

CITY OF BANGOR COUNCIL

BANGOR PIER RENOVATION PROJECT

OUTLINE METHODOLOGY FOR SUPERSTRUCTURE REPAIR

Prepared by:	D R High	
Checked by:		
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Consulting Civil & Structural Engineers

RBA Ltd, 26 Mostyn Road, Colwyn Bay, Conwy LL29 8PB ☎ 01492 533117 ✉ admin@rba.ltd.uk 🌐 www.rba.ltd.uk
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CONTENTS

- 1.0 Introduction
- 2.0 Scope of Works
- 3.0 Methodology and Temporary Works

APPENDICES

- A Drawing 5014/01 Location Plan
- B Drawing 5014/02A Proposed Edge Details
- C Drawings 5014/03 & 5014/04 Maintenance Access and Containment
- D Monarflex Stripe Firesmart Scaffold Sheeting



1.0 INTRODUCTION

- 1.1 Bangor Pier is a 470m long Grade II* listed structure located on the Menai Straits between grid references 53.237026N, 4.1225499E and 53.240577N, 4.1259053E (see **Drawing 5014/01** in **Appendix A**).
- 1.2 It is located in the Menai Strait and Conwy Bay Marine Special Area of Conservation.
- 1.3 The structure is formed of cast iron columns carrying a steel superstructure. The columns are original (dating from 1896), much of the superstructure was replaced around 30 years ago, in the 1980s.
- 1.4 The condition of the steel superstructure is deteriorating and it is in need of urgent repair.
- 1.5 The condition of the pier has been inspected at regular intervals in the past: in 2012 23% of the pier was in a condition which required remedial work. Following recent inspections it is now estimated that 62% requires immediate attention.
- 1.6 The rate of deterioration of the pier (as a whole) varies from component to component and is dependent on a number of factors including the material used for construction. While the columns are over 100 years old, they are formed of cast iron which is remarkably robust in a marine environment. The steel superstructure is more prone to corrosion and it is not surprising that extensive repair work is now required.
- 1.7 At the present time the focus for repair is the superstructure, all of which is above high water level.

2.0 SCOPE OF WORKS

- 2.1 The superstructure of Bangor pier is supported by 110 girders, together with their associated cross bracings etc. All of the girders were inspected either from the foreshore on a small boat in 2012 and 2015. During 2016 a sample of 13 girders were subject to a detailed, hands-on inspection.
- 2.2 From the hands-on inspection a scope of work to arrest decay in the superstructure has been established. This comprises of 3 work elements:
 - cutting out and replacing heavily corroded areas of structure
 - repairs to steelwork
 - grit blasting and painting
- 2.3 In addition to the remedial work on the pier superstructure the detail used to secure the handrails to the timber edge beams is weak; it relies on the integrity of coach screws within the timber to resist weather and pedestrian loads (see **Drawing 5014/02A** in **Appendix B**).



2.0 SCOPE OF WORK (continued)

- 2.4 A discrete detail is proposed to replace the coach screws with a steel saddle, sat over the existing timber beam (see **Drawing 5014/02A** in **Appendix C**). The saddle is secured to the beam by a through bolt.
- 2.5 The existing cast iron handrail stanchions can be re-used; it is proposed to fasten them to the saddle using captive bolts. Replacing the coach screws with bolts produces a robust detail.

3.0 METHODOLOGY AND TEMPORARY WORKS

- 3.1 To provide access to the girders it is proposed to provide an underslung scaffold, hung from the girders (see **Drawing 5014/03** in **Appendix C**).
- 3.2 The repair activities to the girder include patch repairs together with cutting out and replacing the heavily wasted areas of steel.
- 3.3 These activities will loosen rust and also generate grinding dust and sparks as well as weld splatter and welding slag.
- 3.4 Prior to painting all of the steelwork it will require grit blasting (generating 'spent' grit together with rust and paint particles).
- 3.5 Replacing the handrail fixings will generate small quantities of sawdust.
- 3.6 Clearly there is a need to contain the debris generated by the various processes required to repair the girders. It is proposed to provide containment to each individual girder as an integral part of the scaffold access.
- 3.7 Containment will be provided using Monarflex Stripe Firesmart Scaffold Sheeting. This material has a life of 6-12 months in coastal and offshore embankments. It is thus suitable for both the 'hot works' tasks required for the repair works and also for the environment in which it will be placed. The manufacturers' literature confirms that Monarflex Stripe Firesmart is suitable for use with grit blasting operations. A copy of this literature is enclosed in **Appendix D**.
- 3.9 The scaffolding will be provided with a scaffold board deck; the Monarflex will be laid over the boards. A plywood sheet will be laid over the Monarflex on the deck to provide protection to the sheeting and also to provide a shovelling and sweeping surface for the removal of debris. After the initial sweeping operation, the deck will be vacuum cleaned, before the plywood sheeting is removed. A further sweeping / vacuum cleaning operation (after removal of the plywood sheeting) will ensure that all of the grit debris can be collected and removed before the scaffold is dismantled.

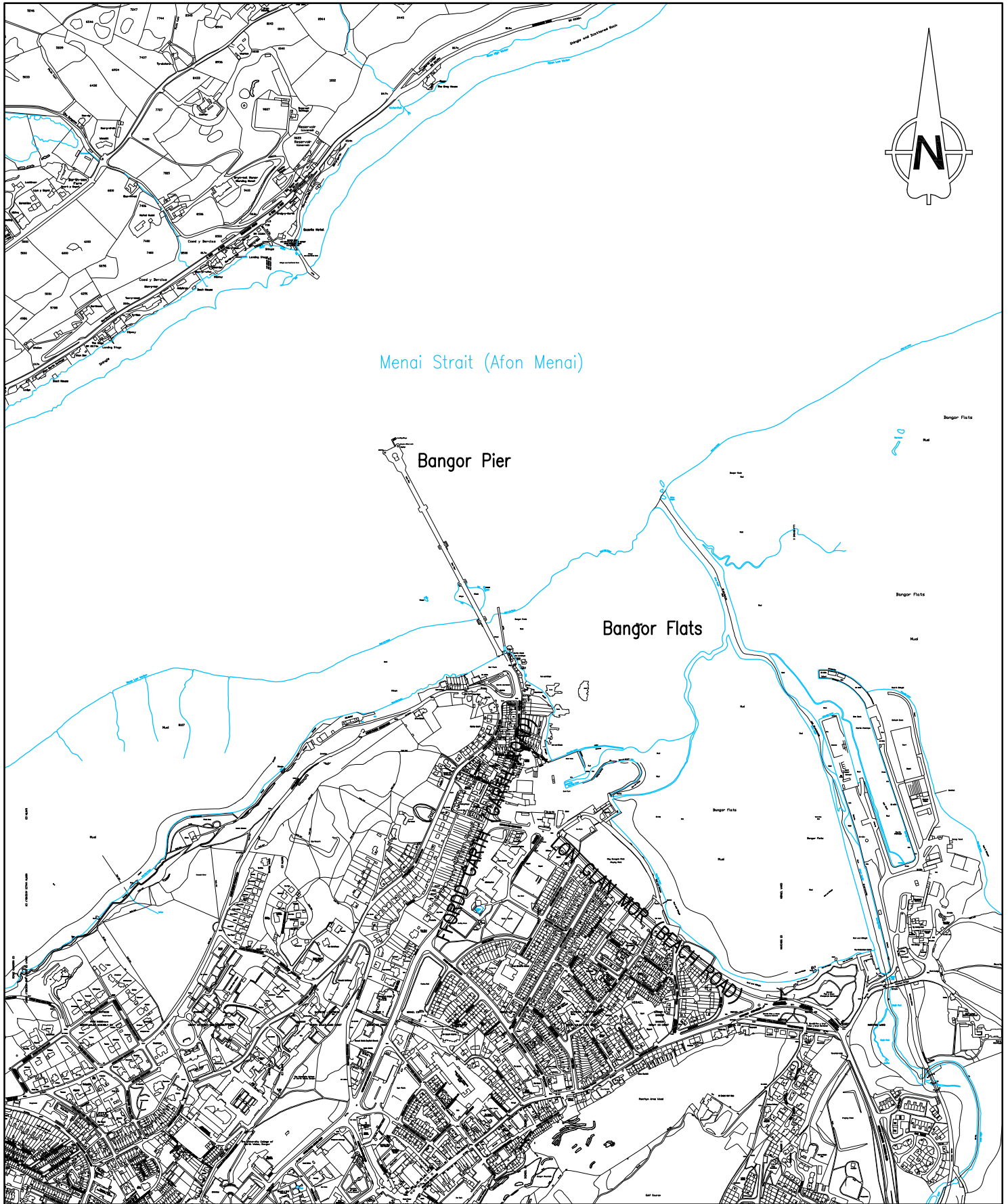


3.0 METHODOLOGY AND TEMPORARY WORKS (continued)

- 3.10 It is envisaged that the remedial works will be carried out in a number of stages, addressing the issues with 2 or 4 girders at any one time, until the whole pier (consisting of 70 girders) has been repaired.
- 3.11 A check has also been carried out on the tide levels to ensure that the scaffolding will remain above the water level at all times. The bottom of the scaffolding will be approximately 3.5m above the highest locally recorded tide level (see **Drawing 5014/04** in **Appendix C**).
- 3.12 The repair of the handrail is a largely separate task. A cantilever scaffold, projecting 1.0m outside the general line of the pier will be provided for access to the exterior of the handrail.
- 3.13 Once dismantled the handrails will be removed from site for shot blasting and painting.
- 3.14 Fitting the saddles may require localised trimming of the existing timbers and drilling to install the through bolts. Once the saddles are fitted the handrails will be re-erected.
- 3.15 Some of the handrail units include an integral bench ends, which have additional bolts to secure them to the decking.
- 3.16 It is proposed to repair the handrails concurrently with the girders. This will ease access for the scaffolders to erect the cantilever scaffold and will also provide access to fit the various fastenings, several of which are located below the deck level.

APPENDIX A

Drawing 5014/01 Location Plan



REV	DATE	NATURE OF REVISION	BY	CHECKED	

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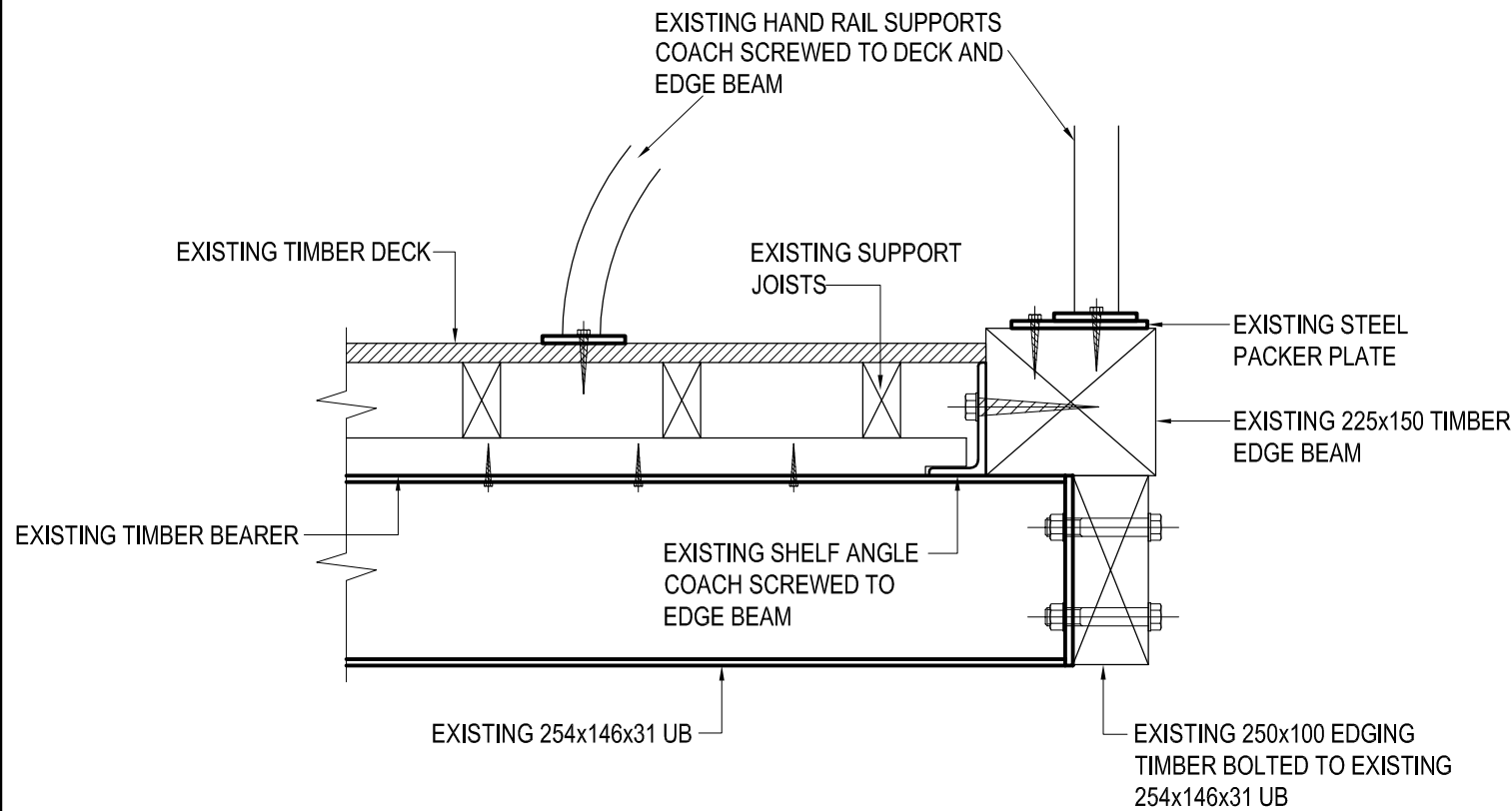
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01492 533117 ✉ admin@rba.ltd.uk 🌐 www.rba.ltd.uk

CLIENT	BANGOR CITY COUNCIL				
PROJECT	GARTH PIER RENOVATION PROJECT BANGOR ENGINEERING INSPECTION				
DRAWING	LOCATION PLAN				
SCALE	1:10000	SIZE	A4	DRAWN JME	CHECKED DH
				DATE 09.16	JOB No 5014
				DRG No 01	REV

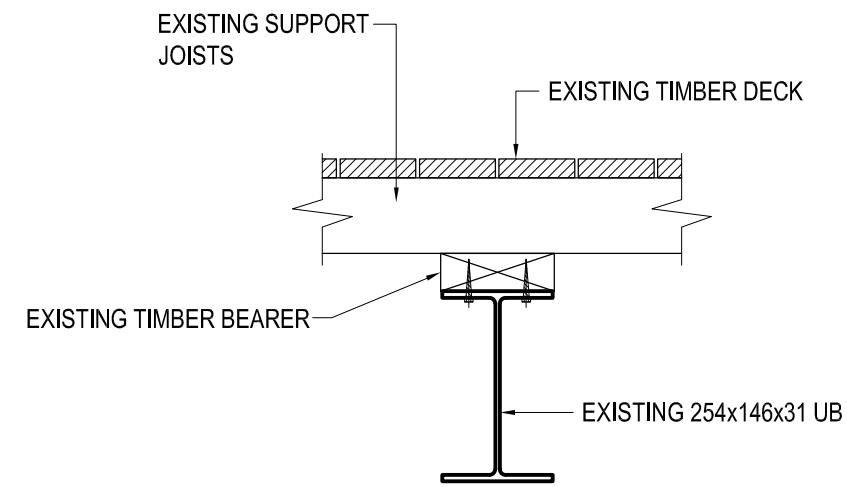
APPENDIX B

Drawing 5014/02A Proposed Edge Details



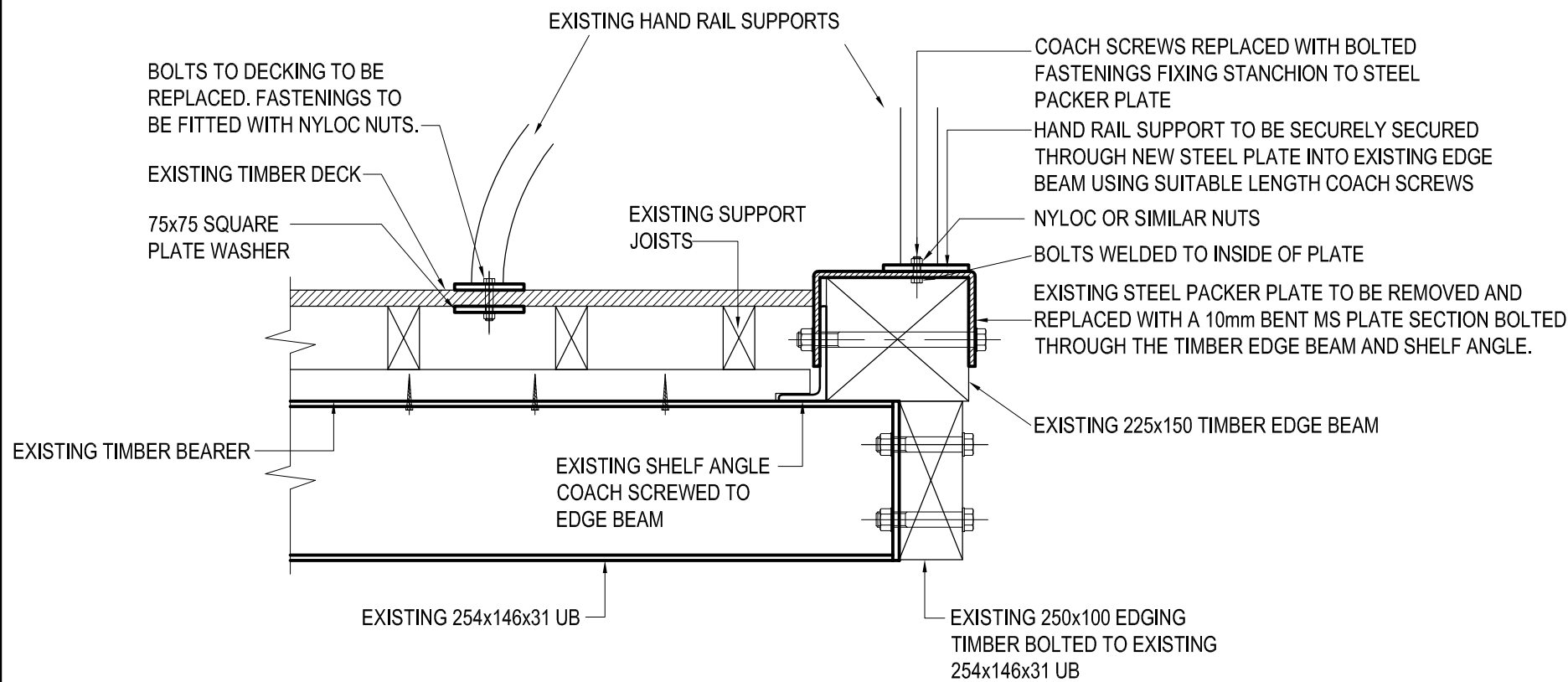
EDGE DETAIL AS EXISTING

Scale 1:10



TYPICAL SECTION

Scale 1:10



EDGE DETAIL AS PROPOSED

Scale 1:10

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 01492 533117 admin@rba.ltd.uk www.rba.ltd.uk

CLIENT BANGOR CITY COUNCIL

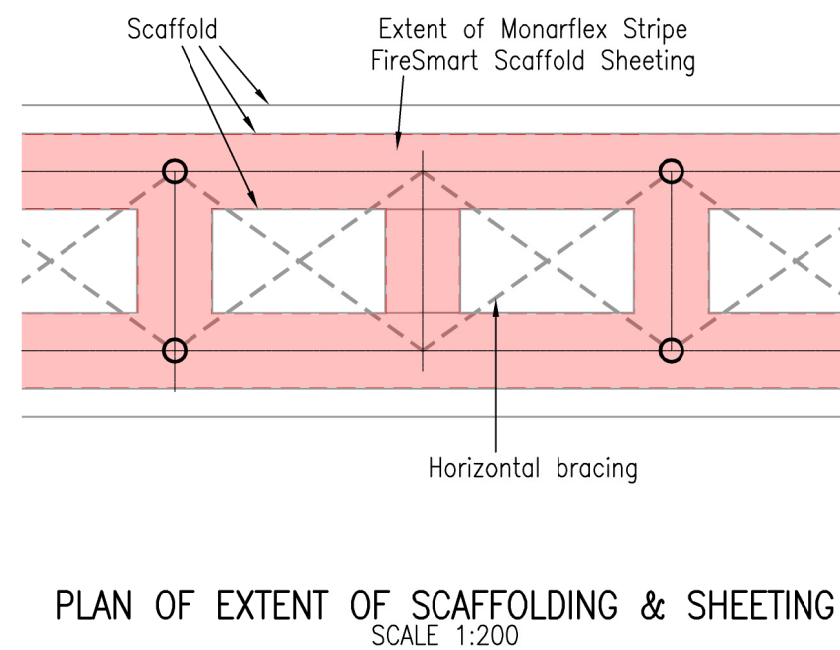
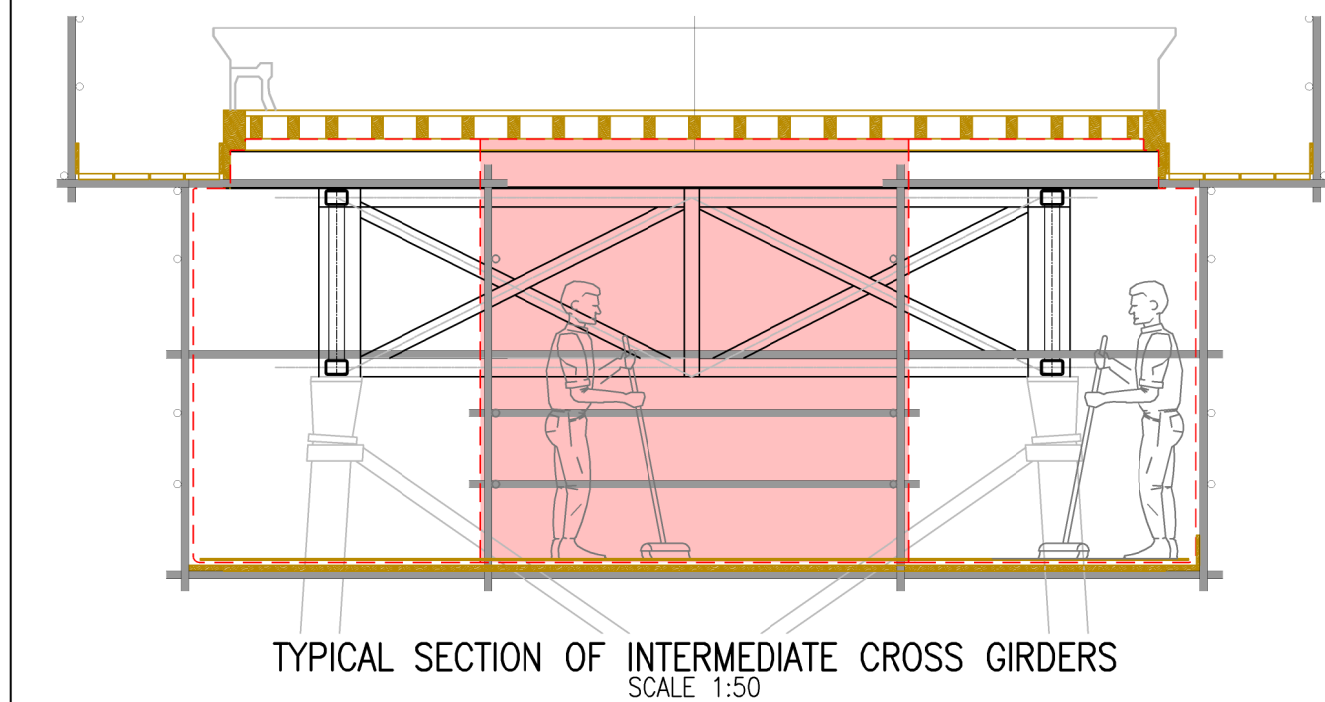
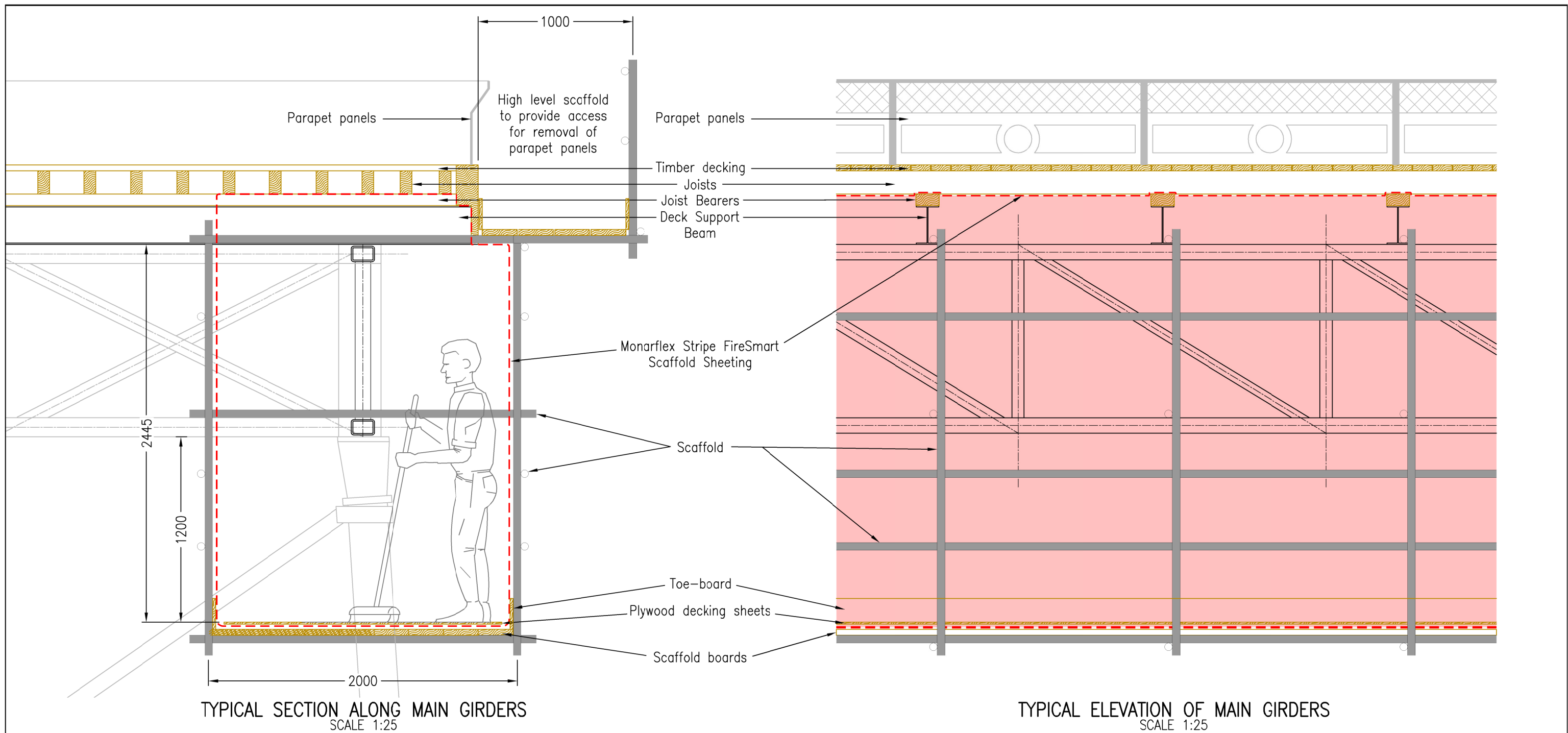
PROJECT GARTH PIER RENOVATION PROJECT
BANGOR

DRAWING PROPOSED EDGE DETAILS

SCALE	1:50	SIZE	A3	DRAWN	CHECKED	DATE	NO	5014	NO	02	REV	A
				RHK	DH	04.16						

APPENDIX C

Drawings 5014/03 & 5014/04 Maintenance Access and Containment



REV	DATE	NATURE OF REVISION	BY	CHECKED

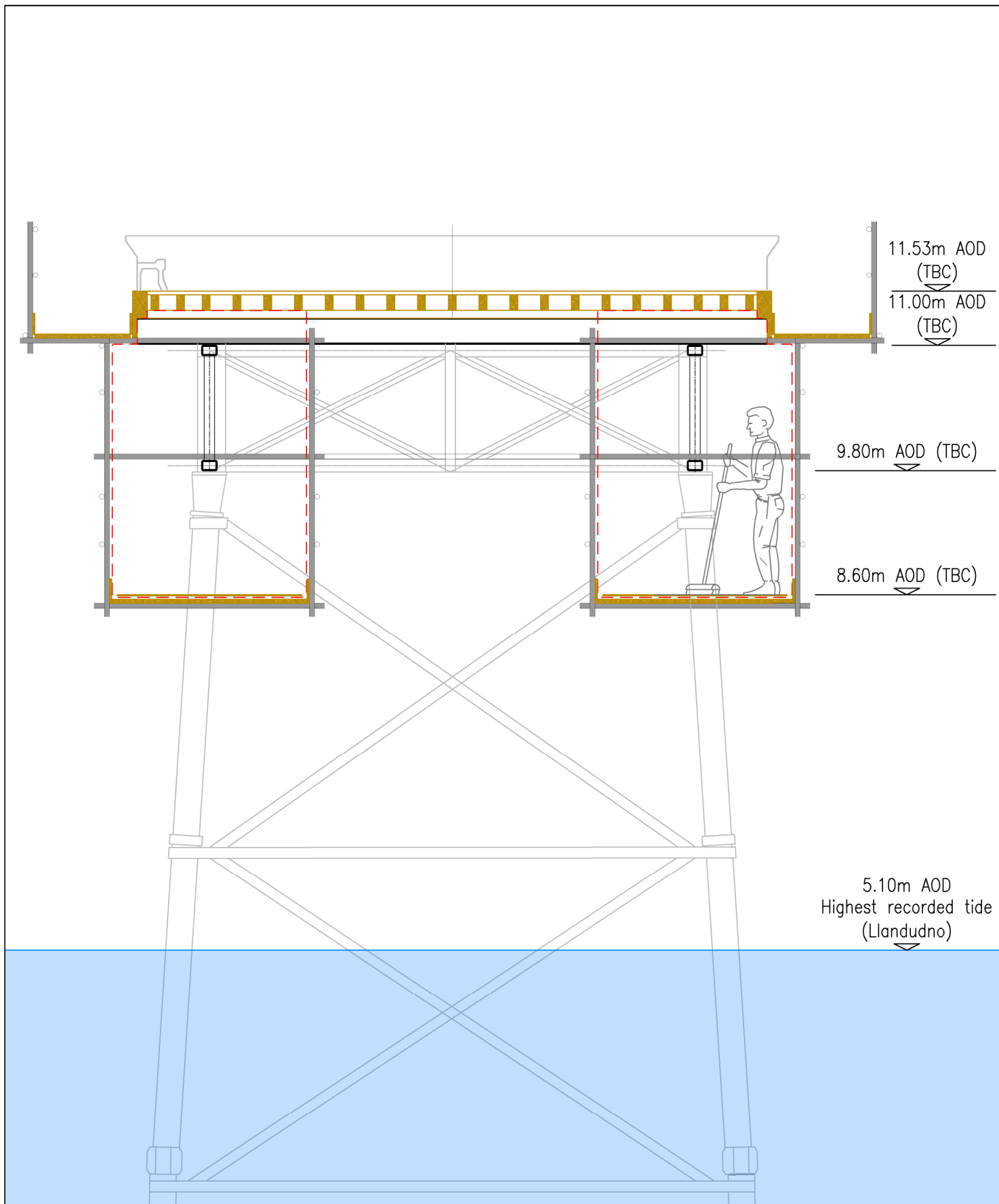
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Consulting Civil & Structural Engineers **rba LTD**

RBA Ltd, 26 Mostyn Road, Colwyn Bay, Conwy LL29 8PB
 ☎ 01492 533117 ✉ admin@rba.ltd.uk 🌐 www.rba.ltd.uk

CLIENT	BANGOR CITY COUNCIL
PROJECT	GARTH PIER RENOVATION PROJECT BANGOR ENGINEERING INSPECTION
DRAWING	MAINTENANCE ACCESS & CONTAINMENT

SCALE	1:25	SIZE	A3	DRAWN	CHECKED	DATE	NO	5014	NO	03	REV
				JME	DH	09.16	JOB		DRG		



REV	DATE	NATURE OF REVISION	BY	CHECKED

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Consulting Civil & Structural Engineers



RBA Ltd, 26 Mostyn Road, Colwyn Bay, Conwy LL29 8PB
 ☎ 01492 533117 ✉ admin@rba.ltd.uk 🌐 www.rba.ltd.uk

CLIENT	BANGOR CITY COUNCIL									
PROJECT	GARTH PIER RENOVATION PROJECT BANGOR ENGINEERING INSPECTION									
DRAWING	TYPICAL PIER CROSS SECTION									
SCALE	NTS	SIZE	A4	DRAWN	CHECKED	DATE	JOB NO	DRG NO	REV	
				JME	DH	09.16	5014	04		

APPENDIX D

Monarflex Stripe Firesmart Scaffold Sheeting

Monarflex® Stripe FireSmart®

For demanding weather conditions



- Suitable for Digiwrap and screen printing
- Flame retardant
- Certified to LPS 1207, LPS 1215
- Band reinforced with HDPE filament tapes
- Compatible with the high performance white Eurostrap fixing system which blends in with the sheet
- Lightweight for easy handling on site





Monarflex Stripe Firesmart is a mid range flame retardant high strength banded scaffold sheeting suitable for use in demanding conditions.

Features & Benefits

- Enhances the security for the workers on the scaffold.
- Serves as a climate shield to protect workers, machinery and open constructions against rain, wind, snow etc.
- Ensures a stable working climate on the scaffold so deadlines can be respected regardless of the weather.
- Protects the surroundings from any inconveniences e.g. particles or building dust from sandblasting or water jetting from facade works.

Choosing the right product

Duration of building project				
Placement of building site	<3 months	3-6 months	6-12 months	>12 months
Surrounded by high buildings		Stripe Fire-Smart	Stripe Fire-Smart	
Urban/ industrial area		Stripe Fire-Smart	Stripe Fire-Smart	
Coast/ Offshore area	Stripe Fire-Smart	Stripe Fire-Smart	Stripe Fire-Smart	
Temporary roof covering system				
Interior	Stripe Fire-Smart	Stripe Fire-Smart	Stripe Fire-Smart	

Approvals

Should fire retardant sheeting be required on site then it's important to choose the right Monarflex scaffold sheeting product. Our products are certified to LPCB standards of LPS 1215 for Super T Plus Firesmart, Stripe Firesmart, Scaffband Flamesafe and TRC Flamesafe. In addition the Super T Plus Firesmart and Stripe Firesmart also have the LPS1207 certification.

Description

The Monarflex Stripe Firesmart is made from a three-ply composition with the two outer layers being made from a special highly weather resistant LPDE with flame retardant additives that encapsulates a strong polypropylene (PP) grid which forms the weather protection. On top of the sheet there are three bands of super high strength woven and plastic coated bands in pre-set patterns and pre-made holes in the bands per 100mm making it fit virtually any type of scaffold.

Performance and Properties

Material	Co-polymer FR LDPE
Reinforcement	10 x 12mm mesh from PP
Roll Sizes	2 x 45m, 2.25 x 40m, 3 x 45m, 4 x 36m
Colour	White
Weight per m²	232g
Tensile strength	700N/50mm
Eyelet pullout	880N
Conforms to	BS7955:1999, BS8410:2007
Fire approval	LPS 1215, LPS 1207
Applications	Internal and External use

Durability

Monarflex Stripe FireSmart can be used for all types of long-term projects up to a period of maximum 12 months. The product is designed for extreme weather conditions. The combination of high quality components forms a tough and durable sheeting for very extreme working conditions i.e. sandblasting and water-jetting. By using Monarflex Stripe FireSmart, you can meet deadlines and avoid economical surprises regardless of the weather and be safe in that it fulfils all relevant British Standards like BS7955:1999 and BS 8410:2007 as well as the high demanding LPS 1207 fire standard.

Application

Monarflex Stripe FireSmart should be applied horizontally while taking care to overlap the lower sheet externally for weather protection and overlap the lower sheet internally if used for containment. Fixing the sheeting to the scaffold must be done according to calculations taking factors like wind, building season and height of the surrounding buildings into consideration. We recommend the use of EuroStrap for Digiwrap or Flexitie fixings/m² but any fixing must be placed according to calculations for each project.

Delivery And Storage

The Monarflex Stripe FireSmart is supplied in pallets of 25 rolls for our 2m x 45m roll, with each roll individually wrapped in PE foil with label and name identification. The rolls must be stored lying on a pallet under cover and away from heat and direct sunlight.

Health And Safety

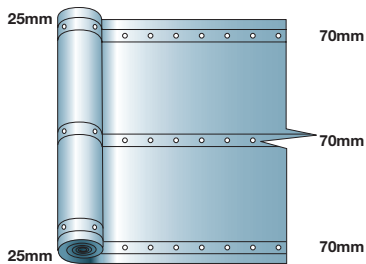
Health and safety data sheets are available for all materials. Please contact Icopal's Technical Services Department for further information.

Quality Assurance

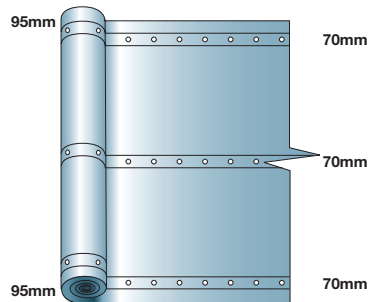
Monarflex Stripe Firesmart is manufactured under a Quality Mangement System approved to ISO 9001:2000 by BSI Quality Assurance.



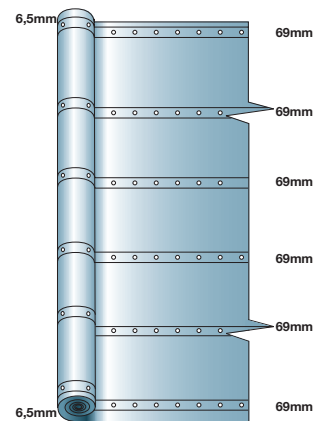
Roll Size: 2m x 45m



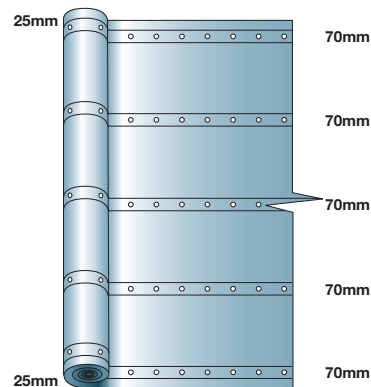
Roll Size: 2.25m x 45m



Roll Size: 3m x 45m



Roll Size: 3m x 45m



For further information call 0161 865 4444 or visit www.monarflex.co.uk

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Icopal Limited Barton Dock Road, Stretford, Manchester M32 0YL ■ Tel +44(0)161 865 4444 ■ Fax +44(0)161 864 2616 ■ Email: info.uk@icopal.com

www.monarflex.co.uk

Monarflex® **Stripe FireSmart®**

Icopal Ltd
Barton Dock Road
Stretford
Manchester
United Kingdom
M32 0YL
Tel: +44 (0) 161 865 4444
Fax: +44 (0) 161 864 2616
info.uk@icopal.com
www.icopal.co.uk

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