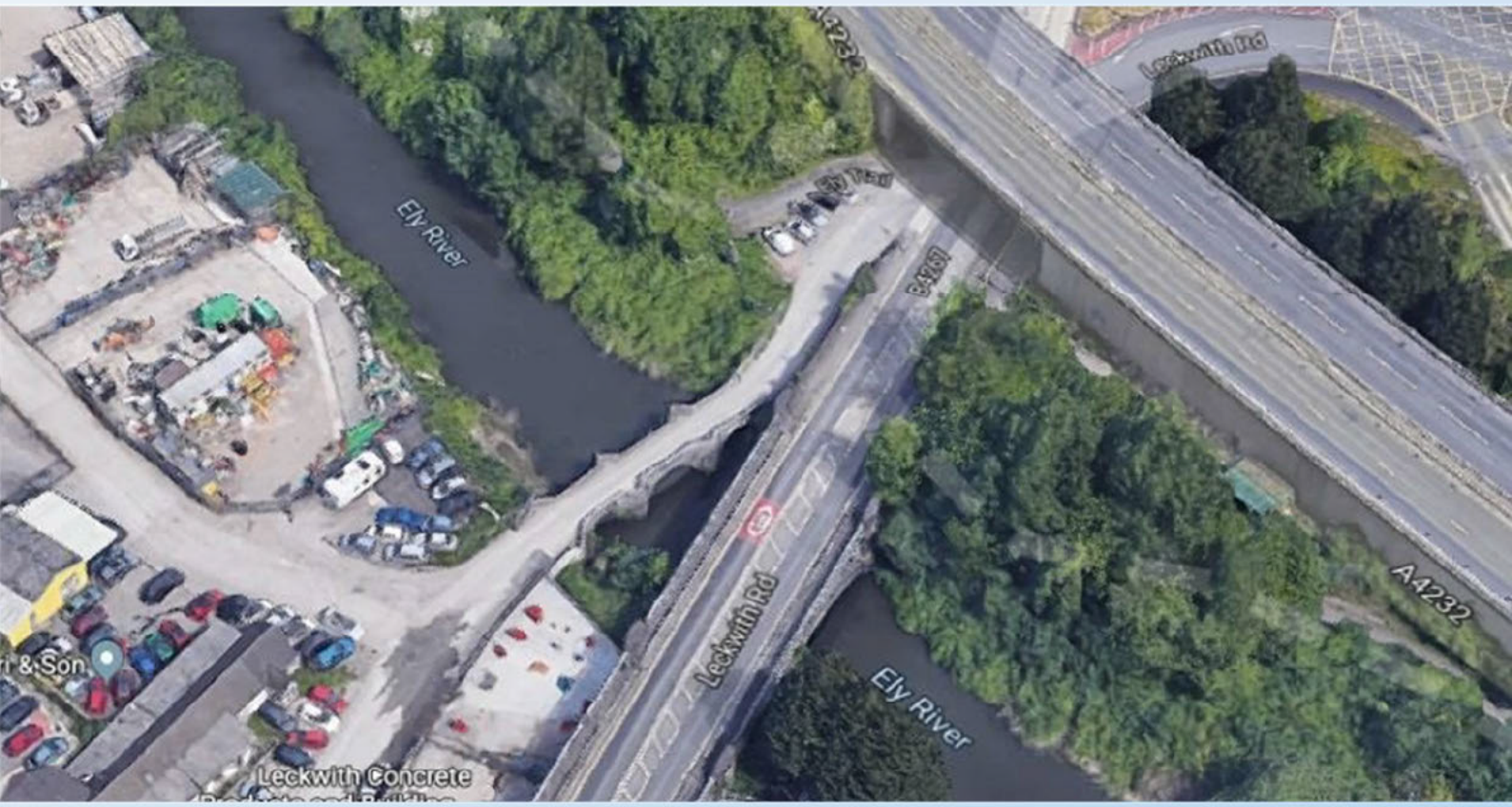
Vale of Glamorgan Council and City of Cardiff Council

TECHNICAL REPORT

Leckwith Quay Development, Ely River Bridge



70053561
SEPTEMBER 2020

CONFIDENTIAL

Vale of Glamorgan Council and City of Cardiff Council

TECHNICAL REPORT

Leckwith Quay Development, Ely River Bridge

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70053561

OUR REF. NO. 70053561

DATE: SEPTEMBER 2020

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2
Remarks	Draft	Final	Final
Date	October 2019	February 2020	September 2020
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Project number	70053561	70053561	70053561
Report number	70053561/STR/DOC/001	70053561/STR/DOC/001	70053561/STR/DOC/001
File reference			

CONTENTS

APPENDICES

1. HIGHWAY DETAILS

1.1. TYPE OF HIGHWAY

The proposed structure will support a re-alignment of the B4267 (Leckwith Road) to facilitate a proposed residential and commercial development on the site of an existing industrial park, which is located adjacent to the existing B4267 and the River Ely. It will also serve to bypass the existing Leckwith Viaduct which will be demolished as part of the development project and provide through traffic access to Llandough and Dinas Powys. The proposed highway over the structure will consist of two westbound lanes to facilitate a right turn into the proposed development and a single east bound/left turn lane. The width of the carriageway will vary from a minimum of approximately 8.75m at the face of the east pilecap to a maximum of approximately 12.76m at the face of the west pilecap. A 2.0m wide verge will be provided on the north edge of the carriageway, and a 3.5m verge on the south edge.

1.2. PERMITTED TRAFFIC SPEED

48 kph (30 mph)

1.3. EXISTING RESTRICTIONS

The road bridge currently giving access to the existing industrial site is listed as an ancient monument. Liaison with CADW and Natural Resources Wales (NRW) will be required during the planning application process and the outline design phase to establish their requirements with regard to the new river bridge.

2. SITE DETAILS

2.1. OBSTACLES CROSSED

The River Ely.

3. PROPOSED STRUCTURE

3.1. DESCRIPTION OF STRUCTURE AND DESIGN WORKING LIFE

The proposed River Ely Bridge will carry the re-aligned B4267 Leckwith Road. The bridge will provide access for vehicles to Llandough and Dinas Powys. It will also provide access to a proposed residential and commercial development at an existing industrial park located adjacent to the existing B4267 and the River Ely. The bridge will have a span of 35m and a skew angle of 0˚. Both bridge abutments will be reinforced soil (RS) with vertical walls and associated concrete facing panels.

The proposed bridge will be a single span fully integral bridge with the deck being built into bankseats/pilecaps. The bankseat/pilecap foundations will comprise a single row of reinforced concrete piles. Each pile will pass through the RS abutments within steel tubes that will provide a voided annulus between the pile and the RS abutment.

The superstructure and substructure of the proposed bridge will have a design working life of 120 years, Category 5 in accordance with BS EN 1990, National Annex Cl NA 2.1.1 and BD 100/16 Table A.1

The waterproofing system and bridge parapets are to have a design working life of 50 Years, Category 2 in accordance with BS EN 1990, National Annex Cl NA 2.1.1 and BD 100/16 Table A.1.

3.2. STRUCTURAL TYPE

Superstructure – The bridge deck will be comprised of standard pre-tensioned Y beams and YE beams constructed compositely with an in-situ reinforced concrete (RC) over-slab.

End Supports – RC bankseats/pilecaps supported on a single row of RC piles. Each pile will pass through a voided annulus between itself and the RS abutment formed using steel hollow section tubes.

A General Arrangement drawing is contained in Appendix A.

3.3. FOUNDATION TYPE

Each bankseat/pilecap will be supported on a single row of RC piles.

3.4. SPAN ARRANGEMENTS

The proposed bridge will have a single span of 35m between the centre lines of the pilecaps and a skew angle of 0°.

3.5. ARTICULATION ARRANGEMENTS

The proposed bridge will be of integral construction with no bearings or expansion joints. Longitudinal translation of the superstructure is accommodated by sliding bankseats/pilecaps backed by a flexible wedge of soil at either end of the structure. Movement of the bank seats in the longitudinal direction will be accommodated by the flexibility of the piles within the voided annulus around the depth passing through the RS abutments. An asphaltic plug joint will be provided in the road surfacing at the back of each sliding bank seat. This will prevent cracking of the road surfacing from movement of the bank seats.

3.6. CLASSES AND LEVELS

3.6.1. CONSEQUENCE CLASS

CC2 as per BS EN 1990:2002 Table B1

3.6.2. RELIABILITY CLASS

RC2 as per BS EN 1990:2002 Table B2

3.6.3. INSPECTION LEVEL

IL2 as per BS EN 1990:2002 Table B5

3.7. ROAD RESTRAINT SYSTEMS REQUIREMENTS

The proposed road restraint system will be painted, galvanised steel parapets with N1 containment level and W1 working width. End protection is required in the form of safety barriers fully connected to the parapets with a containment level of N1 and W2 working width class. The northern parapet will be 1.4m high

3.8. PROPOSED ARRANGEMENTS FOR FUTURE MAINTENANCE AND INSPECTION

3.8.1. TRAFFIC MANAGEMENT

It is anticipated that traffic management will be required for Principal Inspections and future maintenance work of the deck soffit, abutments, and surface of each bridge.

3.8.2. ARRANGEMENTS FOR FUTURE MAINTENANCE AND INSPECTION

Access for future maintenance and inspection to the deck soffits will require the use of scaffolding or an under-bridge unit sited on the road above.

Access requirements for maintenance and/or inspection is reduced by using concrete construction and eliminating the use of bearings and expansion joints by making the deck integral with the support.

Access for future inspection and maintenance to the top of each structure will not require specialist access equipment.

3.9. ENVIRONMENT AND SUSTAINABILITY

Integral construction removes the need for bearings and will minimise inspection and maintenance requirements.

The use of GGBS cement replacement improves the durability of concrete, by reducing its permeability and increasing its resistance to chloride ingress and chemical attack.

Construction will be carried out, where practicable, using locally sourced materials and suppliers and recycled materials, such as GGBS cement replacement, which re-uses a by-product from iron blast furnaces and is abundant in South Wales.

The proposed bridge will be constructed over the River Ely adjacent to an existing bridge that has an ancient monument listing. Liaison will be required during the planning application process and the outline design phase with Natural Resources Wales (NRW) and CADW to establish their requirements prior to detailed design.

A full environmental impact assessment will be carried out prior to detailed design.

3.10. DURABILITY, MATERIALS AND FINISHES

Structural Concrete – see Table below (to BS EN 206-1 and BS EN 1992-1-1):

Structural Concrete					
Element	Comp Strength Class	Surface	Cover		Exposure Classes
			Min	Δc	
Bridge Deck	C40/50	Top (waterproofed)	50	10	XC3/4, XD3
Bridge Deck	C40/50	Soffit (permanent formwork)	35	10	XC3/4, XD1
Bridge Deck Coping Units	C40/50	Sides and top	60	10	XC3/4, XD3, XF4
Bankseat	C40/50	Buried faces	50	10	XC3/4,XD3
Bankseat	C40/50	Exposed faces	50	10	XC3/4, XD3
Piles	C32/40	Embedded length and non-embedded length	25	50	XC3/4, XD3
PC Beams	C50/60	All surfaces	35	5	XC3/4, XD1

Plain Concrete

Verge infill - PAV2

Blinding - ST2

Reinforcement

High yield grade B500B ribbed bars to BS EN 1992-1-1 yield strength 500 N/mm^2.

Pre-stressing Strand

In accordance with BS5896:2012

Concrete finishes

All exposed concrete surfaces – U3 or F3.

U4 finish to top of deck slab.

All unexposed concrete surfaces – U1 or F1

Brushed finish to verge infill

Permanent Formwork

Proprietary approved GRP panels to span between pre-stressed beams

Surface Impregnation

Parapet plinth surfaces are to be impregnated with Hydrophobic Bridgeguard.

Bridge Deck Waterproofing

Proprietary bridge deck waterproofing system in accordance with the Specification for Highway Works Series 2000 without Additional Protection Layer (APL), unless required by the individual waterproofing system.

Backfilled surfaces of concrete will be waterproofed with two coats of bitumen paint in accordance with Specification for Highway Works Clause 2004.

Waterproofing

The top surface of the deck slab will be waterproofed using a proprietary waterproofing system compliant with cl. 2003 of the specification for Highway Works and to the requirements of BD 47/99.

All buried concrete surfaces to be waterproofed in accordance with cl. 2004 of the specification for Highway Works.

Surfacing

The bridge deck surfacing will be comprised of:

- 40mm Hot Rolled Asphalt (HRA) surface course
- Minimum 80mm Dense Bitumen Macadam (DBM) binder course

3.11. RISKS AND HAZARDS CONSIDERED FOR DESIGN, EXECUTION, MAINTENANCE AND DEMOLITION. CONSULTATION WITH AND/OR AGREEMENT WITH THE PRINCIPAL DESIGNER

Risks will be continually assessed throughout the design process in accordance with the CDM regulations 2015. The risks that have been identified to date that are specific to the construction of this structure are contained in Appendix B of this document.

The project risk register will be populated by the designers with the risks identified throughout the design stage which will be reviewed/agreed with the Principal Designer for this project.

3.12. ESTIMATED COST OF PROPOSED STRUCTURE TOGETHER WITH OTHER STRUCTURAL FORMS CONSIDERED (INCLUDING WHERE APPROPRIATE PROPRIETARY MANUFACTURED STRUCTURE), AND THE REASONS FOR THEIR REJECTION (INCLUDING COMPARATIVE WHOLE LIFE COSTS WITH DATES OF ESTIMATES)

A construction cost for the proposed bridge has not been estimated at this stage. The whole life maintenance cost for the structure has not been assessed at this stage

A single span steel composite girder deck alternative was also considered. This option was rejected as it is considered likely that a concrete beam deck will be more economical in terms of both

construction cost and whole life maintenance costs. It was also considered that periodic maintenance painting of steel girders would present environmental risks. The use of weathering steel may not be possible due to the proximity of the proposed bridge to a marine environment.

3.13. PROPOSED ARRANGEMENTS FOR CONSTRUCTION

3.13.1. CONSTRUCTION OF STRUCTURE

The anticipated construction sequence for the bridge will be as follows:

- Bore and cast the RC piles. The piles above formation level for the abutments will be sleeved using a steel circular hollow section to provide an annulus between each pile and the RS abutments.
- Construct each bank seat sufficiently to provide bearing shelves for placing the PC beams.
- Install the PC beams onto the prepared bearing shelves.
- Place the permanent formwork between successive beams to form the soffit of the deck.
- Complete the construction of the sliding bank seats and the reinforced concrete deck slab on top of the PC beams to form the composite integral deck.
- Construct the reinforced concrete edge cantilevers and parapet plinths.
- Carry out backfilling operations behind the bank seats.
- Apply the bridge deck waterproofing.
- Install the steel parapets.
- Install the kerbing and construct the verges.
- Carry out the bridge deck surfacing operations.

3.13.2. TRAFFIC MANAGEMENT

The proposed bridge will be constructed off the line of the existing B4267, therefore traffic management will not be required to construct the proposed bridge.

3.13.3. SERVICE DIVERSIONS

No liaison with statutory authorities has been carried out at this stage, therefore requirements for service diversions have not yet been established. C2 and C3 NRSWA enquiries will be will be made during the preliminary design stage.

3.13.4. INTERFACE WITH EXISTING STRUCTURE

The proposed bridge will be constructed adjacent to an existing 3 span masonry arch structure that has an ancient monument listing. Liaison and agreement with CADW and NRW will be required as part of the planning application process.

4. DESIGN CRITERIA

4.1. ACTIONS

4.1.1. PERMANENT ACTIONS

The self-weight of the superstructure in accordance with EN 1991-1-1 and the associated National Annex. Road surfacing will be considered as a superimposed permanent action.

4.1.2. SNOW, WIND AND THERMAL ACTIONS

Snow loading will not be considered (NA to BS EN 1991-1-3 NA.4.1.1).

Wind actions will be considered in accordance with section 8 of BS EN 1991-1-4 and NA to BS EN 1991-1-4.

Thermal actions will be considered in accordance with Section 6 of BS EN 1991-1-5 and NA to BS EN 1991-1-5. Approach 2 will be used to determine the actions.

4.1.3. ACTIONS RELATING TO NORMAL TRAFFIC UNDER AW REGULATIONS AND C&U REGULATIONS

Load Models LM1 and LM2 (vehicular traffic) will be applied to the trafficked lanes in accordance with BS EN 1991-2:2003 and the associated National Annex.

4.1.4. ACTIONS RELATING TO GENERAL ORDER TRAFFIC UNDER STGO REGULATIONS

Special Vehicles type SV80 and SV100 in Load Model LM3 in accordance with BS EN 1991-2 and the associated National Annex.

4.1.5. FOOTWAY OR FOOTBRIDGE VARIABLE ACTIONS

Footway loading will be applied in accordance with section 5 of BS EN 1991-2:2003.

4.1.6. ACTIONS RELATING TO SPECIAL ORDER TRAFFIC, PROVISION FOR EXCEPTIONAL ABNORMAL INDIVISIBLE LOADS INCLUDING LOCATION OF VEHICLE TRACK ON DECK CROSS-SECTION

Not applicable.

4.1.7. ACCIDENTAL ACTIONS

Accidental actions will be considered in accordance with BS EN 1991-2:2003 Cl.4.7.3 and the associated National Annex.

Collision forces on vehicle restraint systems that are transferred to the bridge deck will be applied in accordance with BS EN 1991-2:2003 Cl.4.7.3 and the associated National Annex.

4.1.8. ACTIONS DURING CONSTRUCTION

All actions during construction will be considered in accordance with BS EN 1991-1-6 and associated National Annex. The actions during execution will consider the construction sequence.

4.1.9. ANY SPECIAL ACTION NOT COVERED ABOVE

None.

4.2. HEAVY OR HIGH LOAD ROUTE REQUIREMENTS AND ARRANGEMENTS BEING MADE TO PRESERVE THE ROUTE, INCLUDING ANY PROVISION FOR FUTURE HEAVIER LOADS OR FUTURE WIDENING

Not applicable.

4.3. MINIMUM HEADROOM PROVIDED

Not applicable.

4.4. AUTHORITIES CONSULTED AND ANY SPECIAL CONDITIONS REQUIRED

Consultation will be carried out with the following bodies during the preparation of the planning application:

Authority	Special Conditions
Vale of Glamorgan Council	To be determined
Cardiff City Council	To be determined
CADW	To be determined
Natural Resources Wales	To be determined
All Statutory Undertakers	To be determined

4.5. STANDARDS AND DOCUMENTS LISTED IN THE TECHNICAL APPROVAL SCHEDULE

To be developed and provided by the designer at the preliminary/AIP stage.

4.6. PROPOSED DEPARTURES RELATING TO DEPARTURES FROM STANDARDS GIVEN IN 4.5

A departure from standard regarding BD43/03 Clause 8.3 – For the use of Hydrophobic Bridgeguard in lieu of Silane will be required. This will be provided by the designer at the preliminary design/AIP stage.

4.7. PROPOSED DEPARTURES RELATING TO METHODS FOR DEALING WITH ASPECTS NOT COVERED BY STANDARDS IN 4.5

None.

4.8. LIST OF RECORD OF OPTIONS AND CHOICES

To be provided by the designer at the preliminary/AIP stage if category 2, in accordance with BD 2/12, is the agreed checking category.

5. STRUCTURAL ANALYSIS

5.1. METHODS OF ANALYSIS PROPOSED FOR SUPERSTRUCTURE, SUBSTRUCTURE AND FOUNDATIONS

5.1.1. METHODS OF ANALYSIS FOR ULTIMATE LIMIT STATES (EXCLUDING FATIGUE)

To be provided by the designer at the preliminary/AIP stage.

5.1.2. METHOD OF ANALYSIS FOR FATIGUE

To be provided by the designer at the preliminary/AIP stage.

5.1.3. METHOD OF ANALYSIS FOR SERVICEABILITY LIMIT STATES

To be provided by the designer at the preliminary/AIP stage.

5.2. DESCRIPTION AND DIAGRAM OF IDEALISED STRUCTURE TO BE USED FOR ANALYSIS

To be provided by the designer at the preliminary/AIP stage.

5.3. ASSUMPTIONS INTENDED FOR CALCULATION OF STRUCTURAL ELEMENT STIFFNESS

To be provided by the designer at the preliminary/AIP stage.

5.4. PROPOSED RANGE OF SOIL PARAMETERS TO BE USED IN THE DESIGN OF EARTH RETAINING ELEMENTS

To be provided by the designer at the preliminary/AIP stage.

6. GEOTECHNICAL CONDITIONS

6.1. ACCEPTANCE OF RECOMMENDATIONS OF THE GEOTECHNICAL DESIGN REPORT TO BE USED IN THE DESIGN AND REASONS FOR ANY PROPOSED CHANGES

A geotechnical design report is not available at this stage. To be developed and provided by the designer at the preliminary/AIP stage.

6.2. SUMMARY OF DESIGN FOR HIGHWAY STRUCTURE IN THE GEOTECHNICAL DESIGN REPORT

Not available at this stage.

6.3. DIFFERENTIAL SETTLEMENT TO BE ALLOWED FOR IN THE DESIGN OF THE STRUCTURE

To be provided by the designer at the preliminary design/AIP stage.

6.4. IF THE GEOTECHNICAL DESIGN 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 Geotechnical Design Report for the piled foundations is available at this stage.

7. CHECK

7.1. PROPOSED CATEGORY AND DESIGN SUPERVISION LEVEL

Category 2 in accordance with BD 2/12.

Design supervision level DSL2 for the whole structure in accordance with BS EN 1990 table B4.

7.2. IF CATEGORY 3, NAME OF PROPOSED INDEPENDENT CHECKER

Not applicable.

7.3. ERECTION PROPOSALS OR TEMPORARY WORKS FOR WHICH TYPES S AND P PROPOSALS WILL BE REQUIRED, LISTING STRUCTURAL PARTS OF THE PERMANENT STRUCTURE AFFECTED WITH REASONS

Not applicable.

8. DRAWINGS AND DOCUMENTS

8.1. LIST OF DRAWINGS (INCLUDING NUMBERS) AND DOCUMENTS ACCOMPANYING THE SUBMISSION

Drawings:

General Arrangement – Existing Leckwith Bridge – 70053561/STR/DWG/001

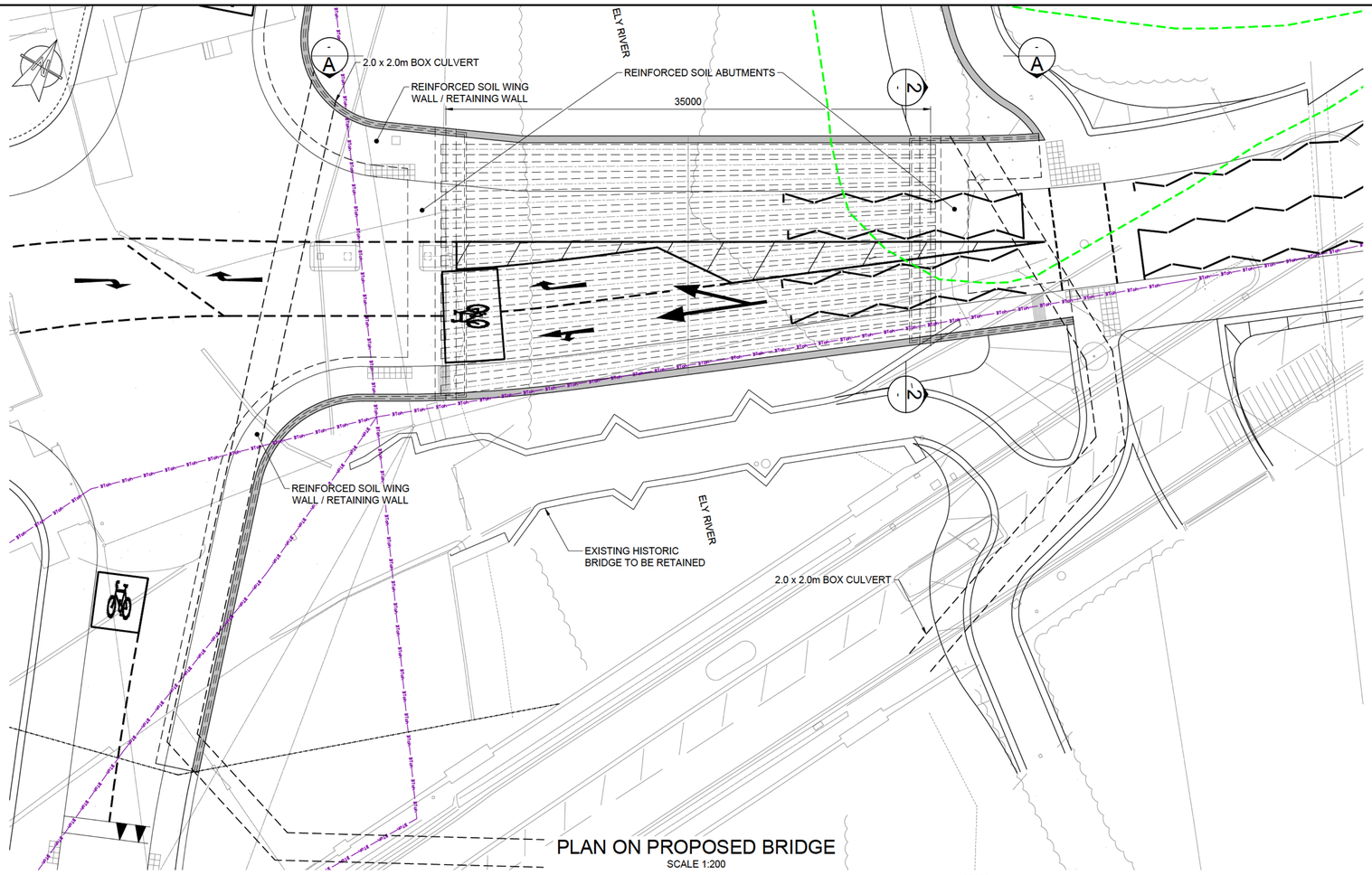
General Arrangement – Proposed Leckwith Quay Bridge - 70053561/STR/DWG/002

Documents:

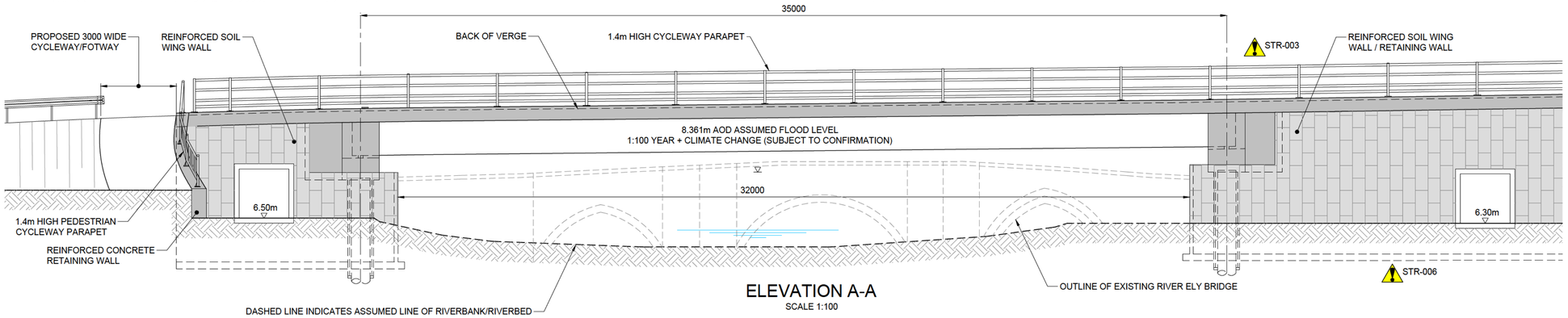
Designers hazard log – 70053561/STR/DOC/002

Appendix A

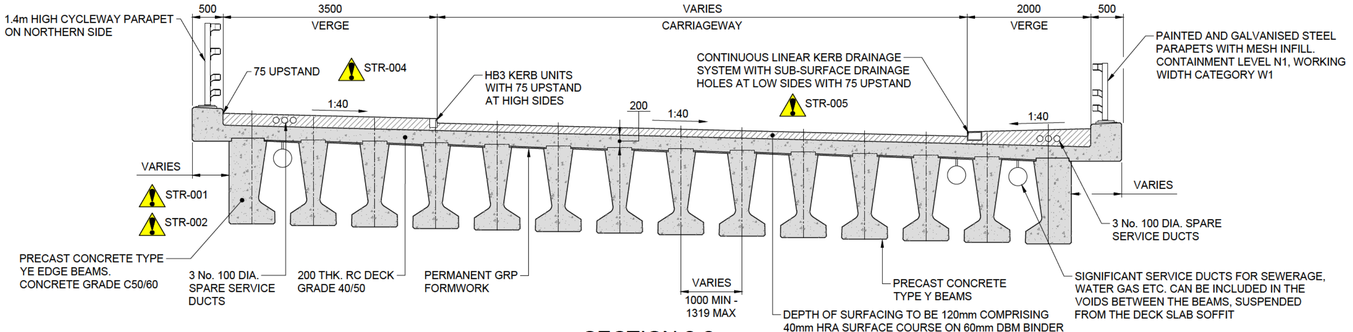
GENERAL ARRANGEMENT DRAWINGS



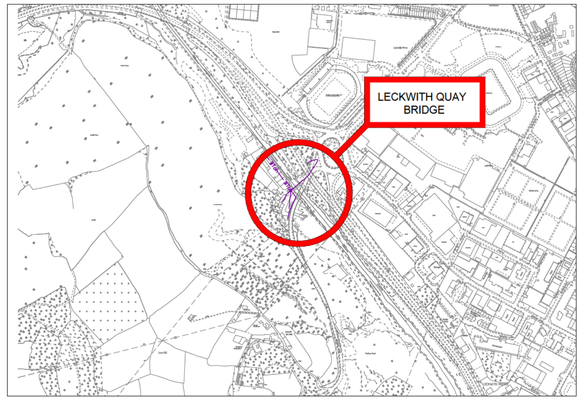
PLAN ON PROPOSED BRIDGE
SCALE 1:200



ELEVATION A-A
SCALE 1:100



SECTION 2-2
SCALE 1:50



LOCATION PLAN
SCALE 1:10,000

DO NOT SCALE

NOTES:

1. DO NOT SCALE FROM THIS DRAWING - USE ONLY VALUES OF STATED DIMENSIONS.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
3. ALL EXISTING STATUTORY INFORMATION SHOWN HAS BEEN PROVIDED BY THE RELEVANT STATUTORY AUTHORITIES. THE CONTRACTOR SHALL CONFIRM THE LOCATIONS AND OWNERSHIP OF THE SERVICES PRIOR TO ANY WORKS BEING CARRIED OUT. ANY DIVERSIONS REQUIRED ARE TO BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITY PRIOR TO CONSTRUCTION.

KEY

BT OPENREACH

WESTERN POWER HV (33kV)

Health and Safety Symbols Legend

All Risks are Recorded in the Significant Residual Design H&S Risk Schedule Document Number: 70053561.***

1.INDICATES A RESIDUAL RISK AS A WARNING.

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS

Construction Risks -	STR001 - Lifting of pre-cast beams.
	STR002 - Landing of pre-cast beams onto capping beam.
	STR003 - Superstructure construction.
	STR004 - Proximity of existing Statutory Undertakers apparatus.
	STR005 - Deck Construction
	STR006 - Wingwall construction.
	STR007 - Fixing reinforcement.
	STR008 - Fixing reinforcement (piles).
Maintenance Risks - No significant maintenance risks identified.	
Demolition/Adapation Risks - No significant demolition risks identified.	

REV	DATE	BY	DESCRIPTION	CHK	APP
P02	27/08/2020	BJ	SPAN INCREASED	SH	SS
P01	21/10/2019	BJ	FIRST ISSUE	SH	SS

DRAWING STATUS: S0 - WORK IN PROGRESS

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CLIENT:

ARCHITECT:

SITE/PROJECT: LECKWITH QUAY DEVELOPMENT

TITLE: LECKWITH QUAY BRIDGE PROPOSED GENERAL ARRANGEMENT

SCALE @ A1:	CHECKED:	APPROVED:
AS SHOWN	SH	SS

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70053651	SS	BJ	September 20

DRAWING No: 70053561-002 REV: P02

File name \\UK.WSPGROUP.COM\CENTRAL DATA\PROJECTS\70053500\XX\70053561 - LECKWITH QUAY, CARDIFF\02 WIP\STRUCTURES\DRAWINGS\70053561-002.DWG, printed on 03 September 2020 15:51:26, by Johnson, Ben

Appendix B

DESIGNERS HAZARD LOG

T446: Design Risk Management Schedule

Project No	70053561	Project Name	Leckwith Quay Development
Document Number	70053561/STR/DOC/002	Structure Name	River Ely Bridge

Guidance Notes (see guidance notes page for more details)
Design risk management should be an integral part of the overall design development and designers should think of it in terms of considering constructability, maintainability, etc. Designers only need to document their consideration of risks in this simple risk management schedule format. There is no requirement for quantative design risk assessments to be carried out/documented and these should be avoided
* Risks should be considered in a logical sequence relating to the location/operational environment, constructability/installability, operability (normal/emergency), maintainability (inc routine cleaning, replacement, etc.), and alteration/decommissioning/dismantling/demolition, and should be categorised against those headings,
CIRIA guidance documents C755, C756, C686, C607, etc. provide a useful checklist and detailed guidance on the identification of risks to be considered during design and how those risks might be addressed - see detailed guidance notes for more details
§ Significant residual risks are those which are unusual, not obvious, difficult to manage, or where critical design assumptions apply. The documentation by designers of residual risks that cover well-known and understood hazards should be avoided.

Ref	Risk Category* & Phase where appropriate, e.g. location/environment, construction, operation, maintenance, alteration/demolition	Work Element/Location (where appropriate)	Hazard or Risk Issue Identified	Risk Management Owner	Design ERIc Action Required (e.g. hazard elimination/risk mitigation action, information to be provided to others)	Significant Temporary Works Requirements/Management Arrangements and/or any Special Erection/Installation Sequences or Requirements	Design Action Status/Final Resolution Notes (e.g. traceability of ERIc action, communication of significant residual risk, critical design criteria, etc.)	Significant Residual Risk§	Date Logged/ Reviewed	Raised By
STR-001	Construction	Lifting of pre-cast beams.	Beam instability in temporary case during construction. Particularly during the landing of the beams and the pouring of the deck and diaphragm.	Principal Contractor / Designer.	Alternative designs considered which eliminate this risk (but in turn, introduce others, e.g. steel composite - maintenance painting at height; in-situ concrete - construction at height). Proposed solution provides optimum solution from consideration of multiple constraints.	Temporary bracing may be required between beams during construction.	Residual risk on drawings.	Yes	18/10/2019	SH
STR-002	Construction	Landing of pre-cast beams onto capping beam.	As precast beams are landed on substructures, projecting strand/rebar from beams intermesh with projecting reinforcement from substructures, resulting in risk of trapping limbs.	Principal Contractor / Designer.	Alternative design considered which eliminate this risk (but in turn, introduce other e.g. steel composite - maintenance painting at height: in-situ concrete - construction at height). Proposed solution provides optimum solution from considerations of multiple constraints. Detailed design will need to consider and detail arrangement of projecting bars from pier and abutment substructures to avoid design clashes with projecting beam strand/reinforcement.	Construction will require accurate setting out of projecting bar positions and maintenance of these positions throughout the concrete pouring operation to avoid clashes with beams landed later in the construction process. Erection methodology to be developed to avoid the need to place hands and fingers in proximity to projecting strand/reinforcement.	Detailed design will consider and detail arrangement of projecting bars from abutment substructures to avoid design clashes with projecting beam strand/reinforcement. Details and notes on drawing.	Yes	18/10/2019	SH
STR-003	Construction/Maintenance	Superstructure construction.	Working at height over a main river. Material falling from structures during construction and maintenance.	Principal Contractor, Owner, Operator.	Proposed form of structure includes an open soffit Y beam superstructure. Following installation of permanent formwork at the top of the pc beams, deck pour creates solid slab for all ensuing operations. This form of construction minimises the risk of materials falling into the river during construction. Detailed design drawings to convey detail Pre-stressed concrete beam design to accommodate loading edge protection - requirements and assumptions to be conveyed on design drawings.	None.	Details and notes on drawing.	Yes	18/10/2019	SH
STR-004	Construction	Excavation	No statutory undertaker enquiries have been carried out at this stage, although existing services may be present and affected by the construction of the proposed bridge.	Principal contractor/Principal designer.	Liaison with service providers to establish the location of existing services and their requirements for any diversions/protection required to facilitate construction.	None anticipated.	The risk will be highlighted on the construction drawings to bring it to the attention of the contractor.	Yes	18/10/2019	SH
STR-005	Construction	Deck Construction.	If paraslim units (or similar) and temporary access platforms are fixed to the edge beams prior to the beam having become a composite part of the deck construction, there is an increased risk of instability of the beams due to eccentricity of the temporary load.	Principal contractor.	The risk cannot be mitigated through permanent works design as the edge beams are required as part of the deck for this form of construction.	None anticipated.	The edge beams are to be restrained against rotation sufficiently to ensure their stability in the temporary state through the provision of suitable temporary works. The temporary works should be designed by an appropriately qualified and competent temporary works designer. Alternatively the contractor can elect to install the paraslim units and associated working platforms after the deck has been poured and sufficiently cured such that the edge beam is fully composite with the insitu-deck concrete and forms a fully integral part of the deck slab.	Yes	18/10/2019	SH
STR-006	Construction	Wingwall construction.	Instability of precast reinforced concrete panels during the construction of the reinforced soil wingwalls	Principal contractor.	Alternative designs considered which eliminate this risk (but in turn, introduce others, e.g. rebar fixing at height, large concrete pours). Proposed solution provides optimum solution from consideration of multiple constraints.	None anticipated.	The wingwall should be installed by an appropriately qualified and competent contractor. The risk will be highlighted and a note included on the construction drawings to bring it to the attention of the contractor.	Yes	18/10/2019	SH
STR-007	Construction	Fixing reinforcement.	Instability and collapse of reinforcement cages during construction prior to the hardened concrete condition.	Principal contractor.	The risk cannot be mitigated through design as the reinforcement cages are necessary to ensure the structural integrity of the elements of the structure. The contractor is to ensure the stability of reinforcement cages in the temporary condition prior to the hardened concrete cond t on	None anticipated.	The risk will be highlighted and a note included on the construction drawings to bring it to the attention of the contractor.	Yes	18/10/2019	SH
STR-008	Construction	Fixing reinforcement.	Instability and collapse of reinforcement cages during the lifting of the pile reinforcement in to place prior to the hardened concrete condition.	Principal contractor.	The risk cannot be mitigated through design as the reinforcement cages are necessary to ensure the structural integrity of the elements of the structure. The contractor is to ensure the stability of reinforcement cages in the temporary condition and during lifting operations.	None anticipated.	The risk will be highlighted and a note included on the construction drawings to bring it to the attention of the contractor.	Yes	18/10/2019	SH

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