



# Harrogate District Sites and Policies DPD: Manse Farm Rail Station Study


May 2013



Working for you



## Foreword

The Manse Farm Rail Station study has been prepared following advice and guidance from Network Rail and provides the first step in the consideration of a potential new station at Manse Farm, Knaresborough. The study was commissioned jointly by Harrogate Borough Council and North Yorkshire County Council and prepared by Arup. This work has been undertaken over a period of several years and has involved detailed discussion with the rail industry during this time. The report represents a technical piece of work undertaken at a particular stage in the development of the Local Plan reflecting the requirements of the rail industry. References to the Sites and Policies DPD therefore refer to an earlier stage in the plan preparation process.

Provision of a station to the east of Knaresborough has been a long term aim of the Council and a site is currently allocated in the Harrogate District Local Plan (2001) to the west of Manse Farm on an embankment and in a location with limited space to provide facilities such as car parking. Background work has therefore been undertaken for the Sites and Policies DPD to investigate the business case for providing a new rail station and car park as part of the Draft Allocation for a mixed use urban extension at Manse Farm, Knaresborough (K2b) further to the east. The Leeds-Harrogate –York Railway Line forms this site’s northern boundary. The line is recognised as a regionally significant transport link within the Leeds City Region and North Yorkshire, facilitating access to labour markets in Leeds, Harrogate and York as well as providing connectivity with regional and intercity services at York and Leeds. A new station at Manse Farm could therefore make a contribution to sustainable development in this location.

However, significant infrastructure projects such as this are complicated, need to follow set processes and have the ‘buy in’ of key organisations and as a result take time to bring to fruition. They need to also be seen within the wider rail environment and the impact that introducing an additional stop on the line will have on wider service provision; in this case two intercity stations at Leeds and York. Good progress on this work has been made over the last two years, and whilst work so far indicates that there is a business case for a new station in this location further work is required to improve the business case and address wider infrastructure issues. Key points arising as a result of this work are:


- **Guidance for undertaking this work** – The work undertaken has from the outset followed guidance set down by Network Rail for the development of new stations. This work includes demand and revenue forecasts, estimates of capital and operating costs, a review of operational issues, economic appraisal and potential funding sources. This work is based on the existing service pattern and is not dependent upon, nor would it preclude, potential future service improvements, such as improved signalling and selected doubling of the rail track.
- **Rail Industry Consultation** -Network Rail and the Department for Transport have been consulted throughout the process and further work has been undertaken in response to

issues they have identified through meetings and a workshop which has informed this final report. Network Rail has also formally consulted the Department for Transport and the train operating company Northern on this work.

- **Harrogate Line Transport Business Case** – The need for improvements to the Leeds-Harrogate-York Railway Line as a whole was identified as a way of improving the viability of a new station. Work undertaken for the Manse Farm Study will now inform the wider Business Case currently being developed for the improvement of the Leeds-Harrogate-York Railway Line as a whole, on behalf of North Yorkshire County Council, Metro, City of York and the Borough Council. This work, once in place, will enable the partners to take advantage of future funding opportunities for rail infrastructure improvements which in turn could also improve the business case for a new station at Manse Farm in the future. Key issues and aspirations for improvements and investment along the line will seek to benefit passengers and support the local economy and include the following key elements:
  - Connectivity** – increased frequency of trains, better journey times, extended operating hours and better connectivity with the rest of the UK including ‘through’ trains. Better journey times, in particular between Harrogate and York, but along the whole route, in combination with other improvements, will ensure that the provision of a new station stop at Manse Farm would not increase journey times between Harrogate and York.
  - Capacity** – sufficient capacity to meet continuing passenger growth, accommodate development and accessibility to employment, education and health.
  - Performance** – improved punctuality of services.
  - Journey Quality** – the whole journey experience needs to meet customer requirements and satisfaction.
  - Access to the Line** – better parking, station travel planning, access by sustainable modes, disabled access, services and facilities
  - High Quality integration between Rail and other modes**
  - Links to Leeds Bradford Airport**
  - Carbon Reduction**
  - Promotion and Marketing** – initiatives to encourage increased growth of the line.
- **Starbeck Crossing** - Network Rail, at the request of North Yorkshire County Council, have provided a variety of options for a high level feasibility study into Starbeck Level Crossing.
- **Site allocation in the draft Plan** - In light of work undertaken so far, which at this stage is positive and has been through significant discussion and consultation with Network Rail and the Department for Transport, it is considered realistic to safeguard land for a site for a new station and car park (draft Sites and Policies DPD, Policy IN3a: Protection of Sites and Routes for Transport Infrastructure).
- **Wider benefits** – Provision of a station as part of a wider mixed use scheme serves to enhance the sustainability of the site and improves access to rail services for Knaresborough as a whole. The current station in the town is small and as a result of gradients in the area


lacks adjacent parking and is unattractive for access by bus, walking and cycling. There is limited scope to improve the station and parking provision as the station is boarded by a tunnel to the east and a viaduct to the west. The provision of a new station at Manse Farm will provide an alternative to travel by car on the A59 corridor in Knaresborough and the adjacent road network, including the Bond End junction which was designated as an Air Quality Management Area in 2010. Opportunities to park and ride at Manse Farm may also contribute to a reduction in congestion in Harrogate especially during conference and other events held in the town.





Harrogate Borough Council and  
North Yorkshire County Council  
**Manse Farm Rail Station**  
Consolidated Project Inception  
Report

Issue | 23 July 2012



This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 216858-00

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## Executive Summary

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Arup has been appointed by Harrogate Borough Council (HBC), and North Yorkshire County Council, to review the viability of a proposed new rail station between Knaresborough and Cattal. The site at Manse Farm would serve a potential mixed use urban extension comprising 700 dwellings, 3ha employment land, a neighbourhood centre, including a primary school and open spaces. The station assessment has been completed in conjunction with Network Rail's Project Inception Report guidance. It includes demand and revenue forecasts, estimates of capital and operating costs, a review of operational issues, a summary of the economic appraisal plus an assessment of potential funding sources. The study recommendations and suggested next steps are also described.

- **Demand and Revenue Forecasts:** five market segments were identified which could generate about 220 wholly new rail trips per day, with a further 160 daily journeys abstracted from adjacent stations. The new station would generate about £190,000 revenue. Once the journey patterns have become established, this would be sufficient to cover the incremental operating costs for the new station although some pump priming funding may be required in the short term. Car parking availability at the new station is a pre-requisite, since 55% of total trips are generated from park and ride;
- **Rolling Stock Requirements:** The additional rolling stock proposed for the Horsforth to Leeds shuttles will help to alleviate current overcrowding issues and enable the Harrogate to Leeds services to adopt a skip-stop pattern to improve journey times and / or offset the station dwell time at Manse Farm. No additional rolling stock is envisaged for services to York, and the extra demand generated will slightly exacerbate the existing crowding problems in the short to medium term until other interventions are implemented.;
- **Estimated Capital and Operating Costs:** A single platform (97 metres long) will be constructed on the south side of the line adjacent to the development. This will enable four 23m units to serve the station. A 150 space car park is to be provided with a 'Kiss & Ride' facility being part of the road network. The estimated capital costs for the station at 2014 prices is £2.595m and this total includes 66% optimism bias in accordance with the Green Book guidance. The scope for alternative delivery mechanisms to construct the station should be considered in order to achieve cost reductions and strengthen the overall business case. A twin platform station is not recommended, regardless of future operational issues, since it fails to offer a positive business case;
- **Review of Operational Issues:** The proposed station is proposed to the east of Green Lane Level Crossing where there is a gradient of 1 in 3,300. The additional journey time incurred by the stop at Manse Farm would mean the level crossing barriers at Starbeck would be lowered more frequently, whilst the turnaround times at Leeds station will be too short unless the stopping patterns were revised or line speeds were increased.
- **Infrastructure Issues:** If it is not permitted to have additional downtime at Starbeck level crossing, full or partial track doubling between Knaresborough and Cattal will be required. Partial double tracking would involve reinstating the second line from the former Hopperton station site at 12 miles 16 chains to Cattal at 10 miles 23 chains, a distance of two miles. This would enable Manse Farm to be planned as a single platform station. It would also support 2

trains per hour between Leeds, Knaresborough and York which will be examined separately as part of the Yorkshire Rail Network Study. The full double tracking option would offer some minor operational benefits, but a twin platform station would be required. The higher capital costs would have a detrimental impact on the overall business case. Further development work will include performance modelling to confirm the implications of calling at Manse Farm and terminating trains at this location. The feasibility of more frequent services over the single line section and the infrastructure changes required to mitigate any performance risk need identifying.

- **Summary of the Economic Appraisal:** the core scenario with 700 homes has been modelled with and without a third party funding contribution. The new station generates a Benefit Cost Ratio of 1.706 if there is a no third party contribution which is less than the threshold used to define 'good value for money'. However this benefit cost ratio rises to 2.234 if a 50% contribution can be secured. The impact of several sensitivity tests was examined, including a higher number of new dwellings, deteriorating congestion, higher fuel costs and rail fares which increase above the rate of inflation. These had a relatively modest impact, helping to strengthen the overall business case.
- **Funding Opportunities:** the economic appraisal highlighted the importance of securing funding support to strengthen the Benefit Cost Ratio and / or identifying mechanisms to deliver the station which would help to reduce the construction costs. Several potential funding mechanisms were identified, including the Local Transport Plan and the Community Infrastructure Levy. Alternatively, some form of additional levy could be imposed on house prices to help fund the construction costs.
- **Study Recommendations:** the delivery of Manse Farm station provides an excellent opportunity to help promote sustainable journey patterns from this proposed new housing development in accordance with the National Planning Policy Framework. The new station generates a robust business case, although this conclusion is predicated on securing the necessary funding contribution from third parties. There are a number of operational issues affecting the viability of serving the station, although these will be addressed by the partial track doubling between Cattal and Knaresborough. A separate funding source would need to be identified to unlock other strategic benefits, for example, 2tph between Knaresborough and York.
- **Suggested Next Steps:** a number of tasks have been identified and will need to be completed to progress this scheme:
  - Examine the opportunities to strengthen the overall business case, for example, agreeing the priorities for the Harrogate Line to help deliver an improved timetable which could generate a higher trip rate;
  - Completion of the engineering feasibility work, to Network Rail GRIP 5;
  - Review the operational assumptions with Northern and Network Rail;
  - Develop and refine the potential funding sources for the new station;
  - Continue the ongoing dialogue with the developer to ensure an adequate plot is reserved for the station and the phased site development is delivered in a manner to maximise the opportunities to encourage rail travel, for example maximising the amount of housing within walking distance of the station;

- Engagement with the organisations responsible for preparing the forthcoming Invitation to Tender (ITT) for the next Northern franchise to ensure this is included as an aspirational scheme.





# 1 Introduction

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## 1.1 Background to the Study

Arup has been appointed by Harrogate Borough Council (HBC), and North Yorkshire County Council, to review the viability of a proposed new station between Knaresborough and Cattal to serve a potential mixed use urban extension at Manse Farm to the east of Knaresborough. The Harrogate rail line is adjacent to the site's northern boundary.

Harrogate Council is in the process of preparing its Local Development Framework and adopted its Core Strategy on 11 February 2009. This Development Plan Document (DPD) provides the strategic policy framework for development and conservation within the District up to 2024. To meet the District's housing requirements it is anticipated that it will be necessary to identify green field urban extensions to Harrogate and Knaresborough. In accordance with government policy delivering sustainable development is a priority, including the need to secure opportunities for sustainable transport.

Work was undertaken in 2007/8 to identify the Council's Preferred Options for Site Allocations for Homes and Jobs and further consultation on site options in Harrogate Knaresborough and Ripon was undertaken in September - November 2011. One of the sites identified as a preferred option for a mixed use urban extension is at Manse Farm to the east of Knaresborough.

Harrogate Council will meet to consider officer recommendations on draft site allocations during August and September 2012. A meeting of the full council in October will agree draft allocations to be taken forward to the Publication Draft Stage and Examination.

The potential site is being promoted by a developer, and initial Masterplan proposals have been produced. An initial business case undertaken on behalf of the developer examined the feasibility of a new railway station, and concluded the scheme was not viable at this stage. However, the developer is prepared to reserve land for a possible new station within the wider project. Following the outcome of the initial feasibility study, HBC has commissioned consultants to review these conclusions as part of work being undertaken. Initial discussions between HBC and Network Rail suggested a Project Inception Report (PIR) should be prepared as a starting point to evaluate the impact of the new station.

## 1.2 Context for the Studies

There are several studies that provide useful context for this commission. Following the completion of a study by Faber Maunsell to prepare a Route Strategy for the Harrogate Line, Arup has completed much of the recent technical work to examine options to improve rail services on this corridor. The main studies include:

- **Harrogate Line Timetabling Study (Arup):** the study examined a number of alternative timetable options including the introduction of a second hourly service between Knaresborough and York, and additional off-peak services

between Harrogate and Leeds. A VISION timetable model was developed for the route, and a demand forecasting model previously developed for the corridor was refined. The study concluded it could be possible to deliver the improved service to York by extending the Knaresborough service (albeit with non-clockface timings), although the performance risks associated with proposed timetable were **not** examined in detail. Furthermore, an additional semi-fast service from Harrogate to Leeds could be introduced. It was recognised that further work was needed to refine the timetabling work, including discussions with industry stakeholders and the use of Railways software to refine the technical work.;

- **Harrogate Line Technology Study (Arup):** this study was undertaken at a similar time to the Timetabling review, and examined the most suitable future technology for the route. A range of potential options were examined, including bus-based solutions, monorail, light rail, tram-train or enhanced heavy rail. A series of key performance indicators were applied to evaluate the suitability of each technology, benchmarking outputs against best practice elsewhere. The technologies recommended for further evaluation included enhanced heavy rail and the introduction of tram-train;
- **Yorkshire and Humber Route Utilisation Strategy (Network Rail):** following the delivery of an innovative partnership arrangement involving various stakeholders to procure some additional rolling stock to help alleviate overcrowding, further capacity enhancements are required. The Harrogate Line has experienced significant patronage growth, and these capacity benefits may only deliver short term relief. The RUS also recommended the introduction of a new shuttle service between Horsforth and Leeds, together with a revised stopping pattern for the longer distance Harrogate / Knaresborough / York trains. In addition, the RUS recommended signalling improvements between Harrogate and Leeds to reduce delays and allow greater flexibility in the timetabling of services;
- **Network Rail Electrification Route Utilisation Strategy (Network Rail):** this study explored the scope for electrifying rail routes in the UK. The Harrogate Line was identified as a potential candidate, although no timescale was provided. The report highlighted that electrification of the route should be implemented in conjunction with other improvements, included double-tracking between Knaresborough and Poppleton. Furthermore, the RUS also suggested that electrification could be linked to the longer term introduction of tram-train vehicles.
- **Leeds City Region Tram-Train Feasibility Study (Arup):** the study examined the feasibility of converting various routes to tram-train operation, including the Harrogate Line, plus a wholly new alignment to Leeds Bradford International Airport. A connection to Bradford from LBIA was identified as a longer term priority, whilst a number of engineering constraints could adversely affect the deliverability of a new link to the Five Towns<sup>1</sup>. The study examined the potential demand that could switch to the new tram-train service, and examined the operational and infrastructure feasibility of converting the Harrogate Line. The improved acceleration / deceleration characteristics of the tram-train vehicles would create sufficient “slack” in the timetable to enable several new stations to be served, for example, Knaresborough East, Horsforth Woodside and Bilton;

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<sup>1</sup> The Five Towns refers to the towns of Castleford, Pontefract, Normanton, Featherstone and Knottingley.

- **Development of New Rail Stations Strategy (SDG):** this report considered proposals for new rail stations, primarily in West Yorkshire, with a small number of schemes located elsewhere in the Leeds City Region. It assessed the case for investment with a view to prioritising development of schemes. An addendum looked at three proposed stations in North Yorkshire including Knaresborough East. The study recommended this station should be a “C” priority. There were several supplementary conditions, including a requirement to secure external funding, ensuring the adjacent development activity goes ahead, and delivering a timetable solution that enables two trains per hour to serve the site;
- **Follow on studies:** examined a number of specific issues, most notably, reviewing the potential capacity benefits offered by the improved heavy rail services that could be delivered as part of the Yorkshire and Humber Route Utilisation Strategy, versus tram-train. This analysis highlighted tram-train could offer higher capacities compared with the enhanced heavy rail services, since the construction of an on-street alignment for tram-train would help to alleviate the capacity bottlenecks affecting the approach to Leeds station. Furthermore, submissions were prepared to the Regional Transport Board examining the case for a new station at Horsforth Woodside and the conversion of the route to tram-train operation. Both submissions included estimates of benefits and costs, with the initial results suggesting a strong value for money case could be generated for both schemes;
- **Leeds City Region Connectivity Study (Arup and SDG):** following the completion of the Transport Strategy, the city region partners secured funding from the Department for Transport to develop a framework to assess transport priorities over the next 25 years. This commission takes account of the guidance outlined in the Delivering a Sustainable Transport System (DaSTS) prepared by the DfT. Emerging findings from the study indicate that a station at Knaresborough East could be a medium to long priority, although this timescale could be accelerated if developer funding can be secured.
- **Yorkshire Rail Network Study:** This recently completed study provides evidence to reinforce the case for the funding of proposed rail investment that benefits the Leeds and Sheffield City Regions in the 5 year funding period 2014-2019 (Control period 5) – including the full Northern Hub, Midland Mainline Electrification and other capacity/connectivity improvements, including at Leeds and Sheffield Stations. It lays the foundations during Control Period 5 for a continuous and step changing rail network investment programme in Yorkshire beyond 2019.

Although a wide range of potential service improvements have been identified in the various studies listed above, this study provides an assessment of the suitability of a new railway station at Manse Farm, based on the existing service pattern. The proposal would neither be dependent on, nor would preclude, potential future service improvements including:

- replacement of existing rolling stock with higher specification diesel units;
- incremental service enhancements to improve connectivity to London from Harrogate via York;
- infrastructure enhancements, possibly including improved signalling and selected track doubling between Knaresborough and Cattal, and /or Hammerton to Poppleton.

### 1.3 Objectives of the Study

In response to recent discussions between Network Rail and Harrogate Borough Council, Arup has been appointed to prepare a business case for the proposed new station at Manse Farm. The aims of this work include:

- provide Network Rail with the initial information they require for their GRIP 1 process to assess a new station at Manse Farm and whether it is likely to be feasible from a rail perspective;
- provide HBC with robust evidence to inform their decision making process on land allocations within the Sites and Policies DPD and whether the construction of a new station in this location is a worthwhile option. The outputs from this study are intended to inform part of the Council's evidence base for the Sites and Policies DPD;
- inform NYCC's work in relation to LTP3 and the preparation of their next LTP period post 2016 and the need for this to include strategies and measures to support the infrastructure requirements of development proposals in the Sites and Policies DPD;
- providing Network Rail, the Department for Transport and train operating companies with the information required to assess whether the new station at Manse Farm is aligned with wider strategic objectives, covering safety, operational and commercial outputs.

### 1.4 Summary of the PIR Consultation

In the course of preparing the initial PIR, a series of consultation meetings were undertaken with DfT, Network Rail and Northern Rail, as follows:

- Network Rail: meetings with David Phillips (Senior Route Planner) on 10 May and 29 July 2010. A second meeting was convened in response to feedback from the DfT and Northern Rail meetings;
- Northern Rail: meeting with Pat Beijer (Commercial Team) on 7 July 2010;
- DfT: tele-conference with Brian Welch on 19 July 2010.

The consultations identified a range of key issues which have subsequently been addressed in this consolidated report.

The draft report was also the subject of a workshop held on 25 April 2012 to explain the findings of this work to key stakeholders including Network Rail, Northern, Metro, North Yorkshire County Council Highways and Rail Officer, and the developer promoting the site. Comments from this workshop have also informed this work. Discussion on the wider service and infrastructure improvements required for the Harrogate Line are on going through the Harrogate Line Rail group which includes Network Rail, East Coast, Northern, Metro, NYCC, HBC, City of York and the Harrogate Chamber of Trade and Commerce.

As part of a separate study, Arup has examined a range of possible options to electrify the Harrogate Line including overhead and 3<sup>rd</sup> rail electrification, plus various alternative technologies. Several of these alternative solutions would enhance the case for a new station at Manse Farm, by improving acceleration / deceleration between stations to cut overall journey times.

## 1.5 Structure of the Report

The remainder of the report follows the recommended structure as outlined by Network Rail's PIR. This approach means the document can be easily circulated as a standalone document. Feedback from the first round of comments, relating to passenger abstraction, sensitivity testing, timetable analysis, funding, track gradient, annual ongoing operating costs, turnaround times at Leeds, requirement for additional rolling stock and the feasibility of line speed increases are examined in this updated report.



## 2 Project Inception Report

### 2.1 Description of the Station and its Location

The proposed Manse Farm station site is located to the east of the Knaresborough urban area, as indicated on Figure 2.1 in relation to the wider Manse Farm site. The Harrogate Line and A59 York Road run along the northern and southern boundary, respectively.

**Figure 2.1: Location of Manse Farm Site**



Note: Proposed station site based on Arup assumption.

The site forms part of a site being investigated by the Council as a potential mixed use urban extension where it is envisaged that development would include:

- 700 new dwellings including an allowance for affordable housing;
- 3 ha business park accommodating office space, light industrial and some B8 storage;
- a primary school and neighbourhood centre.

Work undertaken indicates that the optimum location for the new station due to gradient issues would be to the east of the Green Lane level crossing and details of this are outlined further in para 2.7.2.

It is proposed that a new station located on the Harrogate Line will provide an attractive option for residents or staff at the Manse Farm site, as well as some existing residents living in east Knaresborough that could transfer from the existing station. Given the proximity of the proposed station to the Strategic Road Network (Junction 47 of the A1(M)), Manse Farm station is well located to encourage park and ride journeys to Harrogate and other destinations. It is assumed that existing services from Leeds terminating at Knaresborough would

be extended to terminate at Manse Farm to supplement hourly trains between Leeds and York, providing a service frequency of 2 trains per hour to Leeds. The higher frequencies would be necessary to attract specific types of passengers, including park and ride.

## 2.2 Assessment of Alternative Options

The format of the Network Rail Project Inception Report requires the suitability of different options to be assessed. A series of alternative options have been considered to the proposed railway station:

- **Do Nothing:** Harrogate and Knaresborough already suffer a certain amount of traffic congestion and delay, in particular at the Bond End junction in Knaresborough which was designated as an Air Quality Management Area in November 2010. Other junctions in Knaresborough town centre (along the High Street and York Road) also suffer traffic problems at key times of the day. Future general growth in the number of car trips using the network would have a detrimental impact on journey time reliability for existing car drivers, and cause a detrimental impact on the quality of local amenity. The current Knaresborough station in the town is small and as a result of gradients in the area lacks parking and is unattractive for access by bus, walking and cycling. There is little scope to improve the station and parking provision as the station is bounded by a tunnel to the east and a viaduct to the west. Knaresborough is an historic town and the station lies within the conservation area with little opportunity for redevelopment proposals which might bring forward parking improvements.
- **Improved Bus Services:** improved bus services could improve local accessibility between the Manse Farm site and Knaresborough, and we understand discussions with the main local bus operator have taken place to explore the potential to serve the site. Transdev has indicated that an existing service could be extended to Manse Farm. Whilst this option would offer convenient links with the rest of Knaresborough, bus services to other destinations are relatively slow, and passengers would be required to interchange for most trips. This would severely reduce the attractiveness of this mode to help provide attractive alternatives to driving for longer distance trips to Harrogate, Leeds or York;
- **Expansion of existing parking facilities at adjacent stations:** land constraints adjacent to the existing Knaresborough station mean it is very unlikely the limited car parking facilities could be expanded sufficiently to accommodate demand from the Manse Farm site and the wider Knaresborough catchment. Furthermore, this option would not offer any measures to improve the public transport links to the proposed Manse Farm site. There are alternative stations where car parking could be expanded including Cattal, Hammerton and Pannal. However, this could lead to worsening traffic congestion in Knaresborough as a result of the trips generated to / from the station. The Council has already examined the scope for increasing parking at Cattal, indicating relatively high levels of informal parking on the highway adjacent to the station and limited space available to provide adequate parking facilities. There is an informal arrangement in place with a local landowner. The attractiveness of this option is further constrained by the limited rail service, although this limitation could also apply to Manse Farm unless it can be demonstrated there are no performance risks associated



with terminating trains at this location. Pannal is accessible to the A658 link between Knaresborough and the southern bypass. However, the car park currently operates at capacity and is not conveniently located for trips from Knaresborough.

## 2.3 Demand and Revenue Forecasts

### 2.3.1 Demand Segments

A number of possible demand segments have been identified. These segments focus on wholly new demand that would be generated by the rail station. Furthermore, Manse Farm could abstract some trips from nearby stations, but this impact is examined separately, to avoid potential double counting.

- Rail journeys associated with the proposed housing (**Segment 1**);
- Rail journeys associated with the proposed employment site (**Segment 2**);
- Strategic park and ride journeys to Harrogate (**Segment 3**);
- Tourist journeys to Harrogate (**Segment 4**);
- Mode transfer from car to rail from existing housing in Knaresborough (**Segment 5**);

### 2.3.2 Key Assumptions

To calculate annual demand and revenue, a number of assumptions have been made, as described below:

- the number of daily trips identified for each demand segment has been factored to an annual number of journeys based on separate annualisation factors applied to specific market segments. Conversion factors of 260 (Segment 2) or 312 (Segments 1, 3, 4, 5) have been applied to uplift daily demand, although no demand for Sunday travel has been included in the forecasts;
- revenue has been estimated based on applying actual revenue yields for journeys to Leeds, York, Harrogate and other destinations (representing longer distance journeys). These yields have then been applied to the different market segments described above.

## New Housing – Segment 1

The number of rail trips associated with the proposed housing development at the Manse Farm site has been estimated based on PDFH trip rates<sup>2</sup> (lower estimate) and TRICS<sup>3</sup> (upper estimate) for new stations. Two demand scenarios were identified in the initial work undertaken, as follows:

- 'Scenario A', with 650 dwellings on the Manse Farm site. All dwellings are assumed to be occupied, with the higher trip rate. This forms the more optimistic scenario;

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<sup>2</sup> Table B6.2, PDFH (August 2002)

<sup>3</sup> TRICS® 2010(a)v6.5.1 (December 2009)

- ‘Scenario B’, with 500 houses developed. 75% of dwellings are assumed to be occupied based on the lower trip rate, to represent a more pessimistic scenario.

For both scenarios, the population of the development has been estimated based on the average number of occupants per dwelling, derived from Census data for the Knaresborough East ward. A trip rate for ‘built-up area close to urban centre’ has been applied, based on the population of the Manse Farm development being within 800m of the proposed station site<sup>4</sup>. Outputs from TRICS have been used to estimate the trip rate for the more optimistic scenario. No uplift has been applied to represent demand from a distance beyond 2km from the site, given the specific consideration of other travel markets (as presented in the following sections to avoid potential double counting). Between 22 and 50 daily trips are forecast from proposed housing on the Manse Farm site. Further work was undertaken as the Council progressed with its site options work and the model was re-run using 700 dwellings. Table 2.1 represents a summary of the estimated number of rail journeys.

**Table 2.1: Estimated Rail Journeys from New Housing on the Manse Farm Site**

Methodology	Scenario	
Number of Dwellings	700	(a)
% Occupancy Assumed	100%	(b)
Occupants per Dwelling	2.3	(c)
Population	1495	(a) x (b) x (c)
Daily Trip Rate (trips per resident)	0.033	(d)
<b>Daily Trips</b>	<b>53</b>	(a) x (b) x (c) x (d)
<b>Annual Trips</b>	<b>16,580</b>	

Source: Arup calculation, PDFH. Notes: Daily trip totals rounded to nearest whole number

The assumed trip rates shown in Table 2.1 are lower compared with other rail corridors, especially in West Yorkshire. The introduction of timetable improvements in terms of higher frequencies, more comfortable rolling stock and faster journey times could help to generate trip rates which are up to five times higher. This would help to significantly improve the business case presented later in this Project Inception Report. An incremental package of improvements for the Harrogate Line is being identified, through the work being undertaken by the Harrogate Line Officers group as the basis for future funding bids.

## Employment – Segment 2

Trip generation associated with possible office uses on the Manse Farm site has been estimated using person trip rates derived from the TRICS database<sup>5</sup>. The number of rail journeys has been estimated by applying the existing rail mode share for the Knaresborough wards to the total person trip generation. Based on

<sup>4</sup> The figure of 800m is used within PDFH as research by Preston (1987) shows that, at most stations, the majority of passengers live within 800m of the site (based on actual, straight-line distances rather than walking distances) ([http://www.konsult.leeds.ac.uk/private/leve12/instruments/instrument004/12\\_004b.htm](http://www.konsult.leeds.ac.uk/private/leve12/instruments/instrument004/12_004b.htm)).

<sup>5</sup> TRICS© 2010(a)v6.5.1 (December 2009)

this methodology, approximately 22 rail journeys would be generated daily by the Manse Farm office development. Table 2.2 presents a summary of this analysis. Whilst office development has been used for this initial assessment further work will be needed to look in greater detail at the likely split of employment uses on this site as trips derived from office use may overestimate the likely demand.

**Table 2.2: Estimated Rail Journeys Associated with Office Development at Manse Farm**

Methodology		Calculation
Office GFA	sq ft	160,000
Office GFA	sq m	14,864
Number of Person Trips	24hr total	2401
Rail Mode Share	Knaresborough ward	0.9%
Daily Trips (each direction)	24hr total	22
<b>Annual Trips (both directions)</b>	<b>'Daily trips' x annualisation factor</b>	<b>11,543</b>

Source: Arup calculation, TRICS

Notes: Daily trip totals rounded to nearest whole number

### Strategic Park and Ride to Harrogate – Segment 3

The proximity to the A59 / A658 route between the A1(M) and Harrogate means the proposed Manse Farm station will provide an attractive option for park and ride trips to central Harrogate. Journey to Work Census data from 2001 was used to identify the in-scope car trips from origins to the north and east of Knaresborough, with a particular focus on journeys that would arrive via the A1(M) and / or the A59<sup>6</sup>.

Arup has populated their park and ride model to compare the generalised journey times (GJTs) for trips either by car or by park and ride. Table 2.3 summarises the analysis, indicating that the Manse Farm site would attract 41 daily one-way park and ride journeys to Harrogate or about 12,800 journeys annually.

These totals do not consider the impact of the strategic park and ride trips during the off-peak period.

<sup>6</sup> The 2001 Census Journey to Work dataset, whilst 8 years old, is the most accurate and detailed dataset for trip origins and destinations available for the study area. However, there may be scope to update this source in due course, once the Harrogate traffic model is completed

**Table 2.3: Estimated Demand for Strategic Park and Ride Journeys to Harrogate via Manse Farm**

Methodology	Calculation
In-scope Car Driver Trips (Daily)	726
Park and Ride Mode Share	6%
Park and Ride Trips (daily, each direction)	41
<b>Park and Ride Trips (Annual, both directions)</b>	<b>25,584</b>

Source: Arup calculation using Journey to Work Data and Park and Ride model. Park and ride mode share presented to the nearest whole number

## Tourist Journeys to Harrogate – Segment 4

In addition to strategic park and ride journeys to Harrogate associated with commuting, the Manse Farm station could provide an alternative option for journeys to central Harrogate. An estimate of the annual number of visitors to key tourist attractions including the Harrogate International Centre and showground has been provided by HBC. The second scenario reflects a slightly lower number of visitors attending the Harrogate Showground. The annual number of visitors has been factored to represent the proportion that is likely to be in-scope to the Manse Farm station; for the purposes of this assessment, this factor is based on the analysis undertaken to identify the proportion of in-scope trips for strategic park and ride journeys. The 10% in-scope trips is estimated from the percentage of journey to work trips originating from places to the north or east of Knaresborough via the A59 or A1(M) corridors, compared with the total. A park and ride mode share has also been derived from the analysis undertaken for strategic park and ride, to reflect the likely mode share during off-peak periods.

**Table 2.4: Estimated Number of Tourist Trips to Harrogate via Manse Farm**

Calculation	Scenario	
Annual Number of Visitors	HIC	212,000
	Showground	500,000
	Total	712,000
% In-scope to Manse Farm	10%	
In-scope Tourist Trips	71,024	
Park and Ride Mode Share	4.1%	
<b>Park and Ride Trips (Annual)</b>	<b>5,786</b>	

Source: HBC data, Arup park and ride model. Percentage of in-scope trips rounded to the nearest whole number

However, the results presented in Table 2.4 could under-represent the likely demand, since there are other journey purposes, for example, leisure, shopping, and these are not captured in this dataset or the methodology described above but are likely to make a contribution to the number of trips.

## Existing Housing – Segment 5

Given the improved accessibility to rail services as a result of the new station, the potential for modal shift to rail from other modes has been estimated based on Journey to Work 2001 Census data. Similarly, it is assumed that these journeys represent trips made during weekday AM peak periods. Car driver journeys from the Knaresborough wards to central wards in Leeds and York are assumed to be ‘in-scope’ to the new station. Mode shift is estimated based on the relative change in GJTs for journeys by car and rail from the Knaresborough wards to central wards in Leeds and York. The improvement in journey times is linked to the improved rail service. As presented in Table 2.5, 21 car trips from Knaresborough to either Leeds or York in each are forecast to switch to rail as a result of the Manse Farm station.

**Table 2.5: Estimated Rail Journeys from Existing Housing to Leeds and York**

Origin Ward	Destination	In Scope Trips by Car Drivers	Estimated Rail Journeys
Knaresborough East	Leeds	39	6
Knaresborough King James		79	6
Knaresborough Scriven Park		59	6
Subtotal		177	18
Knaresborough East	York	6	0
Knaresborough King James		0	0
Knaresborough Scriven Park		33	3
Subtotal		39	3
Total (One Way, Daily)		216	21
<b>Total (Annual)</b>		<b>134,784</b>	<b>10,920</b>

Source: Arup analysis of Journey to Work data

### 2.3.3 Abstraction from Knaresborough

It is likely that the provision of the Manse Farm station and the park and ride opportunities that it offers will abstract passengers from other adjacent stations on the Harrogate Line. An initial assessment was conducted which examined the potential abstraction from Knaresborough which estimated that about 69,000 trips will be abstracted. However, this analysis was subsequently updated to include other stations along the Harrogate line.

An assessment has been conducted to examine the likely amount of passenger abstraction from Stations within the Harrogate area using a station choice model. This model used a logit function to examine the relative attractiveness of each station for residents from each ward within the Harrogate District. Changes in the station choice between the ‘do-nothing’ and ‘do-something’ scenarios were used to identify the level of abstraction to Manse Farm.

The results of this analysis have shown that there is some abstraction from stations along the route. Due to its proximity to Manse Farm Knaresborough

station experiences the highest levels of abstraction with around 8,300 trips a year being abstracted. Harrogate and Starbeck both have around 7,600 trips a year abstracted. Levels of abstraction are lower from other stations in the district. In total around 51,000 trips per year are expected to be abstracted.

Although the new station at Manse Farm leads to passenger abstraction from other stations there is no loss of passengers for the railway as a whole. As passengers travelling from Manse Farm will pay a different fare to that currently paid at other stations the proposed station will lead to a marginal change in revenue, but this impact is not material on the wider business case for the scheme.

### 2.3.4 Revenue Yields

Revenue yields form an important part of the overall business case, since they determine how much each passenger will pay to travel. Current yields vary depending on the specific type of journey, for example, it is cheaper to travel to Harrogate, compared with Leeds or York, whilst a ticket to London will be even more expensive. We have calculated average revenue yields using LENNON ticket data, and the yield assumptions have been sub-divided into specific categories. For example, the park and ride trips to Harrogate are based on the specific yield, with office based trips using a weighted average for journeys from stations on the Harrogate Line. This approach enables the revenue generation to be calculated in more detail.

### 2.3.5 Summary of the Demand and Revenue Forecasts

Based on the above assumptions and the methodology outlined in the previous sections, a new station at Manse Farm could generate around 70,400 new journeys per annum. This total excludes the abstracted passengers from Knaresborough station, as outlined in section 2.3.3. It is a relatively cautious forecast, since the methodology for estimating journeys associated with strategic park and ride during the off-peak, plus both existing and new housing in Knaresborough and Manse Farm site respectively reflects journeys to work only. No estimate has been made to reflect park and ride demand during the off-peak. The estimated demand and revenue for each demand segment is summarised in Table 2.6. For some market segments described above, demand is only calculated in a single direction, so the demand forecasts are doubled to reflect the total journeys.

**Table 2.6: Summary of Demand and Revenue Forecasts**

Demand Segment		Daily Single Journeys	Annual Journeys	Annual Revenue (£)
1	Housing Development	53	16,580	90,000
2	Office Development	22	11,543	31,521
3	Harrogate Strategic P&R	82	25,584	30,832
4	Harrogate Tourist P&R	19	5,786	6,973
5	Other Knaresboro' – Leeds	36	9,360	26,433
	Other Knaresboro' – York	6	1,560	5,561
<b>Total (New Demand)</b>		<b>218</b>	<b>70,413</b>	<b>191,319</b>
<i>Abstraction</i>		<i>163</i>	<i>51,000</i>	
<b>Total (inc. Abstraction)</b>		<b>383</b>	<b>121,413</b>	

Note: 'Abstraction' represents demand abstracted from Knaresborough station. Revenue associated with abstracted demand is based on an average yield for all journeys from Knaresborough.

The role of car parking at the proposed station forms an important element in the overall total. Around two-thirds of the total trips using the station would require parking, so this forms an integral element of the overall scheme. If parking was not provided, possibly as a measure to help reduce capital costs, this would significantly reduce the attractiveness of the costs, and hence the patronage forecasts.

Car parking charges are not included in the business case, since the scope for including these daily charges will be dependent on a wider policy. The charging structure and the type of operation merits further consideration. However, by way of example if it is assumed that 100 out of the 150 spaces are occupied for 363 days per year with a charge of £2.50 per day this equates to £90,750 which could provide revenue for ongoing maintenance of the station and associated parking.

### 2.3.6 Rolling Stock Requirement

Services on the Harrogate Line already experience overcrowding during the AM peak periods, particularly on the approach to Leeds and to a lesser extent York city centres with many passengers having to stand between Horsforth and Leeds in the morning peak and between Hammerton and York on one AM service. There is a concern that additional demand generated by the Manse Farm proposals could exacerbate overcrowding problems.

Passenger count data has been obtained from Northern Rail and more detailed analysis has been conducted but for reasons of data confidentiality this data is withheld from this report.

As much of the overcrowding on the route is limited to the section of the route between Horsforth and Leeds the Yorkshire and Humber Route Utilisation Strategy (RUS) suggests that the most appropriate solution is to run additional peak services between Leeds and Horsforth. The RUS recommends five additional services calling at all stops between Horsforth and Leeds in each peak period. To facilitate the operation of these services a new turnback facility will be needed at Horsforth. Following the introduction of this shuttle service it is proposed that the timetable be amended so trains from beyond Horsforth do not call at either Burley Park or Headingley. This should help to alleviate overcrowding problems on Harrogate Line services between Horsforth and Leeds and produce more even loading patterns. The timetable change would also help to improve journey times between Harrogate and Leeds and / or help to offset the additional station dwell time at Manse Farm.

Forecasts undertaken as part of the development of the Project Inception Report suggested that up to 109 peak trips per day would be generated by the new station, these have been halved to provide one way flows and are shown in Table 2.7.

**Table 2.7 Total daily trips from the Manse Farm site**

	Daily Trips
Trips from new homes	25
Office development	18



Park and ride trips (Harrogate)	41
Park and ride trips (Other destinations)	19
Total	109

Source: Arup Project Inception Report (August 2010)

A MOIRA model has been used to obtain destination splits for existing trips from Knaresborough station and these have been applied as a proxy for the new station at Manse Farm. This shows that an estimated 32% of trips are made to York, with 29% to Leeds and 20% to Harrogate with the remaining trips to other stations.

Applying these splits to the new Manse Farm trips indicates that up to 16 additional trips per day will be generated to Leeds, with a similar total to York. These trips have been allocated to individual services based on the proportion of patronage on existing services throughout the peak period. For the busiest train this accounts for an additional 5 passengers.

It is difficult to know the exact impact on services arriving at Leeds during the AM peak as the impact on crowding of the additional shuttle services proposed between Horsforth and Leeds is not yet known. However, we have attempted to model the impact of the additional trips from Manse Farm on the network in light of the additional services. In order to do this the following assumptions have been made:

- Around 50% of total arrivals on the Harrogate Line during the AM peak are from Horsforth, Headingley and Burley Park;
- There will be a 20% uplift on trips from Horsforth to account for generated demand as a result of the introduction of the new services and the crowding relief offered;
- All trips from Horsforth, Headingley and Burley Park will transfer to the new services.

Although there will be capacity improvements towards Leeds, the extra journeys that will be generated in the York direction will exacerbate the existing overcrowding problems and a solution will need to be resolved. This will be identified through the Harrogate Line Rail Officer's Group.

Making these assumptions gives a new crowding profile which shows that the new services help to alleviate many of the crowding problems on the line. Only one service remains over seated capacity during the AM peak, meaning some passengers will have to stand. The small number of additional trips generated by the Manse Farm development will have little impact on the levels of crowding on the route, especially once the additional services from Horsforth are introduced.

### 2.3.7 Comparison with Other Business Case Work

CDL have separately undertaken an analysis of the business case for the proposed Manse Farm station<sup>7</sup>, and this has been reviewed to benchmark the forecasts presented in the previous sections. Figure 2.2 presents a comparison of the estimated demand and revenue forecasts, including the impact of new demand only (excluding abstraction).

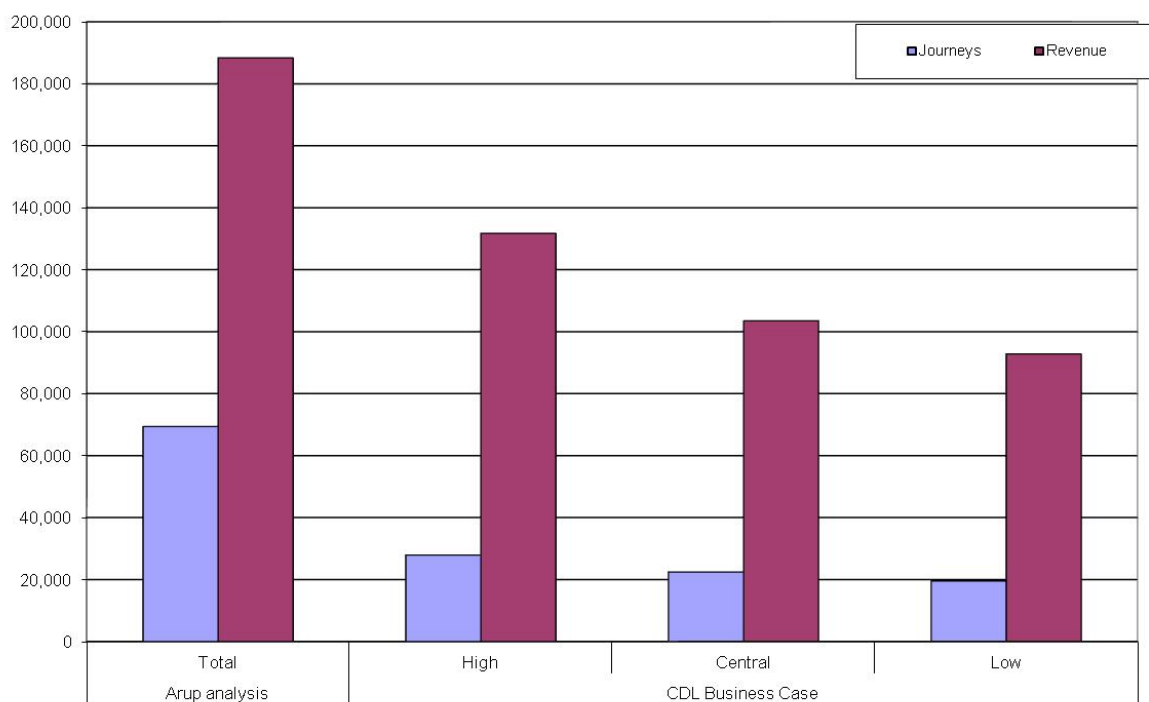
<sup>7</sup> 'Manse Farm Station Proposal – Initial Business Case Analysis', dated 21 December 2009.



The comparison of the results highlights the following:

- Arup's demand forecasts are higher compared with CDL as a result of differences in the methodology used. A range of other demand segments have been included, particularly strategic park and ride to Harrogate and journeys generated by the proposed office development, which were not considered as part of the CDL business case analysis;
- However, the revenue yield per journey assumed by CDL is significantly higher. Explanations of the underlying assumptions for revenue yields are not explicitly discussed in the CDL business case report. The relatively low yield assumed in the Arup business case associated with strategic park and ride journeys to Harrogate is a key difference, whilst the yields for journeys to York and Leeds are lower. The park and ride segment is a key difference, since it accounts for over a third of the total market. In addition, a weighted average revenue yield has been applied to journeys associated with the proposed office development, based on revenue yields for journeys to Leeds, York and Harrogate only. This yield is lower than the average yield for all journeys, which includes revenue from longer distance (and therefore higher yield) journeys, including London.

**Figure 2.2: Comparison of Demand and Revenue Forecasts**



Source: Arup analysis, CDL

## 2.4 Sensitivity Tests

A number of additional sensitivity tests have been suggested by Arup to assess the impact of future scenarios and to examine the resiliency of the overall business case for the scheme. Four main sensitivity tests have been conducted:

- Test 1: a higher number of dwellings on site;

- Test 2: worsening highway congestion (increased car journey times of 15 minutes to Harrogate, Leeds and York);
- Test 3: increased fuel costs (increased to 175p per litre – 30% increase);
- Test 4: increased rail fares (fares increase at RPI +3%).

Due to the methodology followed of using pre-existing trip rates for the residential and commercial development at the site (taken from the Passenger Demand Forecasting Handbook and the TRICs database) it is not possible to examine the impact of sensitivity tests 2-4 on these sectors as the trip rate calculation does not have any mode choice element. This is not to say that the sensitivities will not impact on demand for rail travel from occupants of the new dwellings and employees at the new office developments.

As with the main case two scenarios have been modelled:

- Scenario A – all costs funded through the public sector with higher trips rate and build-out rate for residential property on the site;
- Scenario B - all costs funded through the public sector with lower trips rate and build-out rate for residential property on the site;

### 2.4.1 Higher Number of Dwellings

A sensitivity test has been conducted to examine the impact of increasing the number of dwellings from 700 to 900. This results in the change in annual trips shown in Table 2.8. The results show that with 900 dwellings the number of daily rail trips increases by around 15 per day.

**Table 2.8 Impact of increased dwelling numbers on trip rates**

	Scenario	Sensitivity Test
Number of Dwellings	700	900
% Occupancy Assumed	100%	100%
Occupants per Dwelling	2.3	2.3
Population	1,495	2,070
Trip Rate (trips per resident)	0.033	0.033
<b>Daily Trips</b>	<b>53</b>	<b>68</b>
<b>Annual Trips</b>	<b>16,580</b>	<b>21,313</b>

Source: PDFH trip rates and TRICs database

The additional houses will generate an extra £25,700 per annum from the extra 4,700 journeys.

### 2.4.2 Worsening Highway Congestion

A sensitivity test has been conducted to investigate the impact of increasing car journey times to Harrogate, Leeds and York by 15 minutes. This shows that park and ride trips and trips from existing housing in the area will make rail more competitive. The sensitivity test generates an additional 25,500 park and ride trips

and 8,800 trips from existing housing per annum, generating an additional £57,000 revenue.

### **2.4.3 Increased Fuel Costs**

A sensitivity test has been conducted to model the effect of a 30% increase in car fuel costs from £1.35 per litre to £1.75 per litre. This will reduce the attractiveness of driving and help to encourage more people to use rail since the generalised cost of the former mode will increase. This change will generate around 6,800 additional trips per year, with an extra £13,700 revenue. The impact of higher fuel prices has also been considered in relation to the passenger abstraction from neighbouring stations to Manse Farm. The outputs indicate that fuel will have some impact on station choice, but these issues are relatively modest given the short access times.

### **2.4.4 Increased Rail Fares**

The impact of a fare increase at 3% fare increase above the rate of inflation is shown. Increased rail fares have a modest impact reducing demand for park and ride and from existing housing. The annual revenue increases slightly as the higher yield per passenger offsets the small loss of trips. There is a reduction of about 1,200 trips per annum, although revenue increases by £3,200.

## **2.5 Transport Needs Statement**

### **2.5.1 Trip Generation from New Development**

The proposed location of Manse Farm station is adjacent to a major development site, and is expected to comprise 700 dwellings, 3 ha employment land, a neighbourhood centre including a primary school and open space. If a new railway station was constructed, it could generate around 220 rail trips per day. The travel opportunities offered by the railway station comprise an important element in the wider travel strategy to the development. If there was no rail choice available, the proportion of trips made by car would increase, inevitably exacerbating the existing congestion problems.

### **2.5.2 Accessibility Constraints**

Accessibility to Knaresborough and Cattal stations is severely limited, particularly given the lack of parking facilities at each station. For example, the lack of parking means Knaresborough station primarily serves a walk-in catchment. Furthermore, the relatively low frequencies to / from Cattal mean the opportunities to park and ride are relatively limited. Although the principal routes into Harrogate are affected by peak time congestion, the opportunities to attract strategic park and ride journeys, particularly from the A1(M), by rail is restricted given the constraints affecting these stations.

### **2.5.3 Attractiveness of Alternative Modes**

The attractiveness of alternative modes is limited, particularly in terms of the public transport network. No bus services currently provide direct connections to

Harrogate, Leeds or York from the Manse Farm site. The 57 bus service offers three services per day via the A59 in each direction between Boroughbridge and Knaresborough. However, these services only run during the off-peak period.

Service 1B provides a half-hourly frequency to Knaresborough and Harrogate. The service operates as a circular service via the Eastfield area, and does not directly serve the Manse Farm site. The walking distance between the approximate centre of the Manse Farm site and the closest bus stop is around 420m. Bus journey times to Harrogate are relatively long; for example, in addition to the walking distance, the bus journey time to Harrogate is between 28 and 34 minutes. In comparison, the indicative journey time by rail to Harrogate from the proposed Manse Farm station would be around 13 minutes.

There was an X54 York to Harrogate service operated by Harrogate Coach Travel, although this commercial route was withdrawn on 22 August 2010.

Given the limitations of the existing public transport network to serve the Manse Farm site, it is likely a significant proportion of the trip generation associated with the site would be car-borne. However, additional car journeys from the Manse Farm site would be likely to exacerbate known congestion issues affecting the principal routes to Leeds, Harrogate and York from the Manse Farm site.

By not delivering a new rail station, the potential connectivity and accessibility improvements to the centres of Leeds, York and Harrogate would not be delivered. As a result, the Manse Farm site would be poorly served by the existing public transport network, resulting in the private car becoming the primary means of transport for accessing the site.

## 2.6 Site Suitability – Highway Access

A site visit was completed to examine the potential to serve the station site from the A59. It was concluded there are no significant barriers to address in terms of visibility or levels. The exact type of junctions will need to be agreed with the local highway authority as the development is progressed through the planning process, particularly given the levels of trip generation associated with the wider development, as well as the proposed rail station. Current discussions with NYCC as the Highway authority suggest that two points of access via new roundabouts would be sufficient to provide access to the site.

## 2.7 Railway Planning Context

### 2.7.1 Overview of the Current Service Patterns

The off-peak timetable comprises an hourly service from Leeds to York via Harrogate with a journey time of about 70 minutes. There is a further hourly service between Leeds and Knaresborough, with departures from Leeds about 30 minutes apart to provide an even interval service pattern. There are a small number of additional peak trains, particularly to / from Leeds, to supplement the off-peak timetable. The additional services are required to alleviate overcrowding problems. There are also a small number of additional trains towards York in the high peak periods. With the exception of a small number of peak trains that adopt a skip-stop calling pattern between Harrogate and Horsforth, Harrogate Line trains serve all intermediate stations. Northern is examining the frequency of

service improvements on Sundays, including the scope to start earlier and frequency enhancements to hourly intervals. Northern operates all services on the Harrogate Line, the exception being a daily East Coast train to / from London.

## 2.7.2 Station Location

The proposed station at Manse Farm is situated on the Harrogate to York railway line (ELR HAY) adjacent to the existing User Worked level crossing known variously as Green Lane or Hay a Park Lane at mileage 15 miles 23 chains. The route at this location is single line although previously it had been double track throughout. It was singled in the 1970s between Knaresborough and Skelton Junction where it joins the East Coast Main Line north of York except for the sections between Cattal and Hammerton and Poppleton and Skelton Junction (exclusive).

The station was initially proposed immediately to the west of Green Lane level crossing; however, the gradient at the proposed station location is 1 in 127 rising towards Knaresborough. The current standard indicates that stations need to be on a gradient of 1 in 500 or less. Whilst existing stations exist on gradients steeper than this there is a risk the Office of Rail Regulation may not agree to trains terminating at Manse Farm because of the gradient. To overcome this issue the station is now proposed to the east of Green Lane Level Crossing where the gradient changes to 1 in 3,300. This avoids the need to seek HMRI derogations and / or expensive infrastructure costs associated with lessening the gradient.



To the east of the level crossing is the treadle for operation of the red/green warning lights for the level crossing at Oakwood Farm if the station is to the east of the Green Lane level crossing to terminating trains will activate the treadle. A detailed survey will be required to understand if intervention is required. One mitigation measure, given that all York bound services call at Manse Farm, is to reduce the line speed and acceleration profile and move the treadles closer to Oakwood farm. A separate option to provide a bay platform would involve considerable signalling enhancements and is rejected on cost grounds. The station

would need to be built to current standards, if tram-train traction requires different standards then modifications will be required. The length of the single platform is recommended to be 97 metres to enable four car trains of 23 metres to call. It should be constructed on the south side of the line adjacent to the development. The usual features of signage, lighting, waiting and help facilities should be provided. If the local train service had been converted to tram train by the time the station is constructed, alternative facilities may be needed. A 150 space car park is to be provided with a 'Kiss & Ride' facility being part of the road network.

To enable both the existing service to call and for the current Leeds to Knaresborough service to be extended to Manse Farm a simple low cost modification will be required to the signalling in the form of an annunciator linked to Knaresborough Signal Box but suppressed in the Cattal direction. This will enable the signaller to know when the service has left Manse Farm. In addition a special bell code will be needed for the terminating services.

A risk assessment will be required to ascertain whether Frogmire Lane footpath level crossing between Manse Lane and Knaresborough will require upgrading because of the increase in train service although this is unlikely. The level crossing at Green Lane is a "user worked" example, and it is generally used by dog walkers, joggers and occasionally vehicles making a short cut. Network Rail has indicated the development will remove the existing rights and the pedestrian and cycleway crossings shown in the document 'A Vision for Manse Farm' both at this location and further east should be replaced by a ramped bridge (indicative capital cost of about £1.5m) or the existing cattle creep. The latter may require modification. The scope and indicative cost for the further work are outlined in section 3.

### 2.7.3 Proposed Service Pattern

The route between Harrogate and York is constrained by single line sections and the opening hours of the signal boxes which currently open from 06:35 to 22:35. These factors, together with the finite rolling stock resources available, limit the service pattern that could be introduced to serve Manse Farm. As far as has been practical, the proposed "SLC2" timetable for the East Coast Main Line issued by Network Rail on the 18th December 2009 has been taken into account.

A study examining the suitability of the existing timetable to serve the station highlighted the following issues:

- the morning peak towards Leeds could be served by the existing York departures (06:52 and 07:27) although both will be retimed;
- in addition to these trains it is possible to start the 07:42, 07:56 and 08:56 Knaresborough to Leeds services back from Manse Farm by making alterations to services in the York direction. The 07:56 will have to start from Hammerton running empty from York instead of running as an empty train from Leeds. To achieve this, the Northern Rail rolling stock resources would require reallocating;
- it is not possible due to the constraints of the single line to stop the 08:45 from York at Manse Farm. Trains from Manse Farm to Leeds would depart at 07:10, 07:38, 07:52, 08:21, 08:53, 09:37 then half hourly;



- all the existing services towards York in the AM peak can call serve Manse Farm;
- in the off peak, a half hourly service is provided to Leeds by extending the Knaresborough terminator to Manse Farm and stopping the York service. The existing stopping service to York can also serve Manse Farm;
- in the evening peak services from Leeds can operate at 16:29, 16:59, 17:12, 17:29 and half hourly to 19:29. Existing services from York can all serve Manse Farm;

Some retiming of services is required, although this means it is not always possible to time trains so they cross at the Starbeck level crossing as per the current timetable. The proposed timetable is no worse in the morning peak, whilst in the evening peak, the barrier would be lowered on one extra occasion. During the off peak, the number of occasions when the barriers are lowered increases from 2 per hour to 4 per hour, although this is no worse than in a peak hour. Overall the downtime is likely to increase marginally as there is a benefit of only one train crossing each time, rather than the two services which cross at present. The Timetable Planning Rules state 'Trains crossing at Starbeck must do so within 1 minute of each other except on isolated occasions to avoid excessive level crossing closure'. They do not appear to suggest that you cannot operate services at other times. Further work will be required to explore these issues in more detail, as the scheme is developed. Furthermore, there are minor re-timings required to a few trains between Leeds and Ilkley / Skipton by 1-2 minutes, and this could be explored as part of the additional tasks completed for the consolidated report.

To improve the train service to Manse Farm station described above, the following changes could be required:

- resignalling and centralising control of the line on one work station which would allow earlier and later train services;
- restoration of the double track alignment between Knaresborough and Cattal. This covers a distance of about six miles, and would provide the flexibility to operate more services to Manse Farm. It would also enable frequencies between Knaresborough and York to be increased to three trains per hour, subject to paths being available on the East Coast Main Line. The indicative capital costs to reinstate the double track alignment could be £25-35m using a scheme in South West Scotland as a possible comparator. However, this scheme was two miles longer and including a connection to a private siding which increased the complexity of the scheme and hence the total costs.

In response to the stakeholder feedback relating to the PIR, some additional analysis was undertaken, as set out below.

## **2.7.4 New Service Specification Option A: Addressing Leeds Turnarounds**

To address the short turnarounds at Leeds still requires trains not to cross at Starbeck. The Operational Planning Rules give a minimum turnaround at Leeds station of seven minutes; the service pattern proposed provides turnarounds of less than this. It had been assumed that a turnover train would be provided off peak which could have implications in additional train crew and platform capacity at

Leeds. To overcome the turnaround one minute needs to be taken out of the journey time between Leeds and Cattal in each direction.

To overcome this three options have been considered:

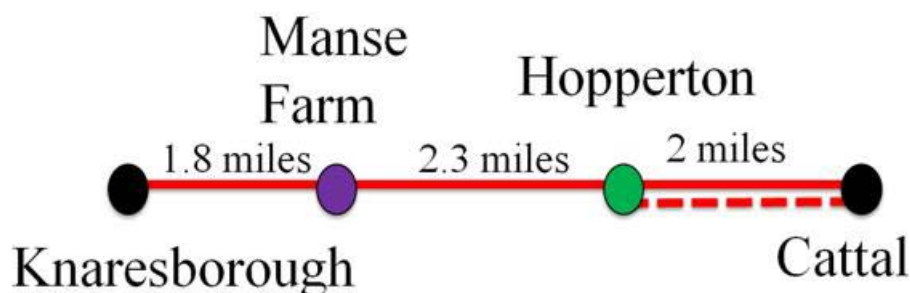
- Review of Sectional Running Times between Cattal and Knaresborough. (To be completed week ending 15th July);
- Review of line speeds between Pannal and Horsforth to assess if the sectional running time can be reduced on this section. A high level assessment has indicated that 75 mph is possible between Pannal and Weeton but not between Weeton and Horsforth;
- Removal of the Weeton calls in York services in the off-peak and contra peak periods.

### 2.7.5 New Service Specification Option B: Partial Double Tracking and Change in Location of Starbeck Station

To overcome the issues raised of additional barrier downtime at Starbeck Level Crossing and shorter turnarounds at Leeds a new train service specification has been devised.

If it is accepted that trains must cross at Starbeck then the only option available is either partial or full double tracking of the section of line between Knaresborough and Cattal. This is driven by the additional running time of a train calling at Manse Farm in each direction. Currently the Eastbound services depart Knaresborough at 00:14½ and arrive Cattal at 00:22½. The westbound service departs Cattal at 00:26½ and arrives Knaresborough at 00:34. The 2012 Timetable Planning Rules state that an eastbound train must arrive at Cattal three minutes before a westbound train departs. It has been estimated that the journey time will be extended by 2½ minutes including dwell time at Manse Farm. This would mean arrivals at Cattal would be 00:25 with departures at 00:24; obviously this is not acceptable over a single line. Raising the speed of the turnouts at Knaresborough and Cattal would probably save ½ minute journey time on an eastbound train which is insufficient; neither would line speed increases provide sufficient reductions in journey time.

Partial double tracking would involve reinstating the second line from the former Hopperton station site at 12 miles 16 chains to Cattal at 10 miles 23 chains, a distance of two miles. Full track circuit block would need to be installed between Knaresborough and Cattal. This would allow Manse Farm to remain as a single platform station.



The Train Service Specification provided by the partial double tracking option is:



- The morning peak towards Leeds could be served by the existing York departures (06:52 and 07:57) although both will be retimed earlier from York;
- In addition to these trains it is possible to start the 07:00, 07:42, 07:56 and 08:55 Knaresborough to Leeds services back from Manse Farm. The 07:56 will have to start from York at 07:14 running empty from Leeds to York instead of Leeds to Knaresborough.
- It was not possible due to the constraints of the single line section between Poppleton and Hammerton to stop the 08:46 from York at Manse Farm. Trains from Manse Farm to Leeds would depart at 06:45, 07:12, 07:38, 07:51, 08:17, 08:51, 09:31 then half hourly; all the existing services towards York in the morning peak can call serve Manse Farm;
- In the off peak, a half hourly service is provided to Leeds by extending the Knaresborough terminator to Manse Farm and stopping the York service. The existing stopping service to York can also serve Manse Farm. Services towards York generally still arrive at the same time as in the current timetable owing to the amount of time spent waiting a path at Skelton Junction. Services from York can start three minutes earlier.
- In the evening peak services from Leeds can operate at 16:29, 16:59, 17:29 and half hourly to 18:59 then 19:30. Existing services from York can all serve Manse Farm.
- In the evening Manse Farm will be served by the hourly York to Leeds service as in the off peak.
- Minor retimings are required to one other service at York and two services at Leeds.

These changes will allow one extra service from Manse Farm to Leeds, the 06:45, as a result of track circuiting the route and one less from Leeds the 17:12, in the evening peak due to timetable retaining the existing crossing movements at Starbeck. This service specification required no additional rolling stock other than if Manse Farm generated a requirement for additional strengthening vehicles. It would also provide a half hourly service between York and Knaresborough.

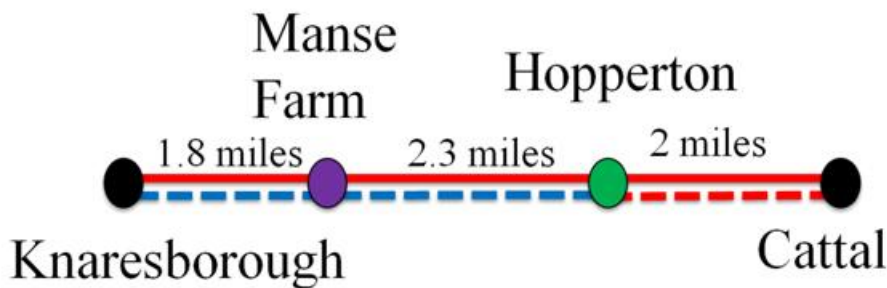
Moving one platform of the station at Starbeck from the north west of the level crossing to the south east side of the crossing will help to reduce the level crossing down time and delays caused to general traffic on the A59. This will allow both trains to clear the crossing before the dwell time associated with boarding and alighting passengers is incurred. Modifications to the Starbeck level crossing may result in Belmont barrier being lowered for a longer time period. Any land purchase, new platform access issues, railway performance and wider traffic management will need to be considered as part of any infrastructure interventions at Starbeck as part of a separate commission.

The introduction of this option would trigger a requirement for re-signalling between Harrogate and York.

### **2.7.6 New Service Specification Option C: New Service Pattern with Full Double Tracking and Change in Location of Starbeck Station**

Full double tracking would involve the reinstating from Knaresborough at 16 miles 24 chains to Cattal at 10 miles 23 chains. It would however eliminate the turnouts at each end of the single line. It may be possible to retain Absolute Block working over this section; however Network Rail is likely to require modern

signalling standards to be adopted. The station at Manse Farm would need to be two platforms with a ramped over bridge for access to the eastbound platform.



The Train Service Specification provided by the full double tracking option would be for a half hourly service to operate all day between York, Harrogate and Leeds. In addition there would as now be two additional peak hour services between into and out of Leeds from Knaresborough together with the Harrogate to London services.

An additional set of rolling stock would be required for this option.

Moving one platform of the station at Starbeck from the north west of the level crossing to the south east side of the crossing will help to reduce the level crossing down time and delays caused to general traffic on the A59. This is because this will allow both trains to clear the crossing before the dwell time associated with boarding and alighting passengers is incurred.

Similar to Option B, this option would also necessitate re-signalling between Harrogate and York.

### 2.7.7 Journey Time Improvements Manse Farm to Poppleton

It would appear possible to raise the line speed to 75 mph between Manse Farm and Cattal, Cattal and Hammerton and Hammerton and Poppleton with the exception of the immediate station areas. Issues that would need addressing are transitions to the track between straight and curved sections, signal positions, and level crossing risk assessments. The Service Specifications would appear to be robust without these improvements.

## 2.8 Key Issues and Costs

### 2.8.1 Capital Costs for the Rail Station

Indicative capital costs for a railway station at Manse Farm have been estimated based on the following assumptions:

- the station would comprise a single platform of 97m length to accommodate trains up to 4-cars in length;
- provision of basic passenger waiting facilities, including lighting, a shelter and help point;
- construction of a car park to accommodate 150 vehicles, plus associated works to provide highway access for station users, taxis and emergency vehicles.

Based on the patronage forecasts presented earlier, a 100 space car park would not be sufficient to accommodate the likely demand;

- an opening year of 2014 has been assumed. However, the constrained funding scenario for transport means there is a strong likelihood that developer contributions associated with the proposed housing and office developments would need to be secured for this timescale to be achieved;
- construction inflation to uplift unit rates expressed in 2009 prices to 2014 is assumed at a rate of 5% per annum.

The inclusion of optimism bias reflects the tendency of transport projects at this stage of development to understate scheme costs, and overstate benefits. No detailed assessment of risk has been undertaken thus far, so an allowance of 66% for optimism bias has been assumed in accordance with standard Green Book guidance. Table 2.9 provides a summary of the estimated capital costs. A detailed breakdown of the capital costs is provided in Appendix A1. A footprint of about 1 hectare needs to be reserved by the development to construct the station and provide associated parking and other facilities.

The scope for delivering the station using an alternative procurement method should be considered, particularly if this approach can realise cost reductions compared with the estimates shown in Table 2.9. For example, there have been a limited number of stations including Warwick Parkway and Coleshill Parkway that have been delivered by private contractors at a lower cost compared with conventional Network Rail procurement methods. This may represent a potential model to be explored in the future.

**Table 2.9: Capital Cost Summary**

Capital Costs	Cost (£)
Railway Earthworks	32,250
Platform Construction	265,000
Permanent Way	20,000
Signalling Works	18,500
Car Park Costs	273,750
Service Connections	100,000
Other Construction Costs	24,090
<b>Subtotal</b>	<b>733,590</b>
Administration Costs	234,835
Ancillary Items	16,672
Possessions	10,000
<b>Total Construction Costs</b>	<b>995,097</b>
Network Rail Costs	229,970
<b>Total Capital Cost (excluding Optimism Bias)</b>	<b>1,225,067</b>
Optimism Bias	808,544
<b>Total Capital Cost (including Optimism Bias)</b>	<b>2,033,611</b>
<b>Total Capital Cost (Out-Turn)</b>	<b>2,595,460</b>

## 2.8.2 Station Operating Costs

Station operating costs have been carefully benchmarked using data from Northern Rail based on data for existing stations. It is assumed that the station would be unstaffed, this assumption is consistent with other stations of similar footfall. Operating costs include maintenance, utilities, lease costs for the land, and the long term maintenance and renewal charge. The estimated annual operating costs would be about £75,000, and has been included in the financial appraisal.

## 2.9 Appraisal

### 2.9.1 Methodology

Based on the forecast demand and revenue associated with the station and estimated capital and operating costs, a financial and economic appraisal has been undertaken. In accordance with WebTag guidance, the appraisal has been calculated over a 60 year period, with prices discounted to a 2002 base. Benefits are discounted at 3.5% per annum for the first 30 years of the appraisal, and 3.0% per annum thereafter.

### 2.9.2 Journey Time Changes for Existing and New Passengers

The impact of journey time changes has been identified based on a comparison of the likely journey times by rail and car for each travel market. The journey time

savings are then multiplied by a weighted Value of Time (VoT), expressed in 2002 market prices for commuting, work and other journey purposes. The weighted average was calculated using the journey purpose splits presented in the WebTag guidance.

Table 2.10 sets out a summary of the changes in journey times for each demand segment, and then converted to a monetary value using the standard value of time parameters. Benefits for new passengers are halved in accordance with standard economic theory, although the full journey time benefits for passengers abstracted from Knaresborough to the new station are assumed.

The proposals would also result in an additional station stop between Knaresborough and Cattal, increasing journey times for existing passengers. These journey time benefits are not sufficient to offset the extended timings for new passengers, and thus equates to a £2.55m reduction over the appraisal period.

**Table 2.10: Summary of Journey Time Changes**

Demand Segment	Journey Time (mins)			Incremental Change in Annual Journeys	Annual Journey Time Impact (mins)
	Car / PT <sup>8</sup>	Rail <sup>9</sup>	Change		
Housing Development	20	13	7	15,393	110,442
Office Development	19	13	6	11,543	72,181
Harrogate Strategic P&R	19	13	6	25,584	153,504
Harrogate Tourist P&R	19	13	6	5,786	34,716
Other Knaresboro' – Leeds	55	49	6	9,360	56,160
Other Knaresboro' – York	55	25	30	1,560	46,800
Abstraction from Knaresborough			10	69,882	698,821
<b>Total Impact (New Users)</b>				<b>139,108</b>	<b>1,172,624</b>
<b>Total Impact (Existing Users)</b>			(2)	<b>610,664</b>	<b>(1,221,328)</b>
<b>Net Journey Time Impact</b>				<b>(471,556)</b>	<b>(48,704)</b>

Source: Arup calculation

### 2.9.3 Highway Decongestion

Highway decongestion benefits have been estimated based on distance by car removed from the highway network for each travel market. This distance was multiplied by the number of forecast trips to calculate the car kilometres removed from the highway network, resulting in up to £4.014m of benefits over the appraisal period. The impact of the extended level crossing down time at Starbeck is not quantified as part of this appraisal but is the subject of further investigation by Network Rail.

<sup>8</sup> Current timing

<sup>9</sup> Future timing

## 2.9.4 Accident Benefits

Accident reduction benefits have been calculated based on the number of car kilometres removed from the network, in accordance with WebTAG guidance. The forecast discounted accident benefit is around £0.096m over the appraisal period.

## 2.9.5 Financial and Economic Appraisal

An economic benefit cost ratio (BCR) has been calculated for the development scenarios identified in section 2.3, whilst a further scenario assuming a developer contribution is also assumed. The following provides some context to explain the benefit cost ratios:

- BCR < 1: poor value for money, and projects would not be recommended for funding;
- BCR between 1 and 1.5: low value for money, and projects would generally not be accepted for funding;
- BCR between 1.5 and 2: medium value for money if the BCR is between 1.5 and 2, with some projects accepted for funding;
- BCR > 2: high value for money, with projects accepted for funding.

The results of the initial appraisal indicated that the economic BCR was reasonable, with an output of 1.71. The impact on journey times for existing users is the main contributory factor for the relatively weak economic performance. The additional station stop would extend journey times between Knaresborough and Cattal for existing rail passengers. However it was recognised that improvements planned and being discussed for the Harrogate Line as a whole could improve this position.

In response to the emerging economic results for the scheme, a second scenario has also been tested. Scenario 2 presents the results if a 50% contribution is secured for the capital costs. The reduced capital costs helps to strengthen the economic benefit cost ratio to 2.23, suggesting the scheme would deliver strong value for money.

**Table 2.11: Financial and Economic Appraisal**

		Core Scenario	Scenario, with funding contribution
Discounted Costs	Operating costs	2.009	2.009
	Capital Costs	1.802	0.901
	Total Costs	3.811	4.586
Discounted Benefits	Revenue Benefit	4.586	4.586
	Journey Time Savings Benefit	-2.194	-2.194
	Decongestion Benefits	4.014	4.014
	Accident Reduction Benefits	0.096	0.096
	Total Benefits	6.501	6.501
Summary	Economic BCR	1.706	2.234

Source: Arup calculation

## 2.10 Funding

The financial and economic appraisal is based on two funding scenarios. Scenarios A and B assume the capital costs for the station would be entirely funded through the public sector. A further scenario C assumes a developer contribution is realised. The potential funding sources therefore include:

- Local Transport Plan (LTP):** the capital costs for the scheme are less than £5m, so DfT approval for Major Scheme funding would not be required. Instead, the scheme would be funded from the Integrated Transport block allocation for North Yorkshire. Whilst the capital costs are significantly less than £5m, the business case for the new station would need to be considered in conjunction with other proposals elsewhere in North Yorkshire;
- Community Infrastructure Levy (CIL):** funding is available for schemes to help unlock large housing development sites, enabling the acceleration of housing development and improving the sustainability of major housing growth. The regulations state when the combined impact of a number of developments creates the need for infrastructure, it may be reasonable for the associated developers' contributions to be pooled, in order to allow the infrastructure to be secured in a fair and equitable way (paragraph B21). In addition paragraph B23 states that in cases where an item of infrastructure necessitated by the cumulative impact of a series of developments is provided by a local authority before all the developments have come forward, the later developers may still be required to contribute the relevant proportion of the costs. Harrogate Council is currently preparing a draft Infrastructure Delivery Plan to accompany the Publication Draft of the Sites and Policies Plan in November 2012. The Council is currently considering its approach in relation to the introduction of the Community Infrastructure Levy and has appointed consultants to undertake an economic viability assessment to support the setting of CIL. It is anticipated that a draft charging schedule will be prepared early in 2013.;

- **Developer contributions:** the results presented in Table 2.9 indicate the economic case for the new station is significantly improved if a third party funding contribution is realised. The proposed housing and employment developments adjacent to the railway station could provide potential mechanisms to secure the funding.
- **Roof-tax:** The feasibility of this mechanism has been examined for a number of growth areas in the South East and requires developers to pay the planning authority a tariff for each house to secure planning permission. A variable "roof tax" could be introduced, with different tariffs to suit local housing markets which could help to fund communal facilities.

NYCC are currently starting work on the preparation of their next Local Transport Plan, so the preparation of this outline business case assessment for the new station is timely. Effective lobbying by HBC could ensure the proposed station is included in the Integrated Transport Block for the next LTP. In addition, revenue costs would be generated as part of the on going running of the new station. These costs do not currently form part of any existing franchise agreement, and would need to be negotiated as part of any future contractual arrangements. Similarly, with consultation regarding the next Northern franchise due to commence shortly, this creates a timely opportunity for HBC and NYCC to highlight this proposal as an emerging priority.

As the feasibility work for the new station has progressed it has become clear that a private developer contribution may be required. This is a matter for further investigation.

## 2.11 Impacts on Wider Objectives

The principal impact on wider objectives resulting from the proposed station would be a result of mode shift to rail for journeys associated with a variety of market segments (as outlined in section 2.3), resulting in benefits related to congestion relief, minimising impacts on air quality and noise. The potential benefits have been partially quantified at this stage, with 55 car trips transferring to rail. Of this total, 34 would be associated with strategic park and ride to Harrogate, providing benefit on the A59 / A661 corridor. Of the remaining commuting journeys, 18 are towards Leeds, with a small number to York. Further benefits would result from mode shift to rail for journeys associated with the new housing, employment and tourist journeys to Harrogate, which would be likely to be made by private car in the absence of the proposed Manse Farm station.





