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Ramsgate Berth 4&5 Pontoon – Condition Survey

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EXECUTIVE SUMMARY

Robert West Consulting were commissioned by Thanet District Council to undertake a condition survey of the existing floating barges forming Berths 4/5 at the Port of Ramsgate, with the aim of outlining the current condition of the assets and to determine whether the barges are deemed *fit for purpose* based upon their current condition. The condition survey was carried out on the 30th August 2019.

The condition survey comprised of a visual walkover survey of the top side of the floating barges and a visual inspection of the perimeter of the barges from a boat. The survey included the inspection of the two no. floating barges, five no. guide piles and an articulated linkspan. The survey did not cover the Brett Aggregates Hopper and conveyor system and the linkspan.

The existing aggregate berth at the Port of Ramsgate consists of two steel hulled floating barges with an articulated link supporting an aggregate conveyor, fed by two hoppers. These are connected onto land by an articulated link via hinge connections, and are maintained in position by a combination of guide piles.

The findings of the inspection of the existing aggregate berth at Port of Ramsgate is as expected, for an asset of this age within the marine environment.

The articulated hinge connections between the two barges are showing significant signs of distress. There are numerous hairline cracks and fractures along welds, and regular maintenance and upkeep of these connections is required to be carried out.

The findings show that the floating barges are significantly corroded in comparison with the guide piles and other structures. It is clear that there is water ingress into the both barges – through penetrations in the deck and the access hatches. A number of alterations have been carried out for the installation of the hoppers and the operational requirements of the berth– such as the articulated hinges between the barges, which aren't fully compatible with the range of movements that the barges are subjected to. This has had an effect on the structural integrity of the restraint frames and the overall stability of the barges – as evident by the structural damage to the hinges themselves and the overall roll rotation of the barges.

There are various other defects to secondary items (e.g.: parapets, fenders etc.). However, the defects to the articulated hinges between the two barges, the corrosion to the external and internal faces of the hulls of both barges and the rotation of the barges about the roll axis are the primary defects. These defects are due to a combination of the age of the

structure and compatibility issues between the barges themselves and the operational requirements of the berth.

In our opinion, the existing barges have reached the end of their design life in their current condition. Localised maintenance works continue to be carried out on an ad-hoc basis. However, a complete repair / refurbishment of the existing berth in situ to extend its design life is not considered practical or feasible.

Therefore, we conclude that the existing aggregate berth has reached the end of its design life and recommend that consideration is given to the installation of a replacement asset in order to maintain the operations taking place at the existing aggregate berth.

1 PROJECT INFORMATION

1.1 Introduction

Thanet District Council operates a variety of bulk cargo, three no. Ro-Ro ferry berths and wind farm maintenance berths at the Port of Ramsgate. The existing aggregate berth (berth 4/5) is primarily operated by Ashford based company, Brett Aggregates.

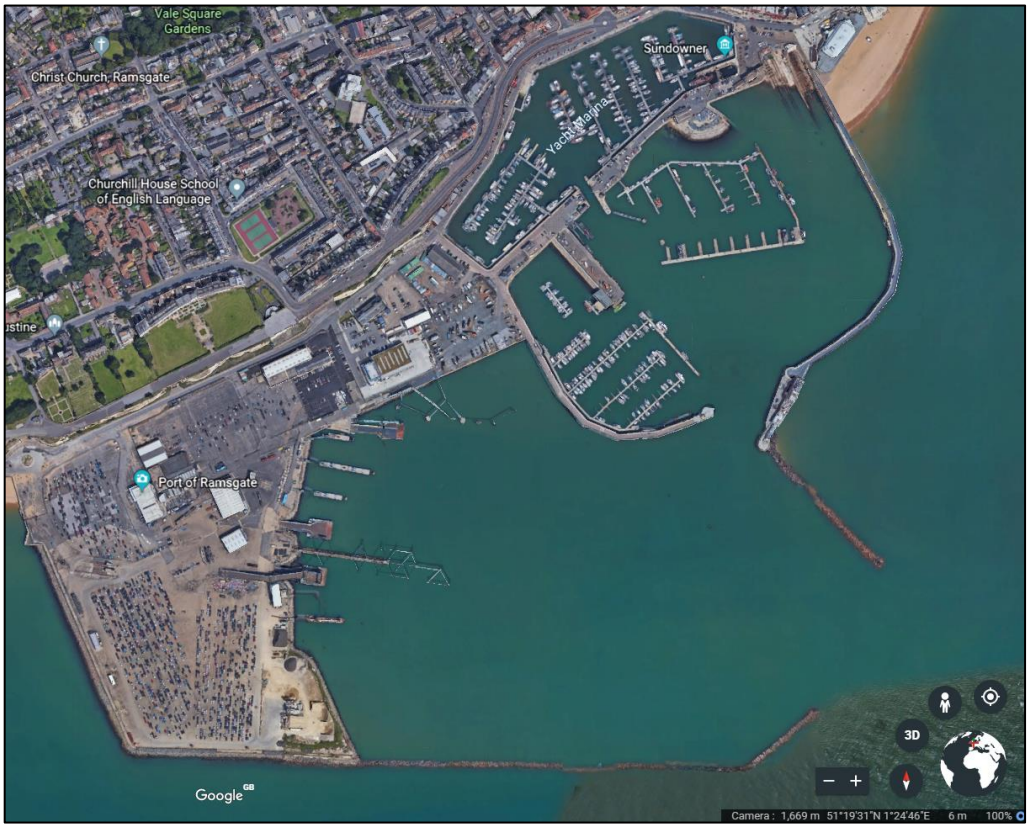

Figure 1 Port of Ramsgate (Google Earth)

The existing aggregate berth (berth 4/5) at the Port of Ramsgate consists of two steel hulled floating barges with an articulated link which supports an aggregate conveyor fed by two hoppers. A hinged ramp with sliding feet provides pedestrian access and also supports the conveyor via articulated link. The barges are held in position by a combination of circular piles with guides and mooring lines to shore and to other adjacent piled structures.

Figure 2 Port of Ramsgate Aggregate Berth 4/5 (Google Earth)

Thanet District Council commissioned Robert West Consulting to undertake a condition survey of the existing floating barges with the aim of outlining the current condition of the assets and to determine whether the barges are deemed *fit for purpose* based upon their current condition. The condition survey was carried out on the 30th August 2019.

1.2 Site information

The Port of Ramsgate is enclosed by two breakwaters. The North breakwater runs in a south-easterly direction and the South breakwater which runs in an easterly direction. A smaller harbour, the Royal Harbour is located north of the main port area. The approach to the Port of Ramsgate is via a dredged channel which runs due East/West. The tidal range between LAT and HAT at the port is in the region of 5.5m. Mean High Water Springs

(MHWS) is at +5.2m Chart Datum (CD), whereas Mean Low Water Springs (MLWS) is at +0.6m CD. The existing aggregate berth (berth 4/5) is located in the main port area.

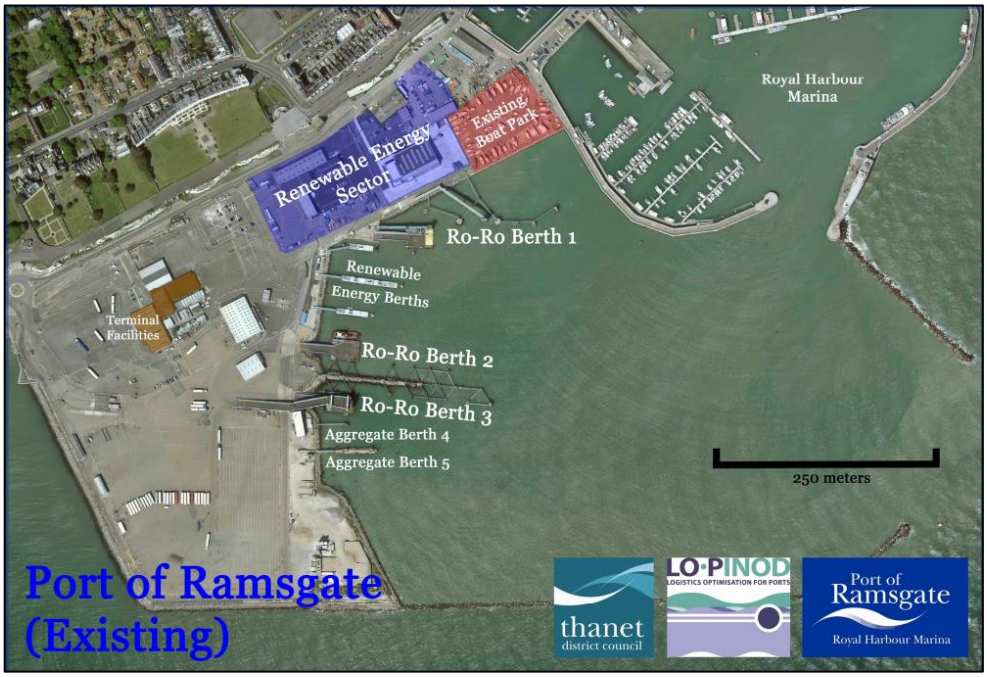

Figure 3 Port of Ramsgate Site Layout

1.3 Scope of Works

The scope of the condition survey included the inspection of the following marine structures

- 2No. Floating barges,
- 5No. Guide Piles; and
- Articulated Linkspan compatibility with Guide Piles;

The following items were excluded from the inspection:

- Brett Aggregates Hopper and conveyor system;
- Articulated Linkspan;
- Adjacent piled structure;

2 EXISTING STRUCTURES

The current arrangement of the aggregate berth at Port of Ramsgate was installed in the early 2000's. The existing aggregate berth consists of two steel hulled floating barges (Barge No.1 & 2) with an articulated link connecting the most westerly barge (barge No.1) onto landside. It is estimated that these two-steel hulled floating barges were originally constructed in the 1960's, and acquired by the Port of Ramsgate early 2000's. They have been positioned at the aggregate berth since that time.

Figure 4 Existing Aggregate Berth 4/5 (North Face)

Figure 5 Adjoining Floating Barges

The floating barges support an aggregate conveyor belt and two hoppers, one hopper per barge. The hoppers and the aggregate conveyor belt are supported by steel cross beams, which are welded onto the steel deck of each barge.

Each barge is held in position by a combination of circular piles with guides and mooring lines to shore and to other adjacent piled structures. Additionally, an articulated hinge connection is located between both barges at each side.

Figure 6 Barges Articulated Hinge Connection (Southside)

Figure 7 Barges Articulated Hinge Connection and Restraint Frame (Northside)

A hinged ramp with sliding feet provides pedestrian access and also supports the conveyor via an articulated link.

Figure 8 Articulated Linkspan

Rubber Tyre fenders are located on the southward face of the barges, which are hooked onto the barges using a mixture of steel chains and rope, connected onto the edge protection, aggregate conveyor supports and steel angles.

Figure 9 Barges Fenders (Southside)

The layout of the berth is further summarised in the below image.

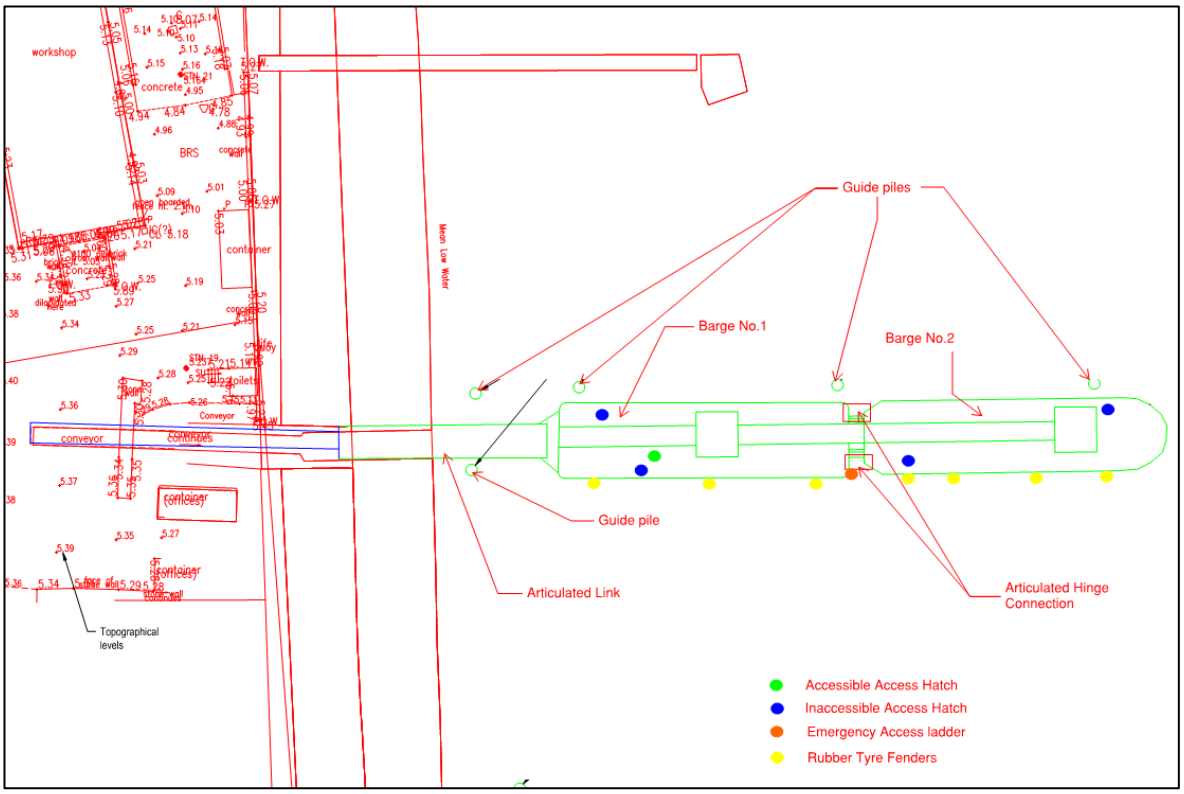

Figure 10 Sketch of Layout of Existing Berth

The main vessels operating at the existing berth are summarised in the below table.

Vessel		1	2
Type		Hopper dredger (DC Vlaandren 3000)	Cargo (Neptune)
DWT	[ton]	4,300	2,400
Displacement	[ton]	6,300	3,800
Moulded depth	[m]	7.5	4.5
Beam	[m]	14.0	12.0
Draft loaded	[m]	6.5	4.0
Draft ballast	[m]	2.5	2.0

LOA	[m]	90.0	75.0
LPP	[m]	80.0	70.0

Table 1 Berth 4/5 Vessels

3 INSPECTION METHODOLOGY

3.1 Methodology

The inspection was undertaken on the 30th August 2019. A visual survey was undertaken by Robert West Engineer Iwan Davies. The condition survey comprised of a visual walkover survey of the top side of the floating barges and a visual inspection of the perimeter of the barges from a boat.

Prior to the inspection, Thanet District Council opened the hatches a day earlier and checked access conditions to investigate inside the hull of the barges.

The inspection commenced at approximately 9:50am and finished at 12:10pm on the 30th August 2019. The time of the inspection coincided with the high tide at Port of Ramsgate.

Table 2 Tide Levels (The UK Hydrographic Office)

Friday 30th August				
Tide	LW	HW	LW	HW
Time (GMT)	06:03	11:09	18:28	23:36
Time (BST)	07:03	12:09	19:28	00:36
Height (m)	0.6	5.2	0.2	5.3

Figure 11 Inspection Tide Levels

3.2 Inspection Conditions

The inspection was carried out in sunny, clear conditions. The temperature was approximately 18-22ºC. The wind was steady at approximately 20mph with minimal gusts. The water was calm, with minimal wave action affecting the barges.

3.3 Inspection Limitations

The inspection was a visual inspection above water. No inspection below the waterline was undertaken.

Access was available into one of the barges (barge No.1) through a hull doorway on the southward side of the barge. Approximately 80% of the inside of the hull of barge No.1 was available to be inspected. The other 20% was inaccessible.

Inspection of the internal hull of Barge No.2 was only available from the top of access hatches and capturing photos from these points (due to uncertainty on the condition of the access ladders, and due to the presence of water within the barge).

The upper deck of the barges was generally covered by the hopper and conveyor system. There was very little visibility underneath these structures.

There was no vessel berthed during the inspection. Therefore, no operational verification was assessed.

4 INSPECTION FINDINGS

4.1 General

The general findings of the inspection are summarised in the below sketch. The subsequent sections of this report provide further detail on the various elements of the berth.

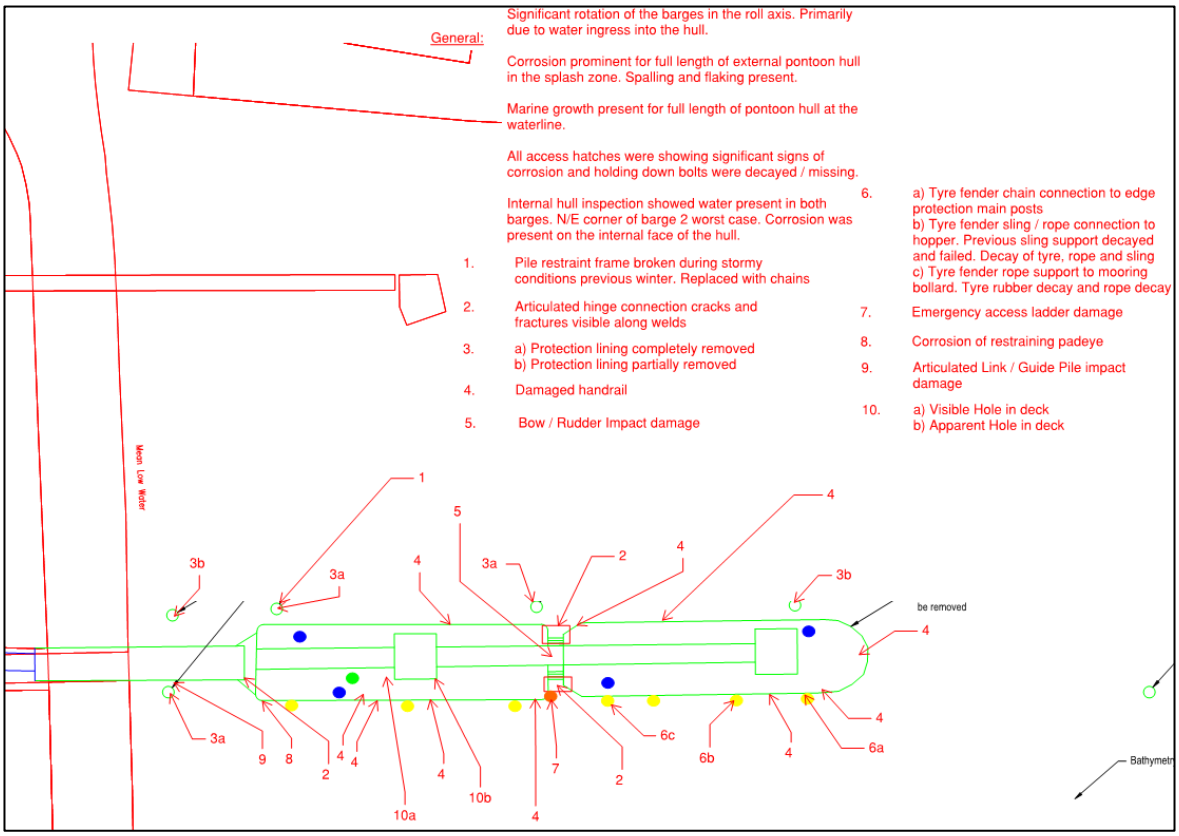

Figure 12 Visual Demonstration of Barges Roll

4.2 Stability

Upon approaching the barges, it was clearly visible that the two barges were not level. Both barges were clearly rotated in the roll axis. This is most likely to be due to water ingress into the hull (refer to later sections of the report for details). Other contributing factors may be the barges being undersized for the actual berthing conditions / loads, and a lack of restraint offered by the restraint frames to the guide piles – however, there was no direct visual evidence to support this, and a nautical assessment has not been undertaken.

Figure 13 Visual Demonstration of Barges Roll

Freeboard measurements were taken at each of the four corners of each pontoon – as shown below. These figures demonstrate the presence of this rotation.

Table 3 Freeboard Measurements

Freeboard Measurement Corner Reading	Barge No. 1 (m)	Barge No. 2 (m)
Northwest	1.20	0.80
Northeast	1.45	0.70
Southeast	1.90	0.90
Southwest	1.55	1.05

4.3 External Hull

4.3.1 General

It was clearly visible that there were significant areas of the hull affected by corrosion on both barges. This ranges from small localised spots, to significant amount of areas showing heavy corrosion and spalling on the hull.

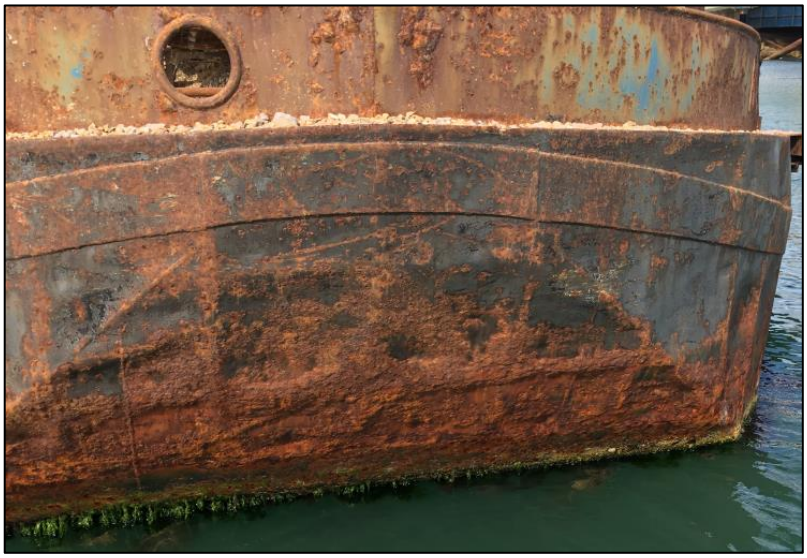

Figure 14 Barge No.2 Bow

Locally, where spalling was present, significant loss of section was visible. The full extent of loss of section cannot be concluded from a visual inspection. However, considerable reduction in section has occurred reducing the structural performance of the barge, and its remaining design life.

Figure 15 Barge No. 1 Hull (Northside)

Furthermore, a significant amount of marine growth was visible along the tidal level of the barges.

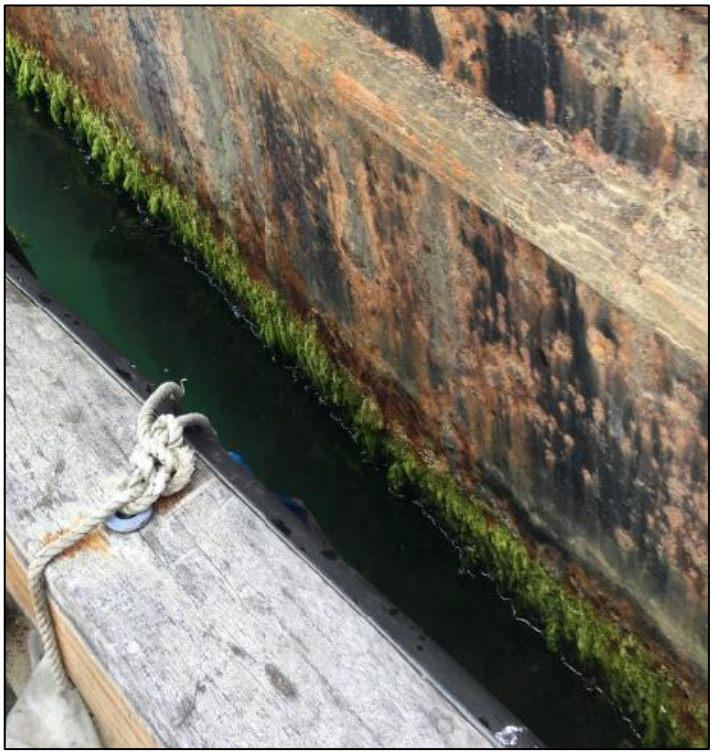

Figure 16 Barge No. 2 Hull (Northside)

4.3.2 Barge No. 1 Bow

The bow of one of the barges (barge 1 on the right) is showing significant deformation and impact damage. There is a tyre fender positioned at this location indicating that there is potential impact from the adjacent barge (barge 2 on the left).

Figure 17 Barge No.1 bow, Barge No. 2 stern

It is apparent that the tyre fender isn't sufficient and the rudder of barge 2 impacts barge 1 in rougher tidal conditions. This could lead to significant damage to the hull and cause water ingress.

4.3.3 Access Hatches

The access hatches are showing significant sign of corrosion and loss of section. One of the access hatches on barge no. 1 has already been replaced.

Figure 18 Barge No. 1 Southside Access Hatch

4.4 Internal Hull

4.4.1 General

The internal face of the hulls were also corroded. However, the extent and severity was significantly less than the external face. The combined effect of the external and internal corrosion, has a considerable effect on the structural performance of the barges.

Figure 19 Barge No. 2 Internal

Figure 20 Barge No. 1 Internal

It was clear that water ingress has occurred into the barges. Speaking with Port of Ramsgate representatives on site, it was clarified that intermittent pumping of water out from the internal structure has been required, dependant on weather conditions. Barge No. 2 showed higher levels of water ingress in comparison with barge No. 1 – particularly in the northeast corner.

Figure 21 Barge No. 2 (N/E Corner)

The water ingress into Barge No. 1 could have been through a number of areas. The access hatches aren't fully sealed and there was a hole visible in the deck. Additionally, it was ascertained that another hole is present in one of the inaccessible areas, below the conveyor in barge No.1. There was no evidence of a water ingress point in barge No.2, except for the seal quality between the access hatches.

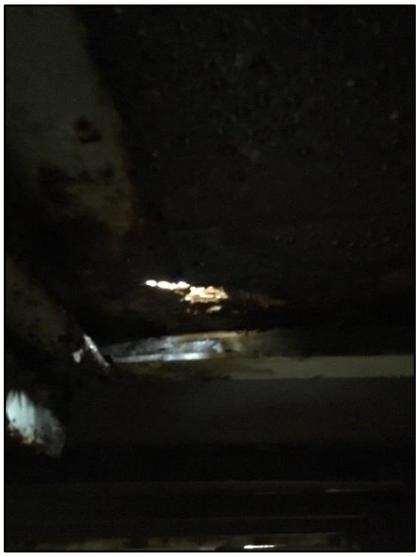

Figure 22 Barge No.1 Deck Penetration

Figure 23 Barge Access Hatch

4.5 Bearing Connection

The hinge connections between both barges had clear signs of hairline cracks and fractures along the welds. It was clarified with on-site representatives of the Port of Ramsgate, that maintenance / repair welding has needed to be regularly carried out in these areas. Multiple layers of welding and decay of welds were visible at crucial joints between the hinge connections and the barge's hull.

Figure 24 Barge Articulated Hinge Connection (Northside)

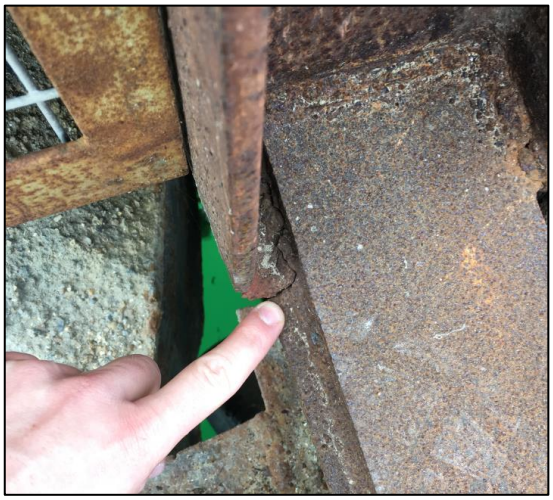

Figure 25 Hinge Connection Hairline Fracture

Figure 26 Hinge Connection Additional Plate (Northside)

Figure 27 Hinge Connection Fracture Repair (Northside)

Figure 28 Barge Articulated Hinge Connection (Southside)

Figure 29 Hinge Connection Fracture (Southside)

4.6 Pile Restraint

In general, the restraint piles of the pontoon were in good condition. There were some areas where local corrosion was present, especially near the position of the barge restraint frames.

Figure 30 Barge No.1 Guide Pile (NW Corner)

The protective coating had totally removed in two of the steel piles and partially removed in the other three.

Figure 31 Barges Guide Piles

For the restraint pile to the northwest corner of Barge, there was no steel guide frame. The restraint was instead made up of steel chains hooked onto a pad eye welded onto the barge deck. This allows a larger range of movement in comparison to the restraint frame.

Figure 32 Guide Pile Broken Restraint Frame (Chain Replacement)

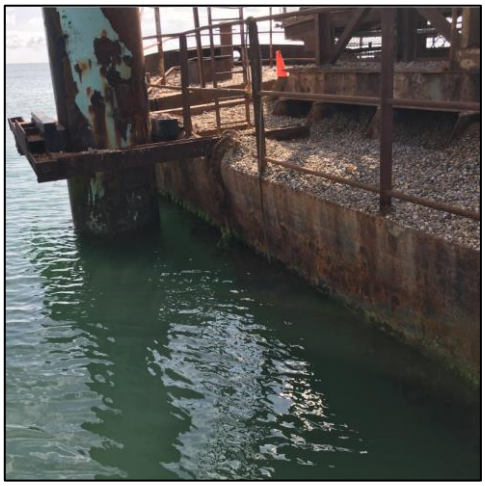

Figure 33 Functioning Guide Pile Restraint Frame

It's understood that the restraint frame element had broken off the previous winter in stormy conditions.

4.7 Linkspan

There was significant deformation of the lower main chord of the articulated linkspan. This has been created by the articulated linkspan impacting one of the circular guide piles. It was not concluded if this due to wave, berthing or mooring forces.

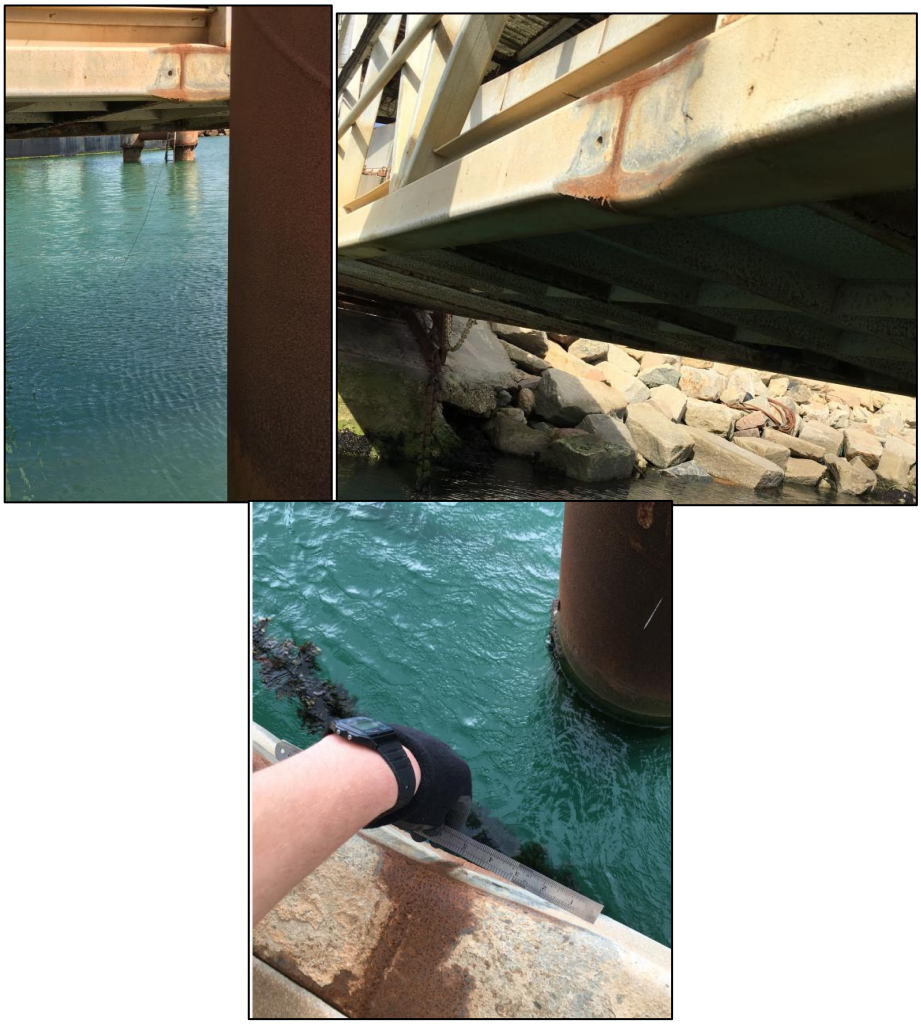

Figure 34 Articulated Linkspan Guide Pile Damage

No rupture of weld or connections of the nearby main chord, column/brace connection were visible.

As stated in section 1.3, inspection of the articulated linkspan isn't part of the scope of works. However, corrosion was visible on the majority of the upper level sections of the articulated linkspan.

Figure 35 Articulated Linkspan

4.8 Emergency Ladder Access

The emergency ladder access of the southward face of the barge did show some level of corrosion on the ladder rungs and stringers. However, the extent of corrosion was not significant.

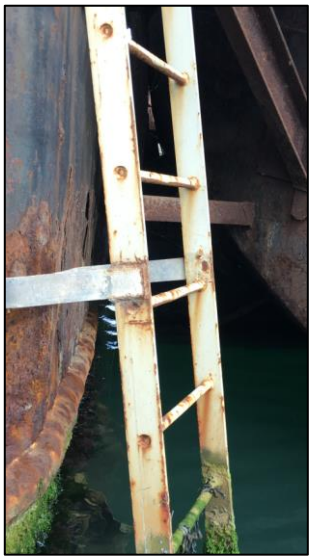

Figure 36 Emergency Access Ladder (Southside)

The top end of the rungs did show slightly more corrosive loss, and it was visible that there was a recent installation of a new access chain link.

Figure 37 Emergency Access Ladder Connection (Southside)

The mid-level backing support of the ladder shows impact damage and deformation. This clearly shows that loads are generated to deform the backing support. This may be due to the aggregate vessels berthing along this face and the position of the ladder not being fully compatible with the current position / arrangement, thus resulting in an accidental impact.

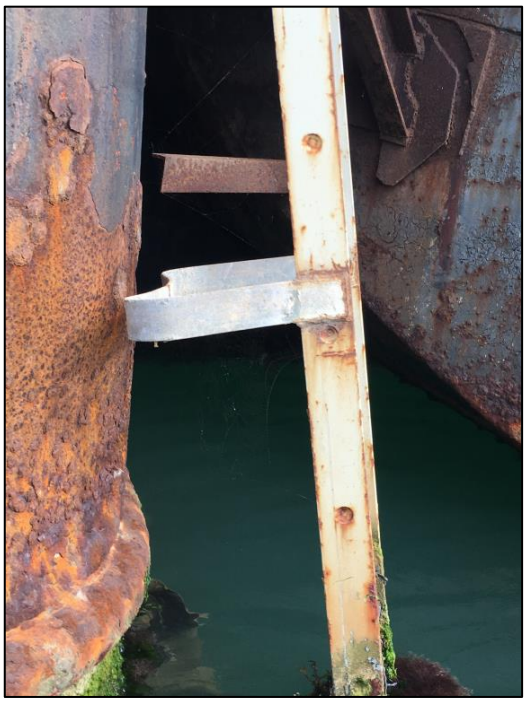

Figure 38 Emergency Access Ladder Damage (Southside)

4.9 Handrails

The edge protection handrail was visibly corroded along the full length on both barges, and damaged in certain points. Varying levels of corrosion were present, with significant loss of

section at localised points. This has produced localised sharp edges to the main handrail, and middle rail, and loss of support to limited number of main posts of the edge protection.

Figure 39 Edge Protection Handrails

Some sections have already been replaced with chains.

In one instance, the edge protection main post is used as a restraint connection for one of the rubber tyre fenders.

4.10 Fenders

Various levels of corrosion were visible on the fender restraint chains which support the fenders.

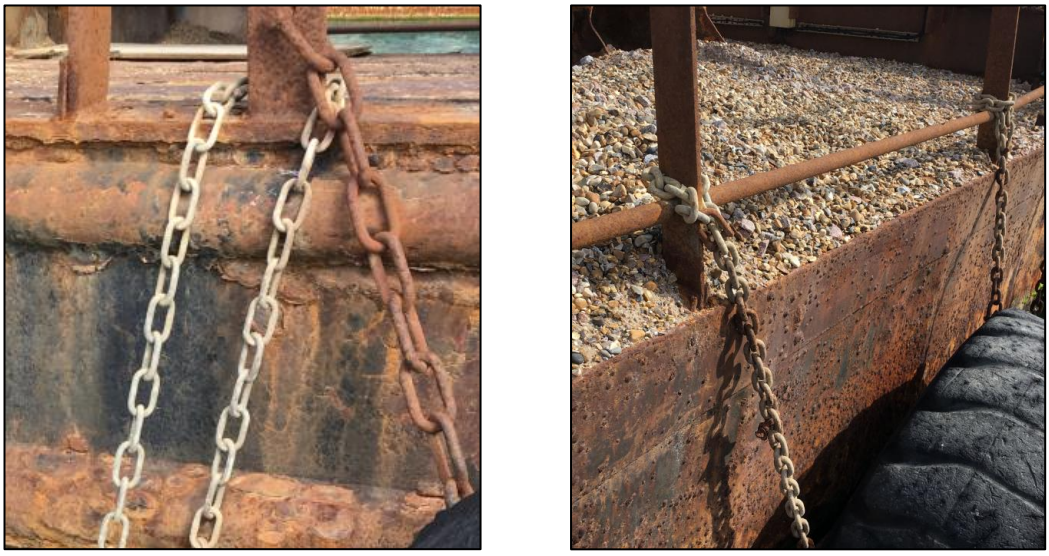

Figure 40 Fender (Chain Support)

There are areas of decay visible on the rubber elements on a limited number of tyre fenders. An additional rubber tyre fender has been installed in one instance to supplement an existing tyre fender.

Figure 41 Fender Decay (Rope Support)

Decay is also visible on the slings and rope connecting one of the fenders to the barges. It is also visible that the sling / rope connection had previously failed, and another sling had to be installed.

Figure 42 Fender Sling / Rope Support Decay

5 CONCLUSION

The findings of the inspection of the existing aggregate berth at Port of Ramsgate is as expected, for an asset of this age within the marine environment.

The findings show that the floating barges are significantly corroded in comparison with the guide piles and other structures. It is clear that there is water ingress into the both barges – through penetrations in the deck and the access hatches. A number of alterations have been carried out for the installation of the hoppers and the operational requirements of the berth – such as the articulated hinges between the barges, which aren't fully compatible with the range of movements that the barges are subjected to. This has had an effect on the structural integrity of the restraint frames and the overall stability of the barges – as evident by the structural damage to the hinges themselves and the overall roll rotation of the barges.

There are various other defects to secondary items (e.g.: parapets, fenders etc.). However, the defects to the articulated hinges between the two barges, the corrosion to the external and internal faces of the hulls of both barges and the rotation of the barges about the roll axis are the primary defects. These defects are due to a combination of the age of the structure and compatibility issues between the barges themselves and the operational requirements of the berth.

In our opinion, the existing barges have reached the end of their design life in their current condition. Localised maintenance works continue to be carried out on an ad-hoc basis. However, a complete repair / refurbishment of the existing berth in situ to extend its design life is not considered practical or feasible.

Therefore, we conclude that the existing aggregate berth has reached the end of its design life and recommend that consideration is given to the installation of a replacement asset in order to maintain the operations taking place at the existing aggregate berth.