Don Valley Railway,
South Yorkshire PTE,
Sheffield City Council

# The Don Valley Railway Project

Engineering Feasibility Study

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## Engineering Feasibility Study

July 2010



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# Executive Summary

Ove Arup and Partners Ltd (Arup) were appointed to undertake a study of the engineering feasibility of running regular passenger services on the Sheffield to Stocksbridge route. Reopening this route to passenger traffic is identified by SYITA as a priority for the medium/long term development of South Yorkshire's rail network. The study concentrated on practical engineering aspects of the line with the aim of developing an initial service on the route.

This study follows previous work (Arup, 2004[1]; Arup, 2006[2]) recommending the heritage option be progressed further. As such, this study is primarily concerned with heritage operation.

This report evaluates the feasibility of reopening the route to passenger traffic from a technical perspective. This report presents options for further consideration, which have been assessed from an infrastructure and passenger / freight demand perspective. These options build on conclusions drawn from the previous work and consider which future enhancements would be feasible propositions.

The line involved in this study runs down the Don Valley from Stocksbridge in the Little Don Valley, to Woodburn Junction (sic) in Woodbourne, Sheffield. It currently carries only freight traffic, serving the Corus Engineering Steel steelworks. The line is currently not able to handle passenger operations, primarily because there are no stations.

In the 2006 Arup report, the estimated passenger demand between Stocksbridge and Sheffield was given as about 1,410 trips per day by 2016 in the central case forecast. It showed that 2 trains per hour (tph) was a reasonable minimum level for a commuter service. However, it did not consider the usage level of a Deepcar to Sheffield service, or of a non-stop shuttle service; this may be worthy of further investigation. Further, several significant changes to the public transport links in the area have occurred since the 2006 report was issued. These include the extension to Middlewood P&R, the new Malin Bridge P&R and the 10-minute frequency 0700-2000 Monday to Saturday TF1 bus feeder service to Middlewood. These are likely to have a significant impact on the original passenger projections.

We consider that the most cost effective train service option is a simple Victoria to Deepcar shuttle. This could operate on a 2tph basis with no intermediate stops, utilising a single unit. This option is also potentially the easiest to get into operation. Enhancements could be made in the future as funds allow, with additional stations at Oughtibridge and Wadsley Bridge, and an extension to Stocksbridge. Diesel-powered rolling stock (particularly DMU) is seen as the most suitable for the operation of the line.

The permanent way currently installed appears to be well built and well maintained. From our line inspection, the line does not appear to require a great deal of work to return the line to passenger operation.

[1] *Working Paper 2: Stocksbridge to Woodhouse, Arup, 2004*
[2] *Feasibility of Reinstating a Passenger Rail Service, Arup, 2006*

An estimated cost has been produced from an initial bill of quantities for the base case, and the operating costs have been revised (from the Arup 2006 report) to reflect the current operating options. This engineering feasibility study has shown that:

- **Reopening the Stocksbridge to Sheffield route to passenger rail traffic is feasible in engineering terms.**
- **The Network Rail owned section from Deepcar to Victoria appears to be in good condition and suitable for the introduction of a DMU shuttle.**
- **The station sites at Deepcar and Victoria appear suitable for the modest station layouts described.**
- **The capital cost for infrastructure is estimated at £4.3m; the annual running costs are estimated at £1.8m.**

It is recommended that further study is conducted into the following areas in particular: operational arrangements; type and cost of rolling stock; station layout arrangements; track gauge and weight restrictions; sources of funding and patronage estimates.

# 1 Introduction

## 1.1 The Brief

Ove Arup and Partners Ltd (Arup) were appointed to undertake a study of the engineering feasibility of running regular passenger services on the Sheffield to Stocksbridge route. The scope for the study is set out in the Arup letter dated 15th February 2010. This scope includes a review of the existing rail infrastructure and possible enhancements, to Network Rail GRIP Stage 1. The joint clients were Don Valley Railway (DVR) and South Yorkshire Passenger Transport Executive (SYPTE). Sheffield City Council (SCC) co-funded the study with DVR and SYPTE.

Reopening this route to passenger traffic is identified as a priority for the medium/long term development of South Yorkshire's rail network[3]. The scope of the study was to establish the optimum strategy towards the introduction of passenger rail services on the rail line between Sheffield and Stocksbridge, concentrating on practical engineering aspects of the line with the aim of developing an initial service on the route.

## 1.2 Scope of this Report

This report details the results of the following:

- A summary of the characteristics of the route and the patronage forecasts prepared by Arup and reported in *"Feasibility of Reinstating a Passenger Rail Service"*, Arup, 2006.
- Site visits and a route inspection examining the quality of the track to ascertain a more accurate and up to date appraisal of costs.
- An appraisal of rolling stock options to provide a reliable commuter service.
- Discussion with Stocksbridge Steelworks' Owners to identify potential methods of operation of the route.
- A review of potential station locations and their viability in terms of introduction of a regular passenger service.
- A review of infrastructure and operation options to reduce journey times and raise service frequencies in order to deliver a viable commuter service.
- Preparation of indicative cost estimates and outline scope for improvements.

[3] *Rail Strategy, South Yorkshire Passenger Transport Authority, 2004*

# 2 Description of the Line

The line involved in this study runs from Stocksbridge in the Little Don valley, to Woodburn Junction (sic) in Woodbourne, Sheffield, see Figure 1. It currently carries freight traffic only, serving the Corus Engineering Steel steelworks in Stocksbridge with steel ingot and bloom produced at their Aldwarke melting plant.

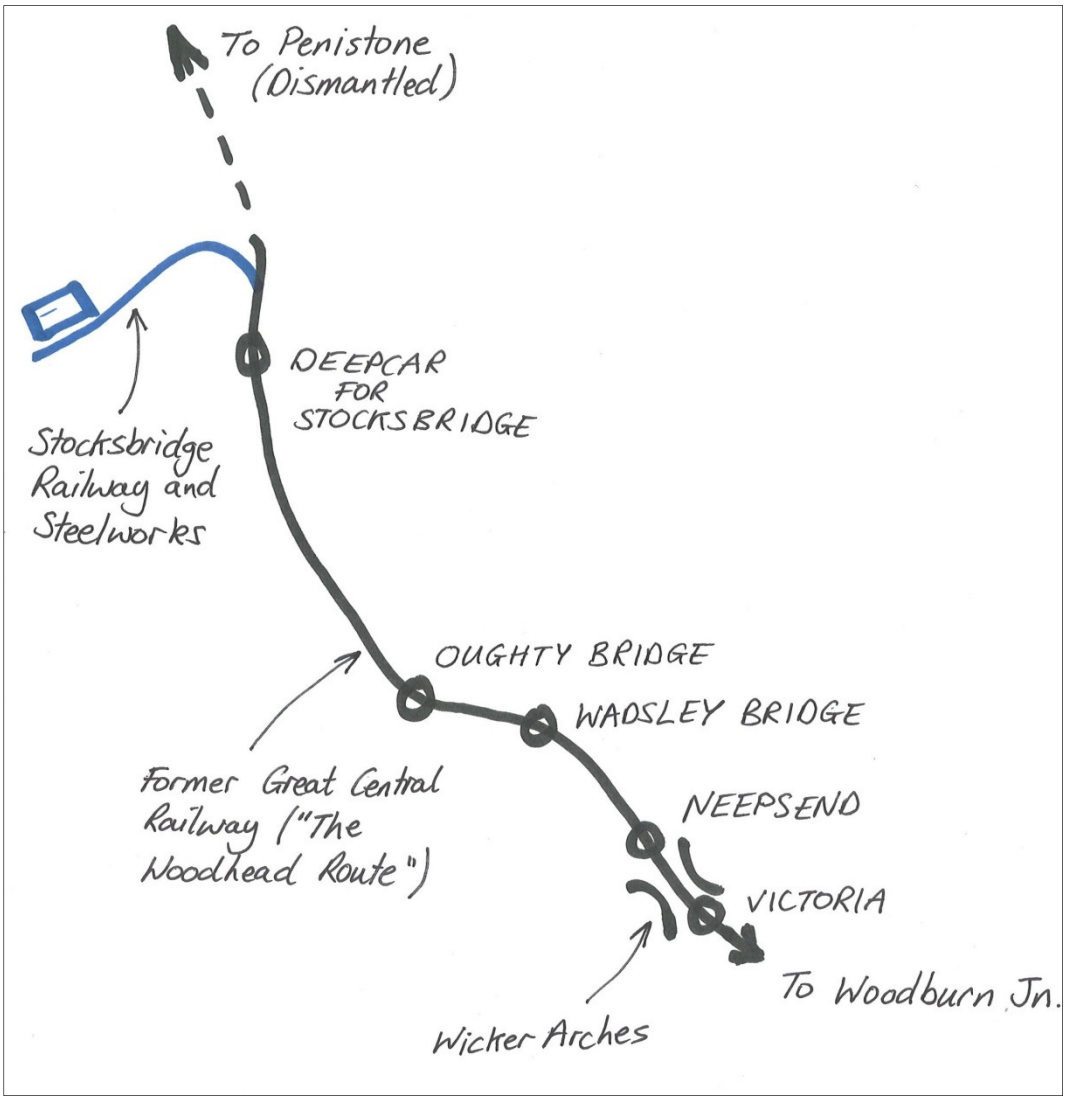


**Figure 1: Stocksbridge to Sheffield**

The section from Stocksbridge to Deepcar is the former Stocksbridge Railway, a company independent of the steelworks. The Stocksbridge Railway Act allows the carriage of passengers, which the railway did until 1931. Later it was taken over by the steelworks, and is now owned and operated as a private freight line by Corus; see Figure 2. There are loops at Exchange Sidings at Deepcar (1no), Ellen Cliff (1no) and Riverside (3no). The steelworks itself has an extensive network of interconnecting lines, loops and sidings.

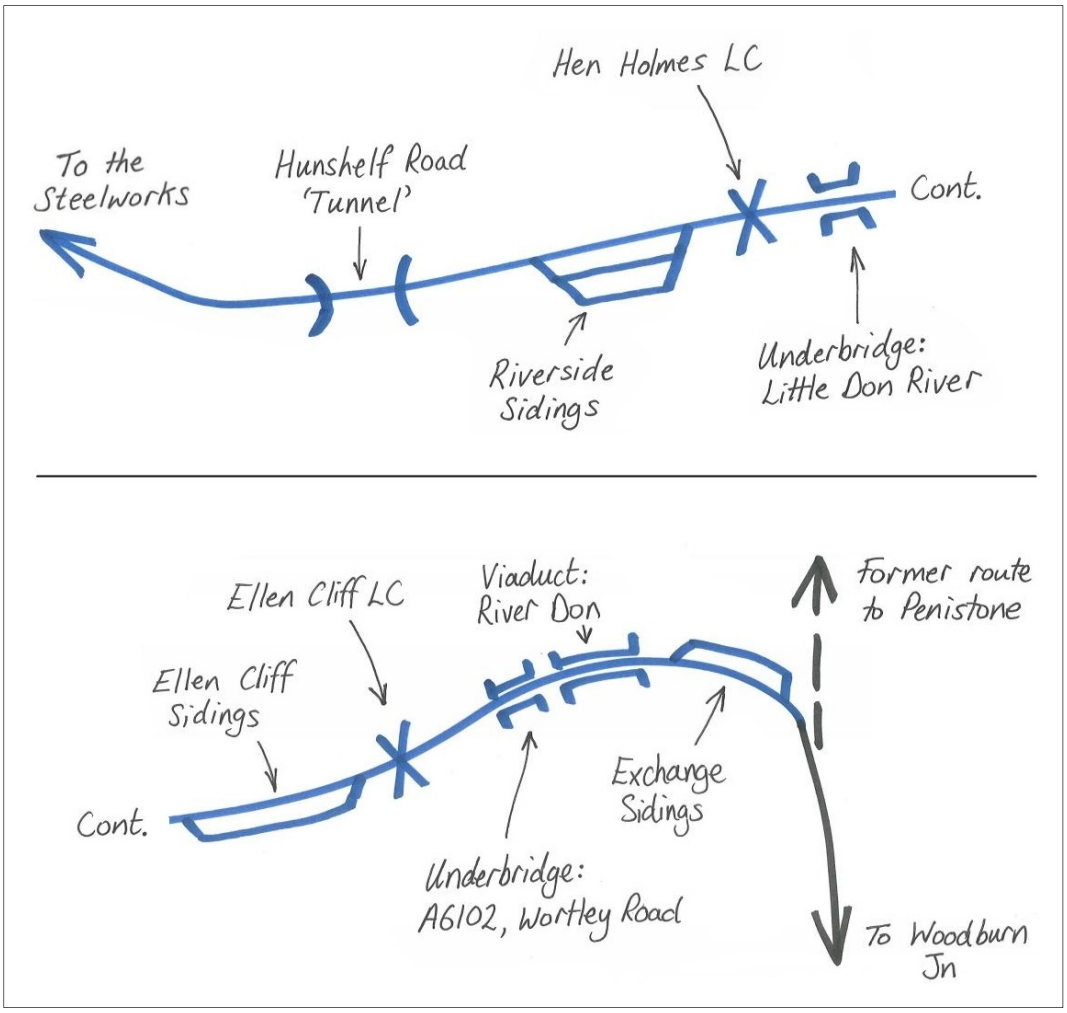


**Figure 2: The Stocksbridge Railway**

The section from Deepcar to Woodburn Junction is owned and managed by Network Rail, and is known to them as the Stocksbridge Line. It is part of the former Woodhead Route of the Great Central Railway, connecting Sheffield with Manchester via Penistone and Woodhead. The section from Deepcar northwards was dismantled after closure in the 1980s and is now severed by the A616 Stocksbridge bypass about half a mile north of Deepcar. Following the Don Valley southwards on a falling gradient, the line had passenger stations serving Deepcar (Deepcar for Stocksbridge), Oughtibridge (Oughty Bridge), Wadsley Bridge, Neepsend and Sheffield (Victoria). Little remains of the station buildings; some of the platforms are still evident though in derelict condition. Previously a 60mph main line alignment with two, three and four tracks, the line has been heavily rationalised and now comprises a single track only. There are no sidings, loops or trap points, and no signalling or communication equipment on the line. Whilst previously electrified, this too was dismantled after closure of the through (Woodhead) route.

In Sheffield, the former Great Central lines run beyond Woodburn Junction to Worksop and Lincoln; see Figure 3. At Woodburn Junction the Tinsley Line diverges to the north, and there is a connection to the former Midland main line and the current Sheffield station to the west.

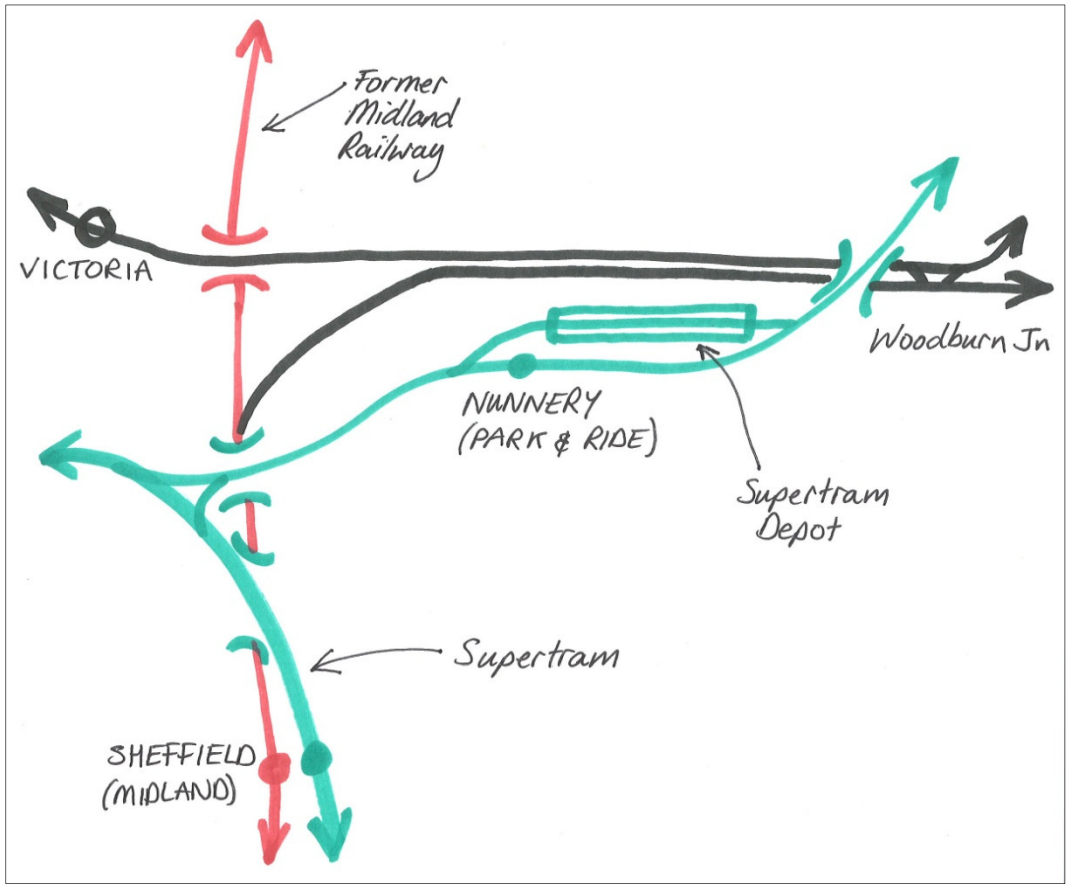


**Figure 3: Railways of Sheffield**

The Sheffield Supertram Yellow Line route runs parallel with the former Great Central lines at Nunnery. A park and ride at Nunnery provides connections to Meadowhall to the north and the city centre to the west. Also situated at Nunnery is the Supertram vehicle and track maintenance and repair depot.

### Infrastructure

The line is currently not able to handle passenger operations, primarily because there are no stations. On the Deepcar to Victoria section, the track and structures appear to be in good condition. The line speed is currently low (30mph) and the track alignment details are not known. On the Stocksbridge to Deepcar section, the structures appear to be in good condition though the track is poor. There is no communication or signalling equipment on the line; this precludes an intensive service but is not prohibitive to a single unit service. The method of operation chosen will affect the required infrastructure improvements.

### Ownership and Liability

The ownership of the line and the responsibility for its maintenance is an issue which is not directly tied in with the proposed operation of the line. This issue is influenced by the multiple current owners and operators. It is not thought that the proposed methods of operation would require a change of ownership.

# 3 Forecast Passenger Usage

This chapter summarises findings of the 2006 Arup report which assessed passenger demand for a Stocksbridge to Victoria service. In this study, we have not added to or updated this data. Based on this data, in particular in 3.3.2 below, we have concluded that any solution has to achieve 2tph at the outset at minimum set-up cost.

It should be noted that the 2006 study did not consider the usage level of a Deepcar to Sheffield service, or of a non-stop shuttle service; this may be worthy of further investigation. Further, several significant changes to the public transport links in the area have occurred since the 2006 report was issued. These include the extension to Middlewood P&R, the new Malin Bridge P&R and the 10-minute frequency 0700-2000 Monday to Saturday TF1 bus feeder service to Middlewood. These are likely to have a significant impact on the original passenger projections. Because of this, the passenger forecast figures quoted from the 2006 Arup report should be considered as indicative.

## 3.1 Catchment Areas

### Review of Existing Travel Markets

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. Public transport links as feeders to the line were not included in the analysis.

The following wards were identified for the inner study area: Stocksbridge, South Wortley, Hillsborough, Walkley, Owlerton, Netherthorpe, Burngreave, Castle, Sharrow and Park, see Figure 4.

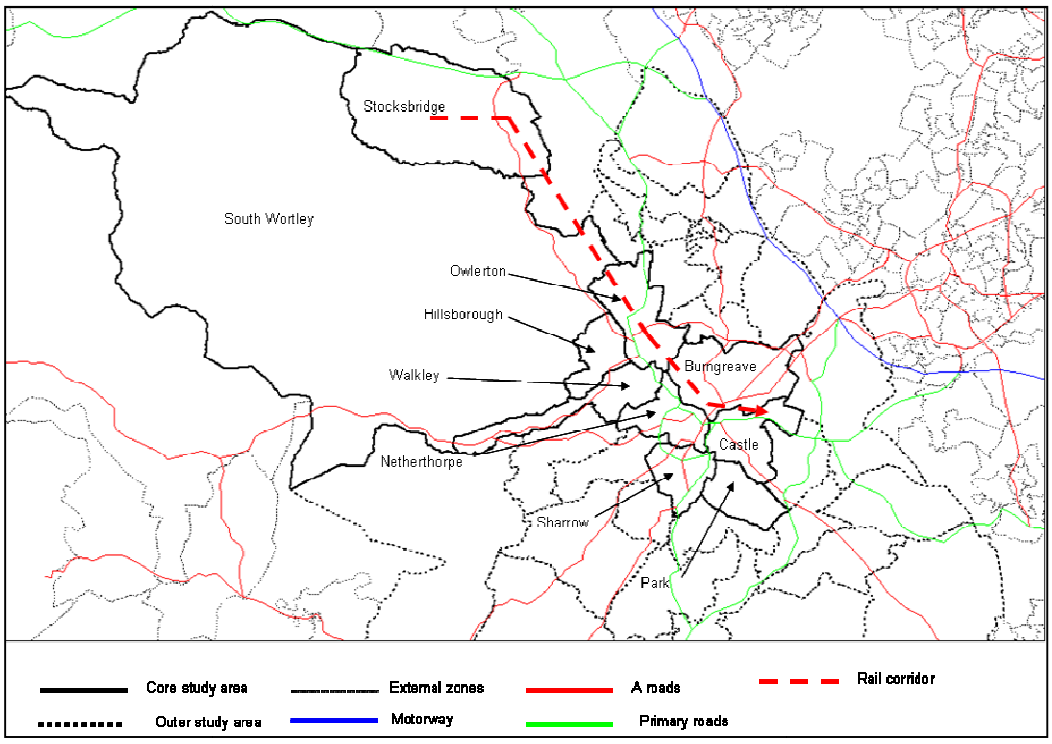


Figure 4: Identification of In-scope Zones

## 3.2 Estimated Demand, 2016

The estimated demand for the AM peak period in 2016 was based on a 2tph frequency, end-to-end rail journey times of about 30 minutes, and a service that terminates at Sheffield Victoria. The number of in-scope rail trips is estimated at 15,050 trips in the AM peak, with 510 passengers choosing rail, see Table 1.

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 AM peak trips, and 2,200 such trips from Walkley. Stocksbridge attracts a relatively high rail mode share (5%). The short access times 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 AM peak trips are forecast to be in-scope to this ward, of which the rail service would attract 170 trips. 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 in the AM peak. 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 AM peak 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 1: AM Peak Rail Trips, 2016**

| 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

### 3.2.1 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.

### 3.2.2 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.

### 3.2.3 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. 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.**

## 3.3 Sensitivity Tests

A series of sensitivity tests were conducted to highlight the parameters with the greatest impact on the overall generalised cost, and to identify the optimum service proposal.

### 3.3.1 Change in Rail Journey Times

The central case assumed an end-to-end journey time of about 33 minutes between Sheffield and Stocksbridge. Table 2 examines the impact if journey times were improved to about 20 minutes. The number of AM peak journeys is forecast to increase by about 40% to 710, and the revenue generated could increase to £930,000 per annum. Additional infrastructure would be required to support the faster journey times.

**Table 2: 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

### 3.3.2 Change in Rail Frequencies

The central case assumed 2tph would operate between Sheffield and Stocksbridge. Table 3 compares the number of AM peak and daily rail trips for 1tph and 4tph with the 2tph proposal. The results demonstrate that the choice between rail and other modes is very sensitive to frequency (and hence wait time).

**Table 3: Sensitivity Test – Impact of Rail Frequencies (2016 demand)**

| 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

### 3.3.3 Change in Car Journey Times

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. The results shown in Table 4 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: 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

### 3.3.4 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. If car parking charges double, the number of rail trips more than doubles, demonstrating the importance of this parameter; see Table 5.

**Table 5: 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

### 3.3.5 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.

### 3.3.6 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, though these changes have a negligible impact on the number of trips choosing rail. As discussed above, several major changes to the public transport links in the area have occurred since the 2006 report was issued. These include the extension to Middlewood P&R, the new Malin Bridge P&R and the 10-minute frequency 0700-2000 Monday to Saturday TF1 bus feeder service to Middlewood. These are likely to have a major impact on the original passenger projections.

### 3.3.7 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.

## 3.4 Impact of Other Demand

The scope for additional park & ride demand originating from Penistone is relatively small. There are about 400 AM peak 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. The extent of future traffic congestion is uncertain, but it is unlikely that journey times would double compared with the current timings.

# 4 Operations

## 4.1 Sheffield to Deepcar

### Historical

The route between Woodburn Junction and Deepcar formed part of the Great Central Railway main line between Sheffield and Manchester via the Woodhead Tunnel. The line was progressively electrified using the 1500v DC system in the 1950s with the section between Sheffield and Penistone being completed in September 1954. Passenger services between Sheffield Victoria and Manchester ceased in 1970 and the route was finally closed in 1981 with freight services continuing to Stocksbridge. Most of the route between Deepcar and Penistone is now used as a recreational path, the Trans Pennine Trail (a bridleway). The section between Deepcar and the A616 crossing to the north is used as an unofficial path; there is no right of way here.

Between Sheffield and Deepcar there were stations at Victoria (closed in 1970), Neepsend (closed in 1940), Wadsley Bridge (see below) and Oughtibridge which were closed in 1959 along with Deepcar. The local passenger services generally called at all stations and in the late 1950s were operating only at peak travel times with occasional off peak Saturday services. Wadsley Bridge had calls on Sundays in Manchester services and also remained open until 1996 for football charter or excursion services for the Sheffield Wednesday Ground at Hillsborough.

The ruling line speed in 1960 was 60mph with no permanent lower speed restrictions. (Source BR (E) Great Northern Line Sectional Appendix)

### Current

The route is currently owned and operated by Network Rail and is a single track line from Woodburn Junction through to the junction with the Stocksbridge Railway north of the former Deepcar station site. The line is operated on the one train working principle with a line speed of 30mph. There are two freight paths in the Working Timetable per day Monday to Friday from Aldwarke to Stocksbridge at 08:48 and 18:48 passing Woodburn Junction at 09:04 and 19:04 returning from Stocksbridge at 11:12 and 21:13 passing Woodburn Junction at 11:42 and 21:44. The services are operated by DB Schenker with generally only the evening path utilised.

## 4.2 Stocksbridge Railway

The Railway was built to service the steels works and opened in 1877. Whilst primarily for freight services it also operated a passenger service between Stocksbridge and Deepcar until 1931. The Act of Parliament allows the operation of passenger services. The current operation is the movement of steel products to and from Aldwarke, worked by DB Schenker to either the Exchange Sidings or to Ellen Cliff Loop. From there the trains are worked usually in two portions into the works by the works own 0-6-0 diesel shunting locomotives. Inside the works there is an extensive network of lines with internal movements between the various facilities. Service can be erratic during periods of inclement winter weather due to operational difficulties on this section of line.

## 4.3 Passenger Train Service Options

The Stocksbridge–Sheffield Rail Study undertaken by Arup in May 2006 identified two trains per hour (2tph) as the central case.

## 4.4 Stations

The following station sites were considered in the May 2006 report; Sheffield Victoria, Wadsley Bridge, Oughtibridge, Deepcar and Stocksbridge. The first four are at the former station sites all of which have some remains of the original station. This did not preclude other stations being added if required. The platforms will need to be long enough for the type of train used together with a stopping allowance of five metres. Level access and platform arrangements will be required to meet the requirements of the Disability Discrimination Act of 1995, unless derogations can be authorised.

## 4.5 Train Service Options

### 4.5.1 Base option: Deepcar – Victoria shuttle

Based on the demand analysis, in our opinion, offering a faster service to the passengers travelling furthest should be considered as the base case. We consider that the most cost effective train service option is a simple Victoria to Deepcar shuttle. This could operate on a 2tph basis with no intermediate stops, utilising a single unit. This would require a 60mph line speed with a probable journey time of eleven minutes. This could be operated with a single rolling stock unit with a four minute turnaround at each end see Table 6.

**Table 6: Example Timetable, Deepcar – Victoria shuttle (1 unit)**

| | DMU | DMU |
|---|---|---|
| Victoria | 00:00 | 00:30 |
| Deepcar | 00:11 | 00:41 |
| | | |
| Deepcar | 00:15 | 00:45 |
| Victoria | 00:26 | 00:56 |

Corus have indicated that they may be amenable to changing the time of operation of the freight service to midday which would enable full operation in the peak periods between 07:00 and 10:00 in the morning and 16:00 and 19:00 in the evening. Whilst the freight train was on the branch the passenger service could not operate and the train would have to leave and rejoin the branch via Woodburn Junction.

It will be necessary to provide a lock-in device in the signalling, thus isolating the freight train on the Stocksbridge Railway. This would allow additional passenger train operation rather than an up to three hour gap in service whilst the freight service operates to Stocksbridge. It would also allow the passenger train unit to be locked in at Stocksbridge if required. We understand that a similar device used to be in operation when Wadsley Bridge was being used for special trains.

### 4.5.2 Enhancement 1: Deepcar – Victoria with intermediate stops

To add more stations will require both additional rolling stock and additional infrastructure, see Table 7. The additional infrastructure required would be a loop with platforms on each line at Oughtibridge. The loop should be long enough to accommodate the freight service with signalling using axle counters between Woodburn Junction and Oughtibridge and one train working thence to Deepcar with lock in facilities on the Stocksbridge Railway. An additional unit of rolling stock would be required. Wadsley Bridge and up to two other stations such as Sheffield College or Ski Village could be added between Oughtibridge and Victoria and still maintain adequate turnarounds. Alternatively the route could also be extended to a station near Nunnery Square Tram Station. The proposed station at Wharncliffe Wood is also a possible addition.

**Table 7: Example Timetable, Deepcar – Victoria stoppers (2 units)**

| | DMU | DMU |
|---|---|---|
| Victoria | 00:00 | 00:30 |
| Wadsley Bridge | 00:05 | 00:35 |
| Oughtibridge | 00:09 | 00:39 |

| | | |
|---|---|---|
| Deepcar | 00:14 | 00:44 |
| | | |
| Deepcar | 00:04 | 00:34 |
| Oughtibridge | 00:09 | 00:39 |
| Wadsley Bridge | 00:13 | 00:43 |
| Victoria | 00:18 | 00:48 |

### 4.5.3 Enhancement 2: Stocksbridge – Victoria

To extend the passenger service to a station at Stocksbridge would require further infrastructure changes but no additional rolling stock, see Table 8. The station site should be clear and trapped off from any internal shunting movements in the works. Ideally a single line from Deepcar to the station would be the best method however this may not be achievable as DB Schenker locomotives, currently Class 66, may not be able to operate through the Hunshelf Road tunnel located under the works entrance or the operation may not be feasible within the works. If through operation is not possible then two loops would be required between Deepcar and Stocksbridge one for arriving traffic and one for departing traffic for use as exchange sidings with appropriate signalling. The signalling could be controlled from the Network Rail signal box at Woodburn Junction or its successor. This system is employed in other locations. Works locomotives would operate between the works and loops as today but would be subject to signalling control and would require additional training and certification for those staff.

The two level crossings on the route would need modification, Ellen Cliff is regularly used by vehicles, horse riders and pedestrians; it is near a curve and visibility is poor. It may require protection with the barriers and a half barrier type crossing may be feasible or it may require gates, a phone-to-signaller system and the train service slowed to 5mph. At Henholmes level crossing it looks as if the vehicle rights could be extinguished and it be reduced to a pedestrian crossing.

**Table 8: Example Timetable, Stocksbridge – Victoria (2 units)**

| | DMU | DMU |
|---|---|---|
| Victoria | 00:00 | 00:30 |
| Wadsley Bridge | 00:05 | 00:35 |
| Oughtibridge | 00:09 | 00:39 |
| Deepcar | 00:14 | 00:44 |
| Stocksbridge | 00:19 | 00:49 |
| | | |
| Stocksbridge | 00:29 | 00:59 |
| Deepcar | 00:34 | 00:04 |
| Oughtibridge | 00:39 | 00:09 |
| Wadsley Bridge | 00:43 | 00:13 |
| Victoria | 00:48 | 00:18 |

### 4.5.4 Further enhancements

More frequent services would require double tracking throughout for a 15 minute interval service or between Deepcar and Oughtibridge, and Wadsley Bridge and Victoria for a 20 minute interval service. The former would be appropriate if the Penistone line was reopened.

A future option might be to operate a cross-Sheffield service towards Worksop or Rotherham especially if significant development occurs in the Don Valley with trains running past Victoria Station. This would require enhanced infrastructure between Victoria and Woodburn Junction.

The proposed train services and infrastructure changes do nothing to prevent restoration of a train service to Penistone although these additional services may require additional infrastructure depending on the level of Stocksbridge service.

## 4.6 Train Operator Options

The passenger service may be operated with any company which has the necessary Passenger Licence. It would also have to hold a non-passenger licence for Empty Rolling Stock movements and a Station Licence as none of the proposed stations are currently on the Network. The Office of Rail Regulation is responsible for the licensing train operators.

Track and Station access agreements with Network Rail would need to be negotiated. These would reflect the increased maintenance costs involved in the operation of the service such as track, signalling and communications as well as other ancillary costs. In addition there would be charges for the British Transport Police.

The options would be to use an existing operator such as Northern Rail Ltd or for the Don Valley Railway to set up as a Train Operator; an example already exists with the North Yorkshire Moors Enterprises Plc being an Operator on the Esk Valley Line. As the Stocksbridge Railway is not part of the National Network any agreement to operate passenger services would be with the company owning the infrastructure. It would be subject to the same standards as the National Network.

If an operator such as Northern Rail was used then their existing depots would be able to deal with maintenance of the rolling stock. If the Don Valley Railway was the train operator and required its own depot the option is to use another existing facility with an agreement or to set up a new depot. If that depot is connected to the National Network a Depot Operators Licence will be required.

# 5 Rolling stock

## 5.1 Route clearance

### Coaching stock

Network Rail's Sectional Appendix shows the Stockbridge Line (i.e. Woodburn Junction to Deepcar) is currently cleared for operation of C1 and C3 coaching stock only, Table 9.

**Table 9: Coaching Stock Gauge**

| | |
|---|---|
| C1 | This is the standard passenger coaching stock gauge for Mark 1 coaches with 9'0" wide bodywork and 64'6" or (57') long under-frames. Mark 2 coaches also conform to this profile. |
| C3 | The standard profile for Mark 3 coaching stock which is 23 metres (75') long overall. HST (class 253/254) stock conforms to this gauge. |
| Mk 4 | (Normally operates as part of the IC225 fleet in fixed formation trains.) |

### Diesel Multiple Unit (DMU)

The line is currently not cleared for operation by any type of DMU, because DMUs have not been considered by Network Rail as requiring clearance. This does not mean DMUs are prohibited from the route, just that specific clearance must be obtained before operating. Given the construction and condition of the line, this is unlikely to present difficulties.

### Diesel Locomotives

The following locomotive classes are permitted to operate over the route without restriction: 37/0 to 6, 37/7 to 9, 43, 47, 56, 57, 58, 60, 59/66, 67, and 73. The Route Availability, a measure used to categorize under-bridges (and rail vehicles by axle weight and spacing), is RA8.

### Freight vehicles

The route is cleared for operation by W6 gauge vehicles; these are freight wagons cleared for national operation and are listed in detail in the appendices. Larger gauge wagons (W7, W8, W9, W10, and W12) are specifically prohibited. This should not affect the proposed passenger services.

### Restrictions

The Sectional Appendix lists the following restriction for the Stocksbridge Line:

> *Deepcar Exchange Sidings*
> *Over Deepcar Viaduct there is a 5mph speed restriction for all locomotives.*
> *Dated: 02/12/06*

The reason for such a restriction is not known, since the RA clearance applies to terminals and sidings connected to the line and yet does not show a restriction. This would require further investigation should a service to Stocksbridge be pursued.

Further, the clearances and weight restrictions on the Stocksbridge Railway (Stocksbridge to Deepcar) are not fully known. In particular, Hunshelf Road tunnel west of the Riverside sidings may well be foul of gauge. Depending on the clearance, or lack thereof, rolling stock may be prohibited from passing through the tunnel, passenger services may be required to terminate before the tunnel, or a speed restriction or other operating rule may be required. Rebuilding the bridge, removing or relocating pipework, and lowering or realigning the track may also be required.

## 5.2 Rolling Stock Options

### Electric

Electrification of the line would be prohibitively expensive in the initial stages of operation and has not been pursued further in this study.

### Diesel

Diesel-powered rolling stock (particularly DMU) is seen as the most suitable for the operation of the line. DMUs in particular do not need run-round facilities and it would be easier to provide in-house light maintenance should a local depot be constructed. Loco-hauled stock could be used but would require a run-round unless operated top-and-tail. Locomotives could be easily hired in however, for example to cover locos undergoing repair, and train lengths adjusted by attaching or detaching coaching stock.

Class 10x/11x/12x 'First Generation' DMUs could be operated. Now rare on the national network, many have been preserved for use on heritage lines. As such there is a good precedent in private operation, maintenance and repair. Central door locking would need to be fitted, such as to those used by Chiltern Railways.

Class 14x 'Pacer' DMUs are relatively cheap and suited to short journeys, especially commuting, though they have a relatively high axle load and their two-step entrance is less accessible. Class 15x 'Sprinter' DMUs would be suitable but are more in demand on the national network, reducing availability.

DMUs would require all vehicles powered; modern DMUs have this feature whilst some heritage units still in operation have power car/trailer car formations.

### Availability

We understand that there are currently no surplus DMUs available in the National Fleet. A tender notice for new DMU rolling stock was issued by the DfT in December 2008. This has been superseded by the announcement of electrification schemes that will enable a cascade of rolling stock, though it is not clear whether any or how many will be available. If there are it is likely to be of the Class 14x variety. An alternative is operation using two diesel locomotives with standard coaches such as that in operation between Maryport and Workington; the availability of such units is good.

## 5.3 Steam Services

The Don Valley Railway (DVR) has an aspiration to operate weekend steam heritage services over the route. Depending on the type of operation involved run round loops may be required at Victoria and Stocksbridge with the option of operating beyond Victoria to Beighton and running round there. The alternative is to operate with a locomotive at each end. If the operation was between Deepcar and Victoria with no passenger service on the Stocksbridge Railway then that Railway could be used as a run round.

Air Quality Officers at Sheffield City Council may need to be involved relating to proposals which may reduce air quality (e.g. steam services).

## 5.4 Maintenance Facilities

Provision of maintenance and repair facilities also needs to be considered. Steam engines are likely to require more extensive facilities than those for DMU operation, and there may be objections to smoke from lighting up in residential areas. The depot could be sited on the disused trackbed of the Woodhead Route just north of Deepcar, though this site would be distant from the Stocksbridge terminus and currently has no road access. Security may be an issue as the site is encompassed by woodland. Other possible sites include Exchange

Sidings on the Stocksbridge Railway, and the former Bridgehouses station. This latter site (on the southwest side of the line between Chatham Street and Derek Dooley Way, grid ref SK355883) appears to be currently vacant, though is not in Network Rail ownership.

## 5.5 Alternative Ownership

As an alternative to the proposal of operating the service as part of the National Network there exists an option to 'take over' the railway from Network Rail. The Wensleydale Railway between Northallerton and Redmire is an example with the Freight Operators rights protected within the agreement. It would mean the new owners would be responsible for maintenance, operation and renewal.

# 6 Stations

## 6.1 Recommendations about station locations

The station sites identified for review are, from north to south:

- Stocksbridge (west of Hunshelf Road tunnel)
- Deepcar (just south of the former station)
- Oughtibridge (site of former Oughty Bridge station)
- Wadsley Bridge (site of former station)
- Victoria (site of former station)
- Nunnery (opposite the Supertram park & ride)

In terms of viability for the introduction of the project, the operational analysis above has shown that a Deepcar to Victoria shuttle is most desirable. Having two stations will reduce the initial capital required and allow a faster service to those making longer journeys, taking advantage of the associated greater model share. In terms of infrastructure cost and operational complexity, the terminus at Deepcar is recommended over Stocksbridge. This allows a half-hourly service with a single unit; hence no passing loop is required. Signalling changes would not be required and track alterations can be kept to a minimum. Our findings are based on a high level review of the data and will need to be confirmed when station layouts are developed in later stages of the project.

### 6.1.1 Base case

**Deepcar**

This site appears suitable for a station with a modest car park. We understand that a commercial property developer has drawn up plans for housing on the site and has included allowance for such a station. The site is relatively remote so many users would arrive by car. The site is on a rail gradient of 1:120. The recommended limit for new build stations is 1:500, so derogation from standard[4] may be required; this is not thought likely to present a problem. The site is large enough for a twin-track, dual-platform station: it is recommended the first platform is constructed to suit future alteration to twin-track alignment.

**Victoria**

This site appears suitable for a city-centre station. There is enough space for a twin-track, dual-platform station and it is recommended that the first platform be constructed to suit future enhancement. Access would likely be via the Victoria Hotel approach and via existing steps down to street level on the Wicker. The feasibility of access via the hotel approach would be worthy of further investigation. Network Rail owns the site, but the approach ramp is thought to belong to the owners of The Victoria Hotel. The rail gradient through the former Victoria station is level, which is the ideal case.

### 6.1.2 Enhancement 1

**Oughtibridge**

This site appears suitable, though is relatively constrained (see drawing 001 in the appendices). There appears to be space for a twin-track, dual-platform alignment on Network Rail land although any car park would have to be sited on adjacent plots. The former platforms would need to be rebuilt and the track realigned to suit. Housing on the former station yard to the west means access from the east would be most favourable. The greenfield site to the south of the 'works' appears suitable for siting a larger station building

[4] *Railway Group Standard GI/RT7016, RSSB, December 2009*

and car park. There is the possibility of siting the station slightly further north: whilst this would be further from the road access, the plot is wider. The rail gradient through the proposed station site is 1:132 so a derogation from standard may be required.

#### Wadsley Bridge

The former station site appears suitable for reconstruction (see drawing 002 in the appendices). This could be accessed via the existing footway and steps by the north-west abutment. There are the remains of a station underpass here which may be suitable for refurbishment and reuse. For car parking, there is good level access via Baxter Road (on the east side of the line) and an adjacent greenfield plot for a possible car park. To the west of the site, the former sidings area would be suitable for a larger station building and car park. Access to this area would be simplest along the existing approach.

Alternatively, south of the A61 underbridge there is a large, unused industrial site to the east of the line. Level access may be more difficult to this alternative site as the railway is elevated above ground level on an embankment. The rail gradient through the proposed sites is 1:132 so derogation from standard may be required.

### 6.1.3 Enhancement 2

#### Stocksbridge

The site identified, west of Hunshelf Road tunnel, would provide a level access, single platform station. However, the site is relatively small and operationally it would be preferred to avoid conflict with the steelworks internal traffic. The rail gradient through this site is thought to be around 1:90. An alternative site to the east, on the current Riverside Sidings site is recommended. This is large enough for a run-round loop should one be required and has level access from the current Outu Kumpu site to the north. Note that in current plans for its development, a flood defence wall is proposed along the boundary. This shouldn't prevent use of the site for a station, especially if a moveable barrier could be installed; this would be worthy of further investigation. The rail gradient through this site is thought to be around 1:160, so derogation from standard may be required.

## 6.2 Alternative end points

#### Nunnery

The site opposite the Nunnery Supertram Park & Ride would be suitable for a compact, single-platform station. However, foot access is limited and could be made via a new footbridge over the Worksop lines to the Park & Ride. Alternative foot access could be made east to Woodbourne Road though this is less convenient. The rail gradient through this site is 1:165, so derogation from standard may be required.

## 6.3 Accessibility

All of the station sites discussed above appear to allow the construction of a level (gradient flatter than 1:20) pedestrian access from the nearest roadway. By siting platforms on the appropriate side of the line, pedestrian access bridges can be avoided. A possible exception to this is at Nunnery, where the Worksop lines separate the Stocksbridge Line from pedestrian access to the Nunnery Park and Ride. The rail gradients of up to 1:120 should not be a concern to station access. Initial measurements taken from the OS MasterMap data suggest that the various station sites will accommodate platforms of sufficient width as given in Railway Group Standards[5] and DfT guidelines[6].

[5] *Section 7, GIRT7016 Iss 3, Interface between Station Platforms, Track and Trains, RSSB, 2009*
[6] *Section 8, Inclusive Mobility, DfT, 2005*

# 7 Permanent Way

Detailed technical notes from the line inspections describing the track condition can be found within the appendices.

## 7.1 Base Case: Deepcar to Victoria shuttle

The permanent way currently installed appears to be well built and well maintained. From our line inspection, the line does not appear to require a great deal of work to return the line to passenger operation. For 60mph operation, a survey and design check of the alignment would be required, possibly leading to realignment work (i.e. tamp and line). Realignment through the proposed station sites would be advisable in any case to give the optimum platform edge alignment. Several of the curves appear under canted at the present, evidenced by flange wear on the inner (lower) rail: rail grinding may be required to restore the rail profile. A rail-stressing survey should be carried out; this may lead to rail stressing works being required. A possible lock-in siding could be constructed within the Exchange Sidings at Deepcar, subject to Corus approval; this should be technically straight forward. Alternatively, use could be made of a currently unused loop there.

Fencing along the line is in poor condition and habitual trespass is a problem that would need addressing. It is understood that informal foot crossings just north of Oughtibridge, and also around 1km south, are currently being claimed as rights of way.

## 7.2 Enhancement 1: Deepcar to Victoria with intermediate stops

This enhancement would involve installing a passing loop at Oughtibridge. This would require signalling improvements to the line including axle counters on the southern section (at Oughtibridge and Woodburn Junction) and associated signals to protect the train movements at the loop.

## 7.3 Enhancement 2: Stocksbridge to Victoria

It is expected that this length would require more work owing to its poorer present state of repair. For costing purposes, a full line renewal with associated drainage and ballast improvements should be expected. These could be carried out with serviceable second hand materials, possibly including recovered material where the rail or concrete sleepers are in good condition. Possession timing and work site planning would have to be arranged to avoid disruption to the steel traffic. Additionally, line simplification at Exchange Sidings and Riverside Sidings should be carried out to reduce signalling complexity. If freight exchange doesn't take place within the steelworks, new loops with protecting trap points should be installed at Ellen Cliff, signalled from Woodburn Junction. Finally, the level crossings at Ellen Cliff and Henholmes would need to be upgraded or closed.

# 8 Costs

## 8.1 Option Costs: Base Case

An estimated cost has been produced from an initial estimated bill of quantities for the base case, see Table 10. A more detailed build up can be found in the appendices.

**Table 10: Estimated Cost, Infrastructure Works, Base Case**

| Item | Cost (£) |
|---|---|
| 1.0 Site Clearance | 10,000 |
| 2.0 Fencing | 15,000 |
| 3.0 Drainage and ductwork | 31,460 |
| 4.0 Railway Earthworks | 35,750 |
| 5.0 Platform Construction | 330,000 |
| 6.0 Permanent Way | 764,000 |
| 7.0 Electrification | 0 |
| 8.0 Structures | 0 |
| 9.0 Highway Works | 273,750 |
| 10.0 Signalling Works | 18,500 |
| 11.0 Communications | 0 |
| 12.0 Services | 200,000 |
| **13.0 Net Construction Costs** | **1,678,460** |
| 14.0 Administration Costs | 576,717 |
| 15.0 Ancillary Items | 33,569 |
| 16.0 Possessions | 25,000 |
| **17.0 Total Construction Costs** | **2,313,746** |
| 18.0 Network Rail Costs | 254,512 |
| 19.0 Risk Allowance (50th Percentile Range) | 0 |
| **20.0 Total Cost including risk** | **2,568,259** |
| 21.0 HM Treasury "Green Book" optimism bias factor | 1,695,051 |
| 22.0 Escalation costs | 69,343 |
| **23.0 Estimated Total Cost** | **4,332,652** |

The estimate assumes a single-platform station at Deepcar with a car park for 100 cars with a notional 100m access road, and a single platform station at Victoria. The platforms were costed at 60m in length each, assuming a two-car DMU operation. Allowance was made for 10 possessions of less than 30 hours and 10 tamping shifts. Costs are included for 800m of plain line renewal; this is to cover 200m of realignment at Deepcar and Victoria, and a contingency of 400m renewal at other sites along the line. Site clearance, trackside drainage and fencing were costed at the station sites only. It is likely that additional fencing would be required along the rest of the line; Network Rail may wish to recoup costs for this. There is a notional allowance for a small signalling alteration and a lump sum for utility diversion.

Project management and other ancillary costs are added pro rata, and HM Treasury optimism bias likewise at 66% to reflect the early stage of the project (high risk). Escalation costs were added pro rata based on estimated construction cost increases to a notional construction period in summer 2011. The total estimated capital cost, at 2nd quarter 2010 prices is £4.3m.

As this is a high-level estimate, there may be scope for cost reduction as the project progresses if it is found the estimate of quantities is overly conservative and as the optimism bias factor is reduced. Further costs savings may be achieved by professional volunteer design, construction and staffing; these options have not been investigated.

## 8.2 Operating Costs

Using the method applied in the 2006 report, the operating costs have been revised to reflect the current operating options. The estimated cost of the 2tph Deepcar to Victoria and Stocksbridge to Victoria services are given in Table 11.

**Table 11: Summary of Train Operating Costs (£'000)**

| Cost Element (per annum) | **2tph Deepcar-Victoria** | **2tph Stocksbridge-Victoria** |
|---|---|---|
| Rolling stock lease charges | 259 | 388 |
| Staff costs | 225 | 600 |
| Fuel | 138 | 116 |
| Maintenance | 243 | 205 |
| Variable station access charge | 152 | 284 |
| Variable track access charge | 30 | 26 |
| Track access charges | 433 | 615 |
| Additional station operating costs | 328 | 328 |
| **Total Operating Costs** | 1.808 | 2.562 |

Using selected data sources as outlined in Rail Industry Monitor 2008 (latest version), operating costs have risen approximately 4% per annum since 2006. Hence the rates given in the 2006 report have been increased by 17% to reflect 2010 prices.

These costs are based on national network TOC rates and are based on leasing a class 14x 'Pacer' unit. Savings could be achieved through heritage DMU operation, self-ownership and maintenance, volunteer staffing *et cetera*. The cost of steam operation and of diesel locomotive hauled operation has not been calculated. The track access charges are based on national network rates; there may be scope for negotiating with Network Rail a reduction in these rates given the current line usage.

## 8.3 Possible funding sources

Several mechanisms for funding were identified in the 2006 Arup report; the feasibility of these opportunities to procure funding support has been reconsidered.

- Section 106 agreements – these are unlikely to provide any more than a nominal contribution, though having commercial developers 'on-side' is likely to be of great benefit where sites adjacent to the proposed stations are being redeveloped;
- Local Transport Plan funding – there remains very limited scope for LTP funding;
- Investment from the Rolling Highway proposal – now highly unlikely to provide any funding;
- Department for Transport – in the light of funding cuts, the likelihood of receiving money for this enhancement is thought to be low;
- Northern Rail – as the franchise is carefully prescribed by the DfT, funding availability for this project is thought to be low.
- It is thought that if a heritage option was introduced, alternative funding mechanisms could be explored, such as lottery grants, contributions from the Yorkshire Tourist Board and Yorkshire Forward. It is recommended that these sources are investigated in more detail.

# 9 Conclusions and Recommendations

## 9.1 Conclusions

1. This engineering feasibility study has shown that reopening the Stocksbridge to Sheffield route to passenger rail traffic is feasible in engineering terms.
2. The Network Rail owned section from Deepcar to Victoria appears to be in good condition and suitable for the introduction of a DMU shuttle.
3. The station sites at Deepcar and Victoria appear suitable for the modest station layouts described.
4. The capital cost for infrastructure is estimated at £4.3m; the annual running costs are estimated at £1.8m.

## 9.2 Recommendations for further study

It is recommended that, if the project is to be progressed, further study is conducted into the following areas in particular:

- operational arrangements,
- type and cost of rolling stock,
- station layout arrangements,
- track gauge and weight restrictions,
- sources of funding and produce an initial business case.

In addition, it is recommended that the 2006 report figures be updated and revised to include the effects of the changes to the public transport links that have occurred since it was issued.

## 9.3 Costs involved in continued study

It is estimated that the costs involved in progressing the project to address the points above may lie in the region £50,000 to £100,000.