**West Lothian Council**

# Airdrie - Bathgate Railway Route Re-opening

## Initial Technical Feasibility Report

BTR0009523 June 2004

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# 1 Introduction

## 1.1. Background to the Study

One of the major projects identified in the Central Scotland Transport Corridor Study (CSTCS) commissioned by the Scottish Executive and published in 2002 was the re-opening of the Airdrie Bathgate railway. This railway is intended to provide a service of four trains per hour between Glasgow and Edinburgh, via Airdrie and Bathgate, greatly improving links between the two cities and reducing road congestion on the M8. The communities of West Lothian and North Lanarkshire will benefit through improved opportunities and accessibility to employment in the Glasgow and Edinburgh economic areas.

Babtie Group was commissioned to carry out the Study in October 2003 and delivered the Final Report in June 2004. To achieve this Babtie Group managed the input from all necessary engineering disciplines including those from our two study partners, AEA Technology Rail Ltd with Parsons Brinkerhoff and Ironside Farrar.

West Lothian Council promoted the Study and a Steering Group was set up to monitor the project and advise on its direction. The Steering Group members included West Lothian Council; North Lanarkshire Council; Strathclyde Passenger Transport; and the Scottish Executive. The Consultant Team reported to the Steering Group at 4-weekly intervals.

## 1.2. History of the Railway Route

The Glasgow to Airdrie route was first opened between Glasgow (College) and Sunnyside Junction in 1871. The Monklands Railway Company's "New Line" from Airdrie to Bathgate opened in 1862 and the Bathgate to Edinburgh Line opened in 1849, which together completed a through route from Glasgow to Edinburgh Waverley.

The fast trains on the route ran limited stop from Glasgow to Airdrie and stopped only at Bathgate and Haymarket. The fastest time between the two cities was from Queen Street Low Level (originating at Clydebank East), which reached Airdrie in 25 minutes and then took 59 minutes to Edinburgh Waverley, giving an overall time of 1 hour 24 minutes.

The route was not intended as an "inter-city" line, as it was built piecemeal by the different railway companies and it was not double tracked until 1904. Timetabled passenger services took considerably longer than the Edinburgh Glasgow railway route via Falkirk, partly because of the steep gradients and sharp curves on the route. The lines relied on mainly coal freight to sustain its existence and as the coalfields were worked out and the mines closed, so the line became a likely candidate for closure. As competition from bus transport increased passenger services were withdrawn in 1956.

However, as suburban commuter demand began to grow after the Second World War, electrification and re-signalling work was completed in the early 1960’s on the double track Airdrie - Glasgow Line.

In 1979 the Airdrie to Bathgate Line was reduced to single track and in 1982 the line from Clarkston (near Drumgelloch) to Bathgate closed to all traffic. The tracks were lifted shortly thereafter and from the mid-1980’s a surfaced cycletrack was constructed on the solum between Drumgelloch and Bathgate. In 1989, the Airdrie - Drumgelloch single-track section was re-opened and Drumgelloch Station was sited a short distance west of the former Clarkston Station. In 1986, Bathgate regained its current half-hourly passenger service to and from Edinburgh.

## 1.3. Format of the Study Report

The study into the reopening of a railway route requires a very wide range of engineering disciplines. These disciplines can be highly specialised and are perhaps not readily

accessible to those not working closely within railway engineering or within each particular discipline.

For this reason the Report is presented in the format below:

- Executive Summary
- Study Report
- Engineering Discipline Findings presented in separate appendices.

We believe that this arrangement will enable the major issues to be quickly imparted to all readers, whilst enabling specialist discipline engineers from the rail industry to examine the relevant engineering discipline appendix for detailed background information and drawings.

## 2. The Study Brief

A comprehensive brief for the Study was prepared by the Steering Group to direct the Study Team and to ensure that the key points for the re-opening of the railway line were addressed.

The Brief made clear that the Study must investigate the engineering requirements and cost for the reopening of the Airdrie to Bathgate route to allow a fast service with a 15-minute frequency between Edinburgh and Glasgow, serving and linking the adjacent communities within West Lothian and North Lanarkshire. Existing local services are to be retained and possibly enhanced to provide attractive public transport link options to various development opportunities within the east of Glasgow, Livingston, and Edinburgh Park, amongst others.

The technical, operational and cost implications of providing stations at communities along the route were to be examined. The proposal to reopen the railway in effect means connecting two railway systems and how they will operate in terms of signalling and Overhead Line Equipment (OLE) provision is crucial. The mining history of the area suggests that mineral stabilisation work needed to be considered, along with bridge clearances and load capacity. The condition of the existing earthworks and drainage systems also needed assessment.

The detailed Study Brief as issued by West Lothian Council is provided in the Annexe to the Report for information.

# 3. Train Operations

## 3.1. Basis of the Train Operation Study

### 3.1.1. Interface with other Studies

The Airdrie Bathgate project is one of several currently under consideration in Scotland. Of greatest relevance is the Edinburgh Airport Rail Link (EARL) Project, designed to provide Edinburgh Airport with a heavy rail link. The proposed junction to the airport is taken off the Edinburgh & Glasgow (E&G) Line section between Newbridge and Haymarket West Junctions. The EARL Proposals are currently being developed but if progressed they will have a major impact on train services at the east end of the study area. If EARL should proceed before the Airdrie Bathgate project it would ease the well-known capacity constraints at and east of Newbridge Junction into Haymarket Station by reducing the E&G service at Newbridge Junction from 4tph each way to 2tph each way. Clearly, there is a need to coordinate effectively between the two studies, particularly as Airdrie Bathgate services are programmed to commence 2 ½ years before EARL would come into operation. For this reason the Airdrie Bathgate train operations study considers the work required with and without the benefit of the EARL proposals.

### 3.1.2. Diesel or Electric Rolling Stock

The Study was to assess the feasibility of running Diesel Multiple Units (DMU) on the route. DMU services between Drumgelloch and Helensburgh/Balloch would limit the use of the electrified line beyond Bellgrove Junction to the additional peak hour electric services to/from Airdrie. The services terminating from the west at Bellgrove, which currently run empty to Shettleston to reverse would also be affected. Similarly electric trains beyond Dalmuir would be confined to peak hour services to and from Helensburgh and Balloch. Diesel operation of the Helensburgh and Balloch services would have implications for the entire SPT rolling stock fleet. This would include train crew matters and this would need to be resolved as all SPT electric services are driver-only operated, which is currently not the case with DMU services.

Environmental concerns relating to diesel operations particularly through tunnels such as at Queen Street Low Level Station would also be an issue requiring attention. Although this might be resolved by the installation of a suitable fan system to evacuate diesel fumes from the tunnels and station, the public would not welcome the perceived reduction in air quality. In addition, depot facilities for diesel units in the west would need to be provided for the DMU trains and there is the risk that because of the longer vehicle lengths of DMU stock platforms in the west would need to be extended to suit.

Consultations with SPT indicate that DMU operations in the west would be seen as a retrograde step. Therefore, although the study considered DMU's to confirm their sectional running times, only Electric Multiple Units (EMU) are considered for the subsequent stages of the train operations work.

Although the route infrastructure is cleared for Freight Traffic and an appropriate freight train was modelled for sectional running times, no significant freight traffic is planned for the route.

### 3.1.3. Infrastructure and Modelling

A railway engineering and cost study is only relevant if the developed infrastructure can support a train service that is workable within the network constraints of other services and infrastructure adjacent to and outwith the study area. For this reason the completion of the train operations study was essential before proceeding with infrastructure engineering design. Factors such as running time and infrastructure constraints on linespeeds were identified and addressed to give confidence that the required operating conditions can be achieved.

From inspection of the former alignment gradient profile, which rises steeply to a height of about 180m just east of Caldercruix, the selection of rolling stock is important in order to achieve adequate acceleration on up-gradients. Existing alignment constraints such as tight radius bends have an influence on achievable speeds. The locations of possible station stops are also influenced by gradients.

The train operations study examined how selected rolling stock might operate on a track infrastructure model developed from the initial outline design for proposed permanent way and signal engineering, and connecting into the existing infrastructure at each end of the re-opened line. This work extended to Helensburgh and Balloch in the west and Waverley Station in the East.

The operations study work was in three distinct steps involving specialised software as described below:

- TRATIM - Sectional Running Times over Route
- PTG - Timetable generation
- VISION® - Detailed operations model

From this work the selected EMU and DMU trains were modelled and assessed under several different operating scenarios to enable an in-depth understanding of the route to be built up. This information is used as design input to all the disciplines but particularly permanent way, signalling, OLE and Power. The latter discipline makes use of the output from VISION, which is fed into another specialist piece of software called OSLO. This software produced a detailed Power Demand Profile for the selected rolling stock and infrastructure model.

3.2. **TRATIM Report**

The first stage of TRATIM generated Sectional Running Times for different traction and train types over the proposed route. These are included in Appendix A in the report *'TRATIM Study Report for Airdrie Bathgate Route' reference LD79538-RP-2.*

The desirable linespeed of 100mph over the reopened line was modelled but it was found that this aspiration was not viable or practicable because of route gradients and infrastructure constraints, such as tight radius bends. Discussions on speed constraints around curves and resulting land-take issues led to the acceptance of a design linespeed of 80mph as an operating model standard for the re-opened line.

When the performance of EMU (electric multiple units) and DMU (diesel multiple units) rolling stock were compared for the route, the Class 320 & 334 EMUs exhibited almost equivalent performance to the high-powered diesel Class 220 DMU [Voyager]. However, the EMU's were significantly faster than the diesel Class 170 DMU currently operating in the region.

3.3. **PTG Report**

The second stage of the Train Operations Study used the sectional running times for the Class 320 EMU to create services over the new line. The results of this work can be found in the report '*PTG Study Report for Airdrie Bathgate Route' reference LD79538-RP-7' included in Appendix A.*

These services had to be formed by extending the existing Helensburgh Central/Balloch to Airdrie/Drumgelloch services through to Edinburgh Waverley, as significant changes would be required to the infrastructure if entirely new services were to be provided in addition to the existing services. The current Bathgate shuttle needs to be removed, although this service can be incorporated into the extended services from Airdrie.

A baseline scenario for services over the new route was produced before undertaking sensitivity analyses on several options in order to investigate and verify the optimum model. It was found that the rail infrastructure at Newbridge Junction must be upgraded from a single-lead junction to a double-lead junction. As the 4tph Airdrie Bathgate services have to interface with the 4tph E&G services, service robustness in this section was identified as an area of concern due to known achievable headways. Subsequent work by the permanent way engineers indicated an achievable linespeed through the double-lead junction was 55mph.

From the train operations modelling it was found that a baseline service of 15-minute frequency was possible on the route. New intermediate stops between Drumgelloch and Bathgate were also modelled and it was found that a 30-minute frequency of service was achievable for any two of the possible intermediate stops, with an increase in journey time of 3 to 3 ½ minutes between Airdrie and Edinburgh Park if the Edinburgh Airport Rail Link removes existing timetabling constraints at Newbridge Junction. If the existing timetabling constraints remain then there would be no journey time penalty for up to 2 intermediate stops when train services were operating normally.

3.4. **The VISION Report**

The final stage of the Train Operations Study used VISION® to successfully model the operation of the timetable at detailed signalling level. The results can be found in the report '*VISION® Modelling Report for Airdrie Bathgate Route' reference LD79538-RP-11*", included in Appendix A.

Some minor adjustments to the timetable were required and some train delays recorded. Most of the delays were not due to the Airdrie-Bathgate services and those of more than 30 seconds appeared to be due to inadequate running times or arose outside the immediate re-signalled area (e.g. around Edinburgh Waverley). The previously mentioned headway concerns between Newbridge and Haymarket translated into some bunching of eastbound trains around Edinburgh Park but the delays arising did not exceed 30 seconds, as the timetable contained appropriate pathing allowances. As there are only 10 trains per hour in each direction at Edinburgh Park with only four not booked to stop, the delays did not propagate through the ensuing timetable.

3.5. **Implications for Rail Infrastructure**

It was confirmed that a twin track railway is essential over the route to deliver the required 4tph train service. The operations study did not identify any need for passing loops on the double-track line, on the assumption that trains would operate at the same speed over the route and that there was no requirement for freight paths.

The approximate running distance of the route is given in the following table:

| | Livingston North – Glasgow Queen St (29 miles 946 yards) | Airdrie – Edinburgh Park (27 miles 1672 yards) | Glasgow Queen St – Edinburgh Waverley (44 miles 596 yards) |
|---|---|---|---|
| Stopping at existing stations only (with Edinburgh Airport Rail Link) | 44½ minutes | 27 minutes | 62½ minutes |
| Stopping at 1 new station | 46 minutes | 28 minutes | 63½ minutes |
| Stopping at 2 new stations | 48 minutes | 30 minutes | 65 minutes |
| Stopping at 4 new stations | 49½ minutes | 32 minutes | 67½ minutes |
| Stopping at existing stations only (without Edinburgh Airport Rail Link) | 47 minutes | 29 minutes | 69 minutes |

The train operations study concluded that 100mph running on a theoretical straight track did not greatly benefit overall journey times. However, the design implications and cost of

achieving this linespeed by realigning curves were examined and are presented in Section 5.1.

To achieve the design linespeed of 80mph over the re-opened section only two curves, one each side of Armadale, needed improvement with increased radii and resulting land-take on the inside of the curves. Signalling design was also developed on this basis.

The train operations study showed that Newbridge Junction would need to be upgraded to a double lead junction layout. An at-grade 50mph double junction has been shown to deliver the necessary train service throughout, although some concerns on service robustness remain to be fully researched. Infrastructure improvements east of Newbridge include major signalling alterations and a cost for this work has been included in the base case. Further work still requires to be done on this issue and it should be noted that much of this work might be under the remit of the EARL project.

Further detailed technical information including TRATIM, PTG, VISION and OSLO are included in Appendix A.

## 1.0 Infrastructure Engineering

The existing infrastructure at the west end of the scheme is a twin-track railway from Glasgow Queen Street Low level to the west of Airdrie station where the railway becomes single track and continues on to the buffer stop at Drumgelloch Station. However, there is a bay platform and siding accommodation at Airdrie. The normal service pattern comprises two trains per hour to/from Drumgelloch and two trains per hour to/from Airdrie only. There are additional limited stop services at peak periods between Airdrie and Glasgow.

At the east side of the scheme, a twin track railway leaves Haymarket West junction heading for Falkirk. At Newbridge Junction a single lead connection provides access to the twin track railway to Bathgate. At Cawburn Junction the railway becomes single track and at Carmondean Junction the single track becomes two single tracks, a bi-directional freight line leading to Bathgate yard and a bi-directional passenger line leading to Bathgate station where all services terminate.

The railway between Airdrie and Bathgate is to be considered as a twin track line with an 80mph design linespeed. In addition, the single line section between Carmondean and Cawburn junctions would be upgraded to twin track. Crossovers would be provided in the vicinity of the 16 and 21 mileposts to facilitate emergency or reduced capacity working. Crossovers would also be installed at Bathgate to enable services to turnback there if necessary.

## 1.1 Civil Engineering

### 1.1.1 Topographical Survey

Topographical land surveys of the site targeted the former route corridor between Drumgelloch and Bathgate, extended where required to record property boundaries, structures and roads. Information on private land was extracted from Ordnance Survey Digital mapping for both validation and boundary proving. A control network of permanent reference markers was established with reference to Ordnance Survey Grid and Level datum's.

The survey was extended on to the operational railway at Drumgelloch and Bathgate during night-time possessions for a sufficient distance to calibrate the electronic survey data to be made available by Network Rail and currently held on their FLIMAP system. This information was produced by helicopter flyover and it is sufficiently accurate for use in feasibility work when assessing design layouts on the operational network. FLIMAP data was obtained for the area local to Newbridge Junction for use in the outline design of junction improvements. Network Rail will make further data available for the detailed design stages of the Study.

### 1.1.2 Permanent Way Design

The reopened section of track between Drumgelloch and Bathgate has been designed to Network Rail Group and Company Standards on the former route alignment to enable a design linespeed of 80mph at a maximum cant of 150mm on improved curves. From its planned use by the specified passenger service and the RA10 load capacity the railway route is classified Category 2. However, given that no significant freight traffic is planned it might be possible to reduce the RA10 loading and lower the route classification to Category 3. This should be considered in the next stage of work.

The materials design includes continuous welded rail (CEN 60) on precast concrete sleepers on minimum 200 mm ballast and drainage blanket feeding into cess drains on each side. The switch and crossings are to be RT60 standard.

Only two curves, one each side of Armadale need remodelling to achieve the 80mph linespeed, to the extent where an additional 10m to 15m wide strip of land is required on the inside of the curves. For the base case, the former alignment curve into the relocated Bathgate Station is retained at a 55mph linespeed.

The horizontal alignment has been designed so that the double track six-foot centre line passes along the centre line or mid-span of existing underbridges and overbridges. The vertical alignment generally follows the former alignment but has been improved for smooth running and to allow the overhead power lines to pass under the over-bridges.

The design of the tie-in locations at Airdrie/Drumgelloch and at Bathgate used Ordnance Survey plan data for the horizontal alignment assessment, which is considered sufficiently accurate at this stage. For the detailed design stage, further design work will be required using the now available topographic survey data over approximately 500m of the tie-ins. This is also considered sufficient to calibrate the FLIMAP survey records to be made available by Network Rail for the entire route, making it possible to assess the horizontal and vertical geometry of the operational track without on-site survey.

The typical Double Track Cross Section for the railway cuttings and embankments assumes side slopes of 1 in 2 from the cess walkway proposed on each side, with crossings at bridges where required. At some locations using this slope, the cut/fill line, where it meets the existing ground level, lies outside the former lineside boundary. This means that either additional land purchase is required, or that retention structures or strengthening works are needed to contain the earthworks within the lineside boundary. The effect of this is shown on the drawings included in Appendix L.

The redoubling section from Carmondean Junction to Cawburn Junction can be treated as track renewal work and we note Network Rail' s renewal programme (see Appendix B) for the line during year 2006/07. Their further advice is that over a period of several years the Bathgate line has been mostly realigned to 90mph geometry. The outline design retains a crossover at both of the junction locations in the interest of operational flexibility. Similarly, two emergency crossovers are provided at suitable locations in the re-opened line section and at the new Bathgate Station. Accommodation works at Bathgate include a replacement siding and signals for the existing STVA car storage yard, in the event that they do not wish to relocate.

The train operations work indicates that passing loops are not required on the route. It also confirms that the single lead junction at Newbridge Junction has insufficient capacity for 4tph in each direction and that the junction needs to be improved to an at-grade double junction. An outline design for this junction has been produced with a linespeed of 50mph achieved while maintaining the track parallel to the parapets of the existing underbridge over the M9 Motorway and avoiding the existing Newbridge Relay Room Should it be found acceptable during the detailed design stage to locate the tracks at an angle to the parapets then from inspection it should be possible to increase the design speed of the junction to nearer 60mph with the requirement to relocate the Newbridge Relay Room. This relocation has been accounted for in the signalling proposals.

It is important to note that Network Rail intend to renew the junction and several sections of the Bathgate Line in year 2007 as part of their continuing S&C Renewals Programme. The proposed junction re-alignment does require the relocation of a signal relay room and this is considered as part of this project.

Further detailed technical information including Horizontal and Vertical design is included in Appendix B.

1.1.3 **Lineside Fencing**

The existing fencing along the re-opened railway route is generally in poor condition and the proposals assume that complete renewal is required. It is assumed that the fencing over the operational railway length has been effectively maintained and does not require renewal or remedial work under this project.

The new fencing would be to Network Rail standards for lineside security. The fence line is generally set back 1.5m back from the proposed toe/crest of embankments/cuttings as indicated on the Land Boundary plans in Appendix L.

The environmental mitigation considers noise attenuation, which if required, should be set outside the lineside fence to simplify future maintenance.

1.1.4 **Railway Drainage**

The drainage scheme extends over the approximate route length of 23km and can be considered in two parts as shown overleaf;

a) Longitudinal drainage for cess and cut-off drains, and
b) Crossing culverts and Outfalls.

The drainage and culverts were designed in accordance with Network Rail's, *Company Standard RT/CE/C/006 (October 2002) 'Design, Installation, and Maintenance of Lineside Drainage'.* Drawings and drainage calculations are provided in Appendix C and aspects of each system are described below.

a) Longitudinal drainage

The drainage calculations are based on a 1 in 5-year storm return period and they provide information on manholes, pipe details and flows. Pipe diameters and locations within each Cess are indicated and where diameters are greater than 450mm a two-pipe carrier system is proposed. Cess drains are not considered necessary on embankments and manholes are proposed at 30m intervals with a silt trap in each location.

Cut-off drains are considered necessary for cuttings more than 2m deep where surrounding land drains to the cutting and it is assumed that 90m of land measured perpendicular to the railway would drain to every cut-off drain. The cut-off drains are designed to be a minimum 100mm diameter with a minimum cover of 500mm.

b) Crossing culverts

The location of the existing culverts was determined by reference to the Ordnance Survey plans and the topographic survey, confirmed by a walkover inspection. Each existing culvert was checked for capacity for a 1 in 20-year storm flow. A greater return period is not required because the land upstream of the culverts is generally unimproved grassland and should not suffer from the very infrequent flooding. Railway operations would generally be unaffected since flooding would surcharge the culverts and greatly increase flow capacity.

However, where culverts were found to have insufficient capacity at a 1 in 20-year flood or where an existing culvert could not be positively identified, a new culvert is included in the design with a return period of 200 years.

Some railway environments with drainage outfalls to sensitive watercourses might benefit from the use of oil interceptors, although water runoff is filtered through the ballast and drain surrounds. Where diesel trains and locomotives are not a consideration as on this route interceptors are not required.

As existing culverts have been retained the existing flood frequency and watercourse regime would be retained, thus avoiding disruption to flora and fauna.

Further detailed technical information regarding Railway Drainage is included in Appendix C.

1.1.5 **Bridges and Retaining Walls**

The condition of the existing structures along the section of operational and disused track between Airdrie and Cawburn Junction has been ascertained from previous inspection and assessment reports where available. The study included underbridges, overbridges, culverts and retaining walls along the route.

The overbridges have been checked for vertical and horizontal clearances for the new electrified double track. In accordance with RT/CE/S/049, a minimum vertical clearance of 4.64m for an existing bridge and 4.78m for a reconstructed or new bridge is required. This is in conjunction with a minimum horizontal clearance of 8.088m for an electrified double track line excluding additional provision for cess walkways. Any bridges found to be unable to accommodate the minimum clearances have been identified and deck or bridge replacement has been recommended.

The underbridges are to be capable of carrying RA10 loading and HTA. The capacity of the bridges has been determined quantitatively from existing Assessment Reports. Any bridges believed to be inadequate to carry this loading have been identified and remedial/replacement works recommended. The parapet requirements for the overbridges have also been reviewed and recommendations made on the requirements for each. It is recognised that the height requirements for bridge parapets on electrified lines are greater than for diesel operations

The study has identified sixty-three existing bridges, twenty-seven existing culverts and ten existing retaining walls along the length of the proposed rail line. In addition to these structures, three new road overbridges, five new culverts and thirteen new footbridges have been proposed.

The condition of the existing bridges varies along the route and, from the information available; forty-six existing bridges have been highlighted for complete replacement. Measures have been suggested in Appendix D to potentially reduce the number and scale of bridge replacements identified.

Along the route between Drumgelloch and Bathgate there are eleven retaining walls. These have been indicated on the location plans included in Appendix D. The retaining walls have been identified from examination of the available topographic survey information and from site inspection. Twelve new retaining walls have also been identified along the route between Drumgelloch and Bathgate. The new alignment would encroach on the water's edge at the southwest corner of Hillend Reservoir. At this location a new embankment and shore protection works would be required. Typical details of the type of structures envisaged are shown on Drawing Numbers BTR0009523/EWK/800 and BTR0009523/EWK/801.

Accessing the operational sections of track to identify existing retaining walls was not possible during the course of the Study. It is therefore recommended that these structures are surveyed, inspected and assessed during the detailed design stages of the Project. Meanwhile, a cost risk allowance has been made for the likely works.

The existing culverts along the disused Drumgelloch to Bathgate section of the line have been identified and the remedial work required summarised for each. There are five new culverts identified along the reopened section. Existing retaining walls along the disused section have also been identified.

It is proposed that there would be ten new footbridges constructed to accommodate the realigned cycle path, two footbridges with segregated footpath / cyclepath to cross the railway line and the other eight footbridges would have combined footpath / cyclepath crossing watercourses. The segregated footbridges are located where the cycle path crosses the solum. These occur near Airdrie between bridges 240/058 and 240/057 and near Bathgate between bridges 240/034 and 240/034A. The combined footbridges are

spread over the length of route between Drumgelloch and Bathgate. It should be noted that the station footbridge at Blackridge would only be provided if the station itself was selected for construction.

To the east of Caldercruix, the Airdrie and District Angling Club use the Hillend Loch. They have an existing clubhouse on the east shore of the loch on the north side of the existing railway alignment. Access to this club is by an at-grade crossing, which would be blocked off when the railway is reopened. The land available for ramps and embankments restricts access to the existing club by bridge. The club has indicated that they might consider moving to a new site west of the existing club and to the east of East Moffat Bay. This new clubhouse site would require a new bridge access over the railway.

Several at-grade crossings across the alignment through Plains, which give access to the sewage works, farm properties and the golf course to the south of the village, would be cut off. A new road overbridge to the west end of Plains is proposed along with a new access road to serve the affected properties as well as a footbridge to access the country park from the village.

Further detailed technical information including review of existing structures and construction methodology are included in Appendix D.

### 1.1.6 Earthworks, Mineral and Geotechnical Surveys

#### 1.1.6.1 Geological Summary and Scope of Preliminary Ground Investigation

The following summary of the drift and solid geology beneath the proposed railway reopening has been compiled from public sources provided by the British Geological Survey in the form of geological plans, environmental geological maps and historical borehole records, as well as ground investigation undertaken by Fugro Engineering Services Ltd (FES) on behalf of Babtie Group (BG).

It should be noted at this stage that due to the age of the historical borehole records their content could not be confidently relied upon for this summary. The geological plans provide a wide range of geological information related to drift and solid lithology, and include type, thickness, structure, and extent.

A preliminary ground investigation was undertaken along the proposed route between March and June 2004. This comprised;

- 5 cable percussion boreholes to determine ground conditions where the proposed route deviates from the original, and for slope and embankment stability
- 22 rotary boreholes to investigate possible shallow mine workings
- 36 machine excavated trial pits to investigate the composition of the existing track bed and provide samples for contamination testing
- 5 hand excavated pits to determine the dimensions and depths of overbridge foundations with regard to lowering the trackbed.

The fieldwork to date is for this initial stage only and a subsequent stage is required following its completion. The initial work was carried out towards the latter stages of the Study and the laboratory testing and core logging is still underway. This summary has therefore been based on published information with GI data used as verification where possible.

#### 1.1.6.2 Drift Geology

Made Ground comprising primarily ballast with clinker, blaes, sand and gravel, and ash underlie the majority of the route. This overlies glacial till deposits, which are typically 5m to 10m thick, but are occasionally thicker, extending from a recorded minimum depth of 1m to a maximum of 18.8m. The glacial till constituents have been identified from the ground investigation results to include predominantly firm to very stiff sandy gravelly clay with cobbles and boulders.

River terrace alluvium likely to typically comprise laminated silts and clays with bands or lenses of sand and gravel are identified on the geological maps southwest of Bathgate and also west of Caldercruix; these generally follow existing watercourses. During the investigation works, glacial till deposits were encountered along the length of the route, however, some pockets of peat were recorded below the made ground underlying the disused railway track.

Elsewhere along the route, areas of peat are present in the area predominantly around Hillend Reservoir and south of Armadale. The peat to the west of Hillend Reservoir could not be investigated due to access limitations, but, the current cycle path lies beneath the level of the surrounding peat bog, and severe drainage problems are present. This area extends from the overbridge at Caldercruix to east of Hillend Sailing Club. Peat was also encountered to a depth of approximately 4.5m just to the east of Forrestfield, east of the reservoir. South of Armadale where the proposed track is to deviate from its original line to achieve the design linespeed, a peat bog is located. Dynamic probing has recorded peat to be present down to 5m depth overlying probable glacial till down to 6.5m recorded depth.

1.1.6.3 **Solid Geology**

The Carboniferous sedimentary deposits as summarised below, in order of increasing age, generally underlie the proposed route.

| Geological Group/Formation | Boundary Marker with Younger Group/Formation |
|---|---|
| Middle Coal Measure Formation | - |
| Lower Coal Measure Formation | Queenslie Marine Band |
| Passage Group | Boundary not clear |
| Upper Limestone Group | Castlecary Limestone |
| Limestone Group | Index Limestone |

The Middle and Lower Coal Measure Formations predominantly comprise sandstone, siltstone, mudstone, and numerous productive coal seams. The latter three geological groups, namely the Passage Group, Upper Limestone Group, and the Limestone Group, typically comprise mainly sandstone with thin siltstones, mudstones, and limestones with fewer productive coal seams.

Coal extraction was prevalent in the general area, particularly between Airdrie and Plains, and in and around Bathgate. A number of the coal seams were worked at varying depths, including seams within 30m of rockhead as indicated on the environmental geology plans.

The ground investigation recently undertaken has identified two areas that have been historically mined for coal. These areas are in Bathgate (North of the Foundry) and the stretch of route between Airdrie (Drumgelloch) and the western end of Plains. Further discussion about the mining situation along the route can be found in last section of this summary.

The Middle Coal Measures predominantly underlie the Airdrie area, while the Lower Coal Measures extend from west of Plains, to west of Teepit Hill near Bathgate. The Bathgate area however, comprises the Passage Group, the Upper Limestone Group, and the Limestone Group.

Volcanic intrusive activity has occurred to create minor intrusions of quartz dolerite in the form of dykes and sills, which are noted particularly around Hillend Reservoir. Evidence of active quarry extraction is prevalent to the south of the route at Hillend Reservoir and also at Blackridge.

A number of geological faults have been identified to cross the proposed railway generally in an east – west and northwest - southeast direction within the western sector of the site around Airdrie and also to the east around Bathgate. The recent history of movement along the line of these faults is presently unknown.

The bedrock outcrops occasionally within the site in and around Hillend Reservoir and also at Blackridge. The solid deposits comprise sandstones, siltstones and mudstones with numerous productive coal seams, and a number of quartz dolerite intrusions, especially in the vicinity of Hillend Reservoir. The outline design of the earthworks and mining stabilisation has been based primarily on assumed ground conditions as the preliminary Ground Investigation was not available until near the end of the study period. This process used published information and site inspection reports, which were verified by the preliminary GI information as it became available.

1.1.6.4 **Earthworks Discussion**

The Permanent Way alignment design typically results in excavation of up to 1.5m beneath the existing cycle path surface, which has been raised above original solum in many locations. However, excavation of up to 3m would be required locally partly because of realignment in the horizontal plane and partly because of necessary improvements in vertical alignment.

Where the proposed cycle path passes to the south of Armadale, locally extensive areas of peat bog are present. The peat within this area extends to a recorded depth of 5m and overlies soft clay deposits. Ground improvement measures would be required to provide suitable support to the proposed cycle path.

The alignment also requires widening of the original track solum for the modern twin track using continuous welded rail and a safe cess on one side, which results in either excavation into cutting slopes or filling to widen existing embankments. This means that in many instances the required width of earthworks using the generally accepted slope for new works of 1(vertical) in 2 (horizontal) slopes extends beyond the original lineside boundary fence.

It is recognised that altering an existing earthwork slope can lead to instability and create a higher risk of failure than currently exists. Therefore, two options have been considered:

- **Option 1: Re-graded Slopes**
  Create 1 in 2 slopes and purchase the additional land

- **Option 2: Existing Slopes**
  Retain existing steep slopes on the side opposite the new cycle path where present, to maintain the works within the former lineside boundary fence. (This is on the assumption that land must be purchased for the cyclepath in any event.)

Our earthwork calculations show that Option 1 results in approximately 250,000 m3 of cut and 80,000 m3 of fill. As this is a very substantial volume we have considered measures to reduce it. The simplest way to reduce cut and fill volumes is to increase or reduce the level of the cess walkway by 0.5m in cuttings and embankments respectively. However, even then, slope steepening measures would be required as for Option 2.

For Option 2 and in cuttings, retaining structures at the toe using gabion walls up to 1m high or sheet piles to retained heights of up to 3.5m could support the existing slopes. For embankments, high quality fill could be used to achieve 1 in 1.7 slopes, or gravity pre-cast or in-situ concrete walls could be installed at the toe.

From inspection of the cross sections developed from the Permanent Way outline design we can estimate the approximate chainage lengths for which retention measures might

be considered in addition to amending the cess walkway levels. These are shown in the table below.

| Retention Measure | Total Length (m) |
|---|---|
| Gabion wall up to 1m | 2070 |
| Sheet piling up to 3.5m | 1450 |
| Steepened embankment | 100 |
| Embankment precast wall | 750 |

The steepening measures could reduce the cut and fill volumes, however further reductions in the volume of cut could be achieved by raising the cess walkway by 0.5m and installing sheet piles in cuttings, even though a 1V:2H slope would fit within the land boundary.

Railway Asset Management is of increasing importance and the view of Network Rail is crucial in deciding on the course of action with regard to hard structures versus increased land purchase.

Both options require varying degrees of maintenance. Option 1: Re-graded Slopes is considered the lowest with maintenance only envisaged for existing structures including bridges; while Option 2:Existing Slopes would require greater maintenance to include concrete and sheet piled retaining walls. Maintenance however can be minimised for this option by modifying the design of sheet piles to cater for corrosion.

Further savings on the earthworks are likely to be possible during the detailed design stage when the horizontal and vertical alignments can be tuned to more accurately fit the lineside fence and the existing topography.

Contamination levels within the material to be excavated are likely to be relatively low, but could include hotspots of elevated hydrocarbons from its former railway use.

The sub-grade generally comprises predominantly firm and stiff clays, which will have a CBR value of less than 15%. Consequently, a formation layer estimated to be 300mm thick along the majority of the route would be required. Work to the existing rock cuttings at Hillend Loch and Blackridge, including widening by up to 3m, would require re-profiling 1V to 1H.

#### 1.1.6.5 Mineral and Geotechnical Surveys

An assessment of the mineral situation has been made from published mining abandonment plans, geological records and preliminary ground investigation results.

Seven sections of the route where coal has been mined at relatively shallow depths using different mining extraction methods have been identified from the published geological information.

The preliminary investigation has confirmed workings in two areas at the western and eastern ends of the route, namely east of Airdrie towards Clarkston, and within Bathgate. These are likely to include longwall and stoop and room methods based on published information. The latter method presents a greater risk of instability beneath the proposed railway track. Based on geological records and mining plans, the extent of the route that is at risk of instability within these areas has been assessed as a total of approximately 1500m. These areas should be stabilised by consolidation grouting techniques. The seams thought to have been worked between Airdrie and Clarkston are the Glasgow Upper, Glasgow ELL, Glasgow Main, and the Airdrie Virtuewell coal seams. Of particular concern are the workings in the Glasgow Upper and Airdrie Virtuewell coals. These seams are shown to subcrop beneath the disused railway from published information

sources. With the exception of the ELL and Main coal seams, the seams are located within separate faulted blocks beneath the route. Within the Bathgate area workings were only identified in one localised area north of the existing Railway Foundry, the working is thought to be within the Balbardie Gas coal.

The preliminary site investigation along the remainder of the proposed route did not encounter workings, but did encounter several coals within 30m of rockhead, a small number of which may be of economic significance. This appears to be inconsistent with published abandonment plans, although these are limited in detail. The risk of shallow workings being present beneath the proposed route in this area is considered to have been reduced as a result of the investigation, however their presence cannot be ruled out altogether at this stage. It is therefore considered that further ground investigation will be required to determine the extent of treatment required with a greater level of confidence.

There are two recorded shafts (whose condition is currently unknown) and an adit beneath the proposed rail route with a further six shafts potentially affecting the cycle path. No intrusive investigation has been carried out for these shafts/adit within the preliminary ground investigation. The location of the adit is approximately 40 – 50m south of the railway track with an azimuth of 298°. The adit has been assumed to have a dip of 10° to 14° suggesting this feature to be located either at or immediately below rockhead beneath the track, presenting a stability risk to the railway. These features would need to be investigated and treated by grouting as a minimum, although it may be possible to cap selected shafts where rockhead is within a few metres of the surface.

For the re-located cycle route, the majority of the proposed route is adjacent to the railway and where stabilisation works are proposed for the railway track, the width of required treatment would reduce the risk of collapse of the cycle path to some extent. Where the cycle path diverges from the proposed track above areas of potential mining instability, no consolidation works are proposed on the basis that the risk of ground instability would be similar to that at present.

Further detailed technical information including Ground Conditions, Earthworks, Contamination, Mining and Ground Risks are included in Appendix E.

1.1.7 **Public Utilities Assessment**

This section relates to existing utilities affected by the re-opening of the railway. The utilities may be underground close to or below the railway or they might be overhead supported on poles or pylons or be buried within a bridge crossing over the railway. For safety reasons adequate separation/protection measures must be put in place or alternatively the utility must be diverted clear of the proposed works.

The utilities include cables, pipes and overhead wires carrying telecoms information, water, sewerage, gas and electricity. Information on utilities were requested and received from utility companies including:

- Scottish Power
- Scottish Water
- Transco
- BT
- Cable & Wireless
- Telewest Broadband
- Thus
- Shell
- BP

Drawings indicating utilities that might be affected by the proposed works were received from Scottish Power, Scottish Water, Transco, BT, Shell, Telewest Broadband, Thus and Cable & Wireless. BP and other companies advised that they do not have plant that will be affected by the proposed route re-opening. Network Rail has confirmed that they are not aware of current service wayleave agreements affecting the works.

The information supplied was examined and services that either crossed the proposed railway corridor or came in close proximity were identified and transferred onto our electronic drawing database. Once the review was complete meetings were held with Scottish Power, Scottish Water and Transco to gain advice on major diversion and protection works. The companies were asked to provide a programme and cost implications for diversion/protection works. It should be noted that all companies have a disclaimer stating that the information given about apparatus is indicative only. Utilities are shown on Drawing No's 0009523/UTL/501 to 0009523/UTL/627 and they are included in Appendix F.

The request for information from the service providers included the need for service depth and invert levels in order to ascertain which services currently crossing under or above the track should be lowered and/ or protected during site works and once the railway is operating. The majority of the utility companies have stated that their records did not allow them to provide the accuracy of detail required with respect to height and level of their apparatus. This necessary detail will only become available through further intrusive investigation. An early enabling works package should ensure that intrusive investigations are undertaken, in conjunction with the Undertakers. This should allow a more robust picture to be determined and will be essential information for the Contractor before site works commencement.

A discussion on each of the major Utility Services is provided below.

*Scottish Power*

Scottish Power has a major domestic transformer station 700m east of Drumgelloch Station and just off the north lineside boundary fence. The outline p-way track design shows that the separation distance between the palisade fence of the Transformer Compound and the running rail is of 2.4m. This is believed to be greater than the minimum 2.0m specified at which point either the sub-station or the track would have to be moved to ensure an acceptable electrification clearance. There is also just sufficient

space to allow a safe walking route but this area will need careful examination during the detailed design stage.

Several overhead transmission lines cross the railway but they are at sufficient height for safety clearance. There are also several overhead power lines on timber poles which would have to be relocated because their support ties come within the railway boundary and some others that cross the railway with inadequate clearance for safety. The bridge replacement or re-decking works would affect some of Scottish Power's underground services, which cross the railway in overbridges and in roads below underbridges.

*Scottish Water*
Scottish Water has several large diameter sewerage services crossing and apparently running parallel to the line. Many of these were laid while the railway was in operation so it is reasonable to assume that they can continue to function with some additional protection measures.

Scottish Water also has water service pipes crossing the railway contained in the decks of overbridges and in the roads below railway underbridges. Some of these services would be affected by bridge replacement or re-decking works. There are also major water trunk mains of 27" diameter crossing under the line at approximate chainage 14760m. More as-built information might be forthcoming but it is clear that the railway line should be raised if necessary to clear this service pipe.

*Transco*
Transco have several gas service pipes crossing the railway. Low-pressure pipes with diameters up to 200mm typically cross the railway route using existing overbridges. The proposed bridge works would affect these.

There are also pipes of medium pressure and of high pressure with diameters up to 900mm crossing the railway. We have received a letter confirming that Transco have given the high-pressure mains a 'High Density' classification in accordance with *The Institution of Gas Engineers document IGE/TD/1 – Steel Pipelines for High Pressure Gas Transmission*. This means the three identified high-pressure mains would require to be re-laid local to the railway using thick walled pipe, as it is not considered that they have adequate protection as required in the current standard. It is estimated that this could cost in excess of £1m per crossing.

*Shell*
The 10" high-pressure trunk main (North Western Ethylene Pipeline) owned and operated by Shell crosses the track at chainage 14838m. It has been confirmed that the pipe was designed as a UTX but we have yet to receive the as-built drawings from Network Rail and Shell.

*British Telecom*
British Telecom has supplied their record drawings, which show they have both overhead and underground services that would be affected by the proposed railway. The underground services generally cross the railway using bridge decks and the proposed bridge works would affect these. The overhead services will have to be checked on site to confirm if they have sufficient safety clearance.

*Other Communication Companies*
Information has also been received from Telewest Broadband, Cable & Wireless and Thus. Only a limited number of these services might be affected by bridge replacement or re-decking works.

*Network Rail*
At time of report production Network Rail was undertaking a search for existing wayleave agreements and utility locations along the route.

### 1.1.8 Existing Station Locations

#### 1.1.8.1 Introduction

The Base Case, without intermediate stations, would require work at the following existing stations:

- Airdrie Station
- Drumgelloch station
- Bathgate Station Option 1, 2, and 3
- Livingston North Station
- Uphall Station.

A summary of works required at these sites is given in the table below.

| Station | Extent of Work |
|---|---|
| Airdrie | Track Doubling, reconstructed flank platform, DDA access and lifts |
| Drumgelloch | Track Doubling and Slew, platform demolition, reconstructed flank platforms, DDA access. |
| Bathgate Options | Complete station new-build and demolition of existing station. |
| Livingston North | Track Doubling and Slew, platform demolition, new & reconstructed flank platforms, and DDA access. |
| Uphall | Track Doubling, new flank platforms, DDA access. |

For all stations with new platforms and/or new facilities the works would be as discussed below and shown on the station layout drawings included in Appendix G.

The stations would have two 6-car length platforms, each 4m wide if possible. Passive allowance is made for future platform extensions to 9-car length (Platform lengths will also depend upon the type of rolling stock to be used). In general for new platforms an elevated construction on piled foundations is proposed, thus avoiding the need for high retaining walls. The platform would be constructed in galvanised steel with precast concrete infill beams and a bitmac surface. The void under the platform would be screened with removable galvanised mesh panels. This construction method allows for ease of maintenance and minimal disruption from future services installation underneath the platform. A 1.5m high galvanised fence would be provided to the rear of the platform in accordance with the Network Rail Group Standard.

A glazed waiting shelter for approximately 20 people would be provided on an extension rear to the rear of the platform construction. This would include a variety of seating types in accordance with the SRA Code of Practice. Lighting to the station is to be in accordance with the SRA Code of Practice providing 100lux at the edge of platforms, 100 lux at the station entrances and 40 lux at the station car park. The CIS and CCTV systems would be extended to serve the new or extended platforms.

Apart from Airdrie Station the passenger movement between the north and south platforms would be by a footbridge accessed by a stair and a ramp. Airdrie Station is the only staffed station under consideration and because of platform width constraints it would have a lift access. Discussion with both Scotrail and the SRA has confirmed that lifts at unstaffed stations are not acceptable on this line and therefore a ramp designed in accordance with the SRA Code of Practice is indicated. The proposed footbridge is galvanised steel-framed structure with steel plates with coloured bitmac finish. A double handrail would be required on both stairs and ramp with vertical bar infill panels below, while the footbridge would have solid barriers in accordance with Network Rail's Group Standard.

1.1.8.2 **Proposed Work at Existing Stations**

The existing stations considered in the study are Airdrie, Drumgelloch, Bathgate, Livingstone, and Uphall Stations. Other stations may benefit from renovation works and improvement as part of the introduction of the new service but this is not considered here. It should be noted that should diesel trains be selected for operations on the route existing platforms west of Airdrie might need to be lengthened.

*i) Airdrie Station*

Airdrie Station is a staffed station with a ticket office located on the island platform. The north platform face serves the single track through route to Drumgelloch while the south face serves the trains from Glasgow Queen Street terminating at Airdrie.

Access to the station is either from Broomknoll Street or the car park to the south. The access from Broomknoll Street is steeply ramped and not compliant with the current SRA Code of Practice. The ramped access from the car park is not fully compliant as it has no landings but it does provide reasonable accessibility for all passengers. The station car park has provision for approximately 150 vehicles and is usually full.

To reinstate twin tracks through Airdrie station requires the construction of a new platform to the north in the approximate location of the abandoned platform structure, which requires demolition prior to the construction of the new platform. The new platform is designed as a 4m wide platform for a 6-car train and it is noted that passive provision for 9-car trains would require extension to both the east and the west ends. It should be noted that the existing island platform cannot be extended to 9-car length without alteration to the S&C for the existing track terminating at Airdrie.

The new platform would be accessed from the existing island platform by a footbridge with both a stair and 16-person lift in accordance with the SRA Code of Practice. At the north end of the footbridge the lift and stair would continue down to street level (the A89 Road) to provide a new fully compliant station entrance. The proposed stair and lift structure on the existing island platform would reduce the platform width to 2.5m in this location.

A new lay-by is currently being provided on the main A89 road near to the new station entrance. This is proposed for drop off by both private vehicles and taxis for which there is minimal existing provision. The proposal for the station car park is to scarify and resurface the existing hardstanding with a limited extension of the car park area to the south and provision of disabled car parking spaces. New footways are shown to improve pedestrian access and safety of movement across the car park. Existing access to the station from major bus routes will be maintained.

Unfortunately, these proposals effectively reduce the parking provision at the station to 131 plus 8 disabled parking spaces but a previous SPT PTF feasibility study on Airdrie transport Interchange indicated a possible extension of the car park to the west to accommodate a further 67 car parking spaces.

However, it is recognised that up to 400-500 parking spaces are necessary and it is understood that SPT plan to carry out further development work on options for car parking at Airdrie in conjunction with North Lanarkshire Council. Our consultations on this matter confirm that as the existing car park is within a conservation zone and is immediately adjacent to a residential area, the extent to which the existing car park can be extended in plan is limited. It might be possible to extend vertically by constructing a multi-storey facility as long as planning conditions can be accommodated. An alternative solution may lie in constructing a multi-storey car park on the footprint of an adjacent town centre car park.

In recognition of this clear need we have assessed the order of cost for a suitable multi car park and present it in Section 13: Cost Analysis as an option cost.

*ii) Drumgelloch station*

Drumgelloch station is currently a terminus station on a single-track line. There are two entrances to the station from Meadowside Place, one providing ramped access and the other level access to the single 6-car platform. There is a small area of car parking adjacent to the station entrance created by the local council within the last 5 years, although this is for use by residents rather than for station parking purposes.

The proposed track alignment at Drumgelloch necessitates the demolition of the existing platform and associated facilities including the waiting shelter, customer help point and station fencing.

It is proposed that alterations are made to adjacent roads to improve car-parking provision at the station. This includes the creation of 15 spaces plus two disabled parking spaces to the south of the station and alteration of the existing car park area to the north of the station to provide 15 spaces plus two disabled parking spaces. Footpaths are provided or altered to give compliant access from the car parks to the station

Existing site constraints prevent the provision of a dedicated drop off facility for either private vehicles or taxis. Current access to the station from major bus routes will be maintained. Alternatively, the level of work required may present an opportunity to consider relocation of the station eastwards where more car parking may be provided.

*iii) Bathgate Station*

All proposals for Bathgate station involve the relocation of the station from its existing terminus position, which would be demolished and become available for another use. The service provision allows for one station only in Bathgate.

The base case for the railway route is to retain the former alignment to the north of Bathgate Golf Course. However, another alignment was considered passing further south through the golf course and next to the Club House. This route is discussed in more detail in Section 4.2.1 below but for consideration of the new Bathgate Station location it can be confirmed here that the radius of both alignment options is less than the 1000m acceptable to the HMRI for new station construction. Therefore, locating a station on the curved alignment on either route is not considered further.

There are three identified options for the relocation site and these are discussed below.

e) Option 1- Edinburgh Road

This option locates the new station adjacent to the Edinburgh Road (A89) to the south of the underpass currently giving access to Bathgate Golf Course. This location is the nearest of the options to the existing station location and the town centre.

A new junction needs to be created on Edinburgh Road to the west end of the proposed station site through an existing masonry wall. This maximises the distance between the proposed junction and the existing junctions on what is a moderately trafficked road. The existing site area is primarily undeveloped with mature trees across most of the area while the area to the west is used as a storage yard. Full site clearance including vegetation would be required prior to construction of the new station.

A bus lay-by and turning area needs to be constructed to the west of the access road. This area would also provide for a taxi drop off and waiting area. A large car park for 312 vehicles plus 15 disabled car-parking spaces can be located to the east

of the access road. Two metre wide footpaths are created between parking zones to facilitate pedestrian movement across the car park to the station entrance. A post and wire fence with hedging or similar planting is suggested to enclose the car park area.

The site provides for adequate car parking with opportunities for future expansion should this be deemed necessary. There would also be minimal impact on adjacent residential areas from the station facilities.

f) Option 2 - Boghall Area

This proposal relocates Bathgate station to the Boghall area at the east end of Bathgate. The site is closer to the M8 and new industrial areas in an area of land bounded by the existing solum, the A7066 and the A779. A hotel and pub restaurant is located in the north portion of the site.

Access to the station would be taken from the A7066 and an improved existing farm access road junction. Two metre wide footpaths are required to both sides of the access road leading to the station car park. The car park would have 341 parking spaces plus 15 disabled parking spaces. Footpaths to facilitate pedestrian movement across the car park divide the parking zones. Post and wire fences with hedging or similar planting are used to enclose the car park area. A bus and taxi drop off/ pick-up is provided adjacent to the station entrance but restriction in available area prevents the provision of waiting spaces for buses and taxis.

The proposed station would have two 6-car length platforms, each 4m wide. The existing overbridge providing farm access restricts the possible platform width under the bridge to 2.5m. Allowance is made for extension to the east to facilitate future 9-car platforms.

Although having good road access, this option is remote from the existing station location and it has limited pedestrian connections to residential areas and the town centre.

g) Option 3 - Whitburn Road

This site option was selected to suit the alternative alignment of the track across the Bathgate Golf Course. It is a triangular shaped site bounded by Whitburn Road (B7002) and an existing residential development. An access road from the Paulville area would provide access to and car parking area for the proposed station.

A new access road from Whitburn Road is proposed. This would give direct access to the proposed station car park providing parking for 317 vehicles plus 16 disabled parking spaces. 2 metre wide footpaths are shown along the access road and between parking zones to facilitate pedestrian movement across the car park to the station entrance. Post and wire fences with hedging or similar planting are used to enclose the car park area. A taxi and bus drop off /pickup turning area is provided adjacent to the station entrance but the restricted site area prevents the provision of a taxi or bus waiting area.

Although future residential developments would be well served by this option, existing residential areas and the town centre would not have reasonable pedestrian access. This option is dependent on the realignment of the track across Bathgate Golf Course, which as indicated in Section 4.2.4, is not recommended for further consideration.

Taking the factors discussed above into account the preferred location for the relocated Bathgate Station is Option 1- Edinburgh Road. This site is readily accessible to the town centre and allows for the provision of adequate parking and bus access and it has no major railway operational or infrastructure difficulties.

*iv) Livingston North Station*

The existing station is in a cutting with a single platform to the north of a single track. The station car park is at the higher level above the cutting. Access to the station is either by a stair with flanking retaining walls or by a dogleg ramp with retaining walls to the lower ramp section. Neither the ramp nor stair complies with the SRA Code of Practice for access. The doubling of the track at this station would require the demolition of the existing platform and waiting shelter and the stair and access ramps. The existing platform is of 4-car length and work is progressing to extend it to 6-car length under a current SRA platform extension contract.

The new station access would require considerable re-grading of the existing embankment to achieve ramp falls in compliance with the SRA Code of Practice. A series of low retaining walls is proposed to achieve the desired levels. Two stair flights with six ramp flights provide the level change from the existing car park to the proposed footbridge level (approx 4.7m above platform level). A dogleg stair or ramp alternative would provide compliant access to platform level. A similar arrangement is proposed to the south of the tracks to provide access to the south platform and from a new station car park to be accessed from south of the station. The designed footbridge is a galvanised steel structure with steel plates and bitmac finish, coloured in accordance with SRA Code of Practice. A double handrail should be provided to both stairs and ramp with vertical bar infill panels below while the footbridge has solid barriers in accordance with the group standard.

A retaining wall over the full length of the platforms would be necessary at the base of the embankment. This would be staggered to create a level area to the rear for the waiting shelters.

Work to the existing car park would be limited to resurfacing the footpath running parallel to the railway. The car park is currently used to capacity with parking on footways regularly observed. A car park of similar capacity (90 spaces plus 5 disabled parking spaces) is currently proposed to the south of the station, although indications are that this provision needs to be increased to nearer 200 spaces and an estimated cost for this is included in the cost risk allowance. Post and wire fences with hedging or similar planting are suggested to enclose the car park areas.

*v) Uphall Station*

The existing station and car park is accessed from Pumpherston Road (B8046) at a traffic light controlled intersection, made necessary because Pumpherston Road is single width where it passes under the railway underbridge to the west of the station. The steep access road to the existing station car park is usually reduced to single carriageway width by parked cars. The car park currently accommodates approximately 110 cars and is normally full during the day. The existing platform is of 4-car length and proposals to extend it to 6-car length under a current SRA platform extension project are underway.

A new one-way road system should be proposed for the new station car park, which would retain the existing car park but also include a new ramp at the east end to give access to a new lower level car park and from there give access on to Clydevale Place. Access to this street is currently blocked from Pumpherston Road but it is proposed that this junction is reopened with alterations to the traffic light system to control traffic flows.

The existing railway track alignment would be maintained at this station, which allows the existing and soon to be extended platform to be retained. A new platform is proposed to the north, formed on an elevated construction on piled or strip foundations. As a steep embankment falls away from the tracks towards the M8 to the north this construction method removes the need for a retaining wall approximately 3m high, which would otherwise run the full length of the new platform.

Fifteen new parallel parking bays are formalised on the south side of the access road. The main car park would reduce to 83 spaces but in compensation, the car park is extended to the west to provide a further 20 parking spaces plus 5 disabled parking spaces. This results in a total parking provision of 123 spaces. However, indications are that this provision needs to be increased to nearer 200 spaces and an estimated cost for this is included in the cost risk allowance.

It should be noted that the level ground area of the existing car park is restricted and does not allow for the provision of footpaths for improved pedestrian accessibility. The new lower car park has capacity for 32 vehicles and works associated with the creation of the lower car park include the demolition and relocation of 7No. timber garages. The ramps and stair from platform to footbridge level are extended to the car park level to accommodate the level change between the platform and car parks.

The new car parks should have 2m wide footpaths in accordance with the SRA Code of Practice with a new stair access between the lower and upper car parks. Post and wire fences with hedging or similar planting are to be used to enclose the car park areas.

Further detailed technical information and drawings are included in Appendix G.

## 1.2 Rail Systems Engineering

### 1.2.1 Signal Engineering

In producing a signalling solution for the scheme the following design parameters have been used:

- Four minute headways
- Design Line Speed of 80mph
- Positions of curves and Junctions as shown on P-way designs.

It was found early in the development work that 2-aspect signalling would provide a solution that would just comply with these parameters. However, as this would offer very little flexibility this option was not pursued. Therefore, the signalling solution adopted is based on 3-aspect signalling and, wherever possible, the signals have been positioned to achieve:

- The required headway
- Elimination of sighting problems, as far as possible, due to potential conflict with bridges and structures.
- Accommodate possible future expansion of the passenger station infrastructure.

This strategy is intended to provide enough flexibility to accommodate future changes without the need to make large-scale amendments.

All existing public crossings would be removed or replaced with alternatives designed to remove the road/rail interface. Therefore no allowance or consideration has been given to the provision of Level Crossings. Accommodation works at Bathgate include a replacement siding and signals for the existing STVA car storage yard, in the event that they do not wish to relocate.

#### 1.2.1.1 Signalling Control

In the west, the existing infrastructure is controlled from Yoker Integrated Electronic Control Centre (IECC) by Sunnyside Solid State Interlocking (SSI), while in the east; the infrastructure is controlled from Edinburgh Signalling Centre (SC) by a GEC Geographical Interlocking located in Newbridge Relay Room.

It is proposed to control the new and double tracked section of railway from two new (SSI's), namely Bathgate SSI and Livingston SSI. Bathgate SSI would be controlled from Yoker IECC, which would control the section of line from Drumgelloch to Livingston North stations (exclusive). Livingston SSI would be controlled from Edinburgh SC, which would control the section of line from Livingston North Station to the protecting signals of Newbridge Junction on the Up / Down Bathgate Lines. Edinburgh SC is crucial to the Airdrie-Bathgate scheme and careful attention to its capability is essential.

In Edinburgh SC a new Panel Multiplexer (PMUX) would be required at the rear of Panel 5, to allow the interfacing of the signallers' controls with indications to the new Livingston SSI. Livingston SSI should be designed with sufficient spare capacity to allow for the upgrading of Newbridge Junction and the section of the E&G lines currently controlled by Newbridge Relay Room. If Newbridge Junction and the E&G lines are upgraded before this scheme is implemented, sufficient spare capacity should be provided in the new interlocking to allow for the proposed infrastructure from Livingston North to Newbridge Junction.

Yoker IECC has the capacity for this additional SSI on its signalling ring and on the power supplies; however both the 'East' and the 'West' Workstations are at full capacity. A third Display Subsystem (DIS), including full database development, would be required to achieve the control of Bathgate SSI. There are however two redundant Training

Workstation carcasses that could be utilised for this purpose. The Yoker equipment room currently contains five SSI's provided with one Technicians Terminal. An additional Technicians Terminal would be required to effectively interface with the new interlocking.

1.2.1.2 **Train Describers and Systems**

The Train Describer (TD) requires an additional two serial signalling channel to receive indications from Livingston SSI.

The existing Waverly-Newbridge GEC 'Type RD' Time Division Multiplexer (TDM) system may require modifications in line with the works at Newbridge Junction. This TDM is a multi-drop system controlling other remote interlocking, so arrangements for modifications will need to consider the effect on other control areas. This needs to be taken into account when deciding on the Possession Strategy for the project.

A new Adjacent TD channel on both Yoker IECC and Edinburgh TD would be required to interface the two signalling control centres to each other, for the handing over of train descriptions.

All business systems that both Yoker IECC and Edinburgh TD communicate with and provide real-time train running information to, would require modifications in line with the re-signalling of the existing and new railway. This includes but may not be limited to: TRUST, SMART, Scotrail P2 planner, ATR, and Tyneside Central Information System. The latter supplies data in turn to GNER planning servers.

If the intention is to run Driver-Only Operated (DOO) trains on the new railway there would be a requirement for Cab Secure Radio to be installed. Yoker has an existing system and this would need to be extended to include the area controlled by Bathgate SSI. This would require a new Signallers Console and possibly an extra signalman position.

Edinburgh does not have a CSR system, and until the rollout of GSM-R, would require one to be installed for DOO areas. A decision is required on the operation of these services over the new railway.

Both Yoker IECC and Edinburgh SCC require new Emergency Alarm circuits. Considering the distances between the two control centres, a direct wire solution would be impracticable and so a TDM (e.g. GE Transportation Systems Delphin1024) or Dedicated Line Modem, such as Marconi Type MS142, shall be required. Two or possibly four circuits would be required, depending upon the type of system chosen.

1.2.1.3 **Interfaces With Other Projects**

A number of other projects are currently under study, which would have a major impact on the project area. The one with the most significant impact on this scheme is the Edinburgh Airport Rail Link or EARL. Without the significant upgrades to the E&G lines between Newbridge Junction and Haymarket the two schemes have critical interface difficulties.

Newbridge Interlocking is a relay-based interlocking controlled from Edinburgh Signalling Centre. The area controlled by Newbridge Relay Room includes Newbridge Junction, the branch to Bathgate, the passenger loop at Newbridge Junction, entry to the yard at the junction and approximately 5 miles of the E&G Lines between Haymarket R.R. and Winchburgh Relay Room.

The re-opening of the Airdrie to Bathgate line would interface with the existing interlocking at the protecting signals on the Bathgate branch. A new SSI would control the new line between Airdrie and Bathgate and the re-signalled Bathgate branch. The signalling study does not address all the operational constraints over Newbridge Junction and only preliminary solutions have been presented.

When the final design solution is agreed for Newbridge Junction and the congested E&G lines, the proposed Interlocking should have sufficient spare capacity for the new junction controls and any alterations to the E&G lines as required. The solution for Newbridge and the E&G lines is also dependent on a number of other projects and studies and these should be considered.

As is thought likely, if the Airdrie-Bathgate scheme assumes responsibility for renewal of the Newbridge Relay Room this has a significant cost implication, especially if the re-signalling of the E&G lines was to be carried out at the same time. Re-signalling into Haymarket Station would be required to ensure capacity, adding a further 14 miles of route to the project and requiring alterations to Haymarket SSI controlled interlocking. However, until the EARL results of detailed analysis of capacity issues in this section are known, the requirement to undertake these changes cannot be firmly concluded. Therefore if the re-signalling was carried out prior to establishing these requirements, the Airdrie to Bathgate project might fund what turns out to be unnecessary works as capacity issues may be solved by other schemes, through changes to conflicting services or upgrading infrastructure other than signalling.

Further detailed technical information including Design Commentary and Signalling Layout Plans are included in Appendix H.

1.2.2 **Telecommunications**

There are two elements of the telecommunications installation for the proposed reopening of the Airdrie to Bathgate rail line:

A) The line side communications system
- Signal Post Telephones
- Emergency Telephones
- Cable route and cables

B) The retail systems located at the stations including
- Customer Information (CIS)
- Closed Circuit TV (CCTV)
- Help Points
- Long Line Public Address
- Driver Only Operation

The new line side telecommunications shall be controlled in the West from the Integrated Electronic Control Centre (IECC) at Yoker and in the East from Edinburgh Signal Centre (SC). The addition of new line side equipment requires either an upgrade or extension to the existing control panel and telephone concentrators at the IECC and SC respectively.

An end-to-end comms network would be required and should be utilised in the provision of private circuits to the line side services. All new stations should be furnished with customer information and security systems. These systems would be in line with those already in operation between Glasgow and Airdrie and would make use of a new communications infrastructure.

Airdrie is currently a GSM/R trial site providing a Fixed Telecom Network (FTN) node at this location. FTN standards will be perpetuated for the transmission system.

Further detailed technical information on the Telecommunication Design Concept is included in Appendix I.

### 1.2.3 Overhead Line Equipment

#### 1.2.3.1 Introduction

This section deals with the electrification proposals for the existing and proposed railway routes between Haymarket East Junction on the East Coast Main Line (ECML) and Airdrie. The present Network Rail electrification interface is at Haymarket.

The proposed electrified route is 51.7km in length. In the west the scheme interfaces with the existing Mk3B overhead line equipment installed in the 1980's over the 2-km route length between Airdrie and Drumgelloch. This equipment presently interfaces with the older Mk1 equipment at Airdrie, which was installed between Glasgow (High Street) and Airdrie as part of the early 1960's Northern Suburban electrification scheme. As much of the existing Mk3B equipment between Airdrie and Drumgelloch is located in what was the 'six-foot' (or track-bed centre-line) of the former and proposed track alignment, it has been assumed that new equipment would completely replace the existing OLE in this section.

In the east, at the Haymarket end, the scheme interfaces with the existing Mk3B overhead line equipment that was installed, in the early 1990's, as part of the East Coast Main Line electrification between London, Berwick, Edinburgh and Carstairs. A compatible electrification sectioning scheme for the entire route, which interfaces with the existing electrified lines is considered.

Locations of likely switching stations have been assumed based upon the new feeder station at Bathgate (adjacent to the A801 overbridge at OS ref. NS 954674) and typical switching station intervals. For operational advantages a mid-point switching station has been assumed at Haymarket East Junction.

#### 1.2.3.2 OLE Outline Design

The outline layout design has been developed using the proposed horizontal P-way alignment designs for the non-operational railway and from Ordnance Survey mapping information on the operational section.

All outline layout plans are designed to Network Rail's standard OLE design arrangements for simple sagged catenary equipment. The maximum train operating speed for the 'slow' speed style of proposed OLE is 160km/h (100 mph). The proposed modern Mk3B equipment design range utilises a hard drawn copper contact wire (107mm$^2$) and an aluminium / stainless steel composite catenary (uppermost) conductor.

The proposed route has auto-tensioned balance weight equipment with over 91 full and half tension lengths conforming to the design series requirements. The average tension length is approximately 1600m compared to the maximum permitted length of 1970m. In open route areas the nominal contact wire height would be 4700mm (above rail level) and a permissible minimum of 4240mm through over-bridges and areas with limited headroom.

An assumed design wind speed for the area of 30 m/s has been applied to determine the OLE structure spacing. Structure locations have been assumed at a nominal 3.5m offset from track centreline.

As detailed ground investigation information on the operational line sections is not available at this stage the structure foundation design has been assumed throughout the route. To validate the design fully detailed condition survey and underground services location investigation will be required at the detailed design stage.

Specific structural steel allocation has not been undertaken for this outline design. Standard Universal Column (UC) masts have been generically applied throughout the route, where possible, in order to minimise structural steel requirements and simplify the design. Double channel masts have been utilised where overlap arrangements and

switching supports are required. Full allocation of structural steel will be required at the detailed design stage, complete with calculations and loading details, undertaken for all new and remodelled equipment.

Network Rail has requested that OLE Portal Gantries be used throughout the re-opened route length. This has implications and an appropriate cost allowance has been included as a risk option. The visual impact on the environment of the horizontal gantry beams will also be greater. Further discussion with Network Rail on this aspect is required in an effort to resolve their concerns on the use of OLE Masts.

An interference suppression system employing return conductors with (300A) booster transformers would be provided throughout the route in accordance with Network Rail Standards and Network Rail E&P Policies. Stranded aluminium return conductors (19/4.22mm) have been assumed throughout.

1.2.3.3 **Overbridges and Stations**

At all overbridges the theoretical headroom clearance required to accommodate the equipment has been applied and assumed to be sufficient to allow the use of standard support and registration arrangements. This requires validation and a fully detailed condition and height survey at the detailed design stage. Where overbridges have been surveyed as part of this study, particularly between Drumgelloch and Bathgate, minimum bridge clearance heights has been indicated for bridge reconstruction or track lowering proposals.

Generally, the station platform arrangements are such that the requirements for OLE structures to be installed at platforms are kept to minimum. The OLE has been located on headspan structures in order to minimise the need for structures close to platform edges and they are usually located behind the platform structure.

1.2.3.4 **Level Crossings**

No former level crossings are being re-opened and so the OLE design does not consider them. Should level crossings be introduced this would involve a re-examination of the OLE structure positions and the remodelling of certain equipment features not compatible with the high contact wire height present at these locations. The required minimum height of 5.6m (above rail level) is necessary for a public level crossing.

1.2.3.5 **Other Structural Features**

The viaduct at Birdsmill House (Clifton Hall, west of Newbridge junction) requires the attachment of OLE portal structures to the outside face of this structure. Sketches of this are contained in the Appendix J. Where the land boundary is the structure face access permission from the landowner is necessary for maintenance. Additionally, if building is listed then listed buildings consent would be required. On the Drumgelloch to Bathgate section, the viaduct at Caldercruix and Hillend *(Underbridge No. 5, former Underbridge No. 50)* does not require OLE structure attachment, as a 60m span would be sufficient to avoid this requirement.

Further detailed technical information including Outline Layout Design Parameters and Methodology, Sectioning Design and Outline Sectioning Diagrams are included in Appendix J.

1.2.4 **Power Supply**

From the VISION® and OSLO™ model runs the power demand profile was assessed and the power supply requirements of the Feeder Stations along the route was confirmed. Train movements in the VISION® model have been incorporated into the OSLO™ simulation to accurately predict the power supply requirements.

It was found that a new 2x18MVA Feeding Station would be required, supplied by Scottish Power as the Regional Electricity Company (REC). The power feeding design

and associated isolation diagram has been modelled. In addition, a second design that was proposed following completion of both the Trains Operations and OLE studies has been modelled. In both modelling scenarios, Normal and First Emergency feeding were considered and the results recorded in the document *'Power Study Report for Airdrie-Bathgate Route' reference LD79538-RP-16* included in Appendix K.

The conclusion is that a new 2x18MVA Feeding Station located at Bathgate would` provide adequate power supply to the new route for the rolling stock and peak services modelled. If new rolling stock were to be procured or services significantly changed, although there is significant designed spare capacity from the new Feeder Station, the power supply requirements would need to be re-assessed.

#### 1.2.4.1 Discussion on Supply Options

Possible supply options have been identified at Bathgate, Broxburn, Drumcross, Gorgie, and Livingston and Sighthill substations. The supply would use the BT (or classic) technique, and comply with Engineering Recommendation P24.

Three of the options have been considered in more detail and approximate costs are detailed overleaf. These are based on two 18 MVA transformers connected in parallel with existing grid transformers through disconnectors at existing grid supply points.

| **SP substation Option** | Rail Supply Point | Substation Voltage | Distance to railway | Shortest distance to railway |
|---|---|---|---|---|
| **Bathgate** | Bathgate | 132kV | 1.5km | 1.0km |
| **Gorgie** | Haymarket Jn. | 132kV | 1.5km | 0.75km |
| **Sighthill** | Haymarket Jn. | 275kV | 5.5km | 50m |

Some aspects of the above location options should be considered as follows.

- Gorgie substation is in a built up area, hence space for transformers may be a problem
- Currie-Gorgie circuits are heavily loaded and the 132 kV cables may require to be upgraded to accommodate the additional load.
- Railway transformers at Gorgie would be on the same circuits as the transformers proposed for Currie. This would mean the loss of two transformers for a single circuit fault.
- Limited space at Sighthill may cause problems in sitting transformers and the railway station at Edinburgh Park has recently been opened beside the substation. Due to the location of Sighthill, the engineering works include 4 km of double circuit cable more than the other two options. However, sitting a Trackside Feeder Station to the west of Haymarket Junction and hence shortening the cable route could reduce this work.
- The proposed Trackside Feeder Station at Bathgate is assumed to be located where the A801 road crosses the track of the disused railway.
- The urban location of Gorgie is likely to result in more work compared to Bathgate and this may be further increased if space is an issue for the transformers or if the Currie-Gorgie 132kV cable circuits require to be upgraded to accommodate the additional load.

Taking these points into consideration the preferred site option for power supply facilities at this stage is at Bathgate. To confirm that this is indeed the recommended site option, further feasibility and analysis studies are necessary as discussed below.

a) Formal Connection/Feasibility Studies
It is necessary to carry out further feasibility studies into fundamental connection parameters to determined connection methods and to consider the technical and

economic case for a range of alternatives. In general, the scope of the studies will be less detailed than those required for a full formal application but facilitate screening of problematic or expensive connections.

The feasibility studies should identify any major issues and provide a level of confidence regarding the method of connection of the development to the system. This would then enable a formal application for connection to be submitted to Scottish Power. The Agents of SP Transmission/Distribution plc (PowerSystems Ltd) will then input the following: -

i. Carry out network studies to assess the issues and implications associated with connecting railway proposal to the system. The will include fault level analysis and reliability studies.
ii. Investigate feasible connection possibilities, including system design, protection, control, cost estimate, timescales and operational limitations.
iii. Recommend the least cost acceptable connection arrangement consistent with the SP Transmission & Distribution design standards and operational procedures.
iv. Transient stability studies.
v. Assessment beyond the point of connection of the impact of any connection method.

We note that a Domestic Sub-station is close to the proposed railway east of Drumgelloch. As described in *Section 4.1.17 Public Utilities* its boundary fence line is at a distance from the nearest running line greater than the minimum for safety 2m. However, a detailed check on the earthing and bonding of this sub-station is required.

Further detailed technical information including Methodology of OSLO Modelling, Initial Simulation Results and Proposed Power Re-Design are included in Appendix K.

# 5 The Route Options

## 6.1 New Route Linespeed of 100mph

A requirement of the brief is to consider the re-opened route as a high-speed line with a running speed of 100mph. At an early stage in the train operations study it was concluded that to achieve this was not worthwhile in terms of project risk compared with running time improvements. A 2.2-minute reduction in running time was identified over the whole route without intermediate stops, reducing to 30 seconds if a single intermediate stop was introduced. It was found that the best electric or diesel powered rolling stock could only achieve 100mph running over a short length at each end of the reopened former alignment route.

However, for completeness an assessment of infrastructure works necessary to achieve 100mph running is discussed below with reference to the drawings and tables included in Appendix B.

a) Permanent Way, Earthworks and Bridges
More than half the route length between Drumgelloch and Bathgate would need to be realigned from its former alignment. Some existing curves need increased radii such that there are over 60m displacements from the original solum. Almost all the bridges would need to be replaced and the original bridges and structures taken down or infilled.

As the route would be shorter by up to 600m a pro rata saving on twin track length would be achieved but as much of the route would be completely new, major earthworks would be required. A major investment in ground investigation for the new route would be necessary to confirm ground conditions and it is likely in some areas around Hillend Loch and Armadale that major rock cuttings would be required.

b) OLE, Signalling and Telecommunications
The increase in design linespeed would necessitate a redesign of the base case signalling proposals as design standards change for 100mph running. Other than this there is little effect on these engineering disciplines.

c) Parliamentary Bill
Additional land purchase would be required for the longer curves over approximately eight miles of the re-opened route. There is the possibility that attempting to achieve this through the future Parliamentary Bill process would invite more objections to the scheme, particularly if by doing so it makes providing intermediate stations impossible or more difficult.

## 6.2 Bathgate Golf Course Railway Alignment

It has been assumed that all trains will stop at Bathgate and the 55mph curve into and out of the relocated station would render high linespeeds irrelevant. However, other considerations including the wishes of local authority planners to move the centre of gravity of the town centre towards the south, means that it was appropriate to consider an alternative route across the Bathgate Golf Course.

Our permanent way design included in Appendix B indicates that it is feasible to achieve an 80mph curve through the golf course. It would leave the reopened line at chainage 25m 25ch and pass just south of the clubhouse, making a connection to the Edinburgh Bathgate line approximately 440 m up line towards Edinburgh from the current Bathgate Station buffer stops. It appears from inspection of ground profiles that a cutting of up to 3 or 4m deep would be required leading to a railway corridor of approximately 30m width. No major effects are considered likely on the other railway engineering disciplines.

Discussion with the Golf Club management and members' comments at the Bathgate public meeting lead to the conclusion that objection to this route is certain. The Golf Club

point out that at least three of their long holes would be lost along with the Club House and the car park as well as the current access to the golf course. Available land for replacing these facilities is very limited given the pressures from developers in the area. Some land to the southwest might be available but it is reported that drainage would be a problem, as it is relatively low lying.

The Club management stated that they were very concerned about the possibility of planning blight affecting their membership and business. If this option were to be selected then Bathgate Golf Club would expect to be compensated and suitable ground found for hole relocation. This would involve the re-planning of the entire golf course to a design by a recognised expert in golf course design and management.

The land area forming the present Edgar Allen site to the north of the golf course is subject to a current planning application for a mixed residential and retail development. If the railway were constructed on the former alignment then the applicant would wish to form a wide access into the site through the existing embankment. Local planners see this as a possibility, depending on the programme of the railway project and the developer. Should the railway be re-aligned through the golf course it would effectively split the development in two and negotiations between the developer and planners are continuing on this issue. We understand that the golf course route has been protected under planning regulations with the understanding that a route decision will be made within two years.

**The route alignment study work now completed enables us to clearly state that there is no justification to retain the golf course route and it should not be considered further.**

## 7.3 Bathgate Station Relocation

### 7.3.1 Existing Location

When the railways in the area were first constructed Bathgate Station was a terminus station. On the opening of the line to Airdrie and Glasgow, Bathgate Upper Station was provided just west of the junction and the golf course. When the Airdrie Line closed, Bathgate Station reverted to its original location where it remains as a one-flank platform serving a single track with two trains per hour from Edinburgh Waverley.

A simple shelter with CIS provision is the only passenger facility on the platform. Parking for up to 100 cars is available but is space restricted and use is made of car parking adjacent to the adjacent supermarket.

### 7.3.2 Re-sited Station

A new Bathgate Station needs to be relocated onto the proposed Airdrie Bathgate line. As discussed in the preceding section the golf course alignment is not recommended for further consideration and therefore only the former alignment will be available for station location on which there were two possible locations identified. These are discussed in section 4.1.1.8.2., which concludes by recommending the A89 Edinburgh Road location as briefly described below.

A twin flank platform station can be constructed adjacent to the A89 Edinburgh Road on the Edinburgh Bathgate line south of the existing underpass giving access to Bathgate Golf Course and 700m east or up-line from the existing station. This site has good access from the main road and has sufficient space for over 325 cars with ample space for taxis and bus parking and turning. This location has a good customer base and will better serve Bathgate College and perhaps the major Rover Residential development to the south. The radius of the permanent way at this location is greater than the 1000m required by the HMRI guidelines. A minor drawback includes the increased walking distance from the existing town centre.

## 7.4 Alternative Routes

### 7.4.1 New Alignment South of Hillend Loch

There are a number of environmental concerns relating to the former route through Plains and Caldercruix and its continuation along the south shore of Hillend Loch. The route through the villages presents engineering challenges where it runs close to residences and at-grade road crossings. At Hillend Loch the members have raised environmental concerns that noise and vibration effects might detrimentally affect this very active angling centre.

To gain an understanding of relocating the railway route from the former alignment and to assess its mitigation effect on the environment an alternative new route to the south of the A89 has been assessed.

The plan for Route Option 1 and 2 is included in Appendix B along with calculated cut and fill volumes. Both of these routes take a more direct route from west to east and by-pass the villages of Plains, Caldercruix and the hamlet of Forrestfield, as well as Hillend Loch. There is a consequent reduction in the overall length of railway of up to 1km and linespeeds could be increased due to the removal of speed constraints around curves.

There is little to choose between the alternative route options. Both require massive excavations to achieve an acceptable track vertical alignment of approximately 600,000 cubic metres in cuttings of up to 25m depth. Although we have no site investigation information for the area it is likely from visual inspection that the excavations would be almost entirely in rock which obviously has a major cost implication

**The high additional cost and environmental impact of the alternative routes render this a high-risk option and one that is very unlikely to be successful. Therefore, it is not recommended that these alternative routes should be progressed any further.**

### 7.4.2 New Alignment South of Armadale

The environmental issues near Armadale are not as clear as those discussed above for the Hillend Loch area. However, some property owners in the Blackridge and Armadale areas might consider themselves to be detrimentally affected and the alternative route for this Option might mitigate these effects. The realignment would also remove curve geometry constraints on linespeed enabling a faster design linespeed.

Comments made in the preceding section are applicable here; namely, that massive excavations and civil engineering work would be required with major cost and environmental effects during construction. If this option were selected then the communities in the area would have no chance of accessing a local station in the future.

**The high additional cost and environmental impact of the alternative route render this a high-risk option and one that is very unlikely to be successful. Therefore, it is not recommended that these alternative routes should be progressed any further.**

# 7 The Train Stop Options

## 7.1 Intermediate Station Stops

The Base Case for the Study is for a high-speed route with no intermediate stations. However, a recognised option is for one or more intermediate stations to be provided. The possible locations for the stations are Plains and Caldercruix in North Lanarkshire, and Blackridge and Armadale in West Lothian. Layouts for each of these sites have been investigated and drawing proposals prepared.

Of particular note at the Caldercruix and Armadale sites is the very steep existing gradient of 2%. The HMRI recommend horizontal platforms at new stations or at worst a slope of 1 in 500.

To achieve this reduced gradient a major cut and/or fill operation would be required. In addition, the possible station site at Caldercruix has difficulty is achieving acceptable platform gradients because of the physical constraints of a nearby road overbridge to the west and a masonry railway viaduct to the east. To improve the existing steep gradient would require demolition and reconstruction of the viaduct and the bridge at considerable additional cost. The Plains site does not have these engineering challenges but it is close to the existing Drumgelloch Station and rationalisation of the site locations might be a consideration. However, this is not considered as part of this study.

In the east, the possible site for a station at Armadale is also on a steep 1in 50 gradient. However, this is more easily improved to 1 in 500 (or perhaps 1 in 150 depending on HMRI acceptance) as the physical constraints are less. The possible site at Blackridge has an acceptable gradient and therefore requires less engineering work for its construction.

A decision on the location of the additional stops on the route depends on the output of the recommended patronage and the economics study for the train services.

An understanding of intermediate stations stops on the route has been developed through site inspection visits and meetings with Local Planners and Property Developers for each location. Meetings were also held with Scotrail to discuss the customer facilities and CIS systems they would require at the stations. Typically the work at each station would include double flank platforms with mobility-impaired access and car parking. A more detailed description of the station locations is given below

*Plains Station*
Before the railway closure Plains Station had a 6-car platform. A platform retaining wall and the deteriorated platform surface from this original station are evident from visual inspection. These features need to be demolished to facilitate the construction of a new station if selected as a viable option.

The new station would have two flank platforms. The north platform can be 4m wide at the station entrance but must reduce to 2.5m for the majority of the platform length because of restricted area between the tracks and adjacent property boundaries. The south platform can be 4m wide over its length. The designed platform and track gradient is approximately 1:333, resulting in a change in ground levels of less than half a metre from the existing railway solum.

Given space restrictions to the north of the tracks, the ramp and stair access to platforms would run perpendicular to the tracks utilising a vacant site running between Main Street (A89 road) and the railway line. On visual inspection of the site it appears to be possible to access the ramp at mid level direct from Main Street. It is assumed that the station footbridge would also be used for local access to Plains Country Park to the south of the

station. A station entrance is consequently provided to the south platform. The footbridge will be provided whether or not the station is provided.

The vacant site can also be utilised to provide a station car park for 27 parking spaces and three disabled parking spaces. This is to adoptable standards with 2m wide footpaths in compliance with the SRA Code of Practice. A drop off area is provided adjacent to the station entrance for use by private vehicles. Access to local bus services would be at the existing halts on Main Street (A89 Road). It may be possible, depending on detailed site survey, to provide a lay-by off the A89 within the proposed station area by altering the access ramp design. This would also have the consequent effect of reducing the number of car parking spaces provided.

*Caldercruix Station*
The original station location prior to the line closure is not suitable for a modern station as it has inadequate land area for platforms and station facilities including car parks and road access. The proximity of adjacent residential properties further restricts the potential for a station to be provided in this location. Furthermore, at this location the constraints on achieving adequate clearance below the existing road overbridge to the west and over the existing viaduct to the east leads to a track design gradient of approximately 1:50.

HMRI guidelines require station platforms to be horizontal. If this is not achievable the guidelines indicate that a gradient no greater than 1 in 500 would be deemed acceptable. On checking the implications for this gradient and also for an increased 1:150 gradient we find that major works are required, including demolition and reconstruction of the viaduct. Should this situation be resolved the station facilities would be constructed to a similar specification as previously described for Plains.

Physical features at Caldercruix are thus a constraint to providing a new station. We have not identified a suitable alternative but, particularly as Plains is nearby to the west, it might be appropriate to consider a new site between Plains and Caldercruix with an improved local bus services to improve access.

*Blackridge station*
HMRI guidelines for station design set a design limit of 1000m for curve radii. Less than this is deemed to have safety implications on driver sighting for signals and passenger movement as well as increased stepping distances onto train vehicles. A station location option *(location 1 on plans)* was discarded because of insufficient length of straight track and the alternative to the east of Harthill Road *(location 2 on plans)* was developed as the preferred option. The platform and track gradient here is an acceptable 1:950.

The original Blackridge station was located to the west of the B718 (Harthill Road) and consequently does not affect the station proposal.

Access to a new station can be gained from Main Street (A89) with a new road across agricultural land. Two metre wide footpaths would be constructed on both sides of the access road from Main Street to give access to the station. The road and footpaths cross a burn requiring a new bridge structure to carry them. The new bridge would have a span of approximately 8 metres. The structure is likely to be a single span structure with foundations to suit existing ground conditions and adequate clearance should be provided to deal with potential flooding. The structure should be designed for full HA Loading and should have vehicle/pedestrian/cyclist parapets connected to safety fencing.

A new station car park should be built to adoptable standards and 48 car-parking spaces plus 5 disabled car-parking spaces have been shown on option plans. Indications are that this provision needs to be increased a small (2-vehicle) drop off area is provided at the end of the access road. Post and wire fences with hedging or similar planting are used to enclose the car park area.

*Armadale Station*

The original Armadale station was located to the west of Station Road but because of access and track design considerations the proposed station site is to the east of the road. West Lothian Council is assessing an outline planning application for development of the area north and south of the railway solum, and between Station Road and the existing residential area. Zoning for a railway station and commercial development are included within the application. The proposals include a new road network accessed from Station Road. The proposed station and its access need alteration to the residential development plan and its road layout.

The station access road should have two metre wide footpaths on both sides. A new station car park is needed, built to adoptable standards. Discussions with the developer were based on the provision of forty-five car-parking spaces along with five disabled parking spaces. Indications are that this provision needs to be increased.

The drawing proposals indicate a 2-vehicle drop off area at the end of the access road. Post and wire fences with hedging or similar planting are shown to enclose the car park area.

# 1 Cycle Path Relocation

## 1.0 Current Situation

The cross-Scotland cycle route identified as National Cycle Route No. 75 links the Clyde Coast with Glasgow, Edinburgh and the Firth of Forth. The currently disused railway solum between Drumgelloch to Bathgate forms part of this important cycle route, which offers a traffic free environment for cyclists, walkers and horse riders. Specially commissioned sculptures along the path are provided to add interest to the open air experience. Unfortunately, there are stretches of the route particularly in the western end near Drumgelloch, where vandalism is a problem made evident by the quantities of broken glasse and debris along the path.

At the west end of the cycle route, travellers connect with the cycleway to Glasgow via a section of on-road route, which passes through the residential streets of Airdrie. At the east end at Bathgate, Cycle Route 75 continues on to Edinburgh via Livingston and to the south of Uphall.

The re-opening of the railway would bring a need to relocate the Cycle Route, a prospect originally addressed in the land transfer agreement with Railway Paths Ltd. Through consultation with Sustrans and Railway Paths Ltd as well as the Local Councils, options have been developed and considered in detail. The views of the local users have been also been taken into account and it is accepted that the relocation work gives an opportunity to make environmental improvements to some of cycle path lengths which have current maintenace difficulties.

## 2.0 Route Options Considered

Two alternative alignments linking the existing start and end points of the existing path were readily identified and a further option arose through comments received during the consultation process.The two options considered were firstly, “The Railway Route” and secondly, “The A89 Road Route”

The Railway Route takes advantage of the existing walkways, country parks, and railway lineside boundaries and also utilises available former railway alignments to link various sections of the route. The overall length of this option is approximately 23km comprising approximately 17km of new track. The path itself is considered to be of 3m wide bituminous construction with grass verges on each side with appropriate fencing on one or both sides.

The “The A89 Route” follows the A89 single carriageway road through Plains, Caldercruix, Blackridge, Armadale and Bathgate. Where sufficient road width is available the cycletrack is positioned on the road with green surface marking. Where road space is not available or where traffic volume and speeds make it unsafe, the cycletrack is placed on the footway or on an entirely new formation.

Another option was identified through the public consultation process. This is a combination of the two previously presented options. The arrangement here is to have the “on-road” section only where the route passess through the villages with a return to the “off-road” railway section once the route leaves the built-up area. The reason for this is to limit opportunities for undesirable behaviour in readily accessible sections and to provide more visible activity in the villages.

## 3.0 Recommended Route Option

Meetings with West Lothian Council, North Lanarkshire Council and Sustrans lead to “The Railway Route” being identified as the preferered realignment option. However, given the issues raised by the public during the consultation process, further consideration for the combination of the on and off-road alignments is deserved.

Further detailed technical information is included in Appendix M.

# 1 Environmental Impact Assessment

## 1.1 Introduction

The purpose of the Environmental Statement is to inform the Council, consultation bodies and the general public of the likely effects of the construction and operation of the rail link on the local environment. With further development the EIA will form a crucial part of the process in the Parliamentary Bill process.

The route option considered for the EIA was confined to the base case, defined as being generally on the former alignment with minor deviations. The options for re-routing south of Plains and Caldercruix and south of Armadale are discussed in Section 5.4, which highlights the major construction and environmental impact of these options and recommends that they are not considered further.

Options were considered for existing crossings, proposed stations, and for the realigned NCN Cycle Route 75.

## 1.2 Assessment of Effects

### 1.2.1 Planning Policy Context

A review of Structure and Local Plans and the relevant Local Transport Strategies indicated that the proposed development complies with statutory planning policy for the site and surrounding area. Additionally, West Lothian Council named the project as being one of the major long-term projects for implementation. Although the proposed alignment is currently designated Green Belt, the site's identification in the West Lothian Local Plan for the old railway to be safeguarded, including the original station sites at Bathgate, Armadale and Blackridge, takes precedence. North Lanarkshire's planning policies contained in both the Monklands District Plan and the Airdrie and Coatbridge Areas Issues report broadly support the proposal. The proposal meets objectives for sustainability, economic activity and transportation and accessibility. Where potential non-compliance occurs, for example in policies related to the Green Belt, and access for pedestrians and cyclists, measures could be put in place to minimise possible adverse effects.

### 1.2.2 Geology & Soils

Loss of soils and geological features is anticipated to be negligible, as the majority of the route is already present. Workable coal reserves may be present under parts of the route but they are not likely to be sterilised to any great extent by this linear feature and the SUSTRANS cycle route effectively already sterilises the same extent. The impact is viewed as minor.

Searches of contaminated land databases identify that there may be a degree of contamination present along much of the route due to its former use as a railway. The proposed end use as a railway is relatively insensitive as a receptor. Construction workers are most likely to be at risk but the impact is likely to be minor and standard PPE should suffice. Any off site materials movement would require to be assessed for contamination. There are some potentially contaminated sites adjacent to the railway in built up areas but these are unlikely to be significant.

### 1.2.3 Land Use & Agriculture

The line would be constructed generally within the railway solum, which has been protected for this land use. The route is entirely on the line of the National Cycle Route-NCN 75. Land use on either side of the route includes:

- extensive areas of open ground, including agricultural land, open space/amenity land, derelict and vacant sites.
- settlements, with a range of urban land uses, including residential, commercial and institutional.

The key land use impact is change to the NCN 75 route and the requirement to re-align it within the route corridor. Direct land use impacts are minor. Additional land take might be required to construct new stations and upgrade existing stations. Land take for stations for the base case is approximately 3.0 hectares and for the optional case with intermediate stations an additional 2.0 hectares would be required. It is recognised that additional car parking would increase these areas.

Outstanding planning consents and applications along the route include a number of significant residential development proposals whose access and amenity may be affected by the new rail line. Land use impact is considered to be minor.

1.2.4 **Landscape & Visual Impacts**

The introduction of overhead electrification gantries and in particular portal gantries, more frequent fast trains and new stations with their associated bridge structures, lighting and car parking would be the main source of visual impacts. The main receptors include residents, commercial and industrial sites, public buildings and green spaces, roads and foot/cycle paths. These are all within 1.5km of the railway.

In the short term the adverse impacts on the affected receptors include the loss of trees and shrubs and the introduction of man-made elements into the landscape. This would be the case particularly around stations and where the line is on embankment. Over time, where mitigation planting has been proposed, such visual impacts would ease as landscape planting matures. Furthermore, the existence of the linear landform of the old and the existing railway would reduce people's visual perception of the changes required in the landscape for reopening/electrification of the line.

The impacts of the proposals on the landscape would relate to landscape fabric, noise and vibration and access. These impacts would generally be slight as the development is limited to a narrow corridor and the basic landform and most of the bridges and stations are already in place and only require upgrading.

1.2.5 **Ecology, Nature Conservation and Biodiversity**

Based on scoping opinions, consultations, and available data and the walkover survey the key issues are:

- No field surveys for birds or protected species as recommended in the scoping opinions and consultations (Scottish Executive, West Lothian Council, SNH, and RSPB). The resulting lack of data means that the assessment is based on limited desktop data that cannot fully address the ecological issues.
- The route would directly impact on four Wildlife Sites/Sites of interest for Nature Conservation (WS/SINC's). It may indirectly impact another seven WS/SINC's.
- Limited protected species data suggests that there may be a Badger issue regarding one sett.
- Local conflicts with biodiversity action plans to include loss of scrub habitat for breeding birds, loss of ponds, loss of improved neutral grassland and a range of individual action plan priority species.
- Control of Japanese Knotweed. Excavation and removal offsite to a licensed landfill would be required.

Protected species surveys are required and recommended. Mitigation measures are required to offset local losses to key habitats, primarily compensatory scrub and pond creation and a sympathetic site biodiversity action plan, based on Network Rail's own plan. The final routing must be reviewed with the appropriate Councils in the context of WS/SINC boundaries. Impacts identified to date are associated with habitat loss and indirect impacts on badgers.

1.2.6 **Cultural Heritage**

There are 124 sites of cultural heritage interest along the route contained within 200m of either side of the railway line. However, most of the sites would not be impacted upon since there is little new land-take in the proposal, and no archaeological impediment to the proposal can be identified. There are three scheduled ancient monuments located within 1 km of the railway but it is unlikely that visual effects on their settings will be significant.

Historic Scotland confirmed that they do not anticipate the proposal will adversely affect any protected sites or monuments of national importance. Nonetheless, it is likely that an element of archaeological fieldwork will be required as part of the development at some sites where new land-take is required. The Sites and Monuments Record data supplied to us by West Lothian Council incorporates some recommendations for archaeological assessment and mitigation at specific archaeological sites, should these be affected by a development proposal. The implications of this would appear to be that an archaeological evaluation would be required at the site of the proposed Bathgate Station.

1.2.7 **Pedestrians, Equestrians, Cyclists & Community**

The route corridor runs between a series of local communities including Airdrie/Drumgelloch, Plains, Caldercruix, Blackridge, Armadale, and Bathgate. The key community effects relate to:

- the realignment of an important linear route and the introduction of a new linear barrier with limited crossing opportunities, compared to the existing route, resulting in severance.
- Loss of amenity as a result of the introduction of a rail line along a route, which has been in use as a path/cycleway for some 20 years.

Cycle Route NCN 75 will be re-routed. For the majority of its length it will adjoin the rail route on a newly constructed path. Community severance occurs at twenty-four locations along the route, although mitigation in the form of alternative crossings will reduce the impacts. Community facilities affected include Plains Country Park and Caldercruix Country Park.

There are currently 11 road/vehicle crossings and 13 access paths (foot/cycle ways), a total of twenty-four at-grade crossings, which would be severed. Mitigation for these is as follows:

- Two would be provided with alternative roads at same location
- Four would have alternative road access provided at some distance away (Plains)
- Four would have alternative footbridges that are suitable for pedestrians, cyclists and equestrians
- At eight sites there would be no alternative access north-south across the railway line but in some cases the severed access is not the main access and will not be missed.
- Six of the severed crossings would have alternative access routes provided elsewhere.
- Community facilities which may feel significant effects from severance or loss of amenity include:
  - Plains Country Park, Plains
  - Hillend Loch, Caldercruix
  - Caldercruix Country Park, Caldercruix
  - Katherine Park, Clarkston
  - Easter Moffat Golf Course, Plains
  - Bathgate Golf Course, Bathgate.

The village of Plains would have the greatest community impacts. Both Plains Country Park and Easter Moffat Golf Course would have links to the local community altered and

would need to use an alternative bridge access. Additionally, a number of private residences alongside the railway line would be affected.

Caldercruix would experience moderate community impacts. Hillend Loch and the Hillend Sailing Club and the Airdrie District Angling Club would both experience adverse impacts, although mitigation measures to reduce this are proposed. The Airdrie and District Angling club access would be severed and mitigation measures include the relocation of the clubhouse to the east of Moffat Bay. The proposed access is from the A89 at East Moffat Bay via a new overbridge over a 3-4m deep cutting. This road would provide access to the proposed club house and boat launch area complete with a new slipway and car parking area. In addition, Caldercruix Country Park, the five Lochs Trail and the North Calder Heritage Trail would experience minor impacts.

1.2.8 **Noise & Vibration**

The noise assessment identified a sample of representative noise sensitive receptors along the route. Sample noise measurements were taken at each of the identified receptors to obtain an indication of the typical noise climate presently experienced. The scope of the baseline survey was restricted in that the receptors are generally described in terms of a specific time of the day.

The scope of the Noise Insulation (Railways and the Guided Transport Systems) Regulations 1996 is set out in the Environmental Impact Assessment (EIA) document. The total number of residential properties within 300m of the proposed Airdrie to Bathgate re-opened track is approximately 3448. Properties outside these limits have not been considered and the properties affected are presented in the table below.

| Noise Band (dB(A) | DMU Unmitigated | DMU Mitigated** | EMU Unmitigated | EMU Mitigated** |
|---|---|---|---|---|
| ≤35 | 2178 | 2361 | 1742 | 1859 |
| 35-40 | 357 | 339 | 517 | 576 |
| 40-45 | 290 | 248 | 334 | 309 |
| 45-50 | 194 | 153 | 288 | 249 |
| 50-55 | 120 | 84 | 171 | 131 |
| 55-60 | 83 | 39 | 120 | 86 |
| 60-65 | 17 | 2 | 75 | 29 |
| 65-70 | 0 | 0 | 12 | 0 |
| Buildings not included* | 26 | 40 | 4 | 25 |

**The 2m along both sides of track at the existing rail boundary.

At this stage of the project development of twenty-four hour noise monitoring is inappropriate and a pragmatic approach to the determination of mitigation needs has been taken. Nationally reported noise levels would suggest that mitigation should be considered as part of the scheme design at predicted rail noise levels of LAeq 57dB and above.

This 57dB(A) level falls approximately halfway along the 55-60dB(A) contour. It should be appreciated that the perceived noise effect of EMU trains is greater than its equivalent DMU, principally because of the location on the train of operating machinery. The DMU vehicles have their diesel engine located lower down that the pantograph and equipment of the EMU, which results in a wider spread of noise energy vibration, particularly in cuttings.

Consequently, for the DMU option, mitigation is thought to be required for a maximum of approximately 100 properties while for the more likely EMU operating scenario the required mitigation number is up to 207 giving an estimated overall affected length of approximately 3000m.

Additional areas such as Hillside Reservoir Angling Club need consideration, although the sample measurement of ambient noise at Hillside reveals that the ambient level is relatively high as a consequence of road traffic noise. Information in schools, commercial buildings and amenity areas are included in the EIA.

Specific construction noise impacts are not included in this stage. The Airdrie to Bathgate railway line has been closed for a number of years. Vibration transmission from the passage of trains to properties close to the line may give rise to adverse comments from the occupants of these buildings. There is also the possibility of interference with vibration sensitive equipment or processes. Where it is planned to locate the closest rail of the re-opened Airdrie to Bathgate railway line within a distance of about 15m of a residential property, or general office, then it is recommended that the tracks should be vibration isolated.

1.2.9 **Air Quality**

The Government's air quality objectives for 2004, 2005 and 2010 are likely to be met in the vicinity of the rail link for train operations.

The construction work for the rail link would give rise to emissions of mineral dust and diesel fume during operations involving the movement of aggregate, soils and other granular materials. Nuisance is most likely to arise at properties within 100m of the proposed rail link. The timing of construction activities would have a critical effect on the likelihood of substantial dust nuisance arising and of the 24 hour standard for $PM_{10}$ being exceeded. Impacts would be greatest if potentially dusty operations are performed during dry warm weather and least during cold wet weather.

Once the rail link is complete and electric trains are operating it would not be a noticeable source of air pollution. The change in concentrations of air pollutants resulting from implementation of the scheme would be extremely small and all relevant air quality objectives are likely to be met in the vicinity of the proposed rail link. The opening of the proposed rail link should divert some traffic from the M8 corridor onto the railway leading to a small reduction in emissions of traffic pollutants within Central Scotland and a marginal benefit to regional air quality.

1.2.10 **Water Quality**

The proposed railway corridor is situated on a plateau with numerous drains, ditches, watercourses and bodies of water. There are at least 20 culverts under the existing rail solum. The proposed drainage for the railway includes retention or replacement of existing culverts to ensure that the existing flood frequency is not altered and to minimise disruption to flora and fauna. If DMU trains are to run on the line oil interceptors are suggested for station areas to retain hydrocarbon leakage the diesel engines but if the more likely EMU trains are to operate then their electric powered engines do not represent a pollution risk and interceptors are not required.

The railway proposals do not constitute a significant source of pollutants in operation but care would be required during construction operations to ensure that water resources were not adversely affected by construction materials or silt, or by the mobilisation of historical contaminants in the soil.

Construction phase impacts on surface water quality should be no greater than moderate significance, provided that there is strict adherence to SEPA pollution prevention guidelines. Railway operation and maintenance are not expected to significantly impact on surface water quality, flooding or groundwater.

1.2.11 **Disruption due to Construction**

The development represents a significant civil engineering project. Impacts would arise from a number of sources:

- noise, emissions and dust arising from vehicles, plant and machinery
- visual impact of construction sites and large plant;
- impacts of construction traffic on the local road network and road safety
- disruption caused by severance of roads and footpaths, disruption to habitats.

The key construction impacts would be on people living and working in the area. Many of the construction impacts would be unavoidable and would require to be controlled and mitigated by the standard conditions, restrictions and responsibilities placed upon site development contractors. Mitigation would include routing of construction vehicles to avoid communities and sensitive receptors.

The materials balance for the project is estimated at approximately 250,000 cu.m. cut and 60,000 cu.m. fill, leaving a balance of around 190,000 cu.m. to be disposed of off site.

Four temporary construction depots are proposed adjacent to the line at Caldercruix, Raiziehill, east of Blackridge, and at the proposed Bathgate Station site. There is potential for traffic disruption where construction vehicles and plant use existing roads, particularly in the vicinity of these depots. No information is available (to date) on existing HGV use of the local road network, however it is likely that traffic disruption will be significant in the short term, particularly on the A89 (Airdrie Road).

Significant adverse impacts may arise from construction traffic: this assessment should be reviewed when further project implementation details are available. No other significant construction impacts are envisaged provided appropriate mitigation is implemented.

Appendix P contains the Full Environmental Impact Statement Report.

## 2 Land Ownership and Regulatory Matters

### 2.1 Planning Aspects and Land Issues

We understand that Railway Paths Ltd is the contracted purchaser of the former railway land between Drumgelloch and Bathgate pending conclusion of final title. We further understand that Railway Paths Ltd entered into a binding legal agreement, dated May 1998, with the former British Railways Board, for the ownership transfer of several disused lines nationally, the Airdrie-Bathgate line being one of these lines. However, Railway Paths Ltd has advised us verbally that title has not yet been concluded for the Airdrie to Bathgate former railway line and this should be resolved in the next stages of the project. The ongoing Rail Review will also influence the outcome of this process.

Copies of the plans, which show the land included in the transfer from the former British Railways Board to Railway Paths Ltd, are included in Appendix L and in the appendix to the Land Issues Report.

The Airdrie Bathgate rail re-opening would require to be authorised via a Bill in the Scottish Parliament. The Bill, if passed, would become an Act of the Scottish Parliament (ASP). An ASP can authorise a wide range of matters in relation to the construction of railways, and can be wide enough to do so as a complete package for the convenience of the Promoter. The acquisition of land and rights in land can be acquired, and this can be authorised by the Bill. The resulting ASP operates in the same way as a compulsory purchase order and it is recommended that all land required by the Airdrie Bathgate Re-Opening including the cycle path re-alignment, should be included in the Bill.

Article 3 of the Town and Country Planning (General Permitted Development) (Scotland) Order 1992 grants planning permission for the classes of development specified in Schedule 1 of the Order. Class 29 in Part 11 specifies development authorised by (among other legislative instruments) an Act of Parliament. The extent of the permission granted is restricted in the ways described in Class 29 and the permission given by Article 3 is subject to the requirement for environmental assessment. A Bill that has passed through the parliamentary process to become an ASP therefore operates as a grant of planning permission in respect of the works it authorises.

Existing Railway Paths Ltd agreements, along with encroachments and registrations of land by third parties have been highlighted in the Land Issues Report. Various land related issues, which have arisen from the Cycle Path Re-alignment Study, are also included in the Land Issues Report.

Details of the existing at-grade crossings and access points on the disused section of the rail line between Bathgate and Drumgelloch are also included in the Land Issues Report. For each crossing / access point it is stated whether the crossing would be severed by the proposed rail line re-opening or whether a bridge is proposed. The purpose of this list is to highlight potential severance issues. An assessment of severance issues is being undertaken as part of the Environmental Impact Assessment and is detailed in the Environmental Statement (see appendix P).

### 2.2 Network Rail

As the owners of the railway infrastructure, the support of Network Rail for the project is essential. Some of their key concerns will include permission to work on operational land, technical approvals, and possession planning.

### 2.3 Other Rail Industry Approvals

#### 2.3.1 Franchise Agreement

The Railways Act 1993 requires Strathclyde Passenger Transport Executive, with the approval of Strathclyde Passenger Transport Authority, to be a co-signatory to the ScotRail Franchise Agreement. This reflects SPT's statutory powers to specify passenger rail services in its area. The franchise operator needs to be contracted

operate the new train service and the involvement of the Scottish Executive, SRA, and SPT, amongst others will be necessary to achieve this.

2.3.2 **HMRI approval**

Under the Railways and Other Transport Systems (Approval of Work, Plant and Equipment) Regulations 1994, HMRI have an overseeing role for the entire scheme. Formal HMRI approval is required prior to the facilities being brought into operation and is only obtained upon completion of the works.

Early discussion and submission of information to HMRI is important to highlight any particular requirements that they may reasonably have in relation to the scheme. Any such requirements can then be included in the tender documents. The scheme promoter or his agent will make formal submissions to HMRI and the time scale for this approval is normally of the order of 16 weeks. Thereafter formal approval is given by HMRI following completion of construction and prior to operation.

2.3.3 **Station Change**

Approval for Station Change is required from the Office of the Rail Regulator (ORR), for proposals which affect the amenity or facilities provided at the station. The need and extent for this approval should be clarified through discussion with the ORR. If required a submission for approval should be made early in the detailed design process. It should also be noted that a procedure exists for station closure as a minor station closure. This function was previously within the remit of the ORR but has now been transferred to the Strategic Rail Authority (SRA). It is unlikely that this method is available for this project as the new station is outside the reasonable boundary of the existing station.

2.3.4 **Station and Network Closure Procedure**

The responsibilities for the Station Closure procedure under the Railways Act 1993, Section 41 passed from the Office of Rail Regulator (ORR) to the SRA as result of the Transport Act 2000. The HMRI continue in their previous role. The SRA now assess and publish Closure Notices prior to a decision being made by the Secretary of State.

Network Rail is a steward of the rail network under the terms of the Network Licence 1994 (modified 1999 by ORR). To make changes Network Rail must apply for Network Change approval by ORR.

The Parliamentary Bill procedures could in theory circumvent the need to perform the Station and Network Closure Procedure through current procedures but it is considered advisable to carry them out in order to involve and advise the rail industry of project intentions. In addition, and because the parliamentary process is still evolving there are several areas of uncertainty in terms of reserved and devolved matters. To avoid legal challenge and to ensure the smooth progress of the Bill, it is better not to legislate over existing powers such as the current closure procedures.

In any event, the Rail Passenger Committee (RPC) has a statutory duty to consider any hardship caused as a result of the proposed closure and is required to report to the SRA with comments and recommendations on how to alleviate this hardship and ensure value for money. It would also be important to ensure that the local community and politicians are consulted and kept advised of the proposals.

Once the Closure Notice is submitted a total time period of 12-18 months should be allowed for the Station Closure process from inception to effect. This is taken up by the following activities: 3 months prior warning; 3 months for SRA assessment before Closure Notice published; 7 weeks Objection Period; 12 weeks for Rail Passenger Committee Report; 4 to 9 months for Secretary of State decision.

The ultimate ownership of the land and the new station would need to be resolved at an early stage and the Train Operating Company (TOC) would be required to amend their

Station Licence through the ORR. The Operator would be required to amend the Station Access Conditions to include an amended Annex for the new station. Typically, Network Rail would be responsible for structures and the TOC would be responsible for fixtures and fittings.

## 2.4 TOC Compensation

The principle adopted in evaluating compensation due under a Competent Authority Possession is based on the need to reimburse the TOC for the actual costs incurred as a direct result of the works. There are a number of issues to be addressed including the impact on staffing; the impact on rolling stock; the fare box impact; and service / operations impact

There may be a clear need to assist vulnerable and disabled passengers during the time of any blockade and to provide additional assistance to guide and advise passengers of the temporary arrangements. This may involve providing an additional presence at Edinburgh Park or Airdrie.

As no detailed timetable work for the temporary situation during blockades has been undertaken as part of this study it has not been possible at this stage to come to a view on the likely costs associated with rolling stock requirements.

There is a risk to the revenue as a result of the proposed blockade. Modelling the likely effect will need to assume that there will be a transfer of passengers to adjacent stations but also some shift in the modal share away from rail during the works. The future Patronage and Economics Study will provide data on station usage and anticipated reductions in use. However, previous experience indicates that 25 to 50% of the current patronage will be lost entirely from rail during a bolckade period. This is on the basis that a number of passengers who access the station by car will not drive to other stations but rather drive all the way to their destination. Others will find difficulty in parking at the adjacent stations, leading to a leakage of patronage from the system.

Passengers not so reliant on car as a means of access are more likely to transfer to other surrounding stations. The variation in the fares from these stations can be used to calculate the direct loss of revenue.

## 2.5 Safety Management

Safety Management and Protection Requirements form an important and high profile process for any construction site on or near an operational railway.

Restrictions affecting the construction works include work being carried out within Rules of the Route Possession (Tiii) and major Blockade shutdowns for OLE, Signalling and Permanent Way and other disciplines. This requires tight control of Health and Safety of employees and sub-contractors by minimising the risks associated with the works. This should be achieved by thorough planning and rigorous utilisation of Network Rail Company and Group Standards including the RIMINI hierarchy of protection methods provided by *RT/LS/S/019 - The Protection of People On or Near the Line*.

All project staff must hold the relevant competency certificates prior to commencement of work. All staff that work on or near the line must hold the necessary Network Rail approved qualifications.

To assist with project specific safety management and protection requirements, a Health & Safety Plan should be implemented to outline all activities associated with the works. This plan will be used to identify risks involved and list corrective measures which will be implemented, as far as reasonably practicable, in order to bring and/or maintain the level of risk at an acceptable level.

# 3 Consultations

## 3.1 The Strategy

A Consultation Strategy was developed to ensure that the Study was taken forward with as much visibility as possible. Initial Consultation was carried out with political leaders and key industry sectors. This was followed by consultation with public stakeholders, which included exhibitions and public meetings. Meetings were also arranged with several organisations that have a special interest in the study. The creation of a website and a dedicated telephone line ensured continual dialogue with the public. The media at local and national level were kept fully updated about various areas of the Study.

## 3.2 Political Leaders and Industry

As any major infrastructure project is of great interest to the general public and as railway construction is a devolved matter for the Scottish Parliament the input from the three local MSP's and fourteen List MSPs was very important. Briefing Meetings were arranged with all these available representatives in their constituencies and in the Parliament buildings. The Transport Minister and SRA Chairman have also been briefed on the project, as has Kenneth Hogg, the Senior Civil Servant responsible for the project. Similar meetings were conducted with Local Councillors and the Planning Authority in the council areas of West Lothian and North Lanarkshire.

The industry stakeholders such as SPT, SRA, HMRI, Strathclyde Passenger Transport, Scotrail, the Rail Passenger Committee and several others contributed to the consultation process and Network Rail are now acting in the role of Technical Reviewer.

## 3.3 Public Exhibitions and Meetings

For the public stakeholders Project Meetings were arranged in Airdrie and Livingston followed by well-attended public meetings in Airdrie and Bathgate. Additional meetings were also arranged in Plains and Caldercruix. Some people most directly affected by the proposals have also viewed draft design information in our offices. Meetings were also arranged with several organisations including local golf clubs, an angling club, and a car storage business. To provide ready access to information an Internet website – www.airdriebathgateraillink.co.uk - was created, enabling people to submit and record their queries. To date the site has received over 2000 visits and over 100 e-mail requests for further information. A dedicated phone line (0131 556 1515) was also established. To date this has received over 70 calls for further information. Press releases have been issued covering a number of subjects and dialogue is on going with key media.

## 3.4 Outcome of Consultations

The Consultation Strategy and record of the consultations are included in Appendix R. In general, the great majority of people consulted from many sections of the community and from those who have shown an interest in the project are very supportive of the railway re opening. The most frequent observations from the exhibitions, meetings, website and phone line are as follows;

- The vast majority of respondents were in favour of passenger rail services being re established between Airdrie and Bathgate. The majority of respondents indicated that they would expect to use the rail service.
- Of those who currently used the cycle track literally 100% wanted to see a replacement cycle track.
- The vast majority of people who live in Armadale, Blackridge, Caldercruix and Plains wanted to see stations built in these villages.
- The vast majority of respondents did not want to see the rail line go through Bathgate Golf Course.
- In a survey carried out by Blackridge Community Council over 95 per cent wanted the rail link if a Station was built in Blackridge.
- The vast majority of people saw it as commonsense that the route of the rail line should follow the present cycle track.

- The vast majority of people indicated that they were happy that the line was to be electrified and double tracked.
- The vast majority of respondents were concerned that there would be inadequate parking at stations.
- A small minority of people were concerned about the perceived costs of the project.
- A small minority of people wanted to see diesel trains rather than electric.
- A small minority of people were concerned about environmental issues especially noise if the line was used for freight.
- Many people put forward the points that the rail link would take away the feeling of isolation they felt due to the difficulties in getting to Edinburgh and Glasgow. This included being able to attend College and University; opening up the job market; shopping and visiting friends and relatives.

Further information on the Consultation Process is included in Appendix R.

# 4 Project Programme and Construction Methodology

## 4.1 Strategic Planning

A draft Strategic Plan has been prepared and key dates for guidance are indicated below.

| | |
|---|---|
| Outline Business Case | - Autumn 2004 |
| Appoint Project Manager | - Autumn 2004 |
| Royal Assent | - Summer 2006 |
| Construction Period | - Spring 2007 to Autumn 2008 |

## 4.2 Construction Programming

For any railway project rigorous planning is essential to its success. A draft programme has been prepared using the "Big Bang" approach with a full closure of the operational line at Airdrie to Drumgelloch and from Newbridge to Bathgate for a period of 3 weeks approximately. This should enable the work to be completed efficiently after rigorous planning. This approach should enable construction to take place effectively within a brown field site with a much reduced safety risk compared to construction within a live railway environment. The duration of the works would be significantly shorter than with a conventional possession strategy and this also has a significant impact on cost.

During the temporary situation of the full blockade travellers would have to use Edinburgh Park station in the east, with a temporary bus service going on to Bathgate. It is clear that the planning for such a Blockade needs extremely careful planning and negotiation with all parties concerned and is outwith the scope of this Study.

Given full and proper planning it may be possible to complete the Newbridge Junction remodelling work during the Blockade period

## 4.3 Construction Methodology

The successful tendering Contractor would plan the works to be most cost efficient while taking account of environmental effects of the operations. Part of the next study phase would be to examine better and less disruptive construction methods but a possible sequence of construction is summarised below:

xv) double track the Airdrie Drumgelloch Line, then with a common start date,
xvi) construct new twin track between Drumgelloch and Bathgate tie-in, and
xvii) renew Bathgate freight line, double track between Carmondean and Cawburn Junction and,
xviii) carry out the doubling of the single lead Newbridge Junction

Station works including the relocation of Bathgate Station would be programmed with the track infrastructure, as would necessary bridgework. Commissioning would follow construction work before rolling stock testing and opening of the line to traffic.

The Contractor would most likely opt to set up a number of Works Depots at suitable locations along the proposed railway. These depots would be used for the storage of materials and for site offices and would service about 5 miles of new railway construction. The Bathgate Depot would also service the renewal and upgrade works for the existing freight line and for the track doubling between Carmondean and Cawburn Junctions.

The Depots would be accessed off the A89, which has good links to the M8 Motorway, and new temporary access roads would have to be constructed. It is advisable that the negotiations for the land purchase for the depots and accesses be concluded through the Bill Process before contract award to avoid delay. The accesses might continue to be used for approved access ways for future railway maintenance.

Further detailed technical information including Strategic Planning, Construction Programming and Construction Methodology are included in Appendix O.

# 5 Risk Management

## 5.1 Risk Management

A Cost Risk Workshop was undertaken on 6th April 2004 in the offices of Babtie Group Glasgow and was attended by key Steering Group, study team members and Network Rail D&C Engineers. David Reid, Babtie Group, facilitated it and an Output Report was produced. Risk Management and Value Management has been addressed for the production of the designs, programmes and cost estimates. These form the baseline for the risk and value exercises.

## 5.2 Value Management

Value options were considered as the project outline designs developed and formal value management workshops should be performed in the next stage of the project. It is not expected that the outcome from this will produce any substantial variation from the designs that are presented with this report.

The major options for track layout were addressed and the constraints of the site have led to the best value being derived from the option in the current design. The signalling options considered were determined by the operational demands, and the available options for the permanent way. This resulted in the signalling design that is presented.

## 5.3 Risk Workshops

The risk management process normally requires: -

- a full risk assessment identifying all of the risks associated with a project and likely to have an affect on the programme or the costs
- together with the establishment of a risk register to form the basis of the risk mitigation and monitoring.

It is recommended that the process to date be extended in the future to encompass the full requirements of a risk management process.

The workshop produced a risk register as part of the Output Report for use in managing the risks as the project progresses. The effect of the risks on the budgets was also evaluated and used in the preparation of the project costs.

This risk evaluation exercise should be continued in the next stages of the project to ensure that the risk management process is successfully established, and all of the stakeholders fully understand the risks prior to the commencement of the construction phase.

The Output Report from the risk workshop is included in Appendix T.

# 6 Cost Analysis

## 6.1 Introduction

The Cost Analysis has been prepared for the necessary works for the Airdrie to Bathgate Railway Re-opening. The cost estimates are based upon the drawings and other information developed in the course of the Outline Design Study.

## 6.2 Basis of Cost Production

The cost estimates are base dated at first quarter 2004 and have been developed using the following sources of information;

- Feasibility estimating data taken from similar Babtie Rail commissions within the period 2001 to 2003.
- Design Specialist's experience.
- Professional experience and knowledge.

## 6.3 Estimating Confidence

The works cost estimates are based on the design information as detailed above and all estimates are consistent with the level of detail developed at this stage of the Project.

While the overall confidence level for project cost is addressed through the HM Treasury Green Book requirements discussed below in section 8.7, discipline elements have been individually assessed to an accuracy level of +/- 20%, in line with Network Rail GRIP Level 4 requirements. This confidence level is attributed to each cost element and is intended to cover uncertainty at this feasibility design stage.

## 6.4 Costing Definitions

The project cost analysis is presented in the table below and the terms used have the following definitions:

*Total Construction Cost*
The cost of constructing the works as detailed in the outline design.

*Management Costs*
The construction company costs of head office administration, site set-up, supervision and sub-contract management. Other costs are also encompassed such as Network Rail costs, Promoter's Costs, Bill Procedure Costs, and other 3rd Party Costs.

*Possession & TOC Costs*
Possession & TOC costs for the possession regime suitable for each constructional phase.

*Risk Allowance*
Identified risks have been costed and a further contingency allowance has been made for unforeseen cost risks.

*Total Maintenance Cost*
Renewal and Annual Maintenance costs over the period of the designed life of the project have been omitted from this cost plan.

## 6.5 Key Cost Areas

| Key Costs Items Table | | Base Cost (M) | Option Costs (M) |
|---|---|---|---|
| Permanent Way | | 30.71 | |
| Track Drainage | | 2.87 | |
| Earthworks, base | | 16.24 | |
| | *Hillend deviation, Route 1* | | *49.27* |
| | *Hillend deviation, Route 2* | | *33.52* |
| | *Armadale deviation* | | *15.80* |
| | *100mph linespeed* | | *4.80* |
| | *80mph linespeed* | 1.49 | |
| Structures | - footbridges | 1.10 | |
| | -overbridges | 4.43 | |
| | -underbridges | 3.00 | |
| | -culverts | 0.69 | |
| Stations | - Uphall | 1.23 | |
| | - Livingstone N | 1.46 | |
| | - Bathgate | 2.51 | |
| | *- Armadale* | | *2.63* |
| | *- Blackridge* | | *1.44* |
| | *- Caldercruix* | | *2.96* |
| | *- Plains* | *0.35* | *0.76* |
| | - Drumgelloch | 1.11 | |
| | - Airdrie (incl. 500 space Car Park) | 4.16 | |
| | *Additional Car Parking (excl Airdrie)* | | *2.0* |
| Fencing | | 0.83 | |
| Signalling | | 10.15 | |
| Telecommunications | | 2.71 | |
| Overhead Line Equipment | | 19.05 | |
| Power Supplies | | 6.17 | |
| Utilities | | 6.20 | |
| Mining Stabilisation Estimate | | 6.94 | |
| Environmental Impact | | 4.65 | |
| Cycleway Relocation | | 2.70 | |
| Possessions & TOC Costs | | 2.52 | |
| | *Depot Provision, EMU in East or DMU in West* | | *7.00* |
| | *Queen Street Tunnel ventilation* | | *1.15* |
| **Total Construction Costs** | | **133.27** | |
| **Management Costs** | | | |
| Preliminaries @15% | | 15.20 | |
| Design @ 7% | | 7.09 | |
| Signalling Telecoms & OLE Design & Development | | 1.51 | |
| Main Contractor management costs @ 4% | | 5.33 | |
| Third Party Costs (Network Rail) | | 1.75 | |
| Promoter's Management Costs | | 1.50 | |
| Bill Procedure Costs | | 2.00 | |
| **Total Construction and Management Costs** | | **167.65** | |
| Identified Risk Allowance | | 8.46 | |
| Contingency Allowance | | 13.17 | |
| **Total Construction Cost including Management and Risk Allowance** | | **189.28** | |
| Optimism Bias (28% of Construction Costs excl land purchase) | | 36.87 | |
| **Total Construction Cost including Management and Risk Allowance** | | **226.15** | |

For a breakdown of the capital costs and risk allocation refer to the costing spreadsheets included in Appendix U. The costs provided for Options in the right-hand column of the Table are provided for information in the event that a decision is made to implement that option.

6.6 **Exclusions to Cost Analysis**

The following items and changes have been excluded from the cost analysis:

- Finance costs (including interest charges).
- Electrifying East of Haymarket Junction including Mound Tunnels
- Operating costs
- VAT
- Rolling Stock
- Renewal and Maintenance Cost

6.7 **Cost Risks**

Following the Cost Risk Workshop held on 6th April 2004, the identified risks were tabulated and included in the Cost Analysis spreadsheets contained in Appendix U. These identified risks represent 6% of the Construction Cost.

In addition, 10% of the construction cost (less £1.6M land purchase costs) has also been allowed.

6.8 **Optimism Bias**

From the HM Treasury Green Book and with reference to normal Civil Engineering Works an Optimism Bias of 44% is suggested. Taking this figure less the 6% and 10% allowances for risk and contingency noted above leads to an applicable optimism bias at this project stage of 28%.

See extract of the main report detailing the methodology and philosophy.

# 7 Conclusions

## 7.1 Achievements

The Outline Design Study has developed a good understanding of the operational and engineering challenges involved in re-opening the double track electrified railway line between Airdrie and Bathgate and have assessed the extent of work required on the operational railway at each end. The Study closely examined the feasibility of operating a service of 4 trains per hour train between the cities of Glasgow and Edinburgh and has concluded that it is possible to provide the desired service.

The options for the Cyclepath Re-location have been examined and the necessary consultation with project stakeholders has been well advanced. Several options for the route and for intermediate station provision have also been considered.

From this understanding a cost estimate within the required boundaries of certainty has been produced and a Strategic Programme for delivery of the entire project in 2008 has been prepared. Programmes for design and construction work have also been produced.

The key points of the study with conclusions are highlighted in the following sections.

## 7.2 Train Operations

The train operations study built an electronic model of the railway infrastructure and selected rolling stock using specialised software. The model showed that it was feasible to run 4tph electric powered trains between Glasgow Queen Street and Edinburgh Waverley under certain defined circumstances.

The operation of diesel powered units on the route was not modelled further as the performance was not significantly different from the performance of electric multiple units. It was found that the a new diesel service could not be overlaid onto the existing 4tph Queen Street to Airdrie electrified service and the majority of the current services would need to be discontinued. Other factors such as the possible difficulty of running diesel services into Queen Street Low Level led to the conclusion that the existing SPT electric services should be extended eastwards from Airdrie to Bathgate and Waverley. The existing half-hourly diesel services from Waverley to Bathgate would become part of the new 15-minute frequency electrified service.

To operate the service a double track was confirmed as necessary but no passing loops were required. The design linespeed of 100mph was only achievable for a short length at each end of the new track section with high power rolling stock and no horizontal curvature constraints. A design linespeed of 80mph was selected as the most practicable linespeed for the new line, with a speed upgrade for the existing operational line. Newbridge Junction needs to be doubled at-grade but service robustness levels needs to be agreed with the train operator. There remain operational difficulties with signalling headways east of Newbridge and discussion is needed with those promoting the EARL project to agree common approach to addressing these.

## 7.3 Engineering Design

Using the train operations output the outline design for re-opened railway was completed. Once the topographical survey of the route was available the track alignment was centred on the former alignment as much as was possible except where the design linespeed required longer radii for the design linespeed. This design alignment was used to prepare the signalling design on the re-opened line section and the OLE design from Airdrie to Haymarket East. The drainage proposals were also developed. No level crossings were included in the design and where a crossing was required, bridges were provided.

Our bridge engineers gathered available documentation on all the bridges on the route but because of limited information in certain areas we have had to make some assumptions on the extent of mine-workings and ground conditions. This aspect needs further work. Geotechnical engineering has been progressed as a desktop study and

preliminary on-site investigations were completed. Land acquisition for the line and the relocated cycle track has been addressed, particularly how improved slope design affects the protected route within the former lineside boundaries.

Stations were examined and proposals for their facilities developed both for existing stations and possible intermediate stops.

The Environmental aspects of the design have been considered and mitigation measures have been proposed.

7.4 **Option Assessment**

In addition to the former alignment route base case other options were considered including:

a) *100mph design linespeed on curves*
The train operations study concluded that this requirement of the Brief was not a practicable option, given the relatively small gain in journey time against the high increased cost and additional project risk involved in land purchase.

b) *Bathgate Golf Club Route*
As all trains are expected to stop at the new Bathgate Station the tight curve here is of little consequence and the recommendation is that the golf course option is not implemented.

c) *Two alternative routes south of Hillend Loch*
These routes were selected as an environmental mitigation measure for Hillend Loch. However, to achieve an acceptable railway vertical alignment it would require massive excavations at very high cost and environmental impact. If these routes were selected, Plains and Caldercruix would lose the opportunity of gaining a station now and in the future. For these reasons these alternatives have been discounted.

d) *One alternative route south of Armadale*
This alternative route has been discounted for the same reasons as above

e) *Possible Intermediate Stops*
The train operations study shows that with the constraint of the current Edinburgh Glasgow services at Newbridge Junction, and the associated pathing allowance, it is possible to stop trains at half-hour intervals at two intermediate stations without penalty to overall journey time, either by the same or alternating trains. Should the constraints be removed through the development of other projects such as EARL then the pathing allowance might be reduced or removed entirely, and the intermediate stops would then affect the overall journey time.

In the west we find that Caldercruix has difficulty in achieving acceptable platform gradients because of the physical constraints of an overbridge to the west and a railway viaduct to the east. To change the existing 1 in 50 gradient to the HMRI acceptance standard of 1 in 500 would require major reconstruction of the viaduct and the road overbridge at considerable cost.

Plains does not have these engineering challenges but is close to the existing Drumgelloch Station and consideration should be given to a possible combined station.

In the East, the possible site for a station at Armadale is also on a steep 1in 50 gradient. However, this is more easily improved towards 1 in 500 (or perhaps 1 in 150 depending on HMR acceptance) as the physical constraints are less. The possible site at Blackridge has an acceptable gradient and therefore requires less engineering work to provide but is remote from the village and has poor road access.

*f) New station location at Bathgate*
Three possible sites for the re-located Bathgate Station were assessed. These were on the former alignment route at Whitburn Road and off the A89 Edinburgh Road as well as a location on the golf course alignment. For ease of accessibility and availability of car parking space the A89 Edinburgh Road site is considered the preferred location.

7.5 **Recommended Engineering Solution**

The engineering work done in the course of this Outline Design Study leads us to conclude that the delivery of a 4tph electrified service from Glasgow Queen Street to Edinburgh Waverley is feasible on the re-opened railway via Airdrie and Bathgate. The engineering work required has been adequately developed to present a cost estimate within the required confidence limits, notwithstanding that some work remains to be done on site investigations, bridge assessments and on surveys on the operational line.

We conclude that constructing the re-opened line on the former route alignment is preferred. The works can be contained within the existing lineside boundary but should move outside where earthworks considerations dictate and where additional land is required in any event alongside the railway for the cycle track. The design linespeed is taken as 80mph, which requires realignment of the track at only two locations near Armadale.

Intermediate stops are possible at two locations within the timetable. Further study work on patronage and train operation economics is necessary before a preferred stop location can be recommended.

7.6 **Delivery Programme**

A Strategic Programme for the entire project was prepared. It indicates that it is possible given dedication and careful planning to deliver an operating train service in late 2008, taking into account the further studies required, the Parliamentary Bill process and Rolling Stock procurement.

11.1 **Recommendations**

11.2 **Work Arising**

This Outline Design Study has performed its role by examining the necessary engineering for the project and by developing a cost estimate to the required accuracy for this stage. The study represents very significant progress one year into a 5 ½ year delivery period for the desired operational service.

However, there remain a number of activities that should be progressed to reduce engineering and cost risks. These works will continue the good progress on the project and ensure that the "level 4" Design Stage can progress with sufficient information. These are summarised in the table below:

| Item | Description | Commentary |
|---|---|---|
| a) | Consultations with Network Rail and other Stakeholders | Additional discussions are required within industry |
| b) | Train Operations | Rail and other project interfaces to be resolved |
| c) | Geotechnical and Mineral Investigations | Completion of approved and additional Site Investigations |
| d) | Bridge Assessments | Limited availability of bridge assessments needs remedied by programme of assessments |
| e) | Permanent Way, signalling, OLE and other disciplines. | Operational line and Newbridge Junction surveys and completed design for route. |
| f) | Utility Site Investigation | Intrusive site investigation for utilities, particularly high-pressure gas mains. |
| g) | Earthworks and Land Boundaries | Confirm slope design and new lineside boundaries |
| h) | Programme Development | Develop programmes and confirm possessions and Blockade times |
| i) | Cycle Route | Third option "on-off road" planning |
| j) | Value Management | Option and design Workshops |

The patronage and the economics of service operations were not part of this study. Therefore, this important aspect of study should be commissioned before proceeding with more detailed design work.

It would also be useful to build on the experience of other projects by preparing a paper on the Parliamentary Bill process. Also of use would be a paper on the experience being developed on the Larkhall Milngavie construction project.

Now that the public consultation process is well under way it should be continued. The website should be maintained along with the dedicated phone line and answers to questions provided.

11.3 **Further Study Works**

The Outline Design Study has identified the engineering infrastructure issues and their associated costs to deliver an operational railway between Airdrie and Haymarket East Junction. This has been achieved through a mix of onsite surveys, examination of archive records, discussions with industry stakeholders and professional experience from similar projects.

However, it is acknowledged that certain aspects of the study and areas of work still carry risks higher than we consider desirable. Therefore, we recommend that the Study be

extended in the following key areas before or concurrently with the Patronage & Economics Study and before the "Level 4" Design Stage.

a) Consultations with Network Rail and other Stakeholders
As Network Rail's involvement in the project began towards the latter stages of the study it is likely that we have not benefited fully from their expertise. Similarly, the HMRI have not had made informed comment on the design proposals. We recommend that consultations be continued with these and other industry stakeholders.

In addition, Babtie Group staff has previously developed invaluable experience in the preparation of the Outline Design of the Larkhall Milngavie Lines Re-opening Project and subsequent input to the planning process. Important lessons for Airdrie Bathgate are no doubt being learned as the Larkhall Milngavie project moves into construction and we recommend that the selected Project Management and Design Team for the next stages be afforded the opportunity of maintaining an observer's role.

b) Train Operations
The train operations work to date provides a high level of confidence that 4tph service can operate over the line. However, it also highlights deficiencies and makes a cost provision for signalling headways between Newbridge Junction and Haymarket West Junction. The interface with the EARL project is very important also, as is the work to the Newbridge Junction signal relay room.

We recommend that further study work be carried out on these aspects of the project as well as the production of a definitive timetable taking into account decisions made on the provision of intermediate stations. Operations planning work is also recommended in order to assess the temporary train services during the construction works.

c) Geotechnical and Mineral Investigations
We recommend that the preliminary site investigation work already completed be extended as necessary.

d) Bridge Assessments
Difficulties were experienced during the Study in obtaining existing bridge assessment data from Network Rail, Railway Paths Ltd and the Councils, North Lanarkshire and West Lothian. We have made conservative assumptions on bridge condition and load capacity from available records and site inspections but the project risk would be better informed if a programme of detailed Bridge Assessments and gauging studies for all bridges on the operational and non-operational line was carried out.

Similarly, although an assessment of retaining walls has been done, records are lacking at present and a complete search of Network Rail records is essential.

e) Permanent Way
The Outline Design developed the permanent way proposals with a base case design for horizontal and vertical alignment broadly following the former railway alignment and without intermediate stations. This led to a decision on a design linespeed through bends of 80mph resulting in curve realignment at only two bends each side of Armadale. We recommend that the permanent way design be re-examined to ensure the most economic design

Network Rail has indicated that the renewals programme for the Bathgate line is fairly extensive and includes renewal of Newbridge Junction in year 2006-07. We

recommend that a detailed programme of works be developed to ensure that no abortive work is undertaken and that full synergy is achieved.

f) Utility Site Investigation
An early enabling works package is required to ensure that intrusive investigations are undertaken, in conjunction with the Undertakers. This should allow a more robust assessment of the necessary protection and diversion works for the utilities affected by the railway reopening. It is also essential before the commencement of construction works.

g) Signalling and OLE
For the same reasons as those mentioned for P-Way the signalling design and the OLE design should be further assessed for the selected design alignment. This work will take into account the archive data released by Network Rail as well as their expert input on engineering matters.

h) Earthworks and Land Boundaries
The Study has assumed land boundaries based on a conservative 1in 2 slope from the track solum. This has led in most locations to a wider land boundary than the former lineside boundary fences. This work should be developed to the stage of the preparation of the Limits of Deviation plans suitable for the future Parliamentary Process and land purchase negotiations.

i) Programme Development
The Strategic, the Design, and the Construction Programmes provided in Appendix O and discussed in the previous section indicate a possible plan for delivery of the project in year 2008.

A key part of the programme is the early booking of Blockade and long weekend possessions. It is essential that these be discussed as early as possible with Network Rail and all those affected including the TOC and other railway users and maintainers. Also identified in the Strategic Programme is the procurement programme for Rolling Stock. This process should be started as soon as possible. Key to everything of course is the Parliamentary Process. Lessons learned on the Stirling Alloa Kincardine project must be brought into play for Airdrie Bathgate.

We recommend that these programme issues be developed as early as possible.

j) Cycle Route
An Option for the Cycle Route re-alignment is to have the “on-road” section only where the route passes through the villages with a return to the “off-road” railway section once the route leaves the built-up area. Although the preferred route as agreed with the stakeholders is for the entirely off-road option the combined option deserves some further consideration.

**Annexe to Report**

**The Study Brief**

**The Study Brief**
To add insight to the study findings it is useful to refer to the study brief issued by West Lothian Council. This is reproduced below for information.

**v) Introduction**

The Project Brief requires that the Consultant should conduct an engineering appraisal of the former railway route between Airdrie/ Drumgelloch and Bathgate with the purpose of assessing the work required to re-instate a double track railway line from Airdrie to Bathgate. This would permit services to operate between Glasgow and Edinburgh via this route. The route should be designed for passenger use with the ability to operate freight services.

The main aim of this proposal is to carry out a thorough study of the requirements for the reopening of the line to allow a fast service with a 15-minute frequency between Edinburgh and Glasgow, serving and linking the adjacent communities within West Lothian and North Lanarkshire. In addition, existing local services would be retained and possibly enhanced, to provide attractive public transport link options to various development opportunities within the east of Glasgow, Livingston, and Edinburgh Park, amongst others.

The technical, operational and cost implications of providing stations at communities along the route were to be examined. The assessment of patronage and service economics of any additional stations is excluded from the study but will form the basis of the next stage of the study.

The initial CSTC assumptions were that the line would be double tracked and electrified throughout, with the potential of extension of Helensburgh and Balloch services beyond Airdrie and Drumgelloch to Edinburgh. Services could also operate to Paisley and Glasgow Airport. The likely route is split between active parts of the Scottish rail network and a section between Drumgelloch and Bathgate where the previous rail alignment has largely been converted to cycleway (“the former alignment”).

**vi) The Outline Design Study**

For the former alignment considerable work will be required to bring it back into use as a modern passenger railway. This is envisaged to include:

- laying track along the entire route length to current standards;
- realignment of sections of the route to meet the line speed criteria and utilise the available solum;
- assessment of impact and identification of possible mitigation options for residential and other developments adjacent to the proposed alignment;
- assessment of and proposed remedial works to the numerous bridges, culverts and retaining walls along the route;
- upgrading or closure of various level crossings;
- electrification of the route;
- installation of an appropriate signalling and telecommunications system along the route;
- associated civils works along the route;
- location of potential new stations; and
- re-alignment of the existing cycle route.

Works are also likely to be required on the existing railway to ensure there is sufficient track capacity to accommodate the new services and to electrify those sections that are not currently electrified. This will potentially include:

- An assessment of works necessary to re-double the Airdrie – Drumgelloch and Bathgate – Cawburn Junction sections of line;
- An assessment of clearances and works necessary to electrify the line from Airdrie/Drumgelloch to Haymarket;
- Construction of passing loops between Glasgow and Airdrie;
- Changes to signalling
- Upgrading of overhead line equipment and power supplies.

Key features of the brief specific to the several engineering disciplines involved are presented below.

**vi) Train Operations**

The construction and operation of the line is to be considered with and without intermediate stations between Drumgelloch and Bathgate and an Operational Review is to include an investigation of capacity and timetable constraints. This is especially important for the service interaction at both ends of the route. The Operational Review is to investigate and identify:

**a)** Operational constraints for a 15-minute headway service between Glasgow and Edinburgh – with and without additional stations.
b) Operational issues relating to the use of diesel or electric multiple units.
c) Extension of existing Airdrie/Drumgelloch services to Edinburgh or additional services.
d) Effect of Bellgrove/High Street/Queen Street capacity problems.

The assumption is that 4 paths per hour are available through Haymarket West junction in each direction.

**vi) Land Constraints**

Land constraints are to be identified with land plans that show

a) Existing railway land available for rail use
b) Former rail solum available for re-use
c) Former rail solum not available for re-use, what the current use is, and in these cases feasible alternative line(s) of route.

**vi) Engineering Appraisal**

**vi) Permanent Way**

An initial design based on the existing alignment is to be developed to current standards for the permanent way. Account should be taken of necessary formation preparation works and trackbed requirement. Consideration should also be given to retaining and re-using existing materials where possible. It is also envisaged that the alignment and associated earthworks will be accommodated within the existing boundary fence lines of the former railway wherever possible and sensible. However, alternative alignments should be considered where there are particular technical and environmental issues that suggest considering a broader range of options.

The desirable design line speed for the passenger line is 160 kph (100mph). However, in order to ensure best value the best achievable line speed should be used if lower than the design value and likely to result in significant cost savings.

There are no level crossings on the existing lines between Glasgow and Drumgelloch and between Bathgate and Edinburgh. The existing level crossings on the Drumgelloch –

Bathgate section of route will not be reinstated but will either be closed or replaced with bridges.

vi) **Structures**

Existing structures are to be appraised including support abutments and wing walls, such appraisal including residual life, cost of refurbishment, and cost of replacement Underbridges must conform to RA10 loading requirements and HTA 102 tonne bogie hopper wagon loading requirements. The required structure gauge is W9.

Some form of structural assessment work will be required to verify the load capacity and structure gauge of the existing bridges, and to identify and develop proposals to provide RA10 and HTA capacity. The Consultant shall develop the design to include any mitigation measures required to achieve the loading and gauging requirements. It will be appropriate for the Consultants to liaise with Network Rail and the Strategic Rail Authority to establish if this route is likely to be used by freight in the future and to confirm the required loading and structure gauges.

There may be a requirement for new footbridges and the Consultant should include any such footbridges within the feasibility study. Initial designs should be developed for these structures in accordance with current design standards. Particular attention should be paid to the requirements of the Disability Discrimination Act and the Strategic Rail Authority's publications.

vi) **Earthworks and Geotechnical Issues**

The Consultant shall undertake sufficient site investigation works to complete an initial design. The Consultant shall interpret the findings of any available desktop information and the site investigation in order to develop the initial design. Design parameters used and assumptions made regarding geotechnical issues shall be clearly documented.

All existing earthworks should be reviewed as part of the feasibility study and any resulting earthwork stabilisation, geotechnical remedial or mitigation measures should be included in the feasibility study. The design of any new earthworks should be developed as part of the feasibility study where necessary.

The project lies within an area of historical coal mining. Particular attention should therefore be paid to coal mining issues and mitigation measures included in the feasibility study where necessary. Contaminated land may exist at various locations along the route, including some due to fly tipping. Remedial measures should be developed where necessary as part of the feasibility study.

vi) **Stations**

It is considered that Bathgate station may need to be replaced by a new station to allow through running of trains. The Consultant should consider options for the station location and produce a feasibility study for the preferred option. The platforms at the stations need to accommodate 6-car (23 metre length vehicles) sets with (if possible) the potential for subsequent extension to 9-car.

The station design work is to incorporate work directly related to the railway, such as track, platform and associated trackside facilities such as station car parks and inter-modal change. The stations will incorporate closed circuit television (CCTV), customer information systems and talkback facilities linked to Dunfermline Control Room if appropriate.

**x) Drainage, Public Utilities and Fencing**

The entire drainage system is to be assessed and an initial design developed for providing adequate drainage along the route. In addition, all discharges must be designed in accordance with Scottish Environment Protection Agency's best practices. The drainage design will incorporate elements of cleaning, regrading and repair work to existing culverts, and the design of new culverts and scour protection works where necessary.

An assessment of the impact of the works on existing public utilities should be incorporated in the feasibility study and cost estimate along with any necessary diversions and accommodation works

The existing fencing on the former alignment will require replacing/repairing to upgrade it to current safety standards. A design should be proposed to provide an adequate level of protection to the route. Particular attention should be paid to road/rail interfaces and areas where vandalism and trespass may be of significant concern.

**i) Signalling and Telecommunications**

An initial design should be developed for the route using modern, innovative and approved methods. The signalling system is to be designed to cater for the predicted passenger traffic, the interface at each end of the route and must be compatible with and tie into the existing Network Rail signalling equipment.

The signalling design should incorporate all necessary associated telecommunications apparatus, including CCTV cameras, power supplies and any related civil works. Where possible the signalling design should take account of the actual traffic characteristics and the achievable line speed to optimise the design and layout of all signalling equipment.

**ii) Costing Appraisal**

A detailed cost estimate for the entire project must be compiled to +/- 20% accuracy. The cost estimate should be based on the initial design developed as part of this project, and should include all costs associated with the project, including design fees, parliamentary fees, service diversions and such like.

**iii) Project Risk Register**

Project Risks that would hamper the final delivery of the line reinstatement are to be recorded along with mitigating actions and timescales.

The risk assessment should identify potential safety issues such as the potential for head-on collisions, side-impact collisions, derailments, and positions of safety. It should also propose solutions for derailment containment and other safety improvements. Particular attention should be paid to level crossings and structures, in order to minimise the potential for conflicts with other modes of travel. The register will be used in discussions with HMRI, and hence should be maintained as a live document.

**iv) Environmental Assessment**

An Environmental Impact Assessment in accordance with current UK and European Legislation is required together with an Environmental Statement (ES) and a Non-Technical Summary.

**v) Alternative Cyclepath Alignment**

Design and costing of an alternative alignment for the cycleway that currently follows the line of the former railway between Airdrie and Bathgate.

**vi) Public and Statutory Consultation**

Initial public and statutory consultation is necessary to develop the feasibility study. Sufficient presentations and public consultation shall be undertaken to ensure that any major objections to the scheme have been identified and addressed within the feasibility study as far as reasonably practical and all statutory requirements have been met.

A Public Relations manager is appointed under a separate commission to prepare and implement a strategy to communicate with the public and achieve acceptance of the scheme.

**Appendix A**
**Train Operations**

**[image not available]**

**Appendix B**
**Permanent Way**

**[image not available]**

**Appendix C**
**Railway Cess Drainage**

**[image not available]**

**Appendix D**
**Bridges & Retaining Walls**

**[image not available]**

**Appendix E**
**Earthworks, Mineral and Geotechnical Survey**

**[image not available]**

**Appendix F**
**Public Utilities**

**[image not available]**

**Appendix G**
**Station and Access Facilities**

**[image not available]**

**Appendix H**
**Signalling**

**[image not available]**

**Appendix I**
**Telecommunications**

**[image not available]**

**Appendix J**
**Overhead Line Equipment**

**[image not available]**

**Appendix K**
**Power Supply**

**[image not available]**

**Appendix L**
**Land Boundaries**

**[image not available]**

**Appendix M**
**Cycle Path**

**[image not available]**

**Appendix N**
**STAG Comments**

**[image not available]**

**Appendix O**
**Programming/Phasing**

**[image not available]**

**Appendix P**
**Environmental Impact Statement**

**[image not available]**

**Appendix Q**
**Regulatory Legal/Commercial (NOT USED)**

**[image not available]**

**Appendix R**
**Consultations**

**[image not available]**

**Appendix S**
**Drawing Schedule**

**[image not available]**

**Appendix T**
**Risk/VM/HAZOP Studies**

**[image not available]**

**Appendix U**
**Cost Analysis**

**[image not available]**