time	Assume 1 minute of access time
In-vehicle time	Google Maps journey times by period (considering typical congestion)
Fuel costs	TAG databook methodology, TAG Databook A1.3.13; distances retrieved from Google Maps
Car park charges	Aberdeen City Council data; average charge considering average duration and levels of free parking
Egress time	Average walking speed (5kph) and assumed average distance from car park within zone to destination centroid
Bus	
Access time	Average walking speed (5kph) to nearest bus stop. Wait time estimation based on bus service frequency and use of PDFHv6.0 Table B4.10 to convert into an equivalent wait time in minutes.
In-vehicle time	Bus timetables, January 2024
Fare	Bus fare data from bus companies, January 2024. Adjusted to 2019 prices. Weighted average of typical full, return, weekly/monthly season tickets, including concession travel. Split sourced from North East Bus Alliance's <i>Assessing the State of the Bus Network in Aberdeen and Aberdeenshire (2019)</i> .
Interchange penalty	Interchange penalty evidence from previous studies
Egress time	Average walking speed and consultants' estimate of typical walking distance from bus station to destination
Park & Ride	
Access time	As per 'Car'. Assumed 4 minutes from Ellon P&R to bus stop.
Access (Fuel) costs	As per 'Car'
Wait time	Wait time estimation based on bus service frequency and use of PDFHv6.0 Table B4.10 to convert into an equivalent wait time in minutes.
In-vehicle time	As per 'Bus'
Bus fare	As per 'Bus'
Interchange penalty	As per 'Bus'
Egress time	As per 'Bus'

4.4.2 Table 18 presents a sample set of weighted costs and times for example journeys between Peterhead (zone 17) and Inner Aberdeen (zone 32) and Fraserburgh (zone 2) and Peterhead (zone 17) in the model. Overall, car costs almost three times the cost of any other alternative mode of transport from Peterhead to Aberdeen, however it provides considerably faster end-to-end journey times than options involving a bus leg (circa 35% quicker). The difference in cost is significantly reduced for the Fraserburgh-Peterhead journey, which reflects the much lower cost for parking outside of Aberdeen, although the car time remains significantly faster than the bus for this journey.

Table 18 Example Times and Costs (Weighted), Baseline AM Peak (CA) model

Variable	Peterhead to Inner Aberdeen [17 - 32]			Fraserburgh to Peterhead [2 - 17]	
	Car	Bus	P&R	Car	Bus
● Access time	1	3	5	1	1
● Access cost	0	0	0	0	0
● Wait time	-	13	6	-	19.5
● In-vehicle time	57	77	71	26	31
● Fuel cost	390	-	188	199	-
● Fare	-	364	206	-	266
● Interchange penalty	-	-	9	-	-
● Car park charge	671	-	-	71	-
● Egress time	6	5	5	2	3
● Egress cost	-	-	-	-	-
● TOTAL (min)	64	98	96	29	55
● TOTAL (pence)	1061	364	394	270	266

Various sources - see Table 18. Out of vehicle times weighted by a factor of 2

4.5 Model Validation

4.5.1 The mode constants have been adjusted to ensure that the modelled mode shares replicate the observed mode shares. Table 19 presents the observed and modelled mode shares for the AM Peak (AM) and Interpeak (IP) models, demonstrating that the modelled mode shares are similar to the observed mode shares. It is important to note that bus is the only mode available in the baseline for the no car available segment of demand.

Table 19 Mode shares in the AM Peak and Interpeak models, 2019 base calibration

Variable	AM		IP	
	Observed	Modelled	Observed	Modelled
<i>Car Available (CA) model</i>				
Car	93.5%	93.4%	96.0%	96.2%
Bus	4.6%	4.8%	3.0%	3.1%
P&R	1.9%	1.8%	1.0%	0.6%
<i>Non-Car Available (NCA) model</i>				
Bus	100%	100%	100%	100%

4.5.2 The observed and modelled demand was also compared for each origin-destination pair and mode. This analysis is important to ensure that the differences in observed and modelled demand for different movements balance out. The GEH metric was used to determine how closely the model outputs fit the observed demand as indicated in TAG. The GEH test showed that all considered movements in the AM Peak and Interpeak models yield a GEH value below 5, which demonstrates an appropriate goodness of fit.

- 4.5.3 Whilst there is no guidance for validating specifically public transport mode-choice models, TAG Unit M2 (Variable Demand Modelling) does provide guidance relating to undertaking realism tests on transport models. It should be noted that these realism tests have been defined principally to test the performance of full transport models incorporating all four stages of the modelling process (generation, distribution, mode-choice, assignment) and that is why these tests are incorporated into TAG guidance note M2 on Variable Demand Modelling. However, the principles of these tests, in our view, provide a robust mechanism for testing the performance of this model with regard to public transport enhancements and therefore we have undertaken the 'change in public transport fares' realism test.
- 4.5.4 In terms of the changes to public transport fares test, the guidance states that the model should be able to demonstrate that a 10% increase in public transport fares results in an elasticity between -0.2 and -0.9 (elasticity to change in public transport trips). The fare realism test has been performed for a scenario in which bus is the only public transport mode available, and for a variant of the baseline including one train per hour between Fraserburgh and Aberdeen. This was to ensure that rail fare increases also yield realistic changes in public transport demand. Table 20 presents the implied elasticities when the public transport fares increase by 10% for the scenario including bus and rail.

Table 20 Fares realism test, public transport elasticities

Demand Segment	AM CA	IP CA
All movements	-0.35	-0.52
All zones to Aberdeen	-0.33	-0.56
Peterhead to Aberdeen	-0.58	-0.91
Ellon to Aberdeen	-0.27	-0.49

- 4.5.5 The elasticity values in the table above fall within the range as defined in TAG. The AM peak model is more inelastic than the Interpeak model across most movements, which is the expected response reflecting how the leisure market is more sensitive to price changes, making up a substantial proportion of the interpeak model demand.

4.6 Demand Uplifts and Growth

Demand Uplift Factors

- 4.6.1 The mode-choice model outputs represent the hourly rail demand that has transferred from other existing modes for journeys wholly within the study area. As such, a number of further uplift factors have been determined to define the full set of demand market segments. The following uplift factors have therefore been determined and applied:
- Factors of 5.39 and 5.88 applied to the Peak and Interpeak modelled demand periods to represent the full modelled period (i.e. morning and afternoon peak plus interpeak period). Source: ASAM19 Model Development Report (Draft v1.1, SYSTRA 2022)
 - All day factor (1.105): trips outside the modelled period (i.e. off-peak demand outside of periods referred to above. Uplift to full weekday demand). Source: ORCATS demand profiles for Inverurie.
 - An annualisation factor of 308.3 was applied to uplift weekday to annual demand. This figure is based in previous studies and intends to capture weekend demand variance compared to the average weekday demand.
 - Induced demand factor (1.550): additional trips due to new journey opportunities. Source: Average from Borders Rail Evaluation Reports (Transport Scotland 2017/2018).
 - Long distance trips (1.171): rail trips to/from stations beyond Aberdeen. Source: LENNON data for stations between Huntley and Dyce.

Aberdeen-Dyce

4.6.2 The demand impact on the existing Dyce to Aberdeen flow has been estimated using an elasticity-based approach. This methodology calculates the change in generalised journey time for each option, estimating the demand uplift factor based on the PDFH elasticities. This demand uplift factor has then been applied to the observed rail demand flow between Aberdeen and Dyce, taken from LENNON data supplied by ScotRail. The additional number of annual single journeys is presented in Table 21.

Table 21 Dyce-Aberdeen additional single journeys, 2023

Additional tph	A2 Options	B1 / B2 Options	C Options	Base Demand (LENNON)	Resulting Demand	Additional demand	Increase
1	1 / 3		1	181,010	219,170	+38,160	+21%
1.5	4	1		181,010	242,200	+61,190	+34%
2	2 / 5	2	2	181,010	262,740	+81,730	+45%

Exogenous Growth

4.6.3 Local exogenous growth assumptions were sourced from the rail-industry standard EDGE (Exogenous Demand Growth Estimation) database⁸. EDGE provides rail growth rate forecasts across Scotland and the rest of the UK based on a set of variables that impact demand growth as identified in PDFH (including factors such as GDP, employment, population, changes to car/bus journey times and costs, etc.), disaggregated by local authority.

4.6.4 Using the Inverurie rail corridor as a proxy for the Buchan area, weighted average growth figures were derived from combining LENNON and EDGE data. The following growth factors were estimated for the future years of 2024, 2034 and 2044 compared to a baseline year of 2019, with COVID behavioural adjustment applied⁹. Outputs in between these years were interpolated. Beyond the appraisal cap year (2044), demand growth is assumed to be in-line with population growth forecasts¹⁰.

Table 22 Exogenous Growth factors applied by Demand Segment (from 2019)

Market Segment	Demand Growth			Revenue Growth		
	2024	2034	2044	2024	2034	2044
Buchan corridor	1.078	1.182	1.281	1.076	1.190	1.295
Long-distance	1.079	1.254	1.388	1.080	1.263	1.403
Dyce-Aberdeen	1.074	1.187	1.300	1.073	1.192	1.309

⁸ The appraisal of rail schemes generally follows a different path to the appraisal of most transport schemes, reflecting the specific tools available to the rail industry, and this includes the treatment of demand growth. STAG guidance specifically references the use of industry projections of growth and Scotland's Railway will be familiar with this approach. Having said that, the economic appraisal of any transport scheme has to follow appraisal guidance, and STAG in Scotland points to the UK government TAG guidance for virtually all of its appraisal parameters, which include some relating to how demand is processed in the appraisal. It is also worth bearing in mind that the basis for the growth parameters used by the rail industry (EDGE) is socio-economic data (forecast GDP growth, population, employment, etc) that is related to the study area and is implemented at a disaggregate level, thus by implication reflecting local, regional, and national policy.

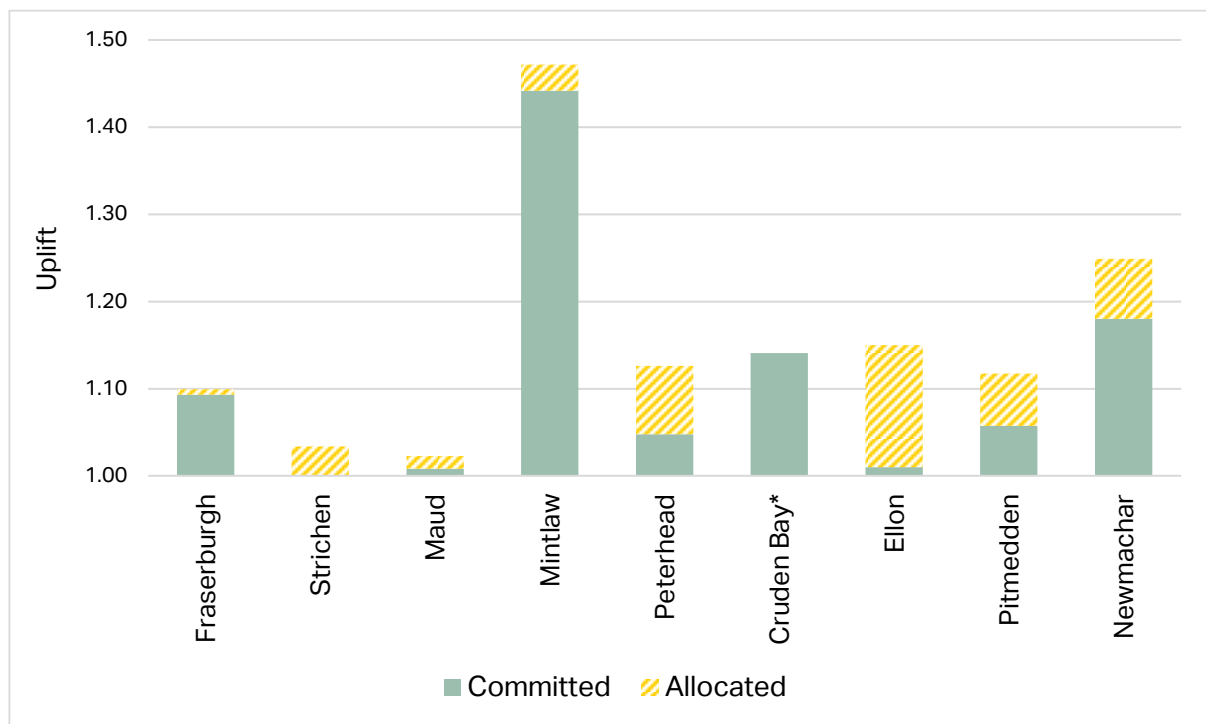
⁹ Following current standard rail scheme appraisal guidance, the forecast long-term impacts from the COVID-19 pandemic need to be factored in any rail demand forecasts that have been undertaken based on pre-COVID baseline demand. The ASAM19 model is based on pre-pandemic travel patterns and thus a COVID 'Medium-recovery' adjustment has been applied. This reflects an increased propensity to working from home thus only impacting on commuting/business trips.

¹⁰ TAG Databook - Appraisal Parameters.

Local Housing Developments

- 4.6.5 The scheme appraisal also takes account of specific local housing development that is planned within the study corridor. A list of relevant housing developments was sourced from the [Aberdeenshire Local Development Plan 2023](#) in Aberdeenshire Council's website (Appendix A). Based on the latest housing land audit, housing schemes identified were classified as either being 'committed' (i.e. either under construction at the time of the study, or with full planning permission) and thus part of the central case scenario, or as being 'allocated' (but not yet 'committed') thus to form part of a sensitivity test that considers full development of all housing schemes in the local development plan by 2037.
- 4.6.6 The average number of people per household in Aberdeenshire was sourced from the Scottish Government's statistics website (2.31 people per household in 2019) and used to estimate a population uplift compared to the baseline population within the station catchment zone. A key assumption to the application of the uplift factor is that the trip rate remains constant leading to a proportionate increase in zone-to-zone trips (by any transport mode).
- 4.6.7 Figure 13 presents the resulting uplift figures applied over the central case demand (and the sensitivity test that assumes all 'allocated' developments have been built by the scheme opening year of 2037). The highest uplift figures are observed within the Mintlaw catchment area, where committed developments will likely increase the catchment population by almost 50%. Newmachar and the Hatton/Cruden Bay catchment areas are the other two catchment areas where the increase in local population exceeds a 10% due to committed housing developments near the station location.

Figure 13 Housing developments uplifts



* Weighted average of Hatton (1.06/.06) and Cruden Bay (1.18/.18)

4.7 Results

Demand and Revenue

4.7.1 The tables presented below summarise demand and revenue for the modelled options for years 1 (2037 – scheme opening year), 3 (2039) and 5 (2041). The appraisal growth cap year (2044) is also presented (Y8). Demand ramp-up of 53% and 90% is applied in year 1 and 3 figures, respectively, in line with rail scheme appraisal guidance.

Alignment A2: Fraserburgh via Peterhead

4.7.2 Table 23 compares the outputs from varying service provision to Peterhead/Fraserburgh.

Table 23 Alignment A2 Options (Fraserburgh via Peterhead): Demand and Revenue forecasts

Option	Annual Demand ('000s)				Annual Revenue (£m, 2024 prices)			
	Y1	Y3	Y5	Y8	Y1	Y3	Y5	Y8
A2-1	647	1,523	1,721	1,765	3.7	6.4	7.2	7.4
A2-2	925	2,173	2,456	2,519	5.2	8.9	10.1	10.3
A2-3	628	1,479	1,671	1,713	3.5	6.1	6.9	7.1
A2-4	771	1,811	2,048	2,099	4.2	7.3	8.2	8.5
A2-5	906	2,128	2,406	2,466	5.0	8.6	9.8	10.0

Y1: 2037; Y3: 2039; Y5: 2041; Y8: 2044 (appraisal growth cap year)

- 4.7.3 Option A2-2 (2tph to Fraserburgh) generates the highest demand and revenue results, which is unsurprising given that it generally provides better access to the rail network from locations north of Peterhead and the service frequency is the highest proposed across the whole corridor through to Fraserburgh. There is a 42% increase in rail demand associated with moving from an hourly service (Option A2-1) to a half-hourly service (Option A2-2).
- 4.7.4 Option A2-5 (1tph to Fraserburgh and 1tph to Peterhead) is the second-best performing option, by providing a half-hourly service between Aberdeen and Peterhead, whilst still providing a regular hourly service through to Fraserburgh. It is worth noting that Option A2-5 captures 98% of the demand generated by Option A2-2, which might indicate that there is not much incremental value in providing 2 tph from Fraserburgh and that a 1 tph service might suffice.
- 4.7.5 Options A2-3 (0.5tph to Fraserburgh and 0.5tph to Peterhead in alternate hours) and A2-4 (0.5tph to Fraserburgh and 1 tph to Peterhead) generate lower demand and revenue outputs, reflecting the fact that Fraserburgh is only served by one train every two hours.
- 4.7.6 All the A2 options provide either 1 tph or 2 tph between Peterhead and Aberdeen. Alignment A2 is the only alignment that will facilitate the ability to operate 2 tph to Peterhead from Aberdeen. By comparing A2-5 with A2-1 it is possible to determine what the demand impact of moving from 1 tph to 2 tph to Peterhead is, which is +40% demand overall.

Alignment B: Fraserburgh via Maud and Strichen (B1) or via Mintlaw (B2)

4.7.7 Table 24 compares the demand outputs for the rail corridor through to Fraserburgh via the former Formartine and Buchan rail corridor, via Maud and Strichen (B1) or via Mintlaw (B2).

Table 24 Alignment B Options (Fraserburgh via (1) Maud or via (2) Mintlaw): Demand and Revenue forecasts

Option	Annual Demand ('000s)				Annual Revenue (£m, 2024 prices)			
	Y1	Y3	Y5	Y8	Y1	Y3	Y5	Y8
B1-1	732	1,720	1,944	1,993	4.2	7.2	8.2	8.4
B1-2	872	2,047	2,314	2,373	5.0	8.6	9.8	10.0
B2-1	723	1,700	1,921	1,970	4.2	7.2	8.1	8.3
B2-2	856	2,009	2,271	2,329	4.9	8.5	9.7	9.9

Y1: 2037; Y3: 2039; Y5: 2041; Y8: 2044 (appraisal growth cap year)

4.7.8 Connecting Fraserburgh by rail via Maud/Strichen (B1) is marginally more beneficial than via Mintlaw (B2) from a demand/revenue point-of-view, generating up 2% more rail demand.

4.7.9 Options B1-1 and B2-1 provide 1 tph for Peterhead and 0.5 tph for Fraserburgh. These can therefore be directly compared to Option A2-3. The B options generate circa 15% more demand (and circa 17% more revenue) compared to A2-3, which will reflect the net impact of marginally quicker journey times to Aberdeen from Fraserburgh, plus the fact that the B options serve intermediate markets (e.g. Maud/Mintlaw), offset by not serving the Fraserburgh-Peterhead market.

4.7.10 It is not possible to compare Options B1-2 and B2-2 (1 tph for Peterhead and 1 tph for Fraserburgh) to an equivalent A2 option as a like-for-like comparison doesn't exist. It is however worth noting that these options provide 2 tph from Ellon southwards and these can be compared to A2-2 and A2-5 which also provide the same level of service from Ellon. The A2 options generate marginally more demand (circa 5% to 7% more) overall, which reflects a number of differing impacts both upside and downside, compared to the B options. The A2 options provide 2 tph from Peterhead and provide a service that directly links Fraserburgh and Peterhead, whereas the B options offer a marginally quicker journey time between Fraserburgh and Aberdeen and serve some intermediate markets between Ellon and Fraserburgh (e.g. Maud/Mintlaw). However, the difference in revenue is less than 1.5% due to the B options capturing a higher proportion of longer distance flows compared to the A2 options.

Alignment C: Peterhead 'Park & Ride'

4.7.11 Table 25 compares the outputs of a rail corridor serving Peterhead only with 1 or 2tph, with Peterhead acting as a Park & Ride station for zones further north, including Fraserburgh.

Table 25 Alignment C Options (Peterhead): Demand and Revenue forecasts

Option	Annual Demand ('000s)				Annual Revenue (£m, 2024 prices)			
	Y1	Y3	Y5	Y8	Y1	Y3	Y5	Y8
C1	584	1,375	1,554	1,593	3.1	5.4	6.1	6.3
C2	822	1,929	2,181	2,237	4.3	7.5	8.4	8.6

Y1: 2037; Y3: 2039; Y5: 2041; Y8: 2044 (appraisal growth cap year)

4.7.12 Providing a half-hourly service to/from Peterhead (C2) generates an additional 39% demand compared to an hourly service (C1). This matches the findings as per paragraph 4.7.7.

4.7.13 Comparing to equivalent options in the other alignments assessed, not serving Fraserburgh with 1tph leads to a decrease in demand of 10% (compared to A2-5), 6% (B1-2) and 4% (B2-2), respectively. The net revenue impact is larger (14%, 14% and 13%, respectively) due to the longer-distance flows served by services serving stations north of Peterhead.

Peterhead Station Location

4.7.14 The analysis above assumes that a station at Peterhead would be located in the 'West' location. Table 26 looks at how the demand impacts might alter if a different station location was chosen ('Central' or 'South'). Please refer to paragraph 2.2.3 for more details on this. The changes in demand reflect the proximity of the station catchment population to the station (access times) and the proximity of the centre of Peterhead for inbound journeys (egress times).

Table 26 Demand and Revenue forecasts for Different Peterhead Station Locations (based on Option C2)

Option	Annual Demand ('000s)				Annual Revenue (£m, 2024 prices)			
	Y1	Y3	Y5	Y8	Y1	Y3	Y5	Y8
West	822	1,929	2,181	2,237	4.3	7.5	8.4	8.6
Central	875	2,053	2,321	2,380	4.7	8.1	9.2	9.4
South	827	1,940	2,193	2,249	4.2	7.3	8.2	8.4

Y1: 2037; Y3: 2039; Y5: 2041; Y8: 2044 (appraisal growth cap year)

4.7.15 For alignment options B and C the alternative station locations at Peterhead are potential opportunities to either reduce cost (the 'South' option) or maximise accessibility to the centre of Peterhead (the 'Central' option). For the A2 alignment options, the 'West' station location is the only viable station location to serve Peterhead.

4.7.16 The proposed 'West' station location is situated within a proposed Local Plan development area. At this early stage of scheme development this needs to be viewed as both a potential constraint and an opportunity. Clearly this development could have a significant impact on the ability to achieve the necessary infrastructure alignments required, and this would need to be part of the design considerations going forward. Equally the presence of this development has the potential to contribute positively to the scheme demand, revenue and benefits.

4.7.17 The Peterhead 'Central' location would generate the highest rail patronage, with circa 6% more demand and +9% / +12% revenue (West / South, respectively) than the other potential station locations. However, it is anticipated that the incremental revenue and benefits generated by this option is likely to only marginally offset the greater impact of scheme costs in the Value for Money calculation. This is the subject of a sensitivity test.

4.7.18 The 'South' station location generates the same levels of demand as the 'West' station location in broad terms. This to some degree reflects the fact that both locations are circa 3km from the centre of Peterhead and both locations are strategically located on the A90 Peterhead Bypass. It is worth noting however that the 'South' station would offer good access to Peterhead Prison. The key advantage of the 'South' location, however, is that it would be cheaper to construct compared to the other two locations and this will be tested as a sensitivity test.

Sources of Patronage

4.7.19 Table 27 presents the sources of demand as identified by the demand forecasting processes. Modal shift from car represents almost half of the total forecast rail demand, with a further 7% coming from bus. The mode-choice model informs 55% of the total demand reported in the study, whilst 45% of the total demand derives from the induced demand and long-distance demand uplifts applied over the central forecasts.

Table 27 Source of patronage

Car	Bus	P&R	Induced	Long-Dist.
46%-47%	6%-7%	1%-2%	30%	15%

Rail Mode Shares

4.7.20 Rail mode shares achieved by the scheme can vary considerably across the different flows considered, as it depends how competitive the rail offer is against other existing modes. In this case, car journey times outside of Aberdeen are going to be quite competitive. Table 28 presents some example mode shares achieved for some of the key flows, based on the best performing options in terms of demand generated by the scheme. From Peterhead and Ellon to Aberdeen, rail mode shares of 10% or above are achieved, whereas some of the rail mode shares achieved from Fraserburgh are lower, which perhaps reflects the fact that the station location is on the outskirts of the town which therefore generates quite high access times.

Table 28 Rail mode shares

Sample Flows	A2-2	B1-2	B2-2	C2
Fraserburgh-Peterhead	4%	<1%	<1%	n/a
Fraserburgh-Ellon	4%	4%	4%	1%
Fraserburgh-Aberdeen	8%	7%	8%	4%
Peterhead-Ellon	4%	3%	3%	4%
Peterhead-Aberdeen	10%	7%	7%	10%
Ellon-Aberdeen	11%	11%	11%	11%

Rail Trips Distribution

4.7.21 The following table indicates the number of Entries & Exits forecast by station and option. A chart is also presented for each of the best performing options by corridor indicating the number of single journeys from/to each station. Please note that they exclude the impacts from demand uplift in the existing Dyce-Aberdeen flow and that the impacts presented at Dyce and Aberdeen are the forecast incremental impacts only.

Table 29 Annual Entries and Exits – 2044 ('000s)

Option	Fraserburgh	Strichen	Maud	Mintlaw	Peterhead	Cruden Bay	Ellon	Pitmedden	Newmachar	Dyce	Aberdeen
Alignment A2											
A2-1	139	-	-	-	280	163	364	135	309	208	447
A2-2	197	-	-	-	402	228	518	189	434	298	633
A2-3	104	-	-	-	265	161	362	135	309	206	442
A2-4	118	-	-	-	318	196	447	165	381	255	542
A2-5	168	-	-	-	385	225	516	188	434	296	626
Alignment B1											
B1-1	81	48	79	-	194	158	406	165	380	252	534
B1-2	138	86	133	-	203	162	471	189	433	294	620
Alignment B2											
B2-1	81	-	-	97	190	157	413	165	380	252	534
B2-2	133	-	-	170	200	162	478	188	433	293	618
Alignment C											
C1	-	-	-	-	196	155	393	136	308	208	447
C2	-	-	-	-	281	217	528	191	432	295	623

Figure 14 Annual Single Journeys (A2-2), 2044

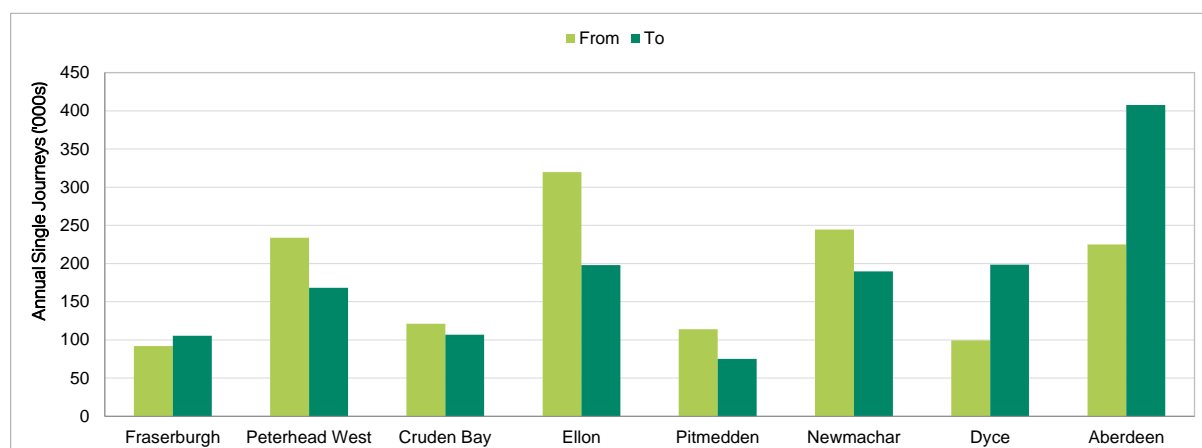


Figure 15 Annual Single Journeys (B1-2), 2044

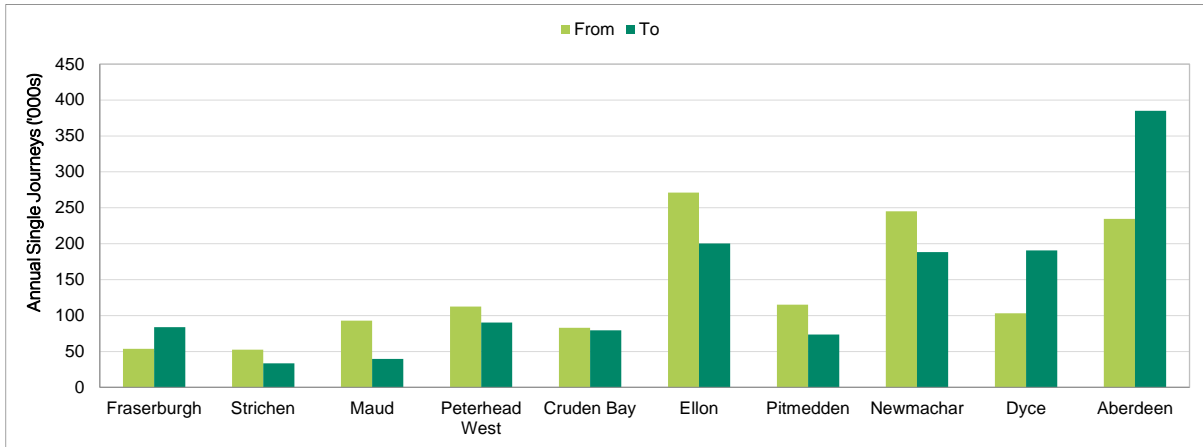


Figure 16 Annual Single Journeys (B2-2), 2044

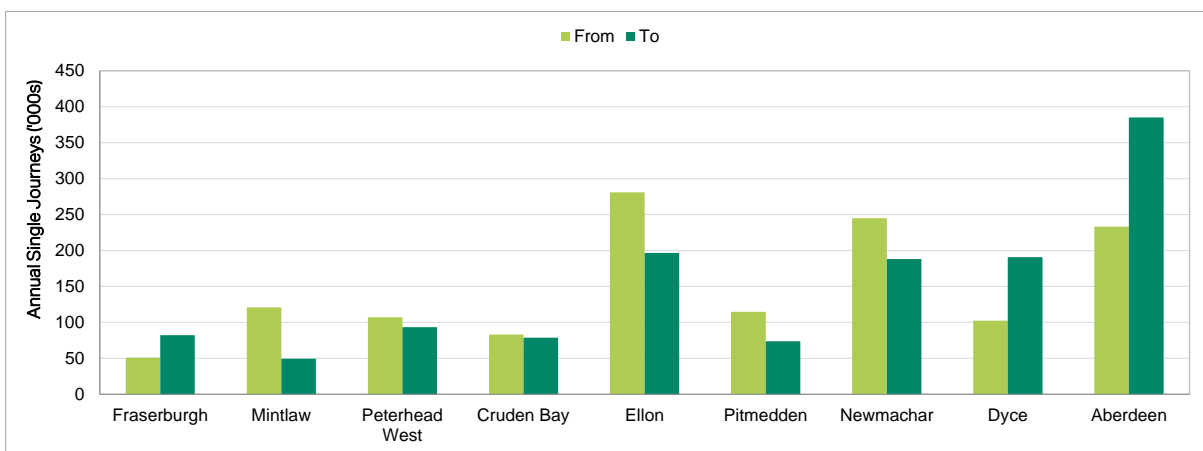
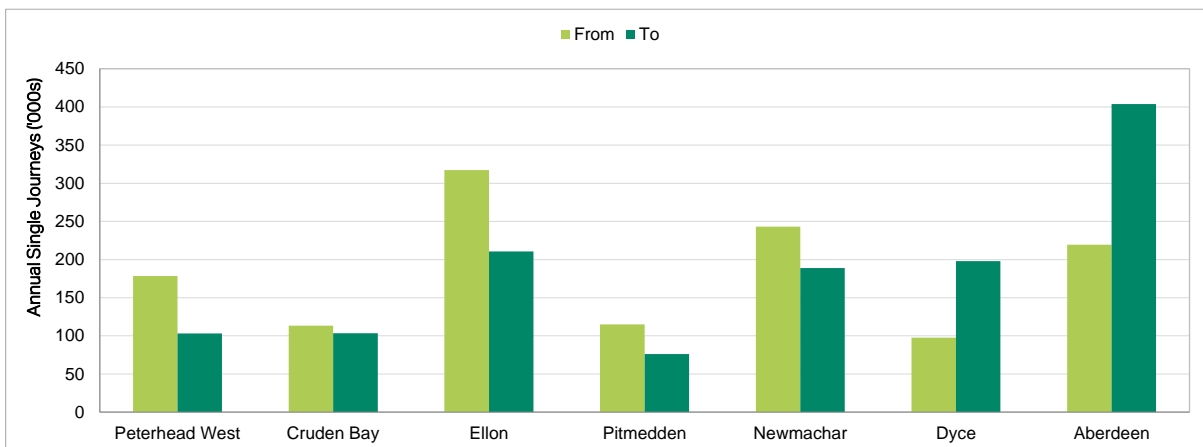


Figure 17 Annual Single Journeys (C-2), 2044



4.7.22 Some key highlights from this analysis include:

- Aberdeen is the main demand attractor across all options.

- Ellon is the station in the Buchan corridor that records the highest usage with between 350,000-500,000 Entries & Exits per annum forecast by 2044 depending on the option considered. This reflects the large station catchment that Ellon has alongside the fact that there is a strong base demand for travel between Ellon and Aberdeen as a whole. It is worth noting at this point that the demand forecasting process does not constrain rail demand on the basis of car parking availability at/around stations.
- The demand at Newmachar is also relatively strong, which reflects its closer proximity to Aberdeen, plus the levels of committed local development planned within the station catchment.
- The Alignment B options impact on forecast demand at Peterhead due to the fact that the ability for rail to serve the Fraserburgh-Peterhead market is removed, plus the fact that the maximum service frequency that can be offered to/from Peterhead is 1 tph.
- The modelling analysis suggests that in a scenario whereby Peterhead is served by a 'Central' location station then there would be a more balanced number of inbound and outbound journeys to/from Peterhead.

4.8 Benchmarking Demand

- 4.8.1 The forecast demand figures have been benchmarked against broadly similar rail corridors in Scotland. Acknowledging that each rail corridor has a unique combination of factors (such as the catchment populations, attractiveness of the destination, competing modes, service frequency, car ownership etc.) that will result in differences in the demand figures, this exercise is therefore intended to provide some context around how the estimated patronage compares to similar corridors rather than attempting to achieve perfect matches.
- 4.8.2 The Borders Line in the Scottish Borders is served by 2 tph linking Tweedbank and Edinburgh. Commercial operation started in September 2015. The existing line from Aberdeen to Inverurie serves communities of a similar nature to the Buchan Line over similar distances (Inverurie to Keith). Inverurie enjoys an approximate 2 tph level of service towards Aberdeen, whereas Inch/Huntly and Keith have an approximate 0.5 tph level of service.
- 4.8.3 Entries and Exit data for 2022/23 has been sourced from the ORR data portal. The table below summarises and compares this data to the forecast demand (2044) for the Buchan Line.

Table 30 Comparison of Demand (entries and exits)

Existing Station	2022/23 Entries & Exits	Buchan Line Station (sample)	2044 Entries & Exits (forecast)
Tweedbank, 2 tph	301,528	Fraserburgh, 1 tph	133,000-139,000
Galashiels, 2 tph	268,720	Strichen, 0.5 tph	48,000
Stow, 2 tph	59,806	Mintlaw, 0.5 tph	97,000
Keith, approx. 0.5 tph	55,948	Peterhead, 2 tph	281,000-402,000
Huntly, approx. 0.5 tph	49,568	Ellon, 2 tph	471,000-528,000
Insch, approx. 0.5 tph	52,348	Pitmedden, 2 tph	188,000-191,000
Inverurie, approx. 2 tph	288,356	Newmachar, 2 tph	432,000-434,000

Source: ORR for existing stations

- 4.8.4 Allowing for growth between 2022/23 and 2044, the forecast station usage at the Buchan Line stations aligns reasonably well against these existing stations. The forecasts for Ellon and Newmachar compare to the Inverurie demand, taking into account that the level of service at Inverurie is not quite a consistent 2 tph. The forecast demand at Peterhead can be compared to Galashiels and Tweedback, taking into account that Peterhead has a larger population than Galashiels. The forecast demand at the smaller station catchments such as Strichen and Mintlaw can be compared to the demand at Inch/Huntly/Keith.

5 Appraisal Model Development

5.1 Core Assumptions & Parameters

- 5.1.1 The economic appraisal has been undertaken in line with STAG guidance, noting that STAG in Scotland points to the UK government TAG guidance for virtually all of its appraisal parameters.
- 5.1.2 The key components are:
- Public transport revenue impacts (rail and bus);
 - Time savings (user and non-user);
 - Marginal external benefits driven by mode shift from the road network;
 - Scheme capital costs;
 - Scheme ongoing costs (operating and renewals/replacement); and
 - Indirect taxation impacts.
- 5.1.3 This Section sets out how the scheme benefits and costs have been calculated and processed to prepare an appraisal in line with appraisal guidance. This involves the creation and population of scheme 'Transport Economic Efficiency' (TEE), 'Costs to Public Sector' and 'Monetised Summary' tables, with the main products being the Net Present Value (NPV) and the Benefit/Cost Ratio (BCR). The NPV measures the monetary value to society and is the difference between the Present Value of Benefits (PVB) and the Present Value of Costs (PVC). The BCR is the indicator of value for money and is the ratio of PVB/PVC.
- 5.1.4 The confirmed scheme opening year for appraisal purposes is assumed to be 2037.
- 5.1.5 The scheme appraisal has assumed a standard 60-year scheme appraisal period from the scheme opening year (i.e. 2037 to 2096). Note that all benefits and costs described below are subject to standard discounting treatment as per STAG guidance (3.5% discount rate for years 1 to 30 years, counting from the appraisal year (thus to 2054) and 3% for years 31 to 75 (through to end of appraisal period). All relevant benefits are also adjusted to account for demand ramp-up over the first 4 years of the service (53% in year 1, 78% in year 2, 90% in year 3, 98% in year 4, and 100% thereafter, sourced from PDFHv6.0).

5.2 Methodology

- 5.2.1 The next table provides an overview of each component appraised and sets out the key assumptions relating to the estimation of these. It also identifies whether the component part contributes to either the PVB or the PVC calculation. In line with appraisal guidance for a rail scheme appraisal, all incremental rail revenue and rail operating costs are allocated to the PVC calculation. This recognises that the Scottish Government is responsible for the railway finances.

Table 31 Economic Appraisal Outline

Variable	PVB or PVC?	Methodology
Public Transport revenue impacts		
Rail	PVC	Increase in rail revenue. Direct output from the demand forecasting model. Uplifted to market prices using the tax correction factor, as per appraisal guidance.
Bus	PVB	Impacts on bus revenue. Direct output from the demand forecasting model due to modal shift to rail. Uplifted to market prices using the tax correction factor, as per appraisal guidance.

Time Savings		
Users (Rail)	PVB	<p><u>Buchan Corridor</u>: Estimated through 'numerical integration' approach¹¹, on a zone-to-zone movement level, from the mode choice model. This is because the rail service is a 'new mode' in the corridor (i.e. not possible to calculate rail user benefits in line with standard appraisal guidance). A final adjustment to account for long-distance journeys was applied.</p> <p><u>Dyce-Aberdeen flow</u>: Elasticity-based estimation (PDFH) due to increased frequency and its impact in the Generalised Journey Time. Total rail user time savings (in minutes) was monetised by applying the appropriate Value of Time (VoT) by journey purpose (estimated from LENNON ticket type splits and TAG/PDFH split of tickets by purpose).</p>
Non-users (Decongestion)	PVB	<p><u>Passenger mode shift</u>: Car-km removed from the road network estimated from mode-choice model (passenger-km converted to car-km based on car vehicle-km diversion factor from TAG/PDFH). Application of TAG MEC rates to estimate (de)congestion benefits.</p> <p><u>Freight mode shift</u>: Equivalent lorry-km removed from the road network estimation based on average number of equivalent lorries/train assumption (28) and freight scenarios developed from interviews with key stakeholders (number of trains/day, average distance travelled by road type). Application of TAG MEC rates to estimate (de)congestion benefits.</p>
Marginal external benefits (car and lorry mode shift)		
Accidents	PVB	Car/Lorries vehicle-km removed from the road network estimated as per described above. Application of TAG MEC rates.
Greenhouse Gases	PVB	Car/Lorries vehicle-km removed from the road network estimated as per described above. Application of TAG MEC rates.
Infrastructure cost savings	PVC	Car/Lorries vehicle-km removed from the road network estimated as per described above. Application of TAG MEC rates.
Scheme capital costs		
Rail infrastructure Active travel infrastructure	PVC	Optimism bias factor of 56% (rail infrastructure) and 70% (stations) applied (in line with the latest TAG guidance for a scheme that sits at a Level 1/2 equivalent project stage); Allowance of 2.1% p.a. for construction cost inflation above standard inflation rate (as per TAG guidance); Market price uplift applied; Costs converted (and discounted) to 2010 prices in line with guidance.
Mobilisation costs	PVC	Market price uplift applied; Costs converted (and discounted) to 2010 prices in line with guidance.
Scheme ongoing costs		
Operating costs	PVC	<p>Optimism bias factor of 41% applied (in line with the latest TAG guidance for a scheme that sits at a Level 1/2 equivalent project stage). Market price uplift applied; Costs converted (and discounted) to 2010 prices in line with guidance.</p> <p><u>Vehicle leasing costs</u>: assumed to depreciate in real terms through to 2044 (capped onwards), in line with TAG guidance.</p> <p><u>Maintenance costs</u>: assumed to increase in line with RPI until 2030 from when it increases by GDP +0.7p.p through to the cap year (2044).</p>

¹¹ The Numerical Integration method gradually increases the Do-Something generalised times to the point where the Do-Something rail trips equal the Do-Minimum (baseline) rail trips. At each increment the user time savings calculation is undertaken. These increments are then summed to determine the overall value.

		<p><u>Staff costs</u>: assumed to increase in line with the real earnings index throughout the whole 60-year appraisal period, in line with TAG guidance.</p> <p><u>Fuel costs</u>: assumed to increase in line with fuel price and consumption rates indexes throughout the whole 60-year appraisal period, in line with TAG guidance.</p> <p><u>Variable costs</u>: assumed to not change in real terms during the appraisal period.</p> <p><u>Station costs</u>: assumed to not change in real terms during the appraisal period.</p>
Renewals and Replacement costs	PVC	<p><u>Infrastructure costs</u>: Assumed to be equivalent of 2% of the direct and indirect construction costs of the rail infrastructure, per annum (to 2044, capped onwards); Allowance of 2.1% p.a. for construction cost inflation above standard inflation rate (as per TAG guidance); Market price uplift applied; Costs converted (and discounted to 2010 prices in line with guidance).</p> <p><u>Station costs</u>: Any renewals costs that are associated with the new station infrastructure are assumed to be represented in the appraisal by the inclusion of the Long-Term Charges within the operating costs.</p>
Indirect taxation impacts		
PT Revenue	PVB	Impacts on the tax revenues collected due to the net change in expenditure on both (non-work) rail and bus fares. Estimated by applying the indirect taxation rate of 19% (which is an average of all taxation) to calculate the revenue denied to the government in tax revenues by this additional expenditure on public transport fares.
Car / Freight (Fuel)	PVB	Car/Lorries vehicle-km removed from the road network estimated as per described above. Application of TAG MEC rates.

6 Appraisal Results

6.1 Economic Appraisal Outputs – Benefits

User Time Savings

6.1.1 Table 32 presents the total net user time savings generated by the scheme in 2044, eight years after the assumed scheme opening year.

Table 32 User Time Savings (million minutes per annum) – 2044

Option	Commuting	Business	Other	Total
Alignment A2				
A2-1	17.9	4.4	53.2	75.5
A2-2	25.6	6.3	76.1	108.0
A2-3	17.3	4.3	51.6	73.1
A2-4	21.3	5.2	63.5	90.1
A2-5	25.1	6.1	74.6	105.8
Alignment B1				
B1-1	20.3	5.0	60.4	85.7
B1-2	24.2	5.9	72.0	102.1
Alignment B2				
B2-1	20.1	4.9	59.8	84.8
B2-2	23.7	5.8	70.5	100.0
Alignment C				
C1	16.0	3.9	47.7	67.6
C2	22.6	5.5	67.4	95.6

6.1.2 Although 2tph to Fraserburgh via Peterhead (A2-2) generates the highest value of minutes saved, the common theme across the scenarios in the top range of minutes saved are those that provide a half-hourly service between Ellon and Aberdeen (A2-2, A2-5, B1/2-2 and C-2).

6.1.3 Routing via Maud and Strichen (B1) is marginally more beneficial than serving Mintlaw via a slightly more direct route (B2).

6.1.4 Table 33 presents the resulting discounted monetised values of user benefits in 2010 prices.

Table 33 User Time Savings (Present Value in 2010 prices, £m)

Option	Commuting	Business	Other	Total
Alignment A2				
A2-1	58.6	32.9	79.7	171.2
A2-2	84.0	46.8	114.0	244.8
A2-3	56.8	31.8	77.2	165.9
A2-4	70.0	39.1	95.1	204.2
A2-5	82.2	45.8	111.7	239.7
Alignment B1				
B1-1	66.6	37.2	90.5	194.3
B1-2	79.3	44.2	107.8	231.3
Alignment B2				
B2-1	65.9	36.8	89.6	192.3
B2-2	77.7	43.3	105.6	226.6
Alignment C				
C1	52.6	29.4	71.4	153.4
C2	74.3	41.3	100.9	216.6

Non-User Time Savings (Decongestion)

6.1.5 The forecast levels of modal transfer from car to rail results in the net reduction of car km from the road network, which in turn is the key driver to determine the non-user and environmental benefits generated by the scheme. The rail scheme is forecast to remove between 17 to 28 million vehicle-km from the road network by 2044 (net impact from modal transfer to rail, partially offset by increases in car-km from access to the proposed new rail stations).

Table 34 Car-Km removed from the road network ('000s)

Option	2037 (Y1)	2039 (Y3)	2041 (Y5)	2044 (Y8)
Alignment A2				
A2-1	9,907	17,137	19,398	19,947
A2-2	14,133	24,434	27,651	28,435
A2-3	9,577	16,565	18,751	19,282
A2-4	11,686	20,206	22,869	23,518
A2-5	13,786	23,833	26,971	27,736
Alignment B1				
B1-1	11,265	19,478	22,043	22,667
B1-2	13,424	23,207	26,261	27,004
Alignment B2				
B2-1	11,122	19,229	21,761	22,377
B2-2	13,177	22,779	25,776	26,506
Alignment C				
C1	8,758	15,149	17,147	17,635
C2	12,308	21,276	24,076	24,761

6.1.6 The removal of car-km from the road network generates decongestion benefits. The generated time savings were converted to monetised values by applying the appropriate decongestion marginal external cost rates, on a year-by-year basis, split by journey purpose. Table 35 presents the resulting discounted monetised decongestion benefits induced by the scheme opening.

Table 35 Decongestion Benefits (Present Value in 2010 prices, £m)

Option	Commuting	Business	Other	Total
Alignment A2				
A2-1	10.7	17.0	93.4	121.1
A2-2	15.4	24.2	133.1	172.6
A2-3	10.3	16.5	90.3	117.1
A2-4	12.5	20.1	110.1	142.8
A2-5	14.9	23.6	129.8	168.4
Alignment B1				
B1-1	12.4	19.2	106.1	137.6
B1-2	14.8	22.8	126.4	164.0
Alignment B2				
B2-1	12.2	18.9	104.7	135.9
B2-2	14.6	22.3	124.0	160.9
Alignment C				
C1	9.2	15.3	82.6	107.1
C2	13.0	21.3	115.9	150.3

Marginal External Benefits

6.1.7 The removal of car-km from the road network generates additional impacts captured by the STAG appraisal including greenhouse gas benefits (tonnes of CO₂ equivalent emissions avoided due to modal shift to rail), accident benefits (reduction in risk of individuals being killed or injured as a result of road accidents), infrastructure benefits (reduction in road infrastructure damage/savings from avoided maintenance) and indirect taxation impacts due to reduction in fuel consumption. It should be noted that indirect taxation impacts also include the estimated net change in expenditure on public transport fares (i.e. money no longer assumed to be spent on otherwise taxable items).

Table 36 Marginal External Costs related to Removal of Car-Km (Present Value in 2010 prices, £m)

Option	Greenhouse Gases	Accidents	Infrastructure	Indirect Taxation
Alignment A2				
A2-1	3.9	16.3	0.8	1.7
A2-2	5.6	23.2	1.1	2.4
A2-3	3.8	15.7	0.8	1.6
A2-4	4.6	19.2	0.9	2.0
A2-5	5.4	22.6	1.1	2.3
Alignment B1				
B1-1	4.4	18.5	0.9	1.9
B1-2	5.3	22.0	1.1	2.2
Alignment B2				
B2-1	4.4	18.2	0.9	1.9
B2-2	5.2	21.6	1.1	2.2
Alignment C				
C1	3.4	14.4	0.7	1.5
C2	4.8	20.2	1.0	2.1

Freight

- 6.1.8 Section 2.4 outlined the freight proposition, including the various freight-related scenarios, that form the basis for determining freight benefits that have informed this rail scheme appraisal¹². As a reminder, the low/medium/high scenarios presented in the table below represent different levels of rail freight service provision (trains per day/week) at each of the proposed freight terminals.
- 6.1.9 Key assumptions for the estimation of freight benefits include the share and distance of freight travelling to terminals within Scotland or cross-border to/from England. Informed by stakeholder interviews, it has been assumed that 80% of all intermodal freight would be cross-border (with the Daventry International Rail Freight Terminal in Northamptonshire, England, used as proxy for all destinations) and that the remaining 20% intermodal and all non-pipeline carbon freight would remain within Scotland (with Mossend Eurocentral terminal used as proxy for all traffic).
- 6.1.10 Splits of lorry-mileage diverted from Motorways and A-Roads in both Scotland and England were estimated to apply the most appropriate Marginal External rates to derive monetised freight benefits for appraisal. No growth has been assumed for freight demand. Table 37 summarises the annual lorry-km estimated to be removed from the road network if considering a freight terminal at each specified location.

¹² In line with STAG appraisal guidance, freight benefits are restricted to those benefits delivered through time savings, associated with the modal transfer of freight from road to rail.

Table 37 Annual Lorry-Km removed from the road network (million)

Scenario	Scotland		England	Total
	Motorway	A Road	Motorway	
Ellon				
Low	1.2	1.8	2.7	5.6
Medium	3.0	4.5	6.7	14.1
High	3.6	5.4	8.0	16.9
Peterhead				
Low	1.5	5.3	1.6	8.4
Medium	3.9	14.6	3.2	21.7
High	6.4	24.2	5.3	36.0
St Fergus				
Low	1.5	5.4	1.6	8.6
Medium	3.9	15.1	3.2	22.2
High	6.4	25.1	5.3	36.9
Fraserburgh				
Low	0.5	0.9	1.1	2.6
Medium	0.6	1.1	1.3	3.0
High	0.7	1.3	1.6	3.6

- 6.1.11 The greatest opportunity to move freight from road to rail lies with the provision of a freight terminal at Peterhead/St Fergus. This could be as much as 36 million lorry km removed from the road network per annum. The marginal differences in the values between Peterhead and St Fergus reflects the differences in local 'trip' movements that would be required to access the freight terminal if it was located in either Peterhead or St Fergus.
- 6.1.12 A freight terminal at Ellon, essentially serving the Brewdog market, would have the potential to remove circa 15 million lorry km per annum. The opportunities to transfer freight from road to rail are considered to be much lower at Fraserburgh.
- 6.1.13 Table 38 summarises the present value of benefits associated with the different freight terminals. Discounted net freight benefits in 2010 prices could amount to circa £3.5m at a single terminal (Peterhead/St Fergus, high scenario). Ellon and Peterhead freight terminals combined could reach a similar level of benefits under the medium scenario. The most optimistic Fraserburgh freight terminal scenario generates 37% less benefits than those estimated with the most pessimistic Ellon scenario.

Table 38 Marginal External Costs related to Removal of Lorry-Km (Present Value in 2010 prices, £m)

Scenario	Decongestion	Greenhouse Gases	Accidents	Infrastructure	Indirect Taxation	Total
Ellon						
Low	0.32	0.13	0.02	0.06	-0.07	0.47
Medium	0.81	0.33	0.04	0.15	-0.17	1.17
High	0.97	0.40	0.05	0.19	-0.20	1.40
Peterhead						
Low	0.53	0.20	0.04	0.13	-0.11	0.81
Medium	1.40	0.53	0.12	0.35	-0.27	2.12
High	2.32	0.88	0.20	0.57	-0.45	3.52
St Fergus						
Low	0.54	0.21	0.05	0.13	-0.11	0.82
Medium	1.44	0.54	0.13	0.36	-0.28	2.18
High	2.38	0.90	0.21	0.59	-0.46	3.62
Fraserburgh						
Low	0.15	0.06	0.01	0.03	-0.03	0.21
Medium	0.17	0.07	0.01	0.03	-0.04	0.25
High	0.21	0.08	0.01	0.04	-0.04	0.30

6.2 Economic Appraisal Outputs – Costs

Cost to Public Sector

6.2.1 Table 39 presents all the public investment costs captured by the scheme appraisal comprising capital costs and rail infrastructure renewals and replacement costs. The costs presented in the table exclude costs associated with any freight infrastructure.

Table 39 Public Sector Investment Costs (Present Value in 2010 prices, £m)

Option	Capital	Renewals	Net Total
Alignment A2			
A2-1	996.3	267.2	1,263.5
A2-2	1,007.4	270.1	1,277.5
A2-3	996.3	267.2	1,263.5
A2-4	1,007.7	269.5	1,277.2
A2-5	1,012.2	271.8	1,284.0
Alignment B1			
B1-1	1,213.3	317.7	1,531.0
B1-2	1,213.5	317.7	1,531.2
Alignment B2			
B2-1	1,187.2	317.3	1,504.5
B2-2	1,187.4	317.3	1,504.7
Alignment C			
C1	686.9	184.0	870.9
C2	698.0	186.9	884.9

Operating Costs

6.2.2 Table 40 presents the profile of net annual incremental costs associated with each option, including both service and station operating costs combined. The variation in cost over time reflects the way that these costs are treated in the scheme appraisal in line with appraisal guidance.

Table 40 Net Incremental Operating Costs (£m, 2024 prices)

Option	2037 (Y1)	2039 (Y3)	2041 (Y5)	2044 (Y8)
Alignment A2				
A2-1	13.5	13.6	13.8	14.1
A2-2	22.5	22.8	23.1	23.8
A2-3	13.0	13.1	13.2	13.4
A2-4	14.6	14.8	15.0	15.4
A2-5	21.3	21.6	21.9	22.4
Alignment B1				
B1-1	16.1	16.3	16.5	16.8
B1-2	19.6	19.9	20.2	20.7
Alignment B2				
B2-1	16.0	16.1	16.3	16.6
B2-2	19.4	19.6	19.9	20.4
Alignment C				
C1	9.1	9.2	9.3	9.5
C2	17.0	17.2	17.4	17.9

6.2.3 The resulting net present value of operating costs is presented in Table 41.

Table 41 Operating Costs (Present Value in 2010 prices, £m)

Option	Service	Station	Net Total
Alignment A2			
A2-1	184.2	8.3	192.5
A2-2	314.2	8.3	322.5
A2-3	176.2	8.3	184.4
A2-4	198.9	9.4	208.3
A2-5	298.1	7.7	305.8
Alignment B1			
B1-1	218.9	11.0	230.0
B1-2	269.8	11.0	280.8
Alignment B2			
B2-1	217.7	9.9	227.7
B2-2	267.4	9.9	277.3
Alignment C			
C1	122.4	6.6	129.0
C2	236.1	6.6	242.7

6.2.4 The net difference between forecast revenue generated by the scheme and the estimated operating costs incurred can provide an indication as to what the net subsidy requirement might be in broad terms. In years 1 to 4 the demand ramp-up impact will significantly reduce revenue.

6.2.5 On the basis of this analysis, the indication is that none of the options are forecast to generate a revenue surplus by 2044, with potential annual subsidy requirements by this year ranging between £1.4m (Option C1, to cover a 15% gap) and £10.3m (Option A2-2, to cover a cost gap of over 40%). However, most of the options sit in the middle of this range, requiring a subsidy of circa £4m to £7m per annum to cover a circa 35% cost gap.

Table 42 Net subsidy requirements (£m / % costs covered, 2024 prices)

Option	2037 (Y1)	2039 (Y3)	2041 (Y5)	2044 (Y8)
Alignment A2				
A2-1	-8.9 (34%)	-5.6 (59%)	-4.6 (66%)	-4.5 (68%)
A2-2	-16.0 (29%)	-11.5 (50%)	-10.2 (56%)	-10.3 (57%)
A2-3	-8.5 (34%)	-5.4 (59%)	-4.4 (67%)	-4.3 (68%)
A2-4	-9.3 (36%)	-5.6 (62%)	-4.5 (70%)	-4.4 (72%)
A2-5	-15.0 (29%)	-10.6 (51%)	-9.4 (57%)	-9.3 (58%)
Alignment B1				
B1-1	-10.9 (33%)	-7.1 (56%)	-6.0 (64%)	-5.9 (65%)
B1-2	-13.4 (32%)	-8.9 (55%)	-7.7 (62%)	-7.6 (63%)
Alignment B2				
B2-1	-10.7 (33%)	-7.0 (56%)	-5.9 (64%)	-5.8 (65%)
B2-2	-13.2 (32%)	-8.8 (55%)	-7.5 (62%)	-7.4 (63%)
Alignment C				
C1	-5.2 (43%)	-2.4 (74%)	-1.5 (83%)	-1.4 (85%)
C2	-11.5 (32%)	-7.7 (55%)	-6.6 (62%)	-6.6 (63%)

6.3 Economic Appraisal Outputs – Results

- 6.3.1 This section presents the STAG appraisal results (completed STAG tables for the best performing options by alignment are attached as Annex B).
- 6.3.2 Table 43 presents the Present Value of Benefits (PVB) and Costs (PVC) that inform the calculation of the Net Present Value (NPV) associated with each freight scenario considered.
- 6.3.3 As a freight terminal located at St Fergus would require the construction of a dedicated freight spur, it is presented with four separate entries, each representing a possible rail alignment configuration. The one marked with an asterisk (*) only applies to a scenario where Alignment A2 is selected and it is associated with the lowest incremental capital costs, as part of the alignment would be shared with passenger services. The other St Fergus freight terminal options presented relate to where the location of Peterhead station is ('West', 'Central' or 'South'), which dictates the additional rail infrastructure required to be built to connect a freight terminal at St Fergus to the core scheme. It is also worth acknowledging that the assumption is that a freight terminal in the Peterhead area would either be at Peterhead or St Fergus.
- 6.3.4 It is also worth noting that it is assumed that a freight terminal at Peterhead would be located next to the passenger line close to either Peterhead 'West' or Peterhead 'South'.
- 6.3.5 The development of rail freight on the Buchan Line has the potential to generate significant positive NPV's, albeit relatively low at Fraserburgh. The only freight scenario that does not record a positive NPV is a freight terminal at St Fergus combined with a 'low' level of service. In this case, the level of benefits generated does not outweigh the more significant cost outlay required to connect St Fergus into the core rail scheme.

Table 43 Net Present Value of Benefits and Costs - Freight

Terminal	Low			Medium			High		
	PVB (£m)	PVC (£m)	NPV (£m)	PVB (£m)	PVC (£m)	NPV (£m)	PVB (£m)	PVC (£m)	NPV (£m)
Ellon	46.6	3.5	43.2	116.5	3.5	113.1	139.9	3.5	136.4
Peterhead	80.6	3.5	77.1	212.1	3.5	208.7	352.4	3.5	348.9
St Fergus (W)*	82.3	89.6	-7.3	217.9	89.6	128.3	362.0	89.6	272.5
St Fergus (W)	82.3	107.7	-25.5	217.9	107.7	110.2	362.0	107.7	254.3
St Fergus (C)	82.3	122.4	-40.1	217.9	122.4	95.5	362.0	122.4	239.6
St Fergus (S)	82.3	176.1	-93.8	217.9	176.1	41.8	362.0	176.1	185.9
Fraserburgh	21.5	3.5	18.0	25.0	3.5	21.6	30.4	3.5	27.0
E + P	127.2	6.9	120.3	328.7	6.9	321.8	492.2	6.9	485.3
E + P + F	148.7	10.4	138.3	353.7	10.4	343.3	522.6	10.4	512.3

[E] Ellon; [P] Peterhead; [F] Fraserburgh

* Alignment A2

6.3.6 Table 44 summarises the STAG Economic Appraisal results and the Benefit:Cost Ratio (BCR). Results are presented firstly for the passenger element of the scheme, followed by the overall BCR range that also incorporates the freight scenarios. This has to be presented as a range due to the fact that there are various freight scenarios as outlined above. The lower end of the range represents a 'Fraserburgh only/low level of service' freight scenario, whereas the higher end of the range represents an 'Ellon + Peterhead + Fraserburgh/High level of service' freight scenario (except in Alignment C where it is an 'Ellon + Peterhead/High level of service' freight scenario).

Table 44 Economic Appraisal STAG Outputs (Present Value in 2010 prices)

Option	Passenger Only				with Freight
	PVB (£m)	PVC (£m)	NPV (£m)	BCR	BCR Range
Alignment A2					
A2-1	300.1	-1,363.6	-1,063.5	0.22	0.23 - 0.57
A2-2	429.0	-1,469.8	-1,040.9	0.29	0.30 - 0.62
A2-3	290.7	-1,359.4	-1,068.6	0.21	0.23 - 0.57
A2-4	356.8	-1,379.2	-1,022.4	0.26	0.27 - 0.61
A2-5	419.5	-1,463.6	-1,044.1	0.29	0.30 - 0.62
Alignment B1					
B1-1	341.4	-1,655.4	-1,314.0	0.21	0.22 - 0.49
B1-2	406.4	-1,686.0	-1,279.6	0.24	0.25 - 0.53
Alignment B2					
B2-1	337.6	-1,627.4	-1,289.8	0.21	0.22 - 0.50
B2-2	398.3	-1,657.2	-1,258.9	0.24	0.25 - 0.53
Alignment C					
C1	268.1	-921.4	-653.3	0.29	0.31 - 0.80
C2	377.9	-1,018.4	-640.5	0.37	0.39 - 0.84

- 6.3.7 Excluding freight impacts, the scheme is estimated to generate benefits (PVB) in the order of £270m to £430m. However, the level of scheme costs (PVC) is 4 to 7 times greater, thus resulting in a (passenger-only) BCR of between 0.2 and 0.4. With freight incorporated into the appraisal, there is the potential to significantly enhance the benefits (PVB) for relatively little additional cost (PVC), resulting in a considerably improved BCR (up to 0.84 in the most positive scenario (C2, with freight terminals at Ellon and Peterhead with a higher level of freight service). Essentially the large PVC values reflect the significant level of initial capital cost (between £1.4bn and £1.8bn excluding optimism bias) associated with the scheme, which in the appraisal process is not discounted very much compared to the scheme benefits (as it is an expenditure item allocated to the initial years of the scheme).
- 6.3.8 The results of the appraisal suggest that the better performing alignment is Alignment C serving Peterhead only. The incremental costs associated with extending the scheme to Fraserburgh significantly outweigh the incremental benefits of doing so. However, the analysis does suggest that should there be a desire for the scheme to reach Fraserburgh, then this should be considered via Peterhead (Alignment A2) as the incremental cost of extending to Fraserburgh is less than extending from Ellon. Extending from Peterhead also allows the scheme to tap into the Fraserburgh-Peterhead market (the largest flow to/from Fraserburgh) and also allows the opportunity to consider 2 tph between Peterhead and Aberdeen (not possible if Fraserburgh is reached via Ellon). However, it needs to be acknowledged that extending the alignment from Peterhead through to Fraserburgh would incur significant 'new build' (as opposed to converting the old rail alignment).
- 6.3.9 Comparing the B alignments, Alignment B2 (via Mintlaw) generates the marginally better appraisal outputs compared to Alignment B1 (Maud). B1 actually generates the larger benefits, but because it is a longer alignment its capital costs are higher. However, the context here is that Alignment B2 via Mintlaw would incur significant 'new build' (as opposed to converting the old rail alignment) which presents a key differential to consider going forward as design costs are refined and planning consent challenges are identified.
- 6.3.10 In terms of service frequency, the better performing options are those that deliver 2 tph between Ellon and Aberdeen. For the A2 alignment options and the Alignment C option this also delivers 2 tph between Peterhead and Aberdeen. There is very little difference between Options A2-2 and A2-5, which might suggest that there is not a lot of added value in doing 2 tph to Fraserburgh and 1 tph would suffice and cover the benefits on offer from serving Fraserburgh. For the Alignment B options, the option that delivers 1 tph from Fraserburgh and 1 tph from Peterhead delivers the better appraisal result.
- 6.3.11 It is worth acknowledging that the BCR values presented in this analysis represent the benefits captured through transport impacts only. They do not include Wider Economic Impacts (WEI), nor any other impacts that have the potential to be monetised (for example, Option values).

6.4 Sensitivity and Switching Values Analysis

- 6.4.1 A number of sensitivity tests have been identified and developed through the process of undertaking this scheme appraisal. These are a mix of expected tests in line with scheme appraisal and those that are bespoke to the scheme and have been formulated to provide some additional information to aid decision making going forward. In order to keep the number of tests manageable, most of the tests are based on the best performing option from each of the four route alignments considered, except where otherwise noted. In all cases, the combination of Ellon and Peterhead freight terminals (high service level scenario) has been selected to inform the sensitivity tests analysis.

Table 45 List of Sensitivity Tests

Variable	Methodology
S1 – Alignment Variations	
a) Hatton station	Consideration of the alternative alignment via the former Boddam Branch line, calling at Hatton.
b) No Pitmedden station	Consideration of the more direct route using the old alignment between Newmachar and Ellon, removing the station call at Pitmedden.
S2 – Alternative Peterhead station locations (only applied to alignments B1, B2 and C).	
a) Peterhead South	Consideration of an alternative station location on the south side of Peterhead.
b) Peterhead Central	Consideration of an alternative station location in central Peterhead (original site of station).
S3 – Alternative Growth Assumptions	
a) Optimistic (CAS High)	Application of the standard rail-industry set of alternative growth figures based on a more optimistic outlook of GDP, employment and population growth compared to the central case (18% higher rail demand than the central case by 2044).
b) Pessimistic (CAS Low)	Application of the standard rail-industry set of alternative growth figures based on a more pessimistic outlook of GDP, employment and population growth compared to the central case (14% lower rail demand than the central case by 2044).
c) Committed plus allocated housing developments	Alternative assumption whereby both committed (included in the central case) and allocated housing developments have been completed by the scheme opening year.
d) Doubling of Aberdeen car park charges	To test the impact that this potential policy-incentive could have on rail patronage. Only applied on Option A2-2 (highest rail patronage overall).
S4 – Switching Values (to obtain a BCR of 1.0)	
a) Demand	To identify the extent which demand would need to increase by in order to generate a BCR of 1.0 (uplift to benefits and revenue). All other impacts remain unchanged.
b) Capital Costs	To identify the extent which the scheme capital cost estimates would need to decrease by in order to generate a BCR of 1.0 (also impacting renewals and replacement costs). All other impacts remain unchanged.
c) Operating Costs	To identify by the extent which the operating costs would need to be reduced by in order to generate a BCR of 1.0. All other impacts remain unchanged.
S5 – Changes to Cost and/or Operational Assumptions	
a) No active travel costs	Removal of the active travel related infrastructure costs.
b) Diesel operation instead of BEMU operation	An alternative operating scenario that reflects what the costs would be if the Buchan Line service was opened sooner using existing diesel rolling stock.
c) More efficient BEMU operation with extended battery range	Recognising that future BEMU technology is likely to extend battery ranges so that operating and infrastructure efficiencies can be captured.

S1 – Alignment Variations

6.4.2 The core scheme assumed that the Buchan Line alignment would serve a new station at Pitmedden, deviating from the original line of route in order to do so. In addition, the core scheme assumed that the route to Peterhead would bypass Hatton on a new alignment that deviated from the old Boddam branch alignment (outlined in paragraphs 2.2.14 and 2.2.15).

- 6.4.3 Considering an alternative alignment to serve Hatton would lead to further incremental capital costs compared to the core scheme (longer alignment and a new station). It would also lead to a net reduction in benefits as the additional demand captured by the new station would be outweighed by the loss in patronage for through journeys (e.g. Peterhead to Aberdeen) that would now experience a slightly longer journey time. It is also worth noting that the Hatton station catchment would also be served by the proposed station at Cruden Bay. As such, the forecast BCRs would marginally reduce.
- 6.4.4 Removing Pitmedden station reduces benefits, as the lost demand at the station outweighs the increase in patronage for through journeys (e.g. Peterhead to Aberdeen) that would now experience a slightly quicker journey time. Scheme costs also reduce (no new station and a shorter alignment), but because the loss in benefits is proportionally greater than the reduction in costs, then the BCRs marginally reduce.

Table 46 Results from set of Sensitivity Tests 1 (alignment variations)

Option	PVB (£m)	PVC (£m)	NPV (£m)	BCR
Core Scheme				
A2-2	845.3	-1,400.8	-555.5	0.60
B1-2	822.7	-1,617.0	-794.3	0.51
B2-2	814.7	-1,588.2	-773.6	0.51
C2	794.2	-949.4	-155.2	0.84
a) Hatton station alignment				
A2-2	837.7	-1,422.7	-585.0	0.59
B1-2	810.9	-1,634.3	-823.4	0.50
B2-2	803.0	-1,606.6	-803.5	0.50
C2	784.8	-970.8	-186.0	0.81
b) No Pitmedden station				
A2-2	816.5	-1,381.1	-564.6	0.59
B1-2	789.9	-1,597.4	-807.6	0.49
B2-2	786.1	-1,568.6	-782.5	0.50
C2	764.4	-930.1	-165.6	0.82

S2 – Alternative Peterhead station locations

- 6.4.5 This set of sensitivity tests identifies the impacts on the scheme appraisal of alternative station locations at Peterhead. The core scheme assumes that the station would be located at Peterhead West, but CNER has also proposed alternative station locations as outlined in paragraph 2.2.3.
- 6.4.6 Peterhead South generates a marginally higher demand than the Peterhead West station location (it is worth noting the housing development at Peterhead West is not yet fully committed hence not part of the core scheme). This, plus the fact that the capital and operating cost savings from the shorter route alignment into Peterhead South, lead to improved scheme BCRs using a station at Peterhead South.
- 6.4.7 For the Peterhead Central location, the increased cost to get access to the site essentially neutralises the increased benefits associated with locating the station at the site of the original station. BCRs are very marginally improved compared to the core scheme.

Table 47 Results from set of Sensitivity Tests 2 (Peterhead station location)

Option	PVB (£m)	PVC (£m)	NPV (£m)	BCR
Core Scheme (assumes Peterhead West)				
B1-2	822.7	-1,617.0	-794.3	0.51
B2-2	814.7	-1,588.2	-773.6	0.51
C2	794.2	-949.4	-155.2	0.84
a) Peterhead South				
B1-2	824.9	-1,557.1	-732.3	0.53
B2-2	817.2	-1,528.2	-711.0	0.53
C2	796.4	-888.0	-91.7	0.90
b) Peterhead Central				
B1-2	845.7	-1,639.6	-793.9	0.52
B2-2	838.7	-1,609.8	-771.1	0.52
C2	818.5	-974.2	-155.7	0.84

S3 – Alternative Growth Assumptions

- 6.4.8 The more optimistic growth scenario (CAS High) pushes up the BCRs by around 0.1 to 0.15, with a new maximum BCR of 0.88 for Option C2. Similarly, the more pessimistic growth scenario (CAS Low) reduces the BCRs by around 0.05 to 0.1.
- 6.4.9 Alternative assumptions to the baseline such as considering all housing development schemes are built by the proposed opening year of the scheme generate circa 5% more PVB increasing the BCR by up to 0.04. The impact of doubling car parking charges in the centre of Aberdeen is greater, with PVB figures increasing by almost 10% leading to increases of the BCR of between 0.04 and 0.06.

Table 48 Results from set of Sensitivity Tests 3 (alternative growth assumptions)

Option	PVB (£m)	PVC (£m)	NPV (£m)	BCR
Core Scheme				
A2-2	845.3	-1,400.8	-555.5	0.60
B1-2	822.7	-1,558.3	-735.6	0.53
B2-2	814.7	-1,529.6	-714.9	0.53
C2	794.2	-949.4	-155.2	0.84
a) Optimistic (CAS High)				
A2-2	955.9	-1,369.9	-414.0	0.70
B1-2	927.5	-1,528.4	-600.9	0.61
B2-2	917.4	-1,499.9	-582.5	0.61
C2	891.6	-923.5	-31.9	0.97
b) Pessimistic (CAS Low)				
A2-2	756.4	-1,425.9	-669.5	0.53
B1-2	738.5	-1,582.6	-844.1	0.47
B2-2	732.1	-1,553.6	-821.5	0.47
C2	715.9	-970.5	-254.5	0.74
c) Committed plus allocated housing developments				
A2-2	873.5	-1,392.2	-518.7	0.63
B1-2	849.1	-1,550.2	-701.1	0.55
B2-2	840.7	-1,521.5	-680.9	0.55
C2	820.0	-941.6	-121.5	0.87
d) Doubling of Aberdeen car park charges				
A2-2	844.2	-1,383.1	-538.9	0.61
B1-2	863.0	-1,541.5	-678.4	0.56
B2-2	854.7	-1,512.8	-658.1	0.57
C2	835.5	-932.3	-96.8	0.90

S4 – Switching Values

- 6.4.10 In order to obtain a BCR of 1.0, demand would need to more than double across all the options that include Fraserburgh. This indicates that the incremental cost to link to Fraserburgh significantly outweighs the benefits the scheme generates when connecting Fraserburgh to the wider rail network. This contrasts with option C2, where an increase of 47% in the forecast demand would increase the BCR to 1.0.
- 6.4.11 Reducing capital costs by one-third would suffice to meet the target of 1.0 BCR in option C2. Capital costs would need to be further decreased to between 30%-40% of the current estimates to achieve a BCR of 1.0 across all the other options. It should be noted that at this stage of development of the scheme, an optimism bias of 56% for new rail infrastructure and 70% to station buildings has been applied.
- 6.4.12 Given the fact that the PVC value is dominated by the capital costs, it is not possible to reduce the operating costs to achieve a BCR of 1.0. In Option C2, the operating costs would have to reduce to virtually zero (ie by 95%) in order to achieve a BCR of 1.0.

Table 49 Results from set of Sensitivity Tests 4 (switching values)

Option	PVB (£m)	PVC (£m)	NPV (£m)	BCR	Factor
a) Demand					
A2-2	1,271.5	-1,271.5	0	1.00	1.994
B1-2	1,384.2	-1,384.2	0	1.00	2.382
B2-2	1,358.9	-1,358.9	0	1.00	2.366
C2	914.6	-914.6	0	1.00	1.319
b) Capital Costs					
A2-2	845.3	-845.3	0	1.00	0.451
B1-2	1,384.2	-1,384.2	0	1.00	0.373
B2-2	1,358.9	-1,358.9	0	1.00	0.377
C2	914.6	-914.6	0	1.00	0.779
c) Operating Costs					
A2-2	845.3	-845.3	0	1.00	n/a
B1-2	1,384.2	-1,384.2	0	1.00	n/a
B2-2	1,358.9	-1,358.9	0	1.00	n/a
C2	914.6	-914.6	0	1.00	0.360

S5 – Changes to Cost and/or Operational Assumptions

6.4.13 The costs for replacing the Formartine and Buchan cycleway are proportionally a very small element of the overall capital costs of the scheme, ranging from just 1.5% of the capital costs for Option C2 to 4% of the costs for the B1 options. Therefore, removing the costs of the cycle infrastructure from the scheme only has a marginal impact on the BCR, decreasing the PVC by up to 2% hence improving the BCR by up to 0.02.

6.4.14 The diesel based sensitivity test has been included to demonstrate how the appraisal of the scheme would be impacted if the service was to be operated by diesel rolling stock that exists today. Compared to the core scheme, the impacts would include:

- Different operating cost rates that reflect the operation of a 3-car Class 170 diesel unit (rather than a 4-car BEMU);
- More efficient rolling stock diagramming due to the fact that the requirement for charging batteries at the terminus stations is removed. This, in turn; reduces the number of trainsets required to operate the service;
- No requirement for OLE.

6.4.15 This test improves the PVC of the scheme by between 7%-9% showing the impact shorter and less train units required would have in the scheme appraisal results. The resulting BCRs would increase by circa 0.05 with C2 option sitting above 0.9.

6.4.16 The more efficient BEMU operation test has been specified to acknowledge that BEMU technology is advancing rapidly, in particular in terms of battery ranges and charging time. A battery range of 30 miles was agreed with Scotland's Railway for the purposes of informing this appraisal, but already it is worth noting that Great Western Railway has recently conducted a trial using their Class 230 BEMU and obtained 86 miles on one charge, whilst in Germany new Stadler Flirt Akku BEMU trains are being timetabled with 50 mile ranges (but are designed for a 90 mile range). This test therefore assumes that the BEMUs on the Buchan Line would have a sufficient range to remove the need for OLE infrastructure and that rapid charging would be available at termini so that more efficient rolling stock diagramming could be adopted that would reduce the number of trainsets required.

6.4.17 Alternative cost assumptions directly linked to the efficiency of battery-operated rolling stock (forecast to improve significantly within the next 15 years) might impact quite significantly in the scheme economic valuation. If battery use/re-charging becomes efficient enough to reduce the required layover times mirroring what a DMU operation could achieve, PVB would be uplifted by circa 10% (combined with a marginal decrease in the PVC due to lower mobilisation costs due to lower number of trainsets required), with the BCR increasing by 0.04 in those scenarios where optimal diagramming is prevented due to current BEMU minimum requirements for battery usage/recharging.

Table 50 Results from set of Sensitivity Tests 5 (changes to costs/operational assumptions)

Option	PVB (£m)	PVC (£m)	NPV (£m)	BCR
Core Scheme				
A2-2	845.3	-1,400.8	-555.5	0.60
B1-2	822.7	-1,558.3	-735.6	0.53
B2-2	814.7	-1,529.6	-714.9	0.53
C2	794.2	-949.4	-155.2	0.84
a) Removal of the active travel costs				
A2-2	845.3	-1,383.9	-538.6	0.61
B1-2	822.7	-1,512.7	-689.9	0.54
B2-2	814.7	-1,506.2	-691.5	0.54
C2	794.2	-938.9	-144.7	0.85
b) Diesel instead of BEMU				
A2-2	845.3	-1,302.5	-457.2	0.65
B1-2	822.7	-1,450.4	-627.7	0.57
B2-2	814.7	-1,421.9	-607.2	0.57
C2	794.2	-866.0	-71.8	0.92
c) More efficient BEMU				
A2-2	845.3	-1,354.8	-509.5	0.62
B1-2	822.7	-1,489.3	-666.6	0.55
B2-2	814.7	-1,460.6	-645.9	0.56
C2	794.2	-903.4	-109.2	0.88

Combined Sensitivity Test

6.4.18 In practice no one sensitivity test works in isolation and by combining certain sensitivity tests it is possible to develop an improved understanding of what the scheme's potential Value for Money case might be. In the exercise below we have selected a number of variables which might be considered to be reasonably prudent assumptions, which when combined start to develop a picture around the potential for the scheme to generate a BCR greater than 1. On that basis the following combined test has been developed and appraised to serve as an illustration:

- Option C2, combined with a freight scenario with Ellon and Peterhead terminals and a medium level of service;
- Peterhead South station location (S2a);
- All housing developments assumed to be completed (S3c);
- Removal of active travel infrastructure costs (S5a); and

- Increased efficiency of BEMU leading to reduced charging times / less units required (S5c).

6.4.19 Combining these variables would generate a BCR of 0.80.

6.4.20 The level of optimism bias applied in this appraisal reflects the design stage that the scheme is currently at (Level 1/2). Moving to the next level of design (Level 3) would lower the level of optimism bias applied to the scheme costs. As a result of applying a Level 3 optimism bias the BCR would move to 0.94. Should it be possible through moving to the next level of design to find capital cost savings of (say) 10% compared to those used in this appraisal, then the BCR would move to 1.02.

6.4.21 This example of how the BCR for the scheme can develop through changing circumstances and updates to input variables, provides an illustration of the scope for the scheme BCR to move towards achieving a more positive BCR in the future. Other variables may well come in to play such as increased freight usage or a better than assumed exogenous growth impact. Equally however, it should be acknowledged that downside impacts could also occur.

Annex A Housing Developments

Table 51 Combination of Sensitivity Test

Catchment	Settlement	Local_Admi	FID	Opportunity	Type	Houses*	Status
Fraserburgh	Rathen	Banff & Buchan	157	OP1	Housing Land	10	14
Fraserburgh	Memsie	Banff & Buchan	179	OP2	Housing Land	20	20
Fraserburgh	Fraserburgh	Banff & Buchan	231	OP2	Housing Land	590	233
Fraserburgh	Fraserburgh	Banff & Buchan	122	OP1	Mixed Use Types	600	600
Strichen	Strichen	Buchan	112	OP2	Housing Land	22	22
Maud	New Deer	Buchan	101	OP2	Housing Land	7	7
Maud	Maud	Buchan	28	OP3	Housing Land	10	10
Maud	Maud	Buchan	170	OP2	Housing Land	30	30
Mintlaw	Mintlaw	Buchan	80	OP3	Housing Land	20	10
Mintlaw	Fetterangus	Buchan	68	OP1	Housing Land	26	9
Mintlaw	Longside	Buchan	171	OP1	Housing Land	30	30
Mintlaw	Mintlaw	Buchan	257	OP4	Housing Land	34	73
Mintlaw	Fetterangus	Buchan	168	OP3	Housing Land	49	49
Mintlaw	Stuartfield	Buchan	59	OP1	Housing Land	75	114
Mintlaw	Mintlaw	Buchan	121	OP1	Mixed Use Types	500	500
Mintlaw	Mintlaw	Buchan	49	OP2	Housing Land	600	600
Peterhead	Peterhead	Buchan	51	OP2	Housing Land	210	240
Peterhead	Peterhead	Buchan	22	OP3	Housing Land	225	225
Peterhead	Peterhead	Buchan	116	OP1	Mixed Use Types	1265	800
Hatton/Cruden Bay	Hatton	Buchan	33	OP2	Housing Land	34	34
Hatton/Cruden Bay	Cruden Bay	Buchan	125	OP1	Mixed Use Types	200	200

Catchment	Settlement	Local_Admi	FID	Opportunity	Type	Houses*	Status
Ellon	Ellon	Formartine	146	OP2	Mixed Use Types	0	60
Ellon	Ellon	Formartine	90	OP3	Housing Land	10	10
Ellon	Ellon	Formartine	118	OP1	Mixed Use Types	980	980
Pitmedden	Pitmedden	Formartine	227	OP4	Mixed Use Types	10	10
Pitmedden	Udny Station	Formartine	135	OP1	Housing Land	35	43
Pitmedden	Pitmedden	Formartine	161	OP1	Housing Land	64	64
Pitmedden	Pitmedden	Formartine	264	OP3	Housing Land	68	68
Pitmedden	Pitmedden	Formartine	180	OP2	Housing Land	100	100
Newmachar	Newmachar	Garioch	61	OP2	Housing Land	130	130
Newmachar	Newmachar	Garioch	127	OP1	Housing Land	340	340

* Estimate based on available information (not considering developments with constraints)

Annex B STAG Appraisal Summary Outputs

Table 52 Option A2-2 (Fraserburgh + Peterhead + Ellon: High)

Buchan Rail Corridor - Feasibility Study			AECOM
Note: All values shown in £'000s, shown in 2010 prices			
Environment	Value	PV	Calculation
Global Air Quality - CO2	£ 141,330	PV1	
Physical Fitness	£ -	PV2	
Monetised Summary	£ 141,330		PV1 + PV2
Monetary Impact Ratio	0.10	Ratio	(PV1 + PV2) / (PVC x -1)
Safety	Value	PV	Calculation
Accidents - Total Discounted Savings	£ 49,848	PV3	
Monetised Summary	£ 49,848		PV3
Monetary Impact Ratio	0.04	Ratio	PV3 / (PVC x -1)
Economy (Transport Economic Efficiency)	Value	PV	Calculation
User Benefits			
Travel Time	£ 767,710	PV4	
< - 5 mins			
-5 to -2 mins			
> -2 to 0 mins			
0 to <+2mins			
+2 to +5 mins			
> 5 mins			
User Charges		PV5	
Vehicle Operating Costs		PV6	
Private Sector Operator Impacts	Value	PV	Calculation
Investment Costs		PV7	
Operating & Maintenance Costs		PV8	
Revenues	-£ 1,773	PV9	
Grant/Subsidy payments	£ -	PV10	
Monetised Summary	£ 765,937	PV11	PV4 + PV5 + PV6 + PV7 + PV8 + PV9 + PV10
Monetary Impact Ratio	0.55	Ratio	PV11 / (PVC x -1)
Economy (Wider Economic Benefits)	Value	PV	Calculation
Agglomeration economies (WB1)		PV12	
Increased output competitive markets (WB3)		PV13	
Labour supply (WB4)		PV14	
Monetised Summary	£ -	PV15	PV12 + PV13 + PV14
Monetary Impact Ratio	0.55	Ratio	(PV11 + PV15) / (PVC x -1)
Cost to Public Sector	Value	PV	Calculation
Public Sector Investment Cost	-£ 1,206,670	PV16	
Public Sector Operating & Maintenance Costs	-£ 322,504	PV17	
Grant/Subsidy Payments	£ -	PV18	PV10 x -1
Revenues	£ 129,016	PV19	
Taxation impacts	-£ 85,543	PV20	
Cost to Funding Agency		PV21	
Monetised Summary	Value	PV	Calculation
Present Value of Transport Benefits	£ 871,573	PVB	PV1 + PV2 + PV3 + PV11 + PV20
Present Value of Cost to Government	-£ 1,400,158	PVC	PV16 + PV17 + PV18 + PV19
Net Present Value	-£ 528,586	NPV	PVB + PVC
Benefit to Cost Ratio	Value	PV	Calculation
Benefit-Cost to Government Ratio	0.62	Ratio	PVB / (PVC x -1)
Benefit-Cost to Government Ratio (including WEBs)	0.62	Ratio	(PVB + PV15) / (PVC x -1)
Benefit-Cost to Funding Agency Ratio	-	Ratio	PVB / (PV21 x -1)

Table 53 Option B1-2 (Fraserburgh + Peterhead + Ellon: High)

Buchan Rail Corridor - Feasibility Study			AECOM
Note: All values shown in £'000s, shown in 2010 prices			
Environment	Value	PV	Calculation
Global Air Quality - CO2	£ 141,051	PV1	
Physical Fitness	£ -	PV2	
Monetised Summary	£ 141,051		PV1 + PV2
Monetary Impact Ratio	0.09	Ratio	(PV1 + PV2) / (PVC x -1)
Safety	Value	PV	Calculation
Accidents - Total Discounted Savings	£ 48,683	PV3	
Monetised Summary	£ 48,683		PV3
Monetary Impact Ratio	0.03	Ratio	PV3 / (PVC x -1)
Economy (Transport Economic Efficiency)	Value	PV	Calculation
User Benefits			
Travel Time	£ 745,512	PV4	
< - 5 mins			
-5 to -2 mins			
> -2 to 0 mins			
0 to <+2mins			
+2 to +5 mins			
> 5 mins			
User Charges		PV5	
Vehicle Operating Costs		PV6	
Private Sector Operator Impacts	Value	PV	Calculation
Investment Costs		PV7	
Operating & Maintenance Costs		PV8	
Revenues	-£ 1,053	PV9	
Grant/Subsidy payments	£ -	PV10	
Monetised Summary	£ 744,459	PV11	PV4 + PV5 + PV6 + PV7 + PV8 + PV9 + PV10
Monetary Impact Ratio	0.46	Ratio	PV11 / (PVC x -1)
Economy (Wider Economic Benefits)	Value	PV	Calculation
Agglomeration economies (WB1)		PV12	
Increased output competitive markets (WB3)		PV13	
Labour supply (WB4)		PV14	
Monetised Summary	£ -	PV15	PV12 + PV13 + PV14
Monetary Impact Ratio	0.46	Ratio	(PV11 + PV15) / (PVC x -1)
Cost to Public Sector	Value	PV	Calculation
Public Sector Investment Cost	-£ 1,460,452	PV16	
Public Sector Operating & Maintenance Costs	-£ 280,770	PV17	
Grant/Subsidy Payments	£ -	PV18	
Revenues	£ 124,914	PV19	
Taxation impacts	-£ 85,200	PV20	
Cost to Funding Agency		PV21	
			PV10 x -1
Monetised Summary	Value	PV	Calculation
Present Value of Transport Benefits	£ 848,993	PVB	PV1 + PV2 + PV3 + PV11 + PV20
Present Value of Cost to Government	-£ 1,616,309	PVC	PV16 + PV17 + PV18 + PV19
Net Present Value	-£ 767,316	NPV	PVB + PVC
Benefit to Cost Ratio	Value	PV	Calculation
Benefit-Cost to Government Ratio	0.53	Ratio	PVB / (PVC x -1)
Benefit-Cost to Government Ratio (including WEBs)	0.53	Ratio	(PVB + PV15) / (PVC x -1)
Benefit-Cost to Funding Agency Ratio	-	Ratio	PVB / (PV21 x -1)

Table 54 Option B2-2 (Fraserburgh + Peterhead + Ellon: High)

Buchan Rail Corridor - Feasibility Study			AECOM
Note: All values shown in £'000s, shown in 2010 prices			
Environment	Value	PV	Calculation
Global Air Quality - CO2	£ 140,953	PV1	
Physical Fitness	£ -	PV2	
Monetised Summary	£ 140,953		PV1 + PV2
Monetary Impact Ratio	0.09	Ratio	(PV1 + PV2) / (PVC x -1)
Safety	Value	PV	Calculation
Accidents - Total Discounted Savings	£ 48,276	PV3	
Monetised Summary	£ 48,276		PV3
Monetary Impact Ratio	0.03	Ratio	PV3 / (PVC x -1)
Economy (Transport Economic Efficiency)	Value	PV	Calculation
User Benefits			
Travel Time	£ 737,795	PV4	
< - 5 mins			
-5 to -2 mins			
> -2 to 0 mins			
0 to <+2mins			
+2 to +5 mins			
> 5 mins			
User Charges		PV5	
Vehicle Operating Costs		PV6	
Private Sector Operator Impacts	Value	PV	Calculation
Investment Costs		PV7	
Operating & Maintenance Costs		PV8	
Revenues	-£ 975	PV9	
Grant/Subsidy payments	£ -	PV10	
Monetised Summary	£ 736,820	PV11	PV4 + PV5 + PV6 + PV7 + PV8 + PV9 + PV10
Monetary Impact Ratio	0.46	Ratio	PV11 / (PVC x -1)
Economy (Wider Economic Benefits)	Value	PV	Calculation
Agglomeration economies (WB1)		PV12	
Increased output competitive markets (WB3)		PV13	
Labour supply (WB4)		PV14	
Monetised Summary	£ -	PV15	PV12 + PV13 + PV14
Monetary Impact Ratio	0.46	Ratio	(PV11 + PV15) / (PVC x -1)
Cost to Public Sector	Value	PV	Calculation
Public Sector Investment Cost	-£ 1,434,023	PV16	
Public Sector Operating & Maintenance Costs	-£ 277,324	PV17	
Grant/Subsidy Payments	£ -	PV18	
Revenues	£ 123,809	PV19	
Taxation impacts	-£ 85,101	PV20	
Cost to Funding Agency		PV21	
			PV10 x -1
Monetised Summary	Value	PV	Calculation
Present Value of Transport Benefits	£ 840,949	PVB	PV1 + PV2 + PV3 + PV11 + PV20
Present Value of Cost to Government	-£ 1,587,538	PVC	PV16 + PV17 + PV18 + PV19
Net Present Value	-£ 746,589	NPV	PVB + PVC
Benefit to Cost Ratio	Value	PV	Calculation
Benefit-Cost to Government Ratio	0.53	Ratio	PVB / (PVC x -1)
Benefit-Cost to Government Ratio (including WEBs)	0.53	Ratio	(PVB + PV15) / (PVC x -1)
Benefit-Cost to Funding Agency Ratio	-	Ratio	PVB / (PV21 x -1)

Table 55 Option C-2 (Peterhead + Ellon: High)

Buchan Rail Corridor - Feasibility Study			AECOM
Note: All values shown in £'000s, shown in 2010 prices			
Environment	Value	PV	Calculation
Global Air Quality - CO2	£ 132,117	PV1	
Physical Fitness	£ -	PV2	
Monetised Summary	£ 132,117		PV1 + PV2
Monetary Impact Ratio	0.14	Ratio	(PV1 + PV2) / (PVC x -1)
Safety	Value	PV	Calculation
Accidents - Total Discounted Savings	£ 45,659	PV3	
Monetised Summary	£ 45,659		PV3
Monetary Impact Ratio	0.05	Ratio	PV3 / (PVC x -1)
Economy (Transport Economic Efficiency)	Value	PV	Calculation
User Benefits			
Travel Time	£ 696,152	PV4	
< - 5 mins			
-5 to -2 mins			
> -2 to 0 mins			
0 to <+2mins			
+2 to +5 mins			
> 5 mins			
User Charges		PV5	
Vehicle Operating Costs		PV6	
Private Sector Operator Impacts	Value	PV	Calculation
Investment Costs		PV7	
Operating & Maintenance Costs		PV8	
Revenues	-£ 1,106	PV9	
Grant/Subsidy payments	£ -	PV10	
Monetised Summary	£ 695,046	PV11	PV4 + PV5 + PV6 + PV7 + PV8 + PV9 + PV10
Monetary Impact Ratio	0.73	Ratio	PV11 / (PVC x -1)
Economy (Wider Economic Benefits)	Value	PV	Calculation
Agglomeration economies (WB1)		PV12	
Increased output competitive markets (WB3)		PV13	
Labour supply (WB4)		PV14	
Monetised Summary	£ -	PV15	PV12 + PV13 + PV14
Monetary Impact Ratio	0.73	Ratio	(PV11 + PV15) / (PVC x -1)
Cost to Public Sector	Value	PV	Calculation
Public Sector Investment Cost	-£ 814,943	PV16	
Public Sector Operating & Maintenance Costs	-£ 242,696	PV17	
Grant/Subsidy Payments	£ -	PV18	PV10 x -1
Revenues	£ 108,213	PV19	
Taxation impacts	-£ 78,629	PV20	
Cost to Funding Agency		PV21	
Monetised Summary	Value	PV	Calculation
Present Value of Transport Benefits	£ 794,191	PVB	PV1 + PV2 + PV3 + PV11 + PV20
Present Value of Cost to Government	-£ 949,426	PVC	PV16 + PV17 + PV18 + PV19
Net Present Value	-£ 155,235	NPV	PVB + PVC
Benefit to Cost Ratio	Value	PV	Calculation
Benefit-Cost to Government Ratio	0.84	Ratio	PVB / (PVC x -1)
Benefit-Cost to Government Ratio (including WEBs)	0.84	Ratio	(PVB + PV15) / (PVC x -1)
Benefit-Cost to Funding Agency Ratio	-	Ratio	PVB / (PV21 x -1)

Appendix C : Freight Technical Note

Freight Technical Note

Client name Campaign for North East Rail / Aberdeen & Grampian Chamber of Commerce	Project name Buchan Sustainable Transport Study	Date 28 March 2024	Project number 60716023
Prepared by Michael Whittaker	Checked by João Ribeiro	Verified by Andy Coates	Approved by Richie Fraser

1. Introduction

This appendix sets out a summary of the evidence which has been gained during the stakeholder engagement phase of the study which has informed the proposed freight scenarios that the report has set out by terminal (see Appendix B). This is then followed by a brief summary of how this information translated into customer / market assessment, number of trains and reduction in number of lorry movements based on assumptions of the demand locations for these movements.

2. Evidence / Stakeholder Engagement

An extensive specific tailored freight stakeholder consultation exercise was undertaken as part of this commission. Fuller details on this process have been covered in the Stakeholder Engagement chapter of the Case for Change report.

A major Scottish Third-Party Logistics Company was of the view that the market potential of the corridor was a long and thin one and that there was a trade in-balance of imports over exports which made the commercials of the further north you went harder as the ability to get a backload was necessarily more limited. That said, provision for freight terminals was essential to have the strategic capability for mode shift from road to rail especially for the aggregation of demand for long distance trunk haul movements to the Central Belt and beyond. The Third Party Logistics Operator noted that most northbound goods into the region were retail-based there were significant flows from food and drink sectors particularly with respect to Beer and Frozen Fish. Other commodities included seafood, ice cream, soups, seasonal agriculture products such as Seed Potatoes.

All stakeholders consulted recognised the potential that rail freight could play to varying degrees of effectiveness in their individual supply chains but there was a consensus that the location of the potential terminals and the commerciality of the rail freight offer was critical to making the case.

Within the food manufacturing sector, North East Scotland is home to several well-known and in some cases international food and drink brands. Relative to their competitors these companies face the challenges of additional distance to their main markets – this has the potential to become an increasing challenge over time particularly with respect to carbon reporting in their supply chains as well as the cost of goods movement into their customer's supply chains. Each of the stakeholders were interested in the use of rail. It was important to note the differences between the operation of road and rail haulage – frequent lorry movements versus a smaller number of trains. This drives a different operation of fewer but more efficient movements. This is both a vice and a virtue at the same time. A train can carry up to 76 trucks (Bulks) and 30 intermodal containers per train but with one driver so there is an efficiency / quantity trade off. A freight train requires a significant investment in a freight terminal and equipment with a long life (multiple decades with a long lead time) vs a HGV (Heavy Goods Vehicles) which can be bought in a brief period and last approximately 10 years. Adjusting the supply chain to accommodate fewer train departures versus an on-demand road operation is a challenge but can only be an option if a suitable enabling terminal can be provided to aggregate the demand.

What was notable in the interviews conducted was a willingness to consider rail freight in conjunction with customers supply chains (mainly in England and beyond) to ensure that the end-to-end connections were as efficient as possible and where the manufacturing facility / warehouse was next to a rail head then this was an essential component to make rail freight a viable option for the trunk haul. This was particularly noted by Aberdeenshire Council with respect to the location of land allocations for such terminals / associated manufacturing and warehousing being so critical to the rail offer.

Oil and Gas sector related goods were not seen, in the main, as a viable option for transport by rail freight over the short distance from Aberdeen to Peterhead. However, key players saw that there might be a role for some volumes off the back of other flows of goods to Peterhead in particular.

Of significant interest was the conversations with organisations involved with Project Acorn and the wider Carbon Capture and Storage sector. What became apparent was a potential opportunity for the transport of Carbon Dioxide from other carbon emitters in Scotland to the terminal site at St Fergus. This demand element is known as the non-pipeline demand segment being that proportion which as the name suggests is not moved by pipeline. The dominant volumes were expected to move from the Central Belt although not exclusively as sectors such as Whisky were dispersed and harder to aggregate. There was significant uncertainty in the potential volume and decarbonisation pathways for the different sectors and this is reflected in the wide demand bands for this low value commodity.

With respect to the Ports, in addition to the potential for fish traffic in certain cases (frozen particularly), alternative fuels (clean fuels) were seen as showing potential along with Carbon Dioxide as noted above. Having a rail connection was on balance seen as advantageous however significant uncertainty on the precise pathway of energy transition was not helpful in being able to provide a more certain view on the cargos that rail could be viable for.

3. Translation of Evidence into Rail Freight Scenarios by Terminal

For the purposes of this early-stage demand appraisal, a scenario-based approach was chosen to reflect the variation in quantity of non-pipeline CO₂ which could be shipped to the region (assumed from the Central Belt – Mossend loading point). The number of trains demand was equated from each of the two sectors (Intermodal and Bulk (Carbon Dioxide)) in terms of the number of existing movements, based on information provided from stakeholders or in the case of CCUS from estimates of the amount of CO₂ that required to be moved by HGV and converted into trains. A view on the modal shift % was taken which was used to derive the number of lorry movements which could be removed from the road network based on several assumptions as set out in the previous section based on several proxy demand points. These being as follows:

- Terminals at Fraserburgh, St Fergus, Peterhead, and Ellon
- Central Belt – Mossend / Coatbridge Freight Terminals
- England – Daventry International Freight Terminal (DIRFT)

Several other assumptions such as the train length (capacity of the train was taken) were made, with a train assumed at 28 wagons with 1 45ft swapbody (Supermarket) or 1 40 or 45ft ISO Container; CO₂ HGVs not currently running; rail freight potential and volumes based on market soundings during engagement.

With respect to the low, medium, and high scenarios as set out these were based on the stakeholders view of future demand from their business plans combined with an AECOM view on additional 3rd party traffic which could be attracted to rail. Where numbers were provided, a conservative view of the mode shift potential was set out in the assumptions made. In the case of CO₂, this range was drawn from the relevant stakeholders with the caveat that significant uncertainty exists given (i) the number of years in advance that the rail scheme is assumed to come into operation; and (ii) the progress of decarbonisation pathways for different industrial sectors as to how much CO₂ will need to be moved. Nonetheless, it was clear from the evidence presented that subject to commercial viability there is the potential for significant volumes of CO₂ to be moved by rail.

