JACOBS

BRB (Residuary) Ltd
Major Works Programme 2004/2007

VAR9-1220 BE4 ASSESSMENT PROGRAMME

ASSESSMENT AND INSPECTION REPORT

Kirtlebridge, Scottish Borders

BRIDGE REF: ANB 4

JACOBS

Document control sheet Form IP180/B

Client: BRB (Residuary) Ltd
Project: Major Works Programme 2004/2007 Job No: J24110-ANB 4
Title: VAR 9 –1220 BE4 Assess. Programme

	Prepared by	Reviewed by	Approved by
ORIGINAL Form AA	NAME [redacted]	NAME	NAME
DATE			
REVISION Form BA	NAME [redacted]	NAME	NAME
DATE 24/03/05			
REVISION	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE
REVISION	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE

Contents

1 Introduction

1.1 Remit

Jacobs was appointed by BRB(R) to conduct the site survey at ANB 4 and inspected the site in sufficient detail to provide data for assessment BE4 work. An inspection pit was excavated by Structural Soils Ltd on the bridge deck to determine the depth and composition of the surfacing / fill.

2 General Description and Structural Details

2.1 Location

Structure ANB 4 is located in The Scottish Borders. It carries the B772 road over the disused Annan to Kirtlebridge line. The OS grid reference is NY 225 727.

2.2 Construction type

The structure is a single span brick arch with stone spandrels, abutments, parapets and wingwalls. The structure has a square span of 7.97m and the headroom below the structure is approximately 4.9m. The east elevation (photograph no. 1) a photograph looking towards the south (photograph no. 2) can be found in section 8 of the report.

The structure carries the B772, which is a moderately used route by all vehicle types. It has grass verges either side of the carriageway measuring 1.4m and 0.9m.

2.3 Assessment summary

2.3.1 BD21/97 Assessment

No previous BD21 assessments were provided.

2.3.2 BE4 Assessment

The bridge is calculated to have full capacity, according to the BE4 Assessment code.

3 Existing Information Search

3.1 Service Search

A service search was carried out by Structural Soils Ltd. The plans are located in Appendix B.

3.2 Ground Investigation/ SI Results

A trial pit was excavated on the bridge deck on the west verge. This determined the depth and composition of fill and the condition and level of the top of the crown.

3.3 Existing Drawings

Existing drawing "L.M.S. Scottish Division – Kirtlebridge – Bridge Carrying Public Road (B722) Over Branch at 0m 55ch" (Drawing number SM020406) was provided by BRB (Residuary) Ltd.

4 Structure Condition

4.1 Arch Barrel

The arch barrel was found to be in good condition and had no defects of notable importance. It had also been recently re-mortared but shows some slight areas of dampness.

4.2 Spandrels

Both spandrels were in good condition with just minor vegetation growing out of the stringcourse.

4.3 Abutments

Both abutments were found to be in good condition.

4.4 Wingwalls

4.4.1 Southeast

The wingwall was in fair condition with the only problem being 5 No. trees of girth less than 500mm growing on top.

4.4.2 Southwest

The wingwall contains an area, $2m^2$ of open joints, of depth 20mm and of width 10mm. There was also approximately $3m^2$ of vegetation growth.

4.4.3 Northwest

The wingwall was in good condition with the only problem being 3 No. trees growing on top of girth less than 500mm.

4.4.4 Northeast

There were isolated open joints totalling an area of $0.5m^2$ in the wingwall, of 10mm wide and up to 20mm deep. There were also approximately 12 No. trees of girth less than 500mm growing on top. There was also a fair amount of vegetation growth.

4.5 Parapet

4.5.1 East

The east parapet was found to be in good condition.

4.5.2 West

The outside face of the west parapet shows minor open joints $3m^2$ area and 50-100mm deep.

4.6 Road Surface

The carriageway was in good condition

4.7 Formation

The formation to the east of the structure is generally dry, but slightly overgrown with a retaining wall to the south edge.

The formation to the west of the structure was found to be heavily boggy. Along the northern edge of the formation there is a drainage ditch that runs adjacent to the northern abutment.

5 Summary Condition

5.1 Summary of Conditions

The condition of the structure was found to be generally good. There were no fractures of any great concern, but there are small areas of deep open joints.

The carriageway was also found to be in good condition.

5.2 MEXE Factors Used in Analysis

Barrel Factor, Fr – 1.0
Fill Factor, Ff – 0.7
Width Factor, Fw – 0.9
Depth Factor, Fd – 0.8
Mortar Factor, Fm – 1.0
Condition Factor, Fcm – 0.9

6 Assessment to BE4 1967

6.1 Structural Parts checked to BE4

The brick arch was assessed according to Part III (Assessment of Masonry and Brick Arch Bridges).

6.2 Methodology

According to Part III, Clause 2 of the BE4 assessment code the assessment of the arch bridge has been adapted from the method set out in "Military Load Classification by the Reconnaissance and Correlation Methods", M.E.X.E, May 1963.

6.3 Results

Following the assessment of masonry and brick arch bridges, Part III of BE4 assessment code, the arch is found to accommodate a capacity of 33 tonnes and the bridge should be unrestricted to all vehicles complying with the Construction and Use Regulations (1967) issue.

7 Recommendations

The structure was found to be in good condition with no major repair work required. Areas of open joints were present in the structure however, mainly in the wingwalls which, would need to be re-pointed.

There was vegetation growth on top of the wingwalls which was causing displacement of some bricks in the wall and so will need to be removed.

Appendix A - Photographs

1. East elevation

2. Looking towards the South

3. Trial pit on the west verge over the crown of the arch

4. Vegetation growth around the northeast wingwall

3. Trial pit on the west verge over the crown of the arch

4. Vegetation growth around the northeast wingwall

7. Southwest wingwall, which showed areas of open joints

8. Retaining wall located to the east of the structure

Appendix B - Services Search

Plan retrieved by:

moleseye

[illegible]

CAN YOU DIG IT?

BT

National Notice Handling Centre
PP 404B, Telecom House,
Trinity Street,
Hanley,
Stoke-on-Trent,
ST1 5ND.

Freephone: 0800 1693849

Thank you for your request to : www.bt.com/btplant

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 be not be relied upon in the event of excavations or other works made near to British Telecommunications plc apparatus which may exists 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 clearance not being adequate we anticipate that your plant is either resited, or an order is placed with British Telecommunications plc for rearrangements of its plant.

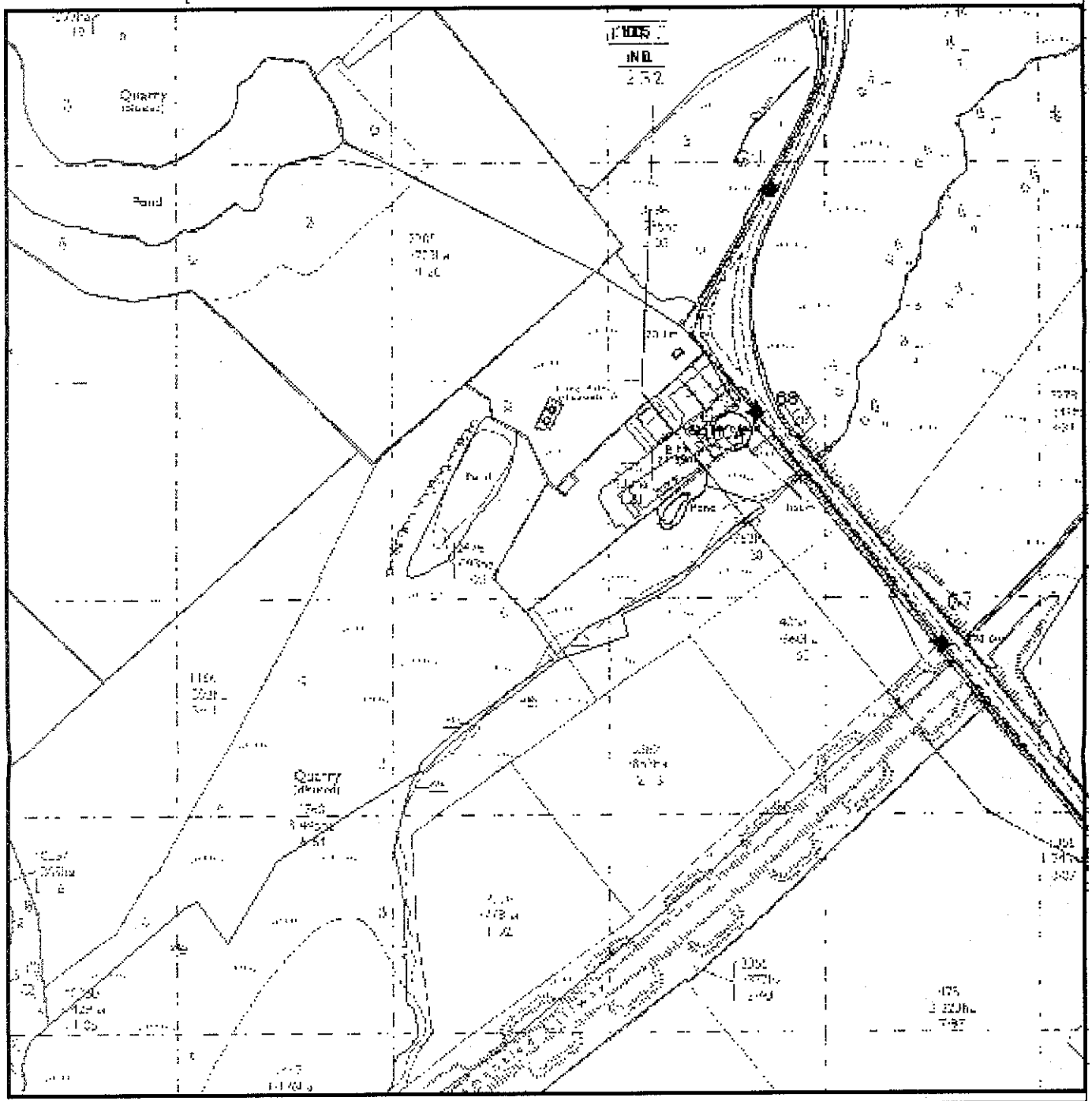
Please contact our Network Protection Service if required by dialling 0800 917 3993 or by Email on DBYD@BT.COM giving seven days notice of your commencement date. This will provide you with on-site advice and a check of location for any BT apparatus.

Please ensure you quote our reference on any future correspondence.

Yours faithfully,

National Notice Handling Centre

BT 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.

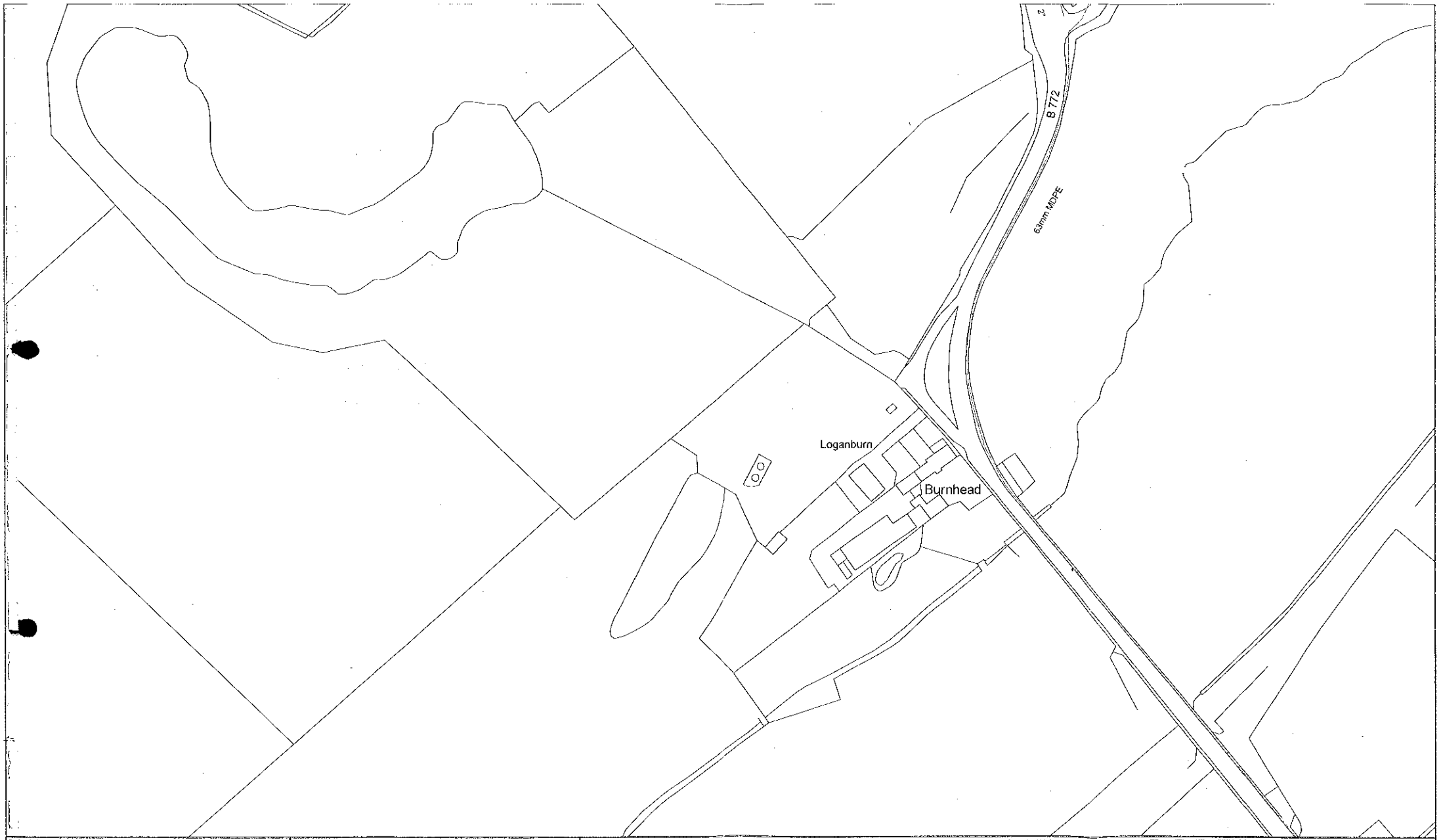
FOR FREE ON SITE LOCATION & MARKING SERVICE CALL DIAL BEFORE YOU DIG 0800 917 3993

KEY TO BT SYMBOLS

- UNDERGROUND PLANT (AIC DAIU or IU)
- OVERHEAD PLANT (AIC DAIU or IU)
- JOINT BOX
- DISTRIB'N POINT
- MANHOLE
- POLE
- CABINET
- BURIED JOINT
- JOINTING POST
- PROPOSED U/G
- PROPOSED O/H
- 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.

BT ref: WHQ09348G
Map reference (centre): NY2227272721
Issued: 07/12/04 14:23:31



Project Information:
Project Name: South
Project Date: 01/11/2003
Plot Date: 29/01/2004

Plot Information:
Date of Plot:
Tuesday, December 07, 2004
09:35:11

Metres
-20 0 20 40 60 80

N

Map Scale 1 : 1531

Legend:
- - - - Abandoned
------ Distribution

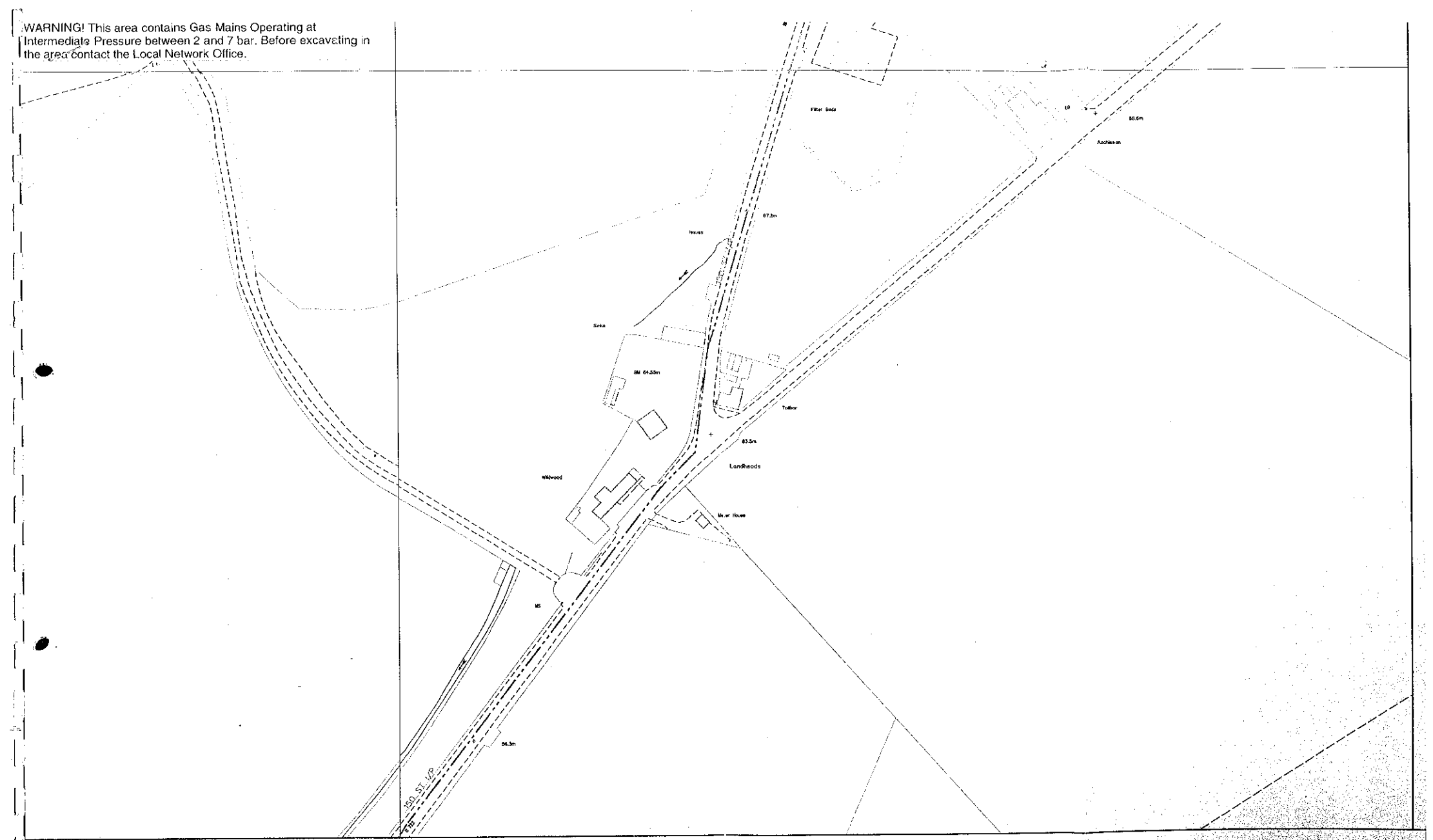
The representation of physical assets and the boundaries of areas in which Scottish Water and others have an interest does not necessarily imply their true position. For further details contact the appropriate Regional Operating Centre.

This map is based upon the OS map by Scottish Water with the permission of the Controller of Her Majesty's Stationary Office, (c) Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.

SCOTTISH WATER

BAT/9053/AN/ST

WARNING! This area contains Gas Mains Operating at Intermediate Pressure between 2 and 7 bar. Before excavating in the area contact the Local Network Office.



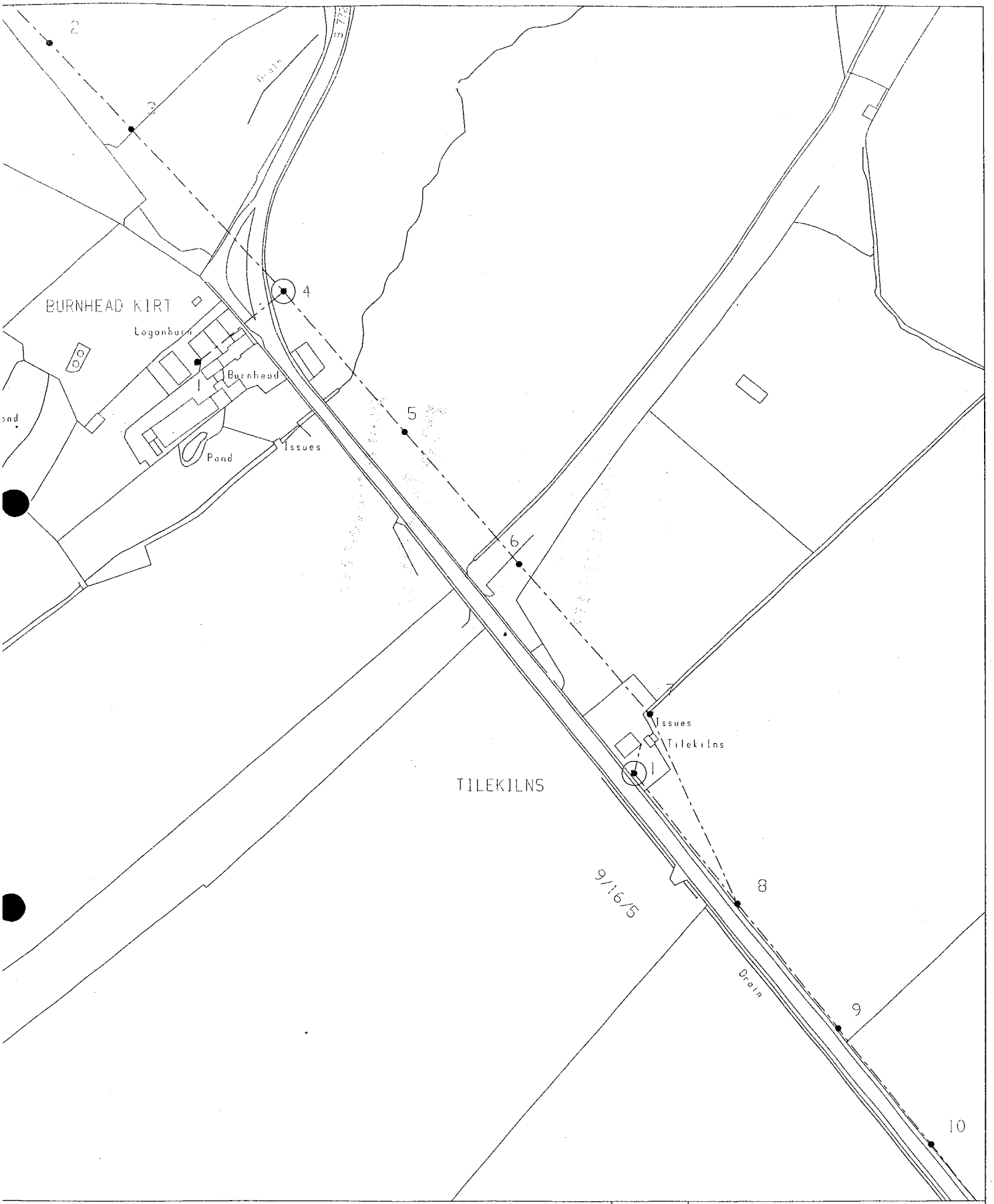
SCALE: Not to scale	LP MAINS
USER ID: ms075	MP MAINS
DATE: 26/11/2004	IP MAINS
INTERNAL USE ONLY	LHP MAINS
GRID REFERENCE : 320138, 569345, NY2069	NHP MAINS
	HISTORY DATA
	LAs
	GTs SSSIs

Some examples of Plant Items: Valve, Depth of Cover, Syphon, Diameter Change, Material Change

This plan shows those pipes owned by Transco plc or the relevant Gas Distribution Network in their roles as Licensed Gas Transporters (GT). Gas pipes owned by other GTs, or otherwise privately owned, may be present in this area. Information with regard to such pipes should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Service pipes, valves, syphons, stub connections, etc. are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Transco plc, the relevant Gas Distribution Network, or their agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue.

BAT/9058/ANB4 10/12

Desktop MAPS Version 4.3.0



PowerSystems

Telephone: 0141 567 4155

D.O.M.1.4.3 APPENDIX 2

SCALE: 1/2500

Date: 29Nov2004

Produced by: [redacted] GIS

Produced for: BAT/9058/ANB4

10/12

nformation about apparatus given on this drawing is indicative only as the original depths and lines of ables and pipes may have been changed by persons unknown. Normally electricity cables are laid in renches between 450mm and 1m deep, and gas pipes are laid in trenches between 375mm and 1m deep but ellars or structures such as bridges may prevent cables and pipes being laid at these standard depths. lso, the depth may be above or below the standard due to regrading of the surface or other work after ne cables or pipes are laid. Where known, non-standard depths are indicated. Any interference with or amage to apparatus may result in a serious accident. Health & Safety Executive booklet HS(G) 47 rovides information on the avoidance of danger from underground services. Authorities and Contractors ill be held liable both for the full cost of repairs to apparatus and all claims made by Third Parties s a result of any interference or damage.

Map Reference: 322476572600

Appendix C - Trial pit logs

STRUCTURAL SOILS

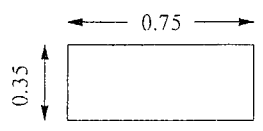
TRIAL PIT LOG

Contract	Client	Trialpit No
BE4 Bridges - ANB/4	Jacobs	TP01

Job No	Date	Ground Level (m AOD)	Local Grid Co-Ordinates	Sheet
47101	18.1.05	---	---	1 of 1

Samples and In-situ Tests				Water	Description of Strata	Depth (Thickness)	Legend
Depth	No	Type	Results				
					Grass over topsoil.	0.10	
					MADE GROUND : Dark grey slightly sandy to sandy slightly gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse sandstone, limestone and brick. Occasional cobbles. Occasional pockets of grey granular trench fill.	0.44	
					MADE GROUND : Stiff red brown slightly sandy slightly gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse of various lithology. Occasional cobbles.	0.65	
					Trial pit ends at 0.65m on extrados of arch.		

Plan (Not to Scale)



No Bearing Taken

General Remarks

1. Groundwater : None encountered
2. Stability : All sides stable.
3. Similarity : All sides similar (small pockets of granular trench fill)
4. Excavation : Easy by hand.
5. Parapet string coarse at 0.35m bgl.

All dimensions in metres	Method	Logged By	Checked By
Scale 1:25	Hand Dug	MD	AGS

Appendix D - Form AA

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

Appendix: 4

ELR/ Bridge No ANB 4 Issue: 1

Revision: B (Nov 2000)

APPROVAL IN PRINCIPLE FOR ASSESSMENT

Bridge/Line Name: Annan to Kirtlebridge

ELR/Bridge No.: ANB 4

Brief Description of Existing Bridge:

(a) Span Arrangement

ANB 4 is a single span structure with a square span measurement of approximately 7.97m.

(b) Superstructure Type

The structure is a stone arch structure with stone spandrels and abutments. The depth of fill above the arch is approximately

(c) Substructure Type

Stone wingwalls and parapets

(d) Details of any Special Features

None

Assessment Criteria

(a) Loadings and Speed

The arch is to be assessed using the MEXE Method of analysis

(b) Codes to be used

BE4 "The assessment of construction and use vehicles" Ministry of Transport, 1967 with amendments to 1969

APPROVAL IN PRINCIPLE FOR ASSESSMENT

(c) Proposed Method of Structural Analysis

It is proposed to use the modified MEXE method of assessment as outlined in Part III of BE4.

Dimensions and conditions factors obtained from site measurements with reference to historic data.

(d) Details of any Special Requirements

None

FORM 'AA' (BRIDGES)

GC/TP0356
Appendix: 4
Issue: 1
Revision: B (Nov 2000)

ELR/ Bridge No ANB 4

APPROVAL IN PRINCIPLE FOR ASSESSMENT

Senior Civil Engineer's Comments ..... None .....

.....

.....

.....

Proposed Category for Independent Check .....

Superstructure ..... I .....

Substructure ..... I .....

Name Of Checker Suggested If Cat 2 Or 3 .....

Category 1

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

Signed .....
Title .....
Date .....

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
Appendix: 4
Issue: 1
Revision: A (Feb 1993)

ELR/ Bridge No: ANB 4

CERTIFICATION FOR ASSESSMENT CHECK

Category 2 and 3 (Note: Category 1 Check Must Also Be Signed)

(a) Assessment

Name	Signature	Date	
			Assessor
			Assessment Checker
			Partner Of the Firm Of Consulting Engineers To Whom Assessor/ Checker Is Responsible

(b) Check

Name	Signature	Date	
			Assessor
			Assessment Checker
			Partner Of the Firm Of Consulting Engineers To Whom Assessor/ Checker Is Responsible

This Certificate Is Accepted By..... [redacted] (S. MEDD) 11/4/05

FORM 'BAA' (BRIDGES)

GC/TP0356
Appendix: 4
Issue: 1
Revision: A (Feb 1993)

ELR/ Bridge No: ANB 4

CERTIFICATION FOR ASSESSMENT CHECK

Notification of Assessment Check

Assessment Group: Jacobs

Bridge Name/Road No.: B722

Line Name: Annan to Kirtlebridge

ELR Code/Structure No.: ANB 4

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

Arch

Full C and U vehicle loading to BE4 – tandem 9 ton axles

Recommended Loading Restrictions

None

Description of Structural Deficiencies and Recommended Strengthening

The structure was found to be in good condition with no major repair work required. Areas of open joints were present in the structure however, mainly in the wingwalls which, would need to be re-pointed.

There was vegetation growth on top of the wingwalls which was causing displacement of some bricks in the wall and so will need to be removed.

BRB (Residuary) Limited	Group Standard

FORM 'BAA' (BRIDGES)

GC/TP0356
Appendix: 4
Issue: 1
Revision: A (Feb 1993)

ELR/ Bridge No: ANB 4

CERTIFICATION FOR ASSESSMENT CHECK

[redacted]

Date
24/03/05 — Assessor

24/03/05 — Assessment Checker

30.3.05 — Partner Of the Firm Of Consulting Engineers To Whom Assessor/ Checker Is Responsible

This Certificate Is Accepted By..... [redacted] 11/4/05

Appendix F - Calculations

Structure Ref ANB 4

Assessment of Masonry Arch by the Modified MEXE Method

Span L (m)	7.97
Rise of arch barrel at crown r_c (m)	2.016
Rise of arch barrel at 1/4 pts r_q (m)	1.752
Thickness of arch barrel adjacent to keystone d (m)	0.472
Av depth of fill between road surface & arch barrel at crown h (m)	0.689

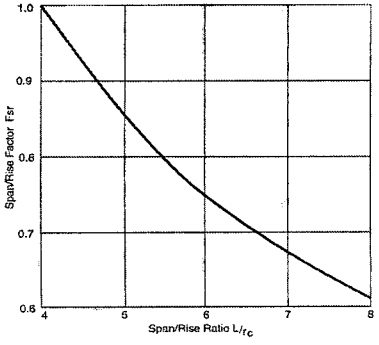


Fig 7

PAL	67.142938	(max = 70)
PAL	**67.1429**	*(formula =(740[d+h]^2)/L $^{1.3}$)*
Span/Rise Ratio	**3.9534**	(4 or less = span/rise factor =1)
Span/Rise factor F_{sr}	1	(if greater than 4, F_{sr} from graph 3/3 of fig 7 be4)
Profile factor F_p	**0.67920**	(Max = 1)
	0.6791972	*(formula =2.3([r_c-r_q]/r_c) $^{0.6}$)*
Barrel factor Fr	1	(use table 3/1 or table 3 be4)
Fill factor Ff	0.7	(use table 3/2 table 4 be4)
Material Factor F_m	**0.82**	*(formula =[(fr.d)+(ft.h)]/(d+h)*
Width factor F_w	0.9	(use table 3/3 or table 5 be4)
Depth Factor F_d	0.8	(use table 3/5 or table 6 be4)
Mortar factor F_m	1	(use table 3/4 or table 7 be4)
Joint Factor F_j	**0.72**	*(formula = F_w.F_d.F_m)*
Condition factor F_{cm}	0.9	(0= poor, 1 = good condition)
Span factor due to pier flexibility	1.000	
MODIFIED AXLE LOAD	**24.29**	> than 9 tons therefore ok for BE4
(formula = F_{sr}.F_p.F_m.F_j.F_{cM}.PAL)	**24 tons**	(Round up or down to nearest ton)

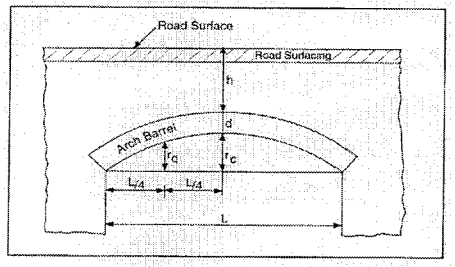


Figure 3/2 Arch Dimensions

Prepared by Jonathan Curry
Checked by

Table 3	Fr
Granite, whinstone and built-in-course masonry, with large shaped voussoirs	1.5
Concrete or engineering bricks	1.2
Limestone, good random masonry and building bricks in good condition	1.0
Masonry of (any kind) or brickwork in poor condition (many voussoirs flaking or badly spalled, shearing,etc). Some discretion is permitted if dilapidation is only moderate	0.7

Table 4	Ff
Concrete slab or saddle	1.0
Grouted materials (other than those with clay content)	0.9
Well compacted materials	0.7
Weak materials evidenced by tracking of the carriageway surface	0.5

Table 5	Fw
Joint with widths up to 6mm	1.0
Joints with widths between 6mm and 12.5mm	0.9
Joints with widths over 12.5mm	0.8

Table 6	Fd
Pointed joints in good condition	1.0
unpointed joints, pointing in poor condition and joints with up to 0.5in from edge insufficiently filled	0.9
Joints with from 0.5in to 1 tenth of the thickness of the ring insufficiently filled	0.8
Joints insufficiently filled for more than 1 tenth the thickness of the ring	At Engineer's discretion

Table 7	Fm
Mortar in good condition	1.0
Loose or friable mortar	0.9

Current equivalent vehicle load = 40/44 Tonnes

(Table 3/6 in BA 16/97 Load Capacity and Gross Vehicle Weight Restrictions for Masonry Arches)