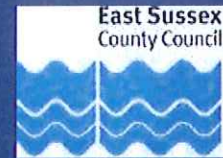


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**East Sussex County Council  
Transport and Environment**

**Bexhill to Hastings Link Road  
G06 Powdermill Stream North Underbridge  
Approval in Principle**

**Doc. Ref: B1297000-PH2/1600.06a/0022  
Revision 0  
September 2012**



**Document control sheet**

**Project:** Bexhill to Hastings Link Road  
**Client:** East Sussex County Council Project No: B1297000  
 Transport and Environment  
**Document title:** G06 - Powdermill Stream North Underbridge - Approval in Principle  
**Ref. No:** B1297000-PH2/1600.06a/0022

	Originated by	Checked by	Reviewed by	Approved by
<b>ORIGINAL</b>	NAME Anuj Vats	NAME Paul Blackie	NAME Paul Blackie	NAME Rob Davenport
DATE 14/09/12	INITIALS 	INITIALS 	INITIALS 	INITIALS 
Document status		Issue for Approval in Principle		

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## Revision Summary

Client: East Sussex County Council  
Project: Bexhill to Hastings Link Road  
Document Title: G06 Powdermill Stream North Underbridge AIP

Transport and Environment  
Job No: B1297000

REVISION / DATE	COMMENT
Rev 0 14/09/12	Amended to incorporate TAA comments raised on Phase 1 AIP ref. JB-B1297000-PH1/1600.06a/0022 (rev 0)  Approach embankment ground treatment proposals added.  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 bank to bank width of 9.5m.

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

Powdermill Stream North Underbridge is located at OS grid reference 576159.311E, 110992.233. It is approximately 340m to the north of the Bexhill to Hasting Link Road Powdermill Stream underbridge. It carries the proposed Environment Agency access track 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 bored, cast in-situ reinforced concrete piles.

**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 bridleway 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 – relating to new construction only**

Concrete	Element	Limiting Exposure Class
C32/40	Piles	DC-3z. Note A
Note A	ACEC class is AC-3z in natural ground therefore Design Chemical Class for pile design will be DC-3z. Refer to Geotechnical Summary Sheet for detail.	
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 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 platform:**

- 2.98m to soffit of discrete main steel girders.
- 3.32m to soffit of deck between discrete girders.

**From west platform:**

- 4.08m to soffit of discrete main steel girders.
- 4.42m to soffit of deck between discrete girders.

**From 100yr flood level + 20%:**

- 5.44m to soffit of discrete main steel girders.
- 4.42m 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.

Abutments are to be analysed assuming vertical load carrying elements cantilever from pile caps.

Pile caps to be analysed assuming rigid pile caps and pinned connections between piles and pile caps.

Piles will be analysed and reinforced assuming a full moment connection with pile caps.

Wing walls will be analysed manually.

**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.

A representative peak angle of friction of  $35^\circ$  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 bored piles extending to the very weak to weak Siltstone / firm to very stiff Ashdown Formation. A maximum differential settlement of 10mm 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 B1297000-PH2/1600.01A/9201 Rev 0	Title Powdermill Stream North Underbridge (G06) 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 8448; 1994	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 9/81	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-94/07	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

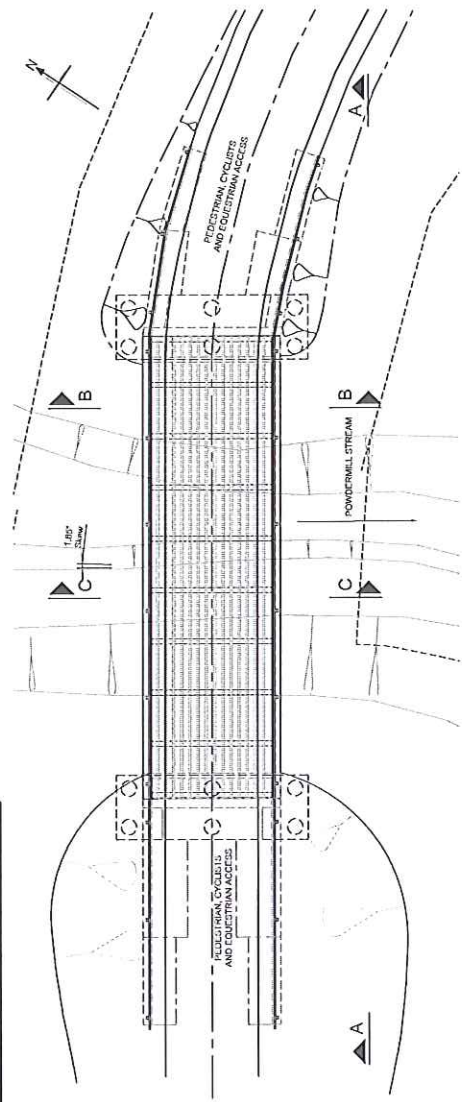
## Appendix B Drawings

Drawing No	Title
B1297000-PH2/1600.01A/9201	Powdermill Stream North Underbridge (G06) General Arrangement

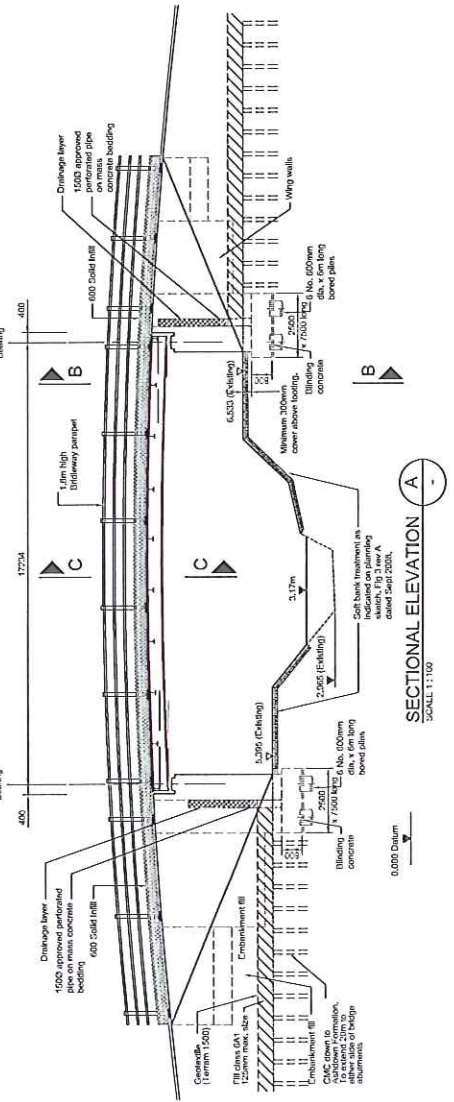




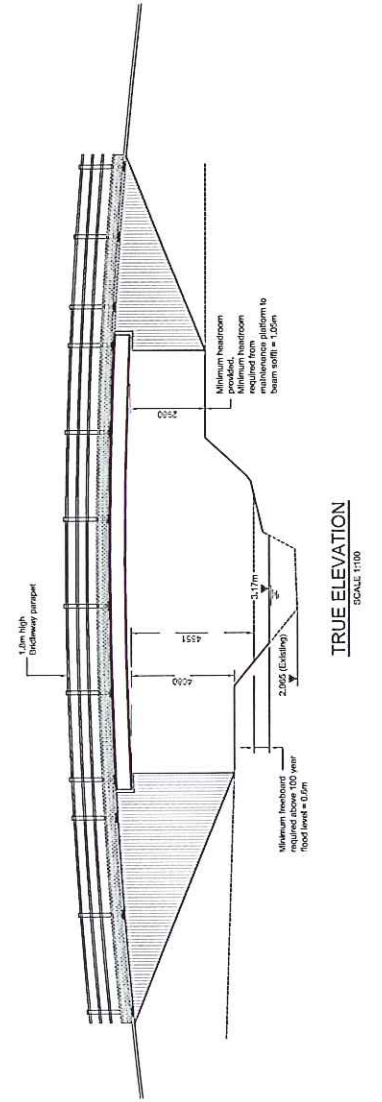
Drawing number from  
**B1297000-PH1/1600.01A/920170**



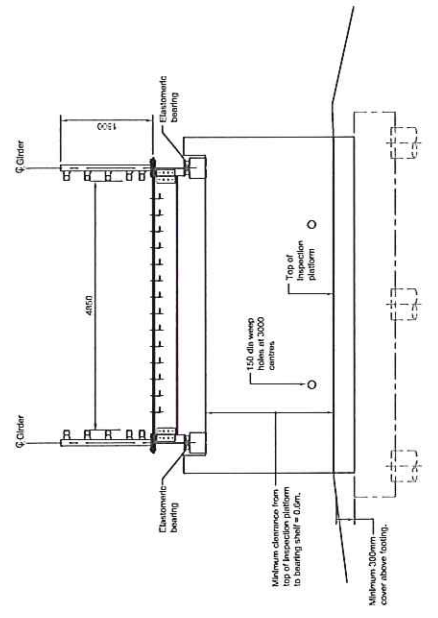
**PART PLAN SHOWING PROPOSED BRIDGE**  
SCALE: 1:1250



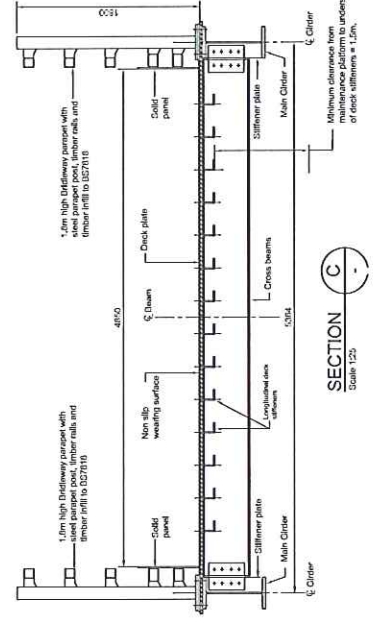
**SECTIONAL ELEVATION A**  
SCALE: 1:1250



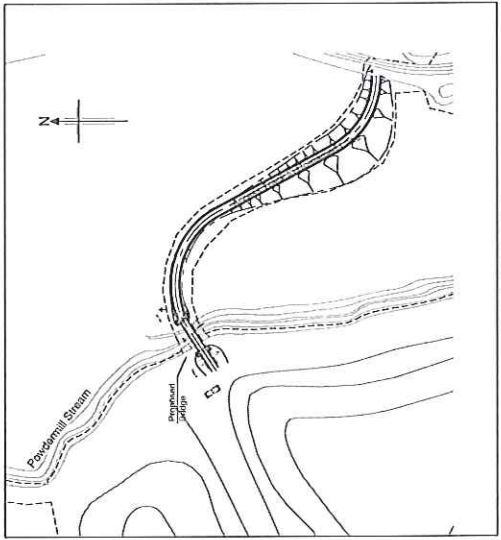
**TRUE ELEVATION**  
SCALE: 1:1250



**ELEVATION B**  
SCALE: 1:1250



**SECTION C**  
SCALE: 1:250



**SITE LOCATION**  
SCALE: 1:1250

**Notes**

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

Client	HOCHTIEFVINCI JOINT VENTURE	Author	AV	SP	MD
Project	EAST SUSSEX COUNTY COUNCIL	Checker	AV	SP	MD
Drawn by	BEXHILL TO HASTINGS LINK ROAD	Design	AV	SP	MD
Checked by	POWDERMILL STREAM NORTH UNDERBRIDGE (G06)	Drawn	AV	SP	MD
Approved by	GENERAL ARRANGEMENT	Checked	AV	SP	MD
Approval in Principle		Scale	DO NOT SCALE		
Scale	1:2000 (R/A)	Drawing No.	B1297000		
Drawing No.	B1297000-PH1/1600.01A/9201				
This drawing is not to be used in whole or part other than for the intention as defined on this drawing. Refer to the contract for full terms and conditions.					

Prepared by: Jacobs  
Checked by: Jacobs  
Approved by: Jacobs  
Date: 17/08/2021  
Drawing No.: B1297000-PH1/1600.01A/9201

## Appendix C Geotechnical Information

**BEXHILL TO HASTINGS LINK ROAD**  
**GEOTECHNICAL SUMMARY INFORMATION**

<b>STRUCTURE NAME</b>	<b>CHAINAGE and OS Grid Reference</b>	
G06 Powdermill Stream North UB	Ch 3955	OS: 576159.311E, 110992.233
	<b>DESIGN LIFE:</b> 120 years	
<b>SOILS/GEOLOGY</b>	<b>RELEVANT EXPLORATORY HOLES:</b>	
	BH192, BH193 (URS Investigation, 2009)	
<b>Strata</b>	<b>Typical depths</b>	
<u>West</u>		
Alluvium	4.56 to -0.8m OD	
Ashdown Formation – Very weak to weak Siltstone	below -0.8m OD	
<u>East</u>		
Alluvium	7.19 to 5.4m OD	
Ashdown Formation – interbedded sands, silts and clay / very weak Siltstone (Top at -0.81m OD)	below 5.4m OD	
<b>PREVIOUS GROUND HISTORY</b>	Agricultural land	
<b>CONTAMINATED GROUND RISK ASSESSMENT REQUIRED</b>	No	
<b>GROUNDWATER</b>		
<p>Groundwater was encountered initially between 3.06m OD (1.5m bgl – BH192) and 6.69m OD (0.5m bgl – BH193) within Alluvium layer and rose to a level of between 4.06m OD (0.5m bgl – BH192) and 7.09m OD (0.1m bgl – BH193). . A second groundwater strike encountered confined groundwater within Ashdown Formation at levels between -0.84m OD (7.5m bgl – BH192) and 5.47m OD (1.72m bgl – BH193) and rose to a level of between 4.06m OD (0.5m bgl – BH192) and 6.69m OD (0.5m bgl - BH193) in 20 minutes.</p> <p>Groundwater monitoring carried out in BH193 between February 2009 and November 2009 indicates a level of up to 3.0m bgl.</p> <p>Allowing for seasonal fluctuations, the preliminary design groundwater level is assumed to be at ground level.</p>		
<b>EARTH PRESSURE VALUE <math>K_0^*</math> <math>K_a^*</math> <math>K_p^*</math></b>		
Refer to Section 5.4 of the AIP.		

<b>TYPE OF FOUNDATION</b>	Piled foundation				
<b>BEARING CAPACITY</b>	N/A				
Structure Element	Founding Stratum	Founding Level (m AOD)	Footing Size	Allowable Bearing Pressure (kN/m <sup>2</sup> )	
<b>PILE DESIGN</b>					
Structure Element	Founding Stratum	Toe Level (mAOD)	Pile dia (m)	Pile length (m)	Pile working Load (kN)
West Abutment	Ashdown Formation	-1.7	0.6	6.0	530
East Abutment	Ashdown Formation	-0.57	0.6	6.0	620
<p>Note: Pile lengths and toe levels are approximate – pile cap elevations to be confirmed.</p> <p>Pile type: Bored / CFA</p> <p>Criteria for selecting pile toe level: Allowable pile capacity</p> <p>Allowance for negative skin friction within design: Negative skin friction considered</p>					
<b>SETTLEMENT</b>					
Differential settlement to be allowed for between adjacent supports: 10mm					
Differential settlement to be allowed between structure and approach embankment: 20mm (within 10 metres of the interface between structures and approach embankments)					
<b>CHEMICAL ANALYSIS</b>					
<p><b>Buried Concrete classification:</b></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 condition at the site is Alluvium overlying Ashdown Beds. Alluvium 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 Alluvium is 5.1m.
2. It is recommended that the foundation of the structure is founded on the very weak to weak Siltstone / firm to very stiff Ashdown Formation at minimum levels of -0.8m OD (aprox 5.4m bgl) for West Abutment and 5.4m OD (aprox 1.8m bgl) for East Abutment. Due to likely depth of excavation, it is proposed to consider using piled foundations. The likely pile type is bored cast-in-place or CFA. The foundation type will also depend on the Formation Levels of the Abutments.
3. The behaviour of the groundwater indicates likely presence of confined aquifer. This should be considered during construction.

SH/16 BEXHILL BOREHOLE LOG File: J:\BEDFORD-JOBSEAL\SUSSEX COUNTY COUNCIL\49325727 BEXHILL TO HASTINGS LINK ROAD\TECHNICAL\FACTUAL REPORT DATA\BEXHILL - HASTINGS URS ALL.GPJ Printed: 14/02/2009 12:34:21  
 URS Corporation Ltd Home Lane Bedford MK40 1T3 Telephone: 01234 340641 www.URS.com

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

  
 Record of Borehole  
**BH192**

SAMPLES & In situ TESTS			STRATA						
Depth	Type/ No.	SPT/U4 (Blows)	Water	Reduced Level (mOD)	Legend	Depth (Thickness)	DESCRIPTION	Instru- ment/ Backfill	
0.30	D1			4.26		0.30	Firm dark yellow-brown slightly sandy slightly clayey SILT. Sand is fine to coarse. Fine rootlets. (TOPSOIL)		
0.50	D2			3.66		0.90	Firm light and dark brown and light grey multicoloured mottled orange-brown slightly sandy clayey SILT. Sand is fine to coarse. Fine rootlets. (Zone V) (ALLUVIUM)		
1.00	D3			3.06		1.50	Firm light grey and orange-brown mottled orange and dark orange-brown CLAY. (Zone V) Becoming light grey mottled/stained orange-brown CLAY. (ALLUVIUM)		
1.50 1.60	D4 U5 W16	(45 - 450mm)							Firm grey-green and blue slightly gravelly slightly organic rich SILT. Organic material comprises pseudo fibrous wood fragments up to 6mm in size. Gravel is dark brown and orange-brown sub-rounded fine to coarse siltstone and sandstone. (Zone V to IV) (ALLUVIUM)
2.00	D6								
2.50	U7	(60 - 450mm)							
3.00	D8 SPT9	N=13 (3/2/3/3/3/4)							Becoming by 3.0m bgl firm grey-brown with stained light blue and orange-brown slightly clayey SILT.
3.50	U10	(80 - 450mm)							Firm yellow-brown and slightly sandy between 3.0m bgl to 3.45m bgl. Sand is fine.
4.00	D11								Becoming by 4.0m bgl stiff to very stiff grey-olive stained light blue-grey, purple and orange-brown slightly gravelly SILT. Gravel is weak thin colour laminated yellow-brown and orange-brown stained dark orange-brown flat subangular fine to coarse siltstone.
4.50	U12	(120 - 300mm)							
5.00	D13 SPT14	N=98 (6/9/13/35/35/15)							
5.50	D15				-0.84		5.40		Weak thin colour laminated yellow-brown and orange-brown stained orange-brown slightly weathered SILTSTONE. Discontinuities appear to be extremely close to closely spaced. Orange-brown staining along discontinuity surfaces. (Zone III to II) (Recovered as flat subangular fine to coarse silty gravel and cobble.) (ASHDOWN BEDS)
6.00	SPT17	N=56 (4/5/7/9/17/23)							
6.50	D18								
7.00	SPT19	N=31 (4/7/6/7/9/9)							
7.50	D20								

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	
24/02/09	13.30	1.60	0.00		1.60	0.60	20		5.40	5.50	00:15			
24/02/09	16.00	5.40	4.00	150	5.40	0.45	20		5.50	5.90	01:00			
24/02/09	17.00	5.90	4.00	150	0.30									
25/02/09	08.00	5.90	4.00	150	0.10									

Draft  
 Hand dug inspection pit to 1.2m bgl  
 During logging no visible or olfactory evidence of contamination.  
 Fast groundwater inflow at 1.6mbgl, very fast groundwater inflow at 5.4mbgl.  
 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: 576151.3 E 110978.7 N	Ground Level: 4.56 mAOD	Date: 24/02/2009 Start 25/02/2009 End	Scale: 1:40.0  Sheet 1 of 2
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S:\Borehole\Borehole Log File - J:\BDFORC-036\BDFORC\SUBSEX COUNTY COUNCIL\4052577 BEXHILL TO HASTINGS LINK ROAD\TECHNICAL\ACTUAL REPORT D\F\A\G\I\B\U\B\H\H\ - HASTINGS URS: ALL GPJ Printed: 14/03/2009 15:34:32

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



Record of Borehole  
**BH192**

SAMPLES & In situ TESTS			STRATA					
Depth	Type/No.	SPT/U4 (Blows)	Water	Reduced Level (mOD)	Legend	Depth (Thickness)	DESCRIPTION	Instrument/Backfill
8.00	SPT21	N=80 (25/20mm/20/25/25/10)			x x		At 7.5m bgl recovered as flat subangular coarse gravel and cobble. Discontinuities very close to closely spaced. At 7.7m bgl band of very stiff light grey SILT.	Instrument/Backfill
8.50	D22			-3.94	x x	8.50  (1.00)	At 8.5m bgl recovered as very weak to weak dark brown-grey stained orange-brown sub-rounded coarse silty gravel of SILTSTONE. Discontinuities close to closely spaced. No orange-brown staining on discontinuity surfaces. (ASHDOWN BEDS)	
9.00	SPT23				x x			
9.50	D24			-4.94	x x	9.50	At 9.5m bgl recovered as very weak to weak dark brown-grey stained orange-brown flat sub-rounded cobble of SILTSTONE. Discontinuities appear to be very close to closely spaced. Orange-brown staining on discontinuity surfaces.	
10.00	SPT25			-5.44	x x	10.00	(SPT samples are recovered as silt.) (ASHDOWN BEDS)	
End of Borehole at 10.00m								

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	
25/02/09	11.30	10.00	8.00	150	0.90				8.30	8.50	00:30			

Draft  
Hand dug inspection pit to 1.2m bgl  
During logging no visible or olfactory evidence of contamination.  
Fast groundwater inflow at 1.6mbgl, very fast groundwater inflow at 5.4mbgl.  
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: 576151.3 E 110978.7 N	Ground Level: 4.56 mAOD	Date: 24/02/2009 Start 25/02/2009 End	Scale: 1:40.0  Sheet 2 of 2
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URS Corporation Ltd Home Lane Bedford MK45 1TS Telephone: 01235 34064 www.urscorp.com

SYKE BEXHILL BOREHOLE LOG File: J:\BEXHILL\JOB\BEXHILL SUSSEX COUNTY COUNCIL\BEXHILL TO HASTINGS LINK ROAD\TECHNICAL\ACTUAL REPORT DATA\BEXHILL - HASTINGS URS ALLOPJ Prime: 14/09/2009 12:34:37  
 URS Corporation Ltd Home Lane, Bexhill MK40 1TS Telephone: 01234 340641 www.URS.com

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



SAMPLES & In situ TESTS			STRATA				
Depth	Type/ No.	SPT/U4 (Blows)	Water	Reduced Level (mOD)	Legend	Depth (Thickness)	DESCRIPTION
0.30	D1		1	6.69		0.50	Soft, medium brown CLAY, with frequent fine rootlets and rare, fine, sub-rounded flint gravels. (TOPSOIL)
0.50	D2						
1.00	D3		2	5.49		1.70	From 1.0m bgl; rare orange/brown, rare, fine sandy patches and fine, sub-rounded lithorelics of weak, randomly orientated, orange/brown mudstone present.
1.20	U4	(16 - Unrecorded)					
1.70	D5 B6		3	4.69		2.50	Stiff, very closely fissured, orange/brown and light grey mottled CLAY, with numerous up to 15mm, horizontally aligned lithorelics of weak mudstone. Occasional up to 40mm lithorelics of weak to medium strong, angular to sub-angular, iron-stained sandstone present. Frequent iron-staining present along fissures within the clay. Rare, extremely thin (<3mm) bands of very weak mudstone also present. (ASHDOWN BEDS)
2.00	W1 U7	(50 - Unrecorded)					
2.50	D8 SPT9 B10	N=21 (4/4/4/6/7)	4	3.79		3.40	Stiff, medium grey, very closely fissured SILT with rare iron staining present along fissures. (ASHDOWN BEDS)
3.00	U11	(48 - Unrecorded)					
3.40	D12 B13		5	2.69		4.50	Becoming slightly clayey with depth from 4.5m to 5.0m bgl. (ASHDOWN BEDS)
3.50	B13						
4.00	U14	(50 - Unrecorded)	6	1.79		5.40	Becoming thinly orange/brown and dark grey/brown colour banded from 6.5m bgl.
4.50	D15 SPT16 B17	N=20 (3/4/4/5/5/6)					
5.00	U18	(50 - Unrecorded)	7				
5.40	D19 B20						
5.50	B20		8				
6.00	U21	(50 - Unrecorded)					
6.50	D22 SPT23 B24	N=28 (3/4/6/10/8/4)	9				
7.00	U25	(50 - Unrecorded)					
7.40	D26 B27		10				
7.50	B27						

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	
26/01/09	13.30	0.50	0.00		0.50	0.10	20		0.00	1.20	01:00			
27/01/09	08.00	6.00	6.00	150	1.80									

Draft  
 150mm casing to 9.0m bgl.  
 During logging no visible or olfactory evidence of contamination.  
 Hand dug inspection pit to 1.2m.  
 Groundwater struck at 0.5m bgl, at 1.8m after 24hrs.  
 Zone of weathering interpreted from from Spinks et al. 1993: (V); (IV); (III); (II); (I).

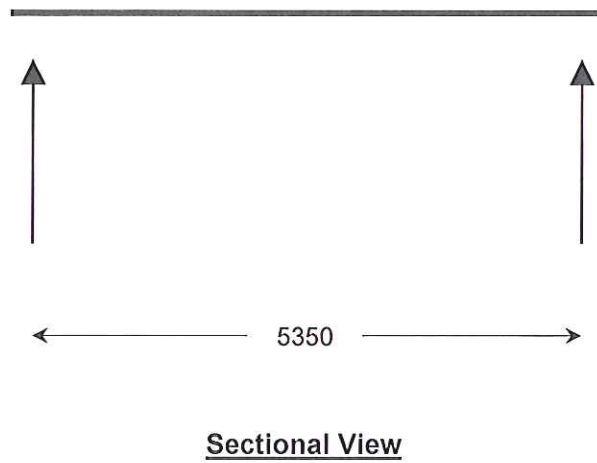
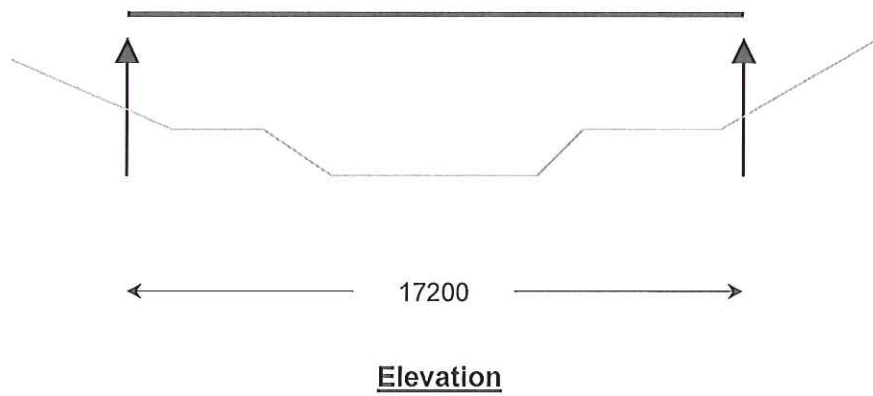
Logged by: HH Checked by: CAB Status: Draft	Equipment: Cable Percussion Rig - Dando 2000 Contractor: Southern Testing Laboratories Ltd	Location: 576176.5 E 110995.2 N	Ground Level: 7.19 mAOD	Date: 26/01/2009 Start 27/01/2009 End	Scale: 1:40.0 Sheet 1 of 2
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**Appendix 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.

