Condensate Pipeline Humber Crossing Free-Span Remediation

UKOPA Meeting Dublin – 27-02-2018

Presented by Paul Hardy
Centrica Storage Asset Integrity TA

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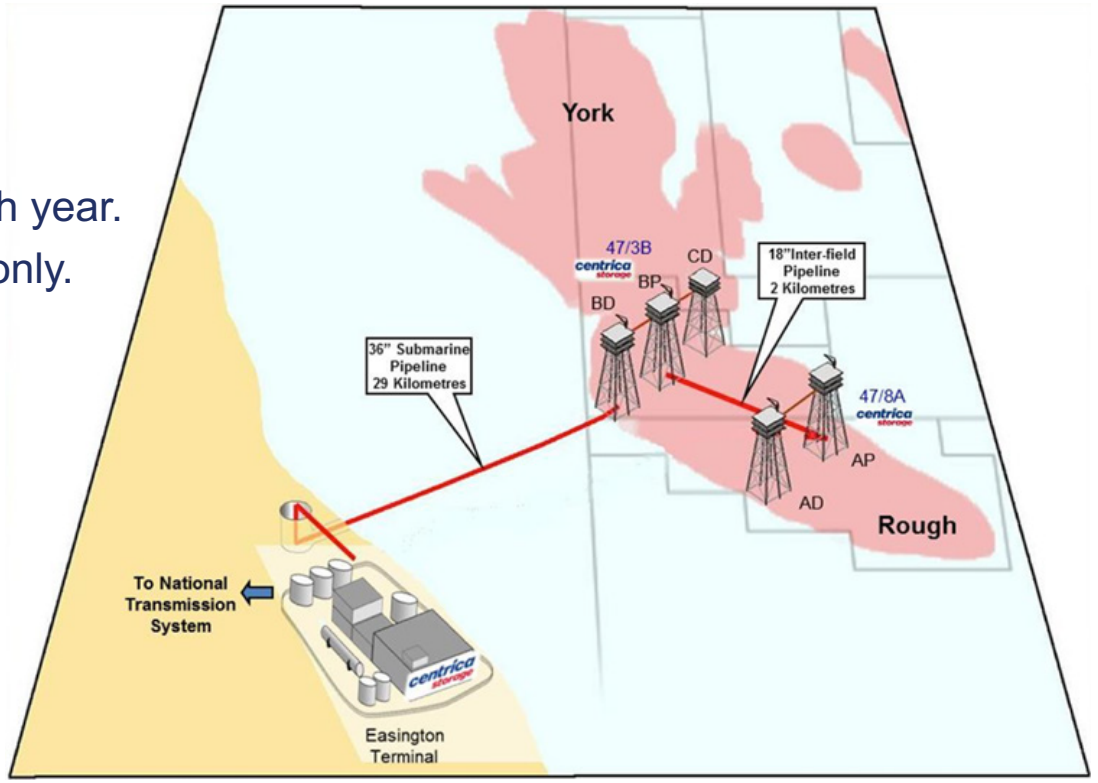
Rough Assets
Overview

- 2 offshore platforms.
- Onshore terminal.
- 4 pipelines.
- UK's largest gas storage facility.
- Operated to design pressure each year.
- Recently operated in production only.
- 30+ years old.



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Rough Assets

Offshore Platforms

47/3B

Max POB 102

47/8A

Max POB 27

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Rough Assets
Onshore Terminal

Easington

- Gas receiving.
- Injection compressor.
- Liquid removal.
- Liquid separation.
- Dew-pointing.
- Filtering.
- Metering.
- NTS connection.
- Condensate storage.
- Condensate dispatch.
- Waste liquid disposal.

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Rough Assets
Pipelines

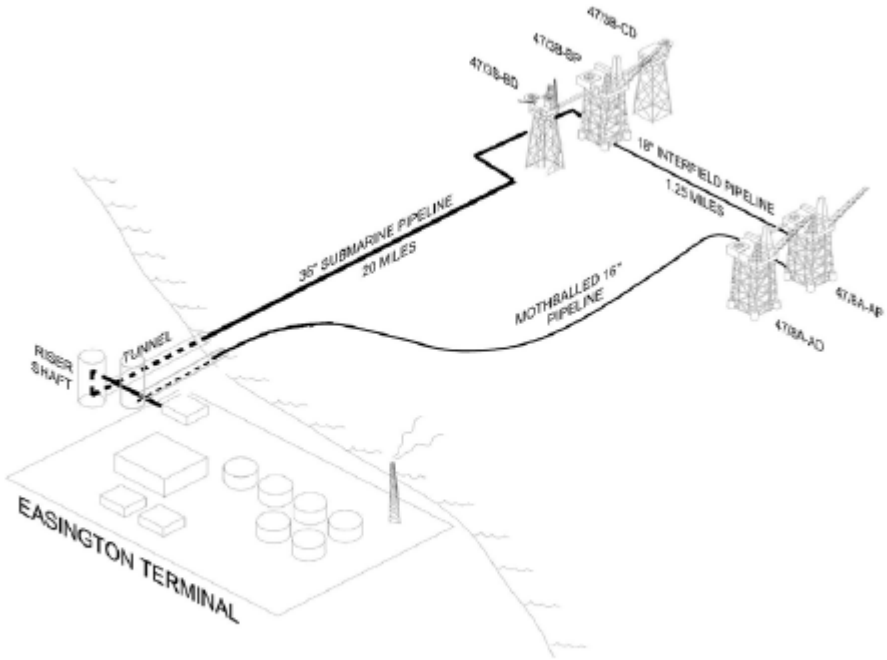

Figure 1-1: Schematic of the Rough Field layout

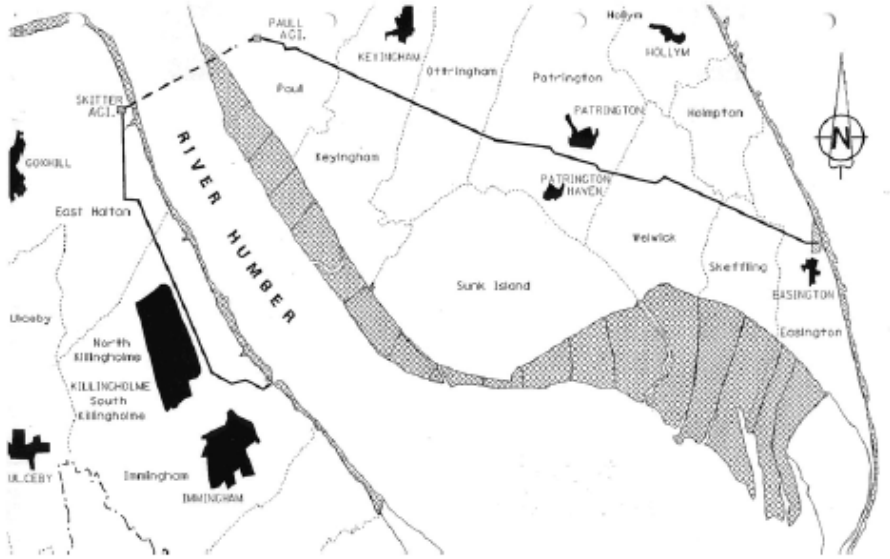

Figure 1-2: 8" Condensate pipeline route

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Condensate Pipeline

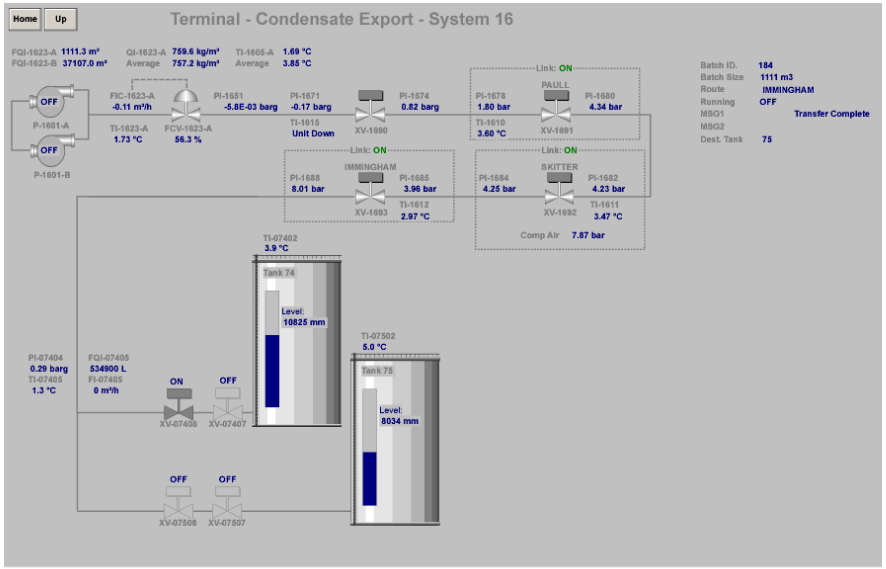
Design and Operating Details

Property	Standard Wall	Heavy Wall
Construction date	1989	
Design life	30 years	
Design code	BS 8010	
Design Pressure	49.65 barg	
Maximum Allowable Operating Pressure	20.0 barg[3]	
Normal Operating Pressure	17.7 barg	
Test pressure	75 barg	
Outside diameter	219.1 mm	
Internal diameter	206.4 mm	193.7 mm
Wall thickness	6.35 mm	12.7 mm
Steel grade	API 5L X42	API 5L X42
External anti-corrosion coating	Polyethylene/epoxy	
Cathodic protection system	Impressed current	
Depth of burial (typical)	1.0 m	
Length	39.068 km	
Flow rate	120 m^3/hr	

Table 3-1: Pipeline physical properties[35, 36]

Property	8" Condensate Line	24" Sleeve Pipe (Humber crossing)
Design Pressure	49.65 barg	2 barg (annulus pressure)[4]
Nominal Outside Diameter	8" (219.1 mm)	24" (609.6 mm)
Wall thickness	12.7 mm	12.7 mm
Steel grade	API 5L X42	API 5L X46
External Anti-corrosion Coating	Polyethylene/Epoxy	6 mm Coal tar Enamel
Internal Coating	Epoxy Resin	Not available
Girth Weld section Coating	Tape wrap/Acothane	Tape wrap
Weight Coating	n/a	100 mm Reinforced Concrete
Maximum Design Temperature	50°C	Not available
Minimum Design Temperature	-20°C	Not available

Table 3-2: Humber crossing pipeline details[37, 38]



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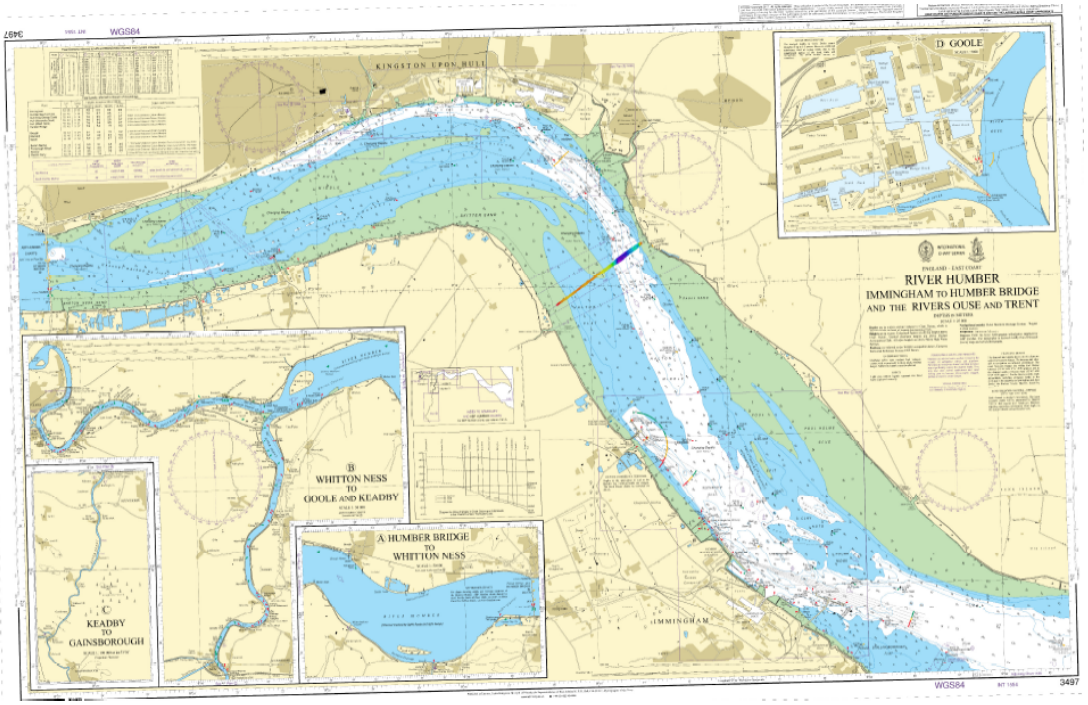
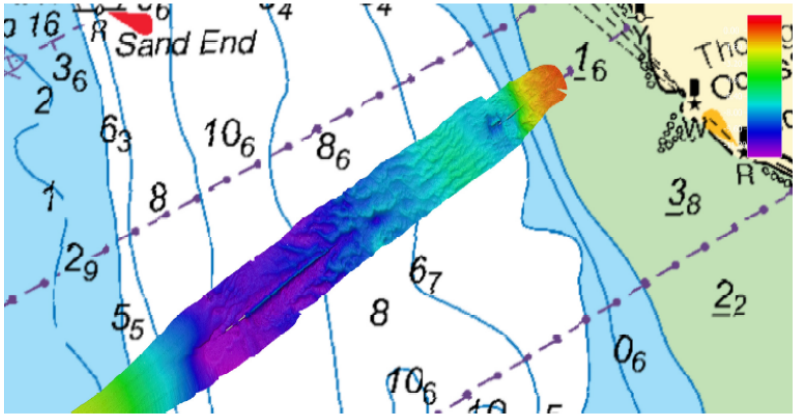
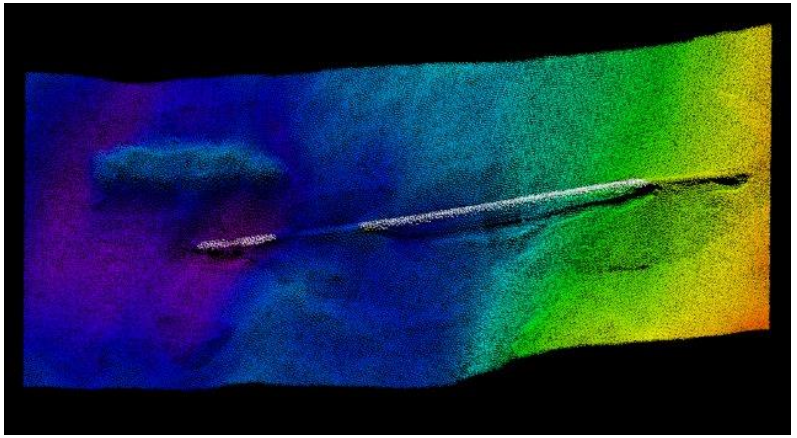
Humber Crossing

Location Details

- Paul to Skitter
- UK's busiest estuary
- Work can affect shipping
- Notice to mariners
- Need to minimise duration
- Very fast flowing
- Neap tides best







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Humber Crossing

Previous Free-Span Remediation – 2013 and 2015

- Pipeline runs in old feeder 1 – 24 inch carrier
- Centraliser clamps at 14 metre centres
- Carrier pipe nitrogen filled
- Carrier pressure monitored via DCS and weekly checks
- Monthly MBES by ABP
- River bed very mobile
- Free-spans and exposures appear and fill back in
- Difficult to project when they will reach acceptance limits for VIV
- VIV limits set via analysis to DNV-RP-F105
- VIV limit probably conservative – pipe within a pipe hard to model
- Latest free-span developed over a few months
- Concern it was in danger of growth via convergence

Acceptance Criteria	Allowable Span Length (m)
Static Stress	50
Onset of In-Line VIV	13
Onset of Cross-Flow VIV	23

Table 3-1: Span acceptance limits

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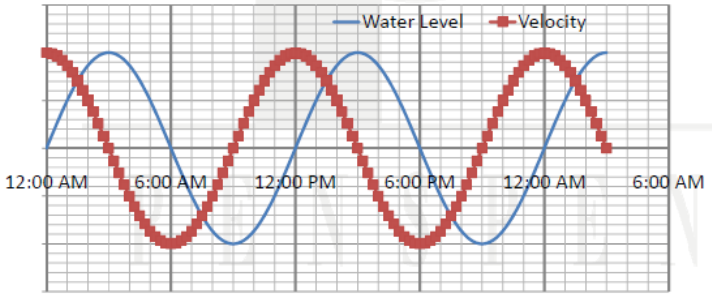
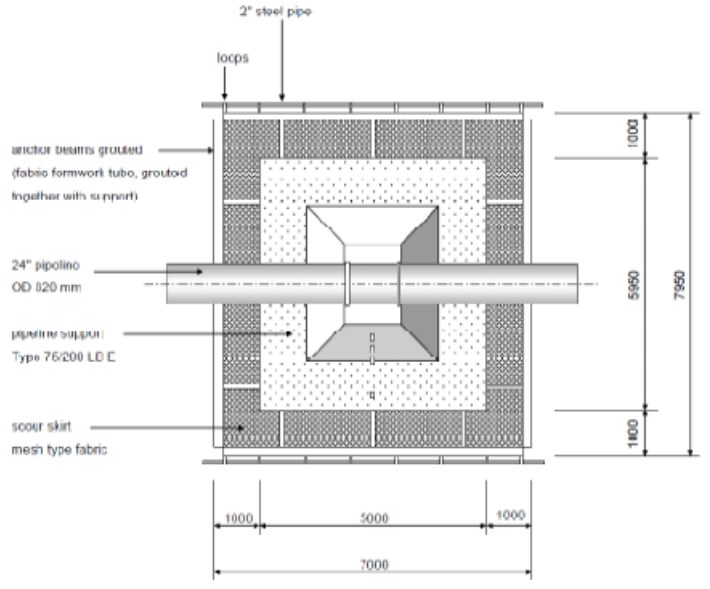
Humber Crossing

Previous Free-Span Remediation – 2013 and 2015

- Initial 2013 design suggestion from Penspen was grout bag
- 28 tonne of cement to fill
- 4.5 hours to pump in – not practical due to currents
- Northern Divers suggested alternative of 4 tonne rock bags – used before





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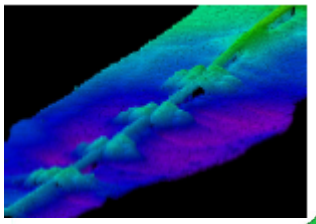
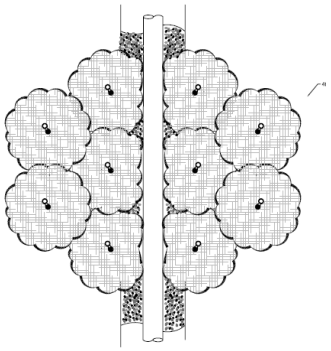
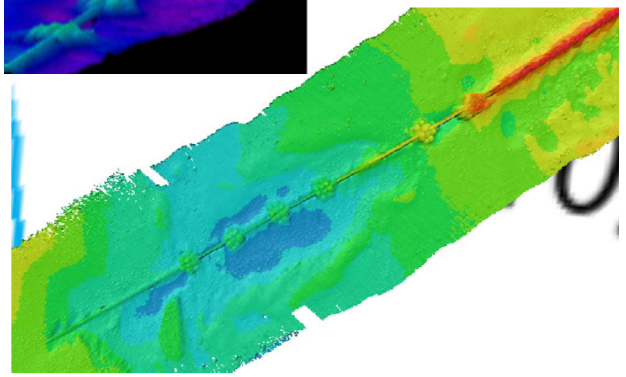
Humber Crossing

Previous Free-Span Remediation – 2013 and 2015







- Divers used – zero visibility
- Very hazardous
- 1 hour slots at slack water only

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Humber Crossing

2018 Free-Span Remediation

- No divers used – hierarchy of control: I wanted to remove the hazard
- Northern Divers still used to PM the work: local knowledge
- Much more advanced vessel used – Delta Marine: Voe Vanguard
- Voe Vanguard has DP2 & twin cranes
- Interocean survey team on board – Blueview MBES used for placing bags

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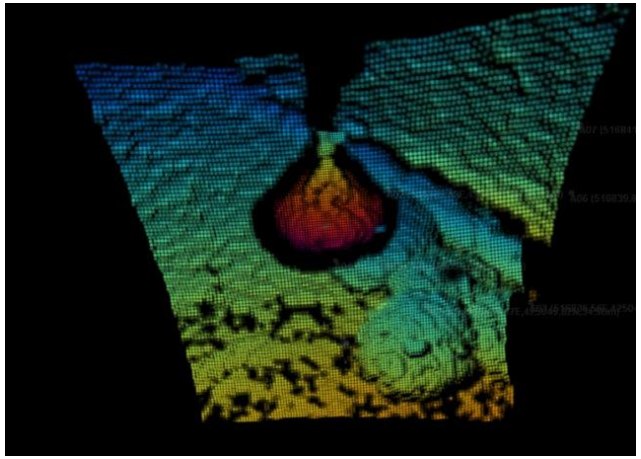
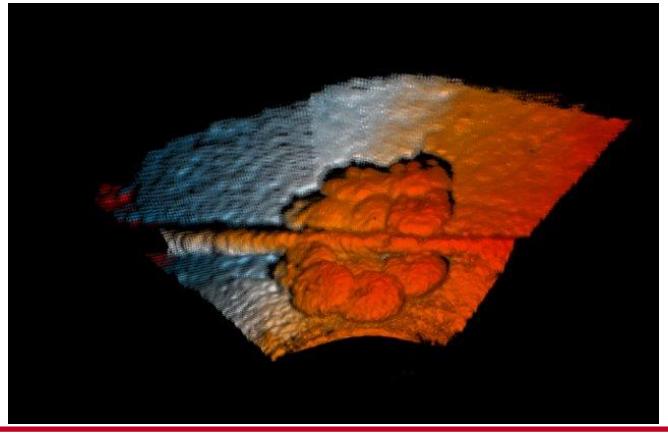
Humber Crossing

2018 Free-Span Remediation

- Work completed in 4 days – shorter time than divers
- Longer working window – tolerant of faster tides





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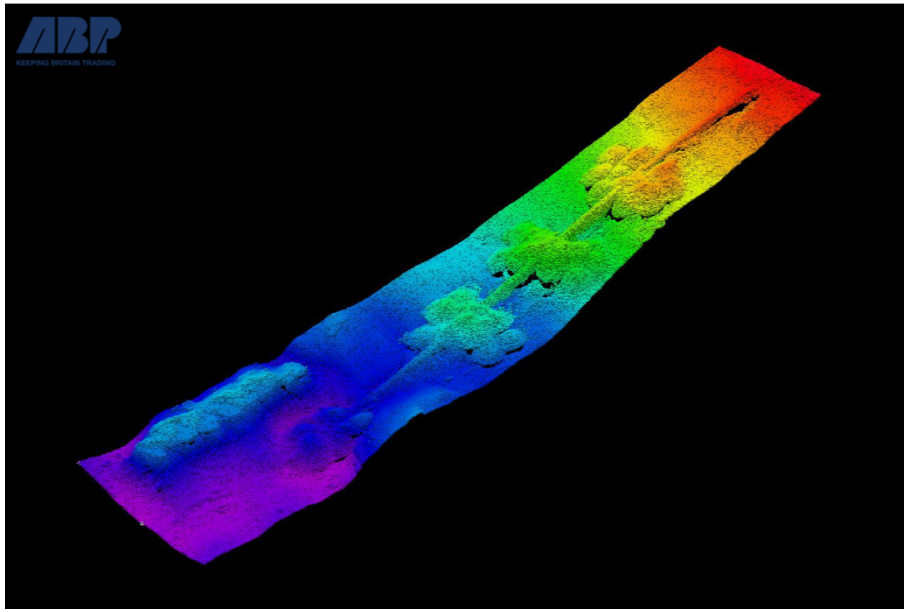
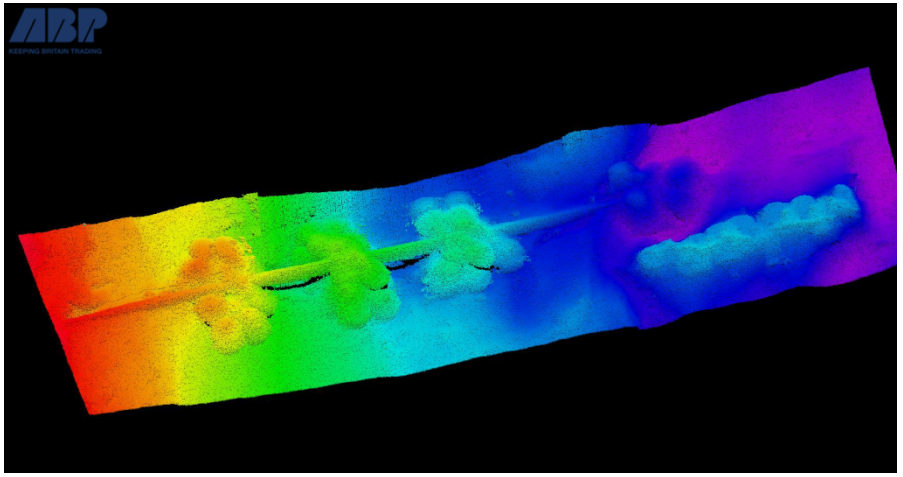
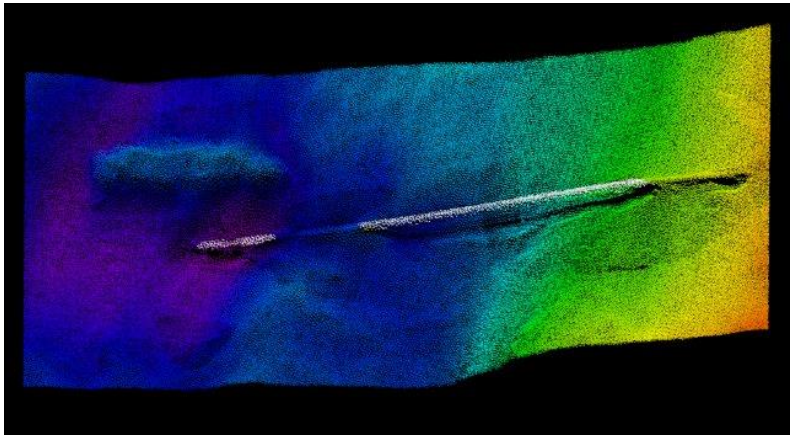
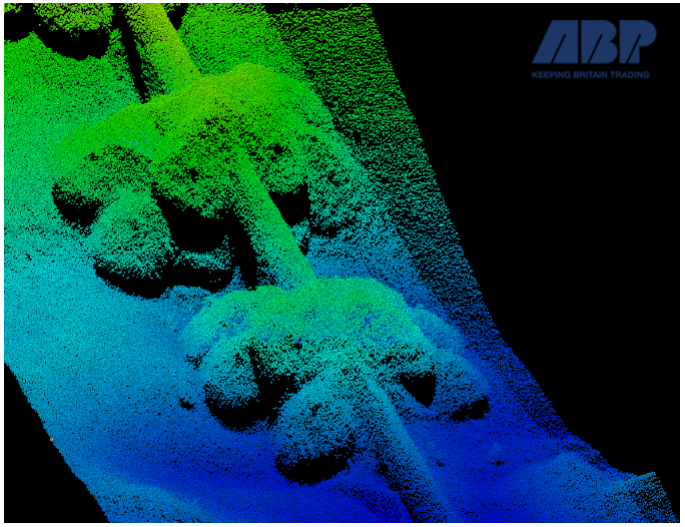
Humber Crossing

2018 Free-Span Remediation – Post Remediation ABP MBES









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Humber Crossing

2018 Free-Span Remediation – Highlights

- Work completed safely and to specification
- Work completed ahead of plan and to cost estimate
- Vessel costs higher than previous, but vastly superior vessel
- Diver risk and costs removed completely
- DP 2 removed the need for anchor spreads
- Reduced risk to mariners – no anchor spread required
- Transit risk removed – no requirement to transit divers at shift changes
- A great example of innovation via technology reducing risk to personnel
- Thanks to Northern Divers, ABP, Delta Marine & Interocean

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