The Lake Lothing (Lowestoft) Third Crossing Order 201[*]

Lake Lothing
THIRD CROSSING

Document 6.3: Environmental Statement Volume 3 Appendices

Appendix 15A

Vessel Simulation Report

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Suffolk County Council

LAKE LOTHING THIRD CROSSING

Vessel Simulation Report

1069948-WSP-MAR-LL-RP-MA-0003
MARCH 2018

CONFIDENTIAL

Suffolk County Council

LAKE LOTHING THIRD CROSSING

Vessel Simulation Report

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1 INTRODUCTION

1.1 GENERAL

WSP Limited have been commissioned to progress approvals, designs and agreements for a third crossing at Lake Lothing, Lowestoft.

1.2 SCOPE OF REPORT

This report details the commissioning, progression and outcome of a real-time vessel simulation exercise conducted to assess the navigation impacts of the Scheme.

1.3 OBJECTIVES

The objectives of the vessel simulation were to establish:

- The navigability through and adjacent to the Scheme bascule bridge
- The suitability of the proposed passage width beneath the bridge
- Confirm the requirements for bridge protection
- Determine any aids to navigation that the bridge may require
- The potential transit times for large vessels through the Scheme bascule bridge.

2 PROJECT DESCRIPTION

2.1 OVERVIEW

Lowestoft is a port town on the east coast of England, in the county of Suffolk. The town is divided in two by a sea inlet, Lake Lothing, which forms Lowestoft Harbour and provides access via Oulton Broad and Oulton Dyke to the River Waveney and the Broads.

Lake Lothing is currently crossed by two road bridges, one carrying the A47 across the passage between the inner and outer harbours and a second carrying the A1117 at the Mutford Bridge, Oulton Broad. These bridges open to allow shipping to access the port, causing significant traffic disruption.

The scheme is a new road crossing over Lake Lothing, improving access to the lake area as well as relieving congestion in, and around, the town centre.

2.2 LOCATION OF SCHEME

The proposed location for the new bridge is shown on Figure 1, below.

Figure 1 – New bridge location

2.3 BRIDGE DESIGN

The bridge will comprise a single counterweighted, rolling-lift bascule leaf, actuated via below deck hydraulic cylinders, supported on 2 reinforced concrete piers. The bridge will be constructed to provide a clear navigational channel, central in the lake, of 32m between fenders and 35m between the pier faces. The bridge deck will have a clear height over water of at least 12m above highest astronomical tide when lowered and raise to provide infinite clearance across the whole of the navigation channel. The fixed over water sections of the bridge will be protected from navigation impacts by passage and approach fendering. The opening bridge will be connected to the existing road network by a series of fixed approach spans. An indicative section showing the bridge outline in both the “raised” and “lowered” position is shown in Figure 2, overleaf.

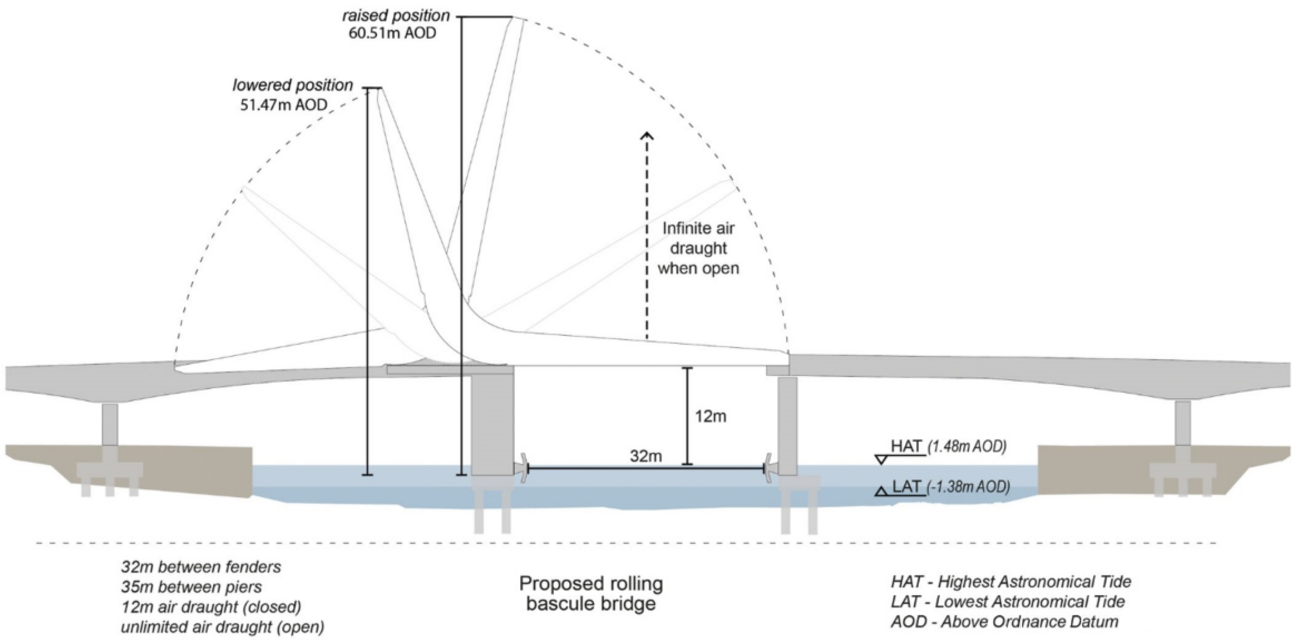

Figure 2 – Bridge outline

2.4 PORT OPERATIONS

The location of the Scheme crosses the navigation waterway within Lake Lothing. The Inner Harbour at the Port of Lowestoft has commercial quays both east and west of the Scheme bascule bridge location, along with a number of marina facilities located west of the bridge. Access to these berths will require an opening of the Scheme bascule bridge should the air draft of the vessel exceed the available headroom, including a suitable safety clearance, with the bridge in the lowered position.

3 VESSEL SIMULATION

3.1 SIMULATION FACILITY

Lowestoft College were commissioned to use their Kongsberg vessel simulator to create a real-time navigation simulation.

The Kongsberg Polaris Full Mission Bridge Simulation Suite consists of a realistic mock-up of a ship's bridge with all conventional controls and instruments you would expect to find on a modern bridge.

These include manoeuvring and throttle controls, navigation instruments including GPS, LORAN and NAVTEX, an ARPA radar and ECDIS plotter. In addition, visuals are provided by a realistic 150° visual of the outside world.

The bridge can be designated as a vessel including offshore supply vessel, container vessel, ferry, fast patrol craft, bulk carriers etc. Movement, controls and instruments will then balance and respond precisely as the real ship.

All aspects of the vessel can be controlled from the instructor station. Weather, tide, visibility and sea state can be changed and varied. Facets can be introduced, including failure of the engines, steering, thrusters etc. Also included in the system is assessment software that enables detailed evaluation of all aspects of the use of the system.

Figure 3 – Lowestoft College Kongsberg Simulator

3.2 EXISTING SITUATION MODEL

A base model of the Port of Lowestoft in its current form was created by Kongsberg from mapping data supplied by ABP. This model covered an area bounded by lower left 52°26'33.16"N 01°41'56.35"E to upper right 52°30'28.19"N 01°48'40.97"E, encompassing the seaward approach, outer harbour, inner harbour and part of the Lake Lothing bend approaching the Mutford Locks. Bathymetric data for the model was taken from the latest navigation charts produced by ABP.

3.3 THIRD CROSSING MODEL

The third crossing bridge was originally modelled as an elevated (12m clear height above highest astronomical tide) twin leaf hinged bascule bridge with fixed spans over the remaining waterway and operational quay areas of the port. The clear width between abutments on the bascule section was set at 35m. The clear width between fender panels within the passage was modelled at 32m, with 3 panels of approach fenders set at an angle of 25° to the passage centreline. The bridge piers have been modelled as piled structures based on the current design philosophy. An extract from the drawing used to create the bridge model is shown in Figure 4, overleaf.

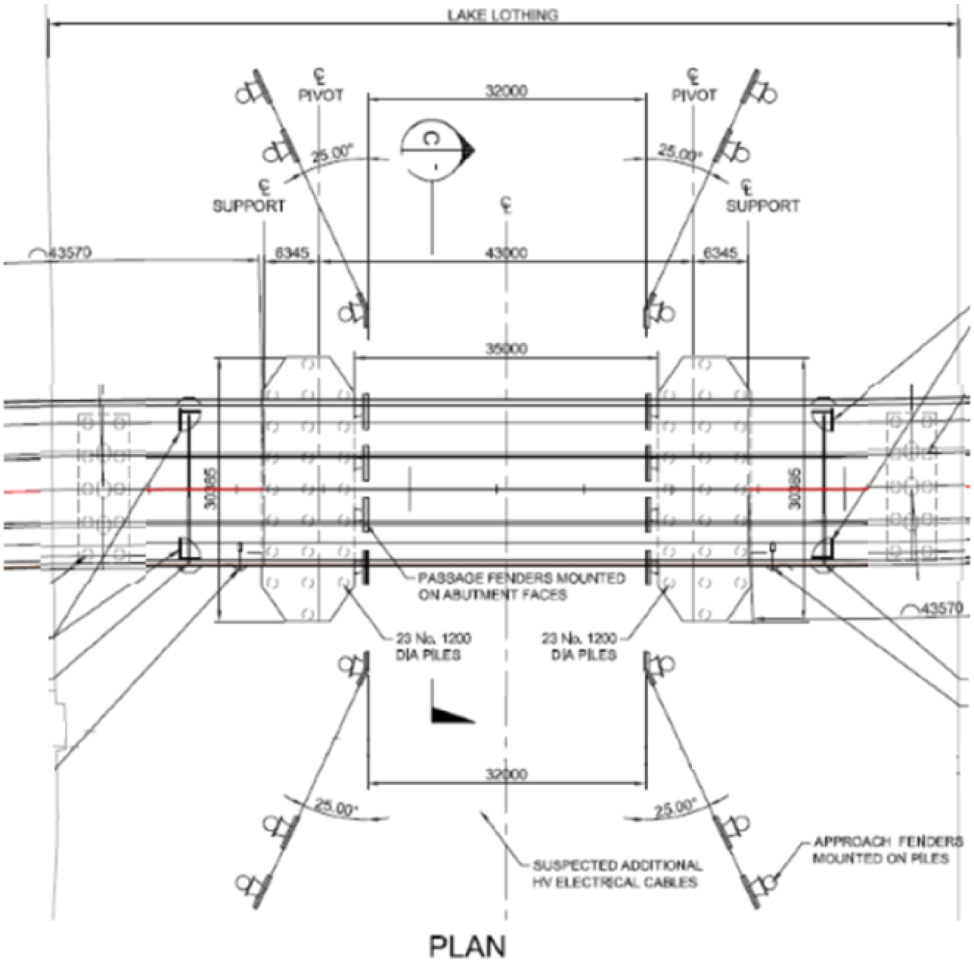

Figure 4 – Model Bridge Design

The bridge model was updated following completion of the first stage simulations to reflect the change in the pier design, from 4 piers to 2 piers in the waterway, and to incorporate and address comments received from the ABP port pilots during the simulation itself. Details of these alterations are presented in section 4.2.2.

The model was further updated following the change in design to a single leaf rolling bascule, details of these alterations are presented in section 4.3.2.

3.4 SIMULATION DATA

The environmental data used during all simulations included the following parameters.

3.4.1 WIND

Wind conditions for each simulation run can be set for both direction and speed, constant velocity or gusting as required by the simulator operator. To ensure the model was conservative no sheltering effects from surrounding structures other than the new bridge has been included. This sheltering is simulated by introducing a reduction in wind speed at the appropriate point in the simulation, due to the limitations of the simulator the sheltering effect is limited to a reduction in applied force at a single point of action on the vessel.

3.4.2 CURRENT

Tidal current modelling is based on flow rates taken from both Admiralty Charts and ABP's navigational and pilotage information. This is typically quoted as 1.5-2 knots in the vicinity of the new bridge during peak tidal periods.

3.4.3 TIDE

Within the simulation, the water depths were represented by a rectangular grid divided into square cells giving the local values of seabed level throughout the study area derived from the navigation bathymetry charts plus an appropriate height of tide, selected by the ABP Pilot.

3.4.4 WAVE

Waves within the inner harbour are limited and considered navigationally negligible for the size of vessels under consideration and were therefore not included within the simulation.

3.5 SIMULATION VESSELS

Table 1 shows some details of the design vessels, taken from the Kongsberg vessel simulation models catalogue, which were agreed with ABP as representative of the type of large commercial vessels (comprising approximately 1% of all vessel movements) which call at the Port of Lowestoft and were available for use in all the navigation simulation trials undertaken at Lowestoft Collage.

The ship manoeuvring models included for motions in three degrees of freedom (3DOF), representing surge, sway and yaw motions (i.e. those directly affecting horizontal motions). However, the models also include representations of vessel squat and shallow water behaviour to ensure representative manoeuvring behaviour in relatively shallow water, where appropriate.

Table 1 – Simulation Vessels

Vessel Designation	Vessel Description	Displacement (T)	Length between perpendiculars (m)	Length Overall (m)	Beam (m)	Draught (m)
BARGE03L	Towed flat top barge	2200.00	73.40	76.20	17.07	1.83
BULKC11L	Typical small laden CCP coastal bulker	5906.00	84.98	89.99	14.00	5.68
CNTNR24B	Small coastal container in ballast	7022.00	108.20	121.40	20.80	4.67
FERRY50	Medium size ferry	5415.00	108.00	117.00	20.00	4.39
DREDG05L	Laden trailer suction dredger	7247.00	88.45	96.10	18.00	5.10
SUPLY10L	Large laden offshore supply vessel	6550.00	75.40	86.20	19.00	6.00
TUG05A	Harbour class tugboat	550.00	30.50	32.00	10.97	2.50
TUG09	Deep draughted tug	668.00	30.02	32.66	9.45	4.12
SUPLY05L	Medium laden offshore supply vessel	2302.00	57.80	66.00	14.00	4.55
TUG15	High performance ocean tug	575.00	28.00	29.50	11.00	2.78

During the navigation simulation runs, the behaviour and performance of the controlled ships, in terms of responses to any helm, engine or tug control, and the local wind, wave and current conditions, is governed by a mathematical ship manoeuvring model. The mathematical model of the ship is calibrated to ensure it behaves in such a way that the position, velocity, swept path and heading of the simulated ship are always representative of real ship behaviour. All models used in the simulation were Pilot Grade, these models are of the highest fidelity and have been compared to the results of actual sea trials of the vessels on which the ships model is based to verify their accuracy. The requirements of the Safety of Life at Sea (SOLAS) convention set out minimum standards for construction, equipment and operation of merchant ships flagged by signatory states. As of 2016 162 states had signed up to the convention covering around 99% of the registered global fleet by tonnage. As such, it can be assumed that vessels using the Port of Lowestoft will be built to SOLAS standards.

4 SIMULATION EXERCISE

4.1 FIRST STAGE SIMULATIONS

4.1.1 GENERAL

Following completion of the models a first stage exercise was undertaken to verify the accuracy of the existing model and to confirm the model reflected actual navigation conditions. This was undertaken by ABP Harbour Master, Gary Horton and ABP Deputy Harbour Master and Pilot, David Morrice on Monday 17th and Tuesday 18th October 2016.

4.1.2 SIMULATION MANOEUVRES

The selection of simulation manoeuvres and the environmental conditions was left at the discretion of the pilots.

Initial trial runs on the existing model with the bulk cargo ship (BULKC11L) indicated that, in general, the simulator performed well, replicating the handling and responses the pilots would expect from this class of vessel. It was noted that some of the visual references that the pilots use during the transit were slightly misaligned which had the effect of putting the vessels slightly offline during manoeuvres, however once identified the pilots were able to compensate for these discrepancies and navigate the model successfully.

Following confirmation of accuracy on the existing model the Third Crossing model was run in the simulator, initially using BULKC11L, to allow direct comparison of the manoeuvre with the bridge and without. Both pilots successfully completed transits up and down stream of the bridge along with a turning manoeuvre upstream of the new bridge.

Further simulation runs were undertaken using a variety of the vessels in differing environmental conditions to gauge the overall effects of the third crossing.

4.1.3 SIMULATION OUTCOMES

Following the completion of the simulations ABP were invited to consider the overall accuracy of the navigation as presented. Their responses and suggested improvements were as follows:

- The bridge leaves did not raise in line with bridge abutments. This caused an obstruction to high sided vessels with extreme beam.
- The floodlights located at Jeld Wen Quay, (currently used as focal point for bridge transit), appeared slightly offset to South. Also with the new bridge in place they were not readily visible. This may require a new navigation mark to be established located either on the bridge flyover or just East of the bridge on the South quay.
- The East Jetty marker needed to be moved very slightly to South, (this light is used as a marker for outward transits of the existing bridge).
- The South Pier Lighthouse needed to be coloured white.
- The Kirkley Sector Light marker needed to be established.
- The Tide Hut structure was shown on model but has been demolished.
- The model showed more mud banks exposed than is the case over LW periods.
- The pilots felt more interaction between the vessel and the lake bed with limited under keel clearances. This may be due to the actual nature/composition of sea bed material, i.e. silt, (navigable mud?).
- Some vessel models/quay areas would overlap, i.e. vessel would blend into quay rather than impact and deflect off. This was an issue with the boundary detection line within the model and was rectified as soon as identified during the simulations.
- The proposed fenders on the East and West sides of the bridge restricted access to the berths immediately East and West of the flyover on the North side. This could be improved with a re-design increasing the angle from bridge ‘cut’ and removing the extreme East and West fenders on the North side.
- The wind parameters for new bridge needed to be less than for the existing bridge due to its exposed position.
- The engine controls for vessels with azimuth propulsion seemed very severe, in that once clutched in the power delivery felt like a full power setting.

4.2 SECOND STAGE SIMULATIONS

4.2.1 GENERAL

Following completion of the first stage simulations the model was altered to reflect the feedback obtained, as detailed above. A second set of simulation runs was arranged and undertaken on 24th and 25th of May 2017 by ABP Harbour Master, Gary Horton and ABP Marine Operations Manager, Richard Musgrove. These second stage simulations were also observed by an independent navigation consultant, Mike Nicholson of Shipmove Ltd.

4.2.2 MODEL ALTERATIONS

Following completion of the first stage vessel simulation the Third Crossing Model was updated to reflect changes in the overall bridge design and the changes in approach fender design resulting from the ABP port pilots' comments. The revised bridge design used in the second stage model is shown in Figure 5 below.

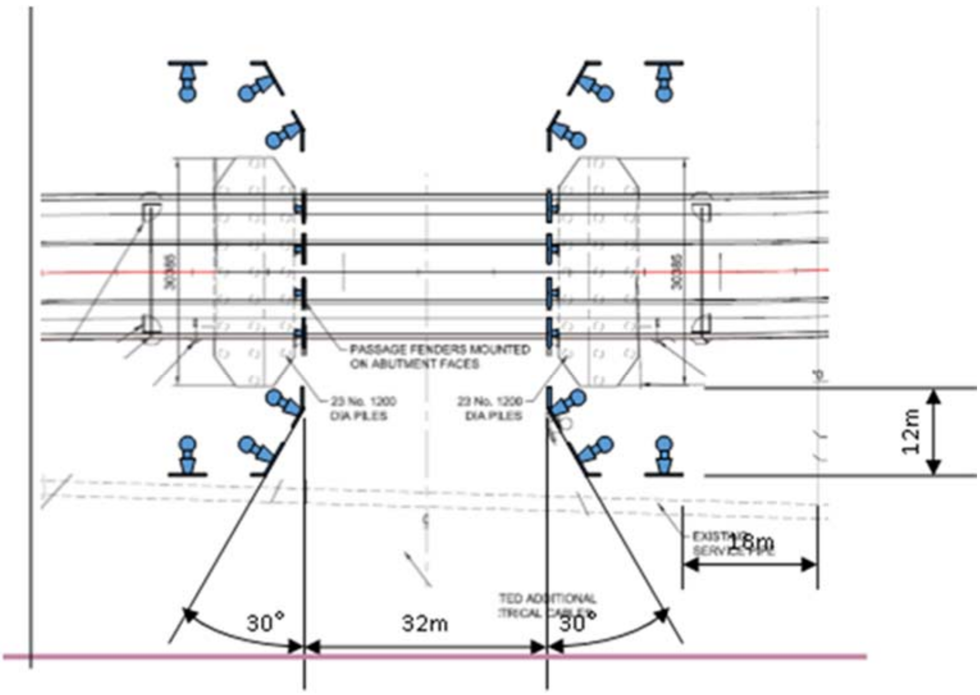

Figure 5 – Revised Model Bridge Design

4.2.3 SIMULATION MANOEUVRES

The selection of simulation manoeuvres and the environmental conditions was initially left at the discretion of the pilots. Once the pilots were comfortable with the vessel handling and general navigation, specific simulations were undertaken to identify operational limits and visibility requirements.

Day 1 – 24th May 2017

A number of trial runs to test vessel handling were undertaken using typical environmental conditions; manoeuvres were performed on a slack water at high tide with a 6 knot westerly wind. Runs where performed with the bulk vessel, dredger and supply vessels. All simulations included passage through the new bridge. No contacts with approach fenders or bridge occurred and no other issues were reported.

Following handling tests, further runs were undertaken to simulate approaches, including tidal flows, bridge failure and backing through. All simulations were undertaken without major issues and, even with the simulated bridge failure, the vessel was brought to a halt in a controlled manner well in advance of the bridge.

Day 2 – 25th May 2017

Simulation runs with the larger Ferry vessel were attempted. Initial runs registered contacts with the passage fenders and the Pilots considered this arose due to a lack of visibility from the bridge deck. During the third run, it was discovered that the simulator was registering fender contact based on the flying bridge wing, rather than the vessel hull, which indicated that the transits would have been satisfactory.

A series of simulation runs was undertaken with increasing wind force. As would be expected, the transits became increasing more difficult as the wind speed increased but all simulations were completed successfully.

A final series of simulations was undertaken to test passage different visibility conditions. An initial run was undertaken with night conditions, with two light buoys added to the simulator to mimic navigation lights, and the simulation was successfully completed. A further run was conducted with visibility set at 0.2 nautical miles (the typical limit for vessel movements with the port area) and again this was completed without incident.

More detailed descriptions of the simulation runs are contained within the Navigation Consultants report, Appendix A to this report.

4.2.4 SIMULATION OUTCOMES

In general, the simulations showed that the presence of the Scheme did not significantly increase the difficulty of navigation within the port.

More detailed commentary on the outcomes is contained within the Navigation Consultants report, Appendix A.

After completion of the second round of simulations the following written comments were received from ABP:

- Many of the quay navigation lights are single lights when they should be two vertical lights.
- The position of a new mark to replace Jeld Wen Quay floodlight was identified as being in line with the first land side pier on the South side, (closest to quay edge). The exact position would need to be ascertained, along with the type and design of the light. This would be determined at a later stage but an LED directional light is considered most favourable.
- The maximum length of vessel which could use North Quay No.1 with the Scheme in place would be 100m for conventional vessels and 110m for highly manoeuvrable vessels.
- Barge work, (tugs and tows), was not achievable due to problems with model controls in anything but Bridge ‘A’.
- Bridge Timings – A maximum of 1 minute expected between completion of first Bridge sequence to commencement of 2nd Bridge sequence, (for two Bridge transits) – for vessels speed at between 3 and 4 knots.
- Port Traffic Control Lights were missing from the South Pier.
- In certain conditions tidal effects were active within the harbour – this does not occur in reality.
- The most useful and typical model, the 90 metre Bulk Carrier, had unreasonably slow rudder response, (considered to be outside of SOLAS requirements for maximum time period hard over to hard over, this refers to Resolution A.325(IX) Annex Regulation 13(a)(iii) adopted 12 November 1975).
- The Scheme fendering commences some 18m from the quay faces on the North and South sides. This exposes the road way to potential impact, (particularly on the North side where berths will be in use immediately East and West of the crossing).

Upon review the majority of the comments received relate to the mechanics of the simulator or model rather than the navigational impact caused by the presence of the new Bridge.

The final comment regarding spacing of the protection fenders was addressed by the addition of a second perpendicular fender located closer to the quay.

4.3 THIRD MODEL SIMULATION

4.3.1 GENERAL

Following the completion of the second stage simulations the decision was made to change from a twin leaf trunnion bascule bridge to a single leaf rolling bascule design. In correspondence ABP stated that they considered this concept change potentially significant in terms of its impact on the navigation, in particular the potential for changes to the sheltering effect the bridge will have during transits. For this reason an additional round of simulations was performed using the revised bridge design.

These simulation runs were undertaken on 7th and 8th of March 2018 by ABP Harbour Master, Gary Horton, ABP Marine Operations Manager, Richard Musgrove, ABP Pilot Jeremy Kingston and observed by independent navigation consultant, Mike Nicholson of Shipmove Ltd.

4.3.2 MODEL ALTERATIONS

The revised bridge model used in the third simulation is shown in Figure 6 below.

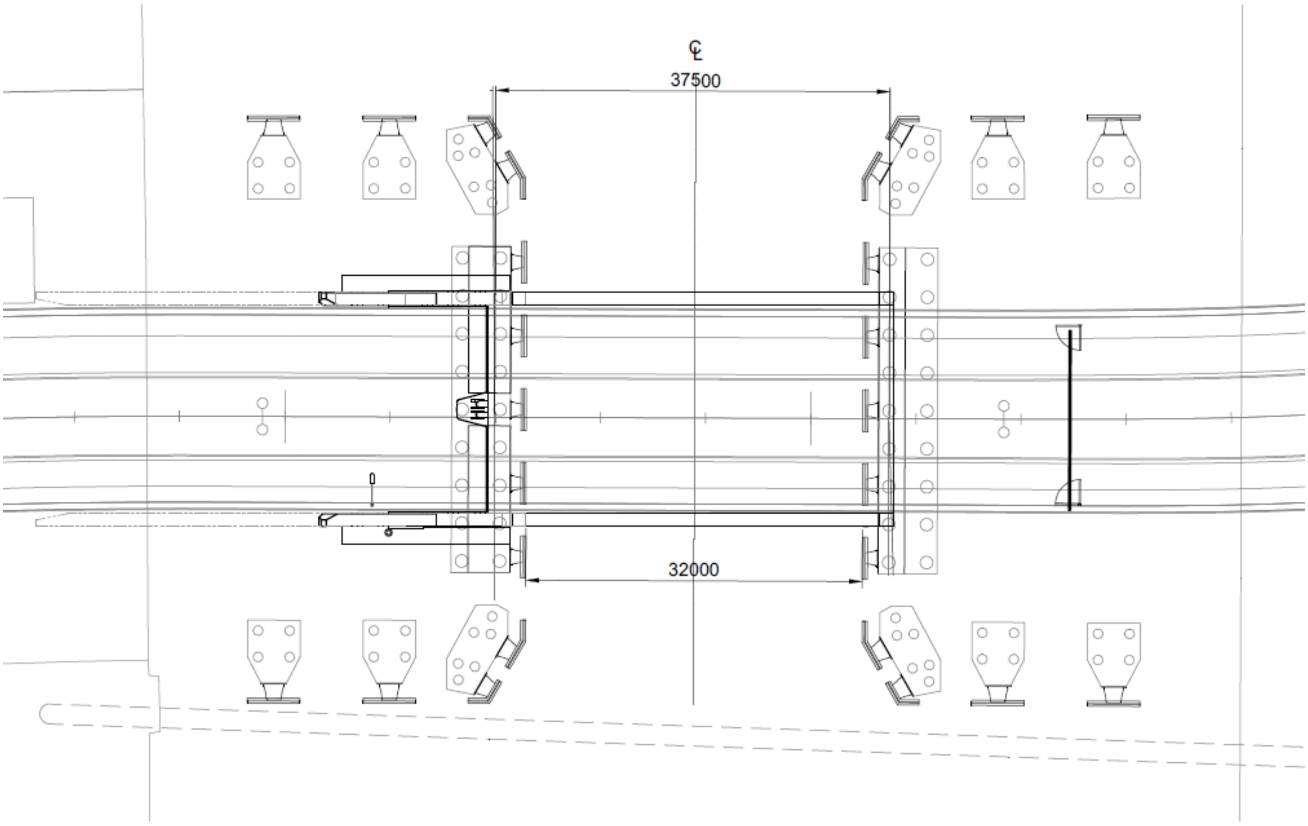

Figure 6 – Third Bridge Model

Additionally, an illustrative anticipated navigation and control lighting scheme was incorporated into the model as shown in Figure 7, below.

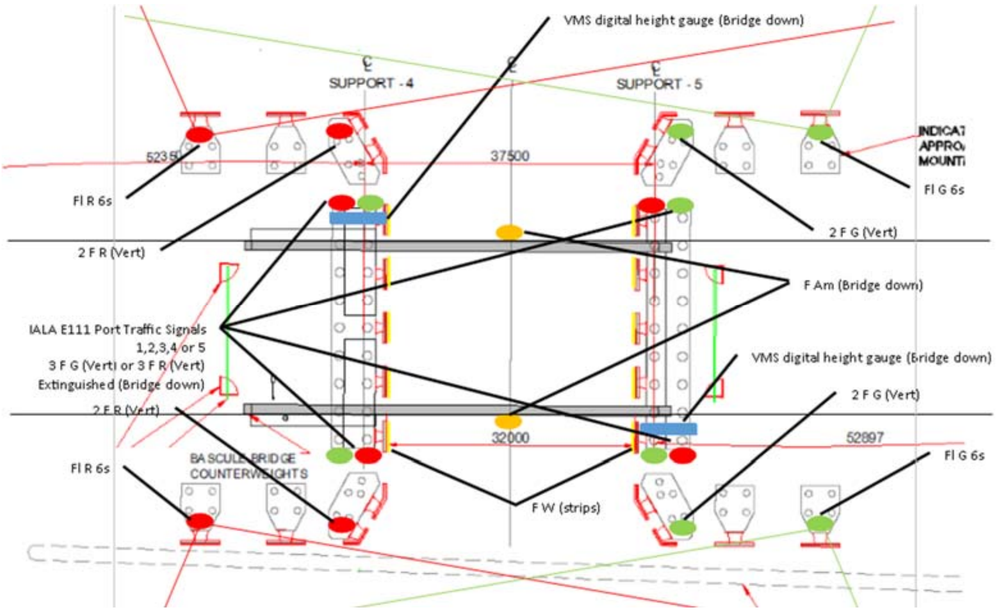

Figure 7 – Navigation and Control Lighting Scheme

A representation of a small craft waiting pontoon was added to the model, located to the south east of the bridge as shown in Figure 8, below, to allow assessment of the impact a pontoon in this location would have on vessel manoeuvres, particularly within the turning area.

Figure 8 – Small craft waiting pontoon location

The movement animation time of the bridge, that is the time taken for the bridge to move from lowered to raised or vice versa, was adjusted to 106 seconds within the simulations to reflect the latest estimates from the operational hydraulic simulation, as detailed within Appendix 3 of the Document 7.5 Design and Access Statement, for raising and lowering times.

4.3.3 SIMULATION MANOEUVRES

Over the two days of simulations a total of 27 separate manoeuvres were undertaken.

The selection of simulation manoeuvres and the environmental conditions was initially left at the discretion of the pilots. Once the pilots were comfortable with the vessel handling and general navigation, specific simulations were undertaken to identify any variations following the bridge design change and then to assess the impact of the waiting pontoon.

More detailed descriptions of the simulation runs are contained within the Navigation Consultants report, Appendix B to this report.

4.3.4 SIMULATION OUTCOMES

In general, the simulations showed that the revised Scheme design did not significantly increase the difficulty of navigation within the port.

The proposed location of the waiting pontoon caused no additional constraints on navigation of larger vessels within the lake.

Various runs were undertaken aiming to replicate a significant wind shear effect on the vessel during bridge transits, this was only partially successful due to the limitation of the simulator as discussed in Section 3.4.1.

This limitation is not considered to be significant as the level of effect for all but the very largest of vessels will be similar or less than that experienced at the existing A47 Bridge, this is based on the fact that when raised the leaves of the A47 Bridge produce a vertical face to approximately 14m above HAT which is comparable to the height of the abutments of the Scheme bascule. Additionally the duration of transit of any single point on a vessels hull past the Scheme bridge abutment would take around 15 seconds in most cases, this is considered to be insufficient time for the force to overcome the inertia of a large vessel and produce significant rotational effects (this value is greater than the 7 seconds stated in the Navigation Consultant Report as it considers the effect of the whole of the abutment on any vessel as opposed to the effect of the bascule leaf which is considered in that report and would affect larger vessels only).

More detailed commentary on the outcomes is contained within the Navigation Consultants report, Appendix B.

During the simulations it was commented that provision of a wind sock, or similar device, in the vicinity of the new bridge would provide mariners with a valuable guide to conditions during passages.

The proposed vessel control lighting was considered too complex for the ports operation and a simple red/green light set on one abutment each end of the bridge would be sufficient for vessel control.

The Harbour Master would like the flashing red and green lights shown on the extreme fender pile caps replaced with single fixed amber lights and replicated on all fender pile caps. Additionally the twin fixed red/green channel marker lights should be located as close as possible to the passage fender line.

After completion of the third round of simulations written comments were received from ABP, they are contained within Appendix C. The comments do not raised any substantive issues that are not already addressed in the evaluation and conclusions of the Navigation Consultant.

5 DISCUSSION OF RESULTS

5.1 FIRST STAGE SIMULATIONS

The objectives of the first stage simulations were to prove the accuracy of the navigation model and to identify any key items within the bridge design that would have an adverse impact on navigation within the Port. In general the simulation performed well and reflected the responses expected during vessel manoeuvres. No major anomalies were identified and the consensus was that the model replicated actual conditions to the level required.

Following completion of the first stage simulation a design change increasing the spans of the fixed bridge sections thereby repositioning the 2 fixed piers from within the waterway to behind the quay walls was confirmed. This allowed a further refinement of the approach fendering resulting in a further reduction in berth take on the adjacent berths. This modification was simulated within the second stage simulations.

5.2 SECOND STAGE SIMULATIONS

The objectives of the second stage simulations were to confirm the changes following the recommendations from the first stage and to quantify operational parameters for the new bridge in particular in relation to opening durations.

The initial simulation runs showed that the changes made following the first stage produced a considerable improvement in accessibility to the berth North East of the bridge. Comments received from ABP indicate that they feel that additional fender protection in closer proximity to the quay sides, particularly for the North Quay, would provide valuable collision protection to the fixed spans of the bridge.

Further simulation runs in varying wind conditions showed transit was achievable even in severe gale conditions and would therefore should not impose additional restrictions on vessel movements due to environmental factors provided the bridge could operate in the extreme conditions.

Timings from all completed simulations indicate a vessel transit time, from calling for the bridge to raise to the vessel clearing the passage fendering of between 6 and 6 ½ minutes, allowing an additional minute for the bridge to lower would produce a “closed to road traffic” time of 7 to 7 ½ minutes per vessel passage. This figure was fairly consistent for the classes of vessels simulated.

Runs undertaken in low visibility and night-time conditions identified the need for edge illumination along the passage, in the simulation this was achieved by adding light buoys positioned in-line with the fendering at either side of the passage. Discussions suggested the addition of lighting strips along the top of the fenders may be an appropriate solution for the final design.

5.3 THIRD STAGE SIMULATIONS

The objectives of the third stage simulation were to confirm any variations in outcomes from the second stage simulations resulting from the change in bridge design from twin leaf hinged bascule to single leaf rolling bascule and assess the impact of the positioning of the waiting pontoon to the south east of the Scheme bascule bridge.

These simulation runs showed little difference in the navigation over the second stage simulation, that is to say the design change has not resulted in an increase in the impacts the bridge would have.

Due to the increased operational time of the revised bridge design the overall transit time for the simulated movements increased by around 1 minute over the values achieved during the second simulation. As a consequence of this the call position for the bridge to raise occurred about 100m earlier than during the previous simulations. The effect of this is that the separation between lowering of the existing bridge and raising of the Scheme bascule bridge reduced from around 3 minutes during the previous simulations to just under 2 minutes for the simulated vessel movements.

Final simulation runs involving turning large vessels indicated that the proposed location of the waiting pontoon would not have an adverse impact on navigation within the lake.

5.4 OVERALL OUTCOMES

In general the simulations have shown that although the bridge, regardless of final design, will have some impacts on navigation within Lake Lothing, for the vast majority of vessel passages these will not be significant. For some of the largest vessels in the most extreme conditions there remains the potential for a noticeable increase in the difficulty experienced in navigating through the bridge. This is considered within the Navigation Risk Assessment and potential mitigations developed through that process as required.

The Scheme bridge opening duration was measured during runs in both the second and third stage simulations, along with the time between the A47 bridge being available to road traffic and the Scheme bridge becoming closed to road traffic for those runs where both bridge passages were simulated. The averages of these times is presented in Table 2, below.

Table 2 – Simulated Bridge Operational Timings

Measure	Second Stage Simulation	Third Stage Simulation
Average Scheme bridge “closed to road traffic” time	7 minutes	8 minutes
Average separation between A47 and Scheme bridge openings	3 minutes	1.5 minutes

The proposed location for the waiting pontoon was confirmed as being the lowest risk location available.

6 CONCLUSION

Generally the vessel simulations showed that the proposed Scheme, in its various modelled designs and proposed location, would not cause a significant hazard to navigation within Lake Lothing.

The bridge had minimal effect on the navigation and berthing of the more manoeuvrable of the vessels simulated, the offshore supply vessels, which comprise the highest frequency vessel class currently using the Port.

The bridge had a larger effect on the transit of less manoeuvrable vessels, particularly the single screw general cargo vessel, although both pilots successfully navigated the Scheme bascule bridge without incident during the simulations. Timing of operations on this vessel model during the second simulations showed that the rudder operation time (hard port – hard starboard) was 45 seconds; this is significantly slower than the 28 seconds required under SOLAS regulations, indicating that the vessel model would be considerably less manoeuvrable than any in-class vessel likely to use the port.

Following the first stage simulations the approach fender layout was adjusted to increase the available berth length adjacent to the bridge.

The fender arrangement was amended again following the second stage simulations to add additional protection to the fixed bridge spans.

Following the second stage simulations the bridge design was revised and a third stage simulation conducted to identify any resulting changes to navigation.

A series of recommendations are contained within the Navigation Consultants reports, Appendix A and B.

Appendix A

NAVIGATION CONSULTANT - 2ND STAGE REPORT

Lake Lothing
THIRD CROSSING

Lake Lothing 3rd Crossing Simulation Trials

Portia

Shipmove

Contents

1 Introduction

1.1 General

Michael Nicholson of Shipmove is a highly experienced **Marine Operations Consultant**, a Master Mariner, Pilot and Harbour Master, the Consultant has a widespread knowledge of all aspects of ports and shipping.

The Consultant has been engaged by Portia to provide independent observation and comment on the real time navigation simulations held at Lowestoft College. These following on from initial (1st Stage) Simulations carried out in November 2016.

This in relation to the proposed Suffolk Council - Lake Lothing Third Crossing, and the bridge designs presented by Mouchel. **The simulations were run over two days. 24th and 25th May 2017.**

1.2 Aims

The aims were to;

- Provide an opinion on the conduct of the simulations, and their robustness.
- Confirm that the objectives of the initial (November 2016) simulation were again met. Namely;
  - The navigability through and adjacent to the proposed bridge
  - The suitability of the proposed passage width beneath the bridge
  - The requirements for bridge protection (updated design)
  - Requirements for aids to navigation that the bridge may require
  - Opening timings & interaction between the new & existing bridges.
- Verify to what extent the simulations demonstrated that risks, both from and to the proposed bridge, passing vessels, and the environment; are in accordance with the Port Marine Safety Code; “As Low as Reasonably Practicable” (ALARP) principle.

Fig 1 The Lowestoft College Simulator – Main Bridge

2 Conduct of the Simulations

2.1 Simulation Facility & Port Modelling

The Facility is described in the November 2016 Simulations Mouchel report, and this should be referred to for further information; *Report ref no. 1069948-MOU-MAR-LL-RP-MA-003.*

The port model used in the facility has been updated since the initial simulation, this to reflect the changes from a four pier to a two pier design, and also the modifications requested by the Port Operator (ABP) to reduce the restrictions imposed by the bridge approach fenders. (see section 4.2.2 of above report).

2.2 Attendees

The following persons attended this second stage simulation.

Name	Organisation	Position / Title	Task / Function
Khaled Abdelsalam	Lowestoft College	Maritime Section Manager	Simulator Operator
Andrew Pearce[1]	Suffolk Council	Highways Engineer	Observer
Steve Horne	Mouchel	Principal Engineer Maritime	Observer
Gary Horton	ABP Lowestoft	Harbour Master & Pilot	Pilot / Master
Richard Musgrove[2]	ABP Lowestoft	Marine Manager	Pilot / Master
Michael Nicholson	Shipmove	Principal	Independent Observer
[1] *Attended 1st Day Only*	[2] *Attended afternoon on both days only*		

2.3 Lowestoft Harbour

2.3.1 Tidal Information

Tide range = 1m Neaps, 2m Springs

Highest Astronomical Tide 2.98m Lowest 0.12m

MHWS 2.58m MLWS 0.64m Mean Spring Range 1.94m

MHWN 2.24m MLWN 1.16m Mean Neap Range 1.08m

Tidal currents run strongly outside the harbour, with 3 knots or more at mid-tide springs. The Ebb running roughly North, and the flood South. At the harbour entrance tides are slack 1 hour before High Water and 1 hr after Low Water Lowestoft. Vessels over 85m LOA and vessels under tow only enter the harbour at slack periods.

Once within the Harbour tides are generally small, reaching an estimated extreme maximum of 1.5 knots in the existing A12 bridge passage (22.7m wide). At the new crossing site, where the channel is 100m wide, tides are reported as being negligible at all times.

The bridge structure itself will introduce a restriction, but this is estimated at 20% of the channel. Tidal flow is expected to remain negligible after installation and for this reason no tidal flows were simulated inside the harbour.

On some of the runs tides outside the harbour were introduced to aid realism to the approach to the harbour.

2.3.2 Lowestoft Harbour Vessel Acceptance Criteria

ABP’s website states “Normal Acceptance Dimensions” as;

Dock, Jetty or Quay	**Length**	**Beam**	**Draught**	**MHWS MHWN**
Outer Harbour – Docks	125 m	35 m	5.5 m	5.2 m
Entrance Channel & Inner Harbour*	125 m	22 m	6.0 m	5.7 m

** Applicable to all vessels transiting bridges*

Other parameters as stated by the Harbour Master are;

- Minimum Visibility - 0.2 Nautical Miles (370m) for normal vessels. 0.5 Nautical Miles (925m) for vessels under tow.
- Wind - Dependent on strength and direction; but also vessel type, characteristics and condition. Assessed on a case by case basis by Pilot and Master.
- Pilotage is compulsory for all vessels over 60metres. While Pilotage Exemption Certificates (PEC’s) are available none are presently held. Many vessels not subject to compulsory Pilotage regularly take pilots, due to the difficult nature of the harbour entrance.
- Smaller commercial vessels (Fishing vessels and wind farm supply and construction vessels predominantly </= 30m LOA) enter and leave the port without pilots.
- Approximately 200 Piloted vessels visit the port per annum.
- Very few vessels presently pass farther upstream than proposed new bridge site, predominantly dredgers and standby vessels seeking layby. Several live enquiries could lead to increased movements past this point.
- Vessels greater than 85m LOA (and tows) only enter the harbour at slack water
- Depths in the main channel are maintained at 4.7m above Chart Datum, and minimum Under Keel Clearance (UKC) on passage is 10%.

2.4 Control of the Vessel Models

Note that in most of the simulations no bridge “team” was present; all manoeuvres were directly controlled by the pilot. This is not unusual, but the support that would normally be provided (operating controls, additional observation, relaying readings from instruments) was not available.

This may have led to a degree of additional control difficulty, though this does not diminish the results. For the Fog and Night time simulations, a second pilot assisted.

2.4 Robustness of the Simulations

The Simulator seemed to perform as expected by the experienced local Pilots, and aside form a few minor technical issues (not uncommon especially with a comparatively new model), the simulations seemed realistic.

The methodology and choice of scenarios (See Section 3.0 below) would I am sure stand up to any scrutiny. These tested a wide variety of vessel types and conditions. Up to, and in some cases in excess of, normal limits.

3.0 Choice of Scenarios

3.1 Methodology

The scenarios modelled were chosen predominantly by ABP Port Operation staff (Harbour Master & Marine Manager – both Pilots), with significant input from Shipmove and Mouchel.

A collaborative approach was developed, using the experience of the local Pilots to indicate what was both sensible and possible, and suggestions from the observers to ensure the aims of the simulation were met.

To summarise, the purpose was to simulate passages by a variety of the most common types of vessel, with dimensions at or near the upper dimensions for the port. This only limited by the finite number of models available.

The majority of these vessels also represented those that would impose the most loading on the bridge protection fenders, should an unplanned impact occur.

Once basic passages in benign conditions were completed, the next objective was to test the limits in terms of conditions. As it would not have been efficient to test every vessel in every condition (which would have meant hundreds of runs being completed), the majority of these limits were tested using one vessel. BULKC11L

This vessel had the benefit of being more challenging in terms of its ability to manoeuvre, but being least compromised in terms of Simulator imposed restrictions. Namely; sight-lines and ease of familiarity with vessel controls.

This vessel also presented an additional complexity in that its helm response was noticeably poor. A hard-to-port to hard-to-starboard time of 48 seconds was measured and this was verified by the Simulator model print-out which stated 45 seconds. International (SOLAS) requirements stipulate a 28 second response is required.

Using this vessel for the runs, demonstrated some degree of redundancy (or at least allowance for sub-optimal vessels) in the simulations.

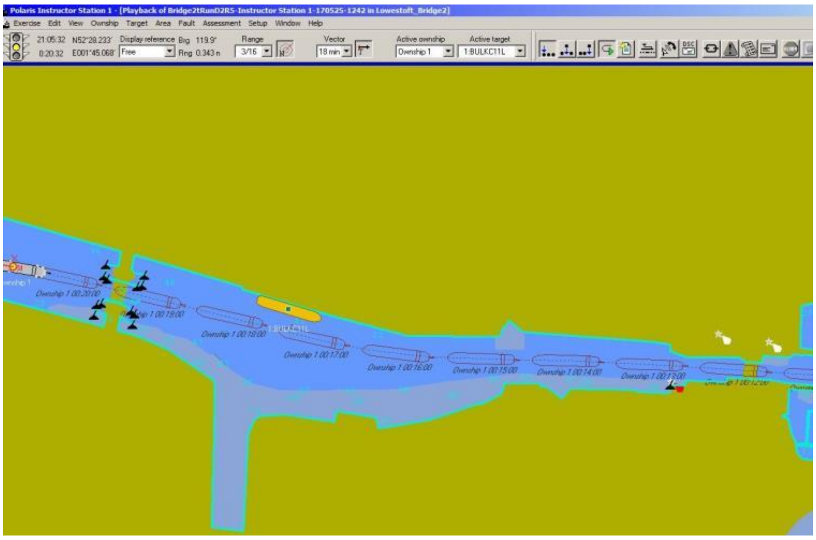

Fig 2 Typical vessel track from simulation

3.2 Actual Scenarios

In all 18 complete runs were simulated, of which three were not completed, due to predominantly technical issues. This resulted in 18 transits through the new bridge (some runs involved passage in both directions).

Due to technical issues with the Simulator or the model, some runs were re-set during the early stages of the passage, these were not recorded here.

A record for each simulation run is annexed to this report but the summary is tabulated below. An attempt was made to quantify the ease of Navigation through the bridge, this assessed in the last column below.

RUN	Vessel	Dimensions L x B x D (m)	Wind Direction Knots	Vis-ibility	Cons-traints	Notes	New Bridge Passage Assessment* Code
1	BULKC11L	90 x 14 x 5.7	270 x 6	Good	Nil		3 (x2)
2	BULKC11L	90 x 14 x 5.7	270 x 6	Good	Nil		4 (x2)
3	SUPPLY10	86 x 19 x 6.0	270 x 6	Good	Nil	Incomplete	
4	DREDG05L	96 x 18 x 5.1	270 x 6	Good	Nil	Abort (Test)	
5	DREDG05L	96 x 18 x 5.1	270 x 6	Good	Nil		4
6	SUPPLY54	66 x 14 x 4.5	270 x 6	Good	Nil		4(x2)
7	BULKC11L	90 x 14 x 5.7	225 x 15	Good	Nil		4
8	TUG15	29 x 11 x 2.9	N/A	N/A	Nil	Incomplete	
9	SUPPLY10	86 x 19 x 6.0	225 x 15	Good	Nil		4 (x2)
10	FERRY50L	117 x 20 x 4.5	225 x 10	Good	Nil		3
11	BULKC11L	90 x 14 x 5.7	200 x 25	Good	Nil		4
12	BULKC11L	90 x 14 x 5.7	200 x 35	Good	Nil		3
13	BULKC11L	90 x 14 x 5.7	200 x 40	Good	Nil		3
14	SUPPLY5L	66 x 14 x 4.5	200 x 40	Good	No thrust		4
15	BULKC11L	90 x 14 x 5.7	200 x 10	Good	Night		4
16	BULKC11L	90 x 14 x 5.7	200 x 10	Poor	Fog		4
17	BARGE03L	76 x 17 x 1.8	200 x 10	Good	Tow	Incomplete	
18	BULKC11L	90 x 14 x 5.7	200 x 10	Mod	Night		4

Key

Code	Description
4	Good; Centred Normal Corrective Input.
3	Fair; Major Corrective Input, off centre.
2	Sub-optimal; Scrape, Minor Damage / Near Miss.
1	Objective Failed; Significant Damage.

4.0 Objectives & Observations

4.1 Navigability Through the New Bridge

As can be seen from section 3.2 above, passage through the new bridge was assessed on each run. An explanation of the code recorded is also detailed above.

- Excluding runs where technical issues were evident, none of the runs resulted in contact with the bridge or its protection structures.
- The majority of passages were straightforward, with only small corrective inputs required.
- Some of the passages required significant corrective input (large rudder angles and/or use of bow-thrust);
    - The first shake-down run, until the Pilot became accustomed to and made allowance for the slow rudder response of the BULKC11L model.
    - The passage of the largest dimensioned vessel.
    - Passages where the wind limits were being tested.

4.1.1 Wind / Shelter

Although the Simulator does allow for shielding from wind (for any modelled structures), the model itself does not include all existing land based structures. It follows that the degree of shelter that will be provided by is not exactly as it will be in real life once the bridge is constructed.

There are two aspects of shelter that need to be considered,

- One is the reduction in the strength of wind experienced; which would tend to decrease the difficulty of Navigation.
- The other is the change in strength of experienced wind from one location to another, or at differing points on a vessel. This includes turbulence or direction changes created by structures, and these aspects would normally increase the difficulty of Navigation.

Within the sensible limits of the simulation, shelter has been considered. Pilots would be expected to allow for and guard against such effects. Experience will assist in pro-actively allowing for such effects.

4.2 Navigability Adjacent to Proposed Bridge (Layby Close NE)

In earlier simulations, it was reported that berthing on this layby berth was difficult, and one led to impact with the (original design) bridge approach fenders. Though some of this may have been exacerbated by the poor sight lines in the Simulator compared with real-life (where access to bridge wings is possible), the confined space made this a difficult manoeuvre with a significant risk of inadvertent contact with bridge fenders or berth knuckles.

For this reason the fender design was altered to allow more berthing space (approximately 120metres). Berthing in this space was attempted several times in this second set of simulations, with vessels up to 90m LOA, and these occurred without incident.

Nevertheless, it is recommended that once the bridge is installed, and a precise distance / length of berth is established, a formal Risk Assessment is used to establish an extreme length of vessel allowed to berth in this location. This may depend on vessel type, but should in any case allow a safe margin for both manoeuvring and ranging on moorings, so that the bridge, its protection structures and any vessel have an adequate margin of safety.

4.3 The Suitability of the Proposed Passage Width

It is important to note that in the context of the new bridge, that the existing (A12) bridge passage is only 22.7m wide. This limits the beam of all vessels intending to pass through the new bridge to 22m. With a proposed distance between fenders of 32m, this gives a minimum clearance of 10m (or 45%) of a transiting vessels beam.

This margin not only significantly in excess of the clearance at the existing bridge but also that of comparable passages (within dock systems) elsewhere. This gives some scope for increasing the width of vessels passing this bridge in the future; if the existing (A12) bridge passage was widened.

4.4 Requirements for Bridge Protection (updated design)

Aside from the ability to resist anticipated forces (dealt with by Mouchel) the bridge protection seemed more than adequate form a practical and Navigation standpoint, in that it;

- Ensured adequate clearance for passage.
- Would not allow vessels significantly off track to impact the bridge.
- Provided visual references that assisted in transiting the bridge.
- Was of sufficient extent either (12metres East & West) to prevent a vessels bow from impacting the bridge structure before the vessel hull made contact with the fenders.
- Was of sufficient transverse extent (1.5m either side of the bridge passage), that taking into account fender deflection, normal vessel hull protrusions (rubbing strakes, outlet covers etc) could not impact the bridge structure.
- Note though that vessels with significant overhangs* (such as protruding bridge wings), could potentially impact the bridge structure or the vulnerable open leaves. This Risk needs to be assessed and managed (See recommendations).

* Any vessel with an overhang of greater than 1.5m could potentially impact the bridge structure before the fender system deflected the hull. Obviously the greater the beam of such a vessel the lesser the deviation from the centre of the passage before such a situation could occur. So the risk increased with both the extent of the projection and the beam of the vessel, Also the conditions for passage (vessel manoeuvrability, wind etc).

4.5 Determine Any Aids to Navigation that the Bridge May Require

The new bridge will obscure visible references currently used for transit of the existing A12 bridge (See also Section 4.3 of Mouchel 1st stage "Vessel Simulation report"). A suitable reference mark or leads should be re-instated with the new bridge in place.

Lighting will be required to be able to determine the outer extremities of the bridge and its protection structure to allow safe passage during night time or poor visibility.

What is required will depend to an extent on the ambient lighting in the vicinity, and any glare / reflections present once the bridge is constructed. It was not possible to evaluate this at the simulation, but one suggestion was for strip lights or similar to illuminate the top edges of the fender panels.

Air draft boards should be installed either side of the bridge to indicate clearance between the water line and the closed bridge. Signal lights should be installed to indicate when the bridge is fully open and safe passage may take place.

The nature, extent and characteristics of such lights and signals should be determined by agreement with the Harbour Master & pilot(s). Trinity House will also need to be consulted.

4.6 Opening Timings & Interaction Between the New & Existing Bridges

4.6.1 Timings

The bridge cycle time, and in particular the realistic vessel transit time, was measured by Mouchel during the real-time simulations, this to aid with vehicular traffic flow modelling. This report will address only the Navigation issues that may arise.

The distance between the A12 existing bridge and the proposed new bridge is approximately 850 metres. Allowing for a typical 100m vessel stern to clear one bridge before its bow reaches the next – the effective distance to travel is 750 metres. At the normal transit speed of 4 knots (2m/s - the speed limit for the harbour), the passage time, from bridge to bridge is thus 6 minutes 15 seconds.

The simulated times allowed for the bridge operations were 2 minutes to open*, and 1 minute to close (*1m to set barriers, clear pedestrians & 1m to physically raise the bridge leaves).

This means that it would be theoretically possible during a normal vessel transit to have both bridges down (closed to ships, open to vehicles) for 3m 15 seconds during the passage.

4.6.2 Effect on Navigation

In reality, and to ensure an adequate margin of safety, a vessel would want the second bridge open well before he arrived. In the simulation runs, the request to open the new bridge was prompted at about 1/3 distance (near the dry dock), and the new bridge was open with the vessel at 2/3 distance; still some 300 metres away.

Under normal circumstances then it should be possible to have one of the bridges open to traffic at all times, without undue pressure on Navigation. That is vessels should not normally have to "hold station" between bridges, which would be more difficult (and therefore more hazardous) than a smooth uninterrupted passage.

Nevertheless, there may be occasions (e.g. an unwieldy vessel or tow or challenging meteorological conditions), when it was prudent or desirable to have both bridges open. Though undesirable from a traffic standpoint, this should be accepted and managed as part of the normal operation of the harbour.

4.6.3 Aborting Passage

There also may be times when (due for example to technical faults, emergency response or un-cooperative pedestrians) that one or both bridges may not open as planned by the vessel or pilot, and a vessel would be compelled to wait between the bridges.

The difficulty of such a manoeuvre would depend on the vessels manoeuvrability and the prevailing conditions (wind etc). There is adequate space and also suitable berths between the bridges for a vessel to abort passage and hold or wait either bridge. This is made easier by the lack of appreciable current in this area.

4.6.4 Abort Test

On run 4 an aborted passage was simulated. A loaded dredger, proceeding at just over 4 knots had cleared the A12 Bridge and had requested the new bridge open. At a point when the pilot expected the bridge would be open or opening (315m from the bridge), the pilot was informed that the bridge was not able to open. The vessel was brought to a halt, with an acceptable level of control and did not approach closer than 200m to the new bridge.

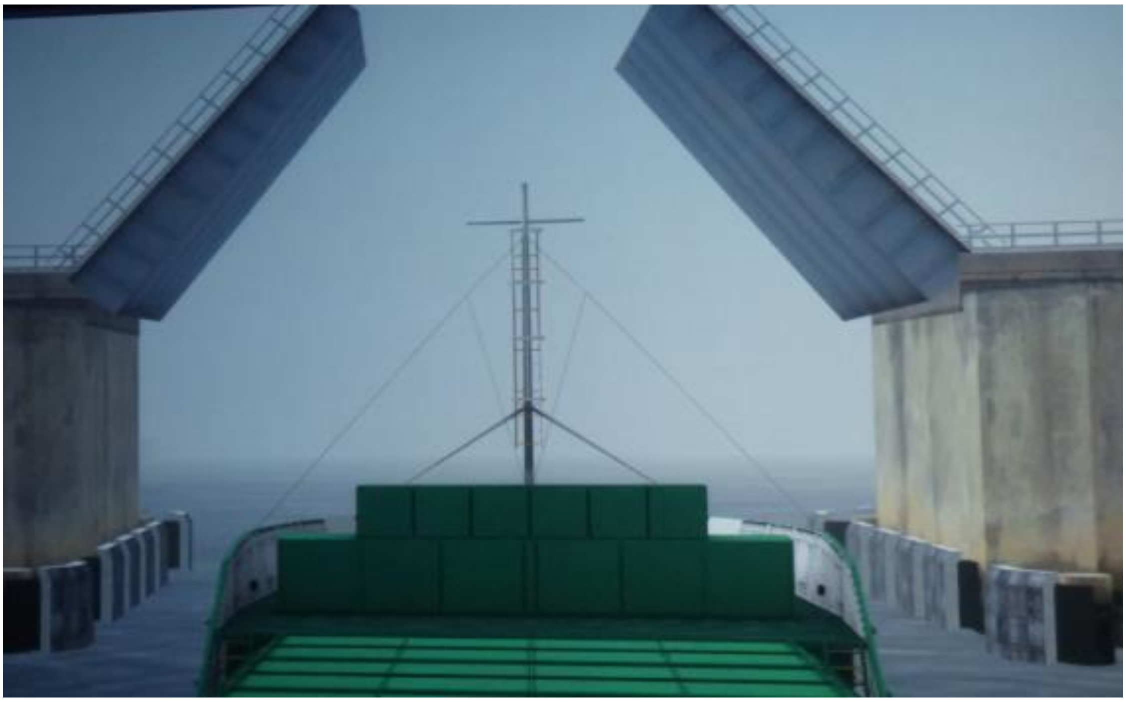

Fig 3 Bulk Carrier Passing under new bridge (Fog)

5.0 Recommendations & Conclusion

The below is a summary of the recommendations, further details are included in the relevant report sections above.

5.1 Use of Layby Immediately East of New Bridge (North Side)

A formal Risk Assessment* should be conducted to establish the extreme length of vessels allowed to berth in this location.

(*Written, recorded, and reviewed from time to time or in light of changes or incidents)

5.2 Vessels with Side Projections (Overhang).

Any vessel with overhangs of greater than 1.5m could potentially contact the bridge structure or its vulnerable leaves. A Formal Risk Assessment* should be conducted, applying to any such vessels. This to determine the clearance required between any such projection and the bridge structure. This should consider both vessel (type) and any limiting conditions for safe passage.

5.3 Marks, Lights & Signals

The following should be established;

1. For passage through the existing A12 bridge. A suitable reference mark or leads should be re-instated with the new bridge in place.
2. Suitable lighting to indicate the extremities of the new bridge and also its protection structure.
3. Air draft boards either side of the bridge to indicate clearance between the water line and the closed bridge.
4. Signal lights to indicate when the bridge is fully open and passage may take place.
5. Any non-navigation lighting on the bridge or its approaches, should take into account the requirements of Navigation in general and BS5489-8 in particular.
6. Information about the new bridge and the establishment and characteristics of marks should be promulgated widely.

5.4 Leisure Users & Small Craft

Consideration should be made to the minimum acceptable overhead clearance for vessels passing the bridge when closed, and how best this will be ensured or enforced. See also 5.3(3) above.

5.5 Timings & Navigation

Acceptance that there may be occasions, when Navigation constraints require both bridges to be open to vessels (or at least closed to vehicles) at the same time.

6.0 Conclusion

The presence of the existing, narrower, A12 Bridge is an important limiting factor on the dimensions of vessels able to transit the new bridge. This importance should not be under-estimated, as (with the exception of vessels with overhangs) it ensures significant clearance for passing vessels.

Contact with the existing bridge is reported* as not uncommon, but mostly such incidents result in slight contact, scrapes or minor damage. There have been no-incidents in recent memory of events that have disabled the bridge or any vessel passing (*Harbour Master).

As the new bridge is both wider and the approaches less confined, it follows then that Navigation through it will entail less inherent risk.

One aspect that may lead to a greater challenge is the degree of sheltering at the new bridge location. This, and the degree of additional complexity, may not be entirely evident until the bridge is constructed. Nevertheless any detrimental effects are expected to be greatly outweighed by the beneficial effects of the increased passage width.

Subject then to acceptance of the above recommendations, or equivalent alternative arrangements being put in place;

It is my opinion that the risks, both to and from the proposed bridge, passing vessels, and the environment will be more than acceptable and As Low as Reasonably Practicable.

Lake Lothing

THIRD CROSSING

Appendix – Simulator Assessment Forms

SIMULATOR ASSESMENT FORMS

Run/Passage	1 (Shake Down)		**Bridge Team**	**Master/ Pilot**	G.Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	24/5/2017				S.Horne
Start / End Time	09:10	09:45			A.Pearce

Scenario	Shake down, and evaluate simulator & model performance.
Objective	Safe entry & passage through both existing and planned new bridge
Any Constraints	Nil

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	BULKC11L	**Wind Direction**	270°
LOA (m)	90m	**Wind Strength**	6 knots
Beam (m)	14m	**Sea / Swell**	Negligible
Draft (m)	5.7m	**Visibility**	Good
Screw(s)	Single, CPP	**Tide Height**	2.7m
Rudder + Type	Single - High Lift	**Current**	Slack Inside & Out
Bow Thrust	Yes	**Other**	
Other	Slow Helm*		

Observations This was intended as a shake-down passage, to evaluate the set-up of the simulation and also to enable the Master/Pilot to familiarise himself with the vessel & simulator controls.

The vessels helm response was noticeably poor, this was timed at approximately 48 seconds.

The model characteristics were interrogated and this confirmed a hard-hard time of 45 seconds.

International (SOLAS) requirements stipulate 28 seconds.

Assessment of ease (difficulty) in manoeuvre;					
Port Entry / Passage through 1st (A12 Bascule) Bridge					
Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	
Passage through New bridge (Planned 3rd Lake Lothing) Crossing					
Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**	**X2**	**Objective Failed; Significant Damage.**	**1**	

Notes

The slow helm led to some difficulty, and the passage was initially reset, and the time taken to put rudder over assessed. After the rest the passage resumed. The vessel passed through the 1st bridge with some difficulty, and did land on the structure (hence the marking above). Passage through the new bridge was noticeably more controlled, though did entail significant use of helm and thruster, but she passed through without contact. Once clear the vessel turned and again passed through without contact but again with significant large input.

Once through the passage the vessel berthed on the layby immediately NE of the bridge opening. This was the manoeuvre that led on the earlier simulations to contact with the bridge fenders. The vessel berthed without contacting the amended / truncated fender design.

SIMULATOR ASSESMENT FORMS

Run/Passage	2		**Bridge Team**	**Master/ Pilot**	G.Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	24/5/2017				S.Horne
Start / End Time	10:00	11:00			A.Pearce

Scenario	Typical Bulk Cargo (eg Grain) Ship, entry.
Objective	Safe passage through both bridges, return & berth at Silo Layby
Any Constraints	Nil

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	BULKC11L	**Wind Direction**	270°
LOA (m)	90m	**Wind Strength**	6 knots
Beam (m)	14m	**Sea / Swell**	Negligible
Draft (m)	5.7m	**Visibility**	Good
Screw(s)	Single, CPP	**Tide Height**	2.7m
Rudder + Type	Single - High Lift*	**Current**	Slack Inside & Out
Bow Thrust	Yes	**Other**	
Other	Very Slow Helm*		

Observations Passage was uneventful, and berthing immediately NE of the bridge (which had proved problematic in the previous set of simulations, was completed without issue or undue difficulty. A discussion ensued on likely maximum vessels for this layby berth.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**	**X2**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes

Having experienced the slow rudder on this vessel and making allowances for its response (e.g. reduced helm input where possible and early anticipation), this run was more controlled and both passages were uneventful.

The vessel was swung and returned through the new bridge a second time and berthed close East of the north abutment protection piles.

SIMULATOR ASSESMENT FORMS

Run/Passage	3 (aborted)		**Bridge Team**	**Master/ Pilot**	G.Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	24/5/2017				S.Horne
Start / End Time	11:15	11:45			A.Pearce

Scenario	Typical Supply Vessel passage, large beam.
Objective	Safe passage through both bridges.
Any Constraints	Nil

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	SUPPLY10	**Wind Direction**	270°
LOA (m)	86m	**Wind Strength**	6 knots
Beam (m)	19m	**Sea / Swell**	Negligible
Draft (m)	6.0m	**Visibility**	Good
Screw(s)	2 x Azipods	**Tide Height**	2.7m
Rudder + Type	N/A	**Current**	Slack Inside & Out
Bow Thrust	Bow & Stern	**Other**	
Other			

Observations Despite having more than sufficient water, the model kept “grounding”.

Reasonable attempts were made to remedy this obvious technical glitch, but it was agreed by all that it was not worthwhile continuing with this vessel model.

This run was thus aborted before any bridge passages were attempted.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Aborted.

SIMULATOR ASSESMENT FORMS

Run/Passage	4		**Bridge Team**	**Master/ Pilot**	G.Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	24/5/2017				S.Horne
Start / End Time	12:00	12:30			A.Pearce

Scenario	Large & Heavy Vessel – 19m Beam Dredger
Objective	Safe passage through both bridges.
Any Constraints	Nil. But see below regarding bridge opening.

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	DREDG05L	**Wind Direction**	270°
LOA (m)	96m	**Wind Strength**	6 knots
Beam (m)	18m	**Sea / Swell**	Negligible
Draft (m)	5.1m	**Visibility**	Good
Screw(s)	2 x Azipods	**Tide Height**	2.7m
Rudder + Type	N/A	**Current**	Slack Inside & Out
Bow Thrust	Yes	**Other**	
Other			

Observations Vessel had forward bridge, which increases the difficulty of passage as sight-lines to vessel extremities restricted. This exacerbated by simulator constraints.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	(marked)
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes.

At 315m from the bridge, the simulator operator reported that the new bridge was not opening. This led to an unplanned stop.

The vessel was achieved with full control from a passage speed of just over 4 knots. The vessel stopping some 200m metres before the bridge passage.

As this was totally unplanned (an issue with the simulator) it was a good test of an abort procedure as the Pilot had no prior warning.

SIMULATOR ASSESMENT FORMS

Run/Passage	5		**Bridge Team**	**Master/ Pilot**	G.Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	24/5/2017				S.Horne
Start / End Time	12:55	13:20			A.Pearce

Scenario	Large & Heavy Vessel – 19m Beam Dredger
Objective	Safe passage through both bridges.
Any Constraints	Nil.

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	DREDG05L	**Wind Direction**	270°
LOA (m)	96m	**Wind Strength**	6 knots
Beam (m)	18m	**Sea / Swell**	Negligible
Draft (m)	5.1m	**Visibility**	Good
Screw(s)	2 x Azipods	**Tide Height**	2.7m
Rudder + Type	N/A	**Current**	Slack Inside & Out
Bow Thrust	Yes	**Other**	
Other			

Observations	Passage through both bridges without incident.

Assessment of ease (difficulty) in manoeuvre;					
Port Entry / Passage through 1st (existing Bascule) Bridge					
Good; Centred Normal Corrective Input.	**4**	✓ (marked)	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	
Passage through new bridge (Planned 3rd Lake Lothing) Crossing					
Good; Centred Normal Corrective Input.	**4**	✓ (marked)	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

This a re-run of Run 4, once the issues with the simulation of the bridge were resolved.

SIMULATOR ASSESMENT FORMS

Run/Passage	6		**Bridge Team**	**Master/ Pilot**	R.Musgrave
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	24/5/2017				S.Horne
Start / End Time	13:55	14:20			A.Pearce
					G. Horton

Scenario	Small Supply Vessel Entry
Objective	Shake-down passage for pilot Richard Musgrove (attended after lunch)
Any Constraints	Nil.

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	SUPPLY54	**Wind Direction**	270°
LOA (m)	66m	**Wind Strength**	6 knots
Beam (m)	14m	**Sea / Swell**	Negligible
Draft (m)	4.5m	**Visibility**	Good
Screw(s)	2 x CPP	**Tide Height**	2.0m
Rudder + Type	40 Degree	**Current**	Ebb tide outside. 1kt N'Going
Bow Thrust	Bow & Stern	**Other**	
Other			

Observations Passage through both bridges without incident. Swung and returned through new bridge. All without incident.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**	**X2**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

SIMULATOR ASSESMENT FORMS

Run/Passage	7		**Bridge Team**	**Master/ Pilot**	R.Musgrave (RM)
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	24/5/2017				S.Horne
Start / End Time	14:45	15:20			A.Pearce
					G. Horton

Scenario	Increased wind passage, with Bulk carrier
Objective	Safe passage through both bridges.
Any Constraints	Nil.

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	BULK11L	**Wind Direction**	225°
LOA (m)	90m	**Wind Strength**	15 knots
Beam (m)	14m	**Sea / Swell**	Negligible
Draft (m)	5.7m	**Visibility**	Good
Screw(s)	Single, CPP	**Tide Height**	2.0m
Rudder + Type	Single - High Lift*	**Current**	Ebb tide outside. 1kt N'Going
Bow Thrust	Yes	**Other**	
Other	Very Slow Helm*		

Observations Took some adjustment for RM with the slow rudder of this model, as he Had not observed the earlier simulation runs. This led to a difficult passage through the 1st Bridge (glancing blow), but the new bridge passage was again without incident.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes.

Noted that passage through the narrower existing (A12) bridge is more difficult than through the new bridge opening. The increased width allows for a greater margin of error.

Run/Passage	8 (Aborted)		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	24/5/2017				S.Horne
Start / End Time	15:30	15:50			A.Pearce
					R.Musgrave (RM)

Scenario	Tug Passage Under Closed Bridge
Objective	Visual Demonstration of Bridge Height in Simulator Model
Any Constraints	Nil.

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	TUG15	**Wind Direction**	N/A
LOA (m)	29.5m	**Wind Strength**	N/A
Beam (m)	11m	**Sea / Swell**	N/A
Draft (m)	2.9mm	**Visibility**	N/A
Screw(s)	2 x Azimuth	**Tide Height**	1.1m
Rudder + Type	N/A	**Current**	N/A
Bow Thrust	Yes	**Other**	
Other	Air Draft 14.7m		

Observations As a visual representation, a model was sought with an appropriate Height (air draft) to simulate passage under a closed bridge.

Calculations were made and a tide height chosen that would have given 0.5m clearance.

The vessel model (despite having adequate apparent depth) kept triggering grounding alarms.

Reasonable attempts were made to remedy this obvious technical glitch, but it was agreed by all that it was not worthwhile continuing with this scenario as it was not testing navigation per-se.

This run was this aborted before any bridge passages were attempted.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

SIMULATOR ASSESMENT FORMS

Run/Passage	9		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	24/5/2017				S.Horne
Start / End Time	16:20	16:50			A.Pearce
					R.Musgrave (RM)

Scenario	Passage of Deep & Large Supply Vessel through new bridge
Objective	Safe passage & return through new bridge only
Any Constraints	Nil.

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	SUPPLY10L	**Wind Direction**	15 Knots
LOA (m)	86m	**Wind Strength**	225
Beam (m)	19m	**Sea / Swell**	N/A
Draft (m)	6.0m	**Visibility**	Good
Screw(s)	2 x Azimuth	**Tide Height**	2.7m
Rudder + Type	N/A	**Current**	N/A
Bow Thrust	Yes	**Other**	
Other	Air Draft 14.7m		

Observations	The first passage through the new bridge resulted in fender contact.
The run was re-set and having had more familiarisation with the vessel model the pilot then	
Undertook two passages through the new bridge without incident. See notes below.	
Vessel berthed on the Silo Layby without incident.	

Assessment of ease (difficulty) in manoeuvre;

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**	**X2**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes

On previous runs, the passage was started from outside the port (this allows the Pilot familiarisation time with the controls, performance of the vessel model & also visibility constraints).

To save time, this simulation run was started between the bridges, this resulted in initial difficulty in getting the model under control and an increase of speed. While passage was made, this was sub-optimal and contact with the fenders occurred.

SIMULATOR ASSESMENT FORMS

Run/Passage	10		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	25/5/2017				S.Horne
Start / End Time	08:50	10:20			

Scenario	Passage of maximum dimension vessel.
Objective	Safe passage through both bridges.
Any Constraints	Vessel overhangs**

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	FERRY50L	**Wind Direction**	225°
LOA (m)	117m	**Wind Strength**	10 knots
Beam (m)	20m	**Sea / Swell**	Negligible
Draft (m)	4.5m	**Visibility**	Good
Screw(s)	2 x CPP	**Tide Height**	2.7m
Rudder + Type	2 x High Lift	**Current**	Nil
Bow Thrust	Yes	**Other**	
Other	**Overhangs		

Observations Vessel had overhangs (Bridge wings some 2.25metres each side),

The only available model closely matching the ports Max dimensions had overhangs.

This prevented passage through the first bridge (effective beam 24.5m).

Passage of the hull through the second bridge was successful, but the overhangs contacted the

Bridge model. This due to a combination of said overhangs but also the angle of the open

Bridge leaves (less than vertical – see photographs). Ignoring these technical issues this was

Still a successful passage.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge					
Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	**
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing					
Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**	**	**Objective Failed; Significant Damage.**	**1**	

Notes.

A vessel model was chosen from the Kongsberg range that most closely matched the normal maximum dimensions for the port (Stated in ABP Literature as 125m x 22m). Overhangs on this model led to difficulties in the simulation as these fouled the bridge leaves.

Shipmove

SIMULATOR ASSESMENT FORMS

Portia

Run/Passage	11		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	25/5/2017				S.Horne
Start / End Time	11:00	11:20			

Scenario	Bulk carrier. Strong cross wind (Force 6)
Objective	Safe passage through both bridges.
Any Constraints	Nil.

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	BULK11L	**Wind Direction**	200°
LOA (m)	90m	**Wind Strength**	25 knots
Beam (m)	14m	**Sea / Swell**	1-2m
Draft (m)	5.7m	**Visibility**	Good
Screw(s)	Single, CPP	**Tide Height**	2.3m
Rudder + Type	Single - High Lift*	**Current**	Nil
Bow Thrust	Yes	**Other**	
Other	Very Slow Helm*		

Observations
While leeway was noticeable, both bridge passages were executed without issue.

Assessment of ease (difficulty) in manoeuvre;					
Port Entry / Passage through 1st (existing Bascule) Bridge					
Good; Centred Normal Corrective Input.	**4**	■	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	
Passage through new bridge (Planned 3rd Lake Lothing) Crossing					
Good; Centred Normal Corrective Input.	**4**	■	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Run/Passage	12		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	25/5/2017				S.Horne
Start / End Time	11:25	12:00			

Scenario	Bulk carrier. Further increase in cross wind to Full Gale (F8)
Objective	Safe passage through both bridges.
Any Constraints	Nil.

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	BULK11L	**Wind Direction**	200°
LOA (m)	90m	**Wind Strength**	35 knots
Beam (m)	14m	**Sea / Swell**	1-2m
Draft (m)	5.7m	**Visibility**	Good
Screw(s)	Single, CPP	**Tide Height**	2.3m
Rudder + Type	Single - High Lift*	**Current**	Nil
Bow Thrust	Yes	**Other**	
Other	Very Slow Helm*		

Observations

The increased wind had a marked effect on the vessels ability to turn outside the piers.
Both bridge passages were executed without issue.
Constant starboard helm was required to hold stern into wind, while significant cross set was experienced.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**	(selected)	**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**	(selected)	**Objective Failed; Significant Damage.**	**1**	

At this wind speed the sheltering effects of the bridge leaves (when open) is felt. This obviously makes passage more difficult as the force on the vessel is not constant and the balance between wind at bow and stern changes during the transit introducing complex and changing turning moments.

Run/Passage	13		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	25/5/2017				S.Horne
Start / End Time	11:40	12:05			

Scenario	Bulk carrier. Further increase in cross wind to near Severe Gale.
Objective	Safe passage through both bridges.
Any Constraints	Nil.

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	BULK11L	**Wind Direction**	200°
LOA (m)	90m	**Wind Strength**	40 knots
Beam (m)	14m	**Sea / Swell**	Negligible
Draft (m)	5.7m	**Visibility**	Good
Screw(s)	Single, CPP	**Tide Height**	2.3m
Rudder + Type	Single - High Lift*	**Current**	Nil
Bow Thrust	Yes	**Other**	
Other	Very Slow Helm*		

Observations

Passage through 1st Bridge led to significant contact

Passage through new bridge was manageable, but challenging.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	(marked)
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**	(marked)	**Objective Failed; Significant Damage.**	**1**	

Notes.

Noted again that passage through the narrower existing (A12) bridge is significantly more difficult than through the new bridge opening.

Shipmove

SIMULATOR ASSESMENT FORMS

Portia

Run/Passage	14		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	25/5/2017				S.Horne
Start / End Time	12:15	12:35			

Scenario	Supply Vessel in Strong Winds (40 kts)
Objective	Safe passage through both bridges.
Any Constraints	No bow thrust for new bridge passage

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	SUPPLY5L	**Wind Direction**	200°
LOA (m)	66m	**Wind Strength**	40 knots
Beam (m)	14m	**Sea / Swell**	Negligible
Draft (m)	4.5m	**Visibility**	Good
Screw(s)	Twin CPP	**Tide Height**	2.3m
Rudder + Type	2x	**Current**	Ebb 1Kn North Outside
Bow Thrust	Bow & Stern	**Other**	
Other			

Observations

Both bridges transited without incident, but 1st bridge (A12) was noticeably more challenging.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**	(highlighted yellow)	**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**	(highlighted green)	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes;

Loss of bow thrust is not uncommon, and this also served to simulate a degree of redundancy available in the passage.

Run/Passage	15		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	25/5/2017				S.Horne
Start / End Time	13:30	13:50			R. Musgrave

Scenario	Bulk Vessel Night Passage
Objective	Safe passage through both bridges.
Any Constraints	Night time (last of twilight)

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	BULK11L	**Wind Direction**	200°
LOA (m)	90m	**Wind Strength**	10 knots
Beam (m)	14m	**Sea / Swell**	Negligible
Draft (m)	5.7m	**Visibility**	Good
Screw(s)	Single, CPP	**Tide Height**	2.3m
Rudder + Type	Single - High Lift*	**Current**	
Bow Thrust	Yes	**Other**	
Other	Very Slow Helm*		

Observations

Both bridges passed without incident.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**	(selected)	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**	(selected)	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

A night time (dusk) passage was simulated, the lack of ambient light (such as from street lighting, and buildings) was noticeable, and as such this was less realistic than the daylight simulations.

It was noticed that the new bridge opening and fenders was difficult to pick out against the background. See also run 18, which was completed in pitch black.

Shipmove

SIMULATOR ASSESMENT FORMS

Portia

Run/Passage	16		**Bridge Team**	**Master / Pilot**	G. Horton R.Musgrave
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	25/5/2017				S.Horne
Start / End Time	13:30	13:50			

Scenario	Bulk Vessel in restricted visibility.
Objective	Safe passage through both bridges.
Any Constraints	Fog

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	BULK11L	**Wind Direction**	200°
LOA (m)	90m	**Wind Strength**	10 knots
Beam (m)	14m	**Sea / Swell**	Negligible
Draft (m)	5.7m	**Visibility**	Poor. 370m (0.2 NM)
Screw(s)	Single, CPP	**Tide Height**	2.3m
Rudder + Type	Single - High Lift*	**Current**	
Bow Thrust	Yes	**Other**	
Other	Very Slow Helm*		

Observations
This simulated anticipated worst visibility conditions considered for passage through the port.
Passage through both bridges uneventful.
The Bridge Team was set up more conventionally, with RM supporting GH.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**	(marked)	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**	(marked)	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

NOTES
Most difficult part of the passage was the port entrance. Once inside the breakwaters there were enough visual markers (supported by radar and ECDIS equipment to make the bridge passages reasonably straight forward.

Run/Passage	17 (Aborted)		**Bridge Team**	**Master / Pilot**	G. Horton R.Musgrave
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	25/5/2017				S.Horne
Start / End Time	13:30	13:50			

Scenario	Barge Tow with 2 x Tugs
Objective	Safe passage through both bridges. West - East
Any Constraints	Dumb Barge, Unmanned.

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	BARGE03L	**Wind Direction**	200°
LOA (m)	76m	**Wind Strength**	10 knots
Beam (m)	17m	**Sea / Swell**	Negligible
Draft (m)	1.8m	**Visibility**	Good
Tug 1	TUG5A	**Tide Height**	2.3m
Dimensions	30m x 11m x 2.9m	**Current**	Nil
Tug 2	TUG15A	**Other**	
Dimensions	29m x 10m x 3m		

Observations
The tugs were set up as Bridge 1 and Bridge 2 with GH & Rm controlling each respectively.
Became quickly evident that the degree of control of the tugs was not realistic.
Visibility and orientation of the Tub bridges also introduced extra complexity.
Barges and tows merged with simulator objects.
All agreed that a realistic simulation would not be possible with the set-up.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

NOTES
It was extremely difficult even lifting the barge off the quay, no passage was commenced.
Aborted, as not feasible / realistic.

Run/Passage	18		**Bridge Team Master / Pilot**	**Master / Pilot**	G. Horton R.Musgrave
Operator	K. Abdelsalam			**Observers**	M.Nicholson
Date	25/5/2017				S.Horne
Start / End Time	16:20	16:45			

Scenario	Bulk Vessel Night Passage
Objective	Safe passage through both bridges.
Any Constraints	Pitch Black and raining

Vessel Characteristics		**Weather & Tidal Conditions**	
Vessel Model	BULK11L	**Wind Direction**	200°
LOA (m)	90m	**Wind Strength**	10 knots
Beam (m)	14m	**Sea / Swell**	Negligible
Draft (m)	5.7m	**Visibility**	Moderate – poor.
Screw(s)	Single, CPP	**Tide Height**	1.5m
Rudder + Type	Single - High Lift*	**Current**	N Going 1 Knot
Bow Thrust	Yes	**Other**	
Other	Very Slow Helm*		

Observations	See also Run 15.
Both bridges passed without incident.	
Additional simulated lighting at new bridge proved beneficial.	

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Centred Normal Corrective Input.	**4**	✓ (green)	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Centred Normal Corrective Input.	**4**	✓ (green)	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, off centre.	**3**		**Objective Failed; Significant Damage.**	**1**	

NOTES

Due to the lack of ambient lighting, 4 lights were placed at each side and end of the new bridge fendering, marking the limits of the bridge opening.

Appendix B

NAVIGATION CONSULTANT - 3RD STAGE REPORT

Lake Lothing

THIRD CROSSING

Lake Lothing 3rd Crossing Simulation Trials – 3rd Stage

Portia

Shipmove

Contents

1 Introduction

1.1 General

Michael Nicholson of Shipmove is a highly experienced **Marine Operations Consultant**, a Master Mariner, Pilot and Harbour Master with a widespread knowledge of all aspects of ports and shipping.

Michael has been engaged by Portia to provide independent observation and comment on the real time Navigation simulations held at Lowestoft College. These following on from initial (1st Stage) Simulations carried out in November 2016.

The (2nd Stage) simulations carried out on 24th and 25th May 2017, were observed and these were the subject of a Portia report "Lake Lothing 3rd Crossing Simulation Trials".

This further report on the (3rd Stage) Simulations carried out on **7th and 8th March 2018** should be read in conjunction with the Portia Report mentioned above.

1.2 Aims

The aims were (as per the stage 2 simulations) to;

- Provide an opinion on the conduct of the simulations, and their robustness.
- Confirm that the objectives of the initial (November 2016) simulation were again met, with particular emphasis on any changes brought by the new (single leaf) bridge design configuration.
- Verify to what extent the simulations demonstrated that risks, both from and to the proposed bridge, passing vessels, and the environment; are in accordance with the Port Marine Safety Code; "As Low as Reasonably Practicable" (ALARP) principle.

Fig 1 The Lowestoft College Simulator – Main Bridge

2 Conduct of the Simulations

2.1 Simulation Facility and Port Modelling Updates

The port model used in the facility has been updated since the previous simulation;

1) To reflect the changes from a twin hinged leaf bascule bridge to a single leaf rolling bascule bridge design.*
2) Alteration of the bridge operation timings. Total (Request – Bridge Open) cycle of 2m 40s. (Approx. 1m from request to commence opening and 1m 40s to physically raise the bridge).
3) The modelling of a small craft "Waiting Pontoon", close SE of the new bridge structure. (see WSP Drawing 622407-R-WSP-Mar-LL-DR-MA002)

*Note that with particular respect to 1) above, attempts were made to simulate the shadowing effect (from the wind) that would be introduced by the new bridge design. This was not entirely successful. See Section 4 and Conclusion for a further explanation.

2.2 Attendees

The following persons attended this second stage simulation.

Name	Organisation	Position / Title	Task / Function
Khaled Abdelsalam	Lowestoft College	Maritime Section Manager	Simulator Operator
Andrew Pearce[1]	Suffolk Council	Highways Engineer	Observer
Warren Davies	Suffolk Council	Project Engineer	Observer
Steve Horne	WSP	Principal Engineer Maritime	Observer
Gary Horton	ABP Lowestoft	Harbour Master and Pilot	Pilot / Master
Richard Musgrove[2]	ABP Lowestoft	Marine Manager	Pilot / Master
Jeremy Kingston	ABP Lowestoft	Pilot	Pilot / Master
Michael Nicholson	Shipmove	Principal	Independent Observer, report author.
[1] *Attended 2nd Day Only* [2] *Attended first day only*			

2.3 Robustness of the Simulations

With the exception of the effects of wind shielding the simulator seemed to perform as expected by the experienced local Pilots, and aside form a few minor technical issues (not uncommon with simulators), the simulations seemed realistic.
The action of the rolling bascule was not modelled accurately, as it pivoted rather than rolled (which induces a translation as well as a rotation of the leaf); however this only affected the cosmetic appearance of the simulation and did not affect Navigation in any way.

3.0 Scenarios and Simulation

3.1 Methodology

The scenarios modelled were chosen predominantly by ABP Port Operation staff (Harbour Master and Pilots), with significant input from Shipmove and WSP.

The choice of scenarios tested a variety of conditions, intended to supplement the 2nd stage simulations, concentrating on testing the changes introduced by the single leaf bridge design and the presence of the new waiting pontoon, and to ascertain if these would introduce more challenges or limitations.

These tested a variety of vessel types and conditions, up to, and in excess of, normal limits.

3.2 Scenarios

In all 27 runs were simulated. Some of these were to simulate the effects of the proposed waiting pontoon, and so not all resulted in passage of the new (or both) bridges.

Due to technical issues with the simulator or the model, some runs were re-set during the early stages of the passage; these were generally not recorded here.

A record for each simulation run is annexed to this report but the summary is tabulated below. An attempt was made to quantify the ease of navigation through the bridge, this assessed in the last column below.

RUN	Vessel	Dimensions L x B x D (m)	Wind Dir° and Knots	Wind Shadowing	Notes	Bridge Passage Assess* Code
1	BULKC11L	90 x 14 x 5.7	Cross 20	Off	Not observed, shake down runs	
2	BULKC11L	90 x 14 x 5.7	Cross 20	Off		
3	BULKC11L	90 x 14 x 5.7	Cross 20	Off		
4	SUPPLY05L	66 x 14 x 4.5	Cross 20	Off		
5	FERRY50	117 x 20 x 4.4	Cross 20	Off		
6	SUPPLY05L	66 x 14 x 4.5	270° x 20	Off	Swung off waiting berth	N/A
7	SUPPLY05L	66 x 14 x 4.5	000° x 40	Off	Swung off waiting berth	3
8	SUPPLY05L	66 x 14 x 4.5	000° x 40	Off	Aborted, loss of control	N/A
9	BULKC11L	90 x 14 x 5.7	000° x 30	ON	Slightly fast, tested timings.	4
10	BULKC11L	90 x 14 x 5.7	000° x 30	ON	Slower run.	4
11	BULKC11L	90 x 14 x 5.7	000° x 40	ON	Stronger wind, both bridges. Inwards	3 (3)
12	BULKC11L	90 x 14 x 5.7	000° x 40	ON	As above, but outwards	3 (2)
13	BULKC11L	90 x 14 x 5.7	000° x 40	ON	As above, but dark	3 (3)
14	BULKC11L	90 x 14 x 5.7	000° x 40	ON	Inwards, full darkness	3
15	DREDG05L	96 x 18 x 5.1	000° x 30	ON	Dredger Inwards	3
16	DREDG05L	96 x 18 x 5.1	000° x 30	ON	Dredger outwards	3
17	SUPPLY10L	86 x 19 x 6.0	225° x 15	Off	Shakedown, new pilot	3 (3)
18	BULKC11L	90 x 14 x 5.7	225° x 30	ON	As above, larger vessel	4 (4)
19	FERRY50	117 x 20 x 4.4	000° x 30	ON	Testing shadowing effects	N/A
20	CARGO06L	140 x 16 x 3.7	225° x 30	ON	Ballast vessel (high windage) V Long	3 (3)
21	SUPPLY05L	66 x 14 x 4.5	000° x 40	ON	Re-Run of Run 8, inwards	3
22	SUPPLY05L	66 x 14 x 4.5	000° x 40	ON	As above, outwards	3
23	TUG15L	30 x 11 x 2.9	090° x 20	Off	Berth at waiting pontoon	N/A
24	BULKC11L	90 x 14 x 5.7	090° x 20	Off	Swing with waiting berth occupied.	N/A
25	CNTNR24B	121 x 21 x 5.0	090° x 25	Off	As above, larger vessel, aborted	N/A
26	FERRY50	117 x 20 x 4.4	090° x 25	Off	Swinging large vessel, berths occ	N/A
27	FERRY50	117 x 20 x 4.4	090° x 25	Off	Swinging large vessel, berths occ	N/A

*** Key**

Bridge Passage Access Code	
Code	**Description**
4	Good; Centred Normal Corrective Input.
3	Fair; Major Corrective Input, off centre.
2	Sub-optimal; Scrape, Minor Damage / Near Miss.
1	Objective Failed; Significant Damage.
(x)	Bracketed figure is existing bridge passage

4.0 Objectives and Observations

4.1 Navigability Through the New Bridge

Navigability through the new bridge did not seem significantly more onerous than previous simulations. Where passage through both existing and new bridges was attempted, the passage through the new bridge was generally the same or easier than through the existing bridge

4.2 Wind / Shelter

The previous report stated;

"Although the simulator does allow for shielding from wind, the model itself does not include all existing land based structures. It follows that the degree of shelter that will be provided by it is not exactly as it will be in real life once the bridge is constructed."

This was based on information given by the simulator operators at the time. As the simulator is comparatively new, this may have been erroneous.

From the effects experienced during the simulation it would certainly appear that even though an object is visible on the simulation, it does not mean it has the effect of shielding the wind. Without intimate knowledge of the workings of the Kongsberg simulator (more than the Consultant and perhaps the operators possess) and the mathematical models used the Consultant cannot be sure.

In any event there are two ways of inputting wind into the simulator at Lowestoft.

1) A global wind that affects the whole geographical area
2) Discrete wind arrows, which affect only the immediate area

Within these overall parameters further modifications are made.

a) Gusts can be added (i.e. +/- so many knots) to modify the wind. This is elective and can be chosen / altered by the operator.
b) The model applies smoothing, so the change from one arrow to the next is gradual, not abrupt. This is automatically actioned by the model.

For runs where no shielding was indicated, a global wind (with gusts if specified) was applied.

For runs where shielding / shadowing was "ON", this was achieved by using discrete wind arrows at and in the approaches to the bridge. Generally the wind in the bridge passage was a negligible 0.2 knots, while in the approaches it was at the strength indicated on the assessment forms.

See Fig 2 "*Fig 2 "Wind Shield Effects on Simulator"* and explanation below.

4.2.1 Wind

Shield effects on Simulator As an example, Run 9 Wind set up would have looked similar to the below, this in an attempt to introduce the expected wind shear. Note also the wind affects the simulation at all heights (not limited by the height of the bridge abutments or bridge leaf).

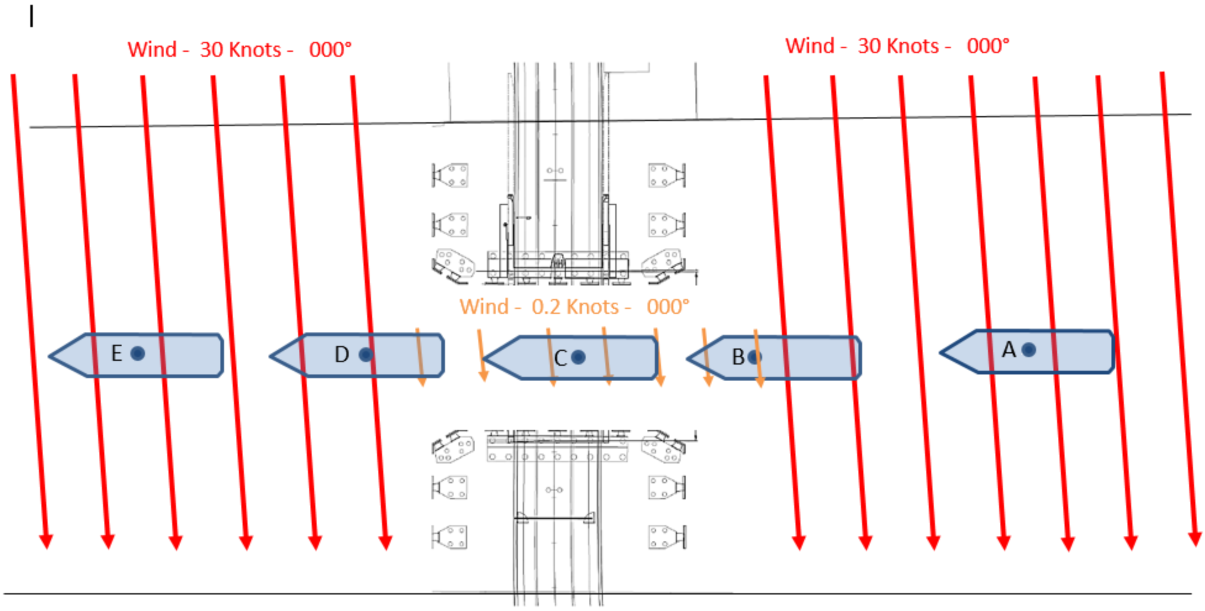

Fig 2 "Wind Shield Effects on Simulator"

Comparison between expected and simulator experienced drift and shear;

Pos'n	Wind at Bow (Knots - 000°)	Wind At Stern (Knots - 000°)	Expected "Real Life" Effect	Simulator Effect
A	30	30	Strong Drift to South Bodily	Strong Drift to South Bodily
B	0.2	30	Bow nearly steady. Stern strong drift south. Giving starboard turn.	Very slow drift to south*
C	0.2	0.2	Slow drift to south	Very Slow drift to south
D	30	0.2	Bow strong drift to south; Stern nearly steady Giving port turn.	Strong Drift to South Bodily*
E	30	30	Strong Drift to South Bodily	Strong Drift to South Bodily

* Movement depends on;

- The position of the vessel
- The precise point on the vessel which the simulator assumes the wind acts
- The wind zone / nearest arrow to this point

4.2.2 Wind Shield considerations

There are two aspects of shelter/ shadowing that need to be considered,

1. One is the reduction in the strength of wind experienced; which would tend to decrease the difficulty of Navigation.

This can be, and was adequately modelled on the simulator.

2. The other is the change in strength of experienced wind from one location to another, or at differing points on a vessel. This includes turbulence or direction changes created by structures, and these aspects would normally increase the difficulty of Navigation.

The change of strength was modelled and; comparing the vessel in positions A, C, and E (Fig 2 above), the change in the drift rate seemed authentic. Turbulence however is complex and so is not represented well in the simulator (regardless of the shielding effect attempted).

The main difference though is shown by comparing the vessel in positions B and D (fig 2).

In real life the shear would have meant differing wind strengths acting on differing parts of the vessel. This leads to a rotational (turning) force acting on the vessel, which will require corrective input to maintain a straight course.

The simulator (at least in its present set-up), does not model this accurately. It simply calculates a single point (presumably at the geometric centre of the above water line area), and applies the wind that is acting at that location. So drift is experienced, but no additional rotation due to the shear. It was the lack of this turning effect that was noticed and commented on (see Run 16 notes).

4.2.3 Wind Shield conclusions

It may well be that within the limits of the Kongsberg Simulator architecture; there is no facility to model the action of wind on two (or more) separate points of a vessel. That being the case, it would not be feasible to further model this aspect. The benefits of such further modelling are also questionable;

- Even if it were the full effects (including turbulence) are unlikely to match accurately what happens in real life, where the degree of shielding can change with a small change in direction or with a single gust.
- The turning effects of the wind shear are comparatively short acting. The bridge leaf itself is some 20m “long”. Any discrete point on the vessel will pass it (at 3 knots) in 7 seconds. The entire vessel will only experience any shielding for around 1m 20 seconds.
- The A47 bridge leaves extend some 15 meters above the water line (tide dependent) when open. The new bridge piers extend to 13 meters above water line. The single bascule, although having a gap in the raised position, also has side beams, which complicates the shelter offered when opened. Effectively it is thought this will provide a similar degree of shelter as the existing bridge for vessels having a superstructure up to 21 meters above the water line. For vessels with superstructure above this the new bridge will offer more sheltering than the existing A47 bridge.

- The pilots at Lowestoft experience the effects of wind shadowing on a daily basis; this on passing the existing bridge. For the majority of vessels the effect will be similar. Experience gained will assist in pro-actively allowing for such effects.
- The new bridge transit is wider; there is more room and time to counteract any effects.

4.3 Effect on Navigation of the Proposed Waiting Berth

It was observed that the presence of the waiting berth imposed no greater restrictions or difficulty in manoeuvring vessels (either to transit the bridge or to swing in its vicinity) than did the existing shallow water immediately East, which remains the limiting distance for swinging large vessels.

The option of ensuring the waiting berth was empty is also available, (should a large vessel need swinging, or should a vessel require extra room in adverse conditions) and can be dealt with procedurally by harbour control.

4.4 Opening Timings and Interaction Between the New and Existing Bridges

4.6.1 Timings

The distance between the A47 existing bridge and the proposed new bridge is approximately 850 metres. Allowing for a typical 100m vessel stern to clear one bridge before its bow reaches the next – the effective distance to travel is 750 metres. At the normal transit speed of 4 knots (2m/s - the speed limit for the harbour), the passage time, from bridge to bridge is thus 6 minutes 15 seconds.

The simulated times for the new rolling Bascule design is 2m 40s. (1m from request to stop traffic, and 1m 40s to physically raise the bridge. This is some 40 seconds longer than the previous design used in the second stage simulations.

If we assume a similar additional closing time (1m 40s as opposed to 1m), this means that it would be theoretically possible during a normal vessel transit to have both bridges down (closed to ships, open to vehicles) for 1m 55 seconds during the passage. (3m 15s previously).

4.6.2 Effect on Navigation

To ensure an adequate margin of safety, a vessel would require the second bridge open well before it arrived. In the previous simulation runs, the request to open the new bridge was prompted at about 1/3 distance (near the dry dock), and the new bridge was open with the vessel at 2/3 distance; still some 300 metres away.

With the new design there is less margin, and so a request for the new bridge to open would have to take place almost as soon as a vessel cleared the existing bridge.

It should still be possible to have one of the bridges open to traffic at all times, without undue pressure on Navigation, though the chances of a vessel having to "hold station" would increase. In adverse weather conditions, where no suitable waiting berths were available, it is possible that a pilot or master would request the second bridge to open before he transited the first.

So the situation where both bridges were closed to traffic could not be ruled out.

Though undesirable from a traffic standpoint, this should be accepted and managed as part of the normal operation of the harbour.

5.0 Conclusion

The below is a summary of the conclusions, further details are included in the relevant report sections above. This should also be read in conjunction with the earlier report, as aspects or conclusions that are unchanged have not necessarily been re-iterated.

The presence of the existing, narrower A47 Bridge remains an important limiting factor on the dimensions of vessels able to transit the new bridge. This importance should not be under-estimated, as (with the exception of vessels with overhangs) it ensures significant clearance for passing vessels. As the new bridge is both wider and the approach less confined, it follows then that Navigation through it will entail less inherent risk.

One aspect that may lead to a greater challenge is the degree of sheltering at the new bridge location. We have been unable to definitively model this, and it is unlikely to be feasible.

This, and the degree of additional complexity, may not be entirely evident until the bridge is constructed.

Nevertheless any detrimental effects, even from the new higher leaf design, are expected to be greatly outweighed by the beneficial effects of the increased passage width.

The rolling bascule bridge will have a significantly larger leaf than the existing bridge or the previous design. While the wind operating limits (the limits imposed by the mechanical lifting / and or securing mechanism) of the new bridge are not known, they may be less than the previous bridge. This could introduce a further limit on the environmental conditions present when a vessel is transiting the bridge. While this may be undesirable from a harbour operational standpoint, any restriction (in terms of wind speeds), is likely to lead to increased control and thus less risk to the bridge and the vessels that may transit it.

Subject then to acceptance of the previous report recommendations, or equivalent alternative arrangements being put in place;

It is the Consultant's opinion that the risks, (while increasing very slightly from the previous design) both to and from the proposed bridge, to and from passing vessels, and to the environment will be more than acceptable and remain As Low as Reasonably Practicable.

Appendix

Simulator Assessment Forms

Run/Passage	1-5		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	R. Musgrave
Date	07/03/2018				S. Horne.
Start / End Time	09:00	12:30			W. Davies

Scenario	Various, see below
Objective	
Any Constraints	

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	Various	**Wind Direction**	
LOA (m)		**Wind Strength**	
Beam (m)		**Sea / Swell**	
Draft (m)		**Visibility**	
Screw(s)		**Tide Height**	
Rudder + Type		**Current**	
Bow Thrust		**Other**	
Other			

Notes / Observations	The morning runs were not observed by M.Nicholson of Shipmove.

These were recorded by the participants and the observers. They are outlined below, but for the Purposes of this report are classed as “shake down” runs;

1 – Bulk Carrier inwards, 20 knots crosswind, no wind “shadowing”

2 – Bulk Carrier inwards, 20 knots crosswind, no wind “shadowing”, low water

3 – Bulk Carrier inwards, 20 knots crosswind, no wind “shadowing”, low water

4 – Supply Vessel, stern-first transit, 20 knots crosswind, with shadowing, swing and return out.

5 – Ferry Outwards (120m), transit bridge, swing at Silo and berth. 20 Knots crosswind.

Notes

Other than some slight refinements to the port model the main differences from the May 2017 simulations were

1) The change to a single leaf rolling bascule design,

2) Alteration of the bridge operation timings. Total (Request – Bridge Open Cycle) 2m 40s.

3) The modelling of a small craft “Waiting Pontoon”, close SE of the new bridge structure.

(see WSP Drawing 622407-R-WSP-Mar-LL-DR-MA002)

Run/Passage	6	**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam		**Observers**	R. Musgrave
Date	07/03/2018			M. Nicholson
Start / End Time	13:22 / 13:32			S. Horne. W. Davies

Scenario	Leave berth North Quay 1 and swing vessel close east of the bridge
Objective	To determine any restrictions imposed by the waiting berth.
Any Constraints	11m Beam vessel positioned on waiting berth

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	SUPPLY05L	**Wind Direction**	270°
LOA (m)	66	**Wind Strength**	20 knots
Beam (m)	14	**Sea / Swell**	Negligible
Draft (m)	4.5	**Visibility**	Good
Screw(s)	Twin	**Tide Height**	1.5m
Rudder + Type	2 x High-Lift	**Current**	Negligible
Bow Thrust	Yes + Stern Thrust*	**Other**	No shadowing / shielding.
Other			

Notes / Observations

Vessel was swung comparatively easily, with nearest approach to vessel on waiting berth of approximately 20m.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	**4**	**NA**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	**4**	**NA**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes As the simulation commenced with a vessel sternway of 3 knots, the exercise was repeated (Run 6b) with the vessel stopped. A similar result was achieved.

Run/Passage	7		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	R. Musgrave
Date	07/03/2018				M. Nicholson
Start / End Time	13:35	13:45			S. Horne. W. Davies

Scenario	Leave berth (NQ) and swing vessel close east of the bridge. Strong wind.
Objective	To determine any restrictions imposed by the waiting berth
Any Constraints	11m Beam vessel positioned on waiting berth &Silo Occupied

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	SUPPLY05L	**Wind Direction**	N'Ly°
LOA (m)	66	**Wind Strength**	40 knots, (+/- 5 Knot gust)
Beam (m)	14	**Sea / Swell**	Negligible
Draft (m)	4.5	**Visibility**	Good
Screw(s)	Twin	**Tide Height**	1.5m
Rudder + Type	2 x High-Lift	**Current**	Negligible
Bow Thrust	Yes + Stern Thrust*	**Other**	No shadowing / shielding.
Other			

Notes / Observations

Vessel was swung comparatively easily, with nearest approach to other vessels / structures of approximately 10 m.

Once vessel was swung an inwards bridge transit (stern-first), was conducted.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	**4**	**NA**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes

Once swung, the bridge controls were switched (to simulate a rear-facing conning position – as is common on such vessels). This led to some confusion as the bow-thruster control then operated the vessels stern thruster*. Nevertheless a transit through the bridge was conducted without incident.

*The intention was not to use the stern-thruster, as this may not be fitted to similar vessels/ Also see Run 8.

Run/Passage	8		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	R. Musgrave
Date	07/03/2018				M. Nicholson
Start / End Time	14:00	14:10			S. Horne. W. Davies

Scenario	Stern-first transit in strong winds. Supply Vessel
Objective	Safe Passage through new bridge.
Any Constraints	11m Beam vessel positioned on waiting berth &Silo Occupied

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	SUPPLY05L	**Wind Direction**	Northerly
LOA (m)	66	**Wind Strength**	40 knots, (+/- 5 Knot gust)
Beam (m)	14	**Sea / Swell**	Negligible
Draft (m)	4.5	**Visibility**	Good
Screw(s)	Twin	**Tide Height**	1.5m
Rudder + Type	2 x High-Lift	**Current**	Negligible
Bow Thrust	Yes + Stern Thrust*	**Other**	No shielding.
Other			

Notes / Observations

In order to clarify the control issue (bow / stern thrust) with the simulation, another sim was run.

Using bow thrust only a passage was attempted. It was found to be very difficult in the strong

Wind to lift the stern into the wind and maintain stern way.

The passage was aborted, as it was ultimately unsuccessful.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	**4**	**NA**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes

Also see Run 7.

Run/Passage	9		Bridge Team	Master/ Pilot	R. Musgrave
Operator	K. Abdelsalam			Observers	G.Horton
Date	07/03/2018				M. Nicholson
Start / End Time	14:17	14:30			S. Horne. W. Davies

Scenario	Large Cargo Vessel Through Bridge in strong wind
Objective	Safe Passage through new bridge.
Any Constraints	Shielding ON

Vessel Characteristics		Weather & Tidal Conditions	
Type	BULK11L	Wind Direction	Northerly
LOA (m)	90	Wind Strength	30 knots, (+/- 5 Knot gust)
Beam (m)	14	Sea / Swell	Negligible
Draft (m)	5.6	Visibility	Good
Screw(s)	Single	Tide Height	1.5m
Rudder + Type	High Lift (SLOW*)	Current	Negligible
Bow Thrust	Yes	Other	Shielding / Shadowing **ON**
Other			

Notes / Observations

Commenced from existing bascule bridge area (just clear of bridge), and opening of new bridge requested straight away.

Bridge timings used as per new parameters (2m 40s request to full open)

Approach at 4.9 knots (see also Run 10) Bow thrust not used.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	4	NA	Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3		Objective Failed; Significant Damage.	1	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	4	x	Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3		Objective Failed; Significant Damage.	1	

Notes

* This is the vessel that was used extensively in the last set of simulations. The rudder is excessively slow and adds a further degree of difficulty / control.

Wind modelled at 30knots throughout, but with only 0.2 knots in immediate area of bridge.

Run/Passage	10		**Bridge Team**	**Master/ Pilot**	R. Musgrave
Operator	K. Abdelsalam			**Observers**	G.Horton
Date	07/03/2018				M. Nicholson
Start / End Time	14:17	14:30			S. Horne. W. Davies

Scenario	Large Cargo Vessel Through Bridge in strong wind
Objective	Safe Passage through new bridge.
Any Constraints	Shielding ON

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	BULK11L	**Wind Direction**	Northerly
LOA (m)	90	**Wind Strength**	30 knots, (+/- 5 Knot gust)
Beam (m)	14	**Sea / Swell**	Negligible
Draft (m)	5.6	**Visibility**	Good
Screw(s)	Single	**Tide Height**	1.5m
Rudder + Type	High Lift (SLOW*)	**Current**	Negligible
Bow Thrust	Yes	**Other**	Shielding / Shadowing **ON**
Other			

Notes / Observations
Commenced from existing bascule bridge area (just clear of bridge), and opening of new bridge requested straight away.
Bridge timings used as per new parameters (2m 40s request to full open)
Speed 3.5 – 3.8 knots

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	**4**	**NA**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	**4**	**x**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes

* This is the vessel that was used extensively in the last set of simulations. The rudder is excessively slow and adds a further degree of difficulty / control.

Wind modelled at 30knots throughout, but with only 0.2 knots in immediate area of bridge.

Run/Passage	11	Bridge Team	Master/ Pilot	G.Horton
Operator	K. Abdelsalam		Observers	R. Musgrave
Date	07/03/2018			M. Nicholson
Start / End Time	14:45 / 14:55			S. Horne. W. Davies

Scenario	Large Cargo Vessel Through Bridge in very strong wind (N 40 knots)
Objective	Safe Passage through new bridge.
Any Constraints	Shielding ON

Vessel Characteristics		Weather & Tidal Conditions	
Type	BULK11L	**Wind Direction**	Northerly
LOA (m)	90	**Wind Strength**	40 knots, (+/- 5 Knot gust)
Beam (m)	14	**Sea / Swell**	Negligible
Draft (m)	5.6	**Visibility**	Good
Screw(s)	Single	**Tide Height**	1.5m
Rudder + Type	High Lift (SLOW)	**Current**	Negligible
Bow Thrust	Yes	**Other**	Shielding / Shadowing **ON**
Other			

Notes / Observations

Passage conducted through both bridges.

Speed maintained below 4 knots.

More difficult to control than Run 9 & 10 (30knots), but manageable. Bow thrust used as required.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3	x	Objective Failed; Significant Damage.	1	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3	x	Objective Failed; Significant Damage.	1	

Notes

Wind modelled at 40knots throughout, with gusts +/- 5 kts, but with only 0.2 knots in immediate area of bridge.

Run/Passage	12		**Bridge Team**	**Master/ Pilot**	G.Horton
Operator	K. Abdelsalam			**Observers**	R. Musgrave
Date	07/03/2018				M. Nicholson
Start / End Time	14:55	15:05			S. Horne. W. Davies

Scenario	Large Cargo Vessel outward bound. Very strong wind (N 40 knots)
Objective	Safe Passage through new bridge, and test timings for departure.
Any Constraints	Shielding ON

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	BULK11L	**Wind Direction**	Northerly
LOA (m)	90	**Wind Strength**	40 knots, (+/- 5 Knot gust)
Beam (m)	14	**Sea / Swell**	Negligible
Draft (m)	5.6	**Visibility**	Good
Screw(s)	Single	**Tide Height**	1.5m
Rudder + Type	High Lift (SLOW)	**Current**	Negligible
Bow Thrust	Yes	**Other**	Shielding / Shadowing **ON**
Other			

Notes / Observations
Passage conducted through both bridges.
Bridge timings kept as new parameters (2m 40s request to fully open)
Wind modelled at 40knots throughout, with gusts +/- 5 kts, but with only 0.2 knots in immediate area of bridge.

Assessment of ease (difficulty) in manoeuvre;					
Port Entry / Passage through 1st (existing Bascule) Bridge					
Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	**x**
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	
Passage through new bridge (Planned 3rd Lake Lothing) Crossing					
Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**	**x**	**Objective Failed; Significant Damage.**	**1**	

Notes

Passage through existing (Easternmost) bascule bridge notably more difficult (glancing strike).

Speed maintained below 4 knots, but increased to 4.5knots to retain control at existing bridge.

<table>
<tr><td>Run/Passage</td><td colspan="2">13</td><td rowspan="4">Bridge Team</td><td>Master/ Pilot</td><td>G.Horton</td></tr>
<tr><td>Operator</td><td colspan="2">K. Abdelsalam</td><td rowspan="3">Observers</td><td>R. Musgrave</td></tr>
<tr><td>Date</td><td colspan="2">07/03/2018</td><td>M. Nicholson</td></tr>
<tr><td>Start / End Time</td><td>15:20</td><td>15:35</td><td>S. Horne. W. Davies</td></tr>
</table>

Scenario	Large Cargo Vessel outward. Very strong wind (N 40 knots). Night.
Objective	Safe Passage through new bridge, test aspect of lights on simulator.
Any Constraints	Shielding ON. Commence at Dusk (18:30 exercise time)

<table>
<tr><th colspan="2">Vessel Characteristics</th><th colspan="2">Weather & Tidal Conditions</th></tr>
<tr><td>Type</td><td>BULK11L</td><td>Wind Direction</td><td>Northerly</td></tr>
<tr><td>LOA (m)</td><td>90</td><td>Wind Strength</td><td>40 knots, (+/- 5 Knot gust)</td></tr>
<tr><td>Beam (m)</td><td>14</td><td>Sea / Swell</td><td>Negligible</td></tr>
<tr><td>Draft (m)</td><td>5.6</td><td>Visibility</td><td>Good</td></tr>
<tr><td>Screw(s)</td><td>Single</td><td>Tide Height</td><td>1.5m</td></tr>
<tr><td>Rudder + Type</td><td>High Lift (SLOW)</td><td>Current</td><td>Negligible</td></tr>
<tr><td>Bow Thrust</td><td>Yes</td><td rowspan="2">Other</td><td>Shielding / Shadowing ON</td></tr>
<tr><td>Other</td><td></td><td>Dark</td></tr>
</table>

Notes / Observations

Passage conducted through new bridge.

Bridge timings kept as new parameters (2m 40s request to fully open)

Wind modelled at 40knots throughout, with gusts +/- 5 kts, but with only 0.2 knots in immediate area of bridge.

Assessment of ease (difficulty) in manoeuvre;

<table>
<tr><th colspan="6">Port Entry / Passage through 1st (existing Bascule) Bridge</th></tr>
<tr><td>Good; Normal Corrective Input.</td><td>4</td><td></td><td>Sub-optimal; Minor Damage / Near Miss.</td><td>2</td><td></td></tr>
<tr><td>Fair; Major Corrective Input, un-planned.</td><td>3</td><td>x</td><td>Objective Failed; Significant Damage.</td><td>1</td><td></td></tr>
<tr><th colspan="6">Passage through new bridge (Planned 3rd Lake Lothing) Crossing</th></tr>
<tr><td>Good; Normal Corrective Input.</td><td>4</td><td></td><td>Sub-optimal; Minor Damage / Near Miss.</td><td>2</td><td></td></tr>
<tr><td>Fair; Major Corrective Input, un-planned.</td><td>3</td><td>x</td><td>Objective Failed; Significant Damage.</td><td>1</td><td></td></tr>
</table>

Notes

Passage through existing (Easternmost) bascule bridge slightly more difficult.

Speed on passage maintained below 4 knots.

Run/Passage	14	Bridge Team	Master/ Pilot	G.Horton
Operator	K. Abdelsalam		Observers	R. Musgrave
Date	07/03/2018			M. Nicholson
Start / End Time	15:55 / 16:10			S. Horne. W. Davies

Scenario	Large Cargo Vessel inward. Very strong wind (N 40 knots). Night.
Objective	Safe Passage through new bridge, test aspect of lights on simulator.
Any Constraints	Shielding ON. Commence at 19:00 exercise time, nearly full darkness.

Vessel Characteristics		Weather & Tidal Conditions	
Type	BULK11L	Wind Direction	Northerly
LOA (m)	90	Wind Strength	40 knots, (+/- 5 Knot gust)
Beam (m)	14	Sea / Swell	Negligible
Draft (m)	5.6	Visibility	Good
Screw(s)	Single	Tide Height	1.5m
Rudder + Type	High Lift (SLOW)	Current	Negligible
Bow Thrust	Yes	Other	Shielding / Shadowing **ON**
Other			Dark

Notes / Observations

Passage conducted through new bridge.

Bridge timings kept as new parameters (2m 40s request to fully open)

Wind modelled at 40knots throughout, with gusts +/- 5 kts, but with only 0.2 knots in immediate area of bridge.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3		Objective Failed; Significant Damage.	1	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3	x	Objective Failed; Significant Damage.	1	

Notes

Speed on passage approx. 2.5 knots but increased to 4.5 knots during bridge transit.

Exact positioning of lights (on runs, 13, and 14) was commented on. As positioned on simulator not optimal, but this will be refined in actual design / as built. Not felt much to be gained from altering positions on sim at this stage. Notable lack of background lights which would be experienced in real-life.

Run/Passage	15		Bridge Team	Master/ Pilot	G.Horton
Operator	K. Abdelsalam			Observers	R. Musgrave
Date	07/03/2018				M. Nicholson
Start / End Time	16:25	16:35			S. Horne.

Scenario	Large Dredger Vessel inward. Strong wind (N 30 knots).
Objective	Safe Passage through new bridge, large beam vessel.
Any Constraints	Shielding ON.

Vessel Characteristics		Weather & Tidal Conditions	
Type	DREDGE05L	**Wind Direction**	Northerly
LOA (m)	96	**Wind Strength**	30 knots, (+/- 5 Knot gust)
Beam (m)	18	**Sea / Swell**	Negligible
Draft (m)	5.1	**Visibility**	Good
Screw(s)	2 x Azipod	**Tide Height**	1.5m
Rudder + Type	2 x Azipod	**Current**	Negligible
Bow Thrust	Yes	**Other**	Shielding / Shadowing **ON**
Other			Daylight

Notes / Observations

Passage conducted through new bridge.

Bridge timings kept as new parameters (2m 40s request to fully open)

Wind modelled at 30knots throughout, with gusts +/- 5 kts, but with only 0.2 knots in immediate area of bridge.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3		Objective Failed; Significant Damage.	1	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3	x	Objective Failed; Significant Damage.	1	

Notes

Speed on passage approx. 4 knots.

Run/Passage	16		Bridge Team	Master/ Pilot	G.Horton
Operator	K. Abdelsalam			Observers	R. Musgrave
Date	07/03/2018				M. Nicholson
Start / End Time	16:40	16:50			S. Horne.

Scenario	Large Dredger Vessel outward. Strong wind (N 30 knots).
Objective	Safe Passage through new bridge. Large Beam Vessel
Any Constraints	Shielding ON.

Vessel Characteristics		Weather & Tidal Conditions	
Type	DREDGE05L	Wind Direction	Northerly
LOA (m)	96	Wind Strength	30 knots, (+/- 5 Knot gust)
Beam (m)	18	Sea / Swell	Negligible
Draft (m)	5.1	Visibility	Good
Screw(s)	2 x Azipod	Tide Height	1.5m
Rudder + Type	2 x Azipod	Current	Negligible
Bow Thrust	Yes	Other	Shielding / Shadowing **ON**
Other			Daylight

Notes / Observations

Passage conducted through new bridge, after swinging at end of Run 15. Bridge kept open.

Wind modelled at 30knots throughout, with gusts +/- 5 kts, but with only 0.2 knots in immediate area of bridge.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3		Objective Failed; Significant Damage.	1	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	4	x	Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3		Objective Failed; Significant Damage.	1	

Notes Speed on passage approx. 4 knots.

During the first day some issues with the nature of the shielding modelled were raised by G. Horton (Harbour Master), in that while the loss of wind was evident, the shear (turning effect) expected (and gained from his experience in Navigating through the existing bridge in strong winds) was not entirely authentic. This after runs 7, 11 etc).

It was proposed to look at this the next day.

Run/Passage	17	**Bridge Team**	**Master/ Pilot**	J. Kingston
Operator	K. Abdelsalam		**Observers**	G.Horton
Date	08/03/2018			M. Nicholson
Start / End Time	09:20 / 09:35			S. Horne.

Scenario	Supply Vessel Inwards.
Objective	Shakedown run for new attendee (Pilot J. Kingston)
Any Constraints	

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	SUPPLY10L	**Wind Direction**	225
LOA (m)	86	**Wind Strength**	15 knots, (+/- 5 Knot gust)
Beam (m)	19	**Sea / Swell**	Slight
Draft (m)	6.0	**Visibility**	Good
Screw(s)	2 x Azipod	**Tide Height**	1.5m
Rudder + Type	2 x Azipod	**Current**	Negligible
Bow Thrust	Yes	**Other**	No shielding.
Other			Daylight

Notes / Observations

Commence outside, swung off port and entered stern first

Approach and transit speed 2-3 knots.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**	**x**	**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**	**x**	**Objective Failed; Significant Damage.**	**1**	

Notes

No issues.

Run/Passage	18		**Bridge Team**	**Master/ Pilot**	J. Kingston
Operator	K. Abdelsalam			**Observers**	G. Horton
Date	08/03/2018				M. Nicholson
Start / End Time	09:50	10:20			S. Horne.
					W. Davies, A. Pearce

Scenario	Bulk Vessel Inwards, Strong Wind.
Objective	Safe Passage through both bridges.
Any Constraints	Shakedown run for new attendee.

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	BULK11L	**Wind Direction**	225
LOA (m)	90	**Wind Strength**	30 knots, (+/- 5 Knot gust)
Beam (m)	14	**Sea / Swell**	Neg
Draft (m)	5.6	**Visibility**	Good
Screw(s)	Single	**Tide Height**	1.5m
Rudder + Type	High Lift (SLOW)	**Current**	Negligible
Bow Thrust	Yes	**Other**	Shielding / Shadowing ON
Other			Daylight

Notes / Observations

Commence just inside port.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	**4**	**x**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	**4**	**x**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes

Initially there was an issue with an inadvertent pressing of a steering control button which led to a loss of control before attempting transit. This was rectified and the simulation reset. The run then proceeded without incident.

After this run there was some discussion as to how best to test effects of wind shielding and any shear. A high windage vessel (Ferry 50) was chosen to test this and loaded.

Run/Passage	19		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	J. Kingston
Date	08/03/2018				M. Nicholson
Start / End Time	10:30	10:55			S. Horne.
					W. Davies, A. Pearce

Scenario	Passage of High windage vessel in strong wind.
Objective	Evaluate wind effects on vessel, including shielding and wind shear.
Any Constraints	

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	FERRY50	**Wind Direction**	N
LOA (m)	117	**Wind Strength**	30 knots, (+/- 5 Knot gust)
Beam (m)	20	**Sea / Swell**	Neg
Draft (m)	4.3	**Visibility**	Good
Screw(s)	Twin	**Tide Height**	1.5m
Rudder + Type	2 x High Lift	**Current**	Negligible
Bow Thrust	Yes	**Other**	Shielding / Shadowing ON
Other			Daylight

Notes / Observations	A passage through the new bridge was attempted.

It was noted that while the wind changed in strength during passage (noted both on model ship anemometer & through observation of the vessels movement) the effects did not lead to the expected shear or turning moment.

To test this further the vessel was placed stopped “across” the area where the wind shielding was modelled. i.e. The stern was in the strong Northerly wind, and the Bow was inside the bridge way in the light (0.5 knot) winds that were modelled to simulate shadowing. It was noted that the vessel only moved slowly and bodily with the light wind, and the stern did not accelerate strongly to the south as would be expected.

The vessel was moved laterally, and this affected the way the vessel moved, (bodily slowly or quickly dependant on position) but no significant wind shear (turning effect) was noticed. It was deduced that the simulator only modelled the effect of the wind on one point of the vessel. This presumably at the centre of the above deck area exposed to the wind.

This did lead to some turning moment (the geometric centre of the above water line area and the below water line ship’s hull, are often not co-incident, which can lead to a vessels bow or stern moving more quickly in a uniform wind), but not to the extent expected.

To further evaluate this a wind was modelled with a strong and opposing wind shear. i.e. 40 knots N’ly and 40 knots S’ly in close proximity. Although unrealistic if a vessel were placed across such a shear it would turn quickly and not transfer (go sideways). The ferry was placed across this shear, and it slowly moved sideways with little turning. It was further observed (not unexpectedly) that the simulator “smoothed” the wind, so as the model moved from one area to another, even if the wind change was input with an abrupt change, the model anemometer indicated a more gradual change. This is expected and realistic.

See full report for further information, discussion and conclusions.

Run/Passage	20	**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam		**Observers**	J. Kingston
Date	08/03/2018			M. Nicholson
Start / End Time	11:00 / 11:15			S. Horne.
				W. Davies, A. Pearce

Scenario	Cargo Ship in Ballast Inwards. Strong wind
Objective	Safe Passage through both bridges.
Any Constraints	Very large vessel, above the normal acceptance criteria for Lowestoft.

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	CARGO6L	**Wind Direction**	225
LOA (m)	140	**Wind Strength**	30 knots
Beam (m)	16.4	**Sea / Swell**	Neg
Draft (m)	3.7	**Visibility**	Good
Screw(s)	Twin	**Tide Height**	1.5m
Rudder + Type	2x Normal	**Current**	Negligible
Bow Thrust	Yes	**Other**	Shielding / Shadowing ON
Other			Daylight

Notes / Observations
Commence just inside port. Speed 4 – 4.5 Knots
Bridge timings as previously (2m 40s)

Assessment of ease (difficulty) in manoeuvre;					
Port Entry / Passage through 1st (existing Bascule) Bridge					
Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**	**x**	**Objective Failed; Significant Damage.**	**1**	
Passage through new bridge (Planned 3rd Lake Lothing) Crossing					
Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**	**x**	**Objective Failed; Significant Damage.**	**1**	

Notes
No significant issues.

Run/Passage	21		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	J. Kingston
Date	08/03/2018				M. Nicholson
Start / End Time	11:15	11:25			S. Horne.
					W. Davies, A. Pearce

Scenario	Supply Vessel Outwards (bow first). Very Strong Wind
Objective	Safe Passage through new bridge.
Any Constraints	

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	SUPPLY05L	**Wind Direction**	N
LOA (m)	66	**Wind Strength**	40 knots (+/- 5 kts)
Beam (m)	14	**Sea / Swell**	Neg
Draft (m)	4.5	**Visibility**	Good
Screw(s)	Twin	**Tide Height**	2.0m
Rudder + Type	2 x High Lift	**Current**	Negligible
Bow Thrust	Yes	**Other**	Shielding / Shadowing ON
Other			Daylight

Notes / Observations

Commence alongside N' Quay 6. Speed 4 – 4.5 Knots

Bridge timings as previously (2m 40s)

Effectively a re-run of Run 8, this time with shielding on.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3		Objective Failed; Significant Damage.	1	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3	x	Objective Failed; Significant Damage.	1	

Notes

No significant issues.

Run/Passage	22		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	J. Kingston
Date	08/03/2018				M. Nicholson
Start / End Time	11:15	11:25			S. Horne.
					W. Davies, A. Pearce

Scenario	Supply Vessel Outwards (stern First) Very Strong Wind
Objective	Safe Passage through new bridge.
Any Constraints	

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	SUPPLY05L	**Wind Direction**	N
LOA (m)	66	**Wind Strength**	40 knots (+/- 5 kts)
Beam (m)	14	**Sea / Swell**	Neg
Draft (m)	4.5	**Visibility**	Good
Screw(s)	Twin	**Tide Height**	2.0m
Rudder + Type	2 x High Lift	**Current**	Negligible
Bow Thrust	Yes	**Other**	Shielding / Shadowing ON
Other			Daylight

Notes / Observations

Commence alongside N' Quay 6. Speed 4 – 4.5 Knots, swung and proceed out stern first.

Bridge timings as previously (2m 40s)

Effectively a re-run of Run 8, this time with shielding on.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**	x	**Objective Failed; Significant Damage.**	**1**	

Notes	No significant issues.

Run/Passage	23		**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam			**Observers**	J. Kingston
Date	08/03/2018				M. Nicholson
Start / End Time	11:50	12:10			S. Horne.
					A. Pearce

Scenario	Moor at waiting berth. Tug (comparatively large for proposed berth)
Objective	Test the approach to the berth etc.
Any Constraints	Wind off berth

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	TUG15L	**Wind Direction**	E
LOA (m)	30	**Wind Strength**	20 knots (+/- 5 kts)
Beam (m)	11	**Sea / Swell**	Neg
Draft (m)	2.9	**Visibility**	Good
Screw(s)	2 x Azi	**Tide Height**	2.0m
Rudder + Type	2 x Azi	**Current**	Negligible
Bow Thrust	Yes	**Other**	No Shadowing
Other			Daylight

Notes / Observations

Started at N Quay, outwards through new bridge, swung and berthed.

Once berthed, vessel un-berthed and proceeded outwards.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge

Good; Normal Corrective Input.	**4**		**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing

Good; Normal Corrective Input.	**4**	**x**	**Sub-optimal; Minor Damage / Near Miss.**	**2**	
Fair; Major Corrective Input, un-planned.	**3**		**Objective Failed; Significant Damage.**	**1**	

Notes

No issues

Run/Passage	24	**Bridge Team**	**Master/ Pilot**	G. Horton
Operator	K. Abdelsalam		**Observers**	J. Kingston
Date	08/03/2018			M. Nicholson
Start / End Time	13:40 / 14:00			S. Horne.
				A. Pearce

Scenario	Large Vessel enter and swing near new waiting pontoon.
Objective	Safe Passage and swing with berths occupied.
Any Constraints	Strong adverse (Easterly) wind

Vessel Characteristics		**Weather & Tidal Conditions**	
Type	BULK11L	**Wind Direction**	E
LOA (m)	90	**Wind Strength**	20 knots (+/- 5 kts)
Beam (m)	14	**Sea / Swell**	Neg
Draft (m)	5.6	**Visibility**	Good
Screw(s)	Single	**Tide Height**	2.0m
Rudder + Type	High Lift (SLOW)	**Current**	Negligible
Bow Thrust	Yes	**Other**	No Shadowing
Other			Daylight

Notes / Observations

Vessel swung with adequate clearance and no issues.

Assessment of ease (difficulty) in manoeuvre;

Port Entry / Passage through 1st (existing Bascule) Bridge N/A

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3		Objective Failed; Significant Damage.	1	

Passage through new bridge (Planned 3rd Lake Lothing) Crossing N/A

Good; Normal Corrective Input.	4		Sub-optimal; Minor Damage / Near Miss.	2	
Fair; Major Corrective Input, un-planned.	3		Objective Failed; Significant Damage.	1	

Notes

Run/Passage	25-27		Bridge Team	Master/ Pilot	J. Kingston
Operator	K. Abdelsalam			Observers	G. Horton
Date	08/03/2018				M. Nicholson
Start / End Time	14:15	15:15			S. Horne.
					A. Pearce

Scenario	Large Vessel, swing near new waiting pontoon.
Objective	Safe Passage & swing with berths occupied. (N' Side and Waiting Berth)
Any Constraints	Strong adverse (Easterly) wind

Vessel Characteristics		Weather & Tidal Conditions	
Type	CNTNR 24B	Wind Direction	E
LOA (m)	121	Wind Strength	25 knots (+/- 5 kts)
Beam (m)	20.8	Sea / Swell	Neg
Draft (m)	5.0	Visibility	Good
Screw(s)	Single	Tide Height	2.0m
Rudder + Type	Normal	Current	Negligible
Bow Thrust	Yes	Other	No Shadowing
Other			Daylight

Notes / Observations
Vessel commenced berthed near silo, singled up and Swung. A software issue led to this vessel
Being unable to move. Visibility was also poor, and one of the displays suffered some slippage.
The scenario (of swinging a large vessel), was repeated with Ferry50.

Notes

Large vessels (CNTNR 24B and FERRY50) were swung several times with varying degrees of difficulty.

It was observed that the presence of the waiting berth imposed no greater restrictions or difficulty than did the existing shallow water immediately East (which is effectively the limiting distance for swinging vessels.

The option of ensuring the waiting berth was empty is also available, should a large vessel need swinging (or in adverse conditions) and can be dealt with procedurally by harbour control.

Appendix C

ABP COMMENTS FROM 3RD STAGE

Bridge Simulator Work at Lowestoft College 7th & 8th March 2018

ABP Port of Lowestoft
Version 1.1

ABP | KEEPING BRITAIN TRADING

From Good to Great

Contents

Participants

ABP
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Observers
Mike Nicholson MNI, Portia Shipmove - both days
Warren Hoskin-Davies, SCC – both days
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Stephen Horne, WSP – both days

Objectives

1. To test model with new design of bridge (single leaf bascule).
2. To evaluate proposed position of a small craft waiting pontoon, just SW of the vessel turning circle off Silo Quay.

Specifically:-

- Timings – when to request that the bridge opening sequence is commenced both inbound and outbound.
- To model for the effects of wind sheer on vessels transiting the new bridge, when strong cross winds are present.
- To measure how close commercial vessels will come to craft moored alongside the waiting pontoon when turning off the Silo Quay, and when transiting the proposed third crossing in strong cross winds.
- To produce model test data for expert Marine Observer from Portia Shipmove Consultancy.

Exercises

A total of 25 exercises were conducted over the two days. Some of these were to re-familiarise users with system controls. A number of ship models were tested in weather conditions, ranging from slight cross winds to gale force winds, (considered to be at the upper limits of operational capability for some of the smaller commercial vessels at Lowestoft). Effect of tidal set was not measured as not considered relevant for the purpose of this exercise, (given little or no tidal effect West of the existing Bascule Bridge). Exercises were also conducted in daylight, half light, and darkness.

Observations/Notable Points

Bridge Model

- Bridge leaf does not raise so that it is in line with Bridge abutment South side. This is believed to be due to the model not accounting for the moving pivot point of the rolling bascule bridge design. This did not appear to affect vessel transits when coming close to the South abutment fendering.
- The navigation lights on the fendering in the new bridge 'cut' would need to be positioned closer to the face of the fenders.
- The central white Bridge leaf light did not move with the bridge leaf when opening, (it remained as a light in the centre channel with the bridge fully raised). This light was removed for exercise purposes.

- More mud banks exposed than is the case over LW periods. This still needs to be addressed, especially on the South side of Bridge Channel just West of Bascule Bridge.
- The engine controls for some vessels with azimuth propulsion still seemed very severe, (particularly Supply 10L), in that once clutched in the power delivery felt like a full power setting. This made exercises using this vessel model unrealistic.
- Certain azimuth vessels, (Supply10L), were still grounding when in deep water. The model tide value had to be set manually, (unrealistically high), to compensate for this.

Exercises

- Advice from WSP was that the new Bridge opening sequence took 106 seconds. This was tested on the model and found to be the case.
- Most vessel transits were conducted at speeds between 3 and 4 knots, (typical speeds for vessels to transit this area at Lowestoft).
- One minute or a further 60 seconds was added for the stopping of road traffic and lowering of pedestrian/vehicle barriers before commencing the Bridge opening sequence.
- Inward bound - for exercises on the original third crossing double Bascule Bridge design, one minute could be allowed between the existing bascule bridge closing and commencing full opening sequence, (including traffic stopping), on the new Bridge. With the slower new bridge design, the full opening sequence needed to be commenced as soon as the existing bridge had been closed.
- Outward bound – for vessels leaving North Quay berths West of the third crossing in moderate weather conditions, (winds below 25kts), the full bridge sequence needed to be requested as soon as the vessel had let go.
- Outward bound – for vessels leaving North Quay berths West of the proposed third crossing in strong cross winds, (ranging 25 – 40kts), the full bridge opening sequence needed to be requested before the vessel had let go.
- Wind sheer on vessels passing through the new bridge could not be properly modelled. This is believed to be due to the ship models only having one reference point along their entire length, for detecting wind strengths. The wind strength at these reference points affects the vessels, (as modelled), as though the wind is acting on the entire length of the vessel.

- Due to a lack of suitable ship models to simulate leisure craft berthed on the new waiting pontoon, a tug was utilised to simulate two leisure craft double rafted on the pontoon.
- Largest vessels were swung off the Silo Quay, (121m LOA). The vessels never came closer than 30m to the craft moored on the waiting pontoon.

Conclusions

- Even though vessel wind sheer when passing through the new bridge could not be modelled, the area of wind shadow caused by the new bridge abutment is very similar to that caused by the existing bascule bridge leaves, (height of new abutments similar to height of existing bridge leaves).
- When in fully raised position, the height of the lower part of the new bridge deck above the abutment is approx. 8m, (with a large gap between the abutment and bridge deck). Small to medium sized commercial vessels would therefore experience similar wind sheer from the existing bridge leaves vs new bridge abutments, although the more exposed position of the new bridge would lead to more effects overall, as the existing bridge does provide some shelter from wind in its approaches, (particularly from the East).
- The large bridge leaf on the proposed third crossing would adversely affect large commercial vessel transits in strong cross winds. This would be an issue for internal vessel transits, as these larger vessels could not transit the existing bascule bridge 'cut' in such conditions.
- Due to the limits in this simulator being able to measure different wind values along the length of the ship models, it is not considered that there is any value in further simulation rounds using this simulator to test for this. This represents a limitation to the results of this simulation exercise.
- The proposed position of the pontoon is considered to present the lowest risk of vessel impact in this area. If commercial vessel transits were planned in extreme weather conditions, (particularly inwards), then a procedure should be established to ensure that no craft are moored alongside the pontoon.
- Overall, the limitations of the model served to limit the effectiveness of the exercises and the ability to accurately assess different vessel types. Whilst the proposed LLTC will probably impose a similar level of restriction to commercial shipping transits as the existing bridge during

normal weather conditions, it remains unclear what the impacts will be during abnormal weather conditions.

Comments

- The modelling/exercises did not take into consideration the affect that the new crossing will have on the ports ability to dredge the Inner Harbour area, using the most efficient dredging methods. It will not be possible to simulate this impact and the related increase in maintenance dredging costs.

- No information was available on weather parameters (maximum wind speed), for operation of the new bridge. It is expected that this is likely to be lower than the existing bascule bridge, which could impact the ability for commercial vessel movements in conditions that would normally be considered as operational, (albeit at the higher end of operational limits). It is worth noting that there are no existing written operational limits for the existing bridge, but the bridge is generally operational up to wind speeds of 50kts from any direction.

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