

165014

Peel Ports Group Ltd

**Winton Pier, Irish Berth
Ardrossan**

Assessment Report

May 2016



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Document Control

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Document Information

	Information
Document Id	165014 Irish Berth Ardrossan
Document Owner	Peel Ports Group Ltd
Issue Date	25 May 2016
Last Saved Date	25 May 2016
File Name	165014 - Irish berth report - may 2016 - 1st Issue - 25-05-2016.docx

Document History

Version	Issue Date	Changes
1st Issue	25 May 2016	First Issue

Document Approvals

Role	Name	Signature	Date
Project Partner	A Kilbride		25 May 2016
Project Review Group	N/A		
Project Manager	G Scilipoti		25 May 2016

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1 Executive Summary

The suspended deck structure has been numerically assessed and found to be serviceable.

Since the new fendering system was introduced in 1996/97, berthing forces are transferred directly to the concrete quay wall and the suspended reinforced concrete deck and steel structure are only taking the self-weight and any imposed deck loads.

There is no evidence that the structure is in danger of a significant failure, although repairs must be considered to both the reinforced concrete deck and steel piles.

2 Introduction

Arch Henderson (AH) have been appointed by Peel Ports Group Ltd (PPGL) to carry out an assessment of the suspended deck structure at the Irish Berth on the Winton Pier at Ardrossan, following a recent inspection report by Royal Haskoning DHV (RHDHV), commissioned by Caledonian Maritime Assets Limited (CMAL).

The RHDHV report states that "...*The suspended deck along the edge of the berth is in a poor condition. There is a real possibility that a sudden failure could occur, especially under load from a berthing vessel...*" ("Conclusions and Recommendations" section).

AH had recently (August 2014) inspected the structure, and made recommendations, as part of the regular inspection regime agreed with Peel Ports.

AH had reported that the suspended deck area of the Irish Berth was in a poor condition but that "*no significant crack or deflections were noted which would suggest that the structure remains serviceable at present, although repairs must be considered*".

AH have also recently inspected and reported on the structural and M&E conditions of both linkspans on the Winton Pier, and made a number of recommendations.

AH have designed the new fendering system for the Irish Berth in 1996/97.

The Irish Berth is used by ferries when rough weather does not allow the use of the adjacent Calmac Berth or when two vessels are running on the Brodick route during the summer.

The structure is owned by PPGL, with the ferry services operated by Calmac Ferries Limited (CFL).

The aim of this report is to:

- Carry out a numerical assessment of the suspended deck main structural elements
- Check whether this structure is at risk of collapse or overloaded as implied in RHDHV report;
- Investigate what actions can be taken to address recommendations made in AH and RHDHV reports.

3 Description of the structure

The original quay wall forming the berth is in concrete.

The alignment of the berth has subsequently been altered by the addition of an irregularly shaped suspended deck, made of a 300mm thick reinforced concrete slab, supported on the original quay wall and longitudinally on steel double I-beams which span between the quay wall and hexagonal (Rendhex) concrete-infilled steel box piles.

The deck slab acts compositely with the double I-beams by means of steel lugs.

Originally, the fenders were fixed to the main box piles, by means of Andre shear rubber units. The original fenders imposed high point loads on the piles. Much of the steelwork which had been installed during the original construction was intended to provide bracing and restraint to the piles under the loads from berthing impacts.

However, following the installation of the new fendering system in 1996/97 (11 No. Fentek Super Cone and panel type fenders), the suspended deck and steel structure are only taking the self-weight and any imposed deck loads. The loads from the fendering system are directly transferred to the quay wall.

4 Numerical Assessment

4.1 General

The assessment of the existing structure has been carried out using British and European standards for the assessment and design of structures.

The suspended deck has been checked for the self-weight, a uniformly distributed load (UDL) of 20 kN/m² (2 tonnes/m²) and for a 120kN (12 tonnes) wheel load. The imposed loads simulate the loading from a 40 tonnes vehicle or general cargo loading.

4.2 Reinforced Concrete Suspended Deck

The slab thickness is assumed to be 300mm (12").

There is no information on the type and spacing of the reinforcement and this, subject to verifications, is assumed to be composed of 20mm dia. mild steel bars ($f_y = 250 \text{ N/mm}^2$) at 200mm centres, top, bottom layers and in both directions. The concrete strength has been assumed to be 30 N/mm².

It has been assumed that the RC slab spans between the double-I beams and the line of the original quay wall; we have ignored any contribution from the edge beams.

The slab longitudinally is acting together with the double-I beam in a composite manner and the capacity is well above the imposed actions; the slab is also spanning continuously over the double-I beams.

The slab was also checked transversely (*conservatively since it may be acting as a plate, depending on the reinforcement*) as a 1 metre wide strip and, on the basis of the assumptions made above, which require to be verified either through record drawings or by site investigations, has sufficient capacity.

4.3 Rendhex steel box piles

It has been assumed that the Rendhex "No. 3" box steel piles have lost 50% of the cross section and that no effective bracing is present from top to bottom. The steel grade has been assumed to be 275 N/mm² and the piles fill has been assumed to be a low strength concrete which does not contribute to the piles axial capacity. Even after all these conservative assumptions the steel piles have been found to have sufficient capacity.

5 Recommendations

5.1 Loading restriction

Until details for the reinforced concrete slab reinforcement have been confirmed, it may be prudent to temporarily restrict loading on the suspended deck to 10 kN/m² (1 tonne/m²) and to vehicles with a maximum total gross weight of 7.5 tonnes as a precautionary measure.

5.2 Site Investigation

Site investigation should be undertaken at the earliest opportunity to:

- Confirm the amount, type and condition of reinforcement present in the slab;
- Take cores and dust samples to confirm concrete strength and degradation.

5.3 Suspended deck – Reinforced Concrete slab repairs

- The reinforced concrete slab should undergo repairs to the soffit, where the reinforcement is exposed and, depending on the outcome of the site investigation, it may require strengthening measures, to bring it up to the 20 kN/m² / 40 tonnes vehicles capacity standard.
- Any spalling or cracking should also be repaired to increase the design life;
- The timber cope should be replaced with either a RC cope or a new timber cope.
- Drainage to the deck should be made effective to eliminate water ponding.

5.4 Suspended deck – Rendhex steel box piles repairs

- The steel box piles will require repairs and strengthening where the thickness is less than 50% the original and where there are holes and voids within the piles.
- A sacrificial anode cathodic protection system should be provided to each of the steel piles to prevent further corrosion.

5.5 Ancillary Steelwork and minor items

- Any elements of the existing steelwork which is no longer required should be removed;
- Steelwork elements retained shall be repaired or replaced as necessary;
- Whilst a contractor is undertaking all the repair items listed above, it will be cost effective to carry out any repairs required to ladders, fenders or any other minor item.

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Appendix A – Location Plan

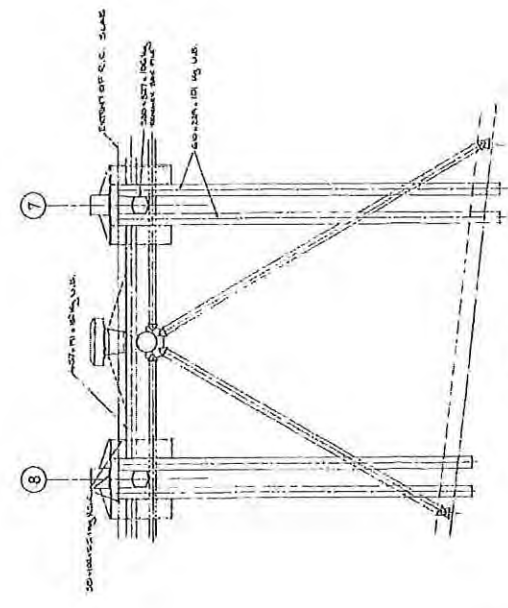
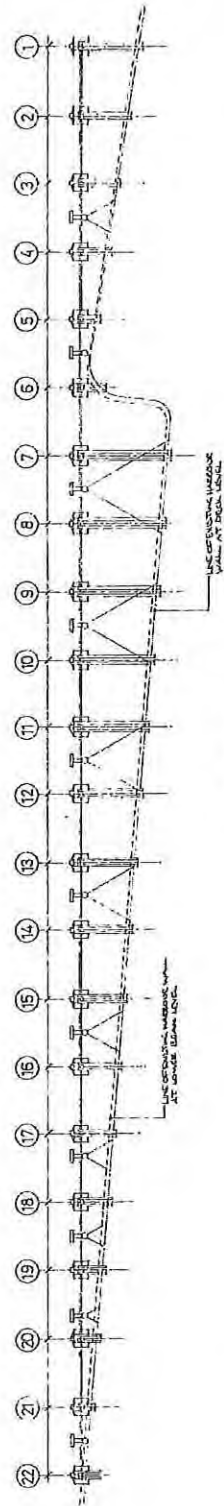
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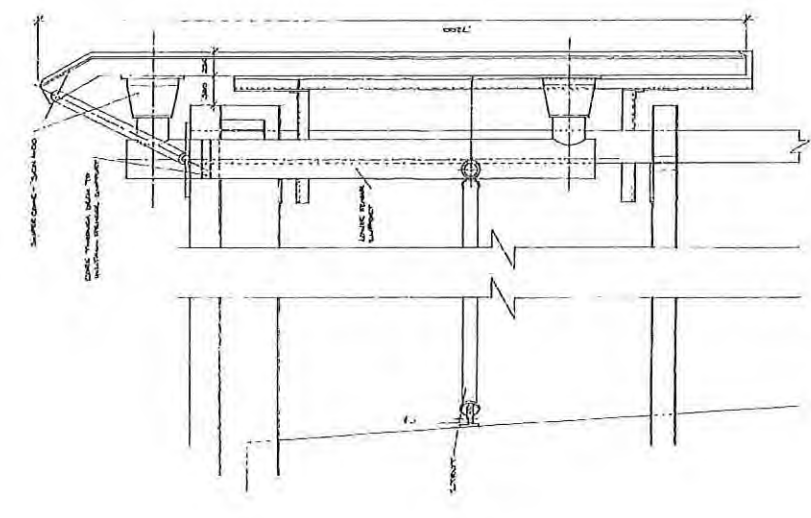
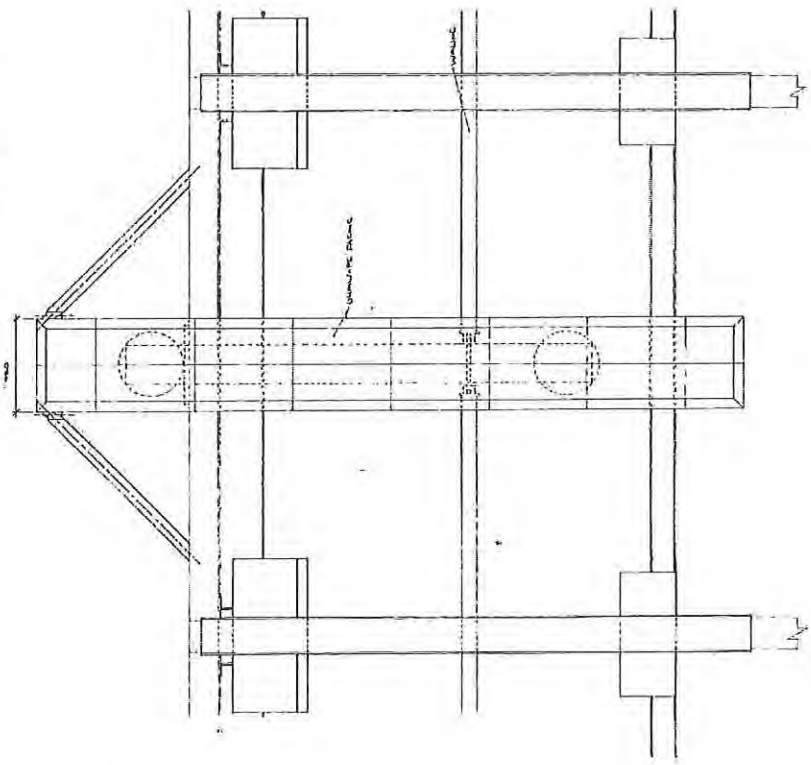
Appendix B – Record Drawings

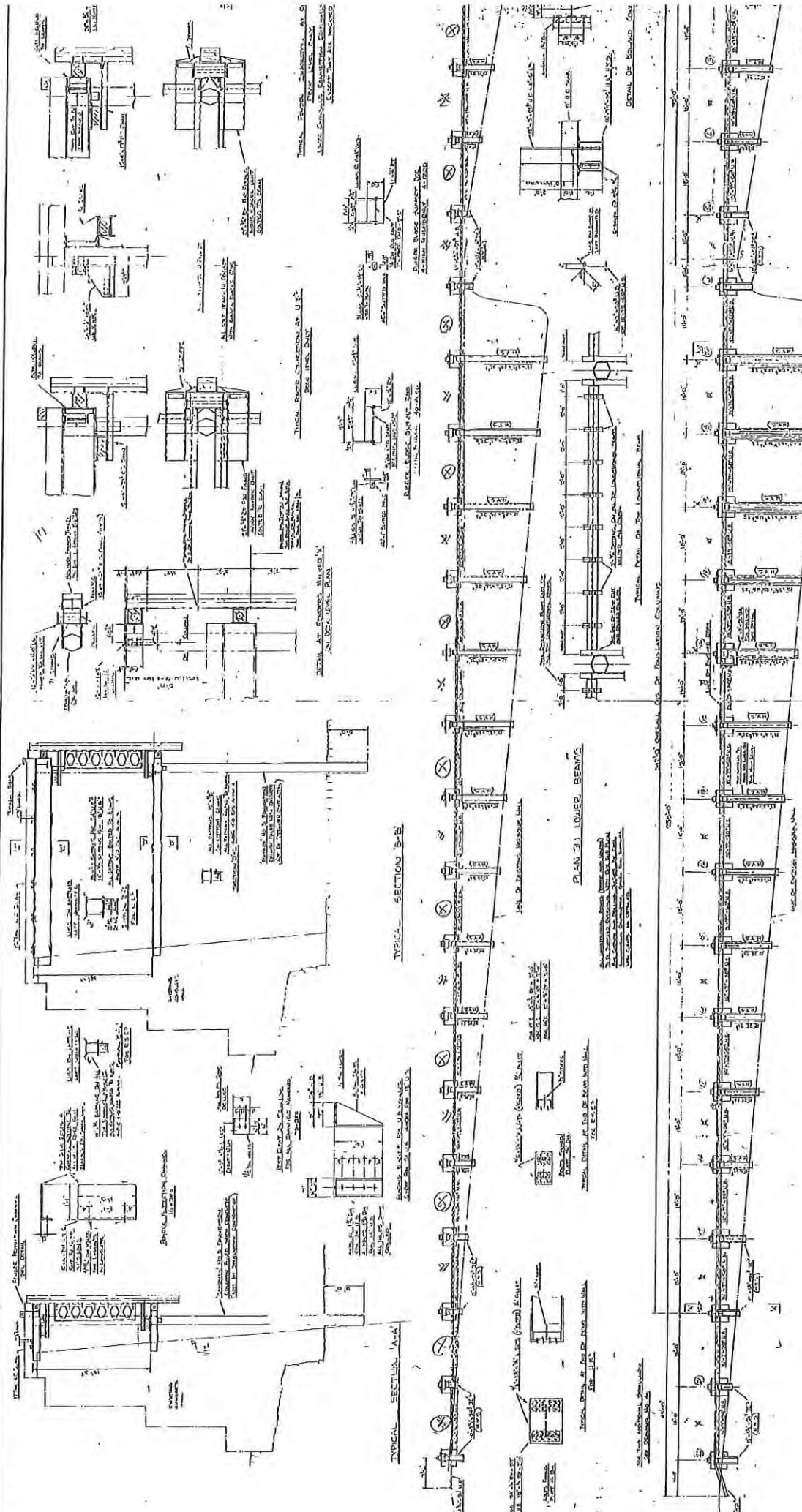
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PLAN OF EXISTING WINDOW FRAME. INDICATES THE LOCATION OF THE WINDOW AND THE LOCATION OF THE WINDOW FRAME.





RECORD DRAWING

PLAN AT DECK LEVEL

ALL STEELWORK TO BE SUPPLISHED BEFORE FABRICATION AND PAINTED IN ACCORDANCE WITH CLAUSE 3 OF THE SPECIFICATION.

ALL STEELWORK, MILD

STEEL 50 M

ALL TIMBER & RUBBER BLOCKS NOT BY SITEWORK CONTRACTORS.

DETAILS OF E

GENERAL CONTRACTOR

ENGINEER

ARCHITECT

DATE

SCALE

PROJECT

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Appendix C - Photographs

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Photo 1 – Suspended deck



Photo 2 – Suspended deck



Photo 3 – Suspended deck

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Photo 4 – Suspended deck

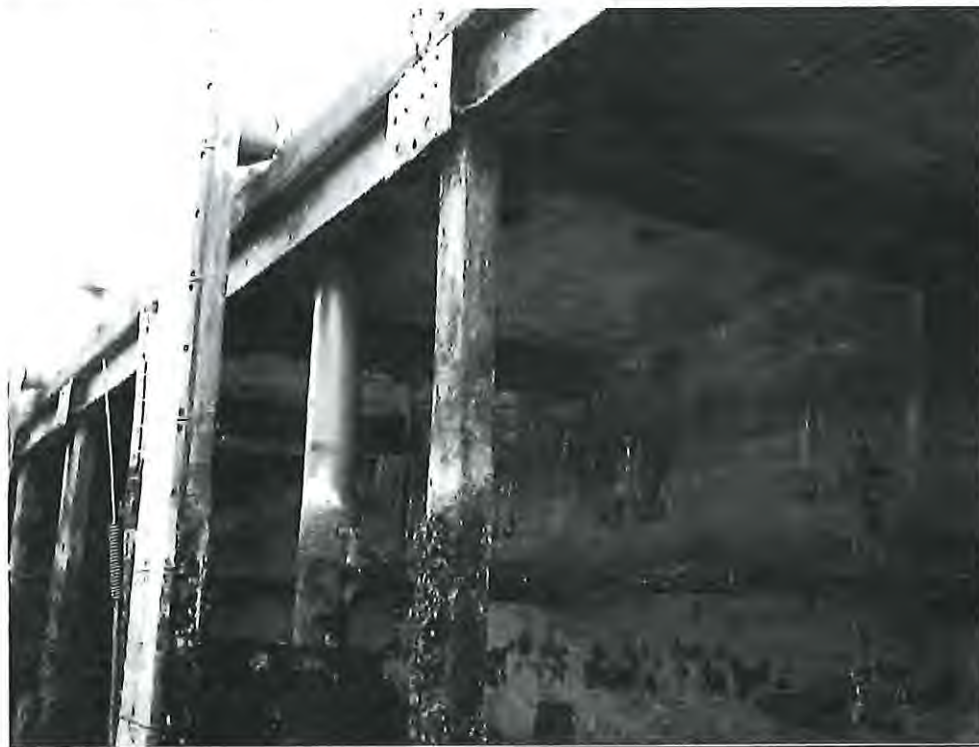


Photo 5 – Suspended deck