







PLANNING, TRANSPORTATION & ESTATES

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RAIL PROPERTY LTD CHILSWORTHY BRIDGE

Assessment Report

Document Reference: \$1897/03/200/001

Prepared by The Design & Maintenance Consultancy

Planning, Transportation and Estates County Hall, Truro, Cornwall, TR1 3AY

Issue and Revision Record

Revision Date Originator Purpose of Issue/Nature of Change

0 March 04 SNS For Approval

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RAIL PROPERTY LTD

BRIDGE ASSESSMENT PROGRAMME 1999/2000

CHILSWORTHY BRIDGE

LINE NAME: CALLINGTON BRANCH

ELR: CAL, 5m 29c

ASSESSMENT REPORT

Prepared by

The Design & Maintenance

Consultancy

Planning Transportation and Estates

Cornwall County Council

B.Sc., CEng., FICE, FIStructE, FIHT Departmental Director, County Hall, TRURO TR1 3AY.

Structure: Chilsworthy Bridge

Date: March 2004

SYNOPSIS

The structure has the capacity of 40 Tonnes Assessment Live Load.

The assessment inspection carried out in February 1999 indicated that the bridge was generally in a reasonable condition and no defects likely to affect durability were observed.

The structure is not on an abnormal load route so HB load cases were not considered.

Structure: Chilsworthy Bridge

Date: March 2004

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Date: March 2004

1.0 INTRODUCTION

Cornwall County Council was appointed by Rail Property Ltd. to undertake the inspection and assessment of 42 Rail Property Ltd. owned bridges. This report covers the Assessment of Chilsworthy Bridge.

The structure carries the Class III C507 road from Delaware Road, Chilsworthy, to Gunnislake, over the Callington Branch Line (ELR: CAL, 5m 29c) and is located at grid reference SX 419 720.

2.0 INSPECTION DETAILS

Chilsworthy Bridge was inspected on 11 February 1999. The detailed findings of the inspection are contained in the Assessment Inspection Report dated May 1999. (See Appendix A).

Generally the structure is in a reasonable condition. The defects noted during the inspection are summarised as follows:-

- i) Surface corrosion on the troughs with areas of flaking paint.
- ii) Loss of section to rivet heads in troughing.
- iii) Damp penetration through abutments.
- iv) Crack in masonry section of parapet.

3.0 ASSESSMENT FINDINGS

3.1 Basis of Assessment

The assessment has been carried out to BD 21/01 and its complementary Advice Note BA 16/97, in accordance with the Approval in Principle dated April 2001.

The width of the carriageway allows for two lanes of traffic, and worst case loadings were assessed accordingly.

Centrifugal effects were ignored as the radius of curvature of the carriageway was estimated to be above 600m.

Record drawings were available for this structure but previous inspection records were not.

Date: March 2004

3.2 Principal Dimensions, Materials and Factors

The structure is an over-line single span fabricated steel trough deck consisting of steel edge girders riveted to longitudinal steel troughing. Steel T-sections riveted to the edge girders with timber panels form the parapets. The skew span was 4.70m and the square 4.34m. The troughing depth was measured as 305mm. The characteristic strength of the steel was taken as 230N/mm². The abutments are of a square rough faced random rubble granite construction. There are currently no limitations on normal highway loading over the structure.

3.3 Analysis Technique

The analysis takes into account both bending and shears for the two typical elements of the deck, an edge trough and a middle trough. The loading, as defined in Clause 5.8 of BD 21/01 was applied as per Clauses 6.10 to 6.12 of BD 21/01, for longitudinal trough decks. Distribution and dispersal of the loading is in accordance with Clause 6.14 of BD 21/01. Reduction Factors were applied to the UDL and KEL for the longitudinal troughing. A check on the shear capacity of the rivets was carried out in accordance with Clause 14.5.3.4 of BD 56/96.

3.4 40 Tonne Assessment Live Load

The analysis resulted in a Live Load Capacity of 40 tonnes.

The following factors were used in the analysis:-

Partial Load Factors	γ_{fl}	-	Troughing	=	1.10
			Fill	=	1.20
			Surfacing	=	1.75
Live Load Factors	Υfl	_	HA live	=	1.50

The characteristic strength of the steel was taken as 230N/mm².

3.5 HB Assessment

Assessment for HB loading was not required since the bridge is not on the abnormal load route.

Structure: Chilsworthy Bridge

Date: March 2004

3.6 Substructure

The abutments are considered adequate by qualitative assessment for 40 tonne assessment live loading.

The assessment of sub-structures, foundations and retaining walls is based upon the results of their detailed inspection.

The abutments showed no signs of distress and there was no evidence of any movement of the foundations. No increases in load are envisaged over this structure which means that, in accordance with 8.5 of BD 21/01, no further assessment is necessary.

Page 5 of 12

Table 1. Steel Trough Deck - Assessment Live Load

Date: March 2004

4.0 RESULTS TABLES

Resultant Live Load	40 Tonnes	40 Tonnes	40 Tonnes	40 Tonnes	40 Tonnes	
fuction for (K) Sa*d)/Sa*1	_					
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Structural Adequacy Ra*/(Sa*d+Sa*l)	1.7	26.0	1.3	3.6	4.4	
Live Load Assessment Effect Sa*I	108.7 kNm	211.8 kNm	133.5 kNm	160.3 kN	112.44 KN	
Capacity For Assessment Live Load	205.68 kNm	205.68 kNm	189.02 kNm	652.29 kN	638.26 kN	
Dead Load Assessment Effects Sa*d	28.32 KNm	28.32 kNm	44.98 kNm	24.91 KN	38.94 kN	
Assessment Resistance Ra*	234 KNm	234 KNm	234 KNm	677.2 kN	677.2 kN	
Position In Span	Mid Span Middle trough	Mid Span Middle trough	Mid Span Edge trough	End Middle trough	End Edge trough	
Load Case/ Load Effect	HA UDL + KEL Single Vehide/ Moment	HA UDL + KEL Two Vehides/ Moment	HA UDL + KEL Single Vehide/ Moment	HA UDL + KEL Two Vehicles/ Shear	HA UDL + KEL Single Vehide/ Shear	

	40 Tonnes	40 Tonnes		
7\	/e <u>r</u> this	structur	e which	means
	40 Tonnes	40 Tonnes		
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	40 Tonnes Mg	40 Tonnes		
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	Traffic and Road Conditions For	Middle Trough Two Vehicles / Movement Lp		

Document Reference: S1897/03/200/001

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RAIL PROPERTY LTD BRIDGE ASSESSMENT PROGRAMME 1998/99 ASSESSMENT INSPECTION REPORT

CHILSWORTHY BRIDGE LINE NAME: CALLINGTON BRANCH REF: CAL/5m29ch DATE: MAY 1999

Prepared by

The Design Consultancy
Transportation and Estates
Cornwall County Council

B.Eng., M.Phil., C.Eng., F.I.C.E., F.I.H.T., M.C.S.M., County Surveyor, County Hall, TRURO TR1 3AY. Scheme: Rail Property Ltd Bridge Assessment, Cornwall_ Structure: Chilsworthy Bridge

Date: May 1999

INSPECTION REPORT

Containing

Inspection Report

- 1. INTRODUCTION
- 2. DRAWINGS USED FOR BASIS OF INSPECTION
- 3. CONDITION REPORT
 - 3.1 Fabricated Longitudinal Edge Plates
 - 3.2 Troughing
 - 3.3 Abutments
 - 3.4 Wingwalls
 - 3.5 Parapets
 - 3.6 Surfacing
 - 3.7 Embankments
 - 3.8 Foundations
 - 3.9 Drainage System
 - 3.10 Summary

4. STATUTORY UNDERTAKERS PLANT

- **APPENDIX A Record Drawings and Statutory Undertakers Plant Returns**
- APPENDIX B Photographs of Structure
- **APPENDIX C** Inspection Record Drawings
- APPENDIX D Approval in Principle Form

Structure: Chilsworthy Bridge

Date: May 1999

1. INTRODUCTION

The inspection forms part of the Rail Property Ltd bridge assessment programme.

An inspection for assessment was carried out on the 11 February 1999 by CP Gladstone, CA Endean and WA Bartle. The inspection was undertaken in accordance with the Departmental Standard BD 21/97.

The structure is a single span bridge consisting of longitudinal steel troughing with steel T sections riveted to the edge with timber panels to form a parapet. The abutments are constructed of squared rough faced random rubble granite. There are currently no limitations on normal highway loading over the structure.

There was no recorded history of this structure available at the time of this inspection. The record drawings were available from Rail Property Ltd.

2. INSPECTION DETAILS

2.1 The record drawings were available at the time of this inspection. The main dimensions of the structure were confirmed during the site inspection.

2.2 Dimensions Measured

Steel troughing sheet thickness	=	0.011 metres
Square span	=	4.340 metres
Steel troughing sheet width	=	0.853 metres
Edge plate (width)	=	0.381 metres
Edge plate (thickness)	=	0.011 metres
Edge plate (height)	=	0.270 metres
Edge plate (thickness)	=	0.095 metres
Steel troughing sheet depth	=	0.305 metres
Depth of fill over troughing	=	0.180 metres

Scheme: Rail Property Ltd Bridge Assessment, Cornwall Structure: Chilsworthy Bridge

Date: May 1999

Carriageway width = 6.020 metres (square between parapets)

Parapet posts = 125mm x 75mm x 12.5mm T sections at 1.25 metre spacings.

The horizontal alignment of the road over the structure is linear and as such no allowance for centrifugal effects is required. The vertical alignment is that of a hump backed bridge therefore axle lift off requires consideration. For further details refer to drawing in Appendix C.

3. CONDITION REPORT

3.1 Fabricated Edge Plates

The edges of the bridge are constructed from two steel plates riveted together with a 100mm x 100mm x 12.5mm angle section with the troughing is riveted to the bottom plate (Plates 4 & 12). The plates were found to be in good condition with no signs of corrosion and the paint system was still intact. The rivets were in good condition with only surface rust evident.

3.2 Troughing

The troughing spans longitudinally between abutments and with seven troughs over the width of the structure. (Plates 4 & 5). There was surface corrosion evident on the troughs (Plates 6, 7 & 11) and the paint system was found to be flaking away in some areas (Plates 4 & 5). The troughs are riveted together with an 11mm plate on the top surface, the bolts are showing particularly significant signs of corrosion (Plate 9). Rivet heads are showing more corrosion with approximately 2mm of loss of section. The troughs were filled with an asphaltic material.

3.3 Abutments

The abutments are of squared rough faced granite in a random rubble construction (Plates 10 & 11). Granite pad stones support the troughs. There is some evidence of damp penetration and algae growth (Plate 11). The joints are well pointed and are generally flush. The granite was found to be in good condition with no signs of delamination or other defects caused by weathering. The abutments were showing no signs of tilting, bulging or other deformation.

Scheme: Rail Property Ltd Bridge Assessment, Cornwall Structure: Chilsworthy Bridge

Date: May 1999

3.4 Wingwalls

The wingwalls to the structure are of squared rough faced granite in a random rubble construction. They were found to be in good condition with no tilting, bulging, cracking or other deformation. The joints are well pointed and generally flush.

3.5 Parapets

The parapets are constructed from timber panels which are riveted to five steel posts. The posts are 125mm x 75mm x 12.5mm steel T sections riveted to an angle section connected to the troughing. The distance between posts is 1.255 metres (Plates 1, 2, 13 & 14). The panels have been painted with a preservative paint and were not showing any signs of rot. There was a localised area of vegetation growth at the base of the parapet (Plate 14). On the north - west side of the bridge there is a masonry retaining wall beyond the extent of the bridge and is constructed from squared rough faced local siltstone. There is a large crack in the parapet in this section (Plate 17).

3.6 Surfacing

The width of the carriageway is 6.020 metres between parapets there is a 300mm verge on the east side (Plates 15 & 16). The inspection recorded no severe rutting or subsidence within the carriageway.

3.7 Embankments

The embankments on each side of the bridge are covered in ground covering vegetation. There was no evidence of slips or water runs.

3.8 Foundations

There was no evidence to suggest the type and form of the foundations of the structure. Since the structure shows no signs of foundation movement it is assumed that the foundations are adequate.

3.9 Drainage System

There was no evidence of any drainage systems.

3.10 Summary

The bridge was in reasonable condition with the corrosion as the only form of deformation. An appropriate condition factor should be Fc = 1.0

Scheme: Rail Property Ltd Bridge Assessment, Cornwall_ Structure: Chilsworthy Bridge

Date: May 1999

4. STATUTORY UNDERTAKERS PLANT

The following statutory undertakers have the following plant at the bridge location:

British Telecom

Overhead line over the bridge.

Underground cable under the west carriageway.

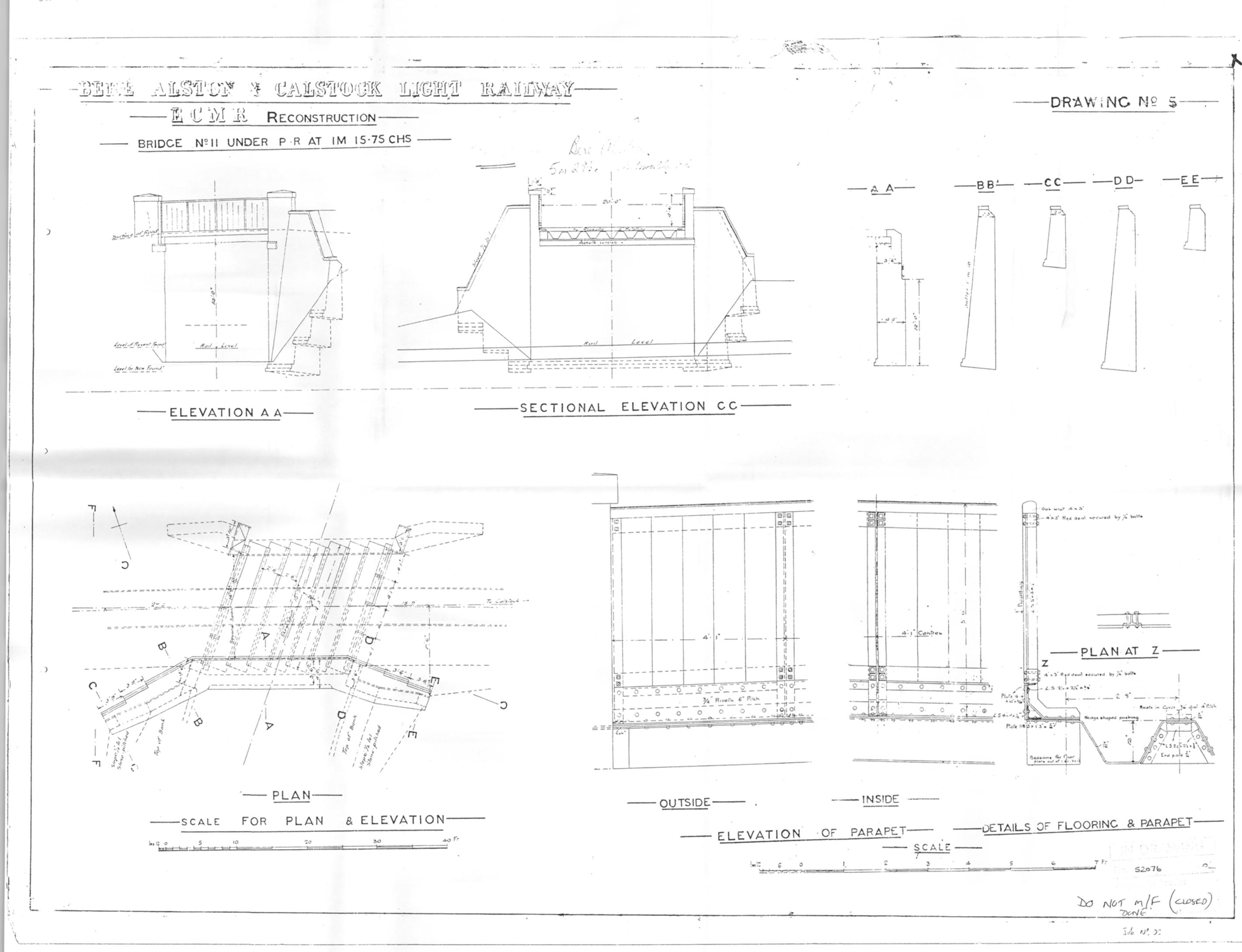
Scheme: Rail Property Ltd Bridge Assessment, Cornwall_

Structure: Chilsworthy Bridge

Date: May 1999

APPENDIX A

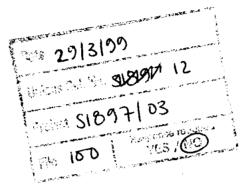
Record Drawings and Statutory Undertakers Plant Returns





Plant Protection Control pp 100 Priorswood T.E.C. Venture Way Taunton TA2 8DB

Yours Faithfully



Tel. FREEFONE DIAL BEFORE YOU DIG VIA THE OPERATOR

Your Ref: 51897/100/18/03

Our Ref: 0109961628

125 MAR 1999

Dear Sir / Madam RE. PROPOSED ROAD WORKS AT CHUSWORTH!
I thank you for your letter dated 18 (CB) regarding the above
described works.
Your plan(s), returned herewith, has / have been marked to show the approximate position of B.T. plant in the vicinity.
If desired, B.T. plant affected by your proposals can be marked on site by my representative, provided the proposed line and extent of your work is indicated on site either by prior marking or by your representative at a joint site meeting.
When works are being carried out, if serious risk of damage is to be avoided, it is recommended that mechanical excavators or borers are not used within 600mm of B.T. plant.

SPECIAL REQUIREMENTS IN RELATION TO BRITISH TELECOMMUNICATIONS PLC

- 1 In this Special Requirement the following terms shall have the meanings assigned to them:
 - a) 'Company' means British Telecommunications Plc
 - b) 'Company Representative' means the staff of British Telecommunications Plc or its Authorised Representatives and Agents.
 - c) 'Apparatus' means all surface or sub-surface equipment and plant including any associated cabling and/or ducting owned, leased or rented by British Telecommunications Plc.

Before commencing any work or moving heavy plant or equipment over any portion of the Site the Contractor shall confirm details of the Apparatus, owned, leased or rented by the Company, within the Site with the Company Representative, who can be contacted at the following point: -

Address: -

British Telecommunications
Engineering Centre
Priorswood Industrial Estate
TAUNTON
Somerset
TA2 8DB

Fax: -

01823

331655

- Where such details show that the works or the movement of plant or equipment may endanger the Apparatus of the Company, the Contractor must give the Company Representative at least 7 days written notice of the date on which it is intended to commence such works or the movement of plant and equipment in order that the presence of any sub-surface Apparatus can be indicated by markers to be supplied by the Company and placed by the Contractor under the supervision of a Company Representative. The Contractor shall ensure that all Company Apparatus, particularly surface running cabling, is adequately protected from damage and such protective measures shall be approved by the Engineer. Also at any point at which Contractors heavy plant crosses the BT duct it should be protected with a 150mm raft of reinforced concrete placed at a minimum of 150mm above the BT ducts.
 - 4 In the event of a Company marker being disturbed for any reason it shall not be replaced other than in the exact position and to its former depth unless repositioning is carried out at the direction and under the supervision of a Company Representative.
 - 5 The Contractor shall take particular care in relation to the protection of Company Apparatus, where such Apparatus includes the

presence within the Site of optical fibre and/or co-axial cabling. The Contractor should particularly note that damage to such Apparatus is extremely disruptive to the Company network and costly to reinstate. The Contractor shall make every effort to avoid the disturbance of Company Apparatus more than is absolutely necessary for the completion of the Works in accordance with the Contract.

- 6 When excavating around, moving or backfilling around Company Apparatus, the Company Representative shall be given adequate notice, which shall not be less than 3 days, of the Contractor's intentions in order that he may supervise the works. The Contractor should note that the normal depth of cover for Company Apparatus and ducts is as follows:
 - a) In carriageways 600mm, which is to be maintained.
 - b) In footways 450mm, which is to be maintained.

Where the 600/450mm depth of cover cannot be maintained the Contractor shall carry out the instructions of the Engineer for the protection of Company Apparatus and such actions that follow from the Engineer's instruction shall be supervised by a Company Representative. Where the required depth of cover cannot be maintained over cabling, such cables as are affected shall be enclosed and protected in PVC duct and encased in concrete as directed by the Company Representative.

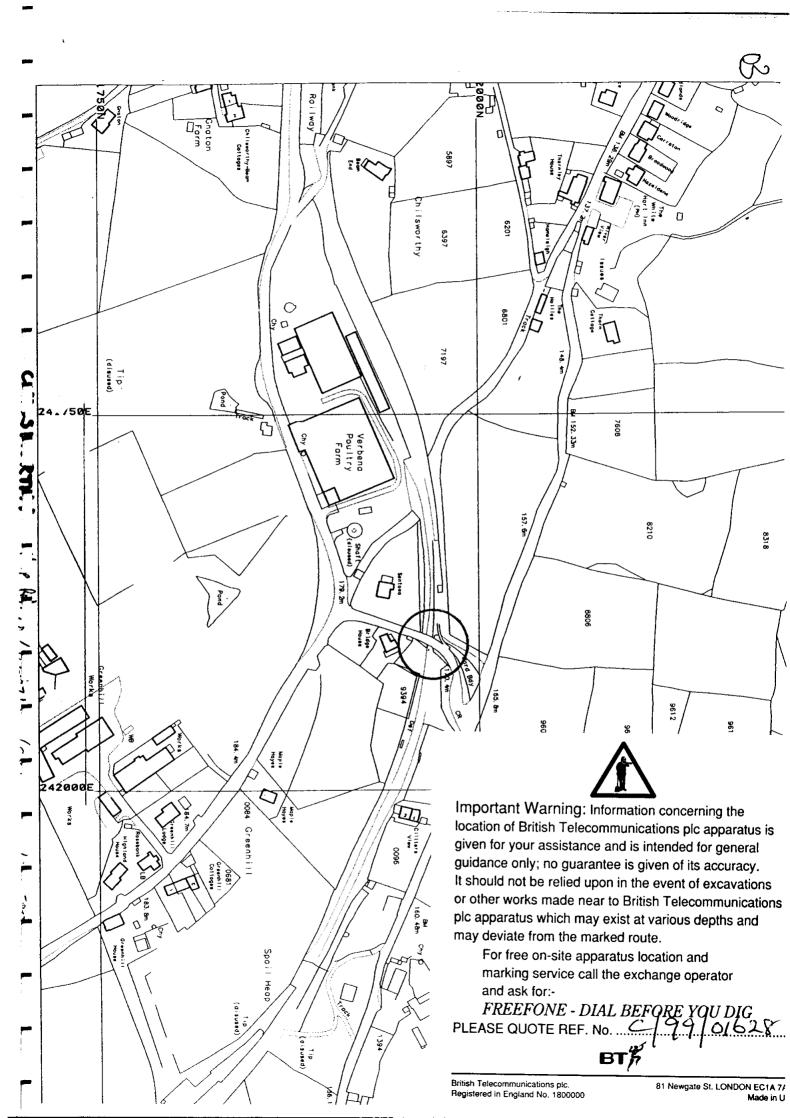
All excavation adjacent to Company Apparatus is to be carried out by hand until the exact extent and/or location of Company Apparatus is known. Mechanical borers and/or excavators shall not be used within 1.0m of Company Apparatus without the supervisory presence of a Company Representative. To prevent any movement of Company Apparatus during excavation, complete shuttering shall be used as directed by the Engineer if: -

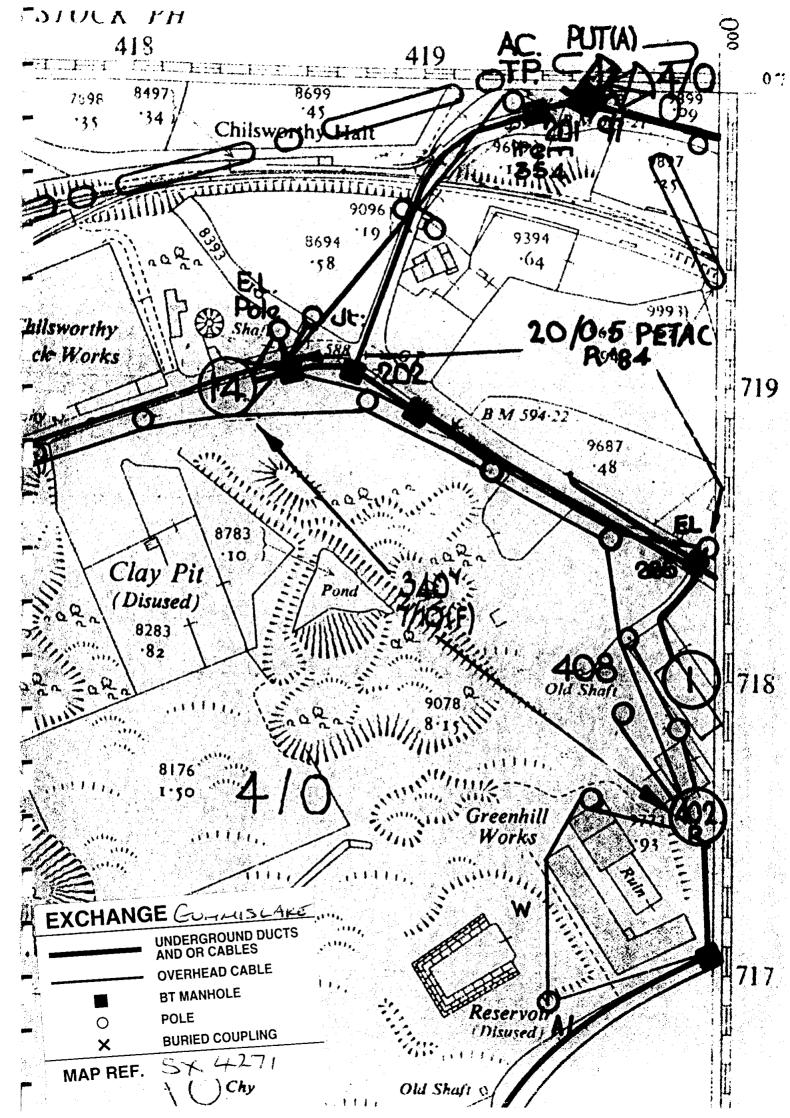
- a) Excavation is deeper than the depth of cover of adjacent Company Apparatus.
- b) Excavation is within 1.0m of Company Apparatus in stable soil.
- c) Excavation is within 5.0m of Company Apparatus in unstable soil.

If for the completion of the Works the Contractor intends using any of the following: -

- i) Pile driving equipment within 10.0m of Company Apparatus.
- ii) Explosives within 20.0m of Company Apparatus.
- iii) Laser equipment within 10.0m of Company Apparatus.

The Contractor shall advise the Company Representative, giving at least 7 days written notice, in order that any special protective





Transco

Our Ref:- NRSWA/W6/33119 Your Ref: - S1897/100/18/03

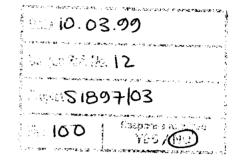
P. O. Box 502 Malago House Bedminster Road Bedminster Bristol BS99 5RS

Telephone 0117 953 5444

Cornwall County Council Transportation & Estates The Design Consultancy County Hall Truro TR13AY

05 March 1999

Dear Sir/Madam.



CHILSWORTHY

We acknowledge receipt of your inquiry on the 04/03/99, and return herewith one copy of our drawing which we have indicated the approximate position of existing gas mains and would request that care is exercised when working in the vicinity of these mains.

In this respect our schedule is also attached which indicates the minimum requirements for the protection of our underground plant, and your attention is also drawn to the liability clause stamped on the plan.

We do not show service pipes on our drawing but their presence should be anticipated. Where the site is indicated as being fed by another Private Gas Transporter (PGT) you should contact that company for details of their mains as we do not hold these on file.

Will you please inform us of your actual date of commencement as soon as possible. If necessary arrangements can be made for our staff to inspect our plant on site as work progresses.

Should you require any further details or information regarding our mains and services please contact work Records at the District Office. Telephone No. 0117 953 6842.

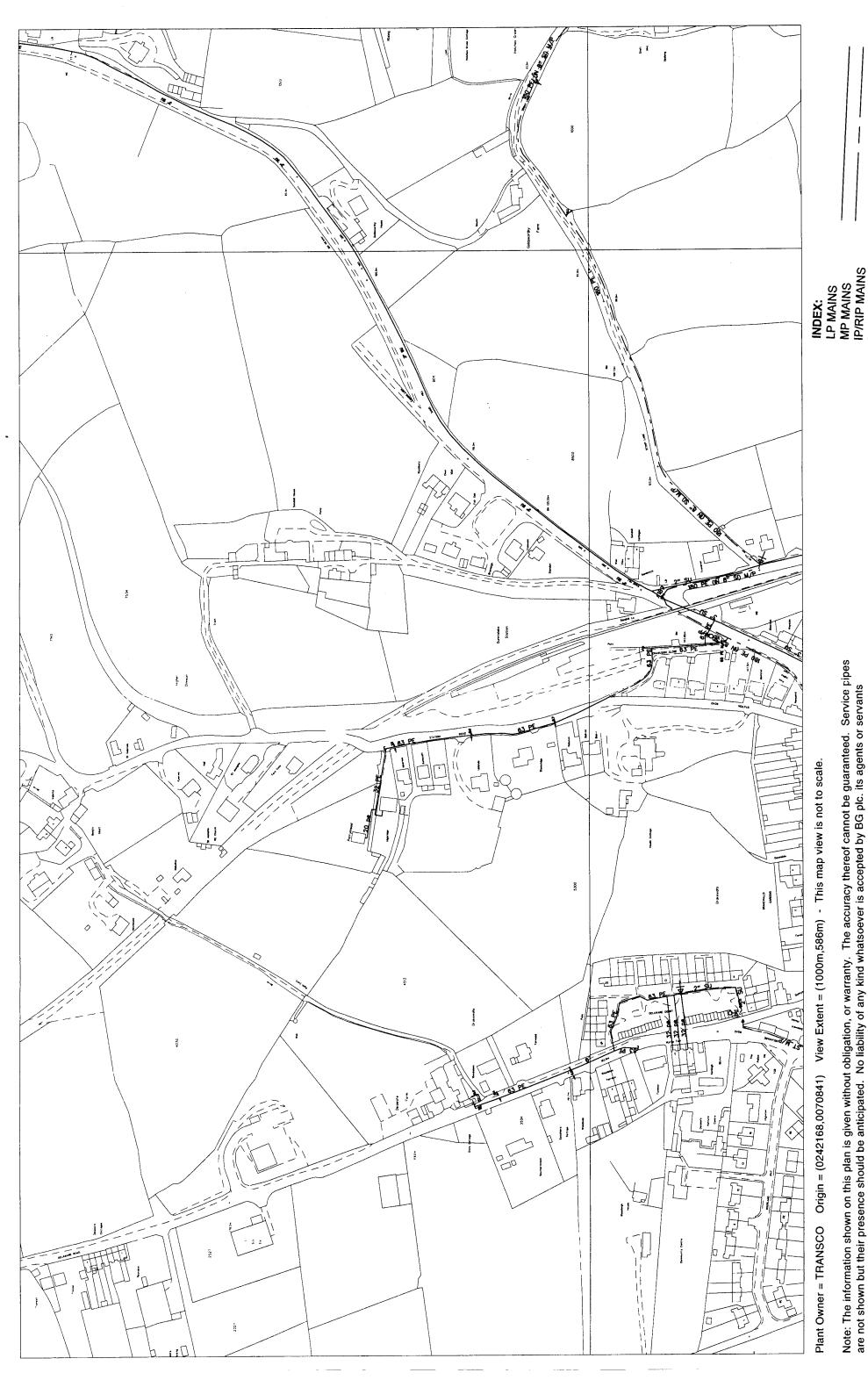
Yours Faithfully



Transco South West LDZ

Transco operates in the UK and is part of BG plc

BG plc Registered in England No. 2006000 Registered Office 100 Thames Valley Park Drive Reading, Berkshire RG6 1PT



Note: The information shown on this plan is given without obligation, or warranty. The accuracy thereof cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by BG plc. its agents or servants for any error or omission. The actual position of mains and services must be verified and established on site before any mechanical plant is used.

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Шининининини

RHP MAINS NHP MAINS MAINS TO BE ABANDONED



Dowrglann, Stennack Road, Holmbush Industrial Estate, St Austell, Cornwall PL25 3SW Telephone Main Switchboard (01726) 66766 Fax (01726) 64057 Customer Service Enquiries 0345 77 66 77 (local call rate)

TRANSPORTATION & ESTATES CORNWALL COUNTY COUNCIL COUNTY HALL TRURO TR13AY

The Records Centre

Date: 05/03/1999

Direct Line: (01726) 626228

Fax Line: (01726) 626297

email: awillicot@south-west-water.co.uk

F.A.O. M.J. STRIBLEY

Our reference: RCW/N/1823 Your reference: S1897/100/18/03

Dear Sir / Madam,

I refer to your notice dated 18/02/1999,

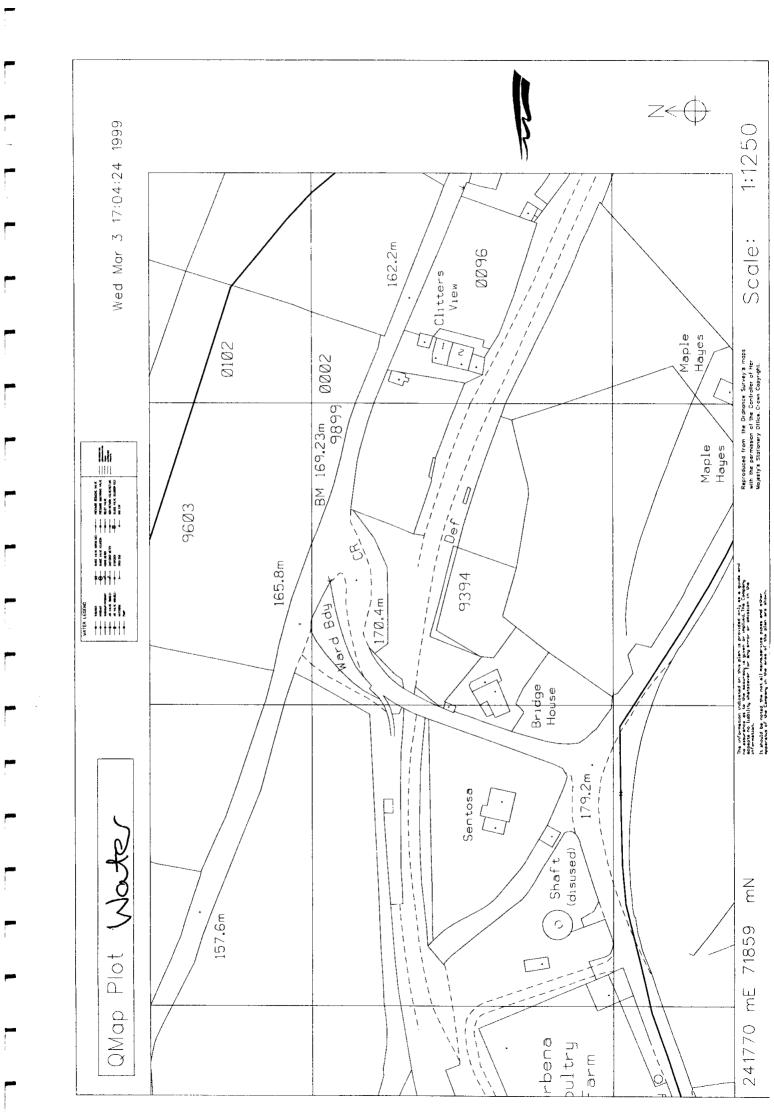
RE: CHILSWORTHY

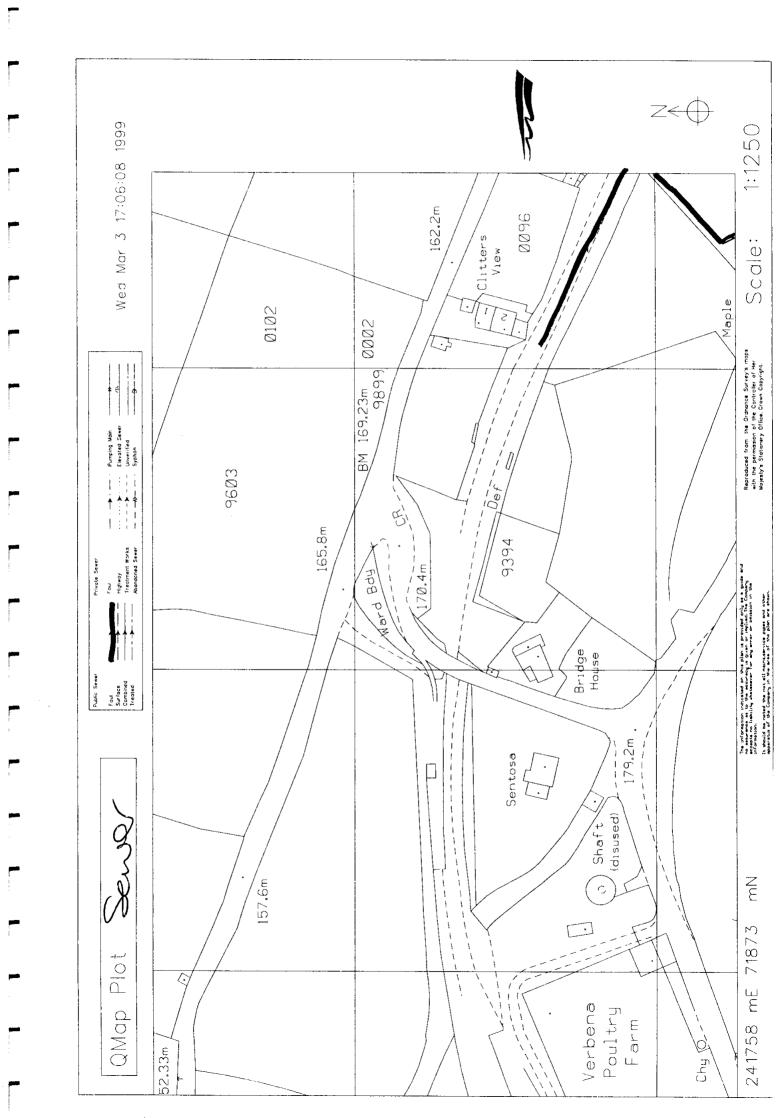
Notice is hereby given that the Company's apparatus, shown on the attached plan, and service connections may be affected by the works proposed.

You are required to comply with the measures specified in the attached schedule which indicate the minimum requirements for the protection of the company's apparatus.

The information indicated on any attached plans is provided only as a guide and no assurance of its accuracy is given or implied. The company accepts no liability whatsoever for any error or omission in the information. It should be noted that not all mains, service pipes, drains and other apparatus of the Company in the area of the plan are shown.

Records Technician.







Cornwall County Council Transportation & Estates The Design Consultancy County Hall Truro, Cornwall TR1 3AY Map Response Team
Mapping Centre
Osprey Road
Sowton Industrial Estate
Exeter EX2 7HZ

Telephone 01392 448722 Fax 01392 444204

Our ref N57850 SO

Your ref \$1897/100/18/03

Date 5 March 1999

Dear

, CHILSWORTHY

Thank you for your enquiry dated 18 February 1999.

I enclose a copy of our mains records indicating the position of the Company's apparatus in the vicinity of your proposed works. This information is given as a general guide only and its accuracy cannot be guaranteed.

Where work is to take place in the vicinity of our plant it is a requirement under the Electricity at Work Regulations 1989 and the Health and Safety at Work Act 1974, that employees should define and practise safe working procedures.

Works should be carried out in accordance with the Health and Safety Executive's publications GS6 and HS(G)47.

Diversions to our overhead lines and/or underground cables may be required to allow the development to go ahead. The cost of any alterations may be charged to the developer.

Would you please inform me in writing as soon as you decide to go ahead with your works. We will then prepare detailed proposals and provide a quotation for any necessary alterations to our equipment on the site. Our scheme may require the negotiation of wayleaves and other statutory consents and could take several months to complete from the date of your notification.

Yours faithfully,



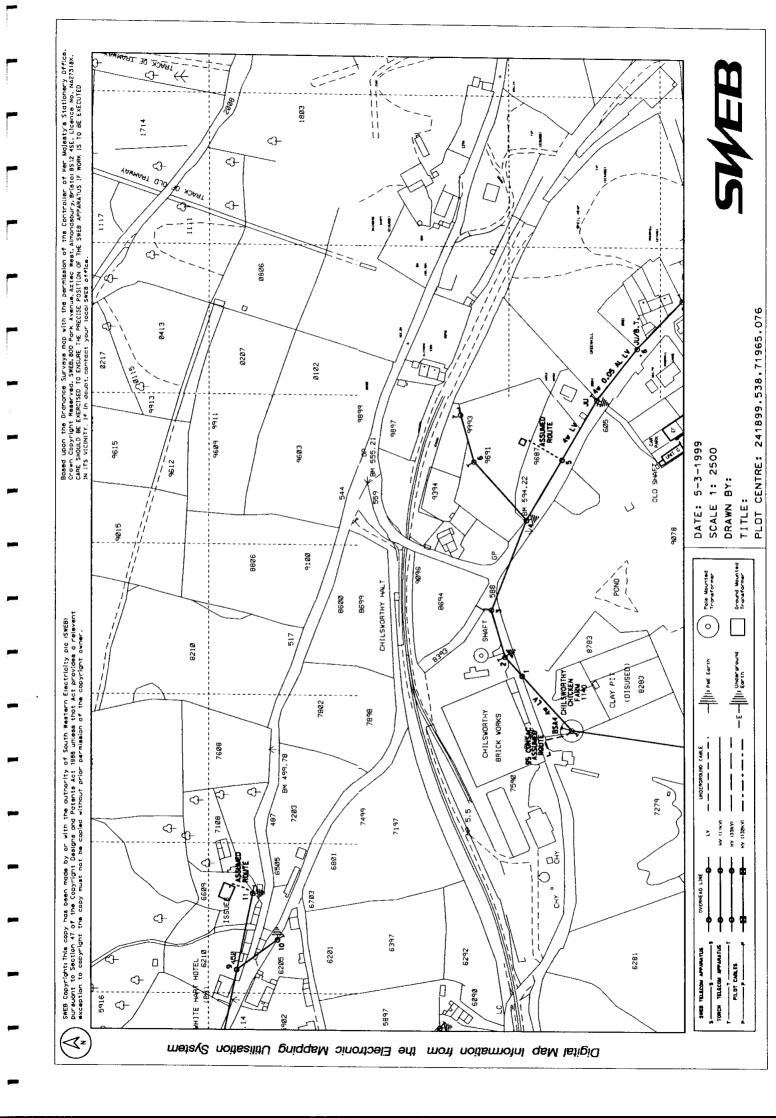
Unique Ref. No. \$

Project 81897/03

File 160 Response required YES / 100

DS8-010





Scheme: Rail Property Ltd Bridge Assessment, Cornwall_ Structure: Chilsworthy Bridge

Date: May 1999

APPENDIX B

Photographs of Structure

Plate 1	Mileage reference and west parapet
Plate 2	West elevation
Plate 3	East elevation
Plate 4	General view of the soffit
Plate 5	Troughing and south abutment
Plate 6	Troughing detail
Plate 7	Troughing detail
Plate 8	Top of abutment and troughing detail
Plate 9	Bolts on soffit
Plate 10	South abutment
Plate 11	South abutment
Plate 12	Vegetation growth through the bridge
Plate 13	Vegetation growth on edge plate
Plate 14	East parapet
Plate 15	View over structure looking south
Plate 16	View over structure looking north
Plate 17	Crack in parapet
Plate 18	Trial pit in the carriageway.

CHILSWORTHY BRIDGE

PLATE 1

Mileage reference and west parapet



09.02.99



RAIL PROPERTY LTD BRIDGE ASSESSMENTS CHILSWORTHY BRIDGE

PLATE 2

West elevation

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RAIL PROPERTY LTD BRIDGE ASSESSMENTS CHILSWORTHY BRIDGE

PLATE 3

East elevation.



09.02.99



CHILSWORTHY BRIDGE

PLATE 4

General view of the soffit.

09.02.99

RAIL PROPERTY LTD BRIDGE ASSESSMENTS

CHILSWORTHY BRIDGE

PLATE 5

Troughing and south abutment.



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RAIL PROPERTY LTD BRIDGE ASSESSMENTS

CHILSWORTHY BRIDGE

PLATE 6

Troughing detail - note extent of corrosion.

CHILSWORTHY BRIDGE

PLATE 7
Troughing detail.

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RAIL PROPERTY LTD BRIDGE ASSESSMENTS

CHILSWORTHY BRIDGE

PLATE 8

Top of abutment and troughing deta

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RAIL PROPERTY LTD BRIDGE ASSESSMENTS

CHILSWORTHY BRIDGE

PLATE 9

Bolts on soffit - note corrosion.



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RAIL PROPERTY LTD BRIDGE ASSESSMENTS CHILSWORTHY BRIDGE

PLATE 10

South abutment.

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RAIL PROPERTY LTD BRIDGE ASSESSMENTS

CHILSWORTHY BRIDGE

PLATE 11

South abutment - note damp penetration and algea growth



11.02.99



RAIL PROPERTY LTD BRIDGE ASSESSMENTS

CHILSWORTHY BRIDGE

PLATE 12

Vegetation growth through the bridge.

CHILSWORTHY BRIDGE

PLATE 13

Vegetation growth on edge plate.



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RAIL PROPERTY LTD BRIDGE ASSESSMENTS CHILSWORTHY BRIDGE

PLATE 14
East parapet.

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RAIL PROPERTY LTD BRIDGE ASSESSMENTS

CHILSWORTHY BRIDGE

PLATE 15

View over structure looking south





CHILSWORTHY BRIDGE

PLATE 16

View over the structure looking north.

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RAIL PROPERTY LTD BRIDGE ASSESSMENTS

CHILSWORTHY BRIDGE

PLATE 17

Cracking in masonry section of parapet.



09.02.99



RAIL PROPERTY LTD BRIDGE ASSESSMENTS

CHILSWORTHY BRIDGE

PLATE 18

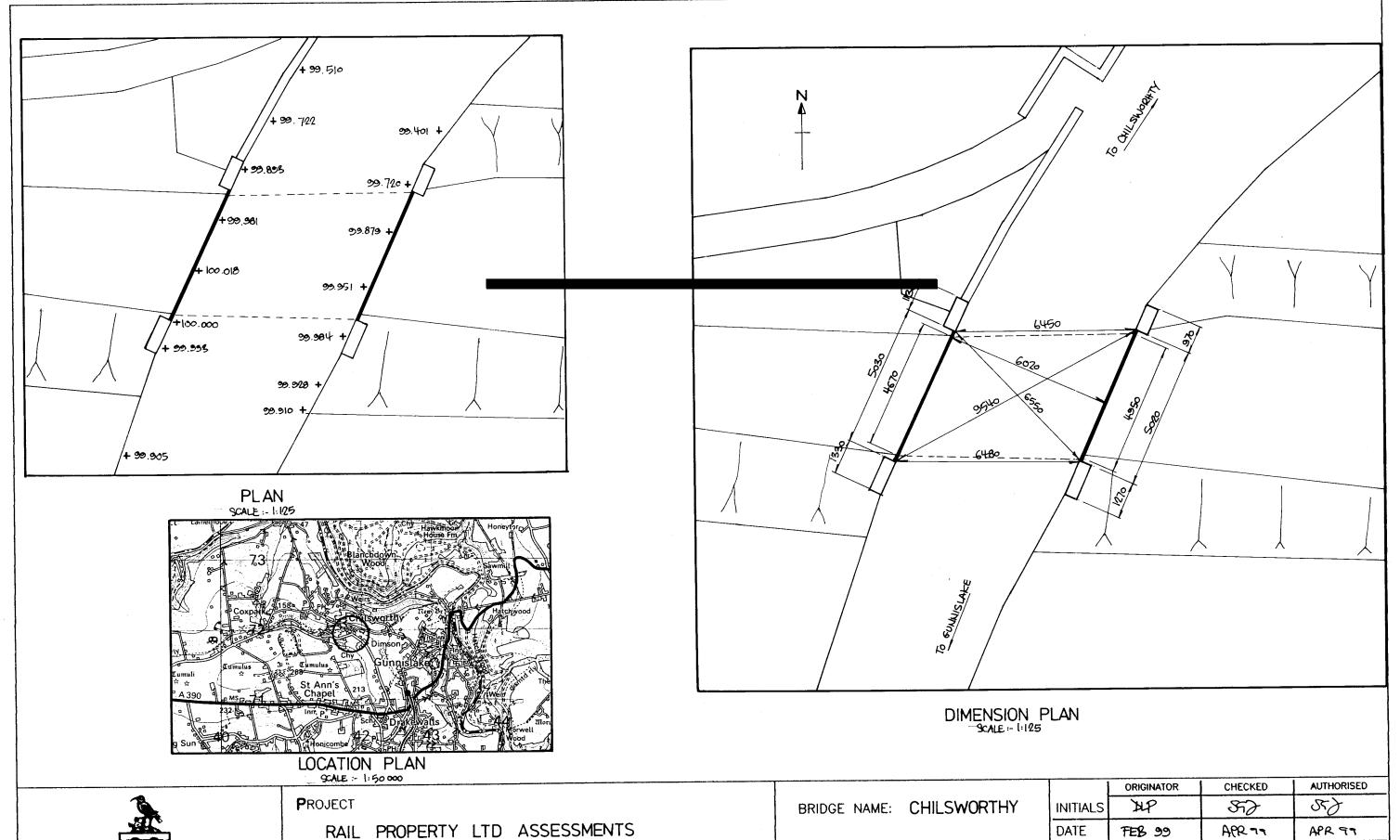
Trial pit in the carriageway

Scheme: Rail Property Ltd Bridge Assessment, Cornwall_ Structure: Chilsworthy Bridge

Date: May 1999

APPENDIX C

Inspection Records Drawings





DRAWING TITLE

CHILSWORTHY BRIDGE - LAYOUT PLANS

E.L.R.: CAL

MILEAGE: 5m 29ch

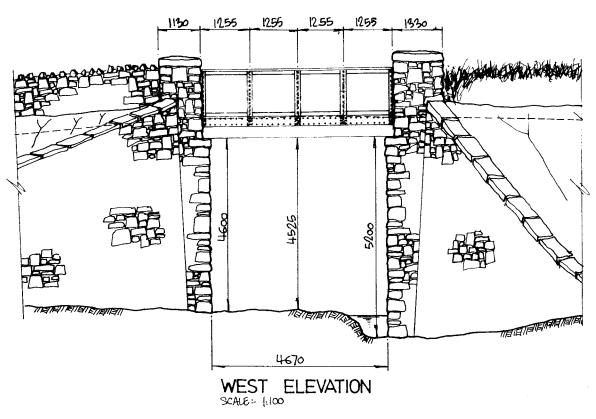
GRID REF No.: SX 419 720

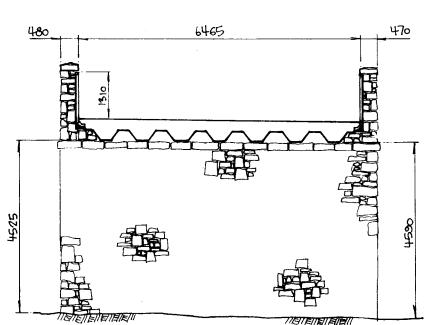
	ORIGINATOR	CHECKED	AUTHORISED	
INITIALS	JUP P	557	57	
DATE	FEB 99	APR 77	APR 97	

SCALE

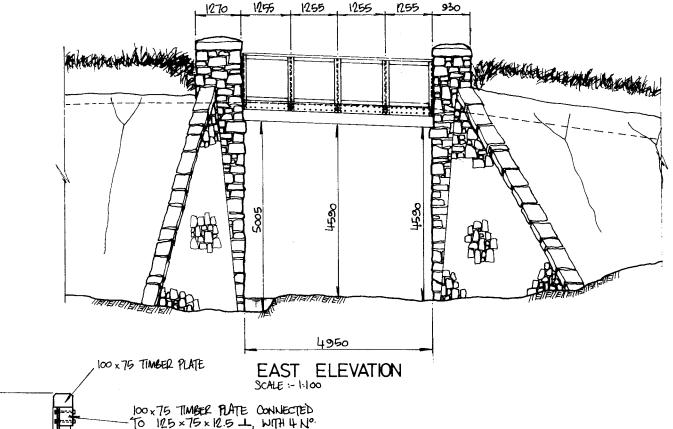
AS SHOWN

DRAWING NO S1897/03/D/S101 REVISION





SECTION THROUGH & OF BRIDGE LOOKING NORTH



IOX 75 TIMBER PLATE CONNECTED
TO 125 x 75 x 12.5 \(\), WITH 4 N°.

125 x 75 x 12.5 \(\), WITH 4 N°.

15 NM THICK TIMBER PLATE WITH 4 N° 12 NM BOLTS

G5 x 65 x 12 ANGLE

30 NM & BOLTS

10 x 10 x 12 ANGLE

30 NM & BOLTS

10 x 10 x 12 ANGLE

30 NM & BOLTS

30 NM

PARAPET DETAILS



PROJECT

RAIL PROPERTY LTD ASSESSMENTS

DRAWING TITLE

CHILSWORTHY BRIDGE - ELEVATIONS & SECTIONS

BRIDGE NAME: CHILSWORTHY

E.L.R.: CAL

MILEAGE: 5m 29 ch

GRID REF No.: SX 419 720

	ORIGINATOR	CHECKED	AUTHORISED
INITIALS	PLF.	557	STZ
DATE	MAR 99	APR 99	APR99

SCALE

AS SHOWN

DRAWING NO REVISION S1897/03/D/S102

Scheme: Rail Property Ltd Bridge Assessment, Cornwall_

Structure: Chilsworthy Bridge

Date: May 1999

Appendix D

Approval in Principle Form

British Railways Board FORM 'AA' (BRIDGES)	Group Standard GC/TP0356 Appendix: 4 Issue: 1 Revision: A
APPROVAL IN PRINCIPLE FOR ASSESSMENT	Date: FEB 93
BRITISH RAILWAYS BOARD	
BRIDGE ASSESSMENTS	
LINE NAME: CALLINGTON BRANCH BRIDGE ID: CAL/5m29ch OS Map Ref: SX 419 720 BRIDGE NAME: CHILSWORTHY	
APPROVAL IN PRINCIPLE FOR ASSESSMEN	T
MAY 1999	

1. Name of organisation carrying out the work

The Design and Maintenance Consultancy

British Railways Board FORM 'AA' (BRIDGES)

Group Standard

Appendix: 4 Issue: 1 Revision: A Date: FEB 93

GC/TP0356

APPROVAL IN PRINCIPLE FOR ASSESSMENT

		Transportation and Estates Cornwall County Council
2.	Identification of Structure	
2.1	Name	Chilsworthy Bridge
2.3	Line Name	Callington Branch
2.4	Engineer's line reference	CAL/5m29ch
2.5	Type of bridge	Steel fabricated edge plates with a troughe deck
2.6	Status of bridge	Road bridge
2.7	Permitted speed of traffic carried by bridge	60mph
2.8	Type of highway passing over bridge	Class III Road
3.	Description of structure, including defects	
3.1	Structure type	Single span fabricated edge plates with a troughed deck
3.2	Foundation type	1.2m wide pad foundations
3.3	Substructure type	Mass granite abutment
3.4	Superstructure type	Fabricated steel edge plates with longitudinal troughing
3.5	Span arrangements	The skew span is 4.700m
3.6	Articulation arrangements	N/A
3.7	Parapet type	Steel T section posts at 1.25m centres with 19mm timber panels
3.8	Details of any special or unusual features	None
3.9	Materials and Finishes	
	3.9.1 Troughing	Steel fy = 230 N/mm ²
	3.9.2 Parapet posts	Steel fy = 230N/mm^2
	3.9.3 Parapet panels	Timber
4.	Assessment Criteria	
4.1	Traffic Speed to be used	The maximum allowable traffic speed is 60mph.

British Railways Board

FORM 'AA' (BRIDGES)

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Issue: 1 Revision: A Date: FEB 93

APPROVAL IN PRINCIPLE FOR ASSESSMENT

4.2	Live loading to be used	
	4.2.1 HA Loading	The steel troughing and fabricated steel edge girders will be assessed for HA UDL, together with KEL, a single axle and single wheel load in accordance with Clause 5.8 of BD 21/97.
	4.2.2 Footway live loading	N/A.
	4.2.3 HB loading	The bridge is not on the abnormal load route therefore HB loading will not be considered.
4.3	Other loads to be used	Axle lift off requires consideration but centrifugal effects are not relevant.
4.4	Authorities consulted and any special conditions required	South West Water South Western Electricity British Telecom Transco Cable & Wireless/Mercury Rail Property Ltd.
	4.4.1 Effect of statutory undertakers plant on strength of structure.	From the inspection and information provided by the bodies listed above. There is no reason to believe any apparatus will affect the assessment.
4.5	List of relevant standards to be used	TAS dated June 1989. See Appendix A.
	4.5.1 Additional relevant DOT Standards published since the above edition of the TAS including amendments.	See Appendix B.
4.6	Proposed departures from standards given in 4.5 and 4.5.1.	None
4.7	Proposed methods of dealing with aspects not covered by standard in 4.5 and 4.5.1.	None
5.	Structural Analysis	
5.1	Method of analysis proposed for superstructure, substructure and foundations.	 (i) The troughing will be analysed in accordance with 6.9 to 6.14 of BD 21/97 and 9.1 to 9.3 of BA 16/97. (ii) Abutments, wingwalls and foundations will be assessed qualitatively in accordance with BD21/97, Chapter 8 (iii) Section properties will be based upon measured dimensions after allowing for corrosion.
5.2	Description and diagram of idealised structure.	See Appendix C.

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APPROVAL IN PRINCIPLE FOR ASSESSMENT

5.3	Assumptions intended for calculation of structural
	element stiffness.

Soil parameters for mechanism methods are detailed in Section 5.4

5.4 Proposed earth pressure coefficients to be used in design N/A of earth retaining elements.

6. **Ground Conditions**

6.1 Information used to justify ground conditions used for No information available analysis.

6.2 Ground condition effects proposed to be taken into account.

No adverse ground conditions found to affect the superstructure

7. **Drawings and Documents**

7.1 List of drawings, numbers, documents and other information accompanying this submission.

Appendix A - TAS Schedule Appendix B - Additional Standards Appendix C - Idealised Structure Assessment Inspection Report dated March

1999

7.1.1 The assessment will be based on the following None record drawings

The above is submitted for acceptance

į

Name:

8.



Title/Professional Qualification:

Project Director The Design Consultancy Cornwall County Council

Date:

8 March 200

(Sections 1 to 8 above shall be completed and signed by the Project Director.)

Group Standard

Appendix: 4 Issue: 1 Revision: A Date: FEB 93

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APPROVAL IN PRINCIPLE FOR ASSESSMENT

9. The above approved subject to the following comments and conditions.

Comments:

Supersmothere to have a Cat I check.

This Form AA has been subject to technical review and is considered to state the appropriate assessment requirements for the bridge.

Name:				
Signed:				

British Railways Board FORM 'AA' (BRIDGES) GC/TP0356 Appendix: 4 Issue: 1 Revision: A Date: FEB 93 APPROVAL IN PRINCIPLE FOR ASSESSMENT

APPENDIX A

TECHNICAL APPROVAL SCHEDULE

Dated June 1989

FORM 'AA' (BRIDGES)

Group Standard

GC/TP0356

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APPROVAL IN PRINCIPLE FOR ASSESSMENT

APPENDIX A

TECHNICAL APPROVAL SCHEDULE 'TAS' (JUNE 1989)

SCHEDULE OF DESIGN DOCUMENTS RELATING TO HIGHWAY BRIDGES AND STRUCTURES (All documents are taken to include revisions current at date of this TAS).

BRITISH STANDARDS

BS 153 Part 3A, Specification for Steel Girder Bridges (see BE 1/77).

BS 5268 Part 2, Structural Use of Timber

BS 5400 - Steel concrete and composite bridges

Part 1: 1978 - General Statement (see BD 15/82)

Part 2: 1978 - Specification for loads (see BD 14/82)

Part 3: 1982 - CP for design of steel bridges (see BD 13/82)

Part 4: 1984 - CP for design of concrete bridges (see BD 24/84)

Part 5: 1979 - CP for design of composite bridges (see BD 16/82)

Part 9: 1983 - Bridge bearings (see BD 20/83)

Part 10: 1980 - CP for fatigue (see BD 9/81)

BS 5930: 1981 - Site investigations

BS-6031: 1981: Earthworks

2. BRITISH STANDARD CODES OF PRACTICE

CP-114 Part 2 Reinforced concrete in buildings (see Tech Memo BE 1/73)

CP 116 Part 2 The structural use of precast concrete (see Tech Memo BE 1/73)

CP 118 The structural use of aluminium

CP 2 Earth retaining structures

CP 2004 Foundations

3. Dtp PUBLICATIONS (HMSO)

Railway construction and Operation Requirements, Structural and Electrical clearances (1977).

Railway construction and operation. Requirements for passenger lines and recommendations for goods lines 1950 (reprinted 1970).

Roads in urban areas and Metric Supplement (as amended by TA-32/82).

Layout of roads in rural areas and Metric Supplement (as amended by TA 28/82).

British Railways Board

IM 5

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Date: FEB 93

APPROVAL IN PRINCIPLE FOR ASSESSMENT Specification for Highway Works and Notes for Guidance (1986 Edition). Highway Construction Details (1987 Edition). Simplified Tables of External loads on Buried Pipelines (1970). **MISCELLANEOUS** Circular Roads No. 61/72 - Routes for heavy and high abnormal loads. **TECHNICAL MEMORANDA (BRIDGES)** 5. The design of Highway bridge parapets (4th revision). BE 27 Waterproofing and surfacing of bridge decks. BE 3/72 Expansion joints for use in highway bridge decks. BE 1/73 Reinforced concrete for highway structures (Relevant ports for the design of buried precast concrete pipes and sign/signal gantries only). BE 1/74 The independent checking of erection proposals and temporary works details for major highway structure on trunk roads and motorways. BE 8/75 Painting of concrete highway structures. Standard highway loadings (Relevant parts for the design of buried precast concrete pipes and sign/signal gantries only). BE 7/77 Department standard (interim) motorway sign/signal gantries. BE 1/78 Design criteria for footbridges and sign/signal gantries (Relevant for the design of sign/signal gantries only). BE 3/78 Reinforced earth and anchored earth retaining walls and bridges abutments for embankments. 6. HIGHWAYS TECHNICAL MEMORANDA Noise barriers - Standard and Materials 7. **INTERIM MEMORANDA (BRIDGES)**

Formation of continuity joints in bridge decks

Group Standard

FORM 'AA' (BRIDGES)

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APPROVAL IN PRINCIPLE FOR ASSESSMENT

8. DEPARTMENTAL STANDARDS 8.1 TRAFFIC ENGINEERING AND CONTROL TD 2778 Pedestrian Subways layout and dimensions TD 3779 Combined pedestrian and cycle subways layout and dimensions TD 9/81 Road layout and geometry. Highway link design TD 19/85 Safety fences and barriers TD 27786 Cross Sections and headroom 8.2 BRIDGES AND STRUCTURES BD 2/89 Technical approval of Dtp highway structures on motorways and other trunk roads BD 6/81 Approval in principle and calibrating of computer programs for use in Dtp highways structures on trunk-roads and motorways BD 7/81 Weathering steel for highway structures BD 9/81 Implementation of BS 5400 Pt 10, CP for fatigue BD 10/82 Design of highway structures in areas of mining subsidense BD 12/82 Corrugated steel buried structures BD 13/82 Design of steel buried structures BD 14/82 Loads for highway bridges—Use of BS 5400 Pt 2: 1978 BD 16/82 Design of composite bridges—Use of BS 5400 Pt 1: 1978 BD 16/82 Design of composite bridges—Use of BS 5400 Pt 2: 1983 BD 19/83 Standard Bridges BD 20/83 Bridge Bearings—Use of BS 5400 Pt 1: 1984 BD 26/86 Design of concrete bridges—Use of BS 5400 Pt 4: 1984 BD 26/86 Design of fighting columns BD 27/86 Materials for the repair of concrete highway structures BD 28/87 Early thermal cracking of concrete bridges abutments		AFFRU	VAL IN FRINCIPLE FOR ASSESSMENT
TD 2/78 — Pedestrian Subways — layout and dimensions TD 3/79 — Combined pedestrian and eyele subways — layout and dimensions TD 9/81 — Road layout and geometry. — Highway link design TD 19/85 — Safety fences and barriers TD 27/86 — Cross Sections and headroom 8.2 — BRIDGES AND STRUCTURES BD 2/89 — Technical approval of Dtp highway structures on motorways and other trunk roads BD 6/81 — Approval in principle and calibrating of computer programs for use in Dtp highways structures on trunk- roads and motorways BD 7/81 — Weathering steel for highway structures BD 9/81 — Implementation of BS 5400 Pt 10, CP for fatigue BD 10.82 — Design of highway structures in areas of mining subsidence BD 12/82 — Corrugated steel buried structures BD 13/82 — Design of steel bridges — Use of BS 5400 Pt 2: 1978 BD 15/82 — General principles — Use of BS 5400 Pt 1: 1978 BD 16/82 — Design of composite bridges — Use of BS 5400 Pt 5: 1979 BD 19/83 — Standard Bridges BD 20/83 — Bridge Bearings — Use of BS 5400 Pt 1: 1983 BD 21/84 — The assessment of highway bridges and structures BD 24/84 — Design of concrete bridges — Use of BS 5400 Pt 4: 1984 BD 26/86 — Design of ilighting columns BD 27/86 — Materials for the repair of concrete highway structures BD 28/87 — Early thermal cracking of concrete BD 29/87 — Design-oriteria for footbridges	.	8.	DEPARTMENTAL STANDARDS
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BD 16/82 Design of composite bridges - Use of BS 5400 Pt 5: 1979 BD 19/83 Standard Bridges BD 20/83 Bridge Bearings - Use of BS 5400 Part 9: 1983 BD 21/84 The assessment of highway bridges and structures BD 24/84 Design of concrete bridges - Use of BS 5400 Pt 4: 1984 BD 26/86 Design of lighting columns BD 27/86 Materials for the repair of concrete highway structures BD 28/87 Early thermal cracking of concrete BD 29/87 Design criteria for footbridges		BD 14/82	Loads for highway bridges - Use of BS 5400 Pt 2: 1978
BD 19/83 — Standard Bridges BD 20/83 — Bridge Bearings – Use of BS 5400 Part 9: 1983 BD 21/84 — The assessment of highway bridges and structures BD 24/84 — Design of concrete bridges – Use of BS 5400 Pt 4: 1984 BD 26/86 — Design of lighting columns BD 27/86 — Materials for the repair of concrete highway structures BD 28/87 — Early thermal cracking of concrete BD 29/87 — Design criteria for footbridges	-	BD 15/82	General principles - Use of BS 5400 Pt 1: 1978
BD 20/83 Bridge Bearings - Use of BS 5400 Part 9: 1983 BD 21/84 The assessment of highway bridges and structures BD 24/84 Design of concrete bridges - Use of BS 5400 Pt 4: 1984 BD 26/86 Design of lighting columns BD 27/86 Materials for the repair of concrete highway structures BD 28/87 Early thermal cracking of concrete BD 29/87 Design criteria for footbridges		BD-16/82	Design of composite bridges - Use of BS 5400 Pt 5: 1979
BD 21/84 — The assessment of highway bridges and structures BD 24/84 — Design of concrete bridges — Use of BS 5400 Pt 4: 1984 BD 26/86 — Design of lighting columns BD 27/86 — Materials for the repair of concrete highway structures BD 28/87 — Early thermal cracking of concrete BD 29/87 — Design criteria for footbridges	,-	BD 19/83	-Standard Bridges
BD 24/84 Design of concrete bridges - Use of BS 5400 Pt 4: 1984 BD 26/86 Design of lighting columns BD 27/86 Materials for the repair of concrete highway structures BD 28/87 Early thermal cracking of concrete BD 29/87 Design criteria for footbridges		BD 20/83	Bridge Bearings - Use of BS 5400 Part 9: 1983
BD 26/86 Design of lighting columns BD 27/86 Materials for the repair of concrete highway structures BD 28/87 Early thermal cracking of concrete BD 29/87 Design criteria for footbridges	pine.	BD 21/84	The assessment of highway bridges and structures
BD 27/86 Materials for the repair of concrete highway structures BD 28/87 Early thermal cracking of concrete BD 29/87 Design criteria for footbridges	gian.	BD 24/84	Design of concrete bridges - Use of BS 5400 Pt 4: 1984
BD 28/87—Early thermal cracking of concrete BD 29/87—Design criteria for footbridges		BD 26/86	Design of lighting columns
BD 29/87 Design criteria for footbridges	-	BD 27/86	Materials for the repair of concrete highway structures
		BD 28/87	Early thermal cracking of concrete
BD 30/87 Backfilled retaining walls and bridge abutments	-	BD 29/87	Design criteria for footbridges
		BD 30/87	Backfilled retaining walls and bridge abutments

British Railways Board FORM 'AA' (BRIDGES)

Group Standard

Appendix: 4 Issue: 1 Revision: A Date: FEB 93

GC/TP0356

APPROVAL IN PRINCIPLE FOR ASSESSMENT

BD 31/87 Buried concrete box type structures

BD 32/88 Piled foundations

BD 34/88 Assessment and Strengthening of Highways Structures on Motorways and other Trunk Roads

BD 35/88 Quality Assurance Scheme for paints and similar protective coatings

BD 36/88 - The Evaluation of Maintenance Costs in Comparing Alternative Designs for Highway Structures

BD 37/88 Loads for Highway Bridges

British Railways Board FORM 'AA' (BRIDGES)

Group Standard

Appendix: 4 Issue: 1 Revision: A Date: FEB 93

GC/TP0356

APPROVAL IN PRINCIPLE FOR ASSESSMENT

APPENDIX B

ADDITIONAL RELEVANT DOT STANDARDS PUBLISHED SINCE THE TAS DATED JUNE 1989

British Railways Board

FORM 'AA' (BRIDGES)

Group Standard

Appendix: 4 Issue: 1 Revision: A Date: FEB 93

GC/TP0356

APPROVAL IN PRINCIPLE FOR ASSESSMENT

8.2 ADDITIONAL RELEVANT DOT STANDARDS PUBLISHED SINCE THE ABOVE EDITION OF TAS:

BS 5400 - Part 1: 1988 See BD 15/92

BS 5628 - Part 1: 1992 - Unreinforced Masonry

BD 15/92 General Principles - Use of BS 5400 Part 1: 1988

BD 21/97 The Assessment of Highway Bridges and Structures

BD 34/94 Technical Requirements for the Assessment and Strengthening Programme for Highway Structures,

Stage 1.

BD 63/94 Inspection of Highway Structures

8.4 ADDITIONAL RELEVANT RAILTRACK STANDARDS:

RT/CE/P/016 Assessment of Bridge Capacity Issue 1 June 1995

RT/CE/P/010 Technical Approval Procedures for Assessment of Bridges and other Structures.

To be used in conjunction with BD 2/89

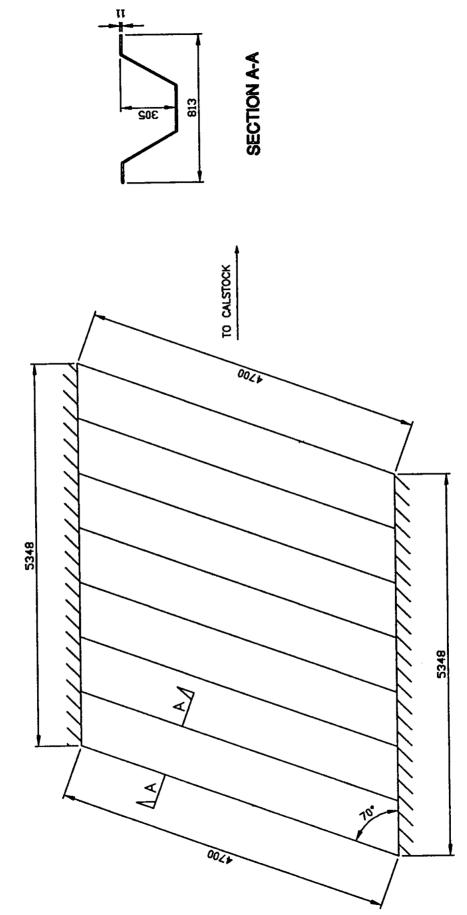
British Railways Board	Group Standard
FORM 'AA' (BRIDGES)	GC/TP0356 Appendix: 4
	Issue: 1 Revision: A Date: FEB 93
APPROVAL IN PRINCIPLE FOR ASSESSMENT	

APPENDIX C

IDEALISED STRUCTURE

CHILSWORTHY BRIDGE CAL 5m 29ch

180 DEPTH OF FILL OVER TROUGHING = 250mm



IDEALISED DIAGRAM FOR ANALYSIS

Structure: Chilsworthy Bridge

Date: March 2004

APPENDIX B

Assessment Calculations

Project Rail Property Ltd Assessments

Part of scheme Chilsworthy Bridge

SUMMARY of RESULTS for STRUCTURAL ASSESSMENT

Comm. No. S1897/03

Assessed by GRB

Date November 2000

checked for 80 21/61 MANCH 2002

			~				T			T	T -	T			T	
_	RESULTANT	WEIGHT	RESTRICTION		<i>+0</i> t	1	40t	40t	40t	40t						
	Reduction Factor (K)	(For HA only)	Ref 3.20 BD21(97) (Ra*-Sa*d)/ Sa*1		1.89	د و (2.2+	1.41	0.4	5.6						
	Structural Adequacy	7	Ref 3.20 BD21/97 Ra*/Sa*d+ Sa*1		۲.۲	100	7.7+	1.3	3.6	4.4						
	Live Load Assessment	Effect	(HA or wheel) Sa*I		108.7 4Nm	11 6 11 6	TII. & KNW	133.5kVm	N4 5.091	(12.44 W)						
	Capacity for	Assessment	Live Load Ra*- Sa*d		28.32 uNn 205.68 uNn 108.7 uNn	•	205-68 4Nm	44.984Nm 189.024Nm 133.54Nm	652.29WN	638 .26 un						
	Dead Load	Assessment	Effects Sa*d	į.		45 41	28 32kNm	44.98 Whm	24 916N 652.29WN	38.94 KN 638.26 LN						
	Assessment	Resistance	Ra*	ļ.	234 6Nm		254 KNm	234 Wm	N42. Ft 8	NAS. 469						
	Position in	Span			MID SPAN	1000	FILE STAN	MID SPAN	END	600						
	LOAD CASE (eg HA or	wheel) and	LOAD EFFECT (eg Moment)	HA SINGLE VEHICLE	HOMENT	HA TWO VEHICLES	MOMENT	HA SMGLE VENICE	HATWO VEHICLES	HA SINGLE VEHICLE						
	Member or	element		MIDDLE	TROUGH	3 70014	TROUGH	HOMOYL SUE	H57001	EDGE						



Project Comm. No. RAIL PROPERTY LTD ASSESSMENTS 51897/03 Calc. sheet No. rev Part of scheme CHILSWORTHY BRIDGE

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	CONTENTS					
	GENERAL			<u>.</u>		
	1ROUGH SECTI	ION PROPERTIES	4			
	CHECK FOR CO	IMPACTNESS	5			
	MOHENT OF A	5				
	DEAD LOADS (MOHENT DUE TO)	6		
	LIVE LOADS			7		
	L.L. MOMENT I MIDDLE TROUG	DUE TO SINGLE HS	VEHICLE	10		
	L.L. MOMENT MIDDLE TROUG	DUE TO TWO UE	EHICLES	11		
	EIGE TROUG DEAD LOADS	ids		13		
	EDGE TROUGH	H D.L. MOMEL	JT	14		
	EDGE TROUG	H L.L. MOME	5VT	16		
	SHEAR RESIST	FANKE OF TROX	GHS	17		
	D.L. SHEAR I	MIDDLE TROUGH	1 s	18		
	D.L. SHEAR	EDGE TROUGH	2.5	18		
	L.L. SHEAR	MIDDLE TRONG	5HS	19		
	L.L. SHEAR	EDGE TROUG	HS.	. 9		
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	GENERAL					
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	ARE CONNEC	763 40 20146	STUDINAL TRO	ughligh.		
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i	ROUGH FACED	random itub	BLE GRANUTE, T	₩£ 147€		
	OF THE STRU	ACTURE 15 11	NUOWN, THER	E ARE		
Ì	CURRENTLY	NO LIMITATIO	NS ON NORMAL	HIGHWAY		
	SUG BUNGALL	R THE STAR	TURE . DIMENSI	ONS OF		
	THE STRUCT	ure were a	STAINED DURI	NG THE		
	SITE INSPECT	ON AND COR	RELATE WELL V	VITH		
	THE RECORD	DRAWING SO	applied by RA	16		
	PROPERTY 1	75.				
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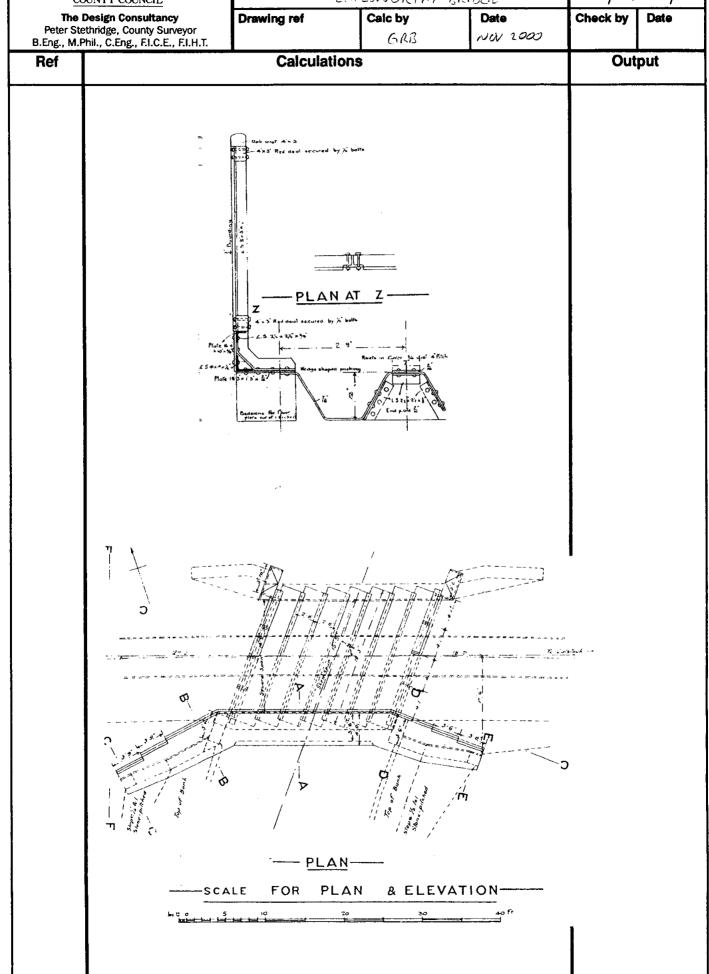
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CHILSWORTHY BRIDGE

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	-ROUGH SE	CT 10115				
:		SPHALT CONC	RETE. DEPTH	TROUGHS		
	250 mm		,			
	EFFECTIVE	SFAN OF TROU	GHS			
	LENGTH OF	TROUGHS =	18'3" > 5	-563 mm		
	SKEW SPAN	= 4700 mn				
3D21/97 16.5	TROUGHS	CEAR OUTO	GRANITE SO			
	4×300 =		-			
	EFFECTIVE S	PAN = 4700	+2x 75 x1	1 3		
		= 4750	nm			
					EFFECT	IUE SPAN
					OF TROU 4750 V	GUS
cl 6.10	CARRIAGEWA	AY WIDTH	6020 mm F TO	PAR APET PARAPET		
	: Two	LANES				
	UDL REPI	lesented by	TNU STRIP	LOADS		
	hel rem	ESENTED BY	TWO POINT	CUADS.		
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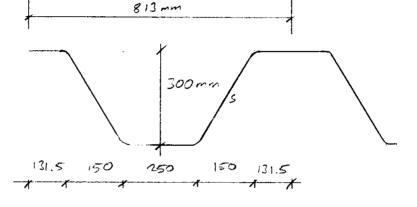
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Output

CHECK	SECTION	PROPERTIES	OF	TROUGH	SECTION

Calculations

TROUGH THICKNESS = $\frac{7}{6}$ " \Rightarrow 11 mm SPLICE PLATE ON TOP OF TROUGHS $\frac{7}{4}$ " \times $\frac{7}{6}$ " \times LENGTH, (178 \times 11).



ASSUMING 1:2 SLOPE TO TROUGH.

$$S = V(150^{\circ} + 100^{\circ})$$
= 335. mm

AREA =
$$(178 \times 11) + 2(131.5 \times 11) + 2(335 \times 11) + (250 \times 11)$$

OF TROUGH

SECTION = $1958 + 2893 + 7370 + 2750$

= 14971 mm²
 $A = -(128 \times 11) \times 3055 \times 11 \times 1045 \times 11 \times 1045 \times 11$

$$A_{\frac{1}{4}} = (178 \times 11 \times 305.5) + 2(131.5 \times 11 \times 294.5) + 2(335 \times 11 \times 150) + (250 \times 11 \times 5.5)$$

$$= 2570783 \qquad \overline{q} = 172$$



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	•	×11 × 133.5)+2 8 × 11×22)+(1				
	= 1.091			,		
BD 56/96 La.3.7.2	CHECK FOR	COMPACTNESS				
	w€8S					
	28 tn	355 Ty ~				
	28 × 11	$\sqrt{\frac{355}{230}} = 382.$	6 > (300 - g =	(43)		
(9.3.7.3.2	FLANGES				:	
	24 tn	ď				
	24 × 11	$\sqrt{\frac{355}{230}} = 328$	> 131.5			
24.7514	.'. PLASTI	C MODULAS CAN (COMPACT)	v BE used.		:	
PARTIAL SAFETY FACTORS BD21/97 TABLES	10 = 54.21 8m 87	$\frac{\partial \mathcal{L}}{\partial x} = \frac{230 \times 1.00}{1.2 \times 1.}$	$\frac{9\times10^6}{1} = 190$	O kNm/trough	170 = 23	4 KN
3.1,3.2	0.813	× 190 = 234				



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BERG MPHIL, CERE, FILET GRO 100 1000		dge. County Surveyor		Check by	Date	
DEAD COADS SURFACING. 0.1 Y 24 × 0.813 × 1.35 = 3.415 hN/m AREA WITHIN TRUBEN CONCRETE FILL [(0.266 × 0.16) + (0.135 × 0.16)) + RESINGEN ATTEM OF SMARKING A TAP OF MEMBER (YF) ((0.25 - 0.1) × 0.813) [24 × 1.15] = 5.678 hN/m TROUGH SELF AREA × 78.5 × 1.05 WEIGHT (1495 × 10° × 78.5 × 1.05 = 0.947 hN/m TOTAL D.L. 3.415 5.671 0.947 10.04 hN/m DEAD COAD MOMENT AT ILLTIMATE FROM AVAILABLE MOMENT OF RESISTANCE FOR LIVE LOADING PERTROUGH WIOTH STAPOF 813mm TOTAL 28.32 = 205.69 hNm PROMERT OF RESISTANCE FOR RESISTANCE FOR LIVE LOADING PERTROUGH WIOTH STAPOF 813mm	B.Eng., M.Phil., C.Eng., F.I.C.E., F.I.H.T.		GRB	1000 2000		•
SURFACING. 0.1 Y 24 x 0.813 x 1.75 = 3.415 kN/m AREA WITH TADWAY CONCRETE FILL [(0.266 x 0.16) + (0.136 x 0.165) + REPAIR OF SOTION OF SHARKWAY THE FAMORY (XF) ((0.25 - 0.1) x 0.813) 24 x 1.15 = 5.678 kN/m TROUGH SELF AREA x 78.5 x 1.05 WEIGHT 11495 x 10 x 78.5 x 1.05 TOTAL D.L. 3.415 5.679 0.947 10.04 kN/m DEAD COAD MOMENT AT ILLTIMATE = 10.04 x 4.75 => 29.32 kNm PARA COAD AVAILABLE MOMENT OF RESISTANCE FOR LIVE LOADING PERTROUGH WIOTH STAIPOF 813 mm 700 MENT OF RESISTANCE ARREA x 1.75 & 69 kNm TOTAL D.L. 3.415 5.679 0.947 10.04 x 4.75 => 29.32 kNm TOMENT OF RESISTANCE ARREA X 1.75 & 69 kNm TOMENT OF RESISTANCE ARREA X 1.75 & 69 kNm		Calculati	ons		Out	put
FROM AGÉ 3 = 10.04 × 4.75 => 28.32 kNm ROMENT 28.32 kNm AVAILABLE MOMENT OF MESISTANCE FOR LIVE LOADING PERTRONALI WIOTH STRIPOF 813mm MOMENT OF MESISTANCE TOMENT OF MESISTANCE AVAILABLE FOR LIVE LOADING PERTRONALI WIOTH STRIPOF 813mm MOMENT OF MESISTANCE AVAILABLE FOR LIVE LOADS	SURFACING. CONCRETE FILL TROUGH SELL WEIGHT TOTAL D.L.	0.1 × 24 × 0 AREA WITH ([(0.266 × 0.) 3 ETWEEN BOTTOM OF ((0.25 - 0.) = 5.678 UN 495 × 10° × 78 3.415 5.678 0.947 10.04	.813 × 1.75 = IN TROUGH .18)+(0.135 × 0. SMAFACING & TOP OF THEM) × 0.813)] 24 1/m (YFL) 78.5 × 1.05 .5 × 1.05 = 0.99	266) + un(8f1) x1.15		
LOADING PERTROUGH WIDTH STRIPOF 813mm TOMENT OF RESISTANCE AVAILABLE FOR LIVE LOADS				2 KNM	MOMEN	7
734 - 28.32 = 205.68 kNm RESISTANCE AVAILABLE FOR	AVAILABLE P	noment of he	SISTANCE FOR	Live		
734 - 28.32 = 205.68 kNm $RESISTANCE$ $AVAILABLE FOR$ $LIVE LOADS$	LOADING PER	ETROUGH WID	OTH STRIPOF 8	13 mm		
	234 -	28.32 = 2 <i>0</i> 5	T.68 KNm		RESISTAI AVAILAL LIVE LOI	UCE SLE FOR 405



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502:/97 CL 6.10	LIVE LOAD	1.8 m	N = 12 x 336 (1/2)			
LEAR SPAN FROM 146E 3	HEL (POINT LUAD) VV = 1/2 x	336 (1/4.75)	0.67 => 59.1	5 hN/m		
250mm DETAINED FROM FRIAL PIT		700	1500	250mm		
BD21/97 Cl 6.14 CASE A.	Lt = 2 x 250 ALt = 4 x 80	o ⇒ 3200	FROM	RLAP OF LOADS M TWO VEHICLES - 700 = 100mm		



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	 		· · · · · · · · · · · · · · · · · · ·	 -		
WETH OF						
- WAY	W SPREAD	OVER 3.2 m	ACROSS CARR	AGEWAY.		
6020mm	W ALSO DIS	TRIBUTED BY	0.8 m ALON	16 DECH		
15.25				G = GG , C .		
7,25	$AF = \overline{a}/25$	⇒ 1.46				
	14DV 59 15	40 = 1	161 10	411	UNFACT	ORED
	1,46	_ = 10.5 /	1EL, <u>60</u> =		UDL = 40	.5 KN/
D21/97					KEL = 4	1.1 KN
iz 6.2 B	SPREAD OF LO	AD AT UNSTIP	FENED EDGE O	FTROUGHS	İ	
		W				
	W Water and a second se					
:						
	\					
	\	1 813m	m ;			
		7	}-			
		4 4	06			
		7	4 2			
ĺ			APPAON	MATE DISTANCE		
	+ 2 Lt	= 1600 / 6	35mm From	CENTRE OF		
		•	TROUG	SH TO PARAPET.		
			(9"+2	OF TROUGH).		
1					1	



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Output

FOR MAIN BODY OF BRIDGE, WITH DISTRIBUTION
OVER 3.2 m = GHEST INTESITY OF LOAD DUE
TO A SINGLE VEHICLE OVER ONE TROUGH
1.813 m == 1DE 15:

Calculations

UDC = 40.5 x 1.5 => 60.75 hN/m

$$y = \frac{3200/2 - 813/2}{3200/2}$$
 $x = > 0.75 x$

FROM 60.75 kN/m

TO ESTABLISH &: 3.2/4 oc = 60.75/2

LOAD TAKEN BY SHADED AREA = 2C+4 x 0 813

$$NEL$$
, $41.1 \times 1.5 = 61.65$
 $y = 0.75x$, ∞ ; $3.2/2 \approx = 61.65$

$$3c = 38.53$$
 ... $y = 28.9$



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one and all onen hag oil	TOPICE TOUT	بهداده الناسي		21317	رري	
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Ref	Calculat	ions		Out	put	
LOAD TAX	IEN BY SHADE.	D AREA = OC+	4 × 0.813			
		<i>-</i>				
	= 27.4	F KN.				
LIVE LOAS						
	27.4 KN	27.01 h	iN/m			
	<u> </u>					
AN.	10.50	4				
GE 3	4852 mm					
noneut A	T NID SPAN.					
<u>n</u>	12 + WL					
27. :	$\frac{2 \times 4.75^{2}}{8} + \frac{23}{8}$	7.4 × 4.75 4	= 108.7 KNm			
GE 6 MOMENT C	DE ILESISTANCE	AVAILABLE FOR	LIVE LOADS			
= 205.68	JeNm.					
205.68	1>108.7	: TROUGHS C				
		,	FOR SINGLE IN BENDING.			
///	Filom Two	10 Jan 20 - 10 15				
LOAD	FROM TWO V	C-1000 70 110	CHECKED			



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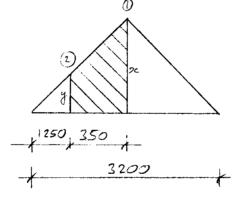
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Date NOV 2000 Check by Date

Output

Calculations

2500 mm OVERLAP: 2500/2 PER LOAD



$$\eta = \frac{12092}{31092} - 350$$
 >c => 0.78 >c

PAGE 9. UDL = 60.75 KN/m

$$x = 37.97$$
 : $y = 29.61$

LUAD TAKEN BY SHADED AREA = 2+4 (0.35x2)

= 23.65 hN/m.

HOWEVER TROUGH IS 813mm WIDE SO:

$$\frac{406.5}{350} \times 23.65 = 27.47 \, hN/m$$

LOAD PER TRONGH WIDTH.



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Ref	Ref Calculations					
1=0.78x FROM PAGE 11 C FROM PAGE 9	٧	5 nN .78 x , 2 . y = 30.05				
		J	AREA = DC+4	(0.35×2)		
	AS THE U	DC AND KEC.	ABOVE ARE THE	E SAME	:	
	FOR BOTH V AS FOLLOWS		SINED LOADS	ARE		
			uN/m = 5	4.9		
	KEL =	2 × 24.0	4N = 48	1.0		
	4	48.6 4750 ma	54.	ጎ		
	MOMENT GT					
	54.9 x	4.75° + 48.	0 × 4.75 -	= 211.8 hNm		
PAGE 6	211.8	205.64	TROUGHS CENTRE IMPEDIATI CHECK K	NOT ELY OK		



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	esign Consultancy nridge, County Surveyor	Drawing ref	Calc by	Date	Check by	Date
B.Eng., M.Phi	i., C.Eng., F.I.C.E., F.I.H.T.		GRB	NOV 2000		
Ref		Calculati	lons		Out	put
EE P.8	EDGE TROU	1645	W the same of the			
	ADDITIONAL	DEAD COAD DO	ME TO PARAPET	-		
	PARAPET CON	SISTS OF STEE	EC STANDARDS	WITH		
	TIMBER INFI	LL BOARDS	er:) TIMBER	TOP RAIL		
	VOLUME OF	TIMBER:				
	4 6" x	3/4" x (4 x 4'	ı")			
	1.372 m x	0.019 x 4.75	= 0.124	3 :n		
	VOLUME OF	STEEL STANDAR	DS :			
	BOTTOM PLA	TE 1'3" x 7	6" x Le ⇒	0.02 m3		
	SMALL ANGLE	4'2" x 4'5'	xxxe =>	0.013 m3		
	VERTICAL PLA	ATE 10" x 38";	×Le >	0.011 m ³		
	VERTICAL UP.	STAND 5" × 3" ×	13"+(1")x	$3N'. \Rightarrow 0.004 m^3$		
			TOTAL (0.048 m3		
	SO WEIGHT	OF TIMBER:	0.124 × 1250	kg/m²		
		=	= 155 kg =	15.8 KN		
	16.5 TOTAL		70 15.8/4.7			
	WEIGHT OF	STEEL: 0.04	18 × 77,22 hN	$/m^3$		
		= 3.5	H KN			
	OR 3	· 7 (= 0.	78 KN/m			



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Peter Ster	Design Consultancy thridge, County Surveyor hil., C.Eng., F.I.C.E., F.I.H.T.	Drawing ref	Calc by	Date Nov 2000	Check by	Date
Ref	nii., C.Eng., E.I.C.E., E.I.H.T.	Calculati		1,000 2000	Out	nut
P. 6 P. 3	O.216 X SURFACING O.216 X O.216 X TOTAL FOD EDGE TROL 3.33 SO MOMENT = (10.04) USING DIST IN FIGURE ON PAGE 8 EFFECT DUI	(0.25-0.1) (0.15 × 24 : 0.15 × 24 × ITTOWAL DEAD (GH + 0.78 + 1. ON EDGE BEA + 5.91) × 4.: 8 TRIBUTION ME 6.28 IN BD OF THESE CALL E TO THE UNSERNINE	$ \begin{array}{c} \times 1.15 = 0 \\ 1.75 = 0 \\ \hline 70TAC & 1 \\ \hline COAD ON \\ 8 = 5.91 \\ \hline M DOME TO D \\ \hline MS $.907 4N/m801 4N/m. 4N/mC98 4Nm.	EDSE D. C. = 44.98	TROUGH



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CHILSWORTHY

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The Decision Connection		ORNWALL	Part of scheme	LSWORTHY		Calc. she	
$Q = \frac{1600 - 406}{1600} \times = 7.75 \times \frac{1}{1600}$ $Z = \frac{1600 - 635}{1600} \times = 0.60 \times \frac{1}{1600}$ $2 = \frac{1600 - 635}{1600} \times = 0.60 \times \frac{1}{1600}$ $2 = \frac{1600 - 635}{1600} \times = 40.5 \times 1.5$ $= 60.95 \text{ kN/m}$ $RACE $	Peter St	tethridge, County Surveyor		Calc by			Date
$\frac{2}{1600} = \frac{155}{1603} \propto \Rightarrow 0.60 \times .$ $\frac{1600}{1603} \times \frac{150}{1603} \times \frac{150}{$	Ref		Calculati	ons		Out	put
'ADC' LOAD TO BE DISPERSED = 40.5×1.5 \$ 60.75 \text{ \text{ AN } / m} AMER ANDGIL CLAVE = 60.75 The and and another							
$= 60.75 \text{ µN/m}$ AMER ANDERL CARVE = 60.75 $\stackrel{?}{NR}. \frac{1.6x}{2} + \frac{x+2}{2} \times 0.635 = 60.75$ $SINCE 2 = 0.6x, \frac{1.6x}{2} + \frac{x+0.6x}{2} \times 0.515 = 60.75$ $1.308 \times = 60.75$ $x = 46.45$ $\therefore y = 34.83$ $2 = 27.87$ LOAD ON TROUGH = $\begin{bmatrix} x+y & 0.406 \\ 2 & 1 \end{bmatrix} \times 2 = 33.00 \text{ kN/m}$ KEL, $411 \times 1.5 = 61.65 \text{ LN}$ AREA LUDGER CURVE = 61.65 $\stackrel{?}{1.6x} + \frac{x+2}{2} \times 0.625 = 61.65$ $SINCE 2 = 0.6x, \frac{1.6x}{2} + \frac{x+0.6x}{2} \times 0.635 = 61.65$ $1.308 \times = 61.65$			1600	Y	;		
i.e. $\frac{1.6 \times 1}{2} + \frac{x+2}{2} \times 0.635 = 60.75$ SINCE $2 = 0.6 \times 1.6 \times 1.6 \times 1.2 \times 0.535 = 60.75$ 1.308 = $= 60.75$ $x = 46.45$ i. $y = 34.83$ $x = 27.87$ LOAD ON TROUGH = $\left[\frac{x+y}{2} + 0.406\right] \times 2 = 33.0 \text{ kN/m}$ KEL, $411 \times 1.5 = 61.65 \text{ kN}$ AREA UNDER CURVE = 61.65 $1.308 \times 1.6 \times 1.65 \times 1.65$ SINCE $2 = 0.6 \times 1.6 \times 1.6 \times 1.65 \times 1.65$ $1.308 \times 1.6 \times 1.65 \times 1.65 \times 1.65$		THE CORD TO) BE DISPERSED				
SINCE $2 = 0.6 \times 1.6 \times 1.6 \times 1.2 \times 1.308 \times 1.$		ANEA UNDERL	CURVE = 60	0.75			
1.308 = $c = 60.75$ x = 46.45 x = 27.87 LOAD ON TROUGH = $\left[\frac{x+y}{2} \times 0.406\right] \times 2 = 33.0 \text{ kN/m}$ KEL, $4(.1 \times 1.5) = 61.65 \text{ kN}$ AREA LUNDER CURVE = 61.65 $x^2 = \frac{1.6 \times 4}{2} + \frac{2c+2}{2} \times 0.625 = 61.65$ SINCE $z = 0.6 \times \frac{1.6 \times 4 \times 40.6 \times 20.635}{2} = 61.65$ 1.308 $x = 6^{1}.65$		ie. <u>1.6 sc</u> 2	+ <u>x+2</u> x 0	0.635 = 60 ·	75		
$x = 46.45$ $y = 34.83$ $z = 27.87$ $LOAD ON TRONGH = \left[\frac{x+y}{2} \times 0.406\right] \times 2 = 33.0 \text{ kN/m}$ $KEL, 41.1 \times 1.5 = 61.65 \text{ kN}$ $AREA UNDER CURVE = 61.65$ $ie \frac{1.6x}{2} + \frac{3c+7}{2} \times 0.625 = 61.65$ $SINCE z = 0.6x, \frac{1.6x}{2} + \frac{x+0.6x}{2} \times 0.635 = 61.65$ $1.308 x = 61.65$		SINCE 2 =	0.6 x, 1.6x	$\frac{2}{2} + \frac{\infty + 0.6 \times}{2} \times 0$	0.335 = 60.75		
$Z = 27.87$ $LOAD ON TROUGH = \left[\frac{x+q}{2} \times 0.406\right] \times 2 = 33.0 \text{ hN/m}$ $KEL, 41.1 \times 1.5 = 61.65 \text{ hN}$ $AREA UNDER CURVE = 61.65$ $ie \frac{1.6 \times + 2c+2}{2} \times 0.625 = 61.65$ $SINCE Z = 0.62c, \frac{1.6 \times + x+0.6 \times 0.635}{2} = 61.65$ $1.308 \times = 61.65$			1.30	8 =c = 60.75			
$Z = 27.87$ $LOAD ON TROUGH = \left[\frac{x+y}{2} \times 0.406\right] \times 2 = 33.0 \text{ kN/m}$ $KEL, 41.1 \times 1.5 = 61.65 \text{ LN}$ $AREA UNDER CURVE = 61.65$ $ie \frac{1.6 \times 1}{2} \times \frac{2c+2}{2} \times 0.625 = 61.65$ $SINCE Z = 0.62c, \frac{1.6 \times 1}{2} \times \frac{x+0.6 \times 0.635}{2} = 61.65$ $1.308 \times = 61.65$		y = 34	. 83	a = 46.45	-		
KEL, $41.1 \times 1.5 = 61.65 \text{ LAN}$ AREA LUNDER CURVE = 61.65 $ie \frac{1.6 \times 1}{2} + \frac{9c+2}{2} = 61.65$ SINCE $2 = 0.69c$, $\frac{1.6 \times 1}{2} + \frac{1.6 \times 1}{2} = 61.65$ $1.30\% \times = 61.65$		· ·					
AREA LUNDER CURVE = 61.65 $10.6 \times 10.6 \times 10.62 \times 10.63 \times 1$			L	-	O KN/m		
$ie \frac{1.6 x}{2} + \frac{9c+2}{2}, 0.635 = 61.65$ Since $z = 0.6 x$, $\frac{1.6 x}{2} + \frac{x+0.6 x}{2} \times 0.635 = 61.65$ $1.308 x = 61.65$							
SINCE $z = 0.6 \infty$, $\frac{1.6 \times + \times + 0.6 \times \times 0.635}{2} = 61.65$ $1.308 \times = 61.65$:						
1.308 = 61.65		$\int_{0}^{\infty} \frac{1.6 \infty}{2}$	2 , 0.6	35 = 61.69			
		SINCE Z =	$0.60c, \frac{1.6x}{2}$	2 x +0.6 x x 6	0.635 = 61.65		
$\propto = 47.12$			1.30%	x = 61.65			
			•	x = 47.12			



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Part of scheme CHILSWORTHY 1 16 1

CORNWALL COUNTY COUNCIL The Design Consultancy Peter Stethnidge, County Surveyor		Part of scheme	HILSWORTHY		Calc. sheet No. rev		
		Drawing ref	Check by Date				
Ref	., C.Eng., F.I.C.E., F.I.H.T.	Calculat	ions	199 1000	Out	tput	
167 FROM P15	.', 2 = 28	7.28 , y=	35.35				
	LOPD ON	TROUGH = [×+4 × 0 406	2 = 33.49 KN	1		
	LIVE LOAD	MOMENT					
		33.2	19 33	24			
			,				
	-	4.75	-		-		
	noneut at 1	MID SPAN					
	WL2 +	WL 4					
	37.24 x 2	1.75 + 31.46	$\frac{9 \times 4.75}{4} = 13$	3.5 KNm.			
	50 D.L.	Mo + L.L.	Mo			= 44.99 kN = 133.5 kN	
PAGE 14	44	.98 + 133.5	= 178.48	4Nm			
AGE 6	MOMENT OF	RESISTANCE 2	34 4Nm > 1	78.48 hNn	EDGE T		
					1		



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Peter Ster	thridge, County Surveyor	Drawing ref	Calc by	Date NOV 2000	Check by	Date
Ref	hil., C.Eng., F.I.C.E., F.I.H.T.	Calculati			Out	put
056/95 (9.9.2	CHEAD DEC.	et allee se a	enania (m. 11. menare)			
1.1.2	SHEAK KEST	STANCE OF	TROUGH SECTION			
	1/ T+	(
	VD = [$\frac{\sqrt{dn-hn}}{8m}$	\mathcal{L}_{λ}			
	tw=11 mm					
	dw = 294 m	- কণ্				
	Lak = 0					
	$\lambda = \frac{dwe}{tw} \sqrt{\frac{\sigma_0}{355}}$	_ due =	12"-76"x3 =>	271 mm		
	tw √ 355	,				
	$\lambda = \frac{271}{11} \sqrt{\frac{230}{355}}$	- -> 19.8	23			
	·					
EFFECTIVE SPAN P. 3	\$ = a	p = 4750	<i>□</i> => 17.5	_		
,,,,,,						
	$mf_{\sim} = \frac{\sigma_{\eta}}{2\sigma}$					
	2	Ju sine cu				
	bfe: 10 tf	355 , 10	x11 \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	_ 136.7		
	\	Topf	$\times 11\sqrt{\frac{355}{230}}$	•	:	
	$OR \frac{271}{2} =$	135.5 WH	CH EVER IS THE	E LESSER		
	-	ne 1	35.5			
	$mf_{\rm w} = 230$	0 × 135.5 × 11	-> 0.0) {		
	2 × 2	30 × 2712 × 11	=> 0.0			
İ						
	USE FIGU	LRE 13. GI	ves			
	$\frac{\mathcal{T}_{I}}{\mathcal{T}_{I}}$	= 1.02				
	2 4	•				
					Ī	



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Peter St	Design Consultancy ethridge, County Surveyor	Drawing ref	Calc by	Date	Check by	Date
B.Eng., M.I	Phil., C.Eng., F.I.C.E., F.I.H.T.	0-1-1-1	GRB	NOV 2000		<u> </u>
Ref		Calculati	ons 		Out	put

	Zy = <u>oy</u> ~	, Ty =	230 = 132	. 8		
	: 71 = 1.	02 × 135.5	⇒ 138.2		:	
		/				
	$SOV_0 = 1$	1(294-0) 1.2 × 1.1	× 138.2			
	V	338.6 HN per W	151 TOTAL - 12	2011	$V_0 = 67$	20.4
	V 2 .	so. o kit per	CS, 101AC = 61	T. Z W O	V 5 = 07	T. CKN
	SHEAR DUE T	O DEAD LOAD)			
	MIDDLE OF DE	CK AT ABUTHE	$\sim \tau$			
P.6			10.49KN1	m.		
	4		4			
	R _A	4750 mm	- Ra			
			·			
	$R_{\rho} = R_{\theta} = \frac{\omega L}{2}$	⇒ 24.°	91 HN.			
:						
	EDGE TROUGH	1 AT ABUTHER	<u>r</u>			
) 1 4			(10.487+5	91) KN/m		
	_			•••		
	4					
	RA		128			
	, , ,					
	0 -	,	al d			
	KA = KO = V	$\frac{\vee L}{2}$ \Rightarrow 3	8.94 hN			
					1	



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COUNTY COUNCIL		C	1 19 1			
Peter Stethn	sign Consultancy idge, County Surveyor , C.Eng., F.I.C.E., F.I.H.T.	Drawing ref	Calc by	Date NOV 2000	Check by	Date
Ref	, O.Dig., Fal.O.L., Fal.II. I.	Calculati			Out	put
		E TO LIVE LOATO				
. 12	RA	+8.0 km	47.3	eN/m		
	RA = RB	$=\frac{\omega L}{2}$	47.3 × 4.75	= 112.3 KN.		
	TOTAL LIVE	LOAD SHEAR A	T END OF TROU	GH		
	112.3 -	· 48.0 = 160.	3 KN			
		HEAR IN CENTA 1.3 + 24.91 = 18 0	5.21 hN < 33	88.6 HN	CENTRE TROUGHS FOR SHE 185.21 <	OK FAR
16, P1 8		SHEAR AT	L.L 37.24 + (10	D.L		
		<u>V</u>	<u> </u>		LC SHE 78.95+ = 112.0	33.49
(L) RA = R2 =	$\frac{\omega L}{2} \Rightarrow \frac{33.7}{2}$	24 × 4.75 =	- 78, 95 an		
		5.91) × 4.75			EDGE S	
	TOTAL: 33.49	+ 78.95 +38.9	4 = 151.38 <	:338.6 hN		
		: OK.				



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Ref Calculations Output CHECK ON RIVETS SMEAN RESISTANCE OF HIVETS $ \begin{array}{cccccccccccccccccccccccccccccccccc$	Peter Stethri	ign Consultancy dge, County Surveyor , C.Eng., F.I.C.E., F.I.H.T.	Drawing ref	Calc by	Date	Check by	Date
SHEAR RESISTANCE OF ILIVETS $\frac{1}{2}$ & RIVETS & 4" PITCH $\frac{1}{2}$ = 19 mm, HOLE SIZE IS $\frac{1}{4}$ + $\frac{1}{16}$ = $\frac{1}{16}$ (20.64) FROM DORMAN CONG HANDBOOK $\frac{1}{2}$ = $\frac{1}{2}$			Calculation	ons		Out	put
$V_{6} = 19 \text{mm} , \text{ HOLE SIZE IS } V_{6} = V_{6} = V_{6} (20.64)$ FROM DORMAN LONG HANDROOM. $T = \frac{V}{N \cdot Aeq} \leq \frac{T_{2}}{V_{11} \cdot V_{2}}$ $V \leq \frac{N \cdot Aeq}{V_{12} \cdot V_{2}} = \frac{T_{2} \cdot V_{2}}{V_{12} \cdot V_{2}}$ $Aeq = T \cdot \frac{20.64}{4} \Rightarrow 334.6 \text{mm}^{2}$ $V = \frac{2 \times 334.6 \times 195.5}{111 \times 1.11 \times \sqrt{2}}$ $V \leq \frac{2 \times 334.6 \times 195.5}{111 \times 1.11 \times \sqrt{2}}$ $V \leq 76.45 \text{kN}.$ 14.5.3.6 $\frac{V}{Aeb} \leq \frac{V_{1} \cdot V_{2}}{V_{2} \cdot V_{2}}$ $V \leq \frac{V_{1} \cdot V_{2}}$				ivets_			
56/96 $T = V$ Aeq $V \leq N$ Aeq $V \leq N$, HOLE SIZE				
Agg = $TT \cdot 20.64$ => 334.6 mm ² $T_{1} = 0.95 \times 230$ => 195.5 N/mm ² $N = 2$ $V \leq \frac{2 \times 334.6 \times 195.5}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq 76.45 \text{ kN}$. 14.5.3.6 RIVETS IN BENDING. $V \leq \frac{10.64 \times 10.000}{1.000000000000000000000000000000$		·	< Ta		VDBOOU.		
MITTAL ACTORS $V \leq \frac{2 \times 334.6 \times 195.5}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq 76.45 \text{ kN}$.			1-	> 334.6 mm²			
Actors $V \leq \frac{2 \times 334.6 \times 195.5}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq 76.45 \text{ kN}$. $V \leq 76.45 \text{ kN}$. $V \leq 76.45 \text{ kN}$. $V \leq \frac{10.45 \text{ kn}}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq \frac{10.45 \text{ kn}}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq \frac{10.45 \text{ kn}}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq \frac{10.45 \text{ kn}}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq \frac{10.45 \text{ kn}}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq \frac{10.45 \text{ kn}}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq \frac{10.45 \text{ kn}}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq \frac{10.45 \text{ kn}}{1.1 \times 1.1 \times \sqrt{2}}$ $V \leq \frac{10.45 \text{ kn}}{1.1 \times 1.1 \times \sqrt{2}}$		•	45 × 130 =	> 195.5 N/	mm²		
$\frac{V}{Aeb} < \frac{11. h_1 h_2 h_3 h_4 \sigma_y}{8m. \delta f_3}$ $Aeb = 20.64 \times (2 \times 11) \implies 454.08$ $V < 0.85 \times 2.5 \times 0.95 \times 1.0 \times 230 \times 454.08$	ACTOAS NOM			.5_			
$Aeb = 20.64 \times (2 \times 11) \implies 454.08$ $V < 0.85 \times 2.5 \times 0.95 \times 1.0 \times 230 \times 454.08$ 1.1×1.1	(14.5.3.6						
V < 0.85 x 2.5 x 0.95 x 1.0 x 230 x 454.08							
V < 174,24 LON SHEAR CRITICAL			5 x 2.5 x 0.95		× 454.08		
		V < 17	4.24 WN	SHEAR C	MITICAL		

MACHINE RIVETING

LENGTHS OF RIVETS FOR VARYING GRIPS PNEUMATIC MACHINE RIVETING

+	L	ength-		-	 -	[_ength-		
[2] (]	(F			—}-J	
0.70	(Grip			-	(Grip		
		L DIAMET	ERS IN IN	CHES	Grip.	NOMINA	L DIAMET		
Grip in inches	1/2	<u>5</u>	3 4	7 8	in inches	1/2	<u>5</u>	34	7
inches	I	ENGTH D	INCHES			I	ENGTH IN	INCHES	
2 4 77	12 12	2 21	2 1 21	2½ 2½	1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	15	5 3 4
-10-14-15-14-14-14-14-14-14-14-14-14-14-14-14-14-	2 218 243 220 2274 278 278 3	24 25 24 25 24 25 27 3 3 4 34	210 - 100 -	2122 2247 247 314 314 314 314		1 2 1 4 2 2 4 4 2 2 4 4 2 4 4 2 4 4 4 4	1478 2 18 1478 2 18 1478 2 18 1478 2 18 1478 2 18 1478 2 18 18 18 18 18 18 18 18 18 18 18 18 18	13-7m 2 - m - m - m - m - m - m - m - m - m -	178 2 18 14 28 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
2 24 24 24 25 21 22 27 27	18-14-78-1-1-1-18 3-3-14-78-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	76 - Mulesierie 75 75 75 75 4 4 4 4 4 4 4 4 4 4 4 4 4 4	3 3 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	3 3 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	2 21 21 21 21 21 21 21 21 21 21 21 21 21	2	23 27 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	27 3 31 31 31 31 31 31 31 31 31 31	276 3 - 16 - 16 - 16 - 16 - 16 - 16 - 16 - 1
3 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	41	41444 4444 5 514 514 514	456 478 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	44.5 55.55.55.55.55.55.55.55.55.55.55.55.5	3	3∄	378 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	37 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	4 44 44 44 44 44 44 44 44 44 44 44 44 4
4 18 44 45 8 44 45 8 44 47 8		_	5555 5 6 6 6 6 6 6 6	5576 Hand-Invierte	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			47 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	5 5 6 1 2 5 6 3 4 7 8 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
5			63	67	5			6	6

For hand riveting deduct 4 inch from above lengths.

Note: All the above lengths are based on the rivet having the clearance in the hole.

Dia. of rivet inches

inche



The Design Consultancy
Peter Stethnidge, County Surveyor

Project Comm. No.

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CHILSWORTHY BRIDGE

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Drawing ref Calc by

Date Nov 2000

Check by Date

Peter Steth B.Eng., M.Phi	ndge, County Surveyor ., C.Eng., F.I.C.E., F.I.H.T.	GRB	NOV 2000	
Ref	Calcula	tions	·	Output
	HORIZONTAL SHEAR			
	APPLIED HONIZONTAL SH	EAR AT SUPPORT	= <u>S A Z</u>	
PAGE 19	SHEAR AT END OF EDGE	TROUGH = 185.	21 hN.	
	A = 2 x (131.5 + OF TOP PLATE => 4851 mm ²	(72) ×11		·
AGE 4	ÿ = 172 mm			
	I = 14971 x 1722 =	> 442902064 mm	.	
	HORIZONTAL SHEAR =	185.21 × 4851 442902064	x172	
	= .	348.9 N/mm		
	RESISTANCE SH	IEAR FORCE		
	76.45 hN >	348.9 N/mm		: SHEAR RESISTANCE O
BD56/96 LI4.5.1	MIN PITCH NOT LESS T	TAAN 2.5 TIMES	\$ OF SHANN.	RIVETS IS OR
A(T. J. (2.5×19 = 47.5 : 101	1.5 mm % OK		
	MAX PITCH NOT GREATER	THAN 32E OR 300	(THE LESSON)	
	32 x 9.5 mm = 304 (.	ns E 200)		j
	101.5 mm < 300 : C	ok.		
	CHILSWORTHY BRIDGE I AN ASSESSMENT LIVE U		ARRYING	
	•			

Structure: Chilsworthy Bridge

Date: March 2004

APPENDIX C

Certificate of Assessment and Checking

Bridge Assessment Cornwall

CERTIFICATE OF ASSESSMENT AND CHECKING

TECHNICAL APPROVAL PROCEDURES FOR ASSESSMENT OF BRIDGES AND OTHER STRUCTURES

1. Identification of Structure

Name - Chilsworthy Bridge

Location and grid reference - C507 road from Delaware Road, Chilsworthy, to Gunnislake

(O.S. Ref.: SX 419 720)

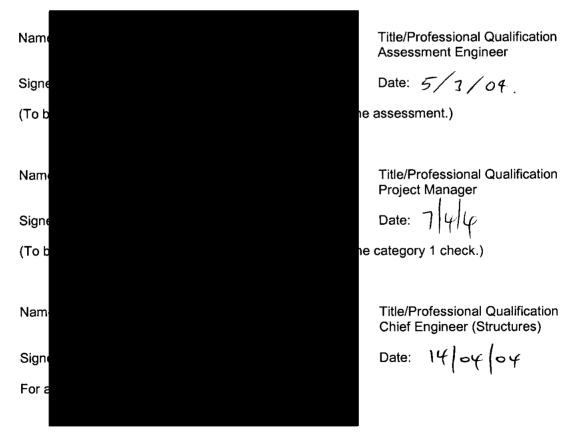
Engineer's Line Reference - CAL, 5m 29c

2. Certification of Assessment and Category 1 Check

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

- i) it has been assessed and checked in accordance with the Approval in Principle dated 22 May 2000.
- ii) The assessed capacity of the structure is as follows:

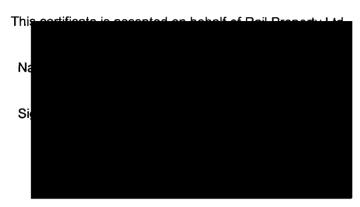
40 Tonnes Assessment Live Loading HB Loading not considered since the bridge is not on the abnormal load route.



Date: March 2004

CERTIFICATE OF ASSESSMENT AND CHECKING

3. Acceptance by the Technical Approval Authority



Title/Professional Qualification
Service Civil Enginee
Date: 19 April 2004.