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**East Sussex County Council
Transport and Environment**

**Bexhill to Hastings Link Road
G04 Powdermill Stream South Underbridge
Approval in Principle**

**Doc. Ref: B1297000-PH2/1600.06a/0020
Revision 0
September 2012**

Document control sheet

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Client: East Sussex County Council Project No: B1297000
 Transport and Environment
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Revision Summary

Client: East Sussex County Council Transport and Environment
Project: Bexhill to Hastings Link Road Job No: B1297000
Document Title: G04 Powdermill Stream South Underbridge AIP

REVISION / DATE	COMMENT
Rev 0 14/09/12	Amended to incorporate TAA comments raised on Phase 1 AIP ref. JB-B1297000-PH1/1600.06a/0020 (rev 0) Approach embankment ground treatment proposals added. Bored piles foundation changed to spread footing. Steel/timber bridleway parapet proposed. Steel deck waterproofing Departure added. Geotechnical information updated.

1. HIGHWAY DETAILS**1.1 Type of highway**

Greenway - 3.65m wide shared equestrian, pedestrian, cyclist and Environment Agency maintenance access track with 0.6m wide margins either side.

1.2 Permitted traffic speed

Over: N/A

Under: N/A

1.3 Existing restrictions

The structure spans a Main River for which the Environment Agency bears responsibility.

2. SITE DETAILS**2.1 Obstacles crossed**

Powdermill Stream, an Environment Agency designated Main River with a square top of bank to top of bank width of approximately 10.0m.

3. PROPOSED STRUCTURE**3.1 Description of structure**

Powdermill Stream South Underbridge is located at OS grid reference 576189.6E, 110614.7N. It is approximately 50m to the south of the Bexhill to Hasting Link Road Powdermill Stream underbridge. It carries the proposed Greenway over the Powdermill Stream.

The structure is a proprietary single span painted steel bridge supported on reinforced concrete abutments.

3.2 Structural type

Simply supported single-span main and secondary steel girders supporting stiffened steel decking plates and metal parapets. Main girders are located on bearings supported on reinforced concrete abutments.

The wingwalls are both cantilevered from the bankseats and free-standing gravity cantilever retaining walls with partially debonded dowel connections to mitigate differential settlement between structural elements.

Approach embankments and earthworks local to the structure are supported on controlled modulus column ground treatment to control differential settlement between earthworks, bridge abutments and free-standing wing walls. The ground treatment will be undertaken in advance of the structural foundation construction.

3.3 Foundation type

Reinforced concrete abutment founded on spread footings.

3.4 Span arrangements

Square span (between bearing centrelines) : 17.2m Skew angle : 0.0 degrees

3.5 Articulation arrangements

Bearings will be elastomeric with longitudinal fixity provided on one abutment.

Expansion joints will consist of steel cover plates.

3.6 Types of road restraint systems

1.8m high bridgeway parapets. Steel parapet posts with timber rails and timber infill to be designed for Class 3 post and rail loading and Type C infill loading to BS7818.

3.7 Proposed arrangements for maintenance and inspection

3.7.1 Traffic management

N/A

3.7.2 Access

A minimum 2.0m wide set back from top of bank will be provided in front of bearing shelves. A minimum 1.5m clear headroom will be provided from the maintenance area in front of abutments to the deck soffit between main girders. Bearing shelves will be a minimum of 600mm above the adjacent maintenance platform level.

Inspection and maintenance of the abutments and wing walls can be carried out at ground level or from a ladder or temporary scaffold for upper areas.

Foundations will not be visible or accessible for inspection.

The deck soffit and outer parapet faces can be accessed by scaffold/ladder from the river banks or from the track above using a small underbridge unit.

Bearings at abutments will be set on plinths as necessary to provide 300mm minimum clearance between the beam soffit and bearing shelves for inspection and maintenance purposes. Jacking points will be provided between main beams for bearing replacement. The bridge will be designed to carry its full design load during bearing replacement.

3.8.1 Materials and finishes

Concrete	Element	Limiting Exposure Class
C40/50	Substructure, buried Substructure, exposed abutment	DC1 XC3/4, XF3
Reinforcement		Grade B500B or grade B500C deformed bars to BS4449 :2005 Dowels to be stainless steel : Strength Grade 500, material designation 1.4436 complying with BS 6744:2001 +A2:2009.
Structural steelwork		All structural steelwork to BS EN 10025 Grade S355J2+N or AdvanceS355J2 for rolled sections.
Bolts		HSFG steel bolts to BS 4395 Part 1

Parapets	1.8m high bridleway parapet to BS 7818. Parapet posts to be galvanised painted steel. Rails and solid infill panels to be timber.
Backfill to abutments and retaining walls	Class 6N/6P structural fill in accordance with DoT Specification for Highway Works.

Concrete Finishes

Hidden and buried surfaces	F1 / U1
Exposed faces of abutment and wing walls	F6 grooved patterned profiled finish / U2

Protection

All accessible concrete surfaces greater than 150mm below finished ground level to receive waterproofing to below ground concrete surfaces in accordance with the SHW CI 2004.

All exposed concrete elements will receive anti-graffiti coating.

All structural steelwork shall be painted with an approved Type II (Inland, Difficult Access) paint system with a maintenance period of 20 years in accordance with DoT Specification for Highway Works.

Deck surfaces shall be coated with a suitable proprietary non-slip surfacing.

Parapet posts shall be galvanised steel painted with an approved Type IV paint system with a maintenance period of 20 years in accordance with the SHW.

Holly Green 14C39 Colour to BS 4800:1989 is proposed for all painted steelwork.

3.8.2 Sustainability issues

The materials and protective measures proposed are intended to maximise the durability of the structure and to minimise the requirement for future maintenance.

3.9 Risks and hazards considered

Standard construction methods are anticipated along with normally associated risks and hazards. The risks and hazards associated with the construction activities relating to these works will be identified by the appropriate method statements and safe working practices, to be completed prior to any construction taking place.

Risks associated with working at height and over water will be limited by maximising the amount of prefabrication of steelwork elements off-site.

3.10 Estimated cost of proposed structure together with other structural forms considered and the reasons for their rejection including comparative whole-life costs with dates of estimates.

The relative advantages, disadvantages and costs of various structural forms are discussed and appraised in Owen Williams reports No. 262701/012 'BHLR Structures Options Report' and No. 262701/060 'BHLR Structures Options Report – Addendum'.

3.11 Proposed arrangements for construction

3.11.1 Traffic management

N/A

3.11.2 Service diversions

N/A

3.11.3 Interface with existing structures

N/A

4. DESIGN CRITERIA**4.1 Live loading , Headroom****4.1.1 Loading relating to normal traffic under AW regulations and C&U regulations**

3t Assessment Live Loading (ALL) in accordance with BD21/01, including wheel and axle loading, assuming Low Traffic Flow and Good Road Surface category.

4.1.2 Loading relating to General Order traffic under STGO regulations

Not required.

4.1.3 Footway or footbridge live loading

Foot/cycle track loading will be in accordance with BD 37/01 CI 6.5.1 with the width of pedestrian area considered as the full width of deck between parapets ie 4.85m. In accordance with CI 6.5.1 the pedestrian load intensity will be reduced by 15% in the 2m-3m width and 30% in the 3m-4.85m range. The applied load will be taken as the average intensity.

4.1.4 Loading relating to Special Order Traffic, provision for exceptional abnormal loads or indivisible loads, including location of vehicle track on deck cross-section

Not required.

4.1.5 Any special loading not covered above

EA maintenance access vehicle – 24t tracked excavator (based on JCB JZ 255). Load factors to be as per BD37/01 HA loading. Impact factor = 1.2 due to extreme low speed.

Construction loading from 6t dumper (W1 = 7.5t, W2 = 3.0t, A1 = 2.4m) to be applied in accordance with BD21/01 Annex D.

Approach embankments founded on soft ground will be subjected to advance works ground treatment ie controlled modulus column installation, in advance of structural foundation construction.

4.1.6 Heavy or high load route requirements and arrangements being made to preserve the route, including any provision for future heavier loads or future widening.

Not required.

4.1.7 Minimum headroom provided

From east side platform:

- 2.72m to soffit of discrete main steel girders.

- 3.27m to soffit of deck between discrete girders.

From west side platform:

- 4.84m to soffit of discrete main steel girders.
- 5.40m to soffit of deck between discrete girders.

Minimum headroom from 100yr flood level+20%:

- 5.67m to soffit of discrete main steel girders.
- 6.03m to soffit of deck between discrete girders.

Minimum headroom required:

- 1.05m to soffit of discrete main steel girders.
- 1.5m to soffit of deck between discrete girders.
- 0.6m free-board above 100yr flood level+20%

4.1.8 Authorities consulted and any special conditions required

Authority Consulted	Special Requirement
Environment Agency	A minimum 2m margin on each bank and the soffit level to be set a minimum 600mm above the predicted 1 in 100 year flood (+20%) level. 24t tracked excavator access requirement with minimum width of 12ft.
British Horse Society	Non-slip deck surface.
ESCC	Planning Condition number 5. Bridge abutments are to be set back 2m from top of waterway channel banks to facilitate green corridor and soft bank solution. 1.5m minimum maintenance headroom to underside of structure between beams. 0.9m minimum maintenance headroom to underside of discrete beams.

4.2 List of relevant documents from the TAS

See Appendix A

4.2.1 Additional relevant standards

BS 8500; Part 1; 2006	Concrete; Complementary British Standard to BS EN 206-1; Method of specifying and guidance for the specifier.
BS 8500; Part 2; 2006	Concrete; Complementary British Standard to BS EN 206-1; Specification for constituent materials and concrete.

CHE Memorandum
227/08

The Impregnation of Reinforced and Prestressed
Concrete Highways Structures Using Hydrophobic Pore
Lining Impregnants.

4.3 Proposed Departures from Standards given in 4.2 and 4.2.1

Implementation of CHE Memorandum 227/08 – Deletion of requirement for impregnation with hydrophobic pore lining Impregnants.

Modified longitudinal loading on Greenway structures – Deletion of BD37 requirements and provision for reduced alternative longitudinal load.

Application of combined waterproofing and surfacing to steel bridge decks – Use of proprietary anti slip coating system.

Refer to Appendix E.

4.4 Proposed methods for dealing with aspects not covered by Standards in 4.2 and 4.2.1

None.

5. STRUCTURAL ANALYSIS

5.1 Methods of analysis proposed for superstructure, substructure and foundations

A static analysis approach will be used to calculate design loadings on superstructure, substructure and foundations.

The main longitudinal girders and cross-members will be analysed manually as simply supported line beams.

The stiffened steel decking will be analysed manually.

The substructure and foundation will be analysed by simple hand calculations.

5.2 Description and diagram of idealised structure to be used for analysis.

See Appendix D

5.3 Assumptions intended for calculation of structural element stiffness

Element stiffness for steel members will be determined in accordance with BS 5400 Part 3:2000.

Element stiffness for concrete members will be derived in accordance with BS 5400 Part 4:1990 Clause 4.4, using full elastic uncracked member cross-sections ignoring the presence of reinforcement.

5.4 Proposed earth pressure coefficients (k_a , k_0 , or k_p) to be used in the design of earth retaining elements

For the analysis of the abutment and wing walls, k_a will be used for stability calculations and k_0 for structural element design. Soil parameters will be determined as a detailed design activity.

A representative peak angle of friction of 35° will be used for 6N/6P granular backfill, for which $k_a = 0.27$, $k_0 = 0.43$, and $k_p = 3.69$.

Back of wall friction will not be considered.

6. GEOTECHNICAL CONDITIONS**6.1 Acceptance of recommendations of Section 8 of the Geotechnical Report to be used in the design and reasons for any proposed changes.**

Section 2 of the Geotechnical Report has not been completed at this stage.

6.2 Geotechnical Report Highway Structure Summary Information (Form C)

A draft Geotechnical Report Highway Structure Summary sheet based on the information available in Part 1 of the Geotechnical Report is attached in Appendix C. A full Geotechnical Report Highway Structure Summary sheet and extracts from the completed Geotechnical Report Section 2 will be produced following development of the Geotechnical Report.

6.3 Differential settlement to be allowed for in the design of the structure.

The structure is founded on spread footings on the firm to very stiff Ashdown Formation. A maximum differential settlement of 25mm between abutments will be considered.

6.4 If the Geotechnical Report is not yet available, state when the results are expected and list the sources of information used to justify the preliminary choice of foundations.

The preliminary choice of foundation is discussed in the draft Geotechnical Report Highway Structure Summary sheet contained in Appendix C. Part 2 of the Geotechnical Report, including Section 2 Highway Structures, is expected to be completed in Phase 2 of the project.

7. CHECKING**7.1 Proposed category of structure**

Category 1 in accordance with BD2/05

7.2 If Category 3, name of proposed Independent checkers.

N/A

7.3 Erection proposals or temporary works for which an independent check will be required, listing parts of the structure affected with reasons for recommending an independent check.

N/A

8. DRAWINGS AND DOCUMENTS**8.1 List of drawings and documents accompanying the submission.**

Appendix A List of relevant documents from TAS dated February 2009

Appendix B	Drawing No	Title
	B1297000-PH2/1600.01A/9181 Rev 0	Powdermill Stream South Underbridge (G04) General Arrangement
Appendix C		Geotechnical Information
Appendix D		Idealised Structure
Appendix E		Departures from Standards

9 THE ABOVE IS SUBMITTED FOR ACCEPTANCE

9.1 Submission by designer

Signed

Name: P. Blackie

Position: Structures team leader, Jacobs

Engineering Qualifications: BEng(Hons), CEng MICE

Date: 14/09/12

9.2 Endorsement by contractor

Signed

Name: S. LAPHORN

Engineering Qualifications: MEng(Hons) CEng MICE.

Position: Design Coordinator

Hochtief Vinci Joint Venture

Date: 20/09/12

10. THE ABOVE IS REJECTED/AGREED SUBJECT TO THE AMENDMENTS AND CONDITIONS SHOWN BELOW.

Reviewed:

Name:

Engineering qualifications:

Date:

Signed:

Name:

Engineering qualifications:

TAA

Date:



Appendix A List of Relevant Documents

Schedule of Design Documents Relating to Highway Bridges and Structures; February 2009

British Standards

BS 5268; Part 2; 2002	Structural Use of Timber
BS 5400	Steel concrete and composite bridges
Part 1; 1988	General Statement (see BD 15)
Part 2; 1978	Specification for loads (see BD 37)
Part 3; 2000	CP for design of steel bridges (see BD 13)
Part 4; 1990	CP for design of concrete bridges (see BD 24)
Part 5; 1979	CP for design of composite bridges (see BD 16)
Part 9; 1983	Bridge bearings (see BD 20)
Part 10; 1980	CP for fatigue (see BD 9)
BS 5628; Part 1; 1992	Unreinforced Masonry
BS 5930; 1999	Site Investigations
BS 6031; 1981	Earthworks
BS 8002; 1994	Earth retaining structures
BS 8004; 1986	Foundations
BS 8118; 1991	The structural use of aluminium
BS EN 1317-1-1998; Road Restraint Systems – Part 1	Terminology and general criteria for test methods
BS EN 1317-2-1998; Road Restraint Systems – Part 2	Performance classes, impact test acceptance criteria and test methods for safety barriers
BS EN 1317-3-2000; Road Restraint Systems – Part 3	Performance classes, impact test acceptance criteria and test methods for crash cushions
DD ENV 1317-4-2002; Road Restraint Systems – Part 4	Terminals and transitions
BS EN 14388; 2005	Road traffic noise reducing devices – Specification

Miscellaneous

~~Circular Roads No 61/72 – Routes for heavy and high abnormal loads.~~

Railway Group Approved Code of Practice GC/RC5510: Recommendations for the Design of Bridges (2000)
(for full list of other Network Rail Standards, refer to RSSB, Railway Safety and Standards Board)

~~Simplified Tables of External Loads on Buried Pipelines (1986)~~

~~Traffic Management Act 2004~~

The Manual of Contract Documents for Highway Works (MCDHW)

Volume 1: Specification for Highway Works 1998, including amendments to May 2009

Volume 2: Notes for Guidance on the Specification for Highway Works 1998, including amendments to May 2009

Volume 3: Highway Construction Details 1991, including amendments to November 2008

The Design Manual for Roads and Bridges (DMRB)

Bridges and Structures (BA Series)

Reproduced on following pages

Bridges and Structures (BD Series)

Reproduced on following pages

Bridges and Structures, Technical Memoranda (BE Series)

Reproduced on following pages

Traffic Engineering and Control, Standards (TD Series)

TD 9/93	Road layout and geometry. Highway link design
TD 19/06	Requirement of Road Restraint Systems & correction No. 1
TD 27/05	Cross Sections and headroom
TD 36/93	Subways for pedestrians and cyclists, layout and dimensions

Highways, Advice Notes (HA Series)

HA 59/92	Mitigating Against Effects on Badgers
HA 80/99	Nature Conservation Advice in Relation to Bats
HA 84/01 (1)	Nature Conservation and Biodiversity
HA 97/01	Nature Conservation Management Advice in Relation to Dormice
HA 98/01	Nature Conservation Management Advice in Relation to Amphibians

Highways, Standards (HD Series)

HD 22/08	Managing Geotechnical Risk
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ADVICE NOTES - BRIDGES AND STRUCTURES (BA SERIES)

BA-9/84	The Use of BS 5400: Part 10: 1980. Code of Practice for Fatigue Amendment No. 1
BA-16/97	The Assessment of Highway Bridges and Structures. Amendment No. 1 Amendment No. 2
BA 19/85	The Use of BS 5400: Part 3: 1982
BA 24/87	Early Thermal Cracking of Concrete Amendment No. 1
BA 26/94	Expansion Joints for Use in Highway Bridge Decks
BA 28/92	Evaluation of Maintenance Costs in Comparing Alternative Designs for Highway Structures
BA-30/94	Strengthening of Concrete Highway Structures Using Externally Bonded Plates
BA-34/90	Technical Requirements for the Assessment and Strengthening Programme for Highway Structures
BA-35/90	Inspection and Repair of Concrete Highway Structures
BA-36/90	The Use of Permanent Formwork
BA-37/92	Priority Ranking of Existing Parapets
BA-38/93	Assessment of the Fatigue Life of Corroded or Damaged Reinforcing Bars
BA-39/93	Assessment of Reinforced Concrete Half-joints
BA-40/93	Tack Welding of Reinforcing Bars
BA 41/98	The Design and Appearance of Bridges
BA-42/96	The Design of Integral Bridges [Incorporating Amendment No. 1 dated May 2003]
BA-43/94	Strengthening, Repair and Monitoring of Post-tensioned Concrete Bridge Decks
BA-44/96	Assessment of Concrete Highway Bridge and Structures
BA-47/99	Waterproofing and Surfacing Concrete Bridge Decks
BA-50/93	Post-tensioned Concrete Bridges: Planning, Organisation and Methods for Carrying Out Special Inspections
BA-51/95	The Assessment of Concrete Structures Affected by Steel Corrosion
BA-52/94	The Assessment of Concrete Highway Structures Affected by Alkali-Silica Reaction
BA 53/94	Bracing Systems and the Use of U-Frames in Steel Highway Bridges
BA-54/94	Load Testing for Bridge Assessment
BA-55/06	The Assessment of Bridge Substructures and Foundations, Retaining Walls and Buried Structures
BA-56/96	The Assessment of Steel Highway Bridges and Structures
BA 57/01	Design for Durability
BA-58/94	Design of Bridges and Concrete Structures with External Unbonded Prestressing
BA 59/94	Design of Highway Bridges for Hydraulic Action
BA-61/96	The Assessment of Composite Highway Bridges
BA-67/96	Enclosure of Bridges
BA-68/97	Crib Retaining Walls
BA-72/03	Maintenance of Road Tunnels

ADVICE NOTES - BRIDGES AND STRUCTURES (BA SERIES)

BA 74/06	Assessment of Scour at Highway Bridges
BA 80/99	Use of Rock Bolts
BA 82/00	Formation of Continuity Joints in Bridge Decks
BA 83/02	Cathodic Protection for Use in Reinforced Concrete Highway Structures
BA 84/02	Use of Stainless Steel Reinforcement in Highway Structures
BA 85/04	Coatings for Concrete Highway Structures & Ancillary Structures
BA 86/06	Advice Notes on the Non-Destructive Testing of Highway Structures
BA 87/04	Management of Corrugated Steel Buried Structures
BA 88/04	Management of Buried Concrete Box Structures
BA 92/07	The Use of Recycled Concrete Aggregates in Structural Concrete
BA 93/09	Structural Assessment of Bridges with Deck Hinges

STANDARDS - BRIDGES AND STRUCTURES (BD SERIES)

BD 2/05	Technical Approval of Highway Structures
BD 7/01	Weathering Steel for Highway Structures
BD 9/81	Implementation of BS 5400: Part 10: 1980. Code of Practice for Fatigue
BD 10/97	Design of Highway Structures in Areas of Mining Subsidence
BD 12/01	Design of Corrugated Steel Buried Structures with Spans Greater than 0.9 Metres and up to 8.0 Metres
BD 13/06	Design of Steel Bridges. Use of BS 5400: Part 3: 2000
BD 15/92	General Principles for the Design and Construction of Bridges. Use of BS 5400: Part 1: 1988
BD 16/82	Design of Composite Bridges. Use of BS 5400: Part 5: 1979 Amendment No. 1
BD 20/92	Bridge Bearings. Use of BS 5400: Part 9: 1983
BD 21/01	The Assessment of Highway Bridges and Structures
BD 24/92	Design of Concrete Bridges. Use of BS 5400: Part 4: 1990
BD 27/86	Materials for the Repair of Concrete Highway Structures
BD 28/87	Early Thermal Cracking of Concrete Amendment No. 1
BD 29/04	Design Criteria for Footbridges
BD 30/87	Backfilled Retaining Walls and Bridge Abutments
BD 31/01	The Design of Buried Concrete Box and Portal Frame Structures
BD 33/94	Expansion Joints for Use in Highway Bridge Decks
BD 34/90	Technical Requirements for the Assessment and Strengthening Programme for Highway Structures
BD 35/06	Quality Assurance Scheme for Paints and Similar Protective Coatings
BD 36/92	Evaluation of Maintenance Costs in Comparing Alternative Designs for Highway Structures
BD 37/01	Loads for Highway Bridges

STANDARDS - BRIDGES AND STRUCTURES (BD SERIES)

BD 41/97	Reinforced Clay Brickwork Retaining Walls of Pocket Type and Grouted Cavity type Construction Use of BS 5628: Part 2: 1995
BD 42/00	Design of Embedded Retaining Walls and Bridge Abutments
BD 43/03	The Impregnation of Reinforced and Prestressed Concrete Highway Structures using Hydrophobic Pore-Lining Impregnants
BD 44/95	The Assessment of Concrete Highway Bridges and Structures
BD 45/93	Identification Marking of Highway Structures
BD 46/92	Technical Requirements for the Assessment and Strengthening Programme for Highway Structures [Stage 2 – Modern Short Span Bridges]
BD 47/99	Waterproofing and Surfacing of Concrete Bridge Decks
BD 48/93	The Assessment and Strengthening of Highway Bridge Supports
BD 49/04	Design Rules for Aerodynamic Effects on Bridges
BD 50/92	Technical Requirements for the Assessment and Strengthening Programme for Highway Structures Stage 3 – Long Span Bridges
BD 51/98	Portal and Cantilever Signs/Signal Gantries
BD 53/95	Inspection and Records for Road Tunnels
BD 54/93	Post-tensioned Concrete Bridges, Prioritisation of Special Inspections
BD 56/96	The Assessment of Steel Highway Bridges and Structures
BD 57/01	Design for Durability
BD 58/94	The Design of Concrete Highway Bridges and Structures with External and Unbonded Prestressing Design of Highway Bridges for Vehicle Collision Loads
BD 60/04	Design of Highway Bridges for Vehicle Collision Loads
BD 61/96	The Assessment of Composite Highway Bridges
BD 62/07	As Built, Operational and Maintenance Records for Highway Structures
BD 63/07	Inspection of Highway Structures
BD 65/97	Design Criteria for Collision Protector Beams
BD 67/96	Enclosure of Bridges
BD 68/97	Crib Retaining Walls
BD 70/03	Strengthened/Reinforced Soils and Other Fills for Retaining Walls and Bridge Abutments Use of BS8006: 1995, incorporating Amendment No. 1 (Issue 2 March 1999)
BD 74/00	Foundations
BD 78/99	Design of Road Tunnels
BD 79/06	The Management of sub Standard Highway Structures
BD 81/02	Use of Compressive Membrane Action in Bridge Decks
BD 82/00	Design of Buried Rigid Pipes
BD 84/02	Strengthening of Concrete Bridge Supports Vehicle Impact Using Fibre Reinforced Polymers
BD 85/08	Strengthening Highway Structures Using Externally Bonded Fibre Reinforced Polymer
BD 86/07	The Assessment of Highway Bridges and Structures For The Effects of Special Types General Order (STGO) and Special Order (SO) Vehicles
BD 87/05	Maintenance Painting of Steelwork

STANDARDS - BRIDGES AND STRUCTURES (BD SERIES)

BD-89/03	The Conservation of Highway Structures
BD-90/05	Design of FRP Bridges and Highway Structures
BD-91/04	Unreinforced Masonry Arch Bridges
BD-94/07	Design of Minor Structures
BD-95/07	Treatment of Existing Structures on Highway widening Schemes

TECHNICAL MEMORANDA - BRIDGES (BE SERIES)

BE-13	Fatigue Risk in Bailey Bridges
BE-23	Shear Key Decks Amendment No. 1 to Annex
BE-5/75	Rules for the Design and Use of Freyssinet Concrete Hinges in Highway Structures
BE-7/04	Departmental Standard (Interim) Motorway Sign/Signal Gantries

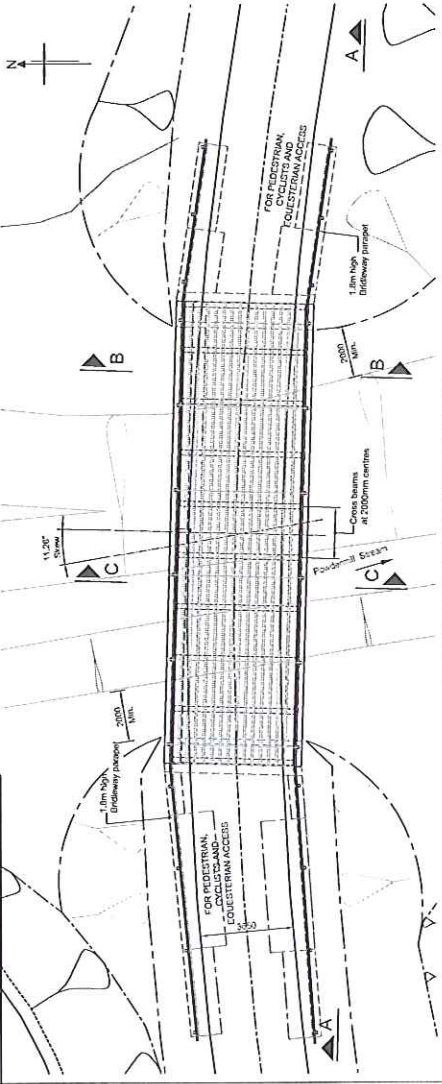
INTERIM ADVICE NOTES (IAN)

IAN-117/08-Rev-1	Certification of combined kerb and drainage products
IAN-116/08	Nature conservation advice in relation to bats
IAN-104/07	The Anchorage of Reinforcement and Fixings in Hardened Concrete
IAN-97/07	Assessment and upgrading of existing parapets
IAN-96/07r1	Guidance on implementing Results of Research on Bridge Deck Waterproofing
IAN-95/07	Revised Guidance Regarding the Use of BS8500(2006) For the Design and Construction of Structures Using Concrete
IAN-91/07	Interim Advice on the identification of "Particularly at Risk" supports
IAN-70/06	Implementation of New Reinforcement Standards
IAN-69/05	Design for Maintenance
IAN-48/03	Measures To Minimise The Risk of Sulphate Attack (Including Thaumasite) - New Construction and Structures Under Construction
IAN-47/02	Post-Tensioned Grouted Duct concrete Bridges
IAN-41/02	European Cement Standards
IAN-05/96	BD-24/92 The Design of Concrete Highway Bridges and Structures. Use of BS 5400: Part 4:1990
IAN-04/96	BD-44/95 The Assessment of Concrete Highway Bridges and Structures
IAN-03/96	BA-50/93 Post-Tensioned concrete Bridges

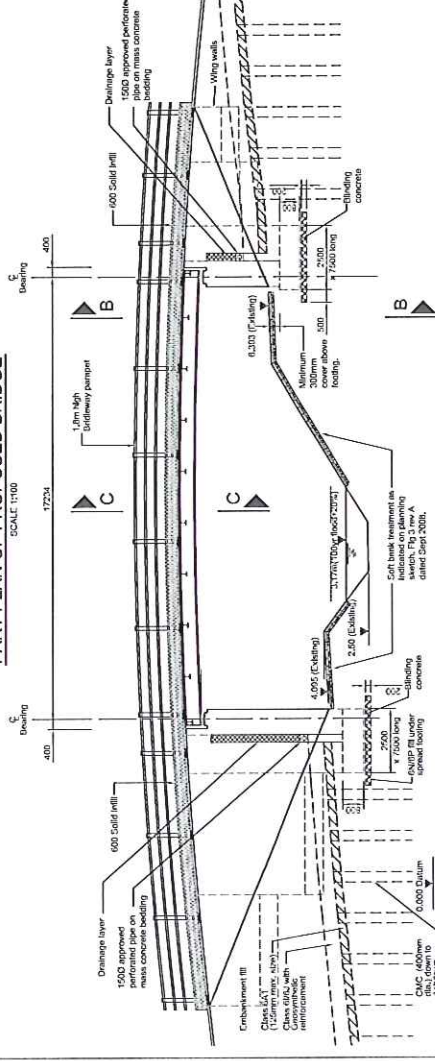
Appendix B Drawings

Drawing No	Title
B1297000-PH2/1600.01A/9181	Powdermill Stream South Underbridge (G04) General Arrangement

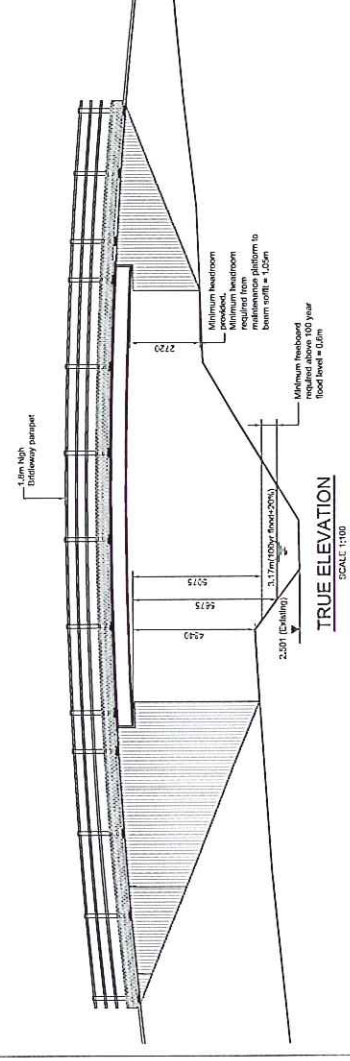
Drawings number / title
B1297000/PH2/1600.01A/9181/0



PART PLAN OF PROPOSED BRIDGE
SCALE 1:100



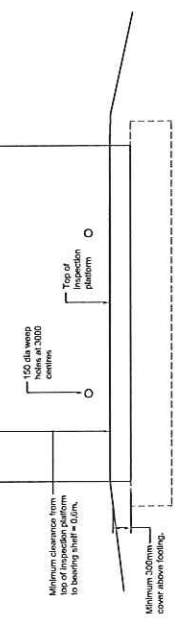
SECTIONAL ELEVATION A
SCALE 1:100



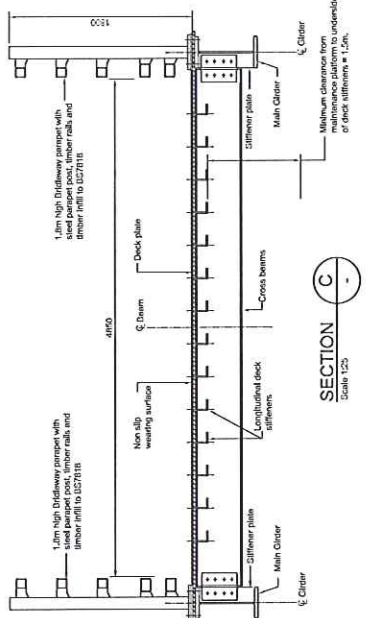
TRUE ELEVATION
SCALE 1:100

Notes

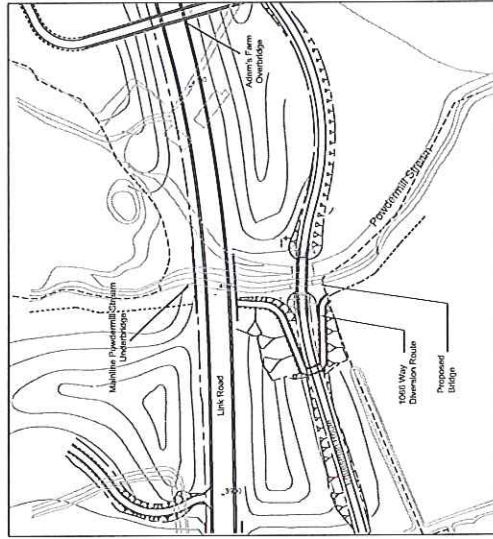
1. All dimensions in millimetres unless noted otherwise.
2. All levels in metres A.O.D. (Above Ordnance Datum - Newlyn).
3. Structural element dimensions are approximate and subject to change during detailed design.
4. Bridge deck will be a proprietary product.
5. Temporary jacking paths will be in line with existing bearings below and upstream.
6. Cross beam and Longitudinal deck stiffener spacing to be confirmed.



ELEVATION B
SCALE 1:20



SECTION C
SCALE 1:25



SITE LOCATION
SCALE 1:1250

Client:	HOCHTIEF/VINCI JOINT VENTURE
Project:	EAST SUSSEX COUNTY COUNCIL
Drawings title:	BEXHILL TO HASTINGS LINK ROAD POWDERMILL STREAM SOUTH UNDERBRIDGE (G04) GENERAL ARRANGEMENT
Approval in principle:	APPROVAL IN PRINCIPLE
Scale:	1:2000 (0.0 A3)
Issue no.:	01/27/2020
Issue date:	12/02/2019
Author:	DL
Check:	DL
Drawn:	DL
Reviewed:	DL
Approved:	DL

JACOBS
Infrastructure
The Westbury House, 100 Westbury Road, Westbury, Wiltshire, Wiltshire, UK

Client: HOCHTIEF/VINCI
Project: EAST SUSSEX COUNTY COUNCIL
Drawing title: BEXHILL TO HASTINGS LINK ROAD
POWDERMILL STREAM SOUTH UNDERBRIDGE (G04)
GENERAL ARRANGEMENT
Approval in principle: APPROVAL IN PRINCIPLE
Scale: 1:2000 (0.0 A3)
Issue no.: 01/27/2020
Issue date: 12/02/2019
Author: DL
Check: DL
Drawn: DL
Reviewed: DL
Approved: DL

This drawing is not to be used in whole or part other than for the intended project. It is to be used in conjunction with the contract for full terms and conditions.
B1297000-PH2/1600.01A/9181
0

Appendix C Geotechnical Information

BEXHILL TO HASTINGS LINK ROAD
GEOTECHICAL SUMMARY INFORMATION

STRUCTURE NAME	CHAINAGE and OS Grid Reference	
G04 - Powdermill Stream South UB	Ch 4015	OS: 576189.6E, 110614.7N
Rev: 1	DESIGN LIFE: 120 years	
SOILS/GEOLOGY	RELEVANT EXPLORATORY HOLES:	
	BH16 (May Gurney, 2006)	
	BH194 (URS Investigation, 2009)	
Strata	Typical depths	
<u>West</u>		
Topsoil/Made Ground	3.7 to 2.7m OD	
Ashdown Formation – interbedded sands, silts and clay	below 2.7m OD	
<u>East</u>		
Topsoil	6.7 to 6.4m OD	
Ashdown Formation – interbedded sands, silts and clay	below 6.4m OD	
PREVIOUS GROUND HISTORY	Agricultural land	
CONTAMINATED GROUND RISK ASSESSMENT REQUIRED	No	
GROUNDWATER		
<p>Groundwater was encountered in BH16 initially at 2.62m OD (4.1m bgl) within Ashdown Formation and rose to a level of 4.12m OD (2.6m bgl) in 20 minutes. . A second groundwater strike encountered confined groundwater within Ashdown Formation at -2.78m OD (9.7m bgl) and rose to a level of 3.47m OD (3.25m bgl) in 20 minutes. Groundwater monitoring carried out between April 2006 and March 2010 indicates a level of up to 1.3m bgl.</p> <p>Allowing for seasonal fluctuations, the preliminary groundwater level is assumed to be 3.4m OD (0.3m bgl based on the west side)</p>		
EARTH PRESSURE VALUE K_0^* K_a^* K_p^*		
Refer to Section 5.4 of the AIP.		
TYPE OF FOUNDATION	Spread Footings	

BEARING CAPACITY		Spread Footings			
Structure Element	Founding Stratum	Founding Level (m AOD)	Footing Size	Allowable Bearing Pressure (kN/m ²)	
West Abutment	Ashdown Formation	2.495	7.5m x 5m	200kN/m ²	
East Abutment	Ashdown Formation	4.89	7.5m x 3m	200 kN/m ²	
PILE DESIGN: N/A					
Structure Element	Founding Stratum	Toe Level (mAOD)	Pile dia (m)	Pile length (m)	Pile working Load (kN)
<p>Note: Pile lengths and toe levels are approximate – pile cap elevations to be confirmed.</p> <p>Pile type:</p> <p>Criteria for selecting pile toe level: ...</p> <p>Allowance for negative skin friction within design:</p>					
SETTLEMENT					
Differential settlement to be allowed for between adjacent supports: 25mm					
Differential settlement to be allowed between structure and approach embankment: 20mm (within 10 metres of the interface between structures and approach embankments)					
CHEMICAL ANALYSIS					
<p>Buried Concrete classification:</p> <p>The results of chemical tests on soil samples taken within the rural areas indicate pH values ranging between 3.8 to 9.4 and sulfates (2:1 Water Extract) values of between 10 to 900mg/l. The recommended Design Sulfate and Concrete Classification based on BRE Special Digest 1 (2005) are DS-2 and AC-3z respectively.</p>					
NOTES					

1. The ground sequence at the site is Topsoil/Made Ground and Ashdown Formation. Made Ground is not recommended as a bearing stratum due to its unpredictable bearing behaviour and poses a risk of differential settlement taking place. The maximum thickness of Topsoil/Made Ground is 1m.
2. Based on the formation levels (2.495m OD West Abutment & 4.89m OD East Abutment) the structure will likely be founded on the firm to very stiff Ashdown Formation.
3. The behaviour of the groundwater indicates likely presence of confined aquifer. This should be considered during construction.



Site
Bexhill to Hastings Link Road

Borehole Number
BH16

Boring Method
Cable Percussion

Casing Diameter
150mm cased to 7.00m

Ground Level (mOD)
6.72

Client
East Sussex County Council

Job Number
SI1085

Location
576201.473 E 110629.515 N

Dates
08/03/2006-09/03/2006

Engineer
Owen Williams

Sheet
1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.30-0.80	B1				6.42	(0.30) 0.30	TOPSOIL. Firm brown slightly gravelly sandy CLAY. Gravel is angular to subrounded fine and medium flint.			
0.80-1.20	B2				5.92	(0.50) 0.80	Firm mottled orange brown and light brown sandy SILT / CLAY.			
1.50	U1			32 blows						
1.95 2.00-2.50	D1 B3									
2.50-2.95 2.50	SPT N=19 D2	1.30		2,2/3,6,5,5		(3.70)			▽1	
3.50 3.50-3.95	U2 D3			50 blows					▽2	
4.00-4.50 4.10	B4 W1			FAST(1) at 4.10m, rose to 2.55m in 20 mins, sealed at 7.00m.					▽1	
4.50 4.50-4.87	D4 SPT 50/220	2.90	2.90	7,10/14,20,16	2.22	4.50	Very stiff mottled brown and grey SILT			
5.50	U3			100 blows		(2.50)				
6.00-6.50	B5									
6.50-6.95 6.50-6.95	SPT N=45 D5	5.90	4.80	14,11/10,8,11,16						
7.50 7.50	D6 U4			50 blows						
8.00-8.50	B6									
8.50-8.95 8.50-8.95	SPT N=50 D7	7.00		6,7/10,12,12,16						
9.50 9.50 9.70	D8 U5 W2			FAST(2) at 9.70m, rose to 3.30m in 100 blows 20 mins.	-0.28	7.00	Very stiff light grey CLAY with pockets of orange and brown fine sand.		▽2	

Remarks
Hand excavated pit to 1.20m
50mm diameter standpipe installed with raised cover protected with fence
PID reading adjacent to BH at 0.30m bgl = 0.4ppm
Water added from 1.50m to 4.10m. Water added from 7.00m to 9.70m.

Scale (approx)
1:50

Logged By
JE/AK

Figure No.
SI1085.BH16



MAY GURNEY						Site Bexhill to Hastings Link Road		Borehole Number BH16		
Boring Method Cable Percussion		Casing Diameter 150mm cased to 7.00m		Ground Level (mOD) 6.72		Client East Sussex County Council		Job Number SI1085		
		Location 576201.473 E 110629.515 N		Dates 08/03/2006-09/03/2006		Engineer Owen Williams		Sheet 2/3		
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.00-10.50	B8									
10.50-10.95 10.50-10.95	SPT N=53 D9	7.00	3.30	12,13/16,14,10,13						
11.50 11.50	D10 U6			100 blows						
12.50-12.80 12.50	SPT 50/150 D11	12.50	3.70	11,14/22,28		(9.00)				
13.50 13.50	D12 U7			100 blows						
13.95	D13									
14.50-14.82 14.50 14.50-15.00	SPT 50/170 D14 B9	14.50	3.90	15,10/20,19,11						
15.50 15.50 15.50-15.95	D15 U8 B10			100 blows						
16.00-16.50	B11				-9.28	16.00	Weak SILTSTONE and brown COAL recovered as a grey and black sandy SILT. Gravel is angular to subangular fine to medium brown coal			
16.50-16.95 16.50 16.50-16.95	SPT N=50 D16 D17	16.30	4.10	6,9/9,10,14,17		(2.00)				
17.50 17.50	D18 U9			150 blows						
18.00-18.50	B12				-11.28	18.00	Weak SILTSTONE recovered as a slightly sandy SILT with occasional bands of coal.			
18.50-18.70 18.50	SPT 25*/80 50/115 D19	18.40	4.50	20,5/28,22		(2.15)				
19.50 19.50 20.00-20.14	D20 U10 50/70 SPT 25*/70	20.00	4.80	150 blows 25/50						
Remarks								Scale (approx) 1:50	Logged By JE/AK	Figure No. SI1085.BH16



MAY GURNEY						Site Bexhill to Hastings Link Road			Borehole Number BH16	
Boring Method Cable Percussion		Casing Diameter 150mm cased to 7.00m		Ground Level (mOD) 6.72		Client East Sussex County Council			Job Number SI1085	
		Location 576201.473 E 110629.515 N		Dates 08/03/2006- 09/03/2006		Engineer Owen Williams			Sheet 3/3	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
20.00-20.15	D21				-13.43	(2.15) 20.15	Complete at 20.15m	***** *****		
Remarks								Scale (approx) 1:50	Logged By JE/AK	Figure No. SI1085.BH16

URS Corporation Ltd Home Lane Bedford MK40 1TS Telephone: 01234 349641 www.URS.com
 File: J:\BEDFORC\JOB\EAST SUSSEX COUNTY COUNCIL\W032577 BEXHILL TO HASTINGS LINK ROAD\TECHNICAL\FACTUAL REPORT DATA\GINT\BEXHILL - HASTINGS URS ALL.GPJ Printed: 14/03/2009 12:34:45

Contract No: 49325727
 Project: Bexhill - Hastings Link Road
 Client: East Sussex County Council



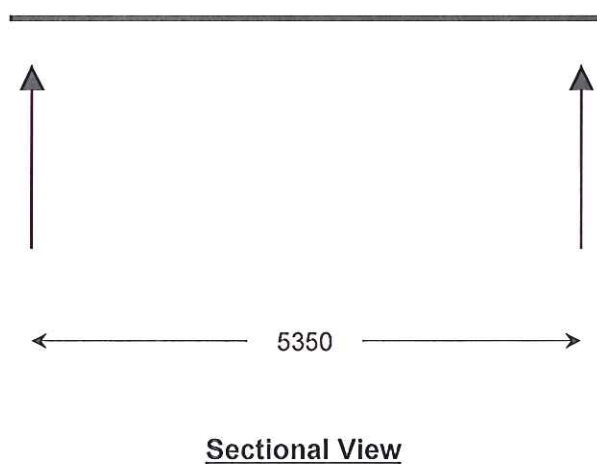
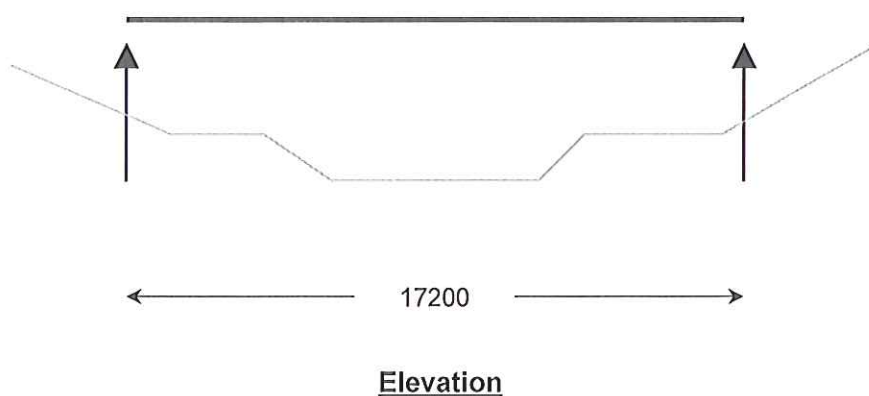
SAMPLES & In situ TESTS			Water	STRATA				
Depth	Type/ No.	SPT/U4 (Blows)		Reduced Level (mOD)	Legend	Depth (Thickness)	DESCRIPTION	Instru- ment/ Backfill
0.30	D1		3.38	////	0.30	Firm brown slightly sandy slightly clayey SILT. Sand is fine to medium. Fine rootlets. (TOPSOIL)	Instrument/Backfill	
0.50	D2			XXXXXX		Firm light grey and brown very slightly gravelly slightly sandy slightly clayey silt. Sand is fine to coarse. Gravel is weak brown-light grey subangular to sub-rounded fine to medium siltstone and flint. Occasional fine to medium red brick, fine charcoal and chalk fragments. (MADE GROUND)		
1.00	D3 U4	(70 - 450mm)	2.68	XXXXXX	1.00	Firm to stiff laminated light grey and orange-brown stained orange-brown SILT. (Zone IV to II) (ASHDOWN BEDS)		
1.50	D5			XXXXXX				
2.00	U6	(90 - 450mm)		XXXXXX				
2.50	D7 SPT8	N=43 (2/6/9/10/12/12)		XXXXXX		At 2.5m bgl stiff to very stiff fissured light grey and orange-brown SILT. Orange-brown staining along fissure surfaces.		
3.00	U9	(120 - 250mm)		XXXXXX				
3.50	D10			XXXXXX		At 3.5m bgl very stiff very closely fissured yellow-orange-brown SILT. Orange-brown staining along fissure surfaces.		
4.00	U11	(120 - 350mm)		XXXXXX				
4.50	D12 SPT13	N=72 (8/10/15/15/20/22)		XXXXXX		At 4.5m bgl extremely closely to very closely fissured light grey and orange-brown SILT. Orange-brown staining along fissure surfaces.		
5.00	U14	(120 - 450mm)		XXXXXX				
5.50	D15			XXXXXX	(9.00)	At 5.5m bgl very stiff fissured dark grey stained dark brown SILT. Dark brown staining along fissure surfaces.		
6.00	U16	(75 - 450mm)		XXXXXX				
6.50	D17 SPT18	N=38 (3/5/7/9/10/12)		XXXXXX		At 6.5m bgl very stiff thickly laminated dark grey slightly clayey SILT.		
7.00	U19	(120 - 150mm)		XXXXXX				
7.25	D20			XXXXXX		From 7.25m bgl becoming very stiff possibly fissured thickly to thinly laminated grey SILT with frequent light grey very slightly sandy silt partings. Sand is fine.		

Boring Progress and Water Observations									Chiselling			Water Added		GENERAL REMARKS
Date	Time	Hole Depth	Cas'g Depth	Cas'g Dia	Water Depth	Rose to	Time (mins)	Sealed (m)	From	To	Time (hh:mm)	From	To	
														Draft Hand dug inspection pit to 1.2m bgl. Zone of weathering interpreted from from Spinks et al. 1993: (V); (IV); (III); (II); (I).

Logged by: JB Checked by: CAB Status: Draft	Equipment: Cable Percussion Rig - Dando 2000 Contractor: Southern Testing Laboratories Ltd	Location: 576181.9 E 110607.2 N	Ground Level: 3.68 mAOD	Date: 06/03/2009 Start 09/03/2009 End	Scale: 1:40.0 Sheet 1 of 2
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Appendix D Idealised Structure

DIAGRAM OF IDEALISED STRUCTURE TO BE USED IN ANALYSIS



Appendix E Departures from Standards

Departure # Hydrophobic Pore Lining Impregnant

BD 43/03 specifies various requirements for the impregnation of highway structures with hydrophobic pore lining impregnant. Following the completion of research into the long term effectiveness of hydrophobic pore lining impregnants on concrete highway structures, the Highways Agency is temporarily suspending requirements to apply all such impregnants as set out in BD43/03.

This suspension is detailed in CHE Memorandum 227/08 - The Impregnation Of Reinforced and Prestressed Concrete Highway Structures Using Hydrophobic Pore Lining Impregnants

This Departure seeks to apply this suspension to structures on the BHLR – i.e. the impregnant will not be applied.

This will not preclude the opportunity to apply impregnant in the future should this be required.

Departure # Longitudinal Loading on Greenway Structures

This Departure seeks approval:

- to delete the BD37/01 Clauses 6.10 and 6.11 requirements for longitudinal load for traction and braking and accidental load due to skidding.
- to apply instead a single alternative nominal longitudinal load of 150 kN. This load will be applied as described in BD37/01 Clause 6.10

The BD37 requirements for these loadings are based on significantly higher traffic loads and speeds than the Greenway structures will be subjected to. The 150 kN proposed is based on the maximum horizontal load that can be generated by the 24 tonne design vehicle reacting on the structure with a coefficient of friction of 0.6 between vehicle and deck. We consider that this approach is moderately conservative and appropriate to the structures concerned.

Departure # Combined Waterproofing and Surfacing on Steel Bridge Decks

This departure seeks approval for use of proprietary product for waterproofing and anti slip treatment of the steel bridge decks. This is required as waterproofing and corrosion protection of steel bridge decks is not covered in Clause 1802 - surface preparation and protection against corrosion – Specification, Structures SHW, MCHW Vol 1, Series 1800 – Structural Steelwork.

It is proposed to use a resin based system with a slip resistant aggregate dressing e.g. Bimagrip or CICOL.

Use of such products is typical on steel footbridges and link span bridges and is recommended for use on equestrian bridges by the British Horse Society.

