



UK Highways A55 Ltd.

TECHNICAL APPRAISAL FORM

MENAI SUSPENSION BRIDGE REMEDIAL WORKS - FOOTWAY REPAIR SCHEME

ANNEX 2(1) TO PART 3 OF SCHEDULE 4





UK Highways A55 Ltd.

TECHNICAL APPRAISAL FORM

**MENAI SUSPENSION BRIDGE REMEDIAL WORKS -
FOOTWAY REPAIR SCHEME**

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70070988

OUR REF. NO. 70070988-TAF01

DATE: AUGUST 2020

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2
Remarks	First Issue		
Date	August 2020		
Prepared by	S. Dorgan		
Signature			
Checked by	S. Heaney		
Signature			
Authorised by	S. Heaney		
Signature			
Project number	70070988		
Report number	01		
File reference	70070988-TAF01		

1. NAME OF SCHEME

Menai Suspension Bridge Remedial Works – Footway Repair Scheme.

1.1 TYPE OF HIGHWAY

A5 trunk road. Over the section of the bridge, the A5 is a single carriageway comprising one running lane in each direction.

1.2 PERMITTED TRAFFIC SPEED (FOR A BRIDGE GIVE OVER AND/OR UNDER)

The permitted traffic speed is 30 mph.

2. NAME OF STRUCTURE

Menai Suspension Bridge.

2.1 OBSTACLES CROSSED

Menai Strait.

3. PROPOSED STRUCTURE

The remedial works within this works package cover the replacements of sixty-three reinforced concrete (R.C.) slabs that form part of the cantilevered footways on both the Anglesey and Caernarvon approach spans of the bridge. Due to areas of spalling and exposed rebar to the soffits of the existing slabs, replacement R.C. slabs have been proposed.

3.1 DESCRIPTION OF STRUCTURE

Each existing footway panel arrangement comprises a 5" (127 mm) deep R.C. slab that spans between two R.C. corbels and overlaid with a 1" (25 mm) thick asphalt surface.

The proposed arrangement for the new footway slabs uses GRP Permanent Formwork panels that span longitudinally between the corbels, with a cast in-situ R.C. slab overlaid. A suitable waterproofing layer will be applied to the concrete with a 25 mm thick layer of Hot Rolled Asphalt (HRA), to form the walking surface of the cantilevered footway which will match the existing arrangement, surface levels and slopes.

Due to the limited bearing length of the slabs and a requirement for full anchorage of longitudinal reinforcing bars, MBT rebar couplers or similar approved are proposed at the ends of the rebars. This results in lower cover to the top and longitudinal sides of the slab, introducing a residual risk. This can be mitigated by correctly installing and maintaining the waterproofing system. See Appendix B and Appendix D for further information.

Given the client's need for the proposed arrangement to replicate the existing slab geometry, it is not possible, without disproportionate intrusive works to existing structural elements, to achieve a 120-year design life. This is attributed to the shallow depth of the existing slabs and limited bearing area on concrete rebates, resulting in shallower cover to the reinforcement and couplers. In accordance with BS 8500-1:2015, a 50-year design life is achievable for 25 mm cover from the top of the concrete slab to the top of the rebar coupler plate when concrete Grade C40/50 is specified. It is acknowledged that the 25 mm cover is greater than the $\frac{3}{4}$ " (19 mm) cover shown on the record drawings. In addition to this, the specified concrete will have significantly greater durability characteristics than the existing concrete slabs.

3.2 STRUCTURAL TYPE

The proposed slab arrangement consists of GRP permanent formwork panels that sit on concrete rebates (R.C. corbels and a continuous R.C. beam) with a cast in-situ R.C. concrete slab overlaid.

3.3 FOUNDATION TYPE

The GRP permanent formwork panels sit on the concrete rebates as described above via a twin track adhesive Butyl bead as per manufacturer's instructions.

3.4 SPAN ARRANGEMENTS

GRP permanent formwork spans approximately 2.7 m between the cantilevered, R.C. corbels.

3.5 ARTICULATION ARRANGEMENTS

The proposed R.C. slab is considered to be simply supported between R.C. corbels.

3.6 PARAPET TYPE

The existing post and rail parapets will be used for the proposed arrangement. The existing fascia plates will be replaced where a new R.C. slab is proposed.

3.7 PROPOSED ARRANGEMENTS FOR INSPECTION AND MAINTENANCE

Inspection and maintenance methods will remain the same as per current practices implemented on the bridge.

3.8 MATERIALS AND FINISHES

The soffit of the GRP permanent formwork panels will be Light (flake) Grey to BS 4800 10-A-03, to match the existing arrangement.

The fascia plates requiring replacement will be painted Grey to BS 4800 18B21 as per the existing arrangement. Paint specification to comply with Series 1900 of the MCHW.

Steel fascia plate – material grade – S275J2.

Concrete exposure class – XC3

Reinforcement – Grade B500B to BS EN 10080:2005 and BS 4449:2005.

Spray-applied Waterproofing in accordance with CD 358.

4. DESIGN/ASSESSMENT CRITERIA

4.1 LIVE LOADING

4.1.1 HA Loading

Not applicable.

4.1.2 HB Loading

Not applicable.

4.1.3 Footway or footbridge live loading

In accordance with BS5400 Part 2:1978 and as implemented by BD 37/88 of the DMRB, the nominal pedestrian live load for loaded lengths of 36 m and under, a uniformly distributed live load of 5.0 kN/m² shall be used.

A 10 kN point load was also considered in the design of the R.C. slab in accordance with BS EN 1991-2 clause 5.3.2.2 but is less onerous than the uniformly distributed live load above.

It was agreed with UK Highways A55 Ltd. that no service vehicle loading is required on the footways due to the narrow width of the cantilevered section and the position of the hangers. The client considers the location of the hangers precludes a service vehicle from using the footway. There is a residual risk of this and is thus recorded on the drawings and will be included in the H&S File.

4.1.4 Provision for exceptional abnormal loads

Not applicable.

4.1.5 Any special loading not covered above

None.

4.1.6 Departmental heavy or high load route requirements and arrangements being made to preserve the route

Not applicable.

4.1.7 Minimum headroom provided

Not applicable.

4.1.8 Authorities consulted and any special conditions required

<u>Authority Consulted</u>	<u>Special Conditions Required</u>
Cadw	It is of paramount importance that the historic features and general arrangement of the Menai Suspension bridge are unaffected by any remedial works and thus the design of the footway replacements have accommodated this stipulation.
Gwynedd Council	None.
North and Mid Wales Trunk Road Agent (NMWTRA)	None.
Natural Resources Wales	FRAP for working over the Menai Strait to be arranged by others.
Statutory Authorities	Ongoing consultation with Statutory Authorities for service infrastructure.
UK Highways A55 Ltd.	Ongoing consultation between client and WSP as Principal Designer.

4.2 LIST OF RELEVANT DOCUMENTS FROM THE APPENDIX HERETO

CD 358 – Waterproofing and surfacing of concrete bridge decks

BS 8500-1:2015 – Concrete – Complimentary British Standard to BS EN 206

Refer to Appendix A for the Design Documents used relating to structures.

4.3 PROPOSED ALTERNATIVE PROPOSALS

Not applicable.

5. STRUCTURAL ANALYSIS

5.1 METHODS OF ANALYSIS PROPOSED FOR SUPERSTRUCTURE, SUBSTRUCTURE AND FOUNDATIONS

The structure has been analysed using simple statics to determine the load effects at both serviceability and ultimate limit states.

All elements of the structure shall withstand dead and live loading in accordance with the appropriate standards set out in Schedule 4 pt. 2 Standards and Advice notes provided by the DBFO.

Analyses for the supporting elements are not applicable.

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

An idealised diagram is not necessary due to the simple nature of the structure.

5.3 ASSUMPTIONS INTENDED FOR CALCULATION OF STRUCTURAL ELEMENT STIFFNESS

The linear elastic analysis will be based on the gross section properties of the structural elements.

5.4 PROPOSED EARTH PRESSURE COEFFICIENTS (k_A , k_0 OR k_P) TO BE USED IN THE DESIGN OF EARTH RETAINING ELEMENTS

Not applicable.

6. GROUND CONDITIONS

6.1 ACCEPTANCE OF INTERPRETATIVE RECOMMENDATIONS OF THE SOILS REPORT TO BE USED IN THE DESIGN AND REASONS FOR ANY PROPOSED DEPARTURES

Not applicable.

6.2 DESCRIBE FOUNDATIONS FULLY INCLUDING THE REASONS FOR ADOPTION OF ALLOWABLE AND PROPOSED BEARING PRESSURES/PILE LOADS, STRATA IN WHICH FOUNDATIONS ARE LOCATED, PROVISION FOR SKIN FRICTION EFFECTS ON PILES AND FOR LATERAL PRESSURES DUE TO COMPRESSION OF UNDERLYING STRATA, ETC.

Not applicable.

6.3 DIFFERENTIAL SETTLEMENT TO BE ALLOWED FOR IN DESIGN OF STRUCTURE

Not applicable.

6.4 ANTICIPATED GROUND MOVEMENTS OR SETTLEMENT DUE TO EMBANKMENT LOADING, MINERAL EXTRACTION, FLOWING WATER, MEASURES PROPOSED TO DEAL WITH THESE DEFECTS AS FAR AS THEY AFFECT THE STRUCTURE

Not applicable.

6.5 RESULTS OF TESTS OF GROUND WATER (E.G. PH VALUE, CHLORIDE OR SULPHATE CONTENT) AND ANY COUNTERACTING MEASURES PROPOSED

Not applicable.

7. CHECKING

7.1 PROPOSED CATEGORY OF STRUCTURE

Category I checking required.

7.2 IF CATEGORY III, NAME OF PROPOSED CHECKER

Not applicable.

7.3 TEMPORARY WORKS FOR WHICH THE DBFO CO WILL BE REQUIRED TO ARRANGE AN INDEPENDENT CHECK LISTING THE PARTS OF THE STRUCTURE AFFECTED

Temporary works are required for the Footway Repair Scheme Proposal and the responsibility and design of such works lies with the Contractor and are covered under a separate approvals process.

The DBFO will be required to arrange an independent check of the Contractor's temporary works design for the removal and installation of existing and proposed R.C. slabs. Suitable temporary works are also required to catch falling debris from the structure as a result of the removal and installation works. These are non-exhaustive and the Contractor shall cover all required elements under a separate proposal.

8. DRAWINGS AND DOCUMENTS

8.1 LIST OF DRAWINGS (INCLUDING NUMBERS) AND DOCUMENTS ACCOMPANYING THE SUBMISSION. TO INCLUDE (WITHOUT LIMITATION):

8.1.1a Location plan (Appendix B);

70070988-WSP-00-XX-DR-BR-00001 – Existing General Arrangement

8.1.2a Preliminary general arrangement drawings (Appendix B);

70070988-WSP-00-XX-DR-BR-00002 – Anglesey Approach Existing Details

70070988-WSP-00-XX-DR-BR-00003 – Caernarvon Approach Existing Details

70070988-WSP-00-XX-DR-BR-00004 – Bridge Approaches Existing Footway Slab Typical Details

70070988-WSP-00-XX-DR-BR-00005 – Footway Repair Scheme Proposal – Proposed Footway Slabs & R.C. Details

70070988-WSP-00-XX-SC-BR-00005 – Footway Repair Scheme – R.C. Slab Bar Bending Schedule

8.1.3a Relevant parts of the ground investigation report;

Not applicable.

8.1.4a Supporting documents;

70070988-FR01 – Footway Repair Scheme Proposal (Appendix C) (to be used for information purposes ONLY. The design of the footway slabs has changed since the submission of this document. Design drawings in Appendix B reflect the most up-to-date design).

T446 – Designer's Risk Management Schedule (Appendix D)

9. THE ABOVE DESIGN AND CONSTRUCTION PROPOSALS ARE SUBMITTED FOR REVIEW

Signed:

Team Leader, Design Team

Name: Stephen Heaney

Engineering Qualifications:..... MEng CEng MICE

Date: 17/08/2020

Signed:.....

DBFO Co's Representative

Name:.....

Date:.....

Note: + The Contractor may sign only in respect of Temporary Works.

10. THE ABOVE TAF IS:

- i. received*
 - ii. received with comments as follows:*
 - iii. returned marked "comments" as follows:*
- *delete as appropriate.

Signed:.....

Name:
for and on behalf of the Secretary of State for Wales

Position:.....

Date:.....

Appendix A

MODEL TECHNICAL APPRAISAL FORM DESIGN DOCUMENTS RELATING TO STRUCTURES



This list of documents is subject to amendment pursuant to Alternative Proposals and Department's Changes.

Part 1 General

1. British Standards

BS 153:	Part 3A, Specification for Steel Girder Bridges (see BE 1/77, DMRB ref 1.3)			
BS 5268:	Part 2, Structural Use of Timber			
BS 5304:		1988	-	Code of Practice for Safety of Machinery
BS 5400:	Steel concrete and composite bridges			
	Part 1:	-	1988	- General statement (see BD 15/92, DMRB ref 1.3.2)
	Part 2:	-	1978	- as implemented by BD 37/88, DMRB ref 1.3
	Part 3:	-	1982	- CP for design of steel bridges (see BD 13/90, DMRB ref 1.3)
	Part 4:	-	1990	- CP for design of concrete bridges (see BD 24/92, DMRB ref 1.3.1)
	Part 5:	-	1979	CP for design of composite bridges (see BD 16/82, DMRB ref 1.3)
	Part 9:	-	1983	- Bridge bearings (see BD 20/92, DMRB ref 2.3.1)
	Part 10:	-	1980	CP for fatigue (see BD 9/81, DMRB ref 1.3)
BS 5628:	Code of Practice for Use of Masonry			
	Part 1:	-	1992	Structural Use of Unreinforced Masonry

	Part 2:	-	1995	-	Structural Use of Reinforced and Pre-stressed Masonry (see BD41-DMRB 2.1)
BS 5930:			1981	-	CP for Site investigations
BS 6031:			1981	-	CP for Earthworks
BS 6651:			1992	-	CP for protection of structures against lightning
BS 8004:			1986	-	Foundations (see BD 32/88, DMRB ref 2.1)
BS4360:			1990		Specification for Weldable Structural Steel
BS 6779:	Part 1:		1992	-	Specification for vehicle containment parapets of metal construction (see BD 52/93, DMRB ref 2.3.3)
BS 7668:			1994	-	Specification for Weldable Structural Steel Hot Finished Structural Hollow Sections in Weather Resistant Steels
BS 8118:			1991	-	Structural use of aluminium
BS EN 40.1:	Part 1:		1992	-	Definitions and terms
BS 5649/EN40:	Part 2:		1978	-	Dimensions and tolerances
BS 5649:	Part 3:		1982	-	Specification for materials and welding requirements
BS 5649/EN40:	Part 4:		1982	-	Recommendations for surface protection of metal lighting columns
BS 5649/EN40:	Part 5:		1982	-	Specification for base compartments and cableways
BS 5649/EN40:	Part 6:		1982	-	Specification for design loads

BS 5649:	Part 7:	1985	-	Method for verification of structural design by calculation
BS 5649/EN40:	Part 8:	1982	-	Method for verification of structural design by testing
BS 5649/EN40:	Part 9:	1982	-	Specification of special requirements for reinforced and pre-stressed concrete lighting columns
BS EN 10025:		1993	-	Hot rolled products of non-alloy structural steels (2nd edition)
BS EN 10113:	Parts 1-3:	1993	-	Hot rolled products in weldable fine grain structural steel
BS EN 10155:		1993	-	Structural steel with improved atmospheric corrosion resistance. Technical delivery conditions
BS 2771/BS 5304 – See Original				
BS EN 10210:	Part 1:	1994	-	Hot finished Structural Hollow Sections of Non-Alloy and Fine Grain Structural Steels. Technical Delivery Conditions

2. British Standard Codes of Practice

CP 114:	Part 2:	Reinforced concrete in buildings (see BE 1/73, DMRB ref 2.3)
CP 116:	Part 2:	The structural use of precast concrete (see BE 1/73, DMRB ref 2.3)
CP 2:		Earth retaining structures
CP 2004:		Foundations

3. DOT Publications (HMSO)

The Standards and Advice Notes listed in Annex 1 of the Construction Requirements to Part 2 of Schedule 4 and forming part of the DMRB, as modified and extended by the amendments in Annex 2 to Part 2 of Schedule 4.

Specification for Highway Works ("**SHW**"), published as Volume 1 of the MCHW, dated August 1993, as amended by Annex 5 to Part 2 of Schedule 4 of the Construction Requirements and extended by the Numbered Appendices to the SHW.

Notes for Guidance on the Specification for Highway Works, published as Volume 2 of the MCHW, dated August 1993.

~~Highway Construction Details ("**HCD**"), published as Volume 3 of the MCHW, dated August 1993.~~

~~Simplified tables of external loads on buried pipelines (1970).~~

4. Miscellaneous

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

Health and Safety at Work etc Act 1974.

Appendix B

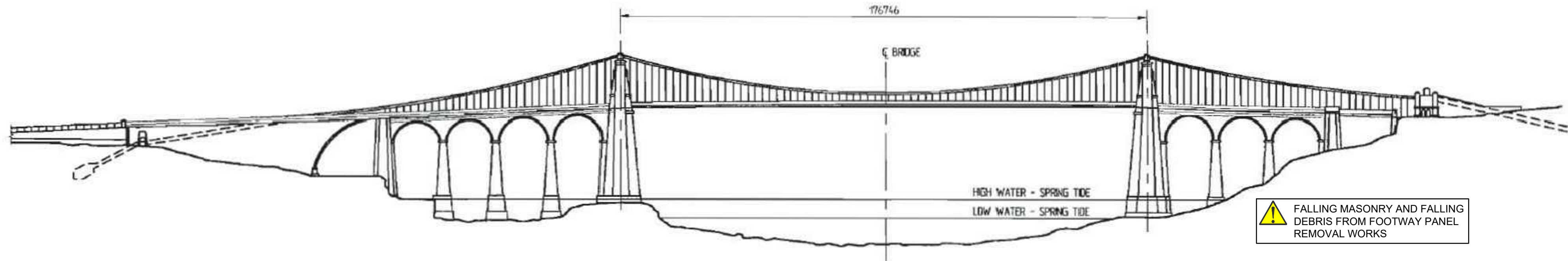
FOOTWAY REPAIR SCHEME WORKS PACKAGE DRAWINGS



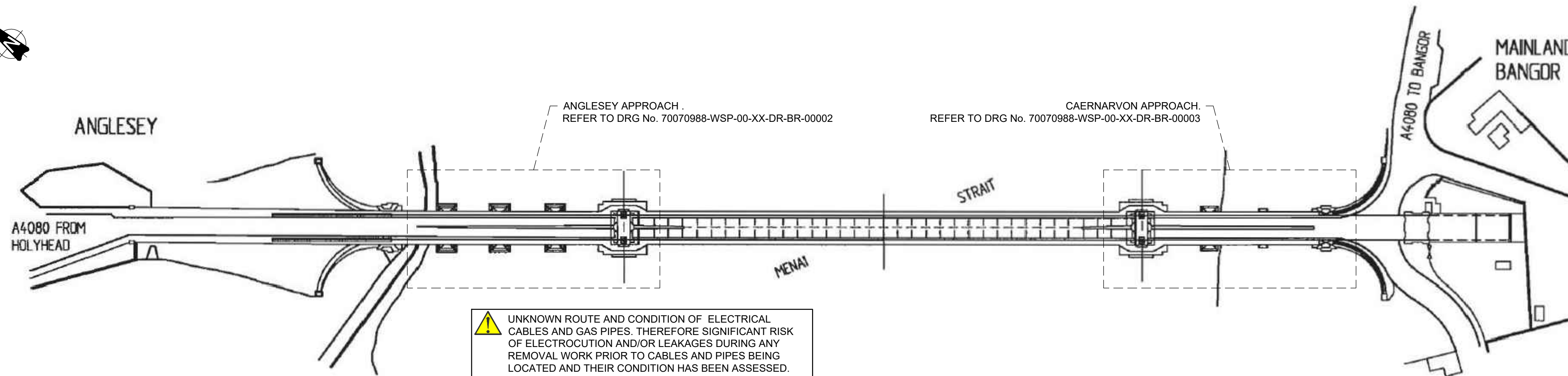


LIST OF DRAWINGS WITHIN THE WORKS PACKAGE AND INCLUDED HERETO:

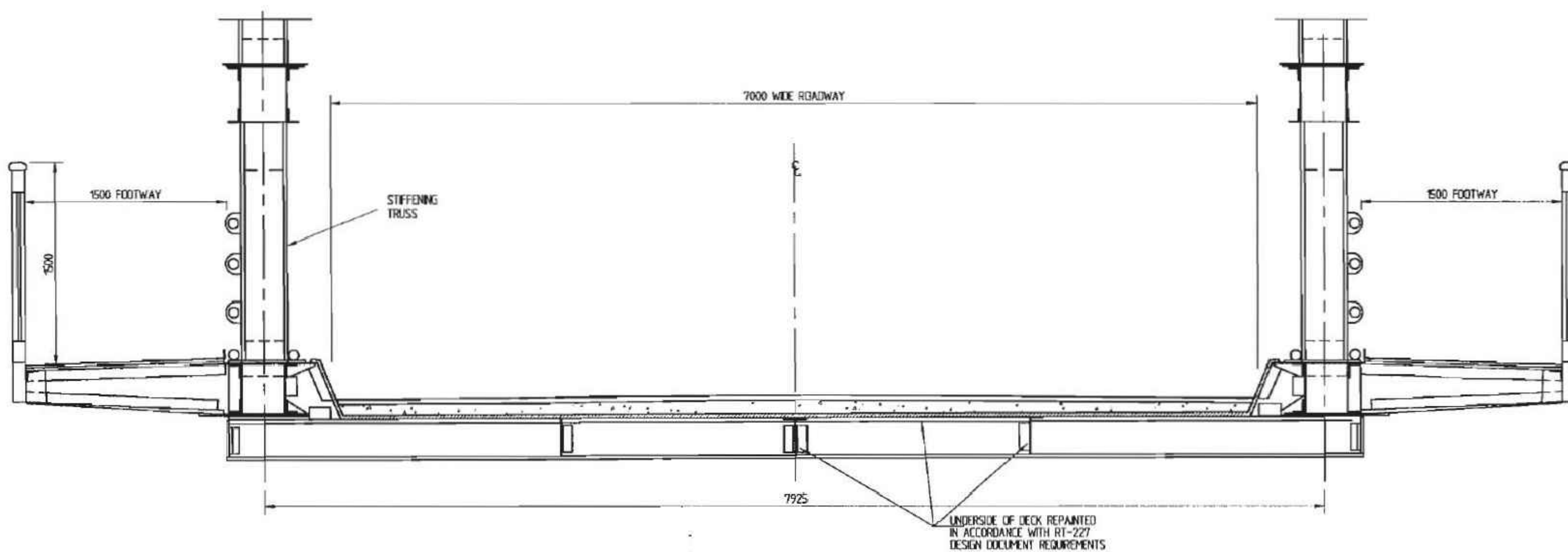
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- 70070988-WSP-00-XX-SC-BR-00005 – Footway Repair Scheme – R.C. Slab Bar Bending Schedule



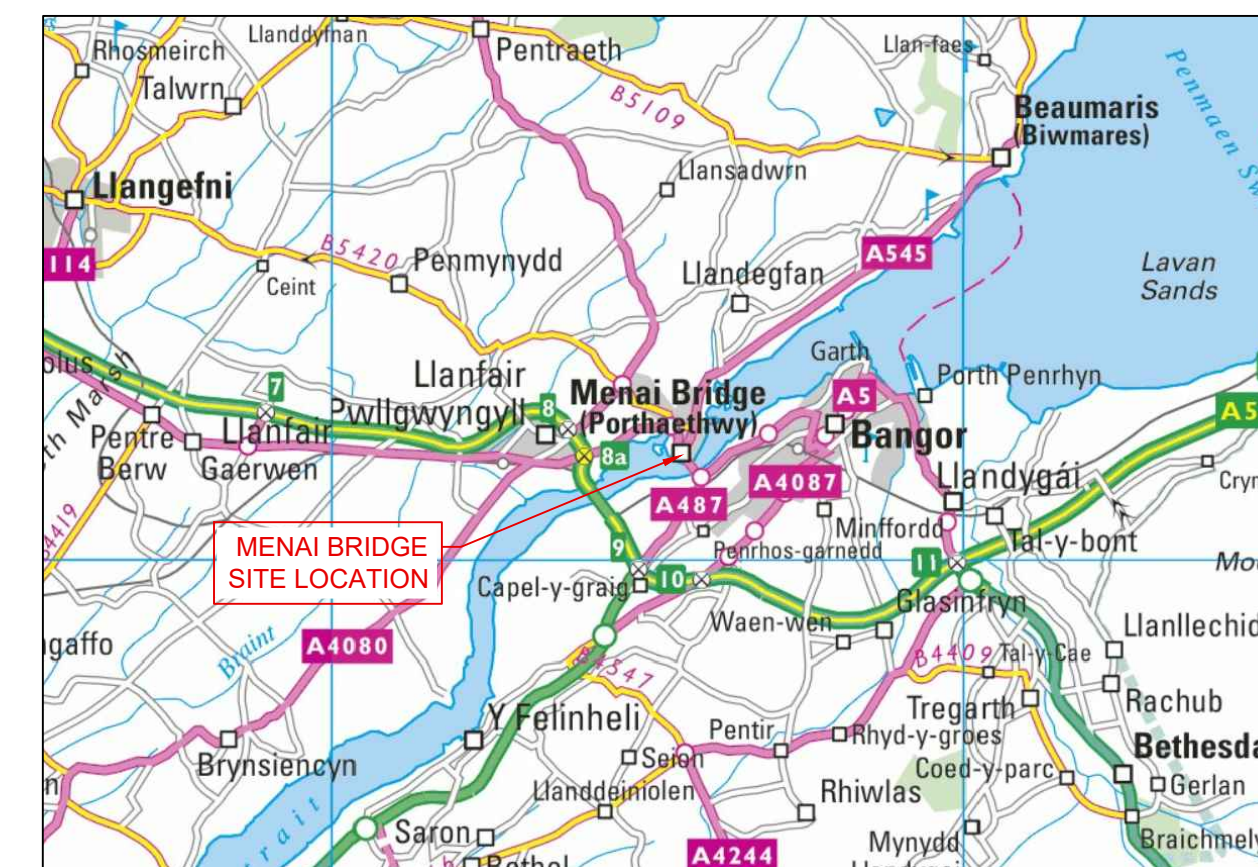
WEST ELEVATION
SCALE 1:1000



PLAN
SCALE 1:1000



TYPICAL CROSS SECTION
SCALE 1:25



LOCATION PLAN
NOT TO SCALE

- Legend/Notes
- DO NOT SCALE FROM THIS DRAWING.
 - ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND DOCUMENTS IN THE DESIGN PACKAGE.
 - THE SITE IS LOCATED AT OS REFERENCE SH 55662 71432.
 - REFER TO THE T446 - DESIGNER'S RISK MANAGEMENT SCHEDULE FOR THE FULL LIST OF IDENTIFIED HAZARDS AND RESIDUAL RISKS.
 - THE CONTRACTOR IS TO CHECK ALL SETTING OUT, DIMENSIONS AND LEVELS PRIOR COMMENCEMENT OF THE WORKS.

- KEY TO HEALTH AND SAFETY SYMBOLS
- INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION
 - INDICATES A RESIDUAL RISK FOR INFORMATION
 - INDICATES A RESIDUAL RISK REQUIRING A PROHIBITIVE ACTION
 - INDICATES A RESIDUAL RISK AS A WARNING

P01	22/07/20	First Revision	JFL	TH	TH
Rev	Date	Description of Revisions	Drawn	Chkd	Appr
Status					Suitability

FOR INFORMATION

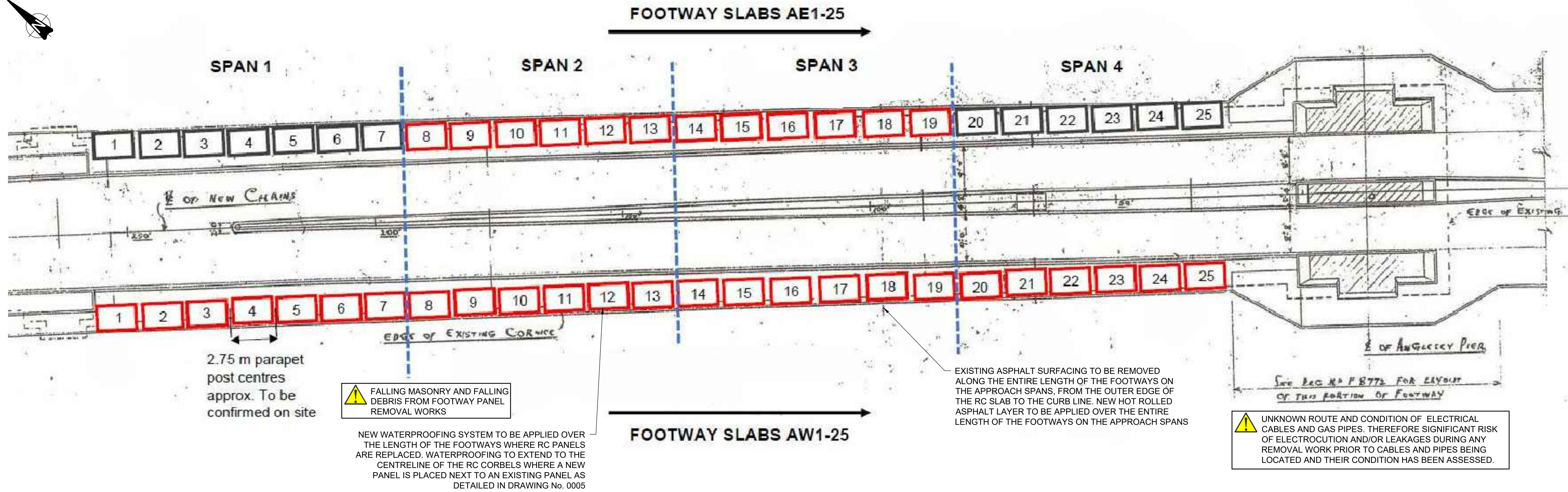
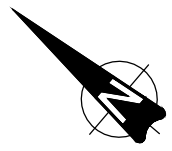
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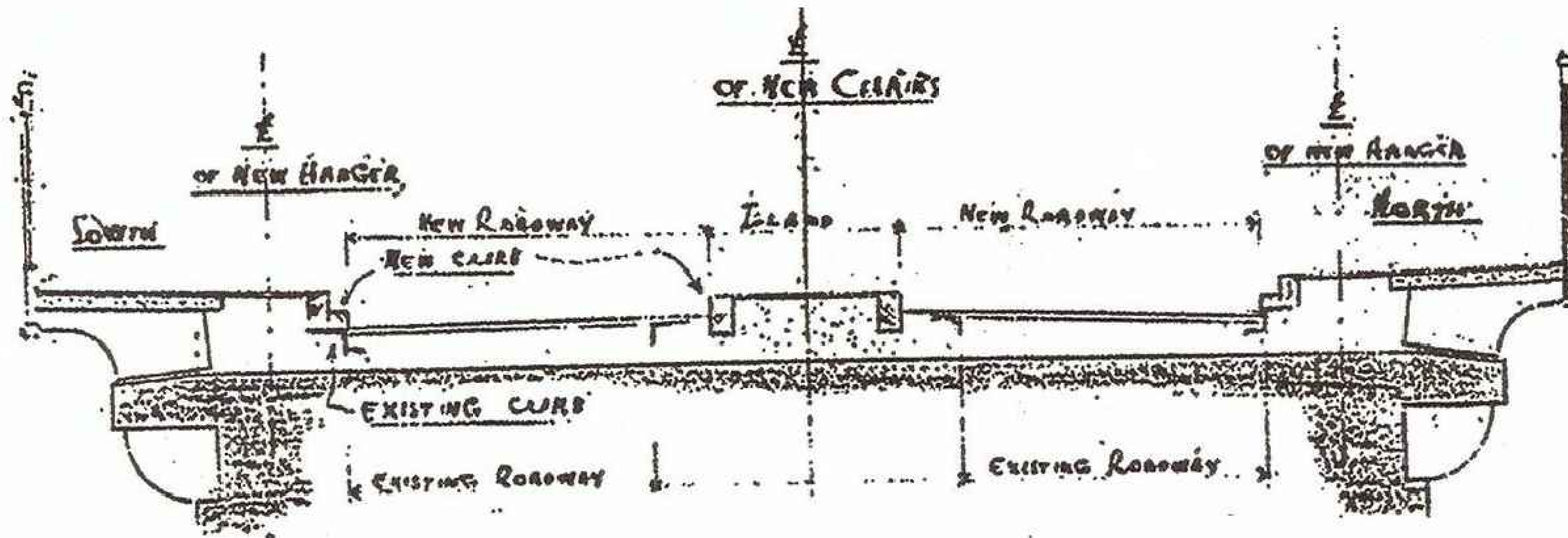
Project
**MENAI SUSPENSION BRIDGE
REMEDIAL WORKS**

Drawing Title
EXISTING GENERAL ARRANGEMENT

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Drawn	JFL	Signed	Date	22/06/20
Checked	TH	Signed	Date	21/07/20
Approved	TH	Signed	Date	22/07/20
Scale(s)	As Shown	ELR & Mileage	N/A	
Alternative Reference		Sheet	1	of 1
Drawing Number	70070988-WSP-00-XX-DR-BR-00001	Revision		P01



PLAN
SCALE 1:150



TYPICAL CROSS SECTION
SCALE 1:25

KEY



FOOTWAY PANELS THAT REQUIRE REPAIRING



FOOTWAY PANELS THAT DO NOT REQUIRE REPAIRING

Legend/Notes

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P01 22/07/20 First Revision JFL TH TH			
Rev	Date	Description of Revisions	Drawn Chkd Appr
Status	FOR INFORMATION		Suitability S2

Contractor(s)



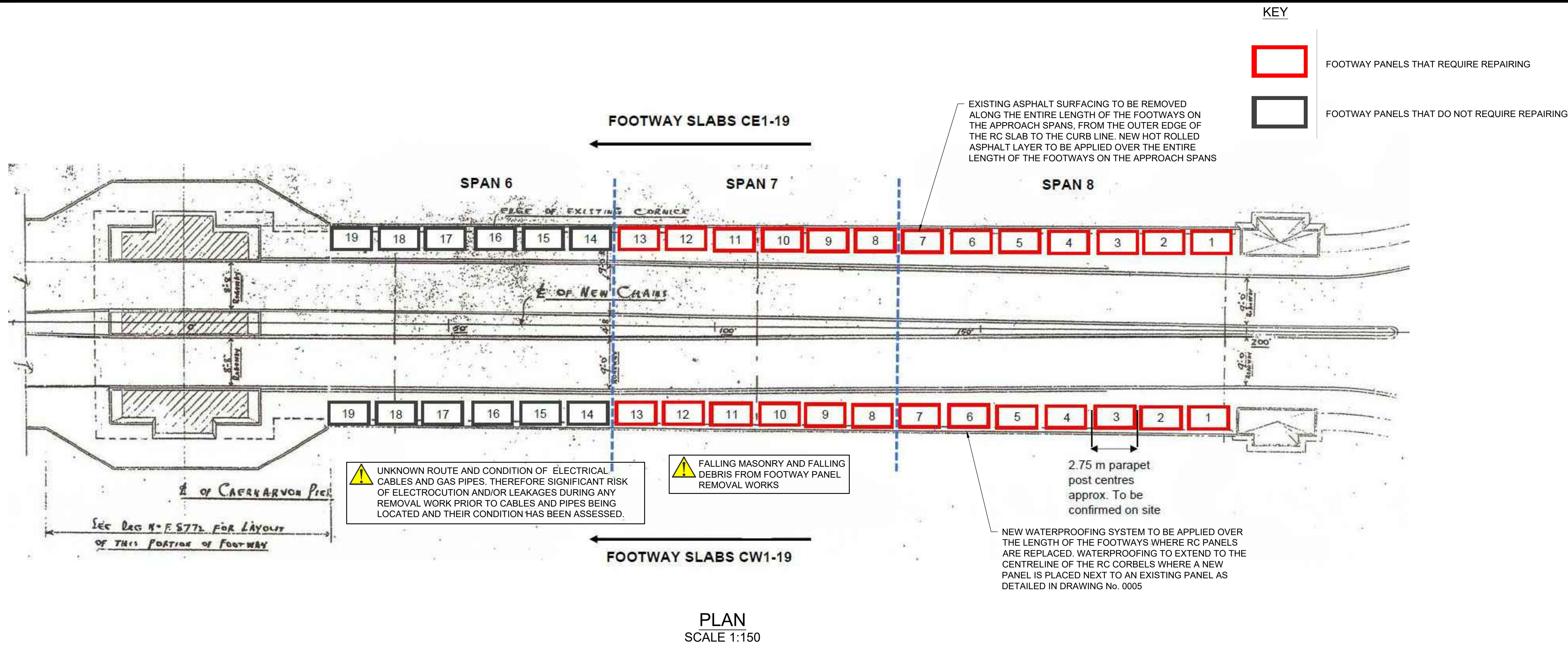
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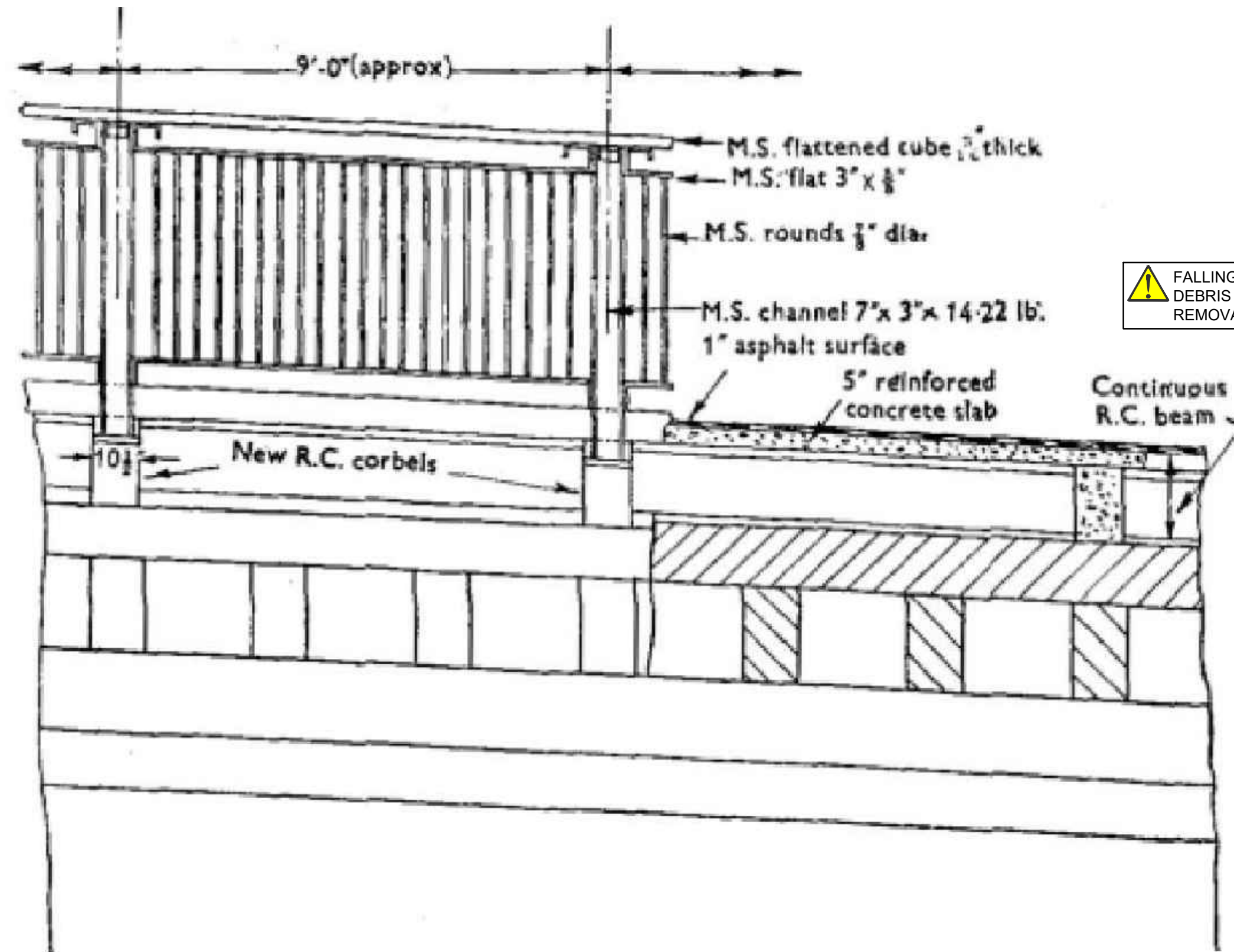
MENAI SUSPENSION BRIDGE
REMEDIAL WORKS

Drawing Title

ANGLESEY APPROACH
EXISTING DETAILS

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Checked	TH	Signed	Date	21/07/20
Approved	TH	Signed	Date	22/07/20
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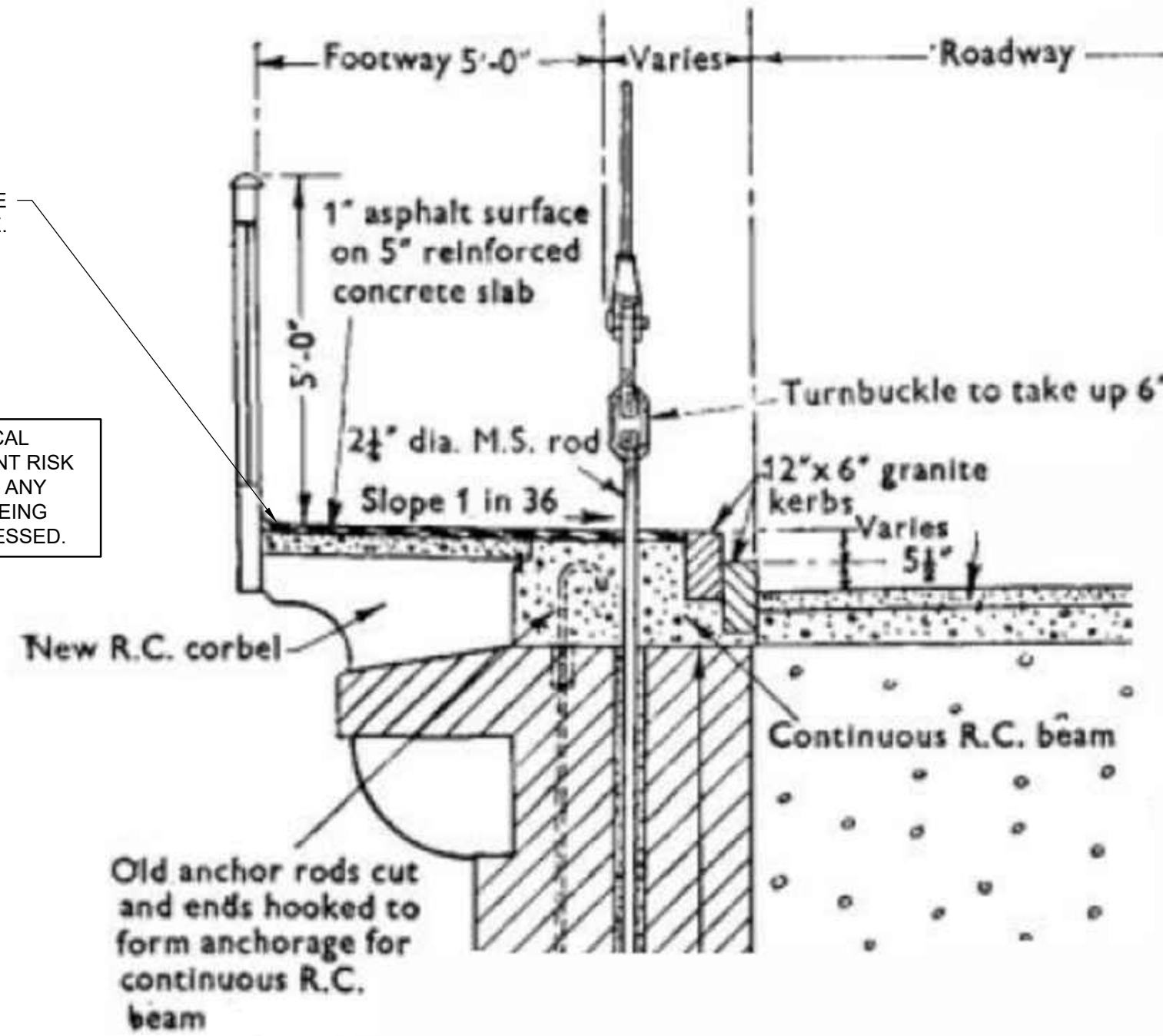


FALLING MASONRY AND FALLING DEBRIS FROM FOOTWAY PANEL REMOVAL WORKS

FOOTWAY TYPICAL LONGITUDINAL SECTION
SCALE 1:25

WATERPROOFING AND SURFACING SHALL BE REPLACED OVER FULL WIDTH AS FAR AS KERB LINE.

UNKNOWN ROUTE AND CONDITION OF ELECTRICAL CABLES AND GAS PIPES. THEREFORE SIGNIFICANT RISK OF ELECTROCUTION AND/OR LEAKAGES DURING ANY REMOVAL WORK PRIOR TO CABLES AND PIPES BEING LOCATED AND THEIR CONDITION HAS BEEN ASSESSED.



FOOTWAY TYPICAL CROSS SECTION
SCALE 1:25

Legend/Notes

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P01 22/07/20 First Revision JFL TH TH

Rev	Date	Description of Revisions	Drawn	Chkd	Appr
Status					Suitability

FOR INFORMATION

S2

Contractor(s)

WSP

Project

**MENAI SUSPENSION BRIDGE
REMEDIAL WORKS**

Drawing Title

**BRIDGE APPROACHES
EXISTING FOOTWAY SLABS
TYPICAL DETAILS**

Designed	SD	Signed	Date	22/06/20
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Checked	TH	Signed	Date	21/07/20
Approved	TH	Signed	Date	22/07/20
Scale(s)	As Shown	ELR & Mileage	N/A	

Alternative Reference	Sheet
-	1 of 1

Drawing Number	Revision
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Appendix C

SUPPORTING DOCUMENTS - FOOTWAY REPAIR SCHEME PROPOSAL

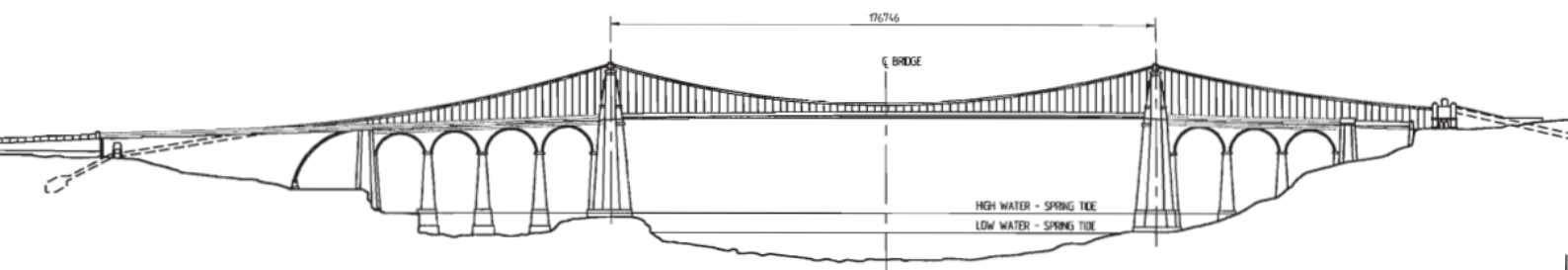




UK Highways A55 Ltd.

MENAI SUSPENSION BRIDGE

Footway Repair Scheme Proposal





UK Highways A55 Ltd.

MENAI SUSPENSION BRIDGE

Footway Repair Scheme Proposal

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DATE: JUNE 2020

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QUALITY CONTROL

Version	Detail	Prepared By: Date:	Checked By: Date:	Authorised by: Date:	Client Acceptance: Date:
1	First issue for Client's comments				
		S.Dorgan 05/06/2020	H.James 11/06/2020	H.James 11/06/2020	
2	Outline construction sequence amended				
		S.Dorgan 18/06/2020	H.James 18/06/2020	H.James 18/06/2020	

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4.3	CONSTRUCTION SEQUENCE FOR PROPOSED SOLUTION	6

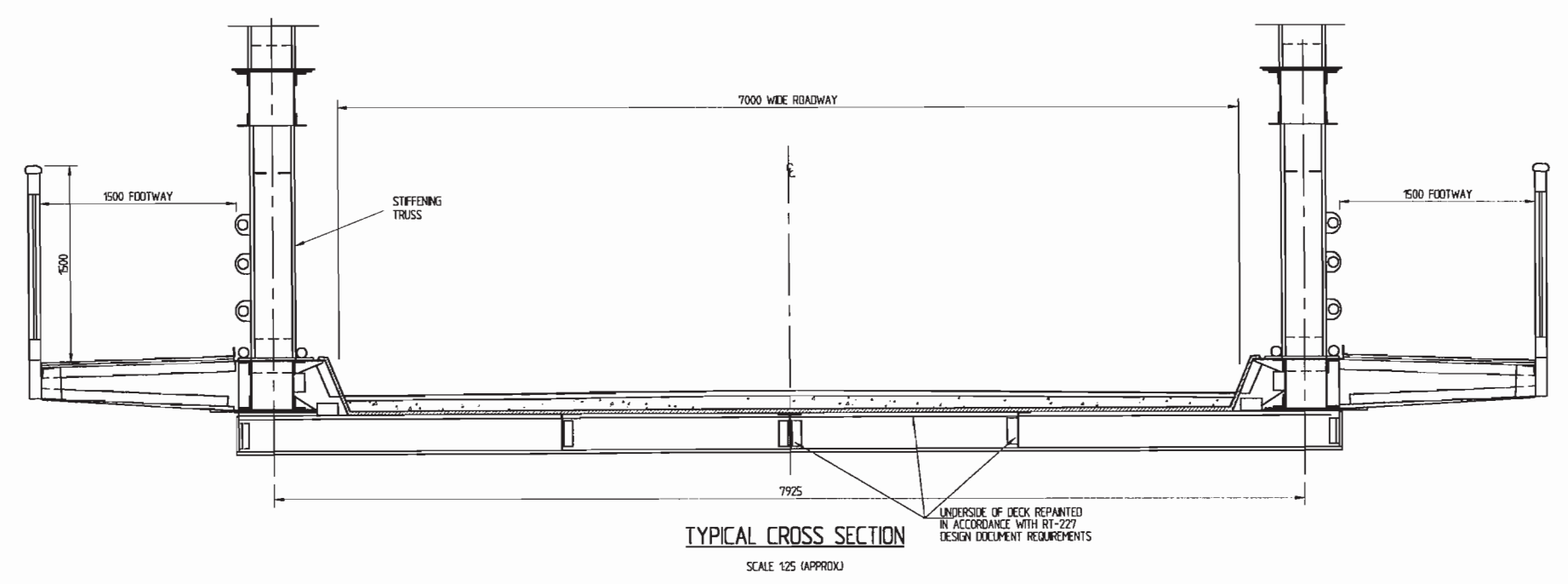
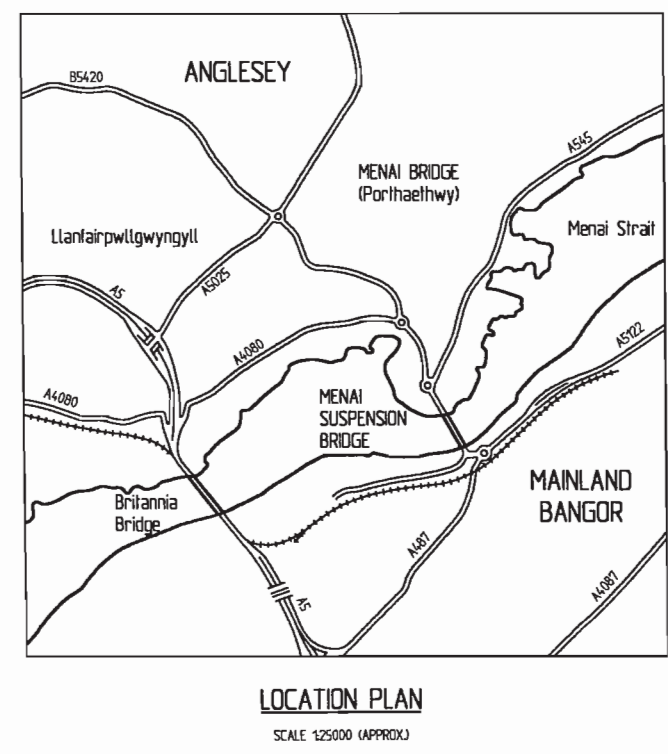
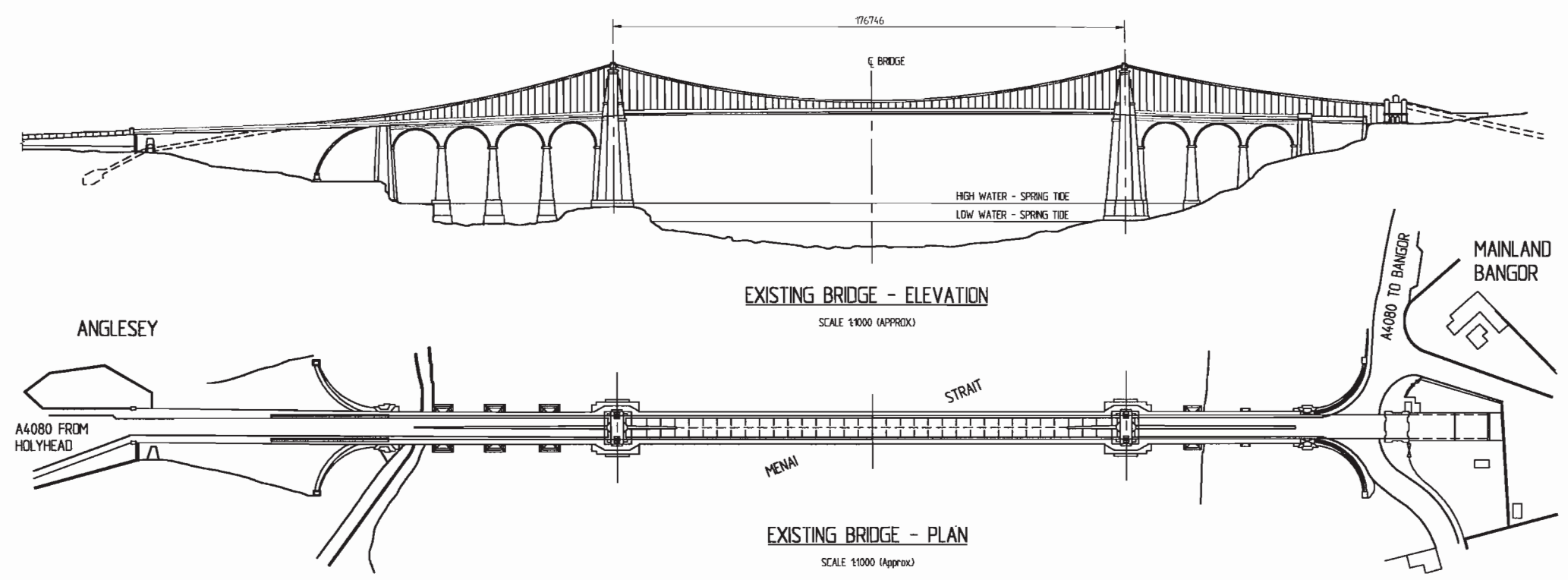
APPENDICES

APPENDIX A – RECORD DRAWINGS OF EXISTING GENERAL ARRANGEMENT

APPENDIX B - PROPOSED GRP PERMANENT FORMWORK & CAST IN-SITU CONCRETE SLAB SKETCH

APPENDIX C - DRAWING OF PROPOSED GRP PERMANENT FORMWORK PANELS BY EMJ PLASTICS

1.0 MENAI BRIDGE GENERAL ARRANGEMENT



GD REFERENCE : D:\CAD DRAWINGS\Struct\BR37\GD00280_BR37_D_001.DWG
DATE PLOTTED : 07/03/2001
TIME PLOTT : 05:5

Issue	Description	Auth.	Chd.	Appd.	Date
1	ISSUED FOR TLV COMMENT	GAP	K.W.	N.J.M.	26/08/99
2	NOTE 2 AMENDED	R.D.F.	K.W.	N.J.M.	02/09/99
3	ISSUED FOR REVIEW	R.D.F.	K.W.	N.J.M.	09/09/99
4	ISSUED FOR CONSTRUCTION	P.M.N.	M.J.A.	N.J.M.	23/09/99
A	ISSUED FOR AS BUILT	GRP	WDR	RKP	07/03/2001

Notes
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED
2. ALL DRAWINGS TO BE READ IN CONJUNCTION WITH SPECIFICATION REF: GD00280/RT/227

UK Highways plc

carillion

Client
CYNULLIAD CENEDIAETHOL CYMRU
Adran y Cyfarwyddwr Prifffyrdd
THE NATIONAL ASSEMBLY FOR WALES
Highways Directorate

Scale (A1)
AS SHOWN

Datum
LOCAL

Project
A55 LLANDEGAI TO HOLYHEAD
DBFO PROJECT

Title
MENAI BRIDGE
GENERAL ARRANGEMENT

AS BUILT DRAWING

Hyder

HYDER CONSULTING
The Surrey Research Park
Guildford
Surrey
GU2 5AR
Tel: +44 01483 535000
Fax: +44 01483 535051

Drawing No.
GD00280/BR37/D/001

Issue
A

2.0 ANGLESEY APPROACH DETAILS

KEY: Footway panels that require replacing

Footway panels that do **NOT** require replacing

- Footway slabs on the Anglesey approach are designated AE1-25 or AW1-25, referring to Anglesey East or Anglesey West respectively.
- A maximum of **37** footway panels will require replacement on the Anglesey approach (25 panels on the West side (AW1-25) and 12 panels on the East side (AE8-19) as detailed in **Figure 1**). These are over spans 1-4 on the West side and over spans 2 & 3 on the East side.

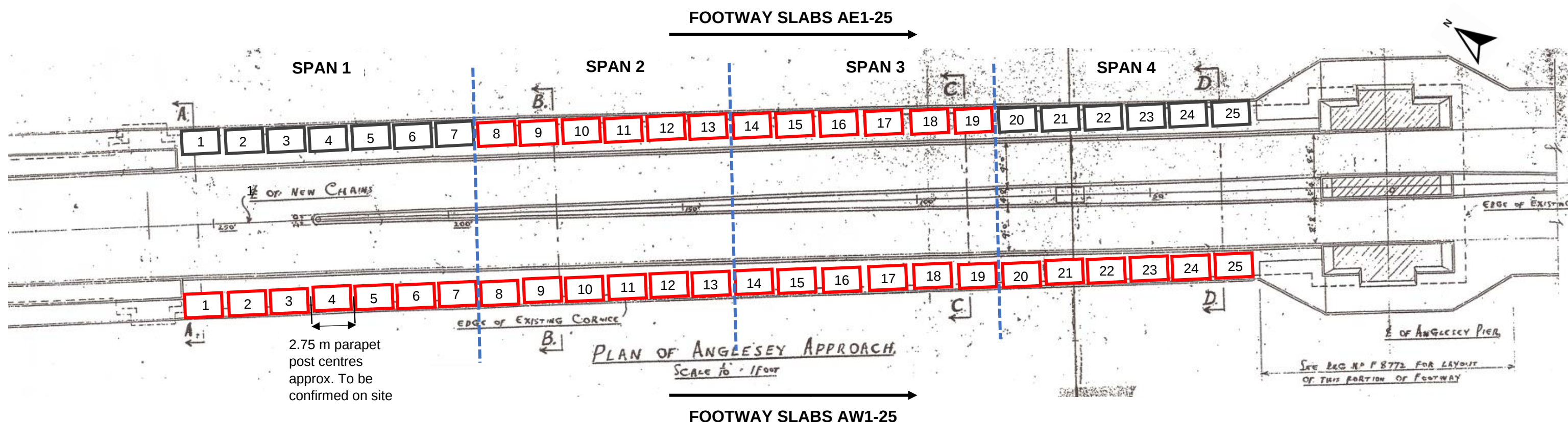


Figure 1: Plan of Anglesey Approach highlighting footway panels and spans

JUSTIFICATION TO REPLACE OUTLINED SLABS

- Spans 1 – 4 (West):** PI Report, 2020 by Atkins states “Repair the several areas of spalling and exposed rebar to soffit of cantilevered footway particularly to the west of spans 1-4” which also forms the basis for the Menai Location Map file provided to WSP by UK Highways A55 Ltd. Hence it is appropriate to replace the all of the above footway panels on the West side.
- Spans 2 & 3 (East):** The Atkins PI report states “...and to a lesser extent throughout” on the Anglesey approach on the East side. The Vertical Access (VA) report prepared in 2009 gives further information on the condition of each span. The VA report for span 2 East states “Areas of spalling concrete and exposed rebar on underside of cantilever”. For span 3 East the VA report states, “Concrete repair crumbling away revealing 250 mm corroded rebar under walkway”. Both of these statements highlight the need for replacement of footway panels over spans 2 & 3 on the East side. However specific footway panels are not specified in any of the reports and so all have been identified as requiring replacement over spans 2 and 3 without further inspection.

3.0 CAERNARVON APPROACH DETAILS

KEY: Footway panels that require replacing

Footway panels that do **NOT** require replacing

- Footway slabs on the Caernarvon approach are designated CE1-19 or CW1-19, referring to Caernarvon East or Caernarvon West respectively.
- A maximum of **26** footway panels will require replacement on the Caernarvon approach (13 each side: CE1-13 & CW1-13 as detailed in **Figure 2**). These are over spans 7 & 8 of the bridge.

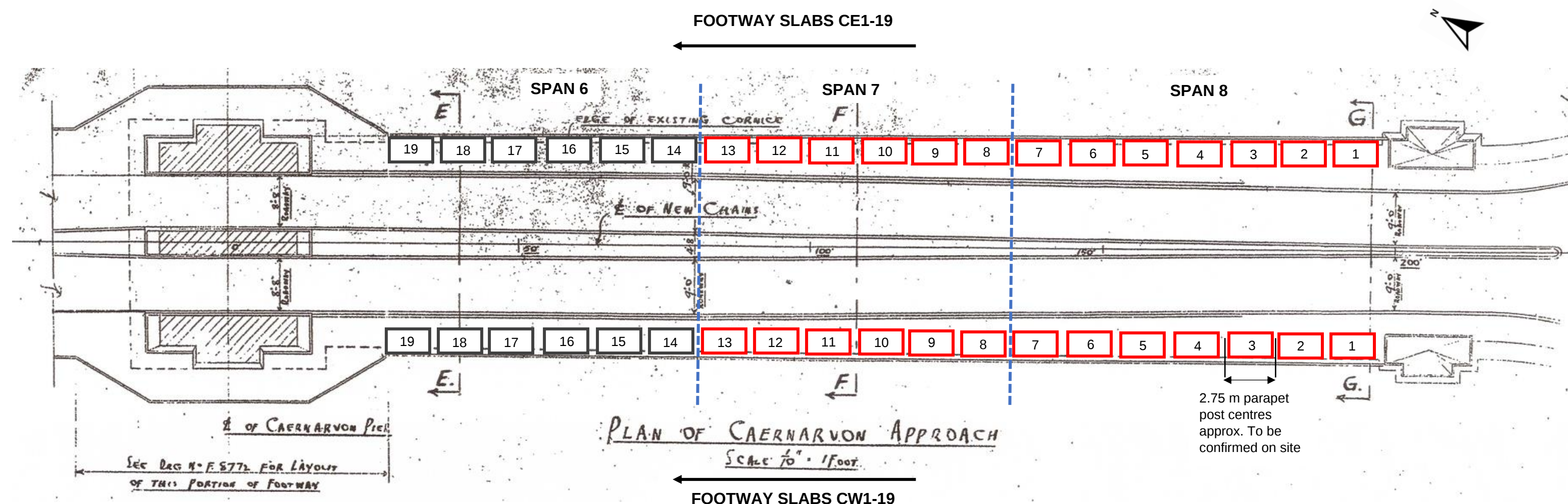


Figure 2: Plan of Caernarvon Approach highlighting footway panels and spans

JUSTIFICATION TO REPLACE OUTLINED SLABS

- **Span 8 (East and West):** PI Report, 2020 by Atkins states "Repair the several areas of spalling and exposed to soffit of cantilevered footway to north side of span 8 and to a lesser extent throughout". Furthermore, the Vertical Access (VA) report states "Large area of concrete missing, rebar exposed 1.5 m underside of cantilever" to span 8 East side and "Areas of missing concrete, rebar exposed" to span 8 West side. Thus, all footway panels on span 8 above have been identified to be replaced given this information and lack of specificity to which particular panels along the span.
- **Span 7 (East and West):** The 2020 Atkins PI report states that there are no high or medium priority defects on span 7, however the Menai Location Map highlights that repairs are required, thus the VA report has been used to identify the defects. The VA report states "Badly corroded or missing rebar under walkway" for the East side of span 7 and "spalling concrete removed, rebar exposed" for the West side of span 7. The reports do not specify which particular panels are affected and therefore justifies the replacement of all footway panels over span 7 without further inspection.

4.0 FOOTWAY PANEL DETAILS

This section details the existing arrangement of the footway panels and the proposed arrangement that will replace the affected panels, along with a construction sequence outline for the replacement.

4.1 EXISTING FOOTWAY PANEL ARRANGEMENT

The existing footway panel arrangement comprises a 127 mm one-way spanning, reinforced concrete (RC) slab overlaid with a 25 mm thick asphalt surface. The RC slab spans between RC corbels which allow the footway to cantilever from the side of the suspension bridge. See **Figure 3** below for an elevation and cross section view of the of the footway slab and parapet details. Record drawings of the arrangement can be found in **Appendix A**. Due to concrete spalling and subsequent exposure of reinforcement; the affected panels are to be removed using suitable methods and replaced with the proposed arrangement described in **Section 4.2** below.

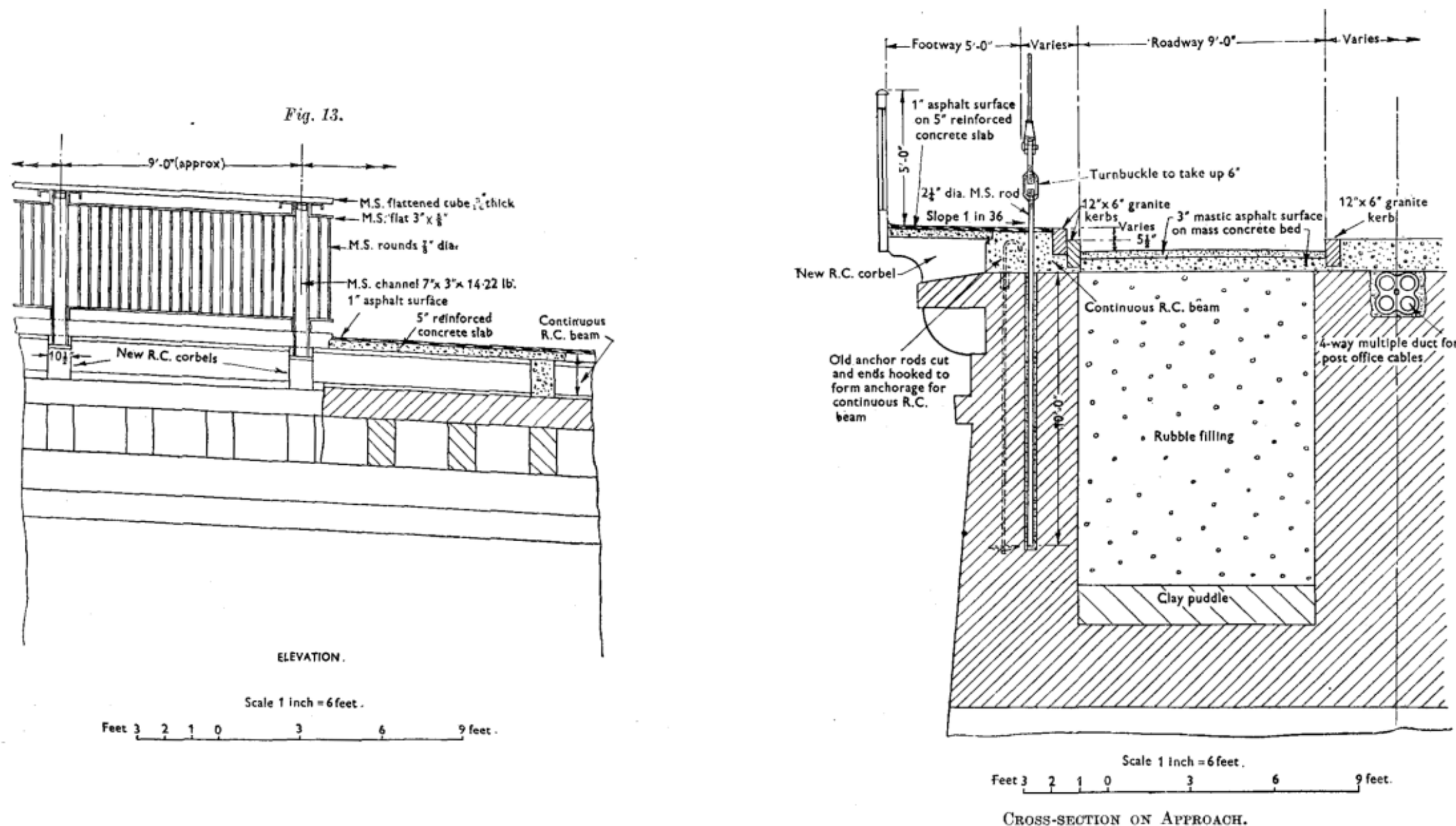


Figure 3: Extract from reconstruction drawings of 1938-1940 showing side elevation and cross-sectional view of footway and parapet details

4.2 PROPOSED FOOTWAY PANEL ARRANGMENET

The proposed arrangement for the new footway panels uses GRP Permanent Formwork from EMJ Plastics or similar approved. Refer to **Appendix C** for a drawing of the GRP Panels by EMJ Plastics. These panels mitigate risk and have an improved economy in comparison to temporary formwork. The GRP panels will span between the RC corbels and a cast in-situ reinforced concrete slab will be overlaid. A suitable waterproofing layer will be applied to the RC slab with a 25 mm layer of Asphalt overlying to match the existing arrangement and levels. See **Appendix B** for proposed GRP Permanent Formwork Footway Panel Sketch and **Figure 4** below for a snapshot of the cross-section of this arrangement.

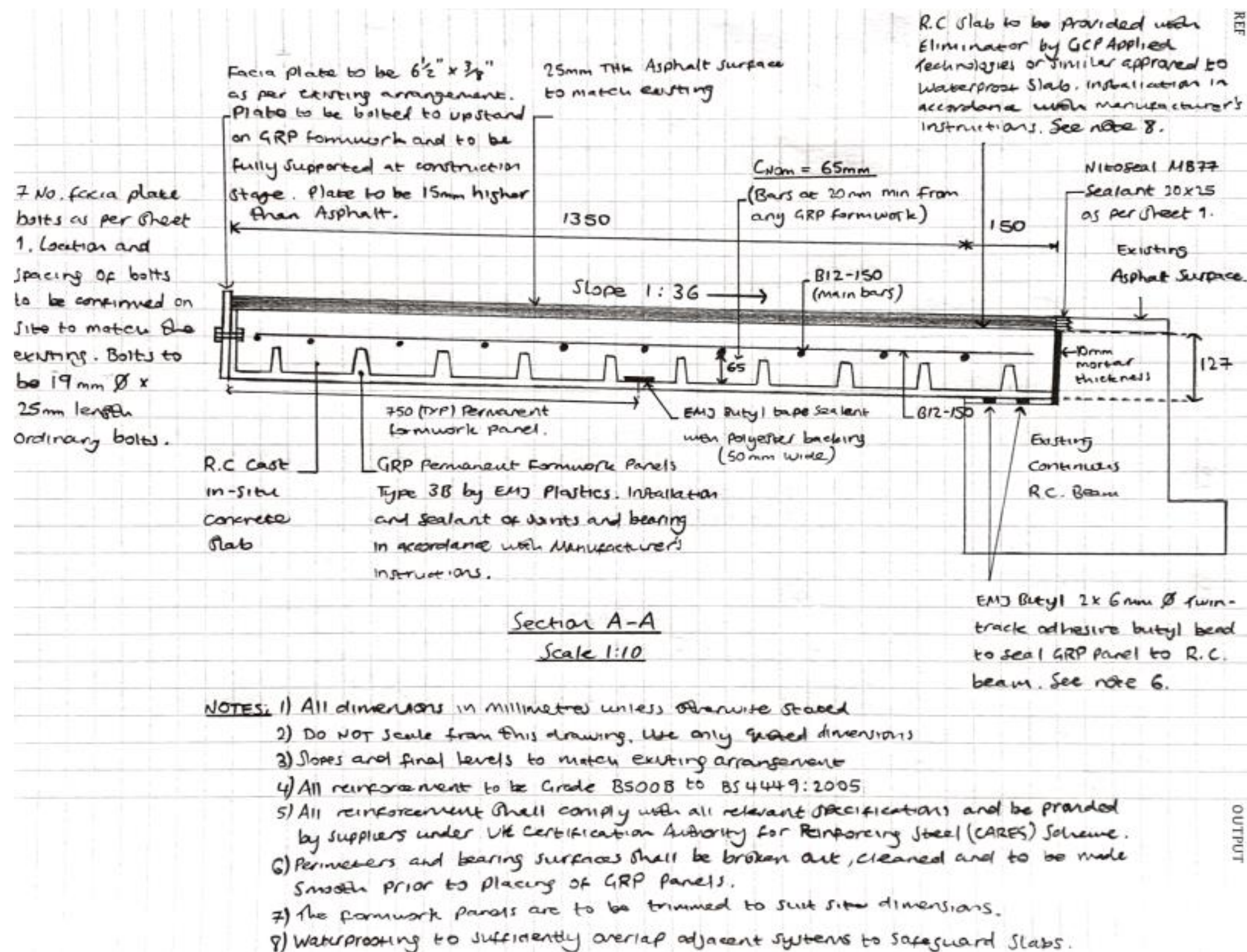


Figure 4: Extract from GRP Permanent Formwork Sketch for Footway Replacements

4.3 CONSTRUCTION SEQUENCE FOR PROPOSED SOLUTION

The outline construction sequence for removal of existing RC slab and installation of proposed GRP Permanent Formwork and cast in-situ RC slab is as follows. Final construction sequence to be prepared by the contractor.

1. Install suitable safety provisions below panel cut-out locations before removal of existing concrete slab to capture debris and for personnel anti-fall safety.
2. Install lifting sockets to suit for the removal of the RC slab.
3. Contractor to saw-cut the existing footway panels in longitudinal strips to suit requirements and lift out using suitable methods and lifting points. Strips to be lifted out using suitable mechanical means and appropriate Traffic Management to suit. Edges around openings to be protected by guardrail as appropriate.
4. Perimeters and bearing surface concrete to be broken out, cleaned and to be made smooth in preparation for the GRP Permanent Formwork panels.
5. Sealants should be applied to smooth concrete rebates once the formwork is ready to be installed. Installation of all elements in accordance with manufacturer's instructions.
6. The formwork panels to be trimmed to suit site dimensions and steel fascia plate to be bolted to GRP panel upstand as outlined in sketch. The fascia plate and GRP panel are to be fully supported when lifted into position and when concrete is being poured.
7. Panels to be lifted into position and rested on the sealant. Care should be taken to ensure the adequate bearing to the ends of the formwork panel.
8. Once panels have been positioned and rested on sealant, the sealants positioned between the panels where the panels butt up against each other should be applied.
9. Once the panels are correctly positioned and fixed in place, the slab reinforcement can be laid.
10. Concrete shall be poured in line with Highways Agency Specification and left to cure.
11. A suitable waterproofing membrane in accordance with Highways Agency Specification is to be applied to the top surface of the RC slab.
12. Asphalt surfacing to be installed and applied to the waterproofing membrane.
13. Install hot applied sealants to perimeter of new asphalt.
14. Repeat procedure on subsequent panels in sequence.

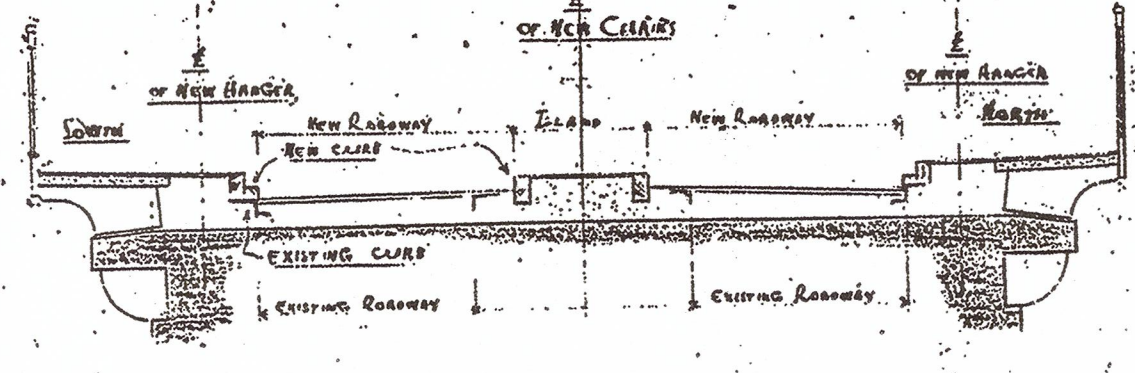
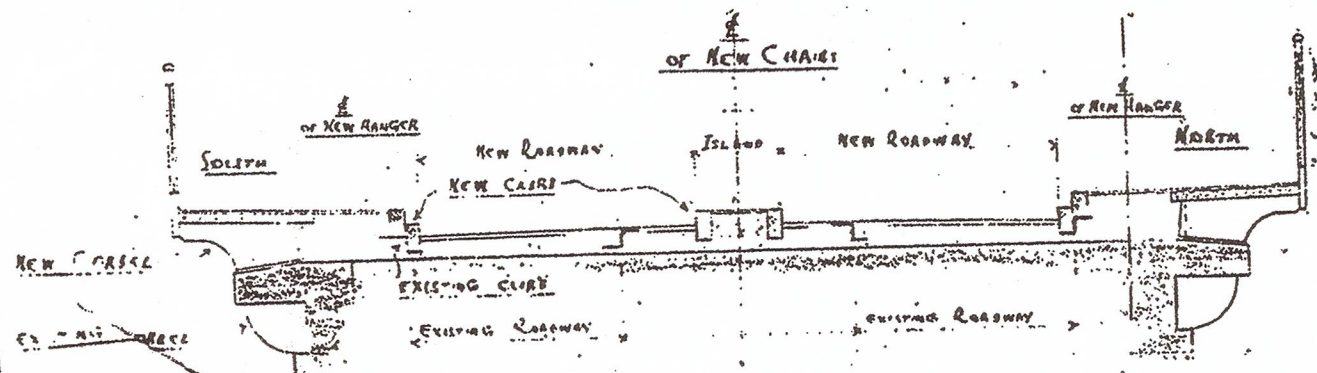


APPENDIX A – RECORD DRAWINGS OF EXISTING GENERAL ARRANGEMENT

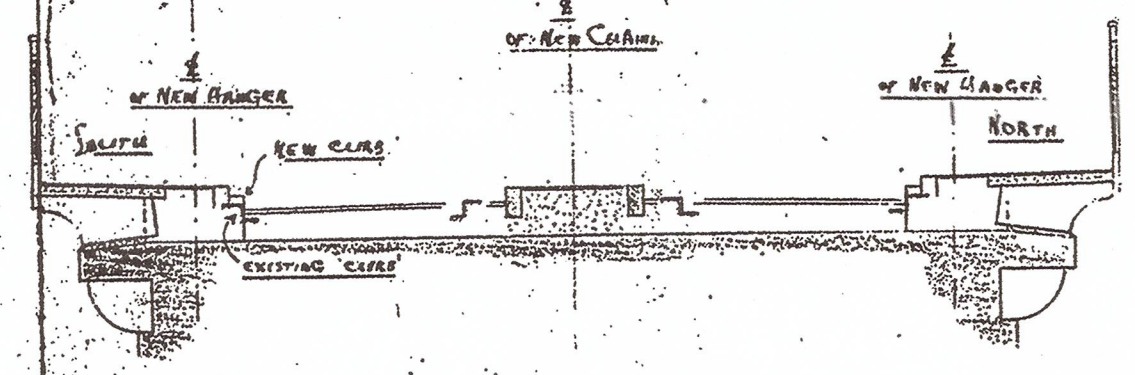


PLAN OF ANGLESEY APPROACH
SCALE 1/16" = 1' 0"

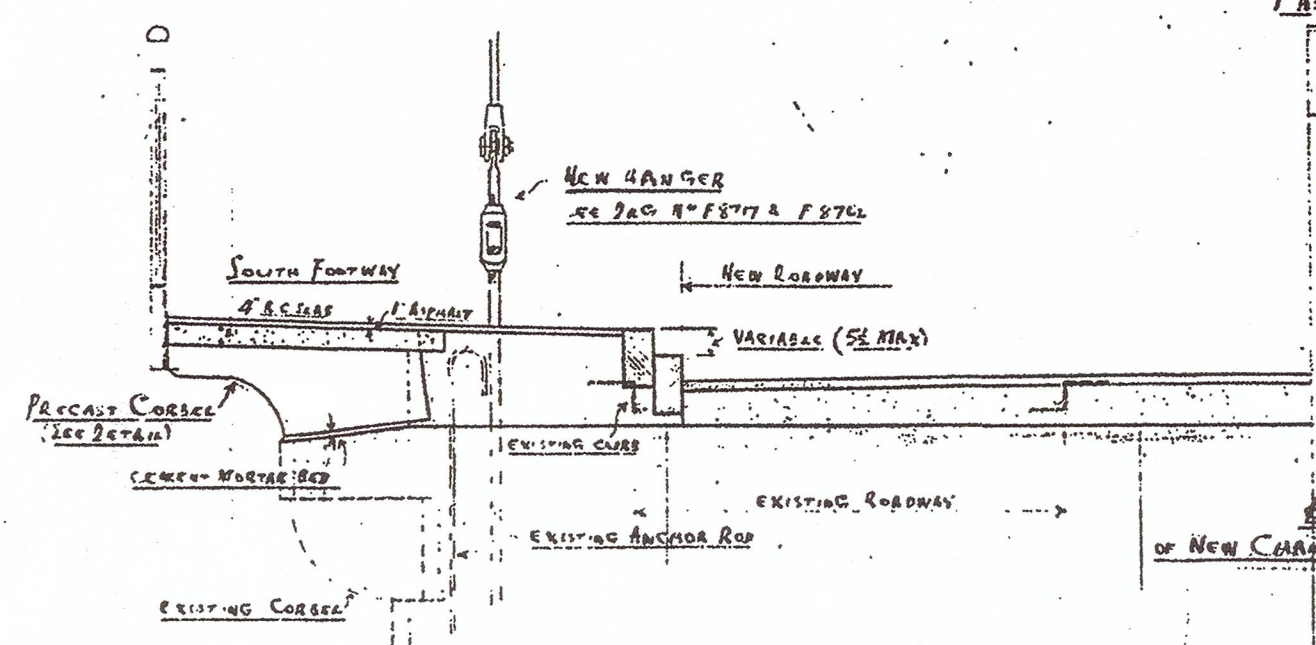
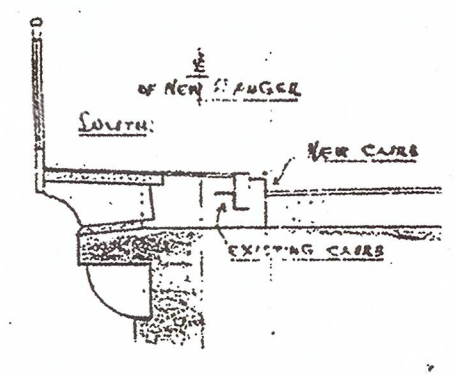
SEE DET. NO. F 8772 FOR LAYOUT
OF THIS PORTION OF FOOTWAY



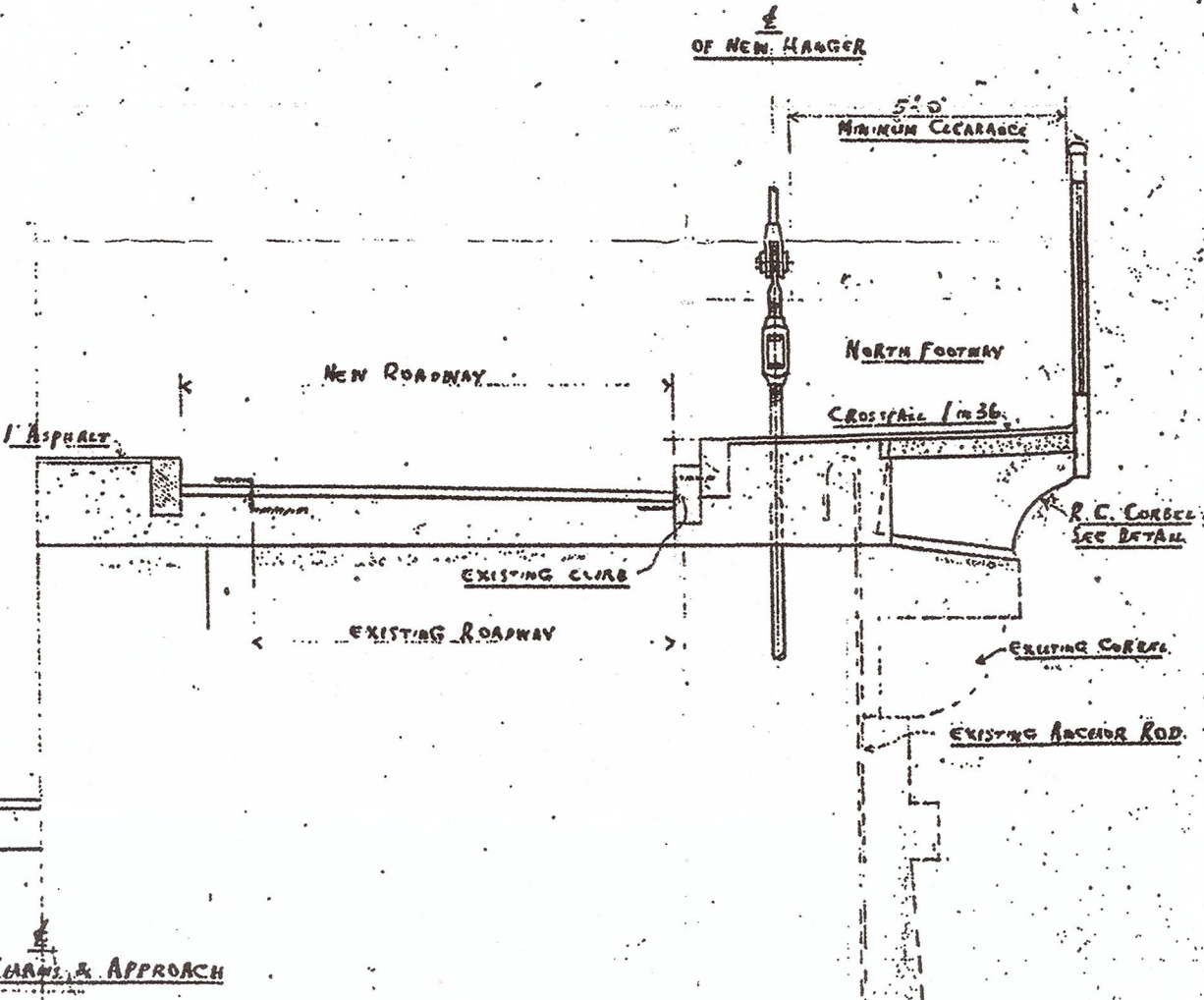
SECTION CC
(Scale 1/4" = 1' 0")



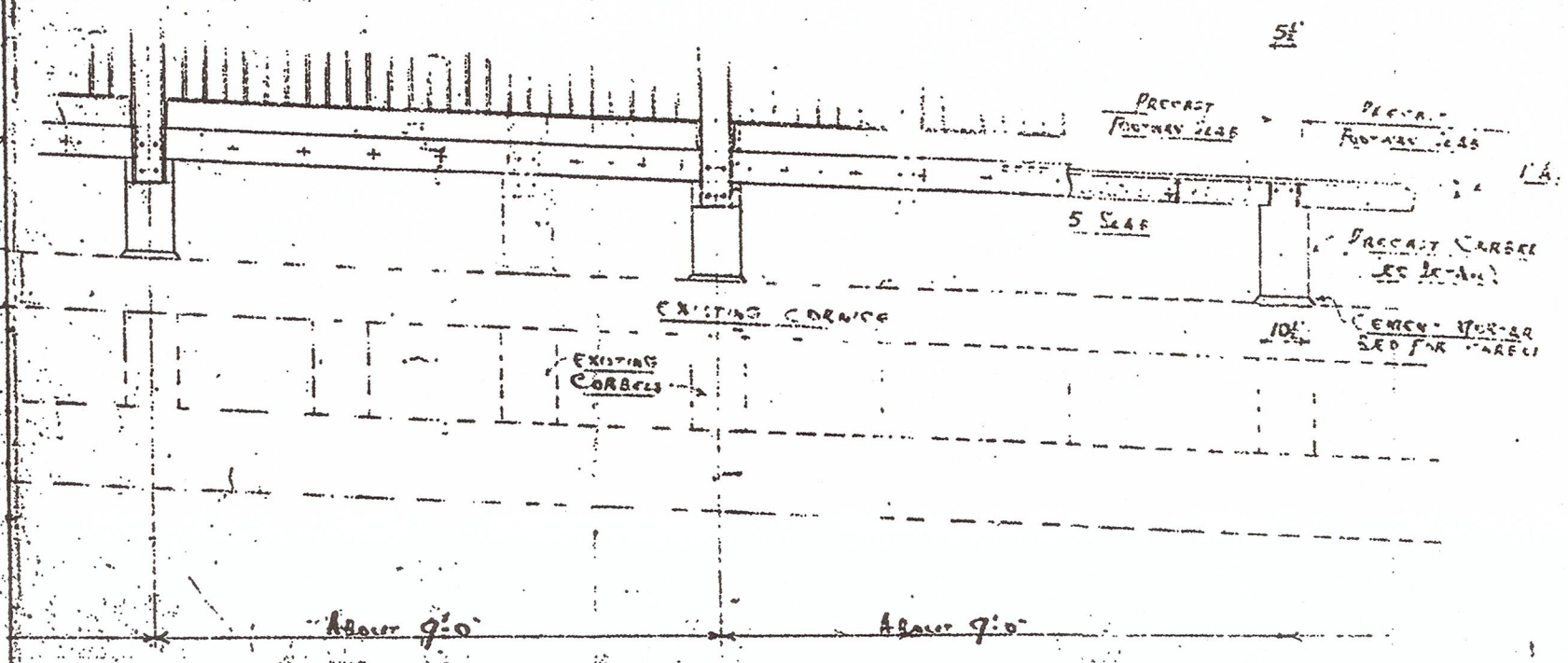
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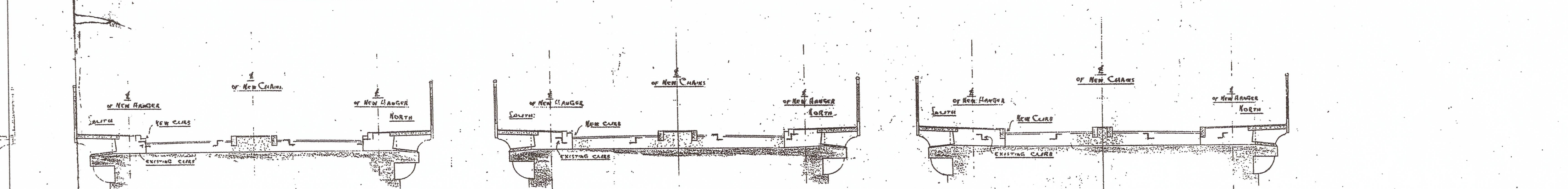
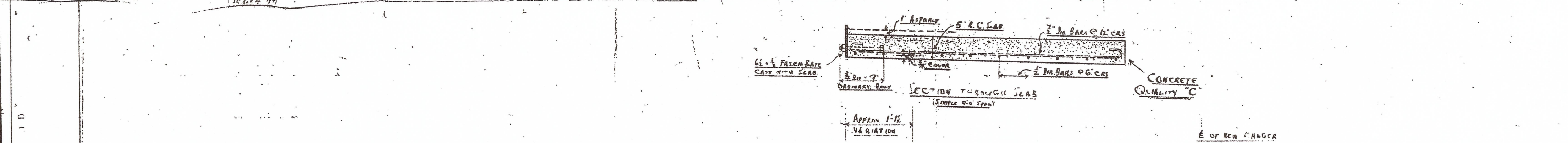
HALF SECTION AA



HALF SECTION DD



TYPICAL ELEVATION OF PIER
(Scale 1/16" = 1' 0")


$$\sum C_A z_i \epsilon_i \frac{1}{10''} = 1 \text{ foot}$$


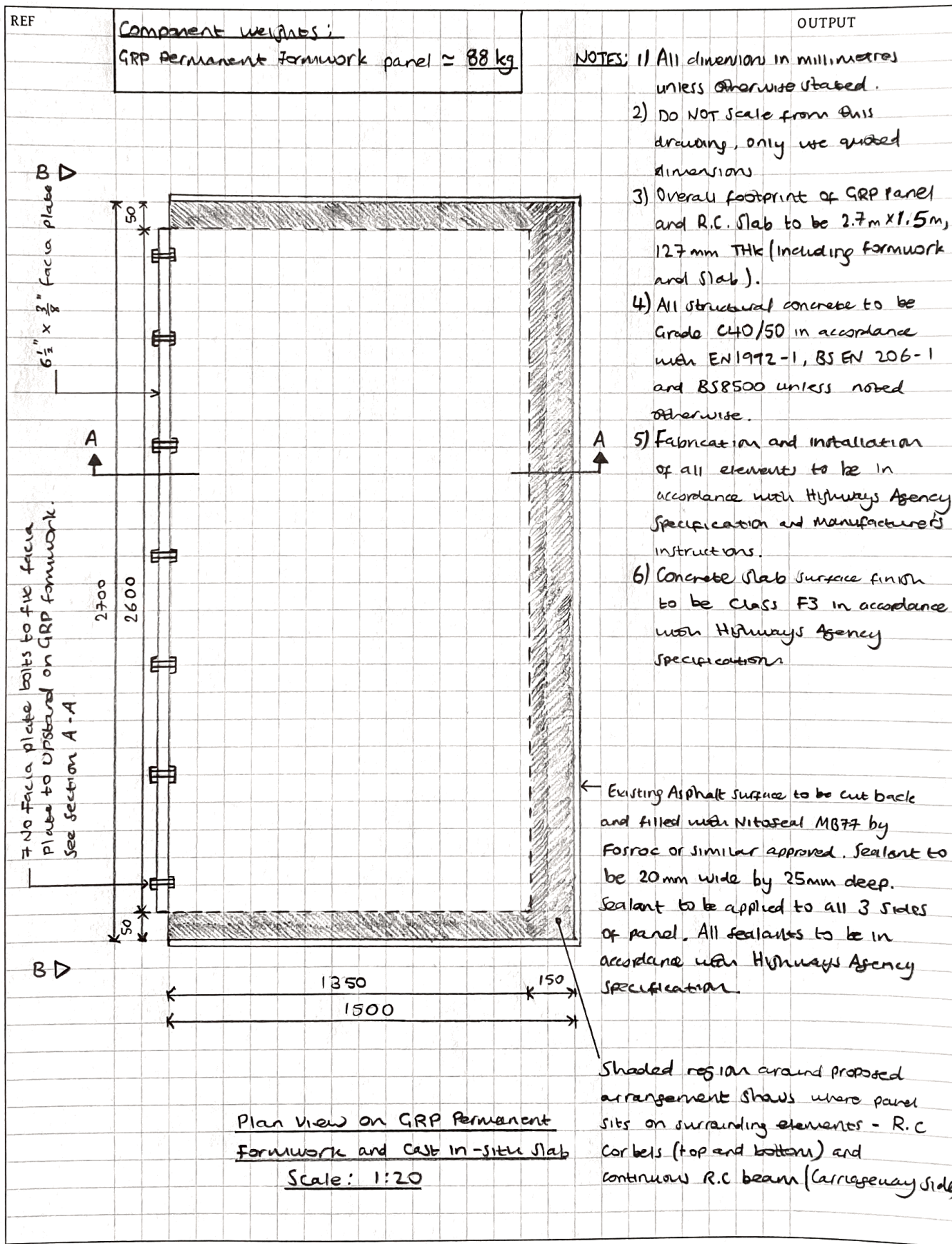
1079^H
REVISION 'A'
CONSTRUCTION OF FOUR
CLAS AND CORREL.
REVISOR - DEC 25TH 1913

DORMAN LONG & CO		
BRIDGE DEPT - BACK ST - MIDDLESEX		
MENAI DISPENSION BRIDGE		
DETAILS OF APPROACH FOOTING		
DATE	SCALE	
OCT 4 th 38	AS NOTED	DRAWN BY E. S. G.

APPENDIX B - PROPOSED GRP PERMANENT FORMWORK & CAST IN-SITU CONCRETE SLAB SKETCH

Project Menai Suspension Bridge - Remedial Works			Status	
Date 05/06/2020	Job no. 70070988	Section	Sheet no. 1 of 3	Rev
By SD	Checked HJ			
Rev	Date	Details Sketch No: Sk70070988-05		Tel
				Fax
Part Footway Repair Scheme Proposal - GRP Permanent Formwork				

wsp



Project	Neval Suspension Bridge - Roundabout works	Status
Date	05/06/2020	Job no.
By	JD	70070988
Checked	HJ	Section
Rev		Sheet no.
		2 of 3
		Rev

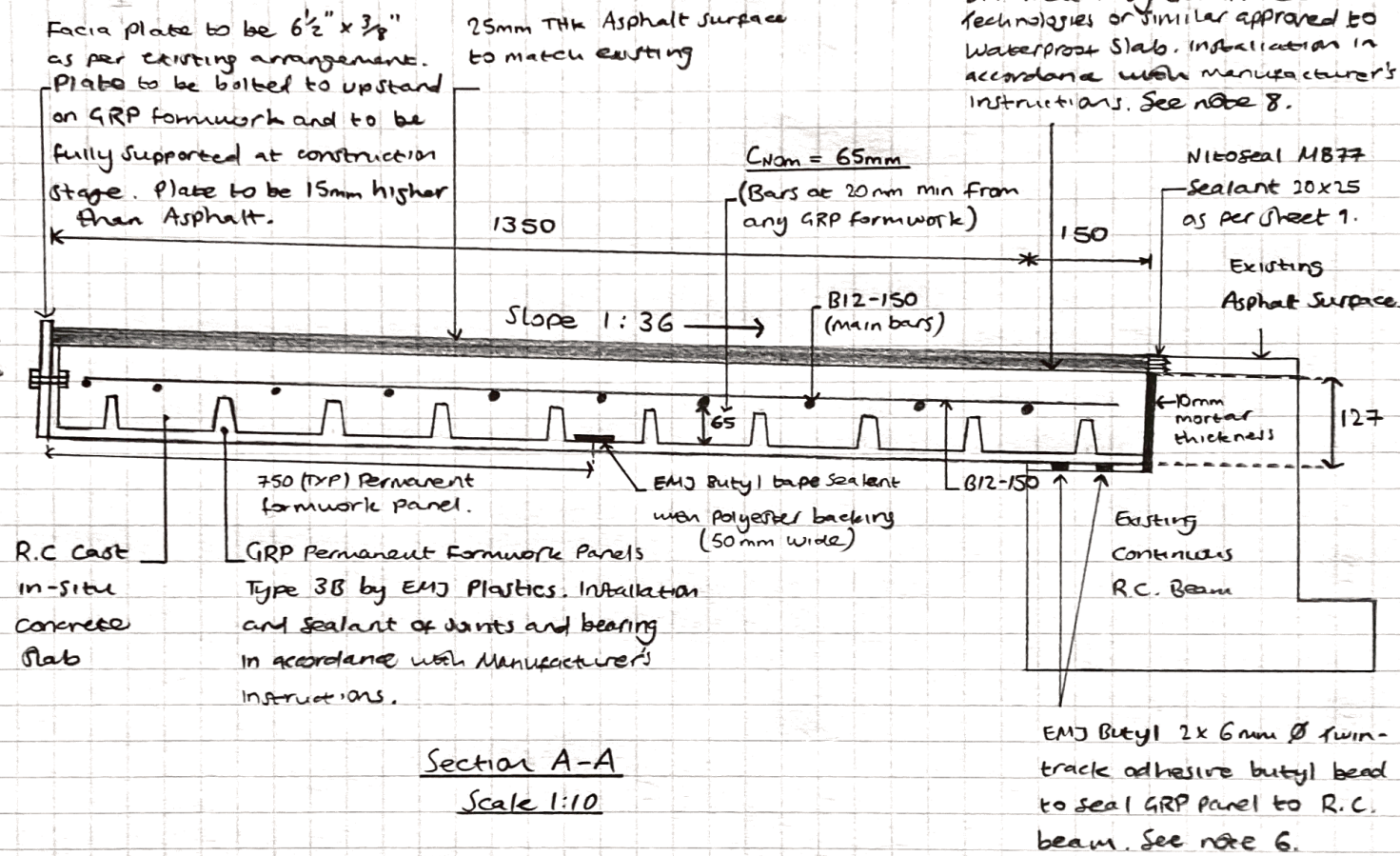
WSP

Part	Details	Sketch No: SK70070988-05	Tel
Rev	Date		Fax

Footway Repair Scheme Proposal - GRP Permanent Formwork

REF OUTPUT

R.C Slab to be provided with Eliminator by GCP Applied Technologies or similar approved to Waterproof Slab. Installation in accordance with manufacturer's instructions. See note 8.



7 No. facia plate bolts as per sheet 1. Location and spacing of bolts to be confirmed on site to match the existing. Bolts to be 19mm Ø x 25mm length ordinary bolts.

- NOTES:
- 1) All dimensions in millimetres unless otherwise stated
 - 2) Do NOT scale from this drawing. Use only quoted dimensions
 - 3) Slopes and final levels to match existing arrangement
 - 4) All reinforcement to be Grade B500B to BS4449:2005
 - 5) All reinforcement shall comply with all relevant specifications and be provided by suppliers under UK Certification Authority for Reinforcing Steel (CARES) Scheme.
 - 6) Perimeters and bearing surfaces shall be broken out, cleaned and to be made smooth prior to placing of GRP panels.
 - 7) The formwork panels are to be trimmed to suit site dimensions.
 - 8) Waterproofing to sufficiently overlap adjacent systems to safeguard slabs.

Project	Status
Menai Suspension Bridge - Remedial works	

WSP

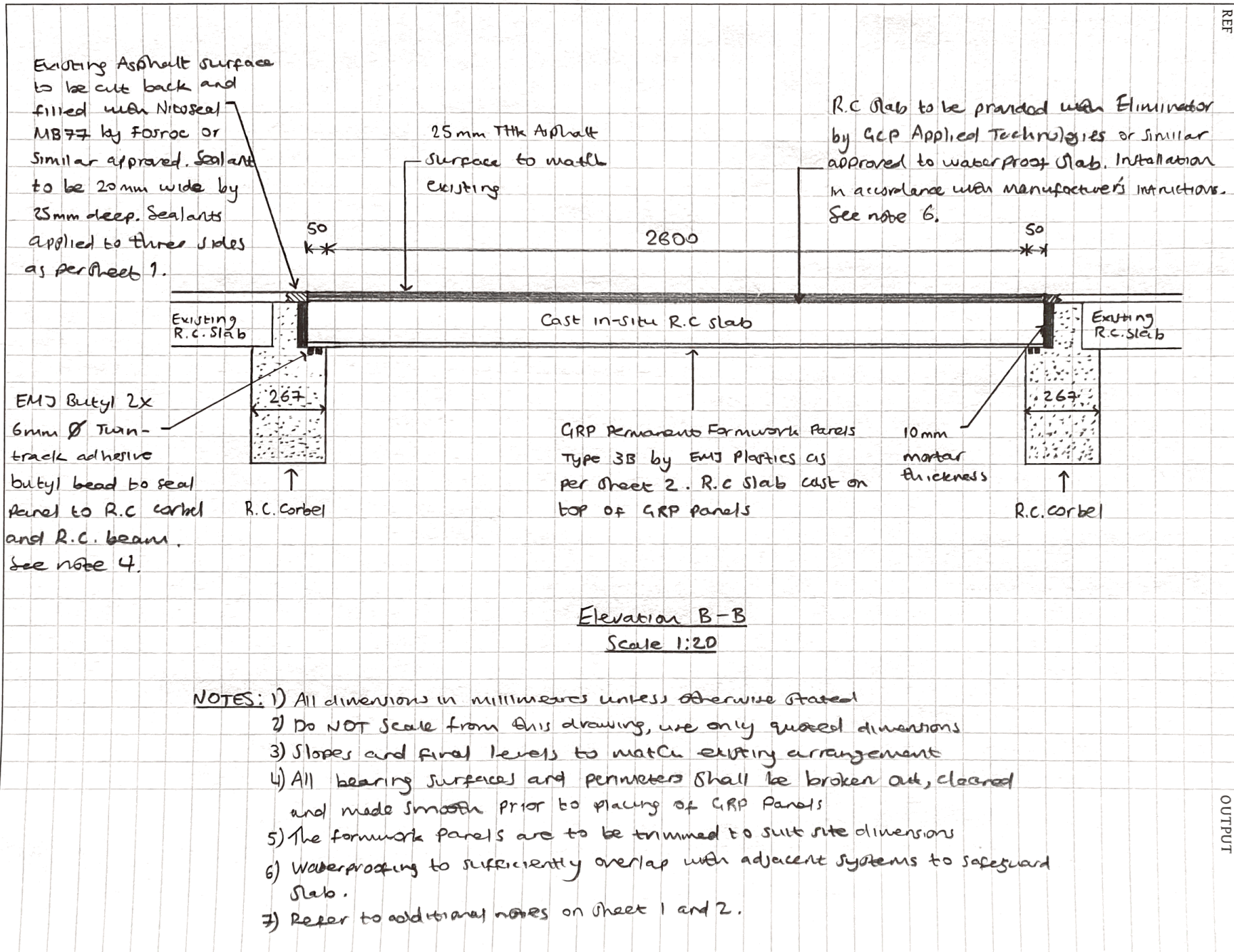
Date	05/06/2020	Job no.	70070988	Section	3 of 3	Rev	
By	SD						
Checked	HTJ						

Rev	Date	Details	Tel	Fax
		Sketch no: SK70070988-05		

Part
Footway Repair Scheme Proposal - GRP Permanent Formwork

REF

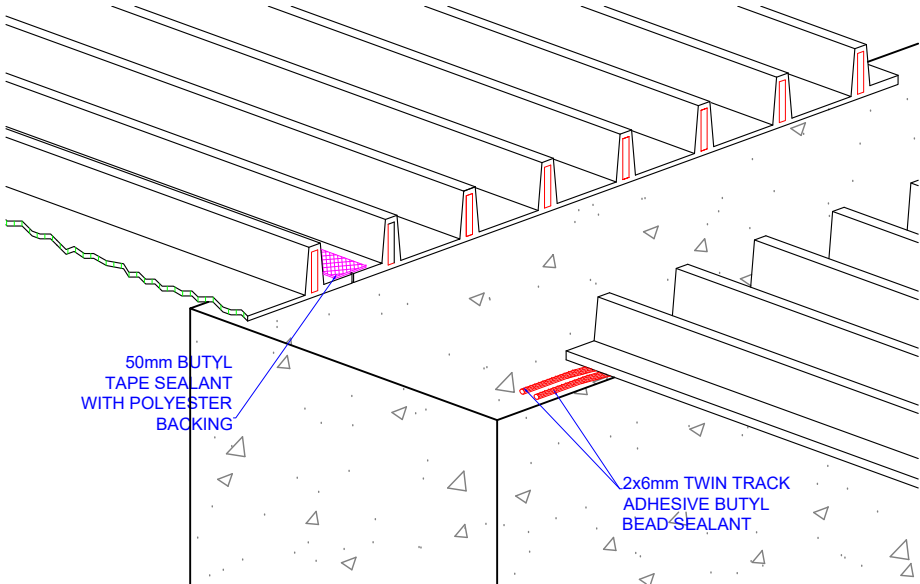
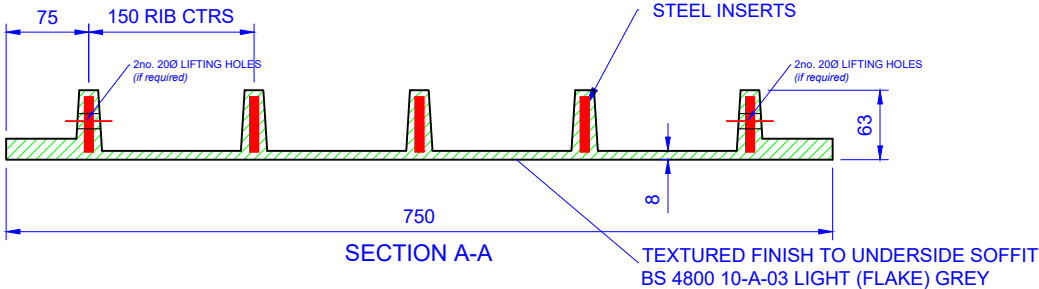
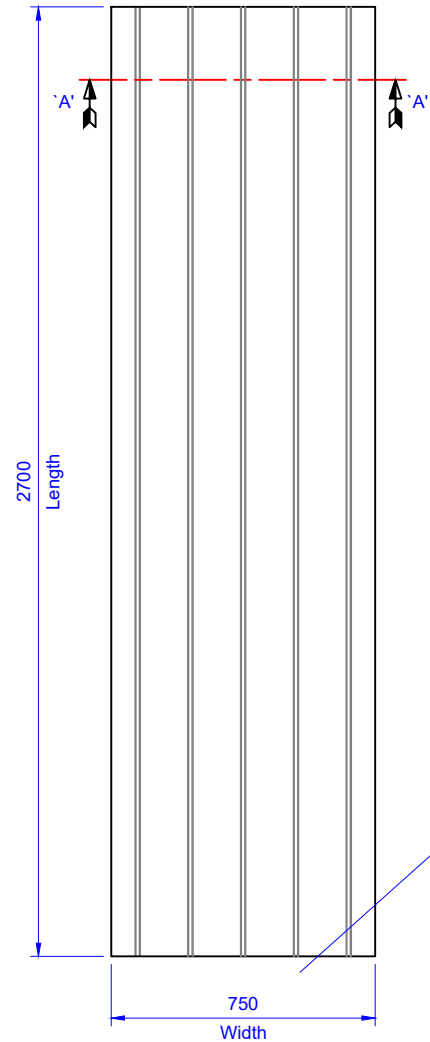
OUTPUT





APPENDIX C - DRAWING OF PROPOSED GRP PERMANENT FORMWORK PANELS BY EMJ PLASTICS

PANEL SCHEDULE		
No. of Panels	Panel Length (mm)	Panel Width (mm)
-	2700	750



ANGLED END PANELS TO BE CUT TO SUIT ON SITE (BY OTHERS) AND SUPPORTED OFF DIAPHRAGM OR DIAPHRAGM SHUTTER BEFORE CONCRETING.
CUT STEEL ENDS TO BE PAINTED WITH GALVAFROID OR SIMILAR

END PANELS 'OF EACH RUN' TO BE CUT ON SITE (BY OTHERS) AVOID EDGE FLANGE WIDTHS OF MORE THAN 75mm.

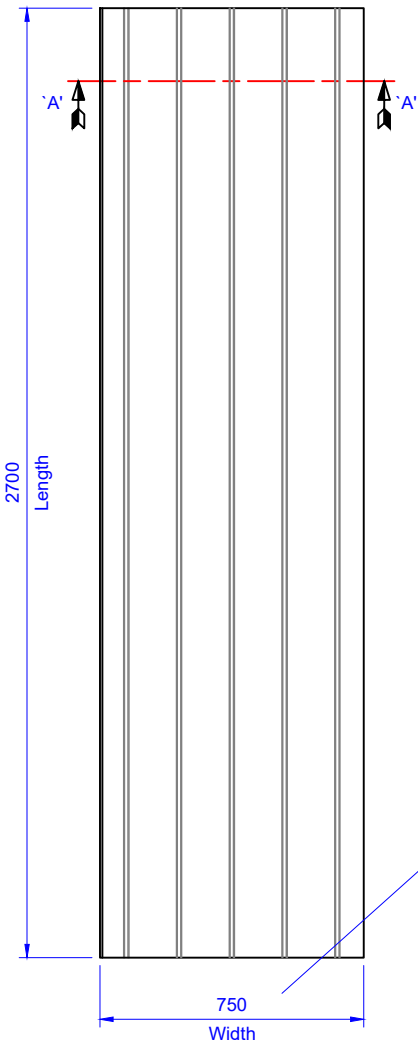
AVOID CUTTING/INSTALLING PANELS OF LESS THAN 1/2 ORIGINAL WIDTH. (TO AID THIS THEN THE PENULTIMATE PANELS MAY REQUIRE CUTTING ALSO).

HEALTH & SAFETY INFORMATION		
• Limit height of concrete on Permadec Formwork to depth of permanent slab		
• Remove all debris from Permadec Formwork at all times		
• Permadec must not be used to support construction materials or for storage purposes		
• Allowable live loading limits of 1.5kN/m² should be maintained at all times		
• Do not assume Permadec Formwork is a safe working platforms until correctly installed in line with EMJ guidelines		
• Do not use Permadec Formwork for storage areas under any circumstances		
• Manufacturing Tolerances - +/- 3mm		
• 200kg Max Point Load (Dead+Live) for spacer blocks (80mm x 50mm typical contact area) sitting on Permadec soffit.		
PANEL INFORMATION		
Max. LENGTH.	2700	mm
Max. CLEAR SPAN	2500	mm
WIDTH	750	mm
OVERALL HEIGHT	63	mm
RIB CENTRES	150	mm
WEIGHT PER m²	43	kg
Min. BEARING	30	mm
Rec. BEARING	100	mm
SOFFIT THICKNESS	8	mm
CONCRETE DEPTH	127	mm
DEFLECTION	10	mm

B	05.06.20	Revised to suit latest email	Information
A	03.06.20	Increased bearing	Information
O	02.06.20	Initial Issue	Information
Rev	Date	Description	Status

REVISIONS		
EMJ PLASTICS LTD Clarence Drive, Filey North Yorkshire YO14 0AD Tel: 01723 512224 Fax: 01723 515512 www.emjplastics.com sales@emjplastics.com		
Contract MENAI SUSPENSION BRIDGE		
Bridge MENAI SUSPENSION BRIDGE		
Client WSP		
Title STANDARD TYPE 3B.3 PANEL DETAIL		
Drawing No. EMJ10921-DG001	Drawn M.TRAIN	Rev B

PANEL SCHEDULE		
No. of Panels	Panel Length (mm)	Panel Width (mm)
-	2700	750

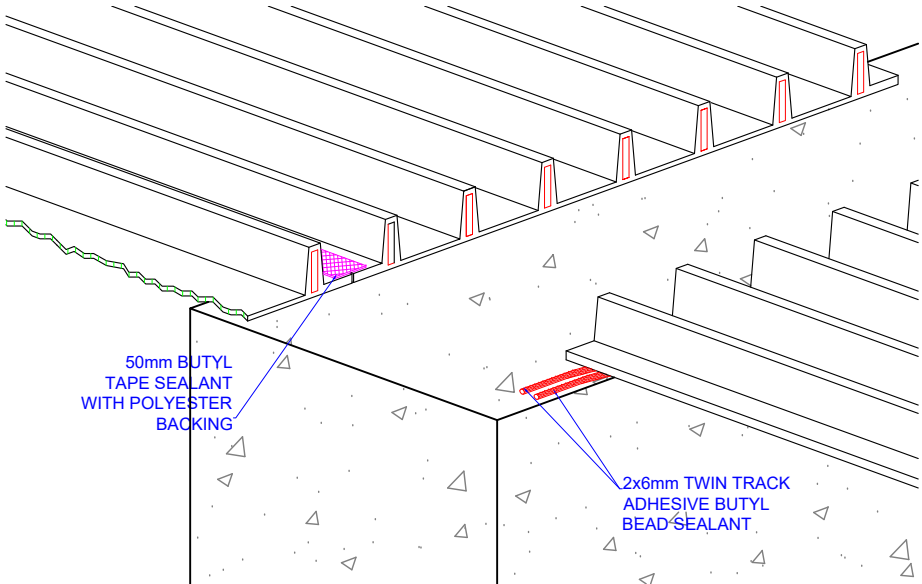
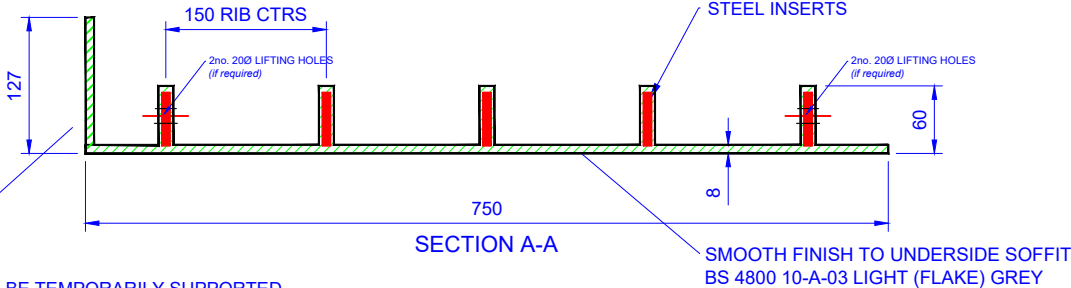


UPSTAND TO BE TEMPORARILY SUPPORTED (BY OTHERS). SUPPORT MUST BE PROVIDED ACROSS FULL WIDTH OF PANELS UNTIL CONCRETE DECK IS SUFFICIENTLY CURED.

ANGLED END PANELS TO BE CUT TO SUIT ON SITE (BY OTHERS) AND SUPPORTED OFF DIAPHRAGM OR DIAPHRAGM SHUTTER BEFORE CONCRETING.
CUT STEEL ENDS TO BE PAINTED WITH GALVAFROID OR SIMILAR

END PANELS 'OF EACH RUN' TO BE CUT ON SITE (BY OTHERS) AVOID EDGE FLANGE WIDTHS OF MORE THAN 75mm.

AVOID CUTTING/INSTALLING PANELS OF LESS THAN 1/2 ORIGINAL WIDTH. (TO AID THIS THEN THE PENULTIMATE PANELS MAY REQUIRE CUTTING ALSO).



HEALTH & SAFETY INFORMATION

- Limit height of concrete on Permadec Formwork to depth of permanent slab
- Remove **all** debris from Permadec Formwork at all times
- Permadec must not be used to support construction materials or for storage purposes
- Allowable live loading limits of 1.5kN/m² should be maintained at all times
- Do not assume Permadec Formwork is a safe working platforms until correctly installed in line with EMJ guidelines
- Do not use Permadec Formwork for storage areas under any circumstances
- Manufacturing Tolerances - +/- 3mm
- 200kg Max Point Load (Dead+Live) for spacer blocks (80mm x 50mm typical contact area) sitting on Permadec soffit.

PANEL INFORMATION

Max. LENGTH.	2700	mm
Max. CLEAR SPAN	2500	mm
WIDTH	750	mm
OVERALL HEIGHT	63	mm
RIB CENTRES	150	mm
WEIGHT PER m²	43	kg
Min. BEARING	30	mm
Rec. BEARING	100	mm
SOFFIT THICKNESS	8	mm
CONCRETE DEPTH	127	mm
DEFLECTION	10	mm

0	12.06.20	Initial Issue	Information
Rev	Date	Description	Status

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sales@emjplastics.com

Contract	MENAI SUSPENSION BRIDGE	
Bridge	MENAI SUSPENSION BRIDGE	
Client	WSP	
Title	SPECIAL TYPE 3B.3 PANEL DETAIL	
Drawing No.	EMJ10921-DG002	Rev
	M.TRAIN	0



Appendix D

SUPPORTING DOCUMENTS – T446 DESIGNER'S RISK MANAGEMENT SCHEDULE





T446: Design Risk Management Schedule

Project No	70070988	Project Name	Menai Suspension Bridge Remedial Works
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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/documentd 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, <i>e.g. location/environment, construction, operation, maintenance, alteration/demolition</i>	Work Element/Location (where appropriate)	Hazard or Risk Issue Identified	Risk Management Owner	Design ERIC Action Required <i>(e.g. hazard elimination/risk mitigation action, information to be provided to others)</i>	Significant Temporary Works Requirements/Management Arrangements and/or any Special Erection/Installation Sequences or Requirements	Design Action Status/Final Resolution Notes <i>(e.g. traceability of ERIC action, communication of significant residual risk, critical design criteria, etc.)</i>	Significant Residual Risk [§]	Date Logged/ Reviewed	Raised By
001	Construction	Removal of existing footway panels on bridge	Exact route and condition of electrical cables and gas pipes unknown therefore significant risk of electrocution and/or leakages during any removal work prior to cables and pipes being located and their condition has been assessed	Principal Contractor	STAT searches to be undertaken to identify local utility infrastructure and any further information from the client will be requested. Advise client on need for detailed services survey including the careful hand digging of trial holes to inspect cable condition. Add warning note to relevant drawings	None	STAT searches for local utility infrastructure have been undertaken and approximate locations of cables and pipes are given. STAT searches have revealed infrastructure from BT, Welsh Water, Wales & West Utilities and Zayo. Further lighting cables are also present on the bridge but are not identified on searches. A further C2 search has been agreed with the client to determine location of live gas pipes.	Yes	08/06/2020	S. Dorgan
002	Construction	Removal of existing footway panels on bridge	A C2 search has identified that a redundant 6” gas pipe is in the vicinity of the footway slabs that are to be replaced. The search has concluded that the pipe is within the R.C. continuous beam on the Caernarvon approach West span and beneath the footway through the corbels on the Anglesey approach west span. This infrastructure is owned by Wales & West Utilities. The pipe is capped and dead, but may still contain residual gas pockets	Principal Contractor	Precise location and depth of the gas pipe is unknown and thus the Principal Contractor must undertake further searches and precautions prior to breaking ground. This residual risk has been presented on the drawings as a warning and will be recorded within the PCIP	None	Residual risk symbol and note present of drawing for contractor's attention. The PCIP will also reflect this residual risk and all other service utility infrastructure present on the approach spans of the bridge	Yes	05/08/2020	S. Dorgan
003	Construction	Removal of existing footway panels on bridge	There is ducting that runs throughout the East side of the bridge and is attached to the parapet posts on both approach spans. The ducting contains lighting and fibre optic cables and must not be damaged during construction works	Principal Contractor	The presence of this ducting will be marked on the drawings and be recorded within the PCIP. The contractor has already been made aware of this, but relevant information will be provided in the PCIP	None	To be added to construction drawings with relevant risk symbols and notes	No	05/08/2020	S. Dorgan
004	Construction	Removal of existing footway panels on bridge	Working at height	Principal Contractor	Working within danger zone unavoidable. Works to be undertaken in accordance with accepted safe system of work. Suitable safety provisions are to be put in place to reduce this hazard and associated risk	Suitable safety provisions underneath footway replacement location and around removal perimeters are to be provided to safeguard workers. Warning note and relevant risk symbols to be included on drawings	Include statement in Pre Construction Information Pack	Yes	08/06/2020	S. Dorgan
005	Construction	Removal of existing footway panels on bridge	Falling masonry and falling debris from footway panel removal works	Principal Contractor	The PD recommends suitable provisions to be provided for catching any falling masonry or debris as a result of the removal works. Warning note and relevant risk symbols to be included on construction drawings	Suitable and appropriate safety provisions underneath footway replacement location and around removal perimeters are to be provided to safeguard workers and public.	For inclusion in the Pre Construction Information Pack. The PC will be made aware that suitable provisions are required	Yes	08/06/2020	S. Dorgan
006	Construction	Removal of existing / installation of proposed panels	Manual handling limits exceeded putting workers health and safety at risk	Principal Contractor	This risk has been reduced as the concrete panels are suggested to be cut in longitudinal strips to reduce lifting loads and mechanical means are recommended for all lifting procedures for this element of the works	None	Principal Contractor to implement a safe system of work to ensure the health and safety of workers is maintained at all times.	Yes	08/06/2020	S. Dorgan
007	Construction	Site access/egress	Vehicle collision	Principal Contractor	Chapter 8 traffic management with clearly marked site access points. Advance signing to warn regular users of route of forthcoming closures to mitigate against impact of closure. The above information to be provided in the Pre Construction Information Pack	Temporary Traffic Management system to close the footway and adjacent carriageway is required	Include statement in Pre Construction Information Pack that a Traffic Management system is required for the duration of the works	Yes	08/06/2020	S.Dorgan
008	Construction	Footway Replacements	Injury to site personnel/workers when using hand tools and other machinery	Principal Contractor	GRP Permanent Formwork Panels will be used as these eliminate the need for the use and removal of temporary formwork, in turn reducing the need for operations on site. Only competent and suitably skilled workers shall operate any machinery and hand tools to reduce the risk of injury to site personnel and public	None	Principal Contractor to implement a safe system of work to ensure the health and safety of workers and public is maintained at all times	No	08/06/2020	S. Dorgan
009	Construction	Footway Replacements	Noise and vibration from works	Principal Contractor	Noise barriers to be provided if required in accordance with DMRB standards. Principal Contractor to plan works and use competent personnel with appropriate briefings	None		No	08/06/2020	S. Dorgan
010	Construction	Footway Replacements	Dust generated from saw-cutting panels	Principal Contractor	Contractor is to put in place means of reducing the dust generated, for example, water dampening	None	Highlighted in the construction drawings and PCIP	No	22/06/2020	S. Dorgan



T446: Design Risk Management Schedule

Project No	70070988	Project Name	Menai Suspension Bridge Remedial Works
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Guidance Notes <i>(see guidance notes page for more details)</i> <i>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</i> <i>* 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,</i> <i>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</i> <i>§ 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.</i>										
Ref	Risk Category* & Phase where appropriate, <i>e.g. location/environment, construction, operation, maintenance, alteration/demolition</i>	Work Element/Location (where appropriate)	Hazard or Risk Issue Identified	Risk Management Owner	Design ERIC Action Required <i>(e.g. hazard elimination/risk mitigation action, information to be provided to others)</i>	Significant Temporary Works Requirements/Management Arrangements and/or any Special Erection/Installation Sequences or Requirements	Design Action Status/Final Resolution Notes <i>(e.g. traceability of ERIC action, communication of significant residual risk, critical design criteria, etc.)</i>	Significant Residual Risk [§]	Date Logged/ Reviewed	Raised By
011	Construction	Installation of proposed footway	Injury to site personnel or breakage of GRP formwork as a result of an unsupported GRP upstand and fascia plate	Principal Contractor	The fascia plate is to be attached to the upstand of the GRP panel prior to moving into place. The fascia plate and upstand are to be fully supported during the construction stage and can only be removed once the concrete has gained sufficient strength	A temporary works solution is required to fully support the fascia plate and GRP upstand	Requirements of this support will be discussed during the Early Contractor Involvement workshop to establish the best solution to fully support the elements	Yes	08/07/2020	S. Dorgan
012	Construction	Installation of proposed footway	A half completed panel installation and left overnight	Principal Contractor	No panels are to be left incomplete overnight. When GRP Panels are laid, the gap in the footway will be covered up and will prevent falling hazards. However, the contractor will be informed not to leave a footway panel incomplete due to health & safety implications this may have	Temporary works will be required around the panel cut-out locations when works cease overnight so that members of the public cannot access these areas	This requirement will be outlined in the PCIP and discussions will be had during early contractor involvement to establish safe practises. This risk will be outlined on the construction drawings	Yes	08/07/2020	S. Dorgan
013	Construction	Installation of proposed footway	Incorrect/insufficient seating of GRP panels on concrete rebates causing poorly bonded concrete slabs	Principal Contractor	All adhesives on concrete rebates and GRP panels are to be seated correctly. Therefore profile of bearing surfaces are to be made smooth, flat and good to ensure continuous seating of adhesive and GRP permanent formwork panels	None	Note added to relevant drawing and risks to be discussed in ECI workshop	No	23/07/2020	S. Dorgan
014	Construction, operation & maintenance	Service vehicles for construction/ maintenance	Service vehicles present on the footways. It was agreed with UK Highways A55 Ltd. that no service vehicle loading is required on the footways due to the narrow width of the cantilevered section and the position of the hangers. The client considers the location of the hangers precludes a service vehicle from using the footway. However, this still presents a residual risk	Principal Contractor	No service vehicles are to be allowed on the footways of the Menai Suspension Bridge. This requirement is to be recorded on the relevant drawings and added to the H&S File	None	Note and risk symbols added to the relevant drawings. Risk and compulsory action to be recorded in the H&S File	Yes	05/08/2020	S. Dorgan
015	Construction, operation & maintenance	New footway slabs	Reduced cover due to the use of MBT rebar couplers to provide full anchorage of the main, longitudinal reinforcing bars. If not properly installed and maintained, the reinforcement may not be fully anchored, potentially leading to failure of the slab	Principal Contractor	Installation of MBT rebar couplers to be carefully monitored during the construction stage to ensure no further reduction in cover. Waterproofing is to be installed strictly in accordance with manufacturer's instructions and maintained to ensure the risk of corrosion to the top of the slab is mitigated	None	Residual risk notes and symbols added to the relevant drawing. This requirement shall be added to the H&S File	Yes	05/08/2020	S. Dorgan
016	Construction	Installation of proposed footway	Due to a small clearance between the GRP Permanent Formwork and the reinforcement, there is a risk that the concrete when poured will not flow between these spaces	Principal Contractor	The concrete specification will be modified to allow a maximum aggregate size of 10 mm in order to mitigate this risk. The Contractor is to ensure full coverage of concrete between reinforcing bars and GRP formwork	None	Concrete specification to be reflect a maximum aggregate size of 10 mm	No	05/08/2020	S. Dorgan
017	Construction	Installation of proposed footway	MBT rebar couplers installed short of the centreline of the supports.	Principal Contractor	The contractor is to ensure that the inside face of the MBT rebar coupler plate is at or beyond the centreline of the support to ensure full anchorage of the longitudinal reinforcement	None	Risk and compulsory action has been added to the relevant drawing	Yes	05/08/2020	S. Dorgan
018	Construction	Installation of proposed footway	Minimum lap of longitudinal bars not achieved leading to bars not being fully effective	Principal Contractor	The contractor is to ensure that a minimum lap of 450 mm is achieved for the longitudinal reinforcing bars. The lap has been specified as 650 mm to accommodate for site variability to ensure a minimum of 450 mm is achieved	None	Lap of 650 mm has been specified on the drawings and the minimum lap of 450 mm is included within this document	No	05/08/2020	S. Dorgan

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