

OCTOBER 2002

RAIL PROPERTY LTD

01/02 BE4 ASSESSMENT PROGRAMME

ASSESSMENT AND INSPECTION REPORT

HAMPSTEAD NORRIS BRIDGE NO.23

OVERBRIDGE REF: NDL(7m46 $\frac{1}{4}$ ch)

Babtie Group
Multi-disciplinary consultants

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1.0 SYNOPSIS

The assessment inspections carried out on 13th September 2002 indicated that the bridge was generally in fair condition and with no major defects likely to affect the long-term durability.

The main arch barrel and the abutment were found to be able to carry 24 Tons Vehicle Load to BE4 requirements.

2.0 INTRODUCTION

The bridge was inspected and assessed by Babbie Group on behalf of Rail Property Ltd.

The report covers the assessment of Hampstead Norris Railway Bridge. (Railtrack Bridge No.23).

The bridge serves as an overbridge over a disused branch line near Hampstead Norris.

3.0 INSPECTION DETAILS

The bridge was inspected on 13th September 2002. The detailed findings of the inspection are contained in the Assessment Inspection Report October 2002 (See Appendix A1).

Generally the structure is in fair condition. The significant defects noted during the inspection which affect the structures durability are summarised as follows:-

- 1) There is a crack at the extrados of the arch barrel at the connection with the spandrel wall.
- 2) There is some loss of mortar, staining and weathering of the brickwork to parts of the barrel and abutment walls.
- 3) The parapet has a vertical crack line near the centre of the arch barrel.

4.0 ASSESSMENT FINDINGS

4.1 Basis of Assessment

The assessment has been undertaken in accordance with The Ministry of Transport Technical Memorandum (Bridges) No. BE4 "The Assessment of Highway Bridges for Construction and Use Vehicles" dated January 1967 (as amended up to 11th Nov. 1970) ((See Appendix A1).

4.2 Condition Factor

The inspection of the structure revealed some defects but these would not affect the durability of the structure and so a condition factor of 0.8 has been assumed for the assessment.

4.3 24 Tonnes Vehicle Load

The single span masonry arch was found to carry 24 vehicle load. The arch barrel can carry the parapet dead loads and support the road construction. The substructures were assessed qualitatively and were deemed adequate for 24 Tons Vehicle Load.

4.4 Substructure

The substructure shows no signs of distress and there is no evidence of settlement that might adversely affect the stability of the structure. The substructure is considered adequate for 24 Tons Vehicle Load by qualitative analysis.

5.0 Conclusion

Both the Arch Barrel and abutment were found to be able to carry 24 Tons Vehicle Load to BE4 requirements.

The remaining superstructure and substructure were found to be capable of carrying 24 Tons Vehicle Load in accordance to BE4 requirements.

The bridge was found capable of carrying 24 Tons to BE4 requirements without restriction.

Appendix A1
Assessment Inspection Report

CONTRACT No:
ASSESSMENT REPORT
NDL - No.23 (7mi, 44¼ch)

Status: Inspection

Zone : ENGLAND
Structure : NDL - No. 23 (7mi 44¼ch)
Location : HAMPSTEAD NORRIS, BERKSHIRE
Grid Ref : SU529773
ELR, Mileage : N/A

Assessment Inspection Report

CONTENTS

1. Introduction
2. Record Data
3. Condition Survey

Appendices

- A. Approval in Principle – Form AA
- B. General Arrangement Drawing
- C. Photographs and Location of Defects

1. INTRODUCTION

- 1.1. Overbridge No. 23 Hampstead Norris Railway Bridge was inspected on 13th September 2002 for Rail Property Limited.
- 1.2. The structure is a single span segmental masonry arch span over bridge. The deck is lying at a right angle to the disused track bed. The abutments, spandrel, and wing walls are built with similar brickwork to the arch barrel.
- 1.3. The clear square span of both spans is 7.620m. The clear width between parapets at deck level is 6.190m.
- 1.4. The bridge serves as an over bridge to a disused branch line at Hampstead Norris, Berkshire. The line has been lifted with the majority of the track bed in the vicinity either flattened or infilled.

2. RECORD DATA

- 2.1. Visual examination reports or detailed examination reports were not made available.
- 2.2. An A4 sketch plan of the structure was provided together with a single sheet from a previous assessment. Sketch details have been produced from details obtained during the site survey (Appendix B).
- 2.3. The structure is built from local red brick.

3. CONDITION SURVEY

3.1. General

3.1.1. An inspection for assessment was carried out on 13th of September 2002, in accordance with RT/CE/P/016 'The Assessment of Bridge Capacity'.

3.1.2. Photographs of the structure layout and the defects encountered, together with a general arrangement drawing marked up with the location of defects, are included in Appendices B & C.

3.2. Findings

3.2.1. Superstructure.

The single span arch barrel is formed from five layers of brick on end. Red brickwork has been used creating a total barrel thickness of 600mm. The arch is 1525mm deep above the springing level at the crown and has a clear span of 7.760m. The spandrel, parapet and wing walls are constructed from the same red brick of the arch barrel.

The arch barrel was found to be generally in fair condition, some weakening and mortar losses in localised places. There is a visible vertical crack at the centre of the parapet wall. Both elevations have the same defects.

There is a crack at the top of the arch barrel at the connection line with the spandrel wall. There are no signs of rotation of the spandrel and parapet wall.

There is no sign of any deformity flattening in the shape of the arch barrel.

There is no footpath located on the structure and there are only small grass verges located on either side of the carriageway. Furthermore there is no form of protection barrier to the bridge approaches, instead only a wooden fence was found at the top of the embankment to the bridge.

3.2.2. Substructure

The abutment walls and wingwalls are formed of similar brickwork to that of the main arch barrel and exhibit some areas of weathering and mortar losses. The wing walls are built with a noticeable batter outwardly from the base of the walls.

APPENDIX A

Technical Approval Form and Assessment and Check Certificates

APPROVAL IN PRINCIPAL FOR ASSESSMENT

STRUCTURE / LINE NAME**Hampstead Norris Bridge****ELR / STRUCTURE No.****NDL-7/44 ¼****BRIEF DESCRIPTION OF EXISTING BRIDGE :**

- | | | |
|-----|---------------------------------|---|
| (a) | Span Arrangement | Single Span Masonry Arch over bridge. |
| (b) | Superstructure Type | Brick masonry arch barrel with brick masonry spandrels. |
| (c) | Substructure Type | Brick masonry abutments, wingwalls and parapets. |
| (d) | Details of any Special Features | None |

ASSESSMENT CRITERIA

- | | | |
|-----|--|---|
| (a) | Loadings and speed | Assessment loading to BE4. Speed 60mph. |
| (b) | Codes to be used | BE4. |
| (c) | Proposed Method of Structural Analysis | Hand calculations using the M.E.X.E. method of BE4. Material, joint and condition factors will be taken into account in the analysis. |
| (d) | Details of any Special Requirements | None. |

STRUCTURAL ASSESSMENT ENGINEER'S COMMENTS**Superstructure**

The arch is generally in fair condition but exhibiting some signs of weathering. There is a crack between the arch barrel extrados and the spandrel wall. The brickwork of the barrel is also exhibiting some loss of mortar at joints and some loss of section to the soffit brick face of the arch barrel at centralised locations.

Substructure

The masonry abutments and wingwalls are generally in good condition. There are some areas of weathering and mortar loss. The parapets were found to be in a reasonable condition.

APPROVAL IN PRINCIPAL FOR ASSESSMENT

CIVIL ENGINEER'S COMMENTS

[Handwritten signature]

BRB WORKS GROUP COMMENTS – If applicable

None

PROPOSED CATEGORY FOR INDEPENDENT CHECK :

SUPERSTRUCTURE

Category 1

(Hand calculations for masonry arch)

SUBSTRUCTURE

Qualitative Assessment

CATEGORY 1

THE ABOVE ASSESSMENT, WITH AMENDMENTS SHOWN, IS APPROVED IN PRINCIPLE:

SIGNED

TITLE..

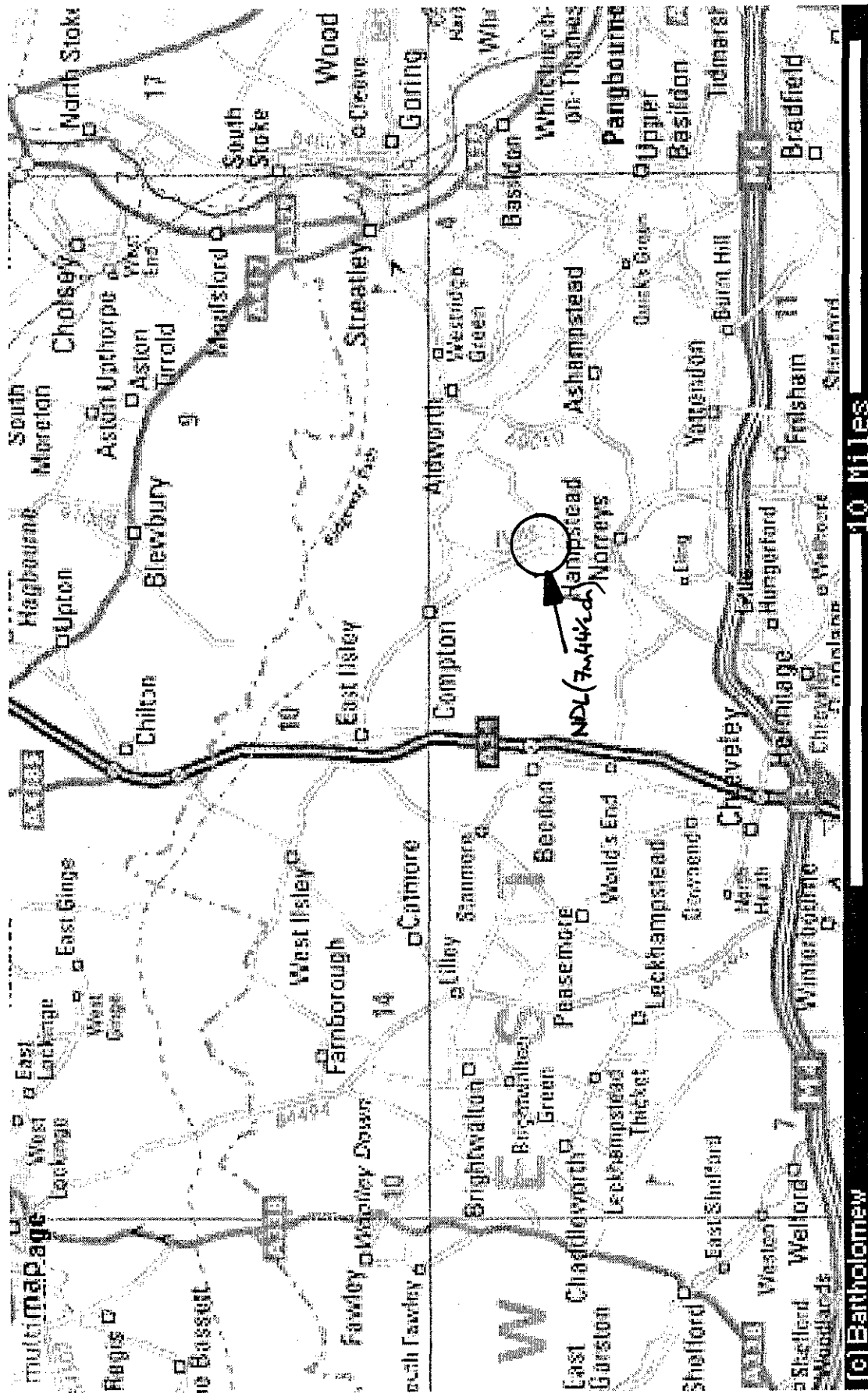
DATE..



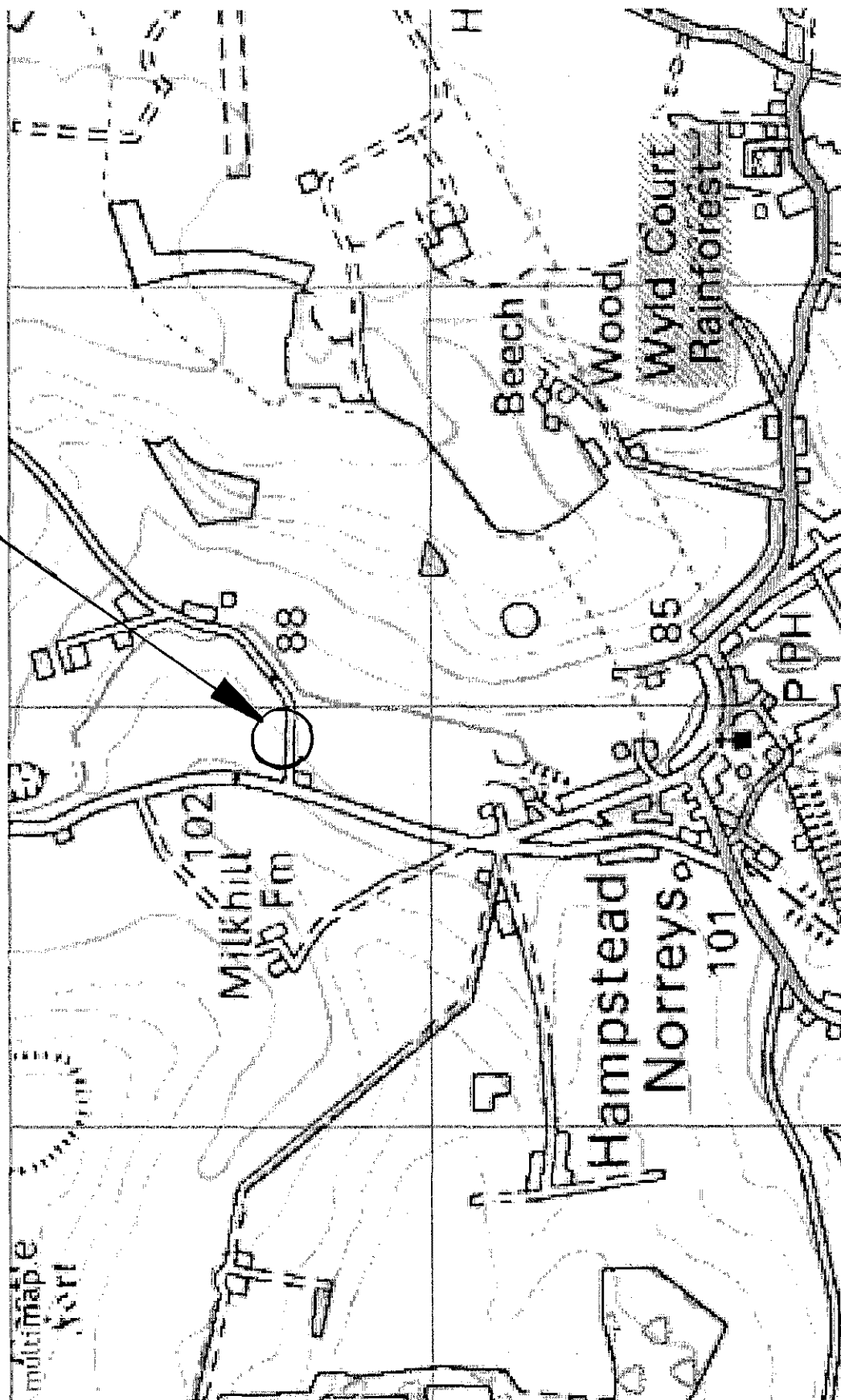
CONTRACT No:
ASSESSMENT REPORT
NDL - No.23 (7mi, 44¼ch)

CONTRACT No:
ASSESSMENT REPORT
OB : WOO/001

LOCATION MAPS

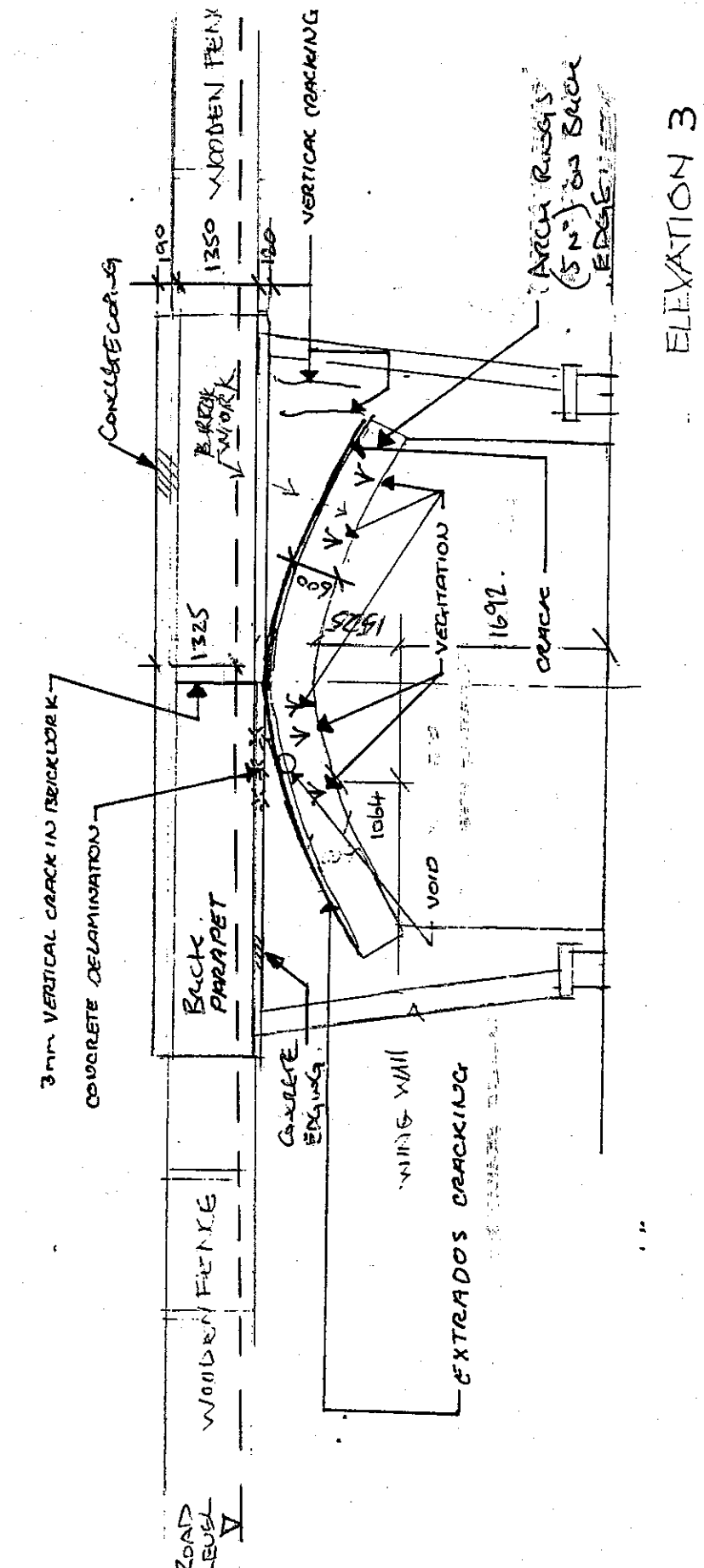


NDL (7m 44 1/4 ch)



APPENDIX B

Sketch Drawings



ELEVATION 3

SCALE 1:100

II HAMPSTEAD NORRIS BRIDGE
BRIDGE No. 23

APPENDIX C

Photographs and Location of Defects

APPENDIX C – PHOTOGRAPH SCHEDULE

Photograph No	Title
1.	General view of South Elevation
2.	General view of North Elevation
3.	General view of Southeast Elevation
4.	General view of Southwest Elevation
5.	General view of Northeast Elevation
6.	General view of Northwest Elevation
7.	General view of Southeast Wingwall
8.	General view of Southwest Wingwall
9.	General view of Northeast Wingwall
10.	General view of Northwest Wingwall
11.	General view of East Abutment
12.	General view of West Abutment
13.	Detail at East Abutment showing previous repair
14.	Detail at soffit of arch barrel showing widespread spalling and mortar loss
15.	General view of the arch barrel soffit showing widespread staining and spalling of brickwork
16.	Detail of severe cracking on the extrados on the south elevation of the arch barrel
17.	Close up of severe cracking on the extrados on the south elevation of the arch barrel
18.	Detail of cracking on the extrados on the north elevation of the arch barrel
19.	Detail of cracking to the parapet wall just above the centre of the arch barrel ring
20.	General view of North Parapet
21.	General view of South Parapet
22.	General view of carriageway



Photo 1 General view of South Elevation



Photo 2 General view of North Elevation



Photo 3 General view of Southeast Elevation



Photo 4 General view of Southwest Elevatio



Photo 5 General view of Northeast Elevation



Photo 6 General view of Southeast Wingwall



Photo 7 General view of Southeast Wingwall



Photo 8 General view of Southwest Wingwall



Photo 9 General view of Northeast Wingwall



Photo 10 General view of Northwest Wingwall



Photo 11 General view of East Abutment



Photo 12 General view of West Abutment



Photo 13 Detail at East Abutment showing previous repair



Photo 14 Detail at soffit of arch barrel showing widespread spalling and mortar loss



Photo 15 General view of the arch barrel soffit showing widespread staining and spalling of brickwork



Photo 16 Detail of severe cracking on the extrados on the south elevation of the arch barrel



Photo 17 Close up of severe cracking on the extrados on the south elevation of the arch barrel



Photo 18 Detail of cracking on the extrados on the north elevation of the arch barrel



Photo 19 Detail of cracking to the parapet wall just above the centre of the arch barrel ring



Photo 20 General view of North parapet



Photo 21 General view of south parapet



Photo 22 General view of carriageway

Appendix B1

Assessment Calculations

OFFICE <i>Reading</i>	PAGE No. <i>01</i>	CONT'N PAGE No. <i>2</i>
JOB No. & TITLE <i>Hampstead Morris N° 23.</i>	ORIGINATOR <i>IM</i>	DATE <i>Nov 02</i>
SECTION	CHECKER <i>Vkc</i> <i>HM</i>	DATE <i>Nov 02</i> <i>22/11/02</i>

Introduction

Hampstead Morris Bridge is a single span (25.46') brick masonry arch structure which is generally in fair condition. The condition factors and all the other factors i.e. span/rise, profile factors & material factors have been based on the site inspection data.

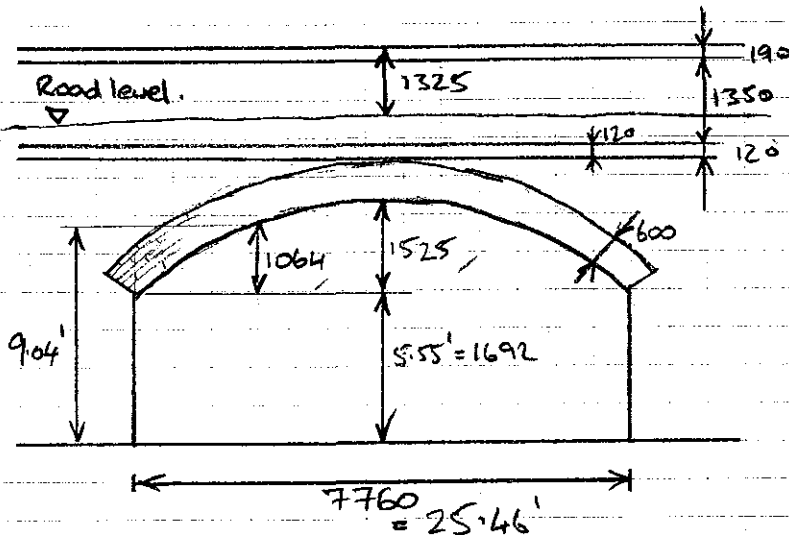
The MEXE method described in BE4, Part III has been used for the assessment/analysis exercise.

Results

The single span arch structure can carry 24T vehicle load to BE4 requirements.

OFFICE <i>READING</i>	PAGE No. <i>2</i>	CONT'N PAGE No. <i>3.</i>
JOB No. & TITLE <i>Hampstead Morris No 23</i>	ORIGINATOR <i>LM</i>	DATE <i>Nov 02</i>
SECTION	CHECKER <i>VKc</i>	DATE <i>Nov. 02</i>

NEXE MEMOS TO BEL



$$r_g = 1064 \text{ mm}$$

$$r_c = 1525 \text{ mm}$$

$$d = 600 \text{ mm}$$

$$h = (190 + 1350 + 120) - 1325 = 335 \text{ mm}$$

$$h + d = 335 + 600 = 935 \text{ mm} = 37.2"$$

$$F_b = 0.7$$

$$F_f = 0.7$$

$$F_w = 0.9$$

$$F_d = 0.8$$

$$F_{m0} = 0.9$$

$$F_c = 0.8$$

$$\text{Span / Rise ratio } \frac{l}{r_c} = \frac{7760}{1525} = 5.09 > 4.0$$

$$\therefore \text{ from fig 7. } F_{sr} = 0.84$$

$$\text{Profile factor} = \frac{r_g}{r_c} = \frac{1064}{1525} = 0.70 < \frac{3}{4}$$

$$\therefore F_p = 1.0$$

$$\text{Material factor } F_m = \frac{F_b \times d + F_c \times h}{(h + d)}$$

$$F_m = \frac{(0.7 \times 0.600 + 0.8 \times 0.335)}{(0.335 + 0.600)} = 0.7$$

BABTIE
CALCULATION SHEET

OFFICE	READING	PAGE No.	3	CONT'N PAGE No.	4.
JOB No. & TITLE	Hampstead Norris N°23	ORIGINATOR	IM	DATE	Nov 02
SECTION		CHECKER	VFC	DATE	Nov. 02

Joint Factor : $F_j = F_w \times F_d \times F_{no}$

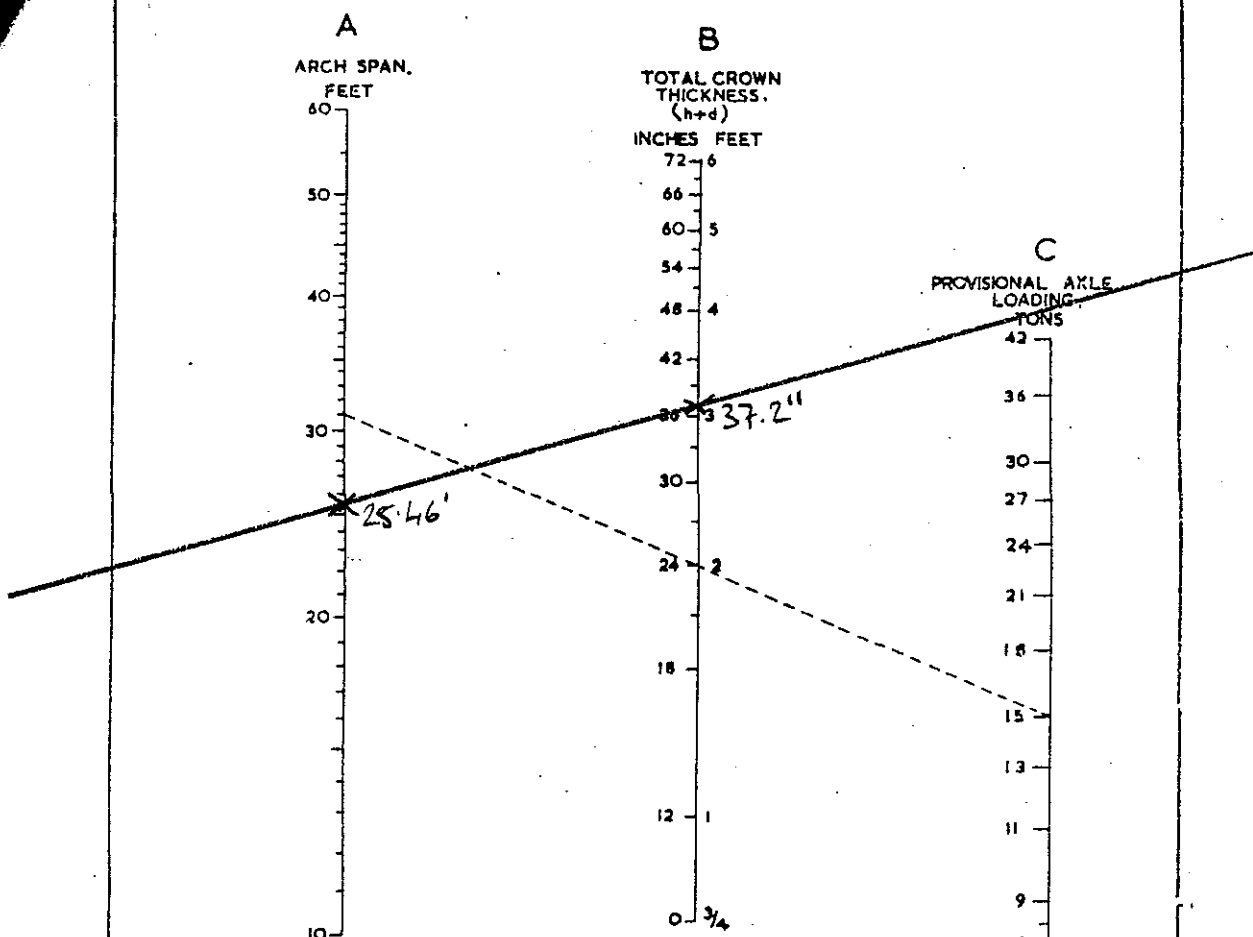
$$F_j = 0.9 \times 0.8 \times 0.9 = 0.65$$

PAL from Graph N°13 = 42 Tons.

$$\begin{aligned} \text{Allowable axle load} &= 42 \times F_{sr} \times F_p \times F_m \times F_j \times F_c \\ &= 42 \times 0.84 \times 1.0 \times 0.7 \times 0.65 \times 0.8 \\ &= 12.8 \text{ Tons.} \end{aligned}$$

BE4 Part III, 2.0 > 9 Tons.

∴ ok, for 24 Tons vehicle.



NOMOGRAM FOR DETERMINING THE
PROVISIONAL ALLOWABLE AXLE LOADING OF
MASONRY ARCH BRIDGES BEFORE FACTORING.

EXAMPLE:-

SPAN = 31 FEET
SPAN/RISE RATIO = 4
∴ SPAN/RISE FACTOR = 1.0
PROFILE FACTOR = 0.9
CROWN THICKNESS = 2.0 FT
RING FACTOR = 1.2
RING THICKNESS = 1.5 FT
FILL FACTOR = 0.7
FILL DEPTH = 0.50 FT
∴ MATERIAL FACTOR = 1.07
WIDTH FACTOR = 0.9
DEPTH FACTOR = 0.9
MORTAR FACTOR = 1.0
JOINT FACTOR = 0.81
CONDITION FACTOR = 0.6

$$\frac{1.2 \times 1.5 + 0.7 \times 0.5}{2.0}$$

$$0.9 \times 0.9 \times 1.0$$

THE PROVISIONAL AXLE LOADING FOR AN ARCH, 31 FT SPAN AND CROWN THICKNESS OF 2.0 FT IS, FROM THE NOMOGRAM, 15 TONS.

ALLOWABLE AXLE LOAD = $15 \times 1.0 \times 0.9 \times 1.07 \times 0.81 \times 0.6 = 7.42$ TONS

∴ APPLY A 7 TON AXLE LOAD RESTRICTION TO THE BRIDGE.

Appendix C1

Form BA

FORM 'BA' (BRIDGES)

Document prepared in accordance with: GC/TP0356

Appendix: 5

Issue: 1

Revision: A

Date: FEB 93

CERTIFICATION FOR ASSESSMENT CHECK

NOTIFICATION OF ASSESSMENT CHECK

STRUCTURE NAME/ROAD NO. HAMPSTEAD ROAD BRIDGE

LINE NAME (DISUSED BRANCH LINE) FLR CODE/STRUCTURE NO. NOL-7/44/24

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 restriction is as follows:

STATEMENT OF CAPACITY

24 tonnes

Critical member/s:

NONE

RECOMMENDED LOADING RESTRICTIONS

N/A

DESCRIPTION OF STRUCTURAL DEFICIENCIES AND RECOMMENDED STRENGTHENING

N/A

te
03
te
2003

FORM 'BA' (BRIDGES)

Document prepared in accordance with: GC/TP0356

Appendix: 5

Issue: 1

Revision: A

Date: FEB 93

CERTIFICATION FOR ASSESSMENT CHECK

STRUCTURE/LINE

NAME..... HAMPSTEAD MOUNTS BRIDGE.....

CATEGORY OF CHECK..... 1.....

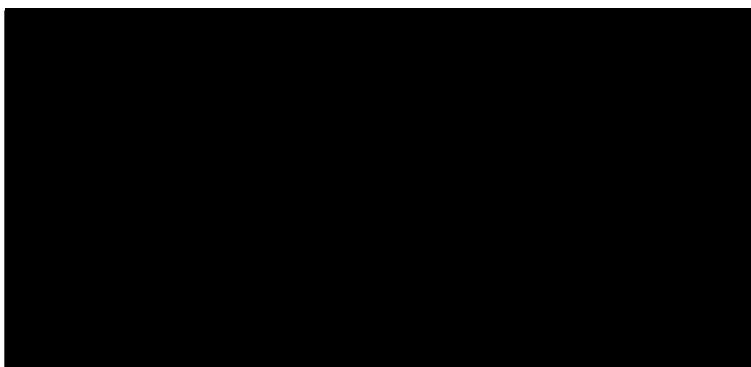
ELR CODE/STRUCTURE NO. NOL-7/44/4

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

- (i) It has been assessed in accordance with the Approval in Principle (where appropriate) as recorded on Form AA approved on 13/11/02 (DATE).
- (ii) It has been checked for compliance with the following principal British Standards, Codes of Practice, BR Technical note and the Assessment standards.

List any departures from the above and additional methods or criteria adopted with reference and justification for their acceptance commenting on the results (if appropriate).

CATEGORY 1

		Date
	(Assessor)	<u>22/11/02</u>
	(Assessment Checker)	<u>22/11/02</u>
	the firm of consulting engineers to whom checker is responsible)	<u>22/11/02</u>

Also Be Signed

(a) ASSESSMENT

Name & Qualifications	Signature		Date
		(Assessor)	
		(BRB section engineer or the partner in firm of consulting engineers to whom checker/assessor is responsible)	

(b) CHECK

Name & Qualifications	Signature		Date
		(Assessor)	
		(BRB section engineer or the partner in firm of consulting engineers to whom checker/assessor is responsible)	

THE CERTIFICATE IS ACCEPTED BY.....

