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East Sussex County Council

East Sussex County Council
Transport and Environment

Bexhill to Hastings Link Road
S14 Decoy Pond Underbridge
Approval in Principle

Doc. Ref: B1297000-PH2/1600.06a/0014
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Project:	Bexhill to Hastings Link Road
Client:	East Sussex County Council
Document title:	Decoy Pond Underbridge AIP
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DATE 07/09/2012	INITIALS [redacted]	INITIALS [redacted]	INITIALS [redacted]	INITIALS [redacted]
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Revision Summary

Client: East Sussex County Council
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Transport and Environment
Job No: B1297000

REVISION / DATE	COMMENT
Rev 0 07/09/12	Amended to incorporate TAA comments raised on Phase 1 AIP ref. B1297000-PH1/1600.06a/0014 (rev 0) Wingwall arrangement modified. Verge widths reduced with Departure included. Analysis proposals substantially revised with additional Idealised Diagram information included in Appendix D. Geotechnical information updated.

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 a stream, which flows from north to south, and a 3.5m wide maintenance access road adjacent to the west bank. The stream feeds into Decoy Pond, located to the south of the bridge. The channel width, measured between the tops of opposing banks is approximately 8.0m 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 a stream feeding into Decoy Pond. The deck consists of prestressed concrete Y/YE beams acting compositely with a reinforced concrete slab. The deck is integral with reinforced concrete abutment walls supported on a piled foundation. The reinforced concrete wingwalls are set perpendicular to the abutment walls.

The parapet stringcourse will be cast in situ reinforced concrete.

The OS grid reference for the structure is 576773E, 110864N.

A ductile iron highway drainage pipe is attached behind the parapet system on the north side of the bridge.

An environmental barrier is attached to the outside of the south parapet stringcourse. 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.

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 piling.

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.

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.

3.3 Foundation type

Reinforced concrete bored or CFA piled foundation.

3.4 Span arrangements

Clear square span..... 13.1m Skew angle ..... 30.0 degrees

Clear skew span 15.11m

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.

A timber environmental (noise) barrier is fixed behind the parapet system on the south side of the bridge.

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 located on the bridge deck or a MEWP located on the access road in front of the west abutment. A single lane closure of the link road will be necessary if an underbridge unit is utilised.

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). Alternatively, a MEWP positioned on the access road adjacent to the west abutment could be used. Environmental barriers shall be designed and detailed to be easily demountable in the event that they need to be removed to allow access.

A minimum 3.5m wide access road is to be provided in front of the west abutment wall. Approximately 5.0m of clear headroom will be provided from the access road level to the underside of the deck soffit, exceeding the 2.3m minimum clear headroom required.

A minimum 2.0 wide clearance to top of bank will be provided in front of the east abutment wall. A minimum headroom of 1.5m will be provided from the top of bank level to the underside of the precast beams.

Inspection and maintenance of the remaining deck soffit, top surface, 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 Y and YE beams	XD1
C40/50	Deck slab	
	Top	XC3
	Cantilever soffit	XD1
	Parapet plinths	XD3
C40/50	Abutment, exposed face below deck	XD1
	Abutment, wingwalls exposed side faces	XD3
	Abutment, wingwalls buried	DC-1
C32/40	Concrete 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.	

Reinforcement

All reinforcement to be grade 500B or 500C deformed bars to BS 4449:2005.

Dowels to be stainless steel : Strength Grade 500, material designation 1.4436 complying with BS 6744:2001 +A2:2009.

Parapets

Painted (HA Type IV), galvanised steel.

Exposure classification to be Inland Difficult Access – no maintenance up to 12 years, minor maintenance after 12 years, major maintenance after 20 years. Colour to be confirmed.

Backfill to abutments and retaining walls

Fill material to structures to be Class 6N or 6P in accordance with DoT Specification for Highway Works.

Concrete Finishes

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	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 Cl. 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 Cl. 2004.

3.8.2 Sustainability issues

Conventional construction materials are proposed, 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' 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

Full HA loading in accordance with BD 37/01

4.1.2 Loading relating to General Order traffic under STGO regulations

45 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 ground treatment ie 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

Actual minimum headroom provision is approximately 5m due to mainline vertical alignment constraints arising from the existing topography ie a large cutting to the east of the structure.

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 at least 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. 2.3m minimum headroom to access track at west abutment.
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

- Departure D3: Verges over/under Structures
- Implementation of CHE Memorandum 227/08 - Deletion of requirement for impregnation with hydrophobic pore lining impregnant
- Implementation of IAN 96/07 Rev 1 Guidance On Implementing Results Of Research On Bridge Deck Waterproofing
- Use of permanent formwork with deflection characteristics exceeding span/300

See Appendix E

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. Torque/twisting effects from unbalanced earth pressure behind opposing abutments will be considered.

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

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

Model layout will be based on the recommendations given in 'Bridge Deck Behaviour, Second Edition' by E.C. Hambly.

See Appendix D

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.

Global member stiffness for analysis will be determined as either composite or non-composite as appropriate to the construction or the permanent stage under consideration.

5.4 Proposed earth pressure coefficients (k_a, k_0, 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^3, maximum ø' = 45°, K_o = 0.6 and Kp = 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_0 = 0.43 (calculated in accordance with BD 30/87). k_a will be used for stability calculations and k_0 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/9141	Title Decoy Pond Underbridge AIP General Arrangement
Appendix C	Geotechnical Information	Draft Geotechnical Report Highway Structure Summary Sheet.
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
Date: 13/09/12

Engineering Qualifications: BEng(Hons), CEng MICE

9.2 Endorsement by contractor

Signed 

Name: S.LAPTHORN
Position: Design Coordinator
Date: 20/09/12

Engineering Qualifications: MEng(Hons) CEng MICE.
Hochtief Vinci Joint Venture

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

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

Miscellaneous

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

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

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

Traffic Management Act 2004

The Manual of Contract Documents for Highway Works (MCDHW)

Volume 1:	Specification for Highway Works 1998, including amendments to May 2009
Volume 2:	Notes for Guidance on the Specification for Highway Works 1998, including amendments to May 2009
Volume 3:	Highway Construction Details 1991, including amendments to November 2008

The Design Manual for Roads and Bridges (DMRB)

Bridges and Structures (BA Series)	*Reproduced on following pages*
Bridges and Structures (BD Series)	*Reproduced on following pages*
Bridges and Structures, Technical Memoranda (BE Series)	*Reproduced on following pages*

Traffic Engineering and Control, Standards (TD Series)

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

Highways, Advice Notes (HA Series)

~~HA 59/92~~	~~Mitigating Against Effects on Badgers~~
HA 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

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: I979 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: I990
~~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 49/01~~	~~Design Rules for Aerodynamic Effects on Bridges~~
~~BD 50/92~~	~~Technical Requirements for the Assessment and Strengthening Programme for Highway Structures Stage 3 – Long Span Bridges~~
~~BD 51/98~~	~~Portal and Cantilever Signs/Signal Gantries~~
~~BD 53/95~~	~~Inspection and Records for Road Tunnels~~
~~BD 54/93~~	~~Post-tensioned Concrete Bridges, Prioritisation of Special Inspections~~
~~BD 56/96~~	~~The Assessment of Steel Highway Bridges and Structures~~
BD 57/01	Design for Durability
~~BD 58/94~~	~~The Design of Concrete Highway Bridges and Structures with External and Unbonded Prestressing Design of Highway Bridges for Vehicle Collision Loads~~
~~BD 60/04~~	~~Design of Highway Bridges for Vehicle Collision Loads~~
~~BD 61/96~~	~~The Assessment of Composite Highway Bridges~~
BD 62/07	As Built, Operational and Maintenance Records for Highway Structures
~~BD 63/07~~	~~Inspection of Highway Structures~~
~~BD 65/97~~	~~Design Criteria for Collision Protector Beams~~
~~BD 67/96~~	~~Enclosure of Bridges~~
~~BD 68/97~~	~~Crib Retaining Walls~~
~~BD 70/03~~	~~Strengthened/Reinforced Soils and Other Fills for Retaining Walls and Bridge Abutments Use of BS8006: 1995, incorporating Amendment No. 1 (Issue 2 March 1999)~~
BD 74/00	Foundations
~~BD 78/99~~	~~Design of Road Tunnels~~
~~BD 79/06~~	~~The Management of sub Standard Highway Structures~~
~~BD 81/02~~	~~Use of Compressive Membrane Action in Bridge Decks~~
~~BD 82/00~~	~~Design of Buried Rigid Pipes~~
~~BD 84/02~~	~~Strengthening of Concrete Bridge Supports Vehicle Impact Using Fibre Reinforced Polymers~~
~~BD 85/08~~	~~Strengthening Highway Structures Using Externally Bonded Fibre Reinforced Polymer~~
~~BD 86/07~~	~~The Assessment of Highway Bridges and Structures For The Effects of Special Types General Order (STGO) and Special Order (SO) Vehicles~~
~~BD 87/05~~	~~Maintenance Painting of Steelwork~~

STANDARDS - BRIDGES AND STRUCTURES (BD SERIES)

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

TECHNICAL MEMORANDA - BRIDGES (BE SERIES)

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

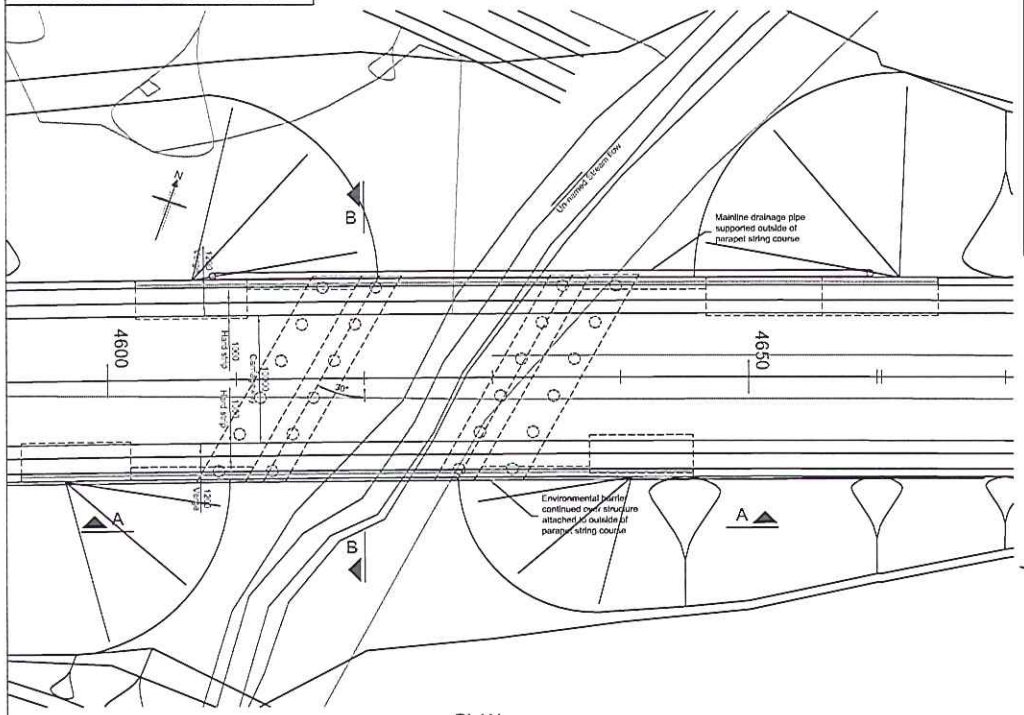
INTERIM ADVICE NOTES (IAN)

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

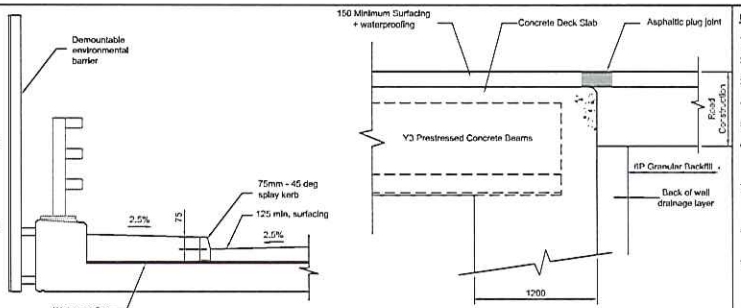
Appendix B Drawings

Drawing No	Title
B1297000-PH2/1600.06a/9141	Decoy Pond Underbridge AIP General Arrangement

Drawing number / Rev
B1297000/PH2/1600.01A/9141/0

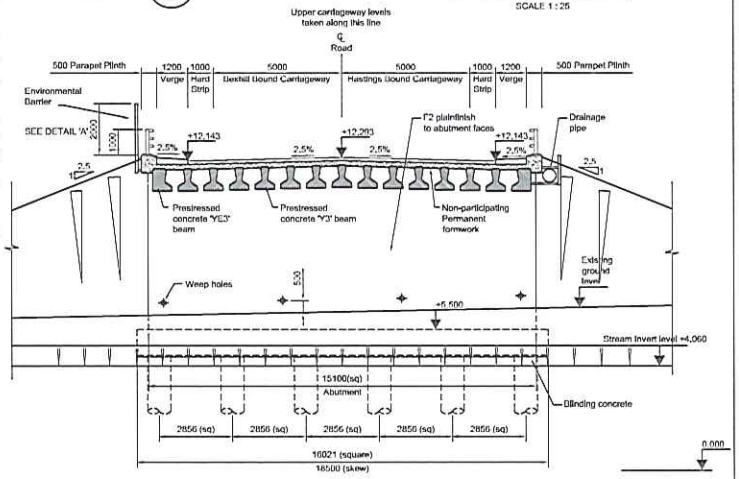


PLAN
SCALE 1 : 200

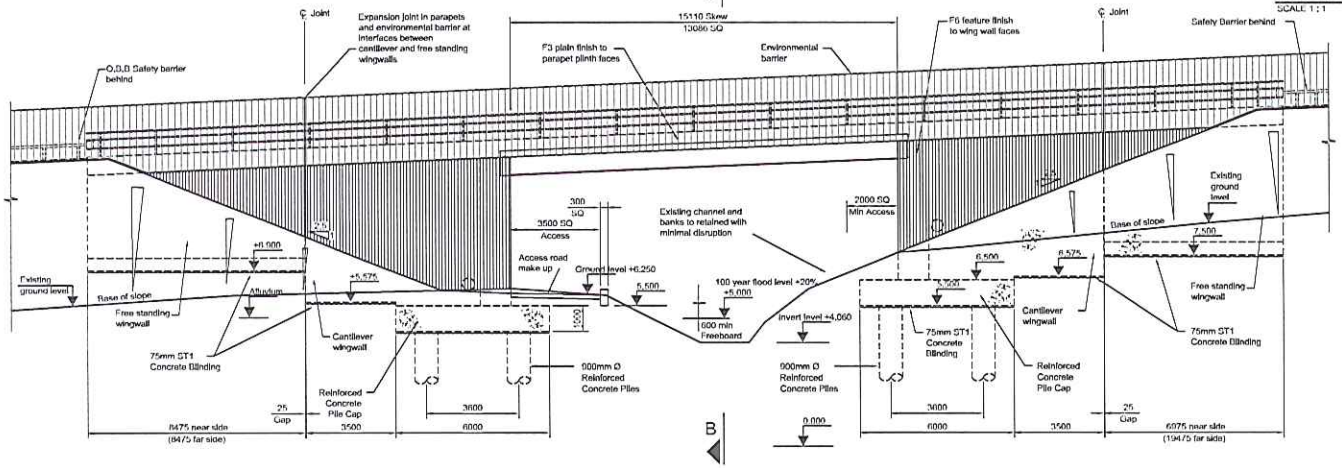


DETAIL A
SCALE 1 : 50

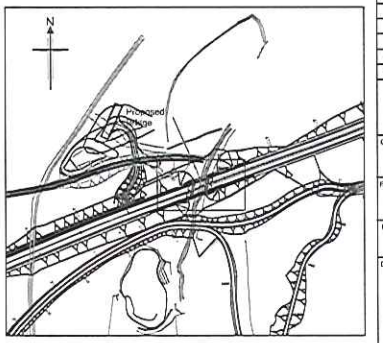
FULLY INTEGRAL ABUTMENT DECK CONNECTION
SCALE 1 : 25



SECTION B
SCALE 1 : 1



ELEVATION A
SCALE 1 : 100



LOCATION PLAN
SCALE 1 : 2500

Notes

1. All dimensions in millimetres unless noted otherwise.
2. All levels in metres above Ordnance Datum - Newlyn.
3. Do not scale from this drawing.
4. Backfill to be 6N or 6P.
5. All external arrises to have 25 x 25mm chamfers.
6. Gulleys shall be provided in the roadside channels immediately to the east (uphill) side of the bridge to minimise the flow of surface water across the pavement / abutment interface.
7. Approach embankments constructed in advance of bridge works. Ground treatment below approach embankments to limit differential settlement where necessary.
8. Both abutments to be backfilled simultaneously with a level difference not exceeding 0.5m.
9. All structural section thicknesses are approximate and subject to change at detailed design stage.

0 0.5 1.0 1.5 2.0 2.5 m
SCALE 1 : 25

0 1 2 3 4 5 6 7 8 9 10 m
SCALE 1 : 100

0 5 10 15 20 m
SCALE 1 : 200

0 50 100 150 200 250 m
SCALE 1 : 2500

Rev	Rev. Date	Purpose of revision	Drawn	Checked	Revd	Apprvd
0	30/08/12	FOR APPROVAL IN PRINCIPLE	RH	PB	PB	ND

JACOBS
Sinclair House, 6 Cherry Orchard Road, Croydon, CR9 6BE
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www.jacobs.com

Client: HOCHTIEF/VINCI JOINT VENTURE

Employer: EAST SUSSEX COUNTY COUNCIL

Project: BEXHILL TO HASTINGS LINK ROAD

Drawing title: DECOY POND UNDERBRIDGE GENERAL ARRANGEMENT

Drawing status: FOR APPROVAL IN PRINCIPLE

Scale	AS SHOWN @ A1	DO NOT SCALE
Jacobs No.	B1297000	
Client no.		

Drawing number: B1297000-PH2/1600.01A/9141 Rev 0

Appendix C Geotechnical Information

BEXHILL TO HASTINGS LINK ROAD

GEOTECHICAL SUMMARY INFORMATION

STRUCTURE NAME Decoy Pond Underbridge	**CHAINAGE and OS Grid Reference** Ch 4625 OS: 576773E, 110864N
Rev: 0	**DESIGN LIFE:** 120 years
SOILS/GEOLOGY	**RELEVANT EXPLORATORY HOLES:** BH25 (May Gurney, 2006), BH159, BH160 (URS Investigation, 2009)
Strata	**Typical depths**
East Abutment Alluvium Ashdown Formation *West Abutment* Alluvium Ashdown Formation	 9.32 to 6.70m OD below 6.70m OD 6.05 to 0.05 m OD below 0.05 m OD
PREVIOUS GROUND HISTORY	Agricultural land and floodplain
CONTAMINATED GROUND RISK ASSESSMENT REQUIRED	No

GROUNDWATER

Groundwater was encountered initially at levels between 0.05m OD (6m bgl – BH25) and 5.71m OD (3m bgl – BH 159) within Ashdown Formation and rose to maximum levels of between 5.85m OD (0.2m bgl – BH 25) and 7.02m OD (2.3bgl – BH160) after 20 minutes. A second groundwater strike encountered confined groundwater in BH159 at a level of 3.11m OD (5.6m) and rose to a level of 4.71 m OD (4m bgl) in 20 minutes.

Groundwater monitoring was carried out in BH25 between April 2006 and March 2010. Results indicate groundwater level at ground level. Artesian condition was also recorded. Thus for preliminary design, groundwater level is assumed at ground level.

EARTH PRESSURE VALUE K_0* K_a* Kp*

See Section 5.4 of the AIP

TYPE OF FOUNDATION	Piled foundation

BEARING CAPACITY	Not used			
Structure Element	Founding Stratum	Founding Level (m OD)	Footing Size	Allowable Bearing Pressure (kN/m2)

PILE DESIGN					
Structure Element	Founding Stratum	Toe Level (m OD)	Pile dia (m)	Pile length (m)	Pile working Load (kN)
East Abutment (Hastings End)	Ashdown Formation	-13.5	0.9	19	2700
West Abutment (Bexhill End)	Ashdown Formation	-21.5	0.9	26	2150

Note: Pile lengths and toe levels are approximate.

Pile type: Bored / CFA

Criteria for selecting pile toe level: Allowable pile capacity

Allowance for negative skin friction within design:

- No negative skin friction considered for East Abutment.
- Negative skin friction considered for West Abutment.

SETTLEMENT

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)

CHEMICAL ANALYSIS

Buried Concrete classification:

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.

NOTES	

East Abutment (towards Hastings)

1. The ground sequence at the site is Made Ground/Alluvium and Ashdown Formation. The available information from boreholes indicates Ashdown Formation layer at 2.0m bgl. No Made Ground or Alluvium was encountered in BH160.

2. Based on the formation level of the structure, the Abutment will likely be founded on the stiff to very stiff Silt / Clay of the Ashdown Formation. The allowable bearing capacity of this stratum at the formation level of 6.25m OD is 200kN/m2. Thus, a shallow foundation is an option if the loads due to the structure are less than the allowable bearing capacity.

3. Alternatively, for structural loadings producing loads greater than the allowable bearing capacity, pile foundations are recommended.

West Abutment (towards Bexhill)

1. The ground sequence at the site is Topsoil, Alluvium and Ashdown Formation. The available information from boreholes indicates Ashdown Formation layer at 6.0m bgl.

2. Based on the formation level, the structure will likely be founded on soft Alluvium layer, which is underlain by soft/firm to very stiff interbedded sands, silts and clays of the Ashdown Formation. The low shear strength of the Alluvium layer prevents the use of thise layers as a bearing stratum due to the risk of excessive settlements and failure. The maximum thickness of the Alluvium is 6.0m. Hence, the load due to the structure will need to be transferred to the competent Ashdown Formation. Thus, pile foundations are recommended

The behaviour of the groundwater indicates likely presence of confined aquifer. This should be considered during construction

MAY GURNEY

Site	Borehole Number
Bexhill to Hastings Link Road	BH25

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 18.60m	6.05	East Sussex County Council	SI1085
	Location	**Dates**	**Engineer**	**Sheet**
	576740.918 E 110877.093 N	13/03/2006-14/03/2006	Owen Williams	1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.10-0.40	B1					(0.40)	Grass onto TOPSOIL. Brown CLAY with occasional roots.		▽1	
0.40-1.00	B2				5.65	0.40	Soft firm mottled orange brown and light grey CLAY.			
1.00	D1					(1.60)				
1.50	U1			30 blows						
2.00-2.45	SPT N=0			0,0/0,0,0,0	4.05	2.00	Soft grey SILT with many dark brown and black organic pockets			
2.00	D2									
2.00-2.50	B3									
3.00	D3									
3.50	U2			55 blows						
4.00-4.45	SPT N=0	4.00		0,0/0,0,0,0		(4.00)				
4.00	D4									
4.00-4.50	B4									
5.00	D5									
5.50	U3			100 blows						
6.00	D6			Fast(1) at 6.00m, rose to 0.20m in 20 mins.	0.05	6.00	Weak SANDSTONE recovered as an orange brown slightly sandy angular to subangular fine to coarse sandstone gravel		▽1	
6.00	W1									
6.00-6.50	B5									
6.00-6.45	SPT N=6	5.50	3.30	1,0/0,1,2,3		(1.00)				
7.00	D7				-0.95	7.00	Stiff mottled orange, brown and light grey SILT with rare sandstone bands			
7.50	U4			100 blows						
8.00-8.45	SPT N=27	7.30	2.80	3,5/6,7,7,7						
8.00	D8									
8.00-8.50	B6									
9.00	D9									
9.50	U5			90 blows		(5.00)				
10.00-10.45	SPT N=39	8.70	2.30	4,6/9,9,9,12						

Remarks
Hand excavated pit to 1.20m
50mm diameter standpipe installed with raised cover protected by fence
PID reading adjacent to BH at 0.30m bgl = 0.4ppm

Scale (approx)	Logged By
1:50	JE/AK

Figure No. SI1085.BH25

MAY GURNEY

Site	Borehole Number
Bexhill to Hastings Link Road	BH25

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 18.60m	6.05	East Sussex County Council	SI1085
	Location	**Dates**	**Engineer**	**Sheet**
	576740.918 E 110877.093 N	13/03/2006-14/03/2006	Owen Williams	2/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.00 10.00-10.50	D10 B7									
11.00	D11					(5.00)				
11.50	U6			100 blows						
12.00-12.45 12.00 12.00-12.50	SPT N=23 D12 B8	11.50	3.20	3,9/7,6,5,5	-5.95	12.00	Very stiff grey slightly sandy CLAY			
13.00	D13									
13.50	U7			150 blows						
14.00-14.14 14.00 14.00-14.50	SPT 25*/75 50/65 D14 B9	13.50	3.20	25/50						
15.00	D15									
15.50	U8			150 blows						
16.00-16.18 16.00 16.00-16.50	SPT 25*/75 50/105 D16 B10	15.50	3.80	25/38,12		(8.00)				
17.00	D17									
17.50 17.50-17.70	U9 D18			150 blows						
18.00-18.32 18.00 18.00-18.50	SPT 25*/130 50/190 D19 B11	17.50	2.80	17,8/16,19,15						
19.00	D20									
19.50	U10			125 blows						
20.00-20.15	50/75 SPT 25*/75	18.90	3.20	25/50	-13.95	20.00				

Remarks

Scale (approx)	Logged By
1:50	JE/AK

Figure No. SI1085.BH25

MAY GURNEY

Site Bexhill to Hastings Link Road			**Borehole Number** BH25
Boring Method Cable Percussion	**Casing Diameter** 150mm cased to 18.60m	**Ground Level (mOD)** 6.05	**Client** East Sussex County Council	**Job Number** SI1085
	Location 576740.918 E 110877.093 N	**Dates** 13/03/2006-14/03/2006	**Engineer** Owen Williams	**Sheet** 3/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
20.00	D21									

Remarks

Scale (approx)	Logged By
1:50	JE/AK

Figure No. SI1085.BH25

Contract No: 49325727

Project: Bexhill - Hastings Link Road

Client: East Sussex County Council

URS

Record of Borehole

BH159

SAMPLES & In situ TESTS			Water	STRATA				
Depth	Type/ No.	SPT/U4 (Blows)		Reduced Level (mOD)	Legend	Depth (Thick-ness)	DESCRIPTION	Instru-ment/ Backfill
0.50	D1					(1.00)	Very soft, grey brown and orange/brown, slightly sandy clay, with frequent fine rootlets and rare fine, angular, red brick fragments. Sands are fine. (MADE GROUND)	
1.00	D2			7.71		1.00		
1.50	U3	(25 - 450mm)				(1.00)	Soft, grey/brown and orange/brown mottled CLAY, with rare, up to 5mm horizontally aligned, dark orange/brown lithorelics, and occasional fine rootlets. (ALLUVIUM)	
2.00	D4		1	6.71		2.00		
2.50	U5	(100 - 450mm)					Firm, very closely fissured, orange/brown and light grey mottled slightly silty CLAY, with occasional dark orange iron staining present along fissures. (ASHDOWN BEDS)	
3.00	D6 W7 D8	N=62 (5/15/15/12/11/14)	1				Very stiff from 3.0m bgl.	
3.50	U	(100 - 0mm)		5.11		3.60		
3.60	D9 B10		2				Poor recovery; recovered as dense, medium-brown, medium grained slightly clayey SAND, with frequent medium to coarse, angular gravels of thickly colour laminated, dark and dark orange/brown sandstone. Iron staining present on sandstone. (ASHDOWN BEDS)	
4.50	SPT11	N=33 (6/8/11/9/7/6)		4.11		4.60		
5.50	U	(100 - 0mm)	3			(1.00)	Poor recovery; recovered as medium dense, orange/brown and light grey mottled slightly sandy SILT with occasional medium, angular, iron stained, sandstone gravels. Sands are fine. (ASHDOWN BEDS)	
5.60	B13 W12			3.11		5.60		
6.50	SPT14	N=18 (4/7/5/7/2/4)					Stiff, very closely fissured, light grey, mottled orange/brown SILT. (ASHDOWN BEDS)	
7.30	D15			1.41		7.30		
7.50	SPT16	N=32		1.21		7.50	Medium-strong, very closely fractured, orange/brown and light grey mottled SILTSTONE.	

Boring Progress and Water Observations

Date	Time	Hole Depth	Cas'g Depth	Cas'g Dia	Water Depth	Rose to	Time (mins)	Sealed (m)
28/01/09	15.45	3.00	0.00		3.00	2.10	20	
28/01/09	16.15	3.00	0.00		2.00			
29/01/09	08.00	3.00	0.00		1.00			
29/01/09	10.30	5.60	3.20	150	5.60	4.00	20	

Chiselling

From	To	Time (hh:mm)
3.60	3.70	00:15
7.20	7.30	00:15

Water Added

From	To

GENERAL REMARKS

Draft
150mm casing to 3.2m bgl.
During logging no visible or olfactory evidence of contamination.
Groundwater struck at 3.0m and 5.6m bgl.
Chiseled from 3.6m - 3.7m bgl, 7.2m - 7.3m bgl and 8.0m - 8.05m bgl.
Zone of weathering interpreted from from Spinks et al. 1993: (V); (IV); (III); (II);(I).

Logged by:	Equipment:	Location:	Ground Level:	Date:	Scale:
HH	Cable Percussion Rig - Dando 2000	576791.6 E	8.71	28/01/2009 Start	1:40.0
Checked by: CAB	Contractor: Southern Testing Laboratories Ltd	110853.9 N	mAOD	29/01/2009 End	Sheet 1 of 2
Status: Draft					

Contract No: 49325727

Project: Bexhill - Hastings Link Road

Client: East Sussex County Council

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Record of Borehole

BH159

SAMPLES & In situ TESTS			Water	STRATA				
Depth	Type/ No.	SPT/U4 (Blows)		Reduced Level (mOD)	Legend	Depth (Thick-ness)	DESCRIPTION	Instru-ment/ Backfill
		(6/7/8/7/7/10)					(Possible siltstone band within the strata) (ASHDOWN BEDS)	
				0.71		8.00	Stiff, orange/brown and light grey mottled SILT, with rare, dark-orange iron staining. (ASHDOWN BEDS)	
8.05	SPT17	N=>100 (25/70mm/-/60/40/50mm/-/-)		0.66		8.05	Medium-strong, very closely fractured, orange/brown and light grey mottled SILTSTONE. (Possible siltstone band within the strata) (ASHDOWN BEDS)	
							End of Borehole at 8.05m	

Boring Progress and Water Observations

Date	Time	Hole Depth	Cas'g Depth	Cas'g Dia	Water Depth	Rose to	Time (mins)	Sealed (m)

Chiselling

From	To	Time (hh:mm)
8.00	8.05	00:15

Water Added

From	To

GENERAL REMARKS

Draft
150mm casing to 3.2m bgl.
During logging no visible or olfactory evidence of contamination.
Groundwater struck at 3.0m and 5.6m bgl.
Chiseled from 3.6m - 3.7m bgl, 7.2m - 7.3m bgl and 8.0m - 8.05m bgl.
Zone of weathering interpreted from from Spinks et al, 1993: (V); (IV); (III); (II);(I).

Logged by:	Equipment:	Location:	Ground Level:	Date:	Scale:
HH	Cable Percussion Rig - Dando 2000	576791.6 E	8.71	28/01/2009 Start	1:40.0
Checked by: CAB	Contractor: Southern Testing Laboratories Ltd	110853.9 N	mAOD	29/01/2009 End	Sheet 2 of 2
Status: Draft					

URS Corporation Ltd Horne Lane Bedford MK40 1TS Telephone: 01234 345641 www.URSCorp.com

Contract No: 49325727

Project: Bexhill - Hastings Link Road

Client: East Sussex County Council

URS

Record of Borehole

BH160

SAMPLES & In situ TESTS			Water	STRATA				
Depth	Type/ No.	SPT/U4 (Blows)		Reduced Level (mOD)	Legend	Depth (Thick-ness)	DESCRIPTION	Instru-ment/ Backfill
				8.82		0.50	Firm reddish brown slightly gravelly slightly sandy CLAY. Gravel is weak grey and orange brown subangular fine to medium sandstone and siltstone. Sand is fine to coarse. Fine rootlets. (IV) (ASHDOWN BEDS)	
0.50	D1							
1.00	D2			8.12		1.20	Firm orangish brown slightly sandy CLAY and frequent randomly orientated lithorelics of very weak dark orangish brown subangular fine to medium siltstone. Sand is fine to coarse. (IV) (ASHDOWN BEDS)	
1.20	D3							
1.50	U4	(35 - 450mm)		7.32		2.00	Firm orangish brown and bluish grey slightly silty CLAY and frequent randomly orientated lithorelics of very weak to weak thinly laminated light and dark orange brown dark orange brown stained subangular fine to coarse siltstone. Sand is fine to coarse. (IV) (ASHDOWN BEDS)	
2.00	D5		1				Stiff orangish brown/brownish yellow and bluish grey/light grey, occasionally black stained SILT interbedded with weathered siltstone. Recovered as silt and lithorelics/gravel of very weak to weak occasionally thinly laminated orangish brown/light brownish yellow and light grey/bluish grey dark orange brown stained subangular fine to coarse siltstone. Sand is fine to coarse. (III - II) (ASHDOWN BEDS)	
2.50	U6	(50 - 450mm)						
3.00	D7 SPT8	N=27 (5/7/7/6/7/7)						
3.50	U9	(70 - 450mm)						
4.00	D10 W11		1					
4.50	SPT12	N=25 (7/10/7/7/6/5)						
5.50	U B13	(100 - 0mm)		3.82		5.50	Very weak to medium strong slightly weathered SILTSTONE interbedded with dark grey and brown, orange brown stained SILT. Recovered as very weak to weak thinly to thickly laminated orangish brown and grey blocky/flat subangular fine to coarse silty gravel/ gravelly silt and cobbles of siltstone. Discontinuities extremely closely to closely spaced. Black staining along discontinuity surfaces. (III - II) (ASHDOWN BEDS)	
6.50	SPT14	N=50 (6/7/10/12/14/14)						
7.40	D15							
7.50	SPT16	N=>100						

Boring Progress and Water Observations

Date	Time	Hole Depth	Cas'g Depth	Cas'g Dia	Water Depth	Rose to	Time (mins)	Sealed (m)
29/01/09	15.00	4.00	2.70	150	4.00	2.30	20	
29/01/09	16.30	6.00	5.30	150	2.30			

Chiselling

From	To	Time (hh:mm)
7.40	7.50	00:15

Water Added

From	To

GENERAL REMARKS

Draft
During logging no visible or olfactory evidence of contamination. Groundwater encountered at 4.0m bgl rising to 2.3m bgl after 20mins. Zone of weathering interpreted from from Spinks et al. 1993: (V); (IV); (III); (II);(I).

Logged by:	Equipment:	Location:	Ground Level:	Date:	Scale:
JB	Cable Percussion Rig - Dando 2000	576802.7 E	9.32	29/01/2009 Start	1:40.0
Checked by: CAB	Contractor: Southern Testing Laboratories Ltd	110876.8 N	mAOD	30/01/2009 End	Sheet 1 of 2
Status: Draft					

Contract No: 49325727

Project: Bexhill - Hastings Link Road

Client: East Sussex County Council

URS

Record of Borehole

BH160

SAMPLES & In situ TESTS			Water	STRATA				
Depth	Type/ No.	SPT/U4 (Blows)		Reduced Level (mOD)	Legend	Depth (Thick-ness)	DESCRIPTION	Instru-ment/ Backfill
		(5/14/20/20/35/25/40mm)						
				1.32		8.00		
8.00	D17						**End of Borehole at 8.00m**	

Boring Progress and Water Observations

Date	Time	Hole Depth	Cas'g Depth	Cas'g Dia	Water Depth	Rose to	Time (mins)	Sealed (m)
30/01/09	12.00	8.00	5.70	150	2.30			

Chiselling

From	To	Time (hh:mm)
7.80	8.00	01:00

Water Added

From	To

GENERAL REMARKS

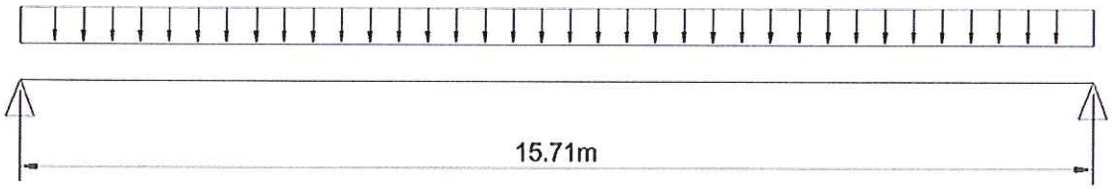
Draft
During logging no visible or olfactory evidence of contamination. Groundwater encountered at 4.0m bgl rising to 2.3m bgl after 20mins. Zone of weathering interpreted from from Spinks et al. 1993: (V); (IV); (III); (II);(I).

Logged by:	Equipment:	Location:	Ground Level:	Date:	Scale:
JB	Cable Percussion Rig - Dando 2000	576802.7 E	9.32	29/01/2009 Start	1:40.0
Checked by: CAB	Contractor: Southern Testing Laboratories Ltd	110876.8 N	mAOD	30/01/2009 End	Sheet 2 of 2
Status: Draft					

Appendix D Idealised Structure

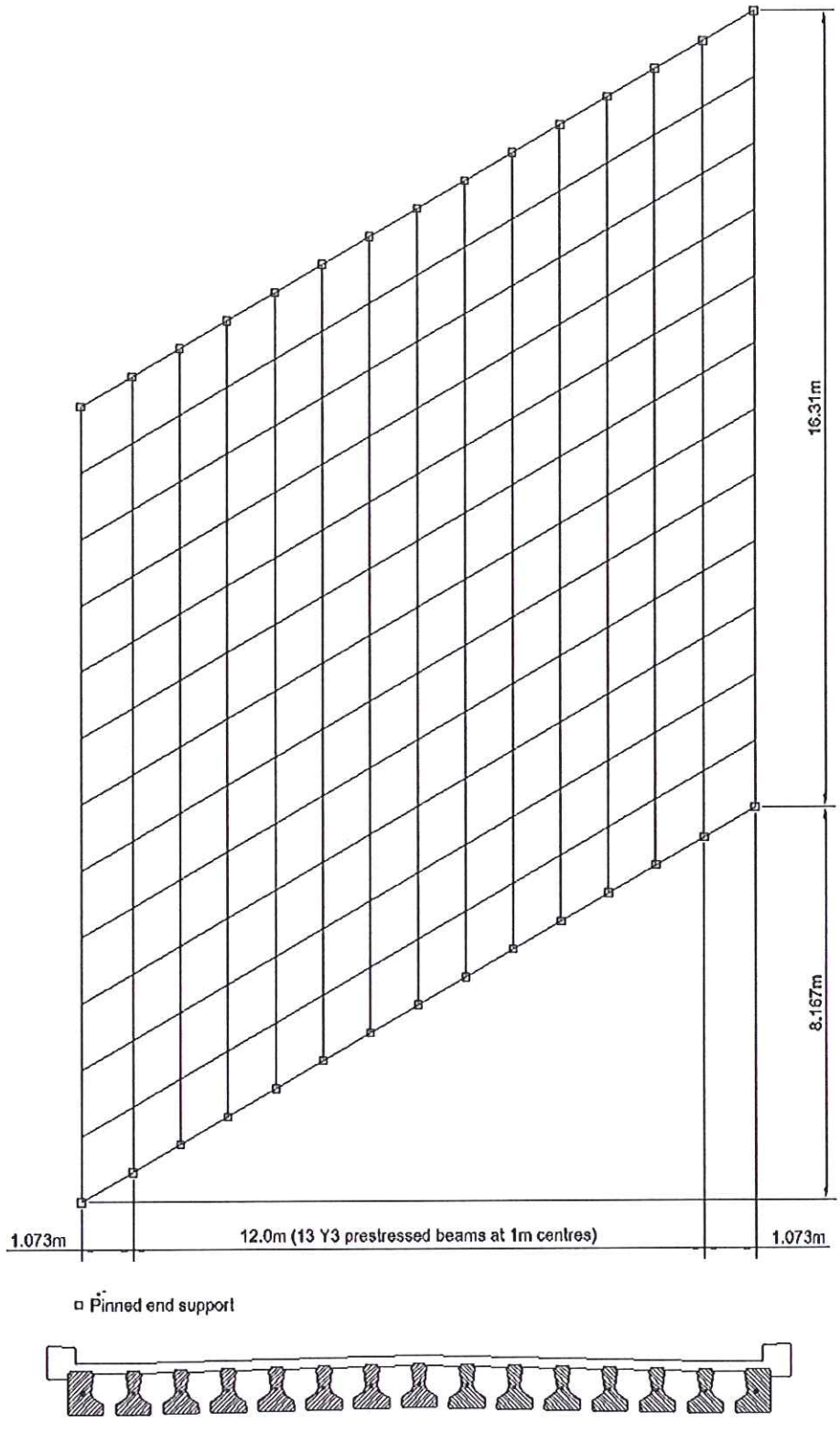
Step 1 Simply supported line beam analysis

- Determine dead and superimposed dead bending moment and shear force distributions for Y3 and YE3 prestressed beams.



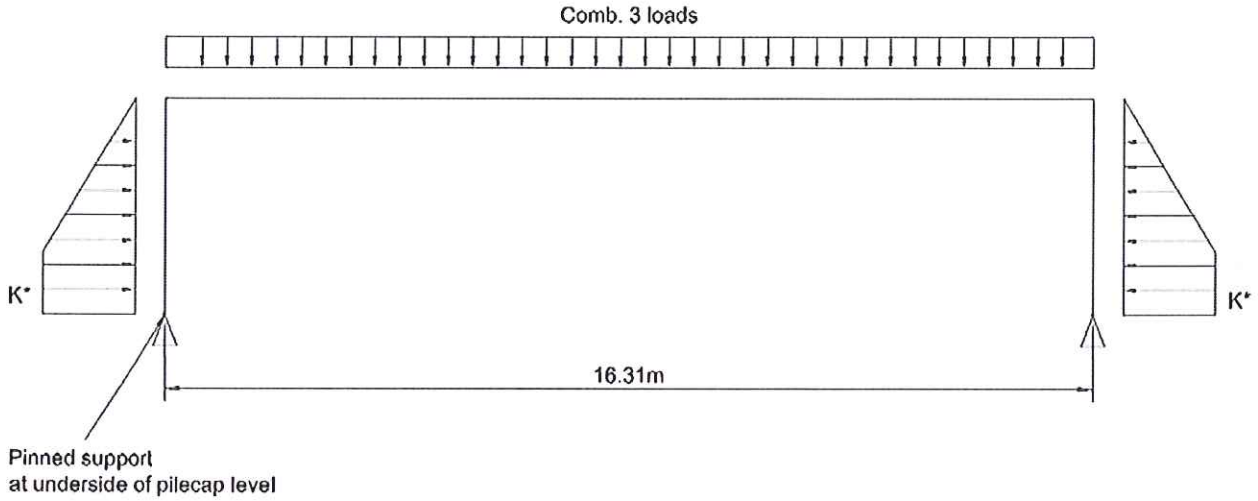
Step 2: Grillage analysis of deck

- 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



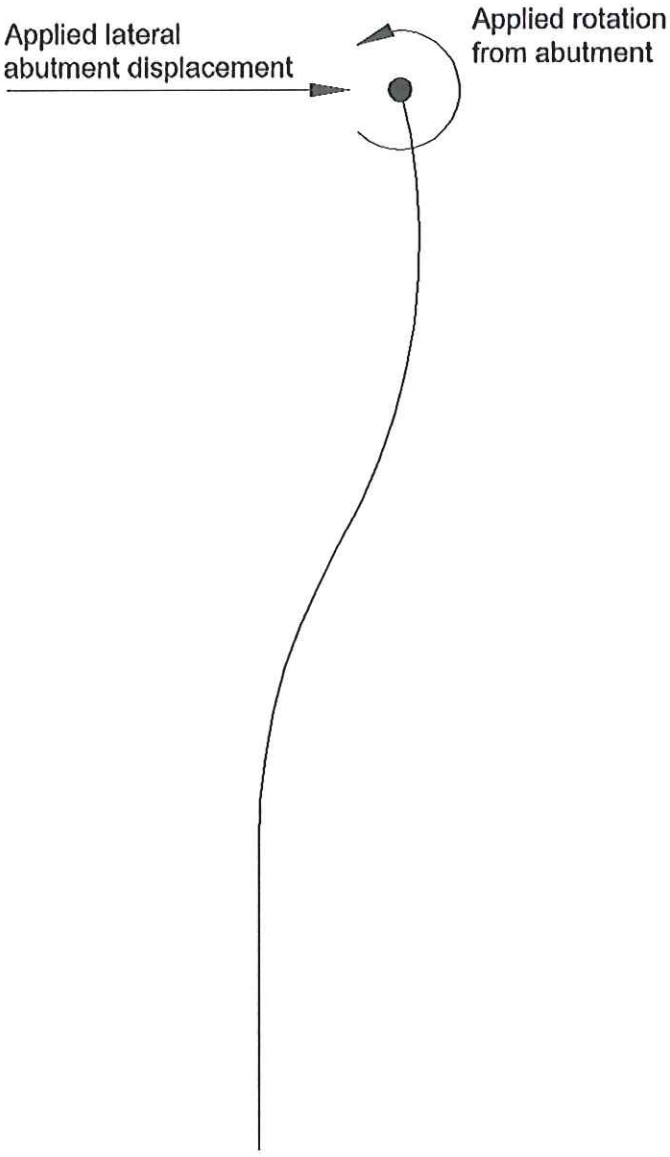
Step 3: Soil structure interaction analysis

- 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 pile heads



Appendix E Departures from Standards

Departure D3: Verges over/under Structures

Nature of Departure

A standard verge width of 2.5m has been applied along the scheme mainline. Where the mainline crosses over an underbridge, or under an overbridge, it has been decided to reduce the verge width to provide associated cost savings on structure construction. Verge widths will also be reduced on sideroads and accommodation works structures. The verges will be reduced to the minimum allowed, while ensuring necessary Stopping Sight Distance is maintained. The verge width will be tapered to the reduced width over an acceptable distance. Where verge widening has been provided around bends to maintain SSD these verges will not be minimised.

Reason for Departure

This departure is sought to minimise construction costs for the structures by minimising the necessary deck width. This departure is requested as the DMRB Standards require the verge width to be continuous and maintained over/under all structures. This leads to excessive structure widths which are uneconomical.

Mitigation Factors

There are no pedestrian facilities over any of the mainline structures so verge reduction will not impact NMUs in the majority of cases. On the accommodation overbridges, there will only be a minor usage, and the likelihood of NMUs coming into conflict with farm vehicles is minimal. In addition, these departures are only requested over short distances over/under structures.

Implications for Safety

Though a reduced verge width will mean vehicles running closer to either the abutments or parapets, a safe minimum required width will be provided. Where deemed necessary as a result of the RRRAP assessment, vehicle barriers will be installed to reroute any errant vehicles away from the parapets or abutments.

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 # Implementation of IAN 96

This Departure seeks approval:

- to delete the requirement for an Additional Protective layer of sand asphalt to waterproofing unless required by an individual waterproofing system.

- to permit the application of bridge deck waterproofing to concrete less than 28 days old, providing this is in accordance with the waterproofing manufacturer's requirements and the provision of special additional coating or treatment to the concrete surface as required.

The above to be in accordance with IAN 96 and all associated provisions of IAN 96 shall apply.

Departure - Deflection of permanent formwork units

BA 36/90 Clause 4.1.7 states that deflection of permanent formwork 4 hours after completion of concreting should not exceed 1/300 of the span of the formwork unit. It is proposed to use proprietary EMJ steel reinforced GRP permanent formwork units as permanent formwork to the concrete deck soffit. These units do not comply with the provisions of BD 36/90 Clause 4.1.7 and a Departure is sought to permit their use.

The reason for the deflection limit in BD 60 is not stated. There are several potential reasons for limiting deflection:

- Aesthetics/visual acceptability
- Avoidance of additional weight due to extra concrete required to make up the sag
- Consequent adverse effects on the design (extra dead weight and additional quantity) Compliance with design assumptions relating to reinforcement positioning and bar bending
- Risk of the deflected formwork units slipping off the support

In the case of the BHLR, the response to these concerns is as follows:

- It is unlikely that the sag in the formwork will be perceptible from ground level. There is no ready visual reference to which the sag can be related.
- The additional weight of concrete will be allowed for in the design and in the measure for the Initial Target Cost
- The design assumptions will allow for the additional dead weight and the effects of the additional sag on the reinforcement positioning and bar bending, including the provision of cover and calculation of crack widths.
- The width of the EMJ units will be chosen so that there is a sufficient and safe overlap of the units onto the beam flanges to obviate concerns regarding units slipping off supports.
- Design assumptions for deflections will be taken from EMJ product data, interpolating for intermediate span lengths and thicknesses of slab if necessary. Load testing as per Cl 4.1.6 will not be carried out.