Appendix E

Previous Reports

South Yorkshire PTE,
Sheffield City Council,
Renaissance South
Yorkshire

Stocksbridge - Sheffield Rail Study

Feasibility of Reinstating
a Passenger Rail Service

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Sheffield City Council,
Renaissance South
Yorkshire

Stocksbridge - Sheffield Rail Study

Feasibility of Reinstating a Passenger Rail Service

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Contents

1 Introduction

1.1 Introduction

Arup was appointed in February 2006 to undertake an outline business assessment for reinstating passenger services on the Stocksbridge to Sheffield line. The purpose of this report is to review the financial and economic case for reinstating passenger services; either as a "conventional" heavy rail service, or operating the line as a heritage route.

The following key tasks were identified:

- review of the potential scope for the route, and to identify opportunities and constraints including consultation with Sheffield City Council (SCC) and South Yorkshire Passenger Transport Executive (SYPTE);
- preparation of an outline business case examining the financial and economic case for the line re-opening.

An assessment of the operational and engineering feasibility would subsequently be completed if the business case identified was robust.

The study was commissioned to assess the potential for a reinstated passenger service, either as part of the existing Northern Rail franchise, or as a heritage rail service. The Stocksbridge corridor is relatively densely populated and there are significant land use proposals that will further increase travel demand. Furthermore, the corridor is also affected by a number of topographical constraints that could improve the attractiveness of rail.

1.2 Description of the Stocksbridge Corridor

No passenger services currently operate on the Stocksbridge route. The only current usage is infrequent (2 trains per week) freight movements to the Corus works from Aldwarke. The communities formerly served by the passenger railway include Stocksbridge, Deepcar-for-Stocksbridge, Oughtibridge, Neepsend and Wadsley Bridge. The potential catchment for the line is relatively constrained by the local topography and there is only limited residential population and employment close to the line.

Passenger services formerly operated beyond Deepcar to Penistone, and then west towards Manchester via the Woodhead Tunnels. Whilst this reinstatement is an aspiration, the opportunities for further service development are unlikely to be released in the short to medium term.

The Stocksbridge corridor also forms part of the route for the proposed Central Railway between Liverpool and northern France. More recently, a proposal for a "rolling highway" that would operate between the Tinsley Marshalling Yard at Sheffield, and a location close to the M67 near Manchester has emerged. The £159m scheme seeks to attract a significant proportion of heavy goods vehicles using the A628 Woodhead Pass. The implementation of this proposal could protect the line for rail freight and provide an alternative funding source for the capital costs. A more regular service could make the delivery of heritage options more difficult from an operational perspective.

The existing track alignment prevents trains from Stocksbridge from directly accessing Sheffield Midland Station. To reach Sheffield Midland, trains would need to reverse east of Woodburn Junction. However, there is very limited spare capacity at the north end of Sheffield Station to accommodate any additional services via Nunnery Junction. Consequently, a terminus station or through running towards Nunnery might be more appropriate from an operational perspective.

1.3 Previous Studies

A number of studies have previously examined the scope for reintroducing passenger rail services on the Stocksbridge line including:

- South Yorkshire Rapid Transit Study;
- South Yorkshire Strategic Rail Study;
- Sheffield Supertram Extensions Study;
- Stocksbridge to Worksop Study.

1.3.1 South Yorkshire Rapid Transit Study (2001)

The opportunities for light rail on various corridors across South Yorkshire were considered, including two options serving Stocksbridge. The Stocksbridge options included extending the existing Supertram corridor from Middlewood, plus a route from Stocksbridge to Nunnery, continuing along the Worksop line towards Beighton before re-joining the existing Supertram alignment to Halfway. The extension of the Middlewood service to Stocksbridge did not cover its operating costs from fare-box revenue, but the route to Halfway from Stocksbridge was forecast to generate a small operating surplus. This corridor was recommended for more detailed analysis.

1.3.2 South Yorkshire Strategic Rail Study (2002)

The South Yorkshire Strategic Rail Study examined potential solutions for the Stocksbridge line, but recognised existing Supertram vehicles and freight could not operate on shared track due to the crash rating of light rail vehicles. A tram-train solution was considered, with the network possibly extended to serve Catcliffe or Sheffield Airport.

1.3.3 Sheffield Supertram Extensions Study (2003)

As a follow up to the South Yorkshire Rapid Transit Study, Oscar Faber undertook further work to examine in more detail the financial and economic case for the best performing options identified in the first phase of the study. This more detailed assessment took account of the updated financial and economic results, consideration of the technical constraints, and the latest DfT guidance. Consequently, the Supertram extensions from Middlewood to Stocksbridge was rejected, and the section from Nunnery to Waverley was included as part of a route from Dore to Hellaby. The conclusion not to pursue Supertram to Stocksbridge also took account of the freight requirements to serve the Corus plant.

1.3.4 Stocksbridge to Worksop Study (2004)

Arup considered the opportunities for connecting Stocksbridge, possibly using light rail, conventional heavy rail or diesel tram-train. Using demand data from the Sheffield Supertram Extensions study, this study concluded that the financial and economic business case for the improvements was weak. Consequently, the study recommended the introduction of a high quality express bus / coach service between Stocksbridge and Sheffield in the short term to help expand the existing public transport market, and to give consideration for a diesel tram train solution in the medium to long term, particularly if significant development occurred in the corridor during this timescale.

1.4 Objectives of the Study

Arup was jointly appointed by SYPTE, SCC and Renaissance South Yorkshire to undertake an outline financial and economic assessment for passenger services on the Stocksbridge line. The study takes account of the housing and employment land use proposals for the Upper Don Valley that will generate new travel demand. The study involved the following:

- estimate of the number of passengers that could use the service;
- forecast revenue;
- a review of the factors that could affect the viability of these forecasts, particularly identifying the potential opportunities and competitive threats.

Don Valley Railway Limited has an aspiration to operate a heritage style service on the line. The study will also assess whether this option is viable, by identifying the existing tourism and local markets that could use the system. Statistics from other heritage routes are used to benchmark the potential for this option.

1.5 Structure of the Report

Chapter 2 summarises the key points from the inception workshop. Prior to the start of the study, the proposed methodology was presented to the study partners to obtain their approval of the process. Chapter 3 considers the scope for demand from the existing travel market, and the potential to expand this catchment from new land use developments. The methodology used to calculate the number of rail passengers is also described.

The patronage and revenue results are summarised in Chapter 4 with a “Central Case” forecast based on a series of assumptions. Given the uncertainties associated with some parameters, several sensitivity tests were conducted to understand the robustness of the forecasts. In Chapter 5 outline operating costs for “conventional” rail services are presented.

In Chapter 6 preliminary financial and economic appraisals are calculated. These appraisals are conducted over a 60 years period in accordance with Department for Transport (DfT) guidance, and the level of financial subsidy and economic benefit cost ratio calculated.

The characteristics of the existing heritage operations are examined in Chapter 7, which also considers whether this approach is suitable for the Stocksbridge line. The conclusions are presented in Chapter 8.

2 Inception Workshop

An inception workshop was held with SCC and SYPTE to discuss the proposed methodology and possible options for the line. This workshop had several components:

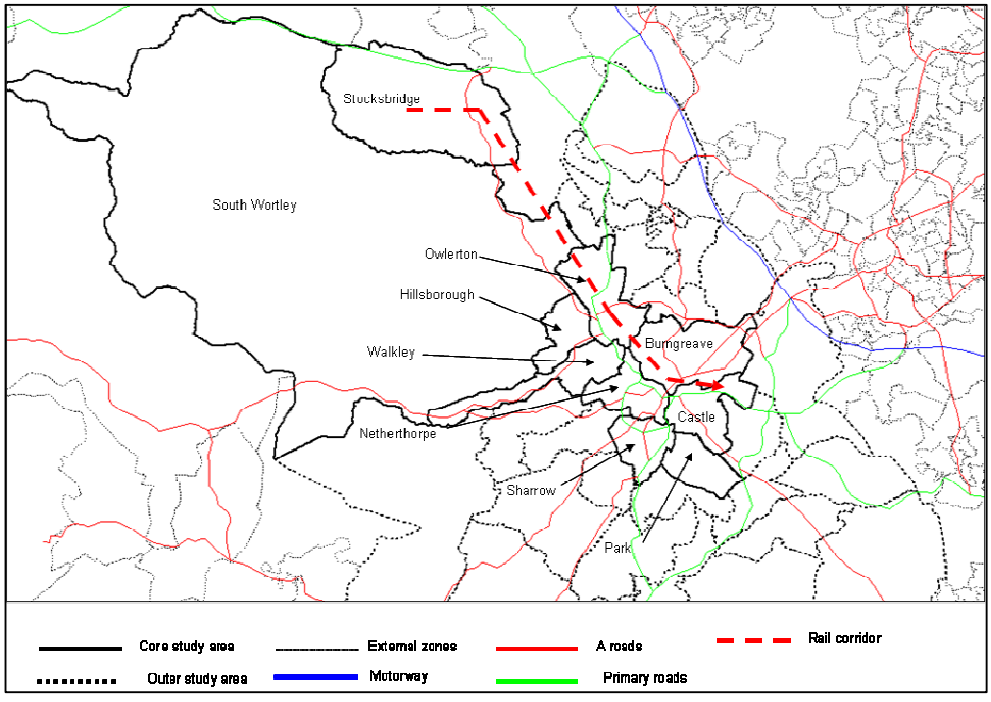
- understanding of the base travel markets;
- identification of potential new travel markets including housing and employment opportunities;
- external factors that could increase travel demand in the Stocksbridge corridor;
- competitive threats and other risks that could reduce the attractiveness of a new rail service;
- consideration of the different technologies that could be introduced;
- overview of the operational and infrastructure issues, and how these could affect the specification of the new service;
- suitability of the "heritage" proposal to the Stocksbridge route;
- possible service specifications.

2.1 Review of Existing Travel Markets

2.1.1 2001 Journey to Work Census Data

To understand the "base" travel market, Arup reviewed outputs from the 2001 journey to work census. This analysis provided a high level indication of the magnitude of existing travel markets, and the number of trips that could be in-scope to transfer to a new rail service. The majority of the catchment would be reliant on car access to the stations, since an 800m catchment would cover a relatively small proportion of the travel market given the topography.

Figure 2.1: Identification of In-scope Zones



Following discussion with the client group, the following wards were identified for the inner and outer study areas respectively:

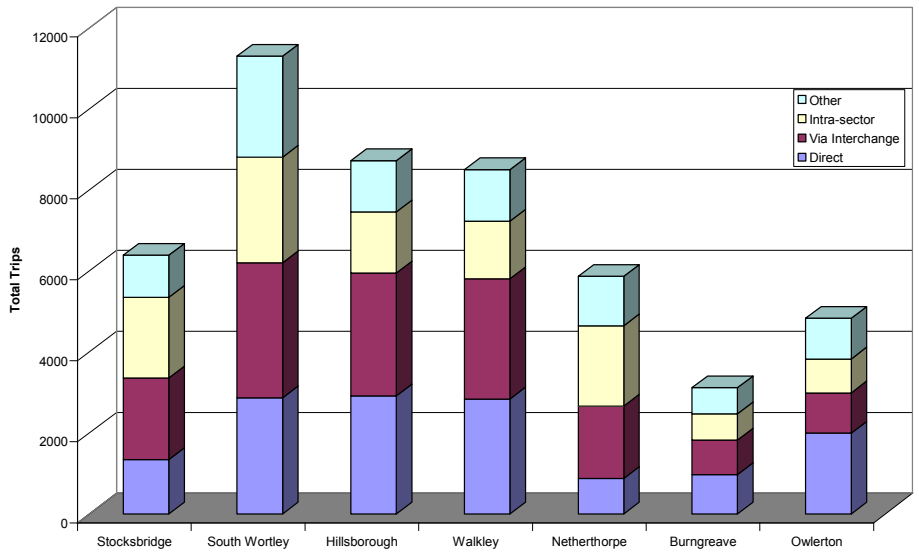
- inner study area: Stocksbridge, South Wortley, Hillsborough, Walkley, Owlerton, Netherthorpe, Burngreave, Castle, Sharrow and Park;
- outer study area: other wards in Sheffield, including Beauchief, Birley, Brightside, Broomhill, Burngreave, Chapel Green, Darnall, Dore, Ecclesall, Firth Park, Hallam, Handsworth, Heeley, Intake, Manor, Mosborough, Nether Edge, Nether Shire, Norton, Southey Green.

The number of journeys to work from the in-scope wards is shown in Figure 2.2. It is assumed these trips are generally made during the AM peak period. The principal flows originating from each in-scope ward were reviewed, and presented the data in terms of:

- direct trips, for example, trips from Stocksbridge to Sharrow;
- interchange trips, with passengers switching to bus or Supertram in Sheffield to complete their journey;
- intra-ward trips, those journeys that start and finish in the same ward. However, it is unlikely these trips would be in-scope to rail, given the relatively short distance;
- trips to other destinations in the UK.

Figure 2.2 illustrates the results. There almost 3,000 in-scope journeys to work from South Wortley, Hillsborough, Walkley, plus about 2,000 from Owlerton. The number of in-scope trips from Stocksbridge, Netherthorpe and Burngreave is smaller. The number of interchange trips with passengers interchanging onto bus or Supertram to complete their journey is generally similar to the number of direct trips.

Figure 2.2: Journey to Work Census 2001 – Analysis of Current Travel Markets



Source: Arup analysis of 2001 journey to work census data.

2.2 Potential New Travel Markets

There is a number of major land use developments proposed for the Stocksbridge corridor that could increase travel demand. We have liaised closely with SCC to understand the details of proposals. The following summarises the main characteristics of each site, in terms of location and the forecast number of jobs that could be created at each site, or the number of new houses to be constructed. The possible housing / employment sites are illustrated in Figures 2.3-2.6.

Figure 2.3: Proposed Development Sites at Clay Wheels Lane

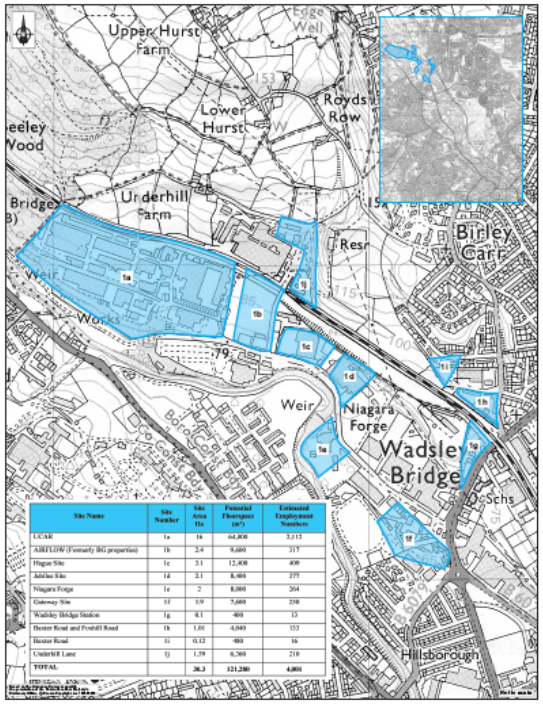
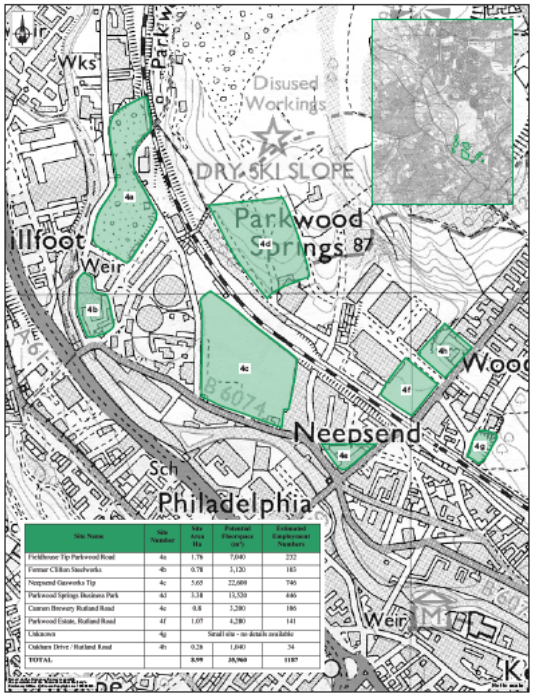


Figure 2.4: Proposed Development Sites at Hillfoot, Neepsend and Parkwood Springs



Source: Plan 4 Travel in the Upper Don Valley

2.2.1 Clay Wheels Lane (Housing)

An outline planning application has been submitted to construct 550 dwellings on the former UCAR site. This will comprise a mixture of flats and larger dwellings, but the split is unknown. To reflect this uncertainty, a 50/50 split of housing and flats was assumed to estimate the number of new trips generated.

2.2.2 Clay Wheels Lane (Employment)

There are several potential sites in the Wadsley Bridge area that could be developed for employment. As part of previous work for SCC (Plan 4 Travel in the Upper Don Valley), nine possible sites were identified, with potential to create almost 1,900 new jobs. The major sites include AIRFLOW close to the UCAR site, and the adjacent Hague site. There are also proposals to develop the UCAR site for employment, but for the purposes of this study, it was assumed this site would be developed for housing.

2.2.3 Hillfoot, Neepsend and Parkwood Springs (Mixed Use)

Several significant employment sites were identified covering a total of 13.7 hectares. Again, outputs from the Plan 4 Travel study were used to estimate the likely employment generation, with over 1,800 new jobs forecast. An outline application has also been submitted to SCC to enlarge the Ski Village. The application includes a snow hall, retail and

leisure facilities, hotels and chalets, and will also be served by a gondola from Langsett Road. However, the level of new employment at the Ski Village to be created is unclear, but the number of staff or visitors using rail is likely to be negligible.

Figure 2.5: Proposed Development Sites at Owlerton / Livesey Street

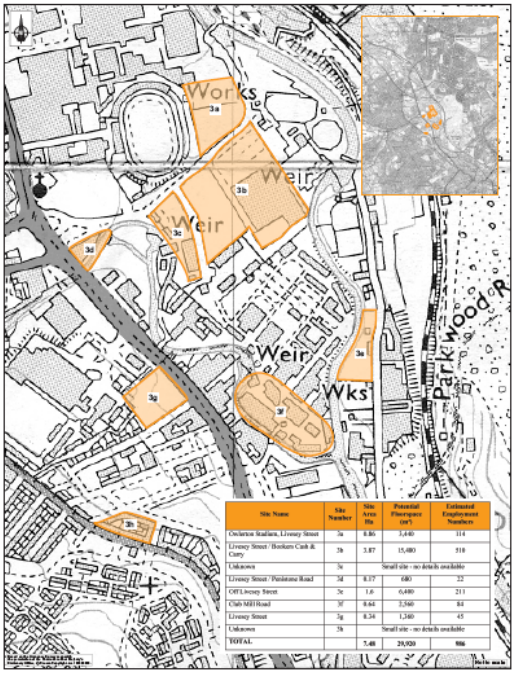
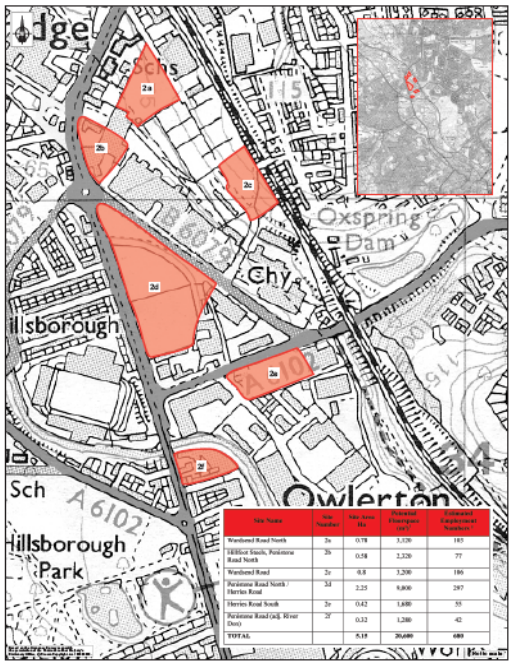


Figure 2.6: Herries Road Development Area



Source: Plan 4 Travel in the Upper Don Valley

2.2.4 Owlerton / Livesey Street Development Area (Employment)

Several sites in the Owlerton / Livesey Street area have been identified for potential employment use. A total of 7.50 hectares has been identified supporting a total of 900 jobs. The major employment sites identified include Livesey Street / Bookers Cash & Carry (510 jobs), plus a further 210 jobs at a site adjacent to Livesey Street.

2.2.5 Herries Road Development Area (Employment)

The Plan 4 Travel study identified six potential employment sites in the Hillsborough area. A total of 5.15 hectares was identified, and these sites could support about 680 new jobs. The main site is located on Penistone Road North / Herries Road.

2.2.6 Burngreave Fir Vale Master Plan (Mixed Use)

SCC is developing a master plan for the Burngreave Fir Vale area of the city, and the proposals include about 310 new residential units, and 950m^2 of business unit to be located on Woodside Lane. Based on other data presented in the Plan 4 Travel report, it is estimated this area of employment land could support about 100 new jobs. A new supermarket is also being planned, but it is assumed the majority of trips generated by this facility would be local, and not in-scope for a new rail service.

2.2.7 Deepcar and Stocksbridge (Housing)

An outline planning application has been submitted for 350-450 new dwellings in Deepcar, with a further 450 houses in Stocksbridge to be located at four potential sites. An additional 350 new houses are planned for Stocksbridge, but the timescales for implementing this development are less certain, and this reduces the likelihood of delivery.

2.2.8 Hillsborough College (Education)

The Hillsborough College has 11,000 students on campus, and this could form an important passenger market. Data was obtained from Sheffield College to understand potential in-scope trips to the Hillsborough College site. Table 2.1 summarises the most important travel markets to Hillsborough College, but there are no significant travel markets to the Hillsborough College site that are in-scope to the Stocksbridge Line

Table 2.1: Largest Travel Markets to Hillsborough College

Origin Postcode	Total Trips	In-Scope to Stocksbridge Line?	
S6	1309	✘	S5 and S6 postcodes represent the Hillsborough / Owlerton / Southey Green area, close to the Hillsborough College; therefore students are unlikely to use rail services.
S5	985	✘	
S35	600	✘	S35 represents the Chapeltown / Ecclesfield areas served by the Sheffield - Barnsley rail line outside the scope of the Stocksbridge Line.
S10	582	✘	S10 represents the Broomhill area, so Supertram or bus are more convenient
S4	449	✘	S4 represents the Pitsmoor / Grimethorpe area, from which the principal public transport mode would most likely be bus.

Source: Arup analysis of Sheffield College catchment data

Smaller travel markets to other sites originating from the Stocksbridge corridor that could be in-scope to other college sites was also considered, for example, the Hillsborough / Owlerton area to the Castle College site on Granville Road east of the city centre.

However, there are no direct trams on weekdays from Nunnery to Granville Road stop, so passengers would need to interchange twice. Direct services only run at weekends, and as trams are routed via Cathedral, they incur a lengthy journey time penalty of about 10 minutes. This option is less attractive than the existing Malin Bridge - Halfway Supertram service which offers a direct route between the Hillsborough area and Castle College. It is concluded there are no in-scope trips to the Sheffield College sites that would use the Stocksbridge Line.

2.3 Other Opportunities

There are a number of factors that could either strengthen the “core” passenger forecasts, or form a significant competitive threat to the delivery of these forecasts. The possible opportunities or threats to a new rail service are examined.

2.3.1 Worsening Congestion

Proposed land use developments for the Stocksbridge corridor will increase traffic flows in the A61 corridor, and a range of studies have been undertaken to assess the impacts. These studies took account of a potential new crossing of the River Don, assessed the impact of the new development related traffic, and re-assignment of local traffic. Some traffic is re-distributed onto the alternative routes, with traffic volumes on some sections slightly reduced. The volume of traffic originating from the Claywheels Lane development to the A61 significantly increases.

The A61 is already operating close to capacity, and the additional traffic that could be generated by the new land use developments along the corridor could lead to a significant

deterioration in journey times for other motorists. This deterioration could improve the relative competitiveness of a new rail service, compared with car, and to a lesser extent, bus. The A61 Penistone Road Local Transport Plan Major Scheme is a potential solution to the worsening congestion.

2.3.2 Park & Ride

Park & ride facilities at stations can encourage motorists to use public transport for part of their journey, particularly if they do not live close to a station. The introduction of safe, convenient parking facilities can attract motorists to transfer to rail. Penistone and the intermediate villages to Deepcar were identified as the main catchment for park & ride. The rail service from Penistone to Sheffield is relatively slow and infrequent (1 train per hour). Therefore, driving to Deepcar to catch a more frequent service may represent a more attractive option in overall journey times. It should be recognised however, that this would result in abstraction from the Penistone Line services.

Other potential park and ride options were rejected, due to the attractiveness of alternative modes, and the indirect access to stations on the Stocksbridge line.

2.3.3 Development of the Local Rail Network

Although the Stocksbridge service could operate as a shuttle to / from Sheffield city centre, there is also potential to expand the scope of this service to operate as a cross-Sheffield route towards Worksop or Chesterfield (via Beighton) in the longer term. At present, there is an hourly rail service to Worksop from Sheffield Midland. Passenger loadings are relatively low, for example, there are about 35,000 passengers per annum using the four stations in South Yorkshire on this route). However, the proposed Waverley Development site envisages a 300 hectares mixed use development, including employment and housing opportunities, which could significantly boost demand.

Any frequency improvements must take account of freight operations, including coal, steel / metals, and aggregates. If trains are extended from Stocksbridge, the operational implications of higher frequencies east of Nunnery Junction must be taken into account.

2.4 Competitive Threats

There are several competitive threats that could affect passenger demand, and these are summarised below.

2.4.1 Existing Bus Services

The Stocksbridge corridor is served by high frequency buses, particularly south of the A61 Leppings Lane roundabout. Table 2.2 summarises the existing bus services using the corridor. Part of the route is served by the high frequency ‘Overground’ network operated by First, with some buses using the A61 Penistone Road, with other services routed via the B6079 and Hillsborough. This equates to about 20 buses per hour south of the Lepping Lane roundabout, with four buses an hour to Stocksbridge. Timetabled journey times from Stocksbridge to central Sheffield are about 45 minutes, offering a high frequency to passengers without access to a car.

Table 2.2: Existing Buses Serving the Site

Service	Route	Mon-Fri daytime frequency per hour
1	Meadowhall – Firth Park – Shirecliffe – Hillsborough	2
13,14	Richmond Park – Manor Park – Shalesmoor – Hillsborough – Loxley	6
20,20A	Hemsworth – Heeley – City – Pitsmoor – Parson Cross – Hillsborough	6
33	Hillsborough – Southey Green – Pitsmoor – City – Heeley – Norton Lees – Jordanthorpe – Gleadless	2
53	Ecclesfield – Parson Cross – City – Woodseats – Low Edges	6
57	City – Hillsborough – Oughtibridge – Deepcar – Stocksbridge	2
58	City – Hillsborough – Oughtibridge – Deepcar – Stocksbridge	2
77	City – Grenoside – High Green – Chapeltown	2
80	City – Fox Hill – Grenoside – Chapeltown – High Green	2
201	City – Crookes – Deepcar - Stocksbridge	1

Source: internet, SYPTE Travel Line

The majority of services on weekdays and Saturdays to Stocksbridge are operated commercially, with all services on Sundays being financially supported by SYPTE. If a significant number of bus passengers switched to rail, the number of bus services that required financial support could increase. In this instance, SYPTE may be required to offer financial support to both the bus and rail service.

2.4.2 A61 Penistone Road Local Transport Plan Major Scheme

The A61 Penistone Road corridor is already served by a high frequency bus corridor, but SYPTE has aspirations to deliver further improvements for this busy corridor in North Sheffield. The proposed regeneration in the Upper Don Valley forms an important growth factor, and the transport requirements to serve this development will change. Several potential options were identified to help achieve patronage growth on the A61 corridor, and maintain existing journey times:

- solutions to support both stopping and express services;
- segregation of buses from other traffic to deliver better bus priority;
- service patterns and priority measures will need to be revised to support passenger flows in both directions, with less emphasis on the “tidality” of peak flows.

The preferred option comprises the development of a new off-line public transport corridor for both local and express services. If new developments were served, it would support wider regeneration objectives, and has the capability to serve both local and express services.

If the A61 Penistone Road Local Transport Plan Major Scheme bid is successful and secures funding support from the DfT, the attractiveness of a rail service in the Upper Don Valley compared with this enhanced bus service would be reduced.

2.4.3 Expansion of the Middlewood Park & Ride

Sheffield Supertram operates from Sheffield city centre via Hillsborough terminating at Middlewood. A park & ride facility is provided at the terminus station. The main car park is a designated park & ride with 180 spaces. Parking costs plus a return journey to the city

centre are £3.00 per day, or £12 per week. Trams operate at intervals of 10 minutes during the daytime. The car park is generally full during the week.

SYPTE conducted passenger surveys in 2003 to identify the trip origin of station users. Table 2.3 illustrates the principal trip origins. There is a relatively high number of trips from origins in the Upper Don Valley including Oughtibridge, Deepcar and Stocksbridge. The distribution of other destinations is relatively dispersed, with about 30% of trips allocated to the "other origins" category.

Table 2.3: Summary of Existing Park & Ride Trip Origins using Middlewood

Origin	Number of trips	Origin	Number of trips
Oughtibridge	23	Grenoside	6
Deepcar	19	Wadsley Bridge	5
Stocksbridge	17	Other Origins	39
Wharncliffe Side	9	**Total**	**126**
Penistone	8		

Source: SYPTE. Table illustrates the number of completed surveys. There is space for 180 cars, indicating 54 drivers were not surveyed.

SYPTE is considering opportunities to expand the car park at Middlewood. Furthermore, a new park & ride site at Malin Bridge will be opened, providing additional capacity for trips from west of Sheffield. The usage of Middlewood will be monitored once Malin Bridge has opened to determine if there is further suppressed demand from the Stocksbridge corridor for park & ride.

2.4.4 Station Locations

Conveniently located stations are an important factor affecting travel choice. Several locations for stations are proposed, including Stocksbridge, Deepcar, Oughtibridge, Wadsley Bridge and a station serving the proposed Ski Village. Accessibility from the proposed UCAR development would also be important. Proposed new bus links to development sites may offer shorter access times than the rail service to Stocksbridge.

2.5 Initial Operational and Engineering Infrastructure Issues

If a satisfactory financial and economic case is identified, the operational and engineering infrastructure issues affecting the route will form part of the next phase of the study. The operational issues have been previously reviewed in outline, and indicative capital costs prepared for a "low cost" passenger service, and a more intensive 2tph service.

It is worthwhile reiterating the key engineering and operational issues as they form key factors in the option specification:

- route from Stocksbridge to Sheffield is an 18km single track alignment, on a predominantly former twin track alignment. In some locations, track has been slewed to the centre of the former alignment to minimise maintenance requirements. Network Rail is only responsible for the track as far as Deepcar. Corus is responsible for maintaining the track between Deepcar and Stocksbridge, it is understood track condition is relatively poor;
- no passenger services currently operate, but the level of freight usage could increase from 2 trains/week to 12 trains/week;

- end-to-end journey times are about 30 minutes, although the current line speed is relatively low due to the poor track condition;
- the line has very limited signalling capability, it is currently operated using a system of "one-token, no staff". Whilst this is suitable for the current freight operation, it would severely restrict the opportunities to develop a regular passenger service;
- restricted access to Sheffield Midland. There is no direct access from the Stocksbridge line to Sheffield Midland, so trains would be required to reverse at Nunnery Junction. This has capacity implications for the north end of Sheffield station, and would extend journey times for passengers when reversing.

2.5.1 Operational Assessment

2.5.1.1 Historic Service

Table 2.4 summarises the 1958 timetable with passenger services operated between Sheffield and Deepcar. The line speed was 60 mph. A passenger service on the Stocksbridge Light Railway (west of Deepcar) has never been operated.

Table 2.4: Former Passenger Timetable Sheffield to Deepcar

Station	Down (westbound)	Up (eastbound)
Sheffield Victoria	xx.00	xx.14
Wadsley Bridge	xx.05	xx.09
Oughtibridge	xx.09	xx.05
Deepcar	xx.14	xx.00

Source: Arup analysis of former timetables.

2.5.1.2 Service Proposals Stocksbridge to Sheffield Victoria

It is assumed that freight services to Stocksbridge would continue to operate during the evening or overnight. If a daytime service was required, the timetable might need to be adjusted to incorporate these flows.

Increasing the line speed to 60mph, with 25 mph between Deepcar and Stocksbridge, it would be possible to operate an hourly service with four stops using a single unit. This is an important consideration, since the current infrastructure would need to be significantly upgraded to achieve this line speed. There would be sufficient "slack" in the timetable to permit further stops, possibly at the proposed Ski Village for example. Three drivers / conductors would be required to operate a daytime service (0700-2000), and further crew for an evening service.

If 2tph were to be operated, a passing loop at Oughtibridge would be required, with a second unit needed. Five drivers and conductors would be required to operate the daytime service pattern, with a further two crews for evenings.

Assuming a frequency of 3tph, track doubling between Deepcar and Oughtibridge and Wadsley Bridge and Sheffield Victoria would be required. Sheffield Victoria could remain as a single platform terminus, but it would be operationally advantageous for Wadsley Bridge, Oughtibridge and Deepcar stations to have two platforms. This would require three train units with eight drivers / conductors for the daytime service. An evening service would require an additional three crew.

A service frequency of 4tph would require double track throughout between Sheffield Victoria and Deepcar, each station also requires two platforms. A 4tph service interval would require four units, with ten drivers / conductors for a daytime service. An evening service

would require an additional four drivers and conductors. All units would operate as empty coach stock movements to / from the depot and Sheffield Victoria at the end of the day.

2.5.1.3 Other Proposals

There would be sufficient capacity to incorporate the "Rolling Highway" proposals if four passenger services per hour operated. The "Rolling Highway" is a £159m private sector scheme to attract lorries crossing the Pennines, primarily using the A628. Terminals would be established at Tinsley Yard at Sheffield and Hattersley near Hyde, Greater Manchester via the Woodhead Tunnel. The outline business case prepared assumes 90% of the existing HGVs using the A628 would transfer from road to rail, although the scheme promoter's website does not contain any details how these targets would be achieved.

2.5.1.4 Extensions to Sheffield 'Midland'

If trains were to be extended to Sheffield Midland, services would need to reverse at Woodburn Junction. There is very limited capacity to access Sheffield Midland from Woodburn Junction, so it is very unlikely four train paths per hour in each direction could be made available. The approximate journey time between Sheffield Victoria and Midland would 13-16 minutes, including the time penalty needed to reverse services and an allowance for delays awaiting a train path into Midland. Previous studies by Network Rail identified the north end of Sheffield Midland as one of the main capacity bottlenecks in South Yorkshire.

Operational modelling, possibly using RailSys, would be required to demonstrate there is sufficient capacity for the additional train paths to / from Sheffield Midland. Reversing trains at Woodburn Junction would also add a substantial time penalty for services to access Sheffield Midland. The timetabling constraint into Sheffield Victoria could also affect the timing of services, and infrastructure requirements on the Stocksbridge Line. If more than 2tph was operated beyond Sheffield Victoria, the section to Woodburn Junction would need to be doubled.

If additional capacity could be identified for the north end of Sheffield Station, the best use for this capacity must be determined. Stakeholders may have other aspirations for other service improvements, for example, an additional Sheffield – Leeds fast service. Consequently, a terminus at Sheffield Victoria may represent a more viable alternative for the Stocksbridge services.

2.5.1.5 Impact of Lower Operating Speeds

The likely infrastructure costs to support a 60mph railway means a lower 30mph speed limit was considered. End-to-end journey time would increase to about 35 minutes, assuming four intermediate stops. This would require additional units and crew, and a passing loop required at Wadsley Bridge to support an hourly service.

The slower end-to-end journey time means three units would be required for a 2tph service. Double track would be required between Sheffield Victoria and Wadsley Bridge, and Oughtibridge to Deepcar. Twin platform stations at Wadsley Bridge, Oughtibridge and Deepcar would also be required. A service interval of 3tph would require double track from Sheffield Victoria to Deepcar, and 4tph is not achievable unless the line speed between Deepcar and Stocksbridge was increased.

2.5.2 Infrastructure Costs

Indicative capital costs at 2003 prices were prepared for different scenarios as part of the earlier Stocksbridge – Worksop Study. The indicative costs for these options are:

- "low cost" options to support an infrequent passenger service – £13m total;

- "higher specification" service option to support a regular hourly passenger service - £36m total;
- 2tph service - £50m.

These estimates of capital costs have been used in the financial and economic appraisal.

2.6 Scope for Heritage Rail Solutions

Don Valley Railway Limited is interested in operating the line as a heritage railway. The opportunity to introduce such a solution is examined in Chapter 7, including the strengths and weaknesses of similar operations elsewhere in the UK, and the suitability of this model for the Sheffield – Stocksbridge route.

2.7 Review of Potential Technologies

The workshop considered the potential alternative rail solutions for the Stocksbridge line. The strengths and weaknesses of the different technologies of each potential system have been evaluated to understand the relative merits of alternative technologies.

2.7.1 Heavy Rail

The heavy rail alternative could be introduced as a "conventional" service, with a regular service interval. Alternatively, a "heritage" option could also be introduced, operated at lower frequencies, using relatively old rolling stock, and slower journey times. The passenger markets for each type of service could significantly differ.

As discussed earlier, there is scope to integrate the local service from Stocksbridge with the wider regional rail network. A station at Sheffield Victoria could provide access to the city centre, with connections for Sheffield Supertram at Nunnery. The interchange at Nunnery would offer access to a wider range of destinations across Sheffield.

Furthermore, the introduction of new rolling stock on the Trans-Pennine network will allow rolling stock to be cascaded. This could free up sufficient units to operate the Stocksbridge service. A heavy rail service would remove the earlier concerns on vehicle crash-worthiness affecting light rail vehicles highlighted earlier. Consequently, the units could inter-work with freight trains, without resorting to "time-locking" freight into certain periods of the day.

However, there are a number of financial constraints that restrict the opportunities for enhancing the local rail network. The operating costs required for a heavy rail service are higher, and is likely to require an on-going subsidy to cover the gap between fare-box revenue and operating costs. Access to Sheffield Station is also restricted, with trains required to reverse at Nunnery Junction, extending journey time. Therefore, the prospects for getting this option included in the Northern Franchise would appear to be low.

2.7.2 Light Rail

Sheffield Supertram offers high standards of service quality, frequency and quality benefits. Journey times may be slightly slower than heavy rail, particularly if the gap between stations is relatively long. A new fleet of vehicles would need to be procured, since the current Supertram vehicles are not sufficiently crash-worthy to operate jointly with the existing

freight trains. The importance of this constraint would increase, particularly given the aspiration to increase movements from 2 trains per week to 12 trains per week.

Furthermore, the recent political appetite to introduce new systems appears from a national perspective to be relatively weak. The government has rejected funding applications for implementing schemes in some cities following concerns about escalating costs.

2.7.3 Diesel tram-train

There are a growing number of European tram-train systems implemented, including Saarbrucken and Karlsruhe. The technology allows units to operate on both the heavy rail and light rail network. The crash-worthiness of vehicles would allow the tram-train vehicles to be introduced, and inter-operated with both freight and other passenger rail services. However, this solution is not suitable to South Yorkshire, since the track gauges differ.

The tram-train solution offers scope to introduce new modern rolling stock that offers improved comfort and reliability to attract passengers. This solution could be delivered incrementally, permitting a gradual expansion of the network as funding opportunities are procured. On-going operating costs may also be lower than a conventional rail service.

2.8 Option Specification

The inception workshop identified various competitive threats and opportunities that could affect patronage using the Stocksbridge to Sheffield route. The key factors affecting rail mode share include:

- service frequency;
- journey time;
- access time to the city centre.

A heritage style operation may reduce infrastructure costs. However, the demand forecasting methodology will allow the impact of different frequencies and operating speeds to be tested (and hence journey times). Frequencies of up to 4tph may be required to allow rail to compete effectively with bus. Furthermore, the assumed journey time must be competitive versus other modes to attract drivers out of their cars.

If the services operate too infrequently, and / or journey times are too slow, the rail service will not be sufficiently attractive to encourage motorists or bus passengers to switch. Consequently a range of scenarios are tested, ranging from different frequencies (1tph to 4tph), and operating speeds (30mph to 60mph) to test the sensitivity of different parameters.

3 Passenger Forecasts

3.1 In-Scope Demand

3.1.1 Zone Plan

The in-scope zones are based on wards as defined in the 2001 journey to work census. The recent boundary changes are not included in this study:

- Stocksbridge
- South Wortley
- Owlerton
- Hillsborough
- Burngreave
- Walkley
- Netherthorpe
- Sharrow
- Park
- Castle

Since the number of in-scope zones is relatively small, a more detailed zoning pattern has been adopted to calculate the potential demand. The in-scope wards have been dis-aggregated to Super Output Areas (SOA). SOA comprise smaller areas with populations of about 1,500. The more detailed zoning enables the journey times and costs to be modelled in more detail, particularly the access / egress element of the trip. The access / egress leg of the trip can be particularly important in selecting one mode compared with an alternative, especially if the overall journey time is relatively short. This flexibility is needed to improve the accuracy of the forecasts.

3.2 Existing Demand Data – Journey to Work Data

3.2.1 Car

Data has been taken from the 2001 journey to work census to identify the in-scope market. Table 3.1 illustrates the results, and the key conclusions are:

- the highest number of trips is generated **from** South Wortley (7,950 journeys to work). There are 860 trips from South Wortley to Netherthorpe, and 610 trips to Burngreave. There are a further 450 trips to Owlerton and Sharrow;
- other important sectors include Hillsborough (4,900 journey to work trips), and Walkley (4,650 trips) and Stocksbridge (4,250 trips). Similar to South Wortley, the largest number of trips from these sectors are made to Netherthorpe and Burngreave;
- the number of car trips generated from wards in central Sheffield is relatively small. For example, there are less than 2,400 trips to work by car originating from Sharrow, Park or Castle, and a relatively small proportion of these trips are in-scope to the Stocksbridge corridor. The central location in Sheffield helps to explain the high proportion of trips to other wards in Sheffield, and beyond;
- the highest number of trips are made **to** Netherthorpe, for example, there are over 3,800 trips from the in-scope zones defined to this ward, including 860 trips from South Wortley, and about 500 trips from Hillsborough;
- there are a significant number of intra-sector trips, including 1,100 trips within South Wortley, 870 within Stocksbridge and 700 within Owlerton. The opportunity for intra-sector trips transferring to rail is relatively small, since the likelihood of conveniently located stations at both origin and destination for short distance trips is small.
- there are a significant number of trips to external zones (up to 60% of the total). This includes journeys to other parts of Sheffield, South Yorkshire, or further afield.

Passengers would need to interchange onto Supertram or bus to complete their journey. The most significant external flows are made to other parts of Sheffield, most notably, Darnall, Firth Park and Broomhill. Trips to these wards account for about 25% of external trips.

Table 3.1: Summary of In-Scope Car Trips

Sector		1	2	3	4	5	6	7	8	9	10	11	Total
Stocksbridge	(1)	868	202	202	45	228	66	436	147	27	72	1,958	4,251
S Wortley	(2)	113	1,095	455	186	610	144	862	447	63	169	3,801	7,945
Owlerton	(3)	24	129	683	51	349	99	282	196	54	137	1,504	3,508
Hillsborough	(4)	36	217	359	576	433	143	486	296	62	165	2,154	4,927
Burngreave	(5)	9	15	69	15	491	21	210	120	36	96	991	2,073
Walkley	(6)	21	117	234	81	333	590	537	278	60	153	2,269	4,673
Netherthorpe	(7)	6	30	66	18	140	57	449	138	42	81	1,434	2,461
Sharrow	(8)	3	9	27	6	114	18	238	377	30	83	1,418	2,323
Park	(9)	6	18	33	3	210	9	162	188	251	126	1,057	2,063
Castle	(10)	3	12	39	9	224	12	161	147	69	327	1,034	2,037
External	(11)												

Source: Arup analysis of 2001 census

3.2.2 Bus

Table 3.2 illustrates the number of in-scope bus trips, and the main trends include:

- the travel market for journeys to work by bus is significantly smaller than the equivalent market for car trips;
- there are fewer than 290 bus trips to work from the nominated in-scope sectors, with about 50% of the trips to external zones. Again, the external sectors include other parts of Sheffield, and other Districts in South Yorkshire;
- similar to the car data, the largest number of journeys to work by bus is made **to** Netherthorpe. There are 520 trips to this ward, including 90 journeys from Hillsborough, and about 70 trips from South Wortley and Walkley.
- with the exception of Netherthorpe and Sharrow, there are less than 100 bus trips to in-scope wards. This analysis demonstrates the potential public transport travel market that could transfer to a new rail service operating on the Stocksbridge line is very small;
- the number of intra-sector bus trips using the Stocksbridge corridor in Table 3.2 is relatively small, demonstrating the limited ability of the bus network to cater for these movements.

Table 3.2: Summary of In-Scope Bus Trips

Sector		1	2	3	4	5	6	7	8	9	10	11	Total
Stocksbridge	(1)	0	0	0	0	0	0	34	3	0	3	110	150
S Wortley	(2)	3	8	9	3	3	3	71	10	3	3	116	232
Owlerton	(3)	3	3	22	3	7	3	43	15	3	16	111	229
Hillsborough	(4)	3	3	12	6	6	3	89	15	3	12	106	258
Burngreave	(5)	0	3	3	3	13	3	25	14	3	7	109	183
Walkley	(6)	3	3	3	3	10	6	67	10	3	10	126	244
Netherthorpe	(7)	0	3	6	3	6	3	44	15	3	3	123	209
Sharrow	(8)	0	3	9	3	7	3	55	10	3	7	191	291
Park	(9)	3	0	3	0	11	3	52	15	10	10	107	214
Castle	(10)	0	3	6	3	6	3	44	10	9	7	153	244
External	(11)												

Source: Arup analysis of 2001 census.

3.2.3 Tram

Supertram operates to both Middlewood and Malin Bridge, offering an attractive journey to work option for trips to Sheffield city centre. The number of journeys to work by tram using the Stocksbridge corridor is considerably smaller than the number of trips by car and bus. Table 3.3 summarises the in-scope trips, and key features of the demand are:

- The wards generating the largest number of trips to work by tram include Owlerton, Hillsborough and Walkley, each ward has convenient access to several tram stops;
- the largest number of tram journeys is made to Netherthorpe (over 330 trips). With the exception of Sharrow, the number of trips to other wards is small (less than 50 trips).

Table 3.3: Summary of In-Scope Tram Trips

Sector		1	2	3	4	5	6	7	8	9	10	11	Total
Stocksbridge	(1)	0	0	0	0	0	0	9	3	0	3	6	21
S Wortley	(2)	3	0	0	0	3	3	39	6	3	3	28	88
Owlerton	(3)	3	3	12	3	3	3	45	6	3	6	49	136
Hillsborough	(4)	0	3	6	6	6	3	106	10	3	6	77	226
Burngreave	(5)	0	0	0	0	3	0	3	3	0	3	24	36
Walkley	(6)	0	0	3	0	6	6	59	6	3	6	36	125
Netherthorpe	(7)	0	0	6	0	6	3	26	6	3	3	40	93
Sharrow	(8)	0	3	3	3	3	3	6	6	0	3	36	66
Park	(9)	0	3	3	0	6	0	22	6	6	6	30	82
Castle	(10)	0	0	6	0	6	3	19	6	3	3	33	79
External	(11)												

Source: Arup analysis of 2001 census.

3.2.4 Other Journey Purposes

Although journeys to work comprise a significant element of trips during the AM peak, they clearly exclude some important journeys, including education, personal business, employers business, and shopping trips. Data from the Sheffield City Council Roadside Interview database has been used to identify the number of journeys to work as a proportion of the total. This database shows that journey to work trips accounted for 44% of the total during the AM peak, and the in-scope trips included in the spreadsheet have been adjusted to represent other journey purposes.

Furthermore, it has been assumed that the outbound leg of a journey to work is predominantly made during the AM peak. Factors to convert AM peak trips to PM peak and inter-peak trips were identified. It is assumed traffic levels in the PM peak are broadly similar to the AM peak.

An appropriate adjustment factor has been used to reflect inter-peak demand. Rail demand is generally concentrated within the peak hour (arrivals between 0800 and 0900), with lower passenger usage at other times of the day. Arrival counts for local rail services to Sheffield were reviewed to derive an accurate factor to represent inter-peak demand. A value of 76% was applied to the AM Peak loadings to represent inter-peak demand.

3.3 Existing Demand Data – Supertram Matrices

The journey to work data provides a detailed source of commuting trips, although it does not represent other trip purposes. To supplement this dataset, the trip matrices developed for the Sheffield Supertram model were reviewed. The Sheffield Supertram model was developed to assess whether it was financially and economically viable to extend Supertram to Dore, Hellaby and Stocksbridge. Zone patterns were compared to understand the compatibility of each system.

Table 3.4: Comparison of Spatial Boundaries – Supertram Model versus Local Authority Wards

Local Authority Ward	Sheffield Supertram Zone(s)
Stocksbridge	232 (but covers a wider area)
South Wortley	232 (part), 225, 223, 192, 198 (part), 199 (part), 193 (part), 218 (part)
Walkley	198 (part), 199 (part), 197, 195 (part), 196 (part)
Hillsborough	193 (part), 199 (part)
Broomhill	203 (part) , 202 (part), 208 (part), 207 (part), 211 (part)
Netherthorpe	99, 100, 101, 104, 105, 106, 107, 116, 102 , 196 (part), 195 (part), 209 (part), 114 (part), 111 (part)
Owlerton	186, 194, 192 (part), 188 (part), 189 (part), 196 (part)
Sharrow	23, 119, 115, 113, 112, 129 (part), 212 (part), 121 (part), 121 (part), 118 (part), 114 (part), 103 (part), 211 (part)
Park	122, 155 (part), 156 (part), 130 (part), 1221 (part)
Castle	120, 108, 124, 109 (part), 110 (part), 215 (part), 158 (part), 159 (part), 160 (part), 161 (part), 216 (part), 155 (part), 118 (part), 127 (part), 107 (part)

Source: 2001 Journey to Work census, Sheffield Supertram model.

Table 3.4 illustrates there is relatively limited similarity between the two zoning systems, with a significant number of the Supertram zones split between different local authority wards. This limits the opportunity to provide a direct comparison of movement patterns using the two zoning systems. Consequently, the movement patterns between zones in the Stocksbridge corridor were reviewed at a relatively high level.

High level comparisons of trips between the data sources by aggregating 'outer' zones (Stocksbridge, South Wortley, Walkley, Hillsborough and Broomhill) to 'city centre' zones (Netherthorpe, Sharrow, Park and Castle) were undertaken. Table 3.5 presents the comparison between the journey to work matrices, and the Supertram matrices. The Supertram matrices include all journey purposes, so it is unsurprising that the number of in-scope trips is higher than the trips represented in the 2001 journey to work census for the AM peak for bus and Supertram. However, the number of car trips in the Supertram matrices is significantly lower than the number of trips to work recorded in the 2001 census. The number of car journeys appears to be slightly under-represented in the Supertram model, particularly given the busyness of the A61 corridor, and the opportunity to use other routes, including the B6079 (Langsett Road / Infirmary Road) and B6074 (Neepsend Lane / Mowbray Street).

Table 3.5: Comparison of Datasets – Journey to Work and Supertram Matrices

Segment	AM Peak		Inter-peak	
	Journey to Work	Supertram Matrices	Journey to Work	Supertram Matrices
Bus Trips	462	1129	No data	491
Car Trips	5391	1799	No data	896
Supertram Trips	316	930	No data	242

Source: Arup analysis of 2001 Journey to Work census and matrices from the Supertram forecasting model.

3.4 New Travel Markets

The inception workshop identified a number of new potential travel markets. The level of new trip generation from the new housing and employment proposed for these sites is calculated.

3.4.1 Clay Wheels Lane (Housing)

The analysis in Chapter 2 indicated 550 units would be constructed on the former UCAR site. The outline planning application indicates a mixture of flats and other dwellings will be constructed, but the actual split is unknown. Consequently, a trip rate for "mixed private housing" from the TRICS database was used. TRICS is a database that calculates trip rates for different land use types (housing, office, retail) using survey results collected from UK sites. A trip rate of 0.26 journeys per household by car and 0.02 journeys by public transport reflect the higher trip rate from private housing, and the slightly lower rate from flats. An additional 154 trips would be generated by the new housing development to the UCAR site.

3.4.2 Clay Wheels Lane (Employment)

A total of 1,900 new jobs are planned for the Clay Wheels Lane development. The precise type of employment is unclear, but the trip rate per employee for office or industrial units is similar - 0.53 or 0.54 trips per employee during the AM peak (Source, TRICS database). The number of new trips that would be generated by the Clay Wheels Lane development is about 1,010 during the AM peak period.

3.4.3 Hillfoot, Neepsend and Parkwood Springs Development

The analysis presented in Chapter 2 identified 1,800 new jobs at the Hillfoot, Neepsend and Parkwood Springs development. About 970 new trips could be generated. Again, the distribution of trips to this ward was used as proxy.

3.4.4 Owlerton / Livesey Street Development Area

The Plan 4 Travel study identified about 990 new jobs for the Owlerton / Livesey Development Area, equating to about 530 trips during the AM peak.

3.4.5 Herries Road Development Area

About 680 new jobs could be generated in the Herries Road Development Area, equating to about 280 trips during the AM peak.

3.4.6 Burngreave Fir Vale Master Plan

The Master Plan envisages that 310 new houses will be constructed, and 100 new jobs created. Using data from TRICS, it is estimated the new housing would generate 81 new trips, with a further 53 trips attracted by the proposed employment.

3.4.7 New Housing in the Stocksbridge Corridor

There are 800-900 new homes planned for Deepcar and Stocksbridge, generating 200-230 new trips during the AM peak. These trips were added to the base year demand. Furthermore, since the 2001 census, an additional 165 new homes are being constructed at the Middlewood Hospital site. The trip generation from this housing has been added to the matrices, since these journeys were not captured by the 2001 census.

3.4.8 Other Travel Markets

There are a number of new employment sites proposed for Sheffield city centre. These sites include:

- Castlegate, Carillion – 1,260 jobs;
- West Bar / North Church Street – 250 jobs;
- Exchange Riverside – 1,340 jobs;
- Blonk Street / Willey Street – 300 jobs;
- Love Street / Bridge Street – 260 jobs;
- E-campus, Pond Hill – 1,700 jobs.

The number of trips to / from Sheffield city centre was uplifted to reflect the additional jobs.

3.4.9 Summary of Trip Generation

Table 3.6 summarises the trip generation from the proposed new developments. The inclusion of both housing and employment growth means there is some potential double counting of new trips (for example, people moving to the new housing developments could also work at the proposed employment sites). Consequently, it is important to note this approach offers the best opportunity for reinstating a rail service between Stocksbridge and Sheffield.

Table 3.6: Trip Generation from Proposed New Developments

Development	Description	New Trip Generation (Single Trips during the AM Peak)
Clay Wheels Lane – housing	550 new houses	154
Clay Wheels Lane – employment	1889 new jobs	1010
Hillfoot / Neepsend / Parkwood Springs	1800 new jobs	970
Owlerton / Livesey Street	990 new jobs	530
Herries Road	680 new jobs	280
Burngreave Fir Vale	310 new houses, 100 new jobs	81+53
Deepcar & Stocksbridge	800-900 new houses	200-230
Middlewood	165 new houses	43

Source: Arup analysis of the Plan 4 Travel in the Upper Don Valley, TRICS database

The additional trips were allocated to the correct zones in the spreadsheet, and added to the base year demand matrices.

3.5 Journey Times and Costs

The different elements of generalised costs were identified for each mode and include:

- car – access / egress times to zone, in-vehicle time, distance (used to calculate car operating costs), and parking cost;
- bus – access / egress time to local stop, service frequency (affects wait time), in-vehicle time, fare;
- Supertram - access / egress time to local stop, service frequency (affects wait time), in-vehicle time and fare. Note, Supertram is only in-scope for certain trips (for example, if the access / egress time is reasonable), so other trips were excluded by filtering these journeys out of scope;
- rail – access / egress time to rail station, frequency, in-vehicle time, and fare.

3.5.1 Car Journey Times and Costs

The zoning pattern is too detailed to use outputs from a formal highway model, so the journey time used to populate the spreadsheet model are calculated based on distance and an assumed traffic speed. Car distances were calculated using crow-fly distances between zone centroids, adjusted to include a 'bendiness factor' of 10% to represent the non-direct route by road. Average link speeds were taken from recent DfT journey time surveys, with assumptions calibrated using local knowledge to ensure the journey times used were representative.

The calculated highway journey times were calibrated against local knowledge, and found to be reasonable. Car access and egress times to the origin and destination zones are 1 and 5 minutes respectively.

Vehicle operating costs were calculated using values from the Transport Analysis Guidance (TAG) Unit 3.5.6. (June 2004) published by the DfT. Car operating costs in TAG comprise two elements; fuel and non-fuel costs, presented in 2002 market prices.

Average city centre parking charges were identified for Sheffield city centre. The parking charges in central Sheffield for commuters range from £5.80 to £9.60 per day. Several car

parks in central Sheffield charge £7.80 per day, so this was used as a proxy. The charging structure used in the spreadsheet model takes account of free commuter parking (50% assumed to have free parking), and halved to represent the tariff for a one-way journey. The average parking cost assumed is £1.95 per single trip.

3.5.2 Bus Journey Time and Costs

There are several bus routes operating on the Stocksbridge corridor for all or part of the journey. A list of bus routes and frequencies were presented in Chapter 2. Bus journey times and fares were coded in the model using published timetable data, fares were based on half the return fare. Services are operated by First Group.

Bus access and egress times were calculated assuming an average walk speed of approximately 80 metres per minute. The access and egress times were calculated from the zone centroid to the nearest bus route stop.

Average weekday bus frequencies on the Stocksbridge corridor have been determined for the station catchments from published timetables. Bus wait times were calculated as half of the headway.

3.5.3 Rail Journey Times and Costs

Walk access and egress times to and from rail stations have been calculated using the same accessibility assumptions for bus access / egress. Rail wait times have been calculated for different operating scenarios: 1 train per hour (tph), 2tph, 3tph and 4tph. Trains are assumed to stop at all stations, so the rail wait time is calculated as half the headway.

As discussed in Chapter 2, the condition of the existing permanent way is varied, and the operating speeds would be dependent on the level of investment available to upgrade the infrastructure. Two possible scenarios were identified, operating at an **average** speed of 20 mph or operating at 40mph (these speeds include dwell time at each station). Journey times have been calculated based on these average speeds, giving an average timing of 33 and 17 minutes respectively.

Rail fares for the new service were estimated using average fare yields per passenger kilometre for existing Northern Rail services. The existing Northern Rail yield is £0.073 per passenger kilometre. Typically, fares in PTE areas are invariably lower given the funding support. This fare structure for rail trips is also lower than the equivalent bus fares (for example, the return fare from Sheffield to Stocksbridge is £3.50, a yield of £0.097 per passenger kilometre). Furthermore, the fare structure for shorter distance trips in South Yorkshire is higher.

3.5.4 Modal Transfer Coefficients

The following methodology was adopted to calculate the generalised costs.

- time and cost inputs for car, bus and rail for trips between the potential catchments for each new station within the Stocksbridge corridor to destinations in Sheffield city centre and beyond via an interchange using Sheffield Supertram or local buses;
- each time and cost input was weighted to calculate the generalised cost;
- the total existing number of car and bus trips between the in-scope zones was quantified (Source, 2001 Journey to Work Census data).

Each part of the journey (access/egress walk time, wait time, in-vehicle time, fare / parking charge) was multiplied by a coefficient that represents the importance attached to each element of the trip. For example, public transport users generally dis-like waiting and

walking for a service, so the coefficients applied are higher than the in-vehicle time. The coefficients used were taken from the previous Sheffield Supertram Extensions study.

- car in-vehicle time: -0.043634;
- car cost: -0.006526;
- car access / egress time -0.080800;
- public transport in-vehicle time -0.043640;
- public transport cost -0.006526;
- PT access / egress time -0.100100;
- public transport wait time -0.096750;
- mode specific constant (rail) -0.218200;
- mode specific constant (bus) -0.839600.
- mode specific constant (tram) 0.135500.
- logsum 0.790000.

These coefficients were consistent with Passenger Demand Forecasting Handbook (PDFH) and other guidance. This suggests coefficients for walk time are 1.5-2 times higher than the in-vehicle time, whereas the wait time coefficients are 1.5-2.5 higher. The coefficients used in the Sheffield Supertram study are within the recommended guidance, and the implied Values of Time are 6.686 pence per minute, or about £4/hour. This VOT is relatively low compared with WebTag and other guidance, particularly given the recommended VOT for non-work time (other - £4.46/hour, and commuting - £5.04/hour).

Generalised costs were calculated by mode and each origin-destination pair. A logit curve was applied to calculate the mode share for car, rail and bus. The relatively low implied VOT indicates that cost (either parking or rail / bus fares) will form an important factor determining the mode selected. A number of sensitivity tests were completed to understand the importance of this parameter on mode share.

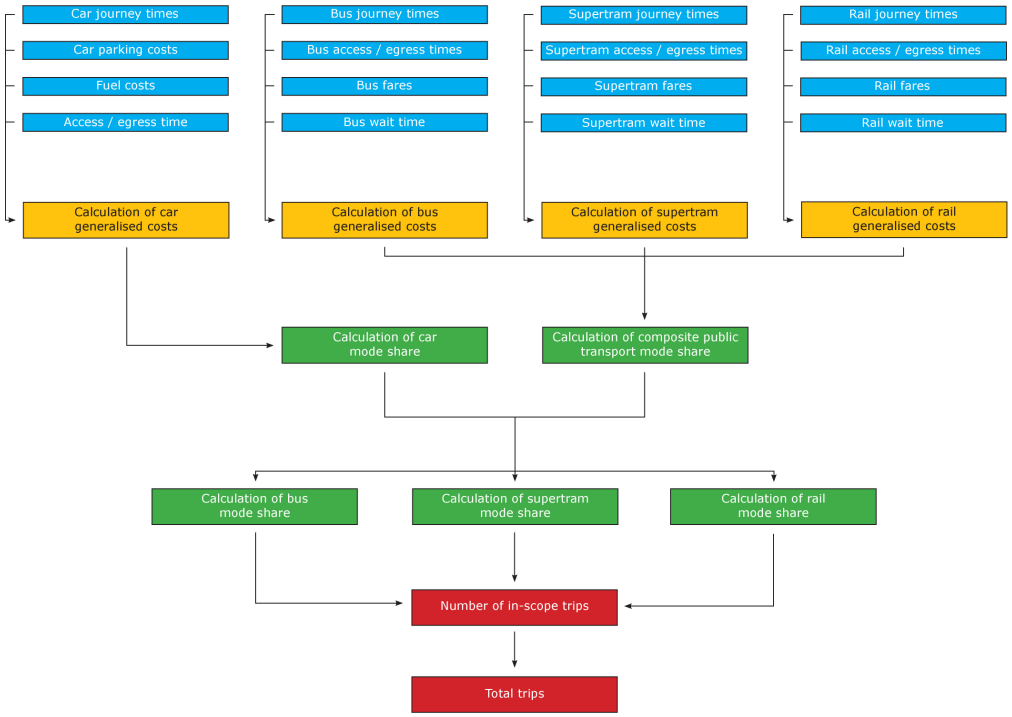
3.5.5 Trip Matrices

Journey to work data from car, bus and Supertram have been incorporated in the model to produce a combined “total trips” matrix. The model calculates the percentage mode share choosing rail from the total in-scope trips, it does not specifically calculate transfer from bus to rail.

3.6 Modelling Methodology

Figure 3.1 shows the modelling methodology, to estimate existing travel and the mode transfer coefficients used to forecast the number of trips switching to rail.

Figure 3.1: Modelling Methodology



3.7 Future Year Growth

Several growth drivers were included in the future year matrices:

- application of National Road Traffic Growth Forecasts to the base year flows;
- additional development-related trips, using the existing distribution as a proxy.

A key assumption applied to the base year matrices is unconstrained growth, and the inclusion of additional development-related trips. A growth factor of 18% is applied to represent AM peak traffic growth between 2001 and 2016.

Unfortunately, the SATURN highway model developed by SCC does not cover the entire Stocksbridge corridor, so the impact on worsening congestion could not be quantified using a detailed network based model. Therefore, a range of sensitivity tests were used to examine the impact of deteriorating traffic congestion. Our assumptions may still be relatively cautious, given the significant increase in link flows using the A61 south of the Leppings Lane roundabout. The additional traffic using this route could lead to slower car journey times, and increase the attractiveness of alternative modes.

4 Results

4.1 Base Case Forecasts

Table 4.1 illustrates the number of in-scope trips to the Stocksbridge corridor. It includes journey to work trips, with an adjustment for other trip purposes, based on results from roadside interviews conducted in Sheffield. There are almost 11,800 in-scope trips during the AM peak, with the largest number of trips originating from South Wortley (2,450), with a further 1,800 trips from Hillsborough. Netherthorpe attracts the largest number of trips, with almost 5,000 trips. The number of new rail trips is calculated, and about 400 new one-way rail trips could be generated during the AM peak assuming a half-hourly service. This equates to average of about 50 passengers per train. South Wortley and Owlerton generate the largest number of trips during the AM peak rail trips (70). Many of the super-output areas are relatively close to the rail alignment, so access times to the station are relatively short. Consequently, the average rail mode share from Owlerton is about 6%. There are about 50 trips from Walkley, Stocksbridge and South Wortley. Hillsborough has the lowest rail mode share (just 1%). The access times from the Hillsborough are longer than Owlerton. Combined with the relative competitiveness of alternative modes including Supertram and bus, just 1% of trips are forecast to use rail. The mode share for other wards is 3-5%.

Table 4.1: Rail Trips Summary: AM Peak Base Year

Wards	In-scope Trips From	Estimated Rail Trips From	Rail Mode Share	In-scope Trips To	Estimated Rail Trips To	Rail Mode Share
Stocksbridge	1,076	56	5%	22	2	11%
South Wortley	2,451	72	3%	74	4	6%
Owlerton	1,177	69	6%	188	17	9%
Hillsborough	1,829	19	1%	39	1	2%
Burngreave	759	17	2%	857	30	3%
Walkley	1,736	55	3%	79	4	5%
Netherthorpe	429	15	4%	6,077	130	2%
Sharrow	753	25	3%	2,546	102	4%
Park	799	37	5%	1,393	80	6%
Castle	816	37	5%	550	31	6%
TOTAL	**11,826**	**401**	**3%**	**11,826**	**401**	**3%**

Source: Arup forecasting model

There are about 130 arrivals into Barnsley from the Penistone Line during the AM peak (this total excludes SYPTE travel-card tickets). A further benchmark is the Worksop Line. There are about 210 trips to Sheffield Midland in the AM peak. These comparisons demonstrate demand from the Stocksbridge corridor is higher than both the Penistone and Worksop lines. This result appears reasonable, given the larger population catchments served by the Stocksbridge, and the higher train frequencies that improve the competitive position of rail.

It is worthwhile comparing the generalised costs for a sample origin / destination by car, bus and rail, to help understand how the rail mode shares have been derived. Table 4.2 illustrates the results. A sample journey between Stocksbridge and Castle has been

reviewed to understand the different elements of journey time and cost, and the calculated proportional shares for each mode.

The generalised costs and mode shares assume 2tph between Stocksbridge and Sheffield would be operated. Access / egress time and wait time are significant factors contributing to the relatively low mode share for rail. Whilst it is convenient to walk from many zones to the nearest rail station, this distance acts as a deterrent for some trips. The number of daily rail trips was calculated. The estimated number of daily rail trips is 1,100 per day (400 trips each during the AM and PM peak, and 300 trips during the inter-peak).

Table 4.2: Comparison of Costs for a Sample Journey – Stocksbridge to Castle

Cost element	Rail	Car	Bus
In-vehicle time (minutes)	34	36	44
Wait time (minutes)	15	0	7.5
Walk time (minutes)	16	6	14
Cost (pence)	200	393	240
Generalised cost (units)	-6.0491	-4.6295	-6.4530
Mode Share (%)	5.1	91.5	3.4

Cost comparisons are not given for Supertram, since light rail is not in-scope from Stocksbridge. The generalised costs are calculated by applying the coefficients presented in Chapter 3 with the values in Table 4.2.

4.2 Impact of Underlying Growth

The National Road Traffic Forecasts (NRTF) represents the likely change in traffic volumes generated from exogenous growth. NRTF does not include the impact of development related in-scope trips, and these impacts were added separately to the in-scope demand. Table 4.3 illustrates the change in in-scope demand from NRTF Growth to 2016, plus trip generation from both the proposed new employment and housing. This information is useful, since it highlights the key growth drivers affecting travel demand on the corridor. The underlying NRTF growth is applied to all wards, whilst trips to the city centre from the in-scope zones are factored by the employment uplift. The fourth column represents demand with the new employment sites located in the Stocksbridge corridor. The final column illustrates the impact of additional housing. There are new houses to be located in Stocksbridge, South Wortley, Owlerton, and Burngreave.

The future year trip forecasts should be treated with some caution. Firstly, the NRTF growth rates are calculated nationally, and a different rate of traffic growth may be applicable to South Yorkshire. Secondly, whilst outline planning permission has been submitted for many of the proposed housing and employment sites, there is an element of uncertainty associated by these developments. These risks should be taken into account when interpreting the results.

Table 4.3: Future Year In-Scope Travel Market (2016)

Ward	Base Year Trips	Impact of NRTF and city centre employment	Additional employment in Stocksbridge corridor	Additional housing
Stocksbridge	1,076	1,295	1,353	1,418
South Wortley	2,451	2,950	3,068	3,084
Owlerton	1,177	1,416	1,460	1,513
Hillsborough	1,829	2,202	2,283	2,283
Burngreave	759	914	942	978
Walkley	1,736	2,089	2,169	2,169
Netherthorpe	429	517	517	517
Sharrow	753	899	983	983
Park	799	951	1,041	1,041
Castle	816	971	1,071	1,071
TOTAL	**11,826**	**14,204**	**14,887**	**15,057**

Source: Arup forecasting model

4.3 Results – Future Year "Central Case"

4.3.1 AM Peak Results

A number of assumptions have been used to identify the "Central Case", based on a 2tph frequency, end-to-end rail journey times of about 30 minutes, and a service that terminates at Sheffield Victoria. Table 4.4 illustrates the number of in-scope future year rail trips has increased from 11,800 to 15,050 trips, with 510 passengers choosing rail. This represents an increase of 26% compared with the base year forecasts. The impact of various sensitivities is presented in section 4.4.

The most important travel markets are South Wortley, Owlerton, Stocksbridge and Walkley. The travel market from South Wortley is relatively large, with 3,100 in-scope trips, and 2,200 trips from Walkley. Stocksbridge attracts a relatively high rail mode share (5%). The short access times from most SOA in the ward to the rail station, and the faster journey times compared with bus are the contributory factors.

Rail is less competitive compared with other modes for journeys originating from wards closer to Sheffield city centre. The journey time advantage offered by rail is reduced, as the trip length is shorter, and the access times to the nearest bus stop are generally less. For example, the rail mode share from Burngreave and Walkley is 2-3%.

Hillsborough has a relatively large travel market, but the proposed station locations are not particularly convenient. Consequently, the rail mode share is just 1%. The convenient access to Supertram and competitive bus network are the contributory factors.

Netherthorpe is the most popular destination ward. Almost 8,000 trips are forecast to be in-scope to this ward, and the rail service would attract 170 trips during the AM peak. However, this equates to just 2% mode share, given the distance from Sheffield Victoria station. Sharrow is also a popular destination, with 125 rail trips. The ward generates a 4% rail mode share, given the shorter egress time from Sheffield Victoria. However, the in-scope market to Sharrow is significantly smaller than Netherthorpe. Other than Castle (99 trips), the number of trips **to** other wards is relatively small, less than 40 trips. This is consistent

with the main movement patterns in north west Sheffield, despite the creation of new employment opportunities.

Table 4.4: Future Year AM Peak Rail Trips

Number of Trips:	In-scope Trips From	Trips From	Rail Mode Share	In-scope Trips To	Trips To	Rail Mode Share
Stocksbridge	1,418	73	5%	26	3	11%
South Wortley	3,084	89	3%	88	5	6%
Owlerton	1,513	86	6%	327	28	9%
Hillsborough	2,283	23	1%	47	1	2%
Burngreave	978	22	2%	1,090	38	3%
Walkley	2,169	67	3%	94	5	5%
Netherthorpe	517	19	4%	7,904	170	2%
Sharrow	983	34	3%	3,106	125	4%
Park	1,041	49	5%	1,703	99	6%
Castle	1,071	50	5%	672	39	6%
TOTAL	**15,057**	**511**	**3%**	**15,057**	**511**	**3%**

Source: Arup forecasting model

4.3.2 Number of Daily Trips

There are about 1,410 trips per day by 2016 in the central case forecast [511 (AM peak) + 511 (PM peak) + 511*0.76 (inter-peak)]. This equates to an average passenger loading throughout the day of about 25-30 passengers per train.

4.3.3 Revenue

The fare-box revenue estimated was based on a 2tph service between Sheffield and Stocksbridge. The estimated revenue (assuming a conversion factor of 338 for daily to annual) is £635,000 per annum. The indicative operating costs are calculated in section 5 to understand whether the fare-box revenue is sufficient to cover the operating costs.

4.3.4 Abstraction from Bus

As discussed earlier, most of the current bus services between Stocksbridge and Sheffield are commercially operated. Passenger abstraction from local buses is a consideration, and this transfer could affect the financial viability of these services. Tables 3.1-3.3 illustrate 15-25% of in-scope trips are made by bus, and the model estimates about 80% of these passengers would switch to rail. This transfer of passengers from bus to rail is likely to affect the commercial viability of the existing bus service.

4.4 Sensitivity Tests

A series of sensitivity tests were conducted. The purpose of these sensitivities is two-fold:

- firstly, to highlight the parameters with the greatest impact on the overall generalised cost;
- secondly, to identify the optimum service proposal, in terms of frequency, journey time etc, and the level of revenue generated. The revenues generated can then be compared with the magnitude of operating costs.

4.4.1 Change in Rail Journey Times

The central case assumed an end-to-end journey time of about 33 minutes between Sheffield and Stocksbridge. Table 4.5 examines the impact if journey times were improved to about 20 minutes. The number of journeys is forecast to increase by about 40% to 710, and the revenue generated could increase to £930,000 per annum.

Additional infrastructure would clearly be required to support the faster journey times. Quantifying the capital costs to deliver these journey times is outside the scope of this phase of the study, but would be considered in the next phase if the outline business case is sufficiently robust.

Table 4.5: Sensitivity Test – Impact of Higher Rail Speeds (2016 Demand)

Operating Speed	No. of AM peak trips	No. of daily trips	Annual Revenue (£'000)
Central Case	510	1,400	635
Faster Journey Time	710	1,940	930

Source: Arup forecasting model

4.4.2 Change in Rail Frequencies

The central case assumed 2tph would operate between Sheffield and Stocksbridge. Alternative frequencies could also be operated, for example, 1tph or 4tph. The lower frequency could reduce the capital cost requirements, whereas the higher frequency could allow rail to compete more effectively with the existing bus service by cutting wait times. Table 4.6 compares the number of daily rail trips for 1tph and 4tph with the 2tph proposal. The results demonstrate the choice between rail and other modes is very sensitive to frequency (and hence wait time). If the service frequency was reduced to 1tph, the number of rail journeys would decline to just 115 during the AM peak, and less than 500 trips all day. However, if the frequency was increased to 4tph, the number of rail trips would increase to 1,060 during the AM peak. Revenues would increase to £1.308m per annum.

Table 4.6: Sensitivity Test – Impact of Rail Frequencies

Service Frequency	No. of AM peak trips	No. of daily trips	Annual Revenue (£'000)
2tph	510	1,400	635
1tph	115	320	140
4tph	1060	2925	1,308

Source: Arup forecasting model

4.4.3 Change in Car Journey Times

As discussed earlier, there is very limited empirical evidence to understand how changes in car journey times could alter in the future. There are proposals to construct a new crossing of the Upper Don Valley north of Middlewood, plus the significant potential for traffic growth associated with land use proposals. The competitiveness of the rail service would be affected by changes in car journey time. Two scenarios have been evaluated to understand the impact of changes - 50% and 100% deterioration in car journey times. If car journey times increase by 50%, the financial impact is broadly similar to the sensitivity test assuming faster rail journey times. The results shown in Table 4.7 demonstrate car journey time is an important component affecting journey choice. If car journey times double, this leads to a 90% increase in rail trips. Load factors increase to an average of 60 passengers per train.

Table 4.7: Sensitivity Test – Change in Car Journey Times (2016 Demand)

Service Frequency	No. of AM peak trips	No. of daily trips	Annual Revenue (£'000)
Central Case	510	1,400	635
50% increase in car journey times	712	1,965	938
100% increase in car journey times	966	2,670	1,333

Source: Arup forecasting model

4.4.4 Change in Parking Costs

Parking costs are also an important factor affecting journey choice. Raising parking charges is often an effective policy tool to encourage greater use of public transport. Given the relatively low implied Values of Time, any change in parking cost could have a larger overall impact on travel choice compared with a higher VOT. Table 4.8 illustrates the results.

If car parking charges double, the number of rail trips more than doubles, demonstrating the importance of this parameter. If parking charges were doubled, rail revenues could increase to £1.49-2.07m per annum.

Table 4.8: Sensitivity Test – Changes to Parking Costs (2016 Demand)

Service Frequency	No. of AM peak trips	No. of daily trips	Annual Revenue (£'000)
Central Case	510	1,400	635
Doubling parking costs	1,160	3,200	1,493

Source: Arup forecasting model

4.4.5 Alternative Trip Distribution

The impact of applying an alternative trip distribution has also been tested. If the current trip distribution was altered, with a higher percentage of trips from Stocksbridge to Sheffield city centre in response to changing employment opportunities, the additional rail trips generated would be small.

4.4.6 Enhanced Bus Service

The delivery of the proposed A61 Penistone Road Major Scheme Bid could strengthen the competitiveness of the bus services, particularly south of the A61 Leppings Lane roundabout. It is assumed the implementation of the Major Scheme Bid would deliver a combination of faster journey times and higher frequencies, and the data inputs in the spreadsheet model have been modified to reflect this.

These changes have a negligible impact on the number of trips choosing rail. The choice between rail, bus and Supertram is conducted at the second tier of the mode choice model once the decision to use public transport has been made. Consequently, the improvement in overall bus journey time has a small impact on the number of passengers choosing rail, as the change in bus journey times have relatively little impact on the overall attractiveness of public transport versus other modes. The mode choice function includes a significant mode constant against bus, so any improvement in frequency and journey time is unlikely to have a significant impact. The mode choice function would need to be re-calibrated in terms of car versus bus to reflect the impact of bus service improvements more closely.

4.4.7 Overview of the Sensitivity Tests

A number of sensitivity tests have been considered that affect journey times, fares and frequencies for rail, car and bus. Halving the rail fares or doubling the parking costs are

forecast to have the greatest impact on rail demand. The improvements to the existing bus service have limited impact.

The impact of combining two or more of the potential policy interventions is not considered, for example increasing parking costs and improving the rail journey times. However, the wider policy implications that could arise are outside the scope of this study.

4.5 Impact of Other Demand

The scope for additional park & ride demand originating from Penistone is relatively small. There are about 400 trips to central Sheffield, so the size of the in-scope market is relatively small that could transfer to the Stocksbridge rail service. This travel market will not materially alter the magnitude of the demand forecasts presented earlier.

4.6 Impact of Competitive Threats and Opportunities

Furthermore, the results of a sensitivity test examining the impact of worsening congestion were previously reported. The extent of future traffic congestion is uncertain, but it is unlikely that journey times would double compared with the current timings. The opening of the Malin Bridge Park & Ride requires careful consideration, since it could release capacity at Middlewood for trips originating from the Stocksbridge corridor. These impacts are likely to be captured as part of a “before and after” monitoring survey.

As discussed earlier, the structure of the mode choice model has a relatively small impact assessing the change in mode share resulting from changes to the bus generalised costs. If the mode choice structure was re-calibrated with the mode constant against bus reduced, this would ensure the introduction of service improvements had a larger impact.

5 Operating Costs

5.1 Methodology

Arup has prepared indicative operating costs for three short-listed options; 1tph, 2tph and 4tph. The unit rates assumed were previously discussed with train operators and include the following elements:

- rolling stock lease charges;
- staff costs;
- fuel and maintenance;
- variable station and track access charges;
- Network Rail track access costs.

Notional timetables were developed, including details of train mileages and the assumed end-to-end journey time. The rolling stock and crew requirements are estimated using these parameters, and unit rates applied. Crew costs are calculated assuming an average of about three drivers / conductors per unit required. This is consistent with standard industry assumptions.

An allowance of £40,000 per annum per station is assumed. This is a conservative estimate, and assumes a minimum specification of facilities, with no station staff present.

The calculation of Network Rail's Track Access Charges is highly complex, so a global factor based on previous project experience has been used. The operating costs have been increased by 25% to reflect the inclusion of Track Access Charges.

5.2 Results

Table 5.1 illustrates the forecast operating costs for the different service options. Staff costs account for largest proportion of the total cost, but given the end-to-end journey times, there is little scope to improve the timetable efficiency to reduce costs. Rolling stock lease costs for the Pacer units are relatively low, just £110,600 per annum.

The first variant to be tested was the 1tph which produce total operating costs of £1.868m, including £0.64m staff costs. If the service frequency is increased to 2tph, annual operating costs increase to £2.417m per annum. Fuel, maintenance and variable track access costs double compared with the 1tph scenario. However, it would be possible to operate the timetable more efficiently when operating 2tph by only having three units.

The service frequency improvement to 4tph generates annual operating costs of £4.381m per annum, double that of the 2tph scenario. Staff costs rise to £1.357m, and six units would be required to operate the 4tph service. Fuel, maintenance, and variable track access costs are 100% higher than the 2tph option.

There is no allowance for spare units in the operating cost calculations to cover unit failure. In the event of unit failure, it is assumed such units would be procured from a central pool held by Northern Rail. A similar allowance is made for staff availability in the event of sickness.

The allowance for station operating costs amounts to £280,000 per annum, regardless of train frequency.

Table 5.1: Summary of Train Operating Costs (£'000)

Cost Element (per annum)	1tph	2tph	4tph
Rolling stock lease charges	221	332	664
Staff costs	641	705	1,347
Fuel	33	62	124
Maintenance	58	110	220
Variable station access charge	179	335	669
Variable track access charge	7	14	27
Track access charges	448	580	1,052
Additional station operating costs	280	280	280
Total Operating Costs	**1,868**	**2,417**	**4,381**

Source: Arup operating cost model

5.3 Heritage Rail

The option of operating the line as heritage rail would give scope for reducing the operating costs. As shown above staff costs constitute a very high proportion of the total costs when operating as a conventional rail system. A heritage rail system could have significantly reduced staffing costs, since other examples are supported by voluntary staff. Clearly, this offers significant scope to reduce costs. However, this option is unlikely to be achievable unless train frequencies were significantly reduced. The lower frequencies would also lead to reduced fuel and maintenance costs.

6 Appraisal and Funding

6.1 Introduction

Arup has developed the Financial and Economic Appraisal in accordance with the DfT guidelines for business cases. This preliminary appraisal would be used to indicate whether this proposal represents Value for Money (VfM) to Government. The appraisal framework quantifies the costs and benefits generated and compares them with per £ of funding support that would be required from the DfT. Costs and benefits are calculated for a 60-year appraisal period, discounted using a discount rate of 3.5% for the first 30 years of the project appraisal, and 3% per annum thereafter to calculate the Net Present Value (NPV). The NPV has been calculated to provide comparison with other rail investments.

The potential funding opportunities is also considered. The suitability of Section 106 contributions given the significant development proposals is considered, together with Local Transport Plan funding, contributions from Translink in response to the "Rolling Highway" proposal, and investment from Northern Rail and the Department for Transport.

6.2 Financial Appraisal

6.2.1 Calculation of Financial Benefits

The results of the appraisal are based on the 2tph scenario between Stocksbridge and Sheffield. The demand and revenue results are calculated for 2016 and take account of the underlying traffic growth and impacts of new development. Forecasts for intermediate years are calculated by interpolation.

6.2.2 Results of the Financial Appraisal

Table 6.1 illustrates the results of the financial appraisal. It is clear that the annual revenue generated from the 2tph service would be insufficient to cover the annual operating costs of £2.417m. A subsidy of £1.782m per annum would be required to meet the difference. Over the 60 years appraisal period, fare-box revenue covers less than one-third of the operating costs, leading to a financial deficit of £37.68m (Net Present Value).

Table 6.1: Financial Appraisal (Central Case)

Financial Impact	Result
Annual Revenue	£0.635m
Annual Operating costs	(£2.417m)
Financial Benefit Cost Ratio	1:0.306
Financial NPV	(-£37.681m)

The financial support that would be required per passenger is also considered. The current level of funding support by SYPTE per passenger journey is £4.11. It is estimated that the Stocksbridge line would require financial support of £3.80 per passenger journey. As previously shown, the Stocksbridge line attracts a higher number of passengers compared with the Penistone and Worksop lines. However, the higher number of passengers using the Stocksbridge is partially offset by the lower fare yields for the short distance journeys.

6.3 Economic Appraisal

6.3.1 Calculation of Economic Benefits

The main economic benefits from new rail passengers are:

- journey time savings;
- highway decongestion benefits;
- accident reductions.

As there is no existing rail service there are no user or non-user benefits for existing rail passengers. Different methodologies are applied to calculate user and non-user benefits generated by the scheme for new rail passengers. In terms of user benefits, no highway model was available, so Arup has assumed the journey time savings for new rail passengers were five minutes.

For the non-user benefits, new rail passengers will also generate benefits for other drivers. It is assumed 50% of new rail trips will switch from car, and this parameter is consistent with former SRA guidance. Consequently, if the number of car kilometres is reduced, other drivers would benefit from a reduction in accidents and highway decongestion.

6.3.2 Results of the Economic Appraisal

Table 6.2 presents the results of the economic appraisal. Overall, the economic appraisal is weak, with an economic NPV of £-63.848m, with the benefits (fare-box revenue and economic benefits) covering just one-third of the operating and capital costs. This represents poor Value for Money. The weak financial performance, the significant capital costs and the small economic benefits contribute to the weak economic performance of the scheme.

Journey time savings for passengers switching to rail, based on a time saving of 5 minutes per trip, gives a discounted value of time of £10.413m Present Value. There is also £3.819m highway decongestion benefits generated from the 2tph rail service. The benefits resulting from accident reductions are smaller, with a total benefit of £0.276m.

Table 6.2: Economic Appraisal

Economic Appraisal	Output
Revenue	£16.626m
Operating costs	(54.307)
Capital Costs	(40.675)
Journey Time Savings	10.413
Decongestion Benefits	3.819
Accident Reduction Benefits	0.276
Economic Benefit Cost Ratio	0.328
Economic NPV	(-63.848)

6.4 Funding Opportunities for Conventional Rail Services

The analysis presented above illustrates funding support is required to cover both the on-going subsidy for the Stocksbridge service, and the capital costs. Several mechanisms were identified earlier, and we consider the feasibility of these opportunities to procure funding support.

- Section 106 agreements – there is scope to obtain funding from developers given the range of proposals outlined earlier in the report, but the magnitude of these contributions may be relatively small;
- Local Transport Plan funding – there are two reasons why there is very limited scope for LTP funding. Firstly, the total funding available through the LTP mechanism is small. Secondly, a new rail service from Stocksbridge is very unlikely to contribute significantly help deliver LTP targets, and would therefore not form an investment priority for SYPTE;
- Investment from the Rolling Highway proposal – the Translink proposal would need to be wholly funded by the private sector (£159m capital costs). Consequently, the improvements to track and signalling could be funded by Translink, although the station improvements would be outside the scope of this potential private sector contribution;
- Northern Rail – The franchise operated by Serco / Ned-Rail is carefully prescribed by the DfT, and there is no allowance to operate additional services, particularly when these services are loss-making;
- Department for Transport – whilst the DfT recently concluded that the Northern Rail franchise is efficiently operated, the review did not identify any scope to operate additional services that would require further subsidy.

7 Opportunities for Heritage Services

7.1 Characteristics of the Other Heritage Systems

The characteristics of other heritage rail systems in England were reviewed. This identifies the journey time competitiveness, frequency and fare structure, and understands if any system operates a service pattern that could be attractive to commuters. This issue is particularly relevant to the West Somerset Railway (WSR), Severn Valley Railway (SVR) and Keighley and Worth Railway (KWR). These heritage railways provide connections to important towns on the national rail network, and consequently, may prove attractive for longer distance journeys.

7.1.1 Weardale Railway

The Weardale heritage railway operates from Bishop Auckland to Eastgate-in-Weardale, a distance of about 30km. There are eight intermediate stations, Escomb, Witton Park, Wear Valley Junction, Witton-le-Wear, Harperley, Wolsingham, Frosterley and Stanhope, but has limited intermediate tourist attractions en-route. Details of the service patterns and fare structure are not currently available. The Weardale Railway Company faced a number of financial problems in 2005, and was forced to cease trading. It is understood an alternative funding package has been identified by the appointed creditors and a passenger service will be resumed in early summer 2006. The travel markets west of Bishop Auckland are relatively small for commuting flows into Darlington, or other destinations, so it is unlikely an eastbound service would operate sufficiently early to provide a commuter service to Bishop Auckland.

7.1.2 Wensleydale Railway

The Wensleydale Railway operates from Leeming Bar to Redmire, a distance of about 26km. There are three intermediate stations, Bedale, Finghall and Leyburn. Leyburn is the main market town for mid Wensleydale, and has a range of facilities to attract tourists. There are just 3 trains per day in each direction until April, and the service only operates at weekends. The end-to-end journey time is about 55 minutes, but service timings are unsuitable to offer commuting opportunities to Leeming Bar, Northallerton or other destinations in North Yorkshire or the North East. There are longer term aspirations to provide a connection with Northallerton, although a high quality bus link provides this connection at present. Fares are structured to attract tourists, as the £10 return fare from Redmire to Leeming Bar is expensive to attract commuters.

7.1.3 West Somerset Railway

The West Somerset Railway operates between Bishops Lydeard and Minehead, with a maximum of 8 trains per day in each direction. One train per day operates to / from Norton Fitzwarren, on the outskirts of Taunton. End-to-end journey times are about 95 minutes for the 32km journey. There are eight intermediate stops, with the terminus at Minehead forming the main tourist attraction. The WSR attracted over 200,000 visitors in 2005. Similar to the other heritage railways, the timing of services is not conducive to attracting commuter journeys. Equally, the fare structure is designed to attract leisure trips rather than commuters, given the £12.40 return fare between Bishops Lydeard and Minehead.

7.1.4 Severn Valley Railway

The Severn Valley Railway operates between Kidderminster and Bridgnorth, with five intermediate stations at Hampton Loade, Highley, Arley, Northwood and Bewdley. Train frequencies vary between 5 and 8 services per day, but services only operate at weekends. End-to-end timings are 70 minutes for the 22.4km trip, with a mixture of steam and diesel services operation. Whilst the SVR offers main line connections at Kidderminster, the first

arrival from Bridgnorth is after mid-day, so the service pattern is structured towards tourists and not commuters. Equally, the return fare between Bridgnorth and Kidderminster (£11.80) is too expensive for regular commuters.

7.1.5 Keighley and Worth Railway

There are up to 11 trains per day in each direction on Sundays and bank holidays during the peak season, this frequency drops to 5 services per day at other times. The line serves a number of important tourist attractions including the Museum of Travel at Ingrow (West), the Railway Children's station at Oakworth, the locomotive viewing works at Haworth. Connections to the national rail network at Keighley are also available. Journey times are relatively slow, about 20 minutes for the 5 mile trip. The journey is important to the industrial heritage of the Worth Valley, and a local preservation society managed to re-open the line in 1968 six years after the line was closed. Some services are operated by heritage diesel units, with others operated by steam trains. The first train to Keighley does not arrive until 1030 hours on weekdays, so it is not a feasible alternative to bus or car for commuters. The fare structure is also designed to attract tourists, it costs £8 for a return trip, but offers a range of ticket offers to attract families.

7.2 Aspirations of the Don Valley Railway Company

The Don Valley Railway Limited was formed in September 2003 with an objective to re-open the Stocksbridge to Sheffield line as a heritage passenger railway. Funding for a small feasibility study was secured. An initial feasibility study has been undertaken, with about 1% of Stocksbridge residents surveyed. The survey results illustrated that 85% thought the reinstatement of a passenger railway was a good idea, although this result does not demonstrate how many passengers would actually use a reinstated passenger rail service.

DVR has aspirations to introduce halts at various stations, and deliver a reliable commuter service. The feasibility of heritage steam trains on Sundays is also being considered, but no specific views on rolling stock have been made. Although the website describes an aspiration to serve Sheffield Midland, the difficulty associated with obtaining train paths means a terminus station at Nunnery offering interchange with Supertram now represents the preferred solution. Although the modelling methodology assumes a station at Sheffield Victoria, the results should not materially differ if an alternative terminus at Nunnery is proposed, since the egress times to the city centre will be comparable.

The new railway could support regeneration in the Upper Don Valley, and help to alleviate congestion affecting roads into Sheffield. A 2tph service is proposed for commuters, with this level of service maintained throughout the day if passenger numbers are sufficient.

The DVR Limited estimate their start up costs would range from £5m to £10m. These cost estimates assume track is in reasonable condition, and significant remedial work is not required. The £5-10m estimate represents a one-off payment, with the line operated without subsidy, and the funding risk transferred from the private sector. These start-up costs include the signalling requirements, the construction of a passing loop near Oughtibridge, and the reinstatement of passenger stations.

7.3 Suitability of this Approach

The examples of heritage railways demonstrated they offer an attractive service for tourists, as the relatively low frequency is not a particular constraint. The fare structure is also geared to infrequent passengers, since the fares would be too expensive for commuters. Furthermore, the first arrival into the major towns is too late to be suitable for commuters.

The benchmarking analysis demonstrates the approach advocated by DVR differs from other heritage railways, with a significantly more intensive service proposed. However, other

heritage railways examined do **not** serve a major city centre like Sheffield, so the potential limitations of this comparative analysis must be acknowledged.

7.4 Quantifying the Potential Tourism Market

To compete successfully with car and bus, journey times would need to be faster than the existing modes, and offer attractive frequencies. The comparative analysis presented above highlights the relatively limited suitability of existing heritage style operations to deliver a commuter service on the Stocksbridge line. However, there may be potential to operate the service as a heritage route, and target a different group of passengers than the mix of commuters and leisure passengers that would otherwise use a "conventional" rail service. If a heritage railway was operated, tourists and other visitors would form the main passenger markets. The potential market for heritage services was assessed by quantifying the number of tourists visiting South Yorkshire, and the local population who could use the route for leisure purposes. The size of each travel market is considered below.

7.4.1 Tourist Markets

Arup has identified the potential number of tourists that could use a reinstated passenger railway between Sheffield and Stocksbridge using data from the English Tourist Board. Table 7.1 presents the number of visitors to selected counties with a heritage railway. The number of tourists visiting County Durham has halved since 2000, with just 600,000 visitors in 2003. The reduction in visitor numbers may have contributed to the financial difficulties affecting the Weardale Railway. Similar to County Durham, the number of visitors to North Yorkshire has declined by 14% since 2000, with about 4.9m visitors per annum in 2003. The number of visitors to Shropshire / Worcestershire has increased since 2000, with a total of 2.6m visitors per annum. About 2m passengers per annum visited Somerset in 2003, a reduction of 13% compared with 2000. A total of 2.6m people visited South Yorkshire in 2003, about 28% lower than the total for West Yorkshire.

Table 7.1: Summary of Tourists to Counties with a Heritage Rail Service

Heritage Rail Service	County	Number of Tourists (millions)			
		2000	2001	2002	2003
Weardale	Durham	1.2	0.9	0.7	0.6
Wensleydale	North Yorkshire	5.7	4.6	5.0	4.9
Severn Valley Railway	Shropshire	1.2	1.5	1.4	1.4
	Worcestershire	1.0	1.0	1.1	1.2
West Somerset Railway	Somerset	2.3	2.9	2.6	2.0
Keighley & Worth Railway	West Yorkshire	3.8	3.2	3.4	3.6
Sheffield – Stocksbridge?	**South Yorkshire**	**2.1**	**1.6**	**2.1**	**2.6**

Source: English Tourist Board website

There are limited statistics available that demonstrate the number of passengers using heritage railways:

- Severn Valley Railway – 250,000 passengers per annum;
- West Somerset Railway – 200,000 passengers per annum;
- Keighley and Worth Railway – 120,000 passengers per annum.

Passenger usage statistics for the Wensleydale Railway could not be obtained, whilst financial difficulties meant no services operated on the Weardale Railway for part of 2005. WSR attracted 200,000 passengers per annum for the first time, despite the 23% reduction in visitors between 2002 and 2003. It is useful to understand the visitor numbers to each county and the usage of heritage railways. Based on the statistics presented above, it may prove challenging to attract more than 100,000 visitors to a heritage rail service between Sheffield and Stocksbridge, given the relatively small number of visitors.

7.4.2 Local Visitors

In addition to the tourists, population statistics were reviewed to assess the potential local catchment. Catchments were identified for local authority Districts within a notional travel time of about 30 minutes. Table 7.2 illustrates the total population within this approximate travel time for the five heritage railways reviewed in Chapter 7, plus the Sheffield to Stocksbridge route. Table 7.2 illustrates that Stocksbridge has a population catchment of almost 1.2m. Sheffield accounts for a significant proportion of this total, although the population catchment in Rotherham and Barnsley comprise important markets. The adjacent population market for Keighley and Worth Railway exceeds 1.6m, whilst 1.8m people are located within about 30 minutes of the Severn Valley Railway.

Table 7.2: Estimated In-scope Population

Heritage Railway	District	Population	District	Population
Severn Valley Railway	Wyre Forest	95,954	South Staffordshire	101,971
	Bridgnorth	51,341	Redditch	79,108
	Dudley	307,885	Birmingham	1,003,471
	Worcester	100,044	**TOTAL**	**1,739,774**
West Somerset Railway	West Somerset	34,604	Sedgemoor	107,918
	Taunton Deane	100,005	**TOTAL**	**242,527**
Keighley and Worth Valley Railway	Bradford	491,389	Harrogate	152,055
	Leeds	732,141	Craven	52,041
	Calderdale	191,585	**TOTAL**	**1,619,211**
Weardale	Wear Valley	61,805	Sedgefield	87,690
	Derwentside	87,688	Darlington	100,716
	Durham	89,648	**TOTAL**	**427,547**
Wensleydale	Hambleton	87,822	Richmondshire	50,291
	Teesdale	24,199	**TOTAL**	**162,312**
Stocksbridge	High Peak	91,063	Chesterfield	101,739
	Sheffield	526,202	Rotherham	249,770
	Barnsley	227,528	**TOTAL**	**1,196,302**

Source: TEMPRO database

The total number of local visitors is significantly larger than the in-scope catchment for Wensleydale (about 165,000), West Somerset Railway (about 240,000) and Weardale (about 430,000).

The analysis of population data indicates there is a significant potential catchment that could be attracted to the Sheffield – Stocksbridge route. Despite the relatively large population catchment, the number of visitors using the Keighley and Worth Railway is lower than other heritage lines. This demonstrates the importance of other "soft" factors, for example, the availability of intermediate destinations that could attract tourists, and the attractiveness of the scenery. These issues form important considerations when developing a business case for the route.

7.5 Funding Opportunities

Chapter 6 considered the mechanisms to fund improvements to a conventional rail service. Whilst a number of mechanisms were considered, the opportunities to procure funding were very limited. However, there are alternative funding mechanisms that could be explored if a heritage option was introduced. The funding mechanisms include lottery grants, contributions from the Yorkshire Tourist Board and Yorkshire Forward. These mechanisms need to be taken considered in more detail, and could be used to cover possible "start-up" costs for a heritage service. Initial estimates of start-up costs are £5-10m, but no funding source has been identified yet.

8 Study Recommendations and Conclusions

8.1 Demand and Revenue Forecasts

This report presents the outline business case for reinstating a passenger rail service between Sheffield and Stocksbridge. A spreadsheet model has been used to estimate the potential demand for a new rail service from Sheffield to Stocksbridge. There are also major housing and employment proposals in the Upper Don Valley, and the scope of these proposals was agreed with SCC. Exogenous traffic growth has also been included.

A "Central Case" was defined, and is based on 2tph with an end-to-end journey time of about 30 minutes. It is estimated that **1,400** boardings per day would choose rail, with about 500 in the morning peak. This equates to an average load factor of 25-30 passengers per train. The new service could generate **£635,000** revenue per annum.

A range of sensitivities were tested, for example, changes to rail journey times, frequencies, and fares, plus amendments to car journey times and costs. The impact of an enhanced bus service was also tested. These sensitivities were not tested in combination though. Doubling parking costs in Sheffield city centre had the largest impact on rail patronage, with the number of rail trips increasing to 3,200 per day.

The remote location of Sheffield Victoria relative to the city centre is one of the weaknesses with the rail service. The egress time from the rail station is relatively long, and this discourages rail passengers. Although bus journey times are slightly longer than the rail alternative, the greater flexibility offered by buses leads to shorter egress times in the city centre. This weakness could be partially addressed by operating to / from Nunnery, with interchange for Supertram.

8.2 Operating Costs

The operating costs for a 2tph between Sheffield and Stocksbridge have also been calculated. Arup used industry-standard parameters for rolling stock, staffing costs, fuel and maintenance. The costs to operate a 2tph service are **£2.417m** per annum. The end-to-end journey times mean 1tph is relatively inefficient, with lengthy lay-overs at either end of the journey. It is not possible to deploy staff and rolling stock more efficiently, so the cost saving for the hourly service compared with the 2tph option is just £550,000. The costs for the 4tph option are double the 2tph option, as no further efficiencies can be delivered (£4.381m).

8.3 Financial Appraisal

The results from the financial appraisal demonstrate about **£1.782m** subsidy per annum to support the rail service (PV of subsidy £37.681m based on a 60 year appraisal period). This subsidy requirement would be additional to the current funding from SYPTE for Northern Rail services. No funding source currently exists, and there are wider funding constraints affecting Northern Rail services that must be taken into account. The Department for Transport (DfT) commissioned a review that examined the opportunities to reduce funding support in late 2005. The DfT study assessed the potential to reduce subsidy by significantly reducing train frequencies on existing routes. Although this study found relatively limited scope to reduce costs and confirmed Northern Rail was efficiently operated. It would be very difficult to develop a robust case to obtain additional subsidy, given these wider constraints.

8.4 Capital Costs

The capital costs associated with reinstating a passenger service were not revised. Clearly, the scope of capital costs will vary dependent on the train frequencies and the assumed

journey times between Sheffield and Stocksbridge. An earlier study considered the potential infrastructure costs, so a one-off allowance of £50m is included to produce an indicative economic benefit cost ratio. The "Rolling Highway" proposal could allow scope to fund some of the capital costs. Further work to refine the capital cost requirements could form the third phase of the study. Unless alternative funding sources can be identified, the weak economic output indicates it is very unlikely a robust case could be generated.

8.5 Subsidy and Funding Requirements

In summary, the main funding constraints are:

- **about £1.782m subsidy per annum to cover the difference between the fare-box revenue and operating costs;**
- **a source to fund the capital costs. These could be in the region of £50m, but may be reduced if the proposed Translink "Rolling Highway" scheme is delivered;**

The funding support required for the Stocksbridge line (about **£3.80** per passenger journey) is lower than the average for South Yorkshire (£4.11), but there is no additional funding source currently available. More may be needed in initial years as patronage is built up.

8.6 Wider Policy Considerations

Several wider policy issues need to be taken into account when assessing the feasibility of reinstating a passenger service on the Stocksbridge line. Firstly, the majority of existing bus services between Stocksbridge and Sheffield are operated commercially (excluding Sundays) without funding support from the PTE. If a rail service was introduced, this would clearly affect existing bus patronage, and could reduce the number of commercially operated services. The level of funding support for local buses needed from SYPTE could increase. Secondly, the A61 corridor forms one of the key bus routes in Sheffield, and the PTE has aspirations to deliver further improvements. A Major Scheme Business Case could be prepared to justify further improvements to the bus network. This would attract further bus patronage using the A61 corridor.

Future proofing the Stocksbridge corridor against possible development opportunities is crucial. Even if a robust business case can't be identified for a heritage rail option, or the proposed Rolling Highway, the existing rail corridor must be protected to maintain the alignment since the severance benefits if the existing rail corridor was removed are small.

8.7 Heritage Option

The feasibility of an alternative heritage option was considered. Our analysis recognises this application of the heritage model would differ compared with other examples. Further market analysis is needed to assess the potential for a heritage railway, since the characteristics of the peak travel market based around commuters and shoppers differs from the tourists and weekend leisure passengers that normally use heritage railways.

Although the tourism market in South Yorkshire is smaller than some other parts of the UK, there is a significant local catchment that could be served. Potential funding mechanisms need to be considered, particularly to cover the initial start-up costs, and support the incremental expansion of the route.

Given the funding constraints affecting the delivery of "conventional" rail service improvements, and the on-going subsidy requirement, it is therefore recommended that the suitability of the heritage option is examined in more detail.

Operational constraints affecting Sheffield Midland mean a terminus station at Sheffield Victoria or Nunnery is likely to be more attractive. If additional train capacity could be

identified at Sheffield Midland or Nunnery Junction, the likely benefits from an additional regional service are likely to be higher than the revenue from short distance trips using the Stocksbridge line. The estimated start-up costs for DVR Limited are £5-10m. We recommend the robustness of these cost estimates is reviewed with Network Rail, and benchmarked against other heritage railways.

A heritage service could also create opportunities to procure funding from a number of sources, including Yorkshire Forward, the lottery and the Yorkshire Tourist Board. It is recommended that the proposal of the DVR Ltd be supported as the most deliverable means of achieving this Rail Strategy aspiration. Furthermore this is also potentially more deliverable given the DVR Ltd will have access to further additional funding from these sources.

South Yorkshire PTE

South Yorkshire Rail Study / Review of Target 2020

Working Paper 2: Stocksbridge to Woodhouse

Final Report

South Yorkshire PTE

South Yorkshire Rail Study / Review of Target 2020

Working Paper 2: Stocksbridge to Woodhouse

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CONTENTS

EXECUTIVE SUMMARY

South Yorkshire Passenger Transport Executive (SYPTE) commissioned Arup to review the feasibility of developing public transport options for the Stocksbridge to Sheffield corridor. Other consultants have reviewed the opportunities for Supertram and or the introduction of a quality bus corridor. Technical complexities with shared operation between Supertram and freight meant the business case for light rail extensions was rejected, but the Stocksbridge corridor could form part of the proposed Yorkshire Bus network.

There is a limited freight service on the Stocksbridge Line, and there are a number of infrastructure constraints that may prevent a frequent passenger rail service operating. It is a single track alignment with a grade-separated junction with the Midland Main Line at Nunnery, but trains would be forced to reverse east of Woodburn Junction to access Sheffield Midland Station. Capacity issues at Nunnery Junction are likely to prevent access to Sheffield Midland, so an alternative interchange station at Nunnery providing connection with Supertram would be required. The Stocksbridge Line is privately owned by Corus west of Deepcar, and not maintained by Network Rail. Consequently, this section of the route is in relatively poor condition.

A 'low-cost' infrastructure solution was identified, with capital costs of approximately £15m. This investment mainly covered station improvements at Deepcar, Oughtibridge, Wadsley Bridge, plus the construction of a new terminus at Nunnery. Signalling and track improvements were very limited, since the low-cost option assumes only one train would be permitted on the route. Trains would terminate at Deepcar in the low cost option, since the line speed to Woodhouse is too low to permit trains to serve Stocksbridge and return to Nunnery in less than one hour.

To operate an hourly service over a preferred route between Stocksbridge and Woodhouse, about £50m of infrastructure investment would be required. New signalling would be required to accommodate more than one train on the route, with 1-2 intermediate passing loops. For the 2 trains per hour option, extra passing loops are needed, increasing the capital investment to approximately £53m.

The summary table illustrates the operating costs for the low-cost options, plus hourly and half hourly frequencies. These costs include rolling stock leasing, staff, fuel, maintenance, and variable track access costs.

Summary of Annual Operating Costs for Heavy Rail Service Options

	Low Cost Option[1]	Hourly	Half hourly
Annual Operating Cost	£0.545million	£1.055million	£1.355million

[1] Hourly service from Deepcar to Nunnery only.

Outputs from the FaberMaunsell Supertram Extensions model were used to develop an understanding of demand and revenue implications for different options. Elasticities were applied to the generalised journey times to reflect changes in frequency and journey times. The FaberMaunsell model was developed in 2000, so the matrices may under-represent the most recent land use changes and emerging proposals for this corridor. Given the relatively small difference in capital costs to operate 1tph or 2tph to Stocksbridge, the half hourly option should provide a more attractive frequency, given the relatively short journey time from Stocksbridge and Sheffield. It is unlikely an hourly service would be sufficiently attractive, given the competition with bus and car.

Even at half hourly frequency, none of the rail-based options generate a positive financial case, so it is recommended that the feasibility of an enhanced bus solution should be further evaluated as the best Value for Money solution in the short term.

A cross-Sheffield service from the Stocksbridge Line could be operated towards Worksop. However, the passenger loadings on the Sheffield to Worksop trains are insufficient to justify any service improvements. Re-routeing the Sheffield-Worksop service to become a cross-Sheffield service could relieve junction capacity at Nunnery. However, important connectivity benefits at Sheffield Midland station would be lost if the existing service to Worksop was replaced by the cross-Sheffield proposal.

Substantial infrastructure costs would be needed to support a sufficiently frequent rail service from Stocksbridge to be attractive. An hourly service is unlikely to be sufficient to compete successfully with car and bus and cannot be provided at significantly lower cost except as a more limited service. Even if a half hourly service was introduced, the incremental revenues are insufficient to meet the operating costs. A combination of scarce demand east of Sheffield, and capacity issues affecting Sheffield Station restrict the opportunities for cross-Sheffield services to Worksop. Given these constraints, it is therefore recommended that enhancements to the existing bus network be explored, possibly as part of the Yorkshire Bus concept.

Recommendations

The strategy we recommend to deliver a high quality public transport connection from Stocksbridge is:

- ***In the short term implement an express, high quality bus service from Stocksbridge into Sheffield, examining in detail a new crossing of the River Don to better feed into existing and proposed QBC and priority measures for the A61 Penistone Road corridor and North Sheffield area and supporting access to regeneration and development opportunities around Clay Wheels Lane and the Upper Don Valley;***
- ***Establish with Network Rail, HSE and the DfT the precise requirements for the minimum infrastructure enhancement to operate a low cost hourly rail service to Deepcar to determine if this would represent value for money in the short to medium term;***
- ***Prepare comparative business cases for the low cost hourly service with the minimum enhancement to existing infrastructure and a more attractive half hourly service involving more substantial infrastructure works and revised signalling, establishing the necessary works with Network Rail, HSE and DfT;***
- ***As a longer term option consider diesel light rail connection to Stocksbridge. This could be one of the following:***
    - ***Diesel light rail from Stocksbridge to Woodhouse with interchange to Supertram at Nunnery;***
    - ***Extension of Supertram from Middlewood to Stocksbridge combined with the proposed extension to Waverley and Canklow Meadows to provide a direct service or via interchange at Nunnery;***
    - ***Extension of Supertram from Nunnery to Stocksbridge on the existing rail alignment combined with the proposed extension to Waverley and Canklow Meadows.***

In the case of a Supertram extension, current interoperability constraints mean that Supertram and heavy rail cannot safely operate on the same infrastructure. However, if freight was to cease on the Stocksbridge Line this case could be revisited.

1. INTRODUCTION

Arup was commissioned by South Yorkshire PTE (SYPTE) under the Engineering Framework Services contract to review the opportunities for improving public transport links between Stocksbridge and Sheffield, with possible integration with passenger rail services on the Worksop Line.

The purpose of this report is to review relevant studies examining the feasibility of providing a local passenger railway service on the Stocksbridge Line prior to the proposed review of the Railplan Target 2020 in August 2004. This review will also inform the scope of possible more detailed studies of fixed public transport links in the corridor and potential connections across Sheffield.

The work takes account of some significant issues raised since the South Yorkshire Strategic Rail Study (SYSRS) was completed. A new station at Wadsley Bridge was included in Railplan 2002 that could be served by this proposal, and the principal of re-opening the Stocksbridge line was supported in the SYSRS. However, the modelling undertaken as part of the SYSRS was too strategic to assess the likely demand and revenue for such a service.

The specific requirements of the Study Brief are to review the opportunities for development of public transport in the corridor, including the relative merits of alternative modes such as bus, light rail options and heavy rail.

The specific requirements of the Study Brief are to review the opportunities for development of public transport in the corridor, including the relative merits of alternative modes such as bus, train/tram, light rail and heavy rail. The work takes into account recent developments in relation to land use and transport that have a direct impact on an outline business case for improvements.

1.1 Background

1.1.1 Stocksbridge Line

Increased density of land use would strengthen the business case for a new high quality public transport service to Stocksbridge. However, the opportunity for new development, or redevelopment is constrained by the topography and access to land adjacent to the railway and the River Don.

The only trains to use the Stocksbridge line are infrequent freight trains to the Stocksbridge steel works. There is no direct connection from the Stocksbridge line to Sheffield Midland and all freight trains are routed towards Darnall. In order to access Sheffield Midland station trains must reverse from Darnall back through Woodburn Junction and Nunnery Junction.

Passenger services used to run on the line as far as Deepcar where they continued north to Penistone then west to Manchester via the Woodhead tunnels. There is an aspiration to improve public transport connections to Sheffield from Deepcar and Stocksbridge, possibly utilising the available rail infrastructure. Alternative solutions have been considered for this corridor, including light rail, although these are not being pursued at this stage.

The line between Stocksbridge and Sheffield is part of the proposed Central Railway between Liverpool and northern France. The proposal involves the re-opening of the Woodhead tunnels and reinstating the line between Woodburn Junction, Sheffield and Guide Bridge, east of Manchester. This is an important scheme of national importance and, if implemented would have significant implications for the Stocksbridge Line, which would form the first nine miles of the reinstated line as far as Deepcar.

1.1.2 Worksop Line

There is an opportunity to enhance the passenger rail service on the Worksop Line in combination with a service from Stocksbridge. The service would not provide access into Sheffield city centre so interchange would be required, possibly with Supertram. For the majority of the day, a service of only 1 train per hour (tph) operates from Huddersfield to Sheffield (via Barnsley) and then on to Worksop and Lincoln, predominantly using Pacer units. However, it is understood that this service may be split at Sheffield in the December 2004 timetable, with the Lincoln to Sheffield leg continuing to Doncaster and Adwick. The combination of low frequencies and unattractive rolling stock are among the factors contributing to the low patronage on these services.

Depending on the type of operation, a passenger service between Stocksbridge and Woodhouse could be delivered, which would offer the potential for connection to serve the regeneration areas of Orgreave and Waverley.

1.2 Report structure

This report is split into the following sections, each relating to key parts of the corridor, followed by our conclusions on the recommended strategy for a high quality public transport solution. The sections are as follows:

- **Section Two**, provides background on the proposals for **Connecting Stocksbridge** including a summary of conclusions from previous studies;
- **Section Three**, sets out the options for improving public transport services between **Stocksbridge and Sheffield**, including heavy rail, light rail and bus options;
- **Section Four**, describes the key issues affecting onward connections **East to Woodhouse and Worksop**;
- **Section Five** presents our **Conclusions and Recommendations**.

2. CONNECTING STOCKSBRIDGE

There is potential to exploit the existing freight railway line between Stocksbridge and north Sheffield to provide a greater level of public transport accessibility in the Upper Don Valley. This would help support regeneration and accessibility objectives to the north west of Sheffield and could provide potential for park and ride.

The existing single track railway only carries freight trains to and from the Corus steelworks at Stocksbridge. Former stations at Deepcar, Oughtibridge, Wadsley Bridge and Victoria have either been dismantled or are disused and in a state of disrepair. Much of the development of existing communities along the line north of Middlewood has taken place on the west bank of the River Don, away from the railway.

Freight trains are usually scheduled for overnight working (after 11.00pm and before 4.00am) in order to avoid conflicts with passenger services elsewhere on the network, particularly between Sheffield and Meadowhall.

The growth of Stocksbridge as a commuter town to Sheffield is consistent with increased development and economic activity along the Upper Don Valley. Accessibility is constrained by the topography, particularly in respect of transport links and the River Don. The railway lies to the east of the river, most of the development (north of Hillsborough) and the main highway route, (A6102) lies to the west of the river. River crossings are located at Deepcar, Oughtibridge and Hillsborough.

Reopening the Stocksbridge line to passenger services could also form part of a new strategic route via the Woodhead tunnel. The scheme would create an alternative rail corridor across the Pennines avoiding the heavily congested routes via Huddersfield and the Hope Valley. The project would offer regional and national benefits, although the likely capital costs of delivering this scheme are substantial. Whilst Central Railway is also looking at reinstating this alignment to form part of a major freight corridor from the North West to northern France, the Government recently announced that the business case was not sufficiently strong enough for them to introduce a bill to support this scheme. If this position were to change, and the Central Railway proposal to be implemented, this would dramatically affect opportunities for local rail services. In particular there would be a need to substantially upgrade the infrastructure and signalling above that discussed in this report to accommodate the Central Railway train movements and this would potentially allow sufficient capacity for a local passenger service to be implemented at a much lower cost than suggested below.

2.1 History

The line from Sheffield Victoria north to Deepcar was formerly part of the Woodhead Railway, originally opened in 1845. Services ran between Manchester, Sheffield and Lincolnshire until the end of the 19th Century when the new extension to London caused the railway company to change its name to the Great Central Railway.

Electrification of the line started in 1936 and was completed in 1954, at which time it was the only British mainline railway electrified to 1500V dc.

The steelworks in Stocksbridge were opened by Samuel Fox in 1851. The short length of single track, unelectrified steelworks railway, privately owned and currently operated by Corus, runs for approximately 4km from Stocksbridge to Deepcar. This was laid in the 1870s and used to link into the mainline Woodhead railway at sidings adjacent to the former Deepcar station.

The last of the scheduled passenger services between Sheffield and Manchester via Woodhead ran in 1970 and the line was finally closed in 1981. By this time the service ran non-stop from Penistone into Sheffield Midland (reversing the last mile after passing Sheffield Victoria).

None of the stations at Wortley, Deepcar, Oughtibridge, Wadsley Bridge, Neepsend (which closed in 1940) and Victoria were close enough to the population catchment to remain viable. Wadsley Bridge station remained open for Football Specials serving Sheffield Wednesday's ground at Hillsborough.

In 1983 the service from Huddersfield to Sheffield via Deepcar was diverted via Barnsley and the line from Penistone to Deepcar was closed. The former mainline was connected directly onto the branch to the Corus steelworks when the remaining sidings at Deepcar were removed in 1994. The steelworks freight traffic now operates on a single track to Woodburn Junction and bypasses the old Victoria Station, which was substantially cleared in 1989 for the extension to the Royal Victoria Hotel.

2.2 Previous studies

2.2.1 South Yorkshire Rapid Transit Study

The South Yorkshire Rapid Transit Study undertaken for SYPTE by Oscar Faber in 2001 considered the scope for light rail in various corridors across South Yorkshire, both as independent routes and as extensions to South Yorkshire Supertram. This included two route options from Stocksbridge, one via the existing Supertram route from Middlewood to Meadowhall and one using Supertram from Middlewood to Nunnery, then following the Worksop Line to Woodhouse and Beighton, before continuing on to Halfway on existing Supertram alignment. In addition to existing Supertram Park and Ride (P&R) a further facility was assumed at Deepcar. Each route was evaluated against the five Central Government objectives for transport and financial and economic assessments were prepared.

The financial and economic assessment of the Stocksbridge-Meadowhall light rail option concluded that the operating revenue would fall short of covering operating costs (approximately £12.0million per annum and £15.3million per annum respectively) but that the economic benefit:cost ratio was greater than one. Capital costs of approximately £45million were estimated. The longer service from Stocksbridge to Halfway was estimated to cover its operating costs (approximately £40.1million per annum revenue and £36.0million per annum operating costs). Including user and non-user benefits the economic benefit:cost was also estimated as being greater than one. Given the relative performance of the options, the Stocksbridge to Halfway route was taken forward in a shortlist of ten for more detailed analysis and was subsequently recommended as one of seven corridors considered for an extension of Supertram.

2.2.2 South Yorkshire Strategic Rail Study

The South Yorkshire Strategic Rail Study reviewed heavy rail options for wider strategic rail network development. It also considered alternative strategies for meeting local objectives, including the long term proposals for developing light rail options in certain corridors. This was reviewed with reference to parallel work on potential extensions to South Yorkshire Supertram. Supertram and heavy rail vehicles cannot operate on shared track. Therefore any opportunities for the line to Stocksbridge would require either a new heavy rail service or some form of new light rail specification as long as freight trains continue to operate.

This proposal would need to operate as a separate line to the Supertram network. The Stocksbridge route is currently used by a single freight train per week, but this is expected to increase to three trains per day in the near future. The scope for maintaining a reliable and frequent passenger service will need to consider "time-locking" on the single track railway, with freight trains operating outside the times when a passenger service is running, or will require significant infrastructure improvements. With existing signalling it would not be possible to operate more than an hourly service.

It was concluded that a tram-train solution could be a potentially attractive option to improving public transport connectivity from Stocksbridge, Deepcar, Oughtibridge and Wadsley Bridge to Sheffield. While the existing track layout prevents a service from Stocksbridge reaching Sheffield Midland, an interchange with Supertram at Nunnery would provide adequate connectivity and good access to the city centre.

Possible destinations for the light rail route include Sheffield Airport or Catcliffe, although the airport is relatively close to the proposed Supertram extension to Maltby via Orgreave. It was recommended that more detailed analysis of public transport infrastructure improvements in Sheffield be undertaken to assess this proposal and to determine the optimum service destinations.

2.2.3 South Yorkshire Supertram Extensions Study

Further to the South Yorkshire Rapid Transit Study undertaken by Oscar Faber additional work on testing the performance of the preferred network of Supertram extensions was undertaken. This work developed a draft Annex E major scheme using the relevant DfT guidance that applied at the time.

Following the review of financial and economic performance, consideration of the technical constraints, and with reference to the latest guidance and emerging issues with funding for light rail schemes, the extension of Supertram from Middlewood to Stocksbridge was dropped, and the section of route from Nunnery to Waverley, just short of Woodhouse, was included as part of a route from Dore to Hellaby. This decision also took account of the practical issues of operating Supertram on the same alignment as heavy rail freight movements and the proposal to use the line as part of the Central Railways scheme.

2.3 Wider Public Transport Issues

2.3.1 Central Railway

The proposal to reinstate the former Sheffield to Manchester route via Woodhead for the Central Railway project would be used to carry freight from Scotland and the north of England to the Channel Tunnel, avoiding already congested railways and transferring traffic from roads. The proposal could also provide passenger services and possible stations were identified at Deepcar and Penistone.

A recent announcement by the Government regarding this proposal stated that a business case could not be supported due to the high cost of implementation, the risks to delivery and uncertainty regarding future freight and passenger flows.

2.3.2 Yorkshire Bus

As part of the Yorkshire Bus Initiative a proposal to improve bus service provision along the A61 Penistone Road, and connecting routes serving the Upper Don Valley, is being developed by SYPTE. This proposal has the support of the principal operator, First, who has indicated that the route will pilot new vehicles intended to portray a high quality image. An example of the type of buses proposed is shown in Figure 2.1.

This will form part of the wider Yorkshire Bus project, designed to mark a significant reversal in trend decline of bus passengers, through a high quality, frequent core bus network, delivered with varying degrees of priority, across South Yorkshire.

Figure 2.1: An example of new high quality bus vehicles

2.4 Land use and transport plans/policy

Stocksbridge grew around mining and quarrying in the early 19th century, and the steelworks that opened in 1851. After the announcement by Corus in April 2003 to halve the workforce to around 350 employees it was feared that the whole plant, which is a specialist supplier to the aerospace industry and major supplier to the automotive industry, would be under threat. Although melting works were due for closure in May 2004 the full restructuring of activity has not yet been finalised. Most of the population of Stocksbridge and Deepcar, around 13,500, have family connections to the steelworks. However, Stocksbridge is increasingly becoming a commuter town for Sheffield. Statistics from the 2001 Census shown in Table 2.1 indicate less than a third of the journeys to work of Stocksbridge residents in permanent employment finish in the local ward. These include a number of recent business start-up projects, training and skills enterprises.

It is interesting to note that 94% of all journeys to work from Stocksbridge recorded by the 2001 Census lie within South Yorkshire and 84% have destinations within Sheffield District, of which 30% remain in Stocksbridge ward.

TABLE 2.1: 2001 Census Journey to Work Statistics for Stocksbridge Ward Residents

Workplace	Percentage
Stocksbridge	32%
Central Sheffield	22%
Rest of Sheffield District	30%
Barnsley District	6%
Rotherham District	4%
Leeds District	1%
Wakefield District	1%
Kirklees District	1%
Doncaster District	1%
Rest of the UK	2%
TOTAL	**100%**

The A61 corridor to the east, which continues north from Hillsborough through Grenoside, is heavily congested in peak periods and carries a number of express and stopping bus services. South Yorkshire Supertram runs on the parallel A6079 Middlewood Road/Langsett Road with a Park and Ride site at Middlewood. Services run every 10 minutes to the city centre and Meadowhall.

The emphasis in the Unitary Development Plan for this area of Sheffield is on sustainable regeneration in the Upper Don Valley area. Vacant industrial land, including that around Clay Wheels Lane and at Neepsend is allocated for industrial re-use with accompanying job creation.

A sustainable "Plan 4 Travel" initiative is being pursued by Sheffield City Council in the Upper Don Valley. It defines a hierarchy of routes, promotes Park and Ride and encourages a reduction in congestion. As part of possible solutions for improving access to development sites, and reducing congestion at key junctions, a road bridge across the River Don, at Clay Wheels Lane has been proposed.

3. STOCKSBRIGE TO SHEFFIELD

3.1 Current rail operations

The Stocksbridge Line ceased to carry passenger services over twenty years ago and is now operated solely for freight access to the Corus steelworks at Stocksbridge. There are limited freight movements on the Stocksbridge Line from Nunnery, most of these pass Nunnery Junction towards Tinsley Yard or onto the "Old Road" at Beighton. These tend to avoid operating during the day due to constraints elsewhere on the network. Current proposals are to increase the number of movements, which could lead to some daytime working.

3.1.1 Existing infrastructure

The current line from Stocksbridge to Woodburn Junction (adjacent to Nunnery junction and the nearby Supertram station) is single track, generally on a twin track formation. The line is approximately 18 kilometres long. Some of the line remains at one side of the formation and some has either been slewed to the centre (to minimise maintenance liability for embankments and cuttings), or may have originated as single track. It is not clear if all of the bridge clearances would be sufficient to carry a reinstated twin track railway.

Some of the track has been refurbished with concrete sleepers and continuously welded rail. If a passenger rail service were to be reinstated it would be necessary to undertake a full route assessment to determine the requirement to refurbish the remainder of the route and to ensure safe operation.

From research we have established that the line is signalled using an OTNS (One Token No Staff) system. This system is the equivalent of each train on the line accepting a token when it leaves Woodburn Junction which then excludes any other train from entering the line until it has returned the token on its return journey. This ensures there is no more than one train set on the Stocksbridge Line in either direction at any one time. This is a severe constraint on the potential capacity of the line and on the ability to operate a regular service with even headways if the round journey time (from accepting and returning the taken) is greater than one hour. Therefore this signalling system would need to be replaced if a regular, frequent, passenger service was proposed.

3.1.2 Infrastructure constraints

The current condition and use of the Stocksbridge Line places some constraints on the ability to operate passenger services. The single track railway requires significant enhancement in order for it to support an attractive and frequent passenger service. In particular, the lack of passing places, and the restrictions imposed by the current signalling system would need to be addressed. Although there would be no timetabling constraints on the Stocksbridge Line itself, integration with other passenger services and freight movements elsewhere on the network will require consideration. The extent of any infrastructure constraints will in part be determined by the interface with the rest of the network, proposals for through running onto the existing network, and the type of rail operation proposed.

The key constraints on the existing passenger railway relate to the network north east of Sheffield including the flat junctions at Nunnery and Wincobank. Trains from Sheffield towards Darnall and Worksop conflict with the higher frequency services between Sheffield and Meadowhall / Rotherham / Doncaster. Immediately north of Sheffield station there are only two through tracks as far as Nunnery Main Line Junction. All trains towards Meadowhall and Worksop from Sheffield must use this section, which severely limits the scope for increasing the number of available train paths.

The single track freight-only alignment to Stocksbridge crosses over the Midland Main Line close to Nunnery Junction, north of Sheffield Station. The introduction of a new passenger service from Stocksbridge would not affect junction capacity at Nunnery Main Line Junction, since the lines are grade separated. The proposed Stocksbridge service would only increase the number of trains passing Woodburn Junction. A new station would be required at Nunnery, providing a convenient interchange with Supertram. There is also a cross-over between Darnall and Woodhouse that services from Stocksbridge could use if terminating at Woodhouse. Currently there is only an hourly passenger service from Sheffield to Worksop, plus occasional freight movements so there should be sufficient capacity for a service from Stocksbridge. A greater number of freight movements use Woodhouse Junction, which may influence timetabling of passenger services east of Woodhouse station.

Significant capacity problems would be created at Nunnery Main Line Junction if the Stocksbridge trains reversed to access Sheffield Midland Station in the same way as the old Manchester to Sheffield via Woodhead service. The typical off-peak service pattern via Nunnery Main Line Junction comprises 11 passenger trains per hour in each direction. The South Yorkshire Bottleneck Study undertaken by Railtrack identified this as one of a number of major constraints on capacity and flexibility. Notwithstanding the analysis of train paths, it would also be necessary to establish that this service was of sufficient priority to risk the potential impact on the reliability of other services.

In addition to the relatively high service frequency using Nunnery, there are timetabling and capacity pinch-points at Dore and Wincobank Junctions, plus issues of platform capacity at Sheffield Station that impose further constraints on the timetabling of trains and influence the capacity for train paths.

Although there are no new committed passenger services to increase demand for train paths, the introduction of a wholly new hourly regional service between Nottingham and Leeds (Yorkshire Express) is discussed in the Midland Main Line Route Utilisation Strategy. Subject to value for money criteria, this proposal will be implemented from December 2005, and would impact on capacity at Nunnery.

The South Yorkshire Strategic Rail Study explored the scope for improving capacity at Nunnery but this was not pursued since extensive and very high cost works would be required.

3.2 Heavy rail options

It is assumed that in order for heavy rail passenger service to be attractive a half hourly frequency would be required, which would necessitate significant enhancement of the existing infrastructure. However, we have also considered the lowest cost option for implementing an hourly passenger service, largely with existing infrastructure, and this is discussed in Section 3.2.2. This assumes the minimum works necessary to provide a passenger service and precludes anything more than an hourly service frequency.

3.2.1 Enhancement of the Stocksbridge Line

Network Rail currently maintains the line as far as Deepcar and it is important that their view of the works required to reinstate passenger services is established. For the purposes of this study we have developed outline cost estimates using unit rates and have checked the status of the existing infrastructure from observation and site visits. No lineside assessment or walking the route has been undertaken. Our assessment is based on the guidance supplied in Railway Group and Railtrack Line Standards, in relation to the introduction of wholly new passenger services to infrastructure that currently only carries freight. In this respect it is different to the requirements set out for a new or enhanced passenger service on infrastructure that already carries passenger trains, and from the introduction of new infrastructure solely for passenger services.

As this is a relatively unusual situation some interpretation of how the guidance will be applied in practice has been required. A crucial step for committing resources to any potential improvement will be to discuss the infrastructure requirements in detail with the Network Rail Regional Asset Manager and the relevant engineers covering trackwork, signalling, safety etc.

Specific locations for stations have not been established, though it is expected that stations at Stocksbridge, Deepcar, Oughtibridge, Wadsley Bridge and Nunnery will be constructed. It is possible that alternative locations to the previous station sites may be considered, particularly at Deepcar where development has taken place at the former station site.

Broadly similar infrastructure enhancements would be required for either an hourly or half hourly service between Stocksbridge and Woodhouse, in terms of permanent way, signalling, stations, safety/security and telecommunications. If a half hourly service is proposed there will be a greater requirement for twin track sections or passing places.

In order to install twin tracks it may be cheaper to widen the embankment or cutting than to attempt to move the existing track back to one side if it currently occupies the centre of the formation. This is particularly true if the line cannot be closed for an extended period and the existing line is in a poor condition, which may be the case on sections of the Stocksbridge line. This would not be possible at bottlenecks such as bridges, where it may be necessary to renew a section of the existing line to allow it to be slewed to make room for the second track.

If the existing trackwork also requires renewal and it cannot be closed for an extended period, the new line will need to be constructed alongside, train services transferred onto the new line and the original line then renewed. The costs estimates should also allow for a new multi-aspect signalling system installed to allow a service frequency greater than hourly, along with telecoms and a cess walkway to comply with current safety and operational standards.

Notwithstanding the need to accommodate freight movements it is likely that the engineering work required for heavy rail operation would mean substantial enhancement for anything more than an hourly service. Indeed, until further detailed discussion with Network Rail it can be assumed that much of the work identified for a half hourly service would apply equally to an hourly service, and therefore that a half hourly service makes better use of the infrastructure. Crucially this is because a reliable hourly service could not be provided over the proposed route without replacing the current signalling system. For this initial estimate we have therefore assumed a half hourly service that will require passing places, but not full conversion to twin track railway. The outline costs for infrastructure works to enable a passenger service between Stocksbridge and Woodhouse are shown in Table 3.1. It should be noted that outturn costs will depend on the assessment of the Network Rail Regional Asset Management team in respect of the works required for a passenger service on this line.

Cost exclusions include:

- Land costs and acquisition;
- Re-location or compensation to adjacent residents / landowners;
- Any assumptions regarding compensation to Corus arising from works or line closures
- Optimism Bias or equivalent uplift for expected outturn value has not been applied.

Table 3.1: Outline Cost Estimates for Stocksbridge Line Improvements for Heavy Rail Passenger Services

Construction Costs		Cost per Item	Number of Items	Total Cost
Permanent way	new track, CWR on concrete sleepers	£ 500 /m	19000	£ 9,500,000
	new turnouts	£150,000 each	6	£ 900,000
Stations	platforms	£ 1,400 /m2	5000	£ 7,000,000
	footbridges	£ 5,000 /m	200	£ 1,000,000
	car parking areas	£ 50 /m2	5000	£ 250,000
	new buildings, CCTV, lighting, etc	£150,000 /station	4	£ 600,000
Safety / security	cess walkway	£ 20 /m	14500	£ 290,000
	works to pedestrian level crossings	provisional sum		£ 100,000
	security fencing	£ 40 /m	19000	£ 760,000
Signalling	signalling to new track	£450,000 /track-km	19	£ 8,550,000
	works to existing interlocking equipment	provisional sum		£ 1,000,000
Telecomms	communications cables	£100,000 /route-km	14.5	£ 1,450,000
Unmeasured items	12.5% of total cost of measured items			£ 3,925,000
Environmental mitigation	3% of construction costs			£ 942,000
TOTAL[1]	**Construction costs (excluding project delivery costs)**			**£ 36,300,000**
TOTAL[1]	**(including 45% project delivery costs)**			**£ 52,600,000**

[1] Figures may not sum due to rounding

Allowances for the following are included in the project delivery costs:

- Design and consultancy fees;
- Land surveys;
- Ground investigation and possible remedial work;
- Planning and Statutory procedures;
- Legal costs;
- Track possessions and temporary restrictions;
- Network Rail management costs.

3.2.2 Lowest cost option

In order to fully explore the earliest opportunity to introduce passenger services on the Stocksbridge Line we have made a preliminary assessment of the lowest cost option. This assumes upgrading the line to meet the minimum passenger service requirements and an estimate of the costs involved. The lowest cost option for the Stocksbridge Line would be to do only those works necessary to bring the single track freight railway line up to passenger standards of safety for it to comply with UK legislation and a HSE safety case. The lowest cost option assumes that the section of line between Deepcar and Stocksbridge remains in Corus ownership and that an hourly service would operate between Deepcar and Nunnery/Darnall. The OTNS signalling requires that the line be unoccupied overnight for freight trains to operate.

In order to assess the current condition of the line, a site visit was undertaken. This included observing the railway from publicly accessible locations such as overbridges, access points and footpaths, This allowed us to form a general opinion of the nature and condition of the current infrastructure. Through discussion with Network Rail and consultation with experienced railway engineers at Arup we have formed a judgement on what work is likely to be required and prepared a preliminary cost range for the work. In addition we have identified what steps are needed to progress this project further. It is important to note that these judgments provide a range of possible outcomes and costs, which will need to be verified by the Network Rail Regional Asset Manager and his/her staff.

From observation, the track formation and permanent way are in generally good condition over the line as far as Deepcar, for which Network Rail is in charge of maintenance. It is not expected that any works to existing structures will be needed although a full review of records will be required. It is unlikely that any telecommunications equipment is in place.

Currently, there is just one freight movement overnight to / from Stocksbridge, and the introduction of a regular passenger service to Stocksbridge will require a scoping study on the need for an environmental impact assessment (EIA) by Sheffield City Council. More train movements will increase noise and air pollution, along with changes to the visual impact of the railway and this could justify the need for an EIA. The additional noise, possible construction impacts if track improvements are needed, and the reconstruction of former stations for passenger use could require mitigation. Negotiations with Corus to ensure freight movements are accommodated will also be required.

One of the greatest potential costs is in relation to signalling. From research of the Network Rail Sectional Appendices we have established that the line is signalled using an OTNS (One Token No Staff) system. This system does not allow more than one train set on the Stocksbridge Line in either direction at any one time. This signalling system would need to be replaced for a regular, frequent, passenger service.

Works to ensure safety on the line include provision of lineside fencing where necessary, possible works at crossings and the provision of infrastructure to allow safe access to the railway for maintenance. These requirements relate to the assessment of risk associated with a regular passenger service operating throughout the day being significantly different to the risks associated with single night-time working freight trains. The need for a Cess Walkway may be avoided as the original formation width allows enough room for safe walking to one side of the tracks. This may be subject to review, either at specific locations or on longer sections of line, depending on the need to access both sides of the tracks or the position of the single line within the formation.

Specific locations for stations have not been established, though it is expected that stations at Deepcar, Oughtibridge, Wadsley Bridge and Nunnery will be constructed. It is possible that alternative locations to the previous station sites may be considered, particularly at Deepcar where development has taken place at the former station site. At this stage no inclusion of the section of line to Stocksbridge has been assumed, therefore initially Deepcar would be the terminal station.

Appendix A contains a summary table setting out the work required. This provides a range for the work that may be required. The detail of the work will be subject to confirmation with Network Rail.

The estimates of total construction costs for the works range from £7.8 to £13.1 million with a median value of approximately £10.5 million. A summary of the cost ranges for broad items is given in Table 3.2. Allowing for project delivery costs (including preliminaries, design, Network Rail costs, etc) at 45%, the total estimated median cost for reinstating passenger services would be approximately £15.2 million.

Table 3.2: Summary of cost range for Lowest Cost Option

Work Element	Lower Range Cost (£000)	Upper Range Cost (£000)
Track Formation	50	100
Permanent Way	1,000	2,000
Structures	0	100
Telecoms	250	400
Environment	230	380
Signalling	100	1,000
Safety/Regulations (lineside security, crossings and cess walkway)	200	650
Stations (Deepcar, Oughtibridge, Wadsley Bridge and Nunnery)	6,000	8,500
TOTAL ESTIMATED CONSTRUCTION COST[2] EXC. PROJECT DELIVERY (£000s)	**10,480**	
TOTAL ESTIMATED CONSTRUCTION COST[2] INC. PROJECT DELIVERY (£000s)	**15,200**	

[1] Allowance for strengthening work to Deepcar Viaduct as possible works to address current speed restriction.
[2] Median value

This excludes any structures (other than as identified), strengthening or remedial work to embankments or cuttings, land purchase costs, possession costs or compensation. It also assumes that the required works can be undertaken without disturbance to freight movements. No allowance has been made for negotiation with Network Rail over any enabling works at Nunnery Junction and Woodburn junction.

Allowances for the following are included in the project delivery costs:

- Design and consultancy fees;
- Land surveys;
- Ground investigation and possible remedial work;
- Planning and Statutory procedures;
- Legal costs;
- Track possessions and temporary restrictions;
- Network Rail management costs.

In order to progress this estimate further a full quantified risk analysis exercise should be carried out with Network Rail, and an allowance for optimism bias made.

This estimate of costs has been prepared on the basis of current usage of the line and the requirement to introduce at least a regular, hourly passenger service. The prospects for the Corus plant at Stocksbridge are still unclear and given recent closures at other plants in the UK it is not certain how long freight movements to the plant will continue. The closure of the Corus plant would present an opportunity for new employment and redevelopment opportunities that could support growth in public transport demand in the corridor.

There are also important implications for the future development of the railway line if activity at Corus Stocksbridge was to cease. Without the need to accommodate freight movements it would be possible to reconsider more flexible operating scenarios for the line, including conversion for Supertram. If a passenger service was the only use of the railway it may be possible for ownership of the railway to be passed to a local provider (perhaps as a Community Rail Project for example), to reduce costs or perhaps to capitalise sums to cover ongoing maintenance costs.

We have consulted with the owners/operators of the Wensleydale Railway and understand that in taking ownership of the infrastructure reduced construction costs, and that operating costs can be offset through access charges for other users. Further research and consultation would be required to establish if these options could be considered for the Stocksbridge Line. To do so would restrict the service to a Stocksbridge to Nunnery shuttle in order to avoid any interaction with the wider passenger network.

3.2.3 Operating cost estimates

Table 3.3 illustrates the total operating costs for different service options on the Stocksbridge Line. The service associated with the lowest cost infrastructure option is for an hourly shuttle between Deepcar and Nunnery/Darnall. With the more expensive infrastructure options both an hourly and half hourly service between Stocksbridge and Woodhouse were costed. The indicative timetable is based on 15 hours operation, 338 equivalent days per annum (including a reduced Sunday service), with unit rates applied for staff, rolling stock, fuel and maintenance. A journey time of approximately 36 minutes has been assumed for the full route options, covering a distance of 25km, allowing for the 30mph speed restriction on the Stocksbridge Line, and 26 minutes for the lowest cost option. Stops at Deepcar, Oughtibridge, Wadsley Bridge and Victoria/Nunnery are assumed in all cases, The full service is assumed to terminate at Stocksbridge and Woodhouse with a further stop at Darnall station.

The journey time is too long to be operated with a single unit (allowing for turn-around time). If linespeed could be improved it should be possible to reduce the rolling stock requirement as the interaction with other rail services is limited and therefore the service should be reliable. The proposal submitted by Midland Mainline to develop a new depot at Beighton has been deferred following discussion with SRA and it is understood that this will not accommodate any stabling for other operators, so the number of empty coaching movements via Nunnery and Woodburn junctions is not expected to increase in the short term.

Given the capacity pinch-point at Nunnery, there would not be sufficient time to operate an hourly service to/from Sheffield Midland including a reversal at Darnall with a single unit. It may be possible to operate an hourly service with just one unit if the journey time from Stocksbridge could be significantly reduced. However, this would be very sensitive to performance risks. No station access charges are included for this service although access to Sheffield Midland would incur costs at £5 per visit. The variable track access charges assume Class 158 operation.

Table 3.3: Operating Costs for Stocksbridge – Sheffield (Woodhouse) Service Options

	Low Cost Option		1tph Option		2tph Option	
Cost	Assumptions	Total (£000s)	Assumptions	Total (£000s)	Assumptions	Total (£000s)
Rolling Stock Lease Charges	2 units @ £132,000 / Class 158 unit	264	3 units @ £132,000 / Class 158 unit	396	3 units @ £132,000 / Class 158 unit	396
Staff – drivers	3 drivers @ £36,000	108	9 drivers @ £36,000	324	12 drivers @ £36,000	432
Staff – conductors	3 conductors @ £24,000	72	9 conductors @ £24,000	216	12 conductors @ £24,000	288
Fuel	15 hr operation, 22km distance, 338 days / annum	28	15 hr operation, 22km distance, 338 days / annum	33	15 hr operation, 22km distance, 338 days / annum	67
Maintenance	15 hr operation, 22km distance, 338 days / annum	51	15 hr operation, 22km distance, 338 days / annum	61	15 hr operation, 22km distance, 338 days / annum	121
Variable track access costs	£0.10 per train kilometre	22	£0.10 per train kilometre	25	£0.10 per train kilometre	51
TOTAL		**545**		**1,055**		**1,355**

The operating costs for a half hourly service, which would be more likely to be attractive to passengers, would require additional staffing, resulting in the estimated operating cost in the region of £1.4million per annum.

3.2.4 Alternatives for access into Sheffield city centre

It is understood that SYPTE has retained a site to the north of Woodburn Junction for a potential railway interchange station to connect with the existing Supertram halt at Nunnery depot. Implementing this interchange could provide some benefit to passengers from the Stocksbridge Line in terms of walk distance to city centre destinations compared with rail access from Sheffield Midland station. The connection distance is estimated to be approximately 100-200 metres compared with 500 metres between Sheffield Midland station and City Hall.

The relative components of the journey are estimated using the following example:

A. Interchange with Supertram at Nunnery

Rail from Stocksbridge to new station at Nunnery	approx 28 minutes
Walk connection to Supertram	approx 2 minutes
Average wait for Supertram	approx 5 minutes
Supertram to city centre	approx 5 minutes
TOTAL	approx 40 minutes

B. Reverse at Woodburn, access into Sheffield Midland

Rail from Stocksbridge to east of Woodburn Junction	approx 30 minutes
Driver change and nominal wait for path through Nunnery	approx 5 minutes
Reverse through Nunnery to Sheffield Midland	approx 4 minutes
Walk connection to city centre	approx 6 minutes
TOTAL	approx 45 minutes

Option B assumes that only the reversing movement will be required to wait for a path through Nunnery Junction and that there would be available capacity, without delay, at Sheffield Midland station. It is understood that this is unlikely to be the case and that the constraints on capacity north of Sheffield Midland would prevent additional train paths being allocated through this section on the basis of the SRA's 'Capacity Utilisation Index' for either an hourly or half hourly service. Furthermore, priority for capacity would need to be established over the proposed Yorkshire Express service, and given the wider connectivity benefits this is very unlikely.

In addition to the relatively high service frequency using Nunnery, there are timetabling and capacity pinch-points at Dore and Wincobank Junctions, plus issues of platform capacity at Sheffield Station that impose further constraints on the flexibility of timetabling of trains. It is likely that this would preclude access for the two trains an hour that would be a minimum requirement for an attractive service from Stocksbridge.

Some of the same issues that lead to the initial closure of the railway stations on this line still apply, in particular the distribution of development in relation to the railway line and potential station sites. As a consequence the estimate of demand and revenue would indicate a revenue:cost ratio less than 0.5.

3.3 Next steps

In the evaluation of the works required, we have identified a list of further work required. The list below summarises the next steps that should be taken.

- Discuss implications with Network Rail, the maintainer and Corus.
- Obtain or undertake full asset condition survey, including track, signalling, telecoms, structures, earthworks and other civil aspects.
- Investigate station locations.
- Define service requirements – frequency and speed.

- Undertake more detailed demand forecasting and value for money assessment;
- Obtain information about signalling and investigate full signalling requirements.
- Obtain structural records.
- Undertake environmental scoping study.
- Undertake risk assessments of level crossings, lineside security and lineside condition (including vegetation clearance and cess walkway provision).

3.3.1 Delivery as a Community Rail Pilot Project

There may be benefit in considering the Stocksbridge Line in relation to the SRA's recently proposed approach to designate Community Rail routes separately from the conventional and high speed rail networks, similar in principle to what happens in Europe. This means that designated Community railways would not need to comply with certain European Union regulations, for example on interoperability and distinctly separate operational and engineering standards more appropriate for the nature of a local secondary or rural passenger railway operation.

Designation of rail services as Community Railways also allow innovative and new approaches to the way the network might be more efficiently and effectively managed, marketed, supported, maintained and renewed, including different service delivery and franchising models.

The SRA consultation document points out that PTEs are co-signatories of franchise agreements for their areas, and these contain local passenger rail services which are identified by the SRA as candidates for designation as Community Railways and that PTEs will have an interest in the benefits that Community Rail designation and in the specification and funding of these services.

Arrangements for exclusive or dedicated light rail operation may be subject to separate arrangements, depending on infrastructure ownerships and operating company structures, investor profile and equity and other shareholdings. There is also a specific requirement for delivering a robust safety case for light rail operation in accordance with UK and European legislation.

The Stocksbridge Line may be a candidate for a Community Rail Partnership initiative if it can be shown to deliver reduced operating costs or a more efficient way of using available resources. The objectives of such a partnership would include how to encourage sustainable demand, whilst managing costs and developing the railway for more efficient operation in the future through close involvement with the local community. An important element to this proposal will be how the railway is managed in respect of the freight movements to the Corus steelworks.

It is likely that reduced operating costs could be achieved through diesel light rail operation rather than heavy rail. Operation using light rail rolling stock may provide a shorter journey time, rolling stock savings and offer greater flexibility for timetabling. Interchange with Supertram at Nunnery will require further analysis to determine if this can be achieved in an efficient and affordable way but it seems likely that there will be insufficient capacity to operate an attractive service frequency into Sheffield Midland.

Demand for a passenger service on the Stocksbridge Line will require development and land use interventions to increase the passenger catchment at local stations. This should include a review of possible station locations as well as the opportunity for transit-centred development. Some development is already proposed and it is possible that park and ride could also be introduced to support future investment in the railway.

3.4 Light rail options

3.4.1 Supertram

There are current operational and safety issues that would preclude operation of Supertram jointly working with freight movements. With the continued use of the line for freight, any light rail option assumes separate infrastructure alongside the heavy rail alignment or on a different route. If there were no heavy rail operations (i.e. freight movements to Corus had ceased) it would be possible to use the alignment for Supertram but with significant alteration to the infrastructure. It would not be possible to run this service through onto the Worksop Line.

A further constraint or cost implication for operation by Supertram would be the connection to the existing network at Middlewood, which would require a bridge over the River Don, probably in the vicinity of Clay Wheels Lane.

Previous studies looking at extensions of Supertram from Middlewood to Oughtibridge and Deepcar found that this was not an economically viable option, and proposals to extend Supertram in other corridors are now being progressed. Concerns have been expressed as to the ability to fund a package of extensions and there is no proposal to prioritise this corridor.

The Oscar Faber Rapid Transit Study estimated the cost for constructing an extension of Supertram to Stocksbridge at approximately £61million (2001 prices). The additional cost for vehicles and depots was estimated at about £9million, in addition to existing operations. Annual operating costs were estimated at £1.8million per annum (2001 prices). Estimates of additional tram demand of 2.5million per annum and revenue of £1.2million per annum indicate an operating revenue:cost ratio less than one.

3.4.2 Diesel Light Rail

In relation to this study the track-based alternative to traditional UK heavy rail passenger services is a diesel-powered light rail solution, itself distinct from the electrically powered trams operated throughout Europe. This technology can be operated on heavy rail infrastructure with interworking of heavy and light rail services. On dedicated sections line-of-sight operation is possible. Vehicles with low floor access require some alterations to stopping facilities.

The characteristics of diesel light rail mean that interoperability would be possible. However, the separation of freight and passenger movements on the Stocksbridge Line into night time and daytime working would still be preferred.

Constructing a light rail system has similar engineering issues to the heavy rail line although it could have greater flexibility and would be better able to take advantage of available capacity on the Worksop Line to the south. Because of the vertical separation of the railway from the highway, particularly between Wadsley Bridge and Victoria it is unlikely that any on-street operation would be feasible, unless deviation from the existing railway alignment was made further north. These options would also directly compete with bus and Supertram. Utilising the same alignment as for the heavy rail would reduce conflict with road vehicles, whilst maintaining a similar number of stops, and would therefore be a better solution.

If the proposed service were to operate into Sheffield Midland beyond Nunnery Junction the same operational and capacity issues as discussed in the heavy rail section would also apply to a light rail system. Although light rail vehicles would be more flexible in terms of acceleration and braking there would also be issues regarding the mix of different vehicle types and pathing between local stopping and express services.

The safety case for light rail, particularly in mixed operation with heavy rail will need to be established, although experience in Europe and the latest EU directives offer some indications for what will be required.

The market for diesel light rail is not yet fully developed and "off the shelf" vehicles are not widely available. Vehicles in operation include the Alstom Citadis 500, running in Kassel and the Stadler GTW in New Jersey, USA.

The GTW railcar, has sold 336 units to date. It is based on a modular vehicle to meet the various requirements in terms of track gauge, structural clearance and capacity that apply across the world. Its typical feature is its Power Module which is located in the centre of the vehicle and which houses the entire power plant. For maintenance purposes, all systems and components are accessible from the outside. This design virtually eliminates the need for any capital investment in the workshop and allows maintenance and repair times to be minimised.

Thanks to the separation of the Power Module and the end carriages, no noise or vibrations are transmitted to the passenger compartments. Since the two-end carriages do not contain any heavy drive components, they can be of lightweight design so that almost the entire available clearance gauge can be used for designing the passenger compartments. The low-floor portion, matched to platform levels, is higher than 65%. Based on a defined standard, the basic equipment can be customised individually. The length and width of the body can be adjusted to suit the available vehicle clearance gauge. Figure 3.6 shows one of the GTW cars currently in operation in Greece and Figure 3.7 the vehicle in operation in New Jersey, USA.

The New Jersey operation is an interesting case study as it consists of diesel light rail vehicles running a 58km route with freight trains "time-locked" into night time running when the passenger service has ceased.

Figure 3.6: An example of a diesel light rail vehicle in operation in Greece

Figure 3.7: An example of a diesel light rail vehicle in operation in New Jersey

3.4.3 Estimated costs

While light rail offers flexibility and some cost savings over heavy rail, both for construction and operation, for new construction of a light rail route the biggest difference is in the signalling and associated infrastructure. The cost for the permanent way infrastructure (based on plain ballasted track) is expected to be the same as for heavy rail, (approximately £500/metre). However, the line of sight signalling and additional safety case requirements for heavy rail mean that the additional infrastructure is cheaper for light rail. The lighter vehicles also impose less track maintenance requirements. While this is a more significant benefit when run on a dedicated route, mixed operation with freight means that some of these economies may not be realised.

The estimated capital cost for introducing a new light rail route over the proposed 18 kilometre alignment to Nunnery, is approximately £45-50million excluding optimism bias, with a further estimated £12million to £15million for vehicles to operate a service to Woodhouse. This assumes a similar specification of works as for the heavy rail route, but with some cost reductions. This estimate excludes preliminaries, planning and design costs, land costs for stations and any structures costs. It also excludes any costs associated with track possessions, compensations and Network Rail management costs.

The estimated operating costs for this type of operation are difficult to estimate given the lack of available data on a similar system. With reference to other systems operating in Europe the estimated operating costs for a half hourly service, comparable with the heavy rail option, are estimated to be approximately £1.0-1.3million per annum.

3.4.4 Programme

The programming issues are similar for light rail as they are for heavy rail with a key constraint being works associated with the live extant rail network.

Diesel light rail vehicles are not as common as electrically powered units, due in part to the availability of electrified lines in Europe and the noise and emissions impact for on-street sections in urban centres. This also means that availability of units for operation, the technical specification of which will need rigorous checking for the safety and operational case to be approved, may also take some time. A more readily available option would be Ultra Light Rail systems, such as the Parry Peoplemover.

The reinstatement of a twin track on the Stocksbridge Line could be engineered more quickly than for a wholly new passenger railway as long as freight movements can be time locked into overnight working. Even so there will be some disruption and this will affect overall construction time. Allowing for the anticipated planning process running in parallel to the safety case testing, and assuming other institutional barriers being overcome it may be possible for the scheme to be operational within approximately six to eight years.

3.5 Bus options

Current bus services for the corridor from Stocksbridge are distinct from services to the east, to Woodhouse and beyond.

Service 57 provides a clockface half hourly service taking 45-50 minutes. This is supplemented by the 58A commuter service providing a further three buses each way (half hourly to Sheffield in the morning peak and away from Sheffield in the evening peak).

Due to the constraints on roadspace and available alignments in this corridor there is no suitable route for a segregated alignment for bus unless it replaces the railway alignment north of Middlewood. Whilst this route is not as heavily congested as parallel routes the topography imposes some constraints on roadspace.

It will be most important for any proposal to be fully integrated with land use and regeneration proposals in the Upper Don Valley and to take advantage of proposed Quality Bus Corridor (QBC) and priority measures in the A61 corridor. The focus should be on a high quality express service.

It would not be possible to introduce a segregated bus route using the existing rail alignment while access is still required for freight movements. Further examination of the route and options would be required to determine the likely costs and arrangement for such a scheme but construction cost is likely to exceed £40million.

An alternative solution using the existing highway would introduce priority measures and associated infrastructure consistent with plans for QBCs on other routes in South Yorkshire and the Yorkshire Bus Initiative. Providing suitable improvements for an express bus solution, acknowledging the possible constraints on achieving significant improvement in journey time, would be expected to cost less than £5million for a QBC. This is additional to any costs for priority measures and QBC schemes associated with the A61 corridor to Hillsborough. Estimates indicate that the operating revenue:cost ratio would be less than 1.0 if a wholly new service were overlaid on existing stopping services. However, this situation could be improved if some existing resources were used.

The QBC could be linked to Park and Ride to extend the catchment area for the service.

3.6 Demand and revenue

The work undertaken by FaberMaunsell on the demand for rapid transit on the Stocksbridge Line concluded that it should not be pursued as part of the Supertram Extensions project on financial, economic and delivery grounds.

The starting point for the demand and revenue forecasts are outputs prepared by Faber Maunsell using the Supertram model developed for SYPTE. The model forecasts demand and revenue based on different service pattern and journey time assumptions. Arup has revised the outputs based on changes to generalised journey time (GJT). Generalised journey times are calculated in accordance with guidance from the Passenger Demand Forecasting Handbook and include frequency and in-vehicle time. Recommended elasticities from the Passenger Demand Forecasting Handbook were applied to the proportional change in generalised journey time. This approach is a simple but robust forecasting approach to avoid re-running the Supertram model for different service scenarios.

The FaberMaunsell model was developed in 2000, so may not reflect recent land use proposals for housing in the corridor. However, it is unlikely the additional development would materially change the overall conclusions. There is proposed development in the Upper Don Valley that could influence travel demand in the area, but this is based predominantly in the A61 corridor and the SEZ that covers the area south of and including Clay Wheels Lane. The constraints on development further up the valley towards Deepcar, and the difficulty in gaining access to the railway, which is the "other" side of the road and river from existing communities, suggest that the impact on demand may be limited.

Demand and revenue estimates by FaberMaunsell suggested an operating revenue:cost ratio less than one and the illustrative demand along the line indicates that much of the revenue was related to the section already operated by Supertram and that there would be low demand north of Oughtibridge (less than 25 peak hour trips per direction per day).

The gain in tram ridership reported by FaberMaunsell in the Rapid Transit study identifies 2.55million extra tram passenger journeys per annum for the Stocksbridge to Meadowhall service. Analysis of the line loading diagram indicates that most of this occurs south of Middlewood with modest off peak patronage between Middlewood and Oughtibridge.

There is an established and well used Supertram Park and Ride site at Middlewood and it is assumed that some of the demand for this site comes from the A6102 corridor. It is therefore possible that the introduction of a high quality public transport service from Stocksbridge may have an impact on Supertram demand at Middlewood.

With reference to the work done by FaberMaunsell we have considered the likely scale of patronage that could be achieved for different service options and journey times, for broadly the same quality and level of attractiveness, using an elasticity approach. This provides an indication of whether each option is likely to require subsidy (i.e. estimated operating costs exceed estimated revenue).

3.6.1 Estimated journey times

Estimated journey times for each option (Stocksbridge to the centre of Sheffield) are as follows. This includes interchange with Supertram at Nunnery for the heavy rail and diesel light rail options.

- Heavy rail - approx. 40 minutes
- Diesel light rail - approx. 30 minutes
- Supertram - approx. 35 minutes
- Bus - approx. 40-45 minutes (existing 45-50 minutes)

The route options for the Rapid Transit Study assume use of the existing freight railway alignment for Supertram. This would also be the case for the diesel light rail and heavy rail passenger services described. With these options there would not be the same problems of interoperability that exist between Supertram and heavy rail operations on the same track. However, the factors affecting demand, including distance from the railway line to the main population centres, accessibility to Sheffield city centre and relative journey time compared to car, would also apply to these rail options.

Current linespeed restrictions limit the degree to which the segregated alignment would yield significantly shorter journey times than Supertram, which operates on-street for part of the route.

With existing land use and travel patterns and the estimated operating costs for any rail based service would probably require subsidy. It would be difficult to demonstrate a business case for this route operated as a traditional local rail service. Options for a more flexible approach that could yield lower operating costs, for example using diesel light rail vehicles, would still require supporting land use policy intervention and integration with other modes to concentrate development close to any proposed station sites. This may be difficult to achieve due to the topography of the Upper Don Valley, existing settlements and land available for development. A bus-based option could be delivered more economically and at relatively low cost. Furthermore this would be seen as an enhancement to the proposed QBC scheme for the A61 and could therefore take advantage of journey time benefits arising from priorities in the southern part of the route.

4. EAST TO WOODHOUSE AND WORKSOP

4.1 Current rail operations

4.1.1 Existing network

The Worksop Line from Nunnery is a twin track railway carrying a mix of freight and passenger services. There are five intermediate stations between Worksop and Sheffield, Woodhouse and Darnall lie to the west of the M1 and are the closest to Sheffield.

Passenger services on the Worksop Line run hourly during the day with additional trains in the peaks. The journey from Woodhouse to Sheffield is timetabled between 14 and 19 minutes. By contrast the reverse journey is timetabled at 10 minutes throughout the day. This illustrates some of the difficulties experienced with capacity through Nunnery and access to Sheffield Midland. It also indicates the lack of flexibility in allocating train paths for the variety of services operated north of Sheffield

There are a number of significant rail infrastructure constraints in this area that impact on capacity and timetabling. The most important of these is the at grade Nunnery Main Line Junction, where services towards Darnall and Worksop conflict with trains between Sheffield and Meadowhall. A further issue is the number of freight movements at Woodhouse Junction, including reversing movements from the "Old Road" for trains towards Worksop.

The hourly service on the Worksop Line currently carries low passenger flows, with an average total annual patronage of approximately 35,000 for the four stations within South Yorkshire combined (Darnall, Woodhouse, Kiveton Bridge and Kiveton Park). This translates to approximately 100 passengers per day. Without a significant increase in the local catchment population there would seem to be no justification for a second hourly service. However, an extension of a service from Stocksbridge to Worksop to replace the existing service could deliver network connectivity benefits.

4.1.2 Freight operations

The main flows of freight traffic are as follows.

Coal

Coal traffic serving the Power Stations at West Burton and Cottam is concentrated on Worksop Sorting Sidings. Traffic from Yorkshire collieries is normally delivered to the sidings at the yards at Worksop via Woodhouse Junction (where the trains reverse), from the South Yorkshire Joint Railway at Brancliffe East Junction and from the "Robin Hood" line at Shireoaks East Junction. Certain trains run directly to the Power Stations through Worksop Station.

Steel / Metals

Steel and scrap trains to and from Stocksbridge, Immingham, Wolverhampton Steel terminal, Scunthorpe plants, Teesside plants etc. operate through this area.

Stone / Aggregates / Limestone / Cement

Minerals originating in the Peak Forest area of Derbyshire and cement trains originating at the Hope works of Earles travel through the Hope Valley to Dore, where some run through Sheffield to Selby, Leeds, Drax and West Burton Power Stations.

Freightliner Trains

A few Freightliner services run along the "Old Road" through South Yorkshire, from Southampton, Ripple Lane, Avonmouth, to destinations such as Glasgow Deanside, Tyne Dock and Leeds Stourton. With the exception of the very heavy coal traffic to West Burton and Cottam, which operates throughout the day, these services are generally overnight from early evening onwards.

EWS has submitted an outline planning application for a marshalling yard at Tinsley on predominantly disused railway sidings between the M1 motorway and Sheffield Airport. The yard would include an inter-modal facility for transferring containerised goods between rail and road, and about five freight trains are expected to operate to / from the site each day.

4.2 Bus competition

There are a number of bus services operating between the Woodhouse area and Sheffield city centre. These combine to over more than 20 buses per hour on weekdays (i.e. for some movements a bus every 3 minutes). The journey time by bus is generally between 25 and 28 minutes, depending on the route. The main bus routes are shown in Table 4.1, most are local stopping services.

Table 4.1: Summary of Existing Bus Services between Woodhouse and Sheffield

Service	Via	Pattern	Journey Time[1]	Frequency
X30	Waterthorpe to Broomhill via Beighton, Woodhouse, Handsworth and Sheffield centre	Express	28 mins.	Half-hourly
25/25A	Woodhouse to Bradway via Richmond, Manor, Sheffield centre, Heeley and Woodseats	Stopping	28 mins.	Every 20 mins
52	Woodhouse to Hillsborough via Handsworth, Darnall, Sheffield centre, Broomhill and Crookes	Stopping	26 mins	Every 10 mins
93	Woodhouse to Firth Park via Manor, Sheffield centre, Meadowhall and Wincobank	Stopping	26 mins	Every 10 mins
123	Sothall to Walkley via Waterthorpe, Woodhouse, Manor Top and Sheffield centre	Stopping	25 mins	Every 20 mins
723/732	Sheffield – Woodhouse Circle (evenings only)	Stopping	25 mins	Hourly

1 Journey time from Woodhouse to Sheffield centre.

4.3 Land use issues

It will be important that any high quality public transport connection to Woodhouse is considered in connection with land use proposals for the Orgreave and Waverley area. The Worksop Line passes to the south west of the Waverley development.

The Waverley Development Site extends to almost 300 hectares. The mixed-use development envisages continuation of employment uses at the northern end of the site, including industrial and commercial floorspace, housing in the central area and open space with a lake to the south. As well as new highway infrastructure there are proposals for a new rail station and the possible extension of South Yorkshire Supertram to serve the site.

A number of key transport issues have been identified during the consultation phases including the impact of development traffic on Sheffield Parkway and other parts of the highway network, access from the south and the appropriateness of public transport proposals and their sustainability.

It would be possible to introduce a new station for the Waverley development on the Worksop Line. However, this would lie very close to both Darnall and Woodhouse stations and further demand analysis would be needed to determine if this would be sustainable. It is likely that bus services will feed the existing railway stations providing interchange for trips to / from the development site. The potential for integration and interchange may depend on the go ahead of proposals for an extension to Supertram.

5. CONCLUSIONS AND RECOMMENDATIONS

This study reviewed options for a high quality public transport link from Stocksbridge to Sheffield and connections east to Woodhouse. The review is based on previous studies that have examined public transport improvements in the Upper Don Valley to Stocksbridge, along with emerging land use and transport proposals for the Upper Don Valley and Waverley/Orgreave. No additional forecasting has been undertaken at this stage, in particular for economic benefits. The main aim of this study has been to identify those options that have the best prospects of achieving significant benefits, and successful implementation.

Improvements to public transport provision to Stocksbridge, the Upper Don Valley and Waverley / Orgreave have important benefits in terms of accessibility and opportunities for sustainable development and connects with important regeneration areas and SEZs.

The main public transport options that have been considered are:

- Heavy rail operation;
- Light rail alternatives including extension to South Yorkshire Supertram and diesel light rail to ultra light rail options;
- Limited stop express bus options using high quality vehicles.

5.1 Heavy Rail

A heavy rail connection from Stocksbridge to Sheffield and Woodhouse would not be viable with current conditions for the following reasons:

- High construction costs, – approx. £53million (excluding Optimism Bias);
- High cost of operating the service – estimated operating revenue:cost ratio <0.5;
- Operational and capacity issues east of Sheffield;
- Low density of demand close to the railway.

Without provision of twin track sections, and associated infrastructure, there would be no scope for providing anything more than an hourly service. Refurbishment of the existing track would also be needed for passenger services.

The lowest cost option for the Stocksbridge Line would be to do only those works necessary to bring the single track freight railway line up to passenger standards of safety for it to comply with UK legislation and HSE inspection. This would require appropriate works to track formation, signalling and safety systems. It would be a requirement of the HSE that a safe route alongside the track, such as a cess walkway, be put in place and appropriate works to ensure safety at any new stations. This may require access at both sides of the single line. Existing station locations that are now overgrown or have been developed (for example at Deepcar), would need to be reviewed so that appropriate alternative sites with adequate access could be provided as necessary.

Without access to the line it is not possible to make an accurate estimate of the work required to refurbish the track to passenger standard. However, the line as far as Deepcar is still maintained by Network Rail and from observation appears to be in good condition. This suggests that for this section at least minimal work would be required. The section of line from Deepcar to Stocksbridge is observed to be in poorer condition and it would be necessary to undertake a more detailed review to determine the optimum terminus for services. There is also a 5mph speed restriction on Deepcar Viaduct, which may indicate a potential issue for gaining access to Stocksbridge.

The lowest cost option to implement a passenger railway solution would be to introduce an hourly heavy rail service. Whilst a diesel light rail option would be expected to cost less there are no examples of this type of operation in the UK and both an operational and safety case would be required before this could be implemented. Allowing for some uncertainty over the condition of the whole route, and excluding a number of items (as set out in Section 3.2) we estimate the median cost for refurbishment to be approximately £15.2million including an allowance for project delivery costs. This estimate should be critically reviewed through a comprehensive risk workshop with Network Rail and Corus. We also recommend the following steps to develop the case for the scheme:

- Discuss implications with Network Rail, the maintainer and Corus.
- Obtain or undertake full asset condition survey, including track, signalling, telecoms, structures, earthworks and other civil aspects.
- Investigate station locations.
- Define service requirements – frequency and speed.
- Obtain information about signalling and investigate full signalling requirements.
- Obtain structural records.
- Undertake environmental scoping study.
- Undertake risk assessments of level crossings, lineside security and lineside condition (including vegetation clearance and cess walkway provision).

There would be significant risks to delivery, including programme, land and planning issues, and negotiation with both Corus and Network Rail in relation to upgrading the existing single track railway and the future of freight services. In addition, we have assumed that the Central Railway proposal is not going ahead since the Government's announcement that it does not support this scheme.

It is possible that a Community Rail Partnership could assist in the delivery of this scheme, and potentially lead to reduced costs. We have consulted the Wensleydale Railway to identify areas where cost savings have been delivered and have referred to the SRA's consultation paper on Community Rail Development. In both cases, the scope for cost savings and efficiencies are greatest if the scheme has no direct interworking with other rail services. In the case of the Stocksbridge Line this would mean a Stocksbridge to Nunnery shuttle offering interchange with Supertram at Nunnery.

In relation to the wider opportunities for a passenger rail service from Stocksbridge two options for connection to Sheffield have been considered. These relate to both the opportunity for access into the centre of Sheffield and the scope for integration with other public transport services.

The first assumes reversing east of Woodburn Junction to gain access to Sheffield Midland station, via the busy Nunnery Main Line Junction carrying services between Sheffield and Meadowhall and Rotherham. Significant capacity problems would be created at Nunnery Main Line Junction if the Stocksbridge trains reversed to access Sheffield Midland Station. The typical off-peak service pattern via Nunnery Main Line Junction comprises 11 trains per hour in each direction. The introduction of a wholly new hourly regional service between Nottingham and Leeds (Yorkshire Express) is discussed in the Midland Main Line Route Utilisation Strategy. Subject to value for money criteria, this proposal will be implemented from December 2005, and would impact on capacity at Nunnery.

In addition to the relatively high service frequency of existing services using Nunnery, there are timetabling and capacity pinch-points at Dore and Wincobank Junctions, plus issues of platform capacity at Sheffield Station that impose further constraints on the timetabling of trains. The feasibility of superimposing these additional train movements via Nunnery Main Line Junction and the resulting impact on other rail services would require detailed discussions with Network Rail. The South Yorkshire Strategic Rail Study explored the scope for improving capacity at Nunnery but this was not pursued since extensive and very high cost works would be required.

Given the capacity pinch-point at Nunnery, it is unlikely there would be sufficient time to operate an hourly service to / from Sheffield Midland including a reversal at Darnall with a single unit.

The second option assumes a service from Stocksbridge to Woodhouse and interchange with Supertram at Cricket Inn Road to provide access to Sheffield city centre. The introduction of a new passenger service from Stocksbridge to Woodhouse via Woodburn Junction would not affect junction capacity at Nunnery Main Line Junction, since the lines are grade separated. The proposed Stocksbridge service would increase the number of trains passing Woodburn Junction, but there is just an hourly passenger service from Sheffield to Worksop, plus freight so the extra trains should not create capacity problems. There is also a cross-over between Darnall and Woodhouse that terminating services from Stocksbridge could use.

Allowing for interchange with Supertram this second option would result in a slightly shorter journey time from Stocksbridge to Sheffield city centre.

Development of the Stocksbridge Line is dependent on the ability to attract sufficient patronage to justify a reasonable level of service and infrastructure enhancement. The main barrier to an attractive service is the capacity of existing infrastructure and the potential costs for enhancement. The single track line makes it impossible to operate more than an hourly service with the required reliability and performance. Passing loops will be required at new stations in order to make a more frequent service possible. More efficient delivery of local services is an approach advocated by the SRA through their consultation paper on Community Rail Development.

The Stocksbridge Line may be a possible candidate for a Community Rail Partnership initiative if it can be shown to deliver reduced operating costs or a more efficient way of using available resources. The objectives of such a partnership would include how to increase demand, whilst managing costs and developing the railway for efficient passenger operation in the future through close involvement with the local community.

The SRA's consultation paper on Community Rail Development raises a number of issues that could reduce the gap between operating costs and operating revenues. The Stocksbridge Line is self contained other than interchange and interworking with other services from Woodburn Junction. This could allow some of the more innovative proposals to be considered with relatively little impact on other services. However, unless the service terminated at a new interchange at Nunnery there would be some implication for ensuring services met with current railway standards.

Despite the current lack of Government support for the Central Railway proposal there may still be an aspiration to re-open the Woodhead Tunnels in the longer term and this would have implications for local operations to Stocksbridge.

5.2 Light Rail

An extension of South Yorkshire Supertram from Middlewood was considered in the recent Rapid Transit Study and Supertram Extensions study, and is not considered part of a preferred network of extensions as currently envisaged by SYPTE. The demand and revenue estimated by FaberMaunsell suggested an operating revenue:cost ratio less than 1.0 and the illustrative demand along the line indicates that much of the revenue is related to the section already operated by Supertram as far as Middlewood and that there would be relatively low demand north of Oughtibridge. Furthermore it is understood that Supertram cannot inter-work with heavy rail freight or passenger services on the same infrastructure.

An alternative diesel light rail, or possibly ultra light rail, solution might support a viable business case for improving local public transport access to Stocksbridge using the existing railway line, with the same service options as for heavy rail but potentially at a higher frequency. It might also offer more flexible, incremental delivery options.

Indicative construction costs for light rail would be about £45-50million, excluding vehicles. If there are no requirements for heavy rail signalling, for example, if movements were time locked or if freight activity had ceased, the costs may reduce to approximately £40million.

However, the operating revenue:cost ratio is likely to be less than 1.0 due to the density of development, its location on the opposite side of the river from the railway line, and the need for interchange with Supertram at Nunnery to provide access to the centre of Sheffield. The estimated journey time into the centre of Sheffield, assuming an operating speed of 40mph on the Stocksbridge Line (i.e. faster than the current linespeed) would be approximately 30mins including interchange and onward journey by Supertram.

Extending this light rail service east to Woodhouse could provide access to the new Waverley development. However, this section of the route has heavy competition from bus, with a high combined service frequency and a journey time of between 22 and 28 minutes. The equivalent journey by light rail would be quicker, estimated at around 18 minutes although a bus rapid transit option is being considered for this corridor.

Alternative vehicle and operating types, including ultra light rail could also be considered to determine the degree to which operating costs can be reduced. However, the relevant safety case for operating with heavy rail would need to be assessed and may preclude consideration of some types of vehicle.

5.3 Bus

A number of bus-based improvements consistent with the Yorkshire Bus Initiative have been put forward for connections from the Upper Don Valley into Sheffield. An express service from Stocksbridge would make use of the QBC programme being proposed for the A61 Penistone Road corridor.

This should be an express service of distinct, high quality and offering a similar image to light rail. One example in the UK is the Crawley-Gatwick Fastway Project currently being implemented. Due to the availability of alignments it is not recommended that a segregated or guided option is pursued north of Clay Wheels Lane / Middlewood unless it replaced the existing railway.

Providing suitable highway improvements for an express bus solution would be expected to cost less than £5million for a QBC. This is additional to any costs for priority measures and QBC schemes associated with the A61 corridor to Hillsborough. Estimates indicate that the operating revenue:cost ratio would be less than 1.0 if a wholly new service were overlaid on existing stopping services. However, this situation could be improved if some existing resources were used.

5.4 Integration

Proposed public transport improvements should be fully integrated with land use planning for the Upper Don Valley and for Waverley / Orgreave.

The strategy should take account of proposed regeneration initiatives from the Wicker north to Stocksbridge, including Neepsend, Owlerton, Clay Wheels Lane, including Objective 1 and SEZ projects. Similarly the land uses and masterplan for Waverley / Orgreave SEZ should be integrated with the rapid transit proposals.

It is also important that consideration be given to the potential for Park and Ride to complement all of the options considered. This should be evaluated as a way of increasing demand and supporting any business case assessment.

5.5 Recommendations

The strategy we recommend to deliver a high quality public transport connection from Stocksbridge is:

- ***In the short term implement an express, high quality bus service from Stocksbridge into Sheffield, examining in detail a new crossing of the River Don to better feed into existing and proposed QBC and priority measures for the A61 Penistone Road corridor and North Sheffield area and supporting access to regeneration and development opportunities around Clay Wheels Lane and the Upper Don Valley;***
- ***Establish with Network Rail, HSE and the DfT the precise requirements for the minimum infrastructure enhancement to operate a low cost hourly rail service to Deepcar to determine if this would represent value for money in the short to medium term;***
- ***Prepare comparative business cases for the low cost hourly service with the minimum enhancement to existing infrastructure and a more attractive half hourly service involving more substantial infrastructure works and revised signalling, establishing the necessary works with Network Rail, HSE and DfT;***
- ***As a longer term option consider diesel light rail connection to Stocksbridge. This could be one of the following:***
    - ***Diesel light rail from Stocksbridge to Woodhouse with interchange to Supertram at Nunnery;***
    - ***Extension of Supertram from Middlewood to Stocksbridge combined with the proposed extension to Waverley and Canklow Meadows to provide a direct service or via interchange at Nunnery;***
    - ***Extension of Supertram from Nunnery to Stocksbridge on the existing rail alignment combined with the proposed extension to Waverley and Canklow Meadows.***

In the case of a Supertram extension, current interoperability constraints mean that Supertram and heavy rail cannot safely operate on the same infrastructure. However, if freight was to cease on the Stocksbridge Line this case could be revisited.

Key actions are as follows:

- Develop feasibility design and detailed costs and benefits for a busway scheme for Stocksbridge to Sheffield, based on integration with the Yorkshire Bus Project proposals and proposed investment in QBCs on the A61 Penistone Road;
- Discuss with Network Rail the lowest cost of enhancement to the Stocksbridge Line for use by passenger services, either of heavy rail or light rail operation, to consider safety, operating and maintenance costs as well as practical programme issues, and conduct a quantitative risk assessment if the proposal appears feasible;
- Arrange a meeting as soon as possible with DfT to discuss light rail options and interoperability with heavy rail;
- Arrange meetings with possible rolling stock manufacturers for diesel light rail vehicles to develop options and programme for light rail solutions.
- Examine timetable options in consultation with Network Rail and Corus for committed services through Nunnery to estimate available capacity for a new service;
- Undertake a detailed comparative evaluation of diesel light rail from Stocksbridge to Woodhouse with interchange to Supertram at Nunnery, against extensions of Supertram either from Middlewood to Stocksbridge or from Nunnery to Stocksbridge using the existing rail alignment;
- Undertake an initial investigation of ultra light rail if this is considered to have merits.

APPENDIX A

Low Cost Rail Option - Summary of works

A1. SUMMARY OF WORKS

Work Element	Current Condition [(i)]	LIKELY WORK REQUIRED [(ii)]	Cost Estimate (£ 000's) [(iii)]	Further Investigation Required [(iv)]	Design Standards and Guidance
Track Formation	The general impression gained from what can be seen of the formation is that it is in a reasonable condition. The original formation was for a double track railway and in places the edges have become partially overgrown. There was no evidence, from what was seen, of any problems with the earthworks. However, the drainage features appeared to be in a poor state of repair.	In order to get the line reopened to passenger services, minimal works are likely to be required to the track formation. Some vegetation clearance would be required, and drains would need to be unblocked, cleared and proved.	50 -100	A full visual inspection should be carried out of the entire route to gain a full appreciation of the work that would be required if the line was to be opened to passenger trains.	HMRI – Railway Safety Principles and Guidance: Part 2 Section A: Guidance on the Infrastructure (HS(G)153/2) Railway Group Standard – Trackbed and Track Drainage (GC/RT5014) Network Rail Company Standard – Formation Treatments (RT/CE/C/039)
Permanent Way	From what could be seen of the track it appeared to be in good condition for the majority of the route. At Deepcar, where ownership passes from Network Rail to the private sidings, the track deteriorates in quality. Predominantly the track is continuously welded rail (CWR) on concrete sleepers although there were isolated sections with timber sleepers. The current speed limit along Network Rail owned track is 30mph. It is believed that there is a limit of 5 mph over Deepcar Viaduct at the start of the private section although the speed limit into the steelworks is unknown. This may or may not be relevant depending upon the location of the final station.	From Sheffield to Deepcar, the section owned by Network Rail, it is felt that only minor works would be required to allow the route to be opened for passenger trains. It is likely that there will be short sections that will need work to be carried out relating to track and sleeper repair or the possibility of some replacement. The exact scope of this would have to be determined by a much more thorough investigation and assessment of the track condition. Depending on where the line was to terminate in the Deepcar/Stocksbridge area, the scope of work that is required to get the track to passenger train standards over this section is likely to be much greater.	1000 – 2000 [(v)]	A full track condition survey should be commissioned to enable a full assessment of the condition of the track and its suitability for passenger trains. As the speed limit along the line is primarily dictated by the track condition an assessment of possible line speed upgrade could be made. It would be possible to identify sections of track that would need upgrading to meet certain speed limits.	HMRI – Railway Safety Principles and Guidance: Part 2 Section A: Guidance on the Infrastructure (HS(G)153/2) Railway Group Standards – Track System Requirements (GC/RT5021) – Categorisation of Track (GC/RT5023) Network Rail Company Standard – Track Construction Standards (RT/CE/S/102)

Work Element	Current Condition [i]	LIKELY WORK REQUIRED [ii]	Cost Estimate (£ 000's) [iii]	Further Investigation Required [iv]	Design Standards and Guidance
Structures	There appeared to be no problems with any of the structures along the route. It could also be assumed that since the route is used by freight trains on a daily basis that it is unlikely that there are any major problems with any of the structures along the route.	Minimal works are likely.	0 - 100	Full records of the structures should be available from Network Rail. These should be obtained and will provide a Route Availability Number that will dictate the possible rolling stock that can be used. Full structural assessments of some of the structures may be required.	HMRI – Railway Safety Principles and Guidance: Part 2 Section A: Guidance on the Infrastructure (HS(G)153/2) Railway Group Standard – Safe Management of Structures (GC/RT5100) Network Rail Company Standard – Managing Existing Structures (RT/CE/P/032)
	The speed restriction over Deepcar Viaduct may be an indication that there is an underlying problem with this structure.	Possible strengthening works required.			
Telecoms	It is not believed that there is any telecommunications equipment along the Stocksbridge line.	New equipment is likely to be required along its full length in order to operate passenger services. This will include providing cabling and equipment at stations for train announcements, CCTV (if required), passenger help points, information displays, lineside communication equipment.	250 - 400	Full requirements can be assessed during detail design.	Railway Group Standard – Installation of Signalling and Operational Telecommunications Equipment (GK/RT0208)
Environment	The current route passes through a mixture of urban and rural areas and runs along the side of the River Don valley. A substantial length of the route is in or along the edge of woodland.	Environmental mitigation measures may be required as a result of increasing the usage of the line.	230 - 380	A full Environmental Scoping Study should be undertaken to identify any possible issues with reopening the line.	Network Rail Company Standard – Project Management & the Environment (RT/LS/P/007)

Work Element	Current Condition [(i)]	LIKELY WORK REQUIRED [(ii)]	Cost Estimate (£ 000's) [(iii)]	Further Investigation Required [(iv)]	Design Standards and Guidance
Signalling	From research of the Network Rail Sectional Appendices we have established that the line is signalled using an OTNS system (One Token No Staff). Essentially this means that once a train enters the Stocksbridge line from Woodburn Junction a second train cannot enter this section of the line. This includes if the first train has left the Network Rail section and entered the private sidings, which would mean that if a train sits in the sidings all day another train couldn't enter the Stocksbridge line until it has left.	It is likely that the current signalling arrangements would be unsuitable for reinstating passenger trains onto the Stocksbridge line. In terms of train operation the token system requires the driver to dismount from the train to remove the token from a lineside cabinet. As a safety issue Network Rail do not usually authorise drivers of passenger trains to do this. In addition the means of protection at Woodburn Junction is probably not suitable. Train Protection and Warning System (TPWS) is likely to be required. It is therefore likely that the section of line will require new signalling. The exact signalling type and extent of work that would be required would need to be developed upon more detailed plans for the reopening of the line. This would be based on the operational requirements in terms of passenger trains and the aspirations of Stocksbridge Steelworks relating to the freight trains.	100 – 1000 [(vi)]	Once more detailed proposals for the reinstatement of passenger trains are in place, a more thorough examination of the signalling issues could take place. This would involve discussion with Network Rail and Corus (as owner of the private sidings).	HMRI – Railway Safety Principles and Guidance: Part 2 Section D: Guidance on Signalling (HS(G)153/5)

Work Element	Current Condition [(i)]	LIKELY WORK REQUIRED [(ii)]	Cost Estimate (£ 000's) [(iii)]	Further Investigation Required [(iv)]	Design Standards and Guidance
Safety/ Regulations	The current provision of **lineside security** i.e. fencing, along the railway is fairly mixed. In the centre of Sheffield the railway is typically on a high level viaduct and therefore requires little in the way of fencing. As the route passes through the outskirts of Sheffield there is a high level of fencing provision and other means to prevent trespass (i.e. high bridge parapets and 1.8m high palisade fencing). As the route goes northwards out of the city the level of fencing provision reduces, typically post and wire.	Due to the change in nature of the railway if a passenger service was introduced a full risk assessment would need to be carried out of the lineside security. It is likely that there are some areas where current levels of unauthorised access are unacceptable and therefore additional measures, typically 1.8m high palisade fencing would be required in these areas. In other areas maintenance of existing fencing provision might also be required to increase the security.	200 - 400	Once detailed proposals are in place regarding station location, service timetable, etc full risk assessments on these issues would need to be carried out in conjunction with Network Rail. This would identify if and what measures are required to improve lineside security, crossings.	HMRI – Railway Safety Principles and Guidance: Part 2 Section A: Guidance on the Infrastructure (HS(G)153/2) Railway Group Standards – Lineside Security (GC/RT5201) – Deterring Unauthorised Access and Vandalism (GE/RT8063) Network Rail Company Standards – Lineside Security (RT/CE/C/030) – Prevention of Unauthorised Access to the Lineside (RT/CE/S/072)

Work Element	Current Condition [(i)]	LIKELY WORK REQUIRED [(ii)]	Cost Estimate (£ 000's) [(iii)]	Further Investigation Required [(iv)]	Design Standards and Guidance
	All road **crossings** of the Stocksbridge line are grade separated, however there are a couple of other crossings along the line. These were not visited on the site visit. The OS mapping would indicate that they are public footpath crossings. In Stocksbridge itself there is one level crossing shown. This does not appear to lead to anywhere in particular so it is likely to only be a minor user worked crossing.	A full risk assessment of all the crossings would need to be undertaken, in line with Network Rail procedures and HMRI standards. In particular this will assess the changing nature of the usage of the line. Some minor improvements work, such as provision of new signs and boarding might be required. It is possible that significant work may be required due to the safety standards set by HMRI.	0 - 50	Full risk assessments of all the crossings need to be carried out in conjunction with Network Rail. In order to do this more detailed proposals for the operations need to be in place.	HMRI – Railway Safety Principles and Guidance: Part 2 Section E: Guidance on Level Crossings (HS(G)153/6) Railway Group Standard – Provision, Risk Assessment and Review of Level Crossings (GI/RT7011) Network Rail Company Standard – Inspection & Risk Assessment Methodology for User-worked, Footpath & Bridleway Level Crossings (RT/LS/P/026)
	There is currently no specific provision for a **Cess Walkway** along the route. However due to the fact that the route was formerly twin-track the formation gives an adequate width to permit a safe walking route and position of safety alongside the current railway.	Network Rail Company Standard RT/CE/S/069 discusses the requirements for lineside facilities. This document indicates that a cess walkway is required for new works, including track reinstatement, track renewals, etc… However, unless the condition of the track requires significant work it could be argued that a cess walkway is not required due to the fact that the formation is quite wide and provides an adequate position of safety along the full length. This would need to be agreed with Network Rail.	0 - 200	Discussion with Network Rail required, establishing whether any enhanced facilities are required.	HMRI – Railway Safety Principles and Guidance: Part 2 Section A: Guidance on the Infrastructure (HS(G)153/2) Railway Group Standard – Infrastructure Requirements for Personal Safety in Respect of Clearances and Access (GC/RT5203) Network Rail Company Standard – RT/CE/S/069

Work Element	Current Condition [(i)]	LIKELY WORK REQUIRED [(ii)]	Cost Estimate (£ 000's) [(iii)]	Further Investigation Required [(iv)]	Design Standards and Guidance
Stations	Originally there were five stations on the section of the route under consideration – Deepcar, Oughtibridge, Wadsley Bridge, Neepsend and Sheffield Victoria although by the time passenger services were withdrawn the station at Neepsend was already disused. There is evidence of the former platforms at Deepcar and Oughtibridge, although they are in a poor condition and quite overgrown.				HMRI – Railway Safety Principles and Guidance: Part 2 Section B: Guidance on Stations (HS(G)153/3) Railway Group Standards – Station Design and Maintenance Requirements (GC/RT5161) – Infrastructure Requirements at Stations (GI/RT7014)
	A key consideration that must be taken into is the requirements of **Mobility Impaired Passengers**.	Key aspects of providing for this user group is suitable ramped access, if ramps are not possible lifts would be required, and appropriate parking and other facilities			

Work Element	Current Condition [(i)]	LIKELY WORK REQUIRED [(ii)]	Cost Estimate (£ 000's) [(iii)]	Further Investigation Required [(iv)]	Design Standards and Guidance
	The station building at **Deepcar** has been converted into a private property so there may be potential problems with reinstating the station at its former location.	The requirement for a station at Deepcar is likely to depend upon where the passenger service terminates. There would appear to be two main options. 1. Reinstate the old alignment northwards towards Wortley and the Stocksbridge Bypass (A616). The new bridge carrying the dual carriageway would prevent any extension further north without substantial structural work. A new station, with Park and Ride facilities, could then be provided adjacent to the A616. 2. Utilise the current private sidings and provide new station facilities close to the centre of Stocksbridge. This would require negotiation with Corus over issues with the private siding and Network Rail. In particular the section of track utilised by the passenger service would have to have to have its ownership transferred to Network Rail.	1500 – 2000 *(vii)*	A detailed investigation of where the passenger service would terminate would be needed. This would need to involve consultation with the relevant stakeholders, in particular Corus and Network Rail. The exact location of the final station will have an impact on many of the other areas, in particular signalling and the timetabling of the passenger service.	
	At **Oughtibridge** a new housing development has taken place alongside the railway. This may constrict the possible reinstatement of a station in its original position.	The reinstatement of the existing platform at Oughtibridge would be one possible solution. However, due to the condition of the platform it might be that a new station be constructed. Access to the railway might be an issue with the new housing development that is taking place. The result might be that the exact location of the platform would depend on possible access points.	1000 - 1500 *(vii)*	Full consideration of station location required.	

Work Element	Current Condition [(i)]	LIKELY WORK REQUIRED [(ii)]	Cost Estimate (£ 000's) [(iii)]	Further Investigation Required [(iv)]	Design Standards and Guidance
	At **Wadsley Bridge** the former run-round loop has been dismantled and there is little evidence of any platforms. However, there would be plenty of room to build a new platform, including a possible loop. In addition there is currently a large area that would make a suitable area for car parking provision.	A new station would have to be constructed close to the location of the former one. A new platform and other facilities would be required. The possibility of utilising adjacent land for car parking as part of a park and ride scheme could be considered.	1000 - 1500 *(vii)*	Full consideration of station location required.	
	There is no proposal to include a station close to the former **Neepsend** site.				

Work Element	Current Condition [(i)]	LIKELY WORK REQUIRED [(ii)]	Cost Estimate (£ 000's) [(iii)]	Further Investigation Required [(iv)]	Design Standards and Guidance
	The former station at **Sheffield Victoria** has been completed demolished, and the adjoining hotel has been extended over the site of the former station. The location of the station would not be ideal for the City Centre or for interchange opportunities with Supertram. Alternative locations have been investigated. In particular a location for a station has been investigated, off Lumley Street. This lies to the north of the railway before Woodburn Junction, but where the Worksop Lines run parallel to the Stocksbridge Line. A location here would provide the most convenient location for interchange with Supertram (using Nunnery Square), via a new footbridge across the railway. Three plots of land exist in this area. One of the plots appears, from the aerial photo of the area to be used as a storage site for skips and refuse collection vehicles whilst the other two appear to have no particular use at present. It is believed that the SYPTE own one of the plots of land and that it has been retained specifically for the purpose of providing interchange.	Assuming that a location off Lumley Street is a feasible the new station facilities, including a new road access, car parking, drop off zone, etc could be provided in this area to the north of the railway. To meet the objective of opening the Stocksbridge Line to passengers only a single platform need be constructed. However, in order to make full use of interchange with Supertram a new footbridge would need to be constructed across the railway. This would ideally be located between the existing Park and Ride facilities and the Supertram depot, and would feed into the access from the Park and Ride to Nunnery Square station. Studies of the mapping and aerial photos of this area would indicate that there are no significant constraints on the footbridge, and in particular the need to provide ramped approaches to meet the needs of Mobility Impaired Passengers. ***Future Expansion*** – The location of a station on the Stocksbridge line would open up the possibility of building an additional platform on the Down Worksop line. This would enable trains using this line to stop in this location. A new crossover would be required from the Up Worksop to Stocksbridge lines to allow trains leaving Sheffield to stop here.	2500 - 3500 *(vii)*	Full consideration of station location and in particular how this would meet the needs of potential passengers is required. In investigating the station further, consideration to the additional infrastructure, i.e. second platform and crossover, which could be constructed at a later date, should be made.	

Work Element	Current Condition [(i)]	LIKELY WORK REQUIRED [(ii)]	Cost Estimate (£ 000's) [(iii)]	Further Investigation Required [(iv)]	Design Standards and Guidance
	Total Estimated Construction Cost [(viii)]		***£10 480 000***		

NOTES:

(i) Based upon site visits undertaken and desk study, including OS Mapping and Network Rail Documents.

(ii) Based on our engineering knowledge and experience, this is an estimate of the likely work that is required to start a passenger service on the line.

(iii) The cost estimate is based on the likely work required and is a best estimate of the likely costs associated. See further notes below.

(iv) An assessment of what further investigations are required to more fully define the scope of works required to open the line to passenger trains.

(v) The cost of permanent way works will be very dependent on, a) the current track quality, and b) what the desired speed limit for the line would be, and therefore what upgrade works may be required. The estimate quoted is for replacing around 10-20% of the track.

(vi) The cost of the works relating to the signalling will be very dependent on the scope of works required. A small modification is unlikely to have implications on the main signalling for the area and therefore the costs will be at the lower end of the scale. However, significant works may be required resulting in much greater costs. The costs stated are based on opening the line as a single track line and do not account for any passing loops. Any passing loops would require an even greater amount of work, and costs upwards of £5million for the signalling alone could be expected.

(vii) The cost estimates for the stations are inclusive of passenger facilities and single platforms. They include a nominal amount for providing access and a minimal level of car parking (i.e. no provision for significant Park and Ride facilities). The estimate for the replacement for Sheffield Victoria includes an allowance for the footbridge required.

(viii) The number quoted is the median value for the Total Construction Costs, i.e. no allowance in this figure for Project Delivery. The estimated maximum construction cost of the works is £13.1 million.

APPENDIX B

List of References

B1. LIST OF REFERENCE DOCUMENTS

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