

Highways Agency, Historical Railways Estate Major Works Programme 2012 - 2015

VAR9/3991 ASSESSMENT PROGRAMME

BD21 ASSESSMENT REPORT

Crawley Hall Bridge,
Crawleyside, County Durham

BRIDGE REF: ASS/2



July 2014

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1 General Description and Structural Details

1.1 Introduction

Jacobs was appointed by the Highways Agency, Historical Railways Estate to conduct the site inspection at structure ASS/2 (Crawleyside) in sufficient detail to provide data for BD21 assessment work.

Structural Soils Ltd. excavated a trial pit in the carriageway, north of the deck centre line at midspan exposing the top of the longitudinal rails.

Data on the trial pit and a description of the investigation is included in Appendix C.

1.2 Location and General Description

Bridge ASS/2 carries a public road (B6278) over the track bed of the former Ashes Branch line in Crawleyside, County Durham.

The road is a single carriageway 6.17m wide at midspan. Stone kerbs line the edges of the carriageway. There are footways 0.81m wide on the north side of the carriageway and 1.56m wide on the south side. The overall width between the parapets is 8.53m at midspan. Refer to the plan at road level in Appendix F for the carriageway dimensions.

The national speed limit of 60mph applies over the bridge though practical speeds are restricted by road geometry. There is a steep incline. The road has a moderate traffic flow. During the inspection a few heavy goods vehicles were observed.

The OS grid reference is NY993402

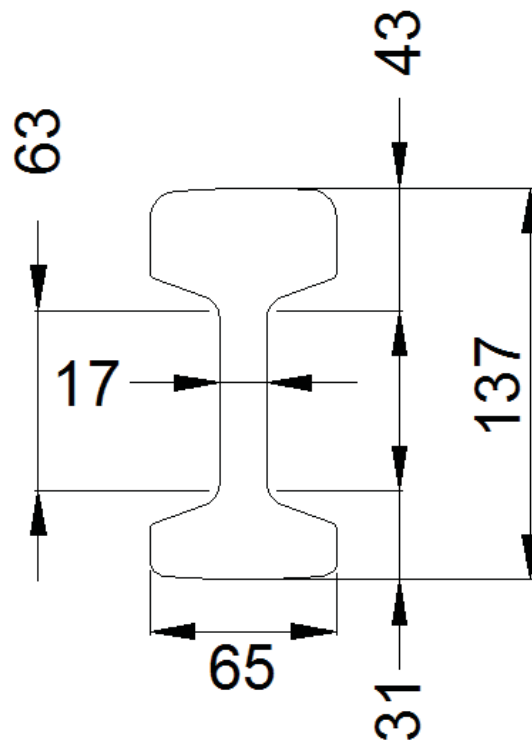
The bridge was first constructed in the late 1850s however the bridge deck was reconstructed circa 1912.

1.3 Construction type

The structure is a skewed single span overbridge. The clear skew span was measured on site to give 3.83m (12' - 7"); the square span is 3.51m (11' - 6"). The angle of skew, as taken from site measurements, is approximately 23°.

The bridge comprises of upright worn 80lb bull-head rails laid contiguously spanning longitudinally between the abutments to form the deck under the carriageway. The dimensions of the rail were measured on site and confirmed through the historic drawing (see Appendix G). See the figure below. Discrete sections of the rail are held together by means of tie bar bolts at 1.07m centres across the span, however not every rail is connected through this method. It is likely that there are the majority of the girders are not connected laterally. This is confirmed through the historical drawing.

Samples of the rails were taken on site and submitted for metallic testing. The results confirm the rails are wrought iron however it is noted that the carbon content of the samples is closer to steel. For the purposes of assessment the rails will be considered wrought iron.



80lb Bull-Head Rail

There are cast iron trough type edge girders that form the support for the bridge parapets. Under the footways some of the rails are laid horizontally. At the south footway a section of rail deck appears to have been removed to accommodate a service pipe. The gap has been covered with a steel plate.

The service bay under the south footway is constructed of $\frac{5}{8}$ " thick steel plate and supports a 9" diameter steel service pipe suspended from bolted hangers. The $\frac{5}{8}$ " plate is simply supported on two upright rails, one each side of the service pipe. This plate does not extend to the continuous section of upright rails. An additional plate of unknown thickness spans between the $\frac{5}{8}$ " plate and the edge of the upright rails (Photograph 10).

The substructure comprises of gravity type abutments constructed from randomly sized stone blocks brought to courses (Photograph 5 and 13). Large, dressed sandstone blocks form pad stones for the spanning rails. A pair of bull-head rails laid horizontally on the pad stones serve as the bearings. The wingwalls are a similar form of construction.

The parapets are a combination of mortar and dry stone wall construction.

Sketches of the structure arrangement are included in Appendix F.

2**Existing Information Search****2.1 Services Search**

A service search was carried out by Jacobs. Information is supplied in Appendix B.

2.2 SI Results

Structural Soils Ltd. excavated a trial pit in the carriageway, north of the deck centre line at midspan exposing the top of the longitudinal rails.

Data on the trial pit and a description of the investigations is included in Appendix C.

2.3 Existing Drawings

Historical drawings from the North Eastern Railway records are included in Appendix G.

3 Structure Condition

3.1 General

The level survey and inspection for the BD21 assessment were undertaken on Thursday 25th July 2013. Weather conditions on the day of inspection were dry with light breeze winds and a temperature of 23°C.

For the purpose of structure orientation this assessment report will refer to the compass orientation.

Parking was available on the road on the north side to the east of the bridge under a temporary lane closure.

Access to the formation was obtained via the south east embankment of the bridge.

3.2 Structure Condition

3.2.1 Edge Girders

Only the outer and bottom faces are visible.

The south edge girder is in fair condition. The paint system is failing on the outer face and has completely failed on the bottom face. Pitting was noted on the outside face and the bottom flange has deep pitting corrosion evident along the full length with up to 2mm loss of thickness (Photograph 4 and 5).

The north edge girder is in fair condition. The paint system has failed on the bottom flange however remains intact on the outer face. There is heavy corrosion on the inside half of the bottom flange with up to 3mm loss of thickness.

3.2.2 Longitudinal Rails

The longitudinal rails are heavily corroded on the bottom flanges with damp staining noted along the length of the span. The paint system has completely failed across the span except for localised sections towards the centre of the deck and east support area where it remains intact. There is heavy damp staining and build up of leachate along the length of the span; stalactites up to 60mm in length were noted towards the west support area (Photograph 6). Up to 5mm section loss to the bottom flange of the rail was noted across the span. The north and south edges of the rail construction were exposed; up to 5mm section loss was evident along the faces (Photograph 11).

One of the rails supporting the steel plate was heavily corroded on all visible faces. There was up to 5mm section loss on all faces (Photograph 9).

The tie bolt heads are in poor condition. Surface corrosion and de-lamination was observed throughout the bolt heads with up to 3mm resultant section loss (See Photograph 12).

3.2.3 Deck Plates

The deck plates are heavily corroded with a total breakdown of the paint system. Damp staining and build-up of leachate deposits were noted throughout. Corrosion of up to 4mm was noted along the length of both plates (Photograph 9).

3.2.4 Parapets & Extension Walls

The parapets are in fair to poor condition. The south parapet has had repairs to the coping stones and the joints are generally well filled in the top 500mm. Below that, the joints are open to the deck level on the inner face. On the outer face there are deep open joints to the coursed stonework and loose stones. There is light weathering to both the inside and outer faces (Photograph 17 and 21).

On the north parapet the joints are generally well filled with light weathering to the inside face. Where the east end of the parapet meets the extension wall there is a large stepped fracture through the joints. On the outside face there are deep open joints to the stonework and loose stones. There is light weathering to both the inside and outer faces.

The stone extension walls beyond the parapets are generally in fair condition. They are lightly spalled with localised areas of recessed mortar joints in the same fashion as the parapets with intermittent vegetation growth.

3.2.5 Abutments

There is heavy corrosion and de-lamination to the west abutment bearing rails. A sample of the first bearing rail was taken and revealed de-lamination and loss of section of up to 4mm on all faces (Photograph 5). The east abutment bearing at the south face was in a fair condition; the paint system was still intact on the end face with up to 1mm of section loss across the exposed west face.

The east abutment is in whole in fair condition, damp staining and rust from the supported rails is evident along the top 700mm across the width of the abutment. Towards the north end of the abutment there is leachate staining over the full height of the abutment. There are deep open joints across the face of the abutment with several vertical fractures; there is a joint fracture open to 5mm, starting from the base of the service pipe approximately 1100mm from the south face, extending vertically down to ground level. There are several spalled stones with loss up to 90mm deep associated with the fracture. At the centre of the abutment there is a gap between the bearing stones 30mm wide. There is a fracture open to 5mm extending from the gap through the joints down to ground level. There is a 2.5m² area of bulging approximately 1000mm from the north end surrounded by deep open joints. There is a 6.5m² damp area from ground level approximately 2000mm from the north face.

The west abutment is in fair condition, damp staining, rust and leachate deposits were noted across the width of the abutment from the bearing points 1000mm in length. There is an area of deep outward bulging 1m², 1000mm from the south face. There is a fracture extending vertically through the joints though the bulging stonework open to 30mm (Photograph 15). There is a fracture open to 3mm from the base of the service pipe extending vertically 1000mm through the joints. At the centre of the abutment there is a fracture extending vertically 1100mm through the joints and below the bearing stones there is a horizontal open to 3mm fracture through the joint 900mm in length. There are localised areas of open joints to 50mm deep. There is a 3.5m wide band of damp extending the full height at the centre of

the abutment.

3.2.6 Formation

The old railway formation to the south has been partially infilled. The land is now used as a private garden and ongoing development. There is land drainage within the formation which becomes open under the span (Photograph 27).

The formation to the north is largely overgrown with bushes and trees growing along both adjacent embankments and the former track bed (Photograph 26).

3.2.7 Road Surface

The road surfacing across the bridge deck is in good condition with minor wear towards the outer edges (Photograph 23 and 24).

4 Assessment to BD21

4.1 Methodology

The capacity of the bull head rails was calculated using simple bending principles after determining the plastic section modulus of the corroded section. The rails were assessed using the Type HA live loading where the UDL was taken as two longitudinal strip loads and the KEL as two wheel loads; this was applied in accordance with clauses 6.10 and 6.11 of BD21 and dispersed through the surfacing and concrete layer down to the top of the rails.

Accidental vehicle loading was considered on the critical element of the south footway, namely the isolated single rail supporting cover plates. Wheel loads from a 3 tonne accidental vehicle, dispersed through the footway construction as permitted, were applied as derived by simple statics. As bending capacity was found to be only just sufficient for 3 tonne loading, checks on larger Annex E accidental vehicles were not carried out.

The substructure was assessed qualitatively.

4.2 Results

Element: Rail Girders beneath carriageway, subject to adjusted HA UDL & KEL

40/44 tonne loading K factors for various road surface and HGV flow combinations are as follows:

Road Surface	HGV Flow		
	High (H)	Med. (M)	Low (L)
Good (g)	0.81	0.79	0.76
Poor (p)	0.91	0.89	0.87

The factor C in the results tables below is produced for the *available live load capacity / live load capacity required* for Adjusted HA loading and relates directly to the K factors in Figures 5.2 to 5.7 of BD21/01.

C should be greater than K which equals **0.79** for 40 tonne loading Mg (Medium HGV flow, good road condition).

Action	Location	Dead load effect	Adjusted HA loading	Total load effect	Assessed resistance	Capacity factor	Live load capacity
Bending	Mid-span	2.8 kNm	15.9kNm	18.7 kNm	36.6 kNm	2.13	40Tonne ALL
Shear	Support	2.7 kN	15.5 kN	18.2 kN	224.1 kN	14.3	40Tonne ALL

Element: Rail Girders – South Footway, subject to accidental vehicle loading

The critical element was identified as the isolated single rail supporting steel deck plates under the south footway adjacent to the service pipe. Checks were commenced with the 3 tonne Annex E accidental vehicle. As surplus capacity was minimal, checks on larger vehicles were not undertaken.

Action	Location	Dead load effect	3T AVL	Total load effect	Assessed resistance	Live load capacity
Bending – trans. dispersal	Mid-span	15.0 kNm	21.4 kNm	36.4 kNm	36.6 kNm	3T AVL
Shear – trans. dispersal	Support	14.6 kN	23.1 kN	37.7 kN	224.1 kN	3T AVL

Element: Sub-structure

The abutments show signs of deterioration including dampness, bulging and spalling and some vertical fractures. There is no evidence of recent load related damage, therefore the abutments are considered adequate for present traffic conditions.

5 Conclusions and Recommendations

The old rails forming the main structural elements of the bridge display advancing corrosion. A conservative estimate of section loss was made, but the capacity may reduce if corrosion is not arrested.

The assessment shows that the structure below the carriageway has sufficient capacity, both in bending and shear, for 40 tonne vehicles. The capacity of the critical member below the south footway is 3 tonnes accidental vehicle load. The abutments are considered satisfactory for current levels of loading.

It is recommended that suitable barriers or a safety kerb system are installed to prevent vehicle loading on the footways.

If the bridge is to be retained, it is recommended that the deck is re-waterproofed to eliminate seepage. Corrosion protection to the old rails is probably impractical. Repairs to the abutments are also recommended.

Appendix A Photographs



1. North elevation



2. South elevation



3. South East Bearing Point



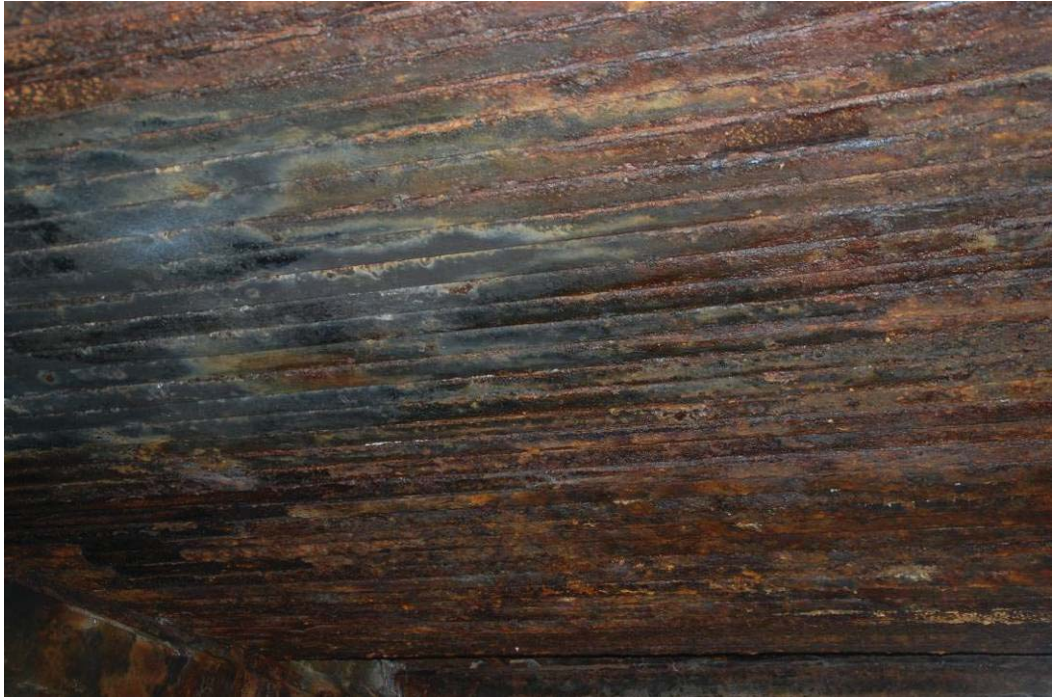
4. South Edge Beam



5. South West Bearing Point



6. Underside of Longitudinal Rails Facing West Abutment



7. Underside of Longitudinal Rails Facing South



8. Horizontally Laid Rails and South Edge Beam Facing West Abutment



9. Service Bay with 9" Pipe, Single Rail and Plate



10. $\frac{3}{8}$ " Plate and Plate of Unknown Thickness



11. Exposed Rail Edge



12. Tie bolt Head



13. East Abutment



14. West Abutment



15. Area of Bulging and Cracking to West Abutment



16. Cracking to East Abutment



17. South East Wing Wall



18. South West Wing Wall



19. North East Wing Wall



20. South West Wing Wall



21. South Parapet



22. Trial Pit in Carriageway Exposing the Top of the Longitudinal Rails



23. Road from Bridge Looking East



24. Road from Bridge Looking West



25. South Formation



26. North Formation



27. Formation Under Span

Appendix B Service Search

Certificate Of Registered Enquiry					
Certificate Number	EQ/PXYBB206		Service	Retriever	
Client Reference	B18280BD-SERV-ASS/2				
Location of Enquiry	Disused Railway Bridge Crawleyside Bank, Stanhope, Durham, DL13 2EL				
Issued to	Jacobs UK Ltd				
Address	Northern House 9 Rougier Street York North Yorkshire		Contact	[REDACTED]	
14/06/2013 15:06:40			Telephone	[REDACTED]	
Copyright 2007 National One Call All Rights Reserved			Fax	01904 661801	
			Email	[REDACTED]@jacobs.com	
Enquiry Date	16/05/2013	Responses Requested by	31/05/2013	Working Days Notice	11
Contacts and Responses					
Organisation	Document	Contacted	Affected	Received	Status
BSkyB Telecommunications Services Ltd	Telecoms. Plan	Yes	No	Yes	Closed
BT Openreach	Telecoms. Plan	Yes	Yes	Yes	Closed
E S Pipelines Ltd	Multi-utility Plan	Yes	No	Yes	Closed
Energetics	Multi-utility Plan	Yes	No	Yes	Closed
Fulcrum Pipelines Ltd	Gas Plan	Yes	No	Yes	Closed
Gamma Telecom	Telecoms. Plan	Yes	No	Yes	Closed
Gas Transportation Co & Electric Network Co	Gas Plan	Yes	No	Yes	Closed
Independent Pipelines & Power Networks	Gas Plan	Yes	No	Yes	Closed
Instalcom	Telecoms. Plan	Yes	No	Yes	Closed
Interoute	Telecoms. Plan	Yes	No	Yes	Closed
Linesearch (Pipeline search service)	Group Members Search	Yes	No	Yes	Closed
Mobile Phone Base Stations	Group Members Search	Yes	No	Yes	Closed
National Grid Transmission (Gas)	Gas Plan	Yes	No	Yes	Closed
National Grid Transmission Electricity	Electricity Plan	Yes	No	Yes	Closed
Network Information Services	Telecoms. Plan	Yes	No	Yes	Closed
Northern Gas Networks	Gas Plan	Yes	No	Yes	Closed
Northern Power Grid	Electricity Plan	Yes	Yes	Yes	Closed
Northumbrian Water	Water / Drainage Plan	Yes	Yes	Yes	Closed
Orange pcs	Telecoms. Plan	Yes	No	Yes	Closed
Scottish & Southern Energy	Electricity Plan	Yes	No	Not Expected	Closed
Spectrum Interactive plc	Telecoms. Plan	Yes	No	Yes	Closed
T-Mobile & H3G	Telecoms. Plan	Yes	No	Yes	Closed
Trafficmaster Ltd	Telecoms. Plan	Yes	No	Yes	Closed
Verizon Business	Telecoms. Plan	Yes	No	Yes	Closed
Virgin Media	Telecoms. Plan	Yes	No	Yes	Closed

Vodafone Limited (formerly C&W UK)	Telecoms. Plan	Yes	No	Yes	Closed
Vtesse Networks Ltd	Telecoms. Plan	Yes	No	Yes	Closed
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Additional Information

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Some asset owners provide additional information regarding their response. This is listed below. Please use this in conjunction with the CoRE Certificate and any plans provided.

Enquiry Number	EQ/PXYBB206	Service	Retriever
Location of Enquiry	Disused Railway Bridge Crawleyside Bank, Stanhope, Durham, DL13 2EL		
Status: Not Affected			
Organisation	Response		
BSkyB Telecommunications Services Ltd	Dear Sir/Madam, RE: Disused Railway Bridge Crawleyside Bank, Stanhope, Durham, DL13 2EL Thank you for your enquiry. Please be advised that BSKyB Telecommunications Services Ltd will not be affected by these works. Best endeavours have been made to ensure accuracy, however if you require further information, please contact us. Regards NRSWA Department Network Infrastructure and Planning BSKYB Telecommunications Services Ltd		
E S Pipelines Ltd	16 May 2013 Reference: EQ/PXYBB206 Dear Sir/Madam, Thank you for your recent plant enquiry at: Disused Railway Bridge Crawleyside Bank, Stanhope, Durham I can confirm that ESP Gas Group Ltd has no gas or electricity apparatus in the vicinity of this site address and will not be affected by your proposed works. ESP are continually laying new gas and electricity networks and this notification is valid for 90 days from the date of this letter. If your proposed works start after this period of time, please re-submit your enquiry. Important Notice Please be advised that any enquiries for ESP Connections Ltd, formerly known as British Gas Connections Ltd, Yours faithfully, Alan Slee Operations Manager		
Energetics	Based on the information provided, I can confirm that Energetics does not have any plant within the area(s) specified in your request.		
Gamma Telecom	Having examined our records, I can confirm that Gamma has no owned apparatus within the search area of your enquiry detailed in the reference/location provided.		
Gas Transportation Co & Electric Network Co	Site Ref: EQ/PXYBB206 Date: 30 May 2013 Dear Sir/Madam Re: Disused Railway Bridge Crawleyside Bank, Stanhope, Durham, DL13 2EL APPARATUS NOT AFFECTED Thank you for your enquiry concerning apparatus in the vicinity of your proposed work. We can confirm that we have no apparatus in the vicinity but please note that other asset owners may have and that you should ensure that all transporters/ distributors have been consulted. Please note our assets now include those owned and operated by: · GTC Pipelines Limited · Independent Pipelines Limited · Quadrant Pipelines Limited · Electricity Network Company Limited · Independent Power Networks Limited · Independent Water Networks Limited · Independent Fibre Networks Limited All future plant enquiries must contain accurate Easting and Northing references to enable us to process your enquiry efficiently. Yours sincerely Harriet Kendall Engineering Support Officer GTC		
Independent Pipelines & Power Networks	GTC/ENC can confirm that we have no apparatus in the vicinity but please note that other asset owners may have and that you should ensure that all transporters/ distributors have been consulted. Please note our assets now include those owned and operated by: - GTC Pipelines Limited - Independent Pipelines Limited		
Instalcom	Your Ref: Crawleyside Bank, Stanhope, Durham, DL13 2EL (EQ/PXYBB206) Our Ref: E05-13-2786 With reference to your enquiry regarding the above noted location, I can confirm that LEVEL 3, GLOBAL CROSSING (UK) LTD, GLOBAL CROSSING PEC FIBERNET UK LTD and FIBRESPAN LTD networks DO NOT have any apparatus within the immediate proximity of your proposed works. Instalcom responds to plant enquiries for LEVEL 3, GLOBAL CROSSING (UK) LTD, GLOBAL CROSSING PEC and FIBERNET UK LTD simultaneously and therefore you only need send one copy of a plant enquiry to cover all of these companies. If you would like to query the location further, please email us accordingly and we can arrange an in depth survey, which will be charged at a cost. As we are moving towards a fully electronic database we urge our customers to request plant enquiries by email which will result in a higher level of service, please forward future plant enquiries to plantenquiries@instalcom.co.uk If you		

	require any further information, please do not hesitate to contact me. Plant Protection Administrator
<i>Interoute</i>	We would advise that we are unaware of any Interoute plant or services in this Location as indicated in your enquiry. We bring to your attention the fact that whilst we try to ensure the information we provide is accurate, the information is provided Without Prejudice and Interoute and its Agents accept no liability for claims arising from any inaccuracy, omissions or errors contained in this response. All responses are only valid for 28 days Yours faithfully PLANCAST Plant Enquiry Department
<i>Northern Gas Networks</i>	According to our records Northern Gas Networks has no gas mains in the area of your enquiry.
<i>Orange pcs</i>	Your reference: EQ/PXYBB206 Location: X = 399200 Y = 540105 With reference to your enquiry regarding the above noted location, please be advised that you have confirmed our records show that we do not currently hold any ORANGE PCS assets within your stated area of interest. Please note, whilst we endeavour to provide accurate information, the information is intended as a general guide only and must not be relied upon in the event of any excavations or other work in the vicinity. Also, the responsibility is on you, the client, to determine the area of works is clear. May Gurney will accept no liability for claims arising from any inaccuracy, omissions or errors contained herein. If you require any further information then please do not hesitate to contact us. Kind Regards Plant Protection Administrator
<i>Spectrum Interactive plc</i>	No Kiosks in the vicinity of the proposed works
<i>Trafficmaster Ltd</i>	Our ref: Geoff Spring (phone: 01234 759100) New Roads and Street Works Act 1991- Sections 83, 84, 142 and 143 Codes of Practice Appendix C2 In response to your notice regarding works which you , are proposing to undertake. I can confirm that Trafficmaster does not have equipment installed within the boundary of the works. If you have any further queries regarding this or any other programme, please do not hesitate to contact me on my details below. Yours sincerely For & on Behalf of Trafficmaster Ltd
<i>Verizon Business</i>	Verizon Business is a licensed Statutory Undertaker. We have reviewed your plans and have determined that Verizon Business (Formally known as MCI WorldCom, MFS) has no apparatus in the areas concerned. If you have any further queries please do not hesitate to call. Yours faithfully Chris Pile
<i>Virgin Media</i>	Plant Enquiry Ref: VM/CIP/156415 Your Letter Date: 16/05/2013 Your Ref: EQ/PXYBB206 Date: 14/06/2013 Enquiry Location: Disused Railway Bridge, Crawleyside Bank, Durham DL13 2EL Thank you for your enquiry regarding work at the above location. Virgin Media and Viatel plant should not be affected by your proposed work and no strategic additions to our existing network are envisaged in the immediate future. Should your request be in relation to a New Development and you require an estimate to be prepared for Virgin Media to service your proposed development, please submit this request for costs along with site drawings (scale 1:500) to: Virgin Media New Build Virgin Media 1 Dove Wynd Strathclyde Business Park Bellshill ML4 3AL This information is only valid on the date of issue. If your start date is 3 months or more from the date of this letter, please re-apply for updated information. Yours faithfully, National Plant Enquiries Team
<i>Vodafone Limited (formerly C&W UK)</i>	This response is made only in respect to electronic communications apparatus forming part of the Vodafone Limited electronic communications network formerly being part of the electronic communications networks of Cable & Wireless UK, Energis Communications Limited, Thus Group Holdings Plc and Your Communications Limited. Please accept this email as confirmation that Vodafone does not have apparatus within the vicinity of your proposed works detailed below. Many thanks. Plant Enquiries Team T: 01454 662881 E: osm.enquiries@atkinsglobal.com ATKINS working on behalf of PLEASE NOTE: The information given is indicative only. No warranty is made as to its accuracy. This information must not be solely relied upon in the event of excavation or other works carried out in the vicinity of Vodafone plant. No liability of any kind whatsoever is accepted by Vodafone, its servants, or agents, for any error or omission in respect of information contained on this information. The actual position of underground services must be verified and established on site before any mechanical plant is used. Authorities and contractors will be held liable for the full cost of repairs to Vodafone's apparatus and all claims made against them by Third parties as a result of any interference or damage.
	Our Ref 0513/1235 I confirm that Vtesse Networks do not have any plant within a 250

<i>Vtesse Networks Ltd</i>	meter radius of your given central coordinates. Plant Enquiry Team Tel: 01992 532100
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Our Ref: Ref shown on map

email: DBYD@openreach.co.uk
Phone: 0800 023 2023. Option 5

Date of issue shown on map

Dear Customer,

NR & SW ACT 1991 – PROPOSED WORKS AT – Crawleyside Bank, Stanhope

Prior to commencement of work: for free onsite guidance and accurate up to date location of BT plant please contact our Plant Protection Service by the following methods

Email Dial before you dig DBYD@openreach.co.uk

Visit the website www.dialbeforeyoudig.com

Thank you for your request of EQ/PXYBB206 describing the above proposals.

Enclosed are copies of our drawing marked up to show the approximate locations of BT apparatus which is present in the immediate vicinity of your works. It is intended for general guidance only. No guarantee is given of its accuracy.

It should not be relied upon in the event of excavations or other works made near to British Telecommunications plc apparatus which may exist at various depths and may deviate from the marked route.

To avoid damage it is recommended that mechanical excavators or borers are not used within 600mm of British Telecommunications plc plant. If scaffolding is erected, please ensure that our equipment is not enclosed, blocked, covered or otherwise obstructed by the scaffolding.

In the event of BT apparatus being in the area of works we recommend that your plant/vehicle crossing is either resited, or apply for a budget estimate by submitting detailed plans to the above address, these will be forwarded to the appropriate department for their comments.

Please ensure you quote our reference on any future correspondence.

Yours faithfully,

Maps by email Plant Information Reply



IMPORTANT WARNING

Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only. No guarantee is given of its accuracy.

It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.

DIAL BEFORE YOU DIG

FOR PROFESSIONAL ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS

ADVANCE NOTICE REQUIRED
(Office hours: Monday-Friday 08.00 to 17.00)

Tel: 0800 9173993
E-mail: dbyd@openreach.co.uk
Website: www.dialbeforeyoudig.com

Reproduced from the Ordnance Survey map by BT by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationary Office
(C) Crown Copyright British Telecommunications plc 100028040

KEY TO BT SYMBOLS

	UNDERGROUND PLANT		POLE
	OVERHEAD PLANT		CABINET
	JOINT BOX		BURIED JOINT
	DISTRIBUTION POINT		JOINTING POST
	MANHOLE		PROPOSED U/G
	DP BOUNDARY		PROPOSED O/H
	OTHER BT BOUNDARY		PROPOSED BOX

Other proposed plant is shown using dashed lines. BT symbols not listed above may be disregarded. Existing BT plant may not be recorded. Information valid at the time of preparation.

openreach
a BT Group business

BT Ref : ZFC02027V

Map Reference : (centre) NY9919840082

Easting/Northing : (centre) 399198,540082

Issued : 16/05/2013 14:02:47

FOOTNOTE: WARNING IT IS ESSENTIAL THAT YOU CONTACT NATIONAL NETWORK HANDLING CENTRE BY EMAIL nnhc@openreach.co.uk BEFORE PROCEEDING WITH ANY WORK IN THE HATCHED AREA



Northern Gas Networks
1st Floor
1 Emperor Way
Doxford International Business Park
Sunderland
SR3 3XR

Telephone No: 0845 634 0508*
www.northerngasnetworks.co.uk

24 hour gas escape
number 0800 111 999

*calls will be recorded and may be monitored

Our Ref: 301192833
Your Ref: EQ/PXYBB206
Date: 07.06.2013

[Redacted]
National One Call
1 Mill Place
Mill Road Industrial Estate Linlithgow Bridge
West Lothian EH49 7TL

Dear Sir / Madam,

Re: Coring / Trial Pits, Disused Railway Bridge, Crawleyside Bank, Stanhope, DL13 2EL.

Northern Gas Networks acknowledges receipt of your notice of your intention to carry out work at the above location.

According to our records Northern Gas Networks has no gas mains in the area of your enquiry.

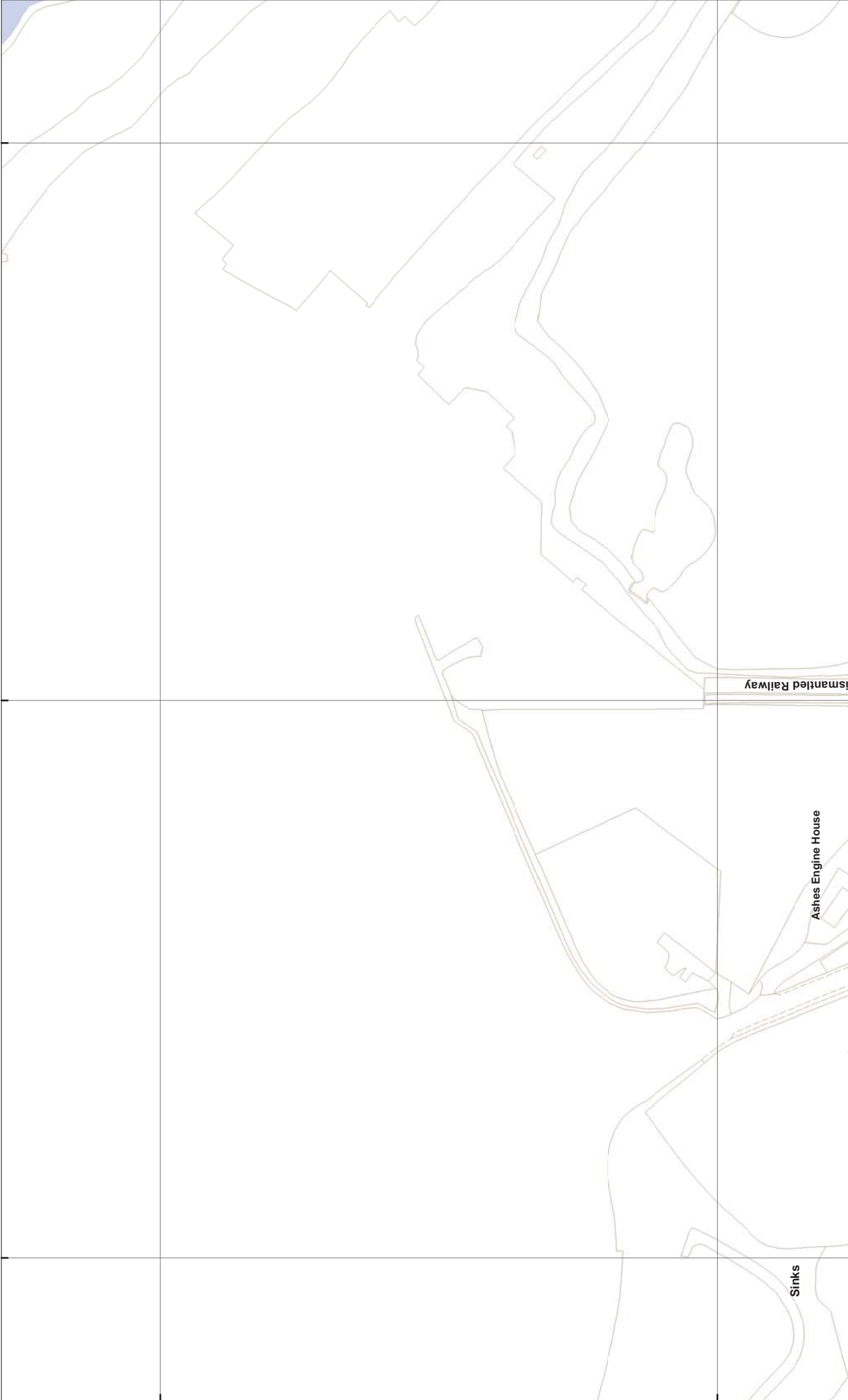
Gas pipes owned by other Gas Transporters and also privately owned may be present in this area. Information with regard to such pipes should be obtained from the owners.

If you have any further enquiries please contact the Telephone number below.

Yours faithfully,

[Redacted]
Network Records Assistant
[Redacted] (Option 6)

Northern Gas Networks Limited
Registered in England & Wales No 5167070
Registered Office
1100 Century Way Colton
Leeds LS15 8TU



SCALE:

1:1,250

USER ID:

N800171

DATE:

07/06/2013 17:25:06

GRID REFERENCE

E: 399200
N: 540105

Low Pressure

Medium Pressure

Intermediate Pressure

Regional High Pressure

Valve

Depth of Cover

Diameter Change

Syphon

Material Change

Our Ref: 13/337580

Your Ref: 03 June 2013

EQ/PK-1BB206
Date:

National One Call
1 Mill Place
Mill Road Industrial Estate
Linlithgow Bridge
West Lothian
EH49 7TL

Dear Sir/Madam

REQUEST FOR RECORDS SHOWING LOCATION OF APPARATUS at:

Crawleyside Bank

Thank you for your enquiry dated 31/05/2013 concerning the above. The enclosed Mains Records only give the approximate location of known Northern Powergrid apparatus in the area. Great care is therefore needed and all cables and overhead lines must be assumed to be live.

Please note that while all efforts are made to ensure the accuracy of the data, no guarantee can be given. We would refer you to the Health & Safety Executive's publication HS(G)47 "Avoiding Danger From Underground Services" which emphasises that:

* Plans must only be used as a guide in the location of underground cables. The use of a suitable cable-tracing device is essential and careful hand digging of trial holes must be carried out to positively identify and mark the exact route of the cable. You should also bear in mind that a cable is unmistakably located only when it has been safely exposed.

* Cable depths are not generally indicated on our records and can vary considerably even when shown.

* Great caution must be exercised at all times when using mechanical plant. Careful trial digging should always be carried out on the whole route of the planned excavation to ascertain no cables exist.

The Health & Safety Executive have another publication, GS6 "Avoidance of Danger from Overhead Electric Lines" that you should be aware of if your work is near overhead power lines. Both of these documents provide comprehensive guidance for observance of statutory duties under the Electricity at Work Regulations 1989 and the Health & Safety at Work Act 1974. Our provision of these records is based upon the assumption that people using them will have sufficient competence to interpret the information given. Any damage or injury caused will be the responsibility of the organisation concerned who will be charged for any repairs.

Please note ground cover must not be altered either above our cables or below overhead lines, in addition no trees should be planted within 3 metres of existing underground cables or 10 metres of overhead lines. All our apparatus is legally covered by a wayleaves agreement, lease or deed or alternatively protected under the Electricity Act 1989. Should any alteration / diversion of our Company's apparatus be necessary to allow your work to be carried out, budget costs can be provided by writing to Network Connections, Northumbria Works, Mill Street East, Dewsbury. WF12 9AH.

Yours faithfully


Northern Powergrid Records Information Centre

Northern Powergrid Mains Records enclosed:

NY992400.TIF NY992400.001 NY990400.TIF NY990400.001

NORTHERN POWERGRID HOLDINGS COMPANY

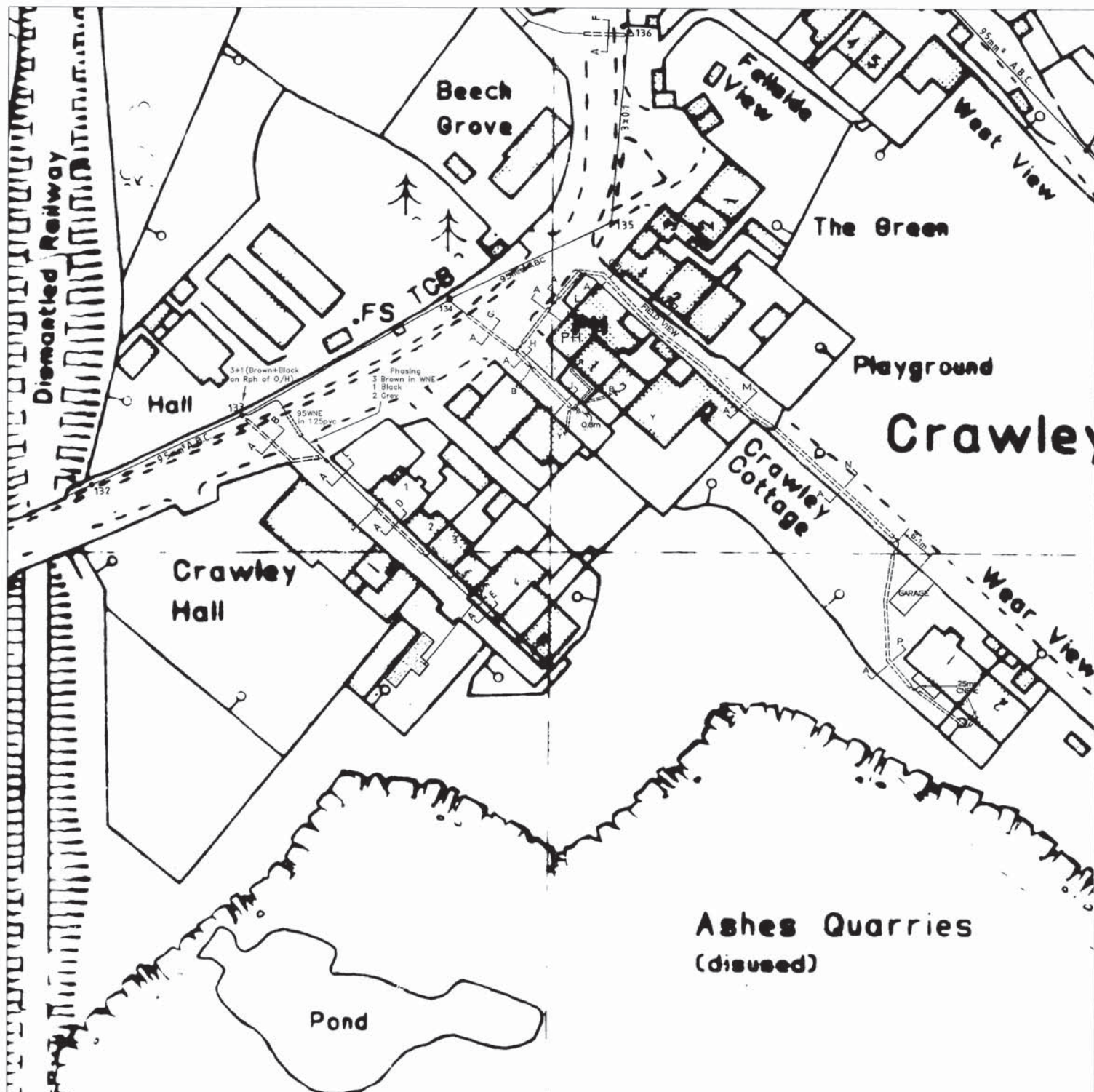
Records Information Centre, New York Road, Shiremoor, Newcastle upon Tyne NE27 0LP.

Registered Office: Lloyds Court, 78 Grey Street, Newcastle upon Tyne NE1 6AF.

Registered in England and Wales. Registered Number: 3476201.

If you would like an audio copy of this letter, a copy in large type, Braille or another language, please call 0800 169 7602.

1. Use Plans
2. Use Cable Locator
3. Hand Dig To Confirm



Scale: 1:500
 Map: NY992400.TIF
 Date: 03 Jun 2013

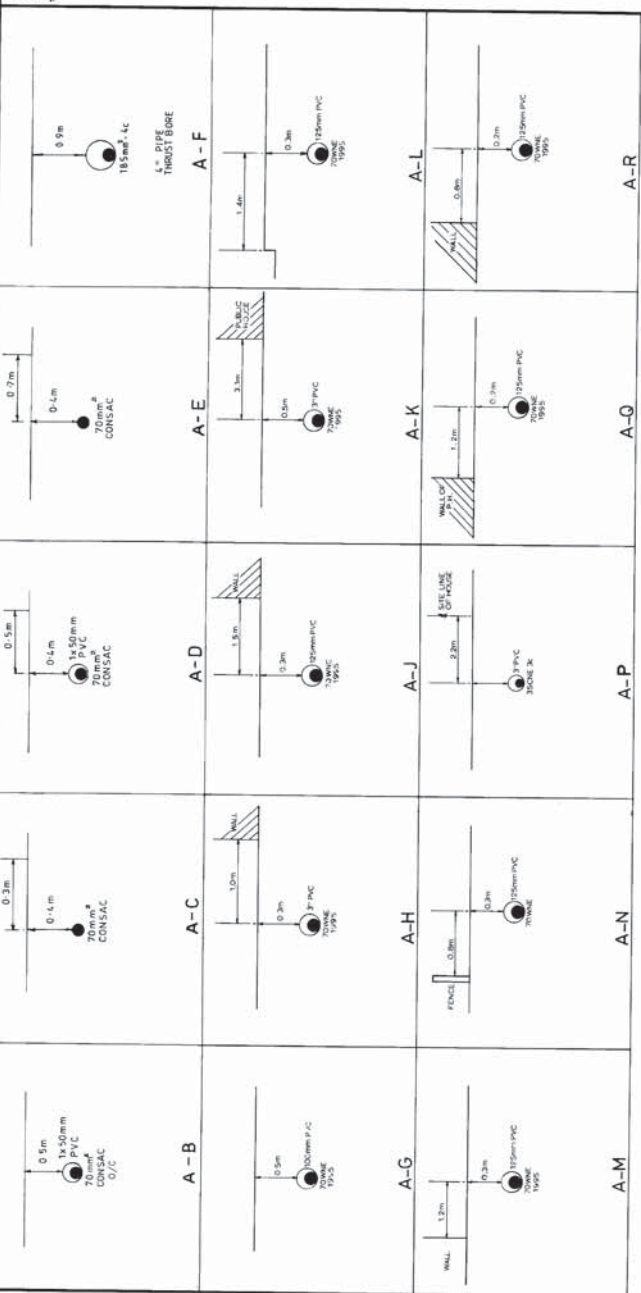
Based upon or Reproduced from the Ordnance Survey
 Map with the sanction of HM Stationery Office.
 CROWN COPYRIGHT RESERVED
 Unauthorised reproduction infringes Crown Copyright
 Northern Powergrid Holdings Company,
 Lloyds Court, 78, Grey Street,
 Newcastle Upon Tyne, NE1 6AF

ELECTRIC CABLES AND/OR OVERHEAD LINE INFORMATION SHOWN ON THE RECORD PLANS ARE TO BE USED IN ACCORDANCE WITH THE HEALTH & SAFETY EXECUTIVE'S BOOKLET HS(G)47, 'AVOIDING DANGER FROM UNDERGROUND SERVICES', AND GUIDANCE NOTE GS 6, 'AVOIDANCE OF DANGER FROM OVERHEAD ELECTRIC LINES'. RECORD PLANS DO NOT ALWAYS SHOW OUT OF COMMISSION CABLES OR SERVICE CABLES FROM NORTHERN POWERGRID'S MAINS TO ADJOINING OR CROSS ROAD PROPERTIES. PLANS DO NOT SHOW LOCAL AUTHORITY OWNED PUBLIC LIGHTING OR SIGN CABLES. THE INFORMATION IS PROVIDED AS A SERVICE BY NORTHERN POWERGRID AND DOES NOT IMPART ANY LEGAL OBLIGATION ON THEIR PART. PERSONS USING IT ARE REMINDED OF THEIR RESPONSIBILITY TO EXECUTE WORKS SAFELY TO AVOID DAMAGING NORTHERN POWERGRID'S APPARATUS. FURTHER ADVICE OR ASSISTANCE IS AVAILABLE FROM THE RECORDS INFORMATION CENTRE ON 0870 1600910. IN AN EMERGENCY OR OUTSIDE NORMAL WORKING HOURS CONTACT OUR CUSTOMER INFORMATION CENTRE ON 0845 0702703. CABLE DEPTHS SHOWN WERE CORRECT AT THE TIME CABLES WERE LAID HOWEVER ALTERATIONS TO GROUND LEVELS OR CABLE DISPOSITION MAY HAVE TAKEN PLACE

Dig Safely

1. Use Plans
2. Use Cable Locator
3. Hand Dig To Confirm

REVISED
1-7-88
30.8.96
27.5.98 DMK



FACING SHEET TO NY.992400

CLEVELAND DISTRICT.

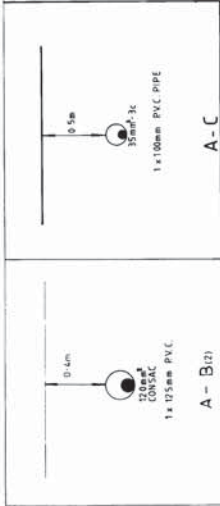
THE NORTH EASTERN ELECTRICITY BOARD.

Based upon or reproduced from the Distance Survey
 of the National Transportation Safety Board (NTSB).
 Copyright © 1997 by the National Transportation Safety Board.
 All rights reserved. No part of this publication may be reproduced
 without the prior written permission of the National Transportation
 Safety Board. Printed in the United States of America.
 1997 Edition. 1st printing. 100 pages. 8 1/2 x 11 inches.
 ISBN 0-16-010000-0. GPO: 1997-0-100000-0.

Scale: 1:500
Map: NY992400.001
Date: 03 Jun 2013

Dig Safely 

1. Use Plans
2. Use Cable Locator
3. Hand Dig To Confirm



Revision	Drawn	Checked	Date
A - B ADDED	D	A	15-7-82
SERVICE SIZE ADDED	D	A	15-7-82
WATER BOARD SERVICE	D	A	23-6-83
	D	A	20.5.93

Note: Metric equivalents are shown in brackets and are in metres unless otherwise stated.

NATIONAL ONE CALL SERVICE
CLAIVER LTD T/A PLAN TO DIG
1 MILL PLACE
MILL ROAD INDUSTRIAL ESTATE
WEST LOTHIAN
EH49 7TL

PO Box 338
Durham
DH1 9ZR

Tel : [REDACTED]
Fax : 0191 301 6517
www.nwl.co.uk

24/MAY/2013

Our Ref: 1072335

Your Ref: EQ/PXYBB206
Enquiry for DISUSED RAILWAY BRIDGE
CRAWLEYSIDE BANK
STANHOPE
DURHAM
DL13 2EL

Dear Sir

Request for Service Information

I attach the replies to your enquiry received on 16 May 2013 for the above location.

VAT RECEIPT VAT Reg No: 499 9803 59						
Date & TAX Point: 16/MAY/2013						
Your Ref EQ/PXYBB206			Cheque No: MasterCard			
	Service	Price	VAT Amount	VAT%	Tax Code	Total
1 x	A4 Water & Sewer Plan	23.00	4.60	20.00%	S	27.60
Totals £		23.00	4.60			27.60
Total Paid £						27.60

Should you require any further information, do not hesitate to contact us.

Yours faithfully

[REDACTED]
[REDACTED]

RASWA Department

EQ/PXYBB206

DISUSED RAILWAY BRIDGE CRAWLEYSIDE BANK STANHOPE DURHAM DL13 2EL

Site Enquiry

Plan

We enclose plan(s) showing the location of any Company apparatus in the vicinity of the area of your enquiry.

If your request for plan(s) is part of a C2 enquiry, or makes reference to development, it has been forwarded to our New Development department for further consultation. If you require any further information regarding this please contact the following:

Northumbrian Water New Development

Leat House

Pattinson Road

District 15

Washington

NE38 8LB

Tel: 0191 4196584

1. The company is not responsible for private water supply pipes, private drains and sewers that connect the property to the public sewerage system and does not hold details of these.

General Notes

A copy of the standard conditions for working near Company apparatus is enclosed for your information. If you require any further assistance to identify Company apparatus, then do not hesitate to make contact with the Area Office at the contact number shown in the standard conditions.

Signed.



For Northumbrian Water Limited

Date: 24/MAY/2013

Ref: 1072335

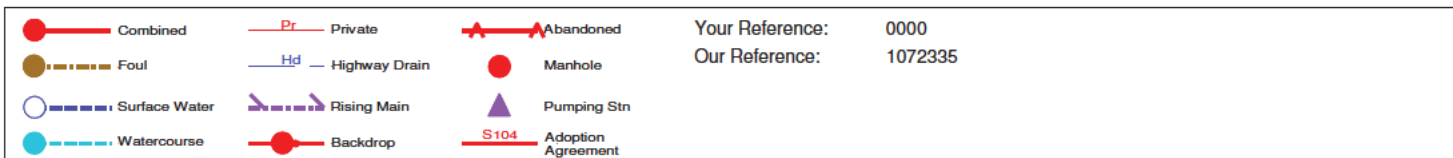
STANDARD CONDITIONS FOR WORKING NEAR NORTHUMBRIAN WATER APPARATUS



THE FOLLOWING CONDITIONS WILL APPLY TO ALL WORKS IN THE VICINITY OF COMPANY APPARATUS

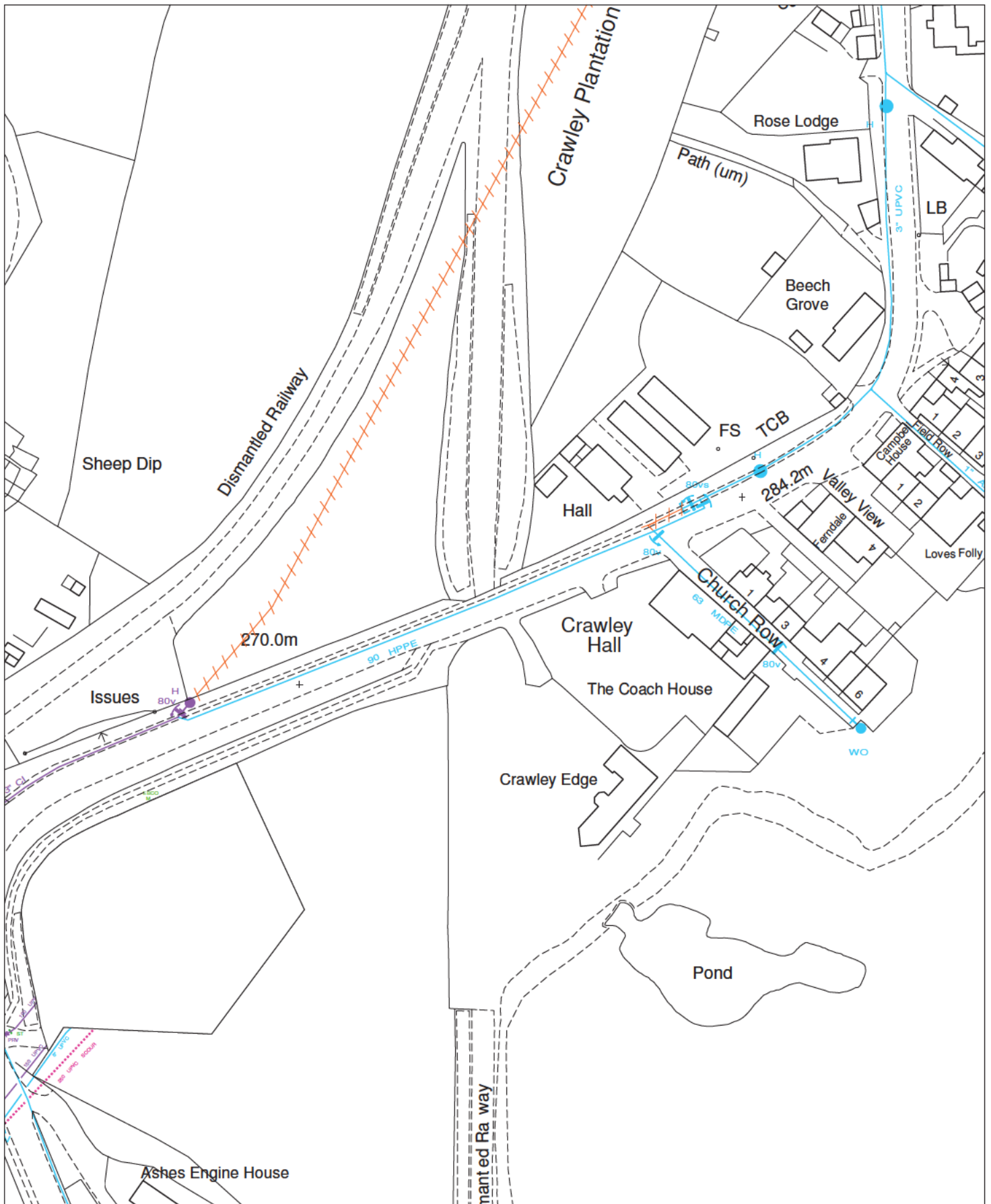
1. Contact should be made with the appropriate Company Area Office prior to the commencement of any work. Arrangements can then be made for the local representative to visit the site and assist in the location and protection of any apparatus affected. The Company must be given two working days notice before any works, including trial holes, are carried out within their easements. Contact **0845 717 1100**.
2. The information shown on any plan provided by the Company is for general guidance only. The position of apparatus shown should not be relied upon as being precise. No service pipes are shown on plans.
3. The actual position of apparatus must be established by taking trial holes in all cases. No machine excavation will be permitted within 1 metre side of a main. The actual position of any apparatus must be found by hand excavation.
4. Where Company apparatus is exposed by excavation, support and protection measures are to be agreed on site. Where excavations are taken out below the invert of a main, adequate support is to be provided to prevent collapse of the excavation and subsequent undermining of the main. Special attention is to be given to the compaction of selected backfill material under the main and the company may require the use of lean mix concrete to replace inadequately compacted or unsuitable support backfill material. The compaction of selected backfill material under, around and up to a level of 300mm above the top of any main shall be carried out by hand. Upon completion of operations, any excavation is to be left open until after inspection by Company's representative.
5. No installation of plant may take place within the Company's easements without the prior consent of the Company and with all special conditions and arrangements being finalised before commencement of work.
6. Indiscriminate crossing of the main by heavy construction plant will not be permitted. Where applicable, Crossing Points must be agreed by the Company and any protective measures necessary taken before work begins.
7. Surface boxes and covers should not be removed without obtaining prior consent of the Company. All surface covers to washouts, valves, air valves, hydrants, stopcocks etc., are to be kept clear of obstruction and with free access at all times. If surface boxes or covers have been temporarily removed, positions should be clearly marked.
8. Where the levels of carriageway and footpath surfaces are raised or lowered, then the Company's surface covers must be adjusted as appropriate.
9. No pipes or cables are to be laid or structures placed directly over the line of Company apparatus.
10. Where drains, pipes or cables cross over or under any mains, a minimum clearance of 300mm must be maintained. Where it is necessary for any plant to lay parallel to the pipelines, a minimum distance of 1 metre shall be maintained between the outside of the pipeline and any plant being installed, except in the case of small diameter plant where N.J.U.G 7 dimensions apply. The Company must agree exceptions to these conditions in writing.
11. All crossing of the company's pipelines and easements shall be at right angles where possible. Where skew crossings are necessary, no more than 3 metres of the Company's pipeline shall be exposed at any time.
12. The Company will require three copies of proposal drawings showing the details of any proposed crossing of pipelines above 300mm diameter. The drawings must show the Company's pipelines in relation to the proposed works, to a scale of no less than 1:500 and no work shall commence until the Company has given approval.
13. Where it is necessary to carry out piling works closer than 6m to the Company's apparatus, or to carry out works using plant that is likely to damage the integrity of the Company's apparatus, the Company will require a method statement of the works shall be consulted before work commences.
14. Where the Company's pipeline is protected by a cathodic protection system, the Company will require a suitable joint testing programme to be agreed before the application of any cathodic protection scheme proposed by another authority or utility undertaking. If any bond-wires or test leads associated with the Company's cathodic protection system are damaged, disconnected or found to be in poor condition, the Company should be notified so that repairs can be made.
15. In the case of Trunk mains which cross development sites, no development is to take place within an agreed distance either side of the pipeline. A guide showing the easement widths for the various diameters and depths of pipe is available from the RASWA department.
16. No tree planting or landscaping work is done in close proximity to Company apparatus unless otherwise agreed in writing by the Company. A planting guide is available from the RASWA department.
17. In the event of any damage to any of the Company's plant the Company must be informed immediately. Where any damage occurs to Company apparatus, the appropriate remedial work will be carried out by the Company and charged to the promoter of the works.
18. Every effort should be made to secure the site against vandalism of the Company's plant.
19. A copy of these conditions is to be made available to all Contractors or Sub-Contractors working in the vicinity of Company apparatus.

Issue: RASWA 2. Oct. 02



The material contained on this plot has been reproduced from an Ordnance Survey map with permission of the Controller of H.M.S.O. Crown Copyright Reserved. Licence No. W/208556. The information shown on this plan should be regarded as approximate and is intended for guidance only. It is not to be used as a basis for any legal proceedings or as a basis for any claims or actions, in whole or in part, by any person, firm or company, for any loss or damage, or for any agents for any omission. The actual position of any water mains or sewers shown on the plan must be established by taking trial holes in all cases. In the case of water mains Northumbrian Water Limited will be pleased to provide the necessary assistance. In the case of sewerage connections and former private drains and sewers transferred to Northumbrian Water on 01/01/01 may not be shown but their presence should be anticipated. **WARNING.** Where indicated on the plan, the presence of asbestos containing materials should be assumed. In the event of any work in the vicinity of these abandoned asbestos cement materials, the appropriate Health & Safety precautions should be taken. Northumbrian Water accepts no liability in respect of claims, costs or damages of any kind arising from the use of this plan or from any failure to take adequate precautions. Emergency Telephone Number: 0845 717 1100





— Distribution Main	- - - Private Main	Your Reference: 0000
— Raw Water Main	- - - Out of Commission Main	Our Reference: 1072335
— Trunk Main	XXXXX Abandoned Asbestos Main	
- - - Proposed Main	/// Abandoned Main	

Author : THRAG	Date : 24-05-2013	<p>The material contained on this plot has been reproduced from an Ordnance Survey map with permission of the controller of H.M.S.O. Crown Copyright Reserved. Licence No. WJ298508. The information shown on this plan should be regarded as approximate and is intended for guidance only. No Liability of any kind whatsoever is accepted by Northumbrian Water, its servants or agents for any omission. The actual position of any water mains or sewers shown on the plan must be established by taking trial holes in all cases. In the case of water mains Northumbrian Water must be given two working days notice of their intention to excavate trial holes. Private connections and former private drains and sewers transferred to Northumbrian Water on 01/10/11 may not be shown but their presence should be anticipated. WARNING: Where indicated on the plan there could be abandoned asbestos cement materials or shards of pipe. If excavating in the vicinity of these abandoned asbestos cement materials, the appropriate Health & Safety precautions should be taken. Northumbrian Water accepts no liability in respect of claims, costs, losses or other liabilities which arise as the result of the presence of the pipes or any failure to take adequate precautions. Emergency Telephone Number: 0845 717 1100</p>
Title : Water	Sheet: NY9940SW	
Centre Point : 399208,540104	Scale : 1:1250	



Appendix C Trial Pit Log

Structural Soils Ltd
The Potteries
Pottery Street, Castleford
West Yorkshire
WF10 1NJ

Report No:	13083062
Order Number :	
Date of Issue:	14/08/2013
Test Date :	13/08/2013
Material Spec:	Not Given
Element No:	8ESH0099

Analysis Report

Tested in accordance with : ICP OES & Combustion

Description: Metal Sample
Identification: 762749
Identification: BE4 Bridges
Identification: Bearing Rail

Identification: ASS/2

Results:

		Test Number
		H3097
Element	Units	Result
C	mass %	0.39
Si	mass %	0.01
Mn	mass %	0.33
P	mass %	0.066
S	mass %	0.094
Cr	mass %	<0.01
Mo	mass %	<0.01
Ni	mass %	0.01

Sample H3097 is Wrought Iron

Issued by:



Senior Analytical Technician



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Appendix D Form AA

FORM 'AA' (BRIDGES)**GC/TP0356**

ELR/ Bridge No ASS/2

Appendix: 4

Issue: 1

Revision: B (Nov 2000)

APPROVAL IN PRINCIPLE FOR ASSESSMENT**Bridge/Line Name: Crawley Hall /Ashes Branch (Stanhope)****ELR/Bridge No. ASS/2****Brief Description of Existing Bridge:****(a) Span Arrangement**

The bridge is a single span skewed overbridge. The clear skew span is 3.83m (12' - 7"); the square span is 3.51m (11' - 6") giving a skew angle of 23°.

(b) Superstructure Type

The bridge is comprised of upright worn 80lb bull-head rails contiguously spanning longitudinally between abutments. A section of rails 6.93m wide form the deck to the carriageway. Discrete sections of the rail are laterally restrained by means of tie bars and bolts at 1.07m centres. Under the footways some of the rails are laid horizontally. At the outer edges there are cast iron trough type edge girders which form the support for the bridge parapets. Under the south footway, there is a service bay constructed of $\frac{5}{8}$ " thick steel plate simply supported by two single upright rails. A plate of unknown thickness is supported between the $\frac{5}{8}$ " thick plate and the edge of the upright rails.

The rails support a 92mm thick concrete backing to form the deck.

The parapets are a combination of mortared and dry stone wall construction.

(c) Substructure Type

The substructure comprises of gravity type abutments, constructed from randomly sized stone blocks brought to courses. Large, dressed sandstone blocks within the abutments form the bearing shelf for the spanning rails. There are 2 No. worn 80lb bull-head rails laid horizontally acting as bearings for the spanning rails on each bearing shelf. The wing walls are also gravity type stone construction

(d) Planned highway works/modifications at this site

None

(e) Road designation class and whether classed as a heavy load route

The bridge carries the B6278. The carriageway is 6.17m wide. There is a 1.56m wide kerbed footpath to the south and a 0.81m wide kerbed footpath to the north of the carriageway.

The road surfacing across the bridge deck is in good condition with minor wear towards the outer edges the surfacing will be rated as "good" for assessment purposes.

FORM 'AA' (BRIDGES)**GC/TP0356**

ELR/ Bridge No ASS/2

Appendix: 4

Issue: 1

Revision: B (Nov 2000)

APPROVAL IN PRINCIPLE FOR ASSESSMENT

The national speed limit of 60mph applies over the bridge; traffic flow is moderate with light HGV traffic; AAHG VF is taken as "medium".

(f) Any other requirements

None

Assessment Criteria

(a) Loadings and Speed

Section sizes used to calculate dead loads and for determining structural capacity obtained from site measurements. (See Jacobs report "VAR9-3991 Assessment Programme – Assessment and Inspection Report – Bridge Ref.: ASS/2 – February 2014"). The bridge is to be assessed for up to 40/44 tonne live loading, with reduced loading being determined where this capacity is not reached.

(b) Codes to be used

BD21/01 – "The Assessment of Highway Bridges and Structures"

BD56/10 – "The Assessment of Steel Highway Bridges and Structures"

(c) Proposed Method of Structural Analysis

The capacity of the bull head rails will be calculated on simple bending principles after determining the plastic section modulus of the corroded section. The rails will be assessed using the Type HA live loading where the UDL shall be taken as two longitudinal strip loads and the KEL as two wheel loads. This will be applied in accordance with clauses 6.10 and 6.11.

This method will also be used in considering accidental vehicle loading on the footpaths. The loading effects on the longitudinal rails from the service bay plate will be derived by simple statics.

The strength of the floor plates themselves will be determined using bending principles. Local load effects can be determined using Pucher charts.

The substructure will be assessed qualitatively.

FORM 'AA' (BRIDGES)**GC/TP0356**

ELR/ Bridge No ASS/2

Appendix: 4

Issue: 1

Revision: B (Nov 2000)

APPROVAL IN PRINCIPLE FOR ASSESSMENT**Senior Civil Engineer's Comments***None.*

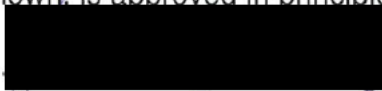
Proposed Category for Independent Check 1

Superstructure 1

Substructure 1

Name of Checker suggested if Cat 2 or 3 *Not Applicable***Category 1**

The above assessment, with amendments shown, is approved in principle:

Signed Title *Civil Engineer*Date *28th February 2014***Category 2 and 3**

The above assessment, with amendments shown, is approved in principle:

Signed

Title

Date

Signed

Title

Date

Appendix E Form BA

FORM 'BA' (BRIDGES)**GC/TP0356**

ELR/ Bridge No ASS/2

Appendix: 4

Issue: 1

Revision: A (Dec 2005)

CERTIFICATION FOR ASSESSMENT CHECK**Assessment Group:** Jacobs UK Ltd**Bridge/Line Name:** ~~Crawley Hall Bridge / Ashes Branch (Stanhope)~~**Category of Check:** 1**ELR/ Bridge No:** ASS/2

We certify that reasonable professional skill and care have been used in the assessment of the above structure with a view to securing that:

- (1) It has been assessed in accordance with the Approval in Principle as recorded on Form AA approved on 28th February 2014.
- (2) It has been checked for compliance with the following principal British Standards, Codes of Practice, BRB (Residuary) Limited technical notes and Assessment standards:
 - BD21/01 The assessment of highway bridges and structures
 - BD56/10 The assessment of steel highway bridges and structures

List any departures from the above and additional methods or criteria adopted, with reference and justification for their acceptance.

None

Category 1**Name****Signature****Date**

15/08/14 Assessor

22/7/14 Assessment Checker

2/9/14
Authorised signatory of the
firm of Consulting
Engineers to whom
Assessor/Checker is
responsible.

FORM 'BA' (BRIDGES)**GC/TP0356**

ELR/ Bridge No ASS/2

Appendix: 4

Issue: 1

Revision: A (Dec 2005)

CERTIFICATION FOR ASSESSMENT CHECKCategory 2 and 3 (Note: Category 1 check must also be signed)**(a) Assessment**NameSignatureDate

.....

Assessor

.....

Assessment Checker

.....

Authorised signatory of the
firm of Consulting
Engineers to whom
Assessor/Checker is
responsible.**(b) Check**NameSignatureDate

.....

Assessor

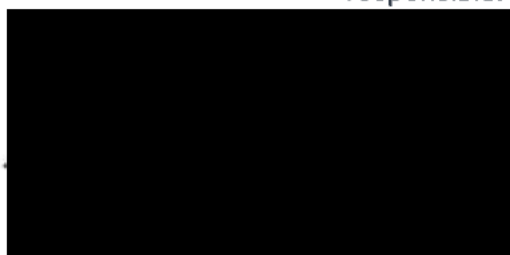
.....

Assessment Checker

.....

Authorised signatory of the
firm of Consulting
Engineers to whom
Assessor/Checker is
responsible.

This Certificate is accepted by.....



FORM 'BAA' (BRIDGES)**GC/TP0356**

ELR/ Bridge No ASS/2

Appendix: 4

Issue: 1

Revision: A (Dec 2005)

CERTIFICATION FOR ASSESSMENT CHECK**Notification of Assessment Check****Assessment Group** Jacobs UK Ltd**Bridge Name/Road No.** Crawley Hall Bridge / B6278**Line Name** Ashes Branch (Stanhope)**ELR Code/Structure No.** ASS/2

The above bridge has been assessed and checked in accordance with Standards which are listed on the appended Form BA. A summary of the results of the assessment in terms of capacity and restrictions is as follows:-

STATEMENT OF CAPACITY**Footway Accidental Loading**

3 tonnes Accidental Vehicle Loading to BD21/01

Carriageway Loading

40 Tonnes Assessment Live Loading to BD21/01

Substructure

Current loading by qualitative assessment.

Recommended Loading Restrictions

No restriction on carriageway subject to measures being taken to prevent vehicle incursion onto footways.

Description of Structural Deficiencies and Recommended Strengthening

The footway only passes for 3 tonnes accidental vehicle load in accordance with BD21/01. It is recommended that barriers or safety kerbs are introduced to prevent vehicles encroaching onto the footways.

Repairs to the abutments and waterproofing of the deck to reduce further corrosion are recommended.

FORM 'BAA' (BRIDGES)**GC/TP0356**


ELR/ Bridge No ASS/2

Appendix: 4

Issue: 1

Revision: A (Dec 2005)

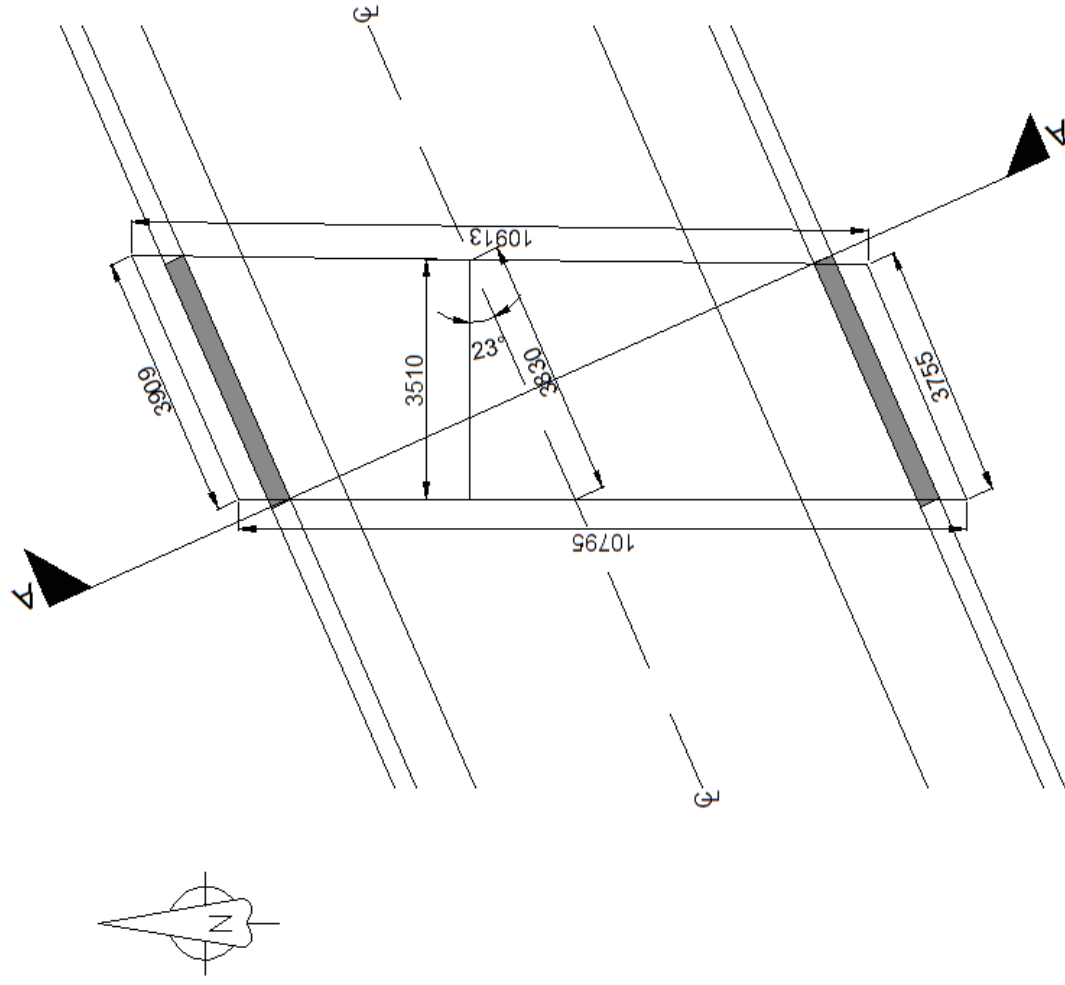
CERTIFICATION FOR ASSESSMENT CHECK

Name	Signature	Date	
		15/08/14	Assessor
		22/7/14	Assessment Checker
		8/9/14	Authorised signatory of the firm of Consulting Engineers to whom Assessor/Checker is responsible.

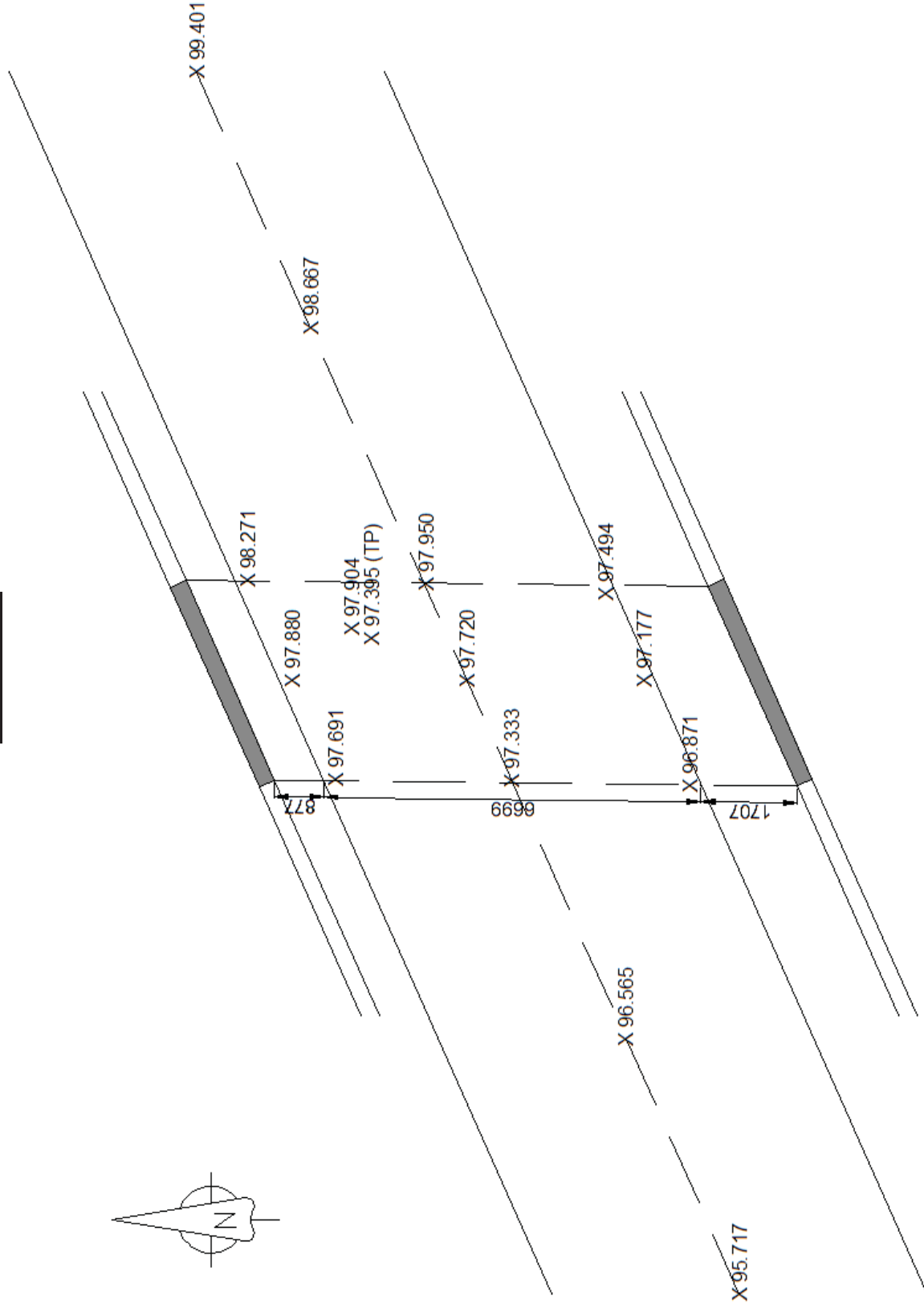
This Certificate is accepted by. 

Appendix F Calculations

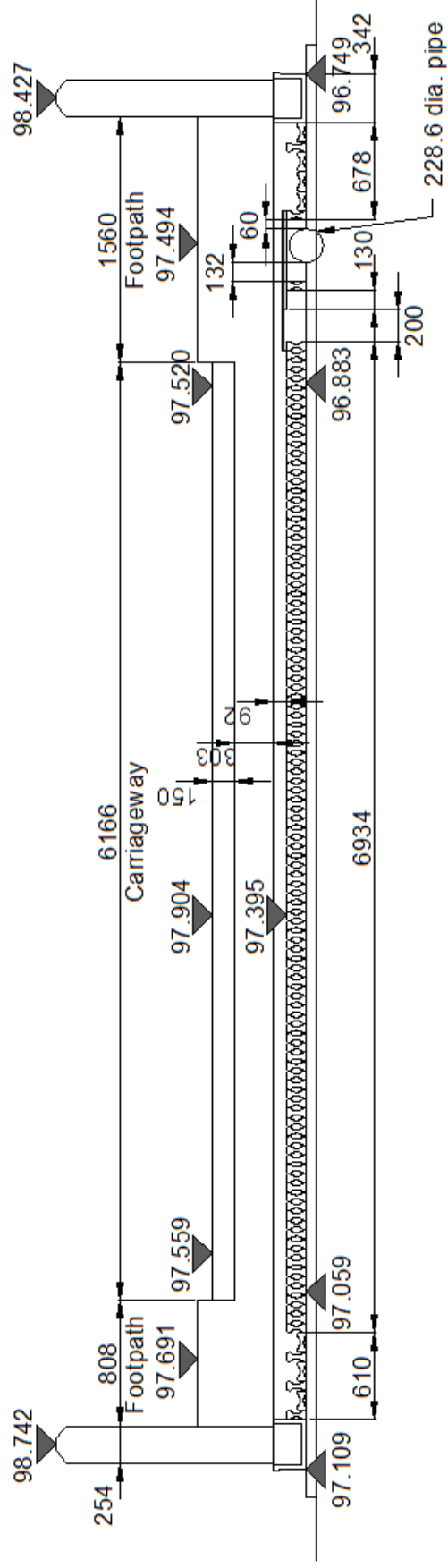
Bridge Plan
(Not to Scale)



Plan at Road Level
(Not to Scale)



Bridge Deck
Section A-A (Not to Scale)



JACOBS™

Fairbairn House
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OFFICE:

Manchester (Sale)

CLIENT:

HA Historical Railways Estate

PROJECT:

VAR9/3391 Assessment Programme

CALCULATION TITLE:

BD21/01 Assessment Calculations for Structure ASS/2, Crawley Hall Bridge

DATE	REV.	REVISION DETAILS	ORIG.	CHECK	REVIEW
March 2014	P01	First Issue			
April 2014	P02	Review comments incorporated			
May 2014	P03	Review comments incorporated			
July 2014	P04	Review comments incorporated			

COMPUTER APPLICATIONS USED:**VERSION/DATE****NUMBER OF CALCULATION PAGES:**

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Page No.

Job No

B18280BD

Originator

Date

06/03/14

Section

ASS/2 BD21 - ASSESSMENT

RAIL GIRDER CHECKER
PCN. 10405

Date

24/04/14

RAIL GIRDER ASSESSMENTEFFECTIVE LENGTH

Clear skew span = 3.83m

Longitudinal girders are resting on two rails at each end, laid on their side. (See photo 5 of Assessment Report) Twice effective length from these rails = 2 rail depth = 137mm

$$\text{Effective length} = (0.137 \times 2) + 3.83 = 4.104\text{m}$$
DEAD LOADSRAIL GIRDERS

$$\begin{aligned} \text{Weight} &= 500 \text{ kg/m} = 39.68 \text{ kg/m} \\ &= 0.39 \text{ kN/m} \end{aligned}$$

Inspection

CONCRETE 92mm thick

Inspection

Each girder supports its own width in concrete = 65mm

BD21/01
Table 4.1
$$\text{Area} = 0.065 \times 0.092 = 5.98 \times 10^{-3} \text{ m}^2$$
Unit weight concrete = 2300 kg/m³

$$\begin{aligned} 2300 \times 5.98 \times 10^{-3} &= 13.75 \text{ kg/m} \\ &= 0.14 \text{ kN/m} \end{aligned}$$

Inspection

FILL

Depth = 303mm

$$\text{Area} = 0.303 \times 0.065 = 0.02 \text{ m}^2$$
BD21/01
Table 4.1Unit weight = 1800 kg/m³ = 17.66 kN/m³

$$\text{Load} = 17.66 \times 0.02 = 0.35 \text{ kN/m}$$

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Job No & Title B18280BD

Originator

Date

06/03/14

Section ASS/2 BD21 ASSESSMENT

RAIL GIRDERS
PERMANENT LOADS

Checker

Date

24/04/14

Inspection

ROAD SURFACE

Depth = 150 mm

Area = $0.15 \times 0.065 = 9.75 \times 10^{-3} \text{ m}^2$ BD21/01
Table 3.1Unit weight = 2300 kg/m^3 Load = 0.22 kN/m

TOTAL PERMANENT LOAD ON RAIL GIRDER =
 $0.39 + 0.14 + 0.35 + 0.22 = 1.10 \text{ kN/m}$
 (NOMINAL)

LOAD	MAGNITUDE ^(kN/m)	YAL *	FACTORED LOAD ^(kN/m)
Self-weight	0.39	1.05	0.41
Concrete	0.14	1.15	0.16
Fill	0.35	1.20	0.42
Road Surface	0.22 <small>Top 100mm = 0.15 50mm below = 0.07</small>	1.75 1.20	0.26 0.08

 $\Sigma 1.33 \text{ kN/m}$

* BD21/01 Table 3.1

PERMANENT LOAD EFFECTS

$$\text{Moment} = \frac{WL^2}{8} = \frac{1.33 \times 4.104^2}{8} = 2.80 \text{ kNm}$$

$$\text{Shear} = \frac{WL}{2} = \frac{1.33 \times 4.104}{2} = 2.73 \text{ kN}$$

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& Title B18280BD

Originator

LG

Date

10/03/14

Section ASS12 BD21 ASSESSMENT RAIL GIRDER
CAPACITY
SECTION PROPERTIES

Checker

JHR

Date

24/04/14

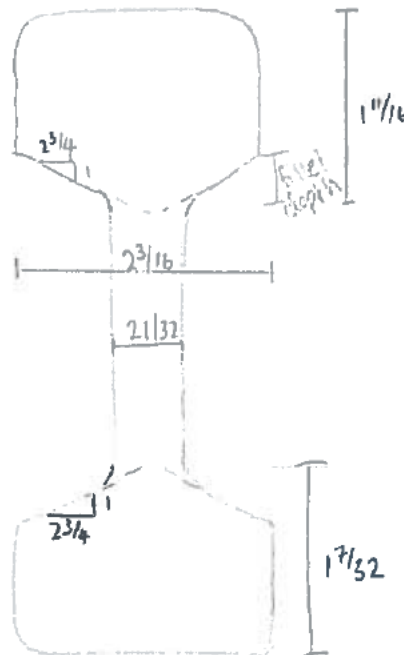
RAIL GIRDER SECTION PROPERTIES

Dimensions measured on side given in form A
and taken as the corroded dimensions

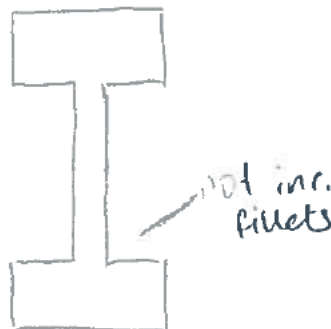
Form A states girder to be 80lb rail.

Historical drawing states 82lb rail.

Rail taken as 80lb section shown below



Simplify section to
(conservative)



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B18280BD

Originator

Date

10/03/14

Section

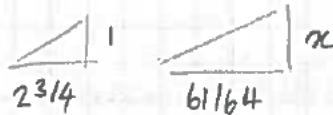
ASS/2 BD21 ASSESSMENT

LAIL GUARDER
SECTION PROPERTIES

Checker

Date

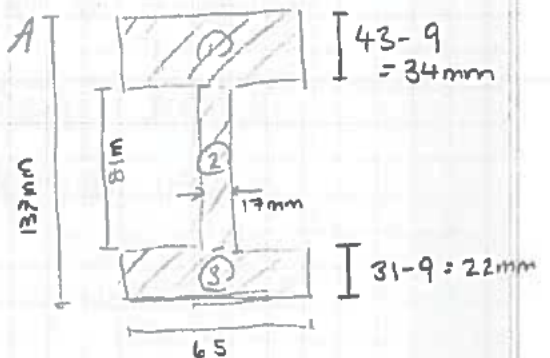
24/04/14

Fillet Width $\rightarrow (2^{9/16} / 2) - (2^{1/32} / 2) = 61/64''$ 

$$x = \frac{1}{2^{3/4}} \times \frac{61}{64} = 0.347''$$

$$= 9\text{mm}$$

Using dimensions from Form A



$$A_1 = 34 \times 65 = 2210\text{mm}^2$$

$$A_2 = 17 \times 81 = 1377\text{mm}^2$$

$$A_3 = 22 \times 65 = 1430\text{mm}^2$$

$$\Sigma A = 5017\text{mm}^2$$

$$y_1 = 22 + 81 + 34/2 = 120\text{mm}$$

$$y_2 = 22 + 81/2 = 62.5\text{mm}$$

$$y_3 = 22/2 = 11\text{mm}$$

$$y = \frac{\Sigma A_i y_i}{\Sigma A} = \frac{(2210 \times 120) + (1377 \times 62.5) + (1430 \times 11)}{5017}$$

$$= 73.1\text{mm from bottom}$$

$$I_1 = 65 \times 34^3 / 12 = 212.9 \times 10^3\text{mm}^4$$

$$I_2 = 17 \times 81^3 / 12 = 752.9 \times 10^3\text{mm}^4$$

$$I_3 = 65 \times 22^3 / 12 = 57.7 \times 10^3\text{mm}^4$$

$$\Sigma I = 1.02 \times 10^6\text{mm}^4$$

$$A_1(y - y_1)^2 = 2210(73.1 - 120)^2 = 4.86 \times 10^6\text{mm}^4$$

$$A_2(y - y_2)^2 = 1377(73.1 - 62.5)^2 = 0.155 \times 10^6\text{mm}^4$$

$$A_3(y - y_3)^2 = 1430(73.1 - 11)^2 = 5.51 \times 10^6\text{mm}^4$$

$$\Sigma A = 10.52 \times 10^6\text{mm}^4$$

$$I_{xx} = 10.52 \times 10^6 + 1.02 \times 10^6 = 11.54 \times 10^6\text{mm}^4$$

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Originator

Date

10/03/14

Section ASS/2 B021 ASSESSMENT

Checker

Date

24/04/14

ELASTIC SECTION PROPERTIES

$$I_{xx} = 11.54 \times 10^6 \text{ mm}^4$$

$$Z_{top} = 11.54 \times 10^6 / 63.9 = 180.6 \times 10^3 \text{ mm}^3$$

$$Z_{bottom} = 11.54 \times 10^6 / 73.1 = 158.9 \times 10^3 \text{ mm}^3$$

PLASTIC SECTION PROPERTIESPLASTIC NEUTRAL AXIS

$$\text{Top flange area} = 2210 \text{ mm}^2$$

$$\text{Bottom flange area} = 1430 \text{ mm}^2$$

$$2210 - 1430 = 780 \text{ mm}^2$$

$$\text{Web to have } 780 \text{ mm}^2 \text{ more on bottom} = 45.88 \text{ mm more}$$

$$\text{Total web depth} = 81 \text{ mm}$$

$$(81 - 45.88) / 2 = 17.56 \text{ mm}$$

$$\text{Web top} = 17.56 \text{ mm}$$

$$\text{Web bottom} = 45.88 + 17.56 = 63.44 \text{ mm}$$

$$\text{Area top web} = 298.52 \text{ mm}^2$$

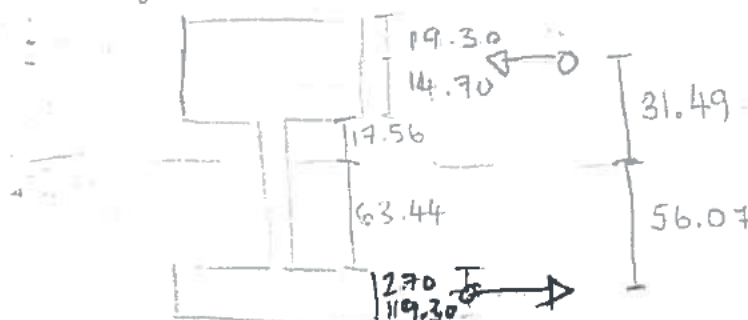
$$\text{Area bottom web} = 1078.48 \text{ mm}^2$$

$$\text{Check } \rightarrow \text{Top} = 298.52 + 2210 = 2508.5 \text{ mm}^2$$

$$\text{Bottom} = 1078.48 + 1430 = 2508.5 \text{ mm}^2$$

$$\text{PNA } 85.4 \text{ mm from bottom} = 137 \text{ mm } \checkmark \text{ OK}$$

$$51.6 \text{ mm from top}$$



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& Title

B18280B-D

Originator

Date

10/03/14

Section

ASS/2 BD21 ASSESSMENT RAIL GIRDER
MOMENT CAPACITY

Checker

Date

12/04/14

$$Z_p = (2508.5 \times 31.5) + (2508.5 \times 56.1) \\ = 219.7 \times 10^3 \text{ mm}^3$$

SHAPE LIMITATIONSBD21
CL 4.9

$$\sigma_y = 220 \text{ N/mm}^2$$

BSS400
CL 9.3.7.2

$$m = \text{depth of web in compression} / \text{depth of web} \\ = 17.56 / 81 = 0.22$$

$$\frac{34tw}{m} \sqrt{\frac{355}{\sigma_{ym}}} = \frac{34 \times 17}{0.22} \times \sqrt{\frac{355}{220}} = 3337.4 \text{ mm}$$

$$81 < 3337.4 \text{ Therefore web is compact}$$

BSS400
CL 9.3.7.3

$$7t_f \sqrt{\frac{355}{\sigma_{yf}}} = 7 \times 34 \times \sqrt{\frac{355}{220}} = 302.3 \text{ mm}$$

$$b_{fo} = 24 \text{ mm} < 302.3 \text{ mm} \text{ Therefore treat as compact.}$$

\therefore Use plastic section properties

$\lambda_T = 0$ as girder considered to be restrained by concrete deck and adjacent rails.

$$M_z / M_{ult} = 1$$

$$\begin{aligned} \text{MOMENT CAPACITY} &= \frac{Z \sigma_y}{\gamma_m \gamma_{f3}} \\ &= \frac{219.7 \times 10^3 \times 220}{1.2 \times 1.1} \\ &= 36.6 \text{ kNm} \end{aligned}$$

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Originator

Date

10/03/14

Section ASS/2 BD/1 ASS/2 SHEAR CAPACITY RAIL GIRDER

Checker

Date

24/04/14

SHEAR CAPACITYBS5400-3
CL9.9.2.2

$$V_D = \left[\frac{t_w (d_w - h_h)}{\gamma_m \gamma_{f3}} \right] \tau_L$$

$$t_w = 17 \text{ mm}$$

$$d = 137 \text{ mm}$$

$$h_h = 0 \text{ mm}$$

$$\lambda = \frac{d_w}{t_w} \sqrt{\frac{\sigma_{yw}}{355}}$$

$$\lambda = \frac{81}{17} \sqrt{\frac{220}{355}} = 3.75$$

$$\tau_y = \frac{\sigma_{yw}}{\sqrt{3}} = \frac{220}{\sqrt{3}} = 127.0$$

$$\phi = \frac{4104}{81} = 50.6$$

$$b_{fe} = \text{smallest } d(a) \cdot 10 \leq \sqrt{\frac{355}{\sigma_{yf}}} = 10 \times 22 \times \sqrt{\frac{355}{270}} = 279.5$$

$$(b) = 65/2 = 32.5 \quad \checkmark$$

$$m_{fw} = \frac{220 \times 32.5 \times 22^2}{2 \times 220 \times 81^2 \times 17} = 0.07$$

(Used smallest flange)

.. Use Figure 17 for $\phi = 50$

$$\tau_L / \tau_y = 1.0$$

$$\tau_L = 1.0 \times 127 = 127.0 \text{ N/mm}^2$$

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B1828080

Originator

Date

11/03/14

Section

ASS/2 BD21 ASSESSMENT

RAIL GIRDER
SHEAR
CAPACITY

Checker

Date

24/04/14

$$V_D = \left[\frac{L_w d_w - h_n}{Y_m Y_{f3}} \right] \tau_l$$

$$V_D = \frac{17 \times (137 - 0)}{1.2 \times 1.1} \times 127 = 224.1 \text{ KN}$$

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Originator

Date

07/03/14

Section

ASS/2 ASSESSMENT

RAIL GIRDERS
LIVELOADING

Checker

Date

24/04/14

LIVE LOADING ON RAIL GIRDER

BD21/01

CL6.10

(in accordance
with Formula)

Carriage way divided into 2.5m notional
lane widths and UDL taken on two longitudinal
strips and KEL taken on two wheel loads

BD21

CL6.10

Longitudinal strips applied over transverse width
0.3m with 1.8m transverse spacing.
wheel load applied over 0.3 x 0.3m square contact
area

Distance between adjacent sets = 0.7m

BD21

CL5.6

& BD21

CL6.10

NOTIONAL LANES = 2

Notional lane width = 2.5m

UDL

$W = 336 (1/L)^{0.67} = 336 (1/4.104)^{0.67} = 130.5 \text{ kN/m}$
130.5 kN/m over lane of width 3.65m

KEL

120 kN over lane width

~~REDUCTION FACTOR~~

~~Track surface as good condition.
Track traffic as medium
for 40 tonnes Assessment Live Loading~~

~~$K = 0.79$~~

~~Inspection
Report~~

BD21

Fig 5.8

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& Title B18280BD

Originator

Date

10/03/14

Section ASS/2 BD21 ASSESSMENT CARRIAGEWAY
LIVE LOAD

Checker

Date

24/04/14

ADJUSTMENT FACTOR, AFBD21
CL 5.23

$$AF = a_L / 2.5 = 3.65 / 2.5 = 1.46 \quad \checkmark$$

LANE FACTORBD21
CL 5.24

$$\text{Both lanes} = 1.0$$

LIVE LOADING

$$UDL \rightarrow \frac{130.5}{1.46} = 89.4 \text{ kN/m} \quad \checkmark$$

$$KEL \rightarrow \frac{120}{1.46} = 82.2 \text{ kN} \quad \checkmark$$

DISTRIBUTION OF KEL and UDL

BD21 CL 6.7 states that no allowance for the UDL and KEL shall be made. However, ~~CL 6.4 allows for distribution across bringing 4x normal amount~~
Not relevant - but not used.

UDL and KEL LOAD

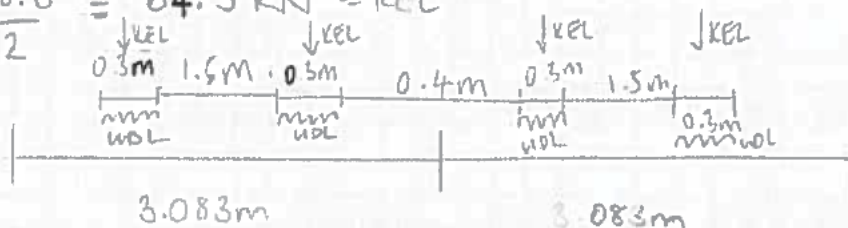
$$UDL \rightarrow 89.4 \times Y_{FL} = 89.4 \times 1.5 = 134.1 \text{ kN/m over 2.5m lane}$$

$$Y_{FL} = 1.5$$

$$KEL \rightarrow 85.7 \times 1.5 = 128.6 \text{ kN over 2.5m lane}$$

$$\frac{134.1}{2} = 67.1 \text{ kN/m} = \text{UDL per strip.}$$

$$\frac{128.6}{2} = 64.3 \text{ kN} = \text{KEL}$$



CROSS SECTION

BD21
Table 3.1

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Job No.
& Title B18280BD

Originator

Date 10/03/14

Section ASS12 BD21 ASSESSMENT CHARGINGWAY
LIVE LOAD

Checker

Date 4/7/14 14/04/14

As the longitudinal girders are not adequately connected, full dispersal in accordance with Fig 6.2.

Disperse load to neutral axis of concrete and take this width for dispersed load.
(conservative :- could be allowed to top of rail as not regarded as concrete reinforced by rails)

Dispersal = 1 to 2 in fill and surfacing
1 to 1 to concrete neutral axis

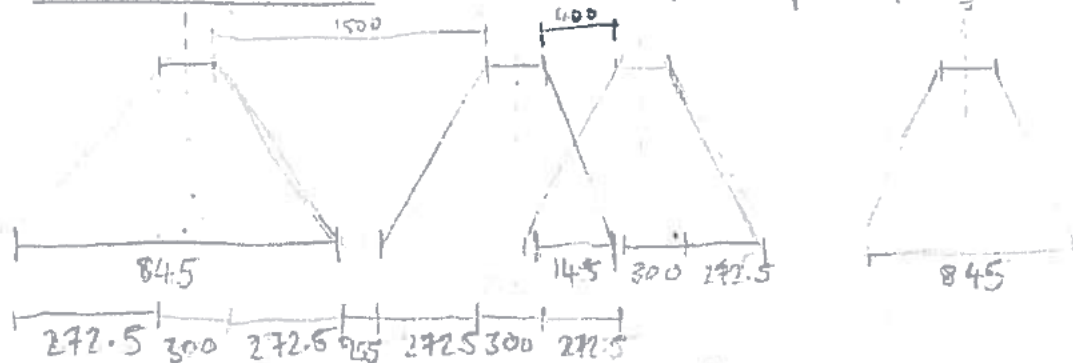
concrete \rightarrow 46 mm to neutral axis

FILL \rightarrow 303/2 = 151.5 mm

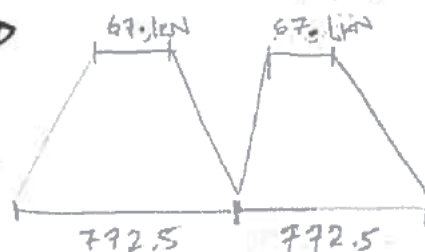
surfacing \rightarrow 150/2 = 75 mm

$$\text{Total} = 300 + 2 \times (46 + 151.5 + 75) = 845 \text{ mm}$$

UDL DISPERSAL = 67.1 kN/m per strip \rightarrow 67.1 / 0.845 = 79.3 kN



Simplify critical point \rightarrow



$$\text{No. rails} = \frac{1545}{65} = 23.8 \text{ say } 23$$

$$67.1 \times 22 / 23 = 5.8 \text{ kN/rail}$$

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& Title BIS 280BD

Originator

Date

10/03/14

Section ASS/2 BD21 ASSESSMENT

RAIL GIRDER
LOAD EFFECTS

Checker

Date

4/7/14

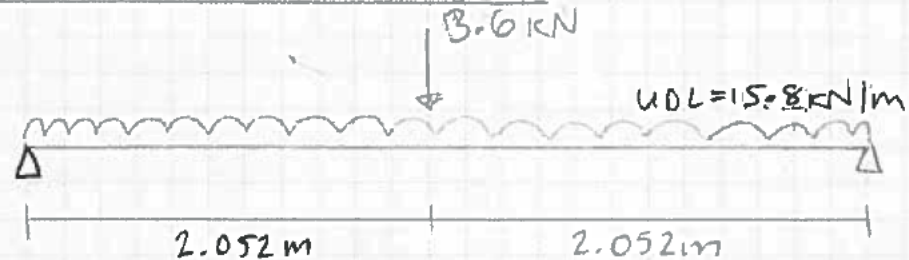
24/03/14

KEL DISPERSAL

64.8 kN loads

$$64.8 / 0.7725 = 83.2 \text{ kN}$$

$$\text{Over 23 rails} = 83.2 / 23 = 3.6 \text{ kN per rail}$$

LIVE LOAD ON ONE RAIL GIRDERLIVE LOAD EFFECTS

$$\begin{aligned} \text{Max. Bending moment} &= \frac{15.8 \times 4.104^2}{8} + \frac{3.6 \times 4.104^2}{4} \\ &= 12.21 + 3.69 \\ &= 15.9 \text{ kNm} \end{aligned}$$

$$\text{Max shear force} = 3.6 + \frac{15.8 \times 4.104}{2} = 15.5 \text{ kN}$$

TOTAL LOAD EFFECTS

$$\text{Max. Bending moment} = 23.6 + 2.80 = 26.40 \text{ kNm}$$

$$\text{Max shear} = 12.5 + 2.73 = 12.2 \text{ kN}$$

$$\text{Bending capacity} = 47.0 \text{ kNm}$$

$$\text{Permanent load bending effect} = 2.8 \text{ kNm}$$

$$47 - 2.8 = 44.2 \text{ kNm live load capacity}$$

~~Sheet 2/~~~~Sheet 2~~~~Sheet 6~~

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Originator

Date

11/03/14

Section ASS/2 BDD/ASSESSMENT

WALL GIRDER
CAPACITY

Checker

Date

4/7/14 ~~11/03/14~~

Sheet 6 Bending capacity = 36.6 kNm

Sheet 2 Permanent load bending effect = 2.8 kNm

Available live load capacity = $36.6 - 2.8 = 33.8$ kNm

Sheet 12 Live load bending effect = 15.9 kNm

$$C = \frac{33.8}{15.9} = 2.13$$

Use fig 5.6 for medium traffic, good surface

 $2.13 > 0.79 \therefore 40$ tonnes assessment live loading OK

Sheet 8 Shear capacity = 224.1 kNm

Sheet 2 Permanent load shear effect = 2.73 kN

Available live load capacity = $224.1 - 2.73 = 221.37$ kN

Sheet 12 Live load shear effect = 15.5 kN

$$C = \frac{221.4}{15.5} = 14.3$$

Using fig 5.6;

 $14.3 > 0.79 \therefore$ OK in shear for 40 tonnes assessment live loading
~~Fig. single axle and single wheel loads.~~

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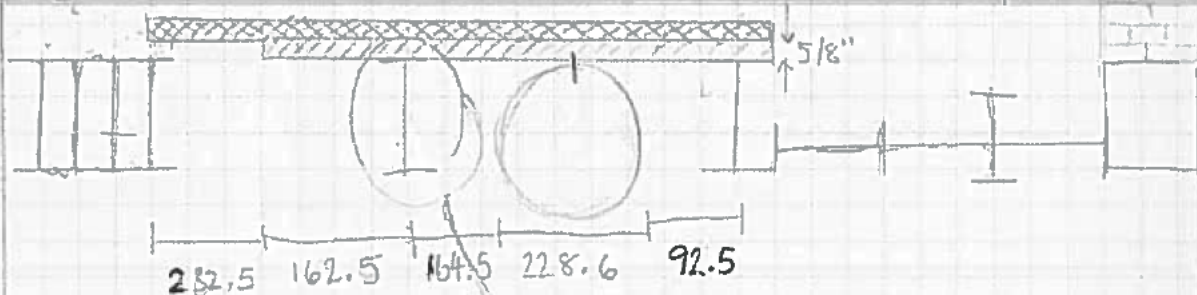
Section ASS/2 BD21 ASSESSMENT

South Footpath Checker
LAK GUZDER
PERMANENT LOADS

Date

4/7/14 ~~24/03/14~~

By observation, South Footpath Weaker than North Footpath



likely most critical element

PERMANENT LOADS

Page 1

SELF WEIGHT = 0.39 kN/m (RAIL)STEEL PLATE (BOTTOM) ⇒ Thickness = $5/8" = 16 \text{ mm}$

$$\text{Area} = (0.016 \times 0.1625) + \left[0.016 \times \left(\frac{0.1625 + 0.2286 + 0.0925}{2} \right) \right]$$

$$= 5.30 \times 10^{-3} \text{ m}^2$$

BD21 table
4.1

$$\text{Unit weight} = 7850 \text{ kg/m}^3 = 77.0 \text{ kN/m}^3$$

$$\text{Load} = 5.30 \times 10^{-3} \times 77 = 0.41 \text{ kN/m}$$

STEEL PLATE (TOP)Plate depth as $5/8" = 16 \text{ mm}$

$$\text{Area} = \left[\frac{0.2325 + 0.165}{2} \times 0.016 \right] + \left[\frac{0.1645 + 0.2286 + 0.0925}{2} \times 0.016 \right]$$

$$= 7.04 \times 10^{-3} \text{ m}^2$$

$$\text{Load} = 7.04 \times 10^{-3} \times 77 = 0.54 \text{ kN/m}$$

PIPE Tube thickness as $1/2" = 13 \text{ mm}$

$$\text{Area} = \pi \times \left(\frac{0.2286}{2} \right)^2 - \pi \times \left(\frac{0.2286 - 0.013}{2} \right)^2$$

$$= 5.54 \times 10^{-3} \text{ m}^2$$

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& Title B182808D

Originator

Date

14/03/14

Section ASS/2 BD21 ASSESSMENT SOUTH FOOTPATH

Checker

Date

4/7/14 24/03/14

Unit weight = 77 kN/m

Load = $4.54 \times 10^{-3} \times 77 = 0.35 \text{ kN/m}$ CONCRETE depth = 92 mm - 16 - 16 = 60 mm

$$\text{Area} = \left[\left(\frac{0.1325 + 0.1625}{2} \right) + \left(\frac{0.1645 + 0.2286 + 0.0925}{2} \right) \right] \times 0.06$$

$$\text{Area} = 0.026 \text{ m}^3$$

BD21 Table
4.1Unit weight = $2300 \text{ kg/m}^3 = 22.6 \text{ kN/m}^3$

Load = 0.60 kN/m

FILL depth = $97.494 - 96.883 - 0.137 - 0.092$
= 382 mmFILL ABOVE 100 mm depth = 100 mm

$$\begin{aligned} \text{Area} &= \left(\frac{0.1325 + 0.1625}{2} \right) + \left(\frac{0.1645 + 0.2286 + 0.0925}{2} \right) \times 0.1 \\ &= 0.44 \times 0.1 \\ &= 0.04 \text{ m}^2 \end{aligned}$$

BD21 Table
4.1Unit weight = $1800 \text{ kg/m}^3 = 17.7 \text{ kN/m}^3$ Load = $0.04 \times 17.7 = 0.71 \text{ kN/m}$ FILL BELOW 100 mm depth = 282 mm

$$\begin{aligned} \text{Area} &= 0.44 \times 0.282 \\ &= 0.124 \text{ m}^2 \end{aligned}$$

Unit weight = $1800 \text{ kg/m}^3 = 17.7 \text{ kN/m}^3$ Load = $17.7 \times 0.124 = 2.19 \text{ kN/m}$

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Section ASS2 BD21 ASSESSMENT

SOUTH FOOTPATH
PERM. LOADS

Checker

Date

4/7/14 ~~24/05/14~~FACTORED LOADS

LOAD	MAGNITUDE	γ_m	FACTORED LOADS
Self-Weight	0.39	1.2	0.47
Steel Plate (t)	0.54	1.05	0.57
Steel Plate (b)	0.41	1.05	0.43
Pipe	0.35	1.2	0.42
Concrete	0.60	1.15	0.69
Fill (above)	0.71	1.75	1.24
Fill (below)	2.19	1.5	3.29

$$\Sigma 7.11 \text{ kN/m}$$

PERMANENT LOAD EFFECTS

$$\text{MOMENT} = \frac{7.11 \times 4.104^2}{8} = 14.97 \text{ kNm}$$

$$\text{SHEAR} = \frac{7.11 \times 4.104}{2} = 14.59 \text{ kN}$$

Note: No allowance made for wheel pipe carries

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Section ASS/2 BD21 ASSESSMENT NORTH FOOTPATH ACCIDENTAL LOAD

Checked

Date

4/7/14 27/03/14

ACCIDENTAL WHEEL LOAD

Footpath will be weak therefore start with stone loads



$$W_1 = 2.1 \text{ tonnes}$$

$$W_2 = 0.9 \text{ tonnes}$$

Only half of axle will act on rail

BD21
Table D2

$$W_1 = 1.05 \text{ tonnes}$$

$$W_2 = 0.45 \text{ tonnes}$$

2 m distance

$$W_2 = 450 \text{ kg} = 4.41 \text{ kN}$$

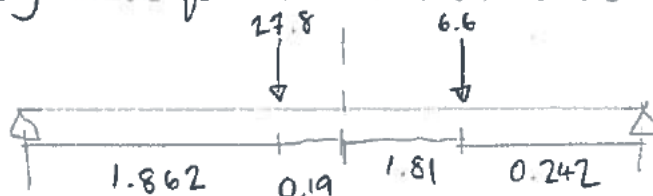
$$W_1 = 1050 \text{ kg} = 10.30 \text{ kN}$$

46.7 mm

Factor plus impact $\rightarrow W_1 = 10.3 \times 1.8 \times 1.5 = 27.8 \text{ kN}$

$$W_2 = 4.4 \times 1.5 = 6.6 \text{ kN}$$

Conservatively check for concentrated loads



$$R_A = 15.19 + 0.389 = 15.59 \text{ kN}$$

$$M_{max} = 15.59 \times 1.862 = 29.03 \text{ kNm}$$

$$V_{max} = 27.8 + \left(\frac{4104 - 2000}{4104} \right) \times 6.6 = 31.2 \text{ kN}$$

Page 18

$$\text{Permanent bending effect} = 14.97 \text{ kNm}$$

Page 6

$$\text{Capacity available for LL} = 36.6 - 14.97 = 21.63 \text{ kNm}$$

$$29.03 > 21.63 \therefore \text{Fails in bending}$$

Page 8
and Page 6

$$\text{Shear available for LL} = 224.1 - 14.59 = 209.5 \text{ kN}$$

$$209.5 > 31.2 \therefore \text{OK in shear}$$

Check bending with transverse dispersed, as girder only marginally fails.

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27/03/14Section **ASS/2 BD21 ASSESSMENT** NORTH FOOTPATH
ACCIDENTAL LOAD
DISPERSAL

Checker

Date

4/7/14 ~~27/03/14~~

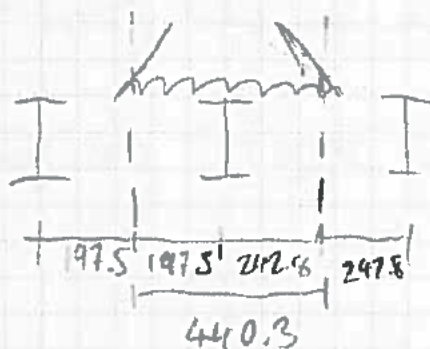
DISPERSAL \rightarrow Through concrete = 60mm
Through fill = $\frac{382}{2} = 191\text{mm}$.

$$\text{TOTAL DISPERSAL} = (191 \times 2) + 60 = 251\text{mm}$$

WHEEL CONTACT AREA $W_1 = \frac{10300}{1.1} = 9363.6\text{mm}^2$
 $= 96.8\text{mm square}$
 $W_2 = \frac{4410}{1.1} = 4009.1\text{mm}^2$
 $= 63.3\text{mm}^2$

$$\text{TOTAL } W_1 = (251 \times 2) + 96.8 = 598.8\text{mm}$$

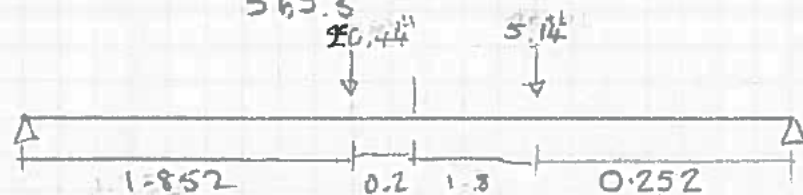
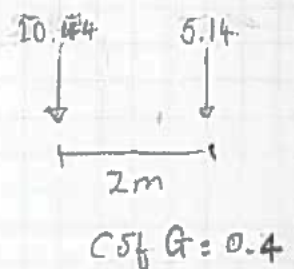
$$\text{TOTAL } W_2 = (251 \times 2) + 63.3 = 565.3\text{mm}$$



only 440.3mm of
load taken transversely

$$W_1 = 27.8 \times \frac{440.3}{598.8} = 20.47\text{kN}$$

$$W_2 = 6.6 \times \frac{440.3}{565.3} = 5.14\text{kN}$$



$$R_A = 0.32 + 11.22 = 11.54\text{kN}$$

11.54

$$M_{\text{max}} = 11.54 \times 1.852 = 21.4\text{kNm}$$

21.38

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Section ASS/2 BD21 ASSESSMENT NORTH FOOTPATH
ACCIDENTAL LOAD

Checker

Date 4/7/14 ~~27/03/14~~

Page 18

Permanent bending effect = 14.97 kNm

Page 6

Capacity available for live load = $36.6 - 14.97$
= 21.6 kNm $21.6 > 21.4 \therefore \text{OK in bending}$

Check shear

$$V_{\text{max}} = 20.44 + \left(\frac{4104 - 2000}{4104} \times 5.14 \right) = 23.1 \text{ kN}$$

Page 18

Permanent shear effect = 14.59 kN

Page 8

Capacity available for LL = $224.1 - 14.59 = 209.5$
kN $209.5 > 23.1 \therefore \text{OK for shear}$

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ASS/2 BD21 ASSESSMENT NORTH FOOTPATH

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Check Group 2 FE vehicles

Not really necessary to check FE loading on footway.

BD21
Table E1

$$W_1 = 2.30 \text{ t}$$

$$W_2 = 4.90 \text{ t}$$

Wheel load

$$W_1 = 2.30/2 = 1.15 \text{ t}$$

$$W_2 = 4.90/2 = 2.45 \text{ t}$$

Minimal pass for 3t GVW vehicle suggests it won't pass anyway.

Factor

$$W_1 = 1.15 \times 1.5 = 1.73 \text{ t} = 16.97 \text{ kN}$$

$$W_2 = 2.45 \times 1.5 \times 1.8 = 6.62 \text{ t} = 64.94 \text{ kN}$$

↑
impact

Contact area (for nominal loads)

$$W_1 = \frac{11282}{1.1} = 10256.4 \text{ mm}^2$$

$$= 101 \text{ mm square}$$

$$W_2 = \frac{24035}{1.1} = 21850 \text{ mm}^2$$

$$= 148 \text{ mm square}$$

Page 10

$$\text{DISPERSAL} = 251 \times 2 = 502 \text{ mm}$$

$$W_1 \text{ DISPERSAL} = 502 + 101 = 603 \text{ mm}$$

$$W_2 \text{ DISPERSAL} = 502 + 148 = 650 \text{ mm}$$

Page 20

Girder flanges 440.3 mm

$$W_1 = \frac{16.67 \times 440.3}{603} = 12.17 \text{ kN}$$

$$W_2 = \frac{64.94 \times 440.3}{650} = 43.99 \text{ kN}$$

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Section ASS/2 BD21 ASSESSMENT NORTH FOOTPATH

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$$\begin{aligned} \text{Cof G} &= \frac{43.99 \times 2}{56.16} \\ &= 1.56 \end{aligned}$$

$$R_A = 24.35 + 0.81 = 25.1$$

$$M_{\max} = 1.832 \times 25.1 = 46.0 \text{ kNm}$$

$$\text{Capacity available for } \therefore = 36.6 - 14.97 = 21.6 \text{ kNm}$$

$$21.6 < 46.0 \therefore \text{NOT OK}$$

Appendix G Historical Information

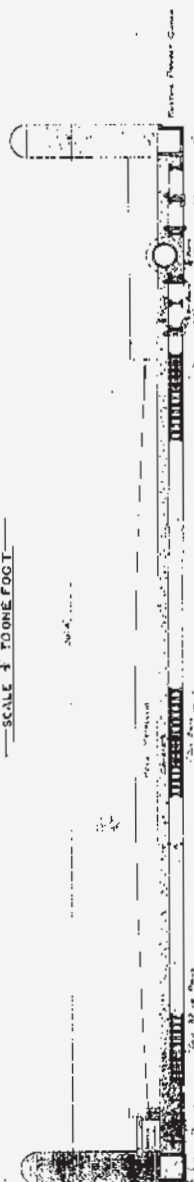
North Eastern Railway

ASHES BRANCH

RENEWAL OF PUBLIC ROAD OVERBRIDGE AT 9.64 CHS.

BRIDGE

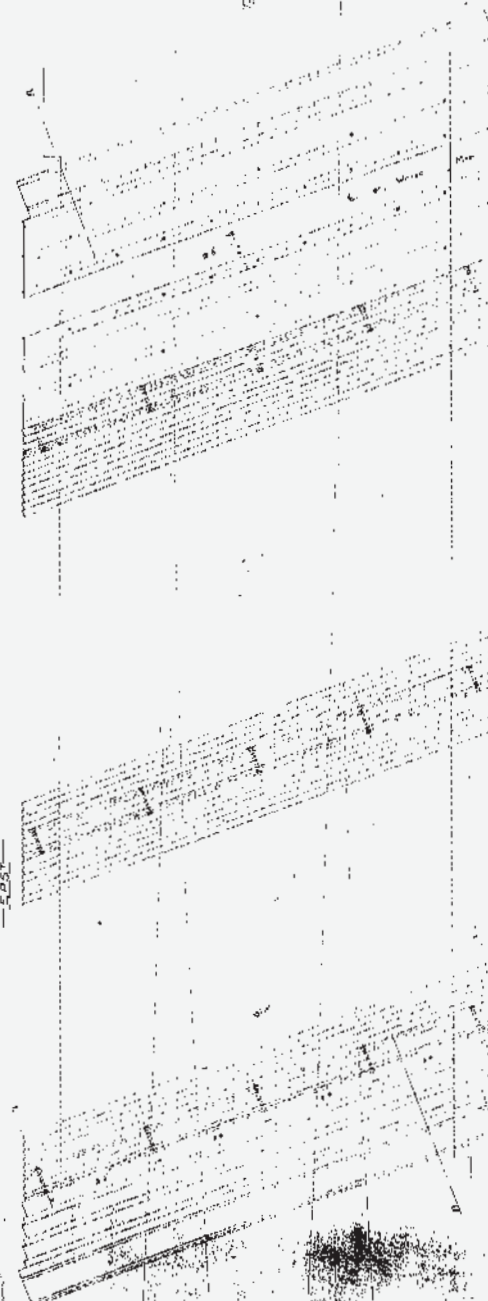
SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH



SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH



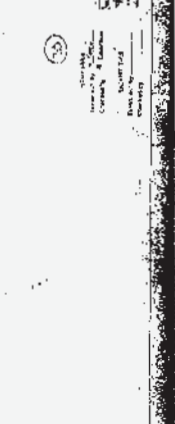
SCALE 4" FEET TO ONE INCH



SCALE 1" TO ONE FOOT



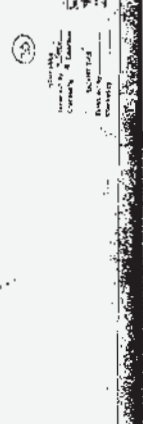
SCALE 4" FEET TO ONE INCH



SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH



SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH



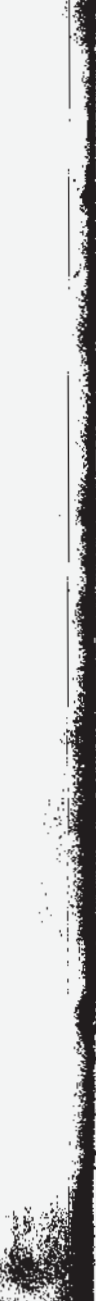
SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH



SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH



SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH



SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH



SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH



SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH



SCALE 1" TO ONE FOOT



SCALE 4" FEET TO ONE INCH

