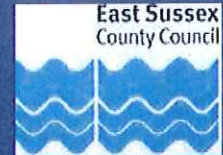


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**East Sussex County Council  
Transport and Environment**

**Bexhill to Hastings Link Road  
S09 Watermill Stream Underbridge  
Approval in Principle**

**Doc. Ref: B1297000-PH2/1600.06a/0009  
Revision 0  
August 2012**



**Project:** Bexhill to Hastings Link Road  
**Client:** East Sussex County Council  
**Document title:** Watermill Stream UB AIP  
**Ref. No:** B1297000-PH2/1600.06a/0009  
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	Originated by	Checked by	Reviewed by	Approved by
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## 1. HIGHWAY DETAILS

### 1.1 Type of highway

Over: Bexhill to Hastings Link Road (BHLR) which is a single carriageway 2-lane rural all purpose road. 12.0m carriageway with 1.2m verge on the north side and 1.2m verge on the south side.

Under: N/A

### 1.2 Permitted traffic speed

Over: 60 mph

Under: N/A

### 1.3 Existing restrictions

None.

## 2. SITE DETAILS

### 2.1 Obstacles crossed

The bridge crosses Watermill Stream which flows from north to south. The channel width, measured between the tops of opposing banks is approximately 8.80m at its widest point below the footprint of the structure.

## 3. PROPOSED STRUCTURE

### 3.1 Description of structure

The structure is a single span underbridge carrying BHLR over Watermill Stream. The deck consists of inverted prestressed concrete T-beams with concrete infill. The deck is integral with reinforced concrete abutment walls supported on a piled foundation. The reinforced concrete wingwalls are set generally parallel to the mainline alignment.

The parapet stringcourse will be cast in situ reinforced concrete.

The OS grid reference for the structure is 575323E, 110635N.

An environmental noise barrier is attached to the outside of the parapet stringcourse along the north edge of the structure. A separate Category 0 technical approval submission covers the environmental barriers generally although framing and fixings specific to this structure will be designed as part of the bridge structure submission.

### 3.2 Structural type

The structure is a single span integral bridge designed as a frame-type integral bridge in accordance with BA 42/96.

Wingwalls consist of a mixture of short sections cantilevering from the rear of the abutment and free-standing cantilever walls.

### 3.3 Foundation type

Reinforced CFA concrete piled foundation.

### 3.4 Span arrangements

Clear square span..... 12.8 m      Skew angle ..... 28 degrees

Clear skew span ..... 14.514 m

**3.5 Articulation arrangements**

The structure is an integral bridge which does not require deck articulation or movement joints. BD33/94 Type 2 (Asphaltic plug) joints are proposed at the approach embankment/deck interfaces.

Thermal movement of the bridge deck is resisted by passive earth pressure behind the abutment wall and rotational stiffness of the end supports.

**3.6 Types of road restraint systems**

The proposed road restraint system requirement has been confirmed by a RRRAP assessment. A metal N2/W4 vehicle parapet 1000mm high with mesh infill will be provided to comply with the requirements of TD19/06.

An environmental barrier is fixed behind the parapet system on the north side.

**3.7 Proposed arrangements for maintenance and inspection**

**3.7.1 Traffic management**

Close inspection or maintenance of the deck soffit over the waterway and the outer faces of the environmental barrier will require an underbridge unit and hence a single lane closure of the link road will be necessary.

**3.7.2 Access**

Over the waterway, the deck soffit can be accessed by underbridge unit from the carriageway above (with removal of environmental barrier).

A minimum 2.0 wide clearance to top of bank will be provided in front of the abutments. 1.5m minimum clear headroom is provided from the maintenance platform level to the precast beam soffit.

Inspection and maintenance of the remaining deck soffit, abutments and wing walls can be carried out from ground level using a platform or ladder to reach upper levels.

Foundations will not be visible or accessible for inspection.

**3.8.1 Materials and finishes**

Concrete	Element	Limiting Exposure Class	
C48/60	Prestressed T beams	XD1	
C40/50	Infill deck slab	Top	XC3
		Cantilever soffit	XD3
		Parapet plinths	XD3
C32/40	Abutment, exposed face below deck	XD1	
	Abutment, wingwalls exposed side faces	XD3	
	Abutment, wingwalls buried	DC-1	
C32/40	CFA 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.		

<b>Reinforcement</b>	All reinforcement to be grade 500B or 500C deformed bars to BS 4449:2005
<b>Parapets and environmental barrier framing</b>	Painted (HA Type IV), galvanised steel.
<b>Backfill to abutments and retaining walls</b>	Fill material to structures to be Class 6N or 6P in accordance with DoT Specification for Highway Works.
<b>Concrete Finishes</b>	
Deck soffit ie PC beam soffits	F5
Surfaces to receive waterproofing	U4
Top of parapet plinth	U3
Sides of parapet plinth	F3
Abutment	F2
Wingwalls (exposed vertical)	F6 (grooved patterned profile finish)
Buried formed surfaces	F1
Buried unformed surfaces	U1

**Protection**

The top deck surface will be protected with a proprietary spray applied bridge deck waterproofing system to SHW CI 2003.

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.

**3.8.2 Sustainability issues**

Conventional construction materials are proposed and therefore no significant sustainability issues are foreseen.

**3.9 Risks and hazards considered**

Standard construction methods are anticipated with normally associated risks and hazards. A design hazard log and risk assessment process is active for the scheme.

**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'.

**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

Full HA loading in accordance with BD 37/01

##### 4.1.2 Loading relating to General Order traffic under STGO regulations

37.5 units of HB loading on any one notional lane only in accordance with BD 37/01

##### 4.1.3 Footway or footbridge live loading

Verge loading in accordance with BD 37/01

##### 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

N/A

##### 4.1.5 Any special loading not covered above

Approach embankments founded on soft ground will be subjected to advance works surcharging and/or ground treatment eg piled platform, band drains or controlled modulus column installation, in advance of structural piling. Any residual lateral load or negative skin friction effects resulting from approach embankment loadings will be assessed and included in the design loadings for the bridge piled foundations.

##### 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.

N/A

##### 4.1.7 Minimum headroom provided

The minimum headroom below bridge beams and concrete infill shall not be less than 1.5m after allowing for deflections arising from dead load, live load and settlement.

In addition, the soffit level of the deck shall be at a level greater than or equal to the 100 year flood level +20% flood flow plus 600mm freeboard.

##### 4.1.8 Authorities consulted and any special conditions required

###### Authority Consulted

###### Special Requirement

1: British Telecom

1x90mm PVC duct required over structure.

2: EDF Energy

1x150mm duct required over structure.

3: ESCC Planning

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.

4. ESCC

1.5m minimum maintenance headroom to underside of structure.

5. Environment Agency

600mm freeboard to be provided above water level during 100yr return period



flood + 20% flood flow.

#### 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 Highway Structures Using Hydrophobic Pore Lining Impregnants

#### 4.3 Proposed Departures from Standards given in 4.2 and 4.2.1

None

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

N/A

### 5. STRUCTURAL ANALYSIS

#### 5.1 Methods of analysis proposed for superstructure, substructure and foundations

The structure will be analysed in accordance with the recommendations given in PCA publication 'Integral abutments for prestressed beam bridges' by B.A Nicholson.

For the construction phase, the distribution of bending moments and shear forces in the deck will be determined by use of a simply supported line beam analysis.

For in service effects the deck analysis will be split into two stages. Firstly a grillage analysis will be undertaken assuming pinned supports at the abutments. The analysis will determine the maximum sagging moments in the deck, shear force distribution and vertical reactions. Transverse thermal and shrinkage effects will be considered in the design and appropriate measures taken to allow for these effects.

Secondly, a portal frame analysis of the deck and abutment stem walls will be undertaken, making allowance for the deck being monolithic with its supports and modelling soil structure interaction. The analysis will make allowance for the restraint to shrinkage and creep due to continuity over the supports. The analysis will return the maximum hogging moments in the deck and evaluate the rotation to be applied to the pile heads in the piled foundation design.

Load effects envelopes will be determined for the prestressed concrete beams which will be designed to Class 1 and Class 2 conditions.

Abutment stem walls will be designed for load effects determined from the portal frame analysis.

Retaining walls will be analysed by hand calculation.

Piled foundations will be analysed using appropriate industry standard software, considering a single representative pile and taking account of soil structure interaction effects including the lateral movements and rotational effects induced by deck load effects. Pile spacing is such that pile group effects are not considered to be appropriate.

Additional lateral loading on piles arising from potential approach embankment settlement will be analysed and added to pile loads arising from the deck and abutment analyses.

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

Refer to Appendix D for diagram of idealised structure(s).

**5.3 Assumptions intended for calculation of structural element stiffness**

Element stiffness for concrete members will be determined in accordance with BS5400; Part 4; 1990; Clause 4.4 using full elastic uncracked member cross sections ignoring the presence of reinforcement.

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

Earth pressure coefficients used in the calculation of lateral earth pressures at the rear of a full-height frame integral abutment will be calculated in accordance with the requirements and recommendations contained in BA 42/96 'The Design of Integral Bridges'. The earth pressure coefficients used in the calculation of the 'K' and 'at rest' earth pressures at the rear of the abutment shall be based on upper bound 6N granular backfill properties of density = 22kN/m<sup>3</sup>, maximum  $\phi' = 45^\circ$ ,  $K_o = 0.6$  and  $K_p = 12.6$  when considering adverse effects.

The earth pressure coefficients used in the calculation of the earth pressures at the rear of the cantilever wingwalls will be based on the guidance presented in "Integral Abutments for Prestressed Beam Bridges" by BA Nicholson 1998.

For the analysis of the free standing earth retaining wingwalls a representative peak angle of friction of 35° will be used, for which  $k_a = 0.27$ ;  $k_p = 3.69$  and  $k_o = 0.43$  (calculated in accordance with BD 30/87).  $k_a$  will be used for stability calculations and  $k_o$  for structural element design.

**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 piles extending to the 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 2 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-PH2/1600.06a/9091	Title S09 Watermill Stream Underbridge AIP General Arrangement
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Appendix C	Geotechnical Information	Draft Geotechnical Report Highway Structure Summary Sheet.
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Appendix D	Idealised Structure	
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**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 24/08/12

9.2 Endorsement by contractor

Signed

Name: .....

Engineering Qualifications:.....

Position:....., Hochtief Vinci Joint Venture

Date:

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

Reviewed .....

Name:.....

Engineering qualifications.....

Date: .....

Signed .....

Name:.....

TAA  
Engineering qualifications.....

Date: .....



## Appendix A List of Relevant Documents

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

### *British Standards*

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

### *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 November 2007

Volume 2: Notes for Guidance on the Specification for Highway Works 1998, including amendments to November 2007

Volume 3: Highway Construction Details 1991, including amendments to May 2007

***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 65/94	Design Guide for Environmental Barriers
HA 66/95	Environmental barriers Technical Requirements
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)**

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

**TECHNICAL MEMORANDA - BRIDGES (BE SERIES)**

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

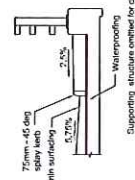
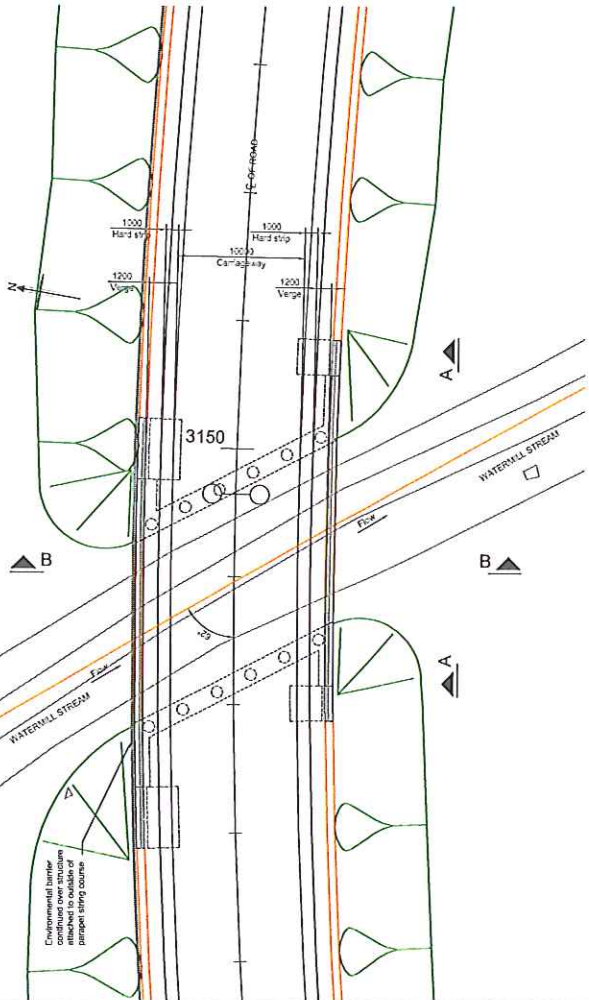
**INTERIM ADVICE NOTES (IAN)**

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

## Appendix B Drawings

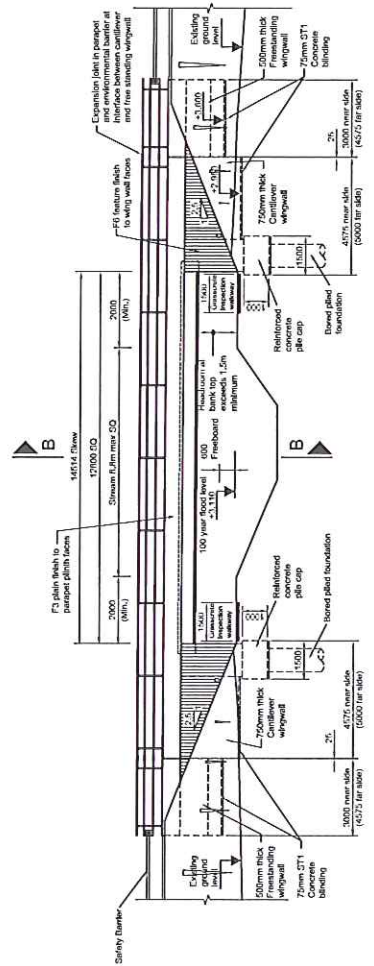
Drawing No	Title
B1297000-PH2/1600.06a/9091	S09 Watermill Stream Underbridge AIP General Arrangement

Drawing Number / Rev  
**B1297000/PH2/1600.01A/9091/0**

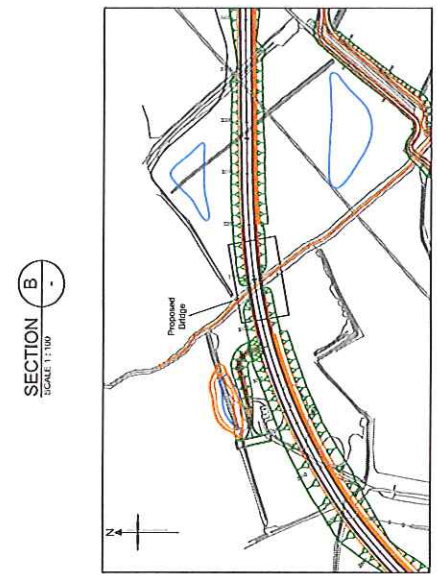


**PLAN**  
 SCALE 1:100

**DETAIL**  
 SCALE 1:20



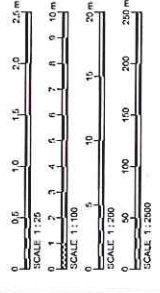
**ELEVATION A**  
 SCALE 1:100



**SECTION B**  
 SCALE 1:100

**LOCATION PLAN**  
 SCALE 1:2000

- Notes**
- All dimensions in millimetres unless noted otherwise.
  - All levels in metres above Ordnance Datum - Newlyn.
  - Do not scale from this drawing.
  - Deck to be 6M or 6P.
  - All external utilities to have 25 x 25mm channels.
  - Gullies shall be provided in the roadside channels immediately to the west (uphill) side of the bridge to maintain the flow of surface water across the pavement / abutment / footpath.
  - Approach embankments constructed in advance of bridge works. Retention structures shall be constructed in advance of abutment settlement when necessary.
  - Both abutments to be bedded simultaneously with a level difference not exceeding 0.5M.
  - All surface thicknesses are approximate and subject to change at detailed design stage.
  - Dimensions are square to abutment faces, unless noted otherwise.



Client	HOCHTIEF/MINCI JOINT VENTURE
Employer	EAST SUSSEX COUNTY COUNCIL
Project	BEXHILL TO HASTINGS LINK ROAD
Drawing title	WATERMILL STREAM UNDERBRIDGE GENERAL ARRANGEMENT
Drawing marks	FOR APPROVAL
Drawn by	AS/SUSSEX/PAAT
Checked by	1/2/2020
DO NOT SCALE	
Drawing number	B1297000-PH2/1600.01A/9091/0

This drawing is not to be used for works or part thereof for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

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## Appendix C Geotechnical Information

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

<b>STRUCTURE NAME</b> S09 - Watermill Stream Underbridge	<b>CHAINAGE and OS Grid Reference</b> Ch 3150      OS: 575323E, 110635N	
<b>Rev : 1</b>	<b>DESIGN LIFE:</b> 120 years	
<b>SOILS/GEOLOGY</b>	<b>RELEVANT EXPLORATORY HOLES:</b> BH10 (May Gurney, 2006) BH130, BH131, BH132 (URS Investigation, 2009)	
<b>Strata</b>	<b>Typical depths</b>	
Alluvium	3.08 to -8.42 m OD	
Ashdown Formation	below -8.42 mOD	
<b>PREVIOUS GROUND HISTORY</b>	Agricultural land and floodplain	
<b>CONTAMINATED GROUND RISK ASSESSMENT REQUIRED</b>	No	
<b>GROUNDWATER</b>		
<p>In BH10 groundwater was encountered initially at 1.70m OD (1.78m bgl) within the Alluvium layer. A second groundwater strike was encountered at level -4.42m OD (7.9m bgl). Third groundwater strike encountered confined groundwater at the top of Ashdown Formation at level -6.82m OD (10.3m bgl) and rose to 1.48m OD (2.0m bgl) in 20 minutes.</p> <p>Groundwater was encountered in BH130 at level 2.64m OD (0.7m bgl) and rose to 2.84m OD (0.50m bgl). In BH131 groundwater was encountered at -7.41m OD (10.50m bgl) at the top of Ashdown Formation. It rose to -6.21m OD (9.30m bgl) in 20 minutes. Monitoring carried out during March 2010 in BH130 showed groundwater reading at 2.26m bgl.</p> <p>In BH132 groundwater was encountered initially at level 2.08m OD (1.0m bgl). A second groundwater strike was encountered at level -5.62m OD (8.70m bgl) and rose to -2.92m OD (6.0m bgl) in 20 minutes. Both the two strikes were within the Alluvium layer.</p> <p>Allowing for seasonal fluctuations, the preliminary design groundwater level is assumed to be at the ground level.</p>		
<b>EARTH PRESSURE VALUE <math>K_0^*</math> <math>K_a^*</math> <math>K_p^*</math></b>		
See Section 5.4 of the AIP		
<b>TYPE OF FOUNDATION</b>	Pile foundation	



<b>BEARING CAPACITY</b>	N/A				
Structure Element	Founding Stratum	Founding Level (m OD)	Footing Size	Allowable Bearing Pressure (kN/m <sup>2</sup> )	
<b>PILE DESIGN</b>					
Structure Element	Founding Stratum	Toe Level (m OD)	Pile dia (m)	Pile length (m)	Pile working Load (kN)
East and West Abutment	Ashdown Formation	-22.52	0.9	23.5	1600
<p>Note: Pile lengths and toe levels are approximate.</p> <p>Pile type: Bored / CFA</p> <p>Criteria for selecting pile toe level: Pile Capacity</p> <p>Allowance for negative skin friction within design: Yes</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>					
<b>NOTES</b>					

1. **The ground sequence at the site is Top Soil, Alluvium and Ashdown Formation. The Alluvium encountered is peaty in nature.**
2. The low shear strength of the Alluvium layer prevents the use of this layer as a bearing stratum due to the risk of excessive settlements and failure. The maximum thickness of Alluvium is 11.5m. The load from the structure should be transferred to the competent stiff to very stiff /very weak to weak interbedded Ashdown Formation. Pile foundations are recommended.
3. Groundwater behaviour indicates presence of confined aquifer. This factor should be considered during construction.

URS Corporation Ltd Home Lane Duffield MK40 1TS Telephone: 01294 246641 www.URS.com  
 Site: BEXHILL BOREHOLE LOG File: J:\BESFOR-USE\GUEST SUSSEX COUNTY COUNCIL\49325727 BEXHILL TO HASTINGS LINK ROAD\TECHNICAL\FACTUAL REPORT DATA\BEXHILL - HASTINGS URS-ALL.GPJ Printed: 14/05/2009 12:29:19

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

<b>URS</b>
Record of Borehole
<b>BH130</b>


SAMPLES & In situ TESTS			STRATA				Instrument/ Backfill	
Depth	Type/ No.	SPT/U4 (Blows)	Water Level	Reduced Level (mOD)	Legend	Depth (Thick- ness)		DESCRIPTION
0.15	D1			3.04	X	0.30	Soft, reddish brown fine slightly sandy silty CLAY. Fine rootlets. (TOPSOIL)	Instrument/ Backfill
0.30	D2			2.84	X	0.50	Soft, light reddish brown silty CLAY with gravel sized pockets of grey slight orange mottled clay. Fine rootlets. (V)	
0.50	D3			2.64	X	0.70	Soft, yellowish brown slightly sandy gravelly CLAY with fragments of brick. Gravel is of sub-rounded fine to medium flint. Sand is fine. (V)	
1.00	D4						Very soft light grey orange mottled slightly gravelly CLAY. Gravel is sub-rounded fine to medium flint. (V)	
1.20	U5	(5 - 0mm)						
1.50	B6						(ALLUVIUM)	
2.00	U7	(7 - Unrecorded)						
2.40	D8	N=0 (1/0/0/0/0)		0.94		2.40	Spongy at 2.4m bgl.	
2.50	SPT9 B10						Very soft to soft, (spongy at 2.4m bgl), pseudo fibrous dark brown grey to light grey orange brown mottled slightly sandy, slightly gravelly, slightly peaty silty CLAY. Sand is fine. Gravel is sub-rounded fine to medium flint. (V)	
3.00	U11	(6 - Unrecorded)						
3.50	D12 B13						At 5.5m bgl very soft to soft, thinly laminated (1-2mm) dark grey to dark brown black slightly peaty silty CLAY. Dark brown black laminations are of pseudo fibrous organic material.	
4.70	B14							
5.00	U15	(14 - Unrecorded)					(ALLUVIUM)	
5.50	D16 SPT17 B18	N=4 (1/0/1/1/1)						
6.00	U19	(15 - Unrecorded)					At 5.5m bgl very soft to soft thinly laminated (1-2mm) dark grey to dark brown-black slightly peaty silty CLAY. Dark brown-black laminations are of pseudo-fibrous organic material.	
6.50	D20 B21			-3.16		6.50		
7.00	U22	(30 - Unrecorded)					Very soft to soft, brownish grey gravelly slightly peaty silty CLAY. Gravel is angular to subangular fine to medium sandstone and siltstone. (V)	
7.30	D23 SPT24 B25	N=5 (1/0/0/1/2/2)		-3.96		7.30		
7.50							Loose to medium dense yellow orangish brown angular to subangular fine to coarse sandstone GRAVEL and fine to coarse silty clayey SAND. (V)	

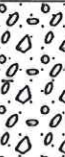
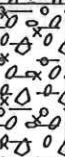
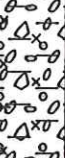
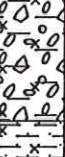
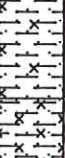
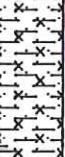
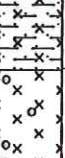
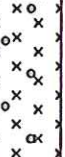
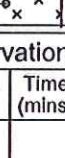
Boring Progress and Water Observations									Chiselling			Water Added		GENERAL REMARKS
Date	Time	Hole Depth	Cas'g Depth	Cas'g Dia	Water Depth	Rose to	Time (mins)	Sealed (m)	From	To	Time (hh:mm)	From	To	
09/01/09	08.30	0.70			0.70	0.50	20							

Draft 150mm casing to 15m bgl. U100 samples taken using double weight. During logging no visual or olfactory evidence of contamination. Groundwater encountered at 0.7m bgl. Zone of weathering interpreted from from Spinks et al. 1993: (V); (IVb); (IVa); (IIc); (IIb); (IIIa); (IIb); (IIa); (Ia); (Ib).

Logged by: JB	Equipment: Cable Percussion Rig - Dando 2000	Location: 575304.8 E	Ground Level: 3.34 mAOD	Date: 09/01/2009 Start	Scale: 1:40.0
Checked by: CAB	Contractor: Southern Testing Laboratories Ltd	110645.4 N		12/01/2009 End	
Status: Draft					Sheet 1 of 3

SHW BEDHILL BOREHOLE LOG File: J:\BEDFORD-ORG\BEDHILL TO HASTINGS LINK ROAD\TECHNICAL\FACTUAL REPORT DATA\GINT\BEDHILL - HASTINGS URS ALL GPJ Printed: 14/01/2009 12:20:23  
 URS Corporation Ltd Home Lane Bedford MK40 1TS Telephone: 01234 56841 www.URS.com

Contract No: 49325727		 Record of Borehole <b>BH130</b>
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	Insitu ment/ Backfill
8.00	SPT26	N=13 (11/2/3/3/4)				(ASHDOWN BEDS)	Insitu ment/ Backfill	
8.50	B27		-5.16		8.50	Medium dense, yellow brown subangular fine, slightly silty, slightly sandy GRAVEL of sandstone, siltstone and mudstone. Sand is medium to coarse. (V) 9.5m bgl gravel becoming fine to coarse (predominantly fine to medium). Coarse graded gravel is flat/tabular. 10.5m bgl increasing clay content and predominantly fine graded gravel. Gravel to clay matrix of 50/50. Subangular sandstone cobble recovered. (ASHDOWN BEDS)		
9.50	B28					At 9.5m bgl gravel becoming fine to coarse (predominantly fine to medium). Coarse graded gravel is flat/tabular.		
10.50	B29					At 10.5m bgl increasing clay content and predominantly fine graded gravel. Gravel to clay matrix of 50/50. Subangular sandstone cobble recovered.		
11.50	D30 SPT31 B32	N=44 (5/5/8/11/12/13)	-7.66		11.00	Very stiff, yellowish olive brown fine sandy silty CLAY and angular to subangular fine to medium lithorelics/gravel of sandstone and siltstone. (V) (ASHDOWN BEDS)		
12.50	D33 B34		-8.46		11.80	Very stiff, light grey slightly clayey, slightly sandy SILT and rare subangular fine to medium lithorelics of very weak grey siltstone. (IV) (ASHDOWN BEDS)		
13.00	SPT35	N=59 (8/10/8/14/18/19)						
13.50	D36 B37		-10.16		13.50	Very stiff, thinly laminated greenish grey (2-3mm) light grey (1mm) slightly clayey SILT and rare angular fine to medium slightly sandy weak siltstone. Light grey laminations are fine silty sand. Occasional black staining/ black deposits along discontinuities. At 14.5m bgl laminated grey (2mm to 8mm) light grey (1mm). (IV - III) (ASHDOWN BEDS)		
14.50	D38 SPT39 B40	N=83 (8/12/15/18/22/28)				Laminated grey (2mm to 8mm) and light grey (1mm) at 14.5 m bgl.		

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	
12/01/09	08.00	10.00	150.00	10	1.00									


  

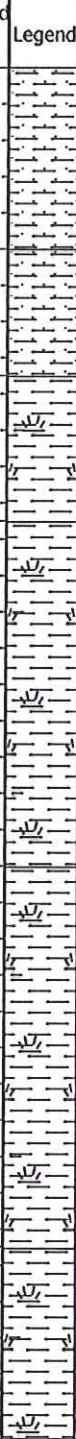

Logged by: JB Checked by: CAB Status: Draft	Equipment: Cable Percussion Rig - Dando 2000  Contractor: Southern Testing Laboratories Ltd	Location: 575304.8 E 110645.4 N	Ground Level: 3.34 mAOD	Date: 09/01/2009 Start 12/01/2009 End	Scale: 1:40.0  Sheet 2 of 3
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Draft  
 150mm casing to 15m bgl.  
 U100 samples taken using double weight  
 During logging no visual or olfactory evidence of contamination.  
 Groundwater encountered at 0.7m bgl.  
 Zone of weathering interpreted from Spinks et al. 1993: (V); (IVb); (IVa); (IIIc); (IIlb); (IIIa); (IIb); (IIa); (Ia); (Ib).



Borehole Log File: J:\BDFORD\JOBS\EAST SUSSEX COUNTY COUNCIL\WDS277 BEXHILL TO HASTINGS LINK ROAD\TECHNICAL\FACTUAL REPORT DATA\BEXHILL - HASTINGS URS ALLGP. Project: 14/01/2009 12:29:28  
 URS Corporation Ltd Home Lane Bedford MK40 1TS Telephone: 01295 346641 www.urscorp.com

Contract No: 49325727		 Record of Borehole <b>BH131</b>
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	Insur- ment/ Backfill
0.30	D1				(1.00)	Soft dark brown sandy CLAY with frequent rootlets. Sands are fine. (TOPSOIL/ALLUVIUM)		
0.50	D2					Rootlets becoming less frequent below 0.5m bgl.		
1.00	D3		2.09		1.00			
1.20	U4	(4 - Unrecorded)				Firm brown and light grey mottled slightly sandy CLAY, with rare rootlets and orange/brown sand patches. Sands are fine. (ALLUVIUM)		
1.70	D5 B6		1.39		1.70			
2.00	U7	(6 - Unrecorded)				Very soft, slightly peaty CLAY with frequent fine to coarse fragments of firm fibrous wood. (ALLUVIUM)		
2.50	D8 SPT9 B10	N=1 (1/0/0/0/1/0)	0.59		2.50			
3.00	U11	(8 - Unrecorded)				Very soft, grey/brown, slightly peaty CLAY, with rare, fine fragments of firm, fibrous wood. (ALLUVIUM)		
3.50	D12 B13					Becoming more peaty below 3.5m bgl, with coarser wood fragments.		
4.00	U14	(12 - Unrecorded)						
4.40	D15 SPT16 B17	N=2 (1/0/1/0/1/0)	-1.31		4.40			
4.50						Very soft, dark brown/black peaty CLAY, with occasional fine to medium fragments of spongy, pseudo-fibrous organic matter. (ALLUVIUM)		
5.00	U18	(16 - Unrecorded)						
5.50	D19 B20					Becoming dark grey/brown below 5.5m bgl, with less frequent fragments of organic matter.		
6.00	U21	(20 - Unrecorded)						
6.50	D22 SPT23 B24	N=5 (1/1/1/2/1/1)	-3.41		6.50			
7.50	U25				(2.00)	Soft, dark grey/brown slightly peaty CLAY, with rare, fine fragments of spongy, pseudo-fibrous organic matter. (ALLUVIUM)		

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  
 150mm casing to 16.5m bgl.  
 No visual or olfactory evidence of contamination identified throughout the borehole.  
 Groundwater struck at 10.5m bgl.  
 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: 575327.7 E 110647.4 N	Ground Level: 3.09 mAOD	Date: 14/01/2009 Start 15/01/2009 End	Scale: 1:40.0 Sheet 1 of 3
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SHE: BEXHILL BOREHOLE LOG File: J:\BDFORC-JOB\BEXHILL TO HASTINGS LINK ROAD\TECHNICAL\REPORT DATA\BEXHILL - HASTINGS URS ALL GPJ Print: 14/09/2009 12:29:29  
 URS Corporation Ltd Home Lane Bedford MK40 1TS Telephone: 01235 30064 www.urscorp.com

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

**URS**

Record of Borehole

**BH131**

SAMPLES & In situ TESTS			STRATA					
Depth	Type/ No.	SPT/U4 (Blows)	Water	Reduced Level (mOD)	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
8.00	B26 U27	(24 - Unrecorded)						
8.50	D28 SPT29 B30	N=6 (2/2/1/1/2/1)		-5.41		8.50	Soft, with extremely closely spaced discontinuities, mottled grey and brown/orange CLAY, with rare up to 5mm lithorelics of angular to sub-angular MUDSTONE. Lithorelics are randomly orientated. (ALLUVIUM)	
9.40 9.50	U31 D32 B33					(2.00)	Lithorelics of mudstone becoming more frequent below 9.4m bgl.	
10.50	U34 D35 SPT36 B37	N=18 (3/2/3/4/5/6)		-7.41		10.50	Medium dense, grey/brown, slightly clayey sandy GRAVEL. Sands are medium to coarse, gravels are fine to medium and angular to sub-rounded. (Alluvium) (Poor recovery from 11.0 - 11.5m bgl) (ASHDOWN BEDS)	
11.50	B38			-8.41		11.50	Medium dense, grey/brown, slightly sandy GRAVEL. Sands are coarse, gravels are fine to medium and angular to sub-rounded. (ASHDOWN BEDS)	
12.50	B39						(Poor recovery from 12.5 - 13.0m bgl)	
13.00	D40			-9.91		13.00	Stiff, thickly laminated, medium brown CLAY. (ASHDOWN BEDS)	
13.50	U41	(6 - Unrecorded)				(1.00)		
13.80	D42						Rare grey/brown silt partings present along fissures from 13.8m bgl.	
14.00	B43			-10.91		14.00	Very stiff, with extremely closely spaced discontinuities, blue/grey slightly silty CLAY, with rare light grey and dark grey/black mottles. (Poor sample recovery; interpreted from drillers log) (ASHDOWN BEDS)	
15.00	SPT44	N=58		-11.91		15.00	Very stiff, with extremely closely spaced discontinuities, slightly silty	

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	
14/01/09	15.00	10.50	9.00	150	10.50	9.30	20							

Draft  
 150mm casing to 16.5m bgl.  
 No visual or olfactory evidence of contamination identified throughout the borehole.  
 Groundwater struck at 10.5m bgl.  
 Zone of weathering interpreted 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: 575327.7 E 110647.4 N	Ground Level: 3.09 mAOD	Date: 14/01/2009 Start 15/01/2009 End	Scale: 1:40.0 Sheet 2 of 3
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URS Construction Ltd Home Lane Bedford MK40 1TS Telephone: 01234 349641 www.urscon.com  
 SHK: BICHILL BOREHOLE LOG File: J:\BEDFORD-JOB\EAST SUSSEX COUNTY COUNCIL\49325727 BICHILL TO HASTINGS LINK ROAD\TECHNICAL\FACTUAL REPORT DATA\BICHILL - HASTINGS URS ALL.DWG Printed: 16/01/2009 12:29:27

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

**URS**

Record of Borehole  
**BH132**

SAMPLES & In situ TESTS			STRATA							
Depth	Type/ No.	SPT/U4 (Blows)	Water	Reduced Level (mOD)	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill		
0.10	CS1		1 ↓		x		Soft dark reddish brown slightly sandy silty CLAY. Sand is fine. Occasional rootlets. (V) (TOPSOIL)	Instrument/ Backfill		
0.30	D1			2.58	x	0.50				
0.50	CS2 D2				x	(1.00)	Stiff light grey mottled dark and orange brown CLAY. Occasional rootlets. (V) (ALLUVIUM)			
1.00	CS3 D3	(3 - Unrecorded)			x	1.50				
1.20	U4			1.58	x		Soft, slightly spongy, dark grey brown slightly peaty CLAY. Plant remains are pseudo fibrous. (V) (ALLUVIUM)			
1.70	D5 B6				x	4.00				
2.50	P7			-0.92	x		Very soft grey brown black/brown mottled peaty CLAY, with frequent, fine to medium gravel sized fragments of spongy pseudo-fibrous organic matter. (V) (ALLUVIUM)			
4.00	D8			2 ↓		x				
4.10	D9 P10					x			Fragments of organic matter becoming fine from 5.0m bgl.	
5.00	D11					x				
5.50	P12				x					
6.50	D13 P14		-3.42		x	6.50	Very soft dark grey slightly peaty CLAY. Organic matter is amorphous and plastic. (V) (ALLUVIUM)			

Boring Progress and Water Observations									Chselling			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	
16/01/09	15.30	1.00	0.00		1.00	0.90	20		0.00	1.20	01:00			

Logged by: HH & JB Checked by: CAB Status: Draft	Equipment: Cable Percussion Rig - Dando 2000 Contractor: Southern Testing Laboratories Ltd	Location: 575352.5 E 110614.0 N	Ground Level: 3.08 mAO	Date: 16/01/2009 Start 20/01/2009 End	Scale: 1:40.0  Sheet 1 of 3
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Draft  
 150mm casing to 16.5m bgl.  
 U100 samples taken using double weight  
 During logging no visual or olfactory evidence of contamination.  
 Zone of weathering interpreted from Spinks et al. 1993: (V); (IV); (III); (II); (I).

S:\ME BEDHILL BOREHOLE LOG File: J:\BEDFORD-JOB\EAST SUSSEX COUNTY COUNCIL\49325727 BEDHILL TO HASTINGS LINK ROAD\TECHNICAL\FACTUAL REPORT DATA\GINT\BEDHILL - HASTINGS URS ALLGP1 PHASE 1\6/20/2009 12:29:28  
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Contract No: 49325727	<b>URS</b>
Project: Bexhill - Hastings Link Road	Record of Borehole
Client: East Sussex County Council	<b>BH132</b>

SAMPLES & In situ TESTS			STRATA							
Depth	Type/No.	SPT/U4 (Blows)	Water	Reduced Level (mOD)	Legend	Depth (Thickness)	DESCRIPTION	Insur-ment/Backfill		
8.00	D15 P16						Becoming less peaty from 8.0m bgl; clay becoming slightly firmer.			
8.30	D17									
9.00	B18			-5.62	8.70				Soft grey/brown slightly gravelly, very sandy CLAY. Sand is fine. Gravels are angular and fine. (V) (ALLUVIUM) Gravels becoming coarser and more frequent below 9.0m bgl (poor recovery).	
10.00	B19			-6.92	10.00					Grey/brown, gravelly fine to medium SAND (poor recovery). Gravels are angular to subangular and fine to medium. (V) (ALLUVIUM)
11.00	B20									
11.50	SPT21	N=12 (3/2/2/3/3/4)		-8.42	11.50					Medium dense medium brown clayey gravelly medium to coarse SAND. Gravels are angular to subangular and fine to medium. (V) (ASHDOWN BEDS)
12.00	D22 B23			-8.92	12.00					
13.00	B24									Very stiff, very closely fissured, blue/grey CLAY, with occasional brown/orange mottles. (ASHDOWN BEDS)
13.50	U25			-9.92	13.00					
14.00	D26 B27				(1.00)					At 14.0m bgl occasional randomly orientated, angular to subangular fine lithorelics of mudstone. Possibly becoming slightly sandy (poor quality sample recovery). (IV)
15.00	D28	N=51		-11.92	15.00				Very stiff, very closely fissured, blue/grey CLAY, with occasional heavy, dark	

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	
19/01/09	14.30	8.70	7.50	150	8.70	5.80	20							

Logged by: HH & JB Checked by: CAB Status: Draft	Equipment: Cable Percussion Rig - Dando 2000 Contractor: Southern Testing Laboratories Ltd	Location: 575352.5 E 110614.0 N	Ground Level: 3.08 mAOD	Date: 16/01/2009 Start 20/01/2009 End	Scale: 1:40.0  Sheet 2 of 3
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S:\HE\Borehole Log File - HIED\FOR-LOG\BEXHILL TO HASTINGS LINK ROAD\TECHNICAL\ACTUAL REPORT DATA\BEXHILL - HASTINGS URS ALL GPJ - Project: 14000000 12-2009

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



Record of Borehole  
**BH132**

SAMPLES & In situ TESTS			STRATA					
Depth	Type/ No.	SPT/U4 (Blows)	Water	Reduced Level (mOD)	Legend	Depth (Thickness)	DESCRIPTION	Insur- ment/ Backfill
	SPT29 B30	(9/9/11/11/13/18)				(1.00)	blue mottles present along fissures. (ASHDOWN BEDS)	
16.00	D31 B32			-12.92		16.00	Very stiff, very closely fissured, blue/grey CLAY, with occasional, tabular, sub-rounded lithorelics of mudstone (poor quality sample). (IV) (ASHDOWN BEDS)	
16.50	U33							
16.80	D34					(2.00)	At 16.8m bgl lithorelics of mudstone becoming horizontally aligned and fine to medium. (IV)	
17.00	B35							
18.00	D36 SPT137 B38	N=85 (13/9/16/19/23/27)		-14.92		18.00	Very weak, grey MUDSTONE interbedded with very stiff blue/grey CLAY with frequent angular to sub-rounded fine to medium horizontally aligned lithorelics of MUDSTONE. (III) (ASHDOWN BEDS)	
19.00	D39 B40					(2.00)	Very rare brown mottling present from 19.0m bgl.	
19.50	SPT41	N=>70 (9/13/20/28/22/50mm/l-)		-16.92		20.00		
End of Borehole at 20.00m								

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	

Draft 150mm casing to 16.5m bgl, U100 samples taken using double weight. During logging no visual or olfactory evidence of contamination. Zone of weathering interpreted from from Spinks et al. 1993: (V); (IV); (III); (II); (I).

Logged by: HH & JB Checked by: CAB Status: Draft	Equipment: Cable Percussion Rig - Dando 2000  Contractor: Southern Testing Laboratories Ltd	Location: 575352.5 E 110614.0 N	Ground Level: 3.08 mAOD	Date: 16/01/2009 Start 20/01/2009 End	Scale: 1:40.0  Sheet 3 of 3
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Site  
Bexhill to Hastings Link Road

Borehole Number  
**BH10**

Boring Method  
Cable Percussion

Casing Diameter  
150mm cased to 20.00m

Location  
575336.475 E 110607.335 N

Ground Level (mOD)  
3.48

Dates  
11/04/2006-  
12/04/2006

Client  
East Sussex County Council

Engineer  
Owen Williams

Job Number  
SI1085

Sheet  
1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.50	B1					(0.60)	TOPSOIL. Firm mottled orangish brown, brown, light yellowish brown and light grey slightly gravelly sandy CLAY. Gravel is angular to subrounded fine and medium sandstone with occasional flint and roots.			
0.60-1.00	B2				2.88	0.60	Soft to firm brown, orangish brown and light grey sandy CLAY and roots			
1.50	D1			7 blows						
1.50	U1			Seepage(1) at 1.70m.	1.78	1.70	Very soft dark brown, greyish brown and light brown organic peaty SILT / CLAY		▽1	
1.70	D2									
2.50-2.95	SPT N=0	2.50	WET	1,0/0,0,0,0		(2.30)			▽3	
2.50-2.95	D3									
2.50-3.00	B3									
3.50	D4			7 blows						
3.50	U2									
4.00	D5				-0.52	4.00	Very soft dark brown dark grey amorphous silty PEAT			
4.50-4.95	SPT N=2	4.50		1,0/0,1,0,1		(2.00)				
4.50-4.95	D6									
4.50-5.00	B4									
5.50	D7			7 blows						
5.50	U3									
5.95	D8				-2.52	6.00	Very soft mottled light and dark grey sandy CLAY			
6.00	D9					(0.80)				
6.50-6.95	SPT N=2	6.50	WET	1,0/0,1,0,1		6.80	Soft light grey and yellowish brown slightly gravelly sandy SILT. Gravel is angular to subangular fine and medium weak mudstone.			
6.50-6.95	D10									
6.50-7.00	B5				-3.32	6.80				
7.00	D11					(1.10)				
7.50	D12			30 blows						
7.50	U4									
7.90	D13			Slow(2) at 7.90m, rose to 7.80m in 20 mins.	-4.42	7.90	Brown and grey sandy very silty angular to subangular fine to coarse mudstone and siltstone GRAVEL.		▽2	
8.50-8.95	SPT N=4	8.50	7.30	1,1/1,1,1,1		(2.40)				
8.50-8.95	D14									
8.50-9.00	B6									
9.50-9.95	SPT N=6	9.50	7.70	1,1/1,1,2,2						
9.50-9.95	D15									
9.50-10.00	B7									

Remarks  
Hand pit excavated to 1.20m  
50mm diameter standpipe installed with raised cover and fencing  
PID reading adjacent to BH at 0.30m bgl = 0.3ppm

Scale (approx)  
1:50

Logged By  
AE/AK

Figure No.  
SI1085.BH10



**Site**  
Bexhill to Hastings Link Road

**Borehole Number**  
BH10

**Boring Method**  
Cable Percussion

**Casing Diameter**  
150mm cased to 20.00m

**Ground Level (mOD)**  
3.48

**Client**  
East Sussex County Council

**Job Number**  
SI1085

**Location**  
575336.475 E 110607.335 N

**Dates**  
11/04/2006-  
12/04/2006

**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
10.30	D16	10.50	2.20	Fast(3) at 10.30m, rose to 2.00m in 20 mins. 1,1/1,1,1,1	-6.82	(2.40) 10.30	Brown light grey and dark grey moderately strong MUDSTONE. Recovered as a sandy angular to subangular fine to coarse mudstone GRAVEL		3	
10.50-10.95	D17					(0.90)				
10.50-10.95	SPT N=4									
10.50-11.00	B8									
11.20	D18	12.50	3.50	100 blows	-7.72	11.20	Stiff light grey slightly sandy CLAY			
11.50	U5					(2.30)				
11.50-11.95	B9									
12.50-12.95	SPT N=26			2,2/5,5,6,10						
12.50-12.95	D19									
12.50-13.00	B10									
13.50	D20	14.50	6.60	100 blows	-10.02	13.50	Stiff to very stiff grey sandy CLAY			
13.50	U6					(4.00)				
14.50-14.95	SPT N=40			3,5/7,10,11,12						
14.50-14.95	D21									
14.50-15.00	B11									
15.50	D22	16.50	6.60	100 blows	-14.02	17.50	Very weak SILTSTONE. Recovered as a sandy SILT			
15.50	U7					(2.50)				
15.50-15.95	B12									
16.50-16.95	SPT N=39			1,4/6,9,12,12						
16.50-16.50	D23									
16.50-17.00	B13									
17.30	D24	18.50	6.00	8,12/14,22,14 100 blows	-16.52	17.50				
17.50-17.85	SPT 50/200					(2.50)				
17.50	U8									
17.50-17.95	B14									
17.50-17.95	D25									
18.50-18.69	SPT 25*/125			23,2/50						
18.50-18.95	D26									
18.50-19.00	B15									
19.50	D27	20.00	6.00	100 blows		20.00				
19.50	U9									
19.50-19.95	B16									
20.00-20.22	SPT 50/70			9,16/50						

**Remarks**

**Scale (approx)**  
1:50

**Logged By**  
AE/AK

**Figure No.**  
SI1085.BH10



**MAY GURNEY**

Site  
Bexhill to Hastings Link Road

Borehole Number  
**BH10**

Boring Method  
Cable Percussion

Casing Diameter  
150mm cased to 20.00m

Ground Level (mOD)  
3.48

Client  
East Sussex County Council

Job Number  
SI1085

Location  
575336.475 E 110607.335 N

Dates  
11/04/2006-  
12/04/2006

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 20.00-20.45	D28 D29									

Remarks

Scale (approx)  
1:50

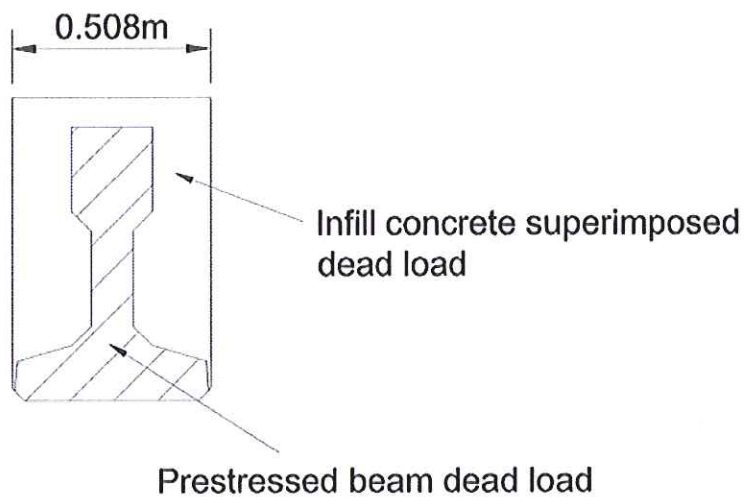
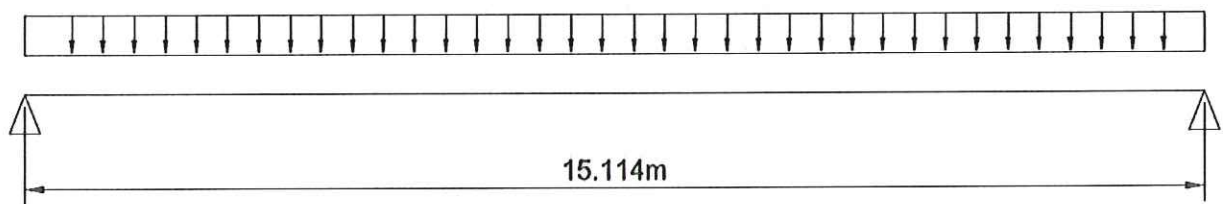
Logged By  
AE/AK

Figure No.  
SI1085.BH10

## Appendix D Idealised Structure

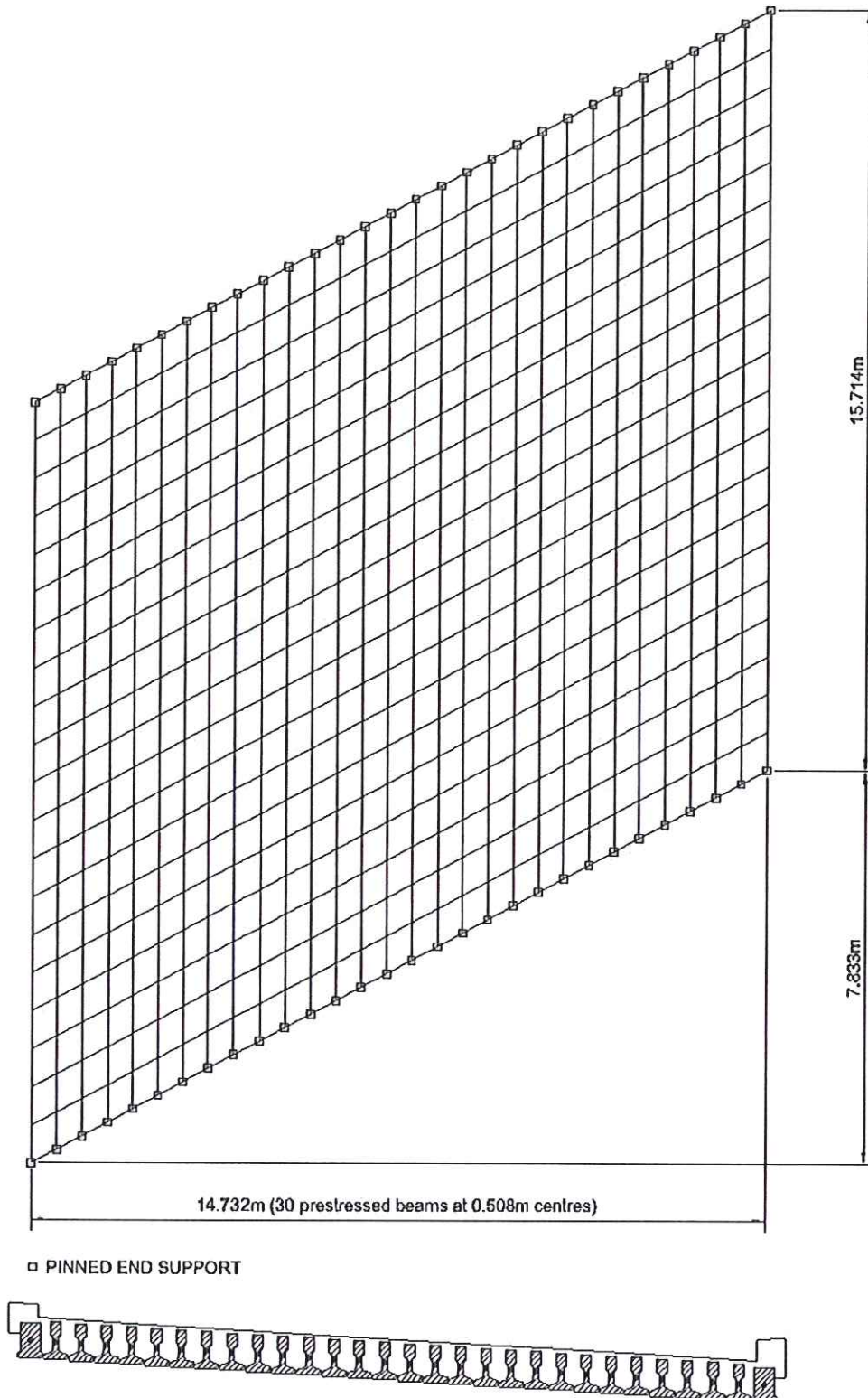
### Step 1 Simply supported line beam analysis

- Determine dead and superimposed dead bending moment and shear force distributions.
- 0.508m width beam



Step 2: Grillage analysis of deck

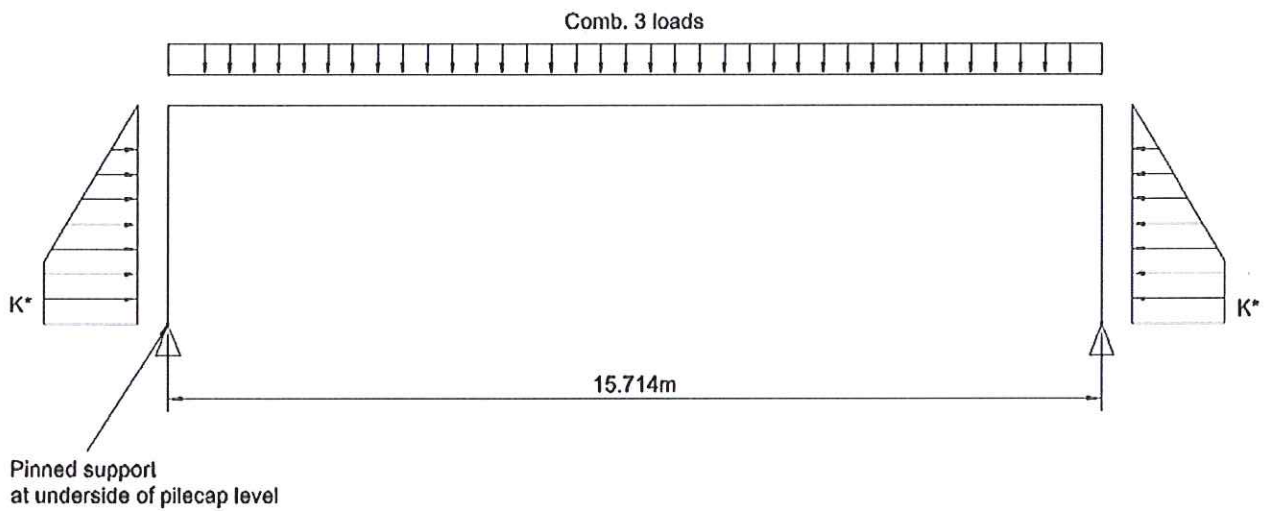
- Determine live loading combinations 1 and 3 maximum sagging moment
- Determine live loading combinations 1 and 3 shear force distributions
- Determine vertical deck design load for piles





Step 3: Soil structure interaction analysis

- 0.508m width of deck
- Apply combination 3 live loads to deck and passive earth pressures to abutments
- Determine hogging moments at beam ends
- Determine bending moments for pile design
- Determine bending moment and shear force distribution in abutment stem walls



Step 4: Pile design

- Abutment movement and rotation applied to pileheads

