Northumberland Line

Option Selection Report

Northumberland County Council

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Quality information

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Acceptance

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Table of Contents

Figures

Tables

EXECUTIVE SUMMARY

Overview

The following report documents the development of the Northumberland Line project from Strategic Outline Business Case (SOBC) to Outline Business Case (OBC) following a tried and tested process of "optioneering" which developed a series of preferred options for the suite of interventions that make up the scheme. This process has led to a much greater understanding of the existing asset base and the proposed design solutions which has ultimately generated a marginal improvement in overall Anticipated Final Cost (AFC) and anticipated journey times.

At the previous SOBC stage, the delivery strategy proposed a four phased approach, however this is now expected to be delivered as two phases (See ***Section 3.4*** for detailed breakdown of phases**). This is subject to anticipated funding being secured in line with the overall development programme, and legal consents and planning consents being secured. The proposed 2 phased scheme will see Phase 1 delivered for the May 2023 timetable change and operable for driver training several months before that. Phase 2 would be delivered under a different funding stream and programme to be agreed, but it is envisaged that Phase 2 will be operational by January 2025. (**A detailed programme for delivery across the 2 phases can be found in ***Appendix R)***

Following completion of the Option Selection Process (detailed in the following pages and appendices), the project team considers the scheme is viable within the timescales and budget that have been set by the promoter and client, Northumberland County Council (NCC).

Background

The overall purpose of this project is to stimulate economic regeneration and community engagement in the areas surrounding the Northumberland Line by providing a reliable, rapid public transport connection from the larger towns along the old Ashington, Blyth and Tyne Railway route into Newcastle Central. Future rail paths could be created beyond Newcastle Central, but this is out with the reach of this project.

The expected outcomes of this include improved access for local people to jobs and recreational activities primarily in Newcastle but also Ashington and other key locations along the route such as Blyth, Bedlington and The Cobalt Business Park. Access to these areas will be enjoyed by several towns and villages along the route, including Newsham, Seaton Deleval, Bebside, New Hartley, Seghill who will all benefit from the six new stations strategically located along the route to serve these communities. The attractiveness of this accessibility is expected to increase demand for housing, and local investment by local, regional, national and international organisations.

The top-level working objectives for the project remain as developed for the original study and are:

- Journey time from Ashington to Newcastle of less than, or as close as practicable to, 30 minutes.
- Existing freight paths to remain unaffected but with improvements in terms of efficiencies and journey time.
- 6 New stations at Ashington, Bedlington, Blyth Bebside, Newsham, Seaton Delaval and Northumberland Park
- Half-hourly passenger services all day
- Safeguarding for future expansion of the route and services

It was determined during the previous phase that – using Class 158 rolling stock for reference – it would not be practicable to achieve the aspirational 30-minute journey times. Nevertheless, journey times of around 35 minutes in each direction were found viable during the SOBC and accepted by the Project Steering Group as the new target to achieve. Future improvements could be gained from faster accelerating rolling stock and bring the project closer to the original aims.

The Technical Summary Report in the SOBC identified locations for the six new stations, and estimated costs and journey times based on a four-phase delivery strategy. This was deemed sufficient to support the SOBC submission to the Department for Transport (DfT) for the 'Decision to Develop' stage gate within the Rail Network Enhancements Pipeline (RNEP) process. (see ***Figure 10 - Rail Network Enhancements Programme (DfT: March 2018)***)

At SOBC the team was limited by the information provided in the outputs of previous studies and publicly available documents or site access. In this latest OBC stage, the Asset Protection Agreement between Network Rail and NCC enabled the team to obtain records data, meet with Network Rail Route Asset Managers (RAMs) and carry out inspections on the railway. Although still incomplete, the step-change in base data to work from has enabled a much greater understanding of the presence, type, condition and plans for the various assets along the Northumberland Line.

In addition, a public consultation exercise, environmental surveys and preliminary engagement with landowners along the route have provided a broader context for the development and selection of sub-options for stations and other route-wide interventions.

Although this is an Option Selection Report, it is important to note that the purpose of this report is not to choose between different routes, since the existing alignment is fixed and there is no appetite to incur the disruption, property purchase and cost that would result from developing new routes. Similarly, the selection of broad station locations has been made in earlier stages, so this report is primarily concerned with refining the station locations and layouts, including car parking arrangements, and confirming the rail system infrastructure to deliver the journey times expected while meeting appropriate safety and other critical requirements.

Methodology

In parallel with enhanced data collection, the project team embarked upon a series of workshops to challenge previous decisions based on emerging information, and then to develop and test each proposal against emerging requirements obtained through stakeholder engagement exercises.

Workshops included relevant discipline design experts, along with representatives from NCC (the client), Network Rail (the infrastructure owner), and Morgan Sindall (a major UK contractor engaged through an Early Contractor Involvement (ECI)). This collaborative and inclusive approach ensured the engineering, operational, planning, Land and environmental decisions were well informed to provide a robust and well tested preferred solution to the various project interventions.

Wider consultation and elicitation of specific requirements was achieved through ongoing project steering group and project board meetings, an initial public consultation exercise, as well as direct discussions with;

- Northern Rail as the representative Train Operating Company (TOC)
- DB Cargo and GB Rail freight as the local Freight Operating Companies (FOCs)
- the Office for Rail and Road (ORR) as the Regulator
- the Department for Transport for its experience and guidance on station opportunities
- NEXUS as the operator of the neighbouring Metro Network between the East Coast Main Line (ECML) and Northumberland Park station
- Northumberland County Council as the client and promoter of the scheme and the authority through which most of the route will pass.
- North Tyneside Council (NTC) as the local authority through which the southernmost section of the route will pass and where Northumberland Park Station will be located
- North East Transport Strategy Unit in terms of alignment with the Transforming Cities Funding
- South East Northumberland Rail Users Group (SENRUG) as a representative of potential rail passengers
- landowners of particularly strategic sites
- other stakeholders.

Through development of design ideas and discussions with organisations and individuals who may be affected by the scheme, the project team has developed a clearer understanding of both the requirements to be met and the constraints within which they must be achieved. In most cases the team has been able to test the proposed solutions with relevant stakeholders and reflect emerging concerns in the selection or development of sub-options, though this work will be refined further in the next stage. This has been undertaken in a collaborative workshop environment with attendees presenting work in progress and peer reviewing across disciplines to ensure integration. This report captures the output of the workshops.

The proposed solutions have been developed for pricing and quantified risk assessment purposes to update the Anticipated Final Cost (AFC) for the scheme and its component Phases. Similarly, a more detailed journey time analysis was undertaken using the industry standard software Railsys rather than the simplified spreadsheet approach that was more appropriate at SOBC, and this informs the demand figures used to calculate the benefits for the OBC.

Project Phasing

The diagrams below (***Figure 1, Figure 2 and Figure 3***) illustrate the current 2 phased strategy in schematic format. The four-phased approach in the SOBC know as Infrastructure Phases (IP1, IP2, etc) was refined by effectively combining IP 2-4 into the new Phase 2. This is because of the extent of signalling work initially proposed in IP3 now needed to be brought forward into the new Phase 1. The remaining works in IP3 and IP4 were then relatively small packages of work and considered likely to be bundled into Phase 2 works for efficient procurement and minimise disruption to what will by then be a live passenger railway environment.

Phase 2 remains primarily defined by works that may require a full Transport and Works Act Order (TWAO) and thus are unlikely to be deliverable within the TCF timescales, and/or are lower priority features that would otherwise increase project costs beyond what the Phase 1 budget is likely to be able to bear. If the Phase 1 budget were to increase, and land negotiations concluded without the need for a TWAO, then it is possible that some Phase 2 elements could be brought forward into Phase 1.

There would also be an opportunity to deliver Phase 2 in smaller sub phases if the need arises. This would allow for the additional stations to be constructed as and when legal powers are obtained in advance of the implementation of the full half-hourly service pattern or independently of each other at different times if capital expenditure were constrained in the future.

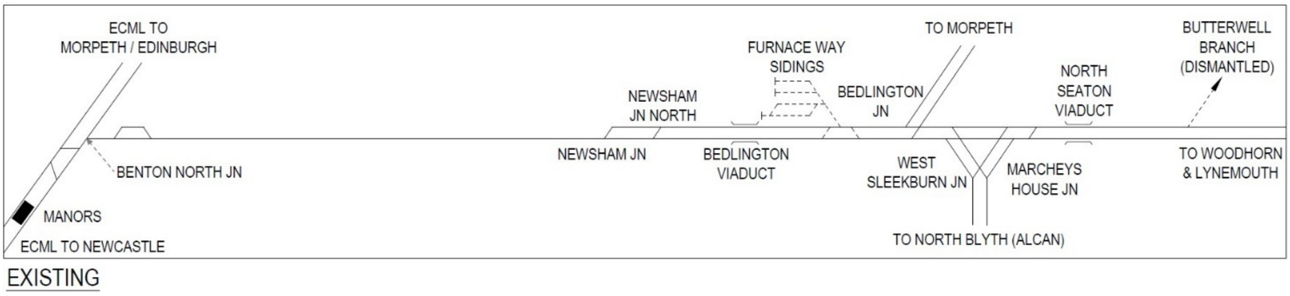


Figure 1 - Existing Schematic

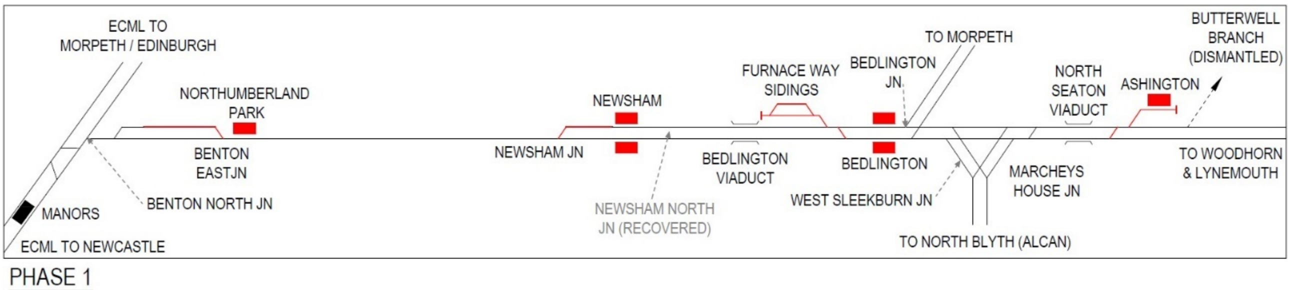


Figure 2 - Phase 1 Schematic

Phase 1 sees the introduction of 4 new stations at Northumberland Park, Newsham, Bedlington and Ashington, and new track for double track extensions east of Benton North Junction and south of Newsham. A new turnback platform siding at Ashington, the reinstatement of Furnace way sidings and significant signalling improvements and enhancements complete the major interventions of Phase 1. Other track, infrastructure and systems works are necessary, particularly to the single line section, to upgrade level crossings, and improve linespeeds.

This work enables hourly services, plus an additional train in the peak, of 32-34 minutes between Ashington and Newcastle Central dependent on how much of the linespeed improvements can be implemented in Phase 1. This is based on average 45 second dwell times and Class 158 Diesel Multiple Unit (DMU) vehicles. Some preliminary work on Class 17X vehicles suggests journey times could be 1 minute quicker.

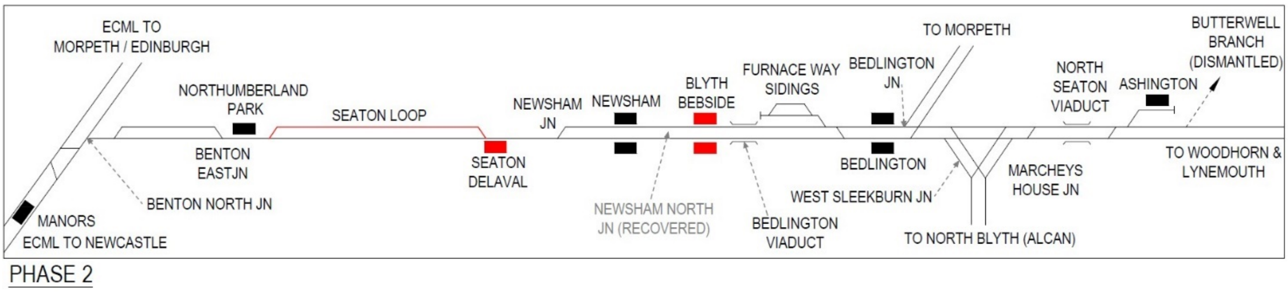


Figure 3 - Phase 2 Schematic

Phase 2 provides the two additional stations, at Seaton Delaval and Blyth Bebside which are subject to the TWAO and so could not be achieved within the timescales of Phase 1. A passing loop south of Seghill between Northumberland Park and Seaton Delaval stations completes the major interventions required at Phase 2. The passing loop is required to enable the hourly freight path to continue when passenger lines step up to half-hourly intervals throughout the day. Remaining line speed improvements partially offset the increased time due to two more station stops and result in 34-minute journey times.

Stations

The selection of stations for Phase 1 and Phase 2 has remained the same and the layout of each station has been comprehensively challenged and refined, but these are all still subject to availability of land through the appropriate legal consents and acquisition processes. The ability to access the railway in this OBC stage has allowed better identification of local constraints with the result that the current situation for each station is as follows:

- Northumberland Park station (Phase 1) has remained in essentially the same position
- Seaton Delaval (Phase 2) has remained broadly in the same position, but is now placed adjacent to the existing track which is now not being shifted for a future passing loop in this location
- Newsham station (Phase 1) now has both platforms on the south side of the level crossing, but each is moved further south than previously indicated to reduce barrier down times at the level crossing
- Blyth Bebside station (Phase 2) location has moved south of the level crossing to take advantage of land currently for sale and reduce traffic risks at the level crossing
- Bedlington station (Phase 1) has remained in essentially the same location
- Ashington station (Phase 1) has remained in broadly the same location but has changed to an offline arrangement to avoid the need for a northern turnback with a difficult crossing arrangement

During the OBC, it was identified that it may be possible to develop the station environment in such a way as to attract or enable Economic Development Opportunities to further deliver the project objective of stimulating economic regeneration. These would be buildings visually connected to the railway stations but physically and commercially separate with the aim of providing employment or training opportunities with excellent connectivity.

The concept has met with wide support in principle, and NCC has asked for assistance from Advance Northumberland, an arm's length wholly-owned subsidiary of NCC with responsibility for management and exploitation of NCC's property assets for economic development. The exploration of Economic Development Opportunities at the stations is an exercise run in parallel with, though separate to, the OBC. This enables the design of station layouts to recognise future potential use of space for these purposes and create appropriate passive provision at this early stage.

Extracts of the drawings showing each of the preferred station options are shown and briefly discussed below.

<u>Northumberland Park station</u> (***Figure 4***) is a single faced platform adjacent to the existing single Network Rail line between Algernon Drive Overbridge and the A186 Overbridge. Access is off the Algernon Drive overbridge to the east via stairs and lift, or via a new pathway into a planned housing development to the west. The platform is positioned to provide interchange with the adjacent metro station, but also to reduce risk of construction over an area to the east where a sink hole opened up under the metro lines. The design limits the degree to which the platform and related infrastructure need to cut into the existing cutting slope between the railway and the housing to the north.

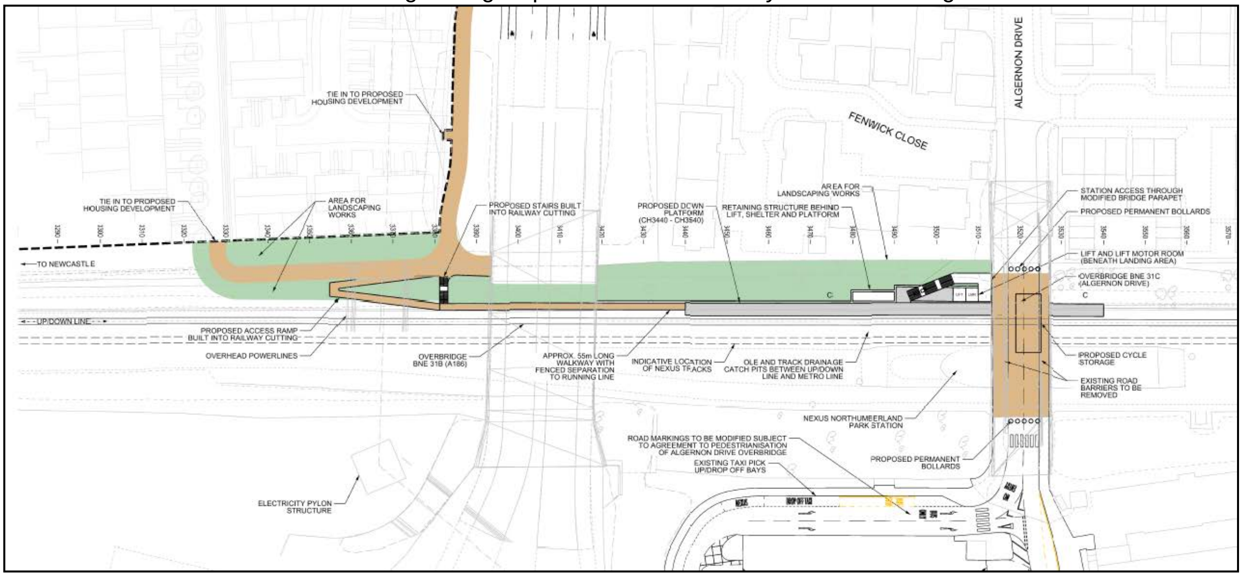


Figure 4 - Northumberland Park

<u>Seaton Delaval</u> (***Figure 5***) is a single face platform to the south-east of the railway, with highway access off the A192 via a signalised junction. The track in this location is single line, and thus only one platform is needed to serve trains in both directions. At SOBC, it was thought that an IP4 freight-only passing loop would be located here, which resulted in the platform being located adjacent to a realigned track. In this design stage, the passing loop was moved south of Seghill, and the station design was refined to avoid moving the existing track. The platform location is away from the overbridge to more level ground and straight track and considers the possibility that at some stage the track might be doubled in this location. The next design stage can assess a temporary or permanent solution to safeguard potential double tracking at this location.

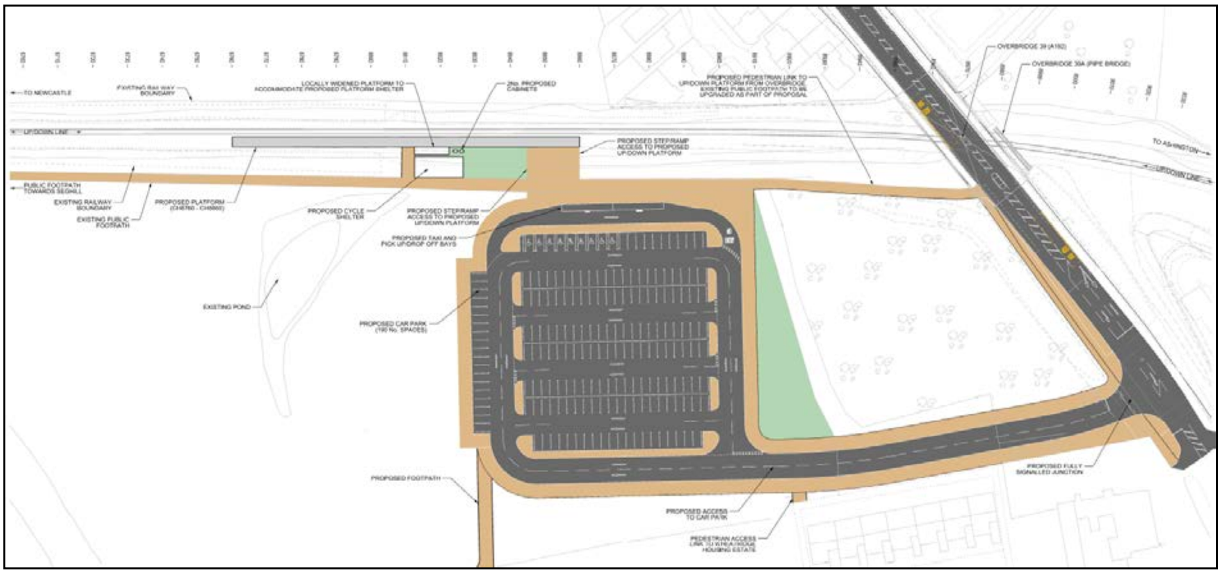


Figure 5 - Seaton Delaval

<u>Newsham station</u> ***(Figure 6***) changed from a staggered platform arrangement either side of the highway at SOBC to a twin platform arrangement south of the level crossing with footbridge with lifts now added. This was considered to assist better management of highway users through easier access to the car park, and for pedestrians by not encouraging unprotected crossing of the highway adjacent to the level crossing. The reasonable availability of land in this location is not yet confirmed, and a reserve option remains to construct a similar arrangement on the east side of the railway instead.

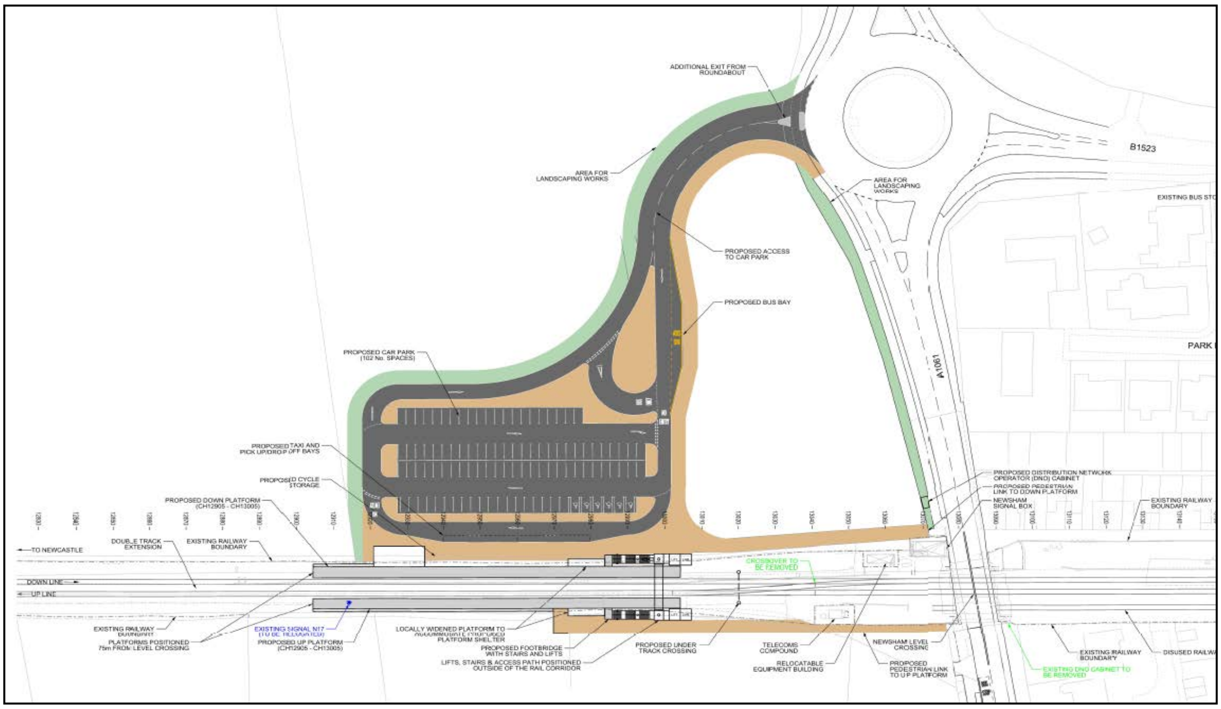


Figure 6 - Newsham

<u>Blyth Bebside station</u> (***Figure 7)*** has moved significantly from the SOBC location which was some 400m north of Blyth level crossing, to the new locations which is approximately 300m south of the level crossing. The factors that impacted on the selection of this location include;

- the position and operation of signals to minimise barrier down time at the level crossing to mitigate the risk of road traffic shunts on the A189 slip road;
- access and visibility from Front Street;
- recognition that 2/3 of forecasted demand traffic is modelled to be from the west (i.e. Bedlington area);
- ease or difficulty of land acquisition;
- and pedestrian/cycle connectivity, amongst others.

The preferred scheme takes advantage of historical railway land currently up for sale and positions the platforms sufficiently far away from the level crossing as to avoid triggering the crossing barriers too soon.

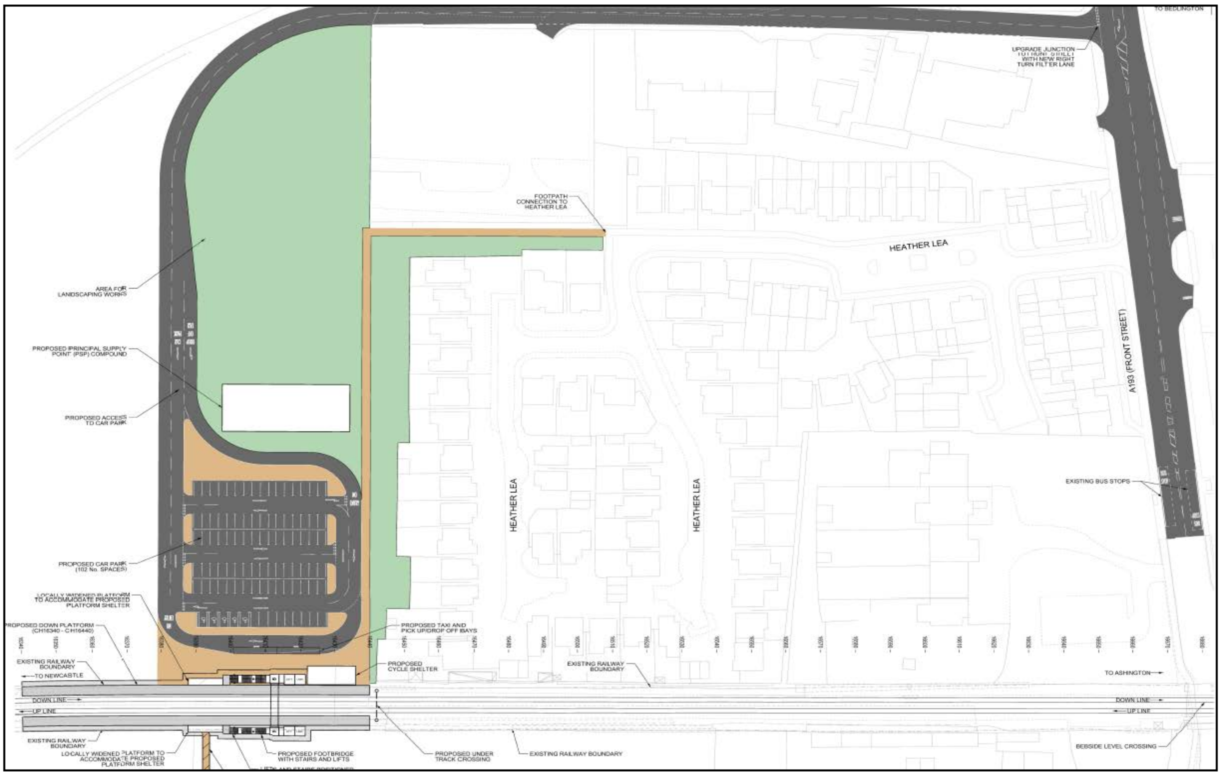


Figure 7 - Blyth Bebside

<u>Bedlington station</u> ***(Figure 8***) is heavily constrained by existing infrastructure, in particular the Bedlington North junction and associated tight radius curve to the north, with signal BS16/18 and Bedlington South level crossing to the south. The changes to the SOBC scheme are subtle, but avoid relocating the signal, and extending the platform onto Bedlington North junction. This refinement is dependent on the proposition to place a low-level co-actor signal on the signal post to enable a shorter stand-back position and acceptance of this proposal is linked to the choice of rolling stock in due course.

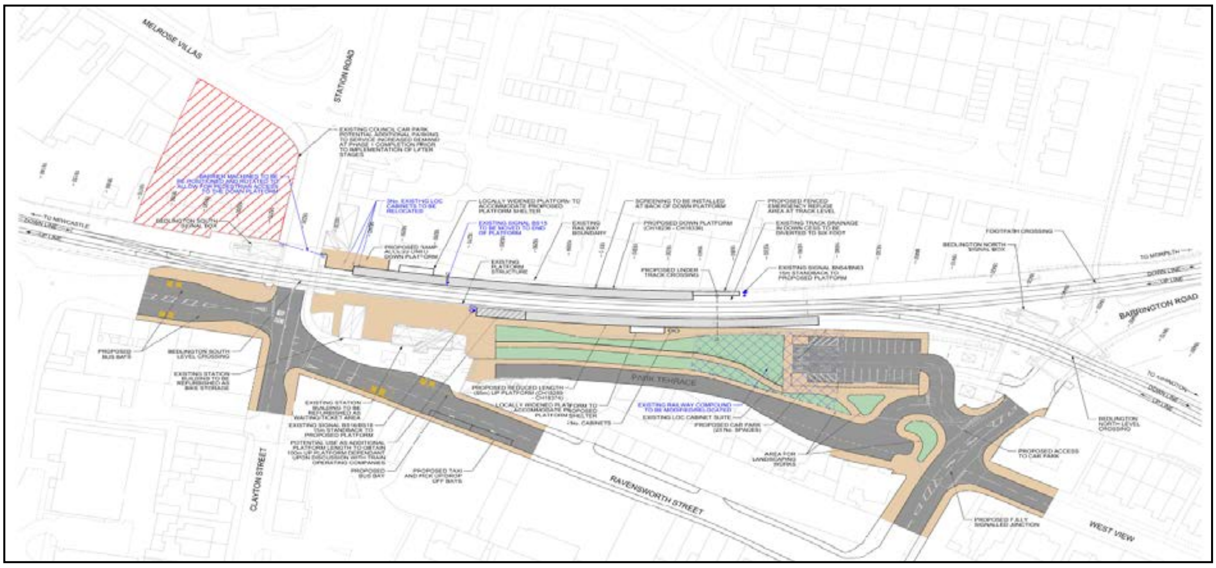


Figure 8 - Bedlington

Ashington station (***Figure 9)*** was changed from a platform adjacent to the running line at SOBC, to a platform adjacent to a turnback siding, with the track positioned to allow future reconnection to the main line if passenger services further north were to be developed. This approach negates the need to provide a turnback on the old Butterwell branch, which would have required a difficult and expensive turnout arrangement off the curved main line. There is also the potential conflict with long freight trains trying to enter Lynemouth which would have blocked the S&C to the turnback. The flank platform is easily accessed from the north and south and the car park, so that it can connect with a possible Wansbeck Square redevelopment but also be accessible by pedestrians from the south without creating a trespass desire line from Hospital Crossing along the track bed.

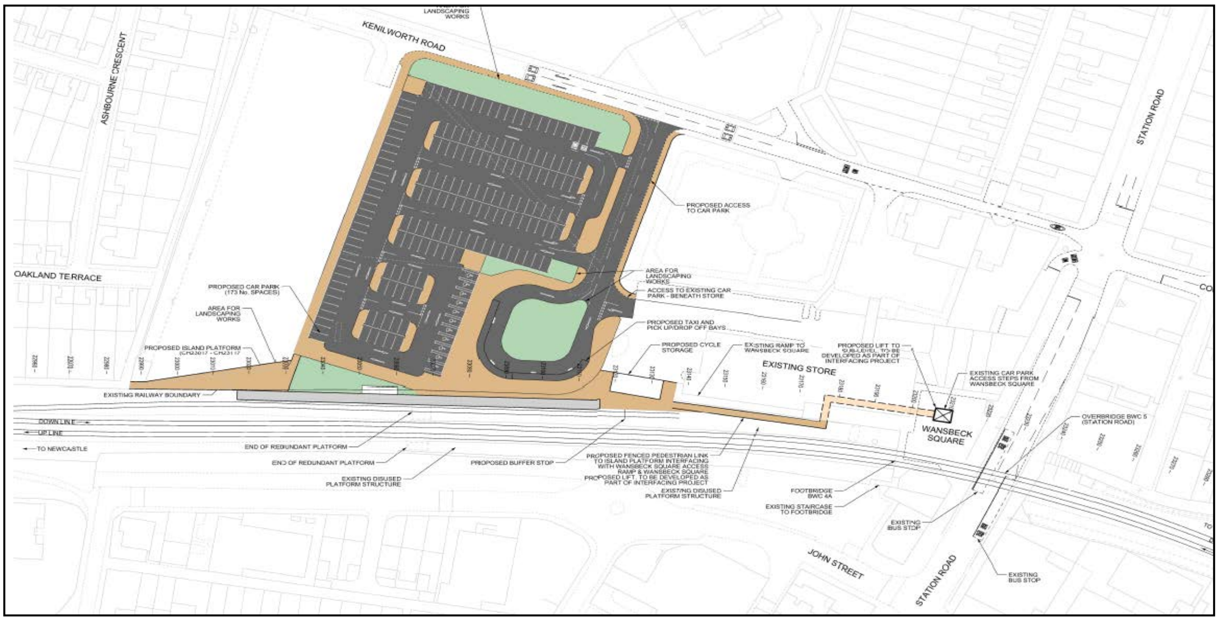


Figure 9 - Ashington

A more detailed description of the chosen options for each stations is within ***Section 5.1*** and larger scale version of the figures described above can be found in ***Appendix C***

Route-wide assets

Track

The operational capacity of the route is significantly constrained by the single line section for approximately the southern half of the route under review between 'Benton East Junction'[1] and Newsham. It is critical that trains can pass through this section as quickly as possible to minimise the single-track occupation times and release the single track for use by a train in the opposite direction.

Therefore, an important focus in Phase 1 is to improve line speeds in this area by increasing curve radius and/or the cant[2], straightening out the alignment where it is subject to unnecessary reversing curves, and upgrading the track where the existing quality is insufficient.

A walk-through examination of nearly all the route, indicated a wide variety of rail types and ages – some as old as 70 years – and consequentially a variety of associated track components and condition. There was evidence of spot repairs and other maintenance commensurate with the type and use of the current railway as a lightly used freight route.

Although ride quality and railhead profile may be appropriate for freight at the current line speeds, there are several sections of the whole route where rail head wear and ride quality would need to be improved for passenger trains to run at the required speeds. For example, where the rail has been worn such that the rail head is flat or lipped, this can increase derailment risk for lighter passenger trains, and would create excessive wear to the trainset wheels.

In general, the suitability of the track for higher speed passenger services have been found to be far less than was originally assumed in SOBC, and this has resulted in almost double the previously anticipated costs for track condition intervention. Other track changes since SOBC have included the movement of Benton East Junction further East, inclusion of the refurbishment of Furnace Way sidings, and relocation and extension of the passing loop south of Seghill.

Benton East junction has been moved approximately 260m further east to create additional freight standing room on the junction approach without overhanding the foot crossing at Palmersville Dairy, thus saving the cost of a footbridge, and reducing the single line section length for operational advantage.

At SOBC, Furnace Way sidings were assumed to be brought back into use at the expense of Network Rail, but this now seems less likely, and although detailed negotiations have yet to take place, the project has incorporated the potential £3.8m of direct costs into the estimate for this work.

The 'freight only' passing loop located adjacent to Seaton Delaval station at SOBC has been relocated south of Seghill which avoids potentially triggering the cost of providing two platforms plus all the related station infrastructure. Its relocation and lengthening take advantage of a long wide track bed south of Seghill and places the passing loop at the timing mid-point of the single line section. It is now a passing loop used by both passenger and freight that enables the freight trains to avoid stopping in normal circumstances. The project team were keen to avoid preventing future additional development of this route and as such this loop location was checked at a high level to ensure it does not provide any barriers to a future station at Seghill if there was a suitably robust business case for it.

Civil engineering

At SOBC, an important unknown was the state of the embankments along the route, particularly in the straight section south of Newsham where the existing track meanders from one former track bed to the other. This was assumed to be indicative of local adjustments for poor embankment quality, but a visual examination of the route during the OBC did not reveal any such evidence and the project team has been able to significantly reduce the extent of earthworks anticipated.

More record information about the bridge structures along the route, along with site visits, has enabled us to determine that three underbridge[3] structures require direct intervention to be strengthened for additional services or a wider track bed. In addition, a review of the limited structural information provided by Network Rail indicates that the two large viaducts,

[1] The junction east of Benton North Junction does not appear to have an official name, but the project team has referred to it as Benton East Junction in this project for ease of reference.
[2] 'Cant' is the term used to describe the vertical difference in levels between the outer rail of a curve and the inner rail, measured in mm. The higher the cant, the more the train is tipped and the faster it is able to go around the curve.
[3] An 'Underbridge' is one where the non-rail crossing passes under the bridge i.e. it is a bridge carrying the railway over something else.

North Seaton viaduct and Bedlington viaduct, were strengthened in 2011 to address pier members which had significant section loss and/or were overstressed. The information currently available does not include full details of the works carried out; however, subsequent detailed examinations indicate that significantly corroded members still exist within the piers. Whilst the passenger trains could theoretically be assumed to be able to be carried at higher speeds while still impacting the bridge less than the much heavier freight trains, confirmation through further inspection and analysis is required. If this should identify that the piers are not capable of supporting the proposed line speeds for both freight and passenger trains, speeds across the structure will be curtailed to work within the capability of the viaducts, rather than embark on a major structural improvement regime that could potentially cost several million pounds. The existing ongoing repair and maintenance regime for the structure would treat the signs of fatigue as and when required.

Designs for highway connections to stations have been developed and some have been modelled to understand the impacts on local traffic flows of different options. This is particularly so for the Blyth Bebside options where the projected impact on the A189 grade-separated junction is crucial to understand. Preliminary station car park layouts have been designed to illustrate the approximate size and functional requirements including provision for taxis, buses, cycles and pedestrians. It is expected that these will all be refined in subsequent design stages once the requirements are defined in more detail.

Railway systems

In determining a strategy to best accommodate the resumption of passenger services and the increase in train frequency and speed, an understanding of the current method of operation has been thoroughly investigated. This was further developed through discussions with the RAM Teams for Signalling and Level Crossings. Additionally, an understanding of the constraints on the line has been investigated. These constraints include junction positions, track (speed) constraints, signalling technology and interlocking constraints and likely Level Crossing requirements.

The resultant design strategy perpetuates the existing control areas but introduces a new control area to accommodate Ashington Station. Consideration was given to a full re-signalling of the area, with operation from a single or multiple control points, but this has been discounted on the basis that full re-signalling (of the whole Northumberland Line) does not offer value for money for NCC. This in part is a result of confirming that the passenger service can be accommodated on some of the control areas with minimal alterations taking place.

In early consultation with Network Rail, it was agreed that each level crossing requires several Suitable and Sufficient Risk Assessments to take place which will assist in determining which level crossing solution is best suited for that crossing. This requires a 9-Day crossing census to take place and input from Network Rail regarding use of the All Level Crossing Risk Measurement (ALCRM) Tool and the normal progression of these is of greater duration than the time available for the development of the Option Selection Report.

Therefore, an ‘agreement in principle’ for each of the level crossings was agreed by Network Rail and the project team which was carried forward into the design process as a provisional solution. Once the Suitable and Sufficient Risk Assessment process is complete, these decisions can be ratified or amended as necessary with further input and discussion with the Office of Rail and Road (ORR).

The telecoms design did not have any direct influence on the proposed stations or track layouts and has therefore largely focussed on providing sufficient operational and retail telecoms functionality to serve the needs of the rest of the railway. No significant provision of new lineside equipment is necessary, with works focussed on lift and shift of cable runs to facilitate track relocation, new Station Information and Surveillance System (SISS) assets in support of the new stations and connections to new signalling infrastructure.

Since there are no plans for this railway to be electrified, the power supply system is restricted to signalling and low voltage supply uses such as points heaters and station equipment. The existing signalling power supply is a 650V IT supply derived from Benton Power Supply Point (PSP). This provides power to the Blyth & Tyne feeder, which is within the scope of this project. It is proposed to renew the existing feeder with enhanced unarmoured cable and extend the feeder to Hartley LC. Benton PSP will not be modified and the existing Distribution Network Operator (DNO) will be retained.

Owing to the length of the route between Benton and Ashington, it is envisaged that a new PSP including a fixed generator and Uninterruptible Power Supply (UPS) will be required at either Bebside or Bedlington North (preferred). The PSP will require a new DNO supply to provide power supply to the Signalling Power Distribution system.

Construction and programme

To assist the project team in developing a construction strategy and programme with high confidence in deliverability, the major UK contractor Morgan Sindall was commissioned to provide input and advise on the emerging design solutions identified. Their views on the practicability of construction within the proposed physical and time constraints were sought.

At SOBC, the assumption was that the modifications to the railway would be delivered during Rules Of The Route (ROTR) closures and limited disruptive possessions, with the suggestion that major works in Phase 1 (notably the expected embankment strengthening) might take place within a blockade of up to 3 or 4 months, with access from the highway network to the foot of the embankments.

During OBC, the reduction in anticipated embankment works reduced the potential need for both a blockade and the highway access, and Morgan Sindall concluded that a delivery strategy based on the original SOBC proposition using ROTR closures and limited possessions as well as access from within the railway corridor was viable and likely to cause less disruption to the Freight Operating Companies (FOCs).

The work done to develop a construction programme illustrates the value in carrying out track realigning works in advance of the main construction activity, since it can be delivered without the need for legal powers, land purchase, or special access considerations. It enables reduction in project risk, efficient delivery of materials and access for the main works and could potentially be procured separately as an advanced works package.

The signalling works are anticipated to be largely delivered in four stages in conjunction with related track works and power supply works, with the final commissioning of Stage 4 requiring an 8-day possession. Station works would generally be delivered by two teams working on two stations at the same time.

Overall the bulk of the main construction works are anticipated to take approximately 10 months adopting the strategy proposed by Morgan Sindall based on the current design. Other contractors could have an alternate proposition and further design refinements may be able to provide a shorter and/or cheaper project delivery, but the Morgan Sindall programme gives confidence that the overall deadline for completion of the works will be in advance of the TCF spending deadline and sufficient allowance for driver route learning time before the May 2023 timetable change.

Environment, land and consents

A review of the environmental characteristics of the route corridor has been undertaken to inform the Options Selection Report (OSR), the OBC, the Pre-Application Enquiries (PreAE) and the Requests for a Screening Opinions (RfSO) which were sent to the NCC and North Tyneside Council (NTC) planning authorities.

Both authorities commented that the environmental impacts which are predicted to occur at the stations and within the rail corridor between the stations are not anticipated to cause any significant impact on environmental resources. As such both authorities concluded that the scheme is not an EIA development for the purpose of the EIA regulations. The process of engaging with the local planning authorities (pre-application enquiries) has confirmed that the preferred options for the construction of the six stations and the associated car parks have the potential to be granted planning permission with relevant conditions.

During the operation of the scheme it is anticipated that there will be changes to the noise and vibration environment in the vicinity of each of the stations, but more so at Northumberland Park and Bedlington where residential properties and noise sensitive receptors are adjacent to the preferred locations. Nevertheless, it is not anticipated that noise from the construction or the operation of the stations will cause any significant impacts.

The entire scheme has the potential to be affected by the presence of former underground coal mining. The presence of former underground mines, shafts, air shafts and capping are material considerations for the detailed design of the scheme, however it has not been a material consideration in the selection of the location for the preferred options for the stations. Based on the assessments and appraisals so far undertaken it is not anticipated that the scheme will cause any significant impacts on soils or increase the risks associated with existing contaminated land.

The presence of protected species has not been a constraint on the selection of the location for the stations or car parks because working methods, pre-start surveys, Construction Environment Management Plans and seasonally programmed works will collectively allow the scheme to mitigate any adverse impact on protected species. Protected species can be safeguarded through translocation and mitigation and it is not anticipated that there will be any adverse impact.

A comprehensive review has been undertaken of the planning policies and environmental constraints pertaining to the potential sites for stations and car parks for the scheme. Detailed discussions have taken place with NCC and NTC to review all the potential sites for the stations and car parks and this process has culminated in the submission of a pre-application enquiry for the stations. The councils confirmed that the proposals conform with the relevant local plan policies.

Most of the construction works for the Northumberland Line project will take place within the boundary of the railway corridor. However, given the significant scale of the project, a substantial amount of land outside of the railway corridor and in third party ownership is also required to deliver the scheme.

Through the optioneering process the project has attempted to reduce the amount of privately-owned land required in order to minimise the impact of land costs on the overall capital budget. Land is required in both temporary and permanent cases for stations, level crossings and other specific interventions. All have been reviewed and have been an influence on design development, though discussions with landowners have relatively recently commenced and have not progressed as far as commercial negotiations.

NCC has taken legal advice on delivery mechanisms from Pinsent Masons, a law firm with significant experience of obtaining powers through a variety of legal instruments to deliver similar infrastructure projects. The normal approach for a project of this type and scale would be to prepare a full Transport and Works Act Order (TWAO) submission, but the timescale imposed on the project to take advantage of the Transforming Cities Fund, as well as budgetary limitations, means that a full TWAO introduces a programme risk, if for example there are difficult or multiple objections taken to the Public Inquiry.

As at SOBC, the phasing was in part driven by delaying works into Phase 2 that it was felt might trigger the need for a full TWAO due to anticipated complexity of land acquisition and other impacts as well as the typical time taken to deliver the Order. Therefore Phase 1 consists of interventions largely delivered within the railway corridor under Network Rail's Permitted Development Rights (PDRs) or by non-TWAO means.

The proposition for Phase 1 by Pinsent Masons is to adopt a 'non-works' TWAO, which is considered to provide many of the powers and consents protection required but with a lower programme risk. Other powers required can be obtained through other mechanisms specific to the infrastructure needed. The programme to date implies that a non-works TWAO should be submitted by Summer 2020 in expectation that it would be 'Made' in Spring 2021. It could be carried out in parallel with procurement of the construction contract which may proceed at risk though not carry out any works applied for through the Order.

Costs and risks

The cost estimate has been based on 3Q2019 prices and is summarised below in ***Table 1.***

Estimate Breakdown	Phase 1	Phase 2	Total
Direct Construction Works Costs	**Value (£)**	**Value (£)**	**Value (£)**
Signalling	£7,576,601	£133,515	£7,710,116
Operational Power	£2,248,520	£0	£2,248,520
Permanent Way	£15,162,357	£5,627,511	£20,789,868
Operational and Retail Telecommunications	£2,172,004	£382,831	£2,554,835
Stations	£9,361,675	£6,770,180	£16,131,855
Civil Engineering	£3,025,540	£107,444	£3,132,984
Level Crossings	£10,666,500	£0	£10,666,500
Structures	£1,276,177	£0	£1,276,177
Utility Diversions	£1,280,000	£250,000	£1,530,000
DIRECT CONSTRUCTION WORKS COST TOTAL	**£52,769,374**	**£13,271,481**	**£66,040,855**
INDIRECT CONSTRUCTION WORKS COST TOTAL	**£26,194,402**	**£7,615,229**	**£33,809,630**
TOTAL CONSTRUCTION COST	**£78,963,776**	**£20,886,710**	**£99,850,486**
DESIGN, PROJECT MANAGEMENT AND OTHER PROJECT COST TOTAL	**£26,074,133**	**£6,706,013**	**£32,780,146**
BASE COST ESTIMATE	**£105,037,908**	**£27,592,723**	**£132,630,631**
RISK COST TOTAL	**£19,502,864**	**£8,032,915**	**£27,535,779**
LAND COST TOTAL	**£443,217**	**£1,307,950**	**£1,751,167**
ANTICIPATED FINAL COST (excluding Inflation)	**£124,983,989**	**£36,933,588**	**£161,917,576**
Comparison with SOBC **(SOBC Phases 2-3-4 compared with OBC Phase 2)**			
SOBC AFC @ 4Q2018:	£117,216,519	£52,197,805	£169,414,324
SOBC AFC @ 3Q2019 (Assumed construction price inflation @ 3/4 x 3.2% = 2.4%):	£120,029,715	£53,450,552	£173,480,268
Change (OBC-SOBC) in £GBP @ 3Q2019	**£4,954,273**	**-£16,516,965**	**-£11,562,691**
Change (OBC-SOBC)/SOBC @ 3Q2019 in %	+4.1%	-30.9%	-6.7%

Table 1 - Cost Estimate

The overall picture is one of remarkably little change since SOBC, which was at 4Q18 pricing and the OBC estimate, which was at 3Q19 pricing, with the total Direct cost for all phases rising by only 1.6% from the SOBC – about half the average annual rate for new build construction costs for the public sector in this period.

The comparison of total costs at SOBC shows a 4.1% increase in Phase 1, and this is dominated by the changes in Permanent Way costs, of which £3.8m in direct costs comes from the inclusion of works to rehabilitate Furnace Way sidings that was specifically excluded in the SOBC. Additional Permanent Way cost increases come from the need to upgrade significantly more track than anticipated. Further Phase 1 increases come from stations and signalling, although these are partially offset by savings in level crossings and utility diversions, as well as a reduction in overhead allowances following further assessment.

The OBC Phase 2 has been compared with SOBC Phases 2-4 combined and shows a significant reduction of £16.5m or 30.9%, contributing to an all-phases reduction of £11.6m or 6.7% at 3Q2019 prices. This is a result of reduced scope in signalling, operational power, and the removal of need for significant earthworks after Phase 1. Risk and overheads have fallen as the relocation of the passing loop has assisted the efficiency of construction.

For the OBC the team carried out a preliminary assessment of the anticipated cost of renewals to be incurred by NR for new assets over 60 years.

Risks

In the development of the OSR, the project team has carried out both a Hazard Identification ("HAZID") and Quantified Cost Risk Assessment (QCRA). These have been used to inform the risk allowance in the cost estimate but also the design investigations.

The primary scheme risks of note are:

- Risk that the project is unsuccessful in being awarded its requested allocation of the Transforming Cities Fund
- Risk that land acquisition becomes complex, time-consuming and more costly than expected
- Risk that procurement and signoff of the remaining stages is delayed, putting pressure on the final delivery date
- Risk that the Non-works TWAO cannot be completed without undue pressure on the construction programme or delay to the Phase 1 delivery date
- Newcastle Central capacity constraints – (However, the project is working with industry Dec 21 Event Steering Group and initial results suggest capacity is available. NR, TOCS and FOCs fully involved and supportive of scheme)

The primary technical risks of note are:

- Risk that new assessment of North Seaton Viaduct results in linespeed limitation that significantly impacts journey time and/or significant strengthening works
- Risk that ground investigations or construction activity at Northumberland Park reveal large voids due to former mine workings beneath the proposed platform location
- Risk that the proposed reduced standback arrangement to signal BS16 at Bedlington platform is not acceptable to Network Rail and/or TOCs and/or the ORR

The mitigation or resolution of these risks is primarily through further investigations and analysis in the next design stage.

Next steps

In recognition that the powers to make changes to level crossings through a Level Crossing Order (LCO) or TWAO require a lengthy process to provide supporting information that is likely to be on the project critical path, this work is continuing beyond the delivery of the OSR to maintain momentum and avoid programme delays.

The next stage of the project will see the development of the design for three purposes: the preparation of materials for a non-works Transport and Works Act Order; the submission of documents to the DfT for Stage 3 Design and seek a Decision to Deliver; and, supporting documentation for the procurement of detailed design and construction. Many of the activities envisaged will serve both purposes, but in general the development of the design to an outline design or 'reference design' status will require more targeted research and site investigations to resolve outstanding variables and unknowns.

It will also involve further consultation and negotiations, particularly with stakeholders such as the public (through consultation in line with TWAO required procedures), landowners, Network Rail, TOCs/FOCs, the ORR, DfT, local authorities etc., building on the discussions carried out to date. Key strategic decisions will need to be made, such as the selection of rolling stock to be used, confirmation of Phase 1 stations, and acceptance of the construction strategy.

The TWAO process will require the development of documents and drawings in heavily defined formats. These have an emphasis on land, property, environment, planning and funding and will refer to this Option Selection Report and others to explain key decisions made in the justification of the proposed solution.

The reference design drawings will resemble some of the engineering design drawings developed to date but will not be the same. Nevertheless, they will be based on the conclusions of the engineering work and consultation, and therefore both must be substantially completed before the reference design drawings can be completed and submitted in support of the TWAO application. The consultation process required by the TWAO will place further pressure on design development to ensure proposals presented to the public are appropriate.

The outline design drawings are more of an engineering nature and are developed to provide a basis to gain relevant approvals in principle from Network Rail and inform a competitive tender process. The drawings and reports themselves are the product of design development as described above and will in some cases require modelling and detailed surveys, which can take several months to prepare and deliver. Examples of this include: Operational timetable refinement; Highways modelling; and, Viaduct bridge assessment. A procurement strategy will need to be developed and agreed with the DfT.

Environmental surveys will be bound by certain times of the year, recognising the seasonal constraints. Where practicable, the project team has already carried out some surveys that will have relevance and acceptability to the TWAO process, but some will need to be completed closer to the submission date to remain valid.

Therefore, timing continues to be tight in order to secure a timely non-works TWAO submission by early Summer 2020 (to avoid delay due to the Summer recess), because many of the outstanding technical and operational issues will need to be closed out by then. The bulk of the procurement documentation may follow the TWAO submission but is likely to run in parallel with the TWAO process to award the winning contractor soon after the Order is Made in Spring 2021.

The more progress that can be made to close out objections before any TWAO Public Inquiry, the shorter the Inquiry will be (if there is one at all), and the quicker the project can get to site.

This remains a viable and exciting project that has plenty of further opportunities for innovation and efficiency as remaining unknowns are closed out, but time is of the essence and further progress will depend on maintaining momentum.

Key to Acronyms

AB –	Assessment Body
ABS -	Automatic Ballast Sample
ABCL -	Automatic Barrier Controlled Locally
ACC -	Accommodation Crossing (Alt: UWC)
ADSL –	Asynchronous Digital Subscriber Line
AEW -	Aerial Earth Wire
AHB -	Automatic Half Barrier
AHBC –	Automatic Half Barrier Crossing
AIP –	Approval in Principle
ALCRM –	All Level Crossing Risk Model
AOCL -	Automatic Open Crossing Controlled Locally
AQMA –	Air Quality Management Area
ASHP –	Air Source Heat Pump
ASP's -	Auxiliary Supply Points
ASR -	Aggregation Services Router
AWI -	Advanced Warning Indicator
AWI -	Ancient Woodland Inventory
AWS –	Automatic Warning System
BGL –	Below Ground Level
BGS –	British Geological Society
BMV –	Best and Most Versatile
BNE -	Benton North Jnc to Earsdon Jnc.
BT –	British Telecom
BTP –	British Transport Police
BTS -	Base Transceiver Station
BWC -	Bedlington Jnc. To Woodhorn Colliery
B2B -	Box to Box
CAD -	Computer Aided Design
CAS -	Circuit Allocation Sheets
CB -	Central Battery
CBC -	Common Bonding Conductors
CBI –	Computer Based Interlocking
CCTV –	Close Circuit Television
CCTVPA -	Close Circuit Television Public Address
CDM -	Construction, Design and Management
CEMP -	Construction Environment Management Plan
CET –	Critical Environment Technology
CIBSE –	Chartered Institute of Building Services Engineers
CIS –	Customer Information System
CP -	Catch Pit
CP –	Clearance Point
CP5 –	Control Period 5, 6, 7…etc
CPC -	Circuit Protective Conductor
CSC -	Customer Service Centre
CSM –	Common Safety Method
CT -	Current Transformer
Cu –	Copper
CUI –	Capacity Utilisation Index
CWR –	Continuous Welded Rail
DABS -	Deep Automatic Ballast Sample
DC –	Direct Current
DC -	Distribution Cabinets
DDA –	Disability Discrimination Act
DEP -	Designated Earthing Point
DK –	Distribution Kiosk
DMRB -	Design Manual for Roads and Bridges
DNO –	Distribution Network Operator
DTM -	Digital Terrain Model
E&P –	Electrification and Power
E&M –	Electrical and Mechanical
EC –	Electronically Commutated
ECI –	Early Contractor Involvement
ECML -	East Coast Main Line
ECoW -	Ecological Clerk of Works
ECS -	Empty Coaching Stock
EHC -	Earthworks Hazard Category
EHO -	Environmental Health Officer
EIA –	Environmental Impact Assessment
EJM -	Earsdon Jnc. To Morpeth North Jnc.
ELR –	Engineering Line Reference
EMC –	Electromagnetic Compatibility
EPC –	Energy Performance Certificate
EPS -	Enhanced Permissible Speed
ESR -	Emergency Speed Restriction
ETB –	Electric Token Block
FAS –	Flood Alleviation Scheme
FB –	Footbridge
FIT –	Feed in Tariff
FP -	Footpath (usually for crossings)
FRA -	Flood Risk Assessment
FOC -	Freight Operating Company
FOV -	Field of View
FPS -	Footpath - Stile
FPS –	Flood Protection Scheme
FPW -	Footpath Wicket
FRA -	Flood Risk Assessment
FRM –	Flood Risk Map
FS -	Feeder Station
FSP -	Functional Supply Point
FTN –	Fixed Telecom Network
FTN-X –	Upgraded FTN
GA –	General Arrangement
GB -	Gate Box
GCN -	Great Crested Newt
GDL –	Garden and Designed Landscape
GI –	Ground Investigation
GIS -	Geographic Information Database
GRIP –	Governance of Railway Investment Projects
GRP –	Glass Reinforced Plastic
GSHP –	Ground Source Heat Pump

GSM-R – Global System for Mobile Communications - Railway
GWDTE – Groundwater Dependant Terrestrial Ecosystems
HAZID - Hazard Identification
HAZOP - Hazard and Operability
HER – Historical Environment Record
HES - Historic Environment Scotland
HLOS – High Level Output Specification
HMI – Human Machine Interface
HSE - Health and Safety Executive
HST – High Speed Train
HVAC – Heating, Ventilation and Air Conditioning
IB - Intermediate Block
IBCL – In-Bearer Clamp Lock
IP – Internet Protocol
KETS - Kestrel Emergency Telephone System
LC – Level Crossing
LCA – Land Capability for Agriculture
LCA – Landscape Character Area
LCU - Level Crossing User
LDP – Local Development Plan
LED – Light Emitting Diode
LiDAR - Light Detection And Ranging
LLPA – Long Line Public Address
LOC - Location Cabinet
LV – Low Voltage
LX - Level Crossing
MAF – Main Aspect Free
MAR – Main Approach Release from Red
MAY-FA - Main Approach Release from Yellow-Flashing Aspect
MCB – Manually Controlled Barriers
MCB-CCTV Manually Controlled Barriers with CCTV
MCB-OD – Manually Controlled Barriers with Obstacle Detection
MDF – Main Distribution Frame
MET - Main Earth Terminal
MEWP - Mobile Elevated Working Platform
MFDSA – Multi-functional Design Services Agreement
MGW - Manned Wicket Gates
MHRV – Mechanical Heat Recovery Ventilation
MPA - Mid Point Anchor
mph – Miles Per Hour
MPLS – Multi-Protocol Label Switching
MSRP- Major Signalling Review Panel
MSL - Mini Stop Light (Level Crossing)
NCC - Northumberland County Council
NMU – Non-Motorised Unit
NTI - Next Train Indicator
NR – Network Rail
NRDT - Network Rail Design Tool
NRAP - Network Rail Acceptance Panel
NRN - National Radio Network
NRT - Network Rail Telecoms
NVR – Network Video Recorder
OB – Overbridge (Rail Overline Structure)
OCLZ - Overhead Contact Line Zone
OLE – Overhead Line Electrification
OS – Ordnance Survey
OSS – Over Speed Sensor
ORR - Office of Rail and Road
PAN – Project Advice Notice
PETS – Public Emergency Telephone System
PHCC – Points Heating Control Cubicle
PHL - Project Hazard Log
PHP – Public Help Point
PHT - Points Heating Transformer
PIR – Passive Infrared
PME – Protective Multiple Earth System
PoE – Power Over Ethernet
POE – Points Operating Equipment
PPM – Public Performance Measure
PRS – Project Requirements Specification
PSP – Principal Supply Point
PSPA - Potential Special Protection Area
PSR - Permanent Speed Restriction
PTZ – Pan-Tilt-Zoom
PV – Photovoltaic
PVA – Potentially Vulnerable Area
PZT - Points Zone Telephone
RA – Route Availability
RAM – Route Asset Manager
RBMP – River Basin Management Plan
RC – Reinforced Concrete
REA – Risk Evaluation and Assessment
REB – Relocatable Equipment Building
RECOS - Running Edge to Centre of Steel
RIR - Railways (Interoperability) Regulations
ROC - Regional Operating Centre
RRAP – Road Rail Access Platform
RSC - Return Screening Conductor
RSR - Railways Interoperability Regulations
RSJ – Rolled Steel Joist
RTU - Remote Terminal Unit
S&C – Switches and Crossings
S&SRA - Suitable & Sufficient Risk Assessment
SAC – Special Area of Conservation
SASSPAD - Starting Against Signal, Signal Passed at Danger
SB – Signal Box
SC – Signalling Centre
SCADA - Supervisory Control and Data Acquisition
SCT - Surface Concrete Troughing
SDG – Signalling Design Group
SDH - Synchronous Digital Hierarchy
SDP - Strategic Development Plan
SEPA – Scottish Environmental Protection Agency
SEU – Signalling Equivalent Unit
SI – Site Investigation

SISS – Station Information and Surveillance System
SM – Scheduled Monument
SMR – Sites and Monument Record
SNH – Scottish Natural Heritage
SOD – Safe Overrun Distance
SOD - Summary of Departures (Station CIS)
SORA - Signalling Overrun Assessment
SORAT - Signalling Overrun Assessment Tool
SORAT-LX Signalling Overrun Assessment Tool Level Crossings
SPA – Special Protection Area
SPEN - Scottish Power Energy Networks
SPP – Scottish Planning Policy
SPT – Signal Post Telephone
SPT - Standard Penetration Test
SRT – Section Running Time
SSI - Solid State Interlocking
SSSI – Site of Special Scientific Interest
STPR – Strategic Transport Projects Review
SUDS - Sustainable Urban Drainage Systems
TAD - Through Alignment Design
TADS - Transmission Asset Database System
TBI - Trackbed Investigation
TC – Track Circuit
TCB – Track Circuit Block
TCB - Termination Connection Boxes
TD - Train Describer
TOC – Train Operating Company
TP&N - Three Phase and Neutral
TPWS – Train Protection Warning System
TRT – Train Running Time
TRTS - Train Ready To Start
TRUST - Train Running Under System TOPS
TSC - Track Section Cabinet
TSR – Temporary Speed Restriction
TSI - Technical Specifications for Interoperability
TSS – Train Stop Sensor
TVM – Ticket Vending Machine
UB – Underbridge (Rail Underline Structure)
UPS – Uninterruptable Power Supply
URX – Under Road Crossing
UTX – Under Track Crossing
UWC – User Worked Crossing
UWC-T - User Worked Crossing with Telephone
UWW - User Worked Crossing (Vehicular) with Wicket Gate
VDU – Visual Display Unit
VoIP - Voice over Internet Protocol
Wi-Fi - IEEE 802.11x wireless network
WFD – Water Framework Directive
XC - Legacy Cross Connection Cabinets
XLPE - Cross-Linked Polyethylene
YN - Up Nearside
YO - Up Offside
ZN - Down Nearside
ZO - Down Offside

1 PROJECT SCOPE

1.1 Introduction

The objective of the Northumberland Line Project is to help reverse decades of decline in the South East of Northumberland following the demise of mining and shipbuilding industries since the 1990's. It is envisaged that providing a faster, more reliable and accessible transport system will open up opportunities for the communities of South Northumberland in the economic hubs of Tyne and Wear. This should in turn improve employment prospects, economic investment opportunities and house building activities to revitalise the area.

Following consideration of the above, the provision of a rail service from Ashington to Newcastle has been identified as a suitable means of unlocking this potential. This Option Selection Report details the various potential options considered for providing the railway and the reasoning behind selecting the options identified. Where options have been considered and rejected, the reason for the rejection has also been recorded.

1.2 Background

In the early 2010s, Northumberland County Council (NCC) became interested in the reintroduction of passenger services over the freight only Lynemouth to Benton North Junction portion of line and then on the East Coast Main Line into Newcastle Central Station.

In June 2013 NCC commissioned Network Rail to complete a GRIP 1 study to examine the best options for the scheme. The GRIP 1 study was received by NCC in March 2014 and in June 2015 they initiated a more detailed GRIP 2 Feasibility Study to be undertaken, again by Network Rail.

The GRIP 2 study, which NCC received in October 2016, confirmed that the reintroduction of a frequent seven-day a week passenger service between Newcastle and Ashington was feasible and could provide economic benefits with more than 380,000 people using the line each year by 2034. The 2016 GRIP 2 study envisaged a project (at the time referred to as the Ashington, Blyth & Tyne Line (ABT)), involving construction of new or reopened stations at Northumberland Park (for interchange with the Tyne and Wear Metro), either Seghill or Seaton Delaval, Newsham, Blyth Park & Ride, Bedlington, Ashington and Woodhorn (for the Woodhorn Colliery Museum and Northumberland Archives) with a potential end to end journey time of around 37 minutes.

Encouraged by the Department for Transport's November 2017 report, A Strategic Vision for Rail, which named the line as a possible candidate for a future reintroduction of passenger services, NCC commissioned a further interim study to be undertaken by Network Rail in November 2017 (dubbed GRIP 2B) to determine whether high costs and long timescales identified in the GRIP 2 Study could be reduced by descoping the initial output of the project.

In early 2018, AECOM prepared a Strategic Outline Business Case (SOBC) for NCC with a view to delivering the project out with Network Rail and the familiar GRIP process by utilizing the Rail Network Enhancements Pipeline (RNEP) and external government funding. With the agreement of NCC, AECOM pursued a strategy focused on improving deliverability by reducing the initial scope of the project. Adopting this strategy, the line could be delivered in phases with initial funding of phase 1 providing an hourly service and four new stations. One or more future phases would then introduce the remaining two stations and improve services to a half hourly frequency throughout the day.

The output of this work supported NCC's submission to the DfT's Rail Network Enhancements Pipeline (RNEP) process at the 'Stage 1: Determine' to apply for a 'Decision to Develop', as shown in ***Figure 10.***

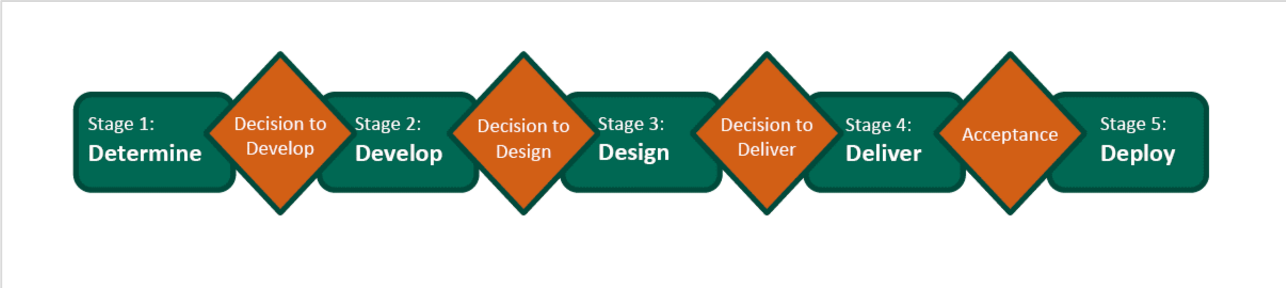


Figure 10 - Rail Network Enhancements Programme (DfT: March 2018)

In early 2019, AECOM was appointed to support NCC in carrying out Stage 2: Develop for which the Outline Business Case (OBC) is required. The inputs for the OBC include this Option Selection Report, the supporting engineering and property works and to generate the OBC summary document in order to secure additional funding from outside of the council's own budget. In particular, the Transforming Cities Fund represents a timely opportunity for which the OBC is a necessary justification when bidding for funds.

1.3 Geographic Scope

The Geographic Scope of this report and the engineering behind it are from Benton North Junction to Ashington along ELRs BNE, EJM & BWC. The East Coast Main Line from Benton North Junction to Newcastle Central has not been considered for any infrastructure changes and as a result no environmental or property impacts. Similarly, no consideration at this time has been given to any extension of the route beyond Ashington except to provide passive provision by not creating any new infrastructure that would prohibit the line from being extended in future.

1.4 Existing Layout

The existing freight only line runs from Benton North Junction to Bedlington and onto Ashington. There are diverging routes at various locations creating the "Bates Branch", "Bedlington to Morpeth Branch", "Cambois Branch" to North Blyth, the "Butterwell Branch" and the line also extends beyond Ashington to Lynemouth.

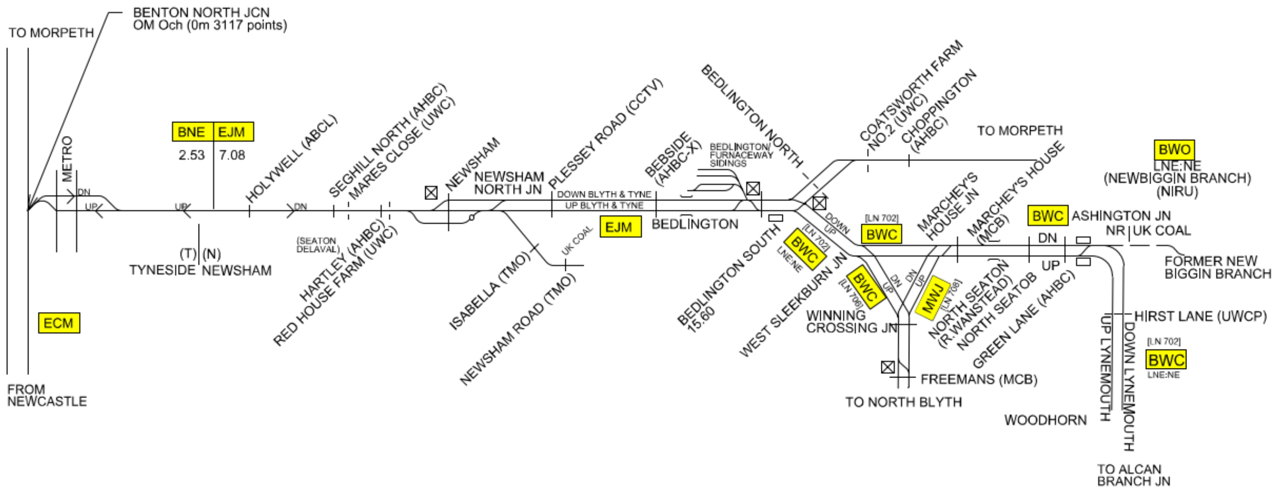


Figure 11 – Existing Layout Diagram

The history of the route is a complex one with many junctions and double track sections now abandoned. Two of the most severe curves on the route, Earsden and Hartley curves, were formerly chord lines connecting lines passing at almost right angles. The previous lines have been abandoned and recovered leaving the connecting chords as the main line. At various locations south of Newsham, there is clear evidence the line was once double track in its history however now runs as a single line snaking over the solum width.

The signalling control systems in use include Track circuit block with a slot for the Down line at Benton, Absolute block between signal boxes on the line and telephone access at North Seaton Gate Box. Lineside there is a mixture of mechanical semaphore signalling and coloured light.

1.5 Project Development to Date

1.5.1 Strategic Outline Business Case (SOBC) design development summary

When the SOBC was carried out, the project team was constrained by minimal access to Network Rail information and local rail staff to obtain key information about the existing assets and future plans for them. Nevertheless, the team was able to glean some information from publicly accessible documents and site visit locations and make engineering judgements on this basis.

As the project developed, several decisions were made subject to better information emerging that enabled the team to identify a four-phase infrastructure development programme:

- Infrastructure Phase 1 (IP1) would enable a service with stations at Ashington, Bedlington, Newsham and Northumberland Parkway because the platforms can be constructed within the railway curtilage, though there is still some dependency on land negotiations for station car parks and highway access. It would also include line speed increases, particularly in the single line section between Benton junction and Newsham, to enable efficient service patterns.
- Infrastructure Phase 2 (IP2) would introduce the final two stations at Blyth Bebside and Seaton Delaval, both of which could require land purchase and highway alterations that could trigger a Transport and Works Act Order (TWAO).
- Infrastructure Phase 3 (IP3) would provide signalling improvements to reduce the journey time from Ashington to Newcastle.
- Infrastructure Phase 4 (IP4) would provide a new passing loop that enables a half-hour all-day service with the same journey times as IP3.

Other interim conclusions on the layouts and locations of stations were adopted as a basis to develop a pricing estimate. In recognition of the degree of uncertainty at this design stage, the SOBC estimate was developed based on quantity and pricing ranges for each asset. Key risks at this stage related to the extent of level crossing, signalling and permanent way works required in IP1.

Therefore, at the end of the SOBC it was identified that the next stage would need much greater input from Network Rail through a Basic Asset Protection Agreement (BAPA), and also:

- to understand the condition of the permanent way, to enable a better assessment of work required
- to undertake initial engagement with landowners to understand likely willingness to negotiate on land purchase
- to explore the concept for the stations and the impact on demand and community

At the more detailed level, once missing information was known, there were several design decisions to be revisited and refined to provide a preferred solution from a series of sub-options relating to layouts.

1.5.2 Outline Business Case (OBC) design development summary

1.5.2.1 OBC activities overview

During the OBC stage, we have been able to gain greater (though not comprehensive) access to Network Rail data and key individuals, as well as arrange trackside site access. This has given the team a much better understanding of the existence and condition of the current assets and informed a much greater level of design development and appreciation of the constraints.

Through a series of focussed workshops, interspersed with design activities, the team has been able to review the strategies for each major asset group and the location and layout of the stations. The team has also carried out a preliminary public consultation exercise and begun preliminary discussions with key land owners to inform the design.

1.5.2.2 Delivery sequence changes

As the design developed, it became apparent that more and more of the signalling works would need to be brought into Phase 1, primarily to support the works needed at level crossings triggered by the introduction of passenger services. This significantly reduced the extent of work packages otherwise planned for IP3 and IP4 such that they could reasonably be combined and realistically delivered with Phase 2, subject to funding and appropriate legal consents.

The working position is therefore that there are likely to be two phases of development, split by prioritised work within the client’s current budget constraints, and the probable timing impacts of interventions likely to require a TWAO. If further landowner discussions should enable early negotiated settlements or indeed identify other issues requiring TWAO powers, then it is possible that some elements of either Phase 1 or Phase 2 could become detached and be pursued as an interim Phase 1a or a revised Phase 3 depending on timing.

1.5.2.3 Station changes

The selection of stations for Phase 1 and Phase 2 has remained the same and the layout of each station has been comprehensively challenged and refined, but these are all still subject to availability of land through the appropriate legal consents and acquisition processes. The ability to access the railway in this OBC stage has allowed better identification of local constraints with the result that the changes to preferred options are as follows:

- Ashington station has remained in broadly the same place but has changed to an offline arrangement to avoid creating a northern turnback with a difficult crossing arrangement
- Blyth Bebside station location has moved much further south to take advantage of land currently for sale and reduce traffic risks at the level crossing
- Bedlington station has remained in essentially the same location
- Seaton Delaval has remained broadly in the same position, but is now placed adjacent to the existing track which is now not being shifted for a future passing loop in this location
- Newsham station has remained on the south side, but is moved further south to reduce barrier down times at the level crossing
- Northumberland Park station has remained in essentially the same position

During the OBC, it was identified that it may be possible to develop the station environment in such a way as to attract or enable Economic Development Opportunities to further deliver the high-level aim of the Northumberland Line project to stimulate economic regeneration. These would be buildings visually connected to the railway stations but physically and commercially separate with the aim of providing employment or training opportunities with excellent connectivity.

Unlike typical station community development projects, this initiative would not involve the reconfiguration of historic railway buildings, which do not exist except at Bedlington, but rather would necessitate new-build facilities and hence must be able to attract sustainable funding – ideally through revenue. The concept has met with wide support in principle, and NCC has asked for assistance from Advance Northumberland, an arm’s length wholly-owned subsidiary of NCC with responsibility for management and exploitation of NCC’s property assets for economic development.

The exploration of Economic Development Opportunities at the stations is an exercise run in parallel with but separate to the OBC and enables the design of station layouts to recognise future potential use of space for these purposes and create appropriate passive provision at this early stage. The actual provision of such opportunities will be subject to a comprehensive local needs and planning assessment as well as negotiations with land owners.

1.5.2.4 Other infrastructure changes

The location of the passing loop as the final piece of the infrastructure jigsaw providing operational capacity for a half-hourly all-day service was further refined to take account of improved understanding of gradients and operational constraints. This has meant it has been moved south of Seghill level crossing where it can be positioned on a long straight wide embankment, though the gradient has led to its lengthening to avoid freight stopping.

Better access to information at OBC has allowed the team to investigate current provision and condition of assets, improving confidence in our understanding as to what needs to be provided to facilitate the passenger services. The most significant findings are in relation to track and the two viaducts.

- A walk-through visual survey indicated that the track has been allowed to degrade to a point that is suitable for the freight traffic it currently bears at the linespeeds, but several sections are unsuitable for the passenger trains and/or the linespeed improvements this project will need.
- The position taken at SOBC was that costs to re-enable the access into the Furnace Way sidings would be borne by Network Rail and the sidings themselves would be suitable following clearance of vegetation. Physical access to Furnace Way sidings and survey data enabled the team to identify that the existing turnouts within the sidings are inadequate for bringing back into use within modern standards. This drives realignment of much of the sidings and is anticipated to incur additional cost to the project.
- A review of the limited structural information provided by Network Rail indicates that the two large viaducts, North Seaton viaduct and Bedlington viaduct, were strengthened in 2011 to address pier members which had significant section loss and/or were overstressed. The information currently available does not include full details of the works carried out; however, subsequent detailed examinations indicate that significantly corroded members still exist within the piers. Whilst the passenger trains could theoretically be assumed to be able to be carried at higher speeds while still impacting the bridge less than the much heavier freight trains, confirmation through further inspection and analysis is required. If this should identify that the piers are not capable of supporting the proposed line speeds for both freight and passenger trains, speeds across the structure will be curtailed to work within the capability of the viaducts, rather than embark on a major structural improvement regime that could potentially cost several million pounds.

1.6 Ownership and Operational Model

The route is relatively self-contained between the point of signalling control interface between Newcastle IECC and Newsham Signal Box (just west of Northumberland Park station) and Ashington, except for the freight branch line from West Sleekburn Junction to the Port of Blyth.

Currently freight traffic operates over the route between Benton North Jn. and Lynemouth (up to 6 return trips per day moving biomass), between Benton N. Junction and Port of Blyth (up to 3 coal trains per week to/from South Wales) and between Bedlington and Port of Blyth (one alumina train movement per day to/from Fort William via Morpeth).

Currently there is no timetabled passenger services operating over the route although it is cleared for modern DMU vehicles between Benton North Junction, Bedlington and Morpeth for diversionary purposes. Regular passenger services last operated on the route in 1964.

Consequently, the opportunity exists to review a number of future ownership and operating options which have the potential to reduce short term delivery and longer-term operating costs. These opportunities were highlighted in the Strategic Outline

Business Case (SOBC) submitted in June 19 but have been further refined in discussion with key stakeholders and through early market testing in the Development Phase.

There are two mechanisms for procuring passenger rail services on the heavy rail mainline network in the UK; franchise and concession.

The current default industry option for a rail project is Network Rail ownership of any completed assets, stations and infrastructure, and franchisee operation; under the standard regulated model.

Further review since the SOBC has concluded that vertical integration for the route would be unnecessarily complex and unlikely to result in any significant operational or financial benefit. This is for several reasons:

- • The route is not entirely self-contained in that the service operates on the East Coast Main Line for 4 miles between Benton North Junction and Newcastle such that a vertically integrated train operator would need a separate agreement on the ECML.
- • Furthermore, the route already has existing Freight Operating Companies who, under a vertically integrated structure would need a further set of Track Access Agreements.
- The route is cleared as a diversionary route for passenger train services and this is likely to be an ongoing and potentially expanding requirement.
- A third party would need to be prepared to accept (and price) existing asset condition risk for any infrastructure that is not being upgraded as part of the scheme, there may not be an efficient cost model that delivers such risk transfer.
- Delivering a PFI-style concession-based approach (such as certain elements of DLR), would be complex to structure and procure, carrying high transaction and set-up costs, unnecessary when alternatives grant funding options exist, such as TCF funding.
- Third party finance would drive cash outflows (repayments and interest), for which a subsidy would be required, the detailed case for this could only be made based on full construction cost risk, something that is difficult to achieve in the rail market at present.

As a result, the current working assumption is that the existing and new track and signalling infrastructure will remain part of the Network Rail Regulated Asset Base although an option exists for the new stations to be ‘owned’ and operated by a third party. The new car parks to be built at Ashington, Bedlington, Blyth Bebside, Newsham and Seaton Delaval will, however, be built on land either already or proposed to be in the ownership of Northumberland County Council. As such it is anticipated that these will be Northumberland County Council assets with an option of them being operated by a third party.

In respect of the procurement and operation of the trains, train service and stations the Outline Business Case will contain the economic and financial cases for both a Franchise and Concession option. Within this there are a number of sub-options relating to the Concession.

The table below illustrates the Franchise and Concession options which are currently under review and discussion with the relevant stakeholders.

<table>
<tr><th>Phase</th><th colspan="4">Operation Phase</th></tr>
<tr><td>Element</td><td>Trains</td><td>Train Service</td><td>Stations</td><td>Infrastructure</td></tr>
<tr><td>Default Option</td><td colspan="3">Northern Franchise</td><td rowspan="4">Network Rail</td></tr>
<tr><td>Alt Base 1</td><td colspan="3">Concession</td></tr>
<tr><td>Alt Base 2</td><td colspan="2">Concession</td><td>Public Body / Other</td></tr>
<tr><td>Alt Base 3</td><td>Direct to Public Body/Other</td><td>Concession</td><td>Direct by Public Body/Other</td></tr>
</table>

Table 2 - Potential Operational Phases

1.7 Early Contractor Involvement

The project team agreed that to provide robust assurance that the options under consideration were viable, the input from a national major contractor would assist. Following on from a short procurement exercise and based on evaluating the responses received, Morgan Sindall was selected to provide support through Early Contractor Involvement (ECI) during the preparation of this Option Selection Report. Morgan Sindall is a top 5 contractor in the UK and have significant experience of delivering rail schemes of this nature.

Early contractor involvement introduces a contractor's skills early into a project to bring design buildability and cost efficiencies to the pre-construction phase.

Morgan Sindall's support has been provided in three principal areas:

- Constructability assessments
- Cost estimate validation
- Programme validation

1.7.1 Constructability Assessments

The team provided by Morgan Sindall attended the engineering workshops in Newcastle and provided feedback on the proposals and options as they were being discussed from the viewpoint of a contractor tasked with building the infrastructure. This feedback was in terms of possible methods of construction, materials and access arrangements required to construct the option under consideration. The team also provided feedback in correspondence, reviewing design proposals and highlighting any potential to provide a cheaper, quicker or safer solution.

An immediate conclusion that the Morgan Sindall team formed after participation in their first workshop was that delivery methodology would be driven by signalling design choices and possession availability. Much of Morgan Sindall's contribution has been focused on these two key areas and their consequences for future delivery. Their findings are described in detail in ***Section 6***.

1.7.2 Cost Estimate Validation

Cost estimate validation makes Morgan Sindall's contractor expertise available in the fields of:

- accurate, up-to-date costing derived using market place labour, plant, materials and subcontract rates
- cost of directly delivered works
- contractor-specific knowledge of preliminaries costs
- overhead levels appropriate to the scheme
- market profit expectations
- appropriate cost risk

Access to Morgan Sindall's estimating database and pricing expertise will provide a valuable cross-check on the construction cost derived by the SLC, who use different historical cost libraries and price build up methodologies to calculate the same out-turn figure.

Deriving the construction costs independently using different methodologies will provide confidence that the out-turn cost is viable, and that cost risk identified by the QCRA is appropriate.

Availability of a coherent, detailed cost plan relatively early in the project development life cycle allows the wider team to focus on value engineering the cost of larger items down.

1.7.3 Programme Validation

Programme validation for the construction phase makes Morgan Sindall's contractor expertise available in the fields of:

- production outputs
- resource availability
- effect of plant and equipment choices
- long lead issues
- project establishment and temporary works
- delivery programme risk

These are areas where accurate knowledge is not readily available to design consultants or PQS advisors.

The primary output for the Northumberland Line scheme is to provide confidence that the duration allowed for construction activities within the overall project programme is sufficient in duration and correctly positioned to not jeopardise the end date and funding deadlines.

Development of a coherent, detailed construction programme relatively early in the project development life cycle allows the wider team to focus on design and procurement choices that de-risk the overall programme, quantify and begin negotiating realistic rail possession requirements, and inform methodology decisions and resource levels.

1.8 Cost Estimates

Each preferred option for a particular infrastructure intervention has been cost estimated and the information provided to the team generating the outline business case. These costs in general form the Capital Cost estimate portion of the overall financial impact of the scheme.

Where two viable options are available and both offer similar engineering challenges or benefits, both have been costed from a CapEx perspective and in general the cheaper option has been presented as preferred at this stage. Value engineering at the next stage of the project development may include whole life cost analysis to be undertaken and a different solution may become preferred on that basis if the CapEx fits within the available initial budget.

The project team cost estimates were validated by Morgan Sindall under an Early Contractor Involvement arrangement.

The full cost estimate is included within ***Appendix T***

1.8.1 Quantitative Cost Risk Analysis

The risks identified by the project team were discussed at a QCRA workshop held on the 4th of October at the AECOM office in Newcastle. The report detailing the process and outcome is included within ***Appendix S*** of this OSR and the full cost estimate, including the apportioned QCRA risk pots for each phase, is included within ***Appendix T***.

2 PROJECT REQUIREMENTS

2.1 Scheme Requirements

The overall purpose of this project is to stimulate economic regeneration and community engagement in the areas surrounding the Northumberland Line by providing a reliable, rapid public transport connection from the larger towns along the old Ashington, Blyth and Tyne Railway route into Newcastle Central.

The expected outcomes of this include improved access for local people to jobs and recreational activities primarily in Newcastle but also Ashington and other key locations along the route. The attractiveness of this accessibility is expected to attract demand for housing, and local investment by local, regional, national and international organisations.

The top-level working objectives for the project remain as developed for the original study and are:

- Journey time from Ashington to Newcastle of less than, or as close as practicable to, 30 minutes.
- Existing freight paths to remain unaffected.
- New stations at Ashington, Bedlington, Blyth Bebside, Newsham, Seaton Delaval and Northumberland Park
- Half-hourly passenger services throughout the day.

It was determined during the previous SOBC stage that – using Class 158 rolling stock for reference – it would not be practicable to achieve the 30-minute journey times. This is primarily because of the presence of several very low radius curves on the route, the dwell times at stations, and the acceleration profile of the reference vehicles.

The low radius curves constrain the speed trains can safely run and cannot be significantly improved without major land take and property acquisition. The dwell times at stations is effectively defined by common practice and guidance from the current Train Operating Company (TOC). The reference vehicle is relatively slow to accelerate and there may be opportunities for significant improvements in the journey time when the most likely rolling stock is determined.

Nevertheless, journey times of around 35 minutes in each direction have been found viable during the SOBC and accepted by the Steering Group.

It was also determined during the SOBC stage that it may not be possible to deliver the whole scheme as one project, due to both funding constraints, and the possibility of some elements requiring legal powers such as a Transport and Works Act Order (TWAO). At SOBC, there were four infrastructure phases identified based on provision of stations, journey time improvements and frequency of service. In this OBC stage, the number of phases has been reduced to two, though there remains the possibility that funding and legal constraints could still warrant further disaggregation.

A less formal emerging requirement was to provide passive provision for future northern extensions and connectivity beyond Ashington if this became desirable as part of a future initiative. These would include future services to Woodhorn and possibly Lynmouth, as well as any connectivity to the ECML north of Ashington via the old Butterwell line.

Similarly, a developing objective in the OBC stage was to explore ways in which the stations themselves might support the overall purpose of the project through delivery of Economic Development Opportunities (EDOs) connected with the stations themselves. The EDOs could be buildings or other facilities owned by NCC and used for purposes that align with the Northumberland Line project purpose through providing jobs or job training opportunities. Though it was recognised that EDOs would need to be funded and delivered separately to the Northumberland Line project, there was a need to develop station layouts in such a way as to facilitate the introduction of appropriate facilities in due course as local needs emerged.

2.2 Interoperability

2.2.1 Interoperability Regulations

Interoperability is a European Commission (EC) initiative to promote a single market in the rail sector.

The Railways (Interoperability) Regulations 2011 (RIR) came into force on 16 January 2012 and implement the EC Directive 2008/57/EC on the interoperability of the UK rail system. They apply to new, major, upgraded or renewed infrastructure and rolling stock. Applicants must follow a framework and seek an authorisation from the Office of Rail and Road (ORR), to place the infrastructure or rolling stock into service.

Generally, the Directives aim to:

- ensure common Technical Specifications for Interoperability (TSI's) are applied across Europe's railways;
- establish a common European verification and authorisation process for placing new, upgraded or renewed infrastructure or rolling stock in service; and
- provide a process for putting certain rail components known as interoperability constituents onto the rail market.

2.2.2 Technical Specifications for Interoperability

Technical Specifications for Interoperability (TSI) define the technical and operational standards which must be met in order to satisfy the 'essential requirements' and to ensure the 'interoperability' of the European railway system. TSIs also set out expected performance levels.

The essential requirements can be summarised as safety, reliability and availability, health, environmental protection, technical compatibility and accessibility.

The formal definition of interoperability in the Interoperability Directive 2008/57/EC is "the ability of the rail system to allow the safe and uninterrupted movement of trains which accomplish the required levels of performance".

2.2.3 Application of Interoperability Regulations

The Northumberland Line Project has undertaken an assessment of the Application of the Railway Interoperability Standards to identify the elements of the project requiring an authorisation. A Preliminary System Definition has been prepared for submission to Network Rail Assurance Panel (NRAP) for ratification of the proposed application of Railway Interoperability Regulations.

An extract from the submission is included below:

It is expected the majority of the route works may be classified as upgrades and therefore would not require authorisation under the Railway Interoperability Regulations.

The introduction of passenger services and the new stations will need to comply with the Railway Interoperability Regulations. Therefore, the project will need to comply with the relevant clauses of the following TSI's, which will be enacted as Code of Practice under CSM:

- *Infrastructure (INF TSI),*
- *Persons with Reduced Mobility (PRM TSI),*
- *Locomotives and Passenger Rolling Stock (LOC & PAS TSI),*
- *Noise (NOI TSI),*
- *Telematics Applications for Passenger Service (TAP TSI),*
- *Command, Control and Signalling (COCOSIG TSI),*
- Operation and Traffic Management (OPE TSI),

Note: Application of COCOSIG and OPE TSI's will be dependent on the signalling solution.

2.2.4 Interoperability Recommendation

NRAP has endorsed the scheme as requiring an authorisation under the Railways (Interoperability) Regulations 2011 (as amended), but only applicable to the new stations.

A Notified Body (NoBo) will require to be appointed to carry out a conformity assessment to verify compliance with TSIs.

3 APPROACH TO DEVELOPMENT

3.1 RNEP Stage 2: Develop

In order to define options and then evaluate their effectiveness, it is necessary to define a set of criteria that the project needs to deliver. These project drivers are used to continuously evaluate if options being generated and progressed meet the overall requirements for the scheme.

The principal requirements for the option selection and OBC phase of the project were derived from the previous SOBC stage and the client brief used to contract AECOM to deliver the OBC. The criteria, or drivers, exist on multiple levels. These are;

- Optioneering Drivers
- Fundamental Principles
- Consequential Principles
- Value Engineering Principles

The Optioneering Drivers, discussed in ***section 3.1.1*** below are the highest-level objectives for this stage in the project lifecycle, namely Stage 2 Develop under the RNEP Process.

The Fundamental Principles are referred to as Level 1 principles and set out criteria for the design options to work within. This constrains the focus of the engineering to realistic options. These are set out in ***section 3.1.2*** below.

Consequential Principles are Level 2 and are generally derived as a result of meeting the Fundamental Principles or in some cases the Optioneering Drivers. These are generally extrapolated as the design develops and may impose a restriction on one or more disciplines. The Consequential principles extracted from the option development works to date are captured in ***section 3.1.3*** below.

Value Engineering Principles are generally where there is value in adopting a method of construction or product that may or may not require the re-evaluation of a Fundamental Principle or Consequential Principle. These may benefit the overall project by reducing costs or delivery timescales. These are shown in ***section 3.1.4*** below.

Figure 12 below shows the flow of these principles and how they interact.

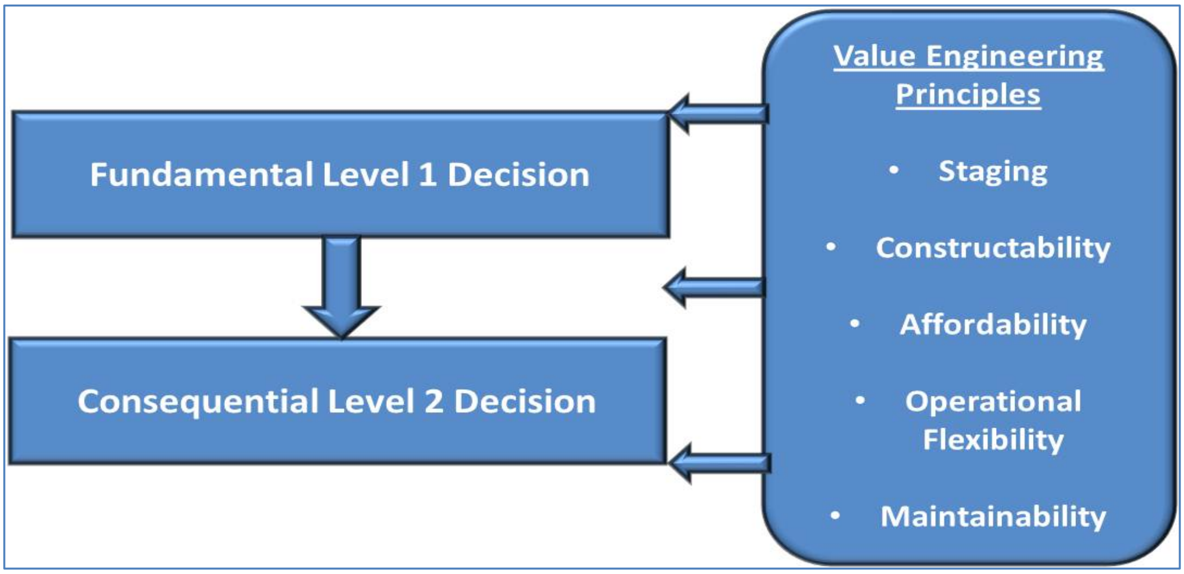


Figure 12 - Decision Making Process

3.1.1 Optioneering Drivers

The Optioneering Drivers for this phase of the projects, as listed in the Client Proposal are as follows:

- Complete RNEP Stage 2: Develop Stage
- Maintain focus on outcomes being sought, access to jobs, economic growth, reduced road congestion and air quality improvements
- Establish Credible Economic and Financial Cases
- Define a single option with the most efficient capital cost and operating costs, including reviewing alternative ownership and operating models
- Produce a passenger service that is attractive enough to users such that the required economic and financial outcomes are generated
- Consider the Government's desire to achieve the benefits incrementally and early

Those drivers shown above in blue are being addressed through the OBC with those in black considered in this report and its supporting documentation.

3.1.2 Fundamental Principles (Level 1)

In order to realise the Optioneering Drivers a set of Fundamental Principles were generated through the project team workshop environment and through detailed consultation the with key scheme Stakeholders. These fundamental principles are summarised as follows:

- Timetable modelling will adopt Class 15x diesel rolling stock as a test train, recognising that other vehicle that perform better may become available closer to the service becoming operational.
- The complete scheme is not deliverable as one project and therefore is to be developed and delivered in manageable phases
- Each delivery phase should contribute towards the efficient provision of the final scheme.
- Each delivery phase should be deliverable within the legal powers, budget and timescales available

    - Phase 1 to include for 1 train per hour and direction between Ashington and Newcastle plus an additional train each way in the peaks
    - Phase 1 to be completed under permitted development or voluntary land sales, no TWAO required.
    - Phase 1 to reflect the requirements of the Transforming Cities Fund and be deliverable by the end of financial year 2022/23
- Minimise disruption and modifications to the East Coast Main Line (ECML) and NEXUS Metro system, and there should be no physical connection or dual use of the Metro infrastructure

3.1.3 Consequential Principles (Level 2)

Beneath the top-level requirements listed above come some important consequential requirements. The single line section for the southern half of the route presents a considerable constraint on operational capacity and flexibility of the line. In particular, the operational interface between freight and passenger trains requires ‘flighting' of services to enable trains in one direction to clear the single line section before services can enter it coming the other way. By applying the fundamental principles outlined in ***Section 3.1.2*** above, the following key consequences were realised through workshop and layout development:

- Minimise the journey time on the single line section between Benton East Junction and Newsham;
- Introduce signalling to break up the block section within the single line section and allow flighting of trains;
- Increase linespeeds on the route between Benton North Junction and Ashington wherever practicable to the maximum attainable speed of the anticipated rolling stock at each location or 65mph, whichever is the least;
- Review existing infrastructure and remove, replace or upgrade where necessary to maintain appropriate standards and safety obligations;
- Provide enough parking, cycling and other transport interchange facilities as will meet the expected demand at each station;
- Ensure that the project may be constructed efficiently and that phased development of the project allows subsequent phases to be provided at minimum additional cost.
- The signalling currently in place on the line does not lend itself to phased upgrades due to the mixture of control arrangements, absolute block, semaphore and colour light signals, mostly mechanically interlocked.
- In order to deliver the scheme during the construction phase, Furnaceway Sidings require to be brought into use and altered to allow a locomotive rounding move to take place in the early phases of delivery.
- At the previous SOBC stage, it had been deemed appropriate to utilise the existing level crossings as a means of platform to platform movement. However, after discussions within the design team and with Network Rail, it has become apparent that the risks of trespass and abuse in doing so are unacceptable, with the notable exception of Bedlington where the level crossing is already heavily used by pedestrians.
- Furnaceway sidings to be taken back under Network Rail management and refurbished under the project in order to avoid additional access charges to GBRf and remove a potential stakeholder objection.
- Benton East Junction to be moved towards Northumberland Park to prevent a freight train held awaiting access to the single line from fouling Palmersville Dairy crossing.

The functional level design solutions are derived from these second-order principles.

3.1.4 Overarching Value Engineering Principles to be applied

The following Overarching Value Engineering Principles were identified during this Develop Stage. These should be taken onto the Design stage and additional items may be identified once outline design begins.

- Staging

    - Does the proposal contribute to the efficient procurement and delivery of the overall project, and enable passive provision of future development? E.g. The signal modifications could not easily be delivered in a multi-phase approach, and therefore have almost entirely been brought into Phase 1.
- Constructability
    - Can the proposal be constructed effectively with due consideration to safety, cost, programme, disruption and risk? E.g. When constructing the lift shaft at Northumberland Park, detailed plans will be required on the methodology of piling and installing foundations and the shaft without impacting the adjacent Metro line and its overhead electrification.
- Affordability
    - Is this proposal likely to be deliverable within the budget envelope envisaged and cost effective in the context of targeted objectives (reasonable cost) and desirable objectives (marginal cost)? E.g. Replacement of sleepers and ballast in sufficient but poor condition where rails need replacing
- Operational Flexibility
    - Does this proposal enable sufficient operational flexibility to accommodate reasonable requests by TOCs, FOCs and Network Rail to access and make use of the network? E.g. Provision of the turnback platform spur at Ashington to avoid blocking northbound freight following a passenger service
- Maintainability
    - Does this support the efficient and reasonable maintenance of the asset(s) in accordance with good asset management practice? E.g. provision of walking route access to new switches and crossings.

3.2 Layout of Report

The AECOM approach to development works leading up to a single option selection and report, such as this document, is to firstly brief out to the engineering disciplines the requirements of the scheme, as defined in ***section 2.1*** above, and then for a number of multi-disciplinary workshops to review and refine options as the designs develop.

The information developed by the various design disciplines is captured within this report in the appropriate sections with drawings and standalone additional reports contained within the appendices.

This report has been laid out with an executive summary at the front, information on the project requirements and approach, a detailed breakdown of the preferred option, constructability for the preferred option, explanation of the option selection process, details of all of the options considered, risks and assumptions, existing asset information, interoperability, environment, safety, land and consents, proposals for the next stage, a conclusion summing up the findings of the report and lastly the individual engineering outputs.

Configuring the report with the preferred solution at the front, brings it into focus for a wider audience, allowing a quick overview of the scheme being proposed. Those readers requiring in depth knowledge of the option selection process or technical aspects of the options can drill into the detail contained later in the report or appendices.

3.3 Stakeholder Consultations

During the course of the development of the single option, various meetings have been held with stakeholders. These can be defined as public bodies, either associated with the councils or independent, rail franchise holders, freight companies, Network Rail, Regulators or public consultations. The extent of these stakeholder consultations demonstrates that the project has been developed with the views and requirements of many taken on board and not developed in isolation.

Table 3 – below provides a summary of the stakeholder companies and key staff that have been consulted during this study, in addition to the sequence of Project Board and Steering Group meetings which include senior management attendees from NCC, DfT, Network Rail, Northern Railway, NEXUS, ORR and the consultant team:

Name	Job Title	Discipline	Company	Date	Location
David Guy	Level Crossing Manager	Level Crossings	Network Rail	08/05/19	Raven House, Gateshead
John Watson	Level Crossing Manager	Level Crossings	Network Rail	08/05/19	Raven House, Gateshead
"Pawel Nowak	FOC Rep	Train Operators	DB Cargo	17/06/19	AECOM Offices, York
Michael Haughian	FOC Rep	Train Operators	DB Cargo	17/06/19	AECOM Offices, York
Jason Bird	FOC Rep	Train Operators	GBRf	17/06/19	AECOM Offices, York
Martin Roger	TOC Rep	Train Operators	Northern	17/06/19	AECOM Offices, York
Mark Beck	TOC Rep	Train Operators	Northern	17/06/19	AECOM Offices, York
David Guy	Level Crossing Manager	Level Crossings	Network Rail	30/07/19	Raven House, Gateshead
John Watson	Level Crossing Manager	Level Crossings	Network Rail	30/07/19	Raven House, Gateshead
Melanie Kitching	Route Level Crossing Safety Specialist	Level Crossings	Network Rail	30/07/19	Raven House, Gateshead
Steve Butcher, NR	Project Engineer	NR Project Engineering	Network Rail	03/09/19	AECOM Offices, Newcastle
Derek Westhorpe, NR	LOM	NR Operations	Network Rail	03/09/19	AECOM Offices, Newcastle
Tony Hewitt, NR	Ops Manager	NR Operations	Network Rail	03/09/19	AECOM Offices, Newcastle
Pawel Nowak	FOC Rep	Train Operators	DB Cargo	18/09/19	AECOM Offices, York
Michael Haughian	FOC Rep	Train Operators	DB Cargo	18/09/19	AECOM Offices, York

Name	Job Title	Discipline	Company	Date	Location
Jason Bird	FOC Rep	Train Operators	GBRf	18/09/19	AECOM Offices, York
Martin Roger	TOC Rep	Train Operators	Northern	18/09/19	AECOM Offices, York
Mark Beck	TOC Rep	Train Operators	Northern	18/09/19	AECOM Offices, York
Eamon McAuley	Signalling RAM	Signalling	Network Rail	19/09/19	York
Phil Glynn	Senior Surveyor	Property Services	Network Rail	13.06.19 & 02.07.19	George Stephenson House, Toft Green, York
Dave Tilbrook	Senior Surveyor	Property Services	Network Rail	02.07.19	George Stephenson House, Toft Green, York
David Shorrocks	Liabilities Advisor	Liabilities	Network Rail	02.07.19	AECOM, Toft Green, York
Tony Rivero	Town Planning Manager	Town Planning	Network Rail	02.07.19	AECOM, Toft Green, York
Niall Cathie	Strategic Property Manager	Property	North Tyneside Council		
23.07.19	Telephone Meeting				
John Cooper	Senior Surveyor	Freight Property Services	Network Rail	06.08.19	George Stephenson House, Toft Green, York
Mike Robbins	Strategic Estates Manager	Property	Northumberland County Council	20.06.19, 14.08.19, 12.09.19, 17.10.19	County Hall, Morpeth
Mike Turner	Head of Property Services and Capital Programme	Property	Northumberland County Council	20.06.19, 16.07.19, 14.08.19, 12.09.19, 17.10.19	County Hall, Morpeth
John Price	Senior Estates Officer	Property	Northumberland County Council	12.09.19	County Hall, Morpeth
Meenu Malhotra	Chairman	Landowner at Ashington	Malhotra Group	02.09.19	Telephone meeting
Roddy Findlay	Partner	Property	Galbraiths, Agent for Lord Hastings, landowner at Seaton Delaval	09.09.19	Galbraiths offices, Hexham

Name	Job Title	Discipline	Company	Date	Location
Peter Combe	Partner	Property	Galbraiths, Agent for Viscount Ridley, landowner at Seaton Delaval	11.09.19	Telephone meeting
Malcolm & Kate Doyle	N/A	Landowner at Newsham	N/A	08.10.19	South Beach Public House, Newsham
Neil Parkin	Route Asset Manager	Track	Network Rail	03/10/19	George Stephenson House, York
Rob Murfin		Town Planning	Northumberland County Council	22.05.19, 20.6.19, 16.07.19	County Hall, Morpeth
Judith Murphy		Town Planning	Northumberland County Council	22.05.19, 20.6.19, 05.07.19, 16.07.19; 2.10.19, 17.10.19	County Hall, Morpeth
Jackie Palmer	Head of Planning	Town Planning	North Tyneside Council	24.05.19, 09.07.19	Quadrant East, Silverlink North, Cobalt Business Park
John Cram	Highways	Highways	North Tyneside Council	24.05.19	Quadrant East, Silverlink North, Cobalt Business Park
John Sparks	Head of Regeneration	Regeneration	North Tyneside Council	24.05.19	Quadrant East, Silverlink North, Cobalt Business Park
Ben Jones	Planning and Investment Manager, Network Services, North	Rail Group	Department for Transport	12/Apr/19	DfT, London
Hannah Fitzpatrick	Head of Stations and Community Rail Policy	Rail Group	Department for Transport	14/May/19	DfT, London

Name	Job Title	Discipline	Company	Date	Location
Kulvinder Bassi	Community Rail Team Leader	Rail Group	Department for Transport	14/May/19	DfT, London
Shawney Murphy	Stations and Community Rail Policy Manager	Rail Group	Department for Transport	14/May/19	DfT, London
Michael Black	Director of Investments	Investments	Advance Northumberland	04/Jun/19	County Hall, Morpeth, Northumberland
Anna Weeks	Interim Regional Director – North East	Management	Northern Railway	06/Jun/19	Newcastle Central
Carolyn Watson	Community Director	Community	Northern Railway	06/Jun/19	Newcastle Central
Paul Milnes	Property Team Lead	Property	Northern Railway	06/Jun/19	Newcastle Central
Catherine Williams	Deputy Director Rail Markets and Economics	Economics	Office of Rail and Road (ORR)	01/Jul/19	Conference call
James Dunshea	Senior Enhancements Projects Manager	Enhancements	Office of Rail and Road (ORR)	01/Jul/19	Conference call
Lisa Scott	Enhancement Manager (North of England)	Enhancements	Office of Rail and Road (ORR)	01/Jul/19	Conference call
Richard Watts	Chair	Community engagement	Lancashire Community Rail Partnership	03/Jul/19	Conference call
Lisa Scott	Enhancement Manager (North of England)	Enhancements	Office of Rail and Road (ORR)	09/Jul/19	York
Gerry Leighton	Head of stations and depots and Network Code		Office of Rail and Road (ORR)	12/Jul/19	Conference call
Stephen Curry	Operational Change Manager	Operations	Northern Railway	16/Jul/19	Conference call
Kaye Robinson	Community Rail Partnership Officer	Community engagement	Lincolnshire County Council	15/Jul/19	Conference call
Brian Beardsley	Operations Manager	Operations	Association of Community Rail Partnerships (ACoRP)	15/Jul/19	Conference call

Name	Job Title	Discipline	Company	Date	Location
Michael Black	Director of Investments	Investments	Advance Northumberland	23/Aug/19	County Hall, Morpeth, Northumberland
Lisa Scott	Enhancement Manager (North of England)	Enhancements	Office of Rail and Road (ORR)	10/Sep/19	Conference call
Stephen Fletcher	Deputy Director	Management	Office of Rail and Road (ORR)	10/Sep/19	Conference call
Gary Taylor	Senior Executive Interoperability & Standards	Interoperability	Office of Rail and Road (ORR)	10/Sep/19	Conference call

Table 3 – Stakeholder Meetings

Further to these stakeholder meetings, a series of public consultations were arranged by Northumberland County Council and attended by members of the project team in order to address any areas of concern raised.

These consultation meetings were held as follows:

Venue	Date	Time
George Stephenson House, York	03/10/19	11:00 – 12:30
Ashington YMCA, (Arts Centre), North View Ashington, NE63 9XQ	(Mon) 02 Sep 2019	10:00 - 16:00
Ashington YMCA, (Arts Centre), North View Ashington, NE63 9XQ	(Thu) 05 Sep 2019	15:00 - 19:00
Bedlington East Bedlington Community Centre (Platform 1), 16 & 17 Station Rd, Bedlington, NE22 7JN	(Tue) 03 Sep 2019	15:00 - 19:00
Bedlington (See above)	(Wed) 04 Sep 2019	10:00 - 16:00
Blyth Buffallo Community Centre (Lower Hall), 55 Regent St, Blyth, NE24 1LL	(Mon) 09 Sep 2019	10:00 - 16:00*
Blyth (See above)	(Tue) 10 Sep 2019	15:00 - 19:00
Seaton Valley	(Wed) 11 Sep 2019	10:00 - 16:00

Venue	Date	Time
Seaton Delaval & Holywell Community Centre (Half Hall), Elsdon Avenue Seaton Delaval, NE25 0BW		
Seaton Valley (See above)	(Wed) 18 Sep 2019	15:00 - 19:00
Northumberland Park St Mark's (Church Hall) Brenkley Ave, Shiremoor, NE27 0PP	(Thu) 12 Sep 2019	10:00 - 16:00
Northumberland Park (See above)	(Mon) 16 Sep 2019	15:00 - 19:00

Table 4 - Public Consultations

These public consultations afforded both the council and project teams an opportunity to hear any concerns that members of the public may have had and to explain the scheme to them, helping to promote the benefits and advantages whilst alleviating any concerns.

Overall, the feedback was consistently supportive but cynical – this is a project that has had several false dawns, and the most common question was 'Is it really going to happen this time?'. A few residents living adjacent to the railway, particularly those near the stations were concerned with loss of privacy due to overlooking, and some were worried about vibration and (to a lesser extent) noise.

Particularly at Bedlington and Newsham, some residents were concerned about the effect of more level crossing closures on the traffic, as their experience to date has been one of long barrier down times and very frustrating queues. At Seaton Delaval, the local Labour leader took to social media to express dismay that Seaton Delaval was not due for delivery until Phase 2, which could be taken as enthusiastic support for the project.

Ticket pricing, impact on local street parking, and the reasons for the phasing were common queries, and several people asked why the service was not going to go into the centre of Blyth, as the old railway had done – though they recognised that some of that route had now been built upon.

Participants were pleased to have the opportunity to be consulted, though it became apparent that the local newspaper within which some of the adverts were placed does not reach all the local communities, and that some had only learned of it through the NCC website or social media or neighbours.

Nevertheless, the vast majority of attendees were very enthusiastic about the prospects for them and their families to get access to jobs and leisure facilities in Newcastle, with the frustrations of congestion and long bus journey times a frequent reason given.

3.4 Phased Layout Consideration

At the previous stage of development, the Strategic Outline Business Case (SOBC), the project scheme was envisioned as being commissioned into service in four distinct phases. The Phased approach was originally driven by the desire to provide a viable scheme in the short term, ideally by May 2021, with later development included as funding and legal powers allowed. The dividing points between phases were driven by:

- Work that can deliver an hourly service early i.e. without requiring a Transport and Works Act Order (TWAO)
- Additional stations delivered through a TWAO
- Signalling and track interventions to optimise linespeed in the double track section
- Additional infrastructure to support a half-hourly service

More details of each phase are described below:

3.4.1 Phase 1

Phase 1 was developed in order to have a basic service running with four stations constructed in the shortest possible timescales. Stations would be commissioned at Ashington, Bedlington, Newsham and Northumberland Park as these were felt to be deliverable within permitted development rights and limited land negotiations with no need to seek a TWAO. An hourly service would operate with trains dwelling at Ashington clear of the running lines and some minor speed improvements being implemented.

3.4.2 Phase 2

Phase 2 was anticipated to be dependent on obtaining a TWAO to enable compulsory purchase of land at Seaton Delaval and Blyth Bebside for the construction of stations at these locations. Further limited linespeed increases between Newsham and Bedlington would be introduced within the relatively modern signalling system to partially offset the additional journey time caused by the two new stops at stations. In order to keep costs down, the intention was to delay all but the absolute minimum changes to the very old signalling north of Bedlington.

3.4.3 Phase 3

Phase 3 was intended to take the cost impact of signalling upgrades north of Bedlington and increase linespeeds to minimise journey times from Ashington. Nevertheless, Phase 3 would not enable the half-hourly all-day service because of the conflict between an hourly freight path and the constraints of the single-track occupation time.

3.4.4 Phase 4

Phase 4 would have seen the addition of a double-track section on the single line section to allow freight services to pass or be overtaken and enable the half-hourly all-day service

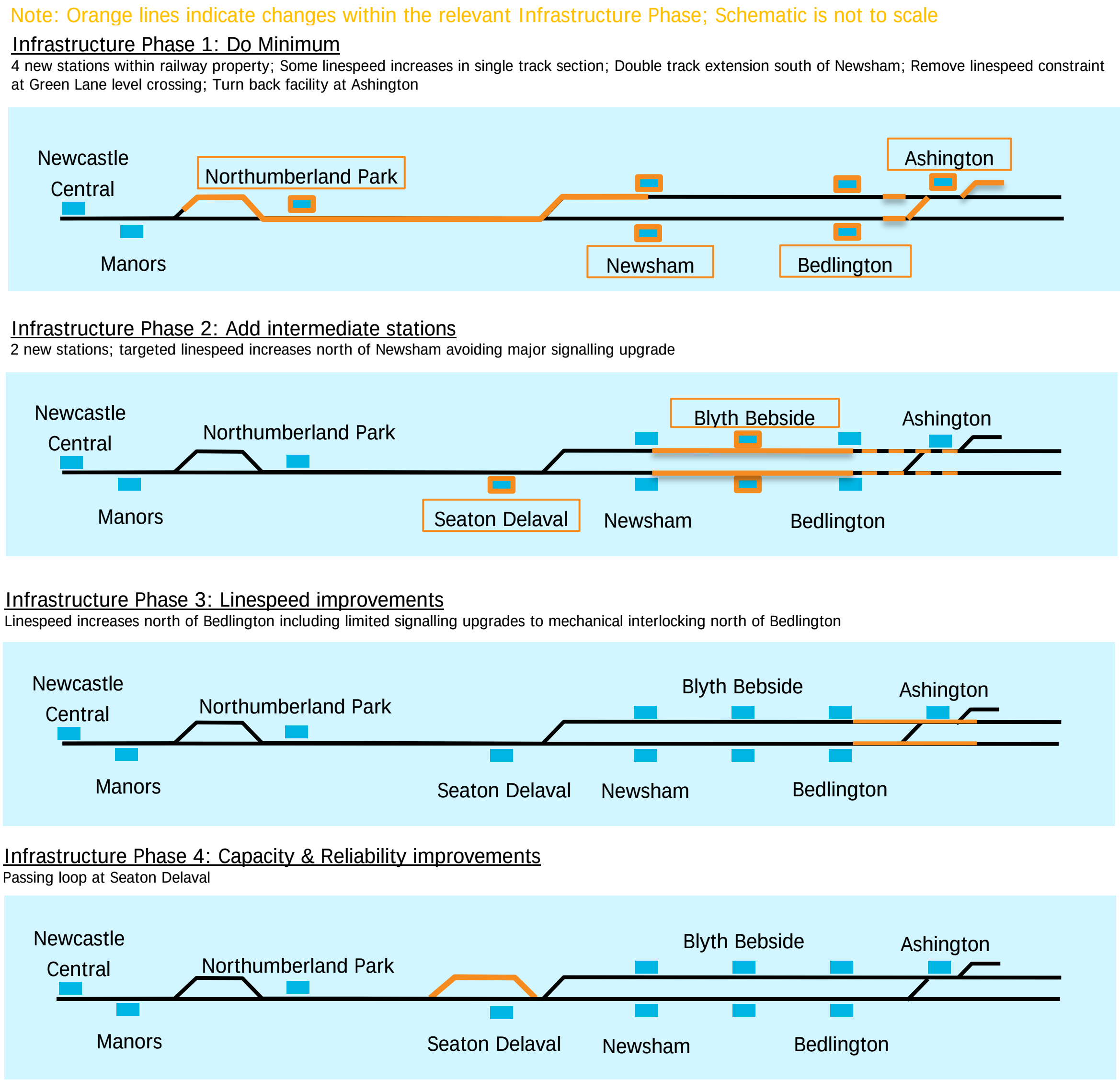


Figure 13 - Phased Approach at SOBC Stage

3.4.5 Revised Phasing for OBC

During the option development for this stage, it became apparent that the level crossing upgrades were going to trigger most of the signalling changes, bringing most of the Phase 3 signalling works into Phase 1. Since the associated linespeed improvements generally amounted to curve realignment, these could be brought into Phase 1 or Phase 2 as budget allowed or the timetable required. Similarly, the incremental cost of the passing loop was seen to be a relatively small amount in railway project terms, and worth bringing into Phase 2 for efficiency in procurement but not worth bringing into Phase 1 because the incremental cost increase would be likely to exceed the Phase 1 budget and the passing loop is not required for the hourly service.

Therefore, the current proposal is for a two Phased approach, subject to budget and legal powers available at each stage. It remains possible that Phase 2 could be subdivided if, for example, one or both of Blyth Bebside and Seaton Delaval stations could be constructed before the full half-hourly service was able to be implemented

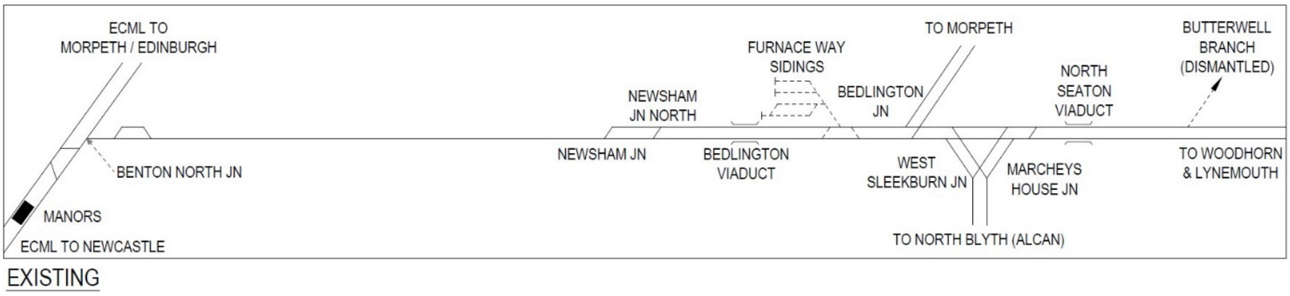


Figure 14 - Existing Schematic

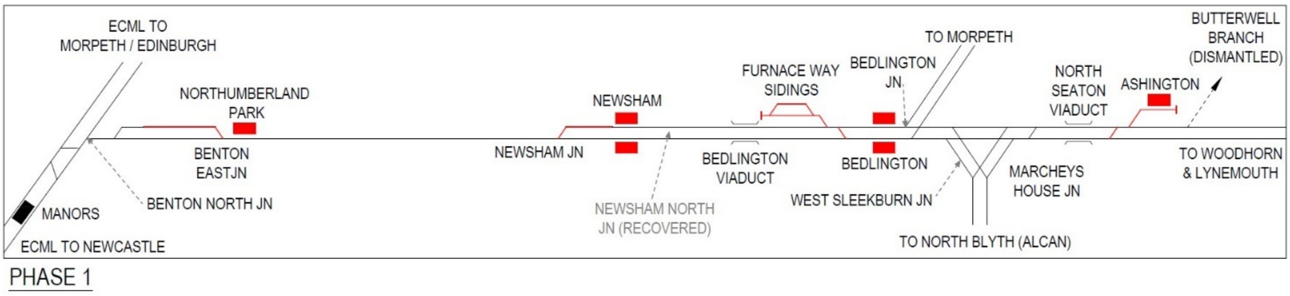


Figure 15 - Phase 1 Schematic

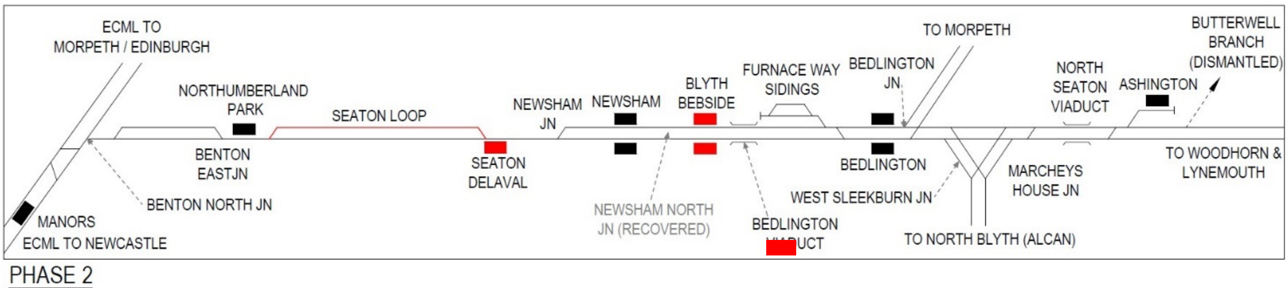


Figure 16 - Phase 2 Schematic

The Schematics above highlight the existing, Phase 1 (or Initial Hourly Service) and Phase 2 (Half-Hourly Service) layouts for the route. It can be seen from these that the Initial Hourly service introduces stations and infrastructure which are subsequently complimented at phase two with two additional stations and infrastructure enhancements that enable a full half-hourly service. No significant phase one enhancements require to be removed in order to facilitate phase 2.

Although shown as a single second phase, there would be an opportunity to deliver Phase 2 in smaller sub phases if the need arises. This would allow for the additional stations to be constructed as and when TWAO powers are obtained in advance of the implementation of the full half-hourly service pattern or independently of each other at different times if capital expenditure was constrained in the future.

The provision of the Down Loop however between Northumberland Park and Seaton Delaval is necessary in order to realise the full half hourly passenger service. The proposed half-hourly timetable structure assumes that the majority of passenger and freight trains will cross on the double track sections north of Hartley curve (Newsham Two track Extension) and south of Benton East Junction but there are a small number of services which will need to cross at the new Down Loop. During service perturbation the new Down Loop also provides a mechanism to reduce secondary network delay by providing signallers with more train regulation options.

Both the hourly and half-hourly passenger timetable options have been designed with the assumption that a freight train will operate in each direction between Benton North Junction and Bedlington every hour between 0600 and 2200. This provides for 36 freight train movements per weekday over the single line. The current total of freight operators access rights over the section is 20 train movements and from discussion held with the current FOCS, these are not anticipated to increase. In practice it is rare that all of these slots are used on any one day. It can be seen, therefore, that a significant amount of spare capacity has been built into both the timetable assumptions and the engineering solution for Phase 2.

3.4.6 Engineering Workshops

The initial briefing workshop for Northumberland took place in York on the 14th of March 2019. At this meeting, each engineering discipline was briefed on the project and the output required by the client. Engineering Management procedures to be adopted, such as design decision logs, option trackers and interface schedules were discussed and adopted.

Further development workshops were held in Newcastle on the 10th of April 15th of May 24th of July 28th of August and 24th of September 2019. At these workshops the options identified by various disciplines (principally signalling, stations and track) were discussed and assessed for their impact with options trackers updated to reflect progress or options no longer being considered.

Workshop	Venue	Date	Purpose
Project Start Up Meeting	York	14/03/19	Brief project requirements to various engineering disciplines and agree programme for delivery and key project risks and interface issues
Workshop 1	Newcastle	10/04/19	Multi-disciplinary review of baseline information including gap analysis to inform RFIs, stakeholder requirements and agree strategy for ongoing delivery of the project.
Workshop 2	Newcastle	15/05/19	Review of first baseline signalling layout, Track and Operational review including sped profile and loop strategy, Update on Land referencing and route wide environmental and planning update, Review of current stations proposals, and agreement of Stakeholder management strategy.
Operators Workshop 1	York	19/06/19	Review by the FOCs and TOC of the current signalling scheme plan, timetable and operational proposal.
Workshop 3	Newcastle	24/07/19	Multi-Disciplinary review of options under consideration and associated land and environmental impacts. Present scheme to Network Rail.
Workshop 4	Newcastle	28/08/19	Review station layouts with highways added to drawings, discuss revised signalling scheme sketch

Workshop	Venue	Date	Purpose
Operators Workshop 2	York	18/09/19	2nd Review by the FOCs and TOC of the revised signalling scheme plan, timetable and operational proposal.
HAZID	York	19/09/19	HAZID workshop.
Workshop 5	Newcastle	24/09/19	Review final options and allocate sections of this report to various discipline leads.
QRA	Newcastle	04/10/19	Multi-disciplinary assessment and valuation of project risks.

Table 5 - Workshop Schedule

Through holding these workshops and participating in cross discipline discussions reviewing the likely constructability, cost and safety impacts of proposals, integrated design solutions were generated and progressed throughout the option selection process.

Further weekly online conference meetings were held between these official workshops in order that disciplines could update on progress and issues and constructive cross discipline conversations could be facilitated.

4 OPTION SELECTION PROCESS

The option selection process was driven by a workshop environment developed with consideration of the scheme Key Drivers and Fundamental Principles set out in ***Section 2.2.1*** of this report.

4.1 Individual Station Option Identifications

The table below shows the various options generated at each of the station locations with a brief description and a note on whether the proposal proved to be viable or not and preferred or not. For the full detail on each option, please see the relevant section of the report.

Option Number	Description	Viable or Non-Viable	Preferred or non-preferred	Option Detail Reference
Northumberland Park Station				
1A	Platform in cutting between Algernon Drive and the A186. Entrance via new footbridge spanning from the existing NEXUS station.	Non-Viable	Non-Preferred	13.1.1.1
1B	Platform in cutting between Algernon Drive and the A186. Entrance via new breakout in Algernon Drive Overbridge parapet.	**Viable**	**Preferred**	**5.1.1**
2	Platform in cutting between Algernon Drive and the A186. Entrance via new breakouts in Algernon Drive Overbridge parapets, with stairs to the east and lifts to the west.	**Viable**	Non-Preferred	13.1.1.3
Seaton Delaval				
1A	Single platform located within the passing loop to the south of the A192 and a car park to the east of the platform.	Non-Viable	Non-Preferred	13.1.2.1
1B	Flanked platforms with a footbridge located within the passing loop to the south of the A192 and a car park to the east of the platform.	Non-Viable	Non-Preferred	13.1.2.2
2	Single platform to the north of the A192 on the existing single-track alignment. Car park provide off Double Row. Footbridge provided from the south / east of the railway to the platform.	**Viable**	Non-Preferred	13.1.2.3
3	Single platform located on the existing single-track alignment to the south of the A192 and a car park to the east of the platform.	**Viable**	**Preferred**	**5.1.2**
Newsham				

Option Number	Description	Viable or Non-Viable	Preferred or non-preferred	Option Detail Reference
1	Platforms split across the level crossing on an extended double track alignment. Down Platform to the northwest, Up Platform to the southeast. Car park to the southeast.	Non-Viable	Non-Preferred	13.1.3.1
2A	Flanked platforms 75m to the south of the level crossing on an extended double track alignment. Car park to the west and access road from the existing roundabout.	**Viable**	**Preferred**	**5.1.3**
2B	Flanked platforms 75m to the south of the level crossing on an extended double track alignment. Car park to the east and access from a new 4 arm junction of the A1061 and Blagdon Drive.	**Viable**	Non-Preferred	13.1.3.3
3	Flanked platforms to the north of the level crossing on the existing double track alignment. Car park to the southeast.	Non-Viable	Non-Preferred	13.1.3.4
Blyth Bebside				
1	Flanked platforms 450m north of the level crossing on the existing double track alignment. Underpass dug between the platforms. Car parks and access roads on both sides of the railway.	Non-Viable	Non-Preferred	13.1.4.1
2	Flanked platforms 300m north of the level crossing on the existing double track alignment. Footbridge between the platforms. Car park and access road to the west of the railway off Front Street.	Non-Viable	Non-Preferred	13.1.4.2
3	Flanked platforms 75m north of the level crossing on the existing double track alignment. Footbridge between the platforms. Car park and access road to the west of the railway off Front Street.	Non-Viable	Non-Preferred	13.1.4.3
4	Flanked platforms 75m south of the level crossing on the existing double track alignment. Footbridge between the platforms. Car park and access road to the east of the railway off the A189 roundabout.	**Viable**	Non-Preferred	13.1.4.4
5	Flanked platforms 250m south of the level crossing on the existing double track alignment. Footbridge between the platforms. Car park and access road to the west of the railway off Front Street and Errington Street.	**Viable**	**Preferred**	**5.1.4**
Bedlington				

Option Number	Description	Viable or Non-Viable	Preferred or non-preferred	Option Detail Reference
1A	Flanked platforms between Bedlington South Level Crossing and Bedlington Junction on the existing double track alignment. Car park on existing railway land to the east of the former station.	**Viable**	**Preferred**	**5.1.5**
1B	Flanked platforms between Bedlington South Level Crossing and Bedlington Junction on the existing double track alignment with a footbridge between. Car park on existing railway land to the east of the former station.	**Viable**	Non-Preferred	13.1.5.2
2	Platforms split across Bedlington South Level Crossing on the existing double track alignment. Down Platform to the northwest, Up Platform to the southeast. Car park on existing railway land to the east of the former station.	Non-Viable	Non-Preferred	13.1.5.3
Ashington				
1	Single platform adjacent to the Down Line on the existing double track alignment adjacent to the existing council car park.	Non-Viable	Non-Preferred	13.1.6.1
2	Single platform on a proposed Platform Line adjacent to the existing council car park.	Non-Viable	Non-Preferred	13.1.6.2
3	Island platform between the Down Line and a proposed Platform Line adjacent to the existing council car park. The car park is proposed to be extended.	**Viable**	Non-Preferred	13.1.6.3
4	Single platform on a proposed Platform Line adjacent to the existing council car park, but further south that Option 2. The car park is proposed to be extended. Option to connect to the North.	**Viable**	**Preferred**	**5.1.6**

Table 6 - Station Options

4.2 Overall Route Option Identifications

Overall route infrastructure options such as the signalling scheme plan and through alignment track design have undergone various iterations as the Option Development and selection has progressed. These do not all have individual Option identification numbers as the preferred solution has evolved more than been compared to another possible alternative.

Where there are options, such as for the loop position and length between Earsden, Seghill or Seaton Delaval, these have been captured and numbered accordingly. The individual options are discussed within the relevant sections of this report.

4.3 Station Considerations

As outlined in ***Section 2.2.1*** of this engineering report a number of Key Drivers and Fundamental Principles were agreed during early workshops and through engagement with key stakeholders.

Critical Fundamental Principles which had a clear influence on the stations are as follows:

- Railway
    - Minimise negative impact on journey times
    - Avoid complicating any signalling changes
- Accessibility
    - from local population centres via anticipated routes (walking/cycling/highway)
    - for Persons of Restricted Mobility (PRMs)
- Transport interchange
    - Provision for cars and sufficient space for car parking
    - Provision for cycles (Storage)
    - Provision for taxis
    - Provision for buses
- Cost
    - Minimum number of platforms
    - Anticipated cost of land purchase
    - Constructability
- Local impacts
    - Impact of platform location on level crossing barrier down times
    - Impact of increased or slow traffic on local highway junctions
    - Requirement for land purchase, particularly residential properties and businesses and risk of creating ransom strips
- Safety risks
    - Effect of barrier down times on pedestrian and driver behaviours
    - Walking desire lines that might encourage trespass
- Future proofing
    - Capacity for additional parking
    - Capacity for areas for Economic Development Opportunities

4.3.1 Northumberland Park

The following unique features of this location had an impact on the assessment of Options at Northumberland Park:

- Connectivity with the metro for passenger interchange
- Construction impacts on the metro – specifically line closures
- Local historical experience of a sink hole due to former mine workings
- Legal/commercial implications of structural and maintenance interfaces
- Construction access at platform level
- Interface with the bridge carrying Algernon Drive including breakthrough of parapets

4.3.2 Seaton Delaval

The following unique features of this location had an impact on the assessment of Options at Seaton Delaval:

- Extensive local land ownership by Baron Hastings and consequential negotiating positions
- Minimise future cost of potential interface with passing loop / future track doubling
- Interface with local traffic on Astley Road, and reported problems with traffic turning right out of Blackhaugh Drive
- Accessibility from Seghill – particularly cyclists and pedestrians
- Impact on local woodland of unknown ecological value
- Local Site of Special Scientific Interest (SSSI)

4.3.3 Newsham

The following unique features of this location had an impact on the assessment of Options at Newsham:

- Impact on green belt land
- Probable negotiating position with local land owners
- Avoidance of impact on property and garden to south-east of the level crossing
- Local reports of flooding, to field south west of level crossing
- Interface with local signal box, particularly due to project signalling changes
- Pedestrian crossing points on South Newsham Road
- Junction configuration considerations with a new crossroads needed to the East option and an existing roundabout available for the West option

4.3.4 Blyth Bebside

The following unique features of this location had an impact on the assessment of Options at Blyth Bebside:

- Complexity of land acquisition, particularly Riverside Farm, Railway Cottages, Jet Garage, Bebside Inn, and local field boundary lines
- Impact on level crossing down times and consequentially on the Front Street / A189 roundabout, with risk of backing up on the slip road
- Impact of cars turning right near the level crossing and accessing/exiting the Front Street / A189 roundabout
- Walking/cycling access from Blyth

4.3.5 Bedlington

The following unique features of this location had an impact on the assessment of Options at Bedlington:

- Anticipating local expectation to re-use the existing platform
- Location of signals BS16&BS18 on the historical platform (Up Side)
- Position of Bedlington North Junction in relation to the Down platform signal
- The A7 bullhead double junction and close proximity of the proposed platforms
- Avoidance of stopping a train on Bedlington North Junction or the underlying curve, which is substandard radius
- Provision of secondary means of escape for Down (northbound) services

- Minimising impact of barrier down times for local level crossings, particularly Bedlington South level crossing
- Minimising potential for local on-street residential parking through provision of adequate parking

4.3.6 Ashington

The following unique features of this location had an impact on the assessment of Options at Ashington:

- Passive provision for future northbound expansion or connectivity of the service with minimal construction works
- Enable efficient turnback of services while allowing freight to pass
- Connectivity to Wansbeck Square in its existing and potential future redeveloped forms
- Passive provision for architectural ‘destination station’ or ‘gateway’ provision
- Avoid creating a pedestrian desire line from Hospital Crossing up the lineside to the platform
- Impact on local car park and Public Open Space as a result of private land ownership earmarked for development

4.4 Signalling & Telecommunications

4.4.1 Signalling

In determining a strategy to best accommodate the resumption of passenger services and the increase in train frequency and speed, an understanding of the current method of operation has been thoroughly investigated. This was further developed through discussions with the RAM Teams for Signalling and Level Crossings. Additionally, an understanding of the constraints on the line has been investigated. These constraints include, junction positions, track (speed) constraints, signalling technology and interlocking constraints and likely Level Crossing requirements.

The resultant design strategy perpetuates the existing control areas, whilst introducing a new control area to accommodate Ashington Station.

Consideration was given to a full re-signalling of the area, with operation from a single or multiple control points, but this has been discounted on the basis that full re-signalling (of the whole Northumberland Line) does not offer value for money for the client, Northumberland County Council. This in part is due to the realisation that the passenger service can be accommodated on some of the control areas with minimal alterations taking place.

4.4.2 Telecommunications

On the Northumberland Line Project, Telecoms did not have any direct impact or influence on the proposed options being considered. Telecoms undertook a support role as a discipline to the project providing the necessary design considerations based on the preferred stations options and the Signalling and Track layouts.

Telecoms undertook the Option Selection Report production in line with NR Standard NR/L1/TEL/30100 – Telecoms Design.

4.4.3 Level Crossings

In early consultation with Network Rail, it was agreed that each level crossing requires a number of Suitable and Sufficient Risk Assessments to take place which will assist in determining which level crossing solution is best suited for that particular crossing. This requires a 9-Day crossing census to take place and input from Network Rail regarding use of the ALCRM Tool and was therefore never going to be completed in time for the submission of the Option Selection Report. Therefore, an ‘agreement in principle’ for each of the level crossings was agreed by all parties which was carried forward into the design process as a likely solution. Once the Suitable and Sufficient Risk Assessment process is complete, these decisions can be ratified or amended as necessary.

4.5 Track Alignment

When assessing the various options for the track interventions for the Northumberland Line, reference has been made to the fundamental requirements and whether or not the options developed meet those requirements in an economical manner. Each intervention is discussed below and with a varying number of alternatives, the approach to each is somewhat different.

4.5.1 Through Alignment

The developed though alignment as described in ***section 5.2,*** highlights the potential speed improvements within the preferred option and has been analysed within the signalling submission to provide the basis for the necessary signalling enhancements. There was no alternative option to consider this against as such, the alignment was prepared based on a minimalistic lift and slue to the existing track alignment.

4.5.2 Benton East Junction

The evaluation of the options for Benton East Junction was based around finding a single option that met all the requirements. The option creation was undertaken hand in hand with the signalling approach in order to ensure that requirements for standage, standback from the signal, overrun and clearance points were co-ordinated. The principal objectives were:

- Ensure a train held at signal T635 would not foul the foot crossing at Palmersville Dairy
- Increase turnout speed to minimise journey times by not imposing a further speed restriction on approach to Benton North Junction

The option identified in ***section 5.2.1.2*** meets these requirements.

4.5.3 Seaton Loop

Seaton Loop options were developed on both the required length of loop and the position of the loop with a more southernly option and more northernly option available. The Southern option was favoured by the initial timetable analysis as it offered the most flexibility and the northern location was very close to the Newsham twin track extension (see ***section 5.2.1.4***) with only a few hundred meters single line between them.

The second variable being assessed was the length of loop to be provided. Minimum lengths were calculated for a 550m and 775m long freight train, with signalling overlaps and 25m standback to generate a minimum Clearance Point to Clearance Point length. This dimension was then superimposed on the track alignment with a view to finding straight locations to land S&C units onto.

In coordination with the signalling proposal, discussions were held with respect to minimising the impact of a train slowing on the main line to take the loop route by providing 50mph turnouts and lengthening the loop to allow trains to brake in the loop for the signal at the end, with a repeater provided 856m on the Up and 1187m on the Down from the loop exit signal.

The various loop configurations are tabulated in ***Appendix W.***

4.5.4 Newsham Twin Track Extension

Currently the single line becomes twin track at Newsham, immediately to the south of the level crossing, with the twin track continuing north from Newsham to beyond the project limits at Ashington. In order to locate Newsham Station at the preferred location to the south of the level crossing, the twin track section required to be extended by replacing the S&C unit and providing additional plain line. As the bulk of the construction cost would be incurred by installing the S&C and mobilising plant and equipment to the site to install the lengths of plain line required, there would be benefit in extending the plain line further south such that a train could depart Newsham on the Up direction (towards Newcastle) with a train still heading North on the Down direction on the single line section. This offers improved flexibility should a northbound train be running late. As there were no real infrastructure constraints between Newsham and Hartley Level Crossing, it was decided to install the new S&C unit at the end of the straight to the north of Hartley Level Crossing.

This portion of track earthwork had previously been two or more tracks and was deemed wide enough without any significant construction to accommodate the twin track extension. The chosen option defined in ***section 5.2.1.4*** provides the maximum flexibility without incurring any significant additional infrastructure costs except the additional plain line renewals.

Section 13.3.4 provides further breakdown of the various options considered for each element of the extension.

4.5.5 Furnaceway Sidings

When assessing the options for Furnaceway sidings, all three considered options met the basic criteria of being able to round a locomotive and turn a freight train north. The defining characteristics of the 3 options were risk and future potential. The selected preferred option identified in ***section 5.2.1.5*** had the lowest risk and highest future potential of the options considered.

Discussions with GB Rail Freight (GBRF) and Network Rail drove the requirement to take the sidings back into Network Rail management and refurbish them as GBRF were unwilling to pay an access fee to DB Cargo for a manoeuvre they currently carry out for free on the main line.

The options considered at Furnaceway are reviewed in more detail within ***section 13.3.5***

4.5.6 Bedlington

The works at Bedlington do not add any real benefit to the project other than as an obstacle to entering the new passenger railway into service. As such the defining principle for the site was to keep the capital expenditure as low as practical whilst achieving the minimum standards required for opening the line to passenger trains again. The preferred option is discussed in ***section 5.2.1.6*** of this report.

The options considered are discussed in more detail within ***section 13.3.6***.

4.5.7 West Sleekburn Junction

The chosen option at Sleekburn Junction, to effectively do no additional works, is defined within ***section 5.2.1.7*** of this report. However, the defining principle adopted at this location was to seek to remove the current speed restriction by undertaking the minimum works by the project.

After reviewing the alignment data and track components on site, it was assessed that at this stage there was no reason to believe that in conjunction with the re-signalling arrangements the speed could not be raised without the need to undertake any track intervention.

The findings are discussed further in ***section 13.3.7*** further in this report.

4.5.8 Ashington Turnback

The track alignment options at Ashington were primarily driven by platform options and signalling requirements. The principle requirements were:

- Train to be able to dwell at the station or vicinity without blocking the main line
- Preference that all S&C was located to the North of Hospital Crossing
- All S&C to be standard, preferred geometries
- A potential onwards connection to the North must be preserved

The options considered at Ashington from a track perspective are reviewed in ***section 13.3.8*** with the preferred option being identified and discussed in ***section 5.2.1.8*** above.

4.6 Routewide

4.6.1 Ancillary Civils

For Ancillary Civils and Access, the basic premise at this stage of the project development has been to assess the extent and constraints of installing standard ancillary civils infrastructure (signal bases, location cases and walkways) to support the proposed track and signalling infrastructure. Any ancillary civils to support M&E or Telecoms infrastructure has been considered with each of these disciplines separately.

To this end, the assumed requirements have been to allow for vehicle, step free access (where possible) to any newly proposed S&C and to any significant infrastructure items such as new signalling infrastructure. The assessment looked into where existing authorised access points could be used or where new ones would be required to provide suitable walking distances (up to 100m for S&C and 450m for signal assets) with adequate cess widths (2.3m minimum), identifying any constraints such as earthworks for the provision of a walking route from the proposed access point to the required infrastructure.

4.6.2 Land and Consents

The land and consents requirements for the preferred options are detailed in ***Sections 8 and 7*** of this document or in further detail within the Land and Consents Strategy, which is a separate, standalone report. The purpose of the Land and Consents Strategy is to set out a detailed strategy of the land and consents processes required for the successful delivery of the project. The report will be reviewed and updated as the project progresses in line with Network Rail's Governance for Rail Investment Projects (GRIP) process or RNEP equivalent.

4.6.3 Earthworks Including Trackbed and Drainage

The walkover survey undertaken along the length of the route, gave the trackbed team an appreciation of the problems involved and assisted in defining the trial hole locations proposed for the next phase. It is difficult to predict the track condition and the solution from the visual inspection, therefore, TAMP data has been used to help decide whether in any given location of poor track quality was caused by poor trackbed condition or some other feature of the track such as poor earthwork, track component, level crossing etc.

The earthworks, cuttings and embankments, along the Northumberland Line scheme are part of the existing operational railway and have been reviewed as part of the Preliminary Sources Study Reports (PSSR), see ***Appendix L***. An initial review of the earthworks along the Northumberland Line scheme was undertaken by Jacobs as part of the GRIP 2 Study undertaken for Network Rail in 2016. The review utilised the Network Rail (NR) London North East & East Midlands (LNE & EM) Earthworks Database; this review was updated in this study using the same database. The earthworks in the database are divided into 5 chain lengths, 110 yards, for reporting purposes. An earthwork is only considered for the NR LNE & EM Earthworks Database if it is 2m or greater in height / depth or if less than 2m high / deep if failure could pose an unacceptable risk to the safe operation or performance of railway infrastructure. Criteria for unacceptable risk are varied and include slope stability, oversteep slopes, sidelong ground, marshy areas, waterlogged ground, sensitive adjacent third parties, etc.

The earthwork summaries include chainage, height / depth, typical slope angle, movement indicators, etc., see ***Appendix L.*** The summaries also include the Earthworks Hazard Category ('A' – 'E') as detailed in the NR Earthworks Database. Typically, Category 'A' earthworks exhibit no defect whilst categories 'B' and 'C' are considered marginal requiring more frequent earthwork inspections. Categories 'D' and 'E' represent the highest risk rating where intervention or remedial works may be required.

The earthworks along the scheme are generally categories 'A' to 'C' with only one Category 'D' embankment. Fourteen 5 chain lengths are designated category 'C' and twenty-six 5 chain lengths are classified as Category 'B', with the remainder being Category 'A' or 'At Grade', i.e. <2m in height / depth. The category 'D' site is located between Ch 1308 to 1408 (length 100m) (BNE 0.1430 to 0.1540) where timber sleepers have been used to stabilise the embankment shoulder and are reported to be tilting downslope. The 5 chain length has a cess width of 3m, a typical height of 1 to 2.5m and a slope angle of 32°. However, the earthworks inspector has suggested this Category class may be excessive and could be downgraded.

Consultation with the Geotechnical RAM identified several locations where earthworks interventions (ballast restraint, reinstatement of embankment due to rabbit burrows, etc.) are currently planned; one which is close to the Category 'D' earthwork.

The Northumberland Line project envisages changing the use of an existing freight only railway line to carry both freight and passenger trains in future. The earthworks have already been constructed and as such there is limited scope for new earthworks option selection. Where track realignment, twin tracking for Seaton Loop and Newsham Extension, and additional infrastructure is proposed, i.e. signals, cabinets, embankment or cutting widening may be necessary to provide a widened cess and position of safety or walkway. As the scheme develops a detailed geometric review will be undertaken to ensure there is enough room for the proposed infrastructure and the position of safety or walkway. Options under consideration for earthwork widening or remedial works are described in ***Section 13.4.4***.

A preliminary geometric review has been undertaken with sections cut every 50m along the scheme. Using the existing data, earthworks will be either widened or include a low height retaining structure to accommodate proposed changes in track alignment and twin tracking.

Earthwork sections where widening, interventions, regrading or low height retaining walls may be required were identified as part of the PSSR' s included in ***Appendix L*** and are summarised in ***Table 7*** below. These were areas where a cess width of <2m was identified in the NR LNE & EM Earthworks Database. These earthwork sections will be subject to a detailed review after a topographic survey of the sites has been undertaken and following ground investigation once the design proposals are finalised. For the purposes of the earthwork assessment, the route was also divided into six sections (EW1 to EW6) over the 23.4 km length of the line, referred to as Local Chainage (Ch) 0 to 23400m.

Upside / Downside	Section	Ch (miles. yards) From	Ch (miles. yards) To	Site Ch (m) From	Site Ch (m) To	Earthworks Type	Earthworks Hazard Category (EHC – Categories 'A' to 'D')
EW1							
Up	BNE	0.0082	0.0110	75	101	Soil Cutting	C
Down	BNE	0.0110	0.0330	101	302	Soil Cutting	A
Down	BNE	0.0440	0.0550	302	503	Soil Embankment	B
Down	BNE	0.1430	0.1540	1308	1408	Soil Embankment	D
EW2							
Down	BNE	2.0330	2.0440	3520	3620	Soil Cutting	A
Down	EJM	9.1650	10.0000	8853	8953.	Soil Cutting	B / A
Down	EJM	9.0660	9.0880	7948	8149	Soil Embankment	A
Down	EJM	9.0880	9.0990	8149	8249	Soil Embankment	B
Down	EJM	9.0990	9.1320	8249	8551	Soil Embankment	A
EW3							
Up	EJM	10.0029	10.0138	8980	9080	Soil Cutting	B
Up	EJM	10.0660	10.1210	9557	10060	Soil Embankment	A
Up	EJM	10.1210	10.1320	10060	10160	Soil Embankment	B
Up	EJM	10.1320	10.1540	10160	10362	Soil Embankment	A

Upside / Downside	Section	Ch (miles. yards) From	Ch (miles. yards) To	Site Ch (m) From	Site Ch (m) To	Earthworks Type	Earthworks Hazard Category (EHC – Categories 'A' to 'D')
Up	EJM	11.0330	11.0660	10864	11166	Soil Embankment	A
Up	EJM	11.1650	12.0550	12071	12675	Soil Embankment	A / Part B
Down	EJM	11.0550	11.0660	11065	11166	Soil Embankment	A
Down	EJM	11.1430	11.1650 (was 11.1540)	11870	TBC (was 11970)	Soil Embankment	C
EW4							
Up	EJM	13.0770	13.0990	14485	14687	Soil Embankment	A
Up	EJM	14.0000	14.0110	15391	15491	Soil Embankment	A
Down	EJM	13.1210	13.1320	14888	14990	Soil Embankment	A
Down	EJM	13.1320	13.1430	14990	15085	Soil Embankment	**C**
Down	EJM	13.1430	13.1540	15085	15190	Soil Embankment	**B**
Down	EJM	13.1540	13.1650	15190	15290	Soil Embankment	**C**
Down	EJM	13.1650	14.0000	15290	15391	Soil Embankment	**B**
Down	EJM	14.0000	14.0110	15391	15491	Soil Embankment	**C (was D)**
EW5	EJM	15.0110	15.1100	17101	18006	**No Interventions**	N/A
EW6							
Up	BWC	0.1100	0.1210	19368	19469	Soil Embankment	B
Up	BWC	0.1210	0.1320	19469	19569	Soil Embankment	B
Up	BWC	1.0000	1.0330	19972	20274	Soil Embankment	B
Down	BWC	0.0990	0.1100	19268	19368	Soil Embankment	A
Down	BWC	0.1100	0.1210	19368	19469	Soil Embankment	B
Down	BWC	0.1210	1.0000	19469	20000	Soil Embankment	A
Down	BWC	2.0550	2.0660	22084	22200	Soil Embankment	B
Down	BWC	2.0660	2.0770	22200	22285	Soil Embankment	A

Table 7 - Possible Earthwork Interventions, regrading or low height retaining walls

Earthwork interventions are also required at five proposed signal locations; four of these are on embankments (N126R, N122, N119, N120) and one is in a cutting (N107R).

4.6.4 Structures

Each structure type was assessed based on the impact the preferred solution for route upgrading presented. This is summarised as follows;

- Underbridge Structures;
  - Impact on capacity from proposed line speed increase
  - Derailment impact assessment
- Overbridge Structures;
  - Road vehicle incursion risk assessment
  - Lateral clearances to abutments
- Culvert Structures;
  - Impact on capacity from proposed line speed increase
- Footbridge Structures;
  - Derailment impact assessment

4.6.4.1 Underbridge Structures

Underbridge structures have been assessed for the proposed route upgrade based on the impact line speed increases and any track alterations have on the structural capacity and lateral clearances. This has aided in identifying structures which require any strengthening, repair or modification works and where no action is required.

The existing Route Availability (RA) number, that is the safe rail traffic load capacity, has been established from the latest assessment reports for each structure. In most cases the RA number has been determined based on Network Rail standard NR/GN/CIV/025 “The Structural Assessment of Underbridges”, which adopts a standard rail loading, represented by 20 British Standard Units of Type RAI loading. Where this is not the case, on structures such as EJM/36 which adopts an earlier revision of the standard, the results have been adjusted and a new theoretical RA number determined. Consideration has also been given to any further deterioration which has been recorded in subsequent examination reports.

To assess the impact the proposed route upgrade presents, the capacity of each structural element determined within the assessments has been reviewed and the standard rail loading modified based on the proposed speed profiles. Speed is accounted for through the application of a dynamic factor on the standard rail loading. This factor allows for impact, oscillation and other dynamic effects, including those caused by track and wheel irregularities. As the dynamic factor is the only variable from the current and proposed scenarios on the route, the RA number determined within the last assessment can be modified with the following equation;

$$RA_{number\ for\ proposed\ scenario} = \left[\left(\begin{array}{c} Number\ of\ British\ Standard\ Units \\ of\ Type\ RAI\ Loading\ determined \\ from\ previous\ assessment \end{array}\right) \times \left(\frac{Old\ dynamic\ factor}{New\ dynamic\ factor}\right)\right] - 10^{*}$$

* *subtract 10 to convert from British Standard Units to RA number*

Figure 17 - RA Calculation Equation

For Arch structures, an initial assessment of the proposed route upgrade has been based on the information provided in ***Section 16.8*** using software programme ArchieM. In this instance the train load model has been modified to represent freight and passenger traffic.

It has been assumed that strengthening works will be required where the existing structure fails to satisfy both of the following criteria:

- Structure must be capable of achieving a minimum route availability number of RA8 for freight traffic (*current Route Availability number of the line*)

- Structure must be capable of achieving a minimum route availability number of RA3 for passenger traffic

This exercise has been carried out for all underbridge structures along the route and is detailed in ***Section 13.4.5.1*** concluding where necessary works are required. Recommendations have been noted where further inspection and assessment is required to validate reported results.

The risk of derailment on underbridge structures has been assessed following UIC Code 777-2R "Structures built over railway lines – Construction requirements in the track zone" as discussed in ***Section 4.6.4.4*** Although this standard is applicable to structures built over the railway, the methodology for calculating the likelihood of a train derailing and impacting a structure is applicable to all structures.

An option selection process has then been carried out on structures which are identified requiring works, whether for capacity enhancement or to accommodate additional tracks. Options have been developed based on a do minimal to maximal works to meet the objective of accommodating the route upgrade. Each option has been scored from 1 to 5 for poor to optimal in design relative to its impact on the project items listed below;

- Technical Risk
- Environmental Risk
- Planning Implications
- Road Traffic Impacts
- Temporary works requirements
- Whole Life Costings
- Health Safety and Welfare Risk
- Programme Duration
- Disruptive possessions
- Interface with existing infrastructure/utilities
- Construction Cost

	Technical Risk	Health, Safety and Welfare	Environmental Risk	Programme Duration	Planning Implications	Disruptive Posessions	Road Traffic Impacts	Interface with Existing Infrastructure / Utilities	Temporary Works Requirements	Construction Cost	Whole Life Costings	Total
Option 1	2	2	5	5	5	3	2	5	1	3	1	34
Option 2	3	2	4	4	5	3	3	4	2	3	2	35
Option 3	4	5	3	3	4	4	5	3	3	3	3	40

Key	
Poor	1
	2
	3
	4
Optimal	5

Option 3 has been scored the highest and is considered the optimal solution

Figure 18 – Example of RAG Table

Scoring for each project item are then summed together providing an overall score for the option considered. The optimal solution to implement for each structure is then identified by the highest score. An example of the Red, Amber Green (RAG) ranking system is illustrated in ***Figure 18***.

4.6.4.2 Overbridges

The risk of road vehicle incursions onto the track at overbridge structure sites have been assessed in accordance with Network Rail standard NR/L3/CIV/00012. This standard provides a risk ranking tool for sites carrying non-public carriageways, single carriageways or dual carriageways over the railway. Each site is scored based on fourteen risk factors considered to increase the likelihood of road vehicle incursion; these include vehicle containment conditions, road alignment, speed and volume, site topography, site specific hazards and road signage. Factors specific to the railway include line speed, track alignment, traffic type and volume. Where a site scores 90 points or more it is considered a high risk and preventative measures should be considered to reduce this risk.

Each structure has been reviewed and scored in its current condition, this has established a base line and aided in identifying the main drivers increasing risk at each site and any existing high-risk sites. Sites were then scored based on the preferred solution for route upgrading. The results of the risk assessment can be found in ***Section 13.4.5.2***.

4.6.4.3 Culverts

Culvert structures are defined within Network Rail standard NR/GN/CIV/025 “The structural assessment of underbridges” as structures with a span of less than 2.0 metres whose primary load carrying element is a flat top slab of natural rock or unreinforced concrete. In accordance with this standard, the load carrying adequacy of a culvert can be determined based on a qualitative assessment provided;

- the span is less than 0.7 metres, or
- the depth of cover exceeds 6.0 metres.

A quantitative assessment is typically required on structures not meeting this criterion. Similar to the assessment of underbridge structures, the quantitative assessment is based on a critical train axle load multiplied by a dynamic factor. In this instance the dynamic factor is set to a value of 1.8. This leaves train axle weights as the only variable.

As the proposed route upgrade does not require any increase in the current route availability of the line, the force exerted from an axle onto a structure will not increase. A qualitative assessment has therefore been deemed sufficient for all culvert structures along the route. This also applies to all short span masonry arch structures, apart from structures located in new double tracked sections where overlapping of load distribution between tracks may occur. In this case, an assessment of available information has been undertaken to determine any implications.

The condition of each structure has been assessed based on the most recent detailed and visual examination reports and validated with a non-intrusive site inspection. Structures owned by third parties were unable to be inspected, however, as no issues have been identified they are assumed to be in suitable condition. The results of the qualitative assessment are provided in ***Section 13.4.5.3.***

4.6.4.4 Footbridges

The risk of derailment at existing footbridge structures due to the proposed route upgrade has been assessed in accordance with UIC Code 777-2R “Structures built over railway lines – Construction requirements in the track zone”. The standard considers various scenarios where a train can become derailed and cause catastrophic damage whether through impact with the structure or collision with oncoming traffic, see ***Figure 19 - Extract of Appendix F.6 of UIC 777-2R (Event tree).*** The probability of occurrence of a scenario is determined based on various influencing factors which include traffic type, speed and volume, track geometry and configuration and the lateral clearance and robustness of structural supports.

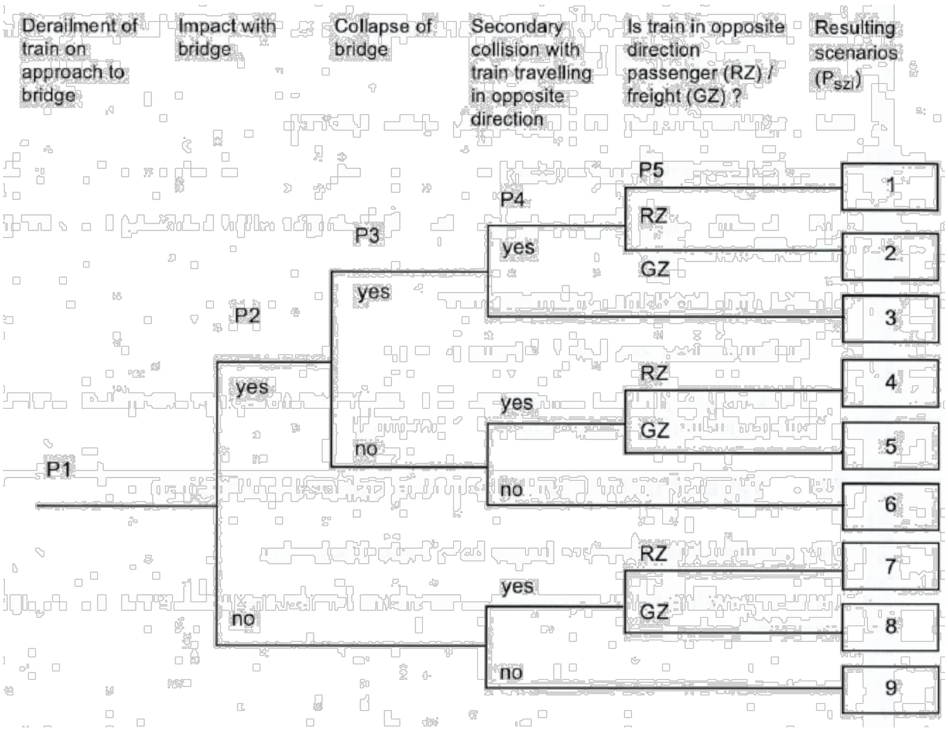


Figure 19 - Extract of Appendix F.6 of UIC 777-2R (Event tree)

Risk is quantified into monetary terms by multiplying the probability for each scenario with recommended values for the average extent of damage and value placed on preventing a fatality (£6 million). This is expressed per annum and can be used to evaluate the value of incorporating additional mitigation/ preventative measures. The cost of installation of any mitigation/ preventative measures should align with the benefit gained in the level of risk reduction they provide.

This assessment has been carried out for each footbridge in both the current and proposed conditions to understand the impact of the proposed route upgrade. Reference can be made to ***Section 13.4.5.4*** for full results.

4.7 Timetable Analysis

Further refinement and operator consultation has been undertaken on the draft hourly and half-hourly timetables since the SOBC was submitted.

Two workshops have been held with Northern, GB Railfreight and DB Cargo in June and September 2019 in order to review the emerging signalling/Track proposals, timetable structures and potential impact of construction and future timetables on current freight flows. These are biomass product between Tyne Dock and Lynemouth Power Station (up to 6 trains per day), Coal traffic between Margam in South Wales and Blyth Port (currently about 3 trains per week) and Alumina traffic between Blyth Port and Fort William (one movement per day alternate loaded and empty).

These meetings have been invaluable in identifying constraints and opportunities which have influenced both the engineering and timetable design and will continue into the Design phase.

The need to obtain more accurate train timings for a range of potential infrastructure interventions across differing traction types (both freight and passenger) has led to the project contracting with Tracsis plc who are widely acknowledged as an industry leader in timetable construction, infrastructure modelling and performance modelling using the Railsys suite of software applications.

Tracsis has constructed models of the existing and proposed phase 1 and phase 2 infrastructure in order to model the impacts of the various timetable options. Technical running times have been produced for all of the potential freight and passenger traction types that currently or are proposed to use the route and these have formed the basis for working timetables produced for each of phase 1 and phase 2.

Timetable graphs have also been produced for each of the phase 1 and phase 2 timetables to demonstrate that the timetable works robustly in relation to the single line section on the route and the proposed passing loop in phase 2. Full performance modelling is proposed to commence early in the Design phase of the project once more information is available on future increases in train services on the East Coast Main Line north of Newcastle

The Northumberland Line timetable has been developed using the December 2019 timetable as the base. However, a significant timetable upgrade is planned for December 21 which will involve retiming of existing services and the introduction of additional services on the East Coast Main Line north of Newcastle.

The project is working closely with the East Coast December 21 Event Steering Group (ESG21) to ensure that the Northumberland Line proposals are considered and that the additional services are modelled by Tracsis and reviewed by the project team to provide progressive assurance that capacity exists to accommodate all the additional services including the Northumberland line trains.

Tracsis are currently embarking on modelling the section of ECML between Benton North Junction and Newcastle based on assumptions provided by Network Rail on the proposed additional ECML services in order to confirm that the required capacity is available on the affected section of route and also within Newcastle station. In order to do so a full platform modelling exercise is also underway. Both workstreams are expected to be completed before the end of November 2019 but will require to be updated as further information is provided by ESG21.

An illustration of the outputs from the Tracsis work is included below in the form of off-peak timetable graphs for both Phase 1 and phase 2 timetables showing the relationship between passenger and freight services. These are subject to further refinement as explained above and as such are illustrative at this stage.

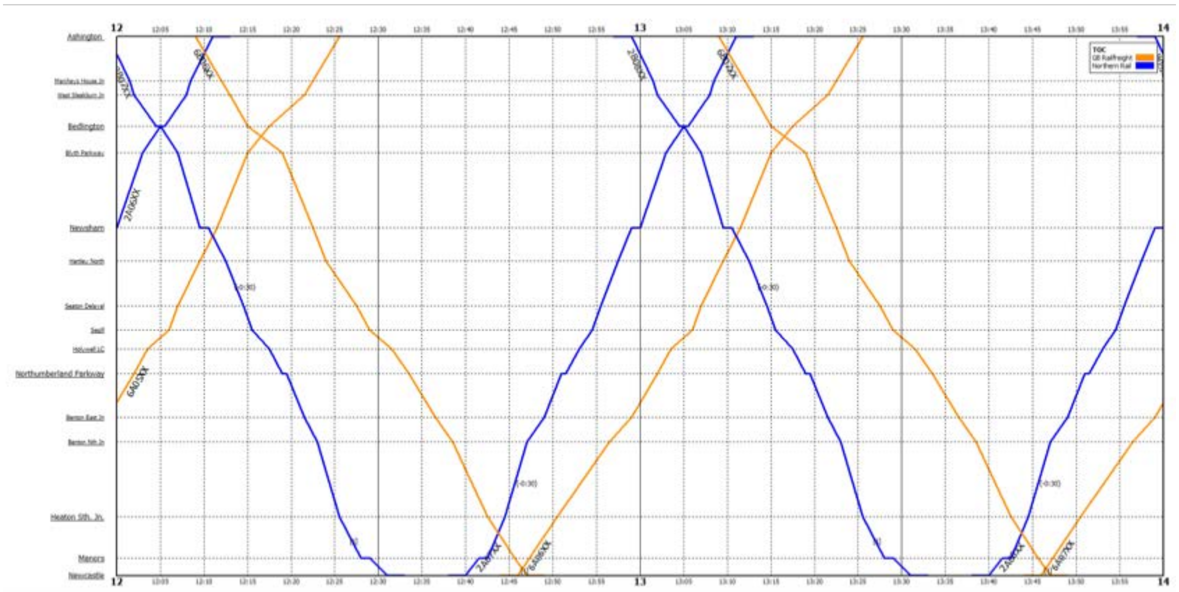


Figure 20 - Off Peak Phase 1 Timetable Graph

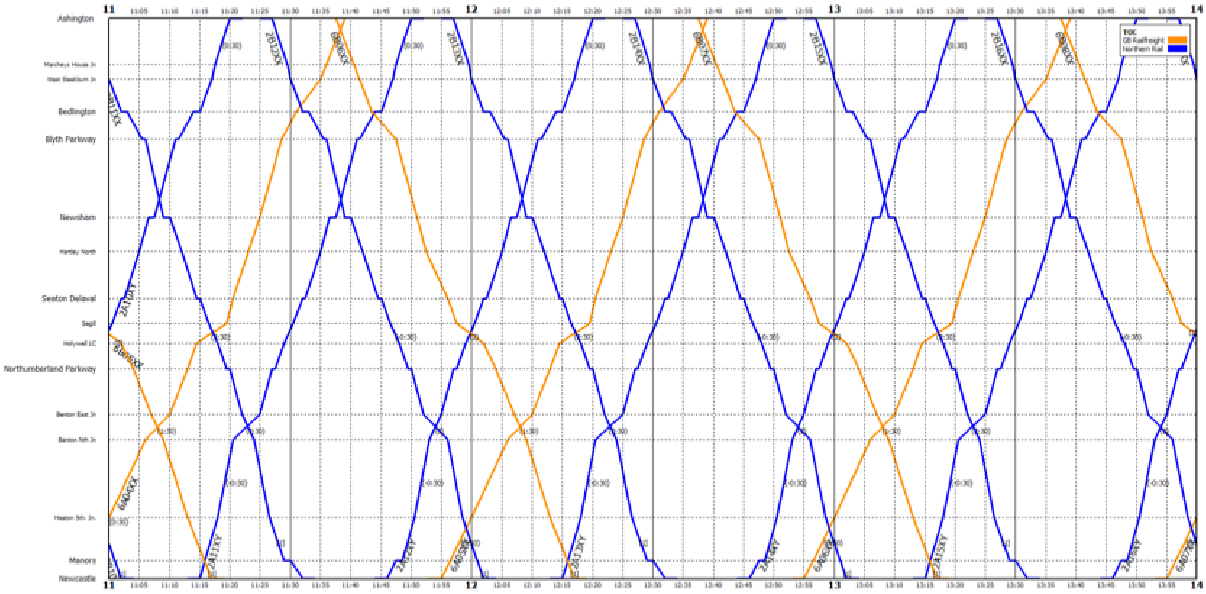


Figure 21 - Off Peak Phase 2 Timetable Graph

5 PREFERRED OPTION

Following on from the engineering workshops and development of the various engineering discipline proposals, the final preferred option for bringing the Northumberland Lines into operational use would be to undertake this in two phases. The initial Phase 1 works are necessary to provide a basic service level between Ashington and Newcastle, calling at Bedlington, Newsham and Northumberland Park.

A subsequent phase includes all the remaining works needed to support the enhanced half-hourly timetable and provide additional stops at Blyth Bebside and Seaton Delaval once the land ownership issues have been resolved through an appropriate TWAO.

The following sections describe the preferred overall scheme option divided into disciplines. For details on the option selection process, see ***Section 4*** of this report. For details of the options considered but not eventually adopted as preferred, see ***Section 12*** later in this report.

The following section is divided into two key distinctions, ***Section 5.1*** for the specific station locations and ***Section 5.1*** for all routewide considerations

5.1 Stations

The following ***sections 5.1.1 to 5.1.6*** describe the preferred option at each station site along the route clearly defining which stations are proposed as part of Phase 1 and Phase 2. ***Section 13.1*** presents descriptions of all options considered at each station site along the route with subsequent comparison tables and option selection summaries.

General platform requirements have been split into three categories:

- Platform Geometry
- Platform Furniture
- PRM (Persons of Reduced Mobility) Access

Platform Geometry

All single face platform widths have been designed to provide 3m from the coper edge to the inside face of the back of platform fence based on current platform interface standards (RIS-7016-INS) which require a minimum useable width of 2.5m. The additional 0.5m space is provided to house platform furniture. Where waiting shelters are proposed on platforms, the platform is to be locally widened or “space-saver” shelters are to be installed to keep a clear useable width of 2.5m from the coper edge in all cases.

Platforms lengths have been designed as 100m* along track based on a 4-car Class 158** rolling stock. A single Class 158 car is 23.3m long, with a 4-car Class 158 89m in length from passenger door to passenger door. Inaccurate stopping distance requirements to current standards (RIS-7016-INS) for a through platform are 4m (+/- 2m), therefore the required platform length is 93m. This has been rounded up to 100m at this stage to space prove for differing rolling stock.

Bedlington Up Platform does not obtain 100m length due to signal positioning and non-compliant track radius. Refer to **section 5.1.5 for further details.*

***The rolling stock that will be used on the line is currently unknown and Class 158 trains have been used as a conservative estimate of car length and the most likely franchise option at the time the route is scheduled to enter into service.*

Platform Furniture

The below <u>minimum</u> specification is based on a combination of Category F, E and D standards as presented in “Better Rail Stations (2009)”. This has been discussed with Network Rail’s Building RAM and is to be discussed and amended to TOC requirements at the next design stage.

Station:

- Totem pole
- Street signs
- Station signs
- Modern secure cycle parking facilities
- Car parking

Platform:

- Customer Information System (CIS) screen – Providing real time information
- Speaker system – Providing real time information
- Passenger Help Point (PHP) – Emergency and Information buttons and audio induction loop
- Ticket Vending Machine (TVM)
- CCTV
- Lighting
- Information boards – Train timetables; Rail industry info; Bus info; Taxi info; Local Map
- Shelter or Canopy
- Seating – Minimum of 8 seats

PRM (Persons of Reduced Mobility) Access

PRM access has been considered in line with the EU commission regulation PRM TSI (Technical Specifications for Interoperability) 2014. As part of these measures, step and obstacle free access has been considered as a requirement to each platform.

Where a station is located adjacent to a level crossing, the platforms have been positioned 75m away from the crossing to reduce level crossing barrier down time and train overrun risk onto the crossing.(For further detail on Level crossing proposal see ***Section 5.2.2***) This would make the walk around distance from platform ends approximately 160m which is deemed too far for passenger transfer between platforms or car parks. The exception to this is at Bedlington station which is positioned at the site of a former station, where the walk around distance is approximately 70m which is considered acceptable.

At Newsham and Blyth Bebside where the walk around is deemed unacceptable, a footbridge has been provided to allow passenger transfer between platforms. At these stations, 3 options were considered for step and obstacle free access:

- No provision over the footbridge with PRMs using the level crossing
- Ramps provided
- Lifts provided

As discussed above, walk around distances to level crossings had been deemed too far for foot passengers to use, therefore it is inappropriate for PRM users to utilise the level crossings. The lengths of proposed ramps were calculated to be between 90m and 100m to achieve the required level change at compliant gradients to the TSI (1:16 to 1:20). The total walk around distance would therefore be between 195m and 235m from platform to platform. This is further than the already discounted walk around distance to the level crossing. As a result, lifts have been chosen as the most appropriate step free solution to crossing the footbridges.

At Bedlington it has been deemed acceptable to have PRM access from platform to platform via the level crossing as the distance is comparatively shorter than the other stations. The PRM route across the level crossing will be designed to be compliant with the appropriate clauses of the PRM TSI at the next design stage.

Diversity Impact Assessment (DIA)

Diversity impact assessment have begun at each station and will be continued throughout the duration of the design development stages. These working DIAs have been developed based on current scheme drawings and will continue to evolve as the schemes are progressed further. At this early stage, several stakeholders have been identified for future engagement, and the outcomes of such engagement will be used to inform the schemes and update and strengthen the DIAs going forward. (The current progress to date DIAs can be read in ***Appendix X***)

5.1.1 Northumberland Park (Phase 1)

The preferred station location at Northumberland Park (Option 1B) is located within the railway cutting between Algernon Drive Overbridge and the A186 Overbridge as shown in ***Figure 22.*** This option is situated adjacent to the existing Network Rail single line track which runs alongside the metro railway lines operated by NEXUS. A single-faced 100m platform is proposed to be installed beneath Algernon Drive Bridge stretching west towards the A186. A layout drawing of this option is included within ***Appendix C.***

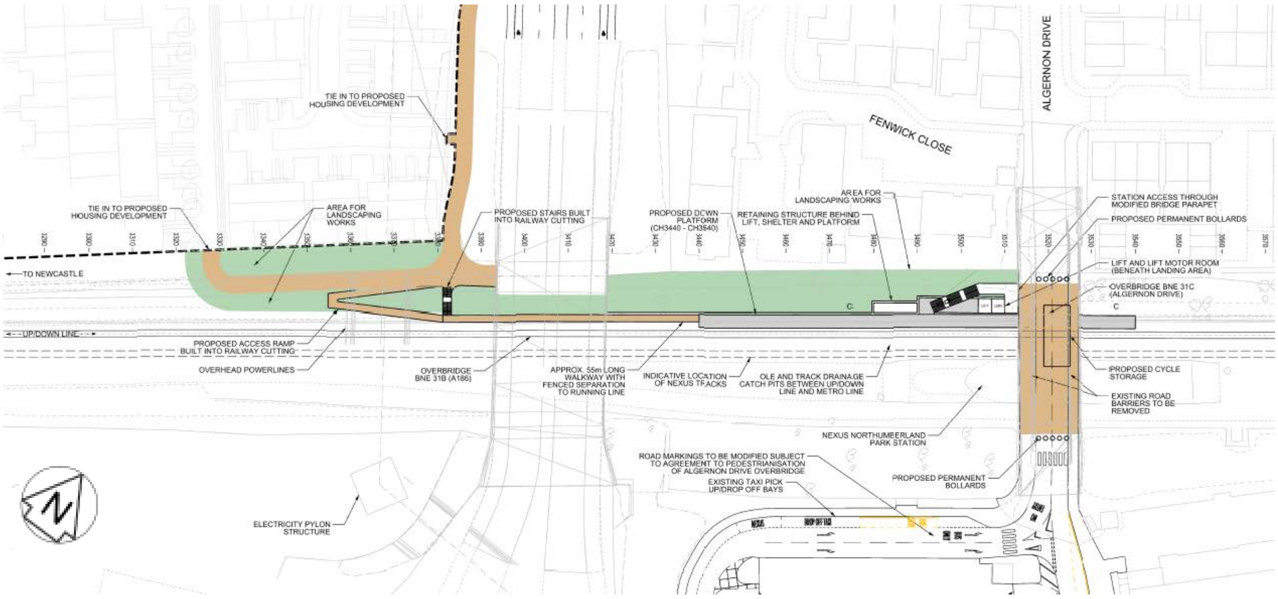


Figure 22 – Northumberland Park Option 1B (Preferred)

Existing vehicular access to Northumberland Park multi-story car park serves the current NEXUS station. No additional vehicle access facilities are proposed as part of this scheme. The existing car park provides 269 car park spaces (including 12 disabled spaces). Car parking occupancy surveys commissioned during this phase of the project showed a current maximum percentage occupancy of 72% (Unused spaces 76). The SOBC demand model is developed around Metro access and assumes negligible car demand change at Northumberland Park Station. As such, no further car parking requirement has been identified.

Pedestrian access from the east is via a proposed breakout within the Algernon Drive Overbridge parapet to the western side. A new high-level landing external to the parapet is proposed from which the proposed stairs and a lift can be accessed to transfer to the station platform within the cutting below. A retaining wall within the cutting slope will be required to construct the lift shaft.

The existing Algernon Drive Overbridge was originally proposed to be part of a bus route but has been closed (using temporary barriers) for several years. This option would seek to permanently close the bridge to vehicle traffic allowing for the creation of a public realm space on top of the bridge to improve the passenger links between the Network Rail and NEXUS stations and the existing bus stops/car park facilities. Modern, secure cycle storage facilities are to be installed within this public realm space, in addition to the existing cycle parking facilities within the multi-storey car park. As there is only one parapet breakout and it is on the same side as the NEXUS station entrance, the road closure is not critical to this option.

Pedestrian access from the west is via a walkway at railway level which connects the station platform to a proposed staircase / ramp to exit the railway cutting. Additional footpaths are to connect this access to the A186 and a proposed housing development to the west of the A186 subject to negotiations with the property developer.

Connectivity to other public transport systems is provided via the station's proximity to the existing NEXUS Northumberland Park station and the existing bus stops located nearby to the existing multi-story car park.

Emergency egress from the platform is provided via the two proposed station access points.

This platform location and station layout was selected as the preferred option primarily due to its buildability and maintainability in contrast to alternative station options. Additionally, the option provides direct pedestrian links to the west of the A186 as well as Algernon Drive via the Overbridge parapet breakout

5.1.2 Seaton Delaval (Phase 2)

The preferred station and car park location at Seaton Delaval (Option 3) is located to the south of the A192 and to the south east of the railway corridor as shown in ***Figure 23.*** This option is based on the passing loop proposed by this scheme being to the south of the proposed station location with the existing single line track alignment remains in its current position, minimising the cost of installation*.* (See ***Section 5.2.1.3*** for further details on the proposed loop location) A single 100m platform is to be positioned approximately 100m south of the A192 Overbridge (OB 39) on the railway formation of the former adjacent track alignment. Whilst budget at this time does not allow for the wholescale realignment of the track onto a twin track alignment under this project, the provision of this station at this location would not preclude any future twin tracking. Some additional works to the platform may be necessary at that time to cater for a second track alignment to pass beneath Overbridge 39 to the North. A layout drawing of this option is included within ***Appendix C.***

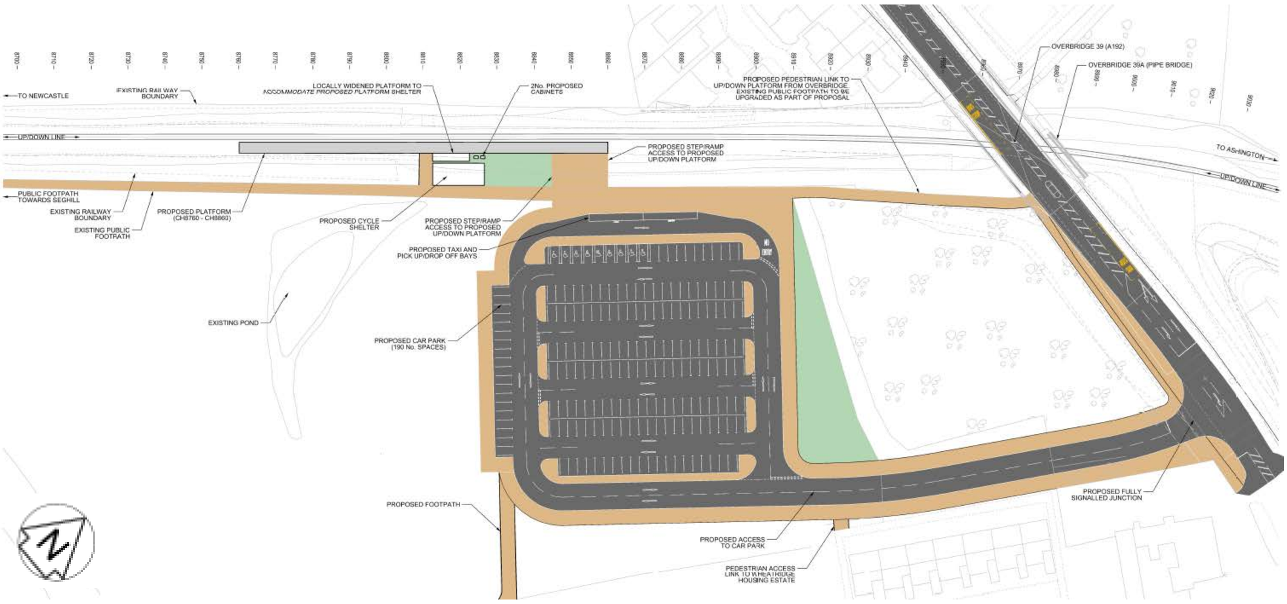


Figure 23 – Seaton Delaval Option 3 (Preferred)

Vehicular access is provided via a new access road, from the A192, to a new 190-space station car park. Highway access is proposed via a signalised three arm junction off the A192 which is located adjacent to the Hastings Arms Public House. Pedestrian crossing facilities are proposed on all arms of the junction. The proposed junction provides a single lane station access/ egress arm, and a single eastbound lane on the A192 mainline. A two-lane eastbound A192 approach is provided, including a right turn lane of approximately 20m. This is accompanied by a right turn reservoir ahead of the stop line to facilitate vehicles turning right in to the station access road.

Signalisation of the access junction was selected as the preferred method of control due to the desire to provide high quality-controlled pedestrian crossings and for the relatively high mainline flows which would limit gap seeking opportunities at a priority junction. Whilst a roundabout solution could meet the vehicle capacity requirements, there is insufficient space for a signalised roundabout, and a mini roundabout would not provide pedestrian facilities to aid pedestrian and cycle access to the station or support continuous east west mainline movement on this key cycle link.

Pedestrian / cycle access from the west / north of the railway corridor is provided via an existing public footpath which accesses the A192 adjacent to Overbridge 39. This footpath also provides connectivity south towards Seghill. It is proposed that the existing footpath be upgraded as part of this scheme to include appropriate lighting and footway surfacing. Pedestrian / cycle access from the east is provided via a new footway running adjacent to the car park access road. Pedestrian / cycle access is also proposed to the adjacent Wheatridge and Linden Road housing estates to the east and south of the proposed site providing further connectivity to the local footpath network. Modern, secure cycle storage facilities are to be installed between the platform and car park adjacent to the public footpath.

Connectivity to the local bus network is provided through the proposed provision of relocated bus stop locations along the A192 which better serve the provided station access routes.

Emergency egress from the platform is provided via the platform access point from the car park and an additional link to the public footpath from the south end of the platform.

This platform location and station layout was selected as the preferred option primarily due to its direct access to the A192, as well as the proximity from the residential areas of Seaton Delaval in contrast to feasible alternative station locations north of the rail line. The site also meets the land take requirements of the station. A single-track layout in this location was identified as the most cost-efficient solution for delivering the project within the funding requirements.

5.1.3 Newsham (Phase 1)

The preferred station and car park location at Newsham (Option 2A) is located to the south of the A1061 and to the west of the railway corridor as shown in ***Figure 24***. This option is based on a double track extension south of Newsham Level Crossing towards the Hartley Curve (See ***Section 5.2.1.4*** for track solution), therefore two lines will be present through the station. Two single-faced 100m long platforms are proposed approximately 75m south of the level crossing with passenger access between platforms provided by a proposed footbridge with stair and lift access. The position of the platforms allows for the barrier down times at the level crossing to be minimised. A layout drawing of this option is included within ***Appendix C.***

Figure 24 – Newsham Option 2A (Preferred)

Vehicular access is provided via a new access arm on the A1061/ B1523 Newsham roundabout. A proposed access road provides connection to the station and a 102-space car park.

Pedestrian access from both sides of the railway is provided by footpaths alongside the railway corridor from both sides of the level crossing. Pedestrian / cycle access is also provided from the A1061 roundabout via a footway alongside the car park access road. Modern, secure cycle storage facilities are to be installed between the platform and car park.

Connectivity to the local bus network is provided by an existing westbound bus stop to the east of Newsham Level Crossing on the A1061 and an existing southbound bus stop on the B1523 to the north of the roundabout. The presence of the roundabout supports efficient access and egress, and the location of it minimises potential for traffic to back up over the level crossing. A new bus stop is also proposed within the station car park to better serve bus-rail interchange.

Emergency egress from the platform is provided via the platform access points from the car park and A1061, with additional egress points from the south end of the platforms and footpath links to the rear of the platforms back to the access points.

Locating the station and access facilities west of the rail line in this location was identified as preferable due to the impact on existing properties and the road configuration of all feasible alternative locations considered. Refer to the Land and Consents Strategy in ***Appendix F*** for further information on the location.

5.1.4 Blyth Bebside (Phase 2)

The preferred station and car park location at Blyth Bebside (Option 5) is located approximately 250m south of Bebside Level Crossing on the existing railway alignment with platforms located to both sides of the railway corridor as shown in ***Figure 25***. Two single-faced 100m platforms are proposed with passenger access between platforms provided by a footbridge with stairs and lift access. The position of the platforms minimises the impact of stopping trains in either direction on the barrier down time and hence on the traffic approaching or leaving the grade separated junction. A layout drawing of this option is included within ***Appendix C***.

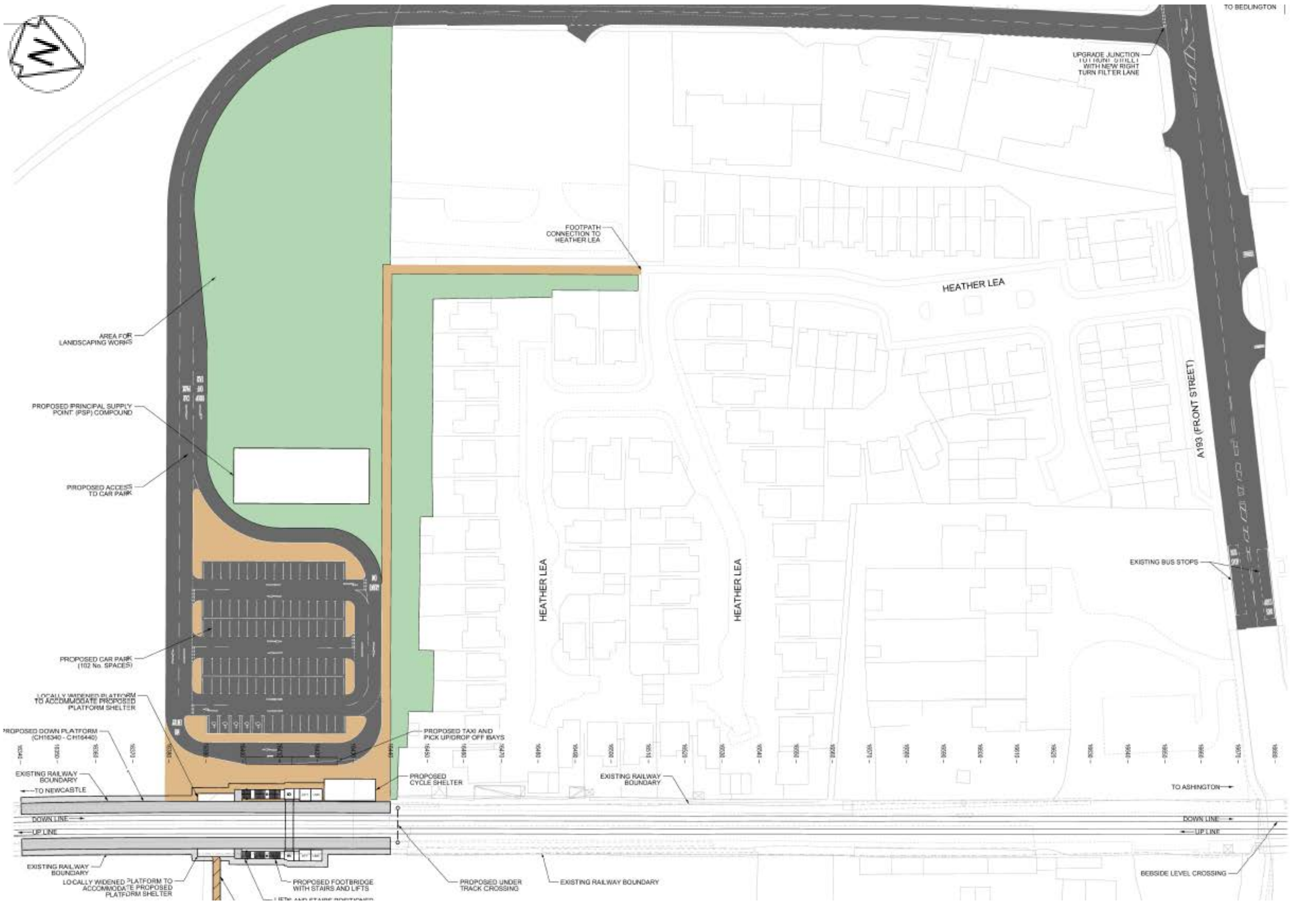


Figure 25 – Blyth Bebside Option 5 (Preferred)

Vehicular access is provided via a new access road to the station and 102-space car park. The proposed access road connects to Errington Street which is to be upgraded in accordance with the Design Manual for Roads and Bridges (DMRB). An improved junction access on to Front Street will also be provided. The proposed junction provides a single lane station access/ egress arm, and single east and westbound lanes on Front Street. Additionally, a right turn reservoir is provided to facilitate eastbound vehicles turning right in to the station access.

Pedestrian / cycle access to the station is provided via a new pedestrian/cycle connection from the station to the Heather Lea housing estate, which provides a route through to Front Street. Modern, secure cycle storage facilities are to be installed between the platform and car park. A future aspiration of Northumberland County Council is to connect the station via a footbridge over the A189 to the existing supermarket and residential area to the east (but this is not proposed as part of the Northumberland Line project).

Connectivity to the local bus network is provided by two existing bus stops on Front Street to the west of Bebside Level Crossing. The new foot / cycle connection from the station to Front Street via Heather Lea will be signposted from the bus stop locations to support bus/ rail connectivity.

Emergency egress from the Down Platform is provided via the platform access point from the car park and an additional link back to the car park from the south end of the platform. Emergency egress from the Up Platform is provided by an additional walkway behind the platform which can be accessed from both ends of the platform.

The preferred vehicle access location was identified as part of a multidisciplinary design process, with principle considerations including the impact of junction movements on the level crossing and on the highway network for accesses closer to the Bebside grade separated junction with the A189, as well as relative proximity to Blyth in relation to other feasible sites to aid pedestrian and cycle access.

5.1.5 Bedlington (Phase 1)

The preferred station and car park location at Bedlington (Option 1A) is located between Bedlington South Level Crossing and Bedlington North Level Crossing at the site of the former Bedlington Railway Station, on both sides of the railway corridor as shown in ***Figure 26***. This option is based on the existing railway alignment, therefore two lines through the platforms with the existing double junction to the north being renewed (See ***Section 5.2.1.6*** for detailed description of track solution). The Down Platform is a 100m long single faced platform positioned 10m north of Bedlington South Level Crossing. The Up Platform is located on the footprint of the existing platform structure and is initially to be 85m long due to non-compliant platform radii at the north end of the platform and the fixed position of signal BS16/18 at the south end of the platform. Due to this reduced platform length and dependent upon the actual rolling stock operated along the route, a reduced signal stand-back or selective door operation will be required (See ***section 5.2.3.16.3.5*** for further detail on signalling option). Passenger access between platforms is across Bedlington South Level Crossing. A layout drawing of this option is included within ***Appendix C***.

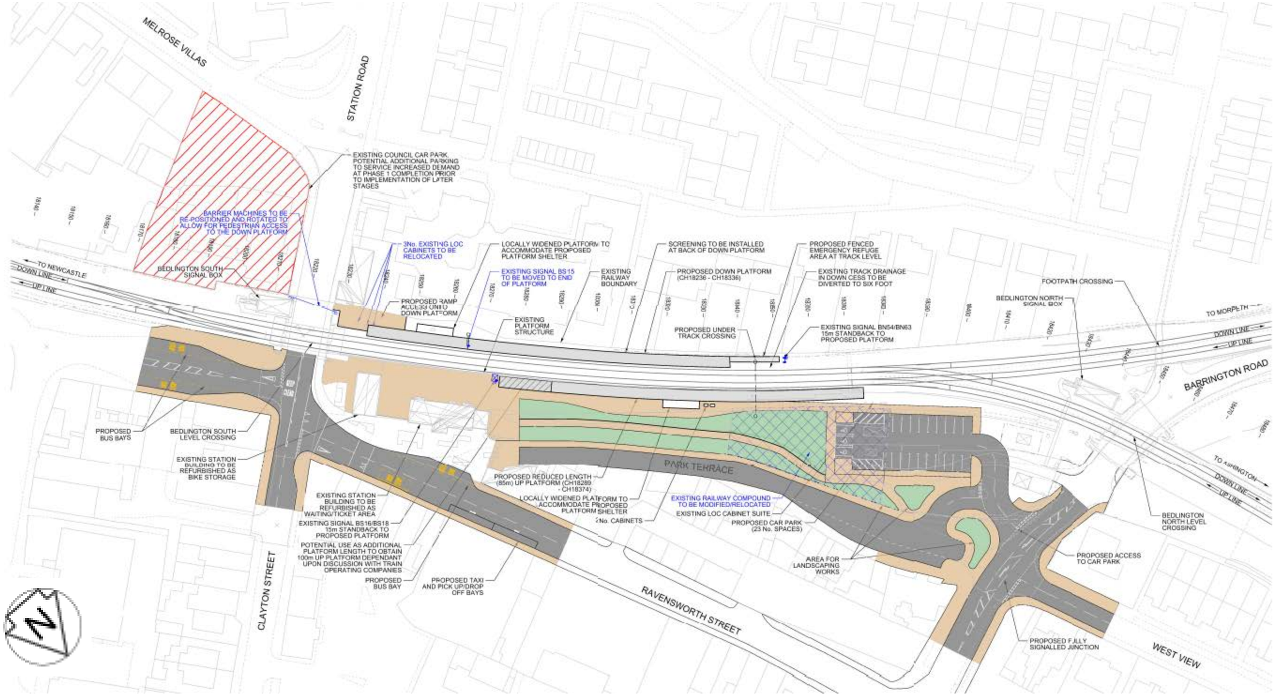


Figure 26 – Bedlington Option 1A (Preferred)

Vehicular access to the proposed station car park is provided via a new junction with Barrington Road. The junction design includes reprioritising the car park access road over the existing Park Terrace junction to prevent car park traffic routing directly adjacent to housing.

An existing council car park is situated to the south west of Bedlington South Level Crossing which is to be utilised as an overflow car park for the station prior to the opening of Blyth Bebside Station.

Pedestrian / cycle access to the Up Platform is via a re-opened / re-developed entrance between the two existing station buildings that reside within the former station footprint. These two buildings are to be refurbished and repurposed as part of this scheme. Pedestrian access to the Down Platform is provided by a new pathway to the west of the level crossing with space created by re-aligning the western barriers of the level crossing.

Connectivity to the local bus network is provided via the two existing bus stops on Ravensworth Street and two existing bus stops on Palace Road.

Emergency egress from the Up Platform is provided via the platform access point from the car park and an additional link back to the car park from the north end of the platform. Emergency egress from the Down Platform is via the platform access point to Station Road at the south end, and a fenced holding area is proposed off the north end of the platform.

5.1.6 Ashington (Phase 1)

The preferred station and car park location at Ashington (Option 4) is located adjacent to the council car park off Kenilworth Road and to the west of the existing railway corridor as shown in ***Figure 27.*** This option is based on a new platform line turning out from the mainline, running to a proposed buffer stop (See ***section 5.2.1.8*** for more detailed description of track option). There will therefore be three lines running through the station, Up, Down, and Platform. A single 100m long platform is to be positioned between the proposed Platform Line and the existing council car park. The Platform is to be installed to provide passive provision for future service extensions north of Ashington and support connectivity to the car park and any future remodelling of the Wansbeck development (by others). A layout drawing of this option is included within ***Appendix C***.

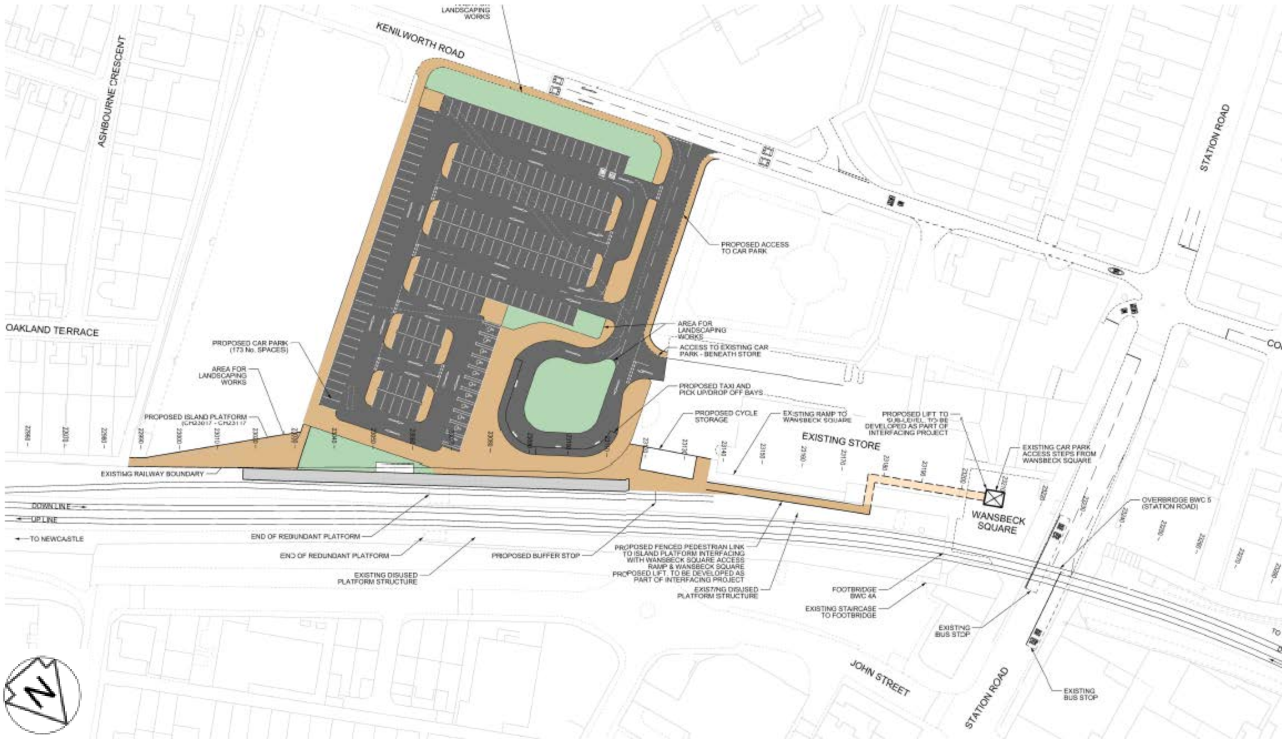


Figure 27 – Ashington Option 4 (Preferred)

Vehicular access to the station is provided by widening the existing car park access road off Kenilworth Road. The existing car park layout has been redesigned to better serve station use and enlarged to provide 173 car parking spaces. The one-way southbound section of Kenilworth Road to the north of the car park access is to be retained. Primary access and egress are to the south via Kenilworth Road and a number of alternative ongoing routes including Darnley Road and Green Lane. However, access between the station car park and additional car parking adjacent to the Wilko building will also be retained. This provides the opportunity to egress north via the Station Road/ Council Road junction.

Pedestrian access from the north is via an existing access ramp from Wansbeck Square leading down to car park and platform level. An interfacing project lead by Advance Northumberland is looking at redeveloping Wansbeck Square to create an attractive public realm space and station access. As part of that scheme a lift would potentially be installed within an existing stairwell within Wansbeck Square to take passengers down to the platform level via an additional walkway beneath the existing store. Pedestrian / cycle access from the south is via existing routes to the proposed re-modelled car park.

Connectivity to the local bus network is provided via two existing bus stops on Station Road adjacent to Wansbeck Square.

5.2 Routewide (Rail Systems Interventions and Routewide Considerations)

An exercise to define a target linespeed profile was undertaken by the Engineering Management team. This was based on the baseline signalling and track alignment designs. Where one discipline was able to achieve a higher linespeed, the constrained discipline was asked to review and carry out basic design to determine if the higher speed could be adopted.

As a basis, we were not looking for passenger stock to go above 65mph and freight to be able to achieve 40mph. At these speeds the braking characteristics of freight and passenger rolling stock is broadly compatible and risks associated with over braking or significant speed differentials could be largely avoided.

The resultant Linespeed profiles utilised to generate the preferred scheme option are located within ***Appendix U.*** It should be noted that a driveable speed profile with acceleration and deceleration curves will be more accurately modelled at the outline design stage, although the premise of the current profiles is such that the speed is even and constant as possible. The current proposal has been presented to the current FOCs and TOC and received little resistance.

In order to have a consistent approach to the gradients used in the station and signalling scheme plan and based on the many contradictions in the existing source material, a decision was taken to utilise the Geo-RINM strung LIDAR dataset to extrapolate gradients. As this information initially was at 10m intervals it was of little use over the 24,500m of the route. As a result, the 10m sections were averaged out where common gradients were observed in successive elements and the route broken down into 38 different gradients. This process, and the gradients derived and utilised in the Option Selection, will need to be redone and refined at the next design phase once a full topographical survey of the track levels is available. These revised gradients will be utilised on subsequent revisions of the signalling scheme plan. The gradients calculated and used on this phase are included within ***Appendix V.***

The preferred option for Phase 1 of the scheme is described below from the various routewide Rail Systems disciplines. Where further works are required for a discipline in order to achieve Phase 2, these have been indicated separately.

5.2.1 Track

The track alignment designs considered in this phase of the project are predominantly derived from the strung LIDAR dataset within Geo-RINM. This was extracted for the entire route length and a design chainage applied from the connection at Benton North Junction through to Ashington and slightly beyond on the route to be converted from Freight use to Passenger use by this project.

The initial task was to generate a through alignment to act as a baseline. This alignment was prepared utilising minimal lift and slues, generally within maintenance tolerances, such that the current track geometry could be assessed for the achievable speed without significant interventions.

The baseline speeds are included below in ***Table 8 - Baseline Speed Increases.*** The achievable speed from this table fed into the initial linespeed profiles to be compared against the signalling speed constraints identified as a result of the signal spacings. Where the track attainable linespeed was less than 65mph or the signal spacing limit, then each area was assessed to understand if 65mph could be attained either by increasing the lift and slue beyond maintenance tolerance but less than that which would drive a renewal or by undertaking a track renewal to realign the track within the current track solum. No offline solutions were considered as these would require Land purchase and add delay and risk into the project delivery. For the purpose of this exercise, and in defining where a slue would drive a renewal, a slue of up to 300mm was considered achievable by tamping with multiple passes and the clearing of sleeper ends. Any slue of 300mm or more was deemed to require a track renewal from trackbed up to ensure that the track would be sitting on a robust formation.

5.2.1.1 Through Alignment

On receipt of the vectorised survey information from Geo-RINM through Network Rail, a minimal slue through alignment was developed from the 0 metres datum (0 miles 0 chains) at Benton North Junction points 3117, to beyond Hirst Lane Crossing 23625m (3 miles 21 chains). This provided a basic alignment on which to assess potential speed improvements, provide a design base line and a reference through chainage for all disciplines. The basic alignment achieves the following theoretical speeds subject to track condition and operational restrictions.

From (m)	To (m)	Extent (m)	Existing Speed (mph)	Achievable speed (mph)	Increase (mph)
0	370	370	25	25	0
380	1220	840	25	35	10
1230	1840	610	45	65	20
1850	2000	150	45	45	0
2010	2340	330	45	65	20
2350	2670	320	45	30	-15
2680	2880	200	45	65	20
2890	3560	670	45	45	0
3570	3610	40	45	30	-15
3620	4060	440	30	30	0
4070	4350	280	30	50	20
4360	4910	550	30	65	35
4920	4980	60	20	65	45
4990	6950	1960	45	65	20
6960	7410	450	30	65	35
7420	7750	330	30	30	0
7760	8520	760	30	60	30
8530	8870	340	30	65	35
8880	9120	240	30	50	20
9130	9160	30	30	65	35
9170	9950	780	45	65	20
9960	10650	690	30	65	35
10660	11120	460	30	30	0
11130	11640	510	30	45	15
11650	11940	290	35	45	10
11950	11980	30	35	50	15
11990	12280	290	45	50	5
12290	13030	740	45	65	20
13040	13110	70	25	65	40
13120	17090	3970	45	65	20
17100	18100	1000	20	65	45
18110	18310	200	20	30	10
18320	18370	50	10	15	5
18380	18410	30	10	15	5

From (m)	To (m)	Extent (m)	Existing Speed (mph)	Achievable speed (mph)	Increase (mph)
18420	18490	70	10	40	30
18500	18920	420	40	40	0
18930	19900	970	40	65	25
19910	20020	110	20	65	45
20030	20630	600	40	65	25
20640	20790	150	30	65	35
20800	21960	1160	30	45	15
21970	22000	30	25	45	20
22010	22180	170	25	65	40
22190	22470	280	10	65	55
22480	22940	460	40	65	25
22950	23000	50	40	40	0
23010	23240	230	25	30	5
23250	23970	720	15	30	15

Table 8 - Baseline Speed Increases

Whilst the minimalistic slue approach was beneficial and aided in development of the speed profile for the scheme, there were a few issues encountered. These are indicated in ***Table 9*** below.

Location	Issue	Comment
Throughout	Existing Multiple radii compound curves	In producing a through alignment with minimal slues based on the vectorised RINM data, many curves regressed as compound curves with short length differing radii. Detailed design will improve these areas geometrically.
Throughout	Transition lengths	Many regressed transition lengths were either too long or too short for the existing line speed. Proposed through alignment transitions are optimised for proposed speed or lengthened to a minimum of 30m. Design transitions lengths will be formalised at detailed design stage following a track topographical survey
Throughout	Reverse curves	Frequent reverses transposing the track position
Throughout	Reliance on Geo-RINM dataset	Whilst the Geo-RINM data is for the most part an improvement on Ordinance Survey data when considering railway schemes, the data can show misleading short element lengths and abrupt changes of direction not seen with more comprehensive topographical surveys. As such, the design alignment will require to be wholly re-assessed once survey data is available to work from.
1850m-2010m	Reverse curve	Realignment required at this location to achieve speeds greater than the existing 45 mph.
2360m-2650m	Reverse curves and wideway at foot crossing	Challenge at detail design to achieve line speeds due to maintaining existing track separation to NEXUS

Location	Issue	Comment
7470m	Seghill level crossing on a transition	Careful detailed design required to optimise the transition length without compromising the highway levels. * *Now superseded by the realignment and proposed road alignment alterations at Seghill.*
10790m	Hartley Curve	There is little scope for speed improvements over this existing 25mph section due to the tight curvature (approximately 200m radius). The fact that it has recently been relayed and also the alignment transposes from the Up side to the Down side with a short reverse. Re-alignment at the Red House UWC to remove the short reverse may be beneficial at detail design phase
18370m - 18500m	Bedlington Junction	Through alignment difficult to create without a new junction solution. Also, proximity of the level crossing and existing platform

Table 9 - Through Alignment Design Issues

5.2.1.2 Benton East

The project is renewing the most easterly set of S&C at Benton. Although not currently named, it has been referred to as Benton East Junction within the signalling scheme plan and this report.

The purpose of renewing this set of S&C is to increase the length of double track available at the southern end of the route. This in turn allows a train to be held at Signal T635 without the rear blocking Palmersville Dairy footpath crossing, saving the need to construct a footbridge in this location. The existing layout is shown below in ***Figure 28***

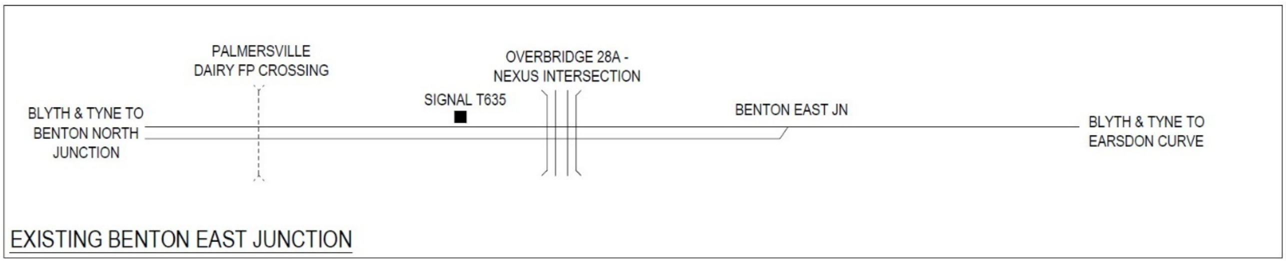


Figure 28 – Benton east Junction – Existing Layout

As the area of twin track is being extended anyway, a faster NR56 Fv24 is proposed with a maximum potential turnout speed of 50mph, minimising the impact on passenger trains heading to Newcastle of having to brake ahead of the junction at Benton North.

In total the proposal calls for a new NR56 Fv24 transitioned turnout, 260m of additional plain line and the recovery of the existing CV turnout. (See Drawing 60601435-ACM-01-TL-DRG-ETR-000001 in ***Appendix D***)

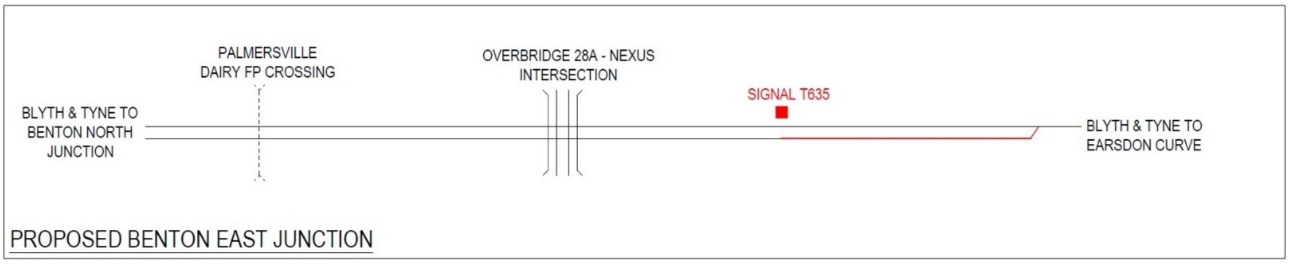


Figure 29 – Benton East Junction – Proposed Layout

Further details of the alternate options considered can be found in ***section 13.3.2***

5.2.1.3 Seaton Loop (Phase 2)

There is a requirement to provide a loop between Northumberland Park and the Newsham twin track section prior to the timetable increasing the frequency of the passenger services from hourly to half hourly. This is due to the requirement under the half hourly service pattern to pass a freight train and passenger train in this area, ideally towards the southern end. See Phase 2 Sketch below:

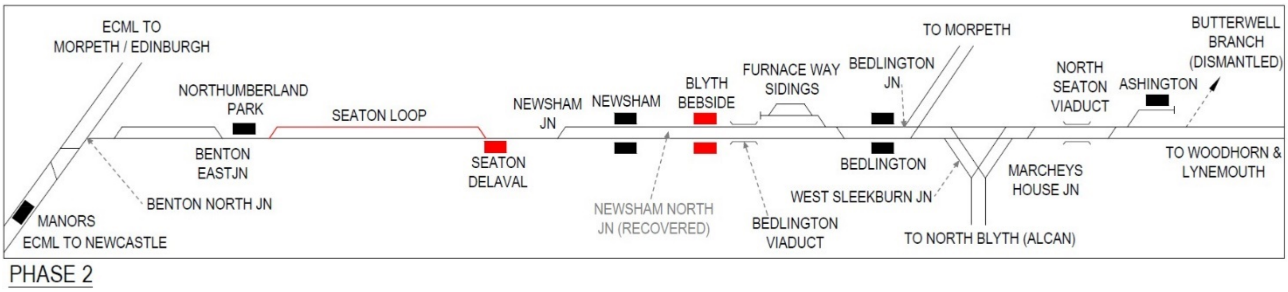


Figure 30 – Phase 2 Layout showing location of Seaton Loop

Various options were considered for the loop position and length, these are available to review in the table contained within ***Appendix W*** and discussed in more detail within ***section 13.3.3*** of this report.

The preferred option identified through the option selection process is identified as Option 12a.

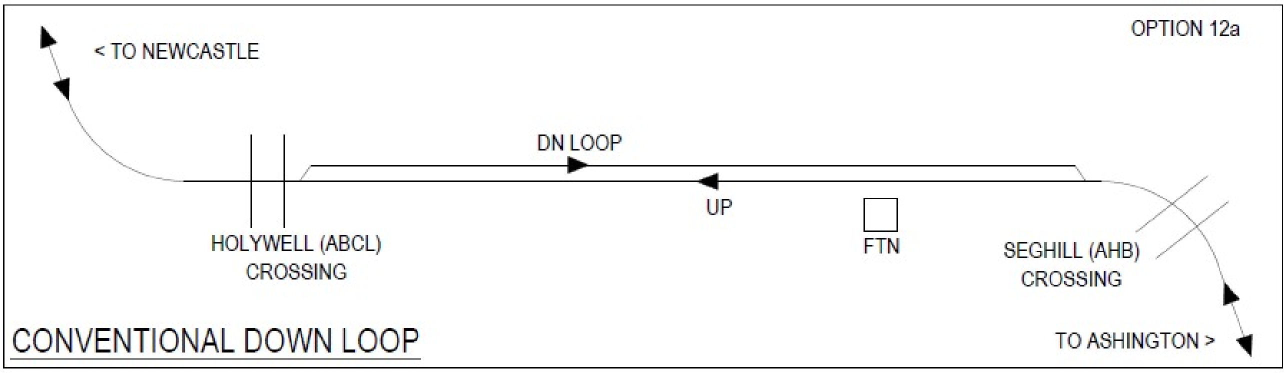


Figure 31 – Seaton Loop Option 12a

This option consists of a long loop of 2.4km length from the toe position of the entry S&C to the toe position of the exit S&C. The switches are proposed to be 50mph capable NR56 Fv24 in order to minimise the impact of a speed reduction when entering or exiting the loop. At the next design stage, once greater certainty has been derived from Railsys Infrastructure modelling and a higher degree of surety is available on where the train paths cross, it may be possible to shorten the loop length in order to reduce the capital costs. The loop as presented however, offers maximum flexibility for where the crossing move can occur and represents the maximum infrastructure requirement in order to ensure the project costs do not suffer from scope creep whilst still allowing potential for future value engineering. (See drawing 60601435-ACM-02-TL-DRG-ETR-000001 in ***Appendix A***)

5.2.1.4 Newsham Twin Track Extension

Phase one of the Northumberland Line project, utilising the basic service pattern, requires additional twin track to be provided to the south of Newsham. The current S&C taking the line from single to double is located immediately south of Newsham Level Crossing, in the area where the preferred station would be sited.

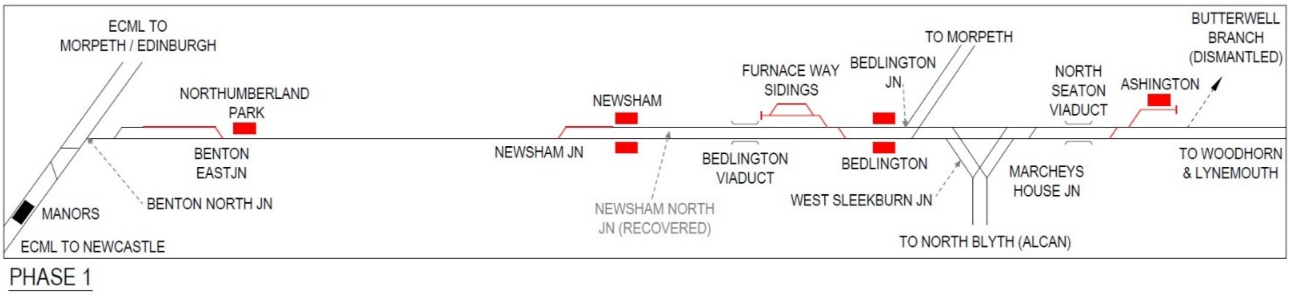


Figure 32 – Phase 1 showing Newsham twin track extension

The preferred track option in this location is to site the single to double turnout as close to Hartley Curve as possible. Utilising the long straight between Hartley Curve and Newsham to have the S&C as standard straight geometry, aiding in procurement, initial cost and ongoing maintenance. Extending the twin track section as far as this, allows for greater flexibility when a late running Northbound train is occupying the single line section. A southbound train can still depart Newsham heading to Newcastle allowing either extra time for the northbound train to clear the single line or before getting held at the protecting signal to await the northbound service passing.

Drawing number 60601435-ACM-05-TL-DRG-ETR-000001 in ***Appendix D*** shows the proposed turnout position and the realignment of the double track onto the original trackbed. The turnout is proposed as an NR56 Fv24 transitioned turnout capable of 50mph. This minimises the impact of any speed reduction on trains accelerating after Hartley Curve. The turnout is also located on the Up-side alignment, allowing easier extension of the double track southwards in future if this should become desired in order to support a different service pattern for the train paths.

The alternative options considered for this location are discussed in more detail within ***section 13.3.4*** of this report.

5.2.1.5 Furnaceway Sidings

Furnaceway sidings sit to the south east of Bedlington station. They are currently managed by DB Cargo but are not used and are currently in a state of disrepair. The options considered and discussions held with respect to Furnaceway can be found in ***section 13.3.5*** of this report.

The preferred option for the sidings at Furnaceway is to take the management back into Network Rail and to clear and renew the sidings in such a manner that they can be used to regularly to round a locomotive. Drawing 60601435-ACM-06-TL-DRG-ETR-000002 contained within ***Appendix D*** shows the proposed configuration of the sidings. This layout allows a freight train to enter the sidings from Blyth Port, the locomotive can uncouple, move onto an adjacent siding, move to the rear of the consist, cross back onto the previous siding, recouple and finally pull out of the sidings and head north to Morpeth and the East Coast Main Line.

This manoeuvre is currently performed at Newsham, using the single to double connection and crossover number 9. However, the project is seeking to extend the twin track south of Newsham and remove number 9 crossover in order to rationalise the signalling scheme and number of signals controlled from Newsham. As a result, the current freight users require a new location to undertake the turning of the locomotive and Furnaceway provides the best available location.

Within the sidings the preferred option is to completely renew the siding with new S&C and either new or more likely serviceable materials for the plain line. Option 2 which shows the new sidings running adjacent to the existing Down line is deemed to be preferred as it allows additional land to the West to be freed for either development of a facility or future expansion be adding additional sidings. The option sketches for Furnaceway are located within ***Appendix D.***

5.2.1.6 Bedlington Remodelling

Bedlington Junction is a double junction consisting of A7 sized bullhead inclined switches and a fixed crossing. Numerous discussions and alternate solutions were considered for this location and these can be reviewed in further detail in ***section 5.2.1.6*** of this report.

The preferred solution proposed of Bedlington is to renew the double junction on a modern like for like basis using vertical flat-bottomed rail.

Below show the existing and proposed solutions for Bedlington:

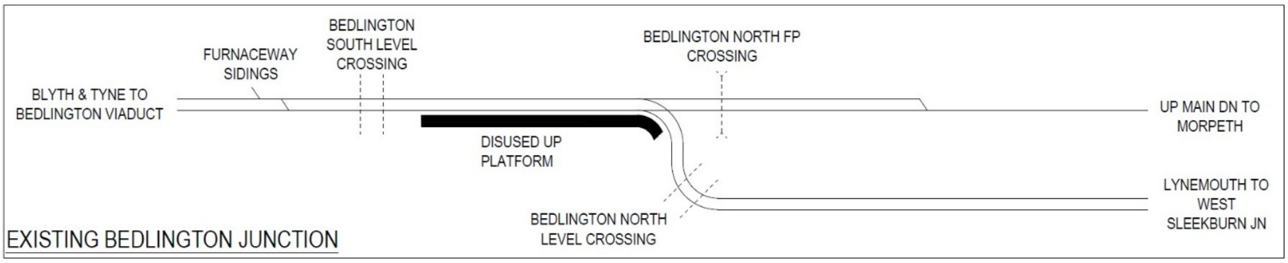


Figure 33 – Bedlington Junction Existing Layout

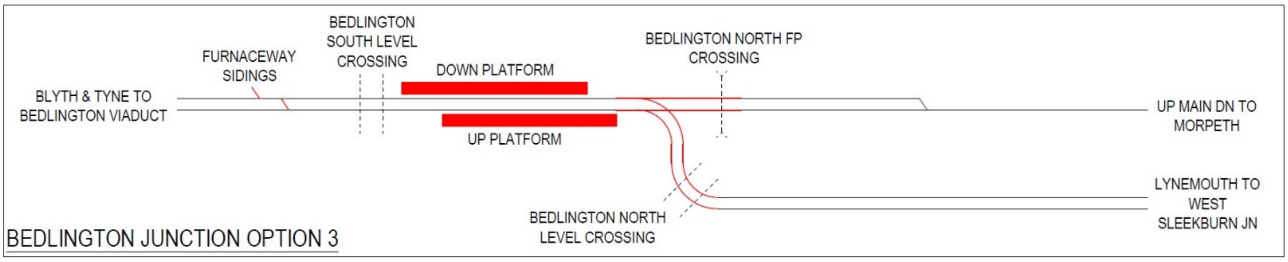


Figure 34 – Bedlington Junction Preferred Option (like for Like renewal)

The project will at the next design stage look further at the options for using B switches instead of A switches, however the track RAM from Network Rail has agreed in principle that brand new A switches would be acceptable. The support from this within CSM comes from the fact that there are other A switches in use within the region where passenger rolling stock are also utilised. Any residual risk is mitigated as far as is reasonable by replacing the junction with brand new components.

As this geometry is now somewhat obsolete, consideration will have to be given to early ordering of the materials as it is unlikely that the current S&C manufacturers will have moulds ready for use for these components and additional time should be allowed for moulds to be created prior to the manufacture of the S&C.

This option is preferred due to the fact that all other options considered resulted in considerable infrastructure changes beyond the remit of the project, the details of which can be found in ***section 13.3.6*** of this report.

5.2.1.7 West Sleekburn Junction

The preferred option at West Sleekburn Junction is to raise the PSR in coordination with the signalling alterations and other track realignment opportunities in the area without undertaking any explicit activities in association with the S&C at West Sleekburn. The current through route geometry appears to meet the requirements of the proposed PSR without the need for further intervention. This will be validated at the next design phase once a survey is available.

Details of the assessments undertaken at West Sleekburn can be found in ***section 13.3.7*** of this report.

5.2.1.8 Ashington Turnback

The service pattern envisaged by the project requires a train arriving into Ashington to sit for over 30 minutes before departing back towards Newcastle. This dwell time is considerable and if performed on the main line would result in the blocking of a freight path. As a result, the project has been tasked with finding a means to allow trains to arrive at Ashington, dwell and turnback towards Newcastle without blocking any current freight paths or preventing any future service enhancement to the North of Ashington in the future.

As a result, Option 4 is the preferred option at Ashington as it meets all the requirements for Ashington and also has passive provision for a connection to the north, to be installed in place of the buffer well, should the passenger service be enhanced further in future. (See ***Figure 35***)

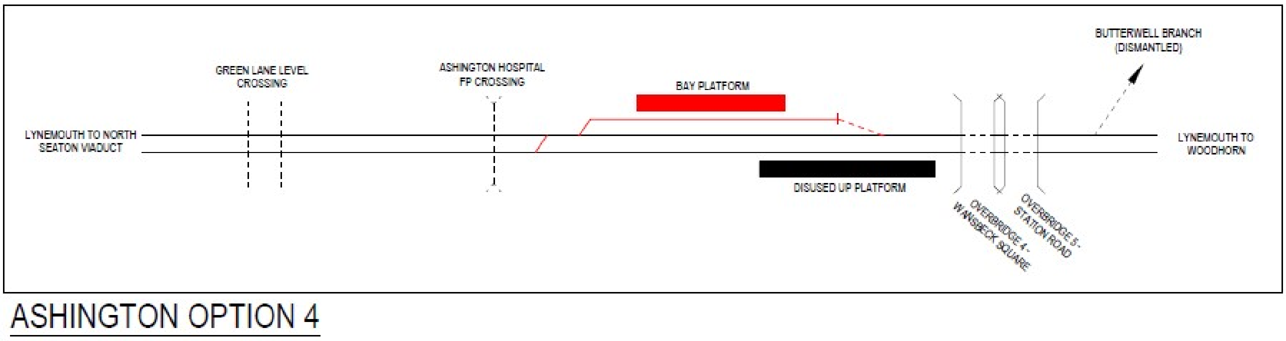


Figure 35 – Ashington Option 4 (Flanked turnback)

Drawing 60601435-ACM-07-TL-DRG-ETR-000004 contained within ***Appendix D*** shows the proposed track alignment for Option 4. Also, in the same appendix, drawing number 60601435-ACM-07-TL-DRG-ETR-000003 shows the arrangement that could be adopted in future if a northwards connection is required from the Down Line, this has been marked as Option 4a. Under this configuration it is expected that a new Up Platform would be connected and utilise the current Up line without the need for a new crossover to be provided. A platform to platform bridge may be required however, depending on the form of the remodelling of Wansbeck Square.

5.2.2 Level Crossings

5.2.2.1 Background

Although Signalling and Level Crossings are, in some ways, separate disciplines, they are intrinsically linked, especially on this project where there are twenty-three level crossings along the route.

The work associated with Level Crossings is ongoing. A 9-day census has been carried out at six Level Crossings with the remaining crossings having their census carried out during September and October 2019. With this information collated and future pedestrian and vehicular usage determined, the results will be entered into ALCRM.

The resultant scoring and risk profiles will feed into several Suitable and Sufficient Risk Assessment (S&SRA) Reports, which will be used to document an agreed solution for each of the Level Crossings with Network Rail, the ORR and the client. Once the solution has been agreed, several Level Crossings will require new Level Crossing Orders and Ground Plans to be developed.

5.2.2.2 Interim Proposals

As the Level Crossing assessment work is ongoing, interim Level Crossing solutions have been put forward in consultation and agreed in principle with the Network Rail Level Crossing RAM Team and the local Level Crossing Managers. The proposed LX solutions are considered ‘worst case’ and as follows:

ELR & Crossing	Mileage	Current Type	Anticipated Solution
BNE			
Palmersville Dairy	0m 34ch	FPW	Upgrade To MSL
Benton Square	1m 30ch	FPS	No Change
Earsdon	2m 48ch	FPW	Upgrade To MSL

ELR & Crossing	Mileage	Current Type	Anticipated Solution
EJM			
Holywell	7m 41ch	ABCL	Upgrade To MCB-OD
Holywell	7m 73ch	UWC	Upgrade To MSL (may be closed – awaiting TQ resolution)
Seghill North	9m 6ch	AHB	Upgrade To MCB-OD
Mares Close	9m 36ch	UWC-T	Upgrade To MSL
Hartley	11m 12ch	AHB	Upgrade To MCB-OD
Red House Farm	11m 30ch	UWC-T	Anticipated to be closed by Network Rail
Lysdon Farm	11m 65ch	FPS	Anticipated to be closed by Network Rail
Newsham	12m 45ch	MCB	Maintain as Existing
Plessey Road	13m 16ch	MCB-CCTV	Maintain as Existing
Chase Meadow	14m 12ch	FPS	Closed via Footbridge
Bebside	14m 67ch	AHB	Upgrade To MCB-OD
Bedlington South	15m 60ch	MCB	Maintain as Existing
BWC			
Bedlington North	0m 0ch	MCB	Maintain as Existing
Red Row Bridge	0m 42ch	Sleeping Dog	Anticipated to be closed by Network Rail
Bomarsund Public	0m 64ch	FPW	Upgrade To MSL
Bomarsund Private	0m 64ch	UWW	Convert to Sleeping Dog
Marcheys House	1m 41ch	MCB	Maintain as Existing
North Seaton	1m 76ch	MCB	Maintain as Existing
Green Lane	2m 43ch	AHB	Upgrade To MCB-OD
Hospital	2m 50ch	FPW	Upgrade To MSL

Table 10 - Level Crossing Solutions

Table 10 details the interim 'agreement in principle' proposals for each of the Level Crossings. In determining what solution can be envisaged, a meeting was held on the 30th July between John Watson, Network Rail Level Crossing Manger North, David Guy, Network Rail Level Crossing Manger South, Melanie Kitching, Network Rail Route Level Crossing Safety Specialist and Ian Ross, Kilborn Consulting Level Crossing Designer.

At this meeting, each Level Crossing was discussed and a number of proposed solutions for each crossing was agreed to be carried forward into an ALCRM Assessment and consideration within the Suitable & Sufficient Risk Assessment. ***Table 10*** details the favoured approach for each Level Crossing but does not detail all variations which will be scored within ALCRM. The principle of the solution agreed was as follows:

- All AHB's and ABCL would be upgraded to MCB-ODs
- All MCB's and the single MCB-CCTV would remain as is
- Where not being closed, all FP's and UWC's would be upgraded to MSL's
- All MSL's solutions would appear to be suitable for an overlay solution
- Bomarsund UWC, because it cannot currently be used as a UWC, will be downgraded to a sleeping dog
- Red Row Bridge, which is currently a sleeping dog, will be fully closed by Network Rail
- Hirst Lane is outside the scope of the project
- Lysdon Farm and Red House Farm are anticipated to be closed by Network Rail

- It may be possible to close Holywell UWC, dependant on what Network Rail Liabilities advise as a cost to close the crossing

5.2.2.3 Future Level Crossing Usage

At some of the Level Crossings, it is anticipated that additional users will be introduced as a consequence of the scheme. The Level Crossings are:

- Bebside MCB-OD
- Newsham MCB
- Plessey Road MCB-CCTV
- Bedlington South MCB
- Bedlington North Wicket Gate
- Bedlington North MCB

The anticipated additional usage as a consequence of the scheme is estimated to be as follows:

Crossing	Increase in Pedestrian Usage (Peak Hour)	Increase in Vehicular Usage (Peak Hour)
Bebside MCB-OD	21	168
Newsham MCB	46	24
Plessey Road MCB-CCTV	24	0
Bedlington South MCB	11	110
Bedlington North Wicket Gate	tbc	tbc
Bedlington North MCB	tbc	tbc

Table 11 - Increased Level Crossing Usage

With respect to train movements, assuming that the project is delivering full anticipated capacity (two trains per hour each way), the following daily services are anticipated to be:

- 66 Passenger Trains
- 1 ECS Train
- 21 Freight Trains (this is worst case as not all freight trains travel the whole route).

5.2.2.4 Level Crossing Down Times

With a high number of level crossings being upgraded in form and an increase in train service on the line, a key consideration with respect to road user experience will be the implications of increased barrier down time experience by the public.

This will manifest itself in several ways:

- All* crossings will be lowered or be activated:

*This excludes Bedlington North Wicket Gate which is only affected by users accessing the new Bedlington Station.

  - Twice more than currently per hour during Phase 1; and
  - Up to four times more than currently per hour during Phase 2.
- Where MSL's are being installed, the amount of time that the crossing will show closed/do not cross will be defined where previously, using line of sight, this was not the case;

- Where MCD-OD's are replacing AHB's, the road users will experience a substantial increase in barrier down time when compared to what is currently the case. For AHB's the road could be closed for 40-50 seconds, for MCB-ODs this could vary between 120-180 seconds and up to 210 seconds. Assuming a worst-case scenario of 4 passenger trains per hour and 2 freight trains per hour, it can be seen that a road could potentially be closed between 12 and 21 minutes every hour.
- Where MCB's are installed and we are proposing no alterations the following are the anticipated consequences:
  - Newsham Level Crossing – Individual operational barrier down time per train will likely decrease because of the new signalling being installed but overall the aggregate per hour barrier down time will likely increase due to the increased number of operations, which applies for all the crossings listed below.
  - Plessey Road CCTV Level Crossing – as per Newsham.
  - Bedlington South Level Crossing – The Signaller at this crossing sometimes suffers abuse from the public due to the length of the time that the barriers are currently down. For passenger traffic and for Down freight movements, the length of time that the barriers are down should, especially for passenger trains, reduce. This is partly due to the change to Track Circuit Block from Absolute Block between Newsham and Bedlington South, but also in the Up direction, passenger trains will be able to stop at Bedlington Station with the barriers up and crossing open to road users. Again, due to the increased number of trains, the overall barrier down time per hour will likely increase from what is happening currently.
  - Bedlington North Level Crossing – Again, for passenger traffic in the Down direction, passenger trains should be able to stop at Bedlington Station with the barriers up and crossing open to road users. Due to the retention of the existing Absolute Block arrangements there will be little change for the arrival of freight trains, but Up passenger trains will arrive quicker than freights so per operation, the barriers will be down less for passenger operation.
  - Marcheys House Level Crossing – Barrier Down time will likely decrease because of passenger trains traveling at a higher linespeed.
  - North Seaton Level Crossing – Barrier Down time will likely decrease because of passenger trains traveling at a higher linespeed.

A full timing exercise will be required to be carried out at the next design stage to accurately model what the barrier down times are and understand the implications of increased roads closures on the associated public highways.

5.2.3 Signalling System

5.2.3.1 General

Reference should be made to Northumberland Line Signalling Scheme Sketch Drawings 1774-DG-001 and 1774-DG-002, which reflect Phase 1 and Phase 2 of the proposed scheme respectively. These can be found in ***Appendix B***

Reference should also be made to the Scheme Design Log 1774-TR-015 Northumberland Line Signalling Design Log which explains in more detail regarding the design decisions surrounding the production of the Signalling Scheme Sketch. This can be found in ***Appendix B***

In determining a strategy to best accommodate the resumption of passenger services and the increase in train frequency and speed, an understanding of the current method of operation has been thoroughly investigated. This was further developed through discussions with the RAM Teams for Signalling and Level Crossings. Additionally, an understanding of the constraints on the line has been investigated. These constraints include, junction positions, track (speed) constraints, signalling technology and interlocking constraints and likely Level Crossing requirements.

The resultant design strategy perpetuates the existing control areas, whilst introducing a new control area to accommodate Ashington Station.

Consideration was given to a full re-signalling of the area, with operation from a single or multiple control points, but this has been discounted on the basis that full re-signalling (of the whole Northumberland Line) does not offer value for money for the client, Northumberland County Council. This in part is due to the realisation that the passenger service can be accommodated on some of the control areas with minimal alterations taking place.

5.2.3.2 ROC Recontrol

At the southern end of the Northumberland Line, Tyneside Signalling Centre is planned for Recontrol to York ROC in 2021. This should have no impact on any works planned on the Northumberland Line, assuming no lineside alterations are proposed by the ROC Recontrol project. This will need to be confirmed at a later design stage. For the remainder of the line, toward Ashington, the area was initially planned for ROC Recontrol in CP6, but this has been postponed until 2029, at the earliest.

Within the design strategy we have tried to take consideration of any future ROC Recontrol plans and be sympathetic to future re-signalling requirements that might take place on the line.

5.2.3.3 Scheme Sketch Dimensions

All scheme dimensions have been derived from Network Rail's Geo-RINM dataset, which was made available to the project and used as the basis for the production of the design upon which the baseline Scheme Sketch was based. A more detailed modelling tool will be utilised at the next design stage.

Multiple, existing Network Rail Signalling Plans cover the area affected by the works; where the plans overlap, inconsistencies have been noted. Consequently, a Geo-RINM survey was undertaken to provide an accurate and agreed source of base information regarding the position of existing equipment and gradient information.

5.2.3.4 Linespeeds

Where practical, for passenger traffic, a 65mph maximum line speed has been proposed along the route. Goods trains (Classes 4 and 6) will also continue to operate over the route. There are a number of instances of lower speeds being imposed along the route due to other factors such as line curvature and bridges; because of this goods trains will have limited opportunity to accelerate to and travel at full line speed.

Consequently, it has been decided to try to keep goods train running at a constant speed that is an improvement over the existing speed along the route and much consideration and discussion has gone into this. The outcome is that, as a basis, 40/65mph has been taken as a baseline at this stage; this prevents the majority of cases of over-braking that would otherwise occur, as 40 mph Appendix A braking and 65 mph Appendix B braking generally provide stopping distances of the same order. Additionally, and based on the ongoing timetabling work, this arrangement supports the proposed train operating requirements of running between stopping passenger trains. A further matter that had to be considered was the actual distances between fixed assets that required signal protection and the need to achieve the 65mph project requirement, where possible, for passenger trains. Consideration of Advanced Warning Indicators (AWI)'s will be made at the next design stage.

5.2.3.5 Signal Spacing

The early development of the design was undertaken with a simple spreadsheet and linear extrapolation. This was driven by the lack of firm gradient information, with the information available being contradictory in nature. The availability of the Geo-RINM data and its general acceptance as suitable, resulted in the adoption of the SSpaM tool to validate signal positions.

5.2.3.6 AWS Provision

This route currently sees only goods traffic, consequently, there is no general AWS provision. The introduction of passenger traffic will require the provision of AWS equipment in line with the relevant standards. Regarding North Seaton / Wansbeck viaduct, due to maintenance access requirements the AWS units have been placed with consideration in a compliant non-standard position, i.e. off the viaduct to avoid maintenance staff having to "work at height" to access them.

5.2.3.7 TPWS Provision

Additionally, there is no general TPWS provision along the line of route. The associated Scheme Sketch indicates provisional TPWS arrangements. A full TPWS validation exercise, including for the Buffer Stop at Ashington, shall be undertaken at the next stage of scheme development.

5.2.3.8 Power Supplies

There is presently a 650V feeder from Benton Junction that runs as far as Seghill. This has a limited capacity and in its present form is unsuitable for extension further north due to voltage drop and the cable not being to present standards.

Consequently, a new DNO derived 650V feeder is to be installed centred on Bebside. The Benton Feeder will be rerun to current standards allowing it to feed as far as Seghill, as is now the case. There will be a south feeder that runs as far as Seghill but does not connect with the existing Benton Feeder. The south feeder with directly power all location cases and equipment en route. The north feeder will do the same (feeding all equipment) as far as the vicinity of Bedlington Viaduct, Beyond Bedlington Viaduct, it is proposed that the new 650V north feeder will replace the existing DNO incoming supply at signal boxes as far as powering signalling equipment is concerned. The existing signal box DNO incoming supplies will continue to provide the signal box domestic supply where appropriate.

North of Bedlington viaduct, the existing location cases will derive their power from the signal box, as is presently the situation, although indirectly this will now be fed from the new 650V feeder.

The new equipment in the North Seaton and Ashington areas will have signalling location cases fed from a PSP. (See ***section 5.2.5.2*** for more detailed information on the proposed signalling power)

5.2.3.9 Signal Sighting

A signal sighting exercise will be started in earnest at the next design stage. During this current design stage, signal sighting has been considered and where possible, signal placement has utilised good signal sighting principles.

5.2.3.10 Signalling Overrun Assessment (SORA)

The publication of RIS-0386-CCS, the Rail Industry Standard on Signal Overrun Risk Evaluation and Assessment in December 2014 led to the updating of Network Rail company standard NR/L2/SIG/14201, the Signalling Risk Assessment Handbook, to take cognisance of the development of the Signal Overrun Risk Assessment Tool (SORAT), which previously had only been accommodated by means of a derogation. SORAT having replaced the earlier Signal Assessment Tool (SAT). The underlying purpose of this is to perform a suitable and sufficient risk assessment for the proposed signalling system.

The stages in the SORA process do not, however, fit exactly within the normal stages described within the Governance for Railway Investment process (GRIP); the first stage, the Preliminary Assessment process, is to take place during feasibility and option selection stages (GRIP 2 and GRIP 3) which the stage this report most aligns with. This stage sees the various options assessed; however, layout changes have been subject to ongoing development, which has delayed any opportunity to start a Preliminary Assessment. Consequently, this work will have to take place between Option Selection and Outline Design, which may not be ideal, however, one benefit will be that the scheme design proposals will be more stable and, as a result, the SORA activities, covering identification of risks and appropriate design related mitigations, will be more efficient than would have been the case had it been carried out during the current stage of the design development.

As far as possible during this development period, the available signalling options were kept fluid. Also, there were regular meetings with train operating representatives, both passenger and goods as well as the infrastructure owners/managers to ensure that the evolving changes met their aspirations, with the lowest achievable risk.

An initial SORAT is to be undertaken at the earliest opportunity and used as the basis for a later more detailed iteration later in the design and used to assist in a risk assessment of the proposed preliminary layout. The use of the recently introduced SORAT-LX forms a key part of the suitable and sufficient risk assessment process for level crossings.

In this context, it is useful to understand the route to approval of the signalling scheme, which includes the level crossing design proposal, given that approvals will be required from Network Rail through the ASPRO arrangements. The processes associated with SORAT, and now SORAT LX, need to be undertaken to support an application for Approval in Principle from Network Rail.

The approval process for signalling and level crossing related schemes is mandated in the NR standard, Signalling & Level Crossing Scheme Approval Process, ref NR/L2/SIG/30035.

This process includes the requirement that both SORAT and SORAT-LX assessments have been undertaken and documented prior to a submission to the relevant Network Rail representatives.

Further, the recently issued version of '30035 (Issue 4) mandates (a) Preliminary Approval, which requires approval by the Signalling (and Level Crossing) RAM and support of Operations representatives, (b) the subsequent Approval in Principle, via Major Schemes Review Panel, and (c) the requirement for a specific Level Crossing Schemes Review Panel. Given the volume and complexity of level crossing interventions required for the Northumberland Line, it is clear that the latter will require a considerable amount of rigour to be applied to the level crossing design proposals.

5.2.3.11 Line Names

As a result of historical nomenclature, and with a view to eventual re-control, the single line section covering ELR BNE and EJM is proposed to be referred to as the "Up Blyth & Tyne Down" during Phase 1. During Phase 2, the southern single line section between Benton East and Holywell is proposed to be named the Blyth & Tyne Reversible. Double line sections on ELR EJM are proposed to be called the Down Blyth & Tyne and Up Blyth & Tyne respectively.

The line from Bedlington North towards Ashington is proposed to be named the Down Lynmouth and Up Lynmouth respectively.

5.2.3.12 Stopping / Non-Stopping Controls

It is envisaged that Signal Box Stopping / Non-Stopping controls will be required for a number of level crossings along the route which will define how the level crossings are activated.

5.2.3.13 Train Ready To Start (TRTS) Plungers / Level Crossing Activation

There are a number of stations on the route where the level crossings are within the activation area for the level crossing and therefore, some form of crossing initiation is required. At this stage of design, it is anticipated to take two different forms:

1. Plunger initiation to start the barrier sequence
2. Plunger initiation for the signaller to set the route which starts the barrier initiation.

Each station where this may be an issue is detailed below:

Ashington – It is anticipated that the plunger acts as a TRTS in that it will alert the Signaller that the route from Ashington Station (ASHST) up to at least NS10 Signal requires setting. With the route being set and the crossing proved down and clear, ASHST will release.

Bedlington – Again, it is anticipated that the plunger acts as a TRTS, advising either Bedlington North or Bedlington South Signaller, as required, that the barriers can be lowered and then the routes set. Minimising Barrier down time at Bedlington South especially is critical.

Bebside Down, Phase 2 – In the case of Bebside it would be proposed that the plunger initiates barrier operation. With Stopping controls applied for Down passenger trains assuming that the route from N129 is set (but not cleared), it is proposed that Bebside Level Crossing will only initiate, and the route cleared forward from N129 Signal, after the plunger has been operated. This will help to facilitate reducing the barrier down time for Bebside Level Crossing to as little time as possible.

5.2.3.14 Cable Routes

The extent of the cable routes works is still to be determined pending a full cable route investigation survey being carried out at the next design stage. As a design assumption it would be a valid assumption to make that where re-signalling is taking place, a new cable route will be required. Further consideration should be made with respect to vandalism on the area and whether the route required burying or not. (see ***Section 5.2.4*** for more detailed description of the telecoms proposal)

5.2.3.15 Locations and Equipment Rooms

New location cabinets will be installed in the areas where re-signalling works are taking place.

Where works are taking place in location cabinets in poor condition or where wire degradation exists, it is highly probable that a new location cabinet will be required.

The following cases are known to require relocation:

- Situated at the southern end of, and at the mid-point of, the new Down Bedlington Platform, are 15/40A&B and 15/41 Location cabinets respectively. These will need to be relocated to a position away from the platform/public access. The condition of these cases will not facilitate a lift and shift, and it will require new cases to be installed.
- Situated at the northern end of the Up Bedlington Platform, are No.3 Location cabinets (3no. in total). These will need to be relocated to a position away from the platform/public access. 2no. of these cases are new and will be suitable for 'lift and shift', but the condition of the 3rd will not facilitate a lift and shift and will require a new case to be installed.

Racking for new relays and equipment will be required at the following existing equipment rooms:

- Newsham Signal Box – Either under the Signal Box or in a new equipment room if the box is to be relocated. The existing level Crossing REB is quite full.
- Bedlington South Signal Box – Under the Signal Box, required to accommodate alterations taking place in the area.
- Bedlington North Signal Box – Under the Signal Box, required to accommodate alterations taking place in the area.
- North Seaton Signal Box – Under the Signal Box, required to accommodate alterations taking place in the area.

Regarding requirements for proposed MCB-OD Level Crossings. Currently the control equipment is either installed in location cabinets or in REB's neither of which is likely to be suitable for reuse. Dependant on the type of CBI chosen will determine whether the LX equipment can be sited in cabinets or whether a small REB is required. From a worst-case scenario, an additional small REB has been assumed.

5.2.3.16 Staff Training

Pertinent to the installation of a CBI, will be the understanding that staff training will be required to interrogate, fault and maintain the system.

The following sections detail keys issues, broken down by Signal Box area.

5.2.3.16.1 Key Issues – Tyneside (York ROC)

5.2.3.16.1.1 Palmersville Dairy Level Crossing

It is not deemed viable to close the crossing due to the excessive detour required.

Currently, to prevent an Up train straddling the crossing, a notice board is installed, which allows freight trains to stop short of the crossing but still observe the Benton North Junction protecting signal, T636. It is not proposed to change this arrangement. Passenger trains will pull up to the signal without any chance of straddling the crossing, waiting for the signal protecting the ECML to clear.

The Down line proves more problematic. Although a passenger train can clear the crossing, if waiting at T635 Signal for the single line section from Newsham to clear, a freight train will straddle the crossing. It can be reasonably argued that this issue is a result of a problem that has the potential to exist today and therefore, should this project carry the burden to address this issue but, this scenario is currently unlikely to occur due to the low occupancy of the current single line section. This project will occupy the single line section for a higher percentage of time per hour as compared to today and, therefore, the chance of a freight train standing at the signal will increase.

It is for this reason that T635 signal is to be moved 393m north; this will allow a 550m long freight train to stand at T635 Signal, clear of the Level Crossing. This arrangement allows a full overlap to be provided at T635 Signal whilst not impinging on the overlap of T638 Signal. No change to Tyneside signalling controls are required, although the proposal will result in track circuits having to be extended (or split) and shortened.

The resultant proposal for this Level Crossing is that an MSL Overlay LX is installed. An overlay type Crossing is being proposed so that no changes are required to the Solid State Interlocking (SSI). As a new power feeder is being installed, power for the MSL Overlay can be provided locally, negating the need for solar/wind generation.

It is a pre-requisite of the design that the Signaller is notified of the health status of the Level Crossing, therefore, if it is not possible to send an alarm to Tyneside, we may need to consider sending an alarm to Newsham instead. This will be resolved at the next stage.

5.2.3.16.1.2 Newsham Down Slot

Currently a slot exists on N101 Signal which, once N101 is at Green, allows T635 Signal to show a Green Aspect. This slotting arrangement currently facilitates a movement onto the single line section as far as N11 Signal at Newsham.

At this stage, we are not certain if the slot is a function within the SSI system so, we are not proposing to amend the principle of the slot and maintain the existing arrangement, albeit the area of the slot will be substantially reduced (Holywell Junction). It may be that, at the next design stage, the slot function can be removed without any impact on the Benton SSI, which covers this area.

5.2.3.16.2 Key Issues – Newsham Signal Box Area

5.2.3.16.2.1 Single Line Controls

Currently there is a slotting arrangement to facilitate train movements onto the single line section between Benton East and Newsham. This slot acts on N101 signal and once N101 is proved to be at Green permits T635 to also show a Green aspect. The proposed scheme would reduce the length of the single line to Benton East to Holywell.

At the current stage in the schemes development we have not been able to ascertain the full extent of the slot's operation regarding the SSI that exists in the Benton area, although the working arrangements are understood.

Signalling Applications Guidance note BD provides guidance on the control of single lines, with and without directional controls using either a directional lock or by establishing the direction of travel by 'setting a route in'.

This matter is to be investigated in greater detail at the next stage to ascertain any directional control requirements.

5.2.3.16.2.2 Benton Square Level Crossing

Benton Square Level Crossing has duel usage with Nexus Metro in that it crosses over a double track of the Metro system. The crossing is an unprotected Footpath Level Crossing where users use their own line of sight as a control method. The physical form of the crossing is that there are steps leading up the crossing onto the Metro lines. Once the user traverses over the Metro Lines, they enter a gated island installed between the Metro and Network Rail single line. Once through the gate and crossing the Network Rail line, steps in the cess take the user away from the Level Crossing along a footpath.

The standards stipulating the installation of MSL's mandate that the crossings cannot be used over more than 2 lines but even if that risk was accepted and an MSL covered all 3 lines or even 2 separate MSLs were installed, Network Rail have experience in other areas of the Network linking into the Metro Interlocking and have not been able to get it to work and fear the same at this site.

It would not be acceptable just to have an MSL on the Network Rail element of the Level Crossing as we would be providing two separate methods of protection on what appears to be a single crossing to the public.

There appears to be ample sighting available and localised de-vegetation works could improve this, therefore, it is proposed not to make any changes to this Level Crossing and maintain the line of sight protection arrangements in place.

5.2.3.16.2.3 N107R Signal

This new two aspect (Y/G) colour light signal acts as the Down direction distant signal for Holywell level crossing and is positioned such as to afford the appropriate braking distance to the stop signal ahead. The proposed position of this signal is such that it is likely to require the provision of a Banner Repeater on sighting grounds due to the line's left-hand curvature in a slight cutting.

5.2.3.16.2.4 Phase 2 – Holywell to Seghill Double Tracking

To accommodate the Phase 2 double tracking works between Holywell and Seghill, the Down direction signals will move over from the single line to the new Down alignment. Speed signage will also be required to accommodate turnout speeds through the S&C.

5.2.3.16.2.5 Holywell User Worked Crossing

A request has been made to Network Rail with respect to the closure of this crossing on the basis that the crossing does not appear to be in use. Network Rail have previously spoken to the rights holder and confirmed that the rights holder (Land Owner) has requested compensation to consider relinquishing their rights to cross the railway at this point. The project has submitted a TQ to Network Rail to clarify what this cost might be and if it would be cheaper than the installation of an MSL then it would be in the projects interests to contribute towards closing the crossing.

Discussions are ongoing so at this stage the project is assuming that the crossing will remain open and upgraded as a worst-case scenario.

As controls are proposed to be applied to N108 Signal, (see below), there should be no scenario that a train will straddle Holywell UWC waiting at N108.

5.2.3.16.2.6 N108 Signal

This new two aspect (R/G) colour light signal situated on the Up Blyth and Tyne Loop protects Holywell Level Crossing and the single line ahead from train movements in the Up direction. It has been afforded a full overlap on the approach to the conflict point at the confluence. The gradient at the signal is on a 1 in 121 rising. For this reason, it is proposed that some form of control is applied to the signal to eliminate the possibility of a freight train coming to a stand at the signal in case it cannot start away again.

5.2.3.16.2.7 Seghill Curve

Seghill Curve, and therefore the speed over the level crossing is currently signed at 30mph. It is the projects aspiration to increase the speed through the curve and level crossing to 50mph. This requires some track re-alignment and change of cant. The practicalities of this are still being investigated, but we have assumed that this can be achieved, and the design reflects as such.

5.2.3.16.2.8 N121 Approach Controls

This 3-aspect colour light signal protects Newsham Level Crossing with a safe overrun distance of just over 50m to the crossing and, therefore, the risk of signal overrun will need to be considered with the barriers in the up position.

A mitigation is that the vast majority of trains will be stopping at the station and there is adequate standback to help minimise SASSPAD (start against signal, signal passed at danger) risk. Comprehensive TPWS will be afforded as part of the mitigation.

5.2.3.16.2.9 Newsham Interlocking

Due to the extensive changes being proposed within the Newsham Control area, including the abolition of the Absolute Block to Bedlington South, it is not practical to maintain the existing mechanical interlocking approach at Newsham. Initially a “conventional” RRI type interlocking was envisaged and multiple amendments to the mechanical interlocking were also considered, however, after careful thought and discussion it was decided to propose a small Computer Based Interlocking.

One consequence of this proposal is to make the southern part of the route more ‘ROC ready’.

5.2.3.16.2.10 Signaller Control Method

Consideration was given to maintaining the existing Lever Frame in Newsham Signal Box, but there are insufficient levers available for the signalling on the route. This leaves the option of a new push button/switch panel being installed or pursuing a VDU option, which is very likely more favoured because of future expandability.

It is also worth considering the poor condition of Newsham Signal Box, which also includes the room under the Signal Box floor. For this reason and depending on the methodology of installation at the next design stage, consideration of relocating the Signal Box to a new site opposite the existing box, will be investigated at the next design stage.

For the purposes of costing, an Ansaldo MicroLok II Interlocking including VDU based Control System with EbiGate 2000 controllers for 4no. MCB-OD’s has been used. The specification of all elements of the CBI will be determined at the next design stage but key to choosing the right system include:

- Ease of procurement;
- Availability of resources; and
- Ease of Upgrade.

5.2.3.16.2.11 Newsham to Bedlington South Absolute Block Controls

Presently the method of control between Newsham and Bedlington South is via Absolute Block however, as Bebside AHB is being converted to an MCB-OD type level crossing, it is proposed to convert this section to Track Circuit block utilising Axle Counters. The provision of Intermediate Block (IB) signals and such like were considered, however, for flexibility of use and the potential application of CBI, track circuit block appears the preferred solution.

5.2.3.16.3 Key Issues – Bedlington South Signal Box Area

5.2.3.16.3.1 Bedlington Viaduct

Due to the unknown condition of the viaduct, a matter which should be resolved at the next design stage, it has been agreed to show a 30mph PSR over the viaduct at this time. It is anticipated that after more investigation, this PSR can be removed later.

5.2.3.16.3.2 Bedlington South Signal Box

The largely mechanical nature of the arrangements at Bedlington South have resulted in an approach to minimise the changes here to as little as possible.

5.2.3.16.3.3 Number 30 Crossover

As part of planned non-project works, Network Rail are intending to recover No.30 crossover and the attendant shunt signals, BS29 and BS31; the crossover currently being unusable due to its deteriorated condition. This work is assumed to have been completed as part of the Signalling Scheme Sketch production.

5.2.3.16.3.4 BS15 Signal

The location of BS15 signal will be affected by the provision of a new Down Platform at Bedlington. It is impractical to leave the signal in its current position as it would be within the footprint of the platform and lateral adjustment is likewise impractical due to the constraints of the site. Consequently, a lightweight cantilevered structure was proposed carrying an LED position light signal, but this has been discounted on the advice of the RAM due to the lack of maintenance access for a cantilevered structure. Therefore, it is proposed to relocate the signal to the southern end of the Down Platform.

As a consequence of removing No.30 Crossover, movements to/from BS15 will be restricted as compared to the movements that can take place currently.

5.2.3.16.3.5 BS16/18 Signal

BS16/18 semaphore signals are mounted at a height of 8/7m above running rail respectively. In the current locking arrangements, it is possible to run a train up to BS16/18 Signals with Bedlington South Barriers in the raised position. Under future passenger running that flexibility will need to be maintained to minimise level crossing abuse.

With the project aspiration to run up to 100m long trains, standback from BS16 signal is key as there is a non-compliant platform curve in rear if a full 25m standback was to be provided. For this reason, it is proposed to change the form of the signal to an LED signal, with Position Light (PL), to consider lowering the signal to driver’s eye level and proposing that the standback to the signal is reduced to 8m. This would have the effect of all stepping distances being installed on a compliant platform radius. Obviously, this proposal requires full agreement by a Signal Sighting Committee.

5.2.3.16.3.6 Bedlington South Level Crossing

To facilitate access into the Down Platform, there is a requirement to amend the alignment of the Downside barrier machines so that they are no longer parallel to the railway. This change will require the production of a new Ground Plan and possibly Level Crossing Order.

5.2.3.16.3.7 Furnaceway Sidings

Bedlington South Signal Box controls access to, and egress from, the adjacent Furnaceway Sidings, which are currently in a moribund state, but which are to be brought back into use as part of this project. The first two sets of points within the sidings are afforded electrical detection. Other than refurbishment to bring assets back into use, no operational changes are proposed other than the removal of ‘A’ electrically detected point end.

5.2.3.16.3.8 BS24 Signal

This high-level shunt signal provides a movement authority for trains departing from the Furnaceway Sidings. These sidings are to be re-modelled and brought back into use as a result of this project. The consequential track realignment will see the lateral interval between the signal and the neck of the sidings increased by about a track width. At this stage it is proposed to leave the signal in its current position; however, this is subject to a signal sighting assessment, taking cognisance of the possible read-through risk to BS40.

5.2.3.16.3.9 Location Case Relocation

Situated at the southern end of, and at the mid-point of, the new Down Bedlington Platform, are 15/40A&B and 15/41 Location cabinets respectively. These will need to be relocated to a position away from the platform/public access. The condition of these cases will not facilitate a lift and shift, and it will require new cases to be installed.

5.2.3.16.4 Key Issues – Bedlington North Signal Box Area

5.2.3.16.4.1 Location Case Relocation

Situated at the northern end of the Up Bedlington Platform, are three Location cabinets. These will need to be relocated to a position away from the platform/public access. Two of these cases are new and will be suitable for 'lift and shift', but the condition of the third will not facilitate a lift and shift and will require a new case to be installed.

5.2.3.16.4.2 BN10 Signal

The fixed distant installed at this signal is proposed to remain as will the very low speed over the junction ahead meaning that replacing it is unlikely to bring about a useful reduction in clearance times. Further, passenger trains are to be the predominant form of traffic and all passenger trains will stop at the station ahead.

5.2.3.16.5 Key Issues – Marcheys House Signal Box Area

5.2.3.16.5.1 MH13 Signal

Much consideration has been given with respect to MH13 Signal. Understanding that the signal has a semaphore distant arm, proposed to be motorised, reading to a new colour light signal ahead, NS17 (required as the existing NS17 has no distant arm). This relates to concerns that the visibility of the distant arm on MH13 not being conspicuous enough. At this stage of the design, it is believed that this issue could be dealt with using an enhanced light source, the signal being well sighted on a straight rising gradient.

Another consideration was to move the signal on the approach to the existing signal to provide a longer overlap to the junction. However, there is currently no foreseeable junction traffic for the signal to protect. Any irregular movements could be subject to double blocking back to Winning. Should another project subsequently wish to provide for a regular traffic flow then the matter would have to be considered as part of that project.

5.2.3.16.5.2 MH10 Signal

Consideration was given to re-positioning this signal so as to afford an improved safe overrun distance. However, at this stage, there is no traffic past this signal nor is there to be any in the foreseeable future. A TPWS TSS has been provided and any risk could be dealt with by means of double block working from Winning. The attendant fixed distant remains as such at this stage, as due to the lack of traffic it is not restrictive.

5.2.3.16.5.3 MH1 Signal

The attendant fixed distant is to become motorised and afforded an identity to assist with the increased speed profile on the route. Consideration had been given to repositioning this signal (see earlier), however, that would result in the possibility of a passenger train coming to a stand on the viaduct. The AWS has been placed at a non-standard distance to negate the need for maintenance staff to be located on the viaduct to maintain the asset.

5.2.3.16.6 Key Issues – North Seaton Signal Box Area

5.2.3.16.6.1 Numbering Sequence

The numbering sequence of signals and other assets at North Seaton will be considered in more detail at the next stage when the lever / control arrangements are also considered in more detail.

5.2.3.16.6.2 North Seaton Gate Box

Due to the spare lever constraints faced at Marcheys House and the previous demolition of Ashington signal box, a decision has been made to control the northern end of the line from here and reinstate the Gate Box to a Signal Box. The initial concept at this stage is to have a small-scale CBI to control the actual interlocking to match that afforded to Newsham; however, given the more limited scale of the control area, and, after discussions with Network Rail, it was subsequently jointly decided that a small RRI would be a better choice.

Associated with the upgrade of the Gate Box to Signal Box, the Signallers will require TRUST and GSM-R Terminals to be installed.

It goes without saying that this option involves a not insignificant OPEX cost to the project, which will initially include sending two Signallers on a 13-week training course.

5.2.3.16.6.3 NS17 Signal

The AWS has been placed at a non-standard distance to negate the need for maintenance staff to be located on the viaduct to maintain the asset.

5.2.3.16.6.4 Green Lane Level Crossing

With the proposed conversion of North Seaton Gate Box to a full Signal Box, the control of Green Lane level Crossing will transfer from Marcheys House to North Seaton Signal Box.

5.2.3.16.6.5 ASHUH Signal

This is a temporary designation for the Up Lynemouth 3-aspect signal that protects the crossover leading from Ashington station bay platform to the Up Lynemouth. The signal is to be provided with TPWS. The signal is positioned close to the portal of Bridge No.5 on a left-hand curve. An initial estimate shows that sighting should be achievable, but this matter, as with all amended and new signals, will be attended to in detail at the next stage.

5.2.3.16.6.6 HLFD Signal

This is a temporary designation for the Down Lynemouth fixed distant board placed at compliant braking distance from the Stop board that protects Hirst Lane Level Crossing. It is co-sited with a 15mph PSR that defines the required braking distance to HFSB Stop Board.

5.2.3.16.6.7 HLSB Signal

This is a temporary designation for the Down Lynemouth fixed Stop Board protecting Hirst Lane level crossing. This board has been slightly repositioned to provide an improved safe overrun distance, in the form of a speed compliant overlap, to the level crossing ahead.

5.2.4 Telecoms

5.2.4.1 Stations

5.2.4.1.1 Northumberland Park Station

5.2.4.1.1.1 Operational Communications

Based on the preferred station option, the main impact to the Telecoms lineside infrastructure will be the C/1/9 S&T concrete trough route.

The preferred option is to abandon the S&T route under the proposed new Northumberland Park Station platform with a new S&T cable route being provided. This shall be either as a through platform multi duct or with a lockable trojan trough to be diverted around the new platform. This will provide for any future cabling requirements for either damaged cabling or new cabling to be installed in this area.

Final details of the new cable route shall be developed at the next design stage in conjunction with the civils design team.

This option was considered the most cost effective as it removes the need for costly lift and shift cable works, in addition it provides the least impact to the operational railway by leaving operational services running whilst building the new station.

5.2.4.1.1.2 SISS (station Information and Surveillance Systems)

Based on the preferred station option, a proposed station overlay was produced detailing the proposed new station SISS assets for the new platform.

These included new Box, Dome and Fish Eye cameras assuming tilt down posts for the platform and approach coverage. The CCTV Field of View (FOV) calculations showed that a total of 15 No IP Power over Ethernet (PoE) CCTV cameras would be required, based on the station detail available at this stage.

The cameras calculations were based on Network Rail Standard NR/L2/TEL/30135 Issue 4 (DRAFT) as the system is based on an IP PoE CCTV system.

Further details are to develop at the next design stage once the station model has been produced.

In addition to CCTV, the station will be provided with 1 No platform Dual sided Next train Indicator (NTI) and 2 No single sided Summary of Departures (SOD). The Customer Information System (CIS) positioning was based on Persons of Reduced Mobility – Technical Specification for Interoperability (PRM-TSI) compliance (See ***Section 2.2.3***). The developed option also calculated the proposed positions of the station speakers based on the station detail available at this stage. It was determined that the station would require a total of 11 No projection and recessed speakers for the station. Further Public Announcement (PA) design shall be undertaken at the next design stage including the production of an acoustic model to inform the PA and station civils design.

5.2.4.1.2 Seaton Deleval Station

5.2.4.1.2.1 Operational Communications

Based on the preferred station option, the main impact to the Telecoms lineside infrastructure will be the C/1/7 S&T concrete trough route.

The preferred option is to abandon the S&T route under the proposed new Seaton Deleval Station platform with a new S&T cable route being provided. This shall be either as a through platform multi duct or with a lockable trojan trough to be diverted around the new platform. This will provide for any future cabling requirements for either damaged cabling or new cabling to be installed in this area.

Final details of the new cable route shall be developed at the next design stage in conjunction with the civils design team.

This option was considered the most cost effective as it removes the need for costly lift and shift cable works, in addition it provides the least impact to the operational railway by leaving operational services running whilst building the new station.

5.2.4.1.2.2 SISS (station Information and Surveillance Systems)

Based on the preferred station option, a proposed station overlay was produced detailing the proposed new station SISS assets for the new platform.

These included new Box, Dome and Fish Eye cameras assuming tilt down posts for the platform, car park and approach coverage. The CCTV FOV calculations showed that a total of 11 No IP PoE CCTV cameras would be required, based on the station detail currently available.

The cameras calculations were based on Network Rail Standard NR/L2/TEL/30135 Issue 4 (DRAFT) as the system is based on an IP PoE CCTV system.

Further details are to develop at the next design stage once the station model has been produced.

In addition to CCTV, the station will be provided with 1 No platform Dual sided NTI and 1 No single sided SOD. The CIS positioning was based on PRM-TSI compliance (See ***Section 2.2.3***)***.*** The developed option also calculated the proposed positions of the station speakers based on the station detail available at this stage. It was determined that the station would require a total of 6 No projection and recessed speakers for the station. Further PA design shall be undertaken at the next design stage including the production of an acoustic model to inform the PA and station civils design.

5.2.4.1.3 Newsham Station

5.2.4.1.3.1 Operational Communications

Based on the preferred station option, the main impact to the Telecoms lineside infrastructure will be the C/1/7 S&T concrete trough route.

The preferred option is to abandon the S&T route under the proposed new Newsham Station platform with a new S&T cable route being provided. This shall be either as a through platform multi duct or with a lockable trojan trough to be diverted around the new platform. This will provide for any future cabling requirements for either damaged cabling or new cabling to be installed in this area.

Final details of the new cable route shall be developed at the next design stage in conjunction with the civils design team.

This option was considered the most cost effective as it removes the need for costly lift and shift cable works, in addition it provides the least impact to the operational railway by leaving operational services running whilst building the new station.

In addition to the station works a new dual track section alignment stating at 11mi 30ch will affect a number of Signalling location cases with co-located telecoms cabling within them. Due to this the following cable sections will need renewing as part of the Newsham Station works.

- 20Pr NCC2582 from Sig Loc 1152B
- 50Pr No ID from Sig Loc 12/37A to Newsham SB
- 20Pr NCC2583 from Sig Loc 11/52B to Newsham SB.

Further details are to be developed with the Signalling design team at the next design stage to determine the Signalling proposals for the location cases listed below.

- Sig Loc 12/37A (New)
- Sig Loc 12/37A (Old)
- Sig Loc 12/17B (New)
- Sig Loc 12/17B (Old)

It is proposed that these location cases shall be replaced with a XCN1 Telecoms cabinets with new cabling replacing the cables affected by the proposed new track alignment. Further details are to be developed at the next design stage once a telecoms copper cable correlation exercise has been undertaken.

5.2.4.1.3.2 SISS (station Information and Surveillance Systems)

Based on the preferred station option, a proposed station overlay was produced detailing the proposed new station SISS assets for the new platform.

These included new Box, Dome and Fish Eye cameras assuming tilt down posts for the platform, car park and approach coverage. The CCTV FOV calculations showed that a total of 29 No IP PoE CCTV cameras would be required, based on the station detail available at this stage.

The cameras calculations were based on Network Rail Standard NR/L2/TEL/30135 Issue 4 (DRAFT) as the system is based on an IP PoE CCTV system.

Further details are to be developed at the next design stage once the station model has been produced.

In addition to CCTV, the station will be provided with 2 No platform Dual sided NTI and 2 No single sided SOD. The CIS positioning was based on PRM-TSI compliance (See ***Section 2.2.3***). The developed option also calculated the proposed positions of the station speakers based on the station detail available. It was determined that the station would require a total of 12 No projection and recessed speakers for the station. Further PA design shall be undertaken at the next design stage including the production of an acoustic model to inform the PA and station civils design.

5.2.4.1.4 Blyth Bebside Station

5.2.4.1.4.1 Operational Communications

Based on the preferred station option, the main impact to the Telecoms lineside infrastructure will be the C/1/9 S&T concrete trough route.

The preferred option is to abandon the S&T route under the proposed new Blyth Bebside Station platform with a new S&T cable route being provided. This shall be either as a through platform multi duct or with a lockable trojan trough to be diverted around the new platform. This will provide for any future cabling requirements for either damaged cabling or new cabling to be installed in this area.

Final details of the new cable route shall be developed at the next design stage in conjunction with the civils design team.

This option was considered the most cost effective as it removes the need for costly lift and shift cable works, in addition it provides the least impact to the operational railway by leaving operational services running whilst building the new station.

5.2.4.1.4.2 SISS (station Information and Surveillance Systems)

Based on the preferred station option, a proposed station overlay was produced detailing the proposed new station SISS assets for the new platform.

These included new Box, Dome and Fish Eye cameras assuming tilt down posts for the platform, car park and approach coverage. The CCTV FOV calculations showed that a total of 25 No IP PoE CCTV cameras would be required, based on the current station detail.

The cameras calculations were based on Network Rail Standard NR/L2/TEL/30135 Issue 4 (DRAFT) as the system is based on an IP PoE CCTV system.

Further details are to develop at the next design stage once the station model has been produced.

In addition to CCTV, the station will be provided with 2 No platform Dual sided NTI and 2 No single sided SOD. The CIS positioning was based on PRM-TSI compliance (See ***Section 2.2.3***). The developed option also calculated the proposed positions of the station speakers based on the available station detail. It was determined that the station would require a total of 12 No projection and recessed speakers for the station. Further PA design shall be undertaken at the next design stage including the production of an acoustic model to inform the PA and station civils design.

5.2.4.1.5 Bedlington Station

5.2.4.1.5.1 Operational Communications

Based on the preferred station option, the main impact to the Telecoms lineside infrastructure will be the C/1/9 S&T concrete trough route.

The preferred option is to abandon the S&T route under the proposed new Bedlington Station platform with a new S&T cable route being provided. This shall be either as a through platform multi duct or with a lockable trojan trough to be diverted around the new platform. This will provide for any future cabling requirements for either damaged cabling or new cabling to be installed in this area.

Final details of the new cable route shall be developed at the next design stage in conjunction with the civils design team.

This option was considered the most cost effective as it removes the need for costly lift and shift cable works, in addition it provides the least impact to the operational railway by leaving operational services running whilst building the new station.

However, it should be noted that due to the proposed new station footprint the following location case and cabling will be affected by the proposed works.

- 50Pr C-STUB-4232-A from Bedlington South SB to location case C-STUB-4232-A-02
- 50Pr C-STUB-4232-A location case C-STUB-4232-A-02 to Location case C-STUB-4232-A-01.
- Location case C-STUB-4232-A-02.

It is proposed that this location case shall be replaced with a Tyrone T197 Telecoms cabinet and the renewal of the 50Pr copper cabling. Further details are to be developed at the next design stage once a telecoms copper cable correlation exercise has been undertaken.

5.2.4.1.5.2 SISS (station Information and Surveillance Systems)

Based on the preferred station option, a proposed station overlay was produced detailing the proposed new station SISS assets for the new platform.

These included new Box, Dome and Fish Eye cameras assuming tilt down posts for the platform, car park and approach coverage. The CCTV FOV calculations showed that a total of 14 No IP PoE CCTV cameras would be required, based on the current station detail.

The cameras calculations were based on Network Rail Standard NR/L2/TEL/30135 Issue 4 (DRAFT) as the system is based on an IP PoE CCTV system.

Further details are to develop at the next design stage once the station model has been produced.

In addition to CCTV, the station will be provided with 2 No platform Dual sided NTI and 2 No single sided SOD. The CIS positioning was based on PRM-TSI compliance (See ***Section 2.2.3***)***.*** The developed option also calculated the proposed positions of the station speakers based on the current station detail. It was determined that the station would require a total of 12 No projection and recessed speakers for the station. Further PA design shall be undertaken at the next design stage including the production of an acoustic model to inform the PA and station civils design.

5.2.4.1.6 Ashington Station

5.2.4.1.6.1 Operational Communications

Based on the preferred station option, the main impact to the Telecoms lineside infrastructure will be the C/1/9 S&T concrete trough route.

The preferred option is to abandon the S&T route under the proposed new Ashington Station platform with a new S&T cable route being provided. This shall be either as a through platform multi duct or with a lockable trojan trough to be diverted around the new platform. This will provide for any future cabling requirements for either damaged cabling or new cabling to be installed in this area.

Final details of the new cable route shall be developed at the next design stage in conjunction with the civils design team.

This option was considered the most cost effective as it removes the need for costly lift and shift cable works, in addition it provides the least impact to the operational railway by leaving operational services running whilst building the new station.

5.2.4.1.6.2 SISS (station Information and Surveillance Systems)

Based on the preferred station option, a proposed station overlay was produced detailing the proposed new station SISS assets for the new platform.

These included new Box, Dome and Fish Eye cameras assuming tilt down posts for the platform, car park and approach coverage. The CCTV FOV calculations showed that a total of 19 No IP PoE CCTV cameras would be required, based on the station detail available.

The cameras calculations were based on Network Rail Standard NR/L2/TEL/30135 Issue 4 (DRAFT) as the system is based on an IP PoE CCTV system.

Further details are to develop at the next design stage once the station model has been produced.

In addition to CCTV, the station will be provided with 1 No platform Dual sided NTI and 1 No single sided SOD. The CIS positioning was based on PRM-TSI compliance (See ***Section 2.2.3***)***.*** The developed option also calculated the proposed positions of the station speakers based on the available station detail. It was determined that the station would require a total of 6 No projection and recessed speakers for the station. Further PA design shall be undertaken at the next design stage including the production of an acoustic model to inform the PA and station civils design.

5.2.4.2 Signal Boxes

5.2.4.2.1 Newsham Signal Box

Based on the signalling scheme plan 1774-DG-001 it has been determined that the existing STS Concept 32 concentrator will not be able to accommodate the proposed new signalling arrangement. Due to this a new 32-line Hawk concentrator will be required at Newsham Signal Box (SB). The concentrator will require 6 No Central Battery Cards and 1 No AUTO Card for Box to Box (B2B) communications.

The STS Concept 32 is to be recovered from site and offer to Network Rail as strategic spares. A full migration strategy is to be developed at the next design stage. The STS Public Emergency Telephone System (PETS) cards currently supporting Holywell AOCL, Seghill North AHB, Hartley AHB and Bebside AHB will not require Kestrel Emergency Telephone System (KETS 2) replacements. This is due to the crossings being converted to MCB-OD crossings and will only require a Central Battery (CB) circuit for the Level Crossing Users (LCU) phone.

In addition, cabling alterations will be required as per ***section 5.2.4.1.3*** Newsham Station.

There are no other alterations needed as part of these works.

5.2.4.2.2 Bedlington South

Currently Bedlington South Signal Box does not have a concentrator, the Signalman communicates to other Signal Boxes using desk mounted handsets. In addition, the only signal post telephone to connect to Bedlington South is BS16/18. NS16/18 connects to a wall mounted Titan Magneto Phone.

Based on the signalling scheme plan 1774-DG-001 it has been determined that a new 16 Line Hawk Concentrator with 2 No Central Battery Cards and 1 No AUTO for B2B communications will be required, a new voice recorder will not be needed as the current Signal Box does have a Nice Vision 3 voice recorder in the frame room for recording phone conversations.

In addition, cabling alterations will be required as per ***section 5.2.4.1.5*** Bedlington Station.

There are no other alterations needed as part of these works.

5.2.4.2.3 Marcheys House

Based on the signalling scheme plan 1774-DG-001 it has been determined that 1 No Central Battery card will be required to accommodate the new signal telephones on the existing 16-line Hawk Concentrator. In addition, the existing KETS2 card and monitor shall be recovered as Green Lane AHB is to be converted to an MCB-OD with only a single CB LCU Phone circuit required.

There are no other alterations needed as part of these works.

5.2.4.2.4 North Seaton

North Seaton is currently a Gate Box (GB) supporting North Seaton MCB crossing. The GB has a single phone back to Marcheys House Signal Box. The gate box is to be converted into a signal box for the scheme based on the signalling scheme plan 1774-DG-001. The new Signal Box will require a 16-line Hawk Concentrator with 2 No Central Battery Cards and 1 No AUTO card for B2B communications.

As the gate box currently does not have a voice recorder a new Nice Vision 3 voice recorder with appropriate licenses will need to be free issued by Network Rail to the scheme.

A new GSM-R Dicora terminal will also be required for train to box communications.

Finally, it is proposed that the existing 10 pair copper cable C-LINK-BEDA-B from location BED_ASH008 to North Seaton gate Box be upgraded to a 50 pair 0.9mm copper cable to accommodate the proposed lineside signal changes.

5.2.4.3 Level Crossings

5.2.4.3.1 Holywell ABCL

Holywell Automatic Barrier Crossing Locally monitored is to be replaced with an MCB-OD level crossing. Due to this alteration the Whiteley 2 Remote unit and battery backup along with the 3 no Yellow Gai-Tronics Titan PETS Push to Talk Phones will be replaced with a single central battery LCU phone and central battery circuit to be presented on Newsham SB HMI.

No other alterations are proposed at Holywell crossing with the Telecoms copper terminations remaining in situ and pairs re-allocated for circuit alterations as necessary.

5.2.4.3.2 Holywell ACC UWC

Holywell Accommodation Crossing or User worked Crossing (ACC UWC) contains now operational telecommunications phone instruments with no planned alterations for Telecoms.

5.2.4.3.3 Seghill AHB

Seghill Automatic Half Barrier (AHB) Level Crossing is to be replaced with an MCB-OD level crossing. Due to this alteration the Whiteley 2 Remote unit and battery backup along with the 3 no Yellow Gai-Tronics Titan PETS Push to Talk Phones will be replaced with a single central battery LCU phone and central battery circuit to be presented on Newsham SB HMI.

No other alterations are proposed at Seghill crossing with the Telecoms copper terminations remaining in situ and pairs re-allocated for circuit alterations as necessary.

5.2.4.3.4 Mare’s Close UWC

Mare’s Close User Work Crossing has no planned Telecoms alterations as part of the project.

5.2.4.3.5 Hartley AHB

Hartley Automatic Half Barrier (AHB) Level Crossing is to be replaced with an MCB-OD level crossing. Due to this alteration the Whiteley 2 Remote unit and battery backup along with the 3 no Yellow Gai-Tronics Titan PETS Push to Talk Phones will be replaced with a single central battery LCU phone and central battery circuit to be presented on Newsham SB HMI.

No other alterations are proposed at Hartley crossing with the Telecoms copper terminations remaining in situ and pairs re-allocated for circuit alterations as necessary.

5.2.4.3.6 Red House UWC

Red House is a User Work Crossing (UWC) and is planned to be closed by the project. The 2 No CB Titan Telephones and 2 pair cabling shall be recovered as part of the crossing closure.

5.2.4.3.7 Lysdon UWC

Lysdon UWC has no planned Telecoms alterations as part of the project.

5.2.4.3.8 Newsham Crossing

Newham Level Crossing is a manually controlled crossing and has no planned Telecoms alterations as part of the project.

5.2.4.3.9 Plessey Road CCTV

Plessey Road is a Closed-Circuit Television crossing and is controlled by the Newsham Signal Box is to remain a CCTV crossing and has no planned Telecoms alterations as part of the project.

5.2.4.3.10 Chase Meadows UWC

Chase Meadows UWC has no planned Telecoms alterations as part of the project.

5.2.4.3.11 Bebside AHB

Bebside Automatic Half Barrier (AHB) Level Crossing is to be replaced with an MCB-OD level crossing. Due to this alteration the Whiteley 2 Remote unit and battery backup along with the 3 no Yellow Gai-Tronics Titan PETS Push to Talk Phones will be replaced with a single central battery LCU phone and central battery circuit to be presented on Newsham SB HMI.

No other alterations are proposed at Bebside crossing with the Telecoms copper terminations remaining in situ and pairs re-allocated for circuit alterations as necessary

5.2.4.3.12 Bedlington South Crossing

Bedlington South Level Crossing has no planned Telecoms alterations as part of the project.

5.2.4.3.13 Bomarsund UWC

Bomarsund UWC has no planned Telecoms alterations as part of the project.

5.2.4.3.14 Marcheys House

Marcheys House Level Crossing is a manually controlled crossing has no planned Telecoms alterations as part of the project.

5.2.4.3.15 North Seaton

North Seaton Level Crossing is a manually controlled no planned Telecoms alterations as part of the project.

5.2.4.3.16 Green Lane

Green Lane Automatic Half Barrier (AHB) Level Crossing is to be replaced with an MCB-OD level crossing. Due to this alteration the Whiteley 2 Remote unit and battery backup along with the 3 no Yellow Gai-Tronics Titan PETS Push to Talk Phones will be replaced with a single central battery LCU phone and central battery circuit to be presented on Newsham SB HMI.

No other alterations are proposed at Green Lane crossing with the Telecoms copper terminations remaining in situ and pairs re-allocated for circuit alterations as necessary.

5.2.4.3.17 Hirst Lane

Hirst Lane Gate Crossing has no planned Telecoms alterations as part of the project.

5.2.4.4 FTN

5.2.4.4.1 Shiremoor FTN Access Node (4230)

Shiremoor FTN Access Node (4230) will not be impacted by the proposed project and will not require any alteration or uplift.

5.2.4.4.2 Newsham Junction FTN Access Node (4231)

Newsham FTN Access Node (4231) will not be impacted by the proposed project and will not require any alteration or uplift.

5.2.4.4.3 Ashington LC FTN Access Node (4233)

Ashington FTN Access Node (4233) will not be impacted by the proposed project and will not require any alteration or uplift.

5.2.4.4.4 Lineside Alterations

In addition to the alterations mentioned above, a number of new Signal Post Telephones are required for the scheme based on the signalling scheme plan 1774-DG-001.

See drawings 60601435-ACM-XX-ZZ-DRG-ETL-000001 - 60601435-ACM-XX-ZZ-DRG-ETL-000016 in ***Appendix H*** for details on the Telecoms SLDs.

5.2.4.4.5 General Considerations

During option development it was not possible to complete a full assessment to the Telecoms infrastructure of the proposed signalling and track changes.

A signalling location area plan (LAP) had not been received from Network Rail as part of the OBC. Due to this it was not known how many or which signalling location cases are to be recovered as part of the signalling changes – This element of the design will be done during the next stage.

It should also be noted that a Telecoms migration / delivery and test strategy will need to be produced as part of the outline design. This shall be undertaken in discussion with other disciplines to determine the migration / enabling stages for the telecoms infrastructure. This will allow the track and signalling alterations to be undertaken in line with the project programme. As it may be cost effective to undertake telecoms enabling works at an earlier or accelerated stage to facilitate the signalling and track alterations.

Finally, during the OBC it was not possible to determine the required telecoms bearer infrastructure needed for signalling as the signalling design is not yet detailed enough to prescribe this. It has been assumed that new Aggregation Services Router (ASR)920 cisco routers will be required at each new crossing to support the new signalling interlocking. Currently there is no FTNx connections / access routers along the Northumberland Line, with the nearest Q Node located at Tyneside IECC (TYNQ). Early discussion with signalling and the FTNx design team within Network Rail will be required at the next design stage, along with early Circuit Allocation Sheets (CAS) submission on Network Rail Design Tool (NRDT). This will allow the FTNx Network Requirement Specification (NRS) and Scheme Outline Design (SOD) to be completed by the specialist design team within Network Rail at Paddington. This design should assume all stages of the project are to be completed and financed as this cannot be done piecemeal and must be completed entirely.

5.2.5 Electrical & Power Engineering

5.2.5.1 Existing Benton PSP

The existing Signalling Power Supply is a 650V IT supply derived from Benton PSP. This provides 650V power to the existing signalling equipment up to Seghill level crossing and is labelled as Blyth & Tyne feeder. Further north, up to Seghill level crossing, all the signalling equipment is supplied at 230V via dedicated local DNO's.

As the existing line is being converted from freight only to mixed freight and passenger use, it is proposed to supply all the signalling equipment along the route via 650V in order to provide a more reliable and robust power supply.

This will be achieved by extending the existing 650V Blyth & Tyne feeder from Benton PSP up to Hartley LC and renewing the existing 650V feeder to class II in line with NR guidelines outlined in Network Rail standard NR/L2/SIGELP/27410 'Specification for Class II Based Signalling Power Distribution Systems'.

However, it should be noted that Benton PSP and any associated equipment shall be retained as existing. For the rest of the route, a new PSP is proposed, which shall be installed at either Bebside or Bedlington North, with Bedlington North being the preferred option due to there being no land purchases required. The new PSP shall include a fixed generator and Uninterruptable Power Supply. The PSP will require a new DNO supply to provide power to the Signalling Power Distribution system.

5.2.5.2 Proposed Signalling Power Modifications

Owing to the length of the route between Benton and Ashington, it is envisaged that a new PSP shall be required, which shall be installed at Bebside or Bedlington North with Bedlington North being the preferred option due to there being no land purchases required. The new PSP shall include a fixed generator and UPS. The PSP will require a new DNO supply to provide power supply to the Signalling Power Distribution system.

During discussions with the Network Rail Route Asset Manager, the project has been advised that any new Bebside or Bedlington PSP provided is to be a brick building as opposed to a containerised unit. The justification for this is the life expectancy of the brick building is greater than that of a metallic containerised unit thus introducing an overall whole life cost saving to the rail network, although at increased capital cost investment to this project.

The Network Rail Asset Manager has also intimated that two new ASP's, at Hartley Level Crossing and Ashington for manual reconfiguration. This will be in line with the existing signalling power configuration along the main route and also provide a backup in mitigation of potential cable theft issues.

5.2.6 Access Points

A high-level assessment of potential access points to provide suitable access for the ongoing maintenance of the Northumberland Line has been undertaken by AECOM. However, a robust review of the requirement would require a level of input and interaction with the maintainer at the next stage of the project, which to date has not been available.

Based on the current signalling scheme plan (see ***Appendix B***), proposed track layouts, and given the high number of existing level crossings, existing authorised access points and a wide railway corridor from the removal of extensive historical track layout, it is considered that most of the proposed signalling and track assets can be suitably accessed with a minimal amount of civils works. Where new access points and earthworks are considered required is listed below:

New Access Points

- 1No. new access steps* on the up line / low mileage side of UB 36 to access signal N108R

- 1No. new access steps* on the down line / low mileage side of UB 36 to access signal N111R
- 1No. new access steps* on the up line / low mileage side of UB 42 to access signal N120
- 1No. new access steps* on the up line / high mileage side of UB 42 to access signal N122
- 1No. new access steps* on the down line / low mileage side of UB 42 to access signal N119

* All new access points are subject to either wayleave agreements or land acquisitions with existing land owners where the access is proposed at a location where the railway boundary is not directly adjacent to a public right of way. Reference should be made to the Land & Consent Strategy.

The project Engineering Layouts in ***Appendix N*** show indicative walking routes to new assets from the nearest existing or newly created access point.

Possible Earthworks for selected new signals (also see drawing in ***Appendix K***)

- 140m of Cutting widening** (on down line side of the Harley Curve) to access signal N107R from Earsdon LC
- 750m of Embankment widening** (on up line side of the Newsham track doubling) to access both signals N120 & N122 in both directions from UB 42 (new access points required, see above).
- 130m of Embankment widening** (on up line side of the existing double track) to access signal N126R from Chase Meadows LC***.

** Any proposed earthworks required to accommodate access to signalling infrastructure (including the signal installation itself) could be subject to alternative forms of cess widening (i.e. earthworks retention) which is to be developed at later design stages.

*** Where an existing level crossing that is subject to closure (see ***section 5.2.2***) is proposed as an access point, the route to the former level crossing / access point is to be maintained with a new access gate.

5.2.7 Ancillary Civils

As a consequence of the proposed track and signalling improvements it has been assumed that typical concrete signal bases for the new signal assets and location cases with suitable hardstanding and handrailing would be required. As with the access strategy above, a high-level assessment has been undertaken to assess if there are any constraints due to available cess widths and earthworks from this assumption to be taken forward to the next design stage. Whilst further development will be required at the next design stage with possible alternative forms of asset foundations or forms of retention, no additional earthworks would be required to that already proposed as part of the access strategy. In terms of quantifying the number of Location Cases it has been done on a ratio basis of 1.2 cases per signal. A full location plan will be developed at the next stage of design.

5.2.8 Structures

There is a total of thirty-nine structures located along the propose route. This is broken down into nine underbridge structures, thirteen overbridge structures, fifteen culverts and two footbridge structures. A desktop study was undertaken of recent examination and assessment reports provided by Network Rail to identify which structures may require strengthening, repair or modification works as a result of the route upgrading. This was validated with non-intrusive site visits which were conducted between June 2019 and August 2019, refer to ***Section 16.8. Table 12*** provides a summary of all structures along the route and highlights where works are required resulting from the preferred solution.

Engineers Line Reference	Railway Structure Identification Number	Mileage	Project Chainage	Structure Type	Project Requirements
BNE	28	0m 0484yds	711m	Culvert	N/A

Engineers Line Reference	Railway Structure Identification Number	Mileage	Project Chainage	Structure Type	Project Requirements
BNE	28A	0m 1042yds	960m	Overbridge	N/A
BNE	29	1m 0201yds	1830m	Overbridge	N/A
BNE	30	1m 1298yds	2809	Overbridge	N/A
BNE	31A	1m 1602yds	3067	Overbridge	N/A
BNE	31B	2m 396yds	3393	Overbridge	N/A
BNE	31C	2m 448yds	3513	Overbridge	Parapet Modifications – Northumberland Park Station Access
BNE	33	2m 0748yds	3711	Overbridge	N/A
EJM	33A	7m 0198yds	4395	Overbridge	N/A
EJM	34	7m 0616yds	4700	Culvert	N/A
EJM	35	7m 0698yds	4730	Underbridge	Deck Strengthening
EJM	36	8m 0770yds	6420	Underbridge	Deck Extension – Part of Seaton Loop
EJM	36A	8m 1541yds	7163	Culvert	N/A
EJM	37	9m 0660yds	7954	Underbridge	N/A
EJM	38A	9m 0792yds	8084	Culvert	N/A
EJM	38	9m 0836yds	8101	Culvert	N/A
EJM	39	10m 0022yds	8951	Overbridge	N/A
EJM	39A	10m 0022yds	8951	Overbridge	N/A
EJM	40	11m 0572yds	11102	Culvert	N/A
EJM	41	11m 1210yds	11694	Culvert	N/A
EJM	42	11m 1540yds	11973	Underbridge	Parapet Strengthening – Newsham Double Track Extension
EJM	43	11m 1562yds	11994	Culvert	N/A
EJM	44	12m 0286yds	12429	Culvert	N/A
EJM	44B	12m 1298yds	13357	Culvert	N/A
EJM	45A	13m 0800yds	14514	Culvert	N/A
EJM	45B	14m 0276yds	15391	Culvert	N/A
EJM	46A	14m 0616yds	15985	Underbridge	N/A
EJM	47	15m 0506yds	17327	Viaduct	Assessment Required
BWC	1	0m 0616yds	18935	Overbridge	N/A

Engineers Line Reference	Railway Structure Identification Number	Mileage	Project Chainage	Structure Type	Project Requirements
BWC	1A	0m 0836yds	19138	Underbridge	N/A
BWC	2	0m 1188yds	19450	Underbridge	Monitoring Required
BWC	2A	0m 1408yds	19660	Culvert	N/A
BWC	2AB	0m 1602yds	19837	Culvert	Monitoring Required
BWC	2B	0m 1672yds	19901	Culvert	N/A
BWC	3	1m 1276yds	21004	Viaduct	Assessment Required
BWC	4	2m 0220yds	21722	Footbridge	N/A
BWC	4A	3m 0021yds	22399	Footbridge	N/A
BWC	5	3m 0022yds	22399	Overbridge	N/A
BWC	5A	3m 0220yds	23412	Overbridge	N/A

Table 12 – Northumberland Line Structures List

5.2.8.1 Significant Structures

5.2.8.1.1 Underbridge EJM/35

Underbridge EJM/35 is a single skew span structure located at 7 miles 0698 yards on the EJM line. The structure comprises two forms of construction and carries the single tracked bi-directional EJM line over a public footpath. The eastern side supporting the track is comprised of longitudinal riveted plate girders and a steel deck plate whilst the west side comprises a single span masonry arch. The west side of the structure is redundant and due to be removed in Network Rail's Control Period 6.

The last full assessment of the metallic deck was undertaken in 2003. This concluded the overall capacity of the structure to have a Route Availability (RA) number of RA4 at 30mph, limited by rivet shear, and RA7 at 30mph limited by web shear. A verification exercise which refined some of the original assessment assumptions was undertaken in 2007 which increased the capacity to RA9 at 30mph for web shear and RA12 at 30mph for rivet shear.

As part of the route upgrade it is proposed to increase the line speed for freight to 40 mph and 65 mph for passenger trains at this location. There are no proposals to alter the existing track alignment and no aspirations of double tracking. The impact of the line speed increase on the Route Availability number for the structure has been reviewed as discussed in ***Section 4.6.4.1***. This has concluded that the structure is at the limit of its safe traffic load capacity for freight, see ***Section 13.4.5.1***. As no maintenance has been carried out to the paint system of the structure since its last assessment, further corrosion and section loss will have occurred to critical elements. It is therefore likely; following a revised assessment of the structure, strengthening works will be required to achieve the aspirational line speeds.

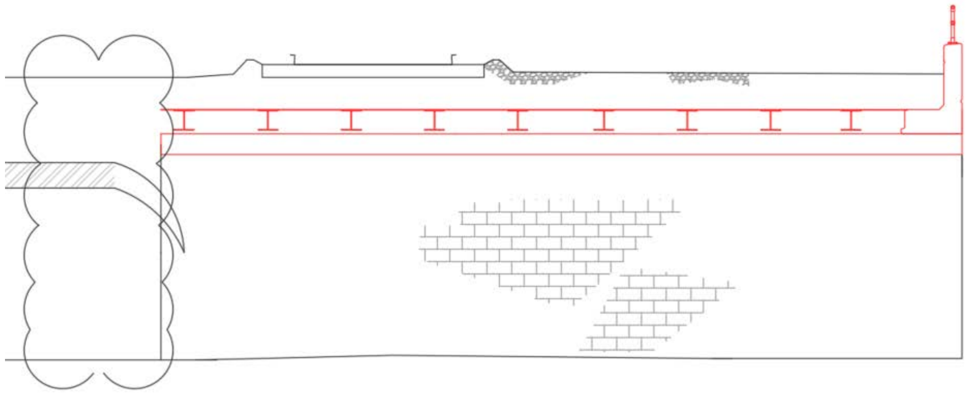


Figure 36 – EJM/35 Elevation of Preferred Solution

On the basis that following a revised assessment to be carried out at later design stages, the aspirational speeds cannot be achieved, a number of options were considered for capacity enhancement and are discussed in ***section 13.4.5.1.*** The preferred solution is to replace the existing superstructure with a new steel deck comprising longitudinal beams supporting a steel deck plate. The new beams will be selected to match the depth of the existing sections with enhanced section properties. A concrete edge beam and integral parapet will provide ballast retention to the structure. The solution does not require alterations to the redundant masonry arch structure and avoids design clashes with Network Rails planned works.

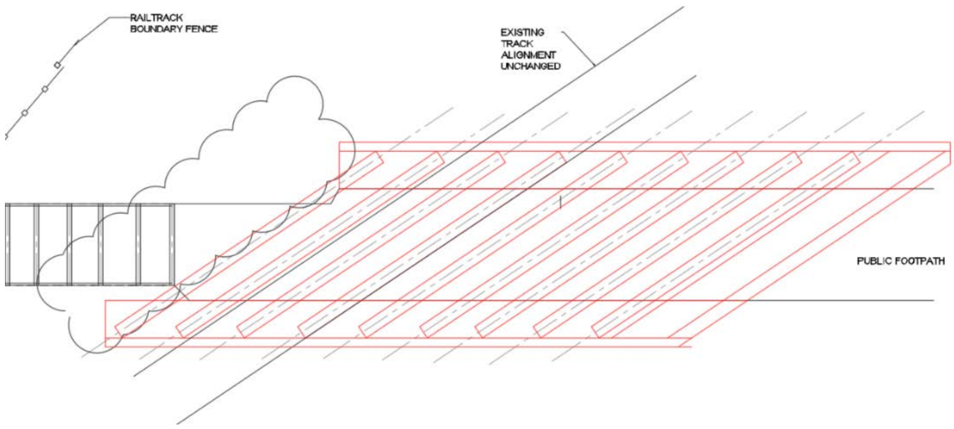


Figure 37 - Proposed plan of structure

5.2.8.1.2 Underbridge EJM/36

Underbridge EJM/36 is a single skewed span structure located at 8 miles 0770 yards on the EJM line between Newcastle and Ashington. The structure, which comprises two forms of construction, carries the single bi-directional line over a public footpath. The eastern side which supports the current single line ballasted track is a concrete filler beam deck and the western side is a metallic deck. The metallic deck has significant corrosion throughout and is due to be demolished as part of Network Rail's Control Period 6. Refer to ***Section 16.8.1.2***.

This structure is located on the proposed Seaton loop. Due to the location of telecommunications mast on the UP line side, it is proposed that the existing line is slued closer to the east parapet and the new track added to the west over the redundant deck. The impact of the track changes on the Route Availability number for the concrete deck has been reviewed as discussed in ***Section 4.6.4.1***. This has concluded that the structure has enough capacity for the proposed track changes; however, to accommodate the additional track the existing concrete deck requires widening. A number of options were considered which are detailed in ***Section 13.4.5.1.2***

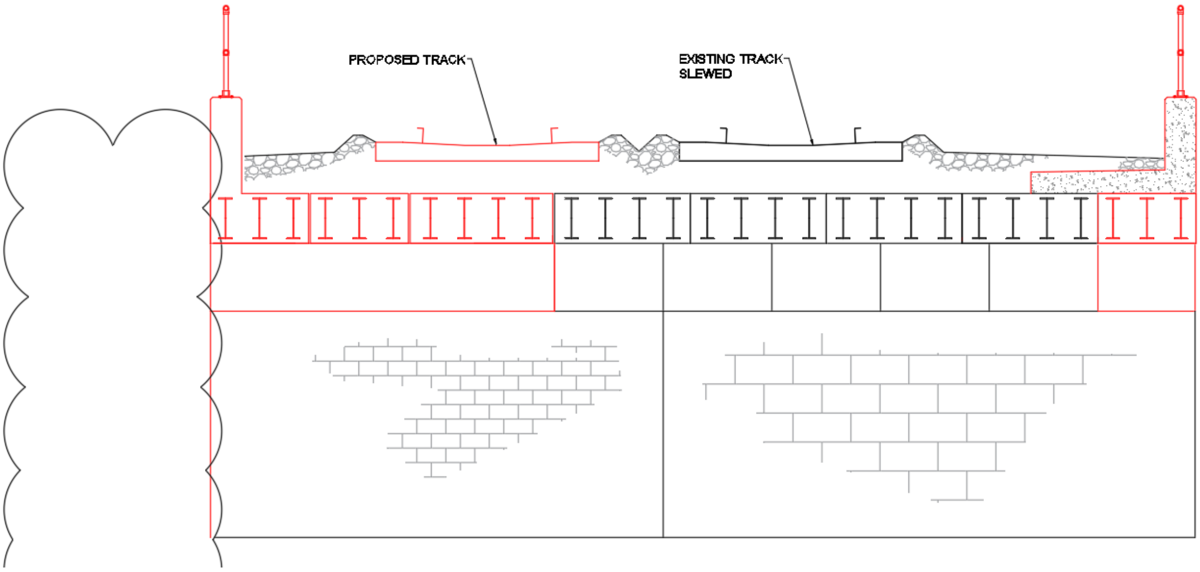


Figure 38 - EJM/36 Option 1

This preferred option proposes installation of new concrete filler beam deck members to support the additional track. This will comprise two internal beams at the interface with the existing deck and one edge beam with integral parapet. On the east side of the structure it is proposed to remove the existing edge beam and install a new edge beam and parapet capable of providing derailment containment over the structure. The existing abutments of the redundant deck will be retained and built up with new precast concrete cill beams to support the deck extension. A geotechnical investigation will need to be carried out to ensure the existing abutments are adequate for supporting the new deck or determining any necessary strengthening required.

5.2.8.1.3 Underbridge EJM/42

Underbridge EJM/42 located at 11 miles 1540 yards on the EJM line is a single spanning masonry arch which carries the single ballasted track over a field to field access. It is located just south of Newsham within the proposed double track extension section of the line. The last detailed examination completed in November 2015 concluded the arch to be in fair condition. An initial assessment of available information indicates the arch to be capable of supporting the proposed route upgrade, see ***Section 13.4.5.1***. The parapets however, are in poorer condition with fractures, spalling and displacement visible.

The combined sluing and double tracking over the structure to accommodate the proposed route upgrade will generate greater lateral forces on the already distressed elements, therefore strengthening works will be required. A series of solutions have been considered for the proposed strengthening works and are detailed in ***Section 13.4.5.1***.

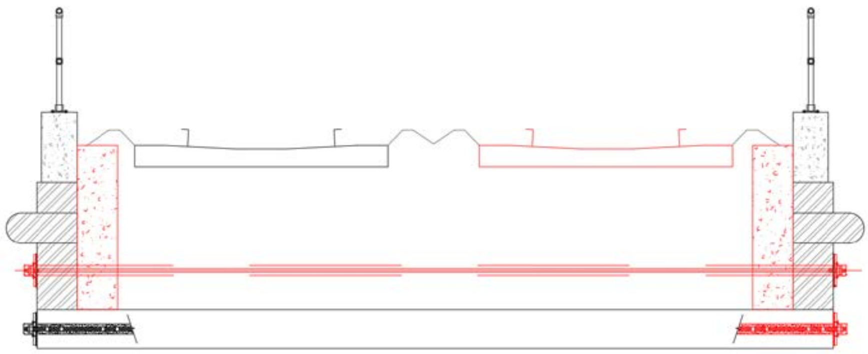


Figure 39 - EJM/42 Option 1

The preferred solution involves retention of the existing parapets through strengthening works. This involves excavating adjacent to the existing parapets and forming a reinforced concrete backing. Increased lateral surcharge pressures will be resisted by new horizontal tie bars which connect the Up and Down Line parapets.

Lateral displacement is also evident in the spandrel walls with tie bars and pattress plate arrangements on the west elevation stitching the voussoir stones to the arch barrel, see ***Section 16.8.1.3***. This appears to have been installed as a secondary measure to individual stone stitching, indicating the initial remedial measure may not have been adequate. New tie bar pattress plate arrangement are therefore proposed on the east elevation to mitigate against separation of the voussoir stones from the arch barrel.

It is also recommended that cracks behind the spandrel wall and in the arch barrel are monitored under live load to determine if movement is occurring. Historic separation of the voussoir stones from the arch barrel may be due to differential deflection under loading as a train passes over. If the cracks are observed to be moving under live loading, then the existing remedial measures may not be addressing the true problem and the cracks will progressively worsen. Further assessment and mitigation measures may then be required.

5.2.8.1.4 Bedlington Viaduct (EJM/47)

Bedlington Viaduct (EJM/47), located at 15 miles 0506 yards on the EJM line carries the twin ballasted track on ten spans over parkland, a public road and the River Blyth. Each deck comprises four steel rail girders and deck plate simply supported between steel trestle piers with end spans supported on one side by mass concrete abutments. The spans are square and vary in length over the structure. The overall length of the structure is approximately 239 metres. Reference can be made to ***Section 16.8.1.6*** for further structure details.

Strengthening works were undertaken on this structure in 2011. This was primarily to the piers which had areas of significant corrosion and some overstressed members, identified in the 2007 assessment. The information provided by Network Rail to date does not include the strengthening works details; therefore, assessing the impact of the proposed route upgrade on this structure has been based on the preceding assessment, refer to ***Section 13.4.5.1.4***

Whilst the passenger trains could theoretically be assumed to be able to be carried at higher speeds while still impacting the bridge less than the much heavier freight trains, confirmation through further inspection and analysis is required.

The preferred solution assumes that following confirmation through assessment, no works will be required to achieve the desired line speed increases. If it is identified that the piers are not capable of supporting the proposed line speeds for both freight and passenger trains, speeds across the structure will be curtailed to work within the capability of the viaduct, rather than embark on a major structural improvement regime that could potentially cost several million pounds.

5.2.8.1.5 North Seaton Viaduct (BWC/3)

North Seaton Viaduct (BWC/3), located at 1 mile 1276 yards on the BWC line carries the twin ballasted track on fourteen spans over parkland, a south riverbank footpath and the River Wansbeck. Each deck comprises four steel rail girders and deck plate simply supported between steel trestle piers with end spans supported on one side by ashlar stone abutments. The spans are square and vary in length over the structure. The overall length of the structure is 317.5 metres. Reference can be made to ***Section 16.8.1.9*** for further structure details.

Similar to Bedlington viaduct (EJM/47), strengthening works were carried out in 2011 which were primarily focused on pier repairs due to significant corrosion and section loss in members, identified in the 2006 assessment. The information provided by Network Rail to date does not include the strengthening works details; therefore, assessing the impact of the proposed route upgrade on this structure has been based on the preceding assessment, refer to ***Section 13.4.5.1.6***.

The results of this assessment come to the same conclusion and requirements as for Bedlington viaduct, detailed in ***Section 5.2.8.1.4***, with the preferred solution assuming no works being required to achieve the desired line speed increases.

5.2.9 Statutory Undertakers

Current utilities records were requested by the project and the plans received were added to the project engineering layout drawings in order to confirm that there were no significant utilities impacted by the station and car park options beyond those expected on a scheme of this size.

At this design stage, no additional site survey work was undertaken to prove the position or validity of the plans received. Once a preferred option is being progressed through Outline Design, a decision can be taken to validate specific utilities impacted by the chosen design.

5.2.10 Land Requirements

The land requirements for the preferred options are detailed in ***Section 7*** of this document or in further detail within the Land and Consents Strategy, which is a separate, standalone report contained within ***Appendix F.*** The purpose of the Land and Consents Strategy is to set out a detailed strategy of the land and consents processes required for the successful delivery of the project. The report will be reviewed and updated as the project progresses in line with Network Rail's Governance for Rail Investment Projects (GRIP) process or equivalent in RNEP.

5.2.11 Trackbed and Track Renewals

It is not appropriate at this stage to refer to the preferred option for any given location as this will depend on the results of the ground investigation yet to be undertaken. However, the general approach for the next stage is summarised below in ***sections 5.2.11.1 to 5.2.11.5***.

It is likely that in many areas the final decision as to the most suitable trackbed treatment will result from a process of value engineering. The cost of installation of a preferred option can be compared with the cost of additional maintenance, considering the estimated residual life of the existing trackbed.

5.2.11.1 No Track Renewal Proposed, Acceptable Track Geometry, Slue less than 200mm

Assume the existing trackbed is acceptable and propose no further works.

5.2.11.2 No Track Renewal Proposed, Acceptable Track Geometry, Slue greater than 200mm

The proposed Trackbed Investigation (TBI) & Ground investigation (GI) will determine the extent of existing trackbed and earthworks in the direction of the slue. Where both are deemed to be acceptable no treatment will be required, and no further works proposed. If existing earthworks are acceptable, but the trackbed doesn't extend far enough laterally, a new trackbed will need to be provided to match the existing (see ***section 5.2.11.4***).

5.2.11.3 No Track Renewal Proposed, Poor Track Geometry

The TAMP analysis indicates where there is historically poor track geometry. The proposed TBI includes investigation at these locations to determine the likely cause of the problem. If there is no trackbed problem identified, no treatment will be proposed. If it is confirmed that the trackbed is in very poor condition, the preferred option will be to reballast. Appropriate geosynthetic treatment(s) will be included if required to address any underlying subgrade/stiffness issues.

Where track slues > 200mm are required, see ***section 5.2.11.2***

5.2.11.4 Skim Dig Proposed

If there are no track geometry problems and the slue is less than 200mm, it is assumed that the existing trackbed is acceptable and a skim dig solution (renewing the ballast 75mm below sleeper level) will be acceptable. Otherwise, refer to ***sections 5.2.11.1 to 5.2.11.3.***

5.2.11.5 Track Renewal Proposed

The new trackbed must at least 500mm beyond the proposed sleeper end and be tied into the existing, e.g. with a geogrid placed beneath the ballast over the new trackbed, overlapping the existing by at least 500mm.

6 CONSTRUCTABILITY STRATEGY

6.1 Engagement

It was agreed early in the development process to engage with a leading UK contractor to provide deliverability assurance services (DAS) and to support scheme development.

The objective for requesting deliverability assurance at this stage of the scheme's development is twofold. Firstly, so that the project team can obtain contractor input on several project technical and construction related matters, to provide confidence that the scheme can be delivered. And secondly, to provide a greater understanding of construction timescales and budget.

The project team, with the support of the Client appointed Morgan Sindall to deliver the following scope:

- input into scheme development through attendance at workshops, discussing each site and each phase together with any constraints on deliverability
- development of an initial construction phase programme using base assumptions on access and scope and any other inputs or expected outcomes of the workshops
- collaboration with the quantity surveying team to review their project cost estimate and comment on the robustness of construction costs
- further development of an initial programme of works supported by a possession strategy and risk register
- completion of a route walk-out, including a site visit to each station location
- providing information with respect to construction compounds, specifically locations and temporary / permanent land take requirements
- consideration of the interface with the Tyne and Wear Metro at Northumberland Park and advising Nexus on option constructability without affecting Metro services

6.2 Competence

Morgan Sindall is a UK top five contractor with an annual turnover of £3.0bn. Its £150m rail business routinely delivers high-value, complex, multidisciplinary rail schemes for major rail clients like Network Rail and Transport for London. Relevant examples include the Edinburgh to Glasgow Improvement Project (EGIP) and Doncaster Chord. Early Contractor Involvement (ECI), is a regular feature of the support they offer to clients seeking robust project assurance.

The Morgan Sindall team provided expertise in track, signalling and civil engineering disciplines supported by planning, estimating, possession planning and health and safety specialists.

Recognising the significant effect that the signalling solution would have on all other aspects of the delivery methodology, programme and cost, Morgan Sindall engaged with their supply chain partner Amaro Signalling Ltd who provided specialist signalling advice, in particular around the availability and suitability of technology choices and the availability of scarce resources.

6.3 Initial findings

It was identified after participation in the first workshop that delivery methodology would be driven by signalling design choices and possession availability. These elements have been the key drivers for the ECI due to the potential consequences on delivery.

Through collaborative working between Kilborn Consulting, AECOM's signalling designer, and specialist signalling contractor Amaro, optimum technology choices were built into the preferred option. The staging programme was informed and shaped by consideration of the need to work with retained signalling equipment, the availability of scarce signalling resources and long lead times for detailed design and equipment procurement.

At SOBC stage, the working assumption was that the modifications to the railway would be delivered during Rules Of The Route (ROTR) closures and limited disruptive possessions, with the suggestion that major works in Phase 1 (notably the expected embankment strengthening) might take place within a blockade of up to 3 or 4 months, with access from the highway network to the foot of the embankments. During OBC, the reduction in anticipated embankment works reduced the potential need for both a blockade and the highway access. Through consultation, it was clear the FOCs were not supportive of a blockade of such duration and the adverse impact it would have on their activities. For these reasons Morgan Sindall proposed an access strategy that is reliant on Rules of the Route (ROR) possessions that are freely available, plus a limited number of disruptive possessions and an eight-day blockade. This model is more likely to be accepted by the FOCs.

A further implication of the reduction in embankment works and this refined access strategy was to change delivery of track works from a solution reliant on use of local highways by road haulage to one that uses rail haulage and track laying equipment travelling along the rail corridor. This has obvious benefits in terms of reducing noise and nuisance from vehicle movements to nearby communities as well as minimising the need for temporary land take for storage and to access the rail route, which is often some distance from the nearest public highway.

6.4 Signalling

The four-stage approach to signalling delivery is shown schematically below and in more detail in ***Appendix Q***. All four signalling stages would be completed in Phase 1 of the project.

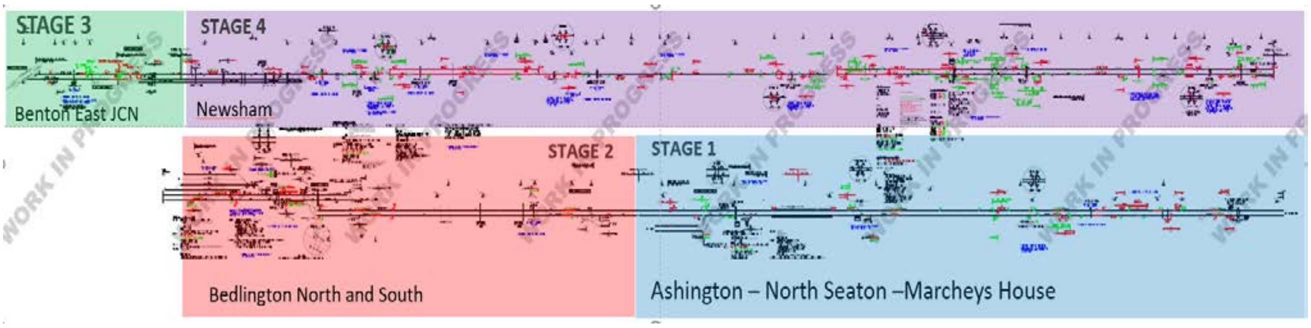


Figure 40 - Morgan Sindall Signalling Stages

The sequence and direction of travel is determined by the relative simplicity and earlier availability of equipment and design for Stage 1, the need to prioritise availability of Furnaceway Sidings to turn back freight trains and stable construction trains in Stage 2, and the relative complexity of remaining stages 3 and 4, which have longer design and procurement periods.

It would be beneficial to prioritise detailed signalling design and approval at the front end of the detailed design stage as this would allow early procurement of long lead items as enabling works; this would de-risk the construction programme.

6.5 Track

Delivery of track realignment, doubling and loops is necessarily interrelated to the staging of the new signalling scheme that controls train movement on the revised track geometry, and this is reflected in the proposed construction programme, see ***Appendix R***

The proposed strategy uses engineering trains to deliver and remove bulk materials and rail mounted plant to move and install track. Work will largely be programmed for long weekend ROR possessions, with enabling works carried out during the preceding mid-week overnight possessions.

Investigations carried out during this develop stage concluded that no significant areas of earthworks intervention were required to provide the correct embankment widths for the new track and existing track realignment. Therefore, it is not viewed as a significant risk to track delivery. Likewise cutting stability appeared satisfactory. Treating the earthworks interventions for the Newsham double tracking section as enabling works would de-risk the construction programme.

The initial track condition survey indicates that significant lengths of track might require renewing. The final amount replaced will depend on careful interpretation of the relevant Network Rail standards that will drive the need for intervention and whether sleepers and ballast can be retained or not. The proposed construction programme currently takes a conservative position, leaving potential for further value engineering in the later design stages.

Morgan Sindall has invested significant time and effort in quantifying track interventions, see ***Appendix Q***. This detailed analysis has informed the track design and provided high confidence levels to the price and programme.

It has been identified that line speed improvements should be considered as an independent work stream as part of advanced works starting during detailed design to reduce work site congestion and de-risk the construction programme.

6.6 Stations

The stations and associated car parks are of conventional design and present no unusual, innovative or risky construction challenges. For the purposes of planning and costing a traditional construction method has been assumed of brick walls on strip foundations, topped by pre-cast concrete slabs. This is because of the concerns expressed by Network Rail’s RAM about the reduced durability and increased maintenance needs of more innovative and cheaper techniques, but this can be explored further at later stages.

Northumberland Park station construction holds specific challenges that have been discussed with NEXUS because it is adjacent to their network. The proposed methodology gave the NEXUS representatives the confidence that the project had addressed their concerns and posed limited risk to their operations and revenues.

6.7 E&P and Telecommunications

The solutions articulated by the discipline design leads were standard and well understood and therefore these have not been examined in detail.

The delivery methodology and programme assume that the project will provide a new cable route the full length of the line installed in parallel with adjacent track works.

6.8 Preliminaries

The working methodology is to adopt Newsham as the best location for the project office and compound. This is because of its good location half way along the project, good road access and availability of land beyond the car park footprint. Satellite offices in the car park footprints at the other station locations will service station construction and other nearby activities. By exception, lack of space at Northumberland Park Station will require the renting of office and storage facilities nearby.

Track and signalling works will be delivered by rail plant operating in the rail corridor with no access points required beyond the Road Rail Access Points (RRAPs) and level crossings that are already available.

This approach minimises the need to negotiate and fund temporary and/or permanent land take

Work along the track will be done by rail competent staff working primarily to ROR shift patterns. Work alongside the track can largely be managed such that it is in a 'high street environment' with weekday, day time shift patterns. The level of detail in the programme and track methodology gives confidence that the estimate of preliminaries is accurate.

6.9 Programme

The construction phase programme has been developed to a high level of detail than is perhaps common at Develop stage of projects. This has been done primarily because of the need to analyse and respond to the complexity of the signalling staging and the interface this has with track works. The benefit of this level of detail is that it increases certainty of time and cost.

The programme is consistent with the master programme, is logic linked with a critical path through track work activities, uses historic production outputs to determine resource levels and durations, and contains time risk allowance and an end allowance for finishing works.

The work done to develop a construction programme illustrates the value in carrying out track realigning works in advance of the main construction activity, since they can be delivered without the need for legal powers, land purchase, or special access considerations. The advance works enable reduction in project risk, efficient delivery of materials and access for the main works and could potentially be procured separately as an advanced works package.

The signalling works are anticipated to be largely delivered in four stages in conjunction with related track works and power supply works, with the final commissioning of Stage 4 requiring an 8-day possession. Station works would generally be delivered by two teams working on two stations at the same time.

Overall the bulk of the main construction works are anticipated to take approximately 10 months adopting the strategy proposed by Morgan Sindall based on the current design.

6.10 Price

The pricing support exercise undertaken by Morgan Sindall was used to evaluate and inform the project estimator's development of the project estimate. As a bottom-up exercise based on a defined programme, methodology and design, it supports an increased level of confidence on the overall estimate and the allowances for overheads in particular.

Overall, the direct and indirect construction cost figure varied by less than 1%, see ***Appendix T.*** Although this is a very positive outcome, it should be noted that there were greater percentage variances at discipline level, but positive and negative differences largely cancelled each other out.

Areas of variance and concern that will require addressing in the following design stages are:

- **Signalling** – Morgan Sindall's combined price for signalling and level crossings at £22.873m was higher than the project team at £18.376m but lower than the budget provided by signalling specialist, Amaro, in the range of £25m to £27m. The project estimate price for the level crossing components was used because Morgan Sindall has insufficient historical data for such replacement / upgrading work. It is anticipated that the range of prices is reflective of the uncertainty inherent in the outline signalling design and differing views of the complexity of staging, testing and commissioning.
- **Telecoms** –Validation was limited to scrutiny of the project team's quantities and rates for adequacy because this discipline was not a focus for Morgan Sindall at this stage

- **Civil engineering** – Variance attributed to differing views on access points allowances not reconciled during this stage
- **Telecoms** –Validation was limited to scrutiny of the project team's quantities and rates for adequacy because this discipline was not a focus for Morgan Sindall at this stage

Morgan Sindall has set out their preliminaries calculation in detail, (see ***Appendix T)*** because this was a specific area where the project team felt they could benefit from contractor expertise.

6.11 Other ECI (DAS) activities

To ensure the option selection process, including programming and costing the delivery of the project was as robust and well informed as possible, Morgan Sindall was asked to provide the following further contributions to the project:

- Attendance at engineering meetings and workshops with project teams and stakeholders
- Complete a route walk out, including a site visit to each station location
- Contribute to the HAZID process
- Contribute to the QCRA process
- Participate in the design development of lift and steps at Northumberland Park Station including briefing Nexus and North Tyneside Council on the likely method of construction.
- Provide detailed analysis of track interventions and line speed improvements
- Advise on structural repair strategies

7 LAND & PROPERTY

Most of the construction works for the Northumberland Line project will take place within the boundary of the railway corridor. However, given the significant scale of the project, a substantial amount of land outside of the railway corridor and in third party ownership is also required to deliver the scheme.

Through the optioneering process the project has attempted to reduce the amount of privately-owned land required – providing there is a sound operational justification to do so – in order to minimise the impact of land costs on the overall capital budget.

This section will describe how land and property issues have guided the decision-making process during optioneering for the following:

- Stations
- Level Crossings
- Interventions
- Temporary Use & Access
- Permanent Access

The section will outline the options available to the project for acquiring privately owned land followed by a recommendation on how to proceed based on expert legal advice received.

7.1 Stations

Sites under consideration for the new stations are constrained by the amount of publicly owned land in those locations. By its nature a linear railway corridor is long and narrow and where, in addition to platforms, an area is required for car parking or associated infrastructure it will usually lead to additional land being required. It has therefore been necessary to consider several options that include the use of privately-owned land.

7.1.1 Northumberland Park

Several options have been considered for this location though all are located within the rail corridor and none require third party land for the platform or associated infrastructure. This station would link in with the existing Metro station and utilise the existing multi storey car park. Therefore, no further car parking is envisaged.

The preferred option (option 1B) is located on an existing rail embankment between the A186 road-over rail-bridge and Algernon Drive road-over-rail bridge, immediately adjacent to Northumberland Park Metro Station.

The option includes an access/egress beyond the western edge of the platform across third party private land owned by Northumberland Estates and to the adopted highway.

Initial discussions with the landowner have been positive though they have implied that they may pursue a consideration for any loss of development land within their site.

7.1.2 Seaton Delaval

Seaton Delaval Station is likely to see large car park demand; four options in total have been considered for the new station with the construction of car parking (and access road where relevant) for each option requiring the acquisition of third-party land.

Options 1A and 1B were both discounted for operational reasons and two options are currently being considered (at separate sites), one of which is located to the south of Station Road (A192), to the east of the railway corridor and is accessed directly adjacent to the Hastings Arms Public House (option 3). The other is located to the north of Station Road between Double Row and the railway corridor (option 2). Option 3 is the preferred option with option 2 under consideration only if land cannot be secured at the preferred site.

Option 2 would require the acquisition of land occupied by a caravan business in order to facilitate the new car park.

The landowner of option 3 has made a Strategic Housing Land Availability Assessment (SHLAA) submission for housing and has wider land ownership; consequently, the landowner may adopt a long-term view that the station could unlock wider land interests. Initial discussions with the landowner have yielded a positive response though there remains uncertainty whether the land could be secured at a sustainable price to the project.

7.1.3 Newsham Station

Two main options for providing station car parks are being taken forward at Newsham – with the preferred option to the west (option 2A) and a further option to the east (option 2B) of the railway corridor to the south of South Newsham Road at Newsham Level Crossing. The latter option will be taken forward if the project is unable to acquire the land required to deliver the preferred option.

Both options are in the Green Belt and require the acquisition of private land. Both options also require private land to be acquired at the opposite side of the railway corridor for a pedestrian access route to the adopted highway and siting of a footbridge/lift.

The landowners at either side of the railway corridor have been approached for initial discussions and whilst both are willing to dispose of their land and are keen to see the project proceed, negotiations to ascertain what they would be willing to accept for the land have yet to begin.

A further option (option 1) was considered which included the down platform being constructed north of Newsham Level Crossing though the platform would have been located wholly within the railway corridor with the car park located in roughly the same position as option 2B although this option has been discounted as the risk to passenger using the level crossing instead of a footbridge is deemed too high.

7.1.4 Blyth Bebside

Several options have been considered for the new station at Blyth Bebside, all of which require the acquisition of significant amounts of third-party land or access rights. Three options (options 1, 2 and 3) are located on land north of Front Street and have been discounted as they require the acquisition of multiple land and/or access rights to assemble the site. All three options also face significant challenges regarding access/egress to/from the local highway network.

A further option (option 4), which is located immediately to the south east of Bebside Level Crossing, required the purchase of a third party owned house and stables, that option has been discounted due to local highways related difficulties.

The location of the preferred option (option 5) is to the south of Front Street and has a frontage onto the adopted highway between Bebside Household Waste Recovery Centre and Errington Street.

The site is currently being marketed by property agents Savills on behalf of owners Harworth Estates. It is approximately 22 acres of scrub land which is used in part for grazing of horses. We understand that the site has historically been used as railway sidings and for a shallow cast mine. As a result, the site may be contaminated, and further investigations are required to determine the extent of that contamination. NCC are pursuing the early acquisition of this site.

7.1.5 Bedlington Station

Current indications are that all railway infrastructure can be accommodated within Network Rail owned land for the preferred option (option 1A). Though no privately-owned land is required, a Network Rail maintenance yard will effectively be removed in order to provide the new station car park. Network Rail may therefore request that an alternative site be made available for an equivalent facility in the immediate vicinity, though no request has yet been made.

Another option, option 1B, which incorporates a footbridge and lifts to/from opposing platforms, has been considered for this location but was discounted partially due to the requirement to purchase land from Sleekburn House Care Home and the visual impact of the footbridge on the residents of that facility.

7.1.6 Ashington

The preferred option for the station at Ashington (option 4) is located immediately to the south of Wansbeck Square roughly on the site of the former station. Current indications are that all new station infrastructure can be accommodated within the railway corridor, on the adjoining NCC public car park and the adjoining public open space to the immediate west, unless that public open space cannot be utilised due to planning policy restrictions.

The project considered the land to the immediate south, owned by Malhotra Commercial Property Limited, a privately-owned property developer, which could potentially be used to extend the existing car park; however, the initial communications with the landowner have indicated only a very high valuation on the land which would be too prohibitive to the project.

Though a commuted sum (yet to be confirmed with the Local Planning Authority) may be payable to compensate for the loss of public open space for option 4, a payment is likely to be considerably less than that requested by the owner of land to the south.

Option 4 will therefore be progressed as the preferred option for this location.

7.2 Level Crossings

There are 23 level crossings along the length of the route and the first phase of the project requires that some of those crossings are upgraded and some are permanently closed.

Where crossings are to be upgraded, works will be accommodated within the existing railway corridor and no third-party land will be required, either temporarily or permanently.

Where permanent closures of private crossings are proposed it has been advised that they are to be progressed by Network Rail rather than by this project and Network Rail will progress any negotiations for the release of private rights.

Equally Network Rail will progress Level Crossing Orders where public highway crossings are to be upgraded.

In the case of crossing closures additional private land outside of the railway corridor may be necessary if for example a footbridge is required to provide an alternative route for a public right of way over the railway. This is relevant in the case of Chase Meadow and Palmersville Dairy where if a footbridge is required, they are unlikely to be accommodated within the railway corridor and third-party land will be required, at a cost to the project.

7.3 Interventions

The project has prepared an ownership schedule of the land identified during this stage as being potentially required for physical interventions such as earthworks (see ***Appendix F*** - Land & Consents Strategy) though it has yet to be confirmed whether the plans are an accurate reflection of what might be needed. Further work is required to identify the precise extent of any third-party land required.

It is currently assumed that a passing loop will be required in the approximate location of between Northumberland Park and Seaton Delaval stations but that all development shall take place within the railway corridor and no additional land will be required.

7.4 Temporary Use & Access

The construction of the Northumberland Line will require compounds/ temporary lay-down areas for storage of equipment, site offices etc to deliver the project.

Morgan Sindall, who have been instructed as a contractor advisor for the option development stage of the project, have provided an initial view for temporary land use, which is as follows:

- land temporarily required for compounds/laydown areas around stations will be restricted to the areas required permanently for station car parks;
- a project office may be sited on land adjacent to the proposed car park at Newsham;
- where possible access for construction works will be undertaken from the railway corridor though this strategy is dependent on the availability of a blockade or long possession periods.
- strengthening works to some structures (such as Underbridges EJM/35 and EJM 42) will likely require access through private land and modest work areas adjacent to each structure

Further consideration will be given to the temporary use of land when there is further visibility of whether full or partial blockades are available, likely to be at the next stage of the project.

7.5 Permanent Access

Permanent access points are required along any typical linear rail infrastructure to provide Network Rail with the ability to inspect and maintain all aspects of the railway corridor. As with the strategy for temporary land use, the approach to permanent access requirements has yet to be defined for this project.

The Hazard Directory, as provided by Network Rail, identifies a large number of existing pedestrian and vehicular access points along the route. However, most of those access points are located at level crossings and may not be suitable for access to newly constructed infrastructure in more remote locations.

The project will look to utilise existing access routes though it is possible that wholly new access rights will be required.

Further consideration will be given to the access and maintenance strategy when there is further visibility of whether full or partial blockades are available, likely to be at the next stage of the project.

Further information on land and property issues relating to the project can be found in the Land & Consents Strategy, attached to this document in ***Appendix F***.

8 ENVIRONMENT AND CONSENTS

8.1 Introduction

The purpose of this chapter is to identify any potential environmental issues and risks associated with the preferred options and to ensure that actions are taken to manage these aspects.

8.2 Environmental Baseline Review

8.2.1 Introduction

A review of the environmental characteristics of the route corridor has been undertaken to inform the Options Selection Report (OSR), the Outline Business Case (OBC), the Pre-Application Enquiries (PreAE) and the Requests for a Screening Opinions (RfSO). Details can be found within the three latter reports, a summary of which follows below.

8.2.2 Air Quality

A desk-based appraisal has been undertaken to identify the current policies and characteristics pertaining to the land affected by the scheme. This has not included any on site surveys and has relied upon published information. Air Quality Management Areas (AQMA's) have been identified and designated by the two relevant local authority as places experiencing exceedances in one or more air pollutants as compared to national air quality standards and objectives.

AQMA's have been determined through an objective review and assessment process that involves measuring air pollution and predicting how it is likely to change in the near future. If it is likely that the objectives will not be met, then the local authority should declare an AQMA and prepare a plan to address the air pollution within that area.

The quality of air in Northumberland is generally good and there are currently no designated AQMAs in the County. However, the section of the existing rail line from Northumberland Park to Newcastle City Centre is within an existing AQMA (No. 1b designated zone).

The existence of this AQMA is a material factor in the detailed design of the scheme. Further assessments will be required together with liaison with North Tyneside Council to understand the sensitivity of the local exceedances to the proposed scheme. This liaison will identify the sensitivity to significant increases in road traffic, new sources of air pollution or changes in exposure levels /characteristics.

The proposed passenger service will not have electricity supplied by overhead line or third rail. At present it is anticipated that the power systems will be conventional diesel engines. In due course the option for hydrogen or battery power systems may be selected. The introduction of a regular passenger service will bring between 38 and 65 new trains per day (Monday to Saturday). Based on the appraisals carried out it is not expected that the introduction of the diesel trains will lead to any material reduction in local air quality within the AQMA.

Subject to the further assessments and liaison with North Tyneside Council, it is not anticipated that because of the additional trains or locally generated vehicle traffic, the local air quality will be adversely impacted.

8.2.3 Archaeology & Cultural Heritage

The scheme will largely be constructed within the railway corridor and on land immediately adjacent to the rail corridor. The desk-based assessment has confirmed that there are no Listed Buildings, Scheduled Ancient Monuments or Conservation Areas which have been designated on land which is within the scheme boundaries. There are a very limited number of Listed Buildings nearby to the scheme. There are two Conservation Areas with boundaries which are close to the boundary of the rail corridor.

There are a small number of unlisted heritage assets within the rail corridor: e.g. mileposts, old signals, signal boxes etc. These will be fully identified and referenced. As these are 'cited' in the register of heritage assets the local planning policy seeks to protect them.

The extent to which these assets have the potential to be adversely impacted by the scheme has yet to be fully assessed.

Where these resources have the potential to be affected by the planning applications, then discussions will take place with the local planning authority to agree the form nature and extent of any evaluation which may be required or be possible.

8.2.4 Contaminated Land, Geology & Soils

Most of the scheme is located on land which has been previously developed – 'brownfield'. This land has the potential to be contaminated by previous uses on the sites and land. Where planning permission will be required for the development on this land then the relevant local planning authority will require an assessment of the potential for contamination. If such contamination is identified, then the scheme will be required to remediate the contaminants to reduce the risk to the environment and human health. It is assumed that all the brownfield sites will require some degree of remediation.

The scheme extends to develop land which is agricultural use. Although agricultural land is a finite resource the land required for the car parks and access roads is very limited in its extent and the soils within the sites are grade 3, i.e. not high-quality soils.

The Preliminary Desk Based Geotechnical Assessment has confirmed that the scheme area is underlain by coal-seams which have been extensively worked. These workings include shallow mining, bell pits, underground workings, air shafts and mine entries. Northumberland has an extensive coal mining legacy for over 125 years and much of this has been recorded and is available to inform the detailed design of the scheme. The land adjacent to and forming the scheme has been affected by mining activities in the form of shallow and deep coal-seams which either dip or sub-crop below the tracks.

Extensive further desk-based assessments and intrusive site investigations will be required to characterise the Contaminated Land, Geology & Soils and to inform the detailed design.

8.2.5 Ecology

Preliminary Ecological Appraisals (PEA) have been undertaken for all the land which may be affected by the proposed scheme. Following the analysis of the PEA further assessments have been undertaken to understand the risk of the proposed scheme adversely affecting protected species and habitats of significance, including bat roosts and great crested newt territories. The PEA can be read in ***Appendix E***

The PEA's have confirmed that none of the land required for the stations or car park are formally 'designated' of local, regional or national importance. There is a site of national importance which has a boundary with the scheme. This site is known as Hartley Ponds SSSI. The Seaton Delaval station site is within the potential impact zone of the SSSI and as such the planning application will consider the need to protect the associated species and habitats. Works are proposed within the railway corridor adjacent to the SSSI. Negotiations with Natural England will ensure that working methods will be adopted which will protect the integrity of this site from any adverse impact from the scheme.

The works to construct two of the new stations and the associated car parking, together with the works to construct the car parking for one other station will take place on agricultural land. The PEA's have confirmed that this agricultural land is of negligible biodiversity value. The car park and some of the Seaton Delaval station will be constructed on a site which was a former coal pit which has now been reclaimed and is semi-naturally vegetated. The scheme can include off site habitat creation to ensure that there is no net biodiversity loss.

Some protected species including bats and great crested newts have the potential to be impacted by the scheme. However, detailed surveys have been used to inform the design so that protected species are not adversely impacted. Mitigation in the form of a sensitive Construction Environment Management Plan will ensure no adverse impact on protected species during construction. The construction programme has been designed to comply with relevant biodiversity legislation.

The removal of vegetation and trees is essential to allow the scheme to be constructed. This loss will have a short-term impact on the scale and extent of the habitats and local biodiversity resource. This is an adverse impact, notwithstanding it being only short term. Protected species can be safeguarded through translocation and mitigation. Whilst there may be a slight adverse impact, it is not anticipated there will be any significant impacts on ecological resources.

8.2.6 Energy and Greenhouse Gases

The Sustainability Appraisal for the Northumberland Plan Development Plan identifies that the councils Infrastructure Delivery Plan (IDP) includes the provision of passenger services on the Northumberland Line as a priority. In part this scheme is identified as having the potential to provide transport and mobility options which are more sustainable and with lower carbon emissions than current options.

The existing freight trains are all powered by diesel units. The passenger trains are also likely to also be powered by diesel units.

The South East of Northumberland within which the scheme is located has a series of nationally important energy related industries and companies. The industrial areas in the vicinity of the Blyth estuary area is being actively promoted to the renewable and low carbon energy, advanced manufacturing and offshore sectors. The provision of passenger services line will provide alternative and sustainable public transport options for those wishing to invest, relocate and provide employment.

Greenhouse gas emissions are assumed to be proportionate to the number of litres of fuel burnt or the number of kilowatt-hours (kWh) of electricity used, with different rates for different fuels and vehicle types. The (SOBC) appraisal for the scheme has estimated that there is likely to be a saving in emissions associated with car-km removed from the road network, via modal transfer from car to rail, and this has been estimated to have a value of between £1.75m and £2.75m (resent value over 60 year appraisal period at 2010 prices). The green-house gas benefits from modal transfer have been estimated to have a value of between £26,000 and £38,000 appraisal period at 2010 prices

8.2.7 Landscape, Townscape and Visual Impact

The areas within which the scheme is located are not designated for landscape value. The scheme is not located within land which is designated as an Area of Outstanding Natural Beauty, a National Park or an Area of High Landscape Value.

The preferred options at Bedlington, Ashington and Northumberland Park are in the centre of built up areas with several existing humanising elements in the surrounding townscape. As such, the stations would be in keeping with the landscape and would not have a negative visual impact. In fact, at Bedlington and Ashington, the proposed stations have the potential improve the appearance of existing brownfield unkempt sites.

The proposed stations at Bebside, Newsham and Seaton Delaval are on the urban fringe of existing settlements. Although there will be some extension of built development into the ‘countryside’ at each of the sites, most are adjacent to existing development.

A significant proportion of the works to implement the scheme are located within the existing railway corridor. This proportion includes; the construction works for the platforms for all the stations, some of the car parking to one of the stations (Bedlington); relaying of track; and works to and at the level crossings. As these works are within the defined railway corridor; therefore, the changes to the character of the local landscape will be very limited and localised.

The ancillary works to provide access to and from the associated car parking for four of the stations will take place outside of the railway corridor. The works will take place at the edge of existing settlements. In these locations there is a poorly defined transition between urban and rural landscape, with elements of both character areas. The landscape of these urban fringe areas will undergo some changes. However, given the interaction of rural and urban elements the mosaic of uses will not be perceived as changing to any great extent, with the overall effect on the character of the local landscape being limited and localised.

The use of land for temporary storage and construction will change the local character of the landscape for a short period but will have no lasting effects.

8.2.8 Lighting

The scheme is not located within any areas which are safeguarded for ‘dark sky’ purposes or where night-time lighting is restricted or constrained by development plan policies.

The new stations and car parks at Ashington, Bedlington and Northumberland Park are located within existing urban areas. These areas have an existing background night-time level of lighting. There will be no significant increase in the level of night-time illumination. The new stations and car parks at Newsham, Seaton Delaval and Bebside are within urban fringe locations where the background night-time illumination levels are more varied, with some localised areas with low levels of illumination.

There is the potential for the scheme to use low level lighting and luminaires which reduce upward and sideward escape of light. It is acknowledged that additional lighting will be needed for the scheme, however these measures taken together with the use of landscaping can collectively ensure that the schemes will not cause light pollution.

8.2.9 Materials and Waste

The construction of the six stations together with the works associated with upgrading the rail corridor will include engineering and construction works. Materials to be deployed for the engineering and used in the construction will be selected using rigorous sustainability criteria that include relevant 'life cycle' and other criteria. The design principles for the scheme include the reduction in the need for new materials, preventing the production of wastes and where these are produced to ensure the 'waste hierarchy' is applied. Materials excavated during the works will be assessed to identify reuse and recycling potential.

The geotechnical assessments and ground investigations will be used to inform the Materials Management Plans (MMP's) and the Construction Environment Management Plans (CEMP's) for the works and the planning applications.

8.2.10 Noise & Vibration

The entire rail line is in use by freight trains. As such the existing background noise and vibration experienced by nearby receptors includes that which is generated by the freight trains. The changes to the local noise and vibration environment because of the scheme will be assessed as part of the preparation of the applications for planning permission for the six stations. These assessments will include confirming with the local planning authorities' representative noise sensitive receptors (NSR's) which can be used to predict the potential impacts of the construction and operation of the stations.

NSR's at the locations proposed for the stations have been identified. Baseline surveys of the background /baseline noise and vibration that are experienced at the NSR's will be undertaken and used to predict if any NSR's would experience excessive noise, either during construction or operation. It is anticipated this assessment will be undertaken in accordance with the requirements of DMRB Volume 11, Section 3, Part 7. This assessment will be used to inform the CEMP and the design of the scheme.

These predictions and models will allow the scheme to be designed so that the potential for NSR's to experience excessive noise can be considered in the design of the scheme. If it is predicted that NSR's would experience excessive noise, then mitigation will be included within the scheme to reduce this level to that which is within relevant limits.

The stopping of trains at stations has the potential to introduce additional and different noise and vibration to that currently experienced from the freight trains. The scheme will carefully consider the need for mitigation for sounders, tannoys and the ways in which these can be deployed. The construction of the stations will need to take place in accordance with relevant safety and access considerations. The potential for night-time noise to cause disturbance will be carefully assessed and the potential assessment will indicate those sensitive receptors which have the potential to be affected by the construction and operation of the scheme.

8.2.11 Water Environment

A significant proportion of the works are within the existing rail corridor. Some works are on undeveloped land and on agricultural land. Most of the works associated with the scheme have the potential to adversely impact on the surface and subsurface hydrology of the local areas. The watercourses, drains, ponds and rivers which have the potential to be impacted by the scheme have been identified.

The construction of the scheme has the potential to impact on the quality and quantity of surface runoff into the local hydrological systems. It also has the potential to affect sensitive hydrological biodiversity resources; various great crested newt ponds and, in particular, the Hartley Ponds SSSI. The working methods for the implementation of the scheme will be informed by discussions with Natural England and any conditions imposed on licences for works that may be required. These will be incorporated into Construction Environment Management Plans and will ensure these hydrological biodiversity resources are safeguarded both during construction and during the operation of the scheme.

The Lead Local Flood Authority (LLFA) has indicated that the scheme will need to give preference and fully utilise SuD's with discharge following the hierarchy of preference; infiltration, watercourse, sewer. The LLFA have advised that greenfield runoff rates will need to be safeguarded for all new developments and, for the stations and car parks. The LLFA have indicated that vegetated, open SuDS features should be considered at the beginning of the design. (e.g. Swales, basins and permeable paving).

A flood risk assessment will be undertaken for the entire scheme and this will inform the drainage designs for the stations, level crossings, relaying of any ballast and works to exiting drains etc. These assessments and designs will be compliant with CIRIA SuDS manual (C753) on assessing pollution and flood risk on controlled waters, including groundwater.

It is anticipated that The SuDs 'management train' approach will allow any mitigation to be included in the detailed design so that there will be no significant impacts on the Water Environment.

8.3 Preferred Option Development at OSR

The OSR option selection process has been informed by the following;

Request for a Screening Opinion (RfSO) – sent to both local planning authorities. Both authorities opined that the environmental impacts which are predicted to occur at the stations and within the rail corridor between the stations are not predicted to cause any significant impact on environmental resources. As such both authorities opined that the scheme is not an EIA development for the purpose of the EIA regulations.

Pre-Application Enquiries (PreAE) were made to both local planning authorities to obtain guidance on the compliance of the scheme with the local development plan policies. In addition, guidance was sought on the scale, location and extent of the environmental and other surveys which would be required to accompany the planning applications. The process of engaging with the local planning authorities (pre-application enquiries) has confirmed that the preferred options for the construction of the six stations and the associated car parks have the potential to be granted planning permission with relevant conditions attached thereto. The 'Land and Consents Strategy' includes the 'Planning Risk Dashboard'. Taken together they describe the relevant policies and the measure that may be included within scheme so that the design, construction and operation are compliant with relevant development plan polices.

8.4 Preferred Option Assessment

8.4.1 Introduction

The extent to which environmental characteristics have influenced the selection of the location of the stations and car parks has been considered in the sections which follow.

8.4.2 Air Quality

Notwithstanding the existence of the Air Quality Management Areas (AQMA) in North Tyneside the local air quality has not been a material consideration in the selection of the preferred options for the stations or the car parks.

During the operation of the scheme it is anticipated that there will be changes to the frequency and characteristics of vehicular traffic in the vicinity of the stations. The scheme is expected to include adaptations to the local highway network in the vicinity of all the stations and car parks. These will be designed to ensure that congestion is minimised, and traffic is kept free flowing as possible. However, if there is congestion, then there is the potential for the local air quality to be adversely impacted.

It should be noted that the scheme has the potential to facilitate a modal shift from private car usage to rail with increased walking and cycling being undertaken by service users in preference to using the car. It is considered that this modal shift will have an overall beneficial effect on air quality.

Notwithstanding the existence of the AQMA in North Tyneside it is not anticipated that either local planning authority will require an air quality assessment to be undertaken and submitted as part of the planning applications.

The six stations and car parks are not anticipated to cause any deterioration in the local air quality, either during construction or operation.

8.4.3 Archaeology & Cultural Heritage

The construction of the scheme has the potential to impact on some locally listed features of historic and archaeological features along the rail line. The local planning authority has identified the former station building at Bedlington Station as worthy of being conserved. However, none of these features are of regional or national significance. As such they are not a constraint on the selection of the options for the stations or the locations for the associated car parks.

The scheme proposes the reuse the former station building at Bedlington as part of the proposals for the new station. Details of the way in which the station building can be reused have yet to be agreed.

Regarding the feature of local historic interest along the line and at the stations, the scheme has the potential to relocate or remove (to storage/display) some or all of these features and consideration will be given to this during the detailed design stages.

Based on the extent of the preferred options for the stations and car parks it is not anticipated that there will be any effect on the setting of these listed buildings. The closest is the Delcor Furniture Ltd Headquarters building at Double Row, Seaton Delaval. This is separated by existing industrial buildings from the rail corridor. No construction works are proposed which would affect the setting of the listed building.

It is acknowledged that there is the potential for unrecorded archaeological assets to be affected by the scheme. This is particularly with reference to the ‘green field’ land proposed to be developed for car parks at Seaton Delaval, Newsham and Bebside. An evaluation strategy will be agreed with the relevant county archaeologists for any sites with the potential to host unrecorded assets. This is a standard requirement for all development on green field sites and so this obligation has not been a material consideration in the selection of the preferred options for the stations. Complying with this obligation as part of the planning application process will ensure that the potential of the scheme to impact on all assets is fully assessed. The scheme has the potential to make available and accessible some of these assets for public appreciation and educational purposes.

Based on the appraisals and assessments so far undertaken it is not anticipated that the scheme will have any impact on archaeological or historic assets which will be significant.

8.4.4 Contaminated Land, Geology & Soils

A series of desk-based assessments have identified the characteristics of the land proposed for the stations and car parks. The associated geology and soils have also been characterised for the entire length of the scheme and for the locations for the stations.

Much of the scheme will be undertaken on ‘brownfield’ previously developed land. It will only be the car parks at Seaton Delaval and Newsham which are constructed on greenfield land. As such it will only be on these two sites where the conservation of agricultural soils will be a consideration. The presence or quality of agricultural soils has not been a material consideration in the selection of the locations for the stations. The extent and quality of the agricultural land required is not significant.

The characteristics taken together have not been material in influencing the selection of the preferred locations for the stations and the car parks. The characterisation will be used to influence the detailed design of the roads, foundations and drainage and will influence the construction specifications and details at each station and car park. These characteristics will also influence the detailed design of the works within the rail corridor between the stations.

The entire scheme has the potential to be affected by the presence of former underground coal mining. The presence of former underground mines, shafts, air shafts and capping are a material consideration for the detailed design of the scheme, however it has not been a material consideration in the selection of the location for the preferred options for the stations.

At the detailed design stage, the adoption of appropriate specifications, standards, designs and measures will allow the risks associated with contamination; subsidence; coal assets; coal mining; and the ground conditions to be mitigated. This will ensure that the construction and operational risks associated with Contaminated Land, Geology & Soils are not significant.

Further desk and site based geotechnical assessments will be conducted prior to submission of a planning application. Further liaison with relevant stakeholders and the Coal Authority will inform the detailed design. It is anticipated that scope for the further ground investigations will include gas monitoring and testing where appropriate.

Based on the assessments and appraisals so far undertaken it is not anticipated that the scheme will cause any significant impacts on soils or increase the risks associated with existing contaminated land. Contamination if identified will remediated and as such the scheme has the potential to reduce the risks associated with existing contamination.

8.4.5 Ecology

The Preliminary Ecological Appraisals (PEA) have confirmed that there are no habitats of local, regional or national significance on land which is proposed as the preferred locations for the stations or car parks. As such, ‘habitats’ have not been a constraint on the selection of the preferred locations for the stations or car parks. The PEA document can be read in ***Appendix E***

The location of Hartley Ponds SSSI has been a consideration in the design of the scheme and in particular on the location of the station at Seaton Delaval. The proximity of the SSSI (to the rail corridor) may be a constraint on the working methods that can be adopted to implement the scheme. Further discussions with Natural England will confirm these constraints.

The bat risk assessments (BRA) and surveys to identify great crested newts ‘host and breeding ponds’ and territories have identified that the construction of certain stations and car parks may require licences from Natural England to be granted.

It may be possible that some works within the rail corridor between stations may also have the potential to impact on protected species – both bats and great crested newts. Further survey work and liaison with Natural England is required to confirm whether any licences are required, and if so the extent of any roosts that will need to be relocated (bats) and trapping that may be required (Great Crested Newts).

The presence of protected species has not been a constraint on the selection of the location for the stations or car parks because working methods, pre-start surveys, Construction Environment Management Plans and seasonally programmed works will collectively allow the scheme to mitigate any adverse impact on protected species.

Where available, land of negligible biodiversity value has been selected as the location for the car parks for the stations. This has been possible at Ashington, Newsham, Bedlington and Seaton Delaval. There is a site of National biodiversity importance adjacent to the rail corridor near to Seaton Delaval (Hartley Ponds SSSI). Based on surveys so far undertaken it is anticipated that working methods can be adopted which will protect the integrity of this site from any adverse impact from the scheme.

The removal of vegetation and trees within the rail corridor is essential to allow the scheme to be constructed. This removal will have a short-term impact on the scale and extent of the habitats and local biodiversity resources. This is an adverse impact, notwithstanding the impact is anticipated to be only short term.

The scheme may be required (by the local planning authorities as part of the planning permissions) to mitigate any adverse impact on biodiversity as a consequence of the development and other works. Any such, it may be necessary to include habitat creation measures as part of the determining of applications for planning permission. Some land is available within that identified for the car parks and it is intended that this can be used if such mitigation is required. The potential need to provide land for biodiversity mitigation has influenced the proposed extent of the land required for the car parks. However, this potential requirement has not been a constraint on the selection of the location for the stations or car parks.

Protected species can be safeguarded through translocation and mitigation and it is not anticipated that there will be any adverse impact. Regarding ecological resources whilst there may be a slight short-term adverse impact, it is not anticipated there will be any significant impacts on ecological resources.

8.4.6 Energy and Greenhouse Gases

Neither the production nor the consumption of energy have been a material consideration in the selection of the preferred locations for the stations or the car parks. The need for power for the scheme has been considered and this is reflected in the inclusion and location or relevant infrastructure. Details are set out in ***section 5.2.5.***

There is the potential for an unknown number of parking spaces at the car parks to require the installation of electric charging facilities. However, the pre-application enquiries with Northumberland County council have not yet confirmed the likely numbers to which this may relate. It is assumed that power can be provided to the spaces and as such this has not been a material consideration in the selection of the location for the stations or car parks.

8.4.7 Landscape, Townscape and Visual Impact

There are no landscapes or townscapes within which the scheme is located that are designated of local, regional or national importance. As such, the local landscape and townscape character has not been a material consideration in the selection of the preferred locations for the stations or the car parks.

The vegetation along the rail corridor includes semi-mature/mature trees together with scrub vegetation. There are no trees which are protected by Tree Preservation Orders, or individual trees which are considered significant regarding their contribution to the local landscape. As such the presence of trees has not been a constraint on the selection of the preferred options for the location of the stations or the car parks.

The location of the stations and car parks has been in part dictated by the economic demand for services, the distribution of potential passengers for stations and the proximity of residential and other areas which will provide the passengers. The locations for the car parks have been in part informed by the availability of land without urban 'built development' physical constraints e.g. Ashington, Bedlington, Newsham, Seaton Delaval, Bebside.

Northumberland County Council are of the view that notwithstanding the limitations on development normally prescribed by green belt policy, 'in principle' the car park at Newsham can be granted planning permission on the basis that it is essential local transport infrastructure if it can demonstrate a requirement for a Green Belt location and preserve its openness. *(*National Planning Policy Framework *NPPF para 146)*.

There are no Conservations Areas adjacent or nearby to any of the locations of the stations. This taken together with the absence of any listed buildings (the setting of which might have been affected by the stations) means that there are no 'urban design' constraints on the appearance or location of the stations or car parks.

The proposed stations at Bebside, Newsham and Seaton Delaval are on the urban fringe of existing settlements. Although there will be some intrusion of development into the 'open countryside' the development of each of the stations and car parks can be justified in landscape, townscape and visual policy terms as extensions to the urban areas. The local planning authorities will require the planning applications for the stations to be accompanied by a Design and Access Statement. This will include details of the ways in which the stations and car parks have been designed to be in sympathy with the local landscape and townscape.

The use of land for temporary storage and construction will change the local character of the landscape for a short period but will have no lasting effects.

8.4.8 Lighting

The relevant standards for the lighting of the car parks and stations is not materially different from that required for any other form of development or infrastructure. Existing lighting and relevant lighting policies are not therefore anticipated to impose any restrictions or constraints upon the selection of the location of the station or car parks. Lighting is not a constraint upon the preferred locations for the stations as set out in this report. Where the stations are located close to residential areas then the detailed design of lighting may need to consider the potential for light pollution to affect bedrooms etc.

Further surveys for protected species, and in particular for bats, may identify the potential for the lighting of the stations and car parks to be required to be adapted to minimise any potential for adverse impact on foraging bats. These design and mitigation aspects will be the subject of negotiation with the relevant local planning authorities.

8.4.9 Materials and waste

The landscape and townscape characterisation of the land within which the scheme is located has confirmed that there are no restrictions or constraints on the selection or choice of materials to be used in the construction or operation of the scheme. There are no preferred or prescribed; external finishes, surfacing, boundary treatments which the scheme is required to employ. As such the scheme has the potential to employ construction and finishing materials which are bespoke. The planning applications will include a Design and Access Statement demonstrating how each station design is a suitable response to the character of the site and its setting. This is likely to include information on the materials to be used. The adoption of appropriate design, with attention to detail and integrated landscaping will soften and improve the visual appearance of some of the urban edges.

The scheme is being designed to ensure that it will be resilient over the lifetime of the scheme. This will include the use of materials and finishes which will be resilient to the increased risk of extreme weather events and climate change. The use of materials which could pollute groundwater will be avoided.

The production of wastes has not been a constraint on the selection of the sites or of the car parks. It is anticipated that any excavated materials or construction wastes can be recycled at local facilities. The CEMP will include a waste management plan to minimise the waste produced during the construction of the six stations.

8.4.10 Noise & Vibration

During the operation of the scheme it is anticipated that there will be changes to the noise and vibration environment in the vicinity of each of the stations. The proximity of noise sensitive receptors has not been a material consideration in the selection of the preferred options for the stations or the associated car parks.

Residential properties and other noise sensitive receptors are some distance from the stations and car parks at Seaton Delaval, Bebside, Newsham and Ashington. Residential properties and noise sensitive receptors are adjacent to the preferred locations for both Northumberland Park and Bedlington. The local planning authorities have indicated that the proximity of residential properties will need to be taken onto account in the detailed design of the scheme for these stations.

Appropriate mitigation and design measures can be taken at each station to ensure that the effects on noise sensitive receptors are mitigated.

Notwithstanding the proximity of residential properties at these two stations it is not anticipated that noise from the construction or the operation of the stations will cause any significant impacts on any noise sensitive receptors.

8.4.11 Water Environment

The local water environment presents constraints on the ways in which elements of the scheme will be constructed and the ways in which surface water is managed during the operation of the stations and car parks. The scheme will be required to comply with relevant 'Controlled Waters', and the 'Water Framework Directive'. A desk-based assessment has established that none of the proposed station sites are within published flood risk zones.

Further studies are required to inform the detailed design of the scheme with respect to the potential impact on surface water flooding, mines and groundwater. These studies will include a flood risk assessment for the entire scheme. This will be used to inform the designs for the; drainage of the scheme, the stations; level crossings; relaying of any ballast and any works within the existing rail corridor including works to existing drains etc.

Based on the preliminary appraisal of the water environment it is not anticipated that there are any constraints in principle to the stations or car parking being located as set out in this OSR. The further studies will influence the detailed design of the stations, car parks and other works to ensure the local hydrological resources are protected. The implementation of the scheme will be guided by 'Construction Environment Management Plans' (CEMP) and these will include details of any permits that may be required for discharge of water from construction operations of from the completed scheme. where these CEMP's relate to works at the stations, they will be the subject of consideration as part of the planning applications.

It is acknowledged that greenfield runoff rates will need to be safeguarded for all new developments and in particular for the stations and car parks (where the latter are on greenfield land). The SuDs 'management train' approach will allow any mitigation to be included in the detailed design so that there will be no significant impacts on the Water Environment.

8.5 Planning Context

8.5.1 Planning Policy Review

A comprehensive review has been undertaken of the planning policies and environmental constraints pertaining to the potential sites for stations and car parks for the scheme.

This baseline planning policy assessment has enabled certain potential sites for stations and or car parks to be discounted as not being capable of being granted planning permission. This review also identified sites which are the subject of planning applications which are yet to be determined or have been granted but not yet implemented.

Detailed discussions took place with Northumberland County Council to review all the potential sites for the stations and car parks and this process has culminated in the submission of a pre-application enquiry for the 5 stations in Northumberland. This pre-application enquiry requested guidance on the supporting surveys and assessments which would be required to accompany the planning applications for the stations and car parks. It also included details of the works which are proposed to be undertaken using permitted development rights. The guidance provided by Northumberland County Council has confirmed that the scheme is congruent with the local planning policies and subject to technical design considerations could be recommended for consent.

Detailed discussions took place with North Tyneside Council to review the potential sites for the station at Northumberland park and this process has culminated in the submission of a pre-application enquiry for the station. This pre-application enquiry requested guidance on the supporting surveys and assessments which would be required to accompany the planning application for the station. It also included details of the works which are proposed to be undertaken using permitted development rights. The guidance provided by North Tyneside Council has confirmed that the scheme is congruent with the local planning policies and subject to technical design considerations could be recommended for consent.

Notwithstanding the guidance from the two local planning authorities the planning policy review has identified the potential risks associated with securing the necessary planning and land related consents. These are set out in the Land and Consents Strategy (L&CS). Appended to the L&CS is a schedule of the planning policy risks ('Planning Risk Register'). The L&CS should be referred to for full details of the relevant planning polices and associated risks.

The process of selecting preferred options has involved engagement with the two relevant local planning authorities as set out above and this has informed in the preparation of this OSR. This process has been iterative and has allowed the schedule of possible options to be refined to those preferred options for the stations which are capable of being granted planning permission.

Notwithstanding the two local planning authorities supporting the scheme in their response to the pre-application enquiries, there remain a limited range of risks to the granting of the necessary consents.

Some measures have already been taken to manage these risks and further measures can be taken. These broad categories of risk are set out in the L&CS and can be summarised as follows;

a. Elements of the scheme are not in conformity with the local plan, and the local planning authority are minded to refuse such elements or applications

b. Elements of the scheme are opposed by objectors and such objections are given substantial weight as material considerations, so far as some elements of the scheme are considered not to be acceptable and would not be granted permission

c. The determination of the application is delayed

d. Applications are granted permission, but conditions are imposed which create programme delays or excessive and unfactored costs

8.5.2 Planning Consent Requirements

The scheme within North Tyneside Council includes Northumberland Park station. The associated works and is governed by the North Tyneside Local Plan 2017-2032.

The remaining five stations and majority of works are within Northumberland County Council. The Northumberland Local Plan is the subject of local plan hearing in late 2019. As such it is considered to be an 'emerging' plan which is anticipated to be adopted in March 2020. As such the polices contained therein will be given considerable weight in comparison to policies within other adopted plans.

Pre -application enquiries were submitted to NTC and NCC on the 9th August 2019. The purpose of these enquiries was to seek guidance from the local planning authorities on the extent to which the proposed development is in accordance with the relevant development plan and the material considerations which the councils would be likely to consider in the determining of any applications.

The councils in responding to the enquiries confirmed that the proposals conform with the relevant local plan policies.

8.5.2.1 Northumberland County Council (NCC)

NCC provided written pre-application advice on the 9th October 2019. They have advised that 'there is a strong case to be made that the Northumberland Line would contribute to the achievement of sustainable development. The principle of the development may vary from site to site, but a case could be made that would be likely to receive support. The proposals are considered to be in accordance with the development plan. If planning applications were submitted, it would be likely that they would be looked upon favourably',

The planning authority have advised that whilst each proposed station has site specific constraints and issues to be addressed, the principle of development is accepted. It is considered that the benefits the scheme will deliver to South East Northumberland should be able to address any harm which may be created by each application. Notwithstanding, NCC have confirmed that submission of a full planning application will need to be informed by supporting surveys to address any site constraints. This includes, but not limited to, noise surveys, land contamination reports, heritage statement, transport assessment and ecological surveys.

There is a risk where the scheme proposes a departure from the local plan. In this situation the application would be advertised as a departure.

Both options being considered at Newsham, and parts of the line at Seaton Delaval are designated as green belt within the emerging local plan.

Green belt land is subject to strict planning controls. However, the National Planning Policy Framework (NPPF) paragraph 146 defines the 'very exceptional circumstances' which can enable a departure from the local plan. 'Local Transport infrastructure' is identified as one of these exceptions. As such, within the planning application, it will need to be demonstrated that these works are required within the green belt and that it will 'preserve the openness' and 'not conflict with the purposes of including land within it'.

The pre-application enquiry response has confirmed that local transport infrastructure is not inappropriate development in the green belt, if it can demonstrate a requirement for Green Belt location. It is considered that each application will have to look carefully at the location, the constraints and, where necessary, build a case to show that any harm created is outweighed by the potential benefits.

The preferred option at Ashington proposes the loss of Protected Open Space, contrary to emerging plan policy INF5. The planning application must mitigate the risk of not being granted planning permission by promoting a sufficient justification for the loss of open space against the criteria in INF5 and NPPF paragraph 97. Further clarification has been sought to obtain a formal opinion on whether this proposal would be supported by NCC.

It is possible this may include utilising the powers in s122 of the Local Government Act 1972 which permits local authorities to 'appropriate' their own land for alternative uses. It should be noted this procedure would include a 'notice' period to allow for objections before this decision is made.

This section will be elaborated when this guidance is provided

8.5.2.2 North Tyneside Council (NTC)

NTC provided written pre-application advice on the 9th September 2019. They advised that 'Whilst the principle of the development is broadly supported, the proposal has the potential to have a significant impact on residential amenity in terms of noise, air quality due to the use of diesel trains; ecology and biodiversity due to vegetation clearance works; highway safety and congestion during construction'

The planning authority have therefore confirmed that the detailed design of the scheme together with the way in which it will be constructed and operate will need to be informed by baseline; noise surveys; air quality surveys; ecological surveys and local transport and mobility surveys.

8.6 Environment Impact Assessment (EIA)

The entire scheme is and has been required to be the subject of a 'Request for a Screening Opinion' (RfSO) under the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations').

A Request for a Screening Opinion for the entire scheme was submitted to both Northumberland County Council and North Tyneside Council as the relevant local planning authorities to opine if the scheme should be the subject of an EIA.

The Screening Reports fully described and explained both the scheme and the potential environmental and other effects. The precautionary principle was adopted in the event on uncertainty, to ensure that any opinion from NTC and NCC was robust enough to take account of future extensions to the sites and expansions of works.

Northumberland County Council opined on the 9th August 2019 that an EIA would not be required for the scheme.

North Tyneside Council opined on the 6th September 2019, that an EIA would not be required.

It must be noted, if the decision was taken to apply for a 'comprehensive' TWAO, a request for a screening opinion would need to be submitted to the Secretary of State. There is a risk that the Secretary of State may adopt a stricter approach and determine that an EIA is required for the scheme.

Notwithstanding the requirement for an EIA, the response stipulates several recommendations to reduce the potential impact of the scheme.

9 SAFETY & CDM (INCLUDING COMMON SAFETY METHOD)

9.1 Safety – Safe by Design

Safety by design compliance is being applied to this project and is part of the AECOM Safety Management Standard SMS302-1. This documents the AECOM 'safety in design' process and how it is to be used by project designers. A Safety by Design Worksheet is developed to enable the design teams to demonstrate that they have designed out hazards, or if this is not possible for recording 'residual risks' and providing information to other designers, clients, contactors or other project partners on the Northumberland Line Project.

9.2 Common Safety Method

Commission Implementing Regulation (EU) 402/2013 (the Regulation on a common safety method (CSM) for risk evaluation and assessment (or 'the CSM RA')) came into force on 30 April 2013. It is a framework that describes a common mandatory European risk management process for the rail industry and does not prescribe specific tools or techniques to be used.

Commission Regulation (EC) 352/2009, which was in force from 1 July 2010, was repealed on 21 May 2015 when Implementing Regulation (EU) 402/2013 started to apply. However, the provisions of 352/2009 will continue to apply in relation to projects which are at an advanced stage of development.

Commission Implementing Regulation (EU) 2015/1136 was adopted by the European Commission on 13 July 2015 and amends Commission Implementing Regulation (EU) 402/2013. The amendments are concerned with 'risk acceptance criteria', which are now called 'harmonised design targets'. The term 'harmonised design targets' has been introduced to distinguish the acceptance of risks associated with technical systems from the acceptance of operational risks and of the overall risk at the level of the railway system.

The CSM RA applies when any technical, operational or organisation change is being proposed to the railway system. A person making the change (known as 'the proposer') needs to firstly consider if a change has an impact on safety. If there is no impact on safety, the risk management process in the CSM RA need not be applied and the proposer must keep a record of how it arrived at its decision.

If the change has an impact on safety the proposer must decide on whether it is significant or not by using criteria in the CSM RA. If the change is significant the proposer must apply the risk management process. If the change is not significant, the proposer must keep a record of how it arrived at its decision.

A key component of the hazard identification and risk assessment process defined in the CSM Regulations is the preparation of a document described as a System Definition. The purpose of the System Definition is to complement the Hazard Record by bounding the scope of the hazard identification and risk assessment process and provide sufficient context to facilitate an assessment of the correct application of the process by an independent body (the assessment body). Clause 2.1.2 of Annex I to the CSM Regulations states:

The system definition should address at least the following issues:

- System objective (intended purpose)
- System functions and elements, where relevant (including human, technical and operational elements)
- System boundary including other interacting systems
- Physical (interacting systems) and functional (functional input and output) interfaces
- System environment (for example energy and thermal flow, shocks, vibration, electromagnetic interference, operational use)
- Existing safety measures and, after iterations, identification of the safety requirements identified by the risk assessment process;

- Assumptions that determine the limits for the risk assessment

9.3 Northumberland Project – Application of CSM

As part of the application of the above regulation for the Northumberland Line Project, a Preliminary System Definition and Significance Test were submitted to Network Rail Assurance Panel (NRAP) on 14 October 2019 for ratification of the CSM-RA Significance Test. These have been registered by NRAP as App 2019/331.

On 31 October 2019, NRAP advised that the project is likely to require authorisation under the Railways (Interoperability) Regulations and that the works are considered to be Significant under Commission Implementing Regulation (EU) 402/2013 (the Regulation on a common safety method (CSM) for risk evaluation and assessment).

Subsequent to the ratification by NRAP, it can now be confirmed that the project will be required to appoint an Assessment Body (AsBo) to independently check compliance with the CSM-RA Regulation throughout the duration of the project. It would be prudent to appoint the same Independent Body to undertake the roles of both AsBo and NoBo.

A System Definition document is currently being developed, based on the information in this Option Selection Report and the current template NR/L2/RSE/100/02/F06. The main sections of the report will be as follows:

- General Description of the System
- Purpose
- Functions and Constituent Subsystems
- Boundary and Interfaces
- Environment
- Safety Measures and Requirements
- Assumptions
- Appendix A – Railway Subsystems – structural areas & functional areas

A System Safety Plan is also currently being developed as it was identified that this had not been completed at an earlier Network Rail commissioned GRIP 2 stage of the project.

An initial HAZID workshop was undertaken on 19 September 2019, the output of which has been developed into a live Hazard Record document, which will be expanded and reviewed as part of the future development phases of the project. The current live snapshot of this record is in ***Appendix I***

10 IMPACT ON EXISTING CUSTOMERS, OPERATORS AND MAINTENANCE PRACTICE

Impacts on customers, operators and associated maintenance practices are listed in ***section 10.1 to 10.4*** below:

10.1 Customers

- New Train Service
- Potential Reduced Journey Times Compared to Alternative Modes of Transport
- New Station Locations

10.2 Operators

- Increased Patronage
- Additional Rolling Stock Requirements

- Potential Impact on Current Freight Practices

10.3 Maintenance

- Route Maintenance Likely Increased.
- New Stations to Maintain
- Possible Provision of New Authorised Access Points and RRAP's

10.4 Renewals

Many of the various interventions required as part of the project works involve replacing or upgrading existing assets, as well as creating new ones, all of which will need to be renewed in accordance with Network Rail's asset management policies.

Where new assets are created these will become Network Rail assets for which it will require funding for replacement in appropriate Control Periods (assuming the current railway industry funding model remains). For the business case with a 60-year horizon, it is necessary to account for this anticipated cost incurred by Network Rail.

The frequency (in years) and extent (as a percentage of first cost) of renewals has been estimated by the discipline engineers to reflect both minor and major renewals. Minor renewals recognise that for some assets, there are significant components that are renewed at a more regular frequency than the major renewals, where the majority (though not necessarily all) of the asset is renewed. The frequency of renewals is assumed to be repeated throughout the 60-year horizon, with costs captured at nominal values and then discounted in the business case model.

Some new assets provided by the project will be replacing existing assets that would otherwise be renewed by Network Rail in accordance with the relevant asset management policy. The benefit to Network Rail is therefore that the renewal of these assets is effectively brought forward.

One complicating factor in this forward projection is the anticipated area-wide signalling renewals programme, which we have assumed will take place in 2030. This is not driven by the design life or condition of the signalling, telecommunications or level crossing assets, but by a wider industry strategy to provide centralised control of the network.

We have assumed that the costs assumed for new and replaced assets by the project will be a reasonable allowance for the extra complexity for new signals, telecoms facilities, and level crossing interfaces that the resignalling project would incur. Nevertheless, it is noted that such allowances cannot be estimated to a high degree of accuracy at this stage given the range and quantum of unknown variables.

10.5 Impact of changes on people and systems – Routewide

Table 13 below is a summary of potential impacts on personnel on Northumberland, whilst considering the following:

- Operations
- Maintenance
- Rolling Stock
- Systems

	Impact on Personnel									Explanation
	Requirements		Users			Ops Staff		Maint Staff		
Persons	**New operating requirements**	**New maintenance requirements**	**New users**	**Different users**	**Competence**	**Number**	**Competence**	**Number**	**Competence**	
Operations										
Route Electrical Control										Not Applicable
Signal Centres	x	x	x		x	2	x			Upgraded signal boxes, new control methods
LOMs/MOMs	X				x		x			Upgraded signal boxes, new control methods
Drivers	x		x	x	x		x			New route learning
Conductors										
Station Staff										No stations are proposed to be staffed.
Maintenance										
E&P										
Signalling	x	x			x				x	New equipment, new training required
Telecoms										
Track										
Buildings										
OLE										
Rolling Stock										
Trains										
RRVs										
Systems										

	Impact on Personnel									Explanation
	Requirements		Users			Ops Staff		Maint Staff		
Persons	New operating requirements	New maintenance requirements	New users	Different users	Competence	Number	Competence	Number	Competence	
Isolation System										Not Applicable
Possession System										

Table 13 - Table of Potential Impacts

11 PROGRAMME AND COST ESTIMATE

11.1 Project Programme

The programme was produced from a starting date determined by the confirmation of Funding for the design phase. Following commencement is the production of the outline design and the feed in of this to the TWAO. This leaves the outline design up to completion not submission/approval, and TWAO on the critical path into the Phase 2 activities which require TWAO. The assumption is that the infrastructure is designed all together during outline design stage, including the stations, but these are delivered in two phases. Phase 1 as this does not require a TWAO and then Phase 2 which waits for the TWAO to be concluded.

Following Design Phase there are two procurement streams one for Phase 1 and one for Phase 2 works – essentially the phase 1 works are procured in isolation, so the D&B relates to only these following sign-off of the outline design. Phase 2 Procurement is driven by the TWAO determination and is on the programme critical path.

An ECI programme for the Phase 1 works was created by Morgan Sindall and merged into the overall programme. This was achieved by working with the ECI contractor to identify several Key interface milestones which enabled the two programmes to be linked together and maintain the flow of activities from one stage to the next. Completion activity milestones were also identified, and these were linked back into the overall programme to identify the entry into service requirements to bring the stations into use and therefore the completion date milestones for the programme. (Both Programmes are contained within ***Appendix R)***

11.2 Cost Estimate

11.2.1 Commentary on project delivery cost changes since SOBC

11.2.1.1 Direct Costs

The cost estimates at SOBC were based on a 'Three-Point Estimate' approach, to recognise the inherent uncertainties associated with the level of design and to inform the risk assessment. Categorisation of Direct Costs was slightly different, and a comparison of the movement in costs with brief explanation is below.

Sum of MOST Likely Direct Cost (£GBP)	Phases				
Disciplines	Phase 1	Phase 2	Phase 3	Phase 4	Grand Total
Building and property	£6,250,306	£4,821,822	£0	£0	£11,072,128
Civil Engineering	£9,410,053	£4,113,614	£0	£0	£13,523,666
Permanent Way	£7,273,717	£1,778,847	£1,108,167	£2,269,108	£12,429,839
Signalling Systems	£19,120,000	£240,000	£480,000	£1,680,000	£21,520,000
Telecoms	£943,400	£305,200	£0	£10,400	£1,259,000
Electric Power and Plant	£2,160,000	£720,000	£360,000	£360,000	£3,600,000
Enabling Works	£1,788,860	£1,025,240	£200,000	£200,000	£3,214,100
Train Power System	£0	£0	£0	£0	£0
Land and consents	£581,200	£1,039,800	£0	£0	£1,621,000
Grand Total	**£47,527,535**	**£14,044,522**	**£2,148,167**	**£4,519,508**	**£68,239,732**

Figure 41 - Extract of Table 4 from the SOBC Technical Summary Report

Ref	Estimate Breakdown		Phase 1	Phase 2	Total
1	Direct Construction Works Costs		Value (£)	Value (£)	Value (£)
1.01	Signalling	11.67%	£7,576,601	£133,515	£7,710,116
1.02	Operational Power	3.40%	£2,248,520	£0	£2,248,520
1.03	Permanent Way	31.48%	£15,162,357	£5,627,511	£20,789,868
1.04	Operational and Retail Telecommunications	3.87%	£2,172,004	£382,831	£2,554,835
1.05	Stations	24.43%	£9,361,675	£6,770,180	£16,131,855
1.06	Civil Engineering	4.74%	£3,025,540	£107,444	£3,132,984
1.07	Level Crossings	16.15%	£10,666,500	£0	£10,666,500
1.08	Structures	1.93%	£1,276,177	£0	£1,276,177
1.09	Utility Diversions	2.32%	£1,280,000	£250,000	£1,530,000
	DIRECT CONSTRUCTION WORKS COST TOTAL		£52,769,374	£13,271,481	£66,040,855

Figure 42 - Extract of the Direct Works Cost from Current Estimate

Figure 43 below illustrates the changes in Direct Construction Cost estimates between SOBC, which was at 4Q18 pricing and the OBC estimate, which was at 3Q19 pricing. The overall picture is one of remarkably little change since SOBC, with the total Direct cost for all phases rising by 1.6% from OBC – about half the average annual rate for new build construction costs for the public sector[4].

[4] ONS construction index data ,downloaded 17 Oct 19: https://www.ons.gov.uk/file?uri=/businessindustryandtrade/constructionindustry/datasets/interimconstructionoutputpriceindices/current/constructionoutputpriceindices2019q2.xlsx

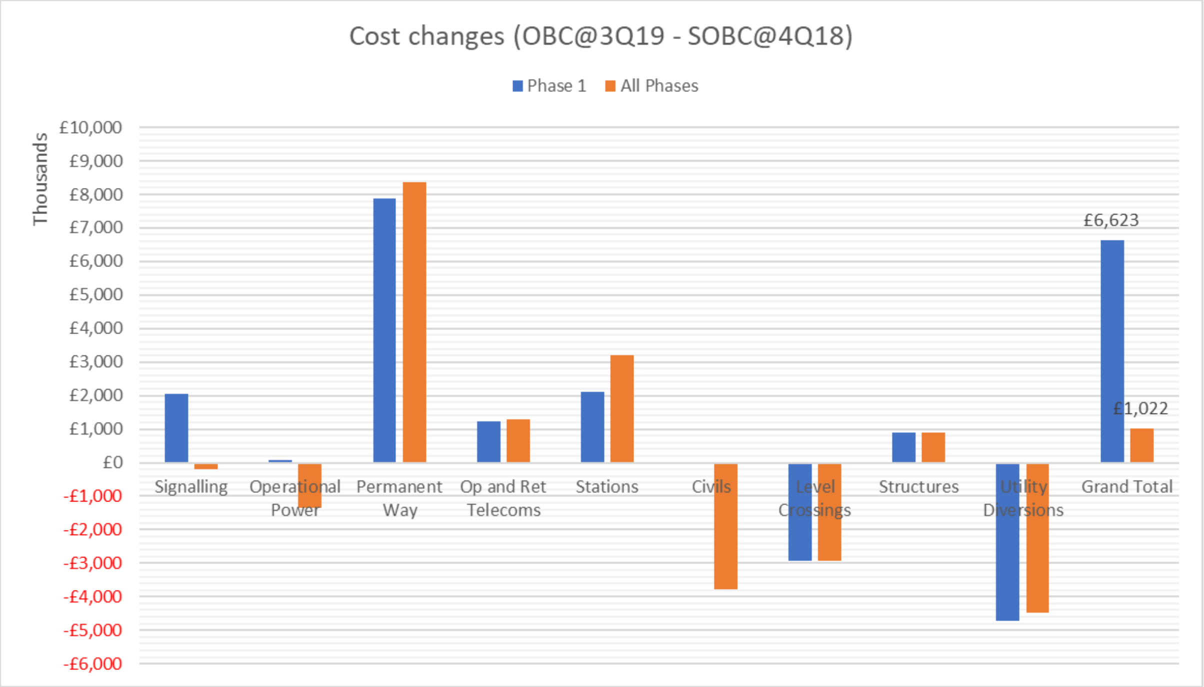


Figure 43 - Chart of Cost Changes between SOBC and OBC

However, the comparative costs for Phase 1 have increased by more than £6m, or 14.4%, and this is dominated by the changes in Permanent Way costs, of which £3.8m comes from allowances to rehabilitate Furnace Way sidings that were specifically excluded in the SOBC because these costs were anticipated to be met by others. Following preliminary discussions with relevant parties, it is now suspected that these costs may have to be met by the project and thus have been adopted in the OBC.

Other changes in permanent way costs have arisen because the track condition was found on preliminary inspection to be far worse than expected, with long sections of railhead worn to a profile that would not be acceptable for passenger vehicles. Further work is under way to investigate opportunities to reduce these costs.

Station costs have risen because of the addition of a footbridge at Newsham (which was previously only allowed for as a risk item), and expansion in car park spaces and highway connection costs generally.

Signalling costs have risen in Phase 1 as it has become necessary to bring almost all the signalling works, except for the passing loop, into Phase 1. A phased approach to signalling was impracticable, although overall costs have remained similar due to adoption of existing signalling equipment wherever possible.

It was known at SOBC that there was a very wide range of possible costs for telecoms because almost no information about the existing telecoms asset was available. The relatively modest increase in estimated costs for OBC is much less than it might have been, and is based on our review of records, a site visit and discussions with the local Route Asset Manager (RAM).

Although fewer structures are now thought to require intervention, the savings are outweighed by identifying that three structures will require strengthening or other modification, and the Chase Meadows footpath crossing is likely to require a new footbridge.

The savings have come primarily from a more informed understanding of the likely utility diversions, and a significant reduction in anticipated Civils embankment costs following a site inspection. Level crossings costs have been reduced following discussions with the local telecoms RAM and better information leading to a more tailored approach.

Land, environmental, and consents costs have been treated differently in OBC and have been moved out of Direct Costs into project delivery costs. They were allocated to 'Measured Direct Costs' in SOBC to ensure that the uncertainty was captured as part of the Three Point Estimate approach.

11.2.1.2 Project delivery costs

As indicated by ***Table 14***, there is close correlation in the assumptions between SOBC and OBC, which is to be expected as many of these are common industry uplifts for this stage of design.

The exception is in the treatment of risk, which is normally subject to a flat 40% allowance at the equivalent to stage 2 design for Network Rail's Governance for Rail Investment Projects (GRIP). GRIP requires that the design for each discipline is brought up to the same level before the 40% is applied. However, at SOBC, a 'Pareto principle' approach was taken, and smaller cost items such as power and telecoms were adopted as lump sums with a confidence range through the Three Point Estimate methodology. In this way, it was possible to take a quantified allowance for risk despite limited design information, and the net effect has been broadly similar to that taken through more formal processes at OBC.

Category	SOBC assumption	OBC assumption
Preliminaries	30.6%	30%
Contractor's overheads and profit	8%	12%
Project Management (NR and industry risk)	9.8%	10%
Project & Design fees	9%	10%
Possession and Isolation costs	2.5%	5%
Treatment of Risk	10% 'unmeasured items' allowance, on top of 80% confidence interval from Three Point Estimate	80% confidence interval from Quantified Risk Analysis exercise

Table 14 - Changes in Key Assumptions on Project Delivery Costs

When the overall uplift multiplier from Direct Costs to Anticipated Final Costs is assessed as in ***Table 15***, it remains fairly consistently around 2.46, with a slight reduction in Phase 1 of the OBC due to a slightly better understanding of risk for this early phase.

[Costs in £m]	Phase 1 SOBC	Phase 1 OBC	All Phases SOBC	All Phases OBC
Direct Cost (DC)	£47.5m	£52.78m	£68.2m	£66.0m
Anticipated Final Cost (AFC) including risk	£117.2m	£125.0m	£169.4m	£161.9m
Multiplier (AFC/DC)	2.47	2.37	2.48	2.45

Table 15 - Summary Costs Comparison

11.2.1.3 Project delivery cost changes summary

Overall, the change in construction costs between SOBC and OBC is minimal, and even presents a slight reduction when construction inflation is considered. This is despite the impact of including the costs of rehabilitating the Furnace Way Sidings and dealing with the unsuitable condition of the track. Both these items will be investigated further in due course with a view to reducing their costs.

However, both Furnace Way sidings and the anticipated track upgrades are required for Phase 1 delivery, and although the overall project cost has in nominal terms marginally decreased by about 4%, the anticipated final cost of Phase 1 has increased by approximately 6.7%. If a 2.4% allowance for construction cost inflation between SOBC and OBC is made, the overall project cost in real terms decreases by about 1.6% and Phase 1 increases by 4.3%.

12 QCRA RISK REGISTER / HAZARD LOG

The QCRA Risk Register can be found within ***Appendix S*** of this report.

The updated Project Hazard Log can be found within ***Appendix I*** of this report

12.1 Uncommon Infrastructure Risks identified during the Option Selection process

The following uncommon Risks have been identified during the development of the various options forming this option selection process. This are highlighted here for information only:

12.1.1 Risk: North Seaton Viaduct

Preferred line speeds for North Seaton viaduct of 40mph for freight and 65mph for passenger trains cannot be achieved without expensive modification for strengthening and/or fatigue mitigations. The current working assumption is that revised detailed bridge assessments will better inform and allow more accurate calculations to be undertaken in order to prove the linespeed can be implemented. There is a risk that excessive structural repairs will prove uneconomical and that a speed restriction will have to be imposed which may negatively impact the journey times and timetable.

12.1.2 Risk: Coal Workings

There is a risk of shallow worked coal seams, both known and unknown, resulting in a risk to the volume of grouting required at station sites, structures or car parks. This is a risk not only to the cost of minework remediation but also the programme duration allowed for the works.

12.1.3 Risk: Bedlington Station

There is currently no way to meet all the standard requirements for signal stand back, track geometry, platform geometry and stepping distances at Bedlington for a full 100m length platform. There will need to be a deviation to one or more standards accepted or the introduction of Selective Door Opening (SDO) at Bedlington if a station is to be provided at this location.

12.2 Project Hazard Record

The Project Hazard Record has been compiled from several sources including the Hazard Log from the previous GRIP 2 Ashington, Blyth & Tyne scheme, notes from the regular Design Review Meetings and a formal HAZID Workshop held on 19 September 2019 and attended by representatives from Design, Construction, Maintenance, Operations and the Infrastructure Manager. The output of the workshop and other sources has been captured and an initial review undertaken to classify the hazards in accordance with Network Rail Core Hazards, which broadly align with the industry common hazards identified by RSSB, and to assign lead Disciplines as owners capable of and responsible for identifying and implementing suitable mitigations. Some items captured through this process have been classified as Project Risk (rather than CDM/CSM Hazards) and will be transferred to the Project Risk Register for management of mitigation actions, however they have been initially recorded in the Hazard Record to provide a complete record of the workshop output.

The second pass review of the Hazard Record will undertake a quantitative assessment of Likelihood and severity of Consequence to enable identified hazards to be ranked and managed according to severity. Mitigating actions will follow the ERIC Hierarchy (Eliminate – Reduce – Isolate – Control) and will be recorded in the Hazard Record. (see ***Appendix I*** for current snapshot of the Hazard Record) The majority of these are currently anticipated to be managed through adoption of industry Codes of Practice, with possible exceptions for Bedlington Station and North Seaton Viaduct. Identified mitigations will be shown in the Approval in Principle (AIP) designs for the chosen single options.

Where any hazard cannot be suitably mitigated through adoption of Codes of Practice, an alternative approach of Reference Systems or Specific Risk Assessment will be considered. This will be documented within the AIP submissions, along with any Derogations or Deviations that may be required to support the approach proposed.

Ongoing periodic reviews of the Hazard Record are planned throughout the RNEP Develop phase, broadly expected to be held bi-monthly as a formal review, although the Hazard Record will be updated as required for actions undertaken or any arising hazards identified. This process is expected to continue throughout the Design and Deliver phases, although the periodicity for these phases has yet to be confirmed.

13 OPTIONS CONSIDERED AND DISCOUNTED

13.1 Stations

13.1.1 Northumberland Park

13.1.1.1 Option 1A (Discounted)

A discounted station location at Northumberland Park (Option 1A) is located within the railway cutting between Algernon Drive Overbridge and the A186 Overbridge as shown in ***Figure 44***. This option is situated adjacent to the existing Network Rail single line track which runs alongside the Metro railway lines operated by NEXUS. A single-faced 100m platform is proposed to be installed to the west of Algernon Drive Bridge stretching west towards the A186.

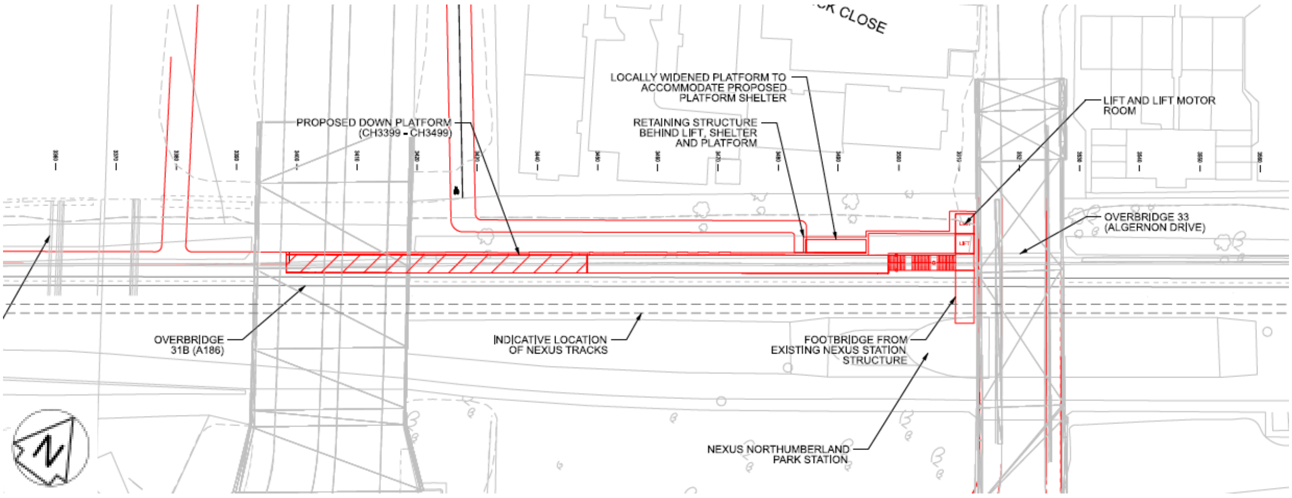


Figure 44 – Northumberland Park Option 1A (Discounted)

Existing vehicular access to Northumberland Park multi-story car park serves the current NEXUS station. No additional vehicle access facilities are proposed as part of this scheme.

Pedestrian access from the east is via a proposed footbridge spanning between the existing NEXUS Northumberland Park Station structure, from its north western face to the proposed landing structure. Across the new bridge, the landing provides access to stairs and a lift linking the proposed footbridge to the platform level below.

Pedestrian access from the west is via a walkway at railway level which connects the station platform to a proposed staircase / ramp to exit the railway cutting. Additional footpaths are provided to provide access to the platform from existing pedestrian and cycles links running east and west of the A186.

Connectivity to other public transport systems is provided via the station's proximity to the existing Metro (NEXUS) Northumberland Park station and the existing bus stops located nearby to the existing multi-story car park.

This option was discounted primarily because the layout of the lift and stairs to Algernon Drive would require a structural connection onto NEXUS' station building which causes ownership, maintenance, structural and security issues for both parties.

13.1.1.2 Option 1B (Preferred)

Option 1B is the preferred option at Northumberland Park. See ***section 5.1.1*** for details of this option.

13.1.1.3 Option 2 (Viable, Non-Preferred)

A viable, non-preferred, station location at Northumberland Park, Option 2, is located within the railway cutting beneath Algernon Drive bridge and opposite the NEXUS Northumberland Park Platform as shown in ***Figure 45.*** This option is situated on the existing single line track adjacent to the Metro railway lines operated by NEXUS. A single-faced 100m long platform is proposed to be installed beneath Algernon Drive Bridge stretching east and west.

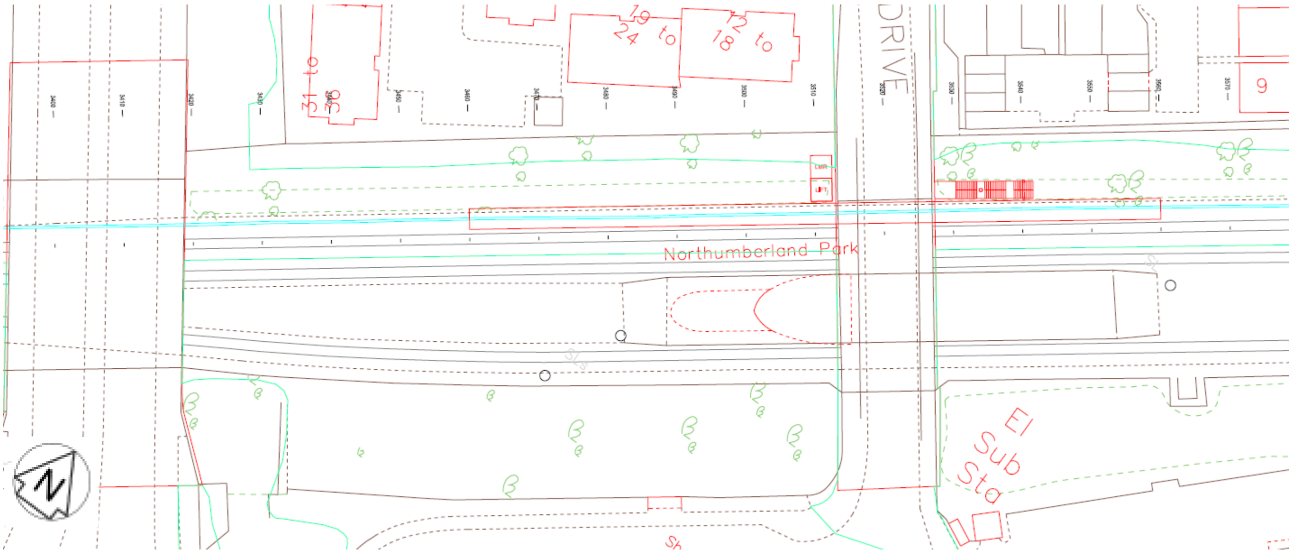


Figure 45 – Northumberland Park Option 2 (Viable Non-Preferred)

Existing vehicular access to multi-story parking currently serves the existing NEXUS station. No additional facilities are proposed as part of this scheme.

Pedestrian access is via two proposed breakouts of the Algernon Bridge parapets (one on either side). The northern parapet breakout would provide access to a staircase down onto the platform and the southern parapet breakout would lead to a lift. The existing Algernon Drive road bridge was originally proposed to be part of a bus route but has been temporarily closed for several years. This option would seek to permanently close the bridge to vehicle traffic and create a public realm space on top of the bridge to improve the links between the train stations and the bus stops/car park. Modern, secure cycle storage is to be installed within this public realm space.

Connectivity to other public transport systems is provided via the station's proximity to the existing Metro (NEXUS) Northumberland Park station and the existing bus stops located nearby to the existing multi-story car park.

This option was rejected primarily because of the lack of Secondary Means of Escape, two parapet wall breakouts, and because the further east the platform is located, the greater the risk of encountering sink holes.

13.1.1.4 Options Appraisal

A summary of the options appraisal is provided in ***Table 16***. This table outlines the key considerations which led to the selection of the preferred option.

Colour coding is used to provide a high-level indication of the performance of the individual options measured against the categories listed. 'Green' presents a positive assessment against the specific category under consideration; 'amber' indicates some potential issues with the option; and 'red' highlights significant issues in meeting potential objectives associated with that category.

The categories listed are location specific and were identified as key considerations during multidisciplinary workshops as the project developed.

Category	Option 1A	Option 1B (Preferred)	Option 2
Interchange between the NEXUS station and Proposed station	Provides a direct connection between the NEXUS station ticketing area and the proposed station lift via a new 15m footbridge.	Connection between the two stations is via Algernon Drive Overbridge from which both stations access points are the same side with approximately 15m walk between. The closure of Algernon Drive could complement this option.	Connection between the two stations is via Algernon Drive Overbridge. The proposed station's lift access is on the same side as the existing Nexus platform access, however stepped access is provided on the opposite, eastern side of the overbridge. Therefore, this option is more dependent on the permanent closure of Algernon Drive to allow passengers to cross the existing overbridge without interfacing with vehicular traffic. This introduces further project risk associated with the formal implementation of a road closure. It also limits future options regarding the use of the bridge space, including the potential for enhanced bus interchange should buses be reinstated on routes via Algernon Drive. Alternatively, if permanent road closure could not be sought, a pedestrian road crossing facility would be required to provide a link to the platform stair access.
Construction	Installation of a new footbridge required including additional loading onto and modification of NEXUS' structure. Cutting retaining solution enters deep into the slope and close to railway boundary. This represents a significant additional cost over the considered alternative arrangements and introduces project risks associated with required additional works on a 3rd party structure.	Single breakout of Algernon Drive Road bridge parapet required. Cutting retaining solution is on one side of the road bridge and will be a single retaining structure.	Requirement for two breakouts of Algernon Drive Road bridge parapet creates additional work and cost over the single breakout preferred option solution. Cutting retaining solution is on both sides of the road bridge and will require two retaining structures.
Station Operation and Maintenance	The two stations will have a direct link over the footbridge. Ownership, operating hours, ticketing and maintenance of this structure will need to be agreed with NEXUS. This introduces project risks in respect of 3rd party reliance, liability and operational requirements.	The two stations will operate separately, and Network Rail / the TOC and NEXUS will not require agreements over a footbridge. The benefit of an at-grade integrated station is not captured but this would require use of NEXUS' infrastructure. The avoidance of integrating the two rail systems is a core project	The two stations will operate separately, and Network Rail / the TOC and NEXUS will not require agreements over a footbridge. The benefit of an at-grade integrated station is not captured but this would require use of NEXUS' infrastructure. The avoidance of integrating the two rail systems is a core project

Category	Option 1A	Option 1B (Preferred)	Option 2
	The benefit of an at-grade integrated station is not captured but this would require use of NEXUS' infrastructure. The avoidance of integrating the two rail systems is a core project assumption as discussed in ***section*** 3.1.2	assumption as discussed in ***section*** 3.1.2	assumption as discussed in ***section*** 3.1.2
Car Parking	No new car parking is provided. Car parking occupancy surveys commissioned during this phase of the project suggest that the existing multi-story NEXUS car park is not yet at capacity (current maximum percentage occupancy of 72% (Unused spaces 76)). Furthermore, demand modelling undertaken suggests that the car parking demand is negligible at Northumberland Park.	No new car parking is provided. Car parking occupancy surveys commissioned during this phase of the project suggest that the existing multi-story NEXUS car park is not yet at capacity (current maximum percentage occupancy of 72% (Unused spaces 76)). Furthermore, demand modelling undertaken suggests that the car parking demand is negligible at Northumberland Park.	No new car parking is provided. Car parking occupancy surveys commissioned during this phase of the project suggest that the existing multi-story NEXUS car park is not yet at capacity (current maximum percentage occupancy of 72% (Unused spaces 76)). Furthermore, demand modelling undertaken suggests that the car parking demand is negligible at Northumberland Park.
Pedestrian / Cycle Access	Existing cycle storage is provided within the NEXUS multi-story car park. Pedestrian / cycle access from the east is provided via Algernon Drive Overbridge. Direct platform access from the west is possible via proposed pathways which connect existing pedestrian/ cycle provision west of the A186, into the railway cutting and under the A186 overbridge. This route links existing and proposed developments west of the A186 to the station, whilst avoiding having to cross the A186 carriageway. An additional access footway running to the east of the A186 links the platform with existing pedestrian facilities east of the A186. Whilst positive for pedestrian access, delivering this link introduces buildability issues as it would require significant earthworks and a large retaining structures to enable an access in this location.	Existing cycle storage is provided within the NEXUS multi-story car park. New cycle storage facilities are also proposed adjacent to the station entrance on Algernon Drive Overbridge. Pedestrian / cycle access from the east is provided via Algernon Drive Overbridge. Direct platform access from the west is possible via proposed pathways which connect existing pedestrian/ cycle provision west of the A186, into the railway cutting and under the A186 overbridge. This route links existing and proposed developments west of the A186 to the station, whilst avoiding having to cross the A186 carriageway.	Existing cycle storage is provided within the NEXUS multi-story car park. New cycle storage facilities are also proposed adjacent to the station entrance on Algernon Drive Overbridge. Pedestrian / cycle access from the east is provided via Algernon Drive Road bridge. No additional pedestrian or cycle access is provided in this option. This negatively impacts wider station accessibility, particularly from the west.

Table 16 – Northumberland Park Options Appraisal

13.1.2 Seaton Delaval

13.1.2.1 Option 1A (Discounted)

Option 1A is a discounted station and car park option located to the south of the A192 and to the south east of the railway corridor as shown in ***Figure 46***. This option is based on the discounted option of the passing loop proposed by this scheme being present at the location of the station, therefore two lines will be present through the station for this option, one for passengers and a second freight only passing loop. A single 100m long platform is to be positioned approximately 100m south of the A192 Overbridge (OB 39) adjacent to the Up line.

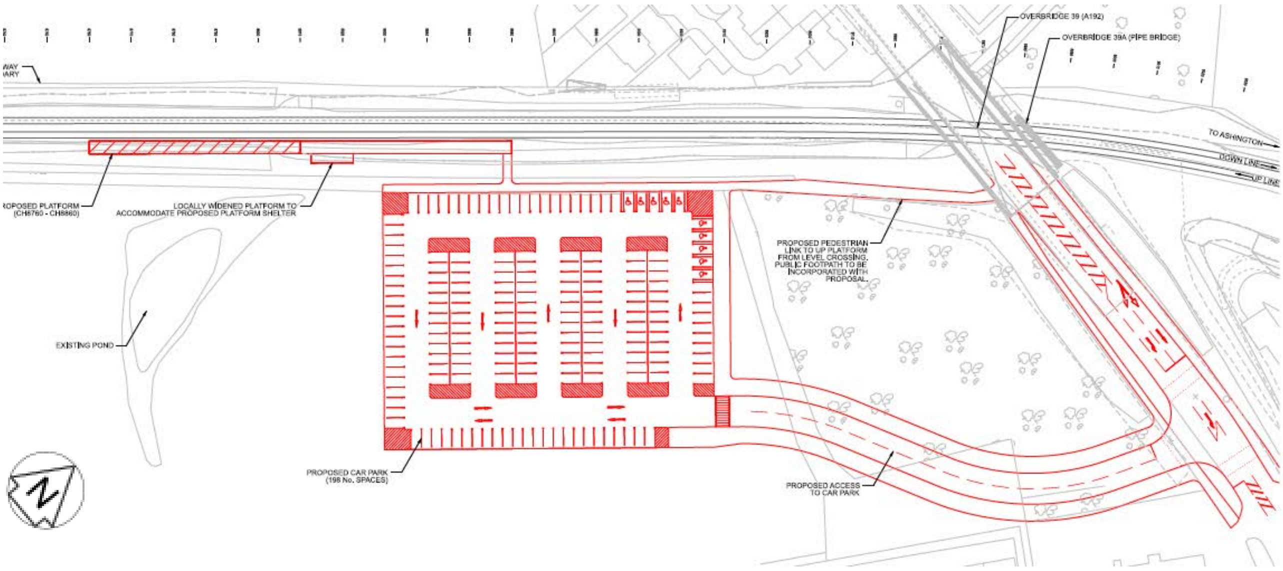


Figure 46 – Seaton Delaval Option 1A (Discounted)

Vehicular access is provided via a new access road, from the A192, to a new 190-space station car park. Highway access is proposed via a signalised three arm junction off the A192 which is located adjacent to the Hastings Arms Public House. Pedestrian crossing facilities are proposed on all arms of the junction. The proposed junction provides a single lane station access/ egress arm, and a single eastbound lane on the A192 mainline. A two-lane westbound A192 approach is provided, including a right turn lane of approximately 20m. This is accompanied by a right turn pocket ahead of the stop line to facilitate vehicles turning right in to the station access road.

The signalised access junction also includes pedestrian facilities to aid pedestrian and cycle access to the station or support continuous east west mainline movement on this key cycle link. Pedestrian / cycle access from the west / north of the railway corridor is provided via an existing public footpath which leaves the A192 adjacent to the Overbridge 39. This footpath also provides connectivity south towards Seghill. It is proposed that the existing footpath be upgraded as part of this scheme. Pedestrian / cycle access from the east is provided via a new footpath running adjacent to the car park access road.

Connectivity to the local bus network is provided through the proposed provision of relocated bus stop locations along the A192 which better serve the provided station access routes.

This option was discounted because the passing loop was repositioned for operational purposes, and the cost of realigning the existing track and drainage was an unnecessary expense.

13.1.2.2 Option 1B (Discounted)

Option 1B is a discounted station and car park location at Seaton Delaval shown in ***Figure 47***. This option is the same layout as Option 1A, see ***section 13.1.2.1***, with the addition of a second platform on the Down side and a footbridge with stairs and lifts to allow passengers to transfer between platforms.

This option was discounted for the same reasons as Option 1A, plus the additional expense of the extra platform and footbridge access.

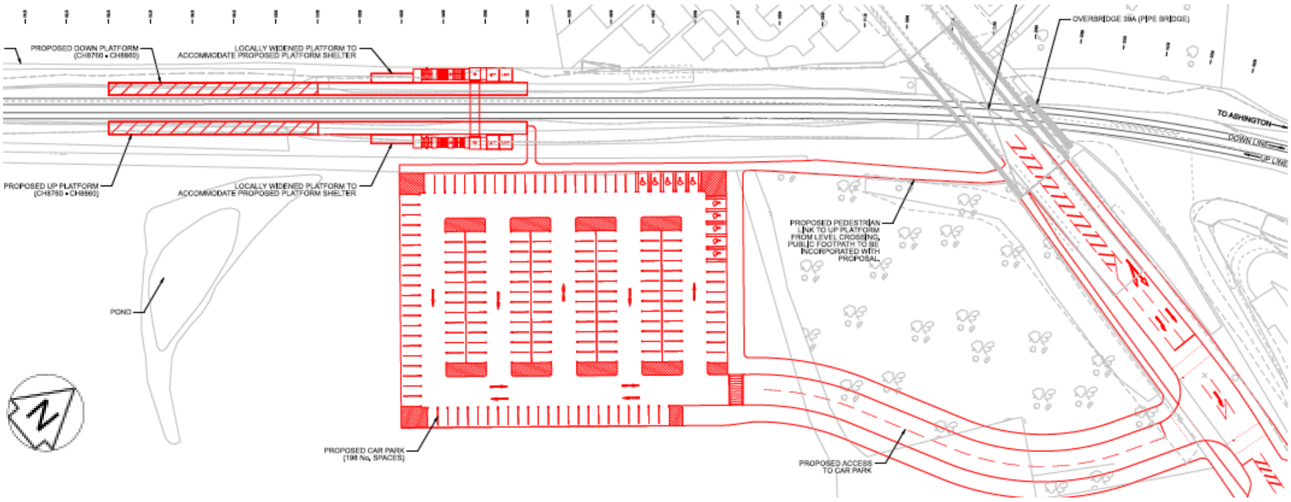


Figure 47 – Seaton Delaval Option 1B (Discounted)

13.1.2.3 Option 2 (Viable, Non-Preferred)

A non-preferred viable option for the station and car park location at Seaton Delaval (Option 2) is located to the north of the A1061 and to the north of the railway corridor within a cutting as shown in ***Figure 48***. This option is based on the passing loop proposed by this scheme being to the south of the proposed station location with the existing single line track remaining on its current alignment. A single 100m platform is positioned approximately 150m north of the A192 Overbridge (OB 39) on the north side of the tracks.

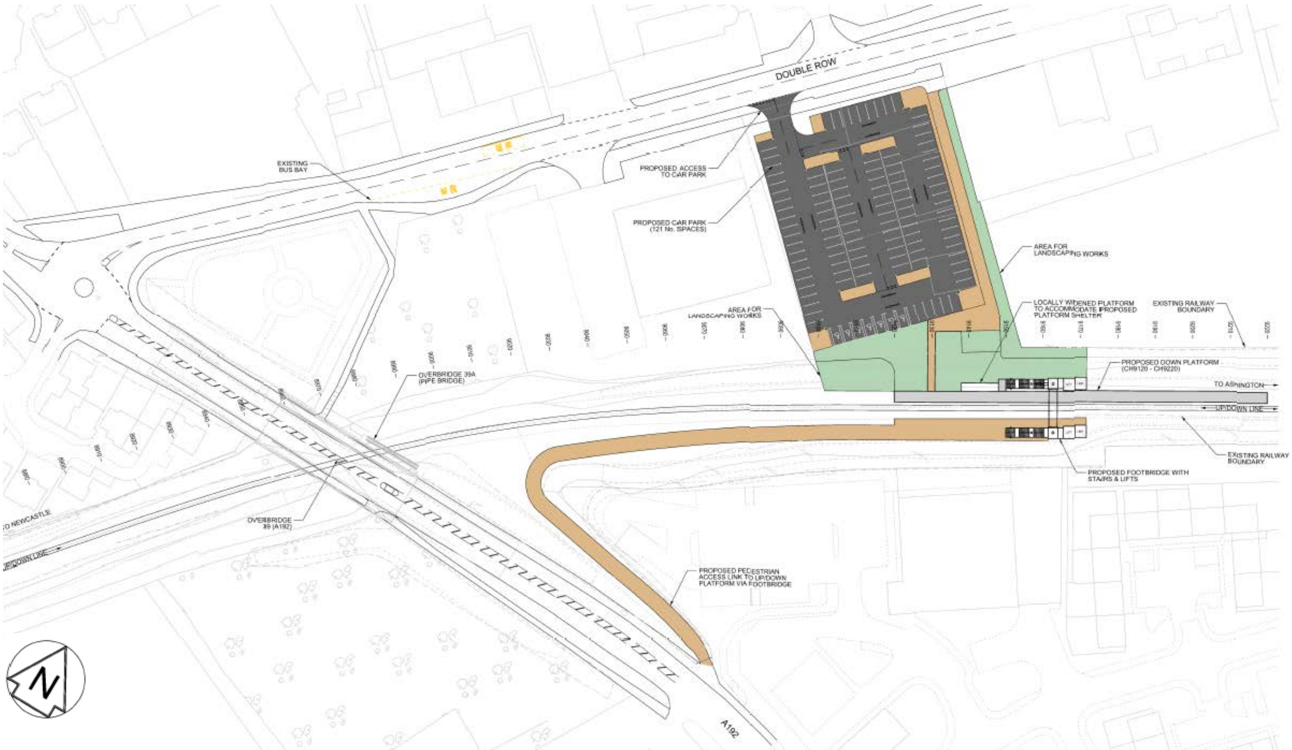


Figure 48 – Seaton Delaval Option 2 (Viable, Non-Preferred)

Vehicular access is provided via a proposed priority junction off Double Row into a new 121 space station car park.

Pedestrian / cycle access from the north and west is via existing routes along Double Row to the car park and then down an access ramp and stairs to platform level within the cutting. In addition to existing pedestrian / cycle access facilities on the A192 and Double Row, a proposed new link from the south and east is provided via an upgraded Network Rail access point from the A192, adjacent to the supermarket car park, and leading to a footbridge to cross the railway onto the platform.

Connectivity to the local bus network is provided by two existing bus stops on Double Row.

This option was rejected because of the limited car parking and poorer pedestrian access from the major population centres of Seaton Delaval and Seghill.

13.1.2.4 Option 3 (Preferred)

Option 3 is the preferred option at Seaton Delaval. See ***section 5.1.2*** for details of this option.

13.1.2.5 Options Appraisal

A summary of the options appraisal is provided in ***Table 17***. This table outlines the key considerations which led to the selection of the preferred option.

Colour coding is used to provide a high-level indication of the performance of the individual options measured against the categories listed. 'Green' presents a positive assessment against the specific category under consideration; 'amber' indicates some potential issues with the option; and 'red' highlights significant issues in meeting potential objectives associated with that category.

The categories listed are location specific and were identified as key considerations during multidisciplinary workshops as the project developed.

Category	Option 1A	Option 1B	Option 2	Option 3 (Preferred)
Proximity to Seaton Delaval residential areas	The majority of Seaton Delaval's residential areas lie to the south of the existing rail corridor. The proposed station location to the south of the rail line represents the closest practical location.	The majority of Seaton Delaval's residential areas lie to the south of the existing rail corridor. The proposed station location to the south of the rail line represents the closest practical location.	The platform and station location north of the rail line does not naturally serve the majority of Seaton Delaval's residential areas, which lie to the south of the existing rail corridor.	The majority of Seaton Delaval's residential areas lie to the south of the existing rail corridor. The proposed station location to the south of the rail line represents the closest practical location.
Track Alignment	Based on the track passing loop being through the station which has been discounted by the track option selection process 13.3.3	Based on the track passing loop being through the station which has been discounted by the track option selection process 13.3.3	Based on existing track alignment.	Based on existing track alignment.
Construction	No complex features.	Footbridge to be installed with one side within a cutting slope which adds cost and complexity to the project not present with other options.	Footbridge to be installed with one side within a cutting slope which adds cost and complexity to the project not present with other options.	No complex features.
Car Parking	Sufficient car parking can be supplied for the forecasted demand.	Sufficient car parking can be supplied for the forecasted demand.	Land available is not large enough to house a car park for the forecasted demand. A decked car park is an option but will	Sufficient car parking can be supplied for the forecasted demand.

Category	Option 1A	Option 1B	Option 2	Option 3 (Preferred)
			add additional expense to the project.	
Highway Network	A signalised access junction was selected as the preferred method of control due to the relatively high mainline flows, which would limit gap seeking opportunities. Additionally, pedestrian crossings to aid pedestrian and cycle access to the station and support continuous east west mainline movement could be provided within the junction design. Option traffic modelling indicates that the junction would operate within capacity in the scheme opening and design years. However, some additional network delay is inherent in the provision of a new junction. Traffic modelling indicated that predicted background traffic growth in future years is likely to exceed the capacity of A192/ Double Row junction. Full details of the modelling undertaken, and likely impacts can be found in the Local Junction Modelling Report ***Appendix O***.	A signalised access junction was selected as the preferred method of control due to the relatively high mainline flows, which would limit gap seeking opportunities. Additionally, pedestrian crossings to aid pedestrian and cycle access to the station and support continuous east west mainline movement could be provided within the junction design. Option traffic modelling indicates that the junction would operate within capacity in the scheme opening and design years. However, some additional network delay is inherent in the provision of a new junction. Traffic modelling indicated that predicted background traffic growth in future years is likely to exceed the capacity of A192/ Double Row junction. Full details of the modelling undertaken, and likely impacts can be found in the Local Junction Modelling Report ***Appendix O.***	New priority access junction on Double Row. Whilst the impact of station traffic on the network is anticipated to be low, traffic modelling indicates that predicted background traffic growth in futures years is likely to exceed the capacity of A192/ Double Row junction, This suggests that passengers accessing a station in this location from the primary southerly direction may endure significant additional journey delay prior to reaching the station access. Full details of the modelling undertaken, and likely impacts can be found in the Local Junction Modelling Report ***Appendix O.***	A signalised access junction was selected as the preferred method of control due to the relatively high mainline flows, which would limit gap seeking opportunities. Additionally, pedestrian crossings to aid pedestrian and cycle access to the station and support continuous east west mainline movement could be provided within the junction design. Option traffic modelling indicates that the junction would operate within capacity in the scheme opening and design years. However, some additional network delay is inherent in the provision of a new junction. Traffic modelling indicated that predicted background traffic growth in future years is likely to exceed the capacity of A192/ Double Row junction. Full details of the modelling undertaken, and likely impacts can be found in the Local Junction Modelling Report ***Appendix O.***
Public Transport Links	Existing bus stops are positioned east along the A192 approximately a 400m walk to the platform	Existing bus stops are positioned east along the A192 approximately a 400m walk to the platforms	Existing bus stops are approximately 70m away from the proposed car park entrance.	Relocated or additional bus stops positioned on the A192 Overbridge adjacent to the pedestrian station accesses.
Pedestrian / Cycle Access	Attractive pedestrian links from A192 Overbridge via a public footpath which stretches further south towards Seghill. A footway is provided along the	Attractive pedestrian links from A192 Overbridge via a public footpath which stretches further south towards Seghill. A footway is provided along the	Attractive pedestrian links are achieved through the provision of a footbridge to support access from the south. If a footbridge cannot be installed,	Attractive pedestrian links from A192 Overbridge via a public footpath which stretches further south towards Seghill. A footway is provided along the

Category	Option 1A	Option 1B	Option 2	Option 3 (Preferred)
	access road to provide links from the north east. Pedestrian crossing phases provided on all arms of the signalised access junction to aid pedestrian and cycle access to the station and support continuous east-west mainline movement.	access road to provide links from the north east. Pedestrian crossing phases provided on all arms of the signalised access junction to aid pedestrian and cycle access to the station and support continuous east-west mainline movement.	pedestrian links become less attractive.	access road to provide links from the north east. Additional footpath links to housing estates to the east are also provided. Pedestrian crossing phases provided on all arms of the signalised access junction to aid pedestrian and cycle access to the station and support continuous east-west mainline movement.
Land Take	Land purchase negotiation required.	Land purchase negotiation required.	Land purchase negotiation required. Existing business within land required would need to be relocated.	Land purchase negotiation required.

Table 17 – Seaton Delaval Options Appraisal

13.1.3 Newsham

13.1.3.1 Option 1 (Discounted)

Option 1 at Newsham is a discounted station and car park with platforms staggered across Newsham Level Crossing with a car park to the south east as shown in ***Figure 49.*** This option is based on a double track extension south of Newsham Level Crossing towards the Hartley Curve. The Down Platform is located 10m north of the level crossing to the west of the railway and the Up Platform is located 75m south of the level crossing. Both platforms are to be single-faced and 100m long. Passenger access between platforms is achieved via the level crossing and the A1061, then following the access road footway to the proposed car park and station.

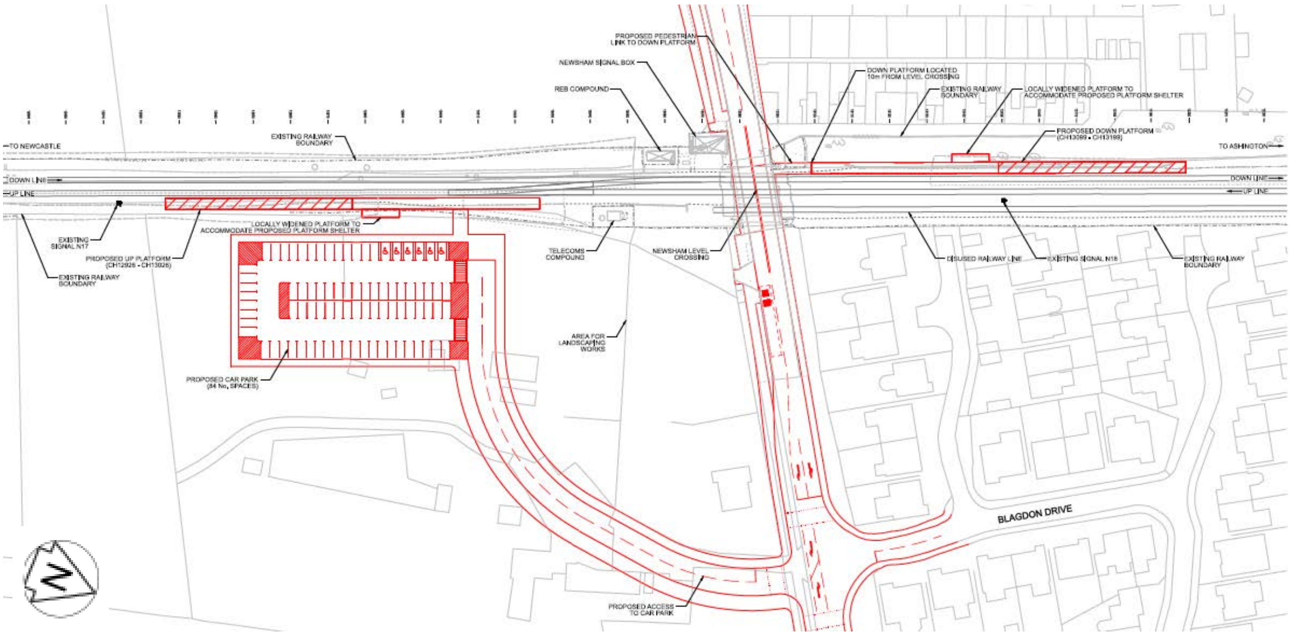


Figure 49 – Newsham Option 1 (Discounted)

Vehicle access to the station and an 84-space car park is provided from the A1061 via a two-way access road, and a signalised, four arm access junction. Pedestrian crossing facilities are provided on three arms to support key movements.

The proposed junction provides a single lane station access/ egress arm, and a single westbound lane on the A1061 mainline. An ahead lane and a short right turn lane of approximately 20m is provided on the eastbound A1061 approach to accommodate vehicles turning right in to the station. Right turn pockets ahead of the mainline stop lines facilitate vehicles turning right in to the station access road and Blagdon Drive. Land take within the road corridor and kerb realignment is required on the A1061, with additional local widening opposite the existing Blagdon Drive junction needed to support the junction layout.

Pedestrian access to the Down Platform is via a proposed footpath between the level crossing and the platform end. Pedestrian access to the Up Platform is via the access road footway to the proposed car park and station.

Connectivity to the local bus network is provided by an existing westbound bus stop to the east of Newsham Level Crossing on the A1061, and an existing eastbound bus stop on the A1061 to the east of Blagdon Drive.

This option was rejected because of the risk that 'kiss and ride' drop off parking would take place on the west-bound carriageway for north-bound passengers, resulting in direct blockage of the level crossing. Similarly, pedestrians crossing between the car park and Down (northbound) platform would almost certainly cross the road at the level crossing, without opportunity to provide the protection of a pedestrian crossing point.

13.1.3.2 Option 2A (Preferred)

Option 2A is the preferred option at Newsham. See ***section 5.1.3*** for details of this option.

13.1.3.3 Option 2B (Viable, Non-Preferred)

A non-preferred but viable option for the station and car park location at Newsham, Option 2B, is located to the south of the A1061 and to the east of the railway corridor as shown in ***Figure 50***. This option is based on a double track extension south of Newsham Level Crossing towards the Hartley Curve. Two single-faced 100m platforms are positioned approximately 75m south of the level crossing with passenger access between platforms provided by a proposed footbridge with stairs and lifts.

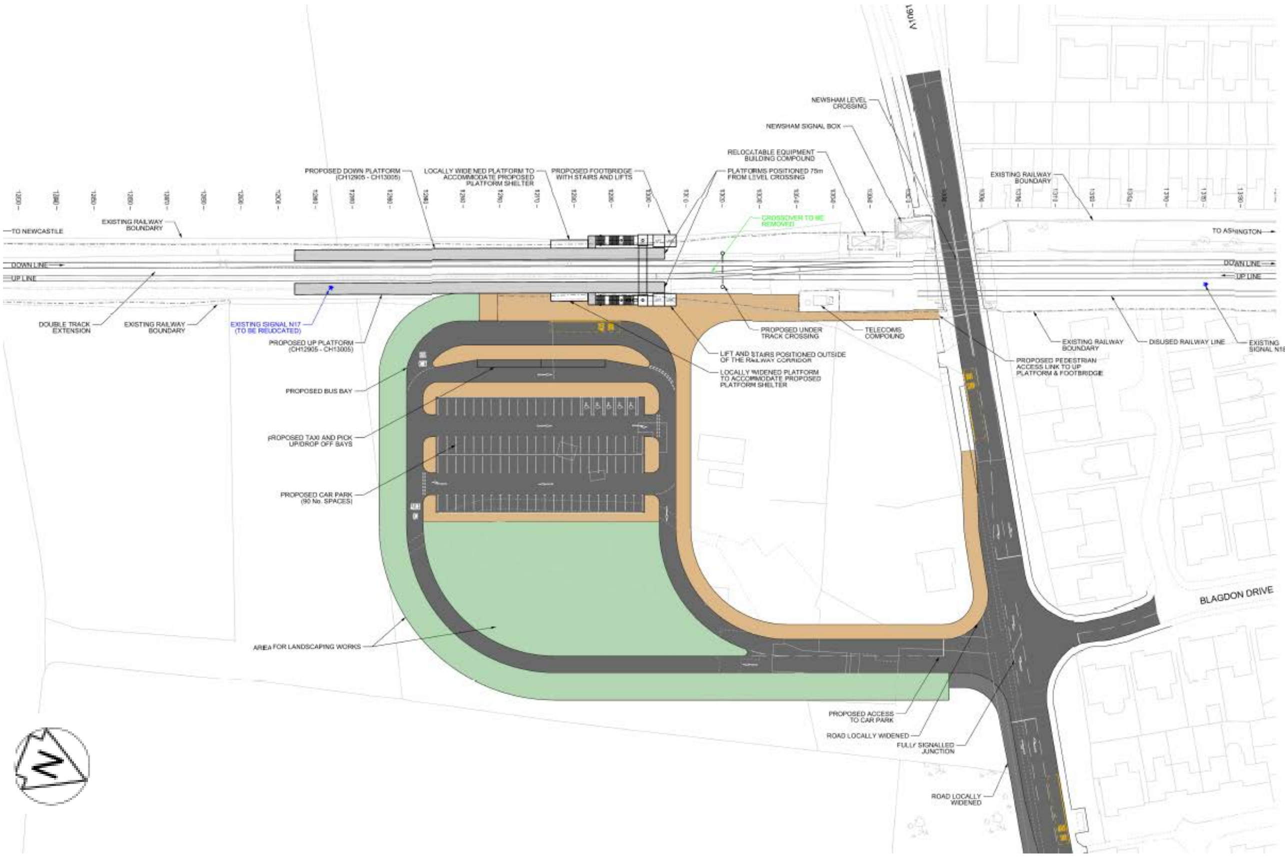


Figure 50 – Newsham Option 2B (Viable, Non-Preferred)

Vehicle access to the station and an 84-space car park is provided from the A1061 via a two-way access road, and a signalised, four arm access junction. Pedestrian crossing facilities are provided on three arms to support key movements. The proposed junction provides a single lane station access/ egress arm, and a single westbound lane on the A1061 mainline. An ahead lane and a short right turn lane of approximately 20m is provided on the eastbound A1061 approach to accommodate vehicles turning right in to the station. Right turn pockets ahead of the mainline stop lines facilitate vehicles turning right in to the station access road and Blagdon Drive. Land take within the road corridor and kerb realignment is required on the A1061, with additional local widening opposite the existing Blagdon Drive junction needed to support the junction layout.

Pedestrian access from both sides of the railway is provided by footpaths alongside the railway corridor from both sides of the level crossing. Pedestrian / cycle access is also provided from the A1061 to the east via the car park access road footway.

Connectivity to the local bus network is provided by an existing westbound bus stop to the east of Newsham Level Crossing on the A1061 and an existing eastbound bus stop on the A1061 to the east of Blagdon Drive. A new bus stop is proposed within the station car park to improve bus/ rail interchange.

This option has been rejected because the vehicular access is slightly poorer than the preferred option, and because of the likely impacts on the property to the south-east of the level crossing. Nevertheless, if the preferred option became unviable, the residents of the property have suggested a variant is considered to take over their property and garden for the car park, allowing them to rebuild a house further south on their land.

13.1.3.4 Option 3 (Discounted)

A discounted station and car park location at Newsham, Option 3, has platforms located north of the A1061 with a car park to the south east as shown in ***Figure 51.*** This option is based on the existing railway alignment, two lines through the platforms, but switching to a single line south of the level crossing. The Down Platform is located 10m north of the level crossing to the west of the railway and the Up Platform is located 85m north of the level crossing. Both platforms are to be single-faced and 100m long. Passenger access between platforms is across the level crossing.

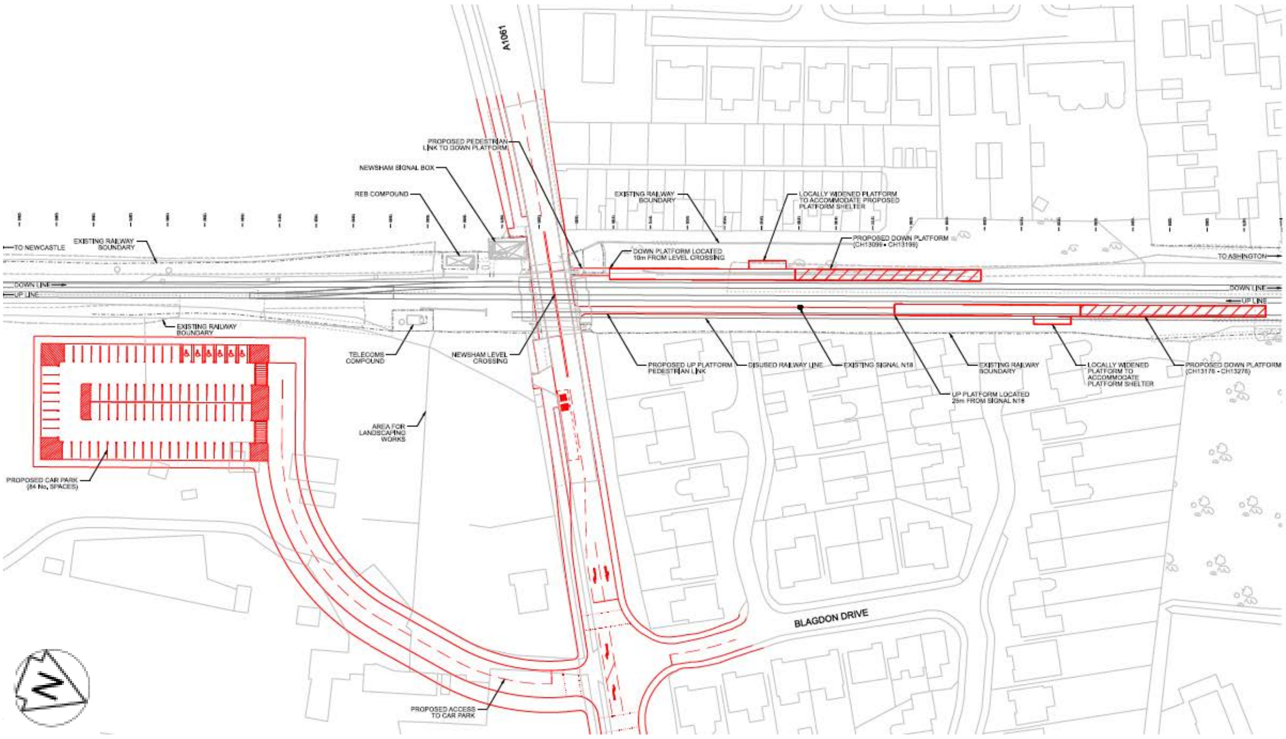


Figure 51 – Newsham Option 3 (Discounted)

Vehicle access to an off-site 84-space station car park is as per Option 1.

Pedestrian access to the platforms is via proposed footpaths between the level crossing and the platform ends.

Connectivity to the local bus network is provided by an existing westbound bus stop to the east of Newsham Level Crossing on the A1061, and an existing eastbound bus stop on the A1061 to the east of Blagdon Drive.

This option was discounted because it is likely to lead to 'kiss and ride' drop-off activity at the level crossing for travel north and southbound, with high risk of blocking the level crossing. It would also provide a car park too far from the platforms and would encourage crossing the A1061 at poor crossing points.

13.1.3.5 Options Appraisal

A summary of the options appraisal is provided in ***Table 18***. This table outlines the key considerations which led to the selection of the preferred option.

Colour coding is used to provide a high-level indication of the performance of the individual options measured against the categories listed. 'Green' presents a positive assessment against the specific category under consideration; 'amber' indicates some potential issues with the option; and 'red' highlights significant issues in meeting potential objectives associated with that category.

The categories listed are location specific and were identified as key considerations during multidisciplinary workshops as the project developed.

Category	Option 1	Option 2A (Preferred)	Option 2B	Option 3
Proximity to Newsham residential areas	Multidisciplinary constraints have ensured that the only feasible station locations are south of Newsham's primary residential areas. Nonetheless, proposed access improvements ensure reasonable pedestrian, cycle and other modes access is achievable.	Multidisciplinary constraints have ensured that the only feasible station locations are south of Newsham's primary residential areas. Nonetheless, proposed access improvements ensure reasonable pedestrian, cycle and other modes access is achievable.	Multidisciplinary constraints have ensured that the only feasible station locations are south of Newsham's primary residential areas. Nonetheless, proposed access improvements ensure reasonable pedestrian, cycle and other modes access is achievable.	Multidisciplinary constraints have ensured that the only feasible station locations are south of Newsham's primary residential areas. Nonetheless, proposed access improvements ensure reasonable pedestrian, cycle and other modes access is achievable.
Track Alignment	Across proposed double track extension.	On proposed double track extension.	On proposed double track extension.	On existing track alignment.
Construction	No complex features. Staggered platform locations will reduce the ease of construction.	Footbridge is required to be installed. Access from the roundabout is beneficial for construction traffic.	Footbridge is required to be installed.	No complex features. Constrained platform locations will reduce the ease of construction.
Car Parking	Sufficient car parking provided to meet the forecasted demand.	Sufficient car parking provided to meet the forecasted demand.	Sufficient car parking can be supplied for the forecasted demand.	Sufficient car parking can be supplied for the forecasted demand. However car parking is offsite.
Highway Network	Proposed access junction on the A1061 could contribute to blocking back over the level crossing. Signalised junction would allow some control over queue lengths and provided right turn storage aims to minimise risk of blocking back.	Additional access arm off the A1061 roundabout causes minimal disruption to existing Highway. Full details of the modelling undertaken, and likely impacts can be found in the Local Junction Modelling Report ***Appendix O.***	Proposed access junction on the A1061 could contribute to blocking back over the level crossing. Signalised junction would allow some control over queue lengths and provided right turn storage aims to minimise risk of blocking back.	Proposed access junction on the A1061 could contribute to blocking back over the level crossing. Signalised junction would allow some control over queue lengths and provided right turn storage aims to minimise risk of blocking back.
Level Crossing	Risk of Down Platform passengers attempting risky manoeuvres at the level crossing. Requirement to cross both the road and railway to get to and from the car park and the Up Platform increases risk of pedestrians jumping rail safety barriers during down times, especially if running late for a train	Footbridge provided with access from both platforms and both sides of the railway. Platform positioned 75m away from crossing to minimise barrier down time.	Footbridge provided with access from both platforms and both sides of the railway. Platform positioned 75m away from crossing to minimise barrier down time. Location of the car park access proposed a potential blocking back risk over the level crossing.	Risk of Down Platform passengers attempting risky manoeuvres at the level crossing. Requirement to cross both the road and railway to get to and from the car park and the Up Platform increases risk of pedestrians jumping rail safety barriers during down times, especially if running late for a train

Category	Option 1	Option 2A (Preferred)	Option 2B	Option 3
	service on an opposing platform. Location of the car park access proposed a potential blocking back risk over the level crossing.			service on an opposing platform. Up Platform passengers are also required to cross the A1061. Challenging to provide suitable crossing facilities to meet the pedestrian station desire lines, due to the risk of mainline traffic blocking back across the rail crossing. Location of the car park access proposed a potential blocking back risk over the level crossing.
Public Transport Links	Existing westbound bus stop is adjacent to the station car park. Existing eastbound bus stop is approximately 150m further east. No provision for taxi / drop off or bus drop off considered in this option.	Proposed bus stop provided within station layout. Likely to be viable for bus operators due to the short route diversion required and simple access arrangements provided by this option.	Proposed bus stop provided within station layout. Relatively minor bus route diversion should be viable for bus operators. However, further increase in bus journey times over the preferred option anticipated.	Existing westbound bus stop is adjacent to the station car park. Existing eastbound bus stop is approximately 150m further east. No provision for taxi / drop off or bus drop off considered in this option.
Pedestrian / Cycle Access	Pedestrian / cycle access is provided from the A1061 at both sides of the level crossing. Pedestrian access from the proposed car park is relativity poor. Whilst pedestrian facilities are provided at the station access junction to facilitate crossing the A1061, the route to the platforms is convoluted. Moreover, provision of a more direct pedestrian route closer to the rail line is problematic as it risks encouraging informal passenger drop off by vehicles on the A1061, which could	Pedestrian / cycle access is provided from the A1061 at both sides of the level crossing. Pedestrian access to both station platforms is achieved via the station footbridge/ lifts. The existing A1061 shared space pedestrian / cycle way is retained with a suitable refuge crossing provided across the new station access arm of the A1061 roundabout to ensure route continuation.	Pedestrian / cycle access is provided from the A1061 at both sides of the level crossing. Pedestrian access throughout the station is achieved via the station footbridge/ lifts. Wide shared space footway is provided on the southern A1061 footway to preserve the existing cycle route along this corridor. Similarly, toucan crossing facilities within the access junction facilitate pedestrian and cycle movements.	Pedestrian / cycle access is provided from the A1061 at both sides of the level crossing. Pedestrian access from the proposed car park is relativity poor. Whilst pedestrian facilities are provided at the station access junction to facilitate crossing the A1061, the route to the platforms is convoluted. Moreover, provision of a more direct pedestrian route closer to the rail line is problematic as it risks encouraging informal passenger drop off by vehicles on the A1061, which could

Category	Option 1	Option 2A (Preferred)	Option 2B	Option 3
	increase traffic delay and lead to blocking back issues. Wide shared space footway is provided on the southern A1061 footway to preserve the existing cycle route along this corridor. Similarly, toucan crossing facilities within the access junction facilitate pedestrian and cycle movements.			increase traffic delay and lead to blocking back issues. Wide shared space footway is provided on the southern A1061 footway to preserve the existing cycle route along this corridor. Similarly, toucan crossing facilities within the access junction facilitate pedestrian and cycle movements.
Land Take	Land purchase negotiation required.	Land purchase negotiation required. Footbridge also takes land from the east of the railway boundary.	Land purchase negotiation required. Footbridge also takes land from the west of the railway boundary.	Land purchase negotiation required.

Table 18 – Newsham Options Appraisal

13.1.4 Blyth Bebside

13.1.4.1 Option 1 (Discounted)

A discounted station and car park location at Blyth Bebside, Option 1, is located approximately 450m north of Bebside Level crossing and both sides of the railway corridor as shown in ***Figure 52.*** This option is based on the existing twin track railway alignment. Two single-faced 100m long platforms are positioned approximately 450m north of the level crossing on the existing railway embankment with passenger access between platforms provided by an underpass with stairs and a lift. The location of the platforms was at the time driven by a preliminary signalling methodology to avoid a southbound train triggering the Blyth level crossing barriers on the approach to the station and causing long barrier down times. A refined signalling strategy reduced the necessary distance to the level crossing for platform positioning.

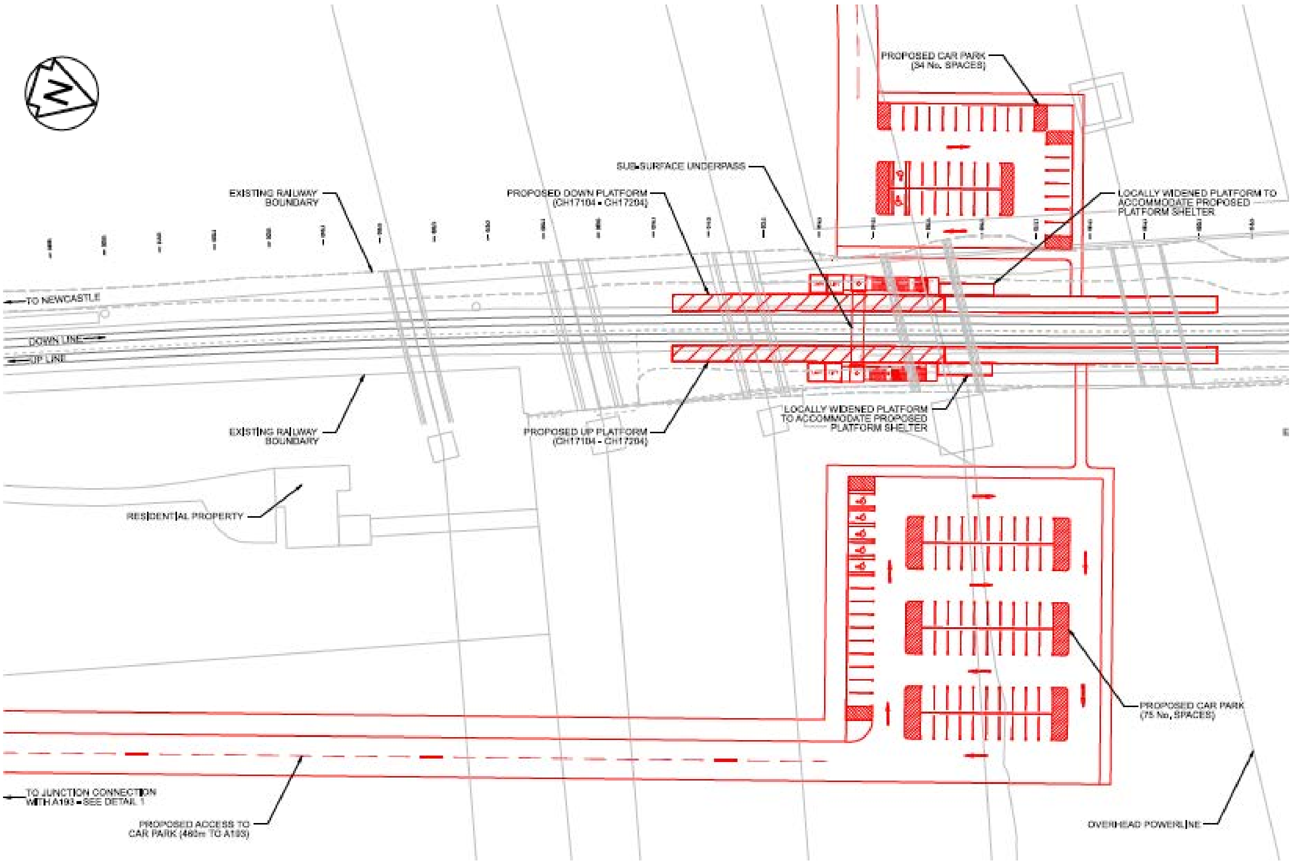


Figure 52 – Blyth Bebside Option 1 (Discounted)

Vehicular access from the west is provided via a new priority junction from Bebside Furnace Road and a new station access road, leading to a 34-space western station car park. Vehicular access from the east is provided by a revised priority junction from Front Street which currently forms part of the petrol station access. This junction provides access to a new station access road leading to a 75-space eastern station car park. Pedestrian / cycle access to the station is provided via the access road footways.

Connectivity to the local bus network is provided by two existing bus stops on Front Street to the west of Bebside Level Crossing. It is anticipated that bus operators would regard the bus route divergence required to serve the station directly as unviable, due to significant journey time increases and modest projected rail/ bus interchange demand.

The platforms are located on the stretch of track alignment where the track is deviating from its original alignment to cross over Bedlington Viaduct. Placing the station here would present a serious constraint on any future replacement of the River Blyth crossing.

This option was primarily rejected because the anticipated level difference between rail level and neighbouring ground level was not as much as expected, making a subway quite expensive to construct – and a footbridge is ruled out because of the Extra High Voltage overhead cables. The station was considered too far from Front Street and it included a difficult access between the Jet garage and Bebside house, as well as multiple land purchase agreements adding complexity.

13.1.4.2 Option 2 (Discounted)

A discounted station and car park location at Blyth Bebside, Option 2, is located approximately 300m north of Bebside Level crossing and both sides of the railway corridor as shown in ***Figure 53***. This option is based on the existing twin track railway alignment. Two single-faced 100m platforms are positioned approximately 300m north of the level crossing with passenger access between platforms provided by a footbridge with stairs and lifts.

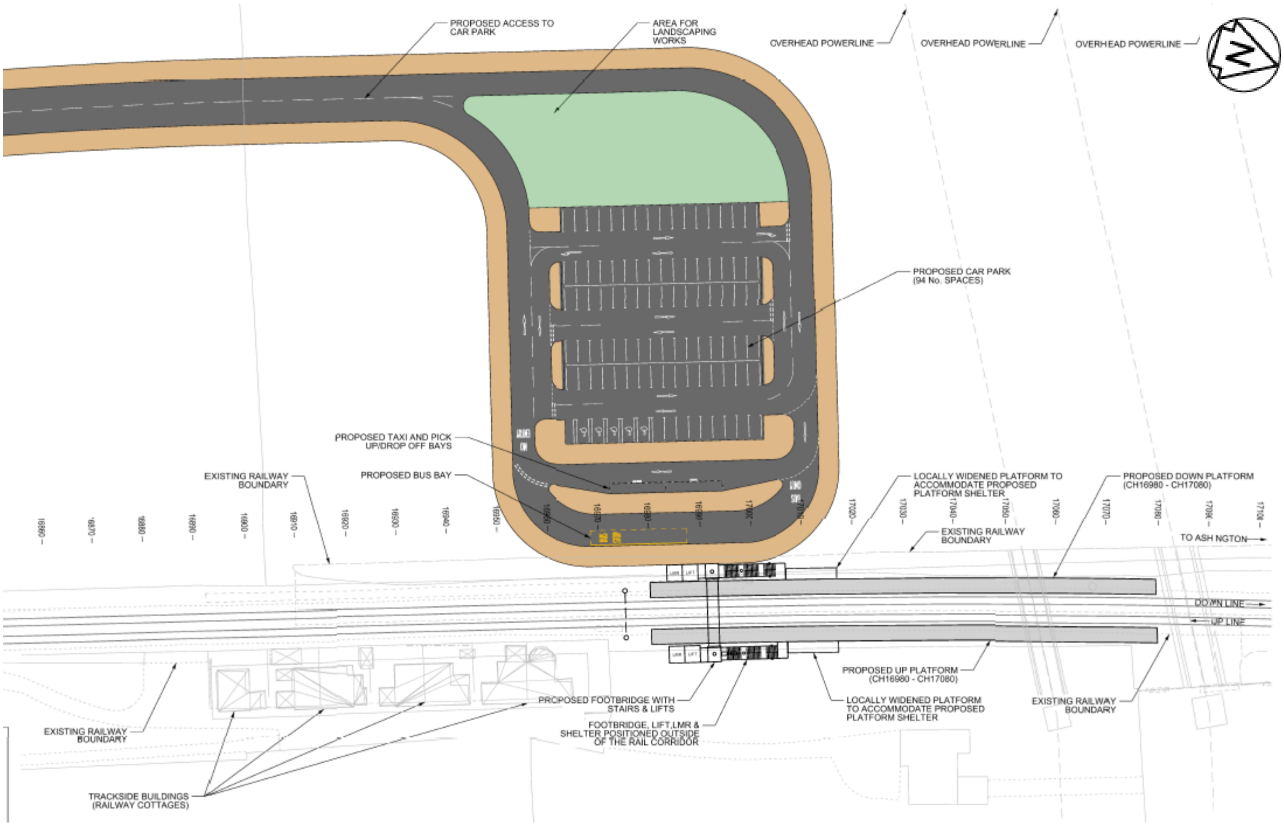


Figure 53 – Blyth Bebside Option 2 (Discounted)

Vehicular access is provided by a new junction from Front Street to the west of Bebside Level Crossing and a new station access road leading to a 95-space station car park west of the railway corridor.

Pedestrian / cycle access to the station is provided along footways adjacent to the vehicular access road.

Connectivity to the local bus network is provided by two existing bus stops on Front Street to the west of Bebside Level Crossing.

Although this option brought the platforms closer to Front Street and enabled use of a footbridge rather than a subway, this option was rejected because of the complexity of and acquisition from the multiple land-owners affected. The location would also likely attract pedestrian (and some kiss-and-ride) traffic accessing via the Railway Cottages to the east of the railway, which would likely trigger objections.

13.1.4.3 Option 3 (Discounted)

Option 3 is a discounted station and car park location at Blyth Bebside shown in ***Figure 54***. This option is a similar layout to that presented for Option 2, ***section 13.1.4.2*** except it is located just 75m north of Bebside Level crossing, bringing accessibility benefits in comparison to Option 2.

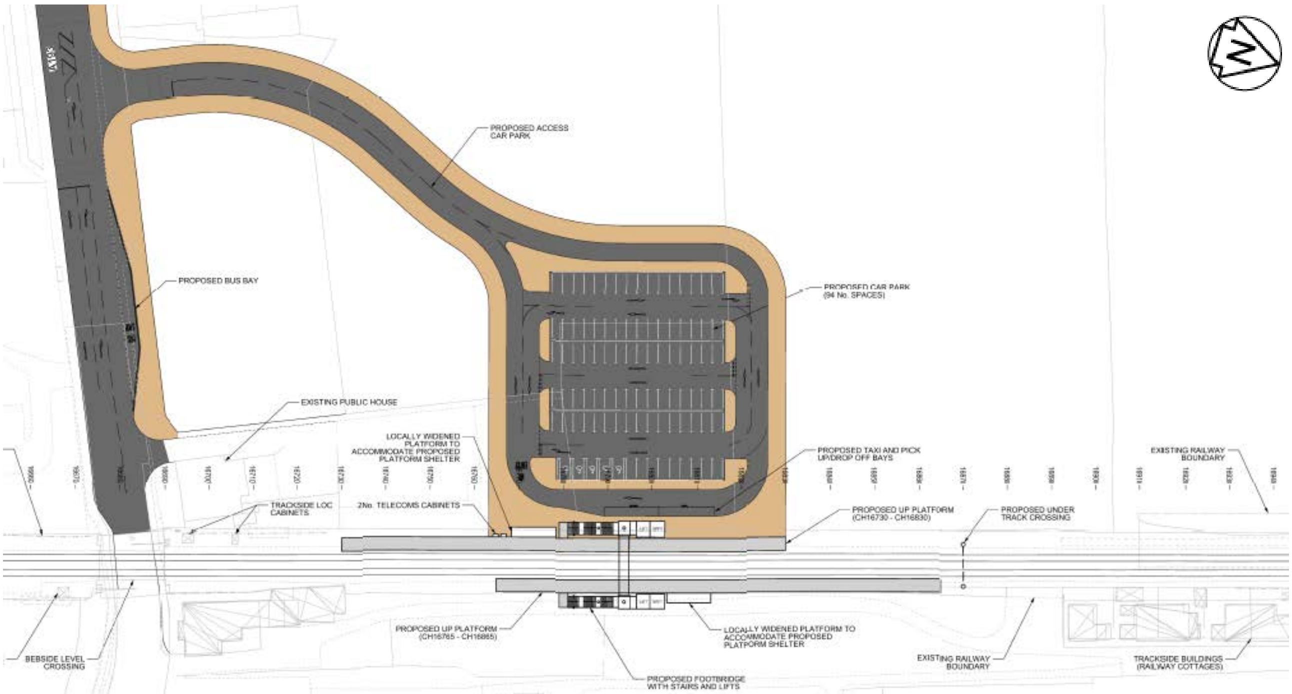


Figure 54 – Blyth Bebside Option 3 (Discounted)

This option was rejected for broadly the same reasons as Option 2, although it reduced the walking distance from Front Street and, as the best option available at the time, was the option presented for public consultation in September 2019. Concerns raised at consultation included the potential impact on properties to the east side of the railway corridor, with risk of trespass and localised parking blocking access for residents.

13.1.4.4 Option 4 (Viable, Non-Preferred)

A viable, non-preferred, station and car park location at Blyth Bebside, Option 4, is located approximately 75m south of Bebside Level Crossing as shown in ***Figure 55.*** This option is based on the existing twin track railway alignment. Two single-faced 100m long platforms are positioned approximately 75m south of the level crossing with passenger access between platforms provided by a footbridge with stairs and lifts.

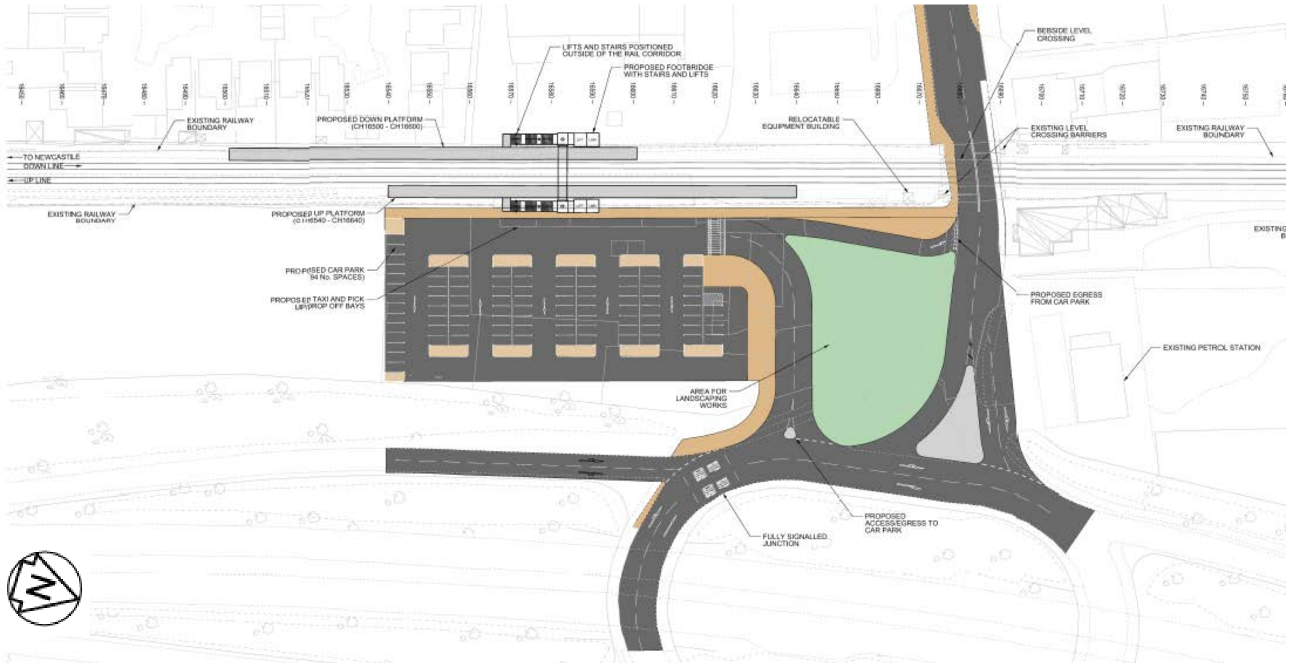


Figure 55 – Blyth Bebside Option 4 (Viable Non-Preferred)

Vehicular access and egress is provided via an additional arm on the A189 roundabout, providing access to a 94-space station car park. The existing exit from the roundabout to Front Street is to be re-aligned towards the existing petrol station to facilitate the additional junction arm. A secondary exit only link from the station car park is proposed to join directly onto Front Street approximately 20m east of the Bebside Level Crossing. Signing and carriageway alignment of the exit only link would ensure a 'left only' exit movement to avoid potential blocking back and safety issues associated with a right turn in this location.

Pedestrian and cycle access to the station is provided via access road footways. Pedestrian improvements to the wider Bebside grade separated junction would also require further consideration to support connectivity with Cowpen Road, Blyth.

Connectivity to the local bus network is provided by two existing bus stops on Front Street to the west of Bebside Level Crossing.

This option was rejected primarily because of concerns regarding the connection with the roundabout causing congestion, and because approximately two-thirds of traffic is expected to approach from the west, which would have to access the car park via the roundabout once the existing car park is full.

13.1.4.5 Option 5 (Preferred)

Option 5 is the preferred option at Blyth Bebside. See ***section 5.1.4*** for details of this option.

13.1.4.6 Options Appraisal

A summary of the options appraisal is provided in ***Table 19***. This table outlines the key considerations which led to the selection of the preferred option.

Colour coding is used to provide a high-level indication of the performance of the individual options measured against the categories listed. 'Green' presents a positive assessment against the specific category under consideration; 'amber' indicates some potential issues with the option; and 'red' highlights significant issues in meeting potential objectives associated with that category.

The categories listed are location specific and were identified as key considerations during multidisciplinary workshops as the project developed.

Category	Option 1	Option 2	Option 3	Option 4	Option 5
Proximity to Blyth & Bebside residential areas	Not close to either conurbation. The existing track alignment does not directly serve central Blyth residential areas. Strong provision for central Blyth is an inherent limitation of the scheme. This location also poorly serves existing residential areas in Bebside,	Not close to either conurbation. The existing track alignment does not directly serve central Blyth residential areas. Strong provision for central Blyth is an inherent limitation of the scheme. This location also poorly serves existing residential areas in Bebside, with only marginal improvement over Option 1 in terms of proximity.	The existing track alignment does not directly serve central Blyth residential areas. Strong provision for central Blyth is an inherent limitation of the scheme. This location is within acceptable walking access of Bebside and close to the A189.	This station location is the closest to Blyth of the considered feasible options. However, proximity and access for the local Blyth community remains poor. This location is within acceptable walking access of Bebside and close to the A189.	The existing track alignment does not directly serve central Blyth residential areas. Strong provision for central Blyth is an inherent limitation of the scheme. This location offers the closest proximity to Bebside of the considered feasible options.
Track Alignment	On existing track alignment but would restrict future realignment to assist with any future viaduct replacement.	On existing track alignment.	On existing track alignment.	On existing track alignment.	On existing track alignment.
Construction	Underpass is required beneath the railway due to presence of overhead cables in this location. Significant additional project risk and cost.	Footbridge is required to be installed.	Footbridge is required to be installed.	Footbridge is required to be installed.	Footbridge is required to be installed.
Car Parking	Sufficient station car parking provided to meet the forecasted demand.	Sufficient station car parking provided to meet the forecasted demand.	Sufficient station car parking provided to meet the forecasted demand.	Sufficient station car parking provided to meet the forecasted demand.	Sufficient station car parking provided to meet the forecasted demand.
Highway Network	New priority junction on Front Street. Heavily constrained access adjacent to petrol station. Conflicts require careful consideration due to multiple use	New signalised junction on Front Street to the west of rail line. Junction access less constrained than options located to the east of the rail line.	New signalised junction on Front Street to the west of rail line. Junction access less constrained than options located to the east of the rail line.	Station access onto the A189 Bebside junction is problematic. The existing junction is considered overcapacity during peak periods, with queuing on the circulatory observed.	Revised Errington Street/ Front Street priority junction. Preferred option junction modelling indicates the junction would operate within capacity in both

Category	Option 1	Option 2	Option 3	Option 4	Option 5
	access and close proximity. Risk that vehicles turning right into access road could cause the mainline to block back onto the A189 Bebside roundabout.			Additional arm risks conflict, collisions and exacerbation of congestion issues. Banned right turn out of secondary exit on Font Street difficult to enforce with limited room for physical constraint preventing movement, increasing risk of conflicts.	opening and design years. Full details of the modelling undertaken, and likely impacts can be found in the Local Junction Modelling Report (***Appendix O***).
Level Crossing	Access located east of the rail line reduces risk of blocking back over the rail crossing due to right turning vehicles.	Risk that vehicles turning right into access road could potentially block back across the level crossing. Signalised junction provides some control over queue lengths to mitigate risk.	Risk that vehicles turning right into access road could potentially block back across the level crossing. Signalised junction provides some control over queue lengths to mitigate risk.	Left turning road traffic from the car park may block back into car park when rail barrier is down.	Junction located further west than alternative options, significantly reducing risk of blocking back across the level crossing.
Public Transport Links	Existing bus stops on Front Street require pedestrians to cross level crossing then walk approximately 450m to the station. It is anticipated that bus operators would regard the bus route divergence required to serve the station directly as unviable, due to significant journey time increases and modest projected rail/ bus interchange demand	Existing bus stops on Front Street require pedestrians to walk approximately 300m to the station. Bus route diversion may prove unviable for bus operators. However, reduced bus journey times over Option 1.	Eastbound bus stop incorporated in to highway layout. Westbound bus stop to be relocated east of the junction. Offers relativity accessible bus/rail interchange in comparison with other options.	Existing bus stops on Front Street require pedestrians to cross level crossing to access the station.	Existing bus stops on Front Street approximately 300m from the station. However, new pedestrian route through the Heather Lea housing estate provided to enhance bus/ rail interchange.
Pedestrian / Cycle Access	Pedestrian and cycle access is poor due to isolated platforms located a significant distance from Front Street and other facilities.	Pedestrian and cycle access is poor due to isolated platforms located a significant distance from Front Street and other facilities.	Station is located close to the road network and pedestrian facilities. However, access from Blyth and the east requires	Station is located close to the road network and pedestrian facilities. Pedestrian improvements to the	Platforms are located significant distance from the road network and pedestrian facilities. However, new pedestrian route

Category	Option 1	Option 2	Option 3	Option 4	Option 5
			crossing the level crossing.	wider Bebside grade separated junction would also require further consideration to support connectivity with Cowpen Road, Blyth.	through the Heather Lea housing estate provided to enhance bus/ rail interchange. Potential to provide a pedestrian / cycle bridge across the A189 east of the station to provide direct access from more central Blyth residential areas. This is a future aspiration of NCC but not considered as part of this project.
Land Take	Car park and access road crosses multiple land parcels. Multiple land purchases required.	Car park and access road crosses multiple land parcels. Multiple land purchases required.	Car park and access road crosses multiple land parcels. Multiple land purchases required.	Land purchase negotiation required.	Land purchase negotiation required.

Table 19 – Blyth Bebside Options Appraisal

13.1.5 Bedlington

13.1.5.1 Option 1A (Preferred)

Option 1A is the preferred option at Bedlington. See ***section 5.1.5*** for details of this option.

13.1.5.2 Option 1B (Viable, Non-Preferred)

Option 1B is a viable, non-preferred, option at Bedlington shown in ***Figure 56***. This option is the same as Option 1A with the addition of a footbridge adjacent to Bedlington South Level Crossing.

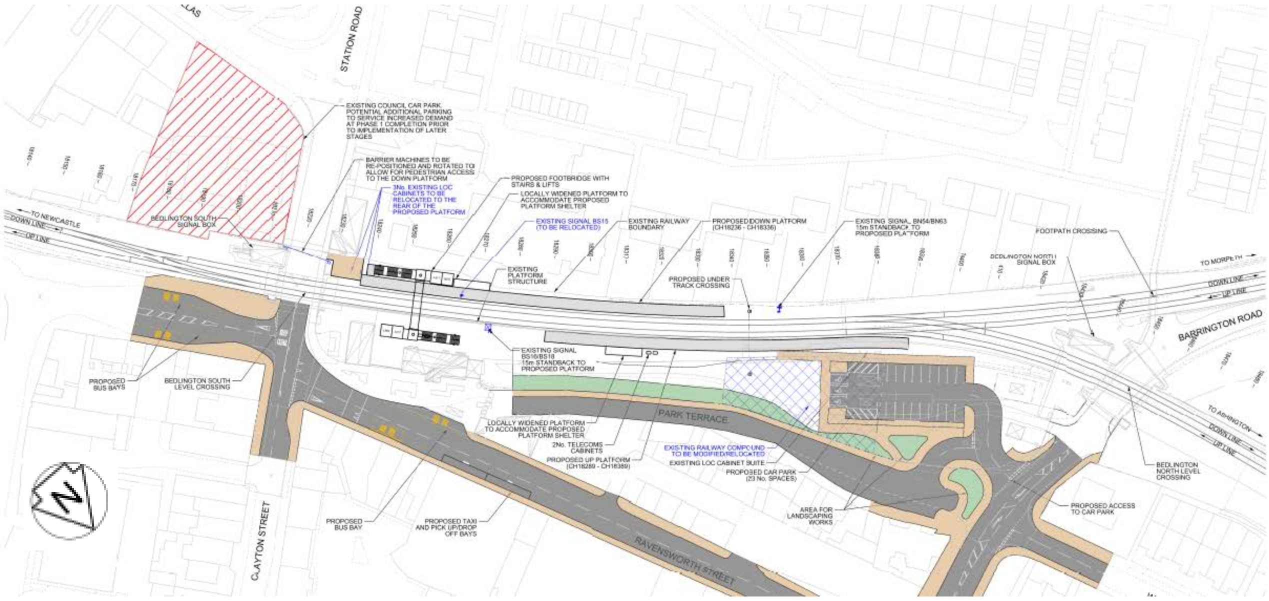


Figure 56 – Bedlington Option 1B (Viable Non-Preferred)

This option was primarily rejected because the platform extends adjacent to the Bedlington north junction and would result in the train stopping on the switches, which is bad practice. The addition of the footbridge was costly, and of limited benefit to users given the proximity of the level crossing.

13.1.5.3 Option 2 (Discounted)

A discounted option for the station and car park location at Bedlington, Option 2, is located with platforms staggered across Bedlington South Level Crossing with a car park to the north east as shown in ***Figure 57***. This option is based on the existing railway alignment, therefore two lines run through the platforms with a double junction to the north being renewed like for like. The Down Platform is located 10m north of the level crossing to the west of the railway and the Up Platform is located 40m south of the level crossing. Both platforms are to be single-faced and 100m long. Passenger access between platforms is across the level crossing and Station Road, then along the proposed pathway behind the re-aligned level crossing barrier.

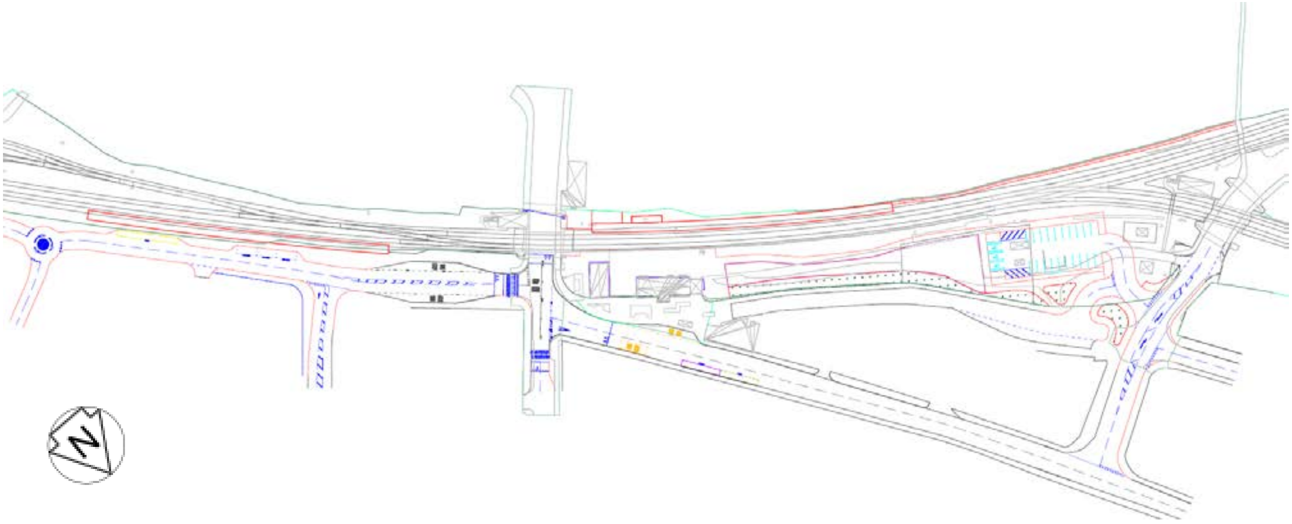


Figure 57 – Bedlington Option 2 (Discounted)

Vehicular access is provided via a re-prioritised junction between Barrington Road and Park Terrace to give priority to vehicles entering the new 23-space car park.

Pedestrian access to the Up Platform is via new access ramps and stair from Palace Road onto the back of the platform structure. Pedestrian access to the Down Platform is provided by a new pathway to the west of the level crossing opened by re-aligning the western barrier of the crossing.

Connectivity to the local bus network is provided via two existing bus stops on Ravensworth Street and two existing bus stops on Palace Road.

This option was primarily rejected because of the complexity of modifications to the highway network that would be likely to discourage the probable driver behaviours concerning drop-offs and pedestrians crossing the highway adjacent to the level crossing. Isolation of the car park from either platform is also unfavourable.

13.1.5.4 Options Appraisal

A summary of the options appraisal is provided in ***Table 20***. This table outlines the key considerations which led to the selection of the preferred option.

Colour coding is used to provide a high-level indication of the performance of the individual options measured against the categories listed. 'Green' presents a positive assessment against the specific category under consideration; 'amber' indicates some potential issues with the option; and 'red' highlights significant issues in meeting potential objectives associated with that category.

The categories listed are location specific and were identified as key considerations during multidisciplinary workshops as the project developed.

Category	Option 1A (Preferred)	Option 1B	Option 2
Proximity to Bedlington residential areas	Central town location considering constraints of the existing rail alignment, which runs to the east of large areas of Bedlington.	Central town location considering constraints of the existing rail alignment, which runs to the east of large areas of Bedlington.	Central town location considering constraints of the existing rail alignment, which runs to the east of large areas of Bedlington.
Track Alignment	On existing track alignment. Radius to north end of the Up Platform causes non-compliant stepping distance. This needs to	On existing track alignment. Radius to north end of the Up Platform causes non-compliant stepping distance. This needs to	On existing track alignment.

Category	Option 1A (Preferred)	Option 1B	Option 2
	be resolved at the next design stage with either clarity of rolling stock, a signal stand back reduction, or SDO.	be resolved at the next design stage with either clarity of rolling stock, a signal stand back reduction, or SDO.	
Construction	No complex features.	Footbridge is required to be installed.	No complex features. Staggered platform locations will reduce the ease of construction.
Car Parking	Sufficient station car parking provided to meet the forecasted demand for Phase 2. However, prior to the building of Seaton Delaval station demand for car parking is higher. Parking surveys show that some spare car parking capacity is available in the vicinity of the station, for example Melrose Villas council car park to the south west of Bedlington South Level Crossing. However, there is insufficient capacity to meet Phase 1 forecast demand.	Sufficient station car parking provided to meet the forecasted demand for Phase 2. However, prior to the building of Seaton Delaval station demand for car parking is higher. Parking surveys show that some spare car parking capacity is available in the vicinity of the station, for example Melrose Villas council car park to the south west of Bedlington South Level Crossing. However, there is insufficient capacity to meet Phase 1 forecast demand.	Sufficient station car parking provided to meet the forecasted demand for Phase 2. However, prior to the building of Seaton Delaval station demand for car parking is higher. Parking surveys show that some spare car parking capacity is available in the vicinity of the station, for example Melrose Villas council car park to the south west of Bedlington South Level Crossing. However, there is insufficient capacity to meet Phase 1 forecast demand.
Highway Network	Revised priority junction arrangements at Barrington Road/ Park Terrace to provide suitable access to the station car park. Preferred option junction modelling indicates the access junction would operate within capacity in both opening and design years. Similarly, network modelling of Station Road / Melrose Villas, Barrington Road / Ravensworth Street (North), and Clayton Street\ Palace Road / Station Road / Ravensworth Street indicates all junctions would operate within capacity with no significant impact from station traffic. Full details of the modelling undertaken, and likely traffic impacts can be found in the Local Junction Modelling Report ***(Appendix O).***	Revised priority junction arrangements at Barrington Road/ Park Terrace to provide suitable access to the station car park. Preferred option junction modelling indicates the access junction would operate within capacity in both opening and design years. Similarly, network modelling of Station Road / Melrose Villas, Barrington Road / Ravensworth Street (North), and Clayton Street\ Palace Road / Station Road / Ravensworth Street indicates all junctions would operate within capacity with no significant impact from station traffic. Full details of the modelling undertaken, and likely traffic impacts can be found in the Local Junction Modelling Report (***Appendix O).***	Potential traffic issues due to informal passenger Drop off adjacent to Up Platform and block back risk over junction and level crossing.

Category	Option 1A (Preferred)	Option 1B	Option 2
Level Crossing	Passengers are required to cross the railway over Bedlington South Level Crossing to get to the Down Platform. Increased barrier down times for road traffic. The Down boom is proposed to be realigned.	Passengers can cross the railway via the footbridge. Increased barrier down times for road traffic. The Down boom is proposed to be realigned.	Passengers are required to cross Station Road to get to the Up Platform and are required to cross the railway to get to the Down Platform at Bedlington South Level crossing. Increased barrier down times for road traffic. The Down boom is proposed to be realigned.
Public Transport Links	Existing bus stops directly outside the station, with further stops and services found on Palace Road.	Existing bus stops directly outside the station, with further stops and services found on Palace Road.	Existing bus stops directly outside the station, with further stops and services found on Palace Road.
Pedestrian / Cycle Access	Pedestrian / Cycle access is provided from the existing road network. Passengers are required to cross the railway over Bedlington South Level Crossing to get to the Down Platform. Pedestrian crossing improvements proposed on Ravensworth Street in the form of a raised table crossing. Shared footpaths provided to provide direct connection between the car park and station platform.	Pedestrian / Cycle access is provided from the exiting road network. Passengers can use the footbridge to cross the railway. Pedestrian crossing improvements proposed on Ravensworth Street in the form of a raised table crossing. Shared footpaths provided to provide direct connection between the car park and station platform.	Passengers are required to cross Station Road to get to the Up Platform and are required to cross the railway to get to the Down Platform at Bedlington South Level crossing.
Land Take	Station on existing Network Rail land. Railway compound to be moved and new location sought.	Footbridge landing will need small land purchase on Down side. Railway compound to be moved and new location sought.	Station on existing Network Rail land. Railway compound to be moved and new location sought.

Table 20 – Bedlington Options Appraisal

13.1.6 Ashington

13.1.6.1 Option 1 (Discounted)

A discounted station and car park location at Ashington, Option 1, is located adjacent to the council car park off Kenilworth Road and to the west of the railway corridor as shown in ***Figure 58.*** This option is based on the existing twin track alignment. A single 100m platform is to be positioned 5m south of the existing redundant platform structure.

Figure 58 – Ashington Option 2 (Discounted)

Vehicular access is provided via the existing access road off Kenilworth Road into a revised car park on the site of the existing car park to better meet the needs of station traffic.

Pedestrian access from the north is via an existing access ramp from Wansbeck Square leading down to car park and platform level. Pedestrian / cycle access from the south is via existing routes to the proposed revised car park. Pedestrian access from the north is via an existing access ramp from Wansbeck Square leading down to car park and platform level and is not currently not DDA complaint. An interfacing project lead being considered by Advance Northumberland is looking into redeveloping Wansbeck Square to create an attractive public realm space into which station access could be integrated.

Connectivity to the local bus network is provided via two existing bus stops on Station Road adjacent to Wansbeck Square. It is noted that bus services do not currently serve these stops. It is anticipated that it may become viable to stop services at these stops once a rail station is in operation. Further existing bus services are located to the east, with Ashington Bus Station located east of Station Road.

This option was discounted on the basis that a passenger train could not block the Down line for the expected length of dwell time at Ashington without blocking a freight path. When an additional branch line was considered utilising the redundant Butterwell branch in order to sit the passenger train clear of the main line, the additional infrastructure required to support this was clearly unfavourable against other options. As a result, no further work was undertaken on this option.

13.1.6.2 Option 2 (Discounted)

A discounted station and car park location at Ashington, Option 2, is similar to the preferred Option 4, see ***section 5.1.6,*** however in Option 2 the new platform and Platform Line are located closer to Wansbeck Square. The station and car park layout is essentially the same, however this Option has no means to extend the service north in the future without rebuilding Ashington Station, which would incur a considerable cost and disruption at that time.

Vehicular access is provided via the existing access road off Kenilworth Road into a re-modelled car park on the site of the existing car park.

Pedestrian access from the north is via an existing access ramp from Wansbeck Square leading down to car park and platform level. Pedestrian / cycle access from the south is via existing routes to the proposed re-modelled car park.

Connectivity to the local bus network is provided via two existing bus stops on Station Road adjacent to Wansbeck Square. It is noted that bus services do not currently serve these stops. It is anticipated that it may become viable to stop services at these stops once a rail station is in operation. Further existing bus services are located to the east, with Ashington Bus Station located east of Station Road.

13.1.6.3 Option 3 (Viable, Non-Preferred)

A viable, non-preferred, station and car park location at Ashington, Option 3, is located adjacent to the council car park off Kenilworth Road and to the west of the existing railway corridor as shown in ***Figure 59***. This option is based on a new Platform Line coming off the Down Line which runs to a proposed buffer stop. The two existing lines run to the east of the platform and a single proposed platform line runs to the west of the island platform. A single 100m long island platform is to be positioned between the proposed spur line and the existing Down line. The platform is to operate as a single faced platform at the end of this project, with the Down line edge fenced to avoid passengers encroaching onto the Down line. This platform edge is to be installed to provide passive provision for future development north of Ashington.

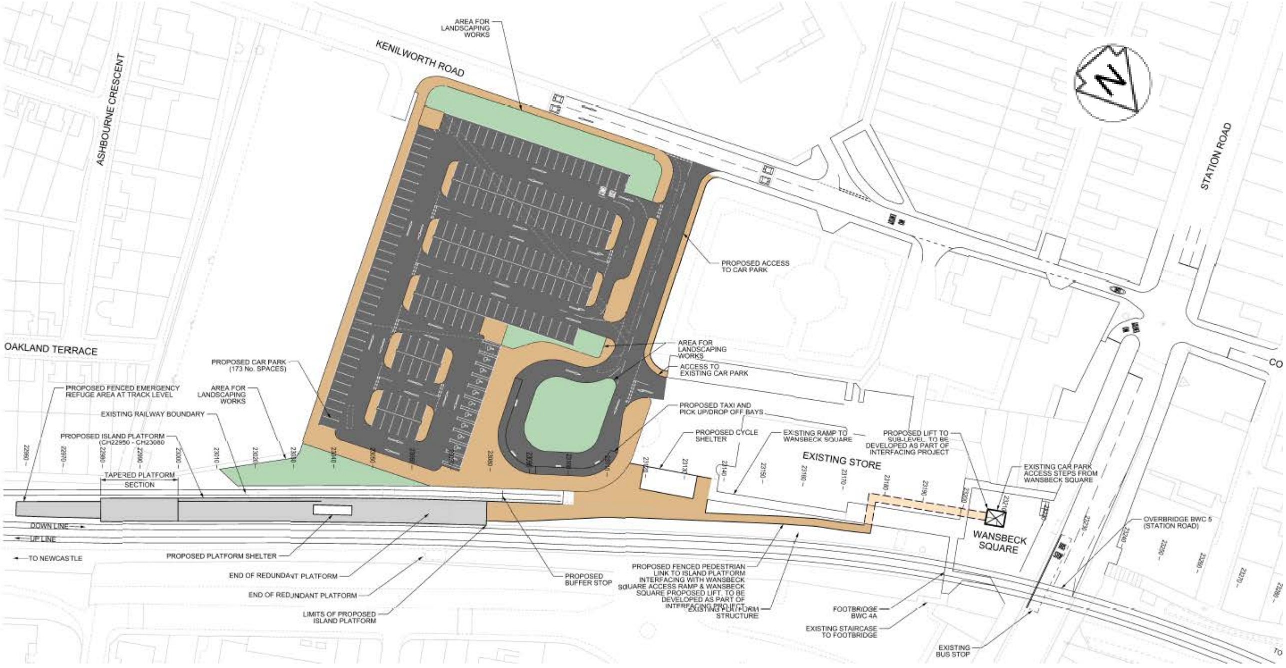


Figure 59 – Ashington Option 3 (Viable Non-Preferred)

Vehicular access is provided by widening the existing access road off Kenilworth Road which will run into a revised and enlarged 173-space car park.

Pedestrian access from the north is via an existing access ramp from Wansbeck Square leading down to car park and platform level. The existing access ramp is not DDA complaint. An interfacing project led by Advance Northumberland is looking into redeveloping Wansbeck Square to create an attractive public realm space as per the previous option. As part of this scheme a lift would potentially be installed within Wansbeck Square to take passengers down to the platform level via an additional walkway beneath the existing store. Pedestrian / cycle access from the south is via existing routes to the proposed re-modelled car park.

Connectivity to the local bus network is provided via two existing bus stops on Station Road adjacent to Wansbeck Square. It is noted that bus services do not currently serve these stops. It is anticipated that it may become viable to stop services at these stops once a rail station is in operation. Further existing bus services are located to the east, with Ashington Bus Station located east of Station Road.

This Option is close to being preferred, the only significant issue is providing a secondary means of evacuation from a single ended island platform. Any future extension to the North can proceed without any alteration to Ashington, this is not the case for any other option, and the platform line could be retained as a stabling point or turnback alternative. The only real negative is the fire evacuation issue, although potential extended walking routes could also be a factor if not addressed through the use of sacrificial panels over the buffer well.

13.1.6.4 Option 4 (Preferred)

Option 4 is the preferred option at Ashington. See ***section 5.1.6*** for details of this option.

13.1.6.5 Options Appraisal

A summary of the options appraisal is provided in ***Table 21***. This table outlines the key considerations which led to the selection of the preferred option.

Colour coding is used to provide a high-level indication of the performance of the individual options measured against the categories listed. 'Green' presents a positive assessment against the specific category under consideration; 'amber' indicates some potential issues with the option; and 'red' highlights significant issues in meeting potential objectives associated with that category.

The categories listed are location specific and were identified as key considerations during multidisciplinary workshops as the project developed.

Category	Option 1	Option 2	Option 3	Option 4 (Preferred)
Proximity to Ashington residential areas	Close proximity is achieved.	Close proximity is achieved.	Close proximity is achieved.	Close proximity is achieved.
Track Alignment	On existing alignment, however the train needs to stable in the station for a period between journeys. During this time a freight train needs to be able to pass the station therefore an additional turnback facility would be required north of the station. Further detail can be found in ***section 13.3.8***	Platform is on a new Platform Line with no future access to the north. Further detail can be found in ***section 13.3.8***	Platform is between a new Platform Line and the Down line. Northwards access is preserved without any further alteration necessary. Further detail can be found in ***section 13.3.8***	Platform is on a new Platform line with potential to install a northbound connection in future. Further detail can be found in ***section 5.2.1.8***
Construction	No complex features.	No complex features.	Island Platform between two lines is to be twice the width of a regular platform adding complexity and cost.	No complex features.
Car Parking	Not possible to provide sufficient station car parking within the existing car park location to meet the forecasted demand.	Not possible to provide sufficient station car parking within the existing car park location to meet the forecasted demand. Additional car parking demand has been met by	Not possible to provide sufficient station car parking within the existing car park location to meet the forecasted demand. Additional car parking demand has been met by	Not possible to provide sufficient station car parking within the existing car park location to meet the forecasted demand. Additional car parking demand has been met by

Category	Option 1	Option 2	Option 3	Option 4 (Preferred)
		expanding the existing car park to encompass the green space area east of Kenilworth Road. Further expansion to the south, or alternatively a decked or multi-storey car park, required to meet the 'higher' car park spaces demand figure. Wider strategic consideration required for Ashington central parking demand.	expanding the existing car park to encompass the green space area east of Kenilworth Road. Further expansion to the south, or alternatively a decked or multi-storey car park, required to meet the 'higher' car park spaces demand figure. Wider strategic consideration required for Ashington central parking demand.	expanding the existing car park to encompass the green space area east of Kenilworth Road. Further expansion to the south, or alternatively a decked or multi-storey car park, required to meet the 'higher' car park spaces demand figure. Wider strategic consideration required for Ashington central parking demand.
Highway Network	The station can be accessed from the north via the one-way section of Kenilworth Road. Egress to the north is possible via the existing car park exit on to Station Road/ Council Road / Kenilworth Road junction. Access to this exit is gained through the existing car park to the north of the proposed station car park site. The majority of traffic is likely to access and egress to the south via Kenilworth Road, which provides links to a variety of strategic routes. Local junction modelling shows that Station Road/ Council Road / Kenilworth Road junction operates within capacity with no significant impact from station traffic. Due to the wide number of routes available to the south, traffic will dissipate throughout the local network.	The station can be accessed from the north via the one-way section of Kenilworth Road. Egress to the north is possible via the existing car park exit on to Station Road/ Council Road / Kenilworth Road junction. Access to this exit is gained through the existing car park to the north of the proposed station car park site. The majority of traffic is likely to access and egress to the south via Kenilworth Road, which provides links to a variety of strategic routes. Local junction modelling shows that Station Road/ Council Road / Kenilworth Road junction operates within capacity with no significant impact from station traffic. Due to the wide number of routes available to the south, traffic will dissipate throughout the local network.	The station can be accessed from the north via the one-way section of Kenilworth Road. Egress to the north is possible via the existing car park exit on to Station Road/ Council Road / Kenilworth Road junction. Access to this exit is gained through the existing car park to the north of the proposed station car park site. The majority of traffic is likely to access and egress to the south via Kenilworth Road, which provides links to a variety of strategic routes. Local junction modelling shows that Station Road/ Council Road / Kenilworth Road junction operates within capacity with no significant impact from station traffic. Due to the wide number of routes available to the south, traffic will dissipate throughout the local network.	The station can be accessed from the north via the one-way section of Kenilworth Road. Egress to the north is possible via the existing car park exit on to Station Road/ Council Road / Kenilworth Road junction. Access to this exit is gained through the existing car park to the north of the proposed station car park site. The majority of traffic is likely to access and egress to the south via Kenilworth Road, which provides links to a variety of strategic routes. Local junction modelling shows that Station Road/ Council Road / Kenilworth Road junction operates within capacity with no significant impact from station traffic. Due to the wide number of routes available to the south, traffic will dissipate throughout the local network.

Category	Option 1	Option 2	Option 3	Option 4 (Preferred)
	Full details of the modelling undertaken and likely traffic impacts can be found in the Local Junction Modelling Report (***Appendix O***).	Full details of the modelling undertaken and likely traffic impacts can be found in the Local Junction Modelling Report (***Appendix O***).	Full details of the modelling undertaken and likely traffic impacts can be found in the Local Junction Modelling Report (***Appendix O***).	Full details of the modelling undertaken and likely traffic impacts can be found in the Local Junction Modelling Report ***(Appendix O***).
Connectivity to Wansbeck Square	A link to a re-developed Wansbeck Square is possible, with a walking distance to the platform of approximately 140m.	A link to a re-developed Wansbeck Square is possible, with a walking distance to the platform of approximately 150m.	A link to a re-developed Wansbeck Square is possible, with a walking distance to the platform of approximately 120m.	A link to a re-developed Wansbeck Square is possible, with a walking distance to the platform of approximately 85m.
Public Transport Links	Existing Bus stops are positioned on Station Road adjacent to Wansbeck Square. It is noted that bus services do not currently serve these stops. It is anticipated that it may become viable to stop services at these stops once a rail station is in operation. Further existing bus services are located to the east, with Ashington Bus Station located east of Station Road.	Existing Bus stops are positioned on Station Road adjacent to Wansbeck Square. It is noted that bus services do not currently serve these stops. It is anticipated that it may become viable to stop services at these stops once a rail station is in operation. Further existing bus services are located to the east, with Ashington Bus Station located east of Station Road.	Existing Bus stops are positioned on Station Road adjacent to Wansbeck Square. It is noted that bus services do not currently serve these stops. It is anticipated that it may become viable to stop services at these stops once a rail station is in operation. Further existing bus services are located to the east, with Ashington Bus Station located east of Station Road.	Existing Bus stops are positioned on Station Road adjacent to Wansbeck Square. It is noted that bus services do not currently serve these stops. It is anticipated that it may become viable to stop services at these stops once a rail station is in operation. Further existing bus services are located to the east, with Ashington Bus Station located east of Station Road.
Pedestrian / Cycle Access	Pedestrian access from the north is via an existing access ramp from Wansbeck Square leading down to car park and platform level. The existing ramp is not DDA compliant. An interfacing project lead by Advance Northumberland is looking at redeveloping Wansbeck Square to create an attractive public realm space and station access. As part of that scheme a lift would potentially be installed within Wansbeck Square to take passengers down to the platform level via an additional walkway	Pedestrian access from the north is via an existing access ramp from Wansbeck Square leading down to car park and platform level. The existing ramp is not DDA compliant. An interfacing project lead by Advance Northumberland is looking at redeveloping Wansbeck Square to create an attractive public realm space and station access. As part of that scheme a lift would potentially be installed within Wansbeck Square to take passengers down to the platform level via an additional walkway	Access from the west and south require passengers to walk around the buffer stop towards the north end of the platform before entering the platform. Pedestrian access from the north is via an existing access ramp from Wansbeck Square leading down to car park and platform level. The existing ramp is not DDA compliant. An interfacing project lead by Advance Northumberland is looking at redeveloping Wansbeck Square to create an attractive public realm space and	Pedestrian access from the north is via an existing access ramp from Wansbeck Square leading down to car park and platform level. The existing ramp is not DDA compliant. An interfacing project lead by Advance Northumberland is looking at redeveloping Wansbeck Square to create an attractive public realm space and station access. As part of that scheme a lift would potentially be installed within Wansbeck Square to take passengers down to the platform level via an additional walkway

Category	Option 1	Option 2	Option 3	Option 4 (Preferred)
	beneath the existing store. Pedestrian / cycle access from the south is achieved via pedestrian links within the proposed car park which links to facilities on Kenilworth Road. Pedestrian access to the north can also be achieved via Kenilworth Road; however, footways are narrow for the northern one-way section.	beneath the existing store. Pedestrian / cycle access from the south is achieved via pedestrian links within the proposed car park which links to facilities on Kenilworth Road. Pedestrian access to the north can also be achieved via Kenilworth Road; however, footways are narrow for the northern one-way section.	station access. As part of that scheme a lift would potentially be installed within Wansbeck Square to take passengers down to the platform level via an additional walkway beneath the existing store. Pedestrian / cycle access from the south is achieved via pedestrian links within the proposed car park which link to facilities on Kenilworth Road. Pedestrian access to the north can also be achieved via Kenilworth Road; however, footways are narrow for the northern one-way section.	beneath the existing store. Pedestrian / cycle access from the south is achieved via pedestrian links within the proposed car park which links to facilities on Kenilworth Road. Pedestrian access to the north can also be achieved via Kenilworth Road; however, footways are narrow for the northern one-way section.
Land Take	Land required for the car park is protected green space. If this land cannot be acquired as part of the planning process a decked solution may be required	Land required for the car park is protected green space. If this land cannot be acquired as part of the planning process a decked solution may be required.	Land required for the car park is protected green space. If this land cannot be acquired as part of the planning process a decked solution may be required.	Land required for the car park is protected green space. If this land cannot be acquired as part of the planning process a decked solution may be required.

Table 21 – Ashington Options Appraisal

13.2 Signalling & Telecommunications

13.2.1 Signalling

13.2.1.1 Signalling Scheme Sketch Dimensions

Multiple signalling plans cover the area affected by the works. It was noted in the early stages of the project that there were inconsistencies in the existing source records, in some cases, at the point where the plans overlap, differences were noted, with regard to gradient and longitudinal positional information. Consequently, and after discussion with NR, a Geo-RINM survey was obtained from Network Rail in order to provide an accurate and agreed source of base information with regards to the position of existing equipment and gradient information. A walk-through site visit was also undertaken, which noted operational signage along in conjunction with visits to all the signal boxes on the route. Where discrepancies have arisen, the information has been prioritised based on their accuracy and reliability, as follows:

1. Geo-RINM survey;
2. Existing signalling records;
3. General arrangement drawings.

13.2.1.2 Control General

Consideration has been given to re-signalling the entire line, particularly as the hours of operation are likely to increase resulting in higher operating costs. Against this has to the weighed the capital cost of a complete re-signalling exercise. Network Rail also indicate that there are also no plans for re-control of the Blyth and Tyne railway in the foreseeable future. This is reinforced by the fairly recent life extension works to existing semaphore signalling in the Marcheys House and Winning area, with new semaphore signal structures being provided.

Consequently, it is felt that for this project to proceed it would be best to amend and change only what was necessary to provide the required output in terms of train throughput.

13.2.1.3 Newsham Signal Box/Interlocking

Initially a “conventional” RRI type was envisaged, multiple amendments to the mechanical interlocking were also considered. However, after careful thought and discussion it was decided to propose a small Computer Based Interlocking, with either a panel or VDU Type interface. As part of this the matter of signaller training was also considered.

The physical condition of the signal box itself was also a consideration and at the next stage the possibility of re-siting a possibly prefabricated structure, possibly raised or with some other manner of improving visibility of the adjacent level crossing, shall be considered.

The manner of the interaction with Bedlington South Signal Box was also considered. Presently this is absolute block, however, the project proposes to introduce an MCB-OD level crossing into this section. The provision of IB signals and such like were considered, however, after much discussion a decision was made to amend control to track circuit block working between Newsham and Bedlington South.

One consequence of these proposals is to make the southern part of the route more “ROC ready”.

13.2.1.4 Marcheys House Signal Box

The introduction of additional signalling to the north of Marcheys House means that there are insufficient available levers for the purpose. The matter of an additional panel of some form was considered as was the complete abolition of the current arrangements. However, taking cognisance of the current arrangements it was eventually felt that a better option would be the use of North Seaton Gate Box.

13.2.1.5 Speed Signage

In general, the position, and signed speeds, have been derived from those laid down by the Permanent Way designers. However, in some instances there have had to be minor longitudinal amendments to suit other infrastructure (such as station platforms for example) or changes to facilitate adequate train braking. There have also had to be some amendments to the maximum speed to prevent under braking between existing signals that, due to project constraints, are not being repositioned as part of these works. These matters have all be subject to numerous discussions with all parties involved as the project has evolved.

13.2.1.6 Linespeed

The project has proposed a 65mph maximum line speed for passenger trains along the route, where this is practical, and these will become the predominant train type. Goods trains (classes 4 and 6) will also continue to operate over the route. Along the route there are a number of instances of lower speeds being imposed due to other factors such as line curvature and bridges. Consequently, it has been decided to try to keep goods train running at a constant speed that is an improvement over the existing speed along the route and much consideration and discussion has gone into this.

The outcome is that, as a basis, 40/65 has been taken as a baseline at this stage; this prevents the majority of cases of over-braking that would otherwise occur as 40 mph Appendix A braking and 65 mph Appendix B braking generally provide stopping distances of the same order.

It must be remembered that some of the signals along the route are not directly affected by this project and existing inter-signal spacings will be a major factor in determining the achievable line speed.

It was felt and subsequently supported by the TOC's and FOC's, that the aim should be to try to afford as smooth and constant a speed profile as possible. There are however local impediments generated by structures, track layout and existing signal spacing.

13.2.1.7 T635 Signal

The repositioning of T635 signal and the junction ahead, has occurred in order to prevent goods trains held at it from standing across Palmersville Footpath Level Crossing, with the attendant risk of people trying to climb through / under a stationary goods train. The provision of a footbridge had been considered as an option but given space constraints and cost and after careful consideration by all parties it was felt repositioning of T635 Signal was a more suitable solution to the problem.

13.2.1.8 N118 Signal

This new two aspect (R/G) colour light signal protects Hartley Level Crossing from train movements in the Down direction. The possibility of using the junction protecting signal (N120) as a 2-aspect level crossing protecting signal was considered. However, even if the junction was amended, such that the signal could be brought as close to the level crossing as possible, it would be on the very edge of the maximum permissible distance. This would also then interact, in an unfavourable way, with road closure times. This matter has been considered a number of times, due to changes in the junction layout that either aided it or worked against it; the final amendment, which saw the junction changing from a right-hand turnout to a left hand turn out occurred late in this stage of development. Consequently, at this stage, the current proposal is to stand; however, at the next stage it is advised that the matter be re-visited again when sufficient time is available to consider it in detail and the permanent way design is more solid.

13.2.1.9 Newsham Signals Form

At present the Newsham area is semaphore signalled; however, after further investigation, including discussions with FOC's and TOC's, it was deemed justifiable to replace these with colour light signals. There were a number of inter-related reasons behind this decision, including: -

- high risk of read-through would be posed when an Up train approached Newsham Level Crossing protecting semaphore.

- The existing Down direction protecting signal for Newsham Level Crossing will have to be re-positioned due to the proposed position of the replacement for the closed station that is to be provided to the south of the level crossing.
- The removal of No. 9 crossover results in the removal of the associated signals.
- The former Isabella branch has already been fully abandoned and the associated infrastructure removed.
- There was an argument for the retention of the Plessey Road semaphore signals on project cost grounds, however, they would have become isolated in an otherwise wholly colour light signalled area and the “driveability” matter raises its head at this point.
- Plessey Road Up Distant is currently a fixed distant board and this will have to be amended to allow a more expeditious throughput of trains as cautioning trains forward was felt to be too restrictive.
- Recovered equipment such as signal arm motors and detection, could be used for amendments on other parts of the route.

13.2.1.10 BS16/18 Signals

This pair of semaphore signals are mounted on a high post and concerns have been raises about signal sighting as, due to constraints regarding the currently moribund platform and its curvature, a long standback may be difficult to achieve. Historically, the post height may have been to improve sighting as there was a concrete footbridge behind them. A colour light replacement has been considered, however, at this stage a lower level co-acting signal was proposed for the main arm, namely BS16, BS18 will not have the same operational constraints as goods trains routed towards Furnaceway Sidings will be able to standback further.

Subsequent to the above and resulting from standback concerns and discussions with the LOM a decision was made to replace these with a 2-aspect colour light signal with a position light for shunt class moves. At the next stage of development consideration shall be given the provision of a third braking aspect to BS16 as possible mitigation to any SOYSPAD risk.

13.2.1.11 BN9 Signal

Consideration has been given to moving the signal back away from West Sleekburn junction to improve the SOD ahead. However, to do so would involve re-positioning signals on the approach and, due to the constraints of other infrastructure, Bedlington Viaduct in particular, this has proved impractical. 4-aspect signalling was contemplated and experimented with as a solution to this problem. The aim being to permit signals to be closed up and adequate braking distances from the first caution to be achieved. However, the introduction of this would mean the route would have just about every form of lineside signalling available in use and on driveability grounds it was felt to be a “step too far”.

13.2.1.12 MH13 Signal

This signal has been subject to much consideration, which has been further complicated by it being a fairly new Collis Engineering replacement of the original structure that was supplied, along with a number of others as part of recent life extension works in the area.

As part of the signalling design development process, it was considered to move the signal on the approach to provide a longer overlap to the junction. However, there is currently no foreseeable junction traffic for the signal to protect. Any irregular movements could be subject to double blocking back to Winning. Should another project subsequently wish to provide for a regular traffic flow then the matter would have to be considered as part of that project.

A further point considered is that of a semaphore distant reading to a colour light signal due to the provision of a replacement colour light signal at Green Lane Level Crossing ahead (see NS17 later). Hence concerns over MH13 being conspicuous enough were considered; this matter it was felt could be dealt with using an enhanced light source, the signal being well sighted on a straight rising gradient.

13.2.2 Telecommunications

Telecoms did not have any direct impact or influence on the proposed options. The affects or requirements from the Telecoms infrastructure were driven by the proposed Track and Signalling alterations for the lineside requirements and the Station / Civils alterations for the SISS requirements. Telecoms as a discipline on the Northumberland Line project provided a support function to the needs of the scheme.

For the proposed SISS works, Telecoms provided design solutions based on the preferred station designs developed by the Civils design team.

For the Operation Communication works, Telecoms provided design solutions against the Signalling scheme plan and the P-Way track layouts.

For the proposed lineside alterations for operational communications, the Telecoms scope of works was to support the requirements of Signalling as a bearer network and design the lift and shift of affected cabling.

The only area this differed was the S&T cable route. Where the new stations would affect the S&T route. The telecoms design considered the benefit of a full lift of the affected cabling against abandoning the route under the proposed platform.

In this instance it was considered more cost effective to abandon the route under the proposed platform with a new diversionary route being provided for future cable installations. Additionally, adopting this method also provided the least impact to the operational railway.

13.2.3 Level Crossings

13.2.3.1 Palmersville Dairy Footpath Level Crossing

There had been concern about the risk posed by a Down direction goods train standing foul of this crossing. A footbridge option was considered; however, space limitations would have made it extremely difficult to achieve a disabled persons compatible bridge within the available site.

13.2.3.2 Benton Square Level Crossing

The standards stipulating the installation of MSL’s mandate that the crossings cannot be used over more than 2 lines but even if that risk was accepted and an MSL covered all 3 lines or even 2 separate MSLs were installed, Network Rail have experience in other areas of linking into the Metro Interlocking and have not been able to get it to work and fear the same at this site.

It would not be acceptable just to have an MSL on the Network Rail element of the Level Crossing as we would be providing 2 separate methods of protection on what appears to be a single crossing to the public.

With ample sighting available (with a little de-veg to assist), it is proposed not to make any changes to this Level Crossing and maintain the line of sight protection arrangements in place.

13.2.3.3 Holywell User Worked Level Crossing

A request has been made to Network Rail with respect to the closure of this crossing on the basis that the crossing does not appear to be in use. Discussions are ongoing so at this stage the project is assuming that the crossing will remain open and upgraded as a worst-case scenario.

13.3 Track Alignment

The following paragraphs describe the iterations and options considered but ultimately rejected for the track interventions associated with the Northumberland Line project. Unlike stations, there is often not a number of discrete options at these points, the design process is more iterative with significant portions of the final proposed alignment common across all options with only minor differences at tie in points or orientation to be captured.

13.3.1 Through Alignment

In producing the through alignment several options were considered. Firstly though, it was essential to recreate an existing alignment from the start at Benton North Junction to the end of the scheme beyond Hirst Lane Level Crossing. This first option replicated the existing alignment as far as was possible to enable a through reference chainage to be produced and provide a datum for referencing all other infrastructure. A second option was produced to highlight potential speed increase improvements and constraints. This second option was also used as a reference to be part of individual station area designs where additional parallel track was to be provided. A third iteration looked to increase the speed to the linespeed profile generated in conjunction with the signalling discipline.

13.3.2 Benton East Junction

The Northumberland line branches off the East Coast mainline via a single lead junction at Benton North Junction, immediately splits into two track and runs as such for nearly ¾ mile before returning to single line at the turnout described by this project as Benton East Junction (there are no formal records of this location being named). See ***Figure 60*** below:

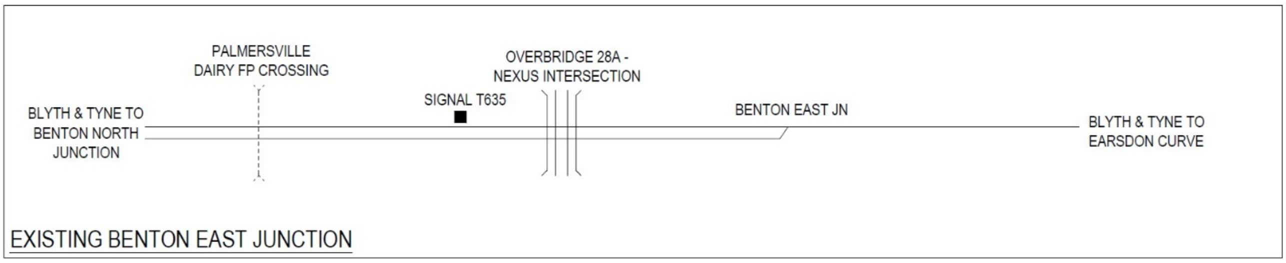


Figure 60 – Benton East Junction Existing Layout

The initial option at Benton East was to “do nothing”, however as the optioneering evolved and it emerged that a long freight train being held at signal T635 which protects the single line in the Down direction (towards Ashington) would block back over Palmersville Diary foot path crossing. This creates a safety risk of people trespassing to get around or under the stationary train. The two possible mitigations to this risk were to replace the footpath crossing with a footbridge or extend the two-track section and move the signal eastwards to accommodate the train length.

The footbridge is a viable solution though would require land take and would need to be fully PRM compliant with either lengthy ramps or lifts, therefore the preferred solution was to move Benton East Junction as described in ***section 5.2.1.2***

13.3.3 Seaton Loop

A loop is required on the existing single section between Benton East and Newsham when the train frequency increases from an hourly service to a half-hourly one in Phase 2. This creates a requirement to pass one passenger service by one freight service per hour (based on current agreed freight paths) on the single line section.

There were several loop options considered during the Option Selection process and these are all tabulated in ***Appendix W.*** The following text will summarise the key decision making that led to the various options being discounted in favour of the preferred Option 12a which is described in ***section 5.2.1.3***.

The first option considered, during the previous stage of this project, was located around Seaton Delaval Station which could provide passive provision for a second platform at the new station if demand and timetable required. This location is at the northern most area of the single-track section and close the end of the two-track section when it is extended to Hartley Curve, there for it was agreed to discount this option in favour of investigating options further south and more central to the single line section.

The two geographic limits to the search were quickly established as being Holywell ABCL Crossing in the south and Seghill AHB crossing in the North to limit any unnecessary level crossing alterations. It was also decided that the S&C would be located on straights so that standard units could be installed without the need for bespoke design and tailored maintenance.

The section between Holywell and Seghill provided the ideal geometry in terms of Pway alignment to land two new S&C units on suitably long straights but also pushed the location more central to the single line thus minimising the length of single line operations at the south end, therefore various options were considered along this section of track.

The length of the loop was initially determined by the maximum train length currently running, which is 550m and the maximum Intermodal train length of 775m. These two dimensions, when added to 105m signalling overlap and a 25m standback created minimum loop lengths of 785m and 1010m respectively.

These lengths were then discussed for 25 and 40mph turnouts and various options were considered to determine the most suitable one to ensure a) S&C landed on a straight, b) the most likely passing place for trains was maximised and c) the volume of other work involved was minimised.

The loops were placed in various locations between Holywell and Seghill paying cognisance to all other features on the rail corridor which may need physical works as a result. (i.e. number of bridges / level crossings / S&T equipment, existing solum width etc.),

The operations of the loops were considered in terms of getting the trains in and out as efficiently as possible without the need for over restrictive signalling (approach control). The initial 785m and 1010m long loops would require just one signal at either end protecting movements back onto the single line sections. This would require the freight train to reduce speed on the single line sections on the approach to the loop so that it did not overrun the signal at the far end and would therefore occupy the single sections for far too long as it crawled slowly into the loop. These shorter loop lengths were subsequently discounted.

Longer loop lengths were considered so that it could accommodate a distant signal within the loop with enough braking distance to the signal at the far end. This arrangement allows the freight train to enter the loop on a green signal at linespeed and will only have to brake if the distant signal is showing a yellow aspect and the protecting signal is showing red. Applying this principle, the signalling scheme sketch determined that the optimum loop length was approximately 2400m.

Suitable locations between Holywell and Seghill were then investigated for this length of loop, again taking into consideration all other features.

The handing of the turnout to maximise use of the land available, the current alignment and to ensure the best possible traction for the freight trains over the S&C units was the next element to be considered. Choosing the correct configuration should maximise traction and minimise the maintenance burden and create the most efficient speed profile with the minimal land take.

This was particularly important at the south end where the is an existing gradient of 1 in 86 and so it was essential the trains could accelerate on the stock rail.

To ensure that the train leaving the loop and entering back onto the single line section was always travelling on the “through route”, two facing points at either entrance to the loops were proposed. The two exits become unrestricted so a slower moving freight train which had to slow for a red yellow or red signal would not be accelerating over the turnout when the signal became green. The down side of this scenario is that both lines on the route are restricted to the speed capacity of the S&C and there is limited option to “fly” a train though on the main line at full linespeed (see diagram below)

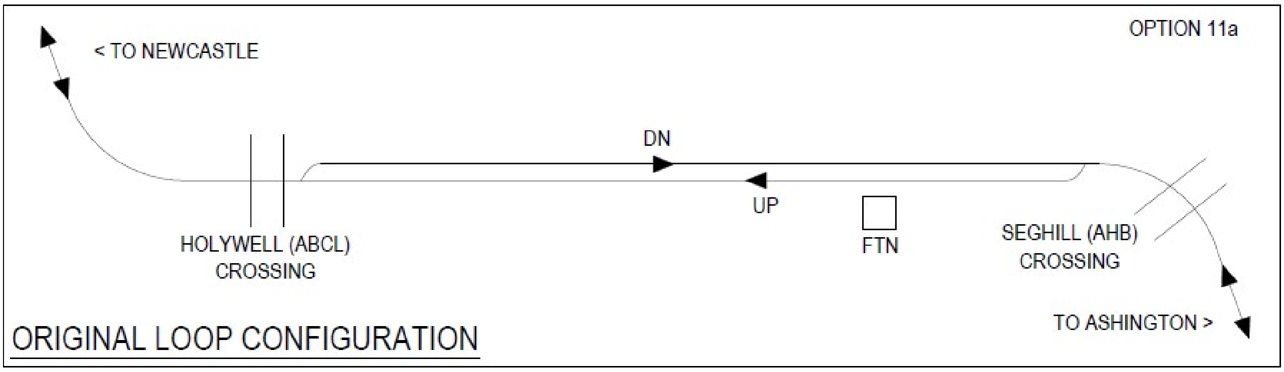


Figure 61 - Option 11a Seaton Loop

This loop layout was the preferred option until it was tested against constructability and how this would be built in the two phased approach to delivery of this project.

The design of loop described above does not easily allow for Phase 1 track alignment to be installed whilst future proofing the Phase 2 introduction of the loop. The phase 1 track alignment would create a “chicane” until the Phase 2 S&C was spliced in and the plain line in-between was built. The alternative would be to leave the track where it is in Phase 1 and then do all the works in Phase 2, but this would be very disruptive to the hourly passenger service which would be operating by then.

The additional distant signal on the longer 2400m loop allowed greater speed into the loops and also reduced the likelihood of a train needing to come to a complete stop at the signal at the end of the loop. This removed the necessity to ensure the “through route” was located at the exit to the loop and so a conventional loop was considered. See diagram below

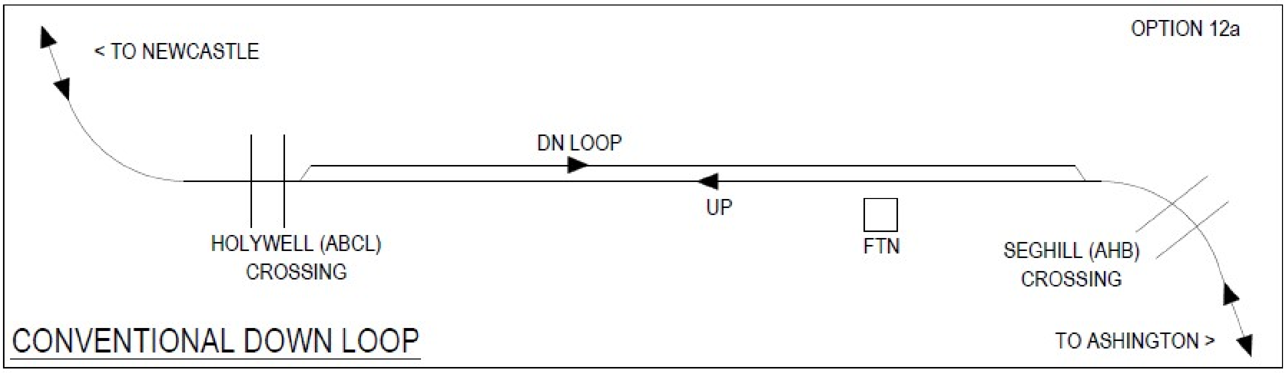


Figure 62 – Option 12a Seaton Loop

In the layout shown above, the existing single line track could be realigned to its final position during the Phase 1 works so that in Phase 2, the two S&C units could be installed during lengthy weekend disruptive possessions but the remaining plain line section creating the Down Loop could potentially be constructed behind a fence with minimal disruption to the passenger service.

On this configuration the speed into the loop becomes more of a critical consideration because a freight train no longer must reduce its speed on entry into the loop because of restrictive signalling and as such the size and therefore speed of the S&C must be optimised.

At the northern end of the loop, is Seghill Level crossing which lies on a tight curve with a current speed restriction of 30mph. The initial option for the entry into the loop was therefore set at 40mph with the proposal to do nothing at the level crossing, the trains would accelerate away from the crossing and into the loop. Speed increases of 50mph and 60mph were considered over the crossing to promote a more regularised overall speed profile in the area with the 60mph option being dismounted on the basis that it required 150mm of cant to be applied at the crossing. This would generate a very poor vertical road profile and potentially impact on the object detection equipment being proposed as part of the crossing upgrade (See ***section 5.2.2.2***) and therefor this option was discounted in favour of a 50mph option.

At the Southern end it was still preferable to maintain the through route for the Up Direction trains because of the steep gradient so the turnout was designed for northbound Down direction trains which would be accelerating away from the tight radius of Earsden Curve and so would not be restricted by S&C turnout speeds.

The lower entry and exit speeds of 25mph and 40mph were discounted in favour of 50mph FV24 S&C units at either end which permitted the most efficient speed profile. The chosen option for the loop is described in more detail in ***section 5.2.1.3***

13.3.4 Twin Track Extension

The introduction of Newsham Station Platforms immediately south of Newsham level crossing clashes with the existing turnout from single track to double track. The turnout located just south of the level crossing therefore needs to be moved southwards away from the new platform and so a “do nothing” option here was instantly discounted.

The next option to be considered was to simply locate the new turnout immediately South of the new station thus minimising the additional Pway. This was regarded as a missed opportunity to provide additional operational flexibility by elongating the double track section and reducing the amount of single line and so was discounted. This option could be revisited as a value engineering exercise in the next stage if cost savings were required.

The length of the twin track extension was discussed, initially based on the Pway and land restrictions, but because the track south of Newsham is a long straight and runs along an old double track solum there appeared to be limited obvious constraints to this decision. The notable exception being the tight curve at Hartley which forms the old connecting line between the original wagon way from Bedlington to Tynemouth and the route from Hartley to Backworth. The radius round the curve is very tight and the limited land available would make double tracking this curve quite complex.

The first thought was to maximise the double track length right down as far the bottom of the transition at the north of Hartley Curve, but this was discounted when the signalling scheme sketch was created. The last southbound signal (N120) was located chainage 11580m approximately 500m north of the bottom of transition at Hartley Curve, creating approximately 500m of redundant track where no two trains would be permitted to pass each other.

Therefore, the Pway length was reduced so that the new points would be located nearer the last signal on the twin track section. Pway and signalling agreed that the clearance point had to be around chainage 11445 and applying a NR56 FV 24 (50mph) S&C unit meant the toes were around 11300m.

Heading north from the single line at Hartley curve the track currently appears to align itself on the Down side of the solum so initial options proposed a righthanded turnout to the Up side. This was discounted in favour of re-aligning the track to the up side on then providing a left-handed turnout to the new Down Line. This would allow a southbound train to continue at linespeed until such times as it needed to brake for Hartley curve speed restriction. Northbound trains are already travelling at the lower speed of 30mph round Hartley curve and so would not be impacted by the 50mph S&C speed limitations as they accelerate up to full linespeed.

The preferred option is described in full in ***section 5.2.1.4***

13.3.5 Furnaceway Sidings

Furnaceway Sidings are required to turnback the Blyth to Fort William Alcan train which currently turns back at Newsham. The extension of the twin track section and recovery of the crossover as described in ***section 5.2.1.4*** means that this current manoeuvre cannot be continued under a new passenger timetable and as such the sidings Furnaceway provide an ideal location.

As described in ***section 5.2.1.5*** the sidings are currently under the ownership of DB cargo who do not regularly use them and as such they have fallen into disrepair and are overgrown. Initial options assumed the siding would be useable with minor de-vegetation and minor localised rail / sleeper spot replacements. The siding could then be used by GB Rail Freight to turn back their Alcan train with an assumed minor fee for usage.

Meetings with the two Freight Operating Companies (FOCs) revealed that GB Rail Freight would be unwilling to pay a fee to DB Cargo for a movement that currently costs them nothing but also DB Cargo were keen to relinquish the sidings back to Network Rail. The topographic survey revealed that the crossover and turnout into the sidings are currently locally clamped out of use and the components are also in a state of disrepair with various rail types and ages spliced together as part of the ongoing maintenance. The initial option 1 of doing the minimum was subsequently discounted

Option 2 became the preferred option and is described in more detail in ***section 5.2.1.5*** but fundamentally this was a like for like replacement of the Up to Down crossover, the turnout into the siding and all the S&C and plain line within the sidings.

The total train length of the Alcan train of circa 220m was considered and the space available within the existing foot print was used to create the preferred option of the two siding roads running roughly parallel with the Down line.

Alternative options of running the siding roads on different paths around the existing footprint were considered and quickly discounted as there were no additional benefits over the preferred Option 2 which satisfied all the requirements and freed up the rest of the land for other use if required.

13.3.6 Bedlington

Bedlington North junction is a double junction which provides onward travel to Morpeth in one direction and to Ashington in the other. The current layout consists of obsolete components and no longer complies with modern track design standards. See sketch below:

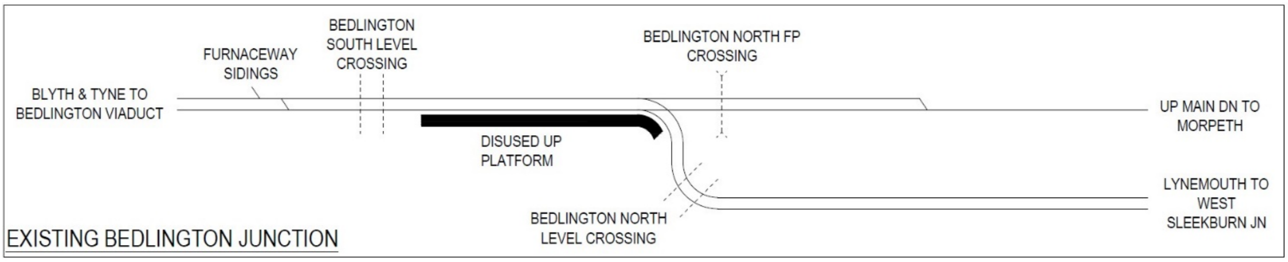


Figure 63 – Bedlington Existing Layout

The initial option was to "do nothing" as the 10mph speed restriction did not have a significant impact on the timetable as all passenger trains would be stopping at the station. The previous SOBC stage of the project had aspired to increase the linespeed to 20mph by renewing the junction like for like. The topographic survey revealed that the current junction is made up of bullhead rail S&C A-size inclined switches which are no longer accepted on modern railways and so options were investigated into redesigning the junction as a single lead with a modern C sized vertical S&C unit. (See ***Figure 64*** below)

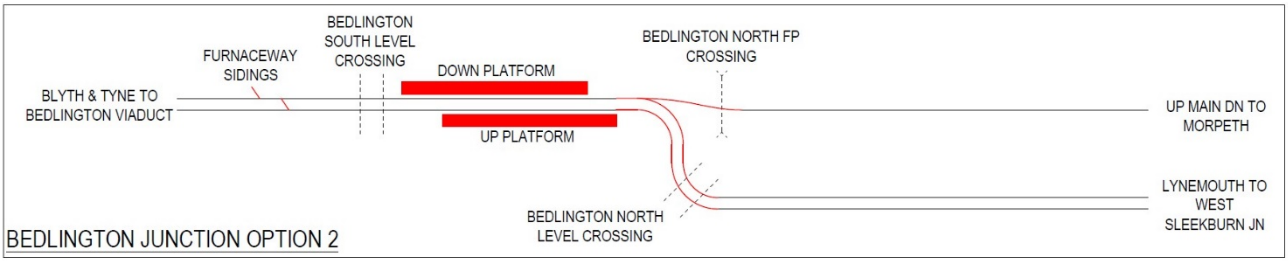


Figure 64 – Bedlington Option 2 (Single Lead Junction Rationalisation

The increase in horizontal radius created, pushed the track alignment so far off line that the Bedlington North Signal Box would likely need to be demolished and relocated, Benton North Level Crossing would need to be re-aligned significantly such that additional land would require to be purchased on the North side of the railway and the foot path crossing on the Morpeth line would need to be remodelled. There would also be an operational impact on the routes to and from Morpeth as this would now be a single line section. (see Drawing 60601435-ACM-06-TL-DRG-ETR-000005 in ***Appendix D***). In order to make this arrangement work, a new S&C crossover would need to be positioned south of Bedlington South Level

Crossing with the Down line being bi-directional between these new S&C units. This considerable infrastructure requirement, coupled to land purchase issues and operational restrictions, led the team to consider alternative options.

Although A sized switches are no longer permitted for use on passenger railways, there are a number of locations where they still exist. Most likely in locations such as Bedlington where their replacement with the more common C sized switches would incur a disproportional cost in terms of impact on other infrastructure or railway neighbours. CSM provides a method of risk assessment known as a reference design, where if you can demonstrate that an element of infrastructure or system is in use safely elsewhere then you can adopt it on your project.

On this basis, discussions were held with the RAM track regarding bringing the new passenger service into service using the existing S&C in place as there are other A switches within the region. The discussions that followed suggested the S&C was nearly life expired and the increase in frequency of the passenger service over the current freight usage would represent an increased risk deemed unacceptable. As a compromise, the RAM accepted that the reference system method of Risk Assessment could be implemented if the junction was renewed with flat bottom A7 S&C on the current geometry. Although the renewal has a cost impact on the project, it is considerably less than the cost of implementing any of the other alternatives. As such, this is the preferred option at this location and can be found in ***section 5.2.1.6***

13.3.7 West Sleekburn Junction

West Sleekburn Junction provides the route to and from the Port of Blyth, mainly for the Alcan Alumina train which travels between here and Fort William in the Scottish Highlands. There is a permanent speed restriction of 20mph on the Up Line coming from Ashington which appears to be related to West Sleekburn Junction. The track designers reviewed the information from the Georinm data, looked at the geometry across the S&C and determined that there no obvious Pway related reasons for the speed restriction. As such the current assumption until further survey information is available is that the speed profile can be raised to the project requirements. This is described in more detail in ***section 5.2.1.7***

13.3.8 Ashington Turnback

Ashington Station is the northern most destination station of the Northumberland Route at this stage of the project. It is therefore a requirement that the driver must be able to change ends of the train and head southwards again towards Newcastle. A turnback siding is usually the best way of facilitating this movement as it takes the train off the mainlines to minimise disruption to other trains. (See below ***Figure 65*** for Existing Layout)

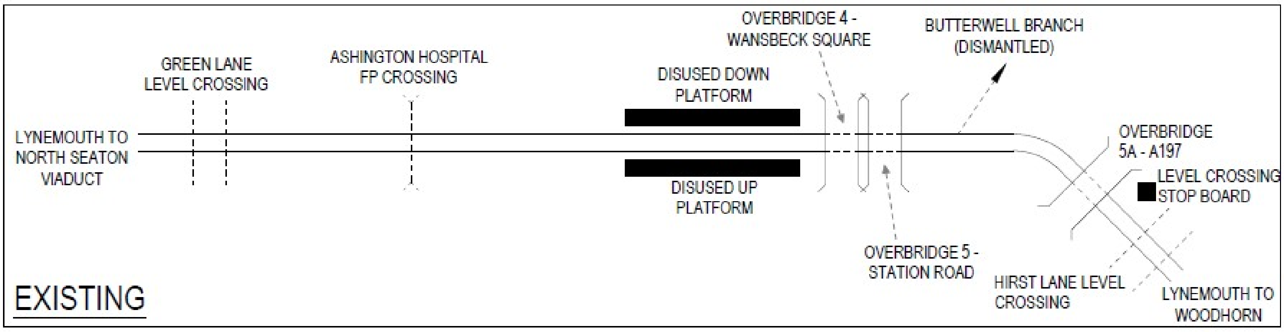


Figure 65 – Ashington existing Layout

At OBC stage it was proposed to create a small section of track just north of the proposed Ashington station which branched off to the North West, along the path of the old Butterwell Branch. Passengers would alight at the new platform adjacent to the Down Line, the empty train would pull away to the new turnback line and wait until it was time to head south again. At phase one, this could be around 35mins, so it was essential to keep the train off the mainline to allow the freight traffic to continue operating.

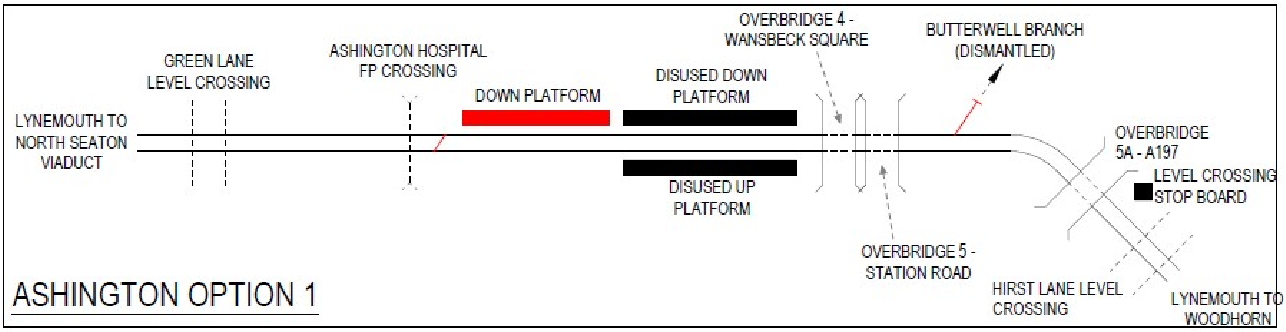


Figure 66 – Ashington Option 1 (Butterwell Turnback)

This option, referred to as Option 1, was discounted because the S&C required to create the turnback would need to be a bespoke and potentially non-compliant unit due to the diverging geometry of the mainline curving east towards Woodhorn and the turnout to the turnback line curving to the west. There was also the potential that a freight train sitting at Hirst Lane level crossing, waiting for instruction to enter Lynemouth, would block back over the S&C and prevent the passenger train from entering or exiting the turnback. See below

The next option to be considered was to create the turnback at the station location by installing a new turnout from the Down line onto a new platform line at the proposed station site adjacent to the existing council car park. Option 2 detailed a flanked platform adjacent to the new platform line with direct access from the existing car park. The platform was located as close to the facilities at Wansbeck Square as possible. The route back to the up line for southbound trains was through a new crossover located between Hospital Foot crossing and Green Lane Level crossing. (See ***Figure 67)***

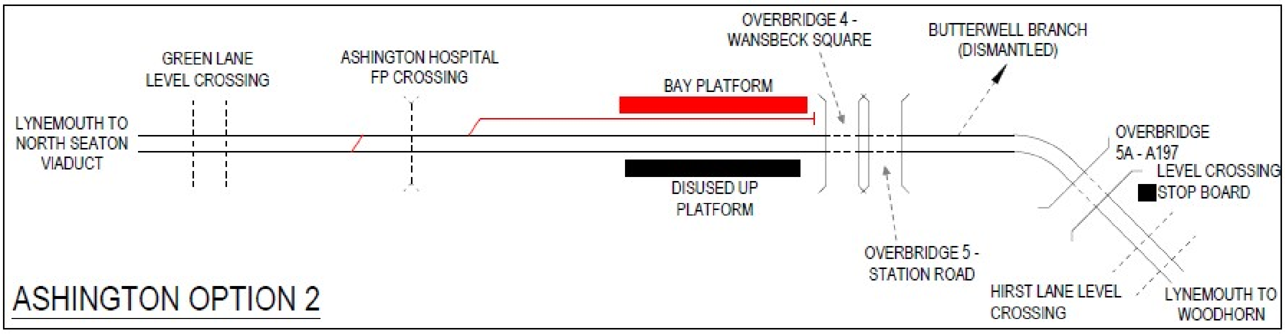


Figure 67 – Ashington Option 2 (Flanked Turnback)

The project acknowledges that future onwards travel to Woodhorn is an aspiration of the local community and council although does not form part of the business case at this stage. Option 2 did not provide suitable provision for a northern connection back onto the Down Line and so it was discounted.

Option 3 investigated an Island platform located between the Down Line and the new platform line which would initially operate with passengers using the platform facing the new platform line but could open up the other face of the platform onto the Down line for future Woodhorn services. The track interval was designed to accommodate a minimum 6m wide two-faced island platform. The angle required to achieve the width of the separation between the Down Line and the new passenger line forced the turnout location southwards towards Hospital Crossing which meant the crossover to the Up line had to be placed south of Hospital Footpath Crossing. (See ***Figure 68***)

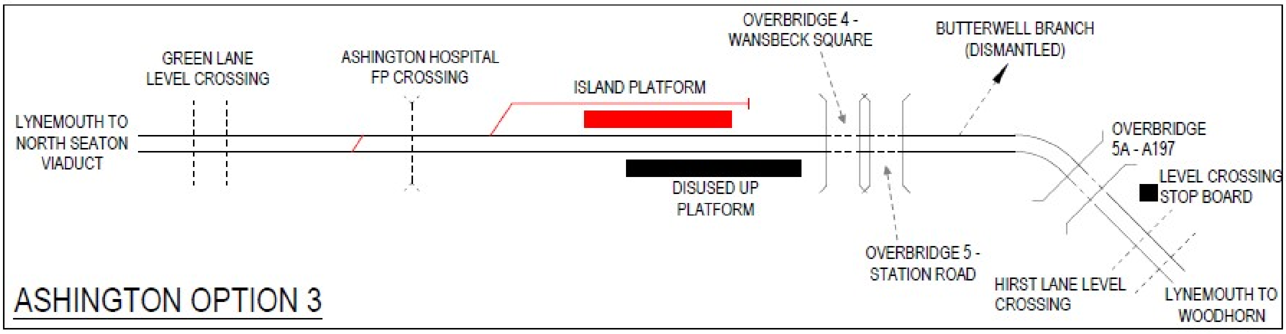


Figure 68 – Ashington Option 3 (Island Turnback)

Option 3 provided a viable solution from a railway systems perspective and safeguarded future onward travel to Woodhorn with no additional Pway alterations required. As such it temporarily became the preferred option. Network Rail Level Crossing Manager and Local Operations Manager (LOM) highlighted the additional risk to the public this option created by having trains travelling in both directions on the Down Line over Hospital Footpath Crossing. The concern was that this could lead to confusion from pedestrians who were not accustomed to trains travelling in both directions. This increased the risk level of the crossing and so it was agreed at the engineering workshops that the crossover had to be located north of Hospital Crossing to ensure unidirectional traffic and mitigate against this risk. There is insufficient room to place the crossover and the turnout to the north of the footpath crossing and still go around the back of 6m wide platform and so this option was discounted. Other reasons that this option was not the preferred are described in ***section 13.1.6.3***

The chosen preferred option for Ashington turnback and station was similar to Option 2 except the crossover is located north of Hospital crossing and the platform is slightly further south to allow passive provision for a connection back onto the Down Line at the north end. This is described in ***section 5.2.1.8*** (Track) and ***section 5.1.6*** (Station).

13.4 Routewide

13.4.1 Electrical and Power Engineering

13.4.1.1 Proposed stations

The proposal includes construction of six new Stations, four Stations are included in Phase 1 of the project and two stations in Phase 2. The proposed stations will be located at Northumberland Park, Seaton Delaval, Newsham, Blyth Bebside, Bedlington and Ashington. Each of the proposed Stations will require a new DNO connection to be provided in order to provide power. Two 3-Phase 200A DNO’s are required for the stations at Newsham and Blyth Bebside due to the heavier anticipated electrical load at these locations. The DNO’s supplying Newsham and Blyth Bebside station shall provide electrical power supply to Platform equipment, two lifts and station lighting. The other four stations will be supplied with a 1-Phase 100A connection, with the DNO’s supplying platform equipment, one lift (Northumberland Park and Ashington) and station lighting.

13.4.1.2 Lift & Lighting

Flat white LED lighting shall be utilised at all station. The prescribed lighting design shall comply with the requirements of BS EN 12464-2:2014. For Platform Lighting, columns will be introduced at approximately every 10m with each platform measuring around 100m in length. There are lifts proposed at four of the stations, with Newsham and Blyth Bebside having two lifts each as part of the platform to platform access arrangements. Northumberland Park and Ashington station both require one lift for step free access as these stations only have a single platform. No lifts are proposed at Seaton Delaval and Bedlington as these stations have step free access via other means. Lift lighting shall be designed in compliance with BS EN 81-70:2018 and NR/SP/ELP/27228. Footbridge lighting is also required with bulkhead lighting mounted to the footbridge structure to be utilised where practicable. Should bulkhead lighting not be available due to the bridge construction form, handrail lighting shall be used instead.

13.4.1.3 Car Park

Apart from Northumberland Park, each other station will have a minimum of one car park. As Network Rail will likely take on ownership of the stations and NCC continue to own the car parks, separate DNO connections shall be provided for the Station building and the car parks. Each car park and associated access road will be supplied by a 1-Phase 100A DNO supply for the lighting columns in the car parks.

13.4.1.4 Proposed Switch and Crossing Heating

Along the line, there are various S&C points that shall be retained, modified or newly installed. Existing Switch Heating installed on switches not being renewed will be retained without alteration. Where existing switches are not currently heated, these shall be provided with Switch Heating in line with current railway standards.

New Switch Heating systems will be installed along with all new S&C being installed by the project. Proposed Switch Heating cubicles will be placed a minimum of 3.5m from the nearest running rail where practicable in line with current safety guidance. If this can't be achieved at any specific locations, non-metallic barriers will be installed in order to protect staff working at the cubicles.

New DNO connections will be required for all new Switch Heating equipment cubicles. Seghill has an existing 230V 100A DNO which will need to be upgraded to 400V 100A. Three additional Switch Heating control cubicles are proposed at Holywell, Lysdon and Ashington. A new 400V 100A DNO supply will be required at Holywell LC which shall provide power to the Switch Heating equipment. Lysdon switch heating shall require a new 230V 100A DNO to be provided for the cubicle and Ashington requires a new 400V 200A DNO supply, shared with Ashington PSP and the existing Ashington signal box.

13.4.1.5 Track Equipment

Switch heaters will use electric strips rated at 200W/m clipped to the rails with heating retainers as the standard for all new switches throughout the line. The 200W/m heating strips are being provided in accordance with current Network Rail standards. The project has proposed 200W/m strips to be utilised across all switches regardless of track categorisation.

Under Track Crossings may be required for carrying cable across the track at various locations along the route. This will be better defined at outline design.

13.4.2 Ancillary Civils

Without maintainer input, it has not been possible to establish detailed requirements at this stage and the current proposal has taken a cautious approach by making allowances within the earthworks and land purchase assessments. A variety of alternative viable earthworks solutions from piled foundations to earthwork retention has been considered, plus alternative access routes to avoid land acquisition issues. However, only with further survey information, 3rd party land availability and detail access requirements can detail solutions be developed at the next design stage.

13.4.3 Land and Consents

The land and consents requirements for the preferred options are detailed in ***Sections 8 and 7*** of this document or in further detail within the Land and Consents Strategy, which is a separate, standalone report. The purpose of the Land & Consents Strategy is to set out a detailed strategy of the land and consents processes required for the successful delivery of the project. The report will be reviewed and updated as the project progresses in line with Network Rail's Governance for Rail Investment Projects (GRIP) process or RNEP equivalent.

13.4.4 Earthworks Including Trackbed and Drainage

The Northumberland Line project lies along an existing freight only railway line. The earthworks have already been constructed and will require geometric review as the scheme progresses, especially in the areas of track dualling, Seaton Loop and Newsham Loop, and areas where additional infrastructure is proposed, i.e. signals, cabinets, etc.

Network Rail has confirmed that where realignment of the track / dualling is required, i.e. for Seaton and Newsham Loops, only a position of safety is required, i.e. level cess / embankment shoulder, and at locations where additional signals, cabinets, etc. are required, a cess walkway should be provided.

Earthwork sections where interventions, regrading or low height retaining walls may be required were identified as part of the Geotechnical and Earthworks PSSR' s included in ***Appendix L*** and are listed in ***Section 4.6.3***. Earthwork interventions are also required at five signal locations; four of these are on embankments (N126R, N122, N119, N120) and one is in a cutting (N107R).

Options that may be considered for widened cuttings and embankments include:

- Grout infilling of rabbit burrows (if not already completed as part of the Control Period 5 Delivery Plan).
- Drainage survey and drainage improvements.
- Granular berm or granular shoulder to stabilise over steep earthwork gradients.
- Low height sheet pile, concrete crib or gabion wall at the toe of the cutting to allow the existing earthwork to be regraded to a shallower slope angle.
- Soil nail stabilisation measures.
- Micro piles or king pile retaining wall for cess restraint on existing embankments.
- Rock netting (localised weathered mudstones in cuttings).

At this preliminary stage earthwork regrading, granular berm or granular shoulder fill and / or low height retaining walls are the preferred earthwork intervention options.

Where earthworks widening is required Network Rail (NR) have standard details which could be utilised, these include use of a gabion retaining wall (NR/CIV/SD/201), precast retaining walls (NR/CIV/SD/202), modular block retaining walls (NR/CIV/SD/203), sheet pile walls (NR/CIV/SD/204), king post walls (NR/CIV/SD/207, 208), embankment regrade using granular fill (NR/CIV/SD/230) and embankment regrade using cohesive fill (NR/CIV/SD/231).

Any structural intervention, i.e. gabion, sheet pile wall, etc. will require regular inspections. Earthwork slopes will also require regular inspections, but are considered more appropriate for the scheme, due to the low number of existing retaining structures along the route.

A preliminary geometric review shows that the proposed signals on embankment can be constructed on widened embankments with 1 vertical to 2 horizontal (1v:2h) slope within Network Rail's existing land ownership boundary.

Where proposed signals are in cutting, the cutting slope will be excavated to allow construction of the signal at the same slope gradient as existing, as no movement indicators have been identified on the cutting slopes in this section on the Earthworks Database. The detailed signal cutting slope design will consider cess/ crest drainage and slope crest width within Network Rail's existing land ownership boundary. If a granular fill or structural solution is required, these will be discussed with the Geotechnical RAM.

The trackbed investigation proposed for the next stage, based on a desk study and walkover survey is included within ***section 17.11.2***. The desk study was undertaken according to NR/L2/TRK/4239. In addition, the Network Rail standard, TAMP analysis has been used to locate any potential trackbed problems. TAMP analysis is a method to analyse successive runs of track recording car data to identify localised track defects, estimating their extents and assessing likely causes. The extent and magnitude of poorly performing earthworks can also be assessed.

No drainage solutions have been prepared at this stage in development, however it has been recognised that with more detailed surveys and the full track alignment design being prepared at the Design stage, active drainage will have to be provided. All designs will be to "NR/L2/CIV/005: Drainage Systems Manual" for example, design events.

13.4.4.1 Track and Earthworks Drainage

At the next stage, it should be assumed that drainage will be required for the following scenarios:

a. Trackbed drainage within cuttings

b. Cut-off drains where side long ground exists at the top of cutting slopes

c. Drainage where valleys are created at the toe of embankments

For existing track and earthwork drainage, a review of the twin track alignment is to be conducted to determine where the alignment clashes with the existing drainage and solutions shall be developed accordingly.

After sites for drainage have been identified, catchment areas are to be established in order to determine discharge values for positive outfalls. These discharge rates are to be discussed with the Local Authority and the Environment Agency. Equivalent greenfield run-off rates will be used as a target discharge rate until otherwise confirmed.

Where possible, filtration systems i.e. soakaways are to be used as the method of outfall. Site investigation (including desk research and ground investigation) will be required to assess the depth of the water table, chemical contamination risks and the suitability of the strata for soakaway discharge.

After adding drainage for the above scenarios at outline design, it would be the intention to review GI, earthworks assessment reports, etc. at Detailed Design stage to de-scope drainage where there is suitable evidence it is not required.

13.4.4.2 Station Drainage

The intent will be to combine platform and car park drainage to the same outfall and, therefore, the same level of SuDs treatment. It would be the intention to use typical SuDs treatment systems such as porous paving under the parking spaces, swales and attenuation ponds. If it is not possible to discharge platform drainage to the car park system, approval would be sought to utilise any available track drainage system.

Where positive outfalls are required, equivalent greenfield run-off rates will be used as a target discharge rate until otherwise agreed with the Local Authority.

13.4.5 Structures

13.4.5.1 Underbridges

The route availability of each underbridge structure has been assessed for the proposed line speed increase for freight and passenger traffic using the methodology discussed in ***Section 4.6.4.1***. ***Table 22*** provides a summary of the current Route Availability numbers for each structure and the impact of the proposed line speed increases, highlighting where necessary works are required. Reference can be made to ***Appendix J*** for full results.

Note: for both viaducts, EJM/47 and BWC/3, design calculations of the strengthening works undertaken in 2011 were not available at the time of writing this report. The numbers indicated within the table are based on the 2006/2007 assessment reports which will have formed the basis for strengthening, therefore for comparative purposes, these loads have been considered.

ELR	Structure I.D. Number	Condition	Track Changes	Lateral Clearance Impact	Route Availability Number			Strengthen, repair, modification works required
					Rail Traffic			
					Existing	Freight	Passenger	
EJM	35	Fair - deteriorating asset. Continuing corrosion primarily	None	No Change	RA8@30mph	RA4@40mph (2003 Assessment), RA8@40mph (2007 RA Verification)	RA2@65mph (2003 Assessment), RA7@65mph (2007 RA Verification)	Strengthen

ELR	Structure I.D. Number	Condition	Track Changes	Lateral Clearance Impact	Route Availability Number			Strengthen, repair, modification works required
					Rail Traffic			
					Existing	Freight	Passenger	
		around supports						
EJM	36	Deck supporting track in fair condition	Double tracking – Seaton loop	Slewing existing track and double tracking over metallic deck	RA13@45mph	RA14@40mph	RA12@65mph	Deck Extension
EJM	37	Fair condition – some open joints, no significant defects noted	None	No Change	RA15@30mph	Based on a comparative assessment of axle weights the structure has sufficient capacity for freight RA8@40mph	Based on a comparative assessment of axle weights the structure has sufficient capacity for passenger traffic RA3@65mph	None
EJM	42	Fair – parapets in poor condition, spalling on abutments, longitudinal fractures on spandrel wall	Double tracking – Newsham extension	Slewing existing track and double tracking on east.	RA14@45mph	Arch has sufficient capacity for RA8@40mph based on available information.	Arch has sufficient capacity for RA3@65mph based on available information.	Parapet Repairs
EJM	46A	Fair – area of sagging, delamination and hollow sounding concrete to soffit at construction gaps	None	No Change	RA10@45mph	RA10@40mph	RA8@65mph	None
EJM	47	Fair	None	No Change	Deck – RA12@45mph Piers – Strengthened to RA10@45mph	Deck – RA13@40mph Piers- Not Confirmed (Loading remains same to current condition)	Deck – RA11@65mph Piers – Not Confirmed (28% reduction in applied rail load)	Assessment required to confirm RA number of piers
BWC	1A	Fair – concrete spalling exposing reinforcement	None	No Change	RA11@40mph	RA11@40mph	RA8@65mph	None

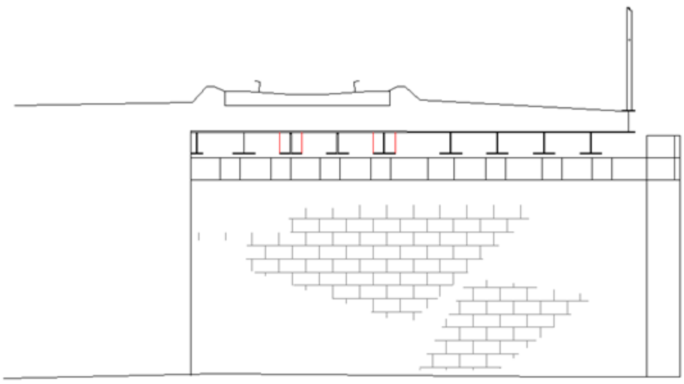
ELR	Structure I.D. Number	Condition	Track Changes	Lateral Clearance Impact	Route Availability Number			Strengthen, repair, modification works required
					Rail Traffic			
					Existing	Freight	Passenger	
		. Corrosion to web of main girder						
BWC	2	Fair – transverse fracture in crown. Several longitudinal fractures some with displacement	None	No Change	Not Assessed	Not Assessed	Not Assessed	Monitoring Required
BWC	3	Fair – severe corrosion, loss of section to full depth of section to piers	None	No Change	Deck – RA12@30mph Piers - RA10@30mph	Deck – RA9@40mph Piers – Not Confirmed (10% reduction in applied rail loading)	Deck – RA9@65mph Piers – Not Confirmed (30% reduction in applied rail loading)	Assessment Required to confirm RA number of piers

Table 22 – Structure RA Number Impact Assessment

13.4.5.1.1 Underbridge EJM/35

The existing deck is in poor condition with severe corrosion in the main longitudinal girders supporting the track. Following a review of the proposed line speed increases, it is concluded that the structure is at the limit of its safe traffic load capacity for freight. As the structural paint system has not been maintained, it is likely that corrosion and section loss to critical elements will have worsened and a revised assessment will identify reduced member capacities. Therefore, subject to confirmation by a revised assessment at later design stages, it is assumed that strengthening/replacement of the existing deck will be required to enhance the route capabilities at this location. A series of solutions ranging from minimum to maximum works have been scored based on the Red, Amber, and Green Ranking system discussed in ***Section 4.6.4.*** Details of each option are provided;

13.4.5.1.1.1 Option 1 – Strengthening Existing Structure



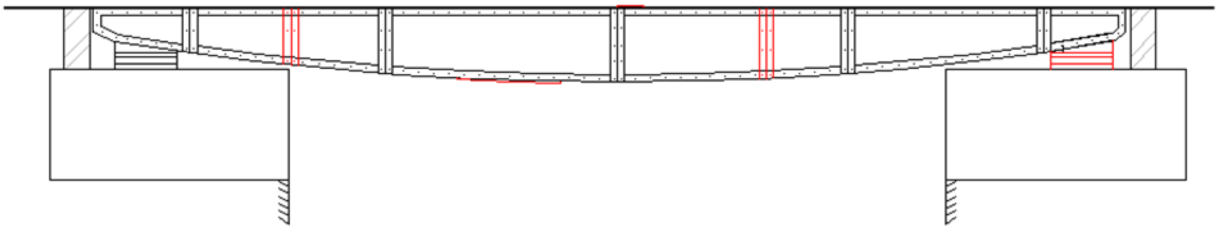


Figure 69 – EJM/35 Option 1

This option considers undertaking strengthening works to the existing longitudinal girders. This will involve blast cleaning all girders and carrying out repair/strengthening work to enhance the structural capacity. Strengthening works may include; additional flange/web plates, replacing rivets with tension control bolts, replacing bearings and/ or replacing sections of the deck plate. The remaining girders which do not support the track will be blast cleaned and painted to enhance residual life.

13.4.5.1.1.2 Option 2 – Replacement of beams supporting the track only

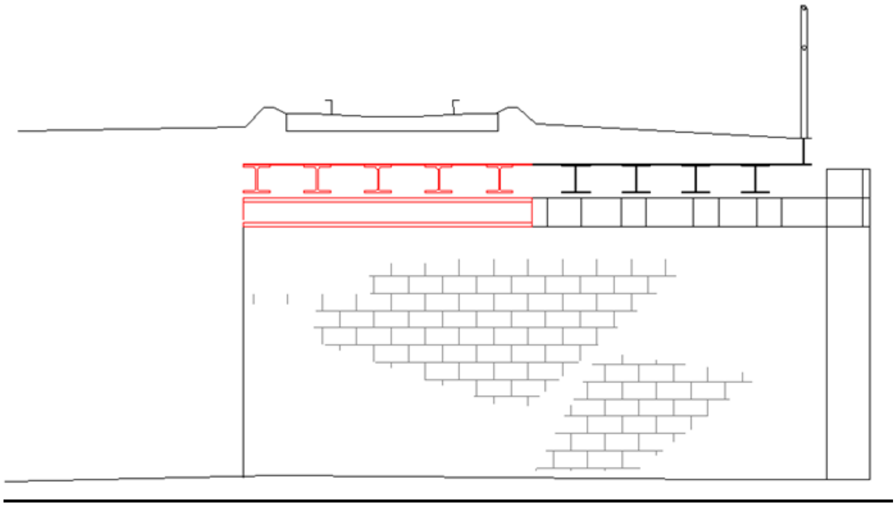


Figure 70 – EJM/35 Option 2

This option considers removal of the existing longitudinal girders supporting the track and installation of new steel beams and concrete cill beams as illustrated in ***Figure 70 – EJM/35 Option 2***. New beams will be selected to match existing dimensions with enhanced capacity. A new deck plate will be installed over the beams and will tie into the existing girders to the east. The existing girders will be blast cleaned and painted to enhance residual life.

13.4.5.1.1.3 Option 3 – Steel deck replacement

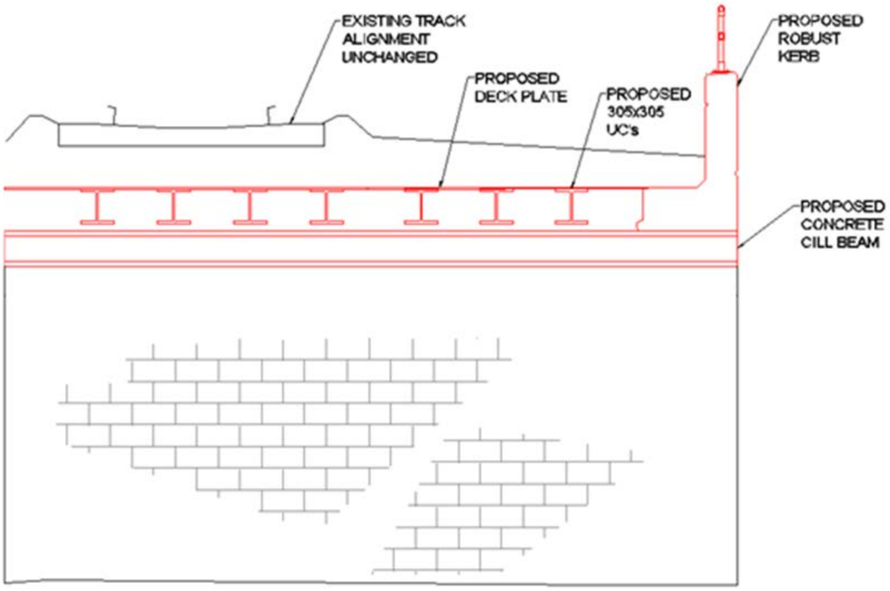


Figure 71 – EJM/35 Option 3

This option considers the complete replacement of the existing deck with like for like beam sections. New beams will be selected to match existing dimensions but with an enhanced capacity. An additional concrete edge beam with integral parapet will also be provided on the Up line side to retain ballast.

13.4.5.1.1.4 Option 4 – Precast Concrete Deck Replacement

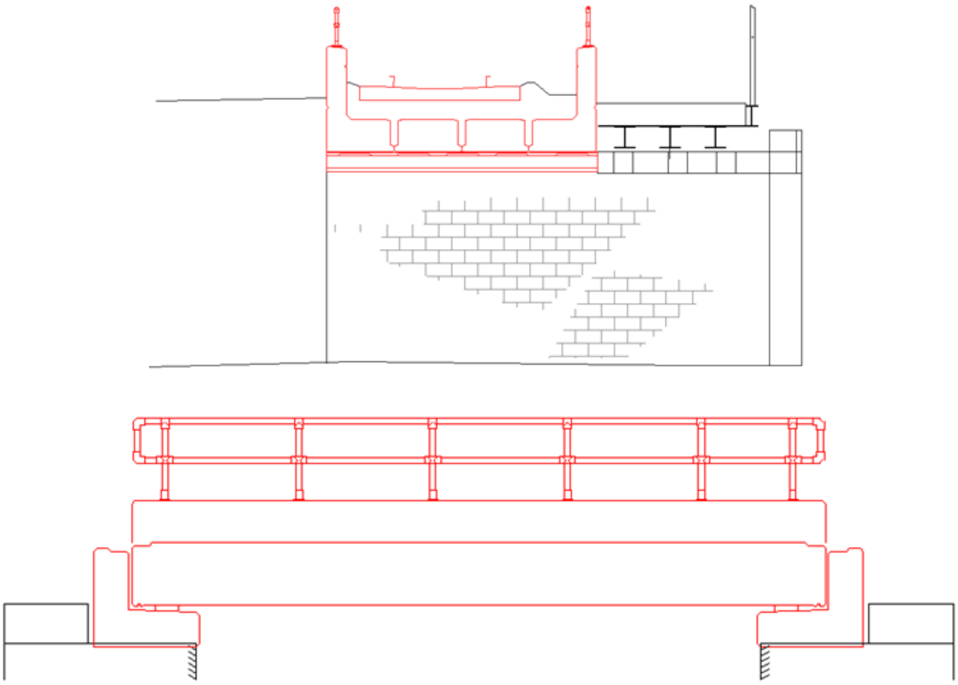


Figure 72 – EJM/35 Option 4

This option considers removing the existing section of deck supporting the track and replacing with a new concrete deck and cill beams as illustrated in ***Figure 72***. The existing abutments will require partial demolition to accommodate new precast concrete cill beams. The new concrete deck elements can be sized to accommodate a continuous position of safety over the length of the structure, or alternatively, the existing deck on the east side not supporting the deck can be retained. Edge beams shall have integral parapets over the structure.

13.4.5.1.1.5 Option 5 – Infill of footpath below structure

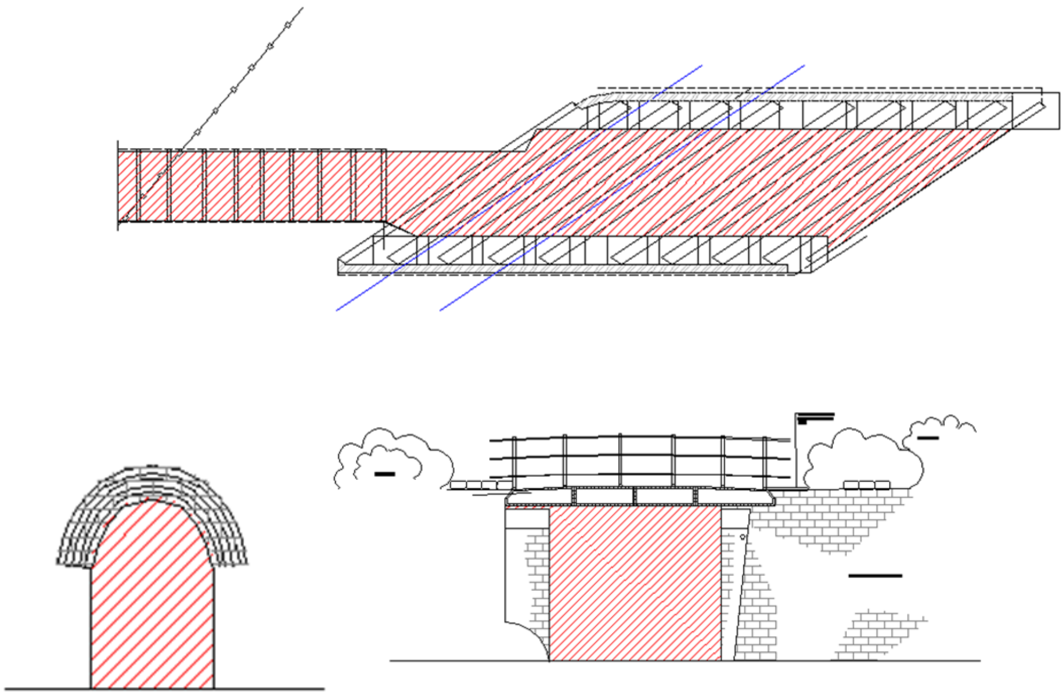


Figure 73 – EJM/35 Option 5

Provided the footpath below the railway is not a designated public right of way and an agreement could be reached with the adjacent landowner to allow its closure, it would be possible to infill the existing structure and thereby remove any future maintenance liability to the railway.

The Existing metallic deck could be retained and infilled as illustrated in ***Figure 73***. Any debris under the structure would be removed and suitably disposed of and the opening filled with a granular material. Strip footings would then be constructed at the structure openings and a 1 metre high reinforced masonry wall constructed. Foam concrete would then be poured and sufficient time allowed to reach its compressive strength. This process would be repeated until the desired height has been achieved and the void is completely closed.

13.4.5.1.1.6 Summary

	Technical Risk	Health, Safety and Welfare	Environmental Risk	Programme Duration	Planning Implications	Disruptive Posessions	Road Traffic Impacts	Interface with Existing Infrastructure / Utilities	Temporary Works Requirements	Construction Cost	Whole Life Costings	Total
Option 1 - Strengthen existing structure	2	2	5	5	5	3	2	5	1	3	1	34
Option 2 - Parital replacement with steel	3	2	4	4	5	3	3	4	2	3	2	35
Option 3 - Complete replacement with steel	4	5	3	3	4	4	5	3	3	3	3	40
Option 4 - Complete replacement with concrete	3	5	2	3	4	3	5	2	2	1	4	34
Option 5 - Concrete infill under structure	5	5	1	5	1	5	1	1	2	2	5	33

Key	
Poor	1
	2
	3
	4
Optimal	5

Figure 74 – EJM/35 RAG Table

Figure 74 illustrates the results of the RAG score for each solution proposed, highlighting Option 3, the complete replacement of the existing deck with a new steel superstructure, as the optimal.

Option 1, the strengthening of the existing structure, was discounted due to the complexity with strengthening repairs to the existing girders, which are fabricated from a combination of wrought iron and steel. In addition, Option 3 also offers a significantly reduced construction time compared to either the refurbishment or partial replacement envisaged under Options 1, or 2 due to avoiding the lengthy processes of blast cleaning, plate repairs and repainting.

The principal disadvantage associated with Option 4, a new concrete deck, is the significant increase in dead load that would be imposed on the existing masonry abutments.

Option 5, the infill of the existing structure would only be possible if agreement could be reached with the adjacent landowner to allow the closure of the existing footpath. As it is uncertain if this agreement would be forthcoming, this option has been discounted at this time.

It should be noted that, whilst strengthening has the potential to offer a more economical solution, the structure will continue to deteriorate if the asset is not adequately maintained and items such as waterproofing and drainage are not renewed on a regular basis.

13.4.5.1.2 Underbridge EJM/36

The existing metallic deck on the west side of the structure is redundant and due to be demolished as part of Network Rail’s Control Period 6. The last assessment of the concrete deck was completed in 2001. The capacities and loads indicated within this assessment have been modified where applicable to meet the revised version of NR/GN/CIV/025 “The Structural Assessment of Underbridges”. The results indicate that the structure has a route availability number of RA13@45mph in the current condition reducing to RA12@65mph for passenger traffic. No strengthening works are therefore required to the existing concrete deck beams; however, as this structure is located on the proposed Seaton loop amendments to the existing structure are will be required to accommodate the proposed second track.

The proposed loop location is to the west of the existing track to avoid an existing telecoms mast on the Up line side. It is not possible to utilise the existing metallic deck due to its condition. A number of options have therefore been considered to widen the existing deck. Each option has been scored based on the Red, Amber, and Green Ranking system discussed in ***Section 4.6.4***.

13.4.5.1.2.1 Option 1- Deck Extension with composite beams

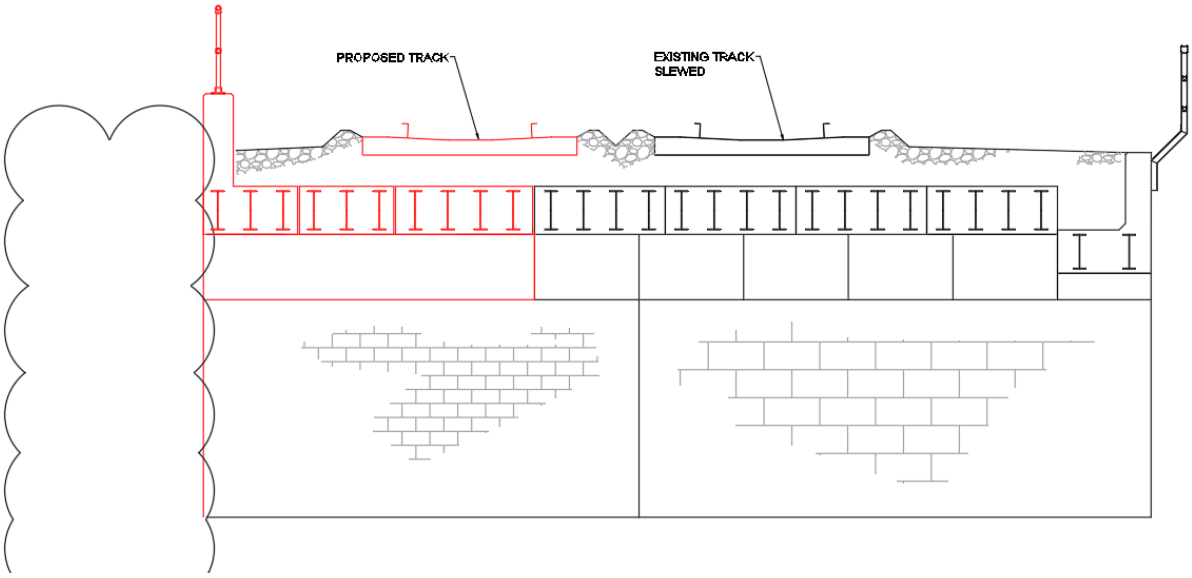


Figure 75 - EJM/36 Option 1

This option considers utilising the existing abutments of the redundant metallic deck to support a new concrete deck extension with beams of similar construction to the original. The edge beam shall have an integral parapet which is capable of providing derailment containment over its length. Partial demolition of the abutments will be required to accommodate new precast concrete cill beams to support the new deck. A geotechnical investigation will need to be undertaken to confirm the adequacy of the supporting abutments.

13.4.5.1.2.2 Option 2 – Deck Extension with composite beams

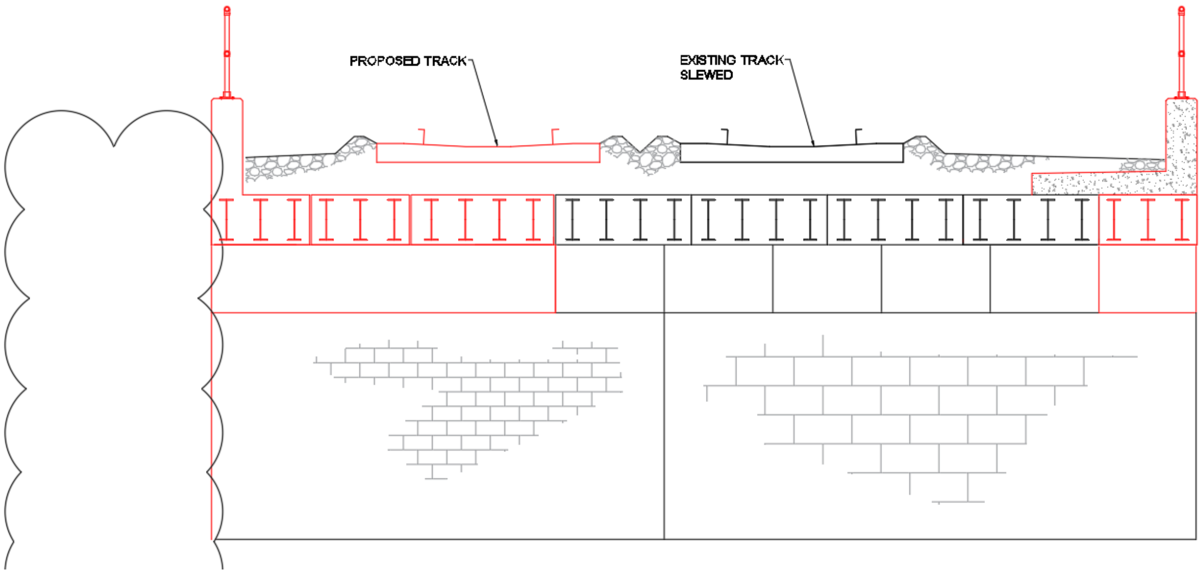


Figure 76 - EJM/36 Option 2

This option considers adopts the same principals as Option 1, however, in this instance the existing edge beam on the east will also be removed and replaced with a new concrete beam to support new parapet sections capable of providing derailment containment over the structure.

13.4.5.1.2.3 Summary

	Technical Risk	Health, Safety and Welfare	Environmental Risk	Programme Duration	Planning Implications	Disruptive Posessions	Road Traffic Impacts	Interface with Existing Infrastructure / Utilities	Temporary Works Requirements	Construction Cost	Whole Life Costings	Total
Option 1 - Deck Extension with composite beams	4	3	3	4	5	3	4	4	3	4	3	40
Option 2 - Deck Extension with composite beams & east parapet beam replacement	4	4	3	4	5	3	4	4	3	3	4	41

Key	
Poor	1
	2
	3
	4
Optimal	5

Figure 77 – EJM/36 RAG Table

Figure 77 illustrates the results of the RAG score for each solution proposed, highlighting Option 2 as the optimal. Whilst both options are very similar, Option 2 provides the additional benefit of incorporating derailment containment on each side of the structure. This also eliminates an ongoing issue noted regarding ballast spilling over onto the public footpath.

13.4.5.1.3 Underbridge EJM/42

The last detailed examination of the structure was completed in November 2015 concluding the structure to be in fair condition with slight deterioration in individual elements. Defects noted include general spalling to all areas of the structure, localised dropped bricks at the crown and longitudinal fractures in the voussoir stones. The route availability of the structure in its current condition is RA14@45mph determined by a Level 0 assessment in September 2013. A preliminary assessment has been carried out using the information available to determine the impact the proposed route upgrade presents on the arch capacity. The results conclude the arch to have sufficient capacity for double tracking subject to a verification assessment recommended at later design stages of the project following the completion of site investigation works highlighted in ***Section 17.7***.

The parapets are in poor condition with fractures, spalling and displacement visible. Lateral displacement is also evident in the spandrel walls with tie bars and pattress plate arrangements on the west elevation stitching the voussoir stones to the arch barrel. This appears to have been installed as a secondary measure to individual stone stitching, indicating the initial remedial measure may not have been adequate.

To accommodate the route upgrade, the existing track will be slued closer to the west parapet to accommodate the Newsham double track extension on the east side of the structure. As the existing parapets are already showing signs of distress and historical strengthening work evident, it is unlikely that the existing parapets will be able to accommodate the increase in lateral loading from the track; therefore, strengthening works will be required. A series of solutions have therefore been considered ranging from minimum to maximum works and have been scored based on the Red, Amber, and Green Ranking system discussed in ***Section 4.6.4***. Details of each option are provided;

13.4.5.1.3.1 Option 1 – Parapet Strengthening

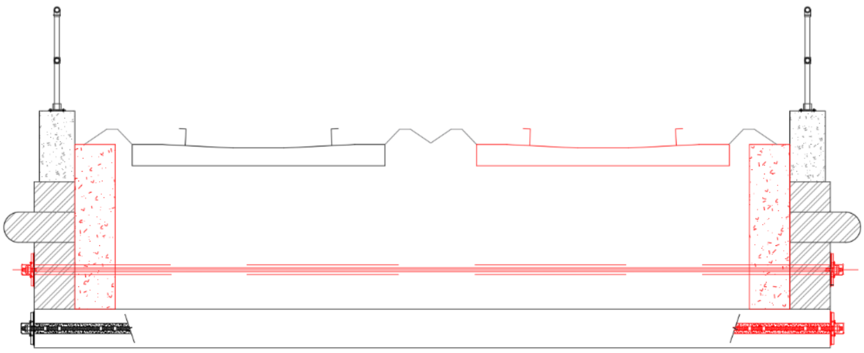


Figure 78 – EJM/35 Option 1

This option considers retaining the existing parapets through strengthening works. This involves excavating adjacent to the existing parapet and forming a reinforced concrete backing. Increased lateral surcharge pressures will be resisted by new horizontal tie bars which connect the Up and Down Line parapets. A new tie bar pattress plate arrangement will also be installed on the east elevation to mitigate against separation of the voussoir stones from the arch barrel.

The strengthened parapets will resist lateral surcharge pressures generated by the passing trains; however, they will not provide protection against derailment. A derailment impact assessment has been carried out and the risk of derailment at this particular location is low using the methodology set out in Section 4.6.4.

13.4.5.1.3.2 Option 2 – Concrete Parapet Replacement

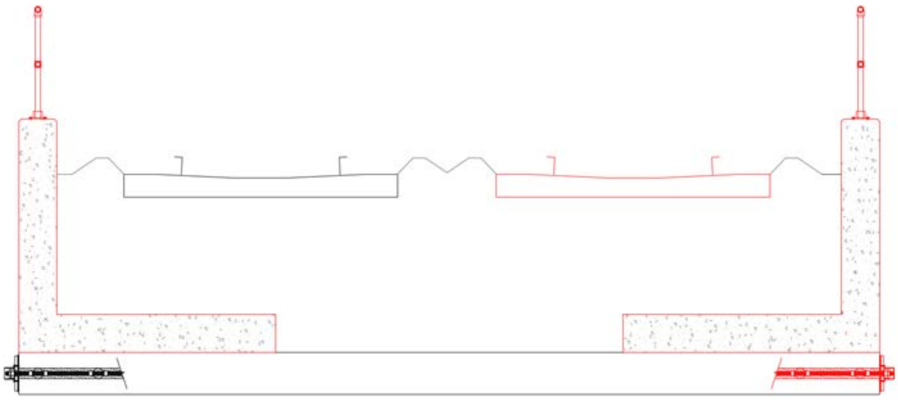


Figure 79 – EJM/35 Option 2a Replacement of parapets with precast concrete L-shape units

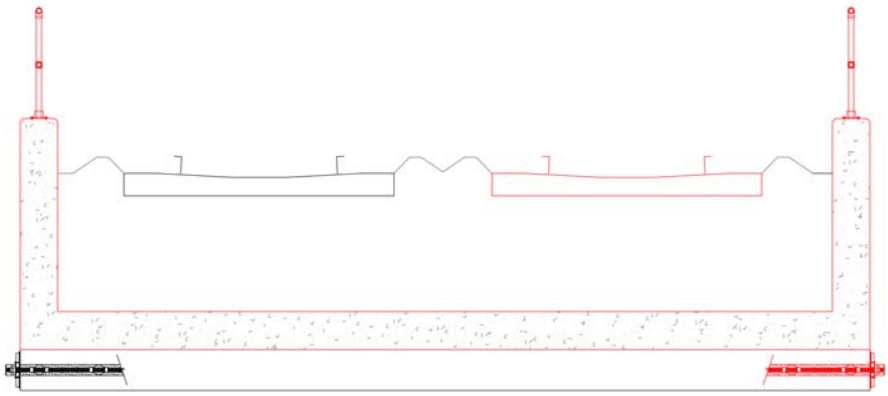


Figure 80 – EJM/35 Option 2b Replacement of parapets with precast concrete U-shape units

This option considers complete replacement of the existing parapets with precast concrete L-shaped or U-shaped units seated on top of the existing arch. Units would be designed to resist lateral loading from the fill and track. Derailment containment can be achieved by designing the parapet as a robust kerb. A new tie bar pattress plate arrangement will also be installed on the east elevation to mitigate against separation of the voussoir stones from the arch barrel.

13.4.5.1.3.3 Option 3 – Structural Renewal

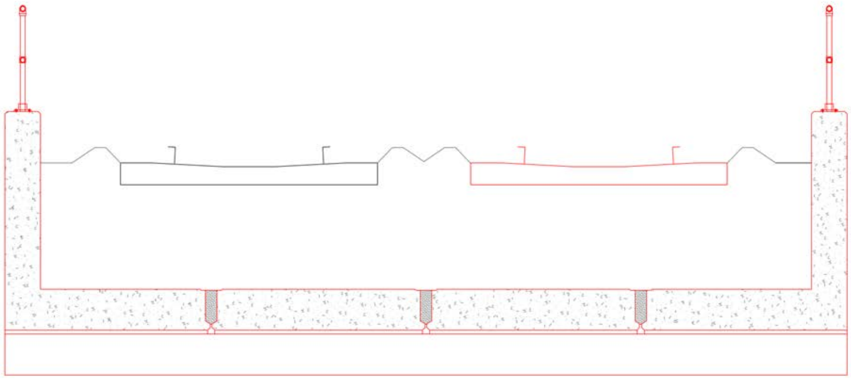


Figure 81 – EJM/35 Complete Deck replacement

This option considers demolition of existing parapets and masonry arch and installation of a new precast concrete deck. This solution will require building up the existing abutments to achieve the same headroom clearance. This could be achieved by precast concrete cill beam units or in-situ concrete. Derailment containment can be achieved over the structure by designing the parapet as a robust kerb.

This solution depends upon the condition of the existing abutments to support the heightened section. If this is not possible, complete structure replacement may be required.

13.4.5.1.3.4 Summary

	Technical Risk	Health, Safety and Welfare	Environmental Risk	Programme Duration	Planning Implications	Disruptive Posessions	Road Traffic Impacts	Interface with Existing Infrastructure / Utilities	Temporary Works Requirements	Construction Cost	Whole Life Costings	Total
Option 1	3	2	4	5	5	4	5	5	4	5	1	43
Option 2	1	3	3	3	3	3	4	3	3	3	3	32
Option 3	4	5	1	1	1	1	3	2	2	1	4	25

Key	
Poor	1
	2
	3
	4
Optimal	5

Figure 82 – EJM/35 RAG Table

Figure 82 illustrates the results of the RAG score for each solution proposed, highlighting Option 1 as the optimal choice. This is largely due to the simplicity in design, savings in construction time and cost and its overall impact on the existing structure. It should be noted that it does not address asset deterioration which will require ongoing maintenance. Monitoring of the structure before and after route upgrading under loading is recommended.

13.4.5.1.4 Viaducts EJM/47

The impact of the proposed line speed increases has been assessed as discussed in ***Section 4.6.4.1*** which has been based on the 2007 assessment report. The results of this assessment are detailed in ***Table 22*** and conclude the deck has enough capacity for the proposed route upgrade. As exact details of the pier strengthening works are not known, it is not possible to formulate the same conclusion.

In this case loads applied to the piers have been compared. Freight loading has been based on the route availability number contained within the sectional appendix (RA8) for the line. For permitted freight travelling over the structure at 40mph, there is no anticipated increase in load over what the structure has been strengthened to. For passenger trains (RA3) travelling at 65mph, there is a reduction in loading of approximately 28% anticipated. As neither of the proposed traffic speed increases result in any anticipated increase in the load that the structure has been strengthened to, it is not anticipated that any further strengthening works will be required. However, this will require confirmation through a more detailed assessment to be completed at a later Design Stage.

13.4.5.1.5 Underbridge BWC/2

Currently there is no assessment on record for Underbridge BWC/2. As noted in the 2018 detailed examination, see ***Section 16.8.1.8***, the structure is in fair condition with the main noted defects being a transverse fracture in the crown and several longitudinal cracks which were identified in February 2012. This appears to be a result of settlement which is evident in the arch barrel with differential displacement of sections of the lining at construction joints.
As the only change is lighter moving passenger trains, no strengthening works are proposed as part of the route upgrade. However, as the structure is exhibiting signs of destress due to ongoing settlement, it is proposed that monitoring of the structure is carried out before and after the route upgrade to ensure that there is no further significant deterioration in the condition of the structure following the completion of the proposed works.

13.4.5.1.6 Viaduct BWC/3

The impact of the proposed line speed increases has been assessed as discussed in ***Section 4.6.4.1*** which has been based on the 2006 assessment report. The results of this assessment are detailed in ***Table 22 a***nd conclude the deck has enough capacity for the proposed route upgrade.

Piers have been assessed based on a load comparison using the same approach adopted for EJM/47. For permitted freight travelling over the structure at 40mph, there is a reduction in vertical loading on the piers of approximately 7.6% and a reduction in horizontal loading of 10% over what the structure has been strengthened to. For passenger trains travelling at 65mph, there is a reduction in vertical loading of approximately 30% and horizontal loading of 35%. As neither of the proposed traffic speed result in any anticipated increase in the load that the structure has been strengthened to, it is not anticipated that any further strengthening works over and above Network Rail's CP6 planned works will be required. However, this will require confirmation through a more detailed assessment to be completed at a later Design Stage.

13.4.5.2 Overbridges

The risk of road vehicle incursions on the railway has been assessed in accordance with NR/L3/CIV/00012 for all overbridge structures along the route as discussed in ***Section 4.6.4.2***. ***Table 23*** provides a summary of each overbridge sites score in relation to both the current condition and the proposed route upgrade; refer to ***Appendix J*** for full results. The results concluded an increase in risk at each site; however, as each structure score is below 90, none are considered a high risk and no preventative measures are proposed.

Engineers Line Reference	Railway Structure ID Number	Carriageway		Road Vehicle Incursion Risk Score					
		Reference	Type	Track Configuration	Approach Corner				Final Score
					Northwest	Southwest	Northeast	Southeast	
BNE	29	B1505 - Great Lime Road	Single	Existing	68	82	82	66	82
				Proposed	72	86	86	70	86
BNE	30	Holystone Farm	Single	Existing	83	83	60	83	83
				Proposed	86	86	63	86	86
BNE	31A	A19 - Holystone	Dual	Existing	58	58	58	58	58
				Proposed	61	61	61	61	61
BNE	31B	A186	Dual	Existing	57	57	57	57	57
				Proposed	60	60	60	60	60

Engineers Line Reference	Railway Structure ID Number	Carriageway		Road Vehicle Incursion Risk Score					
		Reference	Type	Track Configuration	Approach Corner				Final Score
					Northwest	Southwest	Northeast	Southeast	
BNE	31C	Algernon Drive	Single	Existing	58	71	58	71	71
				Proposed	62	75	62	75	75
BNE	33	B1322	Single	Existing	60	60	60	60	60
				Proposed	64	64	64	64	64
EJM	33A	A186	Dual	Existing	49	49	49	49	49
				Proposed	61	61	61	61	61
EJM	39	A192	Single	Existing	62	62	62	62	62
				Proposed	75	75	75	75	75
BWC	1	Stakeford Road	Single	Existing	73	73	73	73	73
				Proposed	86	86	86	86	86
BWC	5	Station Road	Single	Existing	56	54	54	54	56
				Proposed	69	67	67	67	69
BWC	5A	A197- Rotary Parkway	Single	Existing	40	40	40	40	40
				Proposed	53	53	53	53	53

Table 23 – Road Vehicle Incursion Risk Assessment Results Summary

13.4.5.3 Culverts

A qualitative assessment has been carried out for each culvert structure identified as discussed in ***Section 4.6.4.3*** see ***Table 24***. None of the structures are considered to require strengthening works to accommodate the proposed route upgrade.

Engineers Line Reference	Railway Structure Identification Number	Structural Form	Span (m)	Depth of cover (m)	Qualitative Assessment to NR/GN/CIV/025	Impact from proposed route upgrade
BNE	28	Masonry Arch	0.75	2.8	Fair	N/A
EJM	34	Masonry Arch	1.6	3.1	Recently repaired – piped and grouted	N/A
EJM	36A	Masonry Arch	1.5	6.2	Recently repaired – arch barrel repairs	N/A
EJM	38A	Concrete Pipe (Manhole Sewer)	1.1	4	Outside Party – No issues raised. No evidence of failure at track level	N/A
EJM	38	Masonry Arch	1.4	3.2	Fair	N/A

Engineers Line Reference	Railway Structure Identification Number	Structural Form	Span (m)	Depth of cover (m)	Qualitative Assessment to NR/GN/CIV/025	Impact from proposed route upgrade
EJM	40	Masonry Arch	1.3	2.07	Fair	N/A
EJM	41	Masonry Arch / Armco Pipe	1.55	10	Fair	N/A
EJM	43	Masonry Arch	0.95	8	Fair	N/A
EJM	44	Masonry Arch / Reinforced Concrete	1.5	7	Fair	N/A
EJM	44B	Concrete Pipe and Brick Barrel	0.6	1.2	Good	N/A
EJM	45A	Reinforced Concrete Slab	0.6	2	Fair	N/A
EJM	45B	Concrete Pipe (Manhole Sewer)	0.9	4.5	Outside Party – No issues raised. No evidence of failure at track level	N/A
BWC	2A	Concrete Pipe (Manhole Sewer)	1.2	8.3	Outside Party – No issues raised. No evidence of failure at track level	N/A
BWC	2AB	Masonry Arch into 2 Masonry Boxes	0.4	5.5-6	Poor/Fair – Potential collapse in box culvert	For discussion (see ***Section 6.4.5.3.1***)
BWC	2B	2 Earthenware pipes into Masonry Arch Barrel outlet	0.15	3	Fair	N/A

Table 24 –Culvert Structure Details

13.4.5.3.1 BWC/2AB

BWC/2AB has been identified in poor condition. The structure comprises a single span masonry arch which extends under the Down line embankment splitting into two stone slab culverts running parallel under the track. A detailed examination in 2012 identified areas of collapsed and displaced masonry to the central wall between the two culverts and the stone slabs; however, this has not since been confirmed. The most recent detailed assessment was unable to find evidence of collapse when viewed from the ends. A CCTV survey was also carried out; however, it was stopped due to silt deposits on the culvert invert, debris and an obstruction (bicycle wheel). No evidence of failure has been identified at track level. At this point it is considered that the displaced/collapsed masonry has not deteriorated since viewed in 2012 and is unlikely to worsen with the introduction of lighter passenger trains. Track monitoring is proposed as a precautionary measure upon opening to passenger traffic.

13.4.5.4 Footbridges

The risk of derailment at existing footbridge structures BWC/4 and BWC/4A has been assessed as discussed in ***Section 4.6.4.4*** Reference can be made to ***Appendix J*** for full results. ***Figure 83*** and ***Figure 84*** provide a summary of the results for both passenger and freight as leading traffic and considers both with and without additional derailment preventative measures.

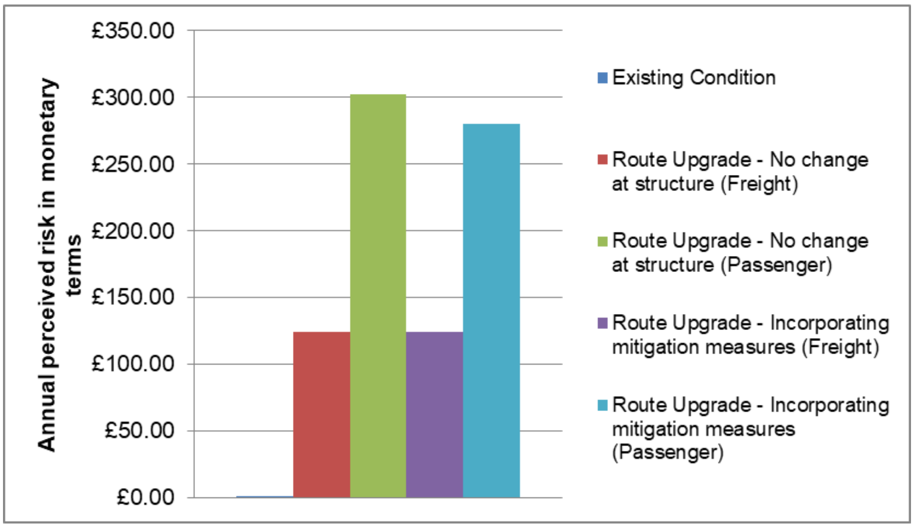


Figure 83 – BWC/4 Annual perceived risk from a derailed train in monetary terms, $\Sigma_{scenarios}$

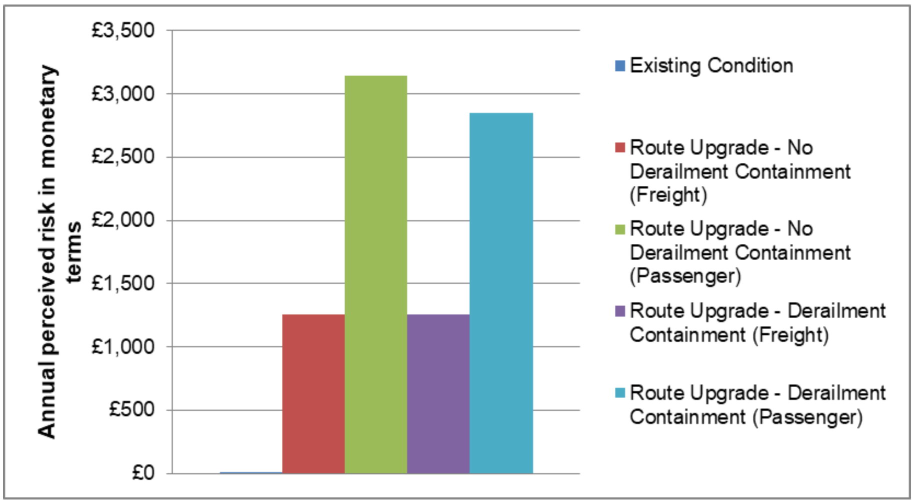


Figure 84 – BWC/4A Annual perceived risk from a derailed train in monetary terms, $\Sigma_{scenarios}$

The results indicate an increase in risk for both train types over the existing condition. This is expected given the volume and speed of freight currently using the track. The perceived risk value is largely based on a train becoming derailed and having no impact with the structures. This would be true for any location along the line. The benefit gained through incorporating mitigation measures indicates a reduction in the annual perceived risk for BWC/4 and BWC/4A of £22 and £292 respectively. Given that both sites remain a low risk in monetary terms, the cost of installation of any mitigation measures would greatly outweigh the benefit gained in their risk reduction. Therefore, given there is a low risk of derailment and structural impact at each site, no works are proposed.

14 ASSUMPTIONS

14.1 List of Assumptions used in Compiling Options

Various Design Assumptions identified during the work to date are included within the discipline specific text and also within the Appendices to this report. However, some higher-level project assumptions are identified below and expanded upon where required;

14.1.1 Assumption: Survey Accuracy

Where Geo-RINM or desktop analysis has taken place, the design and any associated engineering output or estimate will need to be validated once full survey information for the route is available.

14.1.2 Assumption: Earthworks Scope

Where track realignment or an additional track is being laid on the current earthwork, modifications to the earthworks are not required unless earthwork condition or stability requires geotechnical intervention or remedial measures.

14.1.3 Assumption: The Effect of Access Points on Earthworks

Where additional new infrastructure will be provided, i.e. signals, location cabinets, power cubicles, S&C, etc., an authorised access point will be provided, which may require earthwork widening.

14.1.4 Assumption: Mine Remediation Works

Grouting is proposed beneath station platforms and other structures where worked coal seams and potential for voids / cavities have been identified.

Grouting is not proposed beneath station car parks and access roads. Grouting of seams below car parks is considered technically feasible but would incur significant cost. The use of basal reinforcement to temporarily span any surface voids and limit the amount of surface pavement deformation caused by potential subsidence may be considered as a cost-effective alternative. Options for geogrid reinforcement to be incorporated into the unbound granular or a thickened granular sub base construction to provide a reinforced flexible pavement is recommended for further consideration. The requirement for the geotextile will be assessed during detailed design. However, it should be noted that as the Coal Authority is a statutory consultee during the planning process, they may object to the non-treatment of old mine workings at the most sensitive locations. It is therefore recommended that an appropriate contingency allowance is included in the scheme capital budget to allow for unexpected grouting costs.

14.1.5 Assumption: Traffic Demand Data

Traffic demand data used in this phase of the project is based on demand modelling developed for the SOBC. Details of this model can be found in the Economic Appraisal Report (Appendix C in the SOBC). The SOBC demand model has subsequently been re-zoned for the OBC, which may have material impact on the demand outputs. This ensures that both the localised junction modelling, and the car park sizing assumptions for the stations, should be revisited during the next phase of the project. Car parking provision at the stations is based on providing enough spaces to meet the demand identified in the SOBC demand modelling. No further assumptions regarding existing parking provision in and around the vicinity of the stations have been made. This is particularly relevant to the more central station locations in Bedlington and Ashington, where alternative on and off-street car parking may be available. Similarly, provision for non-station use of station car parking has not be accounted for.

14.1.6 Assumption: Level Crossing Orders

Level Crossing Orders can be completed to facilitate Phase 1 operations on time

14.1.7 Assumption: Furnaceway Sidings

Furnace Way sidings can be returned to Network Rail management, refurbished and re-opened for use early in the construction programme for Phase 1

14.1.8 Assumption: Track Access

Sufficient track access can be made available in the form of either extended possessions or blockades to enable works to be constructed within the programme timescales. This particularly impacts the rail system disciplines such as signalling, track, telecoms and power.

14.1.9 Assumption: Environmental Impacts

Any measures required to treat or relocate flora or fauna can be completed without delay to the overall programme.

14.1.10 Assumption: Signal BS16 at Bedlington

A Design Assumption has been made that changing the form of BS16 will facilitate a reduced standback of 8m on the Up Platform at Bedlington Station. This issue cannot be resolved until Signal Sighting has been carried out.

14.1.11 Assumption: Northumberland Park Station

The project will be given approval from North Tyneside Council to break out the parapet and add dead load to Overbridge BNE/31C (Algernon Drive) when forming the station access.

The proposed housing estate developer to the west of the A186 will allow a station access path to enter the housing estate.

14.1.12 Assumption: Bedlington Station

Either a signalling solution can achieve a reduced signal standback to Signal BS16/18, or Selective Door Operation (SDO) will be accepted on the Up Platform in order to achieve a compliant platform radius over the operational length.

The re-alignment of the level crossing barrier at Bedlington South Level Crossing is accepted

The existing buildings on the Up platform can be retained and re-used as part of the scheme

14.1.13 Assumption: Ashington Station

The Wansbeck Square improvement scheme will happen in time to facilitate PRM access down to platform level with the project providing a lift to replace the current stairwell.

14.1.14 Assumption: Driver Training

Driver training will take 3-4 months before public operations can begin and can be accommodated within the overall project timescale via use of simulator technology if necessary.

14.1.15 Assumption: OLE

The project has not considered electrifying the route at this stage although does recognise the future benefits this may have in terms of being a diversionary route for the ECML. While the project has not actively designed passive provision for future electrification, at this early stage, there is nothing significant that would prevent this from being investigated later, should time, budgets and business case permit. It can be discussed and agreed at the next design stage whether or not the new overline structures (i.e. station Footbridges) should be designed and constructed to achieve full electrical clearance or an efficient OLE philosophy should be adopted.

15 CONCLUSION

Fundamentally, this stage of the process has proven again that the re-opening to passenger service of the current freight line, including providing six new stations can all be done within the budget and timescales of the Transforming Cities Funding. The project can be delivered in two infrastructure phases, with Phase 1 achieving an hourly service from Ashington to Newcastle, stopping at Bedlington, Newsham and Northumberland Park, in operation by early 2023. Phase 2, which requires the conclusion of the TWAOs to secure the land required for the final two stations at Blyth Bebside and Seaton Delaval, will be completed soon thereafter, subject to funding and will deliver a half hourly passenger service with end to end journey times of around 35 minutes by 2025. See Sketches below:

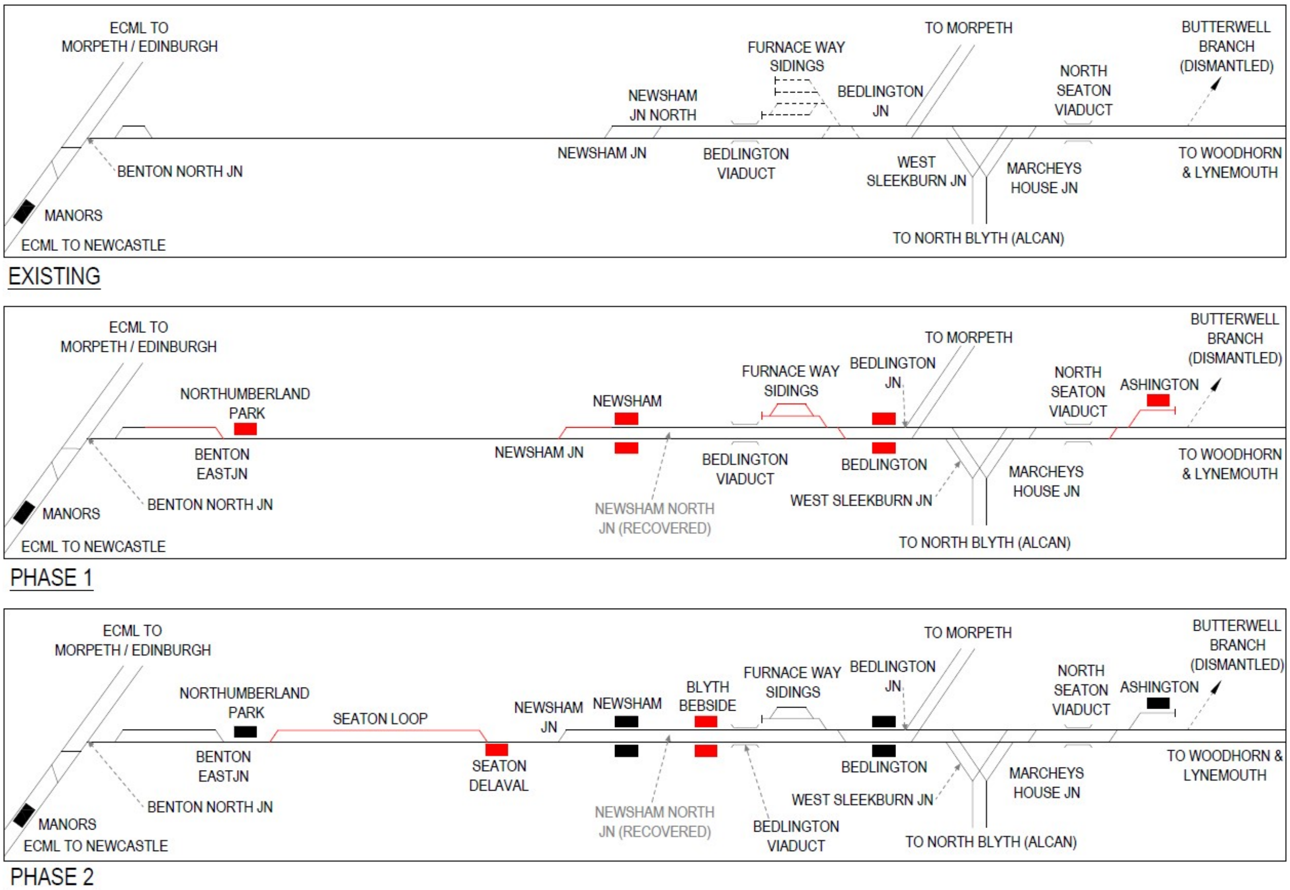


Figure 85 – Northumberland Line 2 Phase Delivery Schematic

The six new stations locations have been confirmed and the process of securing the necessary land and consents has begun. Public consultation has shown that the local population and businesses are strongly in favour of the scheme and the existing freight operators should also benefit from a more efficient linespeed profile and better track and signalling.

The work done in this stage to provide engineering and cost input to the OBC has built on the understanding and momentum from the SOBC, together with a much greater degree of access to asset records, Network Rail asset managers, and the assets themselves on site. The enhanced information base has enabled the project team to review and challenge the previous assumptions and conclusions so that the design can be improved and adopted with greater confidence.

A series of workshops with the project team and frequent representation from the client (NCC), Network Rail, Morgan Sindall, and NEXUS has enabled options to be developed and tested extensively. Public consultation on emerging designs has led to initial feedback from potential users and neighbours to the scheme and provided useful insight and ideas. Oversight by the Steering Group and Project Board has resulted in wide industry consultation and acceptance of the emerging outcomes.

The attached appendices contain standalone reports, drawing, tables and various source material referenced within this report. Whilst not necessarily vital to understanding the context of the report and the selected preferred option, these appendices add further detail and technical information generated during the option development phase of the project lifecycle.

This report highlights the preferred option for each station and route wide disciplines within ***section 5***. A summary of which can be read within the *EXECUTIVE SUMMARY* at the start of this report.

The confidence level of the design has risen considerably through improved knowledge about the type and configuration and condition of the existing assets, the operational constraints, the land and property ownership, and the likely construction methodology. This has allowed the team to provide more accurate estimates of the location and extent of works required to deliver the project and provide an informed basis to select between sub-options. Nevertheless, there are more details to be understood to enable outline design to take place in the next stage and a further reduction in the risk and optimism bias factors. In general, these are:

- Land and property negotiations, which will create the context for access and construction
- Further public consultation, which may result in changes to the design
- Legal powers and consents, which will set the parameters within which works will be delivered
- Development of the procurement strategy, which will define the degree and status of design development, and influence the likely construction methodology
- Operational interfaces, which are evolving and will determine the degrees of freedom for the proposed timetable
- Survey data, to complete the gaps in lower-priority areas and create a complete and consolidated data set
- Asset condition assessment, which will confirm or refine our understanding of the capacity of the existing infrastructure to be adapted for the project’s purposes
- Planned asset maintenance and renewals by Network Rail, which may affect the baseline asset assumptions for the design
- Detailed modelling adopting the preferred sub-options, which will allow refinement of design input criteria
- Cross-discipline design checks on the emerging outline design and check that the solution is fully integrated
- Refined cost estimates, particularly in refining the Quantified Risk Analysis, and determining the overhead costs which are currently on a percentage allowance basis, but which will need to be developed based on a proposed programme and construction methodology
- Updated demand modelling to allow a robust highways, junctions and car parking strategy to be developed along with appropriate Road Safety Audits.
- Understanding and incorporating a mechanism for the signalling layout and level crossing plan approvals under the NRAP process.
- The form of Interlocking to adopted at Newsham requires to be agreed early to allow the signalling scheme to progress.
- Undertake Ergonomic assessments at all Signal boxes and panels.

The more informed and better-defined preferred option has been priced with assistance from Morgan Sindall through an Early Contractor Involvement process such that the methodology, programme and pricing could take advantage of a contractors’ insight.

The net effect has been that the four infrastructure phases referred to in the SOBC have now been contracted to two phases – subject to legal permissions and funding constraints – and the overall cost has been marginally reduced, though the cost of Phase 1 work has slightly increased. This is because of the inclusion of works to Furnace Way sidings, as well as almost all the signalling works, and poorer than previously understood track condition.

The overall technical viability of the scheme therefore remains intact: the budget has been shown to be largely unmoved since SOBC, the programme is realistic (and even a little conservative) and can deliver the project in time. The main risks are manageable, and public consultation indicates the project enjoys strong local support to build on wider industry enthusiasm for the timely delivery of the project.

The next steps involve the development of the design and stakeholder discussions to support the proposed non-works Transport and Works Act Order, scheduled to be applied for in early summer 2020. This will be a critical path activity to ensure that the project has the appropriate consents and powers to deliver the scheme.

16 EXISTING ASSETS – CONDITION SURVEYS / GI / TOPOGRAPHICAL SURVEYS UNDERTAKEN

16.1 Topographical survey and Survey Control Network

16.1.1 Snakegrid background (ECML14)

It is generally standard practice on highway/railway projects that the topographical survey is produced in a local grid which aims to achieve a 1:1 fit between the co-ordinates and the reality on the ground. For smaller sites the inaccuracy introduced by the curvature of the earth is negligible and, therefore, using a local grid is agreeable but as projects increase in size past a few kilometres the curvature cannot be ignored. SnakeGrid software was originally developed by University College London (UCL) for the West Coast Main Line to overcome this problem and is now used on a large number of rail projects, both in the UK and overseas.

A grid (known as ECML14) has been produced for Network Rail, for the railway line between London Kings Cross via East Coast Main Line to Edinburgh. Although the Northumberland Line does not fall directly on this route trend line, it does fall within 10km (as a general rule of thumb the SnakeGrid accuracy falls away if the distance from the trend line is greater than 10km). ECML14 is a unique SnakeGrid designation and can only refer to the grid created for the route described above. It can only be accessed by loading the parameter file (ECML14.dat) into the SnakeGrid software. Aecom have access to this specialised software and the parameter file. Formal approval from Network Rail was granted for the use of this grid for the Northumberland Line.

The advantages of tying into the existing ECML14 SnakeGrid are:

- One grid system which should would reduce the potential for errors that can occur when transitioning from one local grid to another.
- Grid is already created and available.
- Grid system is the same as Network Rail are employing, therefore, any works / consultations in relation to rail crossings, etc should be less problematic.
- The main benefit from a survey point of view is the ability to work without scale factor along longer survey routes. It is also extremely easy to convert co-ordinates between ETRS89, Snakegrid and OS which is useful, especially when dealing with multiple designers, GI professionals and GIS professionals.

16.1.1.1 Northumberland Survey Control

In order to establish a robust and suitable survey control network to survey and design the full length of the route, it was necessary to first establish the Primary and secondary control.

To tie into the existing ECML14 Snakegrid the existing Primary / Secondary ECML14 control markers were requested from Network Rail and new Primary and secondary control baselines were established along the route

The Primary control markers were established and coordinated approximately every 10km along a route with Primary Baselines established at Northumberland Park, Newsham and Ashington.

The Secondary control markers were installed at approximately 2 km intervals near where any targeted survey activity was required for this stage of the project.

The Tertiary Control was established at the targeted site by installing Permanent Ground Markers (PGMs) every 200m along the rail corridor within the limits of the chosen site. These markers were then coordinated back through the Secondary and Primary control grid to tie into the SnakeGrid.

16.1.2 Topographic Survey

Topographic surveys were carried out at various targeted key locations through the route to provide more accurate and up to date data to inform the option selection process and aide in any further design works.

AECOM's Specialist Railway Survey Team surveyed each location under the following remit:

1. Carry out 1/200 scale topographical surveys at various locations on the Northumberland Line between Ashington and Northumberland Park.
2. The topo survey will be related to a newly established SnakeGrid called "ECML14 on ETRF89(2009)" which will use the existing ECML14 parameters but will be compatible with the use of OSTN15 / OSGM15.
3. The GNSS Network baselines will be established at approximately 10km (Primary) and 2km (Secondary) intervals.
4. New Tertiary PGMs will be established at the various survey locations. All new control PGMs will be levelled / traversed in the nearest Primary or Secondary GNSS control.
5. Rails and full lineside detail (+3m from RE) to be surveyed over the length of the various survey extents.
6. Fence to fence detail to be surveyed where possible at the various survey locations. Sufficient levels to be taken to show ground profile.
7. Rails to be taken at 5m intervals (radius <500m) and at 10m intervals elsewhere.
8. The survey should not end on a transition and will have a minimum of 50m of regular geometry.
9. IBJs, AWS and full 4-foot detail to be surveyed.
10. Joints, welds and general track materials will be surveyed to minimise reworks.
11. Structures within the survey extents to be surveyed / gauged
12. Catch-pits to be surveyed with cover levels.
13. All boundaries (walls, fences, hedges, etc.) to be shown within the survey extents.
14. All manholes, ICs and street furniture to surveyed with cover levels for MHs and ICs.
15. Levels to be taken at ~10m centres with additional levels at top/bottom slopes and any breaklines.
16. All isolated, mature, individual trees will be shown with their bole position surveyed approximately 1.0 metres above ground level. Groups of trees and shrubs will be indicated by the extent of canopy.
17. Contours to be shown at 0.5m vertical intervals within soft detail areas.

The chosen areas to be surveyed at this stage of the project were as follows:

- Benton East Jn S&C
- Palmersville Dairy Footpath Crossing
- Northumberland Station site to Earsdon footpath crossing
- Seaton Delaval Station location
- Chase Meadows footpath Crossing
- Bedlington Station area
- Green Lane level Crossing to Hirst Lane Level Crossing (incl Ashington Station site)

The survey team also provided topographic survey and Laser Scanner Cloud survey data for some key level crossings as below:

- Holywell Crossing
- Seghill Crossing
- New Hartley Crossing
- Newsham South Crossing
- Blyth Bebside Crossing

A full survey report can be found in ***Appendix G***.

16.2 Track Condition

16.2.1 Background

The future Northumberland Line, currently the Ashington Blyth and Tyne freight only line, is made up of a mixture of different materials of differing age and condition. In order to ascertain necessary capital expenditure for an upgrade to a mixed freight and passenger route, a track condition assessment was deemed necessary to identify any life-expired and the extent of degraded track assets. The following text focuses on the suitability of plain line track condition and components for an upgrade to passenger use and subsequent increase in line speed. A mainly visual survey of switch and crossing (S&C) units is also included wherever it was possible to undertake.

16.2.2 Inspection Criteria

- Record rail and components' type and extent wherever possible throughout the entire route
- Identify pre 1976 rail or older
- Identify any areas of bullhead
- Take rail wear readings wherever possible
- Visual assessment of ballast, line and level
- Create a photographic record

16.2.3 Extent of Inspection

Between the dates of 24/7/2019 and 14/8/2019 a track asset condition survey was undertaken along the Ashington Blyth and Tyne Line from the points 3117 on the ECML 0 miles 0 chains, ELR BNE, through the ELR EJM between 7 miles 8 chains to 15 miles 60 chains at Bedlington and along the ELR BWC 0 miles 0 chains to Hirst Lane level crossing at 3 miles 21 chains. Due to access and time restrictions over the period some areas were covered in more detail than others. However nearly the whole site was walked, and the following tables list the general recorded information for each ELR. Further and more detailed information can be found in ***Appendix A*** which contains tabulated data of specific rail wear readings, a rail age table for the entire existing route, S&C details and mileage specific photos. ***Appendix A*** also indicates areas where track renewals may be required to bring current components up to suitable quality for passenger services to run.

16.2.4 Findings

16.2.4.1 ELR - BNE

The following table from the survey along ELR BNE, shows the walkout dialogue undertaken on 30/07/2019 to 31/07/2019. All notes and readings are recorded in the direction of increasing mileage. Recorded offsets are to running edge. The chainage datum is 0m at 3117 points.

ELR – BNE		
Down side notes	**Chainage (m)**	**Up side notes**
3117 toes (ECML)	0	
3119 toes	80	
Last long bearer	134	
3118 toes (catch points)	182	
Readings and photos (See ***Appendix A***)	281	Readings and photos (See ***Appendix A)***
	447	Welded up joint LHR
	450	Welded up joint RHR
0M 23 chain marked Down 6' rail	459	
Adjustment switch start CWR	464	
	475	Adjustment switch start CWR
	601	Greaser pot

ELR – BNE		
Down side notes	**Chainage (m)**	**Up side notes**
Greaser pot	674	
No track access	674-2360	
Signal N101 - 1.904m	2360	3.420m Metro Line
O/B BNE 30 start – 1.883m	2801	3.410m Metro Line
Rail head to soffit 5.707m		
O/B BNE 30 end – 1.879m	2807	
Signal 638R – 1.934m	2875	
O/B BNE 31A start – 1.560m	3059	
Rail head to soffit 5.117m		
Rail head to soffit 5.707m		
O/B BNE 31A end – 1.563m	3103	2.198m Metro Line
	3358	1.453m - OLE mast base
O/B BNE 31B start – > 5.000m	3385	
Rail head to soffit 6.188m		
Rail head to soffit 6.272m		
O/B BNE 31B end – > 5.000m	3410	
30mph PSR sign	3422	
	3473	Wide way to Metro + BOR
	3480	Wide way to Metro + TOR
O/B BNE 31C start – > 4.327m	3504	
Rail head to soffit 5.832m		
Rail head to soffit 5.899m		
O/B BNE 31C end – > 4.330m	3520	
Start re-rail. New RHR BSCEN56E1 2017 rail + clips.	3522	
	3594	Greaser pot RHR
New 6 hole IBJ	3619	
O/B BNE 33 start – 1.852m	3702	3.934m to Metro Line
Rail head to soffit cess rail 4.607m		

ELR – BNE		
Down side notes	**Chainage (m)**	**Up side notes**
Rail head to soffit cess rail 4.681m		
O/B BNE 33 end – 2.093m	3714	
Start new LHR rail old mills clips. Poor ballast with coal contamination	3385	RHR heavily worn
Poor ballast with coal contamination	3919	Greaser pot RHR
Timber sleepers very poor condition		LHR mixture of PAN11 and Mills
End new LHR rail renewal	4049	
LHR CORUS Workington 113A + Mills clips		
Readings and photos (See ***Appendix A***) Start new ballast	4101	
Start foot crossing. End new ballast	4190	
End foot crossing	4192	
CP – dry not running	4241	
Both rails 109lb manufacture 1956	4250	
BNE/EJM boundary 7M 9 chains marked	4374	

Table 25 - Track Condition BNE

16.2.4.2 ELR - EJM

The following table from the survey along ELR EJM, shows the walkout dialogue undertaken on 31/07/2019,2/08/2019 and 8/8/2019. All notes and readings are recorded in the direction of increasing mileage. Recorded offsets are to running edge. The chainage datum is 0m at 3117 points.

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
O/B BNE 33A start – > 10m	4300	
Rail head to soffit 5.905m		
O/B BNE 33A end – > 10m	4327	
1956 rail existing joints welded up		
Change of rail to year of manufacture 1949	4376	
IBJ	4390	IBJ
Start of BS113A year of manufacture 1989	4390	
Treadles	4392	

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
Wear Readings and photos (See ***Appendix A***)	4436	
20mph PSR sign	4525	
U/B start	4651	
U/B end	4664	
	4809	Treadle
4 hole Benkler IBJ	4832	4 hole Benkler IBJ
Holywell LC start	4836	
Holywell LC end	4846	
	4953	Treadle
Variable short lengths of rail	↕	
Readings and photos (See ***Appendix A***)	5140	25 mph PSR board
	5199	
Serious rail head delamination	↕	
	5252	
109lb rail manufacture 1954	5281	109lb rail manufacture 1954
Treadle	5382	Treadle
	5505	Previously existing jointed rails converted to CWR. Bolt holes remain
Footpath/vehicular crossing start	5573	
Footpath/vehicular crossing end	5578	
109lb rail manufacture 1950	↕	109lb rail manufacture 1950
photos (See ***Appendix A***)	5579	
109lb rail manufacture 1954	5750	109lb rail manufacture 1954
photos (See ***Appendix A***)	5890	
109lb rail manufacture 1950	↕	109lb rail manufacture 1950
Change to PAN6 baseplates on concrete	6125	8M 438yds photo (See ***Appendix A***)
109lb FB on F27 both rails	↕	
Change to PAN6 on wood	6140	
Readings and photos (See ***Appendix A***)	6171	

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
Rail change to 113lb	↕	Rail change to 113lb
Rail change BS113A 1976	6202	BS110A 1968 Cargo Fleet
	6285	BS113A 2007 closure rail
Change to 110A Cargo Fleet 1965	6307	
Area of poor top	↕	Mixed dates of rail 1965-1968
	6353	
Cable crossing steel sleeper	6405	
U/B EJM not marked 36 start	6441	
U/B EJM not marked 36 end	6451	
	6767	0 cant
Still 110lb rail PAN 9 on concrete	↕	
Top of cant 40mm marked 45mm read (LHC)	6828	photos (See ***Appendix A***)
	6896	Steel sleeper cable crossing
New closure rails	6920	6-hole IBJ
Treadle	6923	Treadle
30mph PSR board	6937	
109lb rail 1965		110lb rail 1953
photos (See ***Appendix A***)	6969	Greaser pot
Change of fastening to PAN 9 both rails ↑		
Change of fastening to Pandrol e clips both rails on concrete ↓	7065	
Readings and photos (See ***Appendix A***)	7111	0 cant
photos (See ***Appendix A***)	7278	0 cant
	7308	20 cant marked 20 cant read 1430 gauge
Gauge 1428	7317	25 cant marked 25 read
8 M 79 chains marked on rail	7319	
New welds both rails. Recently stressed	7319	photos (See ***Appendix A***)
110lb 1962 both rails	↕	
	7400	Greaser pot

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
New 6-hole IBJs both rails	7443	
New 113A both rails	↓	
Seghill LC start	7450	23 cant. Photos (See ***Appendix A***)
Seghill LC end	7464	
Treadle LHR	7469	
	7472	Hollow sleepers
Readings and photos (See ***Appendix A***)	7479	New rail old fastenings
Photos (See ***Appendix A***)	7543	
	7648	TL = 40 ↑ R= 2028m ↓
New CEN56 E1		New CEN56 E1
Change to 110lb rail PAN 9	7679	Change to 110lb rail PAN 9
Photos (See ***Appendix A***)	7752	0 cant
LHR very bad lipping	↕	RHR heavy mushrooming of rail head
Treadles both rails	7876	
photos (See ***Appendix A***)	7879	IBJs 4 hole both rails
(9M 30 chains) U/B EJM 37 start -	7944	
U/B EJM 37 end	7959	
Mare's Close timber crossing start	8049	Photos (See ***Appendix A***)
Mare's Close timber crossing end	8056	
RHC – heavy side wear high rail	↕	Heavy mushrooming low rail
	8073	
	↕	Wheel burns low rail
	8080	
U/B EJM 38A start – 1.605m to ballast board start	8105	
U/B EJM 38A start – 1.777m to ballast board end	8112	
9M 40 chain marker	8130	

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
RHR 109lb 1957	8182	LHR low rail heavy mushrooming Cargo Fleet 1950
photos (See ***Appendix A***)	8280	110A 1962
RHR continues with 110A	8396	Rail change
	↕	113A 1975 as new condition. RHR low rail only
	8406	Change back to 110lb
photos (See ***Appendix A***)	8472	
Poor line and level	↕	
	8527	0 cant - photos (See ***Appendix A***)
Rail change	8642	
2x short lengths of CEN56 closure rails then 110lb	↕	
	8740	photos (See ***Appendix A***)
photos (See ***Appendix A***)	8817	readings
Photos (See ***Appendix A***)	8832	New ballast and drainage
O/B EJM 39 start 2.144m Soffit LR 4.587m	8941	
	8948	5.179m O/B EJM 39 start
O/B EJM 39 end 2.327m Soffit LR 4.597m	8901	
	8969	4.663m O/B EJM 39 end
O/B 39A	8974	Pipe bridge soffit 5.068m
Photos (See ***Appendix A***)	9116	0 cant
45 mph PSR board Down direction ↓	9134	30 mph PSR board Up direction ↑
Photos (See ***Appendix A***)	9330	Heavy lipping both rails
	9461	RHR 98lb Colville 1958 on concrete bad corrosion of all components
Pads and insulators renewed both rails	9630	Photos (See ***Appendix A***)
	9785	Broken sleeper

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
30 mph PSR board Down direction ↓	9793	45 mph PSR board Up direction ↑
98lb rail 1953 on DOWMAC concrete sleepers both rails. Heavy corrosion	9895	Photos (See ***Appendix A***)
Photos (See ***Appendix A***)	10130	Both rails 98lb 1958, heavy lipping
	↕	Spot replacement of pads/clips
	10348	4-hole IBJs both rails
Treadles both rails	10351	
Photos (See ***Appendix A***)	10388	0 cant
Photos (See ***Appendix A***)	10490	
Photos (See ***Appendix A***)	10592	
Rail change 98lb ↑ 113A 1974 ↓	10626	↑ Rail change 98lb ↓ 113A 1974
	10635	Adjustment switches
	10644	Change to jointed track 113A FB PAN 8 on timber
Check rail start (95lb 2002 Corus with wood keys) LR	10656	
Photos (See ***Appendix A***)	10715	
	10750	End of SSSI sign
Greaser pot	10764	Change of rail new CEN56E1 TATA 2015 both rails
Readings	10770	35 cant marked Photos (See ***Appendix A***)
	10774	Treadle RHR
Hartley Level Crossing start	10777	photos (See ***Appendix A***)
Hartley Level Crossing end	10793	
	10798	4-hole IBJs both rails
	10801	Hollow sleeper
Photos (See ***Appendix A***)	10875	↕ Spot replacement of timber sleepers
Check rail end	10970	
Change of rail new CEN56E1 TATA 2015 ↑	10974	↑Change of rail new CEN56E1 TATA 2015

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
113A 1974 PAN11 ↓		↓ 113A 1974 PAN11
Change of fastening PAN 8 on timber ↑ 98lb 1956 on concrete with clips ↓	11011	↑ Change of fastening PAN 8/PAN11 on timber ↓98lb 1956 on concrete with clips
Photos (See ***Appendix A***)		
	11036	Adjustment switches
U/B EJM 40 culvert	11069	
New weld	11121	New weld Cargo Fleet 98lb 1957 both rails
Timber user crossing start	11124	Photos (See ***Appendix A***)
Timber user crossing end	11127	
	11233	Treadles both rails
Rail drop in cess 2 x 60' rails 113A	↕	Rail drop in cess 2 x 60' rails 113A
Photos (See ***Appendix A***)	11237	4 hole Benkler IBJ both rails
113A closure rail/ 98lb	↕	113A closure rail/ 98lb
11M 40 chains mile post	11350	Photos (See ***Appendix A***)
0 cant	11490	Photos (See ***Appendix A***)
Signal N14 1.949m to post, 1.675m to platform	11584	
45 mph PSR board Down direction ↓	11610	30 mph PSR board Up direction ↑
Photos (See ***Appendix A***)	11720	
Footpath crossing. No boards	11827	
Rail BR 98lb 1954 on DOWMAC F27↕	11836	Both rails
U/B EJM 42 start 2.241m	11954	3.855m
	11954	45 mph PSR board Up direction ↑
45 mph PSR board Down direction ↓	11964	U/B EJM 42 end
Rail change 98lb both rails ↑ Cargo Fleet 110lb 1960 both rails ↓	12145	
Photos (See ***Appendix A***)	12350	
U/B EJM 44 12M 286yds start	12418	Culvert
U/B EJM 44 12M 297yds end	12428	

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
Signal N11 2.117m to ladder	12479	
Recent new ballast top dressing 400m	12480	IBJs both rails 6 hole
Photos (See ***Appendix A***)	12650	
Photos (See ***Appendix A***)	12850	
	12892	New 6-hole IBJs and 113A closures
	12894	1.449m to bracket Signal N17
Ground signal offset 0.731m, height 0.815m	12943	
		↕109lb
	12945	New 6-hole IBJs & closures
12.5 mile post	12960	
	12988	5 points
Damaged LHS ‘V’ rail	13015	nose
113A 1989	13027	Last long bearer
Down	Twin ↓Track ↓	Up
113A 1989	13059	6-hole IBJ both rails. CEN56E1 2006 good condition on old concrete sleepers
Newsham Level Crossing start	13062	Newsham Level Crossing start
New 113A		New 113A
Newsham Level Crossing end	13074	Newsham Level Crossing end
		Dis-used head shunt Up side/bullhead heavily overgrown 3.037m
	13085	109lb rail heavily lipped
IBJs both rails	13098	
	13133	IBJs both rails
	13135	1.453m post - Signal N18 1.414m ladder
	13156	RRAP Up
Photos (See ***Appendix A***)	13362	Photos (See ***Appendix A***)
	13443	Ballast heavily coal contaminated

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
F27s	13552	Sleeper change F27 to F40
	13554	End of dis-used head shunt - 3.307m, S&C recovered
Photos (See ***Appendix A***)	13563	IBJ both rails. Photos
	13591	Sleeper change concrete/timber
Signal N12 1.451m	13596	2.046m Signal N6
New IBJs both rails	13598	
	13604	4-hole IBJs both rails
	13606	9A toes (crossover 9A/9B)
New 6-hole IBJs. New rail and chairs on old wood sleepers	13628	
	13633	Nose
Nose	13640	
(crossover 9A/9B) 9B toes	13667	
6-hole IBJs both rails	13674	
Down cess ground signal + cover – 1.157m	13675	
	13717	6-hole IBJs both rails
	13728	2.146m Up cess Signal N19
Photos (See ***Appendix A***)	13764	13mp approximately - photos (See ***Appendix A***)
		↨ Ballast heavily contaminated by coal
Photos (See ***Appendix A***)	13965	Photos (See ***Appendix A***)
	14016	New closure rails
Cantilever Signal N13 Down cess	14032	
	14044	Change of sleepers and fastening PAN8 to clips on concrete DOWMAC
4-hole IBJs both rails	14045	
	14078	6-hole IBJs both rails
Plessey Road Level Crossing start	14080	Plessey Road Level Crossing start
CEN56 good condition both rails		New CEN56 rail – LHR coated

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
Plessey Road Level Crossing end	14095	Plessey Road Level Crossing end
113A 1972	14111	Change of materials 133A to bullhead on concrete sleepers
Photos (See ***Appendix A***)	14166	Photos (See ***Appendix A***)
	14252	4-hole IBJ
	14267	1.890m ladder Signal N20
109/b 1951 rail/ballast good - photos (See ***Appendix A***)	14367	(still B/H rail) photos (See ***Appendix A***)
	14446	4-hole IBJ in B/H rail. Heavy coal contamination of ballast
110lb rail 1960 - photos (See ***Appendix A***)	14570	13.5 MP photos (See ***Appendix A***)
Photos (See ***Appendix A***)	14771	Photos (See ***Appendix A***)
	14842	Greaser pot RHR
	14885	4-hole IBJs both BH rails
109lb rail - photos (See ***Appendix A***)	14972	BH rail - photos (See ***Appendix A***)
109lb rail 1951 - photos (See ***Appendix A***)	15173	BH rail on concrete sleepers - photos (See ***Appendix A***)
	15355	New BH transition rail
	15369	Change of rail BH to CEN56, G44 sleepers and fast clips
Photos (See ***Appendix A***)	15372	Photos (See ***Appendix A***)
	15510	Distance marker board
Greaser pot LHR	15534	
109lb 1951 - photos (See ***Appendix A***)	15574	New CEN56E/G44/fast clip good condition. Minor wear high rail - photos (See ***Appendix A***)
Chase Meadows foot crossing start	15661	Chase Meadows foot crossing start
Chase Meadows foot crossing end	15663	Chase Meadows foot crossing end
110lb 1961 – photos (See ***Appendix A***)	15776	New CEN56E/G44/fast clip good condition. Minor wear high rail - photos (See ***Appendix A***)
4-hole IBJs both rails	15867	
Treadles both rails	15869.5	

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
	15870	6-hole IBJs both rails
	15872	Treadles both rails
U/B EJM 46A start 2.076m	15966	Photos (See ***Appendix A***)
	15979	1.847m U/B 46A start
U/B EJM 46A end 1.751m	16016	
110lb rail 1961	16032	1.672m U/B 46A end CEN56/G44/fast clip
Photos - 109lb rail 1952, Costain concrete sleepers 1981	16178	CEN56/G44/fast clip - photos (See ***Appendix A***)
	16269	25 mph PSR marker board
Photos - 109lb rail 1957	16380	CEN56/G44/fast clip - photos (See ***Appendix A***)
Photos - 109lb rail 1957	16581	CEN56/G44/fast clip - photos (See ***Appendix A***)
	16658	6-hole IBJ change of materials. CEN56/G44/fast clip to FB rail on F27 sleepers
Treadle LHR	16652	
Bebside Level Crossing start	16654	Bebside Level Crossing start
Bebside Level Crossing end	16669	Bebside Level Crossing end
	16670	Treadle RHR
Change of material 109lb rail 1960 - 6-hole IBJ	16674	113A FB rail
Photos - very old FB rail marking illegible	16782	Photos – 113A FB rail on F27 concrete sleepers, light lipping but generally good condition
	16866	↑ New clips and pads
Photos – 98lb rail 1951, AD clips	16970	Photos – 113A FB rail 1985 Workington, moderate wear and lipping
	16980	15 MP marked on rail
20 mph PSR board	17045	
Change of fastenings FB rail Mills clips on wood sleepers	17075	

ELR – EJM		
Down side notes	**Chainage (m)**	**Up side notes**
Treadles both rails	17103	
4-hole IBJs both rails	17105	
Photos - 109lb FB rail 1954 on wood with Mills clips. Sleepers in very poor condition	17181	113A rail 1985, Dowmac sleepers - photos (See ***Appendix A***)
Guard rails start	17298	Change of materials 113A FB to BH on wood sleepers
U/B EJM 47 viaduct start - 113A FB timber	17307	U/B EJM 47 viaduct start - Guard rails start
Photos – 110lb Workington. LHR lipped	17382	BH rails heavily worn – “mushroomed” - photos (See ***Appendix A***)
	17454	Treadles both rails
	17458	4-hole IBJs (BH rail)
U/B EJM 47 viaduct end	17551	U/B EJM 47 viaduct end
	17558	End of internal guard rails
End of internal guard rails	17559	
	17563	Change of materials to BH rail on concrete
	17726	4-hole IBJ RHR (BH rail)
	17730	1.794m Signal B17
4-hole IBJs both rails	17773	
Photos (See ***Appendix A***)	17870	Photos (See ***Appendix A***)
	17933	Change of materials to BH rail on timber
Signal BS 41 1.635m to ladder	17936	
	17946	Bullhead expansion switches
Adjustment switches	17948	
Ground signal in sixfoot	17960	
4-hole IBJs both rails	17963.5	
	17964	30B toes

Table 26 - Track Condition EJM

16.2.4.3 ELR - BWC

The following table from the survey along ELR BWC, shows the walkout dialogue undertaken on 14/8/2019. All notes and readings are recorded in the direction of increasing mileage. Recorded offsets are to running edge. The chainage datum is 0m at 3117 points.

ELR - BWC		
Down side notes	**Chainage (m)**	**Up side notes**
113A rail 1990, Dowmac sleepers. Wear readings. Signal BN 46 post – 2.174m	19644	Wear readings. 113A rail 1998 Costain sleepers
User crossing. FB rail PAN 9 s on wood sleeper	19649	Pandrol clips on concrete sleepers
	19803	Change of materials to FB fast clips on G44 sleepers
113A rail - Readings and photos (See ***Appendix A***)	19845	113A rail 2014 G44 sleepers - Readings and photos (See ***Appendix A***)
	19879	Adjustment switches
Change of materials FB Pandrol clips on F40 sleepers	19891	
	19896	Change of materials timber sleepers and chairs
	19900	Switch toes 7B
Change of materials concrete sleepers and chairs	19908	
	19929	Crossing nose
Adjustment switch	19959	
	19972	Change of materials to BH rail
Photos and 1mp. Change of materials to timber sleepers and chairs	19976	Photos (See ***Appendix A***)
Switch toes 45B	19981	↓No access
95lb BH rail 1960. Nose 1:8	19999	
Change of materials to FB rail full depth	20007	
Adjustment switches	20015	
Change of materials FB and Mills clips	20028	
FB rail 1969 Mills clips on wood sleepers. Readings and photos (See ***Appendix A***)	20177	
FB rail 1970. Readings and photos (See ***Appendix A***)	20378	↑No access
Marcheys Lane Signal Box 1M 41 ch	20810	
Adjustment switch	20831	
	20832	Adjustment switch

ELR - BWC		
Down side notes	**Chainage (m)**	**Up side notes**
	20881	Adjustment switch
Photos (See ***Appendix A***)	20910	Photos (See ***Appendix A***)
Catch rails. Change of materials concrete sleepers to wood. 113A rail FB CWR 1977. Good condition	20982	
	20988	Start inboard guard rails. Change of materials concrete sleepers to wood. 109lb FB CWR 1956. Lipped
U/B BWC 3 North Seaton Viaduct start	21006	U/B BWC 3 North Seaton Viaduct start
Photos (See ***Appendix A***)	21011	Photos (See ***Appendix A***)
	21024	IBJs both rails
113A FB CWR rail 1977. Heavy corrosion - photos (See ***Appendix A***)	21212	109lb FB CWR rail 1956. Heavy corrosion - photos (See ***Appendix A***)
U/B BWC 3 North Seaton Viaduct end. Photos (See ***Appendix A***)	21339	U/B BWC 3 North Seaton Viaduct end. Photos (See ***Appendix A***)
End of guard rails	21368	End of guard rails
	21377	Broken weld six-foot rail (clamped)
	21384	Change of materials wood to concrete
110lb rail 1962 - photos (See ***Appendix A***)	21413	109lb rail 1950 - photos (See ***Appendix A***)
Signal no number	21437	
4-hole IBJs both rails	21441	
	21478	4-hole IBJs both rails
North Seaton Level Crossing start	21497	North Seaton Level Crossing start
New CEN56 rail + closures		New CEN56 rail + closures
North Seaton Level Crossing end	21513	North Seaton Level Crossing end
6-hole IBJs both rails	21516	
Change to wood sleepers poor condition. 109lb rail 1957	21520	
	21551	4-hole IBJs both rail
	21561	Signal no number
Mushroomed rail head - photos (See ***Appendix A***)	21614	Mushroomed rail head. 109lb rail 1958 - photos (See ***Appendix A***)

ELR - BWC		
Down side notes	**Chainage (m)**	**Up side notes**
Footbridge start	21731	Footbridge start
Footbridge end	21733	Footbridge end
110lb rail 1961 on timber. Sleepers poor - photos (See ***Appendix A***)	21815	Photos (See ***Appendix A***)
	21871	Change of sleepers and fastenings. Pandrol clips to AD fasteners
	21973	Disused grease pot
	21975	Disused grease pot
109lb rail 1969 heavy wear LR. 98lb rail RR - photos (See ***Appendix A***)	22016	109lb rail 1953 heavy lipped LR. 109lb rail 1954 RR - photos (See ***Appendix A***)
	22051	Broken sleeper
10 mph PSR board	22180	
Photos. 98lb FB rail 1959	22217	Photos. 113A FB rail 1977 RR 110lb FB rail 1961 LR
4-hole IBJs both rails	22238	
Treadles both rails	22241	
	22277	Distance board
98llb rail 1951 - photos (See ***Appendix A***)	22418	110lb rail 1965 RR, 1964 LR - photos (See ***Appendix A***)
	22440	30 mph PSR board
	22446	Treadle cess rail
Green Lane Level Crossing start. 4-hole IBJ LR.	22451	Green Lane Level Crossing start
113A FB coated rail 2002 + closures		113A FB coated rail 2002 + closures
Green Lane Level Crossing end	22465	Green Lane Level Crossing end
	22467	4-hole IBJs both rails
	22470	Treadles both rails
Treadle RHR	22472	
40 mph PSR board	22495	
98lb rail, heavy corrosion and mushroomed - photos (See ***Appendix A***)	22620	113A rail 1977LR. 109lb rail 1955 RR. Lipped running edges

ELR - BWC		
Down side notes	**Chainage (m)**	**Up side notes**
	22676	Treadles both rails
	22671	6-hole IBJs both rails. New CEN56 panel
Foot crossing start	22792	Foot crossing start
Foot crossing end	22794	Foot crossing end
98lb rail 1956 - photos (See ***Appendix A***)	22821	113A 1977 - photos (See ***Appendix A***)
	22931	Eutectic strip welds on both rails start
	22941	Eutectic strip welds on both rails end
	22953	Adjustment switch
	22960	Change of materials 113A CWR to BH on wood.
98lb rail circa 1950s - photos (See ***Appendix A***)	23022	badly worn BH rail 1947 on timber. Chairs 1926 - photos (See ***Appendix A***)
Platform disused Ashington Station start	23064	Platform disused Ashington Station start
Photos (See ***Appendix A***)	23140	Photos (See ***Appendix A***)
Grease pot RHR	23188	
O/B BWC 05 start. Soffit 4.870m	23199	O/B BWC 05 start
Adjustment switch change of materials CWR rail to FB jointed	23204	Change of materials BH rail to FB jointed
Photos (See ***Appendix A***)	23215	Photos (See ***Appendix A***)
O/B BWC 05 end. Soffit 4.378m	23237	O/B BWC 05 end
113A rail 1968 Coalville	23272	Readings and photos (See ***Appendix A***) 113A FB rail 1978 RHR 113A FB rail 1976 LHR
Marker board	23318	
Adjustment switch	23322	
Change of materials 113A jointed to new CWR 2015 LHR. 110A 1967 RHR	23327	
Photos (See ***Appendix A***)	23380	Photos (See ***Appendix A***)
	23417	O/B BWC 05A start
O/B BWC 05A start. Soffit 5.128m	23422	

ELR - BWC		
Down side notes	**Chainage (m)**	**Up side notes**
O/B BWC 05A end	23431	
	23437	O/B BWC 05A end
Photos (See ***Appendix A***)	23475	Photos (See ***Appendix A***)
113A rail - photos (See ***Appendix A***)	23550	New weld LHR 113A rail - photos (See ***Appendix A***)
	23565	Adjustment switch
Stop sign	23570	
	23582	Re-railed with serviceable rail
Hirst Lane Level Crossing start. New CEN56E1 coated rail	23618	Hirst Lane Level Crossing start. 113A coated rail
Hirst Lane Level Crossing end	23630	Hirst Lane Level Crossing end
CEN56E1 2015 RHR. 109lb rail 1957 LHR	23660	98lb rail 1958 Dowmac sleepers

Table 27 - Track Condition BWC

- For recorded rail wear tables see ***Appendix A***
- For rail age tables see ***Appendix A***
- For track photographs see ***Appendix A***

16.2.4.4 Conclusions and recommendations

Overall the existing materials exhibit heavy wear in most places except where rail has recently been renewed. There are many areas of rail that have been replaced with serviceable old rail and the entire route shows evidence of spot replacement of sleepers and components and is generally very well maintained. There are also areas of re-railing with new rail and some areas of entire renewal. As to be expected the greatest wear is to the rail head on straight track and lipping of the low rail and gauge face wear on the high rail on curved track. There is much rail that pre-dates 1976, and the oldest rail found being manufactured in 1949. The oldest baseplate found was manufactured in 1938. See accompanying tables.

The upgrade to joint passenger and freight running presents an opportunity to modernise componentry, to bring the route up to the relevant specification for the proposed line speed and track category it will become. It is recommended that areas missed out due to track access restrictions also be assessed at the next design phase and a track quality improvement programme developed starting with the replacement of the oldest and most damaged rail and components.

N.B in NR/L2/TRK/2102 Design and Construction of Track, clause 20.00 - Conversion of freight only lines to passenger lines, it states that “Freight only lines converted to passenger traffic shall comply with the minimum track construction standards in clause 19. This applies irrespective of whether the line speeds are to be raised.”

16.3 Signalling

16.3.1 Control Arrangements

Signalling along the section of line affected by the introduction of passenger traffic is controlled by the following Signal Boxes (from South to North):

- Tyneside Signalling Centre – Controls the southern end of the line including Benton North Junction on the ECML, the Up and Down Blyth and Tyne Loop and a small section of the single line;

- Newsham Signal Box – Controls most of the single line section and the double track railway beyond Plessey Level Crossing, toward Bebside Level Crossing;
- Bedlington South Signal Box – Controls the line north of Bedlington Viaduct toward Bedlington North Signal Box;
- Bedlington North Signal Box – Controls the line from Bedlington South Signal Box to either Morpeth via the Choppington Single Line or to Winning or Marcheys House via Sleekburn Junction;
- Marcheys House Signal Box – Controls the line from Winning / Bedlington North Signal Boxes toward North Seaton and Hirst Lane Gate Boxes;
- North Seaton Gate Box – Controls movements over North Seaton Level Crossing; and
- Hirst Lane Gate Box – Controls movements over Hirst Lane Level Crossing.

The existing signalling control arrangements are as follows:

- Between Tyneside Signalling Centre and Newsham Signal Box – Track Circuit Block with a slot arrangement for northbound trains;
- Between Newsham SB and Bedlington South Signal Box – Absolute Block;
- Between Bedlington South SB and Bedlington North Signal Box – Absolute Block;
- Between Bedlington North SB and Winning Signal Box – Absolute Block;
- Between Bedlington North SB and Marcheys House Signal Box – Absolute Block; and
- North of Marcheys House to Lynemouth – Absolute Block via Telephone.

16.3.2 Control Box Areas – Tyneside Signalling Centre

16.3.2.1 Method of Working

Freight trains are normally routed onto and off the Blyth & Tyne Line to/from Tyne Dock. On the ECML, authority to access the Blyth & Tyne via the Down Main is given from T621 Signal, which is located approximately 600m from the Up Main entrance to the Blyth & Tyne Line at Benton Junction (via 3112 and 3117 points reverse).

Route Indication to the driver is given via a Junction Indicator which has approach control applied to the route in the form of BML (berth track circuit) being occupied. The maximum linespeed over 3112 points is 30mph and 3117 points 25mph. The approach control reduced linespeed and distance of T621 Signal from the junction has the consequence of blocking both lines of the ECML for at least 2 minutes as the train needs to traverse from the Down Main, across to the Up Main then move off onto the Blyth and Tyne at Benton Junction.

Heading north, the movement authority from T621 Signal is to Tyneside’s last Signal T635, located on the Down B & T. Newsham Signal Box will receive an annunciation once the berth track to this signal is occupied although sometimes, Tyneside will ring Newsham in advance to advise that a train is on the way. Once Newsham Signaller is aware that the train is on its way, or waiting to come north, providing the single line section is clear, the Newsham Signaller will offer the slot (N101) that releases the proceed aspect on T625 Signal.

There is no slot arrangement between Newsham and Tyneside for the southbound train; Communication with Tyneside is made via telephone. If Tyneside advises that they cannot accept a train, the Newsham Signaller will not allow it to enter the single line section and the train will be likely held at N17 Signal.

Heading South from the single line section, T638 Signal (and T638R) provides authority for movements onto the Up B & T, toward T636 Signal which is the ECML protecting signal. T638 Signal is approach controlled via its berth track circuit (BPW) according to the control table but T638R (berth track BPZ) is provided with a green aspect which would not appear to be superfluous. This will be investigated further at the next design stage.

T636 Signal is installed Up B & T and protects the junction with the ECML. For a proceed aspect to be shown the signaller is required to set the route forward and the berth track circuit (BPS) be occupied.

16.3.2.2 Asset Overview

Interlocking – Benton SSI controls the lineside apparatus over the Tyneside Signalling Centre Control area. Tyneside Signalling Centre is programmed for York ROC recontrol in 2021.

Signals – All signals on the Blyth & Tyne are filament lit colour light signals installed circa 1990 when Tyneside was last resignalled. The signals would appear to be in fair condition for their age, but mesh cages are installed over the lenses indicating that the area is or has suffered from vandalism. Signal T638R is right hand mounted due to the locality of the Metro lines running adjacent to the Blyth & Tyne Line.

T621 on the ECML is an LED signal and appears to be in good condition.

On the Blyth & Tyne Line, AWS and TPWS are only installed on T636 Signal.

Point Operating Equipment – Standard Mk2 Clamp Locks are installed on 3401 point ends. Point ends 3118, 3119 and 3117 are operated by HW point machines. 3112 points are HPSS operated. Where observed, all point equipment appeared to be in good condition.

Track Circuits – All track circuits are GEC Reed Track Circuits.

Location Cabinets and Equipment Rooms – The location cabinets on the Blyth & Tyne date from the time of the resignalling but appear to be in fair condition and suitable for use although some Category 3 wire degradation was recorded.

Cables and Cable Routes – The cable route is located on the Down side throughout the Tyneside controlled area. Near to the junction with the EMCL, the route is C/1/9 in size and quite full. Additionally, up to and slightly past T635 signal, the route is overgrown with vegetation or infilled with slipped bank soil.

Power Supplies – A 650v feeder originates from a generator backed power supply at Benton Junction and feeds the lineside signalling equipment as far as Seghill Level Crossing.

16.3.3 Control Box Areas – Newsham Signal Box

16.3.3.1 Method of Working

Heading north, as soon as the train has passed Signal N101, the Newsham Signaller switches back the Tyneside release (slot). There is no signaller intervention until the train passes Seghill Level Crossing, at which point the signaller waits approximately 1 minute (some wait till the train crosses Hartley LX) then offers the train, via the Block Controls, to Bedlington South Signal Box. Once accepted, Newsham then operates CCTV for Plessey Level Crossing to drop barriers and drops barriers at Newsham Level Crossing. It was observed that Newsham barriers were down for 4 mins 45 seconds and Plessey Level Crossing barriers were down for 6mins. Other than clearing the train through the route and raising Plessey Road barriers, there are no other signaller interventions required.

Heading south, the Newsham Signaller will accept the train from Bedlington South but will not start the barrier initiation until they observe that Bebside Level Crossing has finished its operation. The signaller at Newsham has a Train Describer terminal provided and once they have ‘Train on Line’ from Bedlington South, they input the headcode into the TD.

16.3.3.2 Newsham Signal Box

Newsham Signal Box (formally Newsham South Signal Box) is located at 12m 45ch on ELR EJM and dates from 1945, housing a McKenzie & Holland frame containing 20 levers with tappet interlocking. Currently there are 6no. spare levers on the frame. The block shelf arrangement is typical of a lever Framed Signal Box. As well as a TD Terminal, the Signaller also has access to TRUST. An overhead illuminated panel diagram with track circuit indications displays the control area.

16.3.3.3 Asset Overview

Interlocking – The control area for Newsham is predominantly mechanically based with a small relay interface.

Signals – Apart from at the southern end of the single line section where a single filament lit colour light signal (N101) exists, all the remaining signals are Semaphore which are both mechanically and electrically operated.

AWS and TPWS are not installed on any of the signals.

Point Operating Equipment – Standard Mk2 Clamp Locks are installed on No.9 crossover and appears in good condition. Point end No.5 is mechanically operated and is in good condition.

Track Circuits – Track circuits, where installed, are low voltage DC and appear fit for purpose.

Location Cabinets and Equipment Rooms – The location cabinets on the Newsham control area are in general in fair condition. Not all cabinets could be accessed but those that could, some Category 3 wire degradation was recorded south of Earsdon. Several the cabinets are paint vandalised.

The following exists with respect to Level Crossings:

- Holywell - A small sized REB with minimal additional capacity available located in the YN cess in good condition with Category 1 Wire Degradation.
- Seghill - A suite of a 5no. Location cabinets located in the YO cess providing Level Crossing control and power functions.
- Hartley - A suite of a 4no. Location cabinets located in the ZN cess providing Level Crossing control and power functions.
- Newsham- A medium sized REB with a small amount of additional capacity located to the south of the Signal Box in the Down cess.
- Plessey Road - A suite of a 4no. Location cabinets located in the ZO cess providing Level Crossing control and power functions.
- Bebside- A small sized REB with minimal additional capacity available located in the YN cess in good condition with Category 1 Wire Degradation.

Cables and Cable Routes – The cable route is predominately located on the Down side throughout the Newsham control area. Near to the Earsdon Junction, the route is C/1/9 in size and quite full. One the route is past Earsdon, the cabling along the route is mainly buried in the cess. As is evident by the number of cable repairs, vandalism, especially south of Newsham is a particular problem which is likely why the route/cables have been buried in the first place. Due to the cabling being buried, it is not evident whether the cables are buried themselves or whether the route and cable is buried.

At each of the public highway Level Crossings, URXs and UTXs have been installed. The survey did not assess the condition or capacity of these ducts.

From Benton up to location 6/39, the signalling circuits are carried on 48 and 37 core standard signalling lineside cables. From 6/39 location heading north to Newsham, the signalling circuits are carried on a Telecoms 20pair (0.9mm) as far as Newsham Relay Room (REB). From this point north, as far as Plessey Road Level Crossing, standard signalling multi-core cables are utilised. The function of Bebside Level Crossing is fed back to Newsham via a telecoms cable.

Power Supplies - A 650v feeder with generator backup originates at Benton and feeds the Blyth and Tyne line as far as Seghill Level Crossing. This feeder is not designed to current acceptable standards and cannot facilitate any additional loading of consequence. North of Seghill, a 230v DNO supply is taken from the National Grid at the following locations:

- Hartley Level Crossing;
- Newsham Level Crossing/Signal Box
- Plessey Road Level Crossing; and
- Bebside Level Crossing.

At Newsham, the DNO supply feeds the local signalling, Level Crossing and Newsham Signal Box equipment/building.

16.3.4 Control Box Areas – Bedlington South Signal Box

16.3.4.1 Method of Working

Between Newsham and Bedlington South and Bedlington South to Bedlington North Signalling Boxes the method of signalling control is Absolute Block. The Absolute Block section between the two Bedlington Signal Boxes is very short.

Level Crossing Initiation, Down - The Bedlington South Signaller will receive an annunciator warning when a Down direction train strikes into Bebside AHB Level Crossing. From this point it takes approximately 7 minutes before the train clears the crossing and the barriers can be raised.

Level Crossing Initiation, Up - In the Up direction, activation is a function of the block bell operation between Bedlington North and South but generally, the Signaller will lower the barriers at the same time that Bedlington North lowers theirs. The resultant barrier down time can be up to 10 minutes in extreme circumstances.

16.3.4.2 Bedlington South Signal Box

Bedlington South Signal Box is located at 15m 60ch on ELR EJM and dates from 1940, housing a McKenzie & Holland frame containing 30no. levers (15no. in use) with tappet interlocking. The block shelf arrangement is typical of a Lever Frame Signal Box. An illuminated overhead panel diagram with track circuit indications displays the control area. There are five locking trays.

As well as controlling the semaphore signalling in the area the box controls the adjacent level crossing, which is busy and has complex road approaches; this prevents the adoption of an MCB-OD type crossing here.

The box is in close proximity to Bedlington North Signal Box, which also controls and adjacent level crossing, with absolute bock working between the two.

16.3.4.3 Asset Overview

Interlocking - Bedlington South still appears to have a large degree of mechanical interlocking with shelf / ‘fish tank’ style relays used for additional functions. The equipment within the signal box all appears to be in good order including the lever frame, with the removable panels in the operating floor to gain access to the locking trays showing signs of regular removal for lubrication.

Signals - all signals on the Bedlington South control area are mechanically operated signals (except for the distant signals which are fixed semaphores) which are a combination of main and shunt arm and disc semaphore signals. All appear to be in good condition. It should be noted that signals BS18/16 Signal share a gantry. BS16 signal on this gantry is 8m in height above the running rail.

Point Operating Equipment - Bedlington South Signal Box controls only a small number of mechanical point ends in the locality of the signal box. Of these, no.30 crossover is planned for removal by plain lining in 2019. Of the remaining points, these are not in operation as the destination of the routing over the points is associated with movements into Furnaceway Sidings, which is currently out of use. Therefore, the condition of the points and their operation could not be ascertained.

Track Circuits – Track circuits, where installed, are low voltage DC type and appear fit for purpose.

Location Cabinets and Equipment Rooms – The location cabinets on the Bedlington South control area are in fair condition. Category 2 wire degradation was noted in all location cabinets.

Under the Signal Box, as well as the mechanical locking, a small number of ‘fish tank’ style relays are installed.

A suite of location cabinets is situated on the ZN corner of the crossing which contain control equipment for the Bedlington South Level Crossing.

Cables and Cable Routes – The cable route is located on the Down side throughout the Bedlington South control area. The route is in poor condition in places (adjacent to Furnaceway Sidings).

Across Bedlington Viaduct, cables are hung on loose, informal hangers. It would appear that the signalling functions are carried within a telecoms 20pr cable.

At Bedlington South Level Crossing, URXs and UTXs have been installed. The survey did not assess the condition or capacity of these ducts.

Power Supplies - Terminating into Bedlington South Signal Box, a 230v DNO supply is taken locally from the National Grid to supply the signalling (and Signal Box) infrastructure in the vicinity, including Bedlington South Level Crossing.

16.3.5 Control Box Areas – Bedlington North Signal Box

16.3.5.1 Method of Working

As well as the Absolute Block between Bedlington South and Bedlington North Signal Boxes, Absolute Block is the method of operation between Bedlington North and Marcheys House Signal Boxes and Bedlington North and Winning Signal Boxes.

Level Crossing Initiation, Down - The signaller will lower the barriers at the same time that Bedlington South lowers their barriers (they can 'usually' visually observe those barriers lowering). The signaller does this to save time. The resultant barrier down time is between 3 and 5 minutes.

Level Crossing Initiation, Up - As soon as Winning or Marcheys enter a train into the section, the Signaller lowers the Level Crossing Barriers. This enables a green aspect to be obtained on No.9 (or 8) Signal. This method of operation is a current Signal Box instruction related to not having a train stopping on a rising gradient (and it not being able to restart). Because of this, the barriers can be down for up to 8 minutes.

16.3.5.2 Bedlington North Signal Box

Bedlington North Signal Box is located at 15m 71ch on ELR EJM and dates from 1912, housing a McKenzie & Holland frame containing 64no. levers (28no. in use) with tappet interlocking. The block shelf arrangement is typical of a Lever Frame Signal Box. An illuminated overhead panel diagram with track circuit indications displays the control area.

16.3.5.3 Asset Overview

Interlocking - Bedlington North Interlocking is formed of a combination of mechanical (in the lever frame) and relay (under the Signal Box) based equipment. The equipment within and under the signal box all appears to be in good order. Under the Signal Box, wire degradation is classified as Category 2, Fair.

Signals - Signals on the Bedlington North control area are a combination of mechanically operated (with fixed distants) and colour light signals. All appear to be in good condition, including BN63/54 Signals, which has recently been renewed. Viewing of BN10 Signal is slightly restricted due to leylandii growing in an adjacent residential property's garden.

Point Operating Equipment - Bedlington North controls a number of mechanical points with facing point locks and Mk2 Clamp Lock point ends. All appeared in good condition and fit for use.

Track Circuits – Track circuits, where installed, are low voltage DC and appear fit for purpose.

Location Cabinets and Equipment Rooms – Bedlington North Interlocking is located under the Signal Box floor and has Category 2, Fair, wire degradation.

The location cabinets on the Bedlington North control area are a mixture of new (Location 3) and aged location cabinets, in fair condition at best, and suffering from Category 2 wire degradation.

A suite of new location cabinets is situated on the YN corner of the crossing and these contain the control equipment for Bedlington North Level Crossing.

Cables and Cable Routes – The signalling cable route is predominantly located on the Down side throughout the Bedlington North control area. A 48-core signalling cable carries the signalling circuits through the control area.

At Bedlington North Level Crossing, URXs and UTXs have been installed. The survey did not assess the condition or capacity of these ducts.

Power Supplies - Terminating into Bedlington North Signal Box, a 230v DNO supply is taken locally from the National Grid to supply the signalling (and Signal Box) infrastructure in the vicinity, including Bedlington North Level Crossing.

16.3.6 Control Box Areas – Marcheys Signal Box

16.3.6.1 Method of Working

As well as the Absolute Block between Bedlington North and Marcheys House Signal Boxes, Absolute Block is the method of operation between Marcheys House and Winning Signal Boxes. Winning Signal Box is not affected by these works.

Once a train is offered forward from Bedlington North Signal Box, the Marcheys House Signaller will ring the power station to see if they can accept it, if they cannot, the Marcheys House Signaller will hold the train until they can.

Level Crossing Initiation, Down - The imminent arrival of a Down train is announced by the block bells and then the signalman awaits to see the train descending from Bedlington North towards Bomarsund LX to lower's the barriers.

Level Crossing Initiation, Up - In the Up direction, the arrival of a train from the power station is known about as Lynemouth communicates to Marcheys House by telephone. Once Green Lane LX is in operation, the Signaller will operate the barriers.

16.3.6.2 Marcheys House Signal Box

Marcheys House Signal Box is located at 1m 41ch on ELR BWC and dates from 1895, housing a McKenzie & Holland frame containing 15no. levers (9no. in use) with tappet interlocking. The block shelf arrangement is typical of a Lever Frame Signal Box. An illuminated overhead panel diagram with track circuit indications displays the control area.

The Locking room has a Level Crossing control case installed within it. Electric locks installed on levers. The box has block instruments to Winning and Bedlington North, although the latter is now wholly track circuited, providing full train detection between North Sleekburn Junction and Marcheys House Junction.

16.3.6.3 Asset Overview

Interlocking - Marcheys House Interlocking is formed of a combination of mechanical (in the lever frame) and relay (at the rear of the Signal Box) based equipment. The equipment within in the signal box all appears to be in good order. Under the Signal Box, wire degradation is classified as Category 2, Fair.

Signals - Signals on the Marcheys House control area are all mechanically operated (or fixed in the case of fixed distants). All appear to be in good condition, including MH13, which has recently been renewed.

Point Operating Equipment – Marcheys House controls a small number of electrically operated (clamp lock) point ends and a mechanical emergency trailing crossover operated via a Ground Frame. All appeared in good condition and fit for use.

Track Circuits – Track circuits, where installed, are low voltage DC type and appear fit for purpose.

Location Cabinets and Equipment Rooms – The operating cabinet for Marcheys House Level Crossing is located under the Signal Box. Wire Degradation is classified as Category 2, Fair.

The location cabinets in the Marcheys House control area are a combination of new (Marcheys House Junction) and old (elsewhere). The older ones are in fair condition with Category 2 wire degradation.

Cables and Cable Routes – The signalling cable route is predominantly located on the Down side throughout the Marcheys House control area. The trough route was in fair condition.

At Marcheys House Level Crossing, URXs and UTXs have been installed. The survey did not assess the condition or capacity of these ducts.

Power Supplies - Terminating into Marcheys House Signal Box, a 230v DNO supply is taken locally from the National Grid to supply the signalling (and Signal Box) infrastructure in the vicinity, including Marcheys House Level Crossing.

16.3.7 North Seaton Gate Box

16.3.7.1 Method of Working

As a Gate Box, North Seaton is solely responsible for the operation of North Seaton Level Crossing only. Once the Level Crossing has been operated by the Signaller, they will then either clear No.10 (Up) Signal or No.17 (Down) Signal to allow a train to traverse the Level Crossing.

Level Crossing Initiation, Down - Signaller receives notification from Marcheys House to advise that a train is coming (approaching MH13 Signal). This notification takes the form of a couple of rings on the telephone to allow barriers to be operated and dropped and the Signaller then clears NS17 signal. By this time the train is normally between Marcheys and the viaduct.

Level Crossing Initiation, Up - An annunciator operates when train strikes in at Green Lane Level Crossing. The Signaller then waits 30 seconds before dropping the barriers and can then clear NS10 Signal.

16.3.7.2 North Seaton Gate Box

North Seaton Gate Box is located at 1m 76ch on ELR BWC and dates from 1872, housing a McKenzie & Holland frame containing 21 levers (3 in use) with tappet interlocking. The block shelf arrangement is typical of a Lever Frame Signal Box. An illuminated overhead panel diagram with track circuit indications displays the Level Crossing area.

16.3.7.3 Asset Overview

Signals – NS10 and NS17 Signals at North Seaton are mechanically operated signals. Both appear to be in good condition including

Track Circuits – Track circuits, where installed, are low voltage DC type and appear fit for purpose.

Location Cabinets and Equipment Rooms – There is no equipment room provided. The Level Crossing control equipment is located in a suite of location cabinets that are positioned south of the Signal Box in the Up Cess. Wire degradation is classified as Category 2, fair.

Cables and Cable Routes – The signalling cable route is predominantly located on the Up side in the vicinity of North Seaton.

At North Seaton Level Crossing, URXs and UTXs have been installed. The survey did not assess the condition or capacity of these ducts.

Power Supplies - Terminating into North Seaton Signal Box, a 230v DNO supply is taken from the local National Grid to supply the signalling (and Signal Box) infrastructure in the vicinity, including North Seaton Level Crossing.

16.3.8 Hirst Lane Gate Box

16.3.8.1 Method of Working

As a Gate Box, Hirst Lane is solely responsible for the operation of Hirst Lane Level Crossing only. Once the Level Crossing Operator deems it safe that a train can traverse the level crossing, they will raise a Green flag (or light) to allow the train to pass.

The gate Box operator is informed that a train is approaching via communication from Marcheys House Signal Box.

16.3.8.2 Hirst Lane Gate Box

Hirst Lane Gate Box is located at 3m 21ch on ELR BWC and does not contain any operating equipment as such as the Stop and Distant Boards are all fixed.

16.3.8.3 Asset Condition

Signals – The Stop and Distant Boards are located on each line on the approach to the crossing and are in good condition.

16.4 Level Crossings

16.4.1 Existing Level Crossings

The existing Level Crossings along the route are detailed as follows:

ELR & Crossing	Type	Mileage
BNE		
Palmersville Dairy	FPW	0m 34ch
Benton Square	FPS	1m 30ch
Earsdon	FPW	2m 48ch
EJM		
Holywell	ABCL	7m 41ch
Holywell	UWC	7m 73ch
Seghill North	AHB	9m 6ch
Mares Close	UWC-T	9m 36ch
Hartley	Public AHB	11m 12ch
Red House Farm	UWC-T	11m 30ch
Lysdon Farm	FPS	11m 65ch
Newsham	MCB	12m 45ch
Plessey Road	MCB-CCTV	13m 16ch
Chase Meadow	FPS	14m 12ch
Bebside	AHB	14m 67ch
Bedlington South	MCB	15m 60ch
BWC		
Bedlington North	MCB	0m 0ch
Red Row Bridge	Sleeping Dog	0m 42ch
Bomarsund Public	FPW	0m 64ch
Bomarsund Private	UWW	0m 64ch
Marcheys House	MCB	1m 41ch
North Seaton	MCB	1m 76ch
Green Lane	AHB	2m 43ch
Hospital	FPW	2m 50ch

Table 28 - Current List of Level Crossings

The existing profile of risks at the Level Crossings along the route are based on a backbone of a small number of daily freight trains, running at a (relatively) low speed (between 10 and 45mph).

As would be expected with a large number of Level Crossings along the route, the risk profile of the crossings varies from rarely used footpath crossings of 10 or so users a day, to heavily used public highway crossings upwards of 12,000 vehicles per day.

16.4.2 ALCRM Scoring

Within ALCRM (All Level Crossings Risk Model), which is the Network Rail risk tool used to support it in managing the risk to crossing users, passengers and rail staff by assessing the risks at each crossing and targeting those crossings with the highest risk for remedial measures, the Level Crossings are scored as follows:

ELR & Crossing	Type	Score
BNE		
Palmersville Dairy	FPW	D6
Benton Square	FPS	D7
Earsdon	FPW	D6
EJM		

ELR & Crossing	Type	Score
Holywell	ABCL	G4
Holywell	UWC	C10
Seghill North	AHB	H3
Mares Close	UWC-T	C5
Hartley	Public AHB	H5
Red House Farm	UWC-T	D10
Lysdon Farm	FPS	E12
Newsham	MCB	K6
Plessey Road	MCB-CCTV	K6
Chase Meadow	FPS	D7
Bebside	AHB	H4
Bedlington South	MCB	J5
BWC		
Bedlington North	MCB	K6
Red Row Bridge	Sleeping Dog	M13
Bomarsund Public	FPW	D7
Bomarsund Private	UWW	C10
Marcheys House	MCB	J6
North Seaton	MCB	L6
Green Lane	AHB	J4
Hospital	FPW	D6

Table 29 - Current ALCRM Scores

ALCRM calculates risk within two categories; ‘individual’ and ‘collective’ risk.

Individual Risk

This is the annualised probability of a fatality to a ‘regular’ user. NOTE, a regular user is taken as a person making a daily return trip over the crossing; assumed 500 traverses a year.

- Applies only to crossing users. It is not used for train staff or passengers;
- Does not increase with the number of users;
- Is presented as a simplified ranking:
    - Allocates individual risk into rankings A to M (A is the highest and M is the lowest (e.g. temporary closed); and
    - Allows comparison of individual risk to average users across any crossings on the network.

A high individual risk indicates that the risk of fatality per use is (relatively) high and so the crossing might be susceptible to rapid change in risk if the crossing use changes.

Collective Risk

This is the total risk for the crossing and includes the risk to users (pedestrian and vehicle), train staff and passengers.

Collective risk is presented as a simplified ranking:

- Allocates collective risk into rankings 1 to 13 (1 being highest); and
- Can be used to easily compare the collective risk between any two level crossings on the network.

A high collective risk indicates that the risk per year at this crossing is (relatively) high and hence the expenditure that would be considered reasonably practicable to reduce the risk is larger than a lower collective risk band. It would make sense to prioritise these as there are more options for risk elimination or reduction that might be reasonably practicable.

The highest overall risk is therefore ‘A1’ and the lowest overall risk is therefore ‘M13’.

As can be noted in the scores detailed in ***Table 29***, very few of our Level Crossings are classified within ALCRM as being what is perceived to be ‘high risk’ (Individual risk of ‘C’ and above or collective risk of ‘4’ and above).

16.4.3 Level Crossings by Control Area

16.4.3.1 Tyneside Signalling Centre

Tyneside Signalling Centre only has one of the Northumberland Line Level Crossing within its control area, Palmersville Diary Footpath Crossing.

It has been identified that there are existing issues at this Level Crossing with Freight trains straddling the Level Crossing with anecdotal reports of member of the public traversing under the stationary wagons to get to the other side of the crossing.

To alleviate this in the Up direction, a Notice Board has been installed 15m on the approach to the Level Crossing informing freight drivers to stop at this point whilst waiting for the ECML to clear and signal T636 to show a proceed aspect.

This arrangement is not possible on the Down, as the signal (T635) is not visible from the Level Crossing and, therefore, if a train is stationary at T635 Signal, waiting for the single line section to clear, the Down train will always straddle the Level Crossing. Due to the low daily usage of the line it is not anticipated that it is a regular occurrence for a train to be stationary at this signal.

16.4.3.2 Newsham

Newsham Signal Box controls two MCB crossings, Newsham and Plessey Road and also monitors three AHB Level Crossings at Seghill, Hartley and Bebside. Although not monitored, telephones are also installed and call back to Newsham from:

- Hollywell ABCL
- Mares Close UWC
- Red House Farm UWC

Within the Newsham Control area, the following Level Crossings are installed and not monitored in any way:

- Benton Square FPS
- Earsdon FPW
- Holywell UWC
- Lysdon Farm FPS
- Chase Meadow FPS

Lysdon Farm Level Crossing closure is being progressed by Network Rail.

There are no particular issues at the Level Crossings within the Newsham control area, apart from the following observations:

Chase Meadow FPS – The most recent Narrative Risk Assessment, provided to the project by Network Rail, details that the daily users of the Level Crossing are 6 to 9 pedestrians (Aug 2016). A 9-Day census was carried out in June 2019, which details the daily users to be a maximum of 128 users, which also includes 20 minors using the crossing. The reason for this increase is the recent building of a large housing estate in the area of the crossing that has led to an increase in the number of leisure users utilising the crossing.

Bebside AHB – Bebside AHB is located very close to the A189 slip road and with an increased level crossing closure time, an understanding of potential blocking back issues will need to be considered.

16.4.3.3 Bedlington South

Bedlington South Signal Box controls its own MCB crossing.

It has been reported that the Signaller in the Signal Box has suffered from aggression from motorists and pedestrians when they have been held at the crossing.

16.4.3.4 Bedlington North

Bedlington North Signal Box controls its own MCB crossing as well as having the following Level Crossings installed on its control area, but not monitored in any way:

- Bomarsund FPS
- Bomarsund UWC.

Red Row Bridge is a Sleeping Dog Level Crossing (no longer used but officially not closed); Network Rail are progressing closure for this Level Crossing.

16.4.3.5 Marcheys House

Marcheys House Signal Box controls its own MCB crossing and monitors Green Lane AHB level Crossing.

Hospital FPS Level Crossing also falls within the control area of Marcheys House.

Strictly speaking, North Seaton and Hirst Lane Level Crossings fall within the control area of Marcheys House Signal Box, although these are controlled by North Seaton and Hirst Lane Gate Boxes respectively.

16.5 Highways

MHC Traffic Ltd were commissioned to undertake the below traffic surveys, which were carried out on Tuesday 21 May 2019 (neutral weekday).

The following data was collected:

16.5.1 Manual Classified Turning Counts and Queue Length Surveys

*11 Junctions (12-hour weekday; 07:00-19:00)

MTC / QL ID*	Description	Junction Type	Arms
Northumberland Park Station			
1	Emmerson Place / Cloverfield/ Algernon Drive	Priority Junction (crossroads)	4
2	A186 / Emmerson Place Roundabout	Priority Junction (roundabout)	4
Seaton Delaval			
3	A192 / Double Row	Priority Junction (roundabout)	4
4	A192 / Blackhough Drive	Priority Junction (T-junction)	3
Newsham			
5	A1061 / B1523	Priority Junction (roundabout)	3
Bebside			
6	A193 Front Street Bebside Jet Petrol Station entrance & exit	Priority Junction (T-junction)	2
Bedlington			
7	Station Road / Melrose Villas	Priority Junction (T-junction)	3
8	Station Road / Clayton Street / Ravensworth Street / Palace Road	Priority junction (staggered crossroads)	4
9	Barrington Road / Ravensworth Street	Priority Junction	3
Ashington			
10	Station Road / John Street	Priority Junction (crossroads)	4

11	Station Road / Kenilworth Road/ Council Road/ Car park exit	Signalised Junction	5

Table 30 – Manual Classified Turning Counts and Queue Length Surveys

16.5.2 Parking Surveys (1 hourly beat surveys counting parking occupancy at identified public car parks).

16.5.2.1 Bedlington

- Ravensworth Street car park (adjacent to Barrington Road)
- Clayton Street car park (west of School Road)
- Melrose & Jubilee Terrace car park (at junction with Station Road)

16.5.2.2 Northumberland Park Metro Station

- Existing multi-storey car park

16.6 Telecommunications

16.6.1 Survey

A site survey of the lineside and station Telecoms was undertaken for the project area. No fringe sites were surveyed as part of the Northumberland project.

The survey was undertaken from Benton Junction ELR BNE at 0mi + 0m at T3117 points, the survey was undertaken over a 5-day period working towards Ashington LC FTN Node (4233) located at ELR BWC 3mi + 484m. Ashington LC FTN Access Node is the limit of the Telecoms are for the Northumberland Project.

16.6.2 Considerations

The Telecoms operational communications network is limited to the Northumberland Line with no planned fringe locations. During option development, no fringe Signalling bearer links were identified or requested to be considered as part of the OSR. However, the next design stage team shall liaise with the Signalling design team to confirm that any Signalling bearer requirements are identified at the beginning of the design process.

Note that should any FTN / FTNx design be required to accommodate any new FTNx POP or FTN bearer circuits, the next design stage design teams need to allow a lead time of 4 – 6 months due to FTN/ FTNx design team workload. This is a limited resource pool within Network Rail.

16.6.3 Stations - SISS

There is no existing Telecoms SISS infrastructure located at any of the proposed new stations. A survey was undertaken at the redundant Ashington and Bedlington Stations with no SISS assets located at these sites.

16.6.4 Lineside Operational Communications

16.6.4.1 FTN Fibre Cable

The Northumberland line project contains 24 core DISAC fibre cable backbone. Fibre cable F-6119-MRPS-A connects FTN Access Nodes Benton Junction (6119) at ELR BNE 0mi + 186m to Morpeth SB at ELR ECM7 16mi + 1280m. Note that Morpeth SB FTN Access Node (MRPS) is outside the project work area.

Fibre cable F-6119-MRPS-A forms part of the LNE Core Ring K with STM-1 Subtend 545

The table below details the FTN SPUR fibre cables for the corresponding FTN Access Node.

FTN Access Node	ELR	Mileage	Cable ID	Cable Size and Type	SPUR Joint ID	ELR	Mileage
Shiremoor (4230)	EJM	8.25mi + 226m	F-SPUR-4230-A	24 PE Armoured	F-6119-MRPS-A-21	EJM	8.25mi + 239m
Newsham Junction (4231)	EJM	12.25mi + 55m	F-SPUR-4231-A	24 DISAC	F-6119-MRPS-A-17	EJM	12.25mi + 78m
Barrington (4232)	EJM	16.25mi + 372m	F-SPUR-4232-A	24 PE Armoured	F-6119-MRPS-A-11	EJM	16.25mi + 345m

Table 31 - FTN SPUR Fibre Cables

The cables were found to be in fair good condition with no signs of vandalism or emergency repair.

24 core fibre disac cable F-4232-4233-A connects FTN Access Node Barrington (4232) ELR EJM 16.25mi + 372m to Ashington LC (4233) at ELR BWC at 3Mi + 484m. The cable was found to be in fair good condition with no signs of vandalism or emergency repair. There are no SPUR fibre cables connected to this section of cable. The 24 core disac fibre cable is a node to node connection with no other FTN Access Nodes in between.

Fibre cable F-4232-4233-A forms part of the LNE Core Ring K with STM-1 Subtend 550. It should also be noted that Ashington LC FTN Access Node (4233) has no diverse fibre cable.

During the site survey it was found that the fibre cables were not heavily used with only tube 1 fibres 1 - 4 being used for local access FTN traffic.

No FTNx connections were found to be present on F-6119-MRPS-A or F-4232-4233-A cables.

A web report was requested during option development to be assessed. However, this record was not provided. In addition, a fibre allocation sheet was not available from Network Rail for F-6119-MRPS-A or F-4232-4233-A.

16.6.4.2 Lineside Copper Cables and Lineside Cabinets

The scheme contains varying sizes of copper cable infrastructure, with both Legacy copper and FTN copper cabling. The lineside copper infrastructure is providing local analogue circuit connectivity for the Northumberland line signal boxes and Tyneside IECC.

20 pair 0.6mm copper cable NCC3484 links the Blyth & Tyne line from the East Coast Main Line. During the survey it was not possible to determine the London termination point for NCC3484 as this was outside the area of the scheme.

The 20 pair 0.6mm copper cable NCC3483 ends at location case NTM0043 at BNE 1mi + 425m. this is the limit of connection to the East Coast Main Line and Tyneside IECC. From this point the copper cable serves the Northumberland Line only.

The copper cabling was found to be in fair condition on the main throughout the route.

The table below details the cables within the project area

Control Area	Cable ID	Cable Size	London Termination	ELR	Mileage	Country Termination	ELR	Mileage
Tyneside IECC	NCC3484 (Sec 3)	20PR/0.6	T7279	ECM7	Unknown	NTM00040	BNE	0mi + 540m
Tyneside IECC	NCC3484 (Sec 4)	20PR/0.6	NTM00040	BNE	0mi + 540m	NTM0041	BNE	0mi + 1038m
Tyneside IECC	NCC3484 (Sec 5)	20PR/0.6	NTM0041	BNE	0mi + 1038m	NTM0042	BNE	0mi + 1540m
Tyneside IECC	NCC3484 (Sec 6)	20PR/0.6	NTM0042	BNE	0mi + 1540m	NTM0043	BNE	1mi + 425m

Control Area	Cable ID	Cable Size	London Termination	ELR	Mileage	Country Termination	ELR	Mileage
Controlled by Newsham SB								
Newsham SB	NCC2583 (Sec 14)	20PR	Sig 6/39	BNE	1mi + 1588m	Sig 7/22	EJM	7mi + 440m
Newsham SB	NCC2583 (Sec 13)	20PR	Sig 7/22	EJM	7mi + 440m	Holywell LC REB IDF	EJM	7mi + 800m
Newsham SB	NCC2583 (Sec 12)	20PR	Holywell LC REB IDF	EJM	7mi + 800m	Sig 7/58	EJM	7mi + 1160m
Newsham SB	NCC2583 (Sec 11)	20PR	Sig 7/58	EJM	7mi + 1160m	C-LINK-4320-A-01	EJM	8mi + 720m
Newsham SB / Shiremoor FTN Access Node (4230)	C-LINK-4230-A	10PR/0.63	Shiremoor FTN Access Node (4230) MDF	EJM	8mi + 628m	C-LINK-4320-A-01	EJM	8mi + 720m
Newsham SB	NCC2583 (Sec 10)	20PR	C-LINK-4320-A-01	EJM	8mi + 720m	Sig 8/59	EJM	8mi + 1180m
Newsham SB	NCC2583 (Sec 09)	20PR	Sig 8/59	EJM	8mi + 1180m	Seghill LC REB IDF	EJM	9mi + 100m
Newsham SB	NCC2583 (Sec 07)	20PR	Seghill LC REB MDF	EJM	9mi + 100m	Sig 9/27	EJM	9mi + 543m
Newsham SB	NCC2583 (Sec 05)	20PR	Sig 9/27	EJM	9mi + 543m	Sig 10/71	EJM	10mi + 1428m
Newsham SB	NCC2583 (Sec 04)	20PR	Sig 10/71	EJM	10mi + 1428m	Hatley LC Hut IDF	EJM	11mi + 22m
Newsham SB	NCC2583 (Sec 03)	20PR	Hatley LC Hut IDF	EJM	11mi + 22m	Sig 11/52B	EJM	11mi + 1046m
Newsham SB	NCC2582 (Sec 03)	20PR	Hatley LC Hut IDF	EJM	11mi + 22m	Sig 11/52B	EJM	11mi + 1046m
Newsham SB	NCC2583 (Sec 02)	20PR	Sig 11/52B	EJM	11mi + 1046m	Sig 12/17B (New)	EJM	12mi + 341m
Newsham SB	NCC2582 (Sec 02)	20PR	Sig 11/52B	EJM	11mi + 1046m	Sig 12/37A (Old)	EJM	12mi+ 744m
Newsham SB	Unknown	Unknown	Sig 12/17B (New)	EJM	12 Mi + 341m	Sig 12/17B (New)	EJM	12mi + 351m

Control Area	Cable ID	Cable Size	London Termination	ELR	Mileage	Country Termination	ELR	Mileage
Newsham SB	NCC2583 (Sec 02)	20PR	Sig 12/17B (New)	EJM	12 Mi + 341m	Newsham SB MDF	EJM	12mi + 900m
Newsham SB	Unknown	50PR	Sig 12/17B (Old)	EJM	12mi + 351m	Newsham SB MDF	EJM	12mi + 900m
Newsham SB	Unknown	Unknown	Sig 12/37A (Old)	EJM	12mi+ 744m	Sig 12/37A (New)	EJM	12mi+ 745m
Newsham SB	Unknown	50PR	Sig 12/37A (New)	EJM	12mi+ 745m	Newsham SB MDF	EJM	12mi + 900m
Newsham SB	NCC2582 (Sec 02)	20PR	Sig 12/37A (Old)	EJM	12mi+ 744m	NTM0061	EJM	12mi + 983m
Newsham SB / Newsham Junction FTN Access Node (4231)	C-LINK-4231-A	50PR	Newsham Junction FTN Access Node (4231)	EJM	12mi + 457m	Newsham SB MDF	EJM	12mi + 900m
Newsham SB	NCC2580 (Sec 01)	20PR	Newsham SB MDF	EJM	12mi + 900m	NTM0061	EJM	12mi + 983m
Newsham SB	NCC2579 (Sec 01)	24PR	Newsham SB MDF	EJM	12mi + 900m	NTM0061	EJM	12mi + 983m
Newsham SB	NCC2524 (Sec 11 – Sec 02)	20PR	Newsham SB MDF	EJM	12mi + 900m	Bedlington South SB MDF	EJM	15mi + 1200m
Newsham SB	NCC2579 (Sec 02)	24PR	NTM0061	EJM	12mi + 983m	NTM0063	EJM	12mi + 1509m
Newsham SB	NCC2579 (Sec 01)	24PR	NTM0063	EJM	12mi + 1509m	NTM0064	EJM	13mi + 339m
Newsham SB	NCC2567	20PR	NTM0064	EJM	13mi + 339m	Bebside LC REB IDF	EJM	14mi + 1280m
Newsham SB / Bedlington South SB	NCC2567	20PR	Bebside LC REB IDF	EJM	14mi + 1280m	NTM0069	EJM	14mi + 1294m
Controlled by Bedlington South SB								
Bedlington South SB	NCC2553	10PR	NTM0069	EJM	14mi + 1294m	Joint Unknown – Becomes NCC2552 14PR		

Control Area	Cable ID	Cable Size	London Termination	ELR	Mileage	Country Termination	ELR	Mileage
Bedlington South SB	NCC2552	14PR	Joint Unknown – Becomes NCC2552 14PR	EJM	Unknown	BMM0041	EJM	15mi + 1085m
Bedlington South SB	NCC2556	24PR	BMM0041	EJM	15mi + 1085m	Bedlington North SB MDF	EJM	15mi + 1440m
Bedlington South SB	NCC2559	24PR	BMM0041	EJM	15mi + 1085m	BMM0040	BWC	0m + 722m
Bedlington South SB	NCC2555	24PR	BMM0041	EJM	15mi + 1085m	Bedlington South SB MDF	EJM	15mi + 1200m
Controlled by Bedlington North SB								
Bedlington North SB	BED-ASH-C001	50PR	Bedlington North SB	EJM	15mi + 1440m	BED-ASH002	BWC	0mi + 348m
Bedlington North SB	BED-ASH-C002	20PR	Bedlington North SB	EJM	15mi + 1440m	C-STUB-4232-B-02	BWC	0mi + 1534m
Bedlington North SB	NCC2559 (Faulty)	24PR	BMM0040	BWC	0m + 722m	BMM0029	BWC	1mi + 101m
Bedlington North SB	Unknown	50PR	BMM0040	BWC	0m + 722m	BED-ASH003	BWC	0mi + 1249m
Bedlington North SB	BED-ASHC001	50PR	BED-ASH003	BWC	0mi + 1249m	BED-ASH004	BWC	1mi + 5m
Bedlington North SB	Unknown	50PR	BED-ASH004	BWC	1mi + 5m	BMM0039	BWC	1mi + 101m
Bedlington North SB / Marcheys House SB	C-STUB-4232-C	50PR	C-STUB-4232-B-02	BWC	0mi + 1534m	C-STUB-4232-B-04	MWJ	0mi + 73m
Bedlington North SB / Marcheys House SB	C-STUB-4232-B-03	50PR	C-STUB-4232-B-02	BWC	0mi + 1534m	C-STUB-4323-B-03	BWC	1mi + 748m
Bedlington North SB / Marcheys House SB	C-STUB-4232-B-05	50PR	C-STUB-4323-B-03	BWC	1mi + 748m	C-STUB-4232-B-04	MWJ	0mi + 73m
Controlled by Marcheys House SB								

Control Area	Cable ID	Cable Size	London Termination	ELR	Mileage	Country Termination	ELR	Mileage
Marcheys House SB	C-LINK-4232-C	50PR	C-STUB-4323-B-03	BWC	1mi + 748m	Marcheys House SB	BWC	1mi + 800m
Marcheys House SB	C-LINK-BEDA-A	20PR	Marcheys House SB	BWC	1mi + 800m	BED-ASH007	BWC	1mi + 813m
Marcheys House SB	C-BEDA-ASHA-B	20PR	BED-ASH007	BWC	1mi + 813m	BED-ASH008	BWC	1mi + 1487m
Marcheys House SB	C-LINK-BEDA-B	10PR	BED-ASH008	BWC	1mi + 1487m	North Seaton Gate Box IDF	BWC	1mi + 1500m
Marcheys House SB	C-BEDA-ASHA-B	20PR	BED-ASH008	BWC	1mi + 1487m	BED-ASH009	BWC	1mi + 1487m
Marcheys House SB	C-BEDA-ASHA-B	20PR	BED-ASH009	BWC	1mi + 1487m	BED-ASH011 (BOP)	BWC	3mi + 419m
Marcheys House SB	C-LINK-BEDA-C	10PR	BED-ASH009	BWC	1mi + 1487m	Green Lance LC Keepers Box	BWC	2mi + 834m
Marcheys House SB	C-LINK-BEDA-D	2PR	BED-ASH009	BWC	1mi + 1487m	Sig B&T0023 (PETS Loc)	BWC	2mi + 838m

Table 32 - Telecoms Cables in Project Area

16.6.4.3 Lineside Phones

The Blyth and Tyne Line consists of various type of phone instruments as you would expect from a legacy copper network. They consist of the standard Gai-Tronics Titan Grey CB, RACAL CB and DAC Ltd RA-708 CB Grey phones. Signal Post Telephones are mounted to the Signal Posts throughout the route, with point zone telephones mounted to SPTs powder coated posts.

All phones are connected to local location cases or where they are more than 250m are connected to an FTE termination box with a 2 pair cable connecting to the nearest location. With the final connection to the instrument with a local 2 pair cable.

Phone ID	FTE Connection	Location Case ID	Controlling SB
T636	No	Sig 06/14	Tyneside IECC
T635	No	NTM0041	Tyneside IECC
PZ3401	No	NTM0042	Tyneside IECC
T635	No	NTM0043	Tyneside IECC

N101	Yes	Sig 6/39	Newsham SB
Mare's Close UWC	No	Sig 9/27	Newsham SB
Red House UWC	No	Harley's LC	Newsham SB
N11	Yes	Sig 12/37A	Newsham SB
N6	No	NTM0063	Newsham SB
N19	No	NTM0063	Newsham SB
N13	Yes	NTM0063	Newsham SB
N20	No	NTM0064	Newsham SB

Table 33 - Telephones Within Project Area

16.6.4.4 S&T Trough Route.

The S&T cable trough route consists of various sizes of concrete troughing, the S&T concrete troughing ranges from C/1/6 to C/1/9 and is buried in the main. It has been assumed this is due to cable theft over time.

It was not possible to undertake an S&T route assessment / survey due to much of the route being buried.

During option development the project was provided with a route survey from Network Rail, which was used for the OSR.

See documents DS-4230-6199-Survey-v3, DS-4230-4232-Survey-v4, DS-4232-4233-Survey-v2 for information

16.6.5 Crossings - Operational Communications

16.6.5.1 Holywell ABCL

Holywell Automatic Barrier Crossing Locally monitored is provided with the standard Whiteley 2 Remote unit with battery backup.

The crossing is supplied with 2 no Yellow Gai-Tronics Titan PETS Push to Talk Phones with armoured cords to the PETS IDF located in the crossing REB. The phones are mounted to the right crossing wigwam in line with the Network Rail standard. The crossing also has 1 no Yellow Gai-Tronics Titan PETS Push to Talk Phone for the LCU phone.

No faults were present during the time of the survey. The REB is also a termination point for the lineside cabling with cables 20 pair NCC2583 Section 13 to Signalling Location case 7/22 and 20 pair NCC2583 Section 12 to Signalling Location 7/58.

The PETS remote unit is connected to Newsham Signal Box concentrator using an STS PETS card in the STS Concept 32 concentrator rather than a Whiteley 2 PETS termination unit.

16.6.5.2 Holywell ACC UWC

Holywell ACC UWC contains no operational telecommunications phone instruments

16.6.5.3 Seghill AHB

Seghill Automatic Half Barrier (AHB) Level Crossing is provided with the standard Whiteley 2 Remote unit with battery backup.

The crossing is supplied with 2 no Yellow Gai-Tronics Titan PETS Push to Talk Phones with armoured cords to the PETS IDF located in the crossing REB. The phones are mounted to the right crossing wigwam in line with the Network Rail standard. The crossing also has 1 no Yellow Gai-Tronics Titan PETS Push to Talk Phone for the LCU phone.

No faults were present during the time of the survey. The REB is also a termination point for the lineside cabling with cables 20 pair NCC2583 Section 09 to Signalling Location case 8/59 and 20 pair NCC2583 Section 07 to Signalling Location 79/27.

The PETS remote unit is connected to Newsham Signal Box concentrator using an STS PETS card in the STS Concept 32 concentrator rather than a Whiteley 2 PETS termination unit.

16.6.5.4 Mare’s Close UWC

Mare’s Close User Work Crossing is supplied with 2 No Titan CB Grey phones with armoured cords. With one both phones terminated on a parallel circuit on the STS Concept 32 concentrator at Newsham Signal Box on a CB line card.

16.6.5.5 Hartley AHB

Hartley Automatic Half Barrier (AHB) Level Crossing is provided with the standard Whiteley 2 Remote unit with battery backup.

The crossing is supplied with 2 no Yellow Gai-Tronics Titan PETS Push to Talk Phones with armoured cords to the PETS IDF located in the crossing REB. The phones are mounted to the right crossing wigwam in line with the Network Rail standard. The crossing also has 1 no Yellow Gai-Tronics Titan PETS Push to Talk Phone for the LCU phone.

No faults were present during the time of the survey. The Hut is also a termination point for the lineside cabling with cables 20 pair NCC2583 Section 04 to Signalling Location case 10/71, 20 pair NCC2583 Section 03 and 20 pair NCC2583 Section 03 to Signalling Location 11/52B.

The PETS remote unit is connected to Newsham Signal Box concentrator using an STS PETS card in the STS Concept 32 concentrator rather than a Whiteley 2 PETS termination unit.

16.6.5.6 Red House UWC

Red House User Work Crossing is supplied with 2 No Titan CB Grey phones with armoured cords. With one both phones terminated on a parallel circuit on the STS Concept 32 concentrator at Newsham Signal Box on a CB line card.

16.6.5.7 Lysdon UWC

Lysdon UWC contains no operational telecommunications phone instruments

16.6.5.8 Newsham Crossing

Newham Level Crossing is a manually controlled crossing by the Signaller at Newsham Signal Box and therefore contains no operational telecommunications phone instruments.

16.6.5.9 Plessey Road CCTV

Plessey Road is a Closed-Circuit Television crossing and is controlled by the Newsham Signal Box, the crossing has 1 no Yellow Gai-Tronics Titan CB Lift to Call Phone. The LCU Phone is presented on the STS Concept 32 concentrator at Newsham Signal Box on a CB line card.

16.6.5.10 Chase Meadows UWC

Chase Meadows UWC contains no operational telecommunications phone instruments

16.6.5.11 Bebside AHB

Bebside Automatic Half Barrier (AHB) Level Crossing is provided with the standard Whiteley 2 Remote unit with battery backup.

The crossing is supplied with 2 no Yellow Gai-Tronics Titan PETS Push to Talk Phones with armoured cords to the PETS IDF located in the crossing REB. The phones are mounted to the right crossing wigwam in line with the Network Rail standard. The crossing also has 1 no Yellow Gai-Tronics Titan PETS Push to Talk Phone for the LCU phone.

No faults were present during the time of the survey. The Hut is also a termination point for the lineside cabling with cables 20 pair NCC2567 to Telecoms Location case NTM0064 and 20 pair NCC2567 to Telecoms Location case NTM0069

The PETS remote unit is connected to Newsham Signal Box concentrator using an STS PETS card in the STS Concept 32 concentrator rather than a Whiteley 2 PETS termination unit.

16.6.5.12 Bedlington South Crossing

Bedlington South Level Crossing is a manually controlled crossing by the Signaller at Bedlington South Signal Box and therefore contains no operational telecommunications phone instruments.

16.6.5.13 Bedlington North Crossing

Bedlington North Level Crossing is a manually controlled crossing by the Signaller at Bedlington North Signal Box and therefore contains no operational telecommunications phone instruments.

16.6.5.14 Bomarsund UWC

Bomarsund UWC contains no operational telecommunications phone instruments

16.6.5.15 Marcheys House

Marcheys House Level Crossing is a manually controlled crossing by the Signaller at Marcheys House Signal Box and therefore contains no operational telecommunications phone instruments.

16.6.5.16 North Seaton

North Seaton Level Crossing is a manually controlled crossing by Marcheys House Gate Box and therefore contains no operational telecommunications phone instruments.

The Keeper’s hut contains 1 No DL to Marcheys House Signal Box. The phone is connected to a CB circuit on the 32-line Hawk Concentrator.

16.6.5.17 Green Lane

Green Lane Automatic Half Barrier (AHB) Level Crossing is provided with the standard Whiteley 2 Remote unit with battery backup.

The crossing is supplied with 2 no Yellow Gai-Tronics Titan PETS Push to Talk Phones with armoured cords to the PETS IDF located in the crossing REB. The phones are mounted to the right crossing wigwam in line with the Network Rail standard. The crossing also has 1 no Yellow Gai-Tronics Titan PETS Push to Talk Phone for the LCU phone.

No faults were present during the time of the survey. The REB is also a termination point for the lineside cabling with cables 20 pair C-BEDA-ASHA-B to Telecoms Location case BED-ASH008 and 20 pair C-BED-ASHA-B to Telecoms Location case BED-ASH011

16.6.5.18 Hirst Lane

Hirst Lane Gate Crossing does not have any lineside telephony. The crossing is controlled by the crossing keeper.

16.6.6 Signal and Gate Boxes

16.6.6.1 Newsham Signal Box

Newsham Signal box contains limited Telecoms assets as is expected with a signal box of this type. The main cabling is terminated in Newsham REB which is located adjacent to the signal box. The REB contains a 500 series MDF with lineside cabling, SB cabling and Concentrator link cabling terminated within it.

The MDF has the following cables terminated

- 30 Pr to Newsham SB
- 32 Pr to STS Concentrator
- 10 Pr to Voice Recorder
- Internal 2 Prs
- 24 Pr to Voice Recorder.

The REB also houses the STS Concept 32 with battery backup cabinet. The unit contains 4 No PETS cards supporting Holywell AOCL, Seghill North AHB, Hartley AHB and Bebside AHB crossings. 3 No CB cards supporting local connection and finally 1 No AUTO for B2B communication to Tyneside IECC. The concentrator is connected to a standard Nice Vision 3 voice recorder.

Newsham SB MDF is also a 500 series MDF with a legacy 301 DP. The 500 series contains the following cables

- 30 Pr to Newsham REB
- 10 Pr to 301 DP
- 10 Pr to Ops Floor
- 4 Pr to GSM-R Dicora terminal
- 50 Pr C-LINK-4321-A to Newsham FTN Node (4321)

The 301 DP contains the following cables

- 20 Pr to Ops Floor
- 20 Pr NCC2583 to Seghill AHB
- 20 Pr NCC2584 to Bedlington South
- 10 Pr to 500 Series MDF

The signal box also has an STS Concept 32 48 key HMI located on the operations floor. From the site survey the HMI doesn't appear to be mapped. The key allocation is as follows:

Key No	Circuit / ID
1	Holywell AOCL PETS – Remote Power Fail
2	Holywell AOCL PETS – Single Off Hook
3	Holywell AOCL PETS – Multiple Off Hook
4	Holywell AOCL PETS – Call Tech
5	Seghill North PETS – Remote Power Fail
6	Seghill North PETS – Single Off Hook
7	Seghill North PETS – Multiple Off Hook
8	Seghill North PETS – Call Tech
9	Holywell AOCL Crossing Phones
10 – 12	Unused part of PETS Card
13	Seghill North AHB Crossing Phones

Key No	Circuit / ID
14 - 16	Unused part of PETS Card
17	Hartley AHB PETS – Remote Power Fail
18	Hartley AHB PETS – Single Off Hook
19	Hartley AHB PETS – Multiple Off Hook
20	Hartley AHB PETS – Call Tech
21	Bebside AHB PETS – Remote Power Fail
22	Bebside AHB PETS – Single Off Hook
23	Bebside AHB PETS – Multiple Off Hook
24	Bebside AHB PETS – Call Tech
25	Hartley AHB Crossing Phones
26 – 28	Unused part of PETS Card
29	Bebside AHB Crossing Phones
30 - 32	Unused part of PETS Card
33	Red House Farm
34	N101
35	N19
36	N20
37	N11
38	N13
39	Spare
40	Bedlington South DL
41	Plessy Road CCTV LCU
42	Mares Close
43	Spare
44	N6
45	Spare
46	Spare

Key No	Circuit / ID
47	Spare
48	Tyneside IECC DL

Table 34 – Newsham Signal Box HMI Key Allocation

Finally, Newsham SB has a standard GSM-R Dicora terminal located on the operations floor adjacent to the STS HMI.

16.6.6.2 Bedlington South Signal Box

Bedlington South contains limited Telecoms assets with the main cabling terminated in a 500 series MDF with lineside cabling and SB cabling.

The MDF has the following cables terminated

- 7 Pr to NCC2550 to Sig Loc BT0019
- 20 Pr NCC2524 to Newsham SB
- 20 Pr NCC2523 to Bedlington North SB
- 20 Pr NCC2525 to Furness Shunters Cabin
- Internal Cable to Voice Recorder
- 50 Pr C-LINK-4232-B to Barrington Rd FTN Node (4232)

The signal box does not contain a concentrator, it has a single SPT BS16/18. The SPT links to a wall mounted Titan Phone within the signal box. Also, there is a direct line to Newsham SB and Bedlington North SB, these are presented as desk phones within the signal box. All phones within Bedlington South are linked to a Nice Vision 3 Voice recorder located in the equipment room of the signal box. Finally, a dicora GSM-R terminal is located on the Operations floor of the signal box.

16.6.6.3 Marcheys House Signal Box

Marcheys House signal box contains limited Telecoms assets with the main cabling terminated on a 500 series MDF with lineside cabling and SB cabling.

The MDF has the following cables terminated

- 14 Pr NCC2570 to Telecoms location BMM0038
- 50 Pr C-LINK-4232-C to FTN DC Location C-STUB-4232-B-03
- 20 Pr C-LINK-BEDA-A to FTN DC Location C-BEDA-ASHN-002
- Internal Cable to Voice Recorder

The signal box is supported by a 32 Line Hawk Concentrator containing a KETS2 card and monitor unit for Green Lane AHB. The Hawk concentrator contains 1 No KETS Card, 2 No CB Cards and 1 No Auto Card for B2B Communications. The concentrator is connected to a standard Nice Vision 3 voice recorder.

The signal box also has a Hawk Concentrator with 32 key mapped HMI located on the operations floor. From the site survey the HMI doesn't appear to be mapped. The key allocation is as follows:

Key No	Circuit / ID
1	GREEN LANE AHB
2	SPARE
3	UNALLOCATED

Key No	Circuit / ID
4	UNALLOCATED
5	UNALLOCATED
6	SPARE AUTO
7	WINNING DL
8	BEDLINGTON NORTH DL
9	GREEN LANE LCU
10	UNALLOCATED
11	UNALLOCATED
12	UNALLOCATED
13	UNALLOCATED
14	SPARE AUTO
15	HIRST LANE DL
16	NORTH SEATON DL
17	MH10 SPT
18	UNALLOCATED
19	UNALLOCATED
20	UNALLOCATED
21	UNALLOCATED
22	SPARE AUTO
23	GREEN LANE DL
24	UNALLOCATED
25	UNALLOCATED
26	UNALLOCATED
27	UNALLOCATED
28	UNALLOCATED
29	UNALLOCATED
30	UNALLOCATED

Key No	Circuit / ID
31	UNALLOCATED
32	UNALLOCATED

Table 35 - Marcheys House Signal Box HMI Key Allocation

Finally, the crossing has a standard GSM-R Dicora terminal for train to signal box communications.

16.6.6.4 North Seaton Gate Box

North Seaton gate box only contains a desk mounted direct line to Marcheys House signal Box with an incoming 2 pair cable C-LINK-BEDA-D to FTN DC CBED=ASH009.

16.6.7 FTN Nodes

16.6.7.1 Shiremoor FTN Access Node (4230)

Shiremoor FTN Access Node (4230) is a standard type 2 GSM-R co-located FTN Node. The node has limited transmission assets installed and is solely used for GSM-R on the line.

The node contains the following cables:

- 24 core PE fibre cable F-SPUR-4230-A
- No Copper cable is installed on the Vert A

The node has a now life expired 1511#BA with 3 No S5 cards.

16.6.7.2 Newsham Junction FTN Access Node (4231)

Newsham FTN Access Node (4231) is a standard type 2 GSM-R co-located FTN Node. The node has limited transmission assets installed and is solely used for GSM-R on the line.

The node contains the following cables:

- 24 core fibre DISAC cable F-SPUR-4231-A
- 50 pair copper cable C-LINK-4231-A

The node has a now life expired 1511#BA with 3 No S5 cards and 1 No LT ISDN card.

16.6.7.3 Ashington LC FTN Access Node (4233)

Ashington FTN Access Node (4233) is a standard type 2 GSM-R co-located FTN Node. The node has limited transmission assets installed and is solely used for GSM-R on the line.

The node contains the following cables:

- 24 core fibre DISAC cable F-4232-4233-A
- No Copper cable is installed on the Vert A

The node has a now life expired 1511#BA with 3 No S5 cards.

16.7 Electrical & Mechanical

16.7.1 Benton PSP

The existing Benton PSP is a containerised unit of metallic construction. The existing Signalling Power Supply is a 650V IT supply to lineside and is fed via radial feeders. The Benton PSP is supplied by a 400V 400A DNO supply off Whitley

Road. The Benton PSP is feeding numerous feeders from Benton to Newsham with Benton North Feeder, Benton South feeder and Blyth and Tyne Feeder.

ELR & Crossing	Type
ELR & Mileage	ECM7 4M 0418 yds
Track ID	Up Bi Directional Down Bi Directional
Electrification	OLE
Post Code	NE12 9SL
Access	Briarsyde
Gates/Keys	Keys for Main gate and lock for the fence – XJK859
	Keys to enter the Benton PSP – MMA-C
	Keys to enter the DNO building are within the Benton PSP so need the PSP keys for access to DNO.

Table 36 - Benton Principal Supply Point

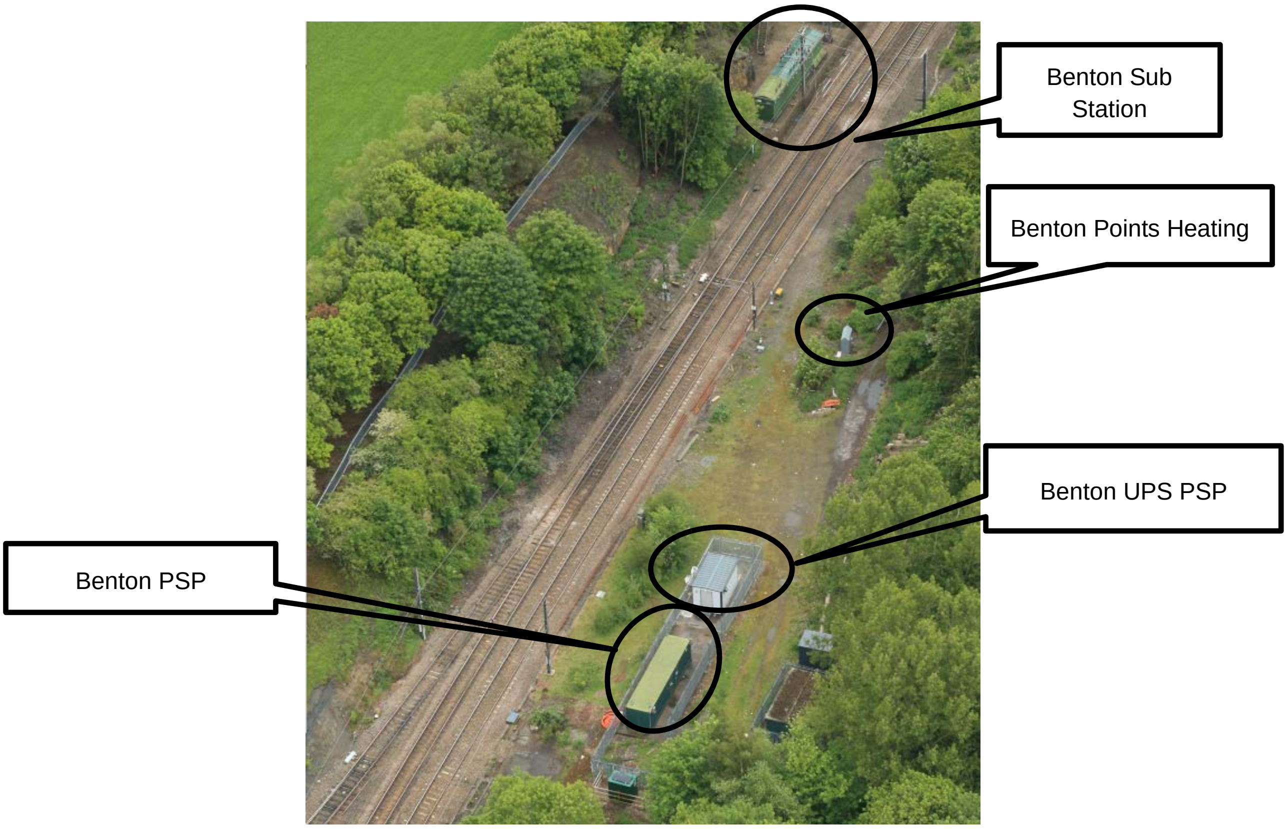


Figure 86 - Benton Principal Supply Point

16.7.2 Benton Site

The existing site contains:

- Benton PSP which is secured within a metal fence
- Benton PSP UPS which is secured within the same metal fence as the PSP
- Points Heating Cubicle is a two-door metallic cubicle locked inside a bigger two door metallic building off the walkway onto the site manufactured by Samuel James Engineering.

16.7.3 Benton PSP Contents

The Benton PSP contains the following components:

- 400V Non-Maintained Panel
- Essential 650V Switchboard
- 650V Mobile Generator Connection Box
- Local Consumer Unit
- 250A Changeover Panel
- Mains Generator
- Static Generator Control Section
- 160A Standby Generator Alternator Circuit Breaker
- 230V Refuelling Pump

16.7.4 Existing Switch Heating

The existing information is gathered by AECOM during non-intrusive site surveys. The table below will summarise the information on existing Switch Heating sites.

Site Name	Rated	Switches Supplied	Condition	DNO Supply Location
Benton Switch Heating	1-Phase 230V 100A DNO	3401	Fair	NE12 9QZ Williams Close
Newsham Switch Heating	Existing 3-phase 230V 80A DNO supply	5	Very good	NE24 3PP Newsham Road
Bedlington North Switch Heating	Existing 1-Phase 400V 100A DNO supply	23A,21A/21B, 48&50	Good	NE22 5UZ Barrington Road

Table 37 - Existing Switch Heating

16.8 Structures

A desktop study was undertaken of recent examination and assessment reports provided by Network Rail to identify which structures may require strengthening, repair or modification works as a result of the route upgrading. This was validated with non-intrusive site visits which were conducted between June 2019 and August 2019. ***Table 38*** below provides a detailed breakdown of all information reviewed and verified.

Engineers Line Reference	Railway Structure I.D.	Information Received			Visual Inspection validating information
		Assessment Report	Visual Examination	Detailed Examination	
BNE	28	N/A	July 2018 report received	July 2017 report received	Partial inspection completed – soffit of culvert not inspected
BNE	28A	N/A	July 2018 report received	No report received	Full inspection completed – information validated
BNE	29	February 2001 Assessment Received	July 2018 report received	May 2014 report received	Full inspection completed – information validated
BNE	30	N/A	July 2018 report received	No report received	Full inspection completed – information validated

Engineers Line Reference	Railway Structure I.D.	Information Received			Visual Inspection validating information
		Assessment Report	Visual Examination	Detailed Examination	
BNE	31A	N/A	July 2018 report received	No report received	Full inspection completed – information validated
BNE	31B	N/A	July 2018 report received	No report received	Full inspection completed – information validated
BNE	31C	N/A	July 2018 report received	No report received	Full inspection completed – information validated
BNE	33	N/A	July 2018 report received	No report received	Full inspection completed – information validated
EJM	33A	N/A	October 2018 report received	No report received	Full inspection completed – information validated
EJM	34	N/A	October 2018 report received	March 2009 report received	Partial inspection completed – soffit of culvert not inspected
EJM	35	May 2007 assessment received	October 2018 report received	December 2017 report received	Full inspection completed – information validated
EJM	36	September 2001 assessment received	October 2018 report received	August 2014 report received	Full inspection completed – information validated
EJM	36A	N/A	October 2018 report received	July 2016 report received	Partial inspection completed – soffit of culvert not inspected
EJM	37	July 2013 assessment received	October 2018 report received	September 2014 report received	Full inspection completed – information validated
EJM	38A	N/A	October 2018 report received	No report received	Manhole identified – unable to determine condition of asset
EJM	38	N/A	October 2018 report received	September 2014 report received	Partial inspection completed – soffit of culvert not inspected
EJM	39	February 2003 assessment received	October 2018 report received	September 2014 report received	Full inspection completed – information validated
EJM	39A	N/A	October 2018 report received	No report received	Full inspection completed – information validated
EJM	40	N/A	October 2018 report received	September 2014 report received	Partial inspection completed – soffit of culvert not inspected
EJM	41	N/A	October 2018 report received	August 2014 report received	Partial inspection completed – soffit of culvert not inspected

Engineers Line Reference	Railway Structure I.D.	Information Received			Visual Inspection validating information
		Assessment Report	Visual Examination	Detailed Examination	
EJM	42	September 2013 assessment received	October 2018 report received	November 2015 report received	Full inspection completed – information validated
EJM	43	N/A	October 2018 report received	August 2014 report received	Partial inspection completed – soffit of culvert not inspected
EJM	44	N/A	October 2018 report received	February 2009 report received	Partial inspection completed – soffit of culvert not inspected
EJM	44B	N/A	October 2018 report received	January 2015 report received	Partial inspection completed – soffit of culvert not inspected
EJM	45A	N/A	October 2018 report received	February 2016 report received	Not inspected – unable to determine location due to dense vegetation
EJM	45B	N/A	No report received	No report received	Manhole identified – unable to determine condition of asset
EJM	46A	April 2018 assessment received	October 2018 report received	September 2014 report received	Full inspection completed – information validated
EJM	47	March 2007 assessment received	October 2018 report received	December 2018 report received (Draft)	Deck viewed from track and soffit level; Piers viewed from ground level
BWC	1	May 2015 assessment received	September 2018 report received	February 2015 report received	Full inspection completed – information validated
BWC	1A	January 2019 assessment received	September 2018 report received	August 2014 report received	Full inspection completed – information validated
BWC	2	N/A	September 2018 report received	May 2018 report received	Partial inspection completed – soffit of bridge no inspected
BWC	2A	N/A	No report received	No report received	Manhole identified – unable to determine condition of asset
BWC	2AB	N/A	September 2018 report received	January 2018 report received	Partial inspection completed – soffit of culvert not inspected
BWC	2B	N/A	September 2018 report received	October 2014 report received	Partial inspection completed – soffit of culvert not inspected
BWC	3	March 2007 assessment received	September 2018 report received	July 2014 report received	Deck viewed from track and soffit level; Piers viewed from ground level

Engineers Line Reference	Railway Structure I.D.	Information Received			Visual Inspection validating information
		Assessment Report	Visual Examination	Detailed Examination	
BWC	4	N/A	September 2018 report received	No report received	Full inspection completed – information validated
BWC	4A	N/A	September 2018 report received	No report received	Full inspection completed – information validated
BWC	5	September 2017 Draft assessment received	September 2018 report received	July 2017 report received	Full inspection completed – information validated
BWC	5A	N/A	No report received	No report received	Full inspection completed – information validated

Table 38 – Northumberland Line Structures List

16.8.1 Underbridge

16.8.1.1 Underbridge EJM/35

Underbridge EJM/35 is a single skew span (56°) structure located at 7 miles 0698 yards on the EJM line. The structure – which comprises two forms of construction – carries the non-electrified ballasted track over a public footpath. This section of the track is a single bi-directional line.

Figure 87 - Underbridge EJM/35

The east side of the structure supporting the track, see ***Figure 87***, is a metallic deck comprised of ten longitudinally spanning riveted plate girders. The main longitudinal girders are fish-bellied whilst the external parapet beam is hog backed. The deck is supported on coursed ashlar stonework block abutments with a clear skew span of 4.49 metres. Each girder bearing is seated on an individual pad stone with stone blocks between. The soffit level at this section has a minimum vertical clearance of 3.6 metres. The metallic deck is in fair to poor condition with a deteriorating protective paint system and moderate to severe corrosion present in the lower structural elements above the bearing shelves; see ***Figure 89***.

Figure 88 - Left: east side metallic deck soffit, Right: view looking east to west

Figure 89 - Left: girder seated on bearing stone, right: corrosion local to bearing area

The eastern wing walls are comprised of the same coursed ashlar stonework block as the abutments. The northeast wing wall is missing some stonework and cope stones at the end of the structure, and there is evidence of movement at the interface with the abutment. It is likely these stones were removed due to displacement caused by vegetation. The south wing wall is in poorer condition with open joints in the masonry, loose cope stones and a large open joint at the interface with the abutment.

Figure 90 - Brick arch structure with corroded reinforcing ribs and supporting plates

The western side of the structure supports the Down line cess and an unclassified footpath. This section comprises a single spanning arch with a square span of approximately 1.83 metres and minimum headroom clearance of 2.87 metres. The masonry arch and supporting abutments are constructed from red brickwork. Approximately one third of the arch structure lies within Network Rail's track boundary, with the remainder of the structure belonging to the Estate of the Duke of Northumberland. The arch is in poor condition with historic strengthening works undertaken comprising arched metallic ribs and an additional lining, see ***Figure 90***. These ribs are now heavily corroded with areas of the web completely void.

Figure 91 - Left: west elevation, right: entrance to arch soffit

The west entrance to the arch is built up beneath the soffit with brickwork supported on a concrete slab and a combination of bullhead rails and an RSJ edge beam as illustrated in ***Figure 91.*** The west wing walls are comprised of brickwork similar to the arch. The concrete slab supporting the brickwork is cracking and there are areas where spalling and voiding is evident. The brickwork at the entrance to the arch appears to be spalling and there is missing mortar and brickwork local to the RSJ bearing points.

As part of Network Rail's Control Period 6 it is planned to demolish the existing redundant arch structure and regrade the adjacent embankments. A ballast retention beam will be installed at the interface with the metallic deck. There are currently no planned works to the metallic structure.

16.8.1.2 Underbridge EJM/36

Underbridge EJM/36 is a single skewed span (58°) concrete structure located at 8 miles 0770 yards on the EJM line between Newcastle and Ashington. The structure, which comprises two forms of construction, carries the single bi-directional line over a public footpath.

Figure 92 - Underbridge EJM/36

The eastern side of the structure supporting the track is formed from five concrete filler beams with an integral parapet on the eastern side. The structure has a clear square span of 3.00 metres and a clear skew span of 5.69 metres. Each internal beam comprises four post 1905 steel RSJs encased in concrete with the edge beam comprising two. The soffit of the internal deck beams is raised above the edge beam via concrete packing blocks as illustrated in ***Figure 93***. The structure is supported on ashlar abutments laid in regular courses with the south end of the structure partly supported by the adjacent abutment comprised of brick. The abutments are approximately 12.18 metres wide with 2.75 metres of headroom from ground level to soffit. A reinforced concrete ballast wall beam provides ballast retention at the interface between the two structure types. This part of the structure is in fair condition.

Figure 93 - Left: Concrete slab deck with damp between the joints, Right: Damp beneath the parapet

The concrete filler beams exhibit some damp patches on the surface of the concrete and around the joints. This water penetration has led to the build-up of minor surface effervescence on the surrounding concrete. The soffit side of the parapet is suffering from the largest amount of dampness. This parapet is not sufficiently retaining the ballast, it is falling on to the public footpath beneath the structure which may be due to track lifts since its construction. The condition of the RSJ's could not be investigated from visual examination alone; however, there is no evidence of corrosion on the soffit of the deck. The last detailed examination completed in August 2014 concluded the concrete deck and supporting abutments to be in fair condition.

Figure 94 - Left: east side concrete deck soffit, Right: redundant west side of the structure

The west side of the structure is redundant and is in significantly worse condition. Similar to EJM/35 this part of the structure is owned by the Duke of Northumberland and is in very poor condition, see ***Figure 94.*** This side of the structure is metallic and comprised of longitudinal beams with jack arches comprising steel plates and concrete backing supported on brickwork abutments. There is significant corrosion throughout this structure with the majority of the steel plates corroded. Preventative measures have been carried out on the structure which includes timber decking and steel props to support the redundant deck. As part of Network Rail's Control Period 6 it is planned to remove the redundant deck and regrade the embankments.

16.8.1.3 Underbridge EJM/42

This report covers Underbridge EJM/42, a single span masonry arch structure, located at 11 miles 1540 yards on the EJM Line between Newcastle and Ashington. The structure – which comprises a single masonry arch, carries the non-electrified ballasted track over a field to field access. This section of the track is currently a single bi-directional line.

Figure 95 - Left: east side concrete deck soffit, Right: redundant west side of the structure

The masonry arch has a clear span of 3.6 metres between abutment faces. The arch barrel is comprised of red brick and ashlar masonry voussoir stones with a headroom clearance of 4.5 metres. The voussoir stones are cut to form a horizontal surface which supports the parapet. The springing level is approximately mid height. Lateral displacement is evident in the spandrel walls with tie bars and pattress plate arrangements on the west elevation stitching the voussoir stones to the arch barrel. This appears to have been installed as a secondary measure to individual stone stitching, indicating the initial remedial measure may not have been adequate.

The voussoir stones support two courses of horizontally laid ashlar masonry blocks, a masonry string course, concrete parapets and a key clamp handrail system. Sections of the concrete have separated over the length of the structure with open joints pointed up recently with mortar. The parapet extensions on the ends of the structure have displaced significantly and remedial measures have been carried out recently; UC H-Piles installed to the rear with timber ballast board shuttering and concrete to prevent further displacement as shown in ***Figure 96***.

Figure 96 - Existing Strengthening Works

The abutments have a width of 8.2 metres and are comprised of 6 visible courses of ashlar masonry blocks. Both the abutments and springing stones are in poor condition and have significant deterioration with large areas of spalling as shown in ***Figure 97.*** The springing stone which originally had a projection from the abutment/arch barrel has spall almost completely off on the high mileage abutment. The high mileage abutment appears to be in poorer condition overall with large open joints between masonry blocks and significant weathering evident.

Figure 97 - Left: High Mileage Abutment, Right: Low Mileage Abutment

The wing walls comprised of ashlar masonry similar to the abutments have not undergone the same level of deterioration; however, vertical cracks and bulging is evident. This appears to be an ongoing issue as crack widths have been monitored as indicated in ***Figure 98***.

Figure 98 - West Elevation, South West Wing Wall

The last detailed examination of the structure was completed in November 2015 concluding the structure to be in fair condition with slight deterioration in individual elements. Defects noted include spalling general to all areas of the structure, six bricks dropped by 30 mm at the crown, longitudinal fractures in the voussoir stones and displacement of the concrete parapet extensions which have since been strengthened with kingpost retention.

16.8.1.4 Underbridge EJM/37

Underbridge EJM/37 is a 3.3 metre single spanning semi-circular arch located at 9 miles 0660 yards on the EJM line between Seghill and Seaton Delaval. The arch is constructed from ashlar stone blocks and carries the single bidirectional ballasted line over the Seaton Burn.

Figure 99 - Underbridge EJM/37

The structure was last assessed in September 2014 concluding a route availability number of RA15 at 30 mph. The most recent visual examination carried out in October 2018 does not highlight any significant defects or action required. Minimal track changes are proposed at this structure except for line speed increases.

16.8.1.5 Underbridge EJM/46A

Underbridge EJM/46A is a two-span continuous half through structure located at 14 miles 0616 yards on the EJM line outside Blyth. The deck comprising steel main girders and cross girders with a concrete jack arch deck carries the twin ballasted track over the A189 dual carriageway. The overall span of the structure is 47.8 metres with a skew angle of 55°. The structure has a headroom clearance of 5.86 metres and is supported on concrete abutments and central pier.

Figure 100 - Underbridge EJM/46A

The structure was last assessed in April 2018 concluding a Route Availability number of RA10 at 45 mph. The structure is generally in fair condition, the most recent visual examination carried out in October 2018 does not highlight any deterioration or action required.

No track changes are proposed at this structure except for a line speed increase for passenger trains, freight speeds remain the same.

16.8.1.6 Underbridge EJM/47

Bedlington Viaduct (EJM/47), located at 15 miles 0506 yards on the EJM line carries two uni-directional, non-electrified, ballasted tracks on ten spans over parkland, a public road and the River Blyth. Each span is simply supported on nine steel trestle piers and mass concrete abutments. The spans are square and vary in length over the structure; the two first spans on the south end have an effective length of 18.26 metres with the remaining spans having an effective length of 19.81 metres. The total length of the structure is approximately 239 metres. The current line speed over the structure is 45 mph on both the Up and Down lines with a Heavy Axle Weight restriction of 30 mph in either direction.

Figure 101 - Underbridge EJM/47 Bedlington Viaduct

The deck of each span comprises four steel rail girders supporting a steel deck plate. Each girder is 1.848 metres deep comprised of steel web sections connected to the flanges with angles and rivets. The web of each girder is the same thickness; however, flange plate arrangements vary dependent upon the girder location. Both inner girder flanges have two additional curtailed plates, while outer girder flanges have three. Each girder cantilevers beyond the bearing support by 1.59 metres with the bottom flange and angles sloping up to accommodate maintenance inspections. Girders are braced in pairs at the ends and intermediate stiffeners which are spaced between 1.37 metres and 1.55 metres using diagonal angle sections. Pairs of girders are then connected at the ends only.

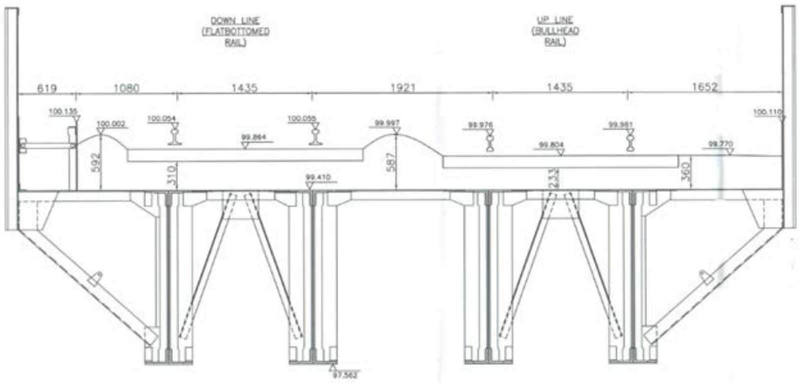


Figure 102 - EJM/47 Typical Cross Section

The steel deck plate which supports the ballasted track is riveted continuously to the top flange of the main girders. The steel deck plate supporting the Up and Down cess is cantilevered from both edge girders supported by bulb angles which connect to the bottom of the edge girder, see ***Figure 102***. The angles subsequently form the vertical members of the lattice parapet.

Figure 103 - EJM/47 Cess walkway supports and parapet vertical members

Each span is supported between two steel trestle piers with end spans supported on one end by mass concrete abutments. Bearings are arranged such that each girder is fixed in translation on one end and free on the opposite. This results in alternating fixed/free piers along the length of the structure. All of the piers are supported on concrete pad foundations.

Figure 104 – from left; pier east elevation, pier south elevation, abutment north elevation

Each trestle pier comprises four columns inclined at approximately 85° to the horizontal in the north and south elevation. The columns comprise steel I sections with riveted flange plates and are braced on all elevations. The north and south elevations are ‘K’ braced with channel sections comprising steel plates riveted to bulb angles whilst the east and west elevations are braced diagonally and horizontally with back to back channel sections and two parallel angles respectively. Additional diagonal bracing is provided in plan comprising angle sections located at the interface between vertical bracing bays. At the pier heads, truss girders, comprising of channel sections provide further restraint and seating for the main girder bearings.

An inspection for assessment of both the steel deck and trestle piers was carried out in 2007. The deck members were all inspected except for the top surface of the top flange and the deck plate. The deck was noted in fair condition with corrosion throughout due to areas of paint loss. Structurally significant corrosion was noted to the main girder bottom flanges, flange angles and deck plates. Areas of corrosion were also noted on the underside of the top flange suggesting waterproofing failure on the deck. The bearings were found to be in fair condition with surface corrosion and lamination noted to the bearing plates. There were no obvious signs of distress noted at the fixed bearings and no obvious signs of seizure noted at the free bearings.

Figure 105 – left; corrosion to K bracing, right; corrosion to diagonal channel bracing

The steelwork on the piers was noted to be in a similar condition to the deck. The column members were generally found to be in fair condition, with areas of moderate section loss and occasional isolated areas of significant section loss to the web and flanges of the members. The truss girders and bracing members were noted to be in fair condition, with up to 90% surface corrosion over the area. Isolated areas of section loss were noted to members with holes and notches varying in size to a maximum of 1000 mm by 50 mm.

The 2007 assessment findings confirmed the deck route availability number as RA13@45 mph, however, the structure was limited by the piers to RA0@45mph. Strengthening works were carried out in 2011 to address the limiting members enhancing the structures overall capacity to RA10@45mph with a heavy axle weight (HAW) restriction of 30 mph. This involved minor strengthening works to the deck including blast cleaning all steelwork and repainting. A new GRP maintenance walkway to the underside of the deck was also installed with new access chambers fitted at track level above the first and last pier.

Significant strengthening works were carried out on the piers; however, full details are not available at the time of writing this report. The works are known to involved complete replacement of the existing diagonal bracing on the east and west elevations of the fixed piers, strengthening the main legs at the lower level of two of the fixed piers and over plating repairs. New drainage channels were also added to the spans to collect any water from the deck joints directing flow away from the piers.

16.8.1.7 Underbridge BWC/1A

Underbridge BWC/1A is a three-span early steel and concrete underbridge located at 0 miles 0836 yards on the BWC line between Bedlington and Ashington. The main span is constructed from early steel with a span of 11.47 metres and carries the double tracked BWC line over the A1147 single carriageway. The other two spans are reinforced concrete and span public footpaths either side of the road. The substructure is concrete throughout with two piers, one located between each side of the carriageway and adjacent footpath. The structure has a headroom clearance of 5.28 metres.

Figure 106 - Underbridge BWC/1A

The structure was last assessed in January 2019 concluding a Route Availability number of RA11 at 40 mph. The last detailed examination was completed in August 2014 and determined the structure to be in overall fair. The most recent visual examination carried out in September 2018 does not highlight any further deterioration from anything mentioned in the previous assessments; some areas with slight corrosion and spalling to the elemental parts examined is noted.

16.8.1.8 Underbridge BWC/2

Underbridge BWC/2 is a 3.6 metre single span concrete arch structure located at 0 miles 1188 yards on the BWC line between Bedlington and West Sleekburn. The arch is comprised of in-situ concrete and carries the twin ballasted track over the Sleek Burn. The headwalls are a combination of cast in-situ concrete and masonry brickwork. There is approximately 9 metres of cover above the bridge.

Figure 107 - Underbridge BWC/2

The last detailed examination of the structure was completed in May 2018 and concluded the arch to be in a generally fair condition. The examination does highlight a transverse fracture in the crown and several longitudinal cracks which were identified in February 2012. This appears to be a result of settlement which is evident in the arch barrel with differential displacement of sections of the lining at construction joints. Minimal track changes are proposed at this structure except for passenger line speed increases. Freight speeds will remain the same.

16.8.1.9 Underbridge BWC/3 – North Seaton Viaduct

North Seaton Viaduct (BWC/3), located at 1 mile 1276 yards on the BWC line carries two uni-directional, non-electrified, ballasted tracks on fourteen spans over parkland, a south riverbank footpath and the River Wansbeck. Each span is simply supported on thirteen steel trestle piers and ashlar stone abutments. The spans are square and vary in length over the structure; both end spans have an effective length of 21.66 metres and internal spans have an effective length of 19.8

metres with the exception of one long span of 21.56 metres. The total length of the structure is 317.5 metres. The current line speed over the structure is 30 mph on both the Up and Down lines.

Figure 108 - Underbridge BWC/3 North Seaton Viaduct

The deck of each span comprises four steel rail girders supporting a steel deck plate. Each girder is 1.829 metres deep comprised of steel web sections connected to the flanges with angles and rivets. The web of each girder is the same thickness; however, flange plate arrangements vary dependent upon the span. Short span bottom flange plates have two additional curtailed plates and top flange plates have three. Long span girder bottom flange plates have three additional curtailed plates and top flange plates have four. All flange plates are the same thickness except for the short span top flange plate. Each girder cantilevers beyond the bearing support by 1.524 metres with the bottom flange and angles sloping up to accommodate maintenance inspections. Girders are braced in pairs at the ends and intermediate stiffeners which are spaced between 1.219 metres and 1.829 metres using diagonal angle sections. Pairs of girders are then connected at the ends only.

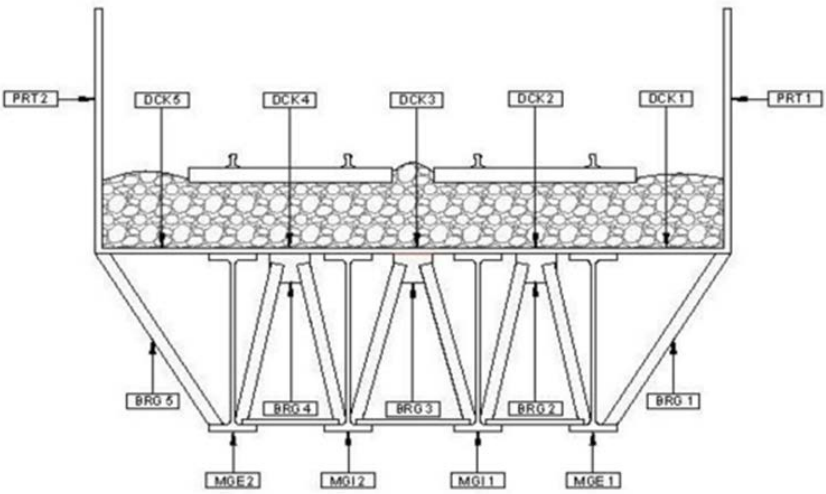


Figure 109 – BWC/3 Typical Cross Section through Deck

The steel deck plate which supports the ballasted track is riveted continuously to the top flange of the main girders. The steel deck plate supporting the Up and Down cess is cantilevered from both edge girders and is supported by bulb angles which connect to the bottom of the edge girder. The angles subsequently form the vertical members of the lattice parapet, see ***Figure 109.***

Figure 110 – BWC/3 Angles forming Vertical Members of Lattice Parapet

Each span is simply supported between two steel trestle piers with the end spans supported on one end by ashlar stone abutments. Bearings are fixed in translation over the length of the structure except for the masonry abutments and over the three piers which are free slide. This divides the deck into four sections. Nine of the piers are supported on concrete pad foundations with the remainder located within the River Wansbeck supported on pile foundations.

Figure 111 – BWC/3 from left; abutment, side elevation, skeletal pier

The trestle piers comprise eight vertical steel I section columns supporting the bearings under each girder end. The size of section is dependent upon the height of the pier which varies between two and six bays dependent on the pier's location relative to the river bed. Bay heights range between 3.352m and 3.860m and are defined by the location of plan and elevation bracing. Plan bracing is located at the interface of each bay and is comprised of both diagonal and horizontal members. Each bay is braced in elevation between each column member in both east to west and south to north directions. Horizontal bracing members in plan comprise H sections and diagonal members in plan and elevation comprise angle sections.

An inspection for assessment of both the steel deck and trestle piers was carried out in 2006. The deck members were all inspected except for the top surface of the top flange and deck plate. The deck was noted in relatively good condition with corrosion primarily at the span ends due to failure of the deck waterproofing at joints; the bottom flange, web, connecting angles and diagonal bracing were noted to have moderate corrosion with local areas of severe corrosion and perforation. Rivet heads were noted to have 30 – 70% section loss in this area. Moderate corrosion was also noted on the bearings.

Figure 112 – BWC/3 from left; diagonal bracing and column defects, horizontal bracing defect

The steelwork on the piers was noted in poorer condition than the deck, see ***Figure 112***. Column members were generally in good condition with areas of moderate corrosion and occasional isolated areas of severe primarily on the edges of flanges, fillets between the webs and splice/bracing connections. The bracing members were noted to be in fair condition; however, some areas were noted to have corrosion losses of up to 80% of the total cross section. The flanges of the horizontal bracing and in some areas on the columns were also heavily pockmarked. This is believed to have resulted from impurities in the steel separating from the parent material caused by pressure induced from general corrosion of the steelwork.

The 2006 assessment findings confirmed the deck route availability number as RA12@30mph, however, the structure was limited by the piers. Strengthening works were carried out in 2011 to address limiting members enhancing the structures overall capacity to RA10@30mph. This involved minor strengthening works to the deck including blast cleaning all steelwork, repainting, bearing refurbishment, GRP walkway replacement and drainage refurbishment. The piers were strengthened by adding additional bracing members parallel to original members, replacement of horizontal bracing beams and plate repairs to the columns. Similar to EJM/47, the exact details of strengthened members are not known at the time of this report.

16.8.2 Overbridges

16.8.2.1 Overbridge BNE/28A

Overbridge BNE/28A is a single skewed span composite structure located at 0 miles 1100 yards on the BNE line. The structure has a span of 15.6 metres and carries two Nexus tracks as part of Northumberland Metro. It comprises steel longitudinal girders with a transverse concrete deck. The structure has a headroom clearance of 4.95 metres over the railway.

Figure 113 - Overbridge BNE/28A

The structure is an outside party owned structure, owned by Tyne and Wear Metro. The most recent visual examination carried out in July 2018 does not highlight any defects. Minimal track changes are proposed at this structure except for speed increases.

16.8.2.2 Overbridge BNE/29

Overbridge BNE/29 is a two-span composite structure located at 1 mile 0440 yards on the BNE line. The structure is comprised of two adjacent spanning decks, the northern half consists of a reinforced concrete slab cast in-situ and the southern half comprises steel I beam sections encased in concrete with precast concrete jack arches spanning between beams. The structure is skewed by approximately 380 and has an overall length of approximately 21.24 metres. It carries the B1505 Great Lime Road over the BNE line on the west and two Nexus lines on the east. Access to Palmersville Metro Station is gained via the southern side of the deck. The structure has a headroom clearance of 4.68 metres over the railway.

Figure 114 - Overbridge BNE/29

The last detailed examination was completed in 2014 and was concluded the structure to be in fair condition. The most recent visual examination in July 2018 does not highlight any new defects or actions required. Minimal track changes are proposed at this structure except for line speed increases.

16.8.2.3 Overbridge BNE/30

Overbridge BNE/30 is a three-span pre-stressed concrete structure located at 1 mile 1518 yards on the BNE line. The structure comprises a pre-stressed concrete beam deck with integral reinforced concrete parapets supported on concrete abutments and piers. The main span is approximately 9.5 metres in length and carries a single farm track access over the single BNE line and two Nexus lines. The structure has a headroom clearance of 4.76 metres over the railway.

Figure 115 - Overbridge BNE/30

The structure is an outside party owned structure. The most recent visual examination carried out in July 2018 does not highlight any significant defects. Minimal track changes are proposed at this structure except for line speed increases.

16.8.2.4 Overbridge BNE/31A

Overbridge BNE/31A is a single spanning pre-stressed structure located at 2 miles 0022 yards on the BNE line. The structure has a span of 12.68 metres and carries the A19 dual carriageway over the BNE line and two Nexus lines. It comprises a pre-stressed concrete deck supported on mass concrete abutments. The structure has a headroom clearance of 5.35 metres over the railway.

Figure 116 - Overbridge BNE/31A

This is an outside party owned structure. The most recent visual examination carried out in July 2018 does not highlight any significant defects. Minimal track changes are proposed at this structure except for line speed increases.

16.8.2.5 Overbridge BNE/31B

Overbridge BNE/31B is a single spanning composite structure located at 2 miles 0396 yards on the BNE line. The structure has a span of approximately 25.77 metres and carries the A186 dual carriageway over the single tracked BNE line and two Nexus tracks. The deck is comprised of steel longitudinal girders and a reinforced concrete deck with integral reinforced concrete parapets and is supported on concrete abutments. The structure has a headroom clearance of 6.80 metres over the railway.

Figure 117 – Overbridge BNE/31B

This structure is outside party owned. The most recent visual examination carried out in July 2018 does not highlight any defects. Minimal track changes are proposed at this structure except for line speed increases.

16.8.2.6 Overbridge BNE/31C

Overbridge BNE/31C is a single span composite structure located at 2 miles 0448 yards on the BNE line. The structure has a span of approximately 33 metres and carries the single carriageway, Algernon Drive, over the single tracked BNE line and two Nexus tracks. The structure also spans the Northumberland Park Metro Station. The entrance to the station is accessed via the southwest parapet. The deck is comprised of steel longitudinal girders and a reinforced concrete deck with integral reinforced concrete parapets and is supported on concrete abutments. The structure has a headroom clearance of 6.32 metres over the railway.

Figure 118 - Overbridge BNE/31C

This is an outside party owned structure. The most recent visual examination carried out in July 2018 does not highlight any defects. This structure forms part of the station proposal for Northumberland Park and is discussed in further detail in ***Section 5.1.1***

16.8.2.7 Overbridge BNE/33

Overbridge BNE/33 is a single spanning pre-stressed concrete structure located at 2 miles 0748 yards on the BNE line. The structure has a span of approximately 15.8 metres and carries the single carriageway, Station Road, over the single tracked BNE line and two Nexus tracks. It is comprised of a pre-stressed concrete deck with integral reinforced concrete parapets supported on mass concrete abutments. The structure has a headroom clearance of 5.10 metres over the railway.

Figure 119 - Overbridge BNE/33

The structure is an outside party owned structure. The most recent visual examination carried out in July 2018 does not highlight any defects. Minimal track changes are proposed at this structure except for line speed increases.

16.8.2.8 Overbridge EJM/33A

Overbridge EJM/33A is a 33 metre single span composite structure located at 2 miles 0448 yards on the BNE line. The structure is comprised of steel longitudinal girders with a concrete deck and integral parapets supported on concrete abutments. It carries the A186 dual carriageway over the single tracked EJM line. The structure has a headroom clearance of 5.99 metres over the railway.

Figure 120 - Overbridge EJM/33A

This is an outside party owned structure. The most recent visual examination carried out in October 2018 does not highlight any defects. Minimal track changes are proposed at this structure except for line speed increases.

16.8.2.9 Overbridge EJM/39

Overbridge EJM/39 is single spanning composite structure located at 10 miles 0022 yards on the EJM line. The structure has a span of approximately 8.8 metres and carries the A192 single carriageway over the single tracked EJM line. The structure is comprised of I beam sections encased in concrete with concrete jack arches spanning transversely between beams and is supported on masonry abutments. The structure has a headroom clearance of 4.50 metres over the railway.

Figure 121 - Overbridge EJM/39

The structure is outside party owned. The last detailed examination was completed in September 2014 and concluded the structure to be in fair condition with defects noted such as spalled concrete exposing steelwork in the soffit and lateral displacement of the southeast wing wall. The most recent visual examination carried out in October 2018 does not highlight any further defects from those highlighted in the previous assessment. Minimal track changes are proposed at this structure except for line speed increases, however, Seaton Deval Station proposed location is to the west. The proposed track changes will not impact existing defects highlighted within the structure.

16.8.2.10 Overbridge EJM/39A

EJM/39A is single spanning pipe bridge structure located at 10 miles 0022 yards on the EJM line. The structure has a span of approximately 20 metres and carries services over the single tracked EJM line. It is comprised of two longitudinally spanning cast iron pipes and is supported on masonry abutments. The structure has a headroom clearance of 5.10 metres over the railway.

Figure 122 - Overbridge EJM/39A

The structure is outside party owned. The most recent visual examination carried out in October 2018 does not highlight any defects. Minimal track changes are proposed at this structure except for line speed increases.

16.8.2.11 Overbridge BWC/1

Overbridge BWC/1 is a skewed single spanning half through structure located at 0 miles 0616 yards on the BWC line. The structure and has a skewed span of approximately 10.8 metres and carries the single carriageway, Stakeford Road, over the double tracked BWC line. The deck is comprised of longitudinally spanning RBE wrought iron girders with brick jack arches spanning transversely between girders and is supported on ashlar masonry abutments. The structure has a headroom clearance of 4.38 metres over the railway.

Figure 123 - Overbridge BWC/1

The last detailed examination was completed in February 2015 and concluded the structure to be in fair condition. The most recent visual examination carried out in September 2018 does not highlight any further defects. Possible ground movement on the northwest side of the structure was noted in 2015 with localised road surface subsidence and displacement of approach fencing, however, this could not side be determined. Minimal track changes are proposed at this structure except for line speed increases.

16.8.2.12 Overbridge BWC/5

Overbridge BWC/5 is a single skew spanned pre-stressed concrete structure located at 3 miles 0022 yards on the BWC line. It has a span of approximately 8.2 metres and carries Station road’s single carriageway and two footpaths over the double tracked BWC line. The deck is comprised of pre-stressed concrete beams with two service bays and is supported on ashlar masonry abutments which have been extended with concrete on the low mileage side. Containment over the structure is comprised of precast concrete parapets on the North side, Footbridge structure BWC/4A is constructed adjacent the south side of the structure. The headroom clearance from rail level is 4.34 metres.

Figure 124 - Overbridge BWC/5

The last detailed examination was completed in July 2017 and concluded the structure to be in fair condition. The most recent visual examination carried out in September 2018 does not highlight any further deterioration. The Up side abutment has a full height vertical fracture which was identified in 2014 along with concrete spalling exposing reinforcement on the Down side abutment. Displacement of the parapet panels was noted in 2012; however, no further deterioration has been noted. Minimal track changes are proposed at this structure except for line speed increases.

16.8.2.13 Overbridge BWC/5A

Overbridge BWC/5A is a single span pre-stressed concrete structure located at 3 miles 0220 yards on the BWC line. The structure has a skewed span of approximately 13.55 metres and carries the A197 single carriageway over the double tracked BWC line. The deck is comprised of pre-stressed concrete beams with metallic vehicle containment. The structure has a headroom clearance of 5.19 metres over the railway.

Figure 125 - Overbridge BWC/5A

The structure is owned by Northumberland Council. The most recent visual examination carried out in September 2018 does not highlight defects. Minimal track changes are proposed at this structure except for line speed increases.

16.8.3 Culvert Structures

16.8.3.1 Culvert EJM/34

Culvert EJM/34 is a single span masonry arch located at 7 miles 0616 yards on the EJM line between Shiremoor and West Holywell. The structure has a span of 1.1 metres on the Up side and 1.6 metres on the Down side and carries the single tracked EJM line over the Bierdene Burn. The arch is comprised of brickwork, 3 bricks in thickness, and is supported on ashlar masonry abutments. It has recently been repaired with a new concrete pipe and grouting the voids between the original arch. Minimal track changes are proposed at this structure except for line speed increases.

Figure 126 - Culvert EJM/34

16.8.3.2 Culvert EJM/36A

Culvert EJM/36A is a single span masonry arch structure located at 8 miles 1541 yards on the EJM line. The structure has a span of 1.5 metres and carries the single tracked EJM line over a small burn to the south of Seghill. The arch is comprised of brickwork supported on rubble masonry abutments. It has a cover of 6.2m on the Up side and 6.0m on the Down side. The structure has recently been repaired which has involved relining the arch barrel as recommended in the 2016 detailed examination and rebuilding of the head wall. This structure is located on the proposed Seghill loop which will involve double tracking.

Figure 127 - Culvert EJM/36A

16.8.3.3 Culvert EJM/38A

Culvert EJM/38A is concrete pipe structure located at 9 miles 792 yards on the EJM line. The structure is a concrete sewer with a diameter of 1.1 metres. Access to the structure is via manholes.

Figure 128 - Culvert EJM/38A

The structure is owned by an Outside Party. The last visual examination in October 2018 was unable to determine the condition of the asset due to no access to the manhole; however, there is no evidence at track level that the structure is in poor condition. Minimal track changes are proposed at this structure except for line speed increases. A qualitative assessment could not be carried out on the structure.

16.8.3.4 Culvert EJM/38

Culvert EJM/38 is a single span masonry arch located at 9 miles 0836 yards on the EJM line near Seghill. The structure has a span of 1.4 metres and carries the single tracked EJM line over a small burn just west of Mares Cottages. The arch is comprised on brickwork, 3 bricks in thickness, and is supported on brickwork abutments with brickwork wingwalls. It has a cover of 3.2 metres.

Figure 129 - Culvert EJM/38

The last detailed examination was completed in September 2014 and concluded the structure to be in fair condition. The most recent visual examination carried out in October 2018 shows no sign of failure at track level and no defects.

16.8.3.5 Culvert EJM/40

Culvert EJM/40 is a single span arch located at 11 miles 0572 yards on the EJM line. The structure has a span ranging between 1.3 metres at the inlet and 1.2 metres at the outlet and carries the single tracked EJM line over a small burn between two fields at Thompson R & Sons farm. The arch is comprised of brickwork supported on ashlar masonry abutments. The headwall on the Down line side is ashlar masonry and the Up line side is reinforced concrete. It has a cover of 2.07 metres.

Figure 130 - Culvert EJM/40

The last detailed examination was completed in September 2014 and was concluded the structure to be in a fair condition. The most recent visual examination carried out in October 2018 shows no sign of failure at track level and no new defects. Minimal track changes are proposed at this structure except for line speed increases.

16.8.3.6 Culvert EJM/41

Culvert EJM/41 is a single span masonry arch structure located at 11 miles 1210 yards on the EJM line. It comprises two forms of construction; an Armco pipe 1.2 metre in diameter extends under the Down line side which transitions into a 1.55 metre span masonry brick arch on the Up. The structure carries the single tracked EJM line and over a small burn between two fields at Thompson R & Sons farm. It has a cover of 10 metres.

Figure 131 - Culvert EJM/41

The last detailed examination was completed in August 2014 and concluded the structure to be in fair condition. The most recent visual examination carried out in October 2018 shows no sign of failure at track and no further defects were highlighted. This structure is located on the proposed Newsham double track extension.

16.8.3.7 Culvert EJM/43

Culvert EJM/43 is a single span masonry arch located at 11 miles 1562 yards on the EJM line. The structure comprises a 0.9 metre span brick arch supported on a combination of rubble and ashlar masonry abutments and carries the single tracked EJM line over a small burn between two fields at Lysdon Farm. The Down side head wall is comprised of brickwork and the Up side headwall is comprised of ashlar masonry. Cover to the structure is approximately 8 metres.

Figure 132 - Culvert EJM/43

The last detailed examination was completed in August 2014 and determined the structure to be in fair condition with minor defects requiring repairs as part of ongoing maintenance works. The most recent visual examination carried out in October 2018 shows no sign of failure at track. This structure is located on the proposed Newsham double track extension.

16.8.3.8 Culvert EJM/44

Culvert EJM/44 is a single span masonry arch structure located at 12 miles 0286 yards on the EJM line. It has a span of 1.55 metres and comprises a concrete slab deck supported on brickwork abutments on the Down line side which transitions into a brick arch supported on ashlar masonry abutments under the track. The structure carries the single tracked EJM line over Meggies Burn between two fields to the south of South Newsham. It has a cover of 7 metres.

Figure 133 - Culvert EJM/44 left; Up line side outlet, right; Down line side Inlet

The last detailed examination was completed in February 2009 and determined the structure to be in fair condition. The most recent visual examination carried out in October 2018 shows no sign of failure at track level and highlights no significant defects. This structure is located on the proposed Newsham double track extension.

16.8.3.9 Culvert EJM/44B

Culvert EJM/44B is a concrete pipe structure located at 12 miles 1298 yards on the EJM line. The structure varies in construction between a concrete pipe under the track to brickwork adjacent to the Down line side and then back to a concrete pipe at the inlet. The diameter varies between 0.6 metre and 0.8 metre. The Down side headwall is comprised of brickwork and the Up side outlet is comprised of a breeze block headwall and wingwalls. It carries the double tracked EJM line and an unused siding over a small burn which outfalls into Newsham Pond. It has a cover of 1.2 metres.

Figure 134 - Culvert EJM/44B

The last detailed examination was completed in January 2015 and determined the structure to be in good condition. The most recent visual examination carried out in October 2018 shows no sign of failure at track and did not highlight any new issues. Minimal track changes are proposed at this structure except for passenger line speed increases.

16.8.3.10 Culvert EJM/45A

Culvert EJM/44B is a single span box culvert located at 13 miles 0800 yards on the EJM line. The structure comprises a combination of stone and concrete slabs supported on stone sidewalls and carries the double tracked EJM line over a small burn beside Blyth Golf Club. It has a cover of 2 metres.

Figure 135 - Culvert EJM/45A

The last detailed examination was completed in February 2016 and does not highlight any defects. The most recent visual examination carried out in October 2018 shows no sign of failure at track and no new defects. Minimal track changes are proposed at this structure except for passenger line speed increases.

16.8.3.11 Culvert EJM/45B

Culvert EJM/45B is a concrete pipe structure located at 14 miles 0276 yards on the EJM line. The structure is a concrete sewer with a diameter of 0.9 metres and passes beneath the double tracked EJM line to the north of Blyth Golf Club. It has a cover depth of 4.5 metres.

Figure 136 - Culvert EJM/45B

The structure is owned by an Outside Party. The last visual examination in October 2018 was unable to determine the condition of the asset due to no access to the manhole; however, there is no evidence at track level that the structure is in poor condition. Minimal track changes are proposed at this structure except for passenger line speed increases, freight speeds will remain the same.

16.8.3.12 Culvert BWC/2A

Culvert BWC/2A is a 1.2 metre circular concrete sewer located at 0 miles 1408 yards on the double tracked BWC line north of Sleek Burn. Access to the culvert is via chambers located outside Network Rail's boundary fence and the distance between the two manholes is 48 metres. The culvert is bricked up at either end with an access door at each side. It has a cover depth of 8.3 metres.

Figure 137 - Culvert BWC/2A

The structure is owned by an Outside Party. The last visual examination in October 2018 was unable to determine the condition of the asset due to no access to the manhole; however, there is no evidence at track level that the structure is in poor condition. Minimal track changes are proposed at this structure except for passenger line speed increases, freight speeds will remain the same.

16.8.3.13 Culvert BWC/2AB

Culvert BWC/2AB is a single span masonry arch/stone slab culvert located at 0 miles 1602 yards on the BWC line. The structure is comprised of two forms of construction; a 0.95 metre brick arch extends under the Down line embankment which splits into two 0.46 metre and 0.40 metre stone slab culverts running parallel under the track. The masonry arch is supported on brickwork abutments and the stone slab culverts are supported on rubble masonry. Cover to the box culverts is approximately 6 metres. It spans a small burn and is and at this location there are two tracks.

Figure 138 - Culvert BWC/2AB

The last detailed examination was completed in January 2018 and concluded the structure to be in fair condition. Areas of collapsed and displaced masonry to the pier and slab decks were reported in 2012; however, this has not since been verified. The most recent visual examination carried out in September 2018 shows no sign of failure at track level. Minimal track changes are proposed at this structure except for passenger line speed increases, freight speeds will remain the same.

16.8.3.14 Culvert BWC/2B

Culvert BWC/2B is a single span masonry arch/earthenware pipe culvert located at 0 miles 1672 yards on the BWC line. The structure is comprised of two forms of construction; a 0.83 metre brick arch supported on brickwork abutments extends under the Down line embankment which splits into two 0.15 metre diameter earthenware pipes extending under the double tracked line to an unknown location. Cover to the culvert is approximately 3 metres.

Figure 139 - Culvert BWC/2B

The last detailed examination was completed in October 2014 and concluded the structure to be in fair condition with no significant defects. The most recent visual examination carried out in September 2018 shows no new defects. Minimal track changes are proposed at this structure except for passenger line speed increases.

16.8.4 Footbridge Structures

16.8.4.1 Footbridge BWC/4

Footbridge BWC/4 is a single span steel box section structure located at 2 miles 220 yards on the BWC line. The main span is 10.47 metres and provides pedestrian access over the double tracked BWC line from the A196 North Seaton Road to an industrial estate on the west. It is supported on each side by two SHS steel columns which are cast into concrete pad foundations. The staircase which is formed of two tiers is supported both on the first landing by a single central column and on the top landing cantilevering from the main span support columns. The structure has a headroom clearance of 4.9 metres.

Figure 140 - Footbridge BWC/4

This structure is owned and maintained by Northumberland Council. The most recent visual examination was completed in September 2018 and concluded the structure to be in fair condition with no significant defects. Minimal track changes are proposed at this structure except for line speed increases.

16.8.4.2 Footbridge BWC/4A

Footbridge BWC/4A is a three span pre-stressed concrete structure located at 3 miles 0021 yards on the BWC line in Ashington. The structure is constructed from pre-stressed concrete deck beams with the main span supported by encased concrete beams on four concrete columns and pad foundations at either end. It supports Wansbeck shopping square and abuts directly up to Overbridge BWC/5. The concrete columns are surrounded by large external concrete foundations which are there for the purpose of protecting against derailment. The structure has a headroom clearance of 4.65 metres.

Figure 141 - Footbridge BWC/4A

The structure is owned by Arch Group and managed by Bradley Hall. The most recent visual examination was completed in September 2018 and concluded the structure to be in fair condition. Minimal track changes are proposed at this structure except for line speed increases.

16.9 Station Civils

Northumberland Park Station

This project is proposing to break out the parapet of Overbridge BNE/31C (Algernon Drive) and fix a landing area for the lift and staircase. The latest assessment of the structure was undertaken in July 2018 which states no structural defects.

Newsham Station

The existing Newsham Signal Box is in poor structural condition, as intimated to the project by Network Rail, and a replacement signal box may come into the scope of this project at the next design stage subject to discussions with Network Rail. A suitable allowance has been made for this within the QRA.

Bedlington Station

The disused station buildings at Bedlington appear to be of stable condition from external visual inspection. At the next design stage an internal and external condition assessment should be undertaken as part of the design development of the station. It is expected that a full internal refurbishment will be required as a minimum as well as weatherproofing.

The disused platform front wall structure at Bedlington is need of removal down to foundation level as a minimum. The wall is unstable along its length and has collapsed in park towards the north end of the platform on the tight radius section. The existing platform surfacing needs replacement as it has been damaged by vegetation growth.

Ashington Station

The disused platform front walls at Ashington appear to be of reasonable condition. The copers have been cut back to their overhang point which suggests that gauging has been an issue in the past. The existing platform surfacing needs replacement in areas that the platform is to be reused as it has been damaged by vegetation growth.

16.10 Drainage

At this stage of development, no drainage specific surveys or investigations have taken place on site. A global assumption has been made that any existing drainage is fit for the purpose it has been installed for and is an acceptable state of repair.

Where the project is proposing to install additional track or renew the existing, consideration will be required with respect to the provision of active drainage in any locations not typically deemed to be free draining.

As part of the survey works proposed in ***section 17.9***, full surveys of the existing drainage runs will be required prior to the next stage of design.

16.11 Environmental

16.11.1 Preliminary Ecological Appraisal

The purpose of the PEA was to identify the key ecological features and species on the land which may be affected by the scheme. The PEA has been undertaken to; identify the scope of further surveys; to provide the basis for negotiations with the Local Planning Authorities and Natural England; and to identify seasonal, programme and site-based constraints which need to be considered.

The PEA identified that further surveys will be required to confirm the location of bat roosts and foraging areas and for the breeding ponds and territories of great crested newts. Further surveys may be required for local Biodiversity Action Plan (BAP) species, otters, water vole and red squirrel, if 'suitable' habitats for these species are likely to be affected by the works then mitigation may be required as part of the scheme. The location, nature and extent of this mitigation will eb the subject of negotiation with the relevant local planning authorities (and Natural England if relating to protected species).

The PEA identified that it is unlikely that any further surveys will be required for badgers, migratory fish, reptiles and white-clawed crayfish. However, it is likely that works to the sites and along the line will need to be undertaken in accordance with a 'precautionary method statement' to safeguard against the (remote) possibility of reptiles being present.

16.11.2 Great Crested Newts

The purpose of the Great Crested Newt Surveys was to identify which ponds have the potential to support breeding populations of Great Crested Newts. It was also to identify those ponds and territories which had the potential to be affected by the construction and operation of the scheme.

A desk study completed prior to the field surveys identified 66 ponds within 500m of the railway line. Permission was sought to gain access to undertake HSI assessment, eDNA analysis, and population class size assessment surveys to all of these. However, access was only granted for 37 of the sites. Notably access was not granted for Cluster C, which includes Hartley Ponds Site of Special Scientific Interest, designated for its amphibian populations, including seasonal GCN population that has exceeded 500 individuals in the past. This SSSI is adjacent to the rail line and is the closest confirmed GCN population site. The desk study highlighted records of 5 amphibian species within 2km of the site boundary.

The Habitat Suitability Index (HSI) assessment indicated that 32 ponds out of 37 visited had potential to support GCN, with a qualitative score of 'below average' or higher suitability. Access was not given for 29 ponds within 500m of the line. The eDNA surveys confirmed that great crested newts are present in 9 waterbodies within 500m of the line, with eDNA data provided by Jacobs confirming the presence in 1 additional pond within 500m of the line. The HSI assessment was followed by breeding season surveys between 15/4/19 and 13/06/19, which confirmed the presence of low populations of the species at 3 sites within 500m of the line, totalling 13 ponds. A low population of great crested newts is considered to be present at each site, a maximum of 4, 1 and 2 individuals being recorded using a single survey method during a single visit to each site.

These surveys have limitations and must be supplemented with additional surveys. Once these surveys are completed it will be possible to agree the mitigation which will required for the construction and operation of the scheme.

It is likely that the mitigation will be the subject of a condition of any planning consent and/or Natural England license which may be granted.

Seaton Delaval is the only station site which lies within 500m of any known (to date) newt pond. As a result, works to this station may also require a licence to be granted by Natural England. (The full GCN Survey Report can be read in ***Appendix E***)

16.11.3 Bat Roost Surveys

The PEA has identified 38 features with bat roost potential (BRP). These have been rated from low, moderate or high. These features include structures (e.g. bridges, buildings, platforms etc.) and trees. If any bat roosts have the potential to be adversely impacted, then a mitigation strategy should be agreed with Natural England in advance of the any planning application being submitted. Any works which have the potential to affect a bat roost require a licence. Further surveys will be undertaken of those features which may be affected by the scheme during the summer of 2020 to inform; the designs for the scheme; the construction method statements; the programme and any applications for licences. (See ***Appendix E*** for the Full PEA Document)

16.11.4 Northumberland Park Station

The Northumberland Park site primarily supports areas of dense, semi-mature broadleaved plantation and scrub habitats, with some scattered trees and scrub, and small areas of semi-improved neutral and amenity grassland. The areas of plantation and scrub typically have a poorly developed ground flora (primarily bare ground or ruderal species at the time of survey), being dominated by tree and scrub species including ash, birch, beech, poplar, hawthorn, gorse and bramble.

A small area of amenity grassland lies to the south of the site, associated with the car park and shops immediately to the south of the existing Northumberland Park (Metro) Station. Small hedgerows dominated by beech or hawthorn separate sections of the hard standing, amenity grassland and/or gabions/retaining walls which run adjacent to the existing line, the latter of which primarily support stands of semi-improved grassland, tall ruderal and dense scrub, dominated by bramble.

Areas of developing (poor) semi-improved neutral grassland, scattered scrub and tall ruderal vegetation run along the edges of the existing line and adjacent track to the east of the survey area, sections of which are likely to have been seeded as part of the adjacent housing development.

The existing habitats are unlikely to be a constraint on the construction of the station.

Additional protected species surveys (bats) are required to allow any such constraints to be identified.

16.11.5 Seaton Delaval Station

The site at Seaton Delaval is bisected by the A192. To the west, the line is lined by a matrix of scattered and dense scrub and tall ruderal vegetation, To the west lies a semi-improved grassland field which was being grazed by horses at the time of survey, with an area of tall ruderal, scrub and broadleaved planation lying between the field and the A192.

To the east of the stone bridge over which the A192 runs is a small park (war memorial) which comprises amenity grassland and introduced shrub planting, bisected by hard standing paths, with small walls and mature trees to the boundaries. An area of broadleaved woodland, scrub and tall ruderal vegetation lies between the park to the north, and the line to the south, with similar habitat adjacent to the track access road to the south of the line.

The broadleaved plantation woodland may be required to be removed to allow the construction of the access and car park. Although this is unlikely to be a constraint on the scheme, its loss is likely to be required to be mitigated.

Additional protected species surveys (as a minimum; BAP species, GCN & bats) are required to allow any species constraints to be identified.

The preferred option at Seaton Delaval lies within 500m of a known GCN pond. As a result, the works to this site may be the subject of (yet unknown) licence conditions imposed by Natural England.

16.11.6 Newsham Station

The preferred option at Newsham comprises a small area of hard standing/bare ground (informal car parking) on the opposite side of the track from the existing signal box, south of South Newsham Road. Small patches of scattered scrub and very small patches (too small to map their extent at a reasonable scale) of ephemeral / short perennial, semi-improved grassland and tall ruderal vegetation lie towards the south east of the survey area, with further areas of tall ruderal separating the line from the arable field to the south west. Boundaries are delineated by small fences. The proposed area for the car park comprises arable land.

The reserve option at Newsham is comprised of gardens and private open space with scattering of shrubs/trees, and paddocks which are overgrazed by horses.

To the north of the road / level crossing, the line width is heavily constrained by adjacent residential developments, with the limited areas present primarily comprising ballast, with small areas of semi-improved grassland, tall ruderal and scrub adjacent to a brick wall which separates the line from the adjacent access road to the north west.

Additional protected species surveys (as a minimum; BAP species & bats) are required to allow any species constraints to be identified.

One moderate bat risk feature has been identified in both the preferred and reserved option as in the location of the proposed pedestrian access. Works to this site may require a license application to Natural England. This will be confirmed through consultation with NE and NCC Ecology.

The habitats on the land for both the preferred and the reserve option are unlikely to be a constraint on the construction and operation of the scheme.

16.11.7 Blyth Bebside Station

The preferred option is dominated by poor semi-improved, and semi-improved neutral grassland with scattered scrub and areas of dense tall ruderal vegetation. Surveys by other parties have identified alien species to be present on site. They have also identified BAP butterfly species. The potential for reptiles or bat roosts to be present has been discounted. Notwithstanding this information being available additional protected species surveys (as a minimum; BAP species) are required to allow any species constraints to be identified and considered in the design of the scheme.

The reserve option is characterised by improved grassland with overgrazing by horses.

The habitats on the land for both the preferred and the reserve option are unlikely to be a constraint on the construction and operation of the scheme. However, it is likely that compensatory habitat planting will be required to be provided as part of the planning conditions.

16.11.8 Bedlington Station

The land required for the station and car parks at Bedlington is dominated by hard standing, with patches of scrub, trees (mature and saplings) and tall ruderal vegetation. To the south of Clayton Street and the signal box, tall ruderal dominates. A hawthorn-dominated hedgerow runs along the eastern side of the line.

Further areas of tall ruderal-dominated vegetation lie to the north of Clayton Street. Areas of hard standing are also present which are being colonised by species such as clovers and meadow buttercup. Additional protected species surveys (as a minimum; BAP species, GCN & bats) are required to allow any species constraints to be identified.

There is one low, two moderate and two high bat risk features identified at Bedlington Station. Works to this site may require a licence application to Natural England. This will be confirmed through consultation with NE and NCC Ecology.

16.11.9 Ashington Station

The site for the Ashington station and car park includes former station platforms which lie immediately adjacent to a shopping centre, car parks, a series of small parks/amenity areas and an area of brownfield land. The former platforms (as well as the track) are fenced off but support sparse semi-improved grassland, with scattered immature trees and scrub between the line and car park to the west, and amenity grassland with mature broadleaves adjacent to the smaller car park to the east.

Large proportions of the survey area to the west support intensively managed amenity grassland, bisected by small hard standing paths, with mature broadleaves and conifers towards the boundaries. The northern of the two parks is surrounded by sections of wall, fence and a small hedgerow, while a small wall also runs along the western edge of the area of brownfield land to the south west of the survey area, with a hedgerow and fence along the eastern side of this habitat.

The brownfield area supports a matrix of semi-improved grassland and scattered scrub, although large areas of the latter appear have been cut back relatively recently. Two small areas which appear damp/to hold water at times lie towards the east, with patches of soft rush and reed canary-grass. Further mature trees run along the southern survey boundary, with dense scrub beneath.

Additional protected species surveys (as a minimum; BAP species & bats) are required to allow any species constraints to be identified.

16.12 Geotechnical

16.12.1 Earthworks

The existing earthworks, except for one site, Ch 1308 to 1408 (100m) (BNE 0.1430 to 0.1540), are all category ‘A’ to ‘C’ earthworks, which are assessed as part of the Network Rail earthworks asset monitoring programme. The earthworks assessments have been summarised in the Geotechnical and Earthworks Preliminary Sources Study Reports (PSSR’s), see ***Appendix L***.

No site-specific ground investigation is available for the scheme. A Ground Investigation (GI) has not been undertaken for this phase of the works. Limited exploratory holes are available on the British Geological Survey (BGS) GeoIndex Onshore Database, which have been consulted during the desk study to confirm superficial soils and bedrock depth in the wider vicinity to the site. Limited GI data from Network Rail has been received; comprising of seven windowless samples drilled along the area of the proposed Newsham Loop, between EJM 11m 1244yds to 12m 0285yds. The maximum drilled depth was 8.38m below ground level at MBH7, where an inclinometer was installed. No inclinometer readings have been received.

GI is proposed to assess the geotechnical and geo-environmental constraints at the sites of all stations (six), access roads and car parks, as well as sections of earthworks where significant embankment widening is required. GI will also be undertaken where bridge works are proposed (EJM/035, EJM/036, EJM/042, BWC/02) and Chase Meadows replacement footbridge.

GI is required to investigate the presence and condition of known mine workings either side of the coal seam sub crops, below proposed station platforms, structures and over length of earthworks where a structural solution may be required to accommodate earthwork widening.

The proposed GI will comprise a combination of cable percussive boreholes extended into bedrock by rotary coring augmented or replaced by trial pits and window samples in areas where access is problematic. The proposed investigation is described in ***section 17.11*** and detailed in Annex A of the PSSR’s included in ***Appendix L.***

16.12.2 Trackbed

The trackbed walkover survey was carried out between the 14th and18th of July 2019. As the walkover survey was a visual inspection, no significant issues were immediately identified. However, an overall appreciation of the route and ballast condition was gleaned. It was noted that a number of the drainage catchpits were found partially filled with ballast or blocked. It was also noted that some vegetation is present in the 4ft at various locations. Furthermore, coal contamination and dirty ballast was found in some sections of the track. These are to be expected given the historical usage of the line.

The desktop study identified some sections for special attention. For instance, where slues of more than 200mm are proposed, where a new track is proposed, existing poor track condition exists or a change in line speed is required. The proposed scope of the trackbed investigation, shown in ***section 17.11.2,*** has been prepared based on a combination of the desktop study and site walkover survey.

During the next design stage, a full trackbed investigation and routewide survey of the drainage needs to be done to determine if there any drainage issues along the route.

16.13 Statutory Undertakers

At this stage of the project, our investigation into statutory undertakers has been limited to desktop exercises. Utilities companies have been asked for record plans via record requests and the output from these has been added to the project mapping to highlight any potential clashes.

Nothing thus far appears to cause any significant concern; however, it should be remembered that no surveys or proving has taken place at this time. The management of statutory undertakers proposed for the next stage is discussed in ***section 17.12***

17 SURVEY WORK REQUIRED TO INFORM NEXT DESIGN PHASE

These surveys have been identified by the design teams as the additional information required in order to deliver the Approval in Principle level of design for the scheme.

17.1 Track

17.1.1 Asset condition

Additional asset condition will be required in the following areas where site access was restricted during this stage: -

- BNE 0 miles 787 yds to 0 miles 1400 yds
- BNE 0 miles 1509 yds to 1 mile 820 yds
- EJM 15 miles 1090 yds to 15 miles 1496 yds
- BWC 0 miles 9 yds to 0 miles 1376 yds
- BWC 1 mile 64 yds to 1 mile 905 yds

17.1.2 Topographical survey

Line and level track topographical survey required as a minimum of route wide rails in addition to recently topographically surveyed areas. Fence to fence lineside detailing to provide accurate and up to date cross section of the railway corridor. Survey of all land required for new stations and carparks, including road alignments and access paths.

All surveys should be coordinated into project SnakeGrid.

17.1.3 Laser profiling survey

Following an NGD structure assessment at the next design phase it may be necessary to laser profile significant structures to provide precise clearance data for the design and speed improvements.

17.2 Signalling

The following signalling survey works will be required in order to inform the next stage of design;

- Correlation of all signalling assets at each Signal Box/Equipment Room
- Correlation of key signalling trackside assets where they are being amended.
- Correlation, including measurement, of signalling assets on the single line to Morpeth (from Bedlington North).
- Signal Sighting committee visit for all signal/sign locations.

17.3 Level Crossings

The following survey works will be required at Level Crossings in order to inform the next stage of design;

- Correlation of all assets at each level crossing including correlation of Ground Plans where these are being changed.

17.4 Highways

17.4.1 Traffic Surveys

Any additional highways survey work requirements to inform the next phase are dependent on further discussion with NCC regarding the Transport Assessment (TA) submission for the scheme.

Whilst a broad agreement on approach and format has been discussed, it is not possible to fully scope future TA requirements at this stage. This is due to factors including the revised demand modelling developed for the OBC, which may materially increase the traffic flows associated with the scheme, leading to the requirement for further junction modelling or a revised approach to the optioneering Local Junction Modelling completed as part of the OBC submission (***Appendix O***). Similarly, level crossing barrier downtime traffic impact assessments completed in the "Reopening of the Ashington Blyth and Tyne Railway Line to Passenger Services, Level Crossings Assessment" report, 2016 will require updating at a time when the revised demand flows and finalised barrier downtimes are available.

Assuming that the traffic impacts remain in the same order of magnitude in the next phase, it is likely that no further traffic surveys would be required.

17.5 Telecommunications

The following Telecoms survey works will be required in order to inform the next stage of design;

- A full cable route survey or correlation of existing cable route surveys undertaken by FTN
- Correlation of all Telecoms copper and fibre cabling
- Correlation of all Telecoms lineside location cabinets including co-located within Signalling location cabinets
- Confirmation of signalling requirements on the telecoms network to allow the early engagement of FTN for FTN / FTNx design
- Correlation of any fringe sites that will be affected by proposed platform / track alterations.

17.6 Electrical & Mechanical

Following survey works will be required in order to inform the next stage of the design.

- Load monitoring of the Benton PSP and individual feeders
- Identification of suitable location for 650V FSP location cases. Up to Seghill its preferred to keep them next to the existing Loc's
- Load monitoring to be carried out at Bedlington North Signal Box & Newsham South Signal box
- Carry out DNO assessment at all LC and carry out load monitoring if required
- Existing Cable route including the rodding of the UTX's

17.7 Structures

Structures impacted by the proposed route upgrade have been identified and are highlighted in ***Section 5.2.8***. To progress the next stage of project development, structural surveys and investigation work have been proposed based on the information reviewed as part of the desktop study. ***Table 39*** indicates all information required to permit design development.

Engineers Line Reference	Railway Structure I.D.	Mileage	Topo Survey	Ground Investigation		Site Investigation	
				Boreholes	Trial Pits	Cores	Inspection
EJM	35	7m 0698yds	Yes	2No. to confirm bedrock level	2No. to confirm abutment footing level	4No. Horizontal to confirm abutment thickness 2No. Inclined to confirm footing level	Detailed inspection required to confirm section sizes and condition
EJM	36	8m 0770yds	Yes	2No. to confirm bedrock level	4No. to confirm abutment footings level of both	8No. Horizontal to confirm abutment thicknesses and	Required to confirm construction

Engineers Line Reference	Railway Structure I.D.	Mileage	Topo Survey	Ground Investigation		Site Investigation	
				Boreholes	Trial Pits	Cores	Inspection
					concrete and redundant deck abutments	4No. Inclined to confirm footing levels of both concrete and redundant deck abutments	methodology of deck extension
EJM	42	11m 1540yds	Yes	No	2No. to confirm parapet dimensions	4No. Horizontal to confirm abutment thickness 2No. Inclined to confirm footing level Vertical core in arch barrel	No
EJM	47	15m 0506yds	No	No	No	No	Detailed inspection of piers required to confirm section sizes and condition
BWC	2	0m 1188yds	No	1No. to confirm ground conditions	No	No	Condition survey
BWC	2AB	0m 1602yds	No	No	No	No	CCTV Survey recommended to determine condition of box culverts
BWC	3	1m 1276yds	No	No	No	No	Detailed inspection of piers required to confirm section sizes and condition

Table 39 – Structures Survey Work to Inform Next Design Phase

17.7.1 SI/GI Location Plan Proposals

17.7.1.1 Underbridge EJM/35 Survey Requirements

The impact of the line speed increase on the Route Availability number for Underbridge EJM/35 has been reviewed as discussed in ***Section 13.4.5.1.1*** and concludes it is at the limit of its safe traffic load capacity for freight. Further corrosion and section loss has since occurred to critical elements which have been highlighted within subsequent detailed examinations. A revised assessment is therefore required to establish the impact of further corrosion on existing members and the suitability of the existing deck. If, however the existing deck is not suitable in its current condition, additional survey data is required to progress the preferred solution detailed in ***Section 5.2.8.1.1***. The following survey data requirements are therefore proposed to inform design decisions at the next stage of development.

- Two boreholes to confirm the bedrock level
- An inclined core in each abutment to confirm the footing level
- Two horizontal cores in each abutment to confirm the thickness
- A trial pit at each abutment to confirm footing level

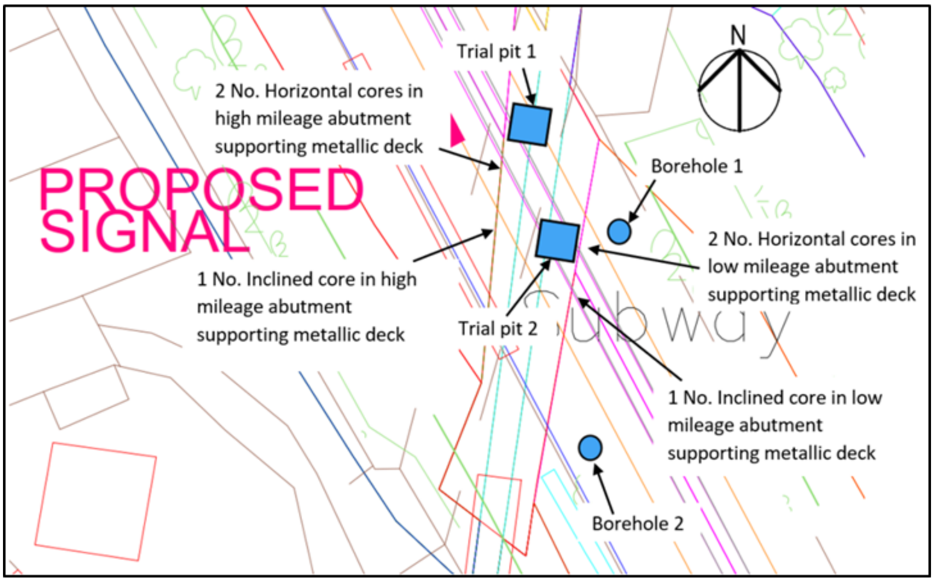


Figure 142 – EJM/035 boreholes, cores and trial pit locations

17.7.1.2 Underbridge EJM/36

The preferred solution for Underbridge EJM/36 as detailed in ***Section 5.2.8.1.2*** is to extend the existing concrete deck with beams of a similar construction seated on the redundant deck abutments. As this was metallic in construction, the weight increase from a new concrete deck will impact ground bearing pressures under the footing. A geotechnical investigation is thus required to determine the suitability of the existing abutments and whether strengthening works are required. The following survey data requirements are therefore proposed to inform design decisions at the next stage of development.

- Two boreholes to confirm the bedrock level
- An inclined core in each abutment to confirm the footing level
- An inclined core in each redundant abutment to confirm the footing level
- Two horizontal cores in each abutment to confirm the thickness
- Two horizontal cores in each redundant abutment to confirm the thickness
- A trial pit at each abutment to confirm footing level and get abutment details
- A trial pit at each redundant abutment to confirm footing level and get abutment details

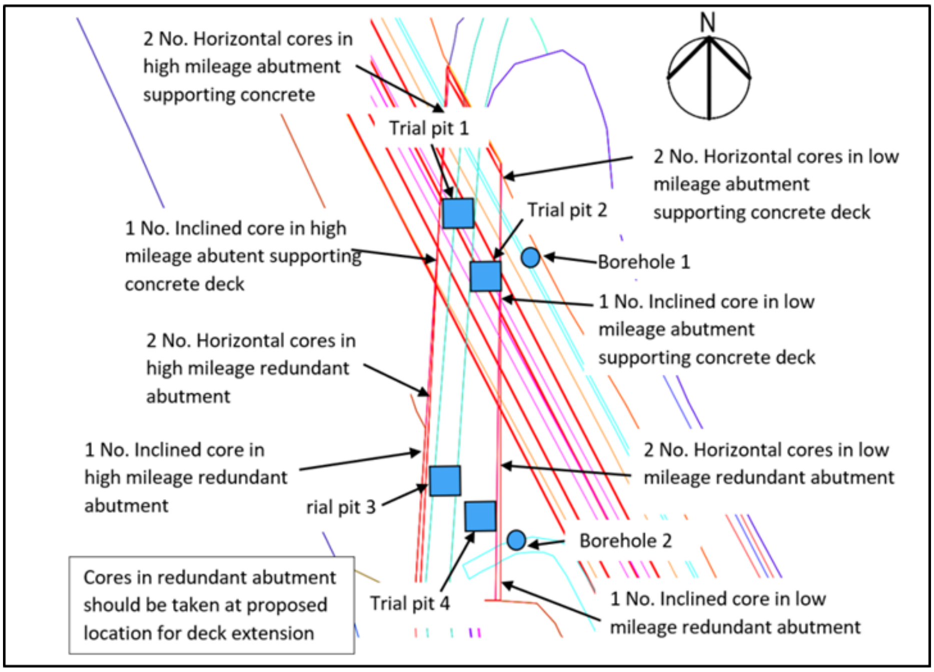


Figure 143 – EJM/036 boreholes, cores and trial pit locations

17.7.1.3 Underbridge EJM/42

An initial assessment of the arch based on the information available indicates it has sufficient capacity for double tracking, see ***Section 13.4.5.1.3***. The preferred solution for as detailed in ***Section 5.2.8.1.3*** is to strengthen the existing parapets using reinforced concrete backing and tie bar/ pattress arrangements to the existing parapets. The following survey data requirements are therefore proposed to inform the suitability of the existing arch and design decisions at the next stage of development.

- Two horizontal cores in each abutment to confirm the thickness
- A vertical core to confirm the arch barrel thickness
- A trial pit at each parapet to confirm structural dimensions

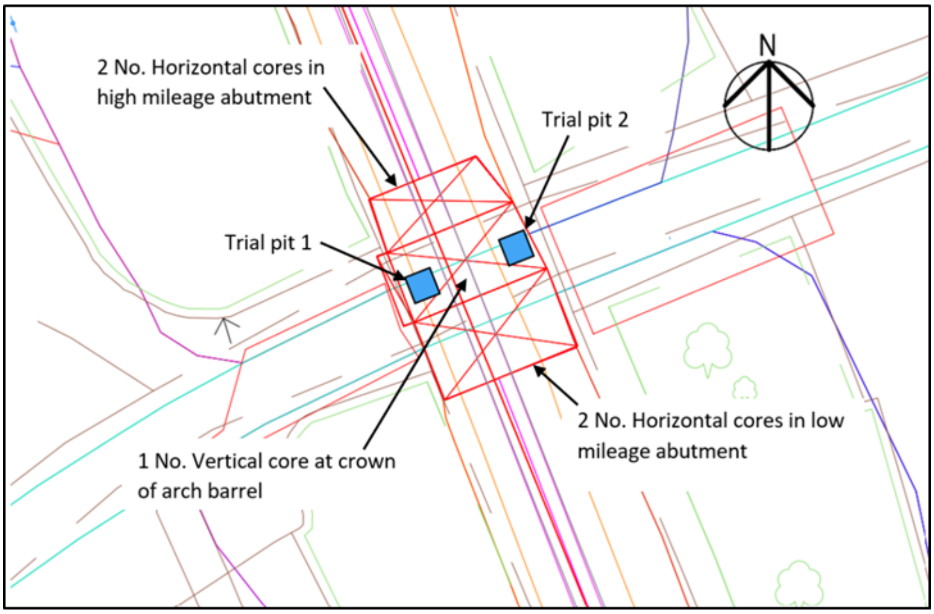


Figure 144 - EJM/042 Cores and Trial Pit Locations

It is recommended that cracks behind the spandrel wall and in the arch barrel are monitored under live load to determine if movement is occurring. Historic separation of the voussoir stones from the arch barrel may be due to differential deflection under loading as a train passes over. If the cracks are observed to be moving under live loading, then the existing remedial measures may not be addressing the true problem and the cracks will progressively worsen. Further assessment and mitigation measures may then be required as a result.

17.8 Stations

17.8.1 Dilapidation Surveys

Dilapidation survey of the two buildings on the existing platform structure at Bedlington are to be undertaken to assess their suitability for reuse or demolition.

17.8.2 Platform Coring

Coring of the existing platform front walls at Bedlington and Ashington Stations to determine the wall thickness and foundation type/size/depth to assess the most suitable demolition method.

17.8.3 Abutment Coring

Coring of the abutment of Overbridge BNE/31C (Algernon Drive) to confirm record drawings to assess the suitability of fixing to the walls with a proposed retaining wall.

17.8.4 10.8.6 – Vegetation clearance

Much of the topography at locations where stations are proposed is heavily vegetated. Vegetation clearance is required prior to further design submissions to understand any hidden cable route, equipment or other items currently not visible.

17.9 Drainage

To date little has been undertaken with respect to drainage on the scheme. The Geotechnical and Trackbed walk over surveys noted the existence of track drainage in some locations however this was far from comprehensive. The drainage surveys below are proposed in advance of undertaking any drainage design required to support the preferred option at the design stage.

17.9.1 Drainage Surveys

Discussions with the Local Authority and the Environment Agency will be required to agree the necessary information to inform design and the methodology proposed.

The information required to develop drainage at the next stage is as follows:

- Topographical surveys
- Ground Investigations – ground water monitoring and infiltration testing
- Network Rail earthworks assessment reports
- Contour mapping
- Local authority/Environment Agency flood risk reports highlighting potentially vulnerable areas
- Network Rail boundary information
- Trackbed investigation information
- Route videos and Routeview website

17.9.2 Track Drainage

Condition and capacity surveys are required for the track drainage at Northumberland Park and Bedlington Stations. This should include the invert levels and diameters of each pipe and the conditional of all equipment. Should Phase 2 be progressed to outline design then include Seaton Delaval.

Where track renewals are proposed, the existing trackside drainage will need to be surveyed, including details of catchpits, pipe diameters, inverts and outfall details.

17.10 Environmental (Including Land and Consents)

17.10.1 Biodiversity

The design of the scheme will need to consider conditions which may be imposed on licences granted by Natural England for works which affect protected species (Bats & Great Crested Newts). The implementation of the scheme, and in particular the construction will require applications to be made to Natural England for licences to carry out works that have the potential to affect these protected species. Further surveys are necessary to provide the baseline data required to make the applications for licences for works to affect Great Crested Newts and Bats. The negotiations to gain access to the ponds should be concluded so that all surveys can commence in February 2020. This requires the negotiations to start as soon as possible.

Surveys for Otters and Water Voles may be required to be carried out during the spring of 2020. Further assessment work is required to understand how the surface water flows from the rail line and the stations/car parks will be drained. If the construction or operation of the scheme will affect the water flow and water quality in any of the watercourses which are culverted to the line or will be fed from the applications sites, then permits to discharge will be required to be obtained from the local authority or the Environment Agency. Water quality surveys may be required to inform these applications.

The design of the scheme will also need to be informed by the results of surveys for Biodiversity Action Plan species and breeding birds. These surveys will need to start early in 2020.

In advance of construction works or vegetation clearance commencing on land required for the stations or within the limits of deviation, pre-construction walkover surveys will be required. These are required to ensure that no protected species are present. The scope and timing of these will be informed by discussions with the local planning authorities and Natural England. The physical extent of these surveys will extend beyond the limits of deviation and the red line boundaries of the proposed planning applications. The scope of the species being surveyed will depend on the proximity and location of species, habitats and wildlife corridors.

17.10.2 Environmental Surveys

The responses from the two local planning authorities to the pre-application enquiries responses specified the baseline surveys and assessments which are required to inform and accompany each of the planning applications for the six stations / car parks;

- Arboriculture and tree survey (x6)
- Baseline noise and vibration survey (x6)
- Heritage survey (locally listed assets – photographic and condition survey of the entire scheme)
- Landscape and visual survey (x6)
- Air Quality Survey (x6)

17.10.3 Ecological impact Assessment

The detailed design of the scheme will need to be informed by the findings of the ecological impact assessment (EcIA). This will identify the measures and changes to the scheme will be needed to ensure compliance with (anticipated); licence, permit and planning permission conditions.

It is important to note that these mitigation measures cannot be devised until the further refining of the designs and construction methods have been undertaken, and the further surveys and EcIA has been completed.

When the detailed designs have been finalised, an EcIA will be prepared including a ‘Mitigation and Compensation strategy’ will be devised in order to ensure the ecological impacts of the proposals is compliant with local and national polices and legislation.

Both the PEA and GCN report identify some of the potential mitigation measures which may be required. (See ***Appendix E)***

17.10.4 Anticipated Ecological mitigation measures

The following paragraphs summarise the measures which are likely to be required in order to minimise the ecological impacts of the proposals, including managing the risk of protected species being adversely affected:

1) Vegetation clearance works must be undertaken outside of the bird nesting period (March – August inclusive) unless a checking survey by a Suitably Qualified Ecologist (SQE) has shown active nests to be absent within the 5 days prior.

   Risk: If an active nest is identified at this time, works will not be permitted in this area / an appropriate buffer zone around the nest until the SQE confirms that the nest is no longer active.

2) In the event Natural England (NE) licenses are required to permit works affecting European Protected Species (bats, GCN, otter etc), NE will require survey data from the most recent survey period prior to the start of works to inform the licence application.

   Risk: Surveys for bat roosts can only be undertaken mid-May to mid-August. Surveys for GCN can only be undertaken mid-March to early-June.

   Natural England quotes that it usually takes 30 working days to get an individual licence.

3) Given the proximity of the works area to statutory nature conservation sites and a series of watercourses, permits may be required from Natural England, The Environment Agency and local authorities (as the lead local flood authorities) prior to the start of works

4) In the event any badger setts are identified which will be affected by the proposals, a licence will be required from NE prior to the start of works.

Risk: NE will not issue a licence to close the sett from December to June inclusive

5) In those areas where specific mitigation under the terms of a licence is not required, works will proceed to a method statement

6) Felling or trimming of trees with a low risk of supporting roosting bats will be undertaken to a method statement.

7) Any buildings, structures or trees with a moderate or high roost risk will be subject to activity surveys.

8) Works will follow current best-practice regarding the prevention of sedimentation and/or pollution of watercourses, with protection measures implemented throughout the works period

9) Strict biosecurity protocols will be implemented to minimise the risk of invasive species being spread, or any adverse impacts upon protected sites or species

10) No lighting will be installed during or following the works period without the approval of an SQE, in order to minimise the risk of adversely affecting nocturnal species such as bats.

17.11 Geotech (Earthworks and Trackbed)

17.11.1 Geotechnical Ground Engineering

A Ground Investigation (GI) is proposed to inform the next phase of design works for the scheme. The GI is divided into three;

(i) stations (six), access roads and car parks

(ii) structures (EJM/035, EJM/036, EJM/042, BWC/02 and Chase Meadows replacement footbridge)

(iii) earthworks where significant widening and / or retaining structures are required.

The GI is proposed to assess the geotechnical and geo-environmental constraints at the sites and is also required to investigate the presence and condition of known mine workings either side of coal seam sub crops (where present), below proposed station platforms, structures and over the length of earthworks where a structural solution may be required to accommodate earthwork widening.

The proposed GI will comprise a combination of cable percussive boreholes extended into bedrock by rotary coring augmented or replaced by trial pits and window samples in areas where access is problematic. Trial pits will also be undertaken to investigate shallow surface deposits for car parking and access roads. The proposed investigation is detailed in Annex A of the PSSR's included in ***Appendix L.***

Based on preliminary layouts used in the PSSRs the following exploratory are proposed, see ***Table 40***. Note the Structures GI is also included in ***Section 17.7*** where further details are provided.

Location	Boreholes	Trial Pits	Inspection Pits	Structural Coring (Inclined (I) and Horizontal (H))	Targets
Station – Northumberland Park	5	-	-	-	Proposed station platform / lift shaft foundations / cutting slope material. Ground conditions including old workings in the High Main and Main seams.
Station – Seaton Delaval	8	8	-	-	Proposed station platform / car park / access road. Ground conditions including old workings in the Moorland seam.

Location	Boreholes	Trial Pits	Inspection Pits	Structural Coring (Inclined (I) and Horizontal (H))	Targets
Station – Newsham	3	8	-	-	Proposed station platform / footbridge / car park / access road.
Station – Blyth Bebside	10	10	-	-	Proposed station platform / lift shaft foundations. Ground conditions including old workings in the Moorland seam.
Station – Bedlington	6	4	-	-	Proposed station platform / car park / access road. Ground conditions including old workings in the Moorland seam.
Station – Ashington	8	8	-	-	Proposed station platform / car park / access road. Ground conditions including old workings in the thin coal seam.
Structures - EJM/035	2	-	2	2(I), 4(H)	Ground conditions including depth to bedrock / structural coring to prove abutment thickness and founding / retained material.
Structures - EJM/036	2	-	4	4(I), 8(H)	Ground conditions including depth to bedrock / structural coring to prove abutment thickness and founding / retained material.
Structures - EJM/042	-	-	2	2(I), 4(H) 1(V)	Inspection pits to confirm ballast depth, existing parapet condition and dimensions/ structural coring to prove abutment thickness and founding
Structures - BWC/02	1	-	-	-	Ground conditions including depth to bedrock and embankment fill material.
Structures – Chase Meadows Replacement Footbridge	3	-	-	-	Proposed footbridge. Ground conditions including shallow workings.
Earthworks – EW1	16	-	-	-	GI identified in areas where cess is <1m wide.
Earthworks – EW2	24	-	-	-	GI identified in areas where cess is <1m wide.

Location	Boreholes	Trial Pits	Inspection Pits	Structural Coring (Inclined (I) and Horizontal (H))	Targets
Earthworks – EW3	25	-	-	-	GI identified in areas where cess is <1m wide.
Earthworks – EW4	18	-	-	-	GI identified in areas where cess is <1m wide.
Earthworks – EW5	-	-	-	-	-
Earthworks – EW6	27	-	-	-	GI identified in areas where cess is <1m wide.

Table 40 - Proposed Ground Investigation (based on preliminary design layouts)

Notes:

The final GI will be subject to amendment as the scheme design develops.

The earthworks GI will depend upon final track alignment, detailed topographical survey, positioning of new infrastructure (signals, cabinets, etc.) and available land take for earthworks widening.

The GI for the stations, structures and earthworks is detailed in the scheme GI Specification, to be issued under separate cover.

During the next phase of the scheme Stage 2 Mining Reports from Network Rail should be obtained for the stations. The Stage 1 Mining Reports have been obtained and identified the route to be underlain by coal bearing bedrock. The Stage 2 Mining Reports will utilise the coal mining records within the Network Rail database to present the risks and hazards associated with mining at station locations. The Report for Northumberland Park will include the grouting records for the work undertaken in the area after a shaft opened up beneath the NEXUS line in the area.

Also, at Northumberland Park, the as-built records for the bridges adjacent to the Northumberland Park station BNE/31B A186 and BNE/31C Algernon Drive should be obtained from North Tyneside Council. Given the historical mine workings in the area, it is likely that the bridge abutments will have been grouted. As Northumberland Park station lies between the two bridges, it may benefit from previous grouting. The presence / absence of the grouting will be proved during the GI.

The Blyth Bebside Station includes a footpath connection to local residential area Heather Lea to the north. This route passes close to three historical mine shafts. The Shaft Reports should be obtained from The Coal Authority to determine their location and confirm if the shafts have been treated. The location and presence of any shaft treatment will be proved during the GI.

17.11.2 Trackbed

17.11.2.1 Route

A trackbed Investigation has been proposed based on the desk study, P-Way drawing, track speed, site walkover and TAMP analysis. A total 194 trial holes (146 ABS and 48 DABS) have been proposed and a table of trial hole locations is presented in ***Appendix M***. The results of the trackbed investigation will inform the necessary formation treatment required to mitigate any incumbent issues.

The following paragraphs describe the trackbed investigation proposal broken down into each ELR and subsections of ELRs as below:

Study route chainage (km)	Engineers Line Reference	Miles and Chainages	Approximate locations
0.0km to 4.3km	BNE (Benton North Junction to Earsdon Junction)	00m 00ch to 02m 53ch	Benton North Junctions to just North of Northumberland Park curve
4.3 km to 18.3km	EJM (Earsden Junction to Morpeth North Junction)	07m 08ch to 15m 68ch	Just North of Northumberland Park curve to Bedlington Junction

Study route chainage (km)	Engineers Line Reference	Miles and Chainages	Approximate locations
18.3km to 23.4km	BWC (Bedlington Junction to Woodhorn Colliery)	00m 00ch to 03m 05ch	Bedlington Junction to Ashington turnback

Table 41 - Engineers Line References

17.11.2.2 Benton North Junction to Northumberland Park Station

Investigation Scope

In this section, it is observed from the tamp analysis that the track geometry mainly deteriorated around the S&C and level crossings locations. The proposed linespeed is planned to increase from 25mph to 40mph for freight services and in some locations will increase to 65mph for passenger services. A new S&C turnout has been proposed at chainage – 1640 forming the new location for Benton East Junction, with the existing S&C (at 1370) being removed. Therefore, a full trackbed investigation is scoped at this location to confirm the trackbed condition and suitability to accommodate the new S&C and linespeeds. A noticeable track geometry deterioration has been observed at chainage 4200, possibly due to the level crossing, and as such, one Deep Automatic Ballast Sample (DABS) and two Automatic Ballast Samples (ABS) have been scoped here. A schematic diagram is presented in ***Figure 145***.

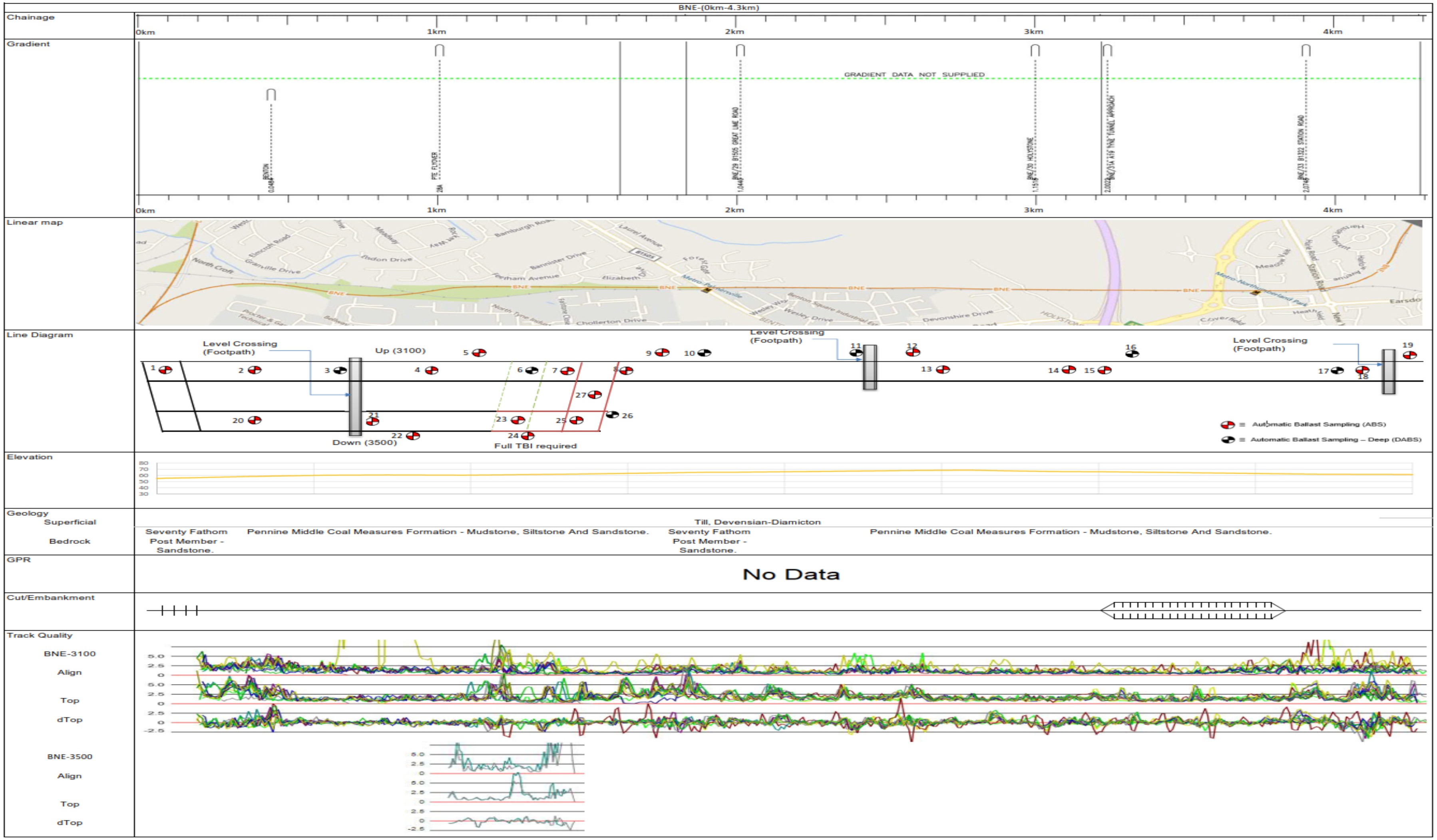


Figure 145 - Trackbed Investigation Scope (BNE 0 - 4.3km)

17.11.2.3 Northumberland Park Curve to Bedlington Junction

EJM-3100 (4.3km – 12.4km)

The tamp analysis for this section of the route indicated that the track geometry mainly deteriorated near the level crossings. The proposed linespeed of the section will increase up to 65mph and in Phase 2, a new S&C turnout into the new loop has been proposed at chainage – 5000 and 7400. This will create a new double track layout between chainage 5000 and 7400 or between Holywell Level Crossing and Seghill Level crossing. It has also been recorded that there is a noticeable track geometry deterioration between chainage 10000-11000m. The scope of work detailed in the schematic diagram in ***Figure 146*** will consider the new S&C at either end of the loop plus any other deterioration in track alignment quality.

EJM-1100 – Up Line (12.4km – 18.3km)

This section shows several areas of very poor track quality with data from TAMP analysis showing occurrences from chainage 12400 to 13800, 14500-16500 and 17000-18000. There are four level crossings within this section which further emphasises the problem. Therefore, the Trackbed Investigation scopes trial holes at regular intervals and a full trackbed investigation with a mix of DABS and ABS. A schematic diagram is presented in ***Figure 147***.

EJM-2100 – Down Line (12.4km – 18.3km)

The down line in this area is similar to up line (1100) described above, with areas of poor quality showing at chainages 13300 to 14300, 15800 to 16500 and 17200-1800 based on other factors. Additionally, linespeed improvements and new S&C Crossover and turnout into the new Furnaceway Sidings around chainage 18000, have driven the need for trial holes at regular intervals and a full Trackbed Investigation scope. A schematic diagram is presented in ***Figure 148.***

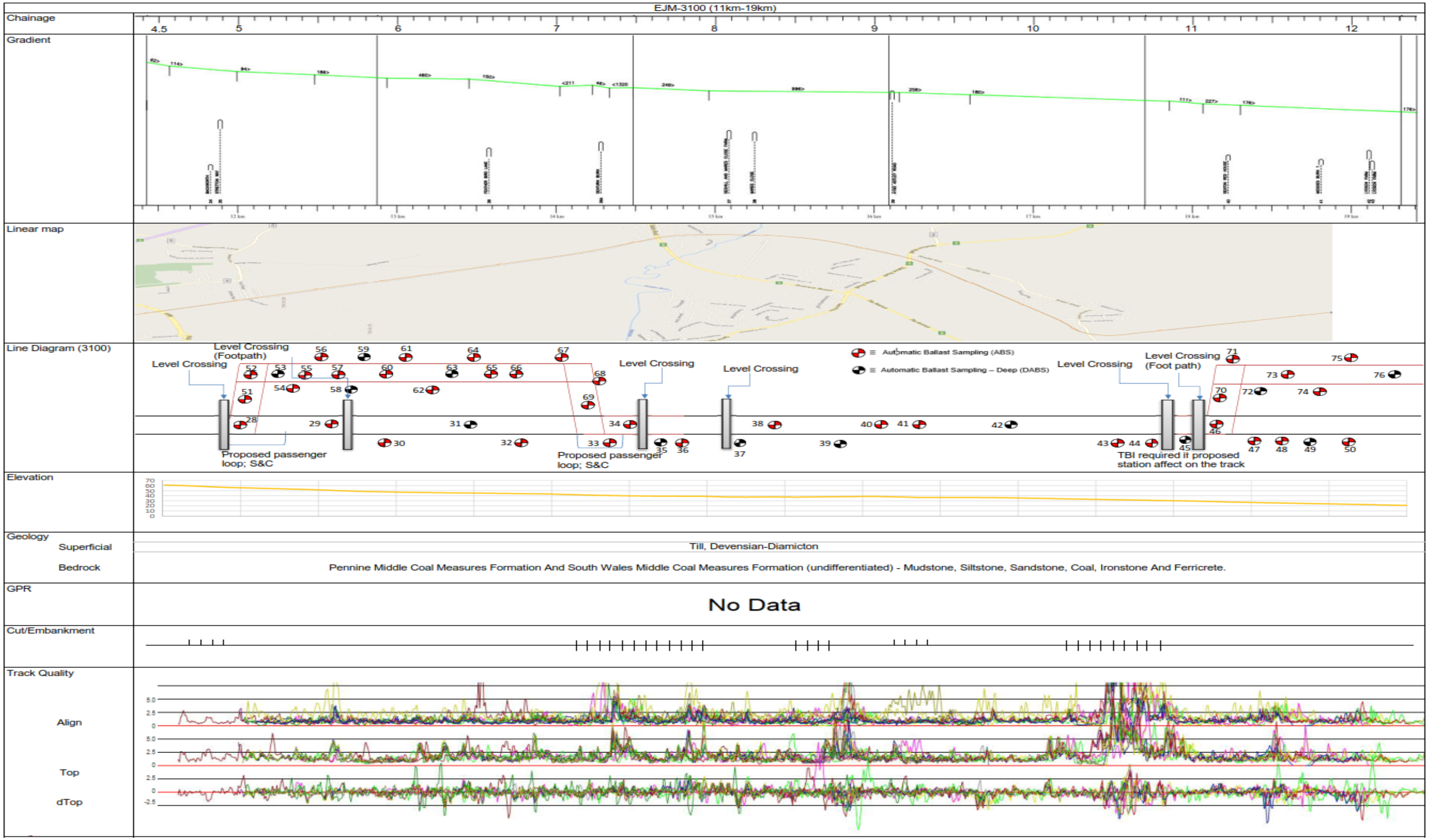


Figure 146 - Trackbed Investigation Scope (EJM 3500 4.3 - 12.4km)

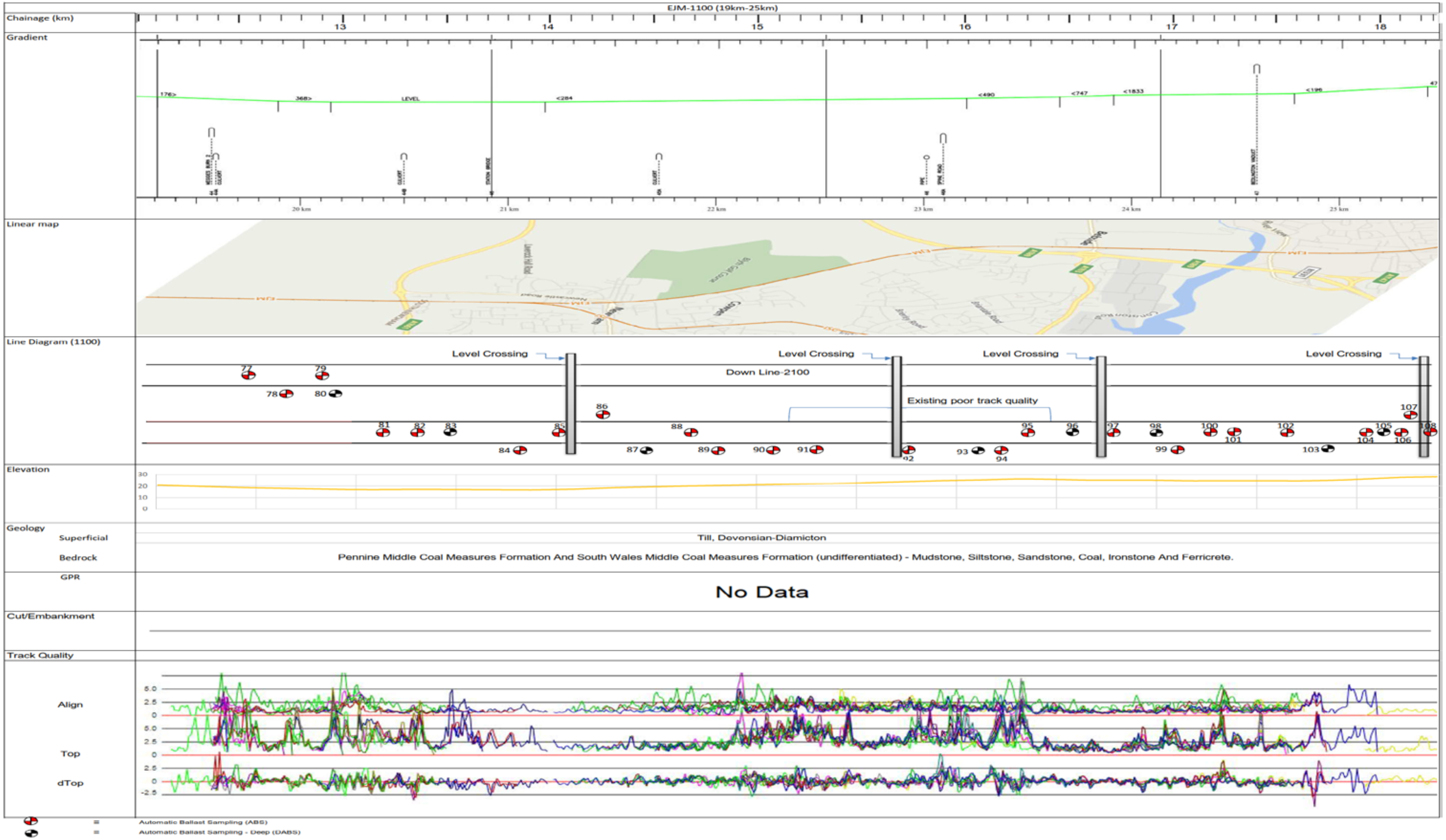


Figure 147 - Trackbed Investigation Scope (EJM 1100 12.4 - 18.3km)

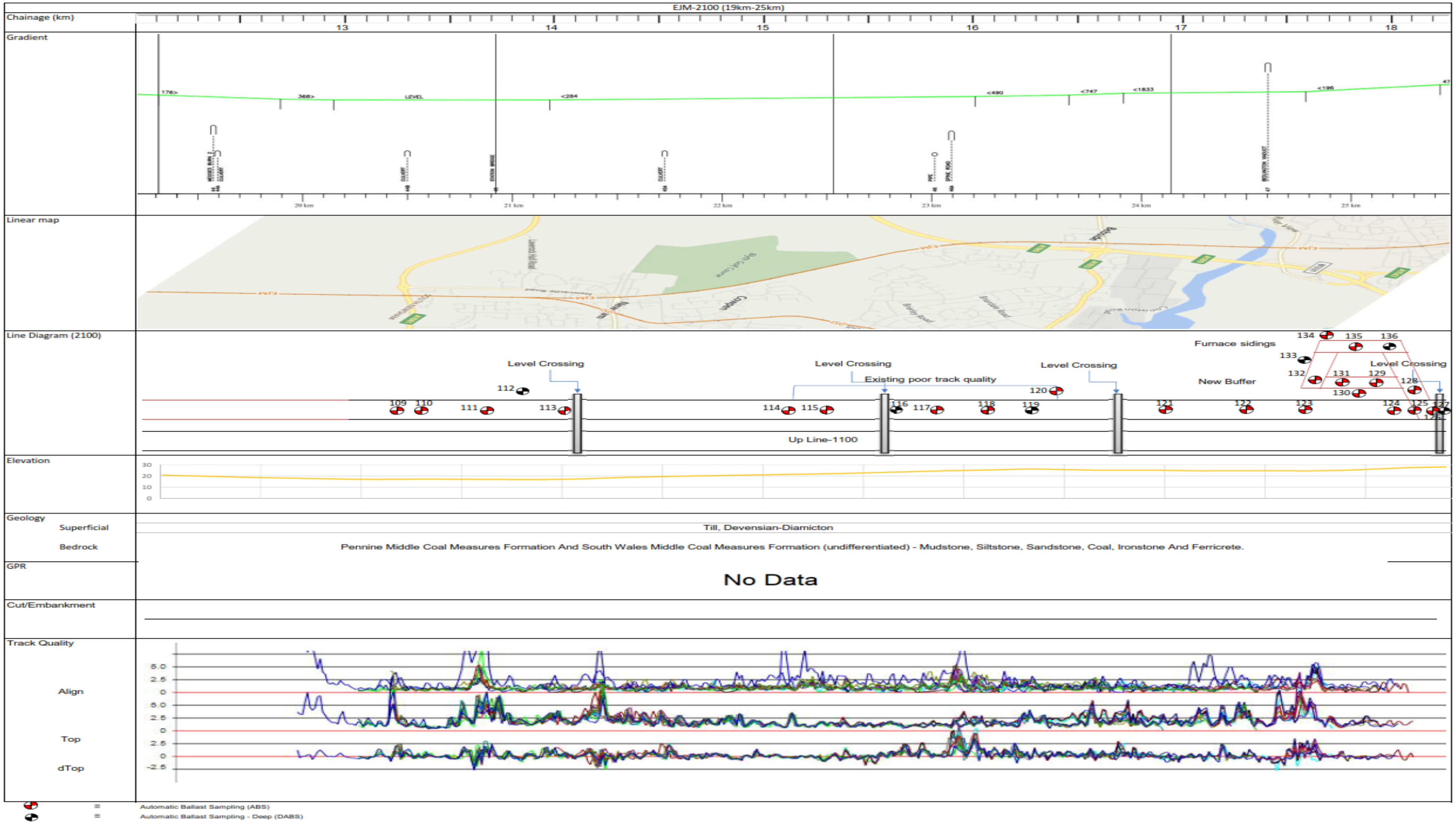


Figure 148 - Trackbed Investigation Scope (EJM 2100 12.4 - 18.3km)

17.11.2.4 Bedlington Junction to Woodhorn Colliery

BWC-1100 – Up Line (18.3km – 24km)

The TAMP analysis shows significant track quality problems in this section which appear to be created by the nine level crossings and three sets of points (Bedlington Junction, West Sleekburn Junction and Marcheys House Junction). Therefore, trial holes at regular intervals and a full trackbed investigation has been scoped over this section. A schematic diagram is presented in ***Figure 149***.

BWC-2100 – Down Line (18.3km – 24km)

The down line over this section is similar to the Up Line although additional Trackbed Investigation has been scoped from chainage 22860 to 23140 to inform the design for the new Crossover and turnout into the new Platform Line at Ashington Station. A schematic diagram is presented in ***Figure 150***.

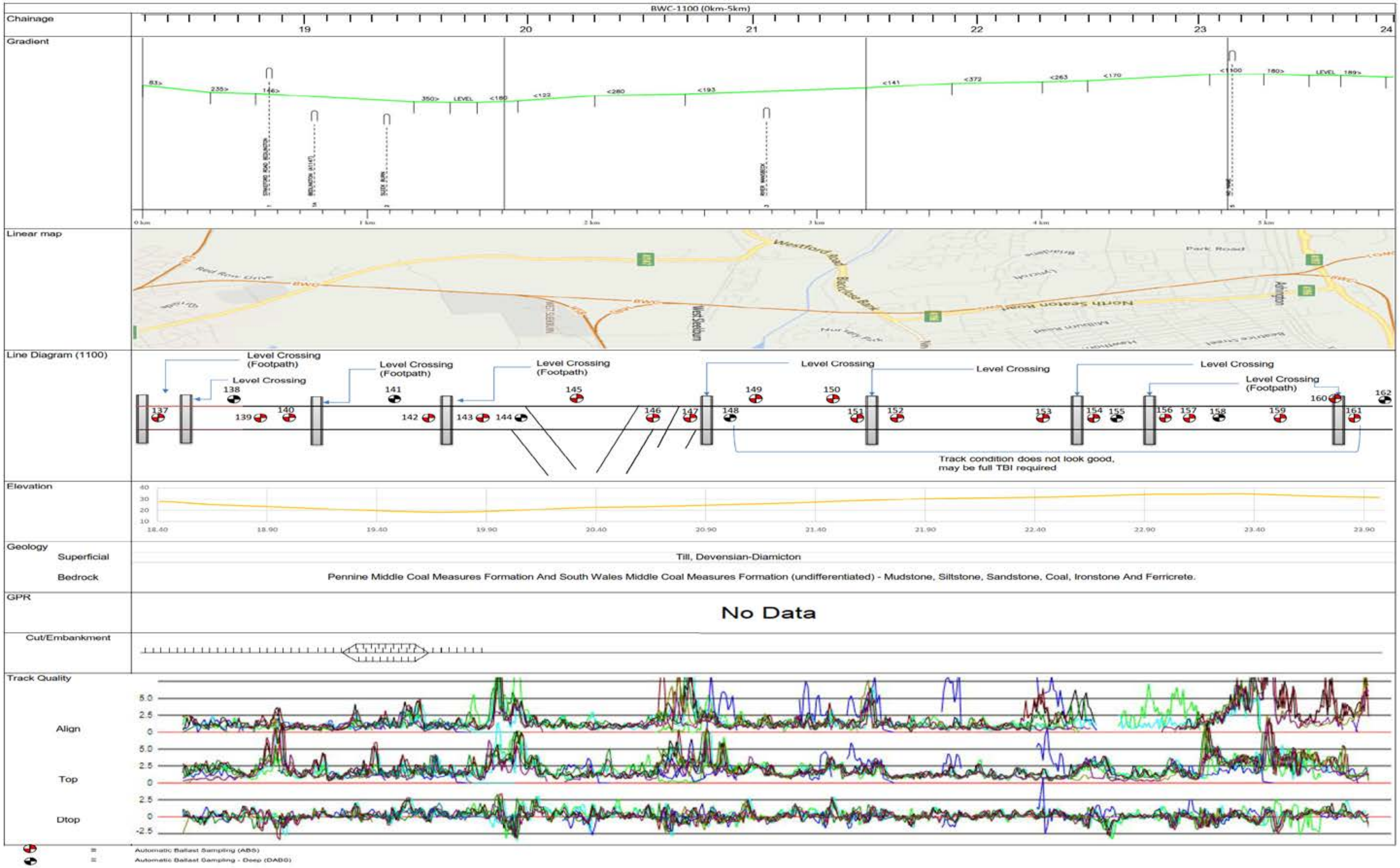


Figure 149 - Trackbed Investigation Scope (BWC 1100 18.3 - 24km)

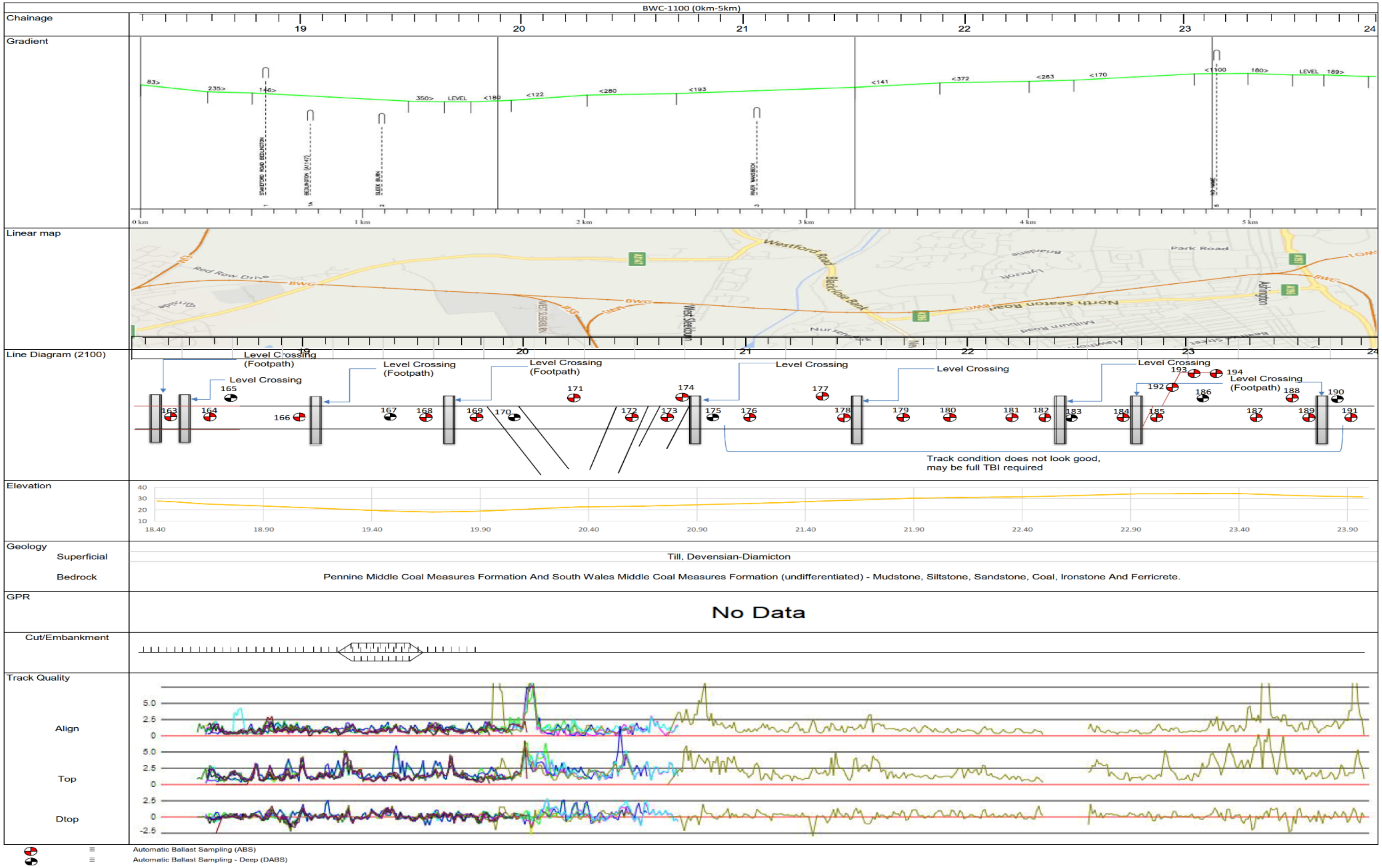


Figure 150 - Trackbed Investigation Scope (BWC 2100 18.3 - 24km)

The trial hole location for the trackbed investigation has been proposed based on Desk study, TAMP analysis, P-Way drawings, track speed and site walkover. In this trackbed investigation only ABS/DABS has been proposed and no Structure investigation has been included at this stage. The trial hole location will be changed if the proposed track alignment changed. Also, the trial hole location will be changed depend on buried services and contamination of the track. If the proposed alignment results in the track running in close proximity of a structure, then a structure investigation will be required.

The following table lists the proposed Trial hole locations:

TRIAL HOLE LOCATION TABLE (THLT)

Sample		ELR	Track ID	Sample Location	Sample Mileage			Comment
Type	Number				Chainage (m)	Miles	Yds	
ABS	1	BNE	3100	4ft	80	0	98	Start of SI - Assess ground condition on Proposed Line.
ABS	2	BNE	3100	4ft	400	0	437	Assess ground condition on Proposed Line-3100.
DABS	3	BNE	3100	4ft	700	0	766	Assess ground condition on Proposed Line just before the FPW crossing.
ABS	4	BNE	3100	4ft	1000	0	1094	Assess ground condition on Proposed Line A - Target switch toes of Proposed Point 1.
ABS	5	BNE	3100	4ft	1180	0	1290	To assess the ground condition - Advance at 2.54m from the west line.
DABS	6	BNE	3100	4ft	1360	0	1509	Assess ground condition on Proposed Line-3100.
ABS	7	BNE	3100	4ft	1460	0	1597	Assess ground condition on Proposed Line-3100.
ABS	8	BNE	3100	4ft	1650	1	44	Assess ground condition on Proposed Line-3100.
ABS	9	BNE	3100	Up Cess	1850	1	263	To assess the ground condition - Advance at 2.27m from the west rail.
DABS	10	BNE	3100	Up Cess	1900	1	318	To assess the ground condition - Advance at 3.5m from the west rail.
DABS	11	BNE	3100	Up Cess	2390	1	854	To assess the ground condition - Advance at 3.30m from the west rail.
ABS	12	BNE	3100	Up Cess	2610	1	1094	To assess the ground condition - Advance at 3.30m from the west rail.
ABS	13	BNE	3100	4ft	2700	1	1182	Assess ground condition on Proposed Line-3100.
ABS	14	BNE	3100	4ft	3100	1	1630	Assess ground condition on Proposed Line-3100.
ABS	15	BNE	3100	4ft	3220	2	1	Assess ground condition on Proposed Line-3100.
DABS	16	BNE	3100	Up Cess	3320	2	111	Assess ground condition on Proposed Line-3100.
DABS	17	BNE	3100	4ft	4050	2	909	Assess ground condition on Proposed Line-3100.
ABS	18	BNE	3100	4ft	4180	2	1051	Assess ground condition on Proposed Line-3100.

TRIAL HOLE LOCATION TABLE (THLT)								
Sample		ELR	Track ID	Sample Location	Sample Mileage			Comment
Type	Number				Chainage (m)	Miles	Yds	
ABS	19	BNE	3100	Up Cess	4270	2	1144	To assess the ground condition - Advance at 2.56m from the west rail.
ABS	20	BNE	3500	4ft	360	0	394	Assess ground condition on Proposed Line-3500.
ABS	21	BNE	3500	4ft	770	0	842	Assess ground condition on Proposed Line-3500.
ABS	22	BNE	3500	Dn Cess	980	0	1072	To assess the ground condition - Advance at 2.7m from the west rail.
ABS	23	BNE	3500	4ft	1380	0	1498	Assess ground condition on Proposed Line-3500.
ABS	24	BNE	3500	Dn Cess	1460	0	1597	To assess the ground condition - Advance at 2.5m from the west rail.
ABS	25	BNE	3500	4ft	1530	0	1673	Assess ground condition on Proposed Line-3500.
DABS	26	BNE	3500	Dn Cess	1580	0	1717	To assess the ground condition - Advance at 2.5m from the west rail.
ABS	27	BNE	3500	4ft	1640	1	276	Assess ground condition on Proposed Line-3500.
ABS	28	EJM	3100	4ft	5000	7	974	Assess ground condition on Proposed Line-3100.
ABS	29	EJM	3100	4ft	5580	7	1584	Assess ground condition on Proposed Line-3100.
ABS	30	EJM	3100	Up Cess	5880	8	166	To assess the ground condition - Advance at 2.5m from the west rail.
DABS	31	EJM	3100	4ft	6500	8	855	Assess ground condition on Proposed Line-3100.
ABS	32	EJM	3100	Up Cess	6860	8	1232	To assess the ground condition - Advance at 2.5m from the west rail.
ABS	33	EJM	3100	Up Cess	7390	9	68	To assess the ground condition - Advance at 2.35m from the west rail.
ABS	34	EJM	3100	4ft	7500	9	188	Assess ground condition on Proposed Line-3100.
DABS	35	EJM	3100	Up Cess	7700	9	407	To assess the ground condition - Advance at 2.58m from the west rail.
ABS	36	EJM	3100	Up Cess	8010	9	726	To assess the ground condition - Advance at 2.63m from the west rail.
DABS	37	EJM	3100	Up Cess	8230	9	987	To assess the ground condition - Advance at 2.52m from the west rail.
ABS	38	EJM	3100	4ft	8600	9	1391	To assess the ground condition - Advance at 2.68m from the west rail.
DABS	39	EJM	3100	Up Cess	8940	10	3	Assess ground condition on Proposed Line-3100.
ABS	40	EJM	3100	4ft	9140	10	220	Assess ground condition on Proposed Line-3100.

TRIAL HOLE LOCATION TABLE (THLT)

Sample Type	Sample Number	ELR	Track ID	Sample Location	Sample Mileage Chainage (m)	Sample Mileage Miles	Sample Mileage Yds	Comment
ABS	41	EJM	3100	4ft	9240	10	330	Assess ground condition on Proposed Line-3100.
DABS	42	EJM	3100	4ft	9760	10	900	Assess ground condition on Proposed Line-3100.
ABS	43	EJM	3100	Up Cess	10580	11	37	To assess the ground condition - Advance at 2.68m from the west rail.
ABS	44	EJM	3100	Up Cess	10740	11	212	To assess the ground condition - Advance at 2.5m from the west rail.
DABS	45	EJM	3100	Up Cess	11020	11	518	To assess the ground condition - Advance at 3.1m from the west rail.
ABS	46	EJM	3100	4ft	11180	11	682	Assess ground condition on Proposed Line-3100.
ABS	47	EJM	3100	Up Cess	11330	11	857	To assess the ground condition - Advance at 2.5m from the west rail.
ABS	48	EJM	3100	Up Cess	11590	11	1141	To assess the ground condition - Advance at 4.3m from the west rail.
DABS	49	EJM	3100	Up Cess	11720	11	1284	To assess the ground condition - Advance at 5.1m from the west rail.
ABS	50	EJM	3100	Up Cess	12010	11	1642	To assess the ground condition - Advance at 4.1m from the west rail.
ABS	51	EJM	New Down Loop	4ft	5010	7	985	Assess ground condition on Proposed Line-New Holywell to Seghill Down Loop
ABS	52	EJM	New Down Loop	4ft	5110	7	1095	Assess ground condition on Proposed Line-New Holywell to Seghill Down Loop
DABS	53	EJM	New Down Loop	4ft	5220	7	1204	Assess ground condition on Proposed Line-New Holywell to Seghill Down Loop
ABS	54	EJM	New Down Loop	Up Cess	5310	7	1313	Assess ground condition on Proposed Line-New Holywell to Seghill Down Loop
ABS	55	EJM	New Down Loop	4ft	5410	7	1423	Assess ground condition on Proposed Line-New Holywell to Seghill Down Loop
ABS	56	EJM	New Down Loop	Dn Cess	5510	7	1532	Assess ground condition on Proposed Line-New Holywell to Seghill Down Loop

TRIAL HOLE LOCATION TABLE (THLT)

Sample		ELR	Track ID	Sample Location	Sample Mileage			Comment
Type	Number				Chainage (m)	Miles	Yds	
ABS	57	EJM	New Down Loop	4ft	5610	7	1642	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop
DABS	58	EJM	New Down Loop	Dn Cess	5710	7	1751	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop
DABS	59	EJM	New Down Loop	Up Cess	5810	8	100	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop
ABS	60	EJM	New Down Loop	4ft	5950	8	253	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop
ABS	61	EJM	New Down Loop	Dn Cess	6050	8	363	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop
ABS	62	EJM	New Down Loop	Up Cess	6250	8	581	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop
DABS	63	EJM	New Down Loop	4ft	6350	8	691	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop
ABS	64	EJM	New Down Loop	Dn Cess	6500	8	855	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop
ABS	65	EJM	New Down Loop	4ft	6600	8	964	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop
ABS	66	EJM	New Down Loop	4ft	6700	8	1064	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop
ABS	67	EJM	New Down Loop	Dn Cess	7070	8	1478	Assess ground condition on Proposed Line- New Holywell to Seghill Down Loop

TRIAL HOLE LOCATION TABLE (THLT)								
Sample		ELR	Track ID	Sample Location	Sample Mileage			Comment
Type	Number				Chainage (m)	Miles	Yds	
ABS	68	EJM	New Down Loop	Up Cess	7260	8	1686	Assess ground condition on Proposed Line-New Holywell to Seghill Down Loop
ABS	69	EJM	New Down Loop	4ft	7370	9	46	Assess ground condition on Proposed Line-New Holywell to Seghill Down Loop
ABS	70	EJM	Down Line	4ft	11190	11	704	Assess ground condition on Proposed Line-Down Line two Track Extension
ABS	71	EJM	Down Line	Up Cess	11250	11	770	Assess ground condition on Proposed Line-Down Line two Track Extension
DABS	72	EJM	Down Line	Dn Cess	11400	11	934	Assess ground condition on Proposed Line-Down Line two Track Extension
ABS	73	EJM	Down Line	4ft	11600	11	1152	Assess ground condition on Proposed Line-Down Line two Track Extension
ABS	74	EJM	Down Line	Dn Cess	11800	11	1371	Assess ground condition on Proposed Line-Down Line two Track Extension
ABS	75	EJM	Down Line	Up Cess	12000	11	1601	Assess ground condition on Proposed Line-Down Line two Track Extension
DABS	76	EJM	Down Line	4ft	12250	12	103	Assess ground condition on Proposed Line-Down Line two Track Extension
ABS	77	EJM	Down Line	Dn Cess	12500	12	377	Assess ground condition on Proposed Line-Down Line two Track Extension
ABS	78	EJM	Down Line	Up Cess	12750	12	650	Assess ground condition on Proposed Line-Down Line two Track Extension
ABS	79	EJM	Down Line	4ft	12950	12	869	Assess ground condition on Proposed Line-Down Line two Track Extension
DABS	80	EJM	Down Line	Dn Cess	13010	12	934	Assess ground condition on Proposed Line-Down Line two Track Extension
ABS	81	EJM	1100	4ft	13200	12	1142	Assess ground condition on Proposed Line-1100.
ABS	82	EJM	1100	4ft	13350	12	1306	Assess ground condition on Proposed Line-1100.

TRIAL HOLE LOCATION TABLE (THLT)

Sample Type	Sample Number	ELR	Track ID	Sample Location	Sample Mileage Chainage (m)	Miles	Yds	Comment
DABS	83	EJM	1100	4ft	13500	12	1470	Assess ground condition on Proposed Line-1100.
ABS	84	EJM	1100	Up Cess	13870	13	115	To assess the ground condition - Advance at 2.7m from the west rail.
ABS	85	EJM	1100	4ft	14080	13	454	Assess ground condition on Proposed Line-1100.
ABS	86	EJM	1100	Dn Cess	14250	13	530	To assess the ground condition - Advance at 2.4m from the west rail.
DABS	87	EJM	1100	Up Cess	14500	13	804	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	88	EJM	1100	4ft	14660	13	979	Assess ground condition on Proposed Line-1100.
ABS	89	EJM	1100	Up Cess	14770	13	1099	To assess the ground condition - Advance at 2.84m from the west rail.
ABS	90	EJM	1100	Up Cess	15090	13	1449	To assess the ground condition - Advance at 2.50m from the west rail.
ABS	91	EJM	1100	Up Cess	15230	13	1602	To assess the ground condition - Advance at 2.50m from the west rail.
ABS	92	EJM	1100	Up Cess	15700	14	356	To assess the ground condition - Advance at 2.54m from the west rail.
DABS	93	EJM	1100	Up Cess	16070	14	761	To assess the ground condition - Advance at 2.65m from the west rail.
ABS	94	EJM	1100	Up Cess	16150	14	848	To assess the ground condition - Advance at 2.54m from the west rail.
ABS	95	EJM	1100	4ft	16250	14	958	Assess ground condition on Proposed Line-1100.
DABS	96	EJM	1100	4ft	16500	14	1231	Assess ground condition on Proposed Line-1100.
ABS	97	EJM	1100	4ft	16670	14	1417	Assess ground condition on Proposed Line-1100.
DABS	98	EJM	1100	4ft	16850	14	1614	Assess ground condition on Proposed Line-1100.
ABS	99	EJM	1100	Up Cess	17000	15	18	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	100	EJM	1100	4ft	17150	15	182	Assess ground condition on Proposed Line-1100.
ABS	101	EJM	1100	4ft	17300	15	346	Assess ground condition on Proposed Line-1100.
ABS	102	EJM	1100	4ft	17590	15	663	Assess ground condition on Proposed Line-1100.
DABS	103	EJM	1100	Up Cess	17750	15	838	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	104	EJM	1100	4ft	17980	15	1090	Assess ground condition on Proposed Line-1100.

TRIAL HOLE LOCATION TABLE (THLT)

Sample		ELR	Track ID	Sample Location	Sample Mileage			Comment
Type	Number				Chainage (m)	Miles	Yds	
DABS	105	EJM	1100	4ft	18100	15	1221	Assess ground condition on Proposed Line-1100.
ABS	106	EJM	1100	4ft	18210	15	1341	Assess ground condition on Proposed Line-1100.
ABS	107	EJM	1100	Up Cess	18310	15	1450	To assess the ground condition - Advance at 2.66m from the west rail.
ABS	108	EJM	1100	4ft	18370	15	1516	Assess ground condition on Proposed Line-1100.
ABS	109	EJM	2100	4ft	13250	12	1197	Assess ground condition on Proposed Line-2100.
ABS	110	EJM	2100	4ft	13400	12	1361	Assess ground condition on Proposed Line-2100.
ABS	111	EJM	2100	4ft	13700	13	115	Assess ground condition on Proposed Line-2100.
DABS	112	EJM	2100	Dn Cess	13870	13	355	To assess the ground condition - Advance at 2.68m from the west rail.
ABS	113	EJM	2100	4ft	14090	13	1351	Assess ground condition on Proposed Line-2100.
ABS	114	EJM	2100	4ft	15100	13	1679	Assess ground condition on Proposed Line-2100.
ABS	115	EJM	2100	4ft	15300	14	225	Assess ground condition on Proposed Line-2100.
DABS	116	EJM	2100	4ft	15690	14	345	Assess ground condition on Proposed Line-2100.
ABS	117	EJM	2100	4ft	15950	14	630	Assess ground condition on Proposed Line-2100.
ABS	118	EJM	2100	4ft	16100	14	794	Assess ground condition on Proposed Line-2100.
DABS	119	EJM	2100	4ft	16300	14	1012	Assess ground condition on Proposed Line-2100.
ABS	120	EJM	2100	Dn Cess	16600	14	1340	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	121	EJM	2100	4ft	16900	14	1668	Assess ground condition on Proposed Line-2100.
ABS	122	EJM	2100	4ft	17310	15	357	Assess ground condition on Proposed Line-2100.
ABS	123	EJM	2100	4ft	17590	15	663	Assess ground condition on Proposed Line-2100.
ABS	124	EJM	2100	4ft	18030	15	1144	Assess ground condition on Proposed Line-2100.
ABS	125	EJM	2100	4ft	18140	15	1265	Assess ground condition on Proposed Line-2100.
ABS	126	EJM	2100	4ft	18200	15	1330	Assess ground condition on Proposed Line-2100.

TRIAL HOLE LOCATION TABLE (THLT)								
Sample		ELR	Track ID	Sample Location	Sample Mileage			Comment
Type	Number				Chainage (m)	Miles	Yds	
DABS	127	EJM	2100	4ft	18370	15	1516	Assess ground condition on Proposed Line-2100.
ABS	128	EJM	New Buffer	4ft	18110	15	674	Assess ground condition on Proposed new Buffer.
DABS	129	EJM	New Buffer	4ft	17900	15	783	Assess ground condition on Proposed new Buffer.
ABS	130	EJM	New Buffer	Dn Cess	17800	15	893	Assess ground condition on Proposed new Buffer.
ABS	131	EJM	New Buffer	4ft	17700	15	1002	Assess ground condition on Proposed new Buffer.
ABS	132	EJM	New Buffer	4ft	17600	15	1232	Assess ground condition on Proposed new Buffer.
DABS	133	EJM	Furnaceway Sidings	Dn Cess	17660	15	1090	Assess ground condition on Proposed Furnace Sidings.
ABS	134	EJM	Furnaceway Sidings	Dn Cess	17750	15	958	Assess ground condition on Proposed Furnace Sidings.
ABS	135	EJM	Furnaceway Sidings	4ft	17860	15	838	Assess ground condition on Proposed Furnace Sidings.
ABS	136	EJM	Furnaceway Sidings	4ft	17980	15	740	Assess ground condition on Proposed Furnace Sidings.
ABS	137	BWC	1100	4ft	18440	0	74	Assess ground condition on Proposed Line-1100.
DABS	138	BWC	1100	Up Cess	18660	0	315	To assess the ground condition - Advance at 2.6m from the west rail.
ABS	139	BWC	1100	4ft	18850	0	523	Assess ground condition on Proposed Line-1100.
ABS	140	BWC	1100	4ft	18950	0	632	Assess ground condition on Proposed Line-1100.
DABS	141	BWC	1100	Up Cess	19420	0	1146	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	142	BWC	1100	4ft	19640	0	1387	Assess ground condition on Proposed Line-1100.

TRIAL HOLE LOCATION TABLE (THLT)

Sample		ELR	Track ID	Sample Location	Sample Mileage			Comment
Type	Number				Chainage (m)	Miles	Yds	
ABS	143	BWC	1100	4ft	19800	0	1562	Assess ground condition on Proposed Line-1100.
DABS	144	BWC	1100	4ft	19910	0	1682	Assess ground condition on Proposed Line-1100.
ABS	145	BWC	1100	Up Cess	20300	1	348	To assess the ground condition - Advance at 2.5m from the west rail.
ABS	146	BWC	1100	4ft	20670	1	753	Assess ground condition on Proposed Line-1100.
ABS	147	BWC	1100	4ft	20740	1	830	Assess ground condition on Proposed Line-1100.
DABS	148	BWC	1100	4ft	20840	1	939	Assess ground condition on Proposed Line-1100.
ABS	149	BWC	1100	Up Cess	20940	1	1048	To assess the ground condition - Advance at 2.56m from the west rail.
ABS	150	BWC	1100	Up Cess	21340	1	1486	To assess the ground condition - Advance at 2.6m from the west rail.
ABS	151	BWC	1100	4ft	21490	1	1650	Assess ground condition on Proposed Line-1100.
ABS	152	BWC	1100	4ft	21600	2	10	Assess ground condition on Proposed Line-1100.
ABS	153	BWC	1100	Up Cess	22300	2	776	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	154	BWC	1100	4ft	22450	2	940	Assess ground condition on Proposed Line-1100.
DABS	155	BWC	1100	4ft	22640	2	1148	Assess ground condition on Proposed Line-1100.
ABS	156	BWC	1100	4ft	22810	2	1333	Assess ground condition on Proposed Line-1100.
ABS	157	BWC	1100	4ft	22950	2	1487	Assess ground condition on Proposed Line-1100.
ABS	158	BWC	1100	4ft	23100	2	1651	Assess ground condition on Proposed Line-1100.
DABS	159	BWC	1100	4ft	23370	3	186	Assess ground condition on Proposed Line-1100.
ABS	160	BWC	1100	4ft	23620	3	459	Assess ground condition on Proposed Line-1100.
ABS	161	BWC	1100	Up Cess	23800	3	656	To assess the ground condition - Advance at 2.6m from the west rail.
DABS	162	BWC	1100	4ft	24000	3	875	Assess ground condition on Proposed Line-1100.
ABS	163	BWC	2100	4ft	18470	0	107	Assess ground condition on Proposed Line-2100.
ABS	164	BWC	2100	4ft	18620	0	271	Assess ground condition on Proposed Line-2100.

TRIAL HOLE LOCATION TABLE (THLT)								
Sample		ELR	Track ID	Sample Location	Sample Mileage			Comment
Type	Number				Chainage (m)	Miles	Yds	
DABS	165	BWC	2100	Dn Cess	18760	0	424	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	166	BWC	2100	4ft	19130	0	829	Assess ground condition on Proposed Line-2100.
DABS	167	BWC	2100	4ft	19450	0	1179	Assess ground condition on Proposed Line-2100.
ABS	168	BWC	2100	4ft	19640	0	1387	Assess ground condition on Proposed Line-2100.
ABS	169	BWC	2100	4ft	19780	0	1540	Assess ground condition on Proposed Line-2100.
DABS	170	BWC	2100	4ft	19980	0	1759	Assess ground condition on Proposed Line-2100.
ABS	171	BWC	2100	Dn Cess	20250	1	294	Assess ground condition on Proposed Line-2100.
ABS	172	BWC	2100	4ft	20450	1	513	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	173	BWC	2100	4ft	20550	1	622	Assess ground condition on Proposed Line-2100.
ABS	174	BWC	2100	Dn Cess	20690	1	775	Assess ground condition on Proposed Line-2100.
DABS	175	BWC	2100	4ft	20820	1	917	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	176	BWC	2100	4ft	21000	1	1114	Assess ground condition on Proposed Line-2100.
ABS	177	BWC	2100	Dn Cess	21370	1	1519	Assess ground condition on Proposed Line-2100.
ABS	178	BWC	2100	4ft	21520	1	1683	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	179	BWC	2100	4ft	21700	2	120	Assess ground condition on Proposed Line-2100.
ABS	180	BWC	2100	4ft	21950	2	393	Assess ground condition on Proposed Line-2100.
ABS	181	BWC	2100	4ft	22200	2	666	Assess ground condition on Proposed Line-2100.
ABS	182	BWC	2100	4ft	22350	2	830	Assess ground condition on Proposed Line-2100.
DABS	183	BWC	2100	4ft	22480	2	973	Assess ground condition on Proposed Line-2100.
ABS	184	BWC	2100	4ft	22700	2	1213	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	185	BWC	2100	4ft	22860	2	1388	Assess ground condition on Proposed Line-2100.
DABS	186	BWC	2100	Dn Cess	23100	2	1651	Assess ground condition on Proposed Line-2100.

TRIAL HOLE LOCATION TABLE (THLT)								
Sample		ELR	Track ID	Sample Location	Sample Mileage			Comment
Type	Number				Chainage (m)	Miles	Yds	
ABS	187	BWC	2100	4ft	23300	3	109	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	188	BWC	2100	Dn Cess	23410	3	230	Assess ground condition on Proposed Line-2100.
ABS	189	BWC	2100	4ft	23540	3	372	To assess the ground condition - Advance at 2.4m from the west rail.
DABS	190	BWC	2100	Dn Cess	23640	3	481	Assess ground condition on Proposed Line-2100.
ABS	191	BWC	2100	4ft	23900	3	765	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	192	BWC	New Down Bay Line	4ft	22920	2	1454	Assess ground condition on Proposed Line-2100.
ABS	193	BWC	New Down Bay Line	Up Cess	23030	2	1574	To assess the ground condition - Advance at 2.4m from the west rail.
ABS	194	BWC	New Down Bay Line	4ft	23130	2	1683	Assess ground condition on Proposed Line-2100.

Table 42 - Trial Hole Location Table

17.12 Utilities

Service drawings have been sourced from the relevant statutory undertakers and have been plotted on a set of Engineering layouts of the route. These engineering layouts for the base drawings of the entire route and reference within, various key considerations such as the land referencing parcels, the key intervention designs, the utilities drawings, the Network Rail boundary. They can be used throughout the duration of the project as a live reference document and can aide in clash detection. The Engineering Layouts can be found in ***Appendix N***

Because much of the scheme development is within the existing rail corridor or on undeveloped adjacent land, little service conflict has been found with the proposed works.

Future engagement with the statutory undertakers during the detailed design phase will focus on the requirement for new or enhanced Network Rail DNO connections to supply increased E&P demand and the need for redundancy / security of supply routes. Additionally, the non-Network Rail infrastructure such as car park lighting and traffic signals will need connection to local supplies.

Because this work can largely be categorised as new connections rather than diversions of existing services, we consider it low risk because the location, timing and means of a new connection is more flexible than diversions, where the solution is more often driven by these criteria. We therefore anticipate being able to minimise statutory undertaker cost and risk, and our outline design allowances reflect this.

At detailed design stage, we propose appointing an experienced utilities manager to engage with the statutory undertakers and commission the connections and any diversions the Northumberland Line requires. The utilities manager's role will be to:

- Work collaboratively with the statutory undertakers to optimise cost and programme
- Commission C3 budgets and C4 quotes
- Place orders in good time, recognising the long lead times and governance processes of the statutory undertakers
- Determine which contestable works might be directly delivered more efficiently
- Where practical remove statutory undertaker works from the programme critical path
- Liaising with stakeholders like landowners, local authorities and highways managers to facilitate statutory undertaker works
- Identify and agree CDM arrangements for non-contestable and contestable works

Ideally the utilities manager will be seconded into the delivery contractor’s team, such that the knowledge gained, and relationships built during detailed design is transferred into the construction phase.

Appendix A – Track Condition Report and Route Clearance Tables

Contents: -

Track Condition Photographs:

- Track Photos for ELR BNE
- Track Photos for ELR EJM
- Track Photos for ELR BWC

Track Survey Tables:

- Track Survey Table for ELR BNE
- Track Survey Table for ELR EJM
- Track Survey Table for ELR BWC

Track Condition Matrices:

- Track Condition Matrix for ELR BNE
- Track Condition Matrix for ELR EJM
- Track Condition Matrix for ELR BWC

- Route Clearance Tables (national Gauging Database)

Appendix B - Signalling Scheme

Contents: -

- 1774-DG-001 v1.0 Signalling Scheme Sketch – Phase 2
- 1774-DG-002 v1.0 Signalling Scheme Sketch – Phase 1
- 1774-TR-015 v1.0 Northumberland Line Signalling Design Log

Appendix C – Station Layouts

Contents: -

Drawings:

- 60601435-ACM-01-ZZ-DRG-ECV-100121 – Northumberland Park Option 1B
- 60601435-ACM-03-ZZ-DRG-ECV-300310 – Seaton Delaval Option 3
- 60601435-ACM-04-ZZ-DRG-ECV-400211 – Newsham Option 2A
- 60601435-ACM-05-ZZ-DRG-ECV-500511 – Blyth Bebside Option 5B
- 60601435-ACM-06-ZZ-DRG-ECV-600111 – Bedlington Option 1A
- 60601435-ACM-07-ZZ-DRG-ECV-700210 – Ashington Option 4

Appendix D – Pway Intervention Layouts

Contents: -

Drawings:

- 60601435-ACM-01-TL-DRG-ETR-000001 – Benton East Option 1
- 60601435-ACM-02-TL-DRG-ETR-000001 – Seaton Loop Option 12a (Seghill)
- 60601435-ACM-05-TL-DRG-ETR-000001 – Newsham Two Track Extension Option 1
- 60601435-ACM-06-TL-DRG-ETR-000001 – Furnaceway Sidings Option 1
- 60601435-ACM-06-TL-DRG-ETR-000002 – Furnaceway Sidings Option 2
- 60601435-ACM-06-TL-DRG-ETR-000003 – Furnaceway Sidings Option 3
- 60601435-ACM-06-TL-DRG-ETR-000004 – Bedlington Option 3
- 60601435-ACM-06-TL-DRG-ETR-000005 – Bedlington Option 2
- 60601435-ACM-07-TL-DRG-ETR-000001 – Ashington Option 3
- 60601435-ACM-07-TL-DRG-ETR-000002 – Ashington Option 2
- 60601435-ACM-07-TL-DRG-ETR-000003 – Ashington Option 4a
- 60601435-ACM-07-TL-DRG-ETR-000004 – Ashington Option 4

Appendix E – Environmental

Contents: -

- Preliminary Ecological Appraisal Report
- Ecological Summary Report
- Great Crested Newt Survey Report

Appendix F – Land and Consents Strategy

Contents: -

- Land and Consent Strategy Report

Appendix G – Topographical Survey Report

Contents: -

Appendix H – Telecommunications

Contents: -

- Station General Arrangements
- Routewide Straight Line Diagrams

Appendix I – Hazard Record (snapshot)

Contents: -

- Current Snapshot of Hazard Record (Live Document)

Appendix J – Structures

Contents: -

Appendix K – New Signal Location Earthworks Sections

Contents: -

- 60601435-ACM-DRG-ECV-000001 - Signal Earthworks Drawing

Appendix L – Geotechnical and Earthworks

Contents: -

The desk based Preliminary Sources Study Reports (PSSR) for the six stations and six earthworks are included in as below.

Report Reference	Report Title	Appendix
Overarching Summary Report		
60601435-ACM-XX-ZZ-REP-EGE-001	Preliminary Sources Study Report – Summary Report	
Station Preliminary Sources Study Reports		
60601435-ACM-01-ZZ-REP-EGE-001	Northumberland Park Station	Appendix 01
60601435-ACM-03-ZZ-REP-EGE-001	Seaton Delaval Station	Appendix 02
60601435-ACM-04-ZZ-REP-EGE-001	Newsham Station	Appendix 03
60601435-ACM-05-ZZ-REP-EGE-001	Blyth Bebside Station	Appendix 04
60601435-ACM-06-ZZ-REP-EGE-001	Bedlington Station	Appendix 05
60601435-ACM-07-ZZ-REP-EGE-001	Ashington Station	Appendix 06
Earthworks Preliminary Sources Study Reports		
60601435-ACM-XX-ZZ-REP-EGE-002	EW1 – ECML to Northumberland Park	Appendix 07
60601435-ACM-XX-ZZ-REP-EGE-003	EW2 – Northumberland Park to Seaton Delaval	Appendix 08
60601435-ACM-XX-ZZ-REP-EGE-004	EW3 – Seaton Delaval to Newsham	Appendix 09
60601435-ACM-XX-ZZ-REP-EGE-005	EW4 – Newsham to Blyth Bebside	Appendix 10
60601435-ACM-XX-ZZ-REP-EGE-006	EW5 – Blyth Bebside to Bedlington	Appendix 11
60601435-ACM-XX-ZZ-REP-EGE-007	EW6 – Bedlington to Ashington	Appendix 12

Appendix M – Trackbed and Drainage

Contents:-

- Ballast Sample Location Long Sections
- Trial Hole Location Table

Appendix N – Engineering Layouts

Contents:-

- Entire route showing various engineering considerations such as:
    - Proposed Signal Locations
    - Indicative walking routes
    - Utility Information
    - Key design Interventions

Appendix O – Local Junction Modelling Report

Contents:-

- Report

Appendix P – Road Safety Reviews

Contents:-

- Road Safety Review – Ashington
- Road Safety Review – Bedlington
- Road Safety Review – Blyth Bebside Option 4D
- Road Safety Review – Blyth Bebside Option 5B
- Road Safety Review – Newsham
- Road Safety Review – Seaton Delaval

Appendix Q – ECI Constructability Strategy

Contents:-

- ECI Construction Strategy Proposal Presentation

Appendix R – Programme

Contents:-

- Overall Scheme Programme
- ECI Construction Programme

Appendix S – Quantitative Cost Risk Analysis

Contents:-

- Northumberland Line Quantitative Cost Risk Analysis Report - RevA

Appendix T – Cost Estimate

Contents:-

- Project Cost Estimate
- ECI Price Validation
- ECI Indirect Cost Breakdown

Appendix U – Linespeed Profiles

Contents:-

Appendix V – Gradient Information Used at OSR Stage

Contents:-

- Gradient Diagram (Created from GeoRINM Data)

Appendix W – Down Loop Options Tracker

Contents:-

Appendix X – Station Diversity Impact Assessments

Contents:-

Appendix Y – Design Workshop Attendance Record

Contents:-

- Record of Attendance at each Workshop (1-5)