North Yorkshire County Council

Harrogate to Ripon Railway Study Phase 2

Preliminary Engineering and Environmental Assessment Study

ISSUE

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Preliminary Engineering and Environmental Assessment Study

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Introduction

Arup was commissioned to carry out a Preliminary Engineering and Environmental Assessment Study to assess the viability of the reinstatement of the Harrogate to Ripon railway line in March 2005.

The study considers the engineering and environmental constraints and capital works required to reinstate the line and builds on an April 2004 study by JMP Consulting which focused on the route's potential patronage. It also considers station locations and off line alternatives to the reinstatement of the line on the former alignment.

This study was commissioned by North Yorkshire County Council, with the steering group comprising members of the County Council, Ripon City Partnership, the Countryside Agency and Ripon Railway Reinstatement Association.

Previous Studies

The JMP study estimated the capital cost at between £39.9m (for a station at Dallamires Lane) to £42.9m (for a station at Rotary Way) to provide a half-hourly Ripon to Leeds service with a single track line with loops. Land acquisition costs were estimated at £3m.

It identified that for the half-hourly service, 31% of passengers would be as a result of mode shift from car, 10% would be as a result of mode shift from bus, 12% would be generated as a result of the service, whilst the remaining 46% of passengers on new services between Leeds and Ripon would be from passengers travelling only between Harrogate and Leeds.

The report concluded that over the 30 year appraisal period, the present value of the capital and operating costs was £104.8 million, while the present value of benefits was £131.2 million. This gave an economic benefit of £23.9 million and a benefit to cost ratio of 1.22. Some items, such as land costs were omitted from the capital cost.

Original Route

Identification of the route features, constraints and baseline information was taken from consultation with the steering group, publicly available information and site visits. The route has been sold off, mainly to adjacent landowners who, in some locations, have blended the former track bed into the surrounding landscape in order to maximise their use of the land. This has included the infilling of cuttings, removal of bridge decks, and building construction, although some 70 to 80% remains largely undeveloped. The line near Harrogate (Bilton) was purchased by Sustrans. The route is generally rural, with the exception of Bilton, Wormald Green, Littlethorpe and Ripon.

Key geological constraints include soft alluvium deposits associated with flood plains, dissolution of gypsum approaching Ripon and deep pockets of soft deposits in the dissolved rock hollow and sink holes.

A total of 32 structures have been identified along the former alignment. Where accessible, these have been inspected. The bridge over the A61 at South Stainley has been removed; however all the other bridges appeared to be in good to excellent condition, without major defects. A list of minor remedial works is included in the report and accounted for in the capital cost estimate.

Environmental Issues

A baseline of environmental factors has been prepared. Key factors which lie immediately on or adjacent to the proposed options comprise:

- ASLVs (Areas of Special Landscape Value) at Nidd Gorge and the Ure Valley.
- A SSSI (Site of Special Scientific Interest) at Quarry Moor. This is beyond the majority of alignment options, but must be considered if within a 2km trigger distance.

- SINCs (Site of Nature Conservation) at Bilton Banks, Spring Wood (Nidd Gorge), Bishop Monkton Railway Cutting, Littlethorpe Embankment, Littlethorpe Manor Pond and Ripon Canal. These are associated with Magnesian and Calcareous grassland, Calcareous wood and open water.
- Potential for protected species including water voles, slow worm, bats and great crested newts
- Grade II listed structures – Gardners Arms (Bilton), Nidd Viaduct, Nidd Railway Hotel and Skell Railway Bridge (Ripon).

Whilst a detailed Environmental Impact Assessment will be required as part of the planning process, none of the above appear to present insurmountable issues at this stage, appropriate mitigation and suitable alignment choice. They are farily typical of a project of this nature.

Operations

In identifying the works required to reinstate the railway, two generic issues were considered - track specification and train control. This was followed by the identification of alignment options where there was opportunity to deviate from the former alignment due to environmental, safety or cost.

The relatively low rail traffic volumes anticipated meant that track specification could be reduced in line with Network Rail standards to Category 3. This allows the use of serviceable as well as new rails, steel or concrete sleepers and reduced ballast depths. It was considered that little relaxation of this standard would be achieved if the track was developed as a Community Railway.

A number of train control and operational options were considered from a single junction, single platform line, with minimal new signalling equipment and the ability to run one train an hour, to two tracks throughout and an island platform at Ripon. This comprehensive solution would require approximately £10.63 million worth of signalling equipment, be able to trains at up to 5 minute headways, and include capacity for trains to recover in the event of delays. In between these scenarios are other options such as basic and dynamic passing loops. It was considered that a double junction at Bilton is required, with the double track extended past Bilton to provide up 4 minutes of timetable perturbation from a 30 minute frequency service. This would require approximately £5.75 million worth of new signalling control.

Key Locations

In five locations it was considered that significant works would be required (including off-line options), to allow the railway to be reinstated. These comprised:

- Bilton – Off-line options considered due to close locality of residential properties and location of former level crossing.
- Nidd – Off-line options considered due to close locality of properties, including development on the alignment, and the location of the former level crossing.
- South Stainley – Options considered for the reinstatement of the bridge over the A61.
- Wormald Green - Off-line options considered due to close locality of properties, including development on the alignment, the location of the former level crossing and Wormald Green Land Fill Site.
- Littlethorpe/Ripon – Off-line options considered due to close locality of properties, including development on the alignment (Ripon by-pass and houses in Littlethorpe), the location of the former level crossing and the need to provide a new station in Ripon to maximise the potential catchment.

In all the locations where off-line sections are proposed, they were compared against a benchmark of a reinstatement on the former alignment.

Bilton

In addition to the on line reinstatement, alignment options to the east of the former route were considered. As the alignment moved further east, the achievable line speed reduces (due to the tight curvature), the impact on Bilton Triangle and the ASLV increases and the extent of earthworks increases. Option B3 was

identified as the preferred, which retains the former alignment as a cycleway and environmental buffer to the properties, proposes a new bridge to pass over Bilton Lane but would require a significant length of new embankment in Bilton Triangle and the ASLV. The estimated capital cost of the preferred option (Option B3) is £10.13 million. The estimated capital cost of the base option (Option B1) is £6.09 million.

Nidd

At Nidd, alignment options to both the east and west of the former alignment were considered. Options to the east were quickly discounted due to the impact on Nidd Hall, the associated listed structures and mature woodland. The western options provide an opportunity for a grade separated road crossing to be provided whilst minimising the length of the deviation. The preferred option (Option N5) differed from the other options in that it proposed the diversion and lifting of the road to achieve a road bridge, rather than extensive earthworks to pass the railway under the road. The estimated capital cost of the preferred option (Option N5) is £4.48 million. The estimated capital cost of the base option (Option N1) is £3.89 million.

South Stainley

In order to determine the required span of the reinstated bridge, measurements of forward visibility were taken along the A61 from site and Ordnance Survey mapping. They indicate that with reprofiling of the embankment, modest land purchase and realignment of fencing, a design speed of 40mph could be achieved. Design speeds above 40mph would require significant realignment of the A61. Three bridge solutions were considered - a single span skew steel through-girder, a three span steel through-girder with square abutments and a single span steel trussed ties arch. It is considered that any of the three structures would be suitable and each would cost approximately £1.5 million to construct. Further development of these options will determine the preferred solution in detail.

Wormald Green

Options both east and west of Wormald Green village were considered. The eastern option would require significant earthworks in the flood plain and two additional crossings of the A61 and was hence discounted. The western option takes advantage of the rising land levels to the west of Wormald Green to provide a new alignment in cutting, passing under the road to Markington. The estimated capital cost of the preferred western option (Option W2) is £11.25 million. The estimated capital cost of the base option (Option W1) is £12.86 million. This base option cost includes a significant amount of junction remodelling on the A61 to provide a safe solution at the level crossing.

Littlethorpe/Ripon

An infinite number of alignment options exist on the approach to Ripon. In order to define a modest number of significantly different options and to demonstrate the corridors of opportunities, the key constraints were considered. These are:

- The location of Ripon Station,
- The existing properties at Littlethorpe,
- Boroughbridge Road and the associated developments of east and south east Ripon,
- Ground Conditions and Flood Plan.

Of these constraints, the location of Ripon Station was considered paramount. Five locations were considered to provide the best compromises between walk-to access, road access, car parking space (estimates at 300 spaces) and integrated development opportunities. They are located at:

- Rotary Way (west of the by-pass) – Option R1a – Estimated at £12.16 million
- Dallamires Lane – Option R1b – Estimated at £6.33 million
- Knaresborough Road – Option R2 – Estimated at £4.94 million
- Rotary Way Roundabout (east of the by-pass) – Option R3 – Estimated at £60.15 million

- Harrogate Road/Morrisons – Option R4 – Estimated at £7.33 million

These options provide significantly different opportunities and the identification of a 'preferred' option is based on significant assumptions about acceptable environmental impacts and the use of the station. The key points are:

- Options R1a requires an elevated railway to be build over the by-pass for part of its length. It was considered that the visual intrusion of this proposal was unacceptable.
- Only Options R1a and R3 propose works which would not be abortive if the line continued north, beyond Ripon.
- The cost of Option R3 is out of context with the other options due to significant structural works to avoid the flood plain and ground conditions. It also has a major impact on developments and the ASLV.
- Options R1b, R2 and R4 are all located south of the Ripon by-pass, with estimated walking times to the Market Place of 17.5, 20 and 25 minutes respectfully. However they benefit from excellent road access off the by-pass, and shorter walking times to the residential areas of south Ripon. Option R1b also has good walking access to the developments along Boroughbridge Road.

For these reasons, Option R1b, on the former alignment, has been considered the base case although Ripon station would be south of the town, rather than north. It is shown to require property purchase at Littlethorpe and a new level crossing. A diversion to the east or west of Littlethorpe may be feasible, but not without significant impact on the properties in the village and Littlethorpe Park. Therefore, in order to avoid the impact on Littlethorpe, Option R2 has been identified as the preferred option.

Summary

For the whole route, a capital cost of £37.03 million for the base case (on line reinstatement) and £39.16 million for the collection of preferred options has been estimated. Including for land, project management, design and legal fees, these become total project estimates of £48.20 million and £47.70 million respectfully. The preferred option removes the need for new level crossings, the demolition of properties or unacceptable environmental impact.

It is estimated that given timely release of funds and approvals, the line could open in 10 years time.

It is noted that the alignments presented in this report are of a very preliminary nature, and will require development and adjustment before a preferred single alignment is fully defined. In parallel with the design development, a significant number of activities are required before the project can be realised. The most significant of these is the preparation of a Business Case in line with the SRA and DfT appraisal guidelines.

1. INTRODUCTION

Arup was commissioned to carry out a Preliminary Engineering and Environmental Assessment Study to assess the viability of the reinstatement of the Harrogate to Ripon railway line.

The study considers the engineering and environmental constraints and capital works required to reinstate the line and builds on a previous study by JMP Consulting which focused on the route's potential patronage. It will also consider station locations and off line alternatives to the reinstatement of the line on the former alignment. A summary of the main points of the JMP report is provided in Chapter 3.

This study was commissioned by North Yorkshire County Council, with the steering group comprising members of the County Council, Ripon City Partnership, the Countryside Agency and Ripon Railway Reinstatement Association.

The report comprises:

- Chapter 2 – An overview of the source of information used in the production of this report, including previous reports, publicly available information, consultations and defining standards.
- Chapter 3 – Summarises the Ripon Rail Study by JMP, noting critical assumptions and conclusions.
- Chapter 4 – Lists existing constraints and assets. This summarises the data collection, information gained on site and the results of consultations.
- Chapter 5 – Identifies locations were it would be unattractive to reinstate the former alignment due to environmental, safety or cost issues. A broad range of options are described with a shortlist of options developed further.
- Chapter 6 – Describes the proposed Ripon Station options.
- Chapter 7 – Presents the capital cost estimate.
- Chapter 8 – Compares and contrasts the on and off line options.
- Chapter 9 – Draws together the conclusions of the study.
- Chapter 10 – Recommends actions for the next steps.

2. SOURCES OF INFORMATION

The conclusions drawn in this engineering and environmental assessment study are based on the following sources of information;

- **Source data**
    - Ordnance Survey Digital Mapping
    - 'Ripon Rail Study' Final Report by JMP, dated 23/3/2004
    - Harrogate District Local Plan 2001 and Selective Alterations of 2004
    - 'The Railways of Harrogate and District' by James Rogers (North Eastern Railway Association), dated May 2000.
    - 1:50,000 solid geology map and 1:50,000 drift geological map
    - Harrogate Borough Biodat site maps
    - Multi-Agency Geographical Information for the Countryside (MAGIC) – www.magic.gov.uk
    - British Geoscience Data Index – www.bgs.ac.uk/geoindex/home.html
    - The UK National Air Quality Information Archive - www.airquality.co.uk/archive/index.php
    - Pastscape (English Heritage online National Monuments Register) – http://pastscape.english-heritage.org.uk/homepage/textpage.asp
    - Environment Agency website – www.environment-agency.gov.uk
    - English Nature 'Nature on the Map' - www.natureonthemap.org.uk/
    - www.sustrans.org.
    - www.webtag.org.uk.
- **Design Guidelines**
    - Network Rail Company Specification – RT/CE/S/049, Track Design Handbook
    - Railway Group Standard – GC/RT5023, Categorisation of Track
    - Network Rail Company Specification - RT/CE/S/102, Track Construction Standard
    - Design Manual for Roads and Bridges
- **Consultation**
    - Ripon Rail Reinstatement Association
    - Countryside Agency
    - North Yorkshire County Council
    - Ripon City Partnership
    - Defra
    - English Heritage
    - English Nature

- Harrogate Borough Council Conservation Officer
- Harrogate Borough Council Planning Department
- Harrogate Borough Council Rural Strategy Officer
- North and East Yorkshire Ecological Data Centre
- North Yorkshire Badger Group
- North Yorkshire Bat Group
- North Yorkshire County Council Heritage Unit
- The Environment Agency
- Yorkshire Wildlife Trust

- **Site Survey**
  - Site Visits by the Project Director, Project Manager, Environmental Scientist, Structural Engineer, Geotechnical Engineer and Railway Civil Engineer during April 2005.
  - Level Survey along Bilton Lane, Ripley Road, Unnamed road between Wormald Green and Markington and Littlethorpe Lane. These tied into Ordnance Survey Bench Marks, where possible, or spot heights identified on the Ordnance Survey Digital Mapping. Results of this survey are provided in Appendix A.

3. PREVIOUS STUDY WORK

This study follows a report entitled 'Ripon Rail Study' by JMP Consulting, dated April 2004. The main conclusions of that report were as follows:

- There was strong demand for travel from Ripon both south and north, but particularly to Harrogate and the south.
- The vast majority of these journeys currently take place by private car.
- There was significant local support for a new heavy rail line.
- The extra capital cost of providing double track compared with a single track line with passing facilities was not justified.
- Of the options tested, there was potential for a small positive benefit cost ratio for a single track line with dynamic passing loop south of Ripon.
- Operating two trains per hour south of Ripon appeared to offer the best option in economic and financial terms, subject to capacity being made available between Harrogate and Leeds.
- Operating one train per hour south of Ripon would be best if no additional capacity was made available.
- The analysis did not support the case for extending north of Ripon at that moment in time.
- JMP considered it unlikely that sufficient strategic benefits would exist for providing a diversionary route to the East Coast Main Line.
- The option to extend north needs to be retained in case the situation changes in the future.

The study estimated the capital cost at between £39.9m (for a station at Dallamires Lane) to £42.9m (for a station at Rotary Way) to provide a half-hourly Ripon to Leeds service with a single track line with loops. Land acquisition costs were estimated at £3m.

JMP identified that for the half-hourly service, 31% of passengers would be as a result of mode shift from car, 10% would be as a result of mode shift from bus, 12% would be generated as a result of the service, whilst the remaining 46% of passengers on new services between Leeds and Ripon would be from passengers travelling only between Harrogate and Leeds.

Considering these figures in line with the objectives of the national and local interested parties;

- 31% would be shifted from private to public transport, therefore reducing congestion and reliance on the private car. This is strongly in line with national transport policy.
- 10% would be taken off the existing Ripon to Harrogate bus service. This would reduce the viability of this bus service unless potential bus passengers are currently dissuaded from using the service due to overcrowding. It is noted that through good integration of the rail and local bus services, bus patronage in Ripon overall may well increase. It is also relevant that this bus service has seen a significant growth in patronage since JMP's report. This has the potential to have a significant impact on the Business Case.
- 12% would be new journeys to and from Ripon, providing development opportunities and economic gain to the city.
- 46% of passengers would benefit if the Harrogate to Ripon line was not constructed, but capacity improvements were made on the Harrogate to Leeds line.

4. EXISTING CORRIDOR ASSETS AND USES

Plans of the complete route are provided as drawings RT01 and RT02. Chainage markers are shown along the former alignment to provide reference for this study. They commence at zero at the location of the former Dragon Junction. Any comparison between these chainage marks and the former mileposts is purely coincidental.

The identification of the former rail corridor was achieved through historical drawings and the location of physical remnants of the route such as bridges, embankments etc. With a number of notable exceptions, the route has been sold off to the adjacent landowners who, in some locations, have blended the former track bed into the surrounding landscape in order to maximise their use of the land. This has included the infilling of cuttings, removal of bridge decks and building construction, although some 70 to 80% remains largely unused. The route is further described in the following section.

4.1 Corridor Description

4.1.1 Harrogate to Holmes Bottom (Chainage 0 to 3+000)

The line commences at the southern end, at the former Dragon Junction, which provided access to Starbeck from the main route from Harrogate to Ripon. When the line to Ripon was removed, the Harrogate to Starbeck route became the through line and the junction was removed. The current line is a twin-track railway; trains are controlled by Harrogate and Starbeck signal boxes using Absolute Block Working. Each line is signalled uni-directionally, with a line speed of 60mph on a curve of approximately 680m radius.

Immediately south-west of the former Dragon Junction adjacent to the existing footbridge is the proposed location for Bilton Station, as defined by the Harrogate Borough Council Local District Plan. The existing footbridge is currently being reconstructed to provide access for disabled users and cyclists. The new footbridge will become the first stage in the redevelopment of the site.

As the former alignment continues northwards from Dragon Junction, the line starts to fall at a gradient of 1 in 66 on a horizontal radius of approximately 620m. The combination of horizontal and vertical curvature results in a compensated gradient of 1 in 62.5 (1.6%) as defined in the Network Rail Track Design Handbook. This is a measure of the resistance felt by a locomotive opposing gravity and the frictional forces of the horizontal curve and is the steepest gradient on the line from Ripon to Leeds. This radius should not initiate significant wheel squeal, which is generally considered to be a problem with radii below 500m, becoming significant below around 300m.

The line starts in a slight cutting adjacent to Dene Park then, as the ground falls away at Bilton Beck, the track bed rises onto an embankment approximately 6m high. Approaching Bilton Lane and north of Bilton Junction, where the chord between Starbeck and Ripon joined the main line, the track bed is in a slight cutting, overlooked by the residential properties of Woodfield Road.

This section of line is now owned by Sustrans and is a well-used recreational corridor.

A level crossing used to provide access for Bilton Lane across the railway. A car park is located immediately south of Bilton Lane, on the former track bed.

Immediately north of Bilton Lane, the former track bed is on a wide embankment, approximately 5m higher than the surrounding ground. At this location, the Harrogate Gas Works Railway started on its route around the north side of Harrogate. Retaining walls and bridge abutments remain on the west side of the corridor as reminders of the hoppers and

lifting equipment which transferred material from the narrow gauge Gas Works trains to the standard gauge trains.

The corridor continues north on a small embankment to reach the River Nidd.

The railway line crosses the river Nidd on Nidd viaduct, a 7 arch stone structure rising approximately 45 metres above the river valley and approximately 130m in length. It is understood that the Viaduct is currently owned by Sustrans, who have aspirations to provide a cycleway from the centre of Harrogate, over the viaduct and up the former Pateley Bridge line.

4.1.2 Holme Bottom to Green Lane (Chainage 3+000 to 6+500)

The line passes through open farmland to the east of Holme Bottom Farm before emerging on an embankment at the location of the former Ripley Valley Junction where the Pateley Bridge line branched off to the west. Here the line is reasonably level rising towards Nidd at a gradient of approximately 1 in 1000.

The line passes the location of the former Nidd station and crosses Ripley Road at a level crossing before passing alongside the grounds of Nidd Hall.

Industrial buildings have been built on the former track bed, south of the former Level Crossing. It is understood that some of these may have been constructed without Planning Permission.

The line continues into a cutting and passes under Nidd Lane and Green Lane road bridges where the railway runs alongside Ripon Road towards South Stainley.

4.1.3 Green Lane to Monkton Moor Bridge (Chainage 6+500 to 10+700)

North of Green Lane, the railway continues in cutting under the access drive to Stainley House and a field access bridge, which has been bypassed by the farmer by filling in the cutting adjacent to the bridge.

North of the farm bridge, the surrounding ground falls away, leaving the railway on embankment and taking it over the A61. The abutments and bridge over the A61 have been removed. The line then continues parallel with the A61, starting on embankment but falling gently into cutting at the south limit of Wormald Green. Through this section, the former railway crossed over one bridge, under two and had one level crossing.

At Wormald Green, the former track bed has been taken over by the adjacent properties including a plant nursery. Although no house buildings have been constructed on the former track bed, gardens and sheds etc have been. The former Wormald Green Station remains intact and has been converted into a private residence and cattery.

The railway crossed the road to Markington on a level crossing before turning north east, towards Wormald Green Tunnel. On approaching the tunnel, the railway entered a relatively deep and wide cutting adjacent to lime kilns and sidings at Monkton Moor Quarries. The railway cutting on both sides of the A61, the tunnel under the A61 and quarry has since been filled in by waste.

According to the Environment Agency, waste input to this site is thought to have commenced in 1973. Waste Disposal Licence NYCC RO32 was issued to North Yorkshire County Council on 23 September 1977 and operations ceased on 31 December 1986. Approximately 510,000 tonnes of household and commercial waste, 119,000 tonnes of industrial waste (including asbestos) and 212,500 tonnes of inert waste were deposited whilst licensed. It is understood that the cutting north of the A61 was only filled with inert material. The former quarry site has gas vents and is understood to be managed by YorWaste on behalf of NYCC.

Approximately halfway between the A61 tunnel and Monkton Moor Bridge, the cutting is once more revealed, and continues to the bridge.

4.1.4 Monkton Moor Bridge to Ripon (10+700 to 16+800)

As the track bed continues north towards Ripon, the surrounding ground levels out on the approach to the River Ure. As this occurs, the railway rises up onto an embankment which continues all the way to Ripon, passing over the various lanes around Bishop Monkton and Littlethorpe, except for Littlethorpe Lane which has been built on a slight ridge. The line returns to ground level and across Littlethorpe Lane via a former level crossing, with sidings to the south. There are currently eight properties which would be impacted by a reinstatement of the former alignment, with seven of these houses built on the former track bed. To the immediate front (west) of the houses is an area of mature trees and drives. To the immediate east, older houses continue on the north side of Littlethorpe Lane for at least 70m.

The embankment has not been maintained and has hence has become heavily vegetated. The exception to this is alongside Littlethorpe Park where gardens have been extended to include the eastern embankment face and half the former track bed. Some of these have been planted with trees while others have been cleared.

At Dallamires Lane, adjacent to the Ripon By-pass, the former track bed comes to an abrupt halt. The Ripon By-pass was constructed on the former alignment, utilising the railway's River Skell bridge. North of the River Skell, the By-pass diverts east of the former alignment and the old railway embankment forms a noise bund between the By-pass and residential properties of east Ripon. This bund is broken by Rotary Way and eventually ends at the southern abutment of the removed River Ure viaduct.

4.2 Ground Conditions

A review of the 1:50,000 solid geology map and 1:50,000 drift geological map was undertaken. This review revealed the following underlying geology:

- Central Harrogate is generally underlain by Millstone Grit series up to South Stainley crossing. A fault aligned south west to north east with a downthrow to the north west crosses the railway line at approximately Claro Road. The Millstone grit to the south of this fault is represented by rocks dating from around the Almscliff grit. To the north of the fault the rocks are younger and represented by a series of rocks between Addlethorpe Grit and East Carlton Grit. Further faults which cross the line have resulted in small outcrops of the younger Lower Magnesium Limestone just beyond Claro Industrial Estate (eastern edge of Bilton) and just to the south of Nidd. Two further long faults of similar orientation (SW to NE) cross the railway just to the north of Nidd and to the south of South Stainley. The railway also passes very close to but not through an outcrop of the Lower Magnesium Limestone just to the south of South Stainley.
- Central Harrogate has no recorded drift deposits on the geological map but it is likely Made Ground is present. Out towards Claro Industrial estate and Bilton the disused line passes into glacial till deposits before passing back into bedrock just to the north of the Nidd Viaduct. Just to the south of Nidd the line passes through a 1.3km section of undifferentiated fluvio-glacial terrace deposits before passing through two small sections of Glacial sand and gravel. The outlines of three glacial moraine features are also identified on and around the railway line in this location. The disused railway remains in Glacial Till until Moor End Farm to the north of Bishop Monkton although alluvium deposits are recorded running along side the railway between South Stainley and Wormald Green, crossing the railway at Wormald Green. A couple of small sections of line lack drift deposits to the north of Wormald Green exposing Lower Magnesium Limestone at the surface.

- To the north of South Stainley the railway passes through an outcrop of Lower Magnesium Limestone until it reaches Monkton Moor Bridge where it then passes into a short stretch of Middle Marl with evaporates outcrop and then Upper Magnesium Limestone until it reaches Ripon, where it passes back into the Middle Marl along the Ripon bypass.
- The review of the geological memoir for Harrogate produced by the Geological Survey identifies subsidence caused by the dissolution of gypsum in the Middle Marl in several locations either side of the disused railway between Ripon and Monkton Bridge (up to 40 cases in 150 years). It is not clear from the memoir if any of the subsidence is recorded on the line. The larger subsidence may be up to 20m deep and 30m across and have been felt locally as earthquakes caused by the roof plug of rock falling into the cavity. Many of the sink holes or hollows caused by dissolution have filled with superficial deposits such as peat and clay. The surface may appear flat but the bottom of the depression is a highly irregular series of intersecting conical depressions, each one representing a subsidence hollow. The infilled deposits range in thickness from a few metres to as much as 30m to 40m.
- To the north of Moor End Farm the line passes through 1km of silt and clay associated with glacial lake deposits. The line then passes into undifferentiated fluvial glacial deposits just to the west of Littlethorpe until reaching Ripon.

Extracts from the relevant memoirs and geological maps are included as Appendix B.

The key geological issues which therefore influence the choice of alignment and capital costs are;

- Dissolution of rock leading to subsidence over 4km of track. When the railway was built this would not have been fully understood. The chosen route to the east of Ripon would have been far more costly and risky than a route to the west.
- Soft alluvium deposits associated with the flood plains.
- Deep pockets of soft deposits in the dissolved rock hollows and sink holes leading to potential differential settlement.

4.3 Bridges

A review of the general condition of the structures was undertaken. The information on which the review was based was from inspections of some of the structures themselves, a review of the original engineer's line plan, and historical data collected from Network Rail archives or British Railways Residuary Board (BRB).

Where access was available, physical inspection of the structures was carried out. However, several of the structures were inspected from a distance as they were situated on private land with limited or no access. While all structures were considered, attention was focussed upon rail-over structures as these would be of more relevance for this study.

The line plan revealed that there were originally up to 32 structures between Harrogate and Ripon station of varying size and construction. A plan showing the locations of the original line structures is provided as drawing RT100. The majority of these structures are still in existence, and are mainly of single-span, masonry-arch construction. In a few locations, total or partial demolition has taken place, primarily at South Stainley where the line crosses the A61, and to the South East of Ripon where structures have been demolished or re-built as part of the A61 Ripon bypass. The options for replacing the bridge at South Stainley are discussed in section 5.6 of this report, whilst the structural requirements around Ripon are discussed as part of the various options appraisals set out in section 5.8.

The major structures on the original line comprise the 7-span Nidd Viaduct, the short tunnel north of Wormald Green, and the demolished Ure viaduct just north of Ripon. The Nidd viaduct is a Grade II listed structure; close inspection revealed that it is in excellent physical condition. The tunnel at Wormald Green has been long since infilled and buried as part of a landfill site. Therefore this structure was not inspected, and for the purposes of this report it was assumed that only minor works will be required. A replacement structure over the River Ure was not considered as this falls outside the geographical scope of this study and the proposed station locations at Ripon. Alignment options for station locations to the east of Ripon do allow for future reinstatement of the line northwards and provision of a new Ure viaduct.

The smaller structures inspected were found to be in good to excellent condition, without major defects. In fact, detailed site investigations coupled with strength assessments of the structures may well prove that many of these structures do not require strengthening works.

A breakdown of the possible works required and associated costs relating to each of the existing structures is presented in tabular format in Appendix C.

It was assumed that any new structures would be provided for a twin-track formation. Further cost savings could be achieved if single track structures were provided at other locations along the route.

4.4 Environmental

4.4.1 Methodology

This section provides initial environmental appraisal of the impacts associated with reinstating the former Ripon to Harrogate railway line. It assesses the environmental viability of the scheme by assessing both the construction and operational impacts of the railway. The appraisal is intended to inform both the feasibility design outputs and the construction process and provides information relating to the potential planning approach required for the scheme.

The appraisal was undertaken using a combination of desk study of existing reports and other available data, site inspection and consultation. No detailed technical surveys were carried out. The methodology followed guidance from the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 and DETR Circular 02/99 and DfT Transport Analysis Guidance (TAG – www.webtag.org.uk).

4.4.2 Constraints

Environmental constraints were considered in terms of both impact on humans and impact on the natural environment. Constraints were considered under the following categories:

- Landscape;
- Ecology;
- Archaeology and Cultural Heritage;
- Water Resources;
- Noise and Vibration;
- Air Quality;
- Traffic and Access;
- Land and Resource Use;
- Social;

- Cumulative Effects.

Detailed constraints information is summarised in Appendix D and on drawing RT07; each constraint is described in terms of:

- Location;
- Duration – whether temporary or permanent;
- Frequency – whether continuous, discontinuous or intermittent.

Outline summaries of the data presented in Appendix D are provided below.

4.4.3 Constraints Mapping

Data was plotted using ArcView version 9 Geographical Information Systems (GIS) mapping, mapped in a 300m corridor either side of the line. This distance is the maximum distance required to consider noise impacts to receptors from transport schemes based on TAG and is considered to include all of the potential receptors and environmental resources that are likely to be impacted by the scheme proposals in this study. In areas where offline proposals were considered (Bilton, South Stainley, Wormald Green and Littlethorpe) the corridor was widened to incorporate a 300m corridor for each of the additional options.

The Environmental Constraints Map is presented at drawing RT07 and identifies all of the constraints discussed in the summary text.

4.4.4 The Environmental Impact Assessment Regulations

The **Town and Country Planning (Environmental Impact Assessment)(England and Wales) Regulations 1999** ("the EIA Regulations") implement Council Directive 85/337/EEC as amended by Council Directive 97/11/EC on the assessment of certain public and private projects on the environment.

Under the Regulations, development that is considered likely to have significant effects on the environment must be subject to Environmental Impact Assessment (EIA) and an Environmental Statement (ES) submitted with the planning application.

Schedule 1 of the Regulations lists those developments for which EIA is mandatory, whilst Schedule 2 describes projects for which the need for EIA is to be judged by the Planning Authority against the criteria provided in Schedule 3, including consideration of whether the development is located wholly or in part in a sensitive area, as defined in regulation 2(1). If it is identified as Schedule 2 development **which is likely to have significant environmental effects** because of factors such as its nature, size or location, it is EIA development, and formal EIA is required. Where EIA is required, environmental information must be provided by the developer in an Environmental Statement. Schedule 4 specifies the information which must be provided in such a statement.

Construction of railways is covered by Annex II Section 10c of the EIA regulations, where EIA may be required. EIA is more likely to be required for new development over 2km in length (DETR circular 02/99). DETR Circular 02/99 gives guidance on the EIA Regulations. Whilst noting that the question of significant environmental effects needs to be considered on a case by case basis the guidance does provide a broad indication of the type and scale of development which is likely to be a candidate for EIA. Circular 02/99 also states that development affecting sensitive areas may also trigger the need for EIA.

While the railway exceeds the length noted by Circular 02/99, the proposed development is not within a "sensitive area" as defined by the Regulations[1]. However the route proposals would impact on several Sites of Importance for Nature Conservation (SINCs) and on the Area of Special Landscape Value at Ure Valley and Nidd Gorge, which increases the probability that the EIA thresholds would be exceeded and it seems likely that an EIA would be required. This view is shared by Harrogate Borough Council Planning Services.

4.4.5 Other Legislation

A number of minor water crossings occur along the proposed route of the Ripon-Harrogate railway line. Any new crossings would require licences from the Environment Agency.

Disturbance of protected species and habitats may require licences from DEFRA.

4.5 Environmental Baseline

4.5.1 Landscape/Townscape

4.5.1.1 Route Description

The line between **Harrogate and the River Nidd** is predominantly residential to the west, with open amenity grassland to the east of the line in the Bilton triangle. The route between the **River Nidd and South Stainley** is within open countryside and passes through ancient woodland at the River Nidd and further north at Sigs Wood. At Nidd village the former alignment cuts across the fast B6165 Ripley Road. Between **South Stainley and Monkton** Moor the route is mostly within open countryside although the railway line is closely aligned with the A61 at points along this stretch. At Wormald Green the line passes through the village and is now incorporated into the back garden of properties. From **Monkton Moor to Littlethorpe** the route is within open countryside until it reaches the village of Littlethorpe. From this point the line is within a mixed urban and rural landscape. Housing has developed up to the railway line and parts of the line are now garden. At Ripon, the former rail alignment is now incorporated into the bypass and passes at variable elevation around the east side of the city. To the west there are urban areas (including industrial and residential properties) whilst to the east is a mixture of industrial and rural areas.

4.5.1.2 Special Designations

The rail alignments between Bilton and the B6165 would fall within a designated Area of Special Landscape Value (ASLV).

Harrogate Borough Council has expressed their concern regarding impacts to the ASLV, which is defined in Harrogate Local Plan as:

THE NIDD GORGE FROM VIADUCT WOOD IN THE WEST TO THE B6164 KNARESBOROUGH - WETHERBY ROAD TO THE SOUTH EAST OF KNARESBOROUGH.

This area includes Old Bilton, Bilton Beck and Birkham Wood. The main feature which contributes to the high quality of the landscape in this area is the Nidd Gorge and the extensive areas of woodland associated with it, together with the landscape of small fields, hedgerows and hedgerow trees to the south of the Gorge. Birkham Wood in particular constitutes a prominent and important landscape feature in relation to a wide area of the southern fringes of Knaresborough and its approaches. The area as a whole plays an

[1] Site of Special Scientific Interest (SSSI), National Park, the Broads, Area of Outstanding Natural Beauty, World Heritage Site, scheduled monument, Special Protection Area (SPA), Special Areas of Conservation (SAC) and Ramsar Sites.

important role in the separation of the town of Harrogate and Knaresborough, and also in the landscape setting of Knaresborough.

The rail alignment at Ripon would fall within a designated ASLV (Drawing RT07). On line proposals would cross into the ASLV in this location.

URE VALLEY

This is an area centred on the valley of the River Ure between Little Studley and Ure Bank in the north and the B6265 Boroughbridge Road in the south and extending approximately from the line of the disused railway in the west to the summit of the ridge south-west of Sharow in the east. The main landform feature of this area is the Ure Valley itself and the low ridge to the east. The area has important belts and groups of trees throughout, particularly along the river bank. It includes attractive and important views of the Cathedral and the city from the Thirsk and Boroughbridge Road approaches.

Policy C9 states that

'Within these areas:

i) new development, or major extensions to existing development, which would have an adverse impact on the character of the landscape or the landscape setting of Harrogate, Knaresborough or Ripon will not be permitted; and

ii) Where development is permitted, high standards of design (including landscape design) and, where appropriate, measures to mitigate the impact of development will be required.'

4.5.2 Ecology

4.5.2.1 Special Designations

There are no International designations that apply within the proposals area.

A single Site of Special Scientific Interest (SSSI) is present to the south of Ripon at Quarry Moor. This site is on the periphery of the study corridor but is within 2km, which is the standard trigger distance suggested for consideration of possible effects on sensitive sites by Circular 02/99. Quarry Moor SSSI is also a designated Local Nature Reserve (LNR). SSSIs are protected under the Wildlife and Countryside Act 1984 (as amended), the Countryside and Rights of Way (CROW) Act (2000) and Local Plan Policy NC2.

Policy NC2

Proposals for development likely to have an adverse effect on a Site of Special Scientific Interest will not be permitted. Strict protection of these sites will be afforded in accordance with their national importance.

LNRs and Sites of Importance for Nature Conservation (SINCs) are protected by Local Plan Policy NC3. All designated sites within the proposals area are listed in Table 1.

Policy NC3

Proposals for development likely to have an adverse effect on a local nature reserve or a site of importance for nature conservation will not be permitted. Protection of these sites will be afforded in accordance with their district wide importance.

Development proposals in these areas will be accepted if there is a demonstrable need for the scheme.

Table 1 Designated ecological sites within the proposed rail corridor.
NB: Sites are listed approximately south to north. Ripon Parks SSSI is outside the current study area but close to the original Ure Bank Station. Bishop Monkton Railway Cutting SINC has been declassified on the north side of Monkton Lane.

Name	Grid Reference	Designation	Feature
Bilton Banks	SE308582	Proposed SINC to be merged with Spring Wood and Scotton Banks to form Nidd Gorge SINC	Magnesian Grassland
Spring Wood, Nidd Gorge	SE328877	SINC	Calcareous wood
Bishop Monkton Railway Cutting	SE312660	SINC Yorkshire Wildlife Trust site	Calcareous grassland
Littlethorpe Ripon Railway Line Embankment	SE318718 but 3 locations spread over a distance of approximately 4km	SINC	Calcareous grassland
Littlethorpe Manor Pond	SE317700	SINC	Open water
Ripon Canal	SE330684	SINC	Open water
Nicholson's Lagoons	Adjacent to canal	Currently undesignated	
Quarry Moor	SE309693	SSSI	Unimproved magnesian grassland limestone
Ripon Parks*	SE310750	SSSI	A series of rare habitats, including sections of both the river itself and associated land on the margins.

4.5.2.2 Railway Corridor

The Ripon-Harrogate line is considered to support diverse vegetation including many rare plant species including Thistle Broom Rape. The trackside SINCs including Bishop Monkton Railway Cutting and Ripon Railway Line Embankment represent previously rich areas of grassland, that are have developed on the calcareous geology. The SINCs are fragmented remains of a previously more extensive grassland wildlife corridor. The SINC sites are deemed to be the best remaining fragments of grassland along the route and are considered to be extremely ecologically valuable according to Harrogate Borough Council.

Bilton Banks is not designated at present but is being considered as having potential to be included in a combined SINC with Spring Wood and Scotton Banks based on the magnesian limestone flora that has developed at this location.

Offline proposals impact on field boundaries, causing damage to hedgerows. The status of the hedgerows was not identified during the study but cutting of hedgerows has potential to

impact on protected species both directly and indirectly by the severance of migratory pathways. Removal of hedgerows will require permission from Harrogate Council and the location of cuttings should include the advice of an ecologist.

4.5.2.3 Flora and Fauna Records

Harrogate Borough Council and NEYEDC have provided a list of records for the area; key points are summarised in Table 2.

Table 2 Summary of protected species and incidental ecological data on the Ripon to Harrogate Railway Line.
Refer also to consultation summary in Appendix D.

Location	Description	Record
Bilton	Scrub adjacent to track in Bilton triangle	Water voles sighted
Old Barber	West of the track to north of Bilton Lane	Slow worm population managed as an informal nature reserve
Old Barber	Disused tunnel under track.	Bats
Bilton Banks Woodland	-	Botanical interest
Oak Beck	-	Water vole
Nidd Viaduct	-	Possible bat roosts
Nidd Gorge	In vicinity of viaduct	Otter breeding reports
Nidd Wood		
Wormald Green	Beck between Wormald Green and south Stainley	Infested with giant hogweed and possibly Himalayan balsam.
Littlethorpe	Littlethorpe Manor Pond and Potteries, possibly along railway line	Great Crested Newts
Ripon	Wetlands to east of bypass	Potential for Great Crested Newts

It is illegal to cause or knowingly permit damage or disturbance to protected species.

4.5.3 Archaeology and Cultural Heritage

4.5.3.1 Special Designations

No Scheduled Monuments have been identified within the proposals area.

4.5.3.2 Listed Structures and Buildings

Seven listed structures are present on the former Ripon-Harrogate railway alignment, comprising bridges and the former Nidd Station Hotel. A summary of listed structures adjacent to or on the former alignment have been provided by Harrogate Borough Council Conservation Officer. These are summarised in Table 3 and plotted on the GIS mapping (Drawing RT07).

The impact these have on the alignment is discussed in Chapter 8.

Table 3 Summary of listed features on or directly adjacent to the former railway alignment

Location	Council Reference(s)	Feature(s)	Listing
Bilton	SE3157 4/60	3 Cottages	Grade II
Bilton	SE3157 4/3	Gardener's Arms Pub	Grade II
Bilton	SE3157 4/3a	Barn	Grade II
Bilton	SE35NW 546	Nidd Viaduct	Grade II
Nidd	SE25NE 4/47	Former Railway Hotel	Grade II
Nidd	SE35NW 5/48	South Lodge to Nidd Hall	Grade II
Nidd	SE35NW 5/49	Gates, gate piers and flanking walls at South Lodge	Grade II
Nidd	SE36SW 2/52-55	Nidd Hall and buildings	Grade II
Nr Birch House Farm	SE36SW 2/126	Milepost	Grade II
Wormald Green	SE36SW9/60	Milestone	Grade II
Littlethorpe	SE36NW 6/49	Thorpe Lodge	Grade II
Littlethorpe	SE36NW 6/50-51	Manor House and wall	Grade II
Littlethorpe	SE36NW 6/54	Church of St Michael	Grade II
Littlethorpe	SE36NW 6/52-53	Littlethorpe House and wall	Grade II
Ripon	SE37SW 7/244	Pendle House	Grade II
Ripon	SE37SW 7/213	Lock House	Grade II
Ripon	SE3170 5/168	Skell Railway Bridge	Grade II
Ripon	SE3171 1/153	Railway Bridge near Hillshaw House	Grade II
Ripon	SE3171 1/152	Railway Bridge near Recreation Ground	Grade II
Ripon	SE3171 1/151	Railway Bridge near the Beeches	Grade II
Ripon	SE3172 4/32	North Bridge	Grade II

4.5.3.3 Archaeological Features

Offline proposals involving excavation work or movements of heavy machinery have potential to impact on archaeological features both known and unknown. NYCC have identified areas of the line with potential archaeological significance (Table 4).

Table 4 Areas with potential to encounter unknown archaeology

Location	Likelihood of Encountering Unknown Archaeology
Bilton triangle	Moderate
Wormald Green	Moderate
Littlethorpe and Ripon	High

4.5.4 Traffic and Access

4.5.4.1 Construction Traffic

Reinstatement of the Ripon-Harrogate line would require significant construction works over the length of the line. One or more site compounds would be required to service the works. Construction traffic movements are not known at this time but it could be assumed that there would be additional movements of heavy vehicles over a period of months. The majority of roads along the route are narrow and rural in style. Access to the construction works is therefore likely to be provided from the main roads (the A61) and routed along the rail corridor. It should be noted that the A61 has known congestion and safety issues.

4.5.4.2 Operational Traffic

At present the main public transport link between Ripon, Harrogate and Leeds is the number 36 bus route. This is a high quality, frequent daily service. The reinstatement of the railway is likely to have an impact on the patronage of this service.

The flow of road vehicles should decrease when the railway is reinstatement as travellers switch onto the railway. The only exception to this is at Ripon station, where Park and Ride traffic could increase traffic locally around the station. The station should therefore be located with easy access to the main distributors around Ripon.

4.5.4.3 Other Traffic Impacts

A number of farm accesses would be impacted by the proposals and will require alternative access provision or the remodelling of farm operations and land boundaries. The exact extend of this is unknown at present and would require consultation with the landowners/farm tenants.

Vehicular access points to structures and the rail corridor are usually requested by Network Rail to assist in inspections, maintenance and renewal works. The location of these would need to be agreed during design development.

4.5.5 Air Quality

Harrogate Borough Council has not declared any Air Quality Management Areas (AQMAs) and air quality is generally considered to be high within the borough given its relatively rural status. However there is an acknowledged issue with air quality in Harrogate due to traffic congestion on the Skipton Road (NO_2/PM10) and in Ripon at Skellgate (NO_2). National Road Traffic Forecasts (low and high growth) suggests that traffic volumes will continue to increase within the borough.

Air quality impacts are considered over 200m distance from the proposed route. Given the strategic nature of the study, population data has not been examined, however the number of properties potentially affected by the proposals numbers in the low hundreds.

4.5.6 Noise and Vibration

The existing noise environment along the Ripon-Harrogate line varies between urban and rural.

- Bilton – Nidd: Minor road traffic noise.
- Nidd – South Stainley: Quiet rural areas, intermittently crossed by fast b roads and traffic noise. At South Stainley the main noise source is the A61.
- South Stainley – Monkton Moor: A61 road noise for a considerable length, then through quiet cross country areas.

- Monkton Moor - Ripon: Varies from quiet rural areas with minor B road traffic noise to significant traffic noise relating to Ripon Bypass, road network and B6265.

WebTAG guidance suggests that noise receptors should be considered within a 300 m corridor from the noise source. This is the width of corridor indicated in RT07 which includes populations in all of the urban areas along the route.

Sensitive receptors include properties in Bilton, Nidd, South Stainley, Wormald Green, Littlethorpe and Ripon. Particularly sensitive receptors include properties in Bilton, Wormald Green and Littlethorpe that are directly adjacent to the line.

4.5.7 Water Resources

4.5.7.1 Flooding

The former alignment crosses the Environment Agency indicative floodplain in the following locations:

Table 5 Floodplains within the route proposals.

Location	Grid Reference	Floodplain	Potential Effect
Bilton	SE307583	River Nidd	None due to height of Nidd Viaduct over River Nidd
South Stainley	SE304649	Stainley Beck	Former alignment and offline proposals would cross floodplain
Ripon	Widespread area	River Skell and River Ure combined floodplain	Dependent on route option selected, former alignment is above floodplain level until reaching River Ure. Offline proposals to east of Ripon would impact on floodplain.

The Environment Agency have stated that any works within the floodplain at Ripon would require modelling works to ensure that there was no increase in flood risk to others.

The Environment Agency is proposes to develop flood defences in Ripon in the North Bridge and Fisher Green Lane areas.

4.5.7.2 Surface Water

The former rail alignment passes or crosses watercourses in fifteen locations (Table 6) between Bilton and Ripon. New drains would be required for the embankment. Works in, over, under or within 8m of a riverbank or flood defences require prior written consent from the Environment Agency in addition to any planning approvals.

Table 6 Watercourses potentially impacted by the scheme proposals.

Location	Grid Reference	Description
Bilton	SE315572	Bilton Beck and rail drain adjacent to east of former alignment
Nidd Viaduct	SE307583	River Nidd viaduct crossing
Holme Bottom	SE301589	Approximately 0.1km from meander bend of River Nidd
Birch House Farm	SE300619	Small stream originates on opposite side of A61 from former rail alignment
South Stainley	SE303632	Tributary of Stainley Beck arises close to Inn east of former alignment

Location	Grid Reference	Description
North of Markington Crossing	SE303642	Alignment crosses tributary of Stainley Beck
Wormald Green		Crossing of culverted Stainley Beck
Hollins Hall	SE319672	Crossing of unnamed watercourse to east of hall
Moor End Farm	SE320679	Unnamed watercourse arises immediately east of former alignment
Littlethorpe	SE321688	Unnamed watercourse arises immediately east of former alignment
Ripon	SE320705	Crossing of Ripon Canal
Ripon	SE323703	Crossing of Ripon Canal
Ripon	SE322708	Crossing of River Skell
Ripon	SE319709	Crossing of River Skell
Ripon	SE319714	Unnamed tributary of River Ure arises immediately east of former alignment and bypass

4.5.8 Land Use and Resource Use

Commercial sheds have been built on the alignment immediately south of the B6165 at Nidd (although these are not considered to have formal planning permission by Harrogate Borough Council) and the Nidd Station hotel building now incorporates the alignment within its garden. Commercial premises in Wormald Green have also been constructed on the former alignment.

Bilton triangle is a possible location for overspill development in Harrogate.

North of Wormald Green the former cutting for the A61 underpass has been infilled with household waste including asbestos.

At Littlethorpe and Wormald Green sections of the railway embankment have been purchased and incorporated into gardens. Gardens face directly onto the line in Bilton.

At Markington Crossing the line passes through a Countryside Stewardship agreement area

Embankment works required for offline proposals would require significant volumes of raw materials to be produced and transported.

There would be a variable loss of agricultural land (predominantly grade 3) due to offline proposals, as well as loss of garden space and relocation of commercial premises.

4.5.9 Social - Recreation and Amenity

The line is a popular route for walkers, dog walkers and cyclists at Bilton and passes within metres of the rear of properties in a number of locations. Other footpaths are outlined in Table 7.

Table 7 Description of access routes affected by the proposals based on OS mapping.

Location	Description	Type of access
Bilton	Nidd Gorge to Bilton Sustrans footpath and cycle route and bridleway	Public footpath and bridleway
	Bilton to Nidd Gorge Nature Reserve footpath	Public footpath
	Line crosses over Nidd Valley footpath	Public footpath
Holme Bottom	Farmers access crosses line	Private track
South Stainley	Footpath between South Stainley and High Cayton Village	Public Footpath
	Footpath between Markington and South Stainley (within DEFRA sensitive area)	Public Footpath
	Footpath between Riseley and Wallerthwaite Village	Public Footpath
Wormald Green	Footpath to Markington	Public Footpath
Ripon	River Skell footpath	Public Footpath
	Former alignment crosses River Ure footpath	Public Footpath

North Yorkshire County Council Local Transport Plan (Consultation Draft) indicates that Sustrans are keen to pursue a Ripon to Harrogate cyclepath and the route is safeguarded for this purpose, however there are current issues with funding sources for this amenity.

There are potential health and safety issues relating minimum safe distances for a combined cyclepath and rail crossing at Nidd Viaduct.

Ripon Canal is designated as an Area of Concentration under Policy C10 of the Local Plan. Facilities related directly to the use of the river for recreation would be allowed provided that proposals meet certain environmental criteria. Works must be sensitive to landscape character, ecology, archaeology and history of the area.

4.6 Statutory Utilities Equipment

As part of the reinstatement, diversion of services would be inevitable. The costs of alterations were included in the cost estimate as percentage add-ons, based on similar projects. Although no services would have existed on the rail alignment when in operational use, the closure would have provided opportunity to lay services with minimal impact on agricultural or residential land. A Yorkshire Water pipeline at Nidd serves as an example of where this has happened.

A desk study of services within the project extents is required to identify any major service routes which could have a greater than average impact on the cost. These could include oil pipelines, major gas pipelines, fibre optics etc.

Statutory undertaker's equipment, which has been identified as part of this study, includes;

- Electricity Transmission lines at Bilton and South Stainley;
- Yorkshire Water Pumping Station at Wormald Green;
- Gas distribution chamber at Wormald Green.

It is highly unlikely that statutory services will provide obstacles which cannot be engineered out at a cost. This is highlighted in the Risk Register in Appendix G.

5. PROPOSED OPTIONS

This chapter describes the engineering issues of a number of options for re-instating the railway, both on-line and off-line.

Consideration was given to the route-wide specification of materials and operations before describing the engineering options. No comment is made on their relative merits; the chapter simply states the works required and the relevant features; the assessment of the options follows.

5.1 Track Specification

The specification of all materials is important at this stage in order to make a realistic estimate of unit rates and hence capital costs. While the majority of material costs will apply equally to all options, some would have significantly more of one type of works, for example level crossings or bridges; hence the unit rates have the potential to bias some options more than others.

One of the items which required consideration at this early stage was the specification of the track construction, as a significant length of track would be needed. Hence, it may have an impact on the financial viability of the project.

Two scenarios were considered:

- Network Rail standard mainline track, with low traffic volumes;
- An alternative, utilising best practice from Community Rail initiatives, experience abroad (e.g. in Germany) or heritage railways.

Network Rail categorises track according the line speed and traffic volume (GMTPA or Gross Mean Tonnes per Annum). At the suggested train frequency of 2 trains per hour for a 16-hour day, the route would have a GMTPA of approximately, 1.7M tonnes/year for a 3-car Class 170 or 0.9M tonnes/year for a 3-car class 142 (Pacer). The Standard defines these as low tonnages, so the resulting track category is derived from line speed, with category 6 < 20mph, category 5 < 60mph, category 4 < 75mph and category 3 < 90mph.

In order to meet JMP report's requirements (for an attractive modelled journey time), a journey time of 11 minutes would be needed for the 15km route length. This requires an average train speed of approximately 50mph. Taking into account acceleration and deceleration times, this would equate to a maximum line speed of approximately 75mph and hence a track category of 4.

It should be noted that the time taken by a Diesel Multiple unit train in 1961 was 14 minutes Harrogate to Ripon and 18 minutes Ripon to Harrogate (due to the gradient). The original alignment had a line speed of 70mph.

In order to meet the 90mph line speed identified in the brief, a track category of 3 would be required.

Track Categories 3 to 5 necessitate the following track specification, in line with Network Rail Company Specification RT/CE/S/102, Track Construction Standard:

- Serviceable 113A, 110A or 109 CWR rail or new 113A CWR if serviceable is not available;
- Steel sleepers at 650mm centres or serviceable concrete sleepers at 700mm centres;
- 200mm of ballast under concrete sleepers or 150mm under steel.

This specification does not relax until Category 6, which would require line speeds of less than 20mph. This would lead to unacceptably long journey times.

Experience on main line projects indicates that new Category 1 track costs approximately £500 per linear metre, of which £70 relates to a 350mm bottom ballast layer. If only the upper 200mm were needed, it would be reasonable to delete the bottom layer, and assume a linear rate of £430 per metre. It should be noted that all track must be laid on a prepared base which provides the minimum strength. Where virgin ground is to be cut or placed, additional ballast or ground strengthening may be required.

The availability of used serviceable rails and sleepers is difficult to predict as it is strongly influenced by availability, haulage costs and Network Rail's commercial stance. At this stage in the project, a conservative approach was adopted, assuming that little cost reduction would be achieved through the use of cascaded materials. The overall rate used was therefore £400/m.

It may be possible to specify track which is as safe as the Network Rail specification, but which takes account of the relatively light axle loads, non-freight status (this could exclude excursions unless they were multiple unit operated), modest line speeds, greater-than-average opportunities for maintenance, and potential relaxations in terms of ride quality. This reduced specification has come to the fore with the Community Rail initiative of the Strategic Rail Authority, and the formation of ACoRP (Association of Community Rail Partnerships). This initiative would allow parties other than Network Rail to own and manage single operator branch lines. The specification would still need to be approved by Her Majesty's Rail Inspectorate and be able to deliver a safe, comfortable, economical, fit-for-purpose solution.

There is currently little experience within the UK or re-engineering these track specifications due to the historical presence of Network Rail/Railtrack/British Rail. It is our view that these Category 3 to 5 specifications are unlikely to be relaxed further.

5.2 Train Control Options

In order to provide the aspirational 11 minute journey time and 2 trains per hour, the following options were identified for the track configuration and signalling;

- Option 1 – Single track line with no passing loop;
- Option 2 – Single track with basic passing loop, requiring one or both trains to stop;
- Option 3 – Single track line with dynamic passing loop, as recommended by JMP;
- Option 4 – Part double and part single track line;
- Option 5 – Double track branch with 2 platform station at Ripon (this was discounted by JMP based on the quantity of track, however it was revisited as it may provide simpler signalling and potential cost savings).

An outline signalling scheme was developed for Dragon Junction, with two variants:

- Option A – Signalling for junction with single line branch (Options 1 to 3);
- Option B – Signalling for junction with double line branch (Options 4 and 5)

The options are discussed in the following sections and presented on drawings RT008 and RT009.

5.2.1 Option 1 – Simple Single Line Branch

This would be the simplest and lowest cost option. Other than the arrangements at the junction with the Harrogate to Knaresborough line at Dragon junction (proposed Bilton Station), the

Ripon line would be single track with no additional facilities. A number of passenger-only branch lines are currently in this form.

In this option, only one train could be on the branch at any time. The frequency of service would be dictated by the cyclic time for a train to run from Dragon Junction to Ripon and back, before the next train could enter the branch.

Assuming the aspirational 11 minute journey time and with a turn-round time of 5 minutes, this would give a minimum branch occupation time of about 27 minutes. Actual occupation is likely to be longer than this:

- Longer terminal turn round times are desirable for timetable robustness;
- Turn round time will need to match the available train paths on the existing lines south of Dragon Junction. 5 minutes should be seen as an absolute minimum and would force a longer turnaround time (around 10 minutes) in the congested Leeds station.

Although it appears that this solution may theoretically offer the opportunity for 2 trains to run each way per hour, it is considered that this would provide an unacceptable level of redundancy in the timetable which would be dictated by physical constraints in Leeds. The reduction in journey time required (and hence increase in average line speed) to provide a robust 2-trains-per-hour service should be investigated in conjunction with the timetabling and infrastructure changes on the Harrogate to Leeds line.

To provide a simple single line from Bilton to Ripon, signalling provision (excluding Dragon Junction) would be minimal, consisting of a reflectorised fixed-distant signal board for trains approaching the terminal, and a fixed Red at the buffer stops.

The indicative signalling cost of Option 1 would be £10,000.

5.2.2 Option 2 – Single Line with Basic Passing Loop

In this option, a passing loop would be provided at a suitable point on the branch. This would allow two trains to pass, thus allowing closer headways and the opportunity to provide a half-hourly interval passenger service (or the opportunity to run additional trains beyond a basic 1 train per hour (tph) service).

In this option, a loop sufficient to accommodate the longest trains to be operated over the line would be provided. An indicative length for the loop would be 700 metres. The first train to arrive at the loop would have to stop to await the other reaching and passing through the loop. If both trains approach together, both would have to stop.

This is the simplest and lowest cost option for a 2 tph capacity. The disadvantages are:

- Additional journey time required while trains stop to pass each other (for timetable robustness, there would probably be further 'pathing time' allowance in the timetable), making the service less competitive with road;
- It introduces unreliability - if one train is late, the other would have to wait until it arrived and stopped, thus introducing a similar lateness into it.

Signalling Provisions (excluding Ripon and Dragon Junction):

Signals	6
Point ends	2

The indicative signalling cost of Option 2 would be £ 2.0 million.

5.2.3 Option 3 – Single line with Dynamic Passing Loop

In Option 3, a longer passing loop would be provided, allowing both trains to run directly into and out of the loop and pass each other on the move. This would have the advantage that journey time would be minimised and would give some flexibility when one of the trains was late, in that not all of the lateness of one train would be transmitted to the other. In simple terms the longer the loop, less overall lateness would be incurred.

It is conventional to timetable trains such that the drivers see only green signals when all trains are running perfectly to time. This convention impacts on the minimum length of loop, and indicative minimum length of which would be about 1 km, allowing for overlaps to the junction from the protecting signal, a signal spacing length, and the sighting distance to the first signal. However, this would only allow trains to pass at line speed when BOTH arrive at the loop at exactly the same time (whether on-time or equally late would be of no consequence). If there were a time differential between arriving times, one or both will be slowed or stopped to allow the crossing movement to be made.

If the loop were to be fully dynamic (to allow the two trains to pass without delay when one is a little late), it would need to be longer. To maximise service robustness, it would be desirable for the loop to accommodate several minutes of delay in one train before imposing any delay on the other. For each minute of delay to be accommodated, the length of the loop would need to be increased by about 1.4 km, assuming a 50mph line speed. Thus indicative loop lengths would be:

Minutes of delay to be accommodated	Indicative loop length
1	2.4 km
2	3.7 km
3	5.1 km
4	6.5 km

The location of the loop would ideally be determined by the optimum timetable requirements for the train service. This is likely to be determined by capacity and pathing on the route between Dragon Junction and Leeds. However, considering the branch in isolation, short dwell times at Ripon to maximise rolling stock utilisation would favour the loop being nearer Dragon Junction than Ripon.

Signalling Provisions (excluding Ripon and Dragon Junction):

Signals	8
Point ends	2

The indicative signalling cost of Option 3 would be £ 2.5 million

5.2.4 Option 4 – Branch Part Double and Part Single Track

The longer lengths of dynamic loop described in Option 3 above demonstrated that a dynamic passing loop could become quite long, and could result in the loop being very close to, or merging with, the double track approach to Dragon Junction. If this was the case, it would be desirable to combine the two, and provide a more significant length of double track. Option 4 reflects this, and would provide better operating flexibility, with fewer signals than Option 3.

Signalling Provisions (excluding Ripon Dragon Junction):

Signals	4
Point ends	1

The indicative signalling cost of Option 4 would be £ 1.25 million.

5.2.5 Option 5 – Double Track throughout

Providing a double track throughout provides the best possible protection from timetable perturbations. It also removes the safety issues associated with single track sections. A pair of crossovers would be required to provide access to two Ripon station platforms, or the station could provide simply a single platform face.

Signalling Provisions (excluding Ripon and Dragon Junction):

Signals	6
Point ends	4

The indicative signalling cost of Option 5 would be £ 2.5 million.

5.2.6 Two Platform terminus at Ripon

This could be added to Options 1 to 4. It would provide additional terminal capacity at Ripon, thus allowing two trains to be in the station at the same time. This could suit:

- Certain timetable situations, such as if very long layovers are needed at the terminus to make the rolling stock diagrams work;
- Operation of additional services at peak times;
- Operation of tourist excursions in addition to normal services;
- Provision of facilities to accommodate a disabled train without the need to suspend services.

Some of these facilities could also be accommodated by extending the platform to twice the length and allowing 'Permitted Working' where two trains can enter the same platform at the same time. The identification of an optimal solution will depend on an assessment of accessibility, land use, station usage and risk.

Signalling Provisions:

Signals	4
Point ends	1

The indicative signalling cost would be £ 1.25 million.

5.2.7 Dragon Junction Track and Signalling - Options A and B

Option A is an indicative signalling layout for Dragon Junction, incorporating a double track junction for the branch. This option assumes that once beyond the junction area, the branch would be single track (Options 1, 2 or 3). Option B assumes the same signalling layout on the Harrogate – Starbeck line, but that the branch would be double track, wholly or partly (Options 4 and 5).

It should be noted that it may be feasible to provide only a single lead to Ripon, however this has an impact on capacity on the Harrogate to Starbeck section of line.

The junction signalling overlaps with the existing signalling for Harrogate and Starbeck signal boxes, thus necessitating some signalling alterations at these boxes to interface with the new junction signalling.

Option A signalling

Signals	11
Point ends	5

The indicative signalling cost for Option A would be £ 4.0 million.

Option B signalling

Signals	9
Point ends	4

The indicative signalling cost for Option B would be £ 3.25 million.

5.2.8 Signalling Control

New interlockings would be required for the new signalling together with signalman's control. There are conventional manned mechanical signal boxes at Harrogate and Starbeck with which the new signalling would have to interface. The box at Harrogate is large and it would be sensible to locate the new signalling control in that signal box, where it could be operated by the existing signalman. Operation could be via a small conventional signalling panel or via VDU screen. A new interlocking would be required to control the new signalling.

5.2.9 Level Crossings

Level Crossings existed on the former alignment at the following locations:

- Bilton Lane (currently 30mph speed limit)
- Ripley Road, Nidd (currently national speed limit – 60mph)
- Wormald Green (currently 40mph speed limit)
- Littlethorpe Lane (currently 30mph speed limit)

In addition to this, user worked crossings, footpath and bridleway crossings may have existed in other locations. One of these can still be seen between South Stainley and Wormald Green.

If the line was reinstated on its former alignment, these level crossings and other crossings would also need to be reinstated. The original level crossings were likely to have been manned, full-width gates and interlocked with the signalling system. This type of level crossing still exists (locally between Knaresborough and York), but they are expensive in terms of manpower and are being phased out due to safety concerns over road vehicles hitting the gates or the operator, and reliability and the availability of spares. The accommodation crossing would have been user worked either by line of sight or via a telephone to the signalman.

The hierarchy of modern level crossings is broadly (starting with the least safe):

- Gated, user worked. The signalman is phoned prior to opening the gates. The gates are closed by the user after crossing;
- Automatic Barrier Crossing, Locally Monitored (ABCL). These crossings have visual and audible warnings. The approaching driver must be able to stop within his sighting distance if the crossing is blocked. Never to be used for line speeds greater than 55mph;

- Automatic Half Barrier Crossing (AHBC). These crossings have visual and audible warnings. A telephone is provided to the signalman in case of blockage;
- CCTV Monitored Barrier Crossing. These crossings have full barriers and visual and audible warnings, and are monitored remotely by the signalman via CCTV.

In light of the considerable amount of money currently being spent by Network Rail to remove or upgrade level crossings, and opposition by the HMRI and NYCC to new level crossings on other schemes, it is considered that if a new level crossing were proposed, it should provide a very high degree of safety. The rail line speed proposed (50 to 90mph) is reasonably high and traffic volumes on all the roads concerned are not insignificant. From experience on other schemes, it was estimated that the cost of a CCTV controlled full-barrier crossing would be in the order £1.0m. This would include two, 3-aspect signals on the approach to the crossing in each direction, additional track circuits or treadles, barriers and lights, the crossing itself, road signs, CCTV cameras, telemetry and monitoring back to the signal box, a CCTV monitor in the signal box and a new power supply (and backup) at the crossing. This cost would exclude any major highway improvements required to improve safety and sighting distances at the crossing or the on-going cost of testing, monitoring and maintaining the crossing.

Considering the suitability of reinstatement of the level crossings in turn;

- Bilton Lane. The reinstatement would have a visual and audible impact on adjacent residents and would require the new line to follow the former alignment, due to the longitudinal gradient of Bilton Lane as it falls to the east. It is considered that the initial capital cost between the Level Crossing and a bridge may be comparable.
- Ripley Road (Nidd). The reinstatement would require the purchase of both the adjacent properties, or a significant proportion of their land. The level crossing would be located to the immediate east of a bend in the road, where visibility distances are in the order of 100m, corresponding to a design speed of 30mph, or 40mph at 'one step below minimum' as defined by the Design Manual for Roads and Bridges.
- Wormald Green. The reinstatement would require the purchase of six properties, or a substantial proportion of their property. The visibility from the west (the A61) is very poor, as it the ability for traffic to queue while the barrier is down. The package of works require to realise a level crossing is discussed further in section 5.7.

The former location of user worked, footpath and bridleway crossings are not clear and hence no allowance has been made in this study to consider their reinstatement. The HMRI and NYCC's approach to a new accommodation crossing, particularly one of lesser standard than a public road crossing is unlikely to be favourable. For the purposes of this study, accommodation crossings have been specifically excluded from the cost estimate. They are included in the Risk Register in Appendix G. The location, number and arrangements for land access will only be identified once land ownership boundaries, severance and any potential reallocation of land packages can be identified.

5.2.10 Summary

In order to identify the 'best' solution, these signalling options need to be considered in conjunction with the other works costs to determine the complete cost of each option. It was assumed that all bridges, earthworks etc., would be designed to accommodate the long-term aspiration of a twin-track railway throughout, and that the minimum train frequency would be 2 trains per hour as identified by JMP. It was also considered that Option 2 would not achieve the journey time or timetabling robustness required.

The shortlisted options shown in Table 8 show that Option 4 would provide the cheapest option, with incremental additions of:

- £1.64 million (£2.74m - £1.10m) would provide two platforms at Ripon,
- £2.20 million (£3.30m - £1.10m) would provide greater timetable robustness,
- £9.53 million (£10.63m – £1.10m) would provide two tracks between Dragon Junction and Ripon and two platform faces at Ripon. This compares with JMP/CDL's estimate of £13.28 million extra cost for a double line from Harrogate to a terminus at Ripon. This reduction in extra-over cost reflects the simplification in the signalling system which occurs from two tracks.

For the purposes of the cost estimate, Option 4 with two platform faces at Ripon was considered the 'Base Case'. This would have a total signalling cost of £1.25m (Option 4) + £3.25m (Option B) + £1.25m (2 platforms at Ripon) = £5.75m. This compares with the JMP estimate of £14m for signalling and four level crossings.

Table 8 Shortlisted Signalling Options

Option	Signalling Cost	Plain Line Cost	Turnout Cost	Total Additional Cost for 1 Ripon Platform	Total Additional Cost for 2 Ripon Platforms
3 – Dynamic Passing Loop with no delay allowance	£2.5m	£0.60m	£0.36m	£3.46m	£5.10m
3- Dynamic Passing Loop with 4 minutes delay allowance	£2.5m	£2.80m	£0.36m	£5.66m	£7.30m
4 – Section of Double Track at Bilton with no delay allowance	£0.5m	£0.60m	0	£1.10m	£2.74m
4 – Section of Double Track at Bilton with 4 minutes delay allowance	£0.5m	£2.8m	0	£3.30m	£4.94m
5 – Double Track Railway with total delay allowance	£2.5m	£6.45m	£0.54m	£8.99m	£10.63m

Notes.

1. The cost is given as an extra-over cost to Option 1 – the single line track with a double junction at Dragon Junction.

2. Based on a 15km line length.

5.3 Introduction to the Options – The Naming Process

In order to aid the reader, the route options were given prefix letters, on the following basis:

- B series – layout options in the Bilton area;
- N series – layout options in the Nidd area;
- S series – bridging / structures options in the Stainley area;
- W series – layout options in the Wormald green area;

- R series – layout options in the Ripon area.

Also for ease of comprehension, it was decided to name as the "Base Option" the one that would re-use the existing formation. This option would always be "Option 1" within each geographical length; there is no implication that this would be the cheapest or most favourable in any particular location.

5.4 Harrogate to the River Nidd Alignment Options (B Series)

Between Dragon Junction and chainage 3+000, the former track bed is largely intact and undeveloped. On and offline alignments were developed due to the following concerns;

- Environmental – visual and noise impact on the adjacent residents
- Safety – the consequences of trespass
- Safety – the consequences of a road vehicle or pedestrian being struck by a train at a level crossing.

For these reasons, options B1 to B6 were developed. These options are shown on drawings RT10 and RT15 to RT18.

5.4.1 Option B1 (Base Option)

This option would follow the original alignment of the Harrogate to Ripon railway. The line would leave the existing Harrogate to Knaresborough railway at the former Dragon Junction. It would then curve round adjacent to Bilton, close to housing. The alignment would fall from south to north as the surrounding ground undulates, leading to a varying height of embankment. The alignment would cross Bilton Lane at the same level as the road before continuing on embankment to Nidd viaduct.

This option would require minimal land take and earthworks and would not require any new structural works apart from upgrading existing structures 49 and 50 already identified. A level crossing at Bilton Lane or closure and diversion of the road would be required. The alternative route to Bilton Dene via the private Bilton Hall Drive/cycleway is understood to have been closed for traffic-calming purposes and, through negotiation with the owners, may have the potential to be re-opened for Bilton Dene traffic. A footbridge could be provided if it was desired to limit pedestrian severance between Bilton and the Bilton triangle. The closure of the road would have the advantage of eliminating the security and safety issues associated with a level crossing.

5.4.2 Option B2

This option would follow a similar alignment to the original alignment but would be about 10m further east to allow for additional landscaping to reduce the visual and noise intrusion. It would rejoin the original alignment (and Option B1) prior to crossing Bilton Lane.

A new embankment and pedestrian underpass would be needed adjacent to the existing, requiring additional land take and earthworks. The proposed form of structure would be simple precast concrete rectangular box sections with end walls faced in masonry. Upgrade work to structure 49 would no longer be required.

Landscaping and noise fencing could be provided between the housing and Option B2, on the residential side of the railway, with the potential to retain a footpath / cycleway for recreation. Similar alternatives at Bilton Lane to those described in Option B1 exist.

5.4.3 Option B3

This option would initially be similar to Option B2, but would then curve slightly further east, to move even further away from the residential area. It would then run further east at Bilton Lane, which would be retained on its existing horizontal alignment but would be lowered to avoid the need for a level crossing; the railway would pass over the Lane on a bridge. The rail to structural soffit dimension would be critical to minimise the vertical re-alignment of Bilton Lane. Therefore the proposed structural solution would be a simple steel U-deck with a steel concrete composite floor slab and a reduced ballast depth of about 250mm to achieve a rail to soffit depth of about 850mm. Option B3 would require additional land take for the new embankment and the cutting for the lowered road, as well as an additional bridge. The road may also need to be widened to bring it up to current standards. By moving the railway further from the residential area, this option would also reduce the number of properties that would be affected by noise and visual intrusion

Option B3 would require a replacement subway structure along the line of the existing footpath, the form of structure proposed would be the same as for option B2. The new alignment would also cross an existing farm access track adjacent to structure 50. It is assumed that a new access subway would be required, which would again be simply formed of precast concrete rectangular box sections with end walls faced in masonry. Upgrade works to structures 49 and 50 would no longer be required.

5.4.4 Other Options

A number of other options were considered. These would progressively move the proposed alignment further east, away from Bilton, by branching off the Harrogate to Knaresborough railway further towards Starbeck. These options would incorporate increasingly tighter radius alignments to turn towards Nidd, with variations as to whether Bilton Lane would be crossed at the original level crossing location or at a point which would allow the railway to pass over the road on a bridge. These are represented as Options B4, B5, B5a, B6 and B6a.

Option B6 would be the most extreme and would maximise the buffer between the residential properties and the railway line, maximise the use of the southeast/northwest former railway corridor and minimise the area bounded by the proposed railway lines and the southeast/northwest former railway corridor. The minimum radius would be 250m, which would be consistent with a 30mph line speed, compared with a line speed of 60mph for options B1 to B3.

Options B4 and B5 would provide possible compromises between the distance from the houses and tightness of the alignment radius, but with the disadvantage of severing the available land for development. Harrogate Borough Council planning department advised that connectivity with Bilton triangle would be a higher priority than connectivity between the triangle and Bilton estate.

Options B5a and B6a would allow the railway to pass over Bilton Lane, similar to Option B3, to avoid the need for a level crossing or road diversion.

Whilst Options B6 and B6a would have the advantage over the other options of utilising existing railway and embankments and moving the railway further from the residential area, this would be outweighed by the disadvantages of increased journey times, increased cost due to the extra length, and the possibility of flange/wheel squeal. Options B4, B5 and B5a would have similar disadvantages and would also divide the triangle land into less attractive areas for future use. These options were therefore not developed further.

5.5 The River Nidd to South Stainley Alignment Options (N Series)

Between chainage 3+000 and chainage 6+500, the former track bed is largely intact and undeveloped with the exception of Nidd. On and offline alignments were developed due to the following concerns;

- Environmental – visual and noise impact on the adjacent residents;
- Social – the potential severance of the village of Nidd;
- Safety – the consequences of a road vehicle or pedestrian being struck by a train at a level crossing.

For these reasons, options N1 to N6 were developed. These options are shown on drawings RT11 and RT20 to RT25.

5.5.1 Option N1 (Base Option)

This option would follow the original alignment. It would utilise the Nidd viaduct, pass to the east of Holme Bottom farm, and continue along an embankment through Ripley valley and past the location of the former Nidd station next to Ripley Road. It would then pass west of the village of Nidd, pass under Nidd Lane and Green Lane road bridges, and would then head north towards South Stainley. In general, the railway would be reinstated on the former alignment with minimal land severance.

Option N1 would sever the access to Holme Bottom Farm. An alternative access would need to be provided either by means of a new access road off Ripley Road or a new bridge over the railway close to the location of the current access. An access bridge would require land take for the bridge and associated access ramps. An access road would need to be 2 lanes, or one lane with passing places over a length of approximately 1100m.

Reinstating the railway along its former alignment through Nidd would require the demolition of a number of commercial buildings located next to Ripley Road currently being used by HACS Construction and S&B Utilities Ltd.

At Ripley Road, two sub-options would be possible: a new level crossing or a road diversion to a bridging location. Ripley Road could be diverted approximately 200m south, away from Nidd cottages and a road over rail bridge could be provided. The new road alignment would be approximately 1000m in length and would cut through farmland, climbing over the railway to provide the sufficient grade separation. The western section of the former Ripley Road could be used for local access, and closed to through traffic. The eastern section could be used as local access to Nidd Hall. The bridge form would attempt to replicate some the original features of other existing structures. In this instance, the bridge would be constructed from precast concrete arch units faced with masonry. The spandrel walls and parapets would be designed to high containment standards in line with current practise.

Further north, the railway could pass under the existing Nidd Lane and Green Lane road bridges.

5.5.2 Option N2

Option N2 would pass to the west of the former railway line, crossing the river Nidd at two locations before crossing Ripley Road approximately 500m to the west of the former railway. The alignment would pass to the west of Flat Farm before crossing Nidd Lane and rejoining the removed railway line south of Green Lane bridge.

This option would require 2 river bridges over the river Nidd, and either a level crossing or road bridge where the railway would cross Ripley Road. For either of these options at Ripley Road, earthworks would be required to either create the same levels for both the railway and road to allow a level crossing, or place the railway in a cutting to allow a road bridge. This

option would cross Nidd Lane where a level crossing or road bridge would be needed. As Nidd Lane is a minor road and traffic could be diverted via other roads, an option here could be to close Nidd Lane to through traffic.

It is considered that the increased structural requirements make this option uneconomic compared to the others.

5.5.3 Option N3

As with Option N2, Option N3 would run west of the removed railway line. Unlike Option N2, it would not cross the River Nidd, but would pass between the river and Holme Bottom Farm, before crossing Ripley Road approximately 300m to the west of the former railway. The new alignment would pass to the east of Flat Farm and cross Nidd Lane before rejoining the removed railway line south of Green Lane road bridge.

This option would require earthworks where the railway alignment would pass between Holme Bottom Farm and the River Nidd, also access would need to be provided to farmland severed by the new railway alignment. As with Option N2, either a level crossing or a road bridge would need to be provided where the railway crosses Ripley Road, and as with Option N2, the proposed railway would cross Nidd Lane.

It is considered that the impact on the flood plain would make these options undesirable compared with Option 4. This option was therefore not considered further.

5.5.4 Option N4

Option N4 would, like Option N3, pass to the west of the former railway alignment. However, it would pass to the east of Holme Bottom farm on the alignment of the former railway before deviating away from the village of Nidd, crossing Ripley Road approximately 270m from the former railway alignment before rejoining the former railway alignment south of Green Lane road bridge

As with Option N1, access would need to be provided to Holme Bottom Farm as the railway would prevent access via Ripley Road. Earthworks are likely to be required between Holme Bottom Farm and Ripley Road as the new alignment would deviate from the former railway line which was on an embankment at this location. The railway would cross Ripley Road where either a level crossing or a road bridge would be needed. As with Options N2 and N3, the railway would cross Nidd Lane.

Some significant differences in alignment could be achieved by reducing the line speed through this section to 50mph.

5.5.4.1 Option N4 (90 mph)

This option would deviate from the former railway alignment north of Holme Bottom Farm. Here earthworks would be required to allow the railway to pass through Ripley valley off the former railway embankment. The new alignment would cross Ripley valley and enter a cutting to allow the railway to pass under Ripley Road approximately 270m west of its current location.

Ripley Road currently rises at a gradient of approximately 1 in 85 as it heads west from Nidd cottages towards Ripon Road. Where the railway would cross Ripley Road, a new road bridge would be required on the current alignment of Ripley Road. The construction of this bridge would cause disruption to traffic on Ripley Road; however diverting the road to allow a new bridge to be built off-line would require additional land take; a number of mature trees would also need to be felled. A possible temporary road closure could be achieved by diverting traffic to an alternative route while construction of the new road bridge and associated works took place.

After passing beneath Ripley Road, the railway would emerge from the cutting and cross Nidd Lane. Here Nidd Lane could be closed to through traffic as there are alternative routes that vehicles could take from Ripon Road to Ripley Road. The new railway would rejoin the former railway alignment south of Green Lane. The proposed alignment would cut through farmland for a length of approximately 3 km approximately at ground level.

As with Option N1, access to Holme Bottom Farm would be required. If an access road were preferred, the total length would be approximately 1200m and could run alongside the new railway alignment. An access bridge would be as for Option N1.

Option N4 would also require a new overbridge to be constructed to carry the Ripon Road which would be partially diverted to allow the bridge and approach embankment construction to take place. The form of the new structure would be as for Option N1. A new farm underpass would possibly be required adjacent to existing bridge 52. However, it may be possible to align the route diversion to make use of the existing structure on the disused spur line to Pateley Bridge. If a new structure were required, it would be formed of simple pre-cast box units as for previous similar structures. Upgrade works to existing bridges 52, 53, and 54 would no longer be required.

5.5.4.2 Option N4 development (for 50 mph)

As with the option for 90mph, this alignment would deviate from the former railway alignment north of Holme Bottom Farm, cutting through Ripley valley towards Ripley Road.

The lower line speed could utilise tighter curve radii, and hence it would be possible to produce an alignment that would require much less deviation from the former railway. The new railway would still be required to deviate away from Nidd cottages by approximately 270m to allow the railway to pass beneath Ripley Road, but it could rejoin the former railway alignment south of Nidd Lane, which could remain open to traffic.

As with the 90mph option, a road bridge would be required at Ripley Road. The new railway alignment would cut through farmland for a length of approximately 2000m.

5.5.5 Option N5

In Option N5, the proposed railway would be diverted approximately 100m to the west of the former alignment at Ripley Road, thus bypassing Nidd cottages and the nearby commercial premises at the location of the former Nidd station before rejoining the former railway alignment south of Nidd Lane. This alignment could achieve a line speed of 90 mph. The alignment would cut through farmland for a length of approximately 1600m.

As with Option N1, alternative access would need to be provided to Holme Bottom Farm. Ripley Road would be closed to through traffic and used for local access. It would be diverted to the south as in Option N1, where a road over rail bridge would be provided. As with Option N1, a bridge would be required to carry Ripley Road over the proposed railway; but the lower vertical alignment would achieve cost and land savings.

5.5.6 Option N6

Option N6 would pass to the east of the former railway alignment. It would follow the former railway line until the location of the former Pateley Bridge junction line near Holme Bottom Farm. The new alignment would cross Ripley Road approximately 80m to the east of the removed railway line, passing through the grounds of Nidd Hall before rejoining the former railway alignment south of Nidd Lane.

This option would require a level crossing at Ripley Road. Earthworks would be required through the grounds of Nidd Hall as the ground is significantly higher than the railway at this location.

5.6 South Stainley to Monkton Moor – Options for the Reinstatement of South Stainley A61 Bridge (S Series)

At South Stainley, the existing A61 passes under the old railway alignment. Originally, there was a single-span, masonry-arch structure with a highly skewed highway alignment. After the closure of the line, the bridge was demolished, the abutments removed, and the approach embankments regraded to improve the highway geometry and visibility.

Visibility measurements were taken from the OS mapping. These indicated that the forward visibility is substandard (as defined by the Highways Agency's Design Manual for Roads and Bridges) and the visibility for traffic turning out of the adjacent lane is also substandard. In order to achieve the desirable forward visibility, and junction visibility, the road speed would need to be reduced to 30mph (from its currently 60mph). These effects are illustrated on drawings RT101, RT102 and RT103. With reprofiling of the embankment, modest land purchase, and realignment of fencing, this could be increased to 40mph. Road speeds above 40mph could only be achieved through road realignment as the resultant bridge spans would become excessive. The design speed of 40mph was therefore used for the purposes of this study.

Three outline options for a new bridge structure were considered. All would be feasible within established technology. The options show the main construction types and the potential compromises between aesthetics, simplicity and span.

5.6.1 Option S1 (Single Span Skew Steel Through-Girder)

This option is shown on Drawing RT105

The likely span arrangement would be a single 60° skew span of approximately 30m. The deck construction would consist of 3 longitudinal girders arranged to minimise the depth of the floor construction and would therefore minimise the rail to bridge soffit level. The required headroom under the bridge would be 5.7m to avoid considering impact load requirements on the bridge superstructure.

The bridge abutments would be reinforced concrete cantilever walls on piled or spread footings. Long approach wingwalls would be required to contain the railway embankment on the bridge approaches creating a rather overbearing structural form with a "closed in" appearance. All concrete substructure elements would probably be faced with masonry to suit local planning requirements.

5.6.2 Option S2 (Three Span Steel Through-Girder with Square Abutments)

This option is shown on Drawing RT106.

The likely span arrangement would consist of staggered 30m spans with 45° skew to the intermediate pier positions. The end supports would be formed of simple square abutments. The deck construction would consist of a pair of longitudinal girders with a steel composite beam and slab floor. This form of construction would have a greater rail to soffit depth than Option S1 because of the increased span of the floor construction, but it is likely to be more efficient in terms of steel quantities per square metre.

Intermediate piers would be simple circular columns dimensions to resist vehicle impact loading and the abutments would be simple reinforced concrete pads sitting at the top of the earth embankments. With this option, only short sections of retaining wall would be required on the bridge approaches, thereby opening up the whole aspect of the bridge and improving sightlines for drivers on the A61 below.

5.6.3 Option S3 (Single Span Steel Trussed Tied Arch)

This option is shown on Drawing RT107.

The span arrangement shown would give a clear span of about 50m, being the shortest span in order to achieve square abutments. The arch would be dimensioned to give a span to rise ratio of about 5:1 which would be the most efficient arrangement for a parabolic arch structure. Trussed hangers would be used in lieu of vertical hangers in order to improve the stiffness of the structure under asymmetric and dynamic loadings.

As in Option S1, fairly long sections of wall would be required to retain the embankment earthworks although these would be reduced in size in comparison to Option S1. The overall impression of the bridge would be quite open, and the arch structure would give a much lighter appearance than heavy through girders and a more attractive profile.

5.7 South Stainley to Monkton Moor - Wormald Green Alignment Options (W Series)

Between chainage 6+500 and chainage 10+700, the former track bed has been used by gardens at Wormald Green, and infilled either side of, and through, Wormald Green Tunnel. On- and off-line alignments were developed due to the following concerns:

- Environmental – visual and noise impact on the adjacent residents;
- Social – the consequences of surrounding the properties at Wormald Green by transport corridors;
- Risk – the reinstatement would require the cooperation of the current residents or legal powers;
- Safety – the consequences of a road vehicle or pedestrian being struck by a train at a level crossing and the knock-on effect on the A61.

For these reasons, Options W1 to W3 were developed. These options are shown on drawings RT12 and RT40 to RT43.

5.7.1 Option W1 (Base Option)

Option W1 would follow the original alignment. From the Harrogate direction, the railway is in a cutting up to 6m deep; it has been filled in over a 200m length by the current landowner. The option would use the former alignment, and would pass close to the rear of approximately 12 properties. These properties have utilised the former railway corridor for gardens and associated development. The old station is now in residential and commercial use. The most southerly property in Wormald Green is a plant nursery, which uses the former alignment as ponds.

The alignment would then cross the road to Markington on a level crossing. Due to the proximity of the level crossing to the junction of the A61 and the Markington road, a signalised road junction would be required to accommodate traffic queuing when the level crossing is closed to road traffic. The layout would extend the existing right turn lane from the A61, widening to provide a left-turn lane from the Harrogate direction, and installation of traffic islands and signals.

The route would then pass over Markington Beck across more open farmland. Bridge 63, which used to carry the railway over Markington Beck, would need to be rebuilt as a simple underline bridge over an existing watercourse. The probable form of construction would be either a reinforced concrete slab on integral wall abutments or pre-cast concrete rectangular culvert units. Headwalls would be faced in masonry.

The former cutting and sidings, which were up to 8m deep, have been filled in with various materials and would need to be excavated and the material appropriately disposed of. In the worst case, the whole landfill site would need to be excavated and the waste disposed. It

would be more likely that a licence would be granted to the contractor to remove some of the waste and recap the land fill site. This was assumed for all the Wormald Green options.

The alignment would then pass under the A61 through a short tunnel.

5.7.2 Option W1a

Option W1a would utilise the same alignment as Option W1, but would avoid the level crossing by diverting the road to Markington to the south, over a reconstructed bridge 62 over the railway, to rejoin the A61 south of Wormald Green. This would increase the land requirements and disruption, but would avoid the implications of a new level crossing.

5.7.3 Option W1b

Option W1b would utilise the same alignment as Option W1, but would divert the road to Markington to the north of Wormald Green, over a bridge over the railway, to rejoin the A61. The existing bridge at the south end of Wormald Green, which would be utilised in Option W1a, would require reconstruction to provide farm access over the railway. Due to the additional bridges required, Option W1b would not appear to have any benefits over W1a and hence was not developed further.

5.7.4 Option W2

Option W2 would leave the old alignment at Markington Crossing, and pass to the west of Wormald Green, under the road to Markington. The alignment would then curve through farmland to rejoin the old alignment prior to passing under the A61 in the tunnel.

It would avoid the residential properties in Wormald Green, and avoid the need for a level crossing on the Markington road. It would require more engineering works and increased land take. It would also increase visual intrusion on the landscape, although the railway would be in cutting for much of its length around Wormald Green.

A new road over rail bridge would be required. This would be a simple pre-cast concrete masonry-faced arch. A culvert would also be required to cross the watercourse with a short section of the watercourse realigned in open ditch. Upgrade works to existing bridges 61, 62, and 63 would no longer be required.

5.7.5 Option W3

Option W3 explored the opportunity of passing to the east of Wormald Green. It would leave the old alignment well south of Wormald Green, and cross over the A61. The alignment would then cross Markington Beck and its associated flood plain before recrossing over the A61 and passing close to the east of Wormald Green.

To the east of Wormald Green, the ground conditions and flood issues might be problematic. Adjacent to the Markington Beck, the underlying alluvium would settle over time due to the train loadings. A foundation solution (e.g. mini-piles) would need to be developed to avoid differential settlement. Compensatory flood storage would also undoubtedly be required.

The alignment would then cross open land that may have been used for landfill before rejoining the old alignment prior to passing under the A61 in the tunnel.

This option would have some large environmental impacts on the flood plain and the landfill areas, and would give little engineering benefit over Option W2. It was not developed further.

5.8 Monkton Moor to Ripon Alignment Options (R Series)

This section covers possible alignment from approximately chainage 13+000 to the northern end of the study area.

A number of alignment options are shown on drawing RT13 and drawings RT30 to RT35. These consider the main challenges to be faced namely:

5.8.1 Initial Considerations on this Length

There were a number of issues and challenges on this length of route:

- The location of Ripon Station;
- The existing properties at Littlethorpe;
- Crossing Boroughbridge Road and the associated developments of east and south east Ripon;
- Ground Conditions and Flood Plain.

It became clear that the station location would tend to "drive" the location of each option, so each "R Series" option consists of one alignment leading to a particular station location. Five station locations were considered, and hence five "R series" options were derived. In addition to the route location issues, there are a number of separate issues associated with the stations themselves: parking, foot and vehicular access, passenger facilities etc. These issues are discussed in Chapter 6.

The Location of Ripon Station

Five station locations were considered. These locations attempted to meet a number of criteria:

- Minimise walking distance to the City Centre;
- Minimise walking distance to residential areas;
- Minimise walking distance to commercial and tourist areas;
- Maximise the potential for associated development;
- Maximise the potential for Park and Ride road access;
- Integrate with the development plan for Ripon.

Two options are shown east of the City Centre, either on the west of the By-pass, on elevated structure, or east of the By-pass with greater potential for associated development, parking etc.

Four options are shown south of the By-pass. These options are located close to existing road junctions, to improve accessibility; however locations between those shown may also have merit.

The existing properties at Littlethorpe

The alignment options considered three scenarios:

- Compulsory purchase of the properties on the former track bed and reinstatement of the former alignment. It was assumed that the reinstatement would be at-grade, with either the level crossing reinstated or a new road overbridge.
- A diversion of the line to the west through agricultural land, either to a new station south of Ripon or to return to the former track bed north of Littlethorpe.
- A diversion of the line approximately 85m to the east, through a gap in the houses along Littlethorpe Lane.

Crossing Boroughbridge Road and the associated developments of east and south east Ripon

A route through this area was not immediately obvious, particularly once the ground conditions, environmental constraints and future development proposals were considered. Three main routes were considered:

- Along the western edge of the existing by-pass,
- Between Dallamires Lane and the Marina
- East of the Marina and Sewage Treatment Work and west of the Race Course and River Ure.

Ground Conditions and Flood Plain

The ground conditions within the Ripon area were described in Chapter 4.2. Any solutions to overcome these conditions would minimise risk, but not remove it completely. Where the proposed line would pass into the high-risk area, both in terms of flood plain, or road crossings, or dissolving gypsum, a number of foundation options were considered.

The geological memoir indicates the Upper Magnesian Limestone to be 10m thick and the underlying Middle Marl to be 20m thick in the area between Moor Monkton and Ripon. Boreholes located in around Littlethorpe and Bishop Monkton encountered bedrock at depths between 8 and 13m bgl. Any engineering solution would need to be piled: either a piled embankment, or a piled structure. It was anticipated that the piles would need to be of the order of 40m long to penetrate the Middle Marl and therefore remove the risk of dissolution hollows.

Initial calculations indicated that a piled structure would be more cost-effective than a piled reinforced embankment, due to cost and land take issues.

It was therefore assumed that 40m span steel or pre-stressed concrete segmental bridge decks would be used, supported on reinforced concrete beams. These beams would be held up by 8 No. 40m length bored piles of 750mm diameter, to reach the solid rock beneath the gypsum seams. A sleeve mechanism could be provided around the pile to allow the ground above the gypsum to collapse and slide down the piles.

Dismissed Options

A number of the initial concepts were not taken forward. These include:

- A diversion to the west of Littlethorpe, returning to the former track bed north of Littlethorpe. This was not shortlisted as it appeared to offer poor value in terms of land purchase, did not provide an opportunity to continue on the former track bed to Dallamires Lane and, due to the tight radius, would impose a speed restriction of approximately 60mph.
- A diversion to the east, through Littlethorpe, returning to the former track bed north of Littlethorpe. This was not shortlisted as alignment would necessitate a significant deviation from the existing alignment, south of Littlethorpe. It is considered that this would offer poor value.
- A diversion to the east of the Marina. This would add significant additional length to the route, impact on the flood plain, the canal, the area of poor ground conditions and allotments. It is considered that through long term planning, a shorter route, with less environmental impact should be achievable.
- A route through land owned by Econ Engineering. This would avoid the property adjacent to the canal on Boroughbridge Road, but would sever the Business Park and require the purchase of a significant proportion of Econ Engineering. Although this

option has not been shortlisted, it is noted that if this corridor is preferred, the exact choice of option should be the subject of further design developed with more detailed topographical survey and consultation with landowners before a single preferred alignment is identified.

- A new station immediately west of the former track bed at Dallamires Lane. This station aligns with the option of diverting east at Littlethorpe. One of the shortlisted options (Option R1b) considers the adjacent station location and possible variations thereon.

5.8.2 The Resulting Options

In response to these challenges, a number of distinct options were developed. These options connected together combinations of solutions at the various constraints, to provide the most viable options to reach each station location. It should be noted that variations around these options would be inevitable were the study to proceed to a more detailed stage.

Options R1 to R4 were shortlisted. Option R1 was broken down into two sub-options, R1a and R1b as they broadly followed the same alignment, thus giving a total of five options.

Option R1a proposes a station adjacent to Rotary Way, to the north east of the City Centre.

Option R1b proposes a station south of the Ripon By-pass between Harrogate Road and Boroughbridge Road.

Options R2 and R4 propose stations south of the Ripon By-pass.

Option R3, like Option R1, proposes a station adjacent to Rotary Way.

5.8.3 Option R1a and R1b (Base Options)

These options would follow the former alignment of the line as closely as possible. They would both remain on the existing embankment to Dallamires Lane, including the reinstatement of the Littlethorpe level crossing and the compulsory purchase and demolition of the properties at Littlethorpe. At Dallamires Lane, the two options take alternative routes.

Option R1a

This option is shown on drawing RT30.

It would continue north of Dallamires Lane on viaduct/bridge over the two roundabouts of the By-pass before 'landing' on the western (northbound) side of the by-pass, passing over the River Skell Bridge and continuing on the retained embankment to Rotary Way. The horizontal and vertical alignment was assumed to follow, as closely as possible, the former alignment. The exception is for the vertical alignment over the two roundabouts, where an increase in the height, and therefore width, of the embankment would be needed to pass the west side of the Littlethorpe Park estate. In order to achieve a visibly attractive structure, it was assumed that the chosen solution would need to be some form of segmental post-tensioned concrete construction with centrally located supporting columns.

North of the roundabouts, it was assumed that the vertical alignment would return to the former alignment over the River Skell as soon as practicable. As the viaduct level falls, the headroom underneath would eventually reduce below that required for road traffic. This would occur approximately at the south-east corner of the Wolsey factory shed. At this location therefore, the road must be narrowed.

The OS mapping shows the road width at approximately 12m, plus a 2.5m wide western verge. If a viaduct/retained embankment width of 7.5m were allowed for (to include a 5.5m wide corridor for the actual rolling stock and 1.0m either side for access, parapets/fencing and road vehicle containment barriers), and the former alignment were followed, the road would need to be reduced to 9.3m width. In addition to this, if a retained embankment were to be

constructed, a corridor of land up to 2.5m wide would need to be purchased off Wolsey. At the River Skell Bridge, the requirement for additional land would be removed; however the road width must reduce to 7.1m, below the standard 7.3m width of a 2-lane carriageway. It was considered that such a layout could be physically possible, if deviations from standard for rolling stock clearances were used; this option should not be discounted.

After crossing the river on the existing structure, a long length of retaining wall would be required against the existing highway. This wall could be of reinforced earth construction with facing panels clad in masonry

The station for Option R1a would be between the existing Park and Ride Car Park, the By-pass and Rotary Way.

Existing bridge 71, which is a cattle underpass, has been partially demolished. It is anticipated that this is replaced with a concrete box culvert type structure.

Option R1b

This option is shown on drawing RT31.

The route would terminate south of the By-pass, at a proposed new station location. The exact elevation and location of the station would require further study, but three broad options exist:

- At the level of the existing embankment, with the intention of continuing north over the By-pass in the future.
- On the former alignment, but the embankment could be removed and the station could be provided at ground level. This option would not affect the choice of option at Littlethorpe, as there would be sufficient distance to provide an acceptable downhill gradient to the station.
- Construct the new railway north of Littlethorpe, slightly west of the former alignment. This would retain the majority of the existing embankment, to serve as a noise bund between the station area and the Littlethorpe Park estate. This option is shown on drawing RT31, although the plan layout would be very similar for the other options.

Option R1b requires the replacement of bridge 71.

5.8.4 Option R2

Option R2 is shown on drawing RT32.

It would deviate from the former alignment south of Littlethorpe and turn north-westwards to a new station location to the south east of the junction of the Ripon By-pass and Knaresborough Road. The alignment would generally fall towards the By-pass off the existing embankment.

Option R2 would require the re-provision of farm access currently provided by bridge 70 on the existing alignment and there is the potential for an Overbridge to be provided over Mankin Lane (assuming the lane cannot be closed). It was assumed that a single access structure would be provided midway between these two points with associated access tracks alongside the rail embankment. The structure would be a simple pre-cast concrete box underpass similar to previous proposals.

The station would be slightly raised above the surrounding ground level to minimise the extent of earthworks required between Littlethorpe and the station.

5.8.5 Option R3

Option R3 is shown on drawing RT33.

It would deviate from the former alignment south of Littlethorpe, in a similar location to Option R2, but would turn eastwards, diving into a cutting to pass through Littlethorpe before heading off to the west of the Marina.

This option would exploit the fact that Littlethorpe village is located on a slight hill. It would therefore be possible to provide a very gentle (1%) fall off the existing embankment, across the fields and into a retained cut-and-cover cutting through a gap in the housing along Littlethorpe Lane. It would require a narrow, retained cutting through the garden of the Old School House/Broom House, involving the removal of the existing garden walls, construction of the tunnel and finally reinstatement of the garden and structures. The tunnel would be up to 100m long, and would be created top-down using either contiguous bored pile or diaphragm wall construction techniques. The tunnel is not thought to be of sufficient length to require any special safety or ventilation measures.

As the ground level falls towards the River Ure, the railway would rise out of cutting, passing over Littlethorpe Road (which would need to be realigned into cutting), over Boroughbridge Road, through the Business Park, over the River Skell to the proposed station location opposite Rotary Way roundabout. The viaduct could be up to 1.5km long in order to cross all the obstructions.

The River Ure flood plain is an area of extremely difficult ground conditions with peat bog and underlying deposits of Gypsum. A continuation of the viaduct was seen as the only sensible option when considering the effects on the floodplain hydrology, and the difficulty of attempting embankment construction. The viaduct would be similar to that in Option R1a, being a post-tensioned concrete segmental structure with spans in the range of about 40m in order to limit foundations. Significant design difficulties and associated construction costs might be encountered with regard to devising piled foundation solutions in this area due to the thick peat and gypsum deposits.

Rotary Way roundabout would require minor modifications to provide an additional east-facing exit.

5.8.6 Option R4

Option R4 is shown on drawing RT34.

It would include a station location adjacent to the Harrogate Road/Ripon By-pass junction, opposite the supermarket. It would deviate from the former alignment approximately 1100m south of Littlethorpe, pass over Knaresborough Road, and would encounter rising land, thereby meeting the station location at-grade. Access to the station site could be provided via a new junction with the By-pass, or as shown, via the supermarket and a new overbridge.

Additionally, a new farm access underbridge would be required to re-provide for the opening at existing bridge 69 and a new underline bridge is required over Mankin Lane.

6. REVIEW OF RIPON STATION OPTIONS

6.1 Options

Five Ripon station locations were identified. These are shown on drawings RT30 to RT35 are summarised as:

- Option R1a – Rotary Way Park and Ride;
- Option R1b – Dallamires Lane;
- Option R2 – Knaresborough Road;
- Option R3 – Rotary Way;
- Option R4 – Harrogate Road/Morrisons.

There are a number of issues common to all locations, and these are dealt with below.

6.2 Station Buildings and Platforms

The platforms are shown at a 100m length. This would provide for a 3-car train for the immediate operations, but would also allow a future extension for 6-car trains. The station is shown with two side platforms, in order to minimise the width of the formation on the approach to the station, but it would increase the walking distance to the more remote platform. In the short term, this should only occur following the failure of a train or other exceptional operations (charter etc).

The platforms would be provided with covered waiting areas, customer information boards, CCTV, lighting and advertising hoardings.

It was assumed that the station building would be modest in size, providing approximately 50m² of building space to provide a ticket office, waiting area, caretaker room, plant/electrical switchroom and retail outlet/kiosk. The option of an unmanned station monitored from Harrogate could be considered if there was sufficient adjacent development to ensure that security of passengers was not compromised.

6.3 Accessibility

The station proposals were developed with consideration to walk-to access, car access for Park and Ride and Kiss and Ride (drop-off) customers, and bus and taxi access.

6.3.1 Walk Access

Customers travelling to the station by foot, or arriving at Ripon by train, would require desirable walk-to access. Options proposing stations south of the By-pass would therefore need to provide a safe, desirable crossing point. This is unlikely to be an at-grade crossing due to safety concerns and disruption to road traffic, so a grade-separated crossing would be required.

In order to comply with the Disability Discrimination Act (DDA), this would need to provide access for all, including the mobility impaired. Common solutions could include a spiral of ramps or lifts. Ramps would be visually imposing but would have no operational cost. Lifts would require a far smaller footprint, but would have an operational cost and need to be supported in the event of a failure. Both would increase the cost, visual intrusion and journey times for passengers unless land was available to 'unravel' the ramps in the direction of travel to minimise the walking distance.

The options at Rotary Park and Ride (R1a) and Dallamires Road (R1b) would be at the level of the former embankment. They would also require DDA-compliant access to platform level.

As an indication of the walk-to accessibility, Table 9 indicates approximate walk-to distances from the station to Ripon Market Place.

Table 9 Walk-to Journey Times

Option	Distance to Ripon Market Place	Journey time at 3mph
R1a	900m	11 minutes
R1b	1400m	17.5 minutes
R2	1600m	20 minutes
R3	1000m	12.5 minutes
R4	2000m	25 minutes

6.3.2 Road Access

In order to appeal to car users, the station would need to be located close to the main arterial routes (the By-pass, Harrogate Road, Boroughbridge Road and Rotary Way). All the proposed locations would be close to one or other of these arteries, and would be readily accessible to the others.

Option R1a would be accessible via the existing access to the car park on Rotary Way. Traffic volumes into the car park would increase, however traffic volumes along Rotary Way are modest and significant traffic congestion would be unlikely to occur as a result of the station.

Option R1b would be well-located adjacent to the Boroughbridge Road/By-pass junction, however a suitable location for a road connection was not immediately obvious. Option R1b, as shown, therefore proposes a left-in, left-out arrangement off the By-pass. The allocation of lanes between the two roundabouts could be amended to provide a dedicated route into the station. Vehicles leaving the station would have to turn left, travel down to the Harrogate Road roundabout and back, before continuing north or east. This would be a journey of approximately 2.3km. Measures to encourage safe U-turns prior to this roundabout and to discourage unsafe U-turns may be needed for this option.

Option R2 would be well-located adjacent to the existing Knaresborough Road junction. It is currently possible to turn right out of Knaresborough Road to travel north east up the By-pass and to turn right from the eastbound lane on the By-pass, into Knaresborough Road. These manoeuvres conflict with a number of other moves and may not be appropriate with increased traffic volumes. Highway improvements needed may include increasing the right turn lane lengths, enforcing left-in, left-out moves only, or upgrading the junction to a roundabout. The exact solution would require further study.

Option R3 would be positioned adjacent to the existing roundabout. An additional exit at the roundabout should be achievable with only minor works.

Option R4 would be adjacent to the Harrogate Road/By-pass junction. An additional exit at the roundabout for the station would not appear to be readily achievable. Access would therefore have to be provided either from the By-pass, Harrogate Road, or from a bridge from the Morrison site. The impact of this bridge on the operations at Morrisons would require further study, but may provide opportunity for mutual benefits.

6.4 Parking

In order to determine the size of the car park required, the JMP data was used. This identified the 2001 annual passenger trips leaving Ripon which may shift to rail if a half-hourly service ran from Ripon to Leeds;

- Ex Car – 208,000
- Ex Bus – 71,000
- Generated and Tourism – 83,000

In order to estimate the number of car parking spaces required, the following assumptions were made:

- Of those transferring from car:
    - 30% will not Park and Ride at Ripon station
    - 30% are for Mon-Fri peak trips (Work or Education), with a vehicle occupancy of 1.16.
    - 70% are Mon-Sat and Bank Holidays off-peak trips, with vehicle occupancy of 1.70.
    - They will generate the need for 172 spaces at 2001 volumes.
- Of those transferring from bus:
    - 10% would Park and Ride, with the same mix of peak and off-peak users as the car journeys.
    - They will generate the need for 12 spaces at 2001 volumes.
- Of the generated trips:
    - 75% will Park and Ride, with the same peak/off-peak mix as the other modes.
    - They will generate the need for 73 spaces at 2001 volumes.
- It is unlikely that tourist users arriving at Ripon will have any need for a parking space.
- A small number of spaces may additionally be required for staff.

The station car parking would therefore require 257 spaces at 2001 volumes. With a growth forecast of 34% by 2011, this could rise to 345 spaces in 2011. Therefore, in order to allow a phased construction of the car park and to test the market, to avoid unnecessary start-up costs but to still satisfy the immediate demands, the station layouts in this report were provided with 300 spaces. It is noted that the local plan to provide car parking/Park and Ride at Rotary is not being progressed due to major ground condition problems. This has a significant impact on the viability of Option R1a.

6.5 Integrated Development Opportunities

The construction of a new railway station at Ripon would generate new traffic flows, pedestrian routes and demands on adjacent land.

Commuters would see the advantage in living close to the station, to avoid an additional change of mode. Businesses would have the advantages in locating near the station to attract potential employees and customers. Leisure, retail and service industries would see the attraction of providing additional services to rail travellers on their way to and from the station. Any improvements in accessibility and road capacity could also provide the opportunity to release development land which was previously unviable.

All these pressures would provide opportunity for integrated development to be incorporated into the railway proposals at this early stage.

Harrogate Borough Council is currently preparing a Local Development Framework for the District which will consider development proposals up to 2021. From public consultation undertaken in relation to this, indications are that there is not generally a desire for large scale development around Ripon.

There are no current plans for development south of the By-pass and it was noted that development east of the By-pass, between the City and the River Ure is limited by the unstable ground conditions, flood plain and designation as a Special Landscape Area.

Potential development areas may therefore include:

- North and south of Rotary Way;
- North of the Bypass on the south side of Ripon;
- Boroughbridge Road.

Options R1a and R3 would provide stations near Rotary Way. Option R3, and its associated car parking may provide opportunity for development of the existing car parking site, in addition to land north of Rotary Way. It should be noted that both these sites are in the area prone to unstable ground conditions. Harrogate Borough Council has therefore noted that large scale development would not be approved, although smaller scale mixed development may be permissible.

Options R2 and R4 would include stations near the Bypass on the south side of Ripon. Assuming these station sites would be developed with good quality grade-separated pedestrian access across the By-pass, they could provide connectivity with the proposed development sites.

Option R1b's station would be near Boroughbridge Road. From the proposed station location, the walk-to distances would be:

- To Econ Engineering – 600m (7 ½ minutes at 3mph)
- To Boroughbridge Business Park – 500m (6 minutes at 3mph).

7. COST ESTIMATES AND PROGRAMME

7.1 Construction Costs

A breakdown of capital cost estimates is presented in Appendix E and summarised on the two tables below.

These estimates include construction activities, service diversions, preliminaries, the contractor's core team, design and consultancy charges and testing and commissioning.

Table 10 below highlights the base reinstatement options in yellow, and the preferred options hatched.

Table 10 Capital Costs (£millions)

Location	**Option** **Cost Estimate (£millions)**				
Bilton	1 (LC) 6.09	1 (Closure) 4.60	2 (LC) 8.43	2 (Closure) 6.73	3 (Bridge) 10.13
Nidd	1 (LC) 3.89	1 (Bridge) 4.51	4 (90mph) 4.56	4 (50mph) 3.88	5 4.48
Wormald Green	1 12.86	1a 11.38	2 11.25		
Littlethorpe and Ripon	1a 12.16	1b 6.33	2 4.94	3 60.15	4 7.33
Base Line Structural Repairs	2.61				
Signalling Control	5.75				
BASE TOTAL	**37.03**	**Preferred Option TOTAL[1]**	**39.16**		

Notes. 1. The identification of the Preferred Option is discussed in Chapter 8. These figures compare with a capital cost estimate of £36.23 million prepared by JMP/CDL in the Ripon Rail Study.

7.2 Total Project Costs

A breakdown of total project costs is presented in Appendix E. They include all the add-on costs including Land, Project Management, design and legal fees. The percentages are consistent with those used for other major railway projects.

Table 11 below highlights the base reinstatement options in yellow, and the preferred options hatched.

Table 11 Total Project Costs (£millions)

Location	**Option** **Cost Estimate (£millions)**				
Bilton	1 (LC) 6.88	1 (Closure) 5.21	2 (LC) 9.55	2 (Closure) 7.63	3 (Bridge) 11.46
Nidd	1 (LC) 4.41	1 (Bridge) 5.12	4 (90mph) 5.21	4 (50mph) 4.43	5 5.10
Wormald Green	1 15.47	1a 13.80	2 12.66		
Littlethorpe and Ripon	1a 13.60	1b 8.56	2 5.60	3 67.62	4 8.32
Base Line Structural Repairs	4.02				
Signalling Control	8.86				
BASE TOTAL	**48.20**	**Preferred Option TOTAL[1]**	**47.70**		

Notes. 1. The identification of the Preferred Option is discussed in Chapter 8. These figures compare with a capital cost estimate, including fees, but excluding land, of £39.95 million, prepared by JMP/CDL in the Ripon Rail Study.

7.3 Project Programme

A Forward Programme is provided in Appendix F. This identifies that with adequate funding and prompt decision making, the line could be open within 10 years. The statutory planning and consultation periods have been identified on the assumption than an application for Rights and Possession of Land is made under the Transport and Works Act.

8. ASSESSMENT OF ALIGNMENTS

8.1 Capital Cost

At Bilton, reinstatement on the former alignment emerges as the cheapest option by removing the need for significant earthworks. Closure of Bilton Lane at the location of the former level crossing further reduces the cost; assuming only reasonable mitigation works are required. The most expensive option is Option B3, which requires a significant amount of earthworks and a new bridge. Over time, this additional cost will be at least partially offset by the ongoing maintenance and operational cost of a level crossing.

At Nidd, reinstatement of the former alignment is again the cheapest option, based on our assessment of the land value. Option N4 is essentially the same cost. It avoids Nidd but requires a reduction in the line speed. Those options which divert further from the former alignment require a greater extent of earthworks, thereby increasing the cost. Options which propose a bridge rather than level crossing appear to be slightly more expensive. This will be offset by the maintenance and operational cost of the level crossing, and the potential highway improvements required to allow a level crossing to be constructed.

At Wormald Green, the diversionary route is cheaper than reinstating the former alignment. This is due to the package of highway works required to install a new level crossing, and does not consider any mitigation measures required to retain the A61 capacity.

At Ripon, those options which propose a station north of Boroughbridge Road are significantly more expensive than those on the south side of the city. This is most significant with Option R3, which requires substantial structural works over difficult ground. Options R1b, R2 and R4 vary by a small percentage due to landtake and the extent of earthworks. Other factors such as highway access, varying land prices and compensation costs dictate that the detailed cost definition of these options will require significant further design development and consultation.

8.2 Ground Conditions

At Bilton and Nidd, the ground has been assumed to be generally good and although the extent of earthworks varies with the options, this is reflected in the cost estimate. Significant risks associated with ground conditions are therefore not expected in these locations, and unlikely to significantly influence the choice of preferred alignment.

At Wormald Green, the eastern diversionary route was quickly discounted due to the poor ground conditions anticipated in the flood plain of the Beck. The western diversionary route will require a greater extent of earthworks, notably cutting. However both the western route and the former alignment converge as they pass through the land fill site, through the former tunnel and off toward Bishop Monkton. Both these options have a significant cost and risk attached to them through this area and hence the identification of a preferred alignment cannot be based on ground conditions alone.

Past Littlethorpe and on to Ripon, ground conditions have a significant impact on the choice of option. The significant cost attached to Option R3 is due largely to ground conditions and the significant risk associated with the dissolving gypsum and thick pockets of soft ground. Options R1a and R1b also lie (in part) in areas identified as susceptible to dissolving gypsum and hence carry some risk. Design of Option R1a, which continues above and adjacent to the by-pass would be well informed in terms of ground conditions due to the recent by-pass works. The loading however, especially for the elevated structure would be significantly different to the by-pass and further work would be required before ground condition risks

were removed. Options R2 and R4 to the west carry the least amount of risk in terms of ground conditions.

8.3 Bridges

The only significant optioneering under bridges is at South Stainley where the rail underbridge will need to be replaces in situ.

Option S1 would be the most economic and give the best vertical geometry in terms of headroom clearances due to its shallow floor construction.

Option S2 may be very competitive in price with S1. Although the deck area would be increased, the substructure requirements would be vastly reduced. It would have a greater structural depth which may be difficult with vertical road geometry. It would improve sight lines for drivers on the A61 and would have a more open aspect to the structure improving overall aesthetics.

Option S3 would be the most expensive, even though it would have an efficient structural form; the complex steelwork would be complex to design and fabricate. It would have the most attractive overall structural form, although it would still create a "closed-in" view and restricts sightlines for approaching drivers.

Options S1and S2 are therefore recommended for future detailed development.

8.4 Environmental

8.4.1 Landscape/Townscape

Reinstatement of the Ripon-Harrogate railway line would impact on the Nidd Gorge ASLV and potentially also the River Ure ASLV (options R3 and R1A). Although the railway line is part of the existing landscape, reinstatement would result in visual impacts arising from clearance of lineside vegetation and construction of new embankments. Policy C9 states that priority will be given to landscape protection over other planning considerations in these areas.

The reinstated line would pass close to a number of listed structures such as Nidd Viaduct. The setting of listed structures needs to be considered and any reinstatement or landscaping proposals must have regard for the special architectural and historic interest of these features.

Table 12 Summary of listed features on or directly adjacent to the former railway alignment and proposed route options

Location	Feature(s)	Affected by Option
Bilton	3 Cottages	B4-B6
Bilton	Gardener's Arms Pub	B4-B6
Bilton	Barn	B4-B6
Bilton	Nidd Viaduct	All
Nidd	Former Railway Hotel	N1, N5, N6
Nidd	South Lodge to Nidd Hall	N1, N6
Nidd	Gates, gate piers and flanking walls at South Lodge	N1, N6
Nidd	Nidd Hall and buildings	N1, N5, N6

Location	Feature(s)	Affected by Option
Nr Birch House Farm	Milepost	Unlikely to be impacted but in close proximity
Wormald Green	Milestone	As above
Littlethorpe	Thorpe Lodge	Views of all options
Littlethorpe	Manor House and wall	Views of all options
Littlethorpe	Church of St Michael	Views of all options
Littlethorpe	Littlethorpe House and wall	Views of all options
Ripon	Pendle House	R1A and R1B
Ripon	Lock House	R3
Ripon	Skell Railway Bridge	R1A
Ripon	Railway Bridge near Hillshaw House	R1A
Ripon	Railway Bridge near Recreation Ground	R3
Ripon	Railway Bridge near the Beeches	-
Ripon	North Bridge	-

Three areas on the route are likely to have particular visual impact on local residents, namely the line proposals at Bilton, Wormald Green and Littlethorpe. Due to the proximity of the line to properties in these locations it is unlikely that visual impacts can be fully mitigated.

Sensitive construction and landscaping of bridges, embankments and a new station in Ripon could achieve an engineering solution consistent with the visual character of the ASLV but a detailed Landscape Assessment and planting proposals as part of an EIA would be required by Harrogate Borough Council to support this conclusion.

Key receptors are properties directly adjacent to the railway line in the locations indicated in Table 13.

Table 13 Visual receptors to the scheme, stating location and type of receptors impacted by proposals

Area	Type of Receptor	Viewpoint	View	Options Visible
Bilton	Residential	Northern end of Bilton Lane near railway line	Partial and direct close views of former level crossing	B1, B2, B4, B5,.B6
	Residential	Dene Park	Direct and close view of former line	B1. B4 – B6 in part.
	Residential	Sandhill Drive and adjacent streets	Partial views of former line	B1-B4, B5, B6
	Residential	Woodfield Road	Direct and close view of former line	B1-B4, B5, B6
	Residential	Tennyson Avenue and adjacent streets	Partial, direct and some close views of former line, including views at elevation (line is topographically higher at this location)	B1, B2, B4, B5,.B6 Distant views of B3, B5a, B6a

Area	Type of Receptor	Viewpoint	View	Options Visible
Nidd	Residential	Holme Bottom Farm	Direct views of former line	All options
	Residential	Nidd Moor Farm	Direct views of former line	N1, N4-N6
	Residential and commercial	Nidd Hall, Nidd Station Hotel, Nidd Lodge, properties adjacent to Station Hotel	Direct views of former line	N1, N5, N6, other options at greater distance
South Stainley	Residential	Birch House Farm, Hill House Farm, Stainley House	Direct views of former line	All options
	Residential and commercial	Properties in South Stainley (off Church Lane)	Direct and partial views of former line at elevation	All Options
Wormald Green	Residential and commercial	Properties adjacent to the railway and the A61	Close, direct and partial views of line at ground level	W1, W3. W2 is within cutting
Monkton Moor	Residential	Yorbus Grange	Partial views of former line in cutting	All options
Monkton Moor	Residential and commercial	Occasional properties adjacent to line near Knaresborough Road and Moor End Farm	Partial and direct close views of line at elevation	All options
Littlethorpe	Residential	Properties on Pottery Lane	Partial and direct views at distances of 0-300m.	All options
		Properties on Littlethorpe Road at intersection with former alignment	Direct, close views of line	R1A, R1B, R2,
	Residential	Thorpe Lodge	Direct views at distance of 400m	All options
	Residential	Properties on Thorpe Chase and Littlethorpe Park	Close partial and direct views at elevation	R1A, R 1B
Ripon	Residential	Properties on north side of Ripon bypass e.g. Dallamires Lane, Littlethorpe Road, Knaresborough Road	Partial and direct views, some screening by A61 embankments and vegetation	R1, R2, R4

Area	Type of Receptor	Viewpoint	View	Options Visible
	Residential, commercial and industrial	Properties to west of bypass between B6265 and A61 roundabouts e.g. Low Mill Estate, Grainger Road, Hillshaw Parkway, Rotary Way, Magdalens Road. Also to north in Hutton Bank area.	Close partial and direct views at elevation, heavy screening by lineside vegetation in sections north of the Rotary Way roundabout.	R1A
	Residential, commercial and industrial	Properties to east of bypass between B6265 and A61 roundabouts e.g. on Fisher Green Lane.	Close partial and direct views at elevation and at ground level	R1A, R3
	Ripon Canal Area of Concentration Ure Valley ASLV	Properties to east of bypass and south of B6265 off Littlethorpe Lane	Views at moderate distance and at elevation	R3
	Residential	Isolated properties to the south of Ripon bypass	Variable partial and direct views generally at ground level	R1, R2, R4

8.4.1.1 Harrogate – River Nidd

Options B3, B5a and B6a involving construction within the ASLV would result in a negative impact to the visual aspect of the area. Option B1involves construction directly adjacent to properties in Bilton. Options B2 and B4 remain within the corridor but are screened by the former line.

8.4.1.2 River Nidd - South Stainley

Between the River Nidd and the B6165 Ripley Road, the line remains within the Area of Special Landscape Value and would be subject to the Landscape Assessment outlined above.

Options passing close to former station buildings (e.g. Option N1) would have a significant visual impact, although these would be in keeping with the historic setting. Options N4-N6 keep to the original alignment and therefore have less impact on the surrounding landscape character.

8.4.1.3 South Stainley – Monkton Moor

Options that pass through gardens in Wormald Green or through the Stainley Beck floodplain would have a significant visual impact. Option W2, in cutting, would greatly reduce this visual impact.

8.4.1.4 Monkton Moor – Ripon

Options that pass through Littlethorpe will have a greater visual impact than cross country options (Options R1B, 2 and 4). Option R3 impacts on the visual character of the canal. Option 1A impacts on the River Ure ASLV and on residential areas to the west of the bypass.

8.4.2 Ecology

Reinstatement of the Ripon – Harrogate railway line would have a significant impact on two SINC sites, designated for their diverse magnesian limestone grassland flora that are situated on the rail alignment, Bishop Monkton Railway Cutting (also a Yorkshire Wildlife Trust Site) and Ripon Railway Line Embankment. Bilton Banks, a potential future SINC site would also be impacted. Harrogate Borough Council has stated that the reinstatement would have a significant impact on these sites, which are protected under policy NC3.

Restoration and management of the railway line as a grassland wildlife corridor may be able to compensate for damage to the remaining grassland SINC sites but a detailed case would be required for mitigation and compensation, which would include detailed survey works.

A number of records of protected species have been provided by Harrogate Borough Council and detailed survey works would be required to ascertain the presence or absence of these species prior to any construction works.

Great Crested Newts are likely to be present along the line or in the area of Littlethorpe Manor Pond and Potteries area. Watervoles have been identified in Oak Beck, Bilton Beck and in scrub within Bilton Triangle. No badger or bat records have been provided for the route itself, although there are records within the broader assessment corridor.

One record of the noxious weed Himalayan Balsam has been provided by Harrogate Borough Council at South Stainley.

Nidd Wood is designated as Ancient Woodland and any works in this location would be required to minimise impacts to the existing forest vegetation. Vegetation developed close to the branch of the former Harrogate-Ripon line has potential to provide habitat for protected species such as nesting birds.

The impact on hedgerows is summarised in Table 14.

Table 14 Approximate numbers of hedgerows impacted by route options.

Location	Offline Route	Approximate number of hedgerow cuts	Comments
Bilton	B3, B5a, B6a	6-8	Online routes do not result in hedgerow loss
Nidd	N5, N6 N4 (50) N3, N4(90), N2	Minimum 2 Minimum 5 13-16	Shorter offline routes result in loss of fewer sections of hedgerow
Wormald Green	Offline options	3-4	
Ripon	Offline options (east) Offline options (west)	8 2-6	Shorter offline routes result in loss of fewer sections of hedgerow

In summary, there is potential for significant impacts to ecology along the route.

8.4.2.1 Harrogate – River Nidd

Online proposals have potential to impact on the calcareous flora, whilst offline proposals have potential to impact on protected species, possible nesting sites in Bilton Triangle scrub and involve hedgerow cuttings. Option preferences would require further data from an ecological survey.

8.4.2.2 River Nidd - South Stainley

Offline options at Nidd result in significant numbers of hedgerow cuttings. Online proposals or shorter offline proposals reduce this impact.

8.4.2.3 South Stainley – Monkton Moor

Offline proposals through the floodplain have potential to impact on flood waters which may lead to dispersion of Himalayan Balsam. Option W1 and W2 remove this risk.

8.4.2.4 Monkton Moor – Ripon

Online proposals have potential to impact significantly on the Ripon Railway Line Embankment SINC (Options R1A, R1B).

Option R3 passes through the Ripon Canal SINC.

Options R2 and R4 minimise the ecological footprint. It should be noted that Option R4 is the closest route to Quarry Moor SSSI and the potential impact to this site would need to be considered.

All options have potential to encounter Great Crested Newts, in particular Option R3.

8.4.3 Archaeology and Cultural Heritage

Online proposals are not considered to impact on archaeological or cultural heritage features except at Nidd Village, where views from the Grade 2 Listed Nidd Station Hotel, Nidd Hall and Nidd Lodge could be impacted by the restored line. However, the line itself is in keeping with the former visual aspect of the buildings (at least in the case of the Station Hotel).

Reuse of existing railway structures on the Ripon-Harrogate line would be consistent with their former use and therefore not considered to be a significant impact, although any designs must have appropriate regard for the special architectural and historic interest of the various listed bridges. Sympathetic maintenance of these structures as part of the scheme operation would have a beneficial effect.

Offline proposals in previously undeveloped land have greater potential to encounter previously unknown archaeological remains. This is of particular relevance to the construction of Ripon station. Offline proposals therefore increase the risk of disturbing archaeological or cultural features.

A detailed archaeological desk study of the route would be required, with particular emphasis on offline route proposals and areas where construction compounds and vehicles will be located.

8.4.4 Traffic and Access

Provision of a new railway service between Ripon and Harrogate has potential positive benefits in terms of reduced traffic volumes, increased access to the broader commuter network and potential benefits to tourism.

Reinstatement of the railway line will require road crossings in a number of locations. Options requiring level crossings are contrary to national policies and significantly increase the safety risks. There are also significant noise and visual issues relating to level crossings in Bilton (Option B1, B2, B5, and B6), Nidd and Littlethorpe (Option 1B).

The project is only to have a net negative traffic impact during construction, where construction vehicles may impact on the already congested A61.

The location of Ripon Station is likely to be critical to the success of the scheme. Sites to the south of Ripon bypass at distance from Ripon City centre may be perceived to be too great a

distance for public transport users, although this could be mitigated by provision of Park and Ride facilities. Stations located to the east of the city are closer to the centre and employment areas and hence may be better subscribed and bring employment to Ripon.

Access impacts are locally significant for farm accesses. In these locations alternative access provisions are required within the design. This will have an impact on the farmers operations. It is noted that through early consultation, mutual benefits may be achievable.

Severance is a potentially significant issue in areas where railway line cuts through existing urban areas or directly through clusters of housing, e.g. Nidd and Wormald Green. Severance is also potentially significant in the Bilton Triangle, where future development could be restricted by route options.

8.4.4.1 Harrogate – River Nidd

Options B1, B2 and B3 reduce severance, since they permit the greatest area of the Bilton Triangle to be retained. However B4, B5 and B6 would increase the division of land within the Bilton triangle reducing the potential usefulness of the area for possible future overspill development. Options B5a, B6a and B3 require a bridge rather than a level crossing to be constructed, which has significantly safety benefits.

8.4.4.2 River Nidd - South Stainley

Option N1 proposes a level crossing at Nidd. This would have a detrimental effect on road safety and capacity. A variation of N1 and N5 propose the diversion of traffic from Nidd. This would improve the local environment at Nidd due to reduced through traffic, however the variation on N1 proposes the severing of the village. Option N4 would have no impact on traffic except during the construction works.

8.4.4.3 South Stainley – Monkton Moor

Option W1 and W3 give rise to significant severance of properties within the village. Option W1 has a significant impact on A61 and Markington Lane traffic capacity and safety.

8.4.4.4 Monkton Moor – Ripon

Which option increased traffic locally around the station would only be determined once more detailed designs for the stations had been completed. This is beyond the scope of this project.

8.4.5 Air Quality

WebTAG guidance indicate that rail transport accounts for less than 1% of total UK transport emissions to air. Rail transport can contribute to an overall, regional improvement in air quality where schemes reduce road transport usage, although local impacts may arise. In contrast road traffic is a major cause of air pollution.

A successful rail scheme could reduce car journeys and lead to an improvement in local air quality; however the proximity of the rail to properties in Bilton, Wormald Green, Littlethorpe and Ripon means that there are potentially significant localised issues relating to diesel exhaust emissions. Fumes produced during idling at Dragon Junction may be significant.

A detailed air quality assessment would be required as part of an EIA.

8.4.5.1 Harrogate – River Nidd

Options further from the Bilton properties are preferable in terms of air quality.

8.4.5.2 River Nidd - South Stainley

Offline proposals reduce the impact of exhaust fumes, however trains will not stop in this location therefore fumes are likely to disperse rapidly and cause limited impact.

8.4.5.3 South Stainley – Monkton Moor

W2 or W3 offline proposals minimise the impact of air pollution on the local residents.

8.4.5.4 Monkton Moor – Ripon

R2 and R4 Offline proposals pass through rural rather than urban areas. They therefore minimise the localised reduction in air quality to the urban area.

8.4.6 Noise and Vibration

WebTAG guidance indicates that a 3dB increase in noise is required for a perceptible impact to receptors and suggests that this may arise from a simple doubling of railway movements. It is likely that this threshold will be exceeded by the twice hourly rail service; therefore a more detailed assessment of effects would be required.

Online options in Bilton, Nidd, Wormald Green, Littlethorpe and Ripon are most likely to experience noise impacts due to the proximity of receptors to the line. Noise barriers could be used but the proximity of the receptors to certain route options e.g. Option B1 in Bilton may reduce the efficiency of the barriers.

8.4.6.1 Harrogate – River Nidd

Option B1 would have the greatest potential impact due to the potential for noise and visual disturbance and air quality impacts to residential receptors adjacent to the former alignment in Bilton. All other options reduce this impact, since they move the rail alignment further from the residential receptors. In this context, the original embankment would serve as a screening barrier for noise and visual impacts and the new line would be shifted further from housing receptors.

All route options must cross Bilton Lane. Current level crossing standards would give rise to considerable disturbance to residential receptors adjacent to Bilton Lane.

A detailed noise impact assessment would be required as part of an EIA.

8.4.6.2 River Nidd - South Stainley

Offline options will have less noise impact on the former Nidd Station building, Nidd Lodge and associated houses, although Options N2, N3 and N4 (90mph) are closer to Flat Farm. Options N5 would minimise the noise and vibration impact on Nidd residents.

8.4.6.3 South Stainley – Monkton Moor

W2 and W3 offline options will have significantly less impact on properties than Option W1. W1 would give rise to a cumulative noise impact when considered in conjunction with the existing A61 traffic noise. W2 is within cutting, providing some noise screening and is at greater distance from Wormald Green.

8.4.6.4 Monkton Moor – Ripon

Options R1A, R1B and R3 pass closer to receptors and are not preferred. Station locations in Option R1A, R2, R3 and R1B are located close to existing residential areas and hence have the potential to transmit a greater noise and vibration impact on properties.

8.4.7 Water Resources

Reinstatement of the Ripon-Harrogate railway line could have potential negative impacts on the floodplains of Stainley Beck and the rivers Ure and Skell. Construction of embankments in these locations would potentially impact on flood conveyance (movement of floodwaters within the floodplain) and flood storage (the physical volume of the floodplain able to retain floodwaters) and could exacerbate flooding elsewhere. Compensatory flood storage could be required to replace lost floodplain volume and detailed modelling of the potential impacts of embankments on flooding could be required by the Environment Agency.

The main impacts to water resources could arise from construction works, where there is potential to contaminate surface and ground water with contaminated runoff (oils, fuel and greases from poorly maintained machinery and silt laden runoff). These issues could be dealt with through site practices and are not considered significant.

New crossings of watercourse have the greatest potential for environmental impact. Online options would require no new crossings.

Railway ballast has the potential to attenuate contaminants in rail runoff. All new drainage schemes must consider the need for systems to intercept drainage including Sustainable Drainage Systems such as attenuation ponds.

8.4.7.1 Harrogate – River Nidd

Options B2, B3, B4, B5a and B6a have potential to impact on Bilton Beck, Options B5, B6 do not.

8.4.7.2 River Nidd - South Stainley

Water resources are not considered to impact on options selection in this section of the route.

8.4.7.3 South Stainley – Monkton Moor

Option W3, through the centre of Wormald Green, passes through the Environment Agency indicative 1 in 100 year floodplain. Options W1 and W2 avoid this impact.

8.4.7.4 Monkton Moor – Ripon

Option R3 involves new crossings of the River Skell and an unnamed water course and would impact on the proposed Environment Agency flood defences. Options R1A ,R1B, R2 and R4 remove this impact.

8.4.8 Land and Resource Use

Bilton triangle is a possible location for development in Harrogate. Any rail reinstatement must take into consideration any constraints or opportunities that this possible development might bring. This includes the potential for a rail line to increase severance of the triangle.

Construction of embankments in the Bilton, Nidd, Wormald Green, Littlethorpe and Ripon areas will require significant use of raw materials and vehicle movements. Offline embankment construction will also result in loss of moderate grade agricultural land.

The DEFRA footpath at Markington Crossing is adjacent to the embankment and forms part of a broader area included within a Countryside Stewardship Agreement. Since the agreement holder is considered liable for any damage to the area the construction programme would need to be carefully controlled in this area to ensure that the integrity of the site was maintained.

In areas of Nidd, Littlethorpe and Wormald Green the former alignment has been incorporated into sections of garden. Reinstatement along the former alignment at these locations is likely to require the purchase of part or all of certain properties.

The main constraint is the requirement to excavate and dispose of the former railway cutting landfill to the immediate north of Wormald Green. This is discussed in greater detail as part of the Geotechnical Desk Study but has potential for a significant negative environmental impact if managed inappropriately or significant benefit if taken as an opportunity to clean up the site.

8.4.8.1 Harrogate – River Nidd

B1, B2 and B3 options reduce severance of Bilton Triangle. Options B1, B5 and B6 require the least raw material use in embankment works.

8.4.8.2 River Nidd - South Stainley

N2, N3, N4 and N5 options remove the need for the purchase of residential properties.

8.4.8.3 South Stainley – Monkton Moor

W2 and W3 options remove the need for the purchase of residential properties. Option W2 would result in significant excavation requirements. Option W3 would require significant embankment works.

8.4.8.4 Monkton Moor – Ripon

R2 and R4 Options would not involve the purchase of residential properties. Significant embankment works are required for options R1B and R3.

8.4.9 Social - Recreation and Amenity

A well established Sustrans cycle and footpath (Bilton to Nidd Gorge) has been developed on the former alignment in Bilton. Although Sustrans supports the principle of reinstatement loss of the route for recreational use would be a significant loss of amenity unless alternative cycle and footpath routes were provided.

Two options are feasible:

- There is potential to accommodate a footpath within the railway corridor, although working widths across the Nidd Viaduct may not be sufficient to allow a safe crossing for both foot and rail users.
- Alternative facilities could be substituted elsewhere within the area, e.g. new cyclepaths within Harrogate. This is less satisfactory since it would still result in a loss of a popular amenity to residents in Bilton.

8.4.9.1 Harrogate – River Nidd

All options impact on the Sustrans footpath. Offline options B5a, B6a retain the greatest distance of the Sustrans footpath. Option B1 has the greatest impact.

8.4.9.2 River Nidd - South Stainley

No preferences. All the options remove the opportunity for Sustrans to create a cycle route to Pateley Bridge.

8.4.9.3 South Stainley – Monkton Moor

No preferences.

8.4.9.4 Monkton Moor – Ripon

Option R3 impacts on Ripon Canal; an important leisure amenity and Area of Concentration for recreational uses. Option R1a is closer to the City Centre and therefore has the potential to encourage a greater number of pedestrians and cyclists to the station.

8.5 Statutory Utilities Equipment

As the design develops, more detailing information about the location and extent of the statutory utilities will be required. Generally, is may be fair to say that on line options have less risk than off line options, however at Nidd and Wormald Green utilities are known to have been laid since the closure of the line. Statutory utilities are therefore unlikely to be a deciding factor in the choice of alignment at this stage.

8.6 Track Specification

Track specification is a route wide issue which affects the cost of all options; the longer the track, the greater the cost. With all options approximately the same length, with the exception of Options R1a and R3 at Ripon, the specification of track formation does not affect the choice of alignment.

8.7 Train Control & Operations

A key assumption made at the start of this study was that all options should allow for the long term vision of a double track railway throughout. The location and length of single and double track options does not therefore affect the choice of option as all options can accommodate double track throughout. If it was believed that the complete double tracking of the line would only occur once the line continues north of Ripon, there may be an opportunity to provide a narrower single track formation for those options at Ripon which propose stations south of Ripon. The final length of track may be abandoned once a route north was identified. This would however, discount the option of running a more frequent service from Harrogate to Ripon only.

8.8 Level Crossings

At all locations, only the base options propose new level crossings. The safety implications of would need to be fully assessed and justified before this route was pursued.

8.9 Summary

8.9.1 Harrogate to River Nidd

Based on the above discussion, **Option B3 is identified as the preferred option** since it is screened from Bilton residential areas by the former railway alignment, retains the popular footpath routes, reduces impacts to the important line flora and provides a bridge crossing with potential for a sensitive landscaping solution. However this option will still result in environmental impacts, since it requires significant embankment works, land take and material requirements and could potentially impact on protected species such as watervoles in Bilton Beck. It would also have a significant visual impact on the Nidd Gorge ASLV. This option will require a Landscape Impact Assessment. Reinstatement of the Ripon – Harrogate line may provide a means to fund the connection of this route into the cyclepath network, however there are potential health and safety issues associated with line clearance distances at locations such as Nidd Viaduct.

8.9.2 The River Nidd to South Stainley

Six options have been proposed for routes in Nidd Village. Options closest to the existing alignment are preferred since these will involve the least land take and reduce the need for culverting (Options N1, N4: 50mph, N5, N6), Options N2, N3 and N4:90mph are therefore not preferred. However, options closer to the original alignment have greater potential to impact on the visual aspect of the listed former Railway Station Hotel and to create the

greatest disturbance to local residential receptors at the former level crossing area in Nidd. In addition, Option N1 with a level crossing has greatest level of disturbance due to the associated operational equipment (flood lights, sirens etc). In this respect, Option N1 with a road bridge would have a comparatively lower level of disturbance. Road bridge options are also preferred on the basis of increased road safety and reduced traffic impacts on the properties currently adjacent to the road.

Based on the above discussion, **Option N5 is considered to be the preferred option**. It is located away from the residential properties but close to the former alignment and with a road bridge. However it should be noted that this option would involve greater land take than options involving level crossings.

8.9.3 South Stainley to Monkton Moor

The next section of offline proposals occur at Wormald Green. Route proposals include a diversion to the west of the village and one through the centre of the village. Routes through the centre of the village pass through the Environment Agency indicative 1 in 100 year floodplain, which would potentially impact on flood conveyance (movement of floodwaters within the floodplain) and flood storage, (the physical volume of the floodplain able to retain floodwaters). Although these are not insurmountable issues from an engineering perspective, they would require detailed consultation with the Environment Agency, culverting and potentially significant excavations in the Wormald Green area to provide alternative flood storage volume. Offline proposals to the west of Wormald Green are preferred due to the shorter length of floodplain to be crossed. In addition, routes through the centre of the village have potential to increase severance between eastern and western sections of the village.

Option W1 leads to significant severance and disturbance to residential receptors in Wormald Green and are not preferred. Option W3 to the east of the main road is not preferred since it cuts through a significant volume of the floodplain and has potential to disrupt flooding patterns in the area. This option would require modelling and consultation with the Environment Agency. **Option W2 to the west of Wormald Green is therefore preferred** since it creates less noise and visual disturbance to residential receptors than other options sited closer to the village and only requires a short crossing of the floodplain. This option still results in a more significant land take with a potentially greater number of hedgerow crossings.

8.9.4 Monkton Moor to Ripon

Reinstatement of the line along its former course would result in landscape, visual, noise, vibration and air quality impacts. Much of the housing in this area was built after the closure of the current railway line therefore the impacts would effectively be treated as new impacts for the purposes of assessment.

Littlethorpe and Ripon have been noted as areas of strong archaeological potential by North Yorkshire County Council. An archaeological desk study of the route will be required by the Council. Significant archaeological remains would have potential to impact on the viability of certain routes due to the potential cost of archaeological mitigation. Final route options would need to be informed by the desk study.

Of the four offline proposals, **Option R2 is the preferred option** since it avoids one of the SINC sites at Littlethorpe and the residential receptors in the village of Littlethorpe whilst still providing a station location within a reasonable walking distance of Ripon centre. The option will still result in significant land take, the requirement for hedgerow cuttings and impacts on one of the Littlethorpe SINC sites. Option R3 is considered to be the worst of the options since it passes through the Littlethorpe Conservation Area, River Ure and Skell floodplains, residential and industrial areas, Littlethorpe SINC site and Leeds-Liverpool Canal SINC, Ripon Area of Special Landscape Value and would require demolition of a section of the

Grade 2 Listed Lock House. This option may provide a long-term solution for continuing the line north of Ripon, however it would require significant changes to land use planning, compensatory environmental mitigation and further study on the geological and flooding implications. It would also require adjustment during the design development to avoid Lock House.

9. CONCLUSIONS

Reinstatement of the Ripon-Harrogate railway line is considered beneficial in that it provides potential to:

- Reduce congestion/traffic emissions and road fatalities between Ripon and Harrogate by effecting modal shift to rail;
- Create commuter links into the national rail network;
- Provide an opportunity for economic regeneration and development in Ripon and the region; notably Harrogate, Leeds and York;
- Increase tourism in Ripon and links the city into the national rail network.

The conclusion of this report is that it is feasible to reinstate the railway line without the demolition of residential properties, without a requirement for new level crossings and at the line speeds and service frequency identified by JMP as providing the best economic return.

The environmental impacts of the scheme are associated with:

- Noise and visual disturbance and local air quality impacts in Bilton, Nidd, South Stainley, Wormald Green and Littlethorpe;
- Impact to Areas of Special Landscape Value (Bilton, Ripon);
- Ecological impacts to a minimum of three SINC sites (potentially a maximum of 6);

Like most major infrastructure projects, the proposed reinstatement has a significant number of negative impacts; however these are predominantly associated with the construction process. A number, including visual impact, noise and vibration, and water resources can largely be mitigated against through careful design and alignment choice.

It is considered that these environmental constraints can be overcome through further alignment development, appropriate mitigation and well considered design. None should be considered as so significant as to jeopardise the feasibility of the project.

The preferred alignment options are as follows:

- Bilton: Option B3 is the preferred option based on a balance of reduced disturbance to residential receptors, a safer line crossing and retention of the existing footpaths (it may however cause severance to Bilton triangle).
- Nidd: Option N5 reduces visual and noise impacts to Nidd Lodge and the former Station Hotel and improves the existing road traffic situation for these properties. Options further east are not preferred due to the large amount of landtake.
- Wormald Green: Option W2 is the preferred offline option since it minimises disturbance to local receptors and to the floodplain.
- Ripon: Option R2 is the preferred offline option, since it has the least impact on SINC sites and residential receptors in Littlethorpe but provides a station location reasonably well placed to pick up Park and Ride and Walk-to patrons.

The JMP report concluded that over the 30 year appraisal period, the present value of the capital and operating costs was £104.8 million (but with notable exceptions), while the present value of benefits was £131.2 million. This gave an economic benefit of £23.9 million and a benefit to cost ratio of 1.22.

This study has identified that JMP's estimated capital cost of £39.95 million may have been an underestimation and an estimate of £47.70 million may be more appropriate, however

within the estimating tolerances expected at this stage of the study, these figures confirm that subject to the successful management of risk (specifically confirmation of the operational and patronage assumptions) the scheme is economically viable. Increases in travel demands on the A61 and parallel bus services since the JMP report indicate that benefit to cost ratios may indeed have increased and the recently revised DfT assessment period of 60 years will influence these figures.

The main risks are outlined in Appendix G. A number of these have been identified as having the potential to add between £1 million and £10 million to the project and hence in combination, have the potential to affect the economic viability of the project. The risks are however typical of a project of this size and at this stage of the project development.

10. NEXT STEPS

The Countryside Agency's publication 'Rail Re-opening Toolkit' provides a flowchart of the various stages which are required to reopen a disused line. These are reproduced in Appendix H and are grouped into two stages. Stage 1 starts with a *Local Idea* and ends in a *Credible Proposal*. Stage 2 takes the *Credible Proposal* and ends with the line open to traffic. The Harrogate to Ripon line is in this initial stage 1 of the process. This stage comprises the following main activities;

- Identification of the Transport Need.
- Set up of the Steering Group.
- Deciding the Role of the Promoter.
- Identifying sources of funding, current ownership and status and key stakeholder consultation.
- Examination of the route condition, assets and structures (the purpose of this study), the operational requirements and the National Transport Network Implications.
- The preparation of an Outline Business Case (in line with the Strategic Rail Authority's Appraisal Criteria). This appraisal must consider the environment, safety, economy, accessibility and integration, whilst also answering the questions;
    - Are there better ways to achieve this objective?
    - Are there better uses for these resources?

Specific to the Ripon railway reinstatement, this means:

- Establish a steering group and promoter to take the project forward.
- Define what is preferred for Ripon city regarding station location in terms of accessibility, land use etc.
- Fix the route and project in planning documents and Network Rail strategy documents.
- Revisit the business case to updated criteria and inputs.
- Carry out surveys and data collection as the process demands (e.g. topographical surveys, structural and condition assessment of bridges and earthworks, consultation with interested parties, buried services searches, environmental consultation etc.).

In parallel with these procedural steps, is the need to increase support and backing for the scheme, to provide funding for activities before the completion of the Business Case and to ensure that the project is integrated into the development and transport plans of the region. An outline of this approach is included as a Positioning Statement, included as Appendix I.