

Bailey Bridge possible means of temporary access with flood openings under embankment

Reinforced concrete bridge under A4, jacked box or in-situ construction

Retaining wall wing walls angled to provide sighting distances for slip road traffic

Box or portal jacked under railway line ext. dimensions 12.0m wide x 7.5m high

Public footpath right of way to be diverted at level crossing

Car park area 3.27 hectares

Level crossing sole means of access to Bathampton Farm to be closed upon completion of the works

Electricity sub station

Proposed station platform 185m long

Hampton Rocks Cutting SSSI

Alternative access track to timber yard

Canal bridge 4 ton axle limited and hump unsuitable for large vehicles

SITE PLAN
Scale 1 in 1250

NOTES
1

250 0 250 500
1:1250

Revision	By	Checked	Approved	Date	Description

Client
Bath and North East Somerset Council
The Guild Hall, High Street, Bath BA1 5AW
Tel 01225 477000 Fax 01225 477000
www.bathnes.gov.uk

Halcrow Transportation Infrastructure
Burdock Park, Salway, Wiltshire SN4 0GD
Tel 01793 812479 Fax 01793 812089
www.halcrow.com

Halcrow

Project
BATHAMPTON PARK & RIDE

Drawing
GENERAL ARRANGEMENT

Drawn by JCS Date: 21/01/13
Checked by Date:
Authorised by Date:
Drawing No. **204269-001** Revision
Drawing Scale: 1:1250 at A1 Plot Scale: 1:1
CAD Filename: Plot Scale: 1:1

Drawing No. 204269-001, Name: 1:\01\1250\General Arrangements\204269-001_Bathampton Park & Ride.dwg, User and Plot Date: 21/01/2013 11:11 AM

Latest News

[Birse Rail completes 'Access for All' improvements at Slough Station](#)

[May is Sustainability Month at Balfour Beatty](#)

[Birse Rail hands back 'Access For All' scheme at Sittingbourne Station](#)

[Birse Rail awarded £16m contract on the Birmingham Gateway project](#)

[Birse Rail awarded two Building and Civils Delivery Partnership Contracts](#)

[News Archive >>](#)

Petts Hill Underbridge Reconstruction

Customer: Network Rail

Petts Hill railway bridge carries the Chiltern Line over the road on the boundary between Harrow and Ealing, immediately south of the junction of the A312 (Northolt Road) and A4090 (Alexandra Avenue). It was a 'bottleneck' for all traffic and had been identified as a source of delay to buses because of the restricted width of the carriageway under the bridge.

Birse Rail was appointed to replace the existing structure in order to accommodate a four lane carriageway with footways and cycleways on both sides.

Works included the installation of four 3.6m overall diameter caisson-constructed reinforced concrete piles. The piles, which were approximately 22m deep, carried the transverse precast reinforced concrete crosshead beams and provided direct support to the bridge superstructure. The bridge abutment walls and wing walls were formed by contiguous bored piles which provided earth retention and resistance to train surcharge loading.

Demolition of the existing structure and installation of the new bridge deck took place during a 60 hour possession over Christmas 2008.

Innovation

The original design for the works to Petts Hill railway bridge was based on using four large diameter bored piles installed during possession to support the new bridge deck. The use of piling rigs to install the piles would necessitate possession access requiring additional cost and programme time to complete.

Birse Rail's alternative solution involved replacing the existing bored pile solution with four 3.6m diameter Caisson piles which allowed the works to be undertaken in normal working hours.

The piles were constructed using low headroom equipment and were positioned such that a fenced 'green zone' could be established adjacent to the running lines.

The benefit of this approach was a significant reduction in the number of possessions required to construct the caissons. Furthermore, during the tender process Birse Rail was able to develop the alternative solution to AIP status and offer this to the client. This approach led to a reduced design programme for Birse Rail's alternative solution.

[// show all case studies](#)



Birse Rail Limited is a company registered in England & Wales (company number 4319685) with its registered office at 86 Station Road, Redhill, Surrey, RH1 1PQ.

A  Company

Copyright © 2010 Birse Rail Ltd

Website by Fat Media

[About us](#)

[History](#)

[Our People](#)

[Awards](#)

[Innovation](#)

[Assurance](#)

[Health and Safety](#)

[Quality](#)

[Environment](#)

[Sustainability](#)

[St](#)

[Ca](#)



Vehicular under-bridge, M1 motorway, J15A,

Northamptonshire, England

45m long, 14m wide, 8.5m high



The improvement of Junction 15A on the M1 motorway was a requirement of the planning consent for the Swan Valley Industrial area. The existing junction consists of a two lane underpass beneath the motorway, with roundabouts on each side servicing the M1 slip roads. The capacity of the junction was to be increased by providing a second underpass and remodelling the roundabouts.

In order to minimise disruption to the 112,000 vehicles which daily use the motorway the new underpass was tunnelled under the M1 using the 'Jacked Box Tunnel' technique rather than by conventional 'cut-and-cover' methods that would have involved diversions, lane closures and contra-flow systems. The under-bridge was to be installed at a minimum of 1.5m below the motorway surface.

The ground conditions consisted of stiff clay and glacial deposits with clay fill and pulverised fuel ash in the motorway embankments. The water table was below the box.

A three level concrete cellular shield with steel cutting edges was used. Face excavation in the upper cells was carried out by miners and in the middle and lower cells by machine excavators. The motorway was monitored for movement throughout the construction and installation periods.

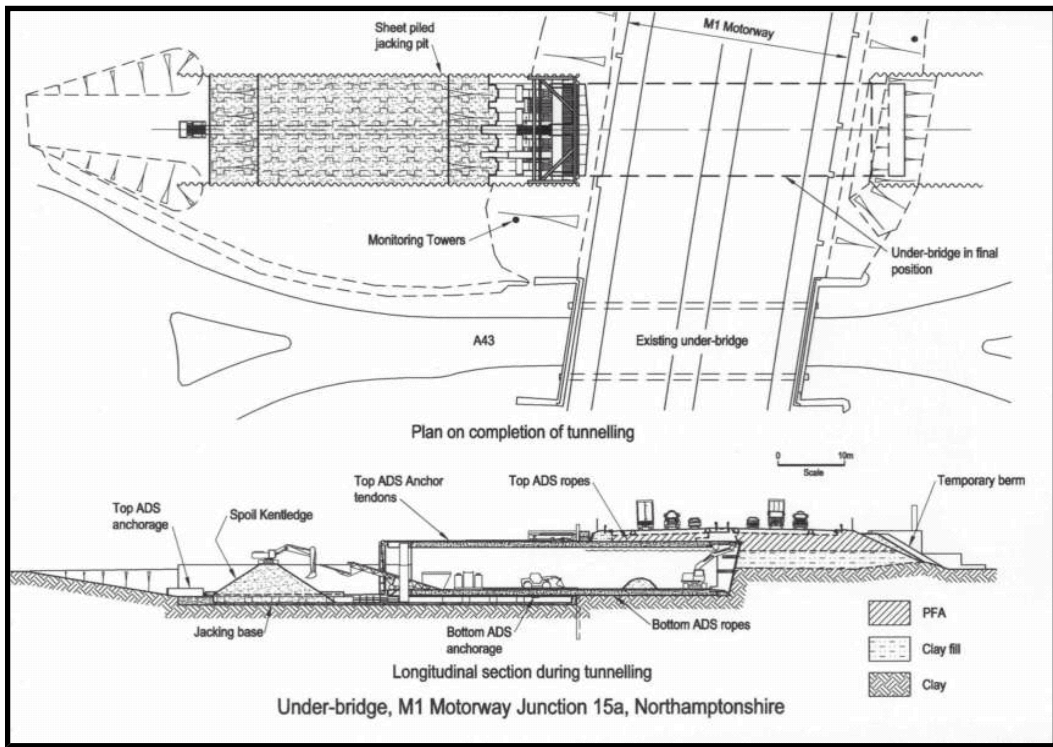


The patented 'anti-drag system' (ADS) was used at the top and bottom of the box and anchored to the jacking base. Due to geometric constraints the top ADS was anchored at each side to the sheet pile side walls of the jacking pit, and at the centre by a series of tendons that were passed around pulleys mounted on the back of the box and then fixed to anchorages at the rear of the jacking base. Jacks were used at the tendon anchorages to compensate for stretch in the tendons as the load in the tendons progressively increased to around

350t.

The tunnel was installed to within 30mm of level and 60mm of line and required a maximum jacking thrust of 4,500t. The jacking operation took three weeks following headwall entry and was successfully completed in December 2002. Surface movements were well within specified tolerances and motorway traffic continued uninterrupted throughout.

The first application of the technology beneath a live motorway proved to be highly successful.



Client: Highways Agency

System design: John Ropkins Ltd

Contractor: Edmund Nuttall Ltd

Scope of work: Design and construct

Contract period: 17 months

Completion date: April 2003

[Menu - Home](#)

© John Ropkins Ltd

Technical note

Project Bath Eastern Park and Ride Option Sites
Subject Site H: Bathampton Junction - Bridge Works
Author John Sreeves
Date 22 January 2013
Ref 204269.AI.00.09/App C

1 Introduction

In order to ease traffic congestion in Bath, a possible Park and Ride (P&R) scheme is proposed at Bathampton junction. This P&R option would be rail based making use of train services that currently serve the route to or from Trowbridge and Westbury. A new railway station with parking facilities would be required; this station being alongside and east of the location of the previous station that closed to passengers in 1966.

The following entries were extracted from The Bristol Railway Archive; http://bristol-rail.co.uk/wiki/Bathampton_Station_and_Junction, and gives the history of the Bathampton station site:

- *Opened on 2nd February 1857;*
- *Closed to goods services on 10th June 1963 and passenger services on 3rd October 1966;*
- *Both Bathampton and Bathampton West signal boxes were replaced by a single box on 21st September 1956; and*
- *There were sidings to a timber mill on the south side of the station which came into use on 10th October 1922.*

Bathampton forms a junction between the London to Bristol main line and the Trowbridge line. Historical maps show that the original station had platforms flanking the main line west of the junction divergence point, thus trains on both the mainline and the branch could serve the station.

The A4 Batheaston bypass opened in 1996 and this runs parallel to and immediately north of the London to Bristol railway line for a distance of 1.5km. Direct vehicular access from the

Prepared by	John Sreeves	Date	22/01/13
Checked by	David Lear	Date	11/02/13
Approved by	David Lear	Date	11/02/13

P&R to the bypass is proposed. This Technical Note considers the engineering issues and potential costs associated with bridging under the Great Western Main Line (GWML); and also under the A4 to create a new 'diamond' interchange.

2 Bridge Engineering Works

2.1 Proposed Concept

Road access is envisaged from the A4 Batheaston bypass to the P&R via a grade separated junction on the A4 and a bridge passing under the GWML. At this point, 375 metres east of Mill Lane over bridge, the railway and the A4 road are approximately at the same level, and the road is at the summit of a crest curve. This gives maximum headroom availability underneath the road. On/off slip roads in both directions flanking the dual carriageway descend at gradients of about 5%.

2.2 Construction Methodologies

The two bridges under the A4 and railway line need to provide a minimum internal width of 10.3m based upon two 3.65m lanes and 1.5m wide verges (TD 27/05). There will be a need for wing-walls in the form of retaining walls at either end splayed back to satisfy sighting distance criteria. The minimum headroom required is 5.3m to be provided over the full width of the carriageway and verges, to which must be added an allowance for cross fall and longitudinal drainage gradient. The thickness of the roof, walls and floor for a reinforced concrete box would be about 0.85m resulting in external box dimensions in the order of 12.0m wide and 7.5m high. On top of the box must be added 0.468m for track and 0.35m for ballast and waterproofing, thus total construction depth would be a minimum of 1.668m from soffit to rail level.

Possible forms of construction include:

- Jacked box advanced through the embankments under live traffic (example: M1 J15a). **Refer to Annex A;**
- Jacked box constructed off line for positioning during an extended possession (example: Owen St, Tipton, <http://www.halcrow.com/Our-projects/Project-details/Owen-Street-Relief-Road-England>);
- Portal structure constructed off line and slid into place on guides pre-placed within small tunnels within the base of the embankment; the slide taking place during an extended possession (example: Chippenham A350 bypass http://www.hochtief-construction.co.uk/bridges_holywell.shtml);
- Railway Bridge Only: A conventional half through steel bridge superstructure on transversely spanning crossbeams supported by large diameter piles or caissons at each corner. The piles are bored outside the railway clearance so do not interfere with operations. The bridge is lifted in by crane during a short possession (example Petts Hill <http://www.birserail.co.uk/Case-Study/Petts-Hill-Underbridge-Reconstruction>). **Refer to Annex B**
- Road Bridge Only: in-situ concrete construction with traffic diverted along the slip roads that would be constructed in advance.

A major consideration is avoidance or minimisation of disruption to railway operations. Possession planning often requires a three year lead in time and 'extended possessions' up to four days or more are typically only available at Christmas and Easter. The box jack under the M1 motorway at junction 15a was accomplished without any interruption of traffic; in this case the top surface of the box was 1.5m below the highway running surface. Such an approach would be preferred if acceptable to Network Rail albeit a temporary rail speed restriction would be necessary for a period of about three weeks.

At the proposed bridge location, the A4 road is in a cutting about 3m to 4m deep as shown in the photo below, looking eastwards:



Photo 3.1 View east along the Bathampton bypass at proposed under-bridge location

The raised earth profile currently occupying the space between the road/railway and on the north side of the road would have to be fully removed and a cutting excavated in its place over a distance of some 400 metres in order to accommodate the slip roads on descending gradients. The depth of these cuttings would need to reach about 7m below existing road level to gain sufficient headroom for turning vehicles to pass under the road and railway bridges, to which must be added a further volume of excavation to represent the height of the ground above existing road level at the site. Subject to soil investigation and slope stability considerations, a 1 in 2 side slope may be expected, requiring a top cutting width of around 37 metres at the level of the A4 road. This width would fully occupy the space between the road and the railway, suggesting the need for retaining walls to ensure slope stability at the toe of both of the road and the railway embankments.

Drawing No 204269-001 in **Annex C** shows a General Arrangement of the bridge and allied slip-road works with possible bridge construction forms indicated.

2.3 Construction Access

The triangle of land proposed for the area of the P&R car park is land-locked with the railway on two sides and the River Avon on the third side. The only means of access at present is via the level crossing to Bathampton Farm, and this is at the end of the single track no-through Tynning Road. The former accommodation bridge under the railway next to Bathampton Farm was filled in when Batheaston Bypass was built.

The level crossing has user worked gates with miniature lights to indicate approach of trains. The road approach to the level crossing from the west is on the inside of the railway curve with reduced sighting distances of and from trains. Despite the use of gates and lights, use by frequent construction traffic would increase the risk of a collision between road and rail vehicles. Tynning Road itself passes a primary school and can only be reached via the toll bridge to the north (4 ton weight limit) or a humped canal bridge to the south (4 ton axle limit shown on a heritage sign). Both of these bridges are historic and Grade 2 listed.

Use of Tynning Road and the level crossing for large volumes of construction traffic and materials would be impractical and unacceptable. Consequently all construction activities for both P&R bridges under the A4 and railway would have to be carried out from the north of the railway. Furthermore, since the space between the A4 and the railway would need to be excavated for the junction slip roads, it follows that the construction compound can only be north of the road.

Any off line construction of a new railway bridge (e.g. jacked box or portal) will need to be as close as possible to its final position in order to be viable. Therefore such construction would need to be immediately south of the railway; subject to access constraints discussed above being overcome, or north of the railway in the narrow strip of land between the railway and the road. For in-situ railway bridge construction similar to Petts Hill, the same proximity requirements would apply for crane positioning.

To obtain sufficient working space and a site compound in the area between the railway and the road; the area would need enlarging by temporarily narrowing the A4 dual carriageway to single lanes in each direction and diverting to the north. The northern extremity of the road diversion would ideally be maintained within the future highway footprint to minimise encroachment onto the flood plain further north. Working space thus obtained would be sufficient for construction for both the railway bridge the road bridge. Depending upon the limitations of the available space that could be obtained by this method; construction of the two bridges is likely to be consecutive as opposed to concurrent. As such; a construction period of up to 18 months would be needed, during which the temporary traffic diversion with speed restriction would need to be in force on the A4.

The option of having the site compound and working area wholly to the north of the A4 is unlikely to be feasible since any off-line railway bridge construction would be more remote from its final position. The temporary working area required would be likely to extend beyond the future highway boundary into the flood plain to the north, with greater risk to the project, environmental impact and the need for remediation measures.

3 Other Structural Works and Issues

3.1 The Grange and Mallard Cottage

There will be a need for a retaining wall at the back of the gardens of The Grange and Mallard Cottage to support the foot of the cutting which needs to be widened to accommodate the new track alignment. There used to be an accommodation bridge crossing over the railway in this area; probably demolished as part of the Batheaston bypass works. The presence of foundations and old abutments should be expected in the area just north of The Grange, and the need for removal of these obstructions should be expected. The likely extent of this retaining structure is shown on Drawing 204269.001 (Annex C).

3.2 Multi-Storey Car Park

The area earmarked for the car park is on rising land between the two railway lines as shown on the aerial Photo 3.2 below.



Photo 3.2 <http://bristol-rail.co.uk/wiki/File:Bathamptonjunction6.jpg>

Substantial volumes of excavation will be needed to create a three storey car park, and the basement retaining walls will need to be sufficiently deeply founded to secure the railway embankment against slope instability. The lowest level of the car park is likely to be affected by extreme flood events, as the Environment Agency flood map envelopes the whole of Bathampton Farm (just off the right of the picture above). To minimise disposal costs, all of the excavated material could be reused on site to create a flood bund to the east of the site; which would offer an environmental screen as well. However, this will impact on land within Flood Zone 3 (High Risk) and, as such, flood compensation works may be a requirement.

The presence of a Pleistocene-aged rock outcrop in the nearby Hampton Rocks Cutting SSSI gives an indication of what may lie beneath the surface, subject to a fully detailed ground investigation.

3.3 Mill Lane Bridge

Mill Lane Bridge is a Grade 2 listed structure (ref. no. 1320554) designed by I K Brunel and built in 1840. It has three arches; currently as shown in Photo 3.3 below; but only the larger central span is in use accommodating two lines of railway. The northern arch has adequate space for a single track of railway to be reinstated underneath.



Photo 3.3 Mill Lane bridge west elevation photographed from George Inn PH car park

Historical maps between 1903 and 1970 show a loop line passing underneath the northern arch; this line had been removed by 1989.

There is no evidence that a railway track was ever laid through the southern arch but as the bridge appears to be symmetrical the four-track scheme suggested by Dorian Baker should be possible. It is assumed that sufficient clearance for overhead electrification wires would be obtained by track lowering if it is needed, in deference to the Grade 2 listed status of this bridge.

4 Third party interfaces

Parts of the works outside the foot print of the former station and goods yard would require purchase of adjacent land which affects one residential property, an industrial area and an SSSI. The level crossing which is currently the only means of access to Bathampton Farm would be closed as part of the works requiring an alternative route via the P&R car park area. Realignment of tracks towards the west end of the station will bring the railway closer to the rear of properties in Church Close, namely The Grange and Mallard Cottage. In addition to retaining wall works, screening and other mitigation measures may be needed to reduce detrimental affect on these residences.

5 Procedures

In addition to planning consents granted by the local planning authority (B&NES), a Transport & Works Act Order is likely to be needed prior to the construction and operation of the new railway alignment and its station. A level crossing order will be required for stopping up the level crossing that provides access to Bathampton Farm; and further orders will be required for the diversion of the public footpath right of way that currently uses this route. Other consents will be needed in relation to the SSSI and construction on or near the flood plain.

Any objections will have to be dealt with; possibly through a Public Inquiry, leading to uncertain outcomes in terms of decision, cost and programme. Land acquisition may require compulsory purchase powers.

6 Estimated Cost of Bridge/Interchange Construction

The cost of construction of a bridge under the A4, a bridge under the railway, earthworks, retaining walls, slip roads and for maintaining a road diversion is estimated to be in the order of **£10-12M**. This is based upon a construction working area being established between the road and the railway as described earlier. This estimate does not include for railway costs such as possessions, removal/reinstatement of track, protection of signalling cables or monitoring of settlement during adjacent excavation and retaining wall works.

7 Conclusions and recommendations

If this site is to be taken forward a number of issues need to be addressed and investigated more fully, mostly on grounds of practicability. This will be needed to provide a more robust estimate of out-turn costs although these are likely to be considerable. The main issues identified; in addition to any rail engineering ones identified separately, are as follows:

- Optimum means to place bridge under live railway;
- Temporary site access;
- Reinstatement of tracks under side arches of Mill Lane Bridge;
- Impact on SSSI;
- Possession planning;
- Land purchase;
- Impact on residential properties;
- Availability of specialist railway resources; and
- Programme relating to time needed for consents, Orders, land acquisition and compulsory purchase powers.