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

Document SCC/LLTC/EX/60:

Justification and Traffic Effects of draft Scheme of Operation Revision 0

Planning Act 2008

The Infrastructure Planning (Examination Procedure) Rules 2010

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Author: Suffolk County Council

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1 Introduction

1.1 Purpose of document

1.1.1 The draft Scheme of Operation has been prepared following consultation with the Navigation Working Group and was submitted to Deadline 3 of the examination (Document Reference SCC/LLTC/EX/41, PINS Reference REP3-033).

1.1.2 The draft Scheme of Operation seeks to strike an appropriate balance between safeguarding;

- the statutory duties of the harbour authority;
- the commercial interests of Associated British Ports (ABP) as the port owner and operator;
- the interests of recreational maritime traffic and;
- the traffic benefits of the Scheme.

1.1.3 The draft Scheme of Operation has both marine and traffic implications in that clearly when the Scheme bridge is lifted for vessels it is not available for vehicular traffic and vice versa.

1.1.4 The purpose of this paper, therefore, is to complement the Port Impacts Paper (Document Reference SCC/LLTC/EX/59), which is submitted alongside this document, in assisting the Examining Authority and Secretary of State to better understand this interaction.

1.1.5 The draft Scheme of Operation, while restricting peak hour vessel movements in generality, includes discretion to permit the Harbour Master to open the Scheme bridge in particular circumstances that could give rise to navigational risk. Specifically;

- The Harbour Master can open the Scheme bridge if a vessel is tidally restricted (paragraph 2 of the draft Scheme of Operation)
- The Harbour Master can open the Scheme bridge at any time in the incidence of an emergency (paragraph 12 of the draft Scheme of Operation)

1.1.6 These provisions are therefore very similar to those set out in the 1969 Order which governs (in law) how the A47 Bascule Bridge should be operated today when vessel movements are sought outside the core permitted hours (which in that case is generally the overnight period).

1.1.7 Nevertheless, recognising that the principal difference between the draft Scheme of Operation and the current operating regime of the A47 Bascule Bridge is the peak hour restriction on bridge lifts proposed for the Scheme Bridge, this paper supports the conclusions of the Port Impacts Paper that a peak hour restriction (subject to certain caveats) on Scheme bridge lifts does not unduly interfere with either the harbour authority's statutory duties or ABP's commercial activities and is justified by the traffic benefits that it secures.

2 Traffic effects of A47 Bascule Bridge openings

2.1 Introduction

2.1.1 This section explains the current effect of an A47 Bascule Bridge opening in the peak traffic hours by reference the Applicant's VISSIM Model (as described in the Transport Assessment (TA) (Document Reference SCC/LLTC/EX/23, PINS Reference REP3-056)) and by reference to observed traffic count data.

2.1.2 This section examines the impacts of the opening of A47 Bascule Bridge based upon current conditions drawing upon the results of an assessment using the 2016 VISSIM traffic microsimulation model. It also presents the impacts of the A47 Bascule Bridge opening for the 2022 forecast year.

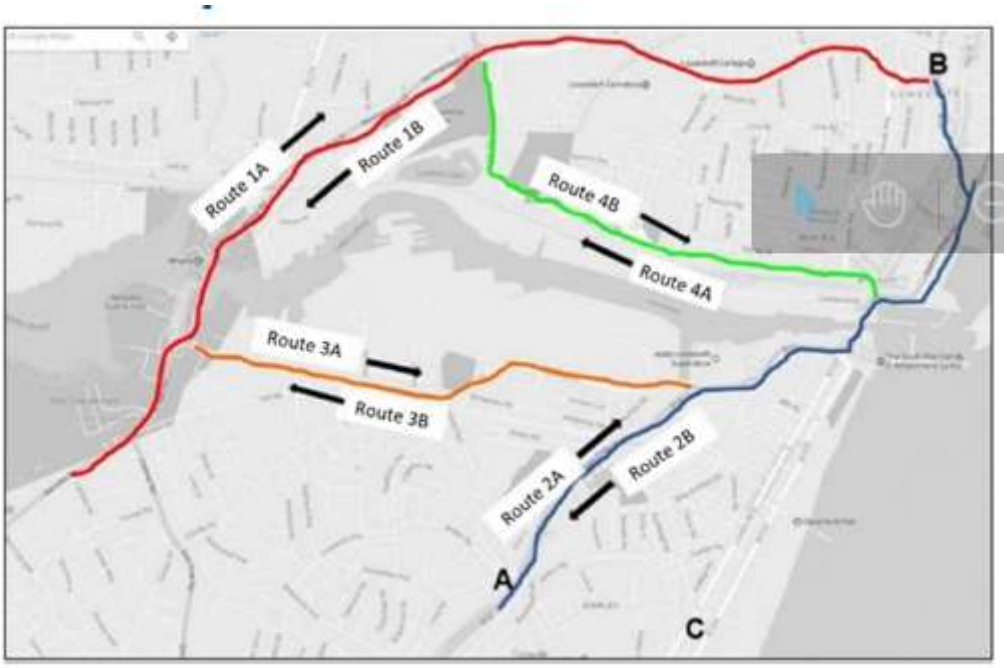
2.2 Impact of A47 Bascule Bridge opening (base year)

2.2.1 The existing traffic conditions are described in section 3.14 of the TA.

2.2.2 A VISSIM traffic microsimulation model was developed to represent the existing level of congestion and delays on the highway network in Lowestoft for a 2016 base year. Key routes and movements through the town were assessed to understand the extent of existing queuing and delays.

2.2.3 The evaluation of the extent of queuing from the VISSIM model was carried out with reference to journey times on a series of key routes, as shown in Figure 3.38 of the Transport Assessment and reproduced in Figure 1 below.

Figure 1- Routes for Journey Time Assessment



2.3 Base Year Journey Times

2.3.1 The Transport Assessment considered the effect of a 5 minute and 10 minute A47 Bascule Bridge lift on journey times in both the AM and PM peaks in the base year (2016) together with the bridge fully open to traffic throughout the period. On average

each opening in the peak hour (as observed in the vessel survey) was approximately five and a half minutes.

2.3.2 An assessment of journey times for key north-south movements for different bridge lift scenarios is provided in Tables 3.19 and 3.20 of the TA, and reproduced as Table 1 and Table 2 below.

2.3.3 These tables show journey times between points A and C to the south and point B to the north in the AM and PM peak respectively. This analysis includes dynamic route choice for vehicles within the model since multiple route options are available.

2.3.4 The analysis of journey times of key movements shows that the average journey time is noticeably longer with a five-minute bridge lift, with journey times rising between 12% and 23% in the AM, and between 16% and 50% in the PM, depending on the origin and destination. This is around 45 seconds to a minute and a half extra for each journey on average.

Table 1 - Comparison of Journey time (sec) between key N-S movements – Base 2016 AM

Route	Description	No Lifts	With 5 minute Lift	With 10 minute Lift
A to B	A12 Tom Crisp Way to A47 Jubilee Way	482	539	691
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	402	450	539
C to B	London Rd South to A47 Jubilee Way	413	508	674
B to C	A47 Jubilee Way to B1532 Marine Parade	220	265	351

Table 2 - Comparison of Journey time (sec) between key N-S movements – Base 2016 PM

Route	Description	No Lifts	With 5 minute Lift	With 10 minute Lift
A to B	A12 Tom Crisp Way to A47 Jubilee Way	448	521	655
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	460	570	721
C to B	London Rd South to A47 Jubilee Way	367	551	739
B to C	A47 Jubilee Way to B1532 Marine Parade	245	339	533

2.4 Journey Time Variability

2.4.1 More significantly, the TA demonstrates that not only does the lifting of the A47 Bascule Bridge have a large impact on the average journey time on key routes within the peak hours, there are significant variations in journey time for individual users of the network over the course of the peak periods, which is hidden by the presentation of average figures.

2.4.2 An analysis of average journey times across the modelled hour is presented in Figure 3.39 to Figure 3.46 of the TA for the AM peak and Figure 3.47 to Figure 3.54 for the PM peak. These illustrate how the average journey time on each route changes across the peak hour for each of the three base scenarios i.e. A47 Bascule Bridge remains open to traffic, it lifts for five minutes and it lifts for ten minutes.

2.4.3 The analysis for Routes 2A and 2B (Figures 3.41 and 3.42 of the TA respectively) are re-produced as Figure 2 and Figure 3 below. Routes 2A and 2B are directly affected as they cross the A47 Bascule Bridge.

Figure 2 - Route 2A - AM average journey time by 5 minute interval

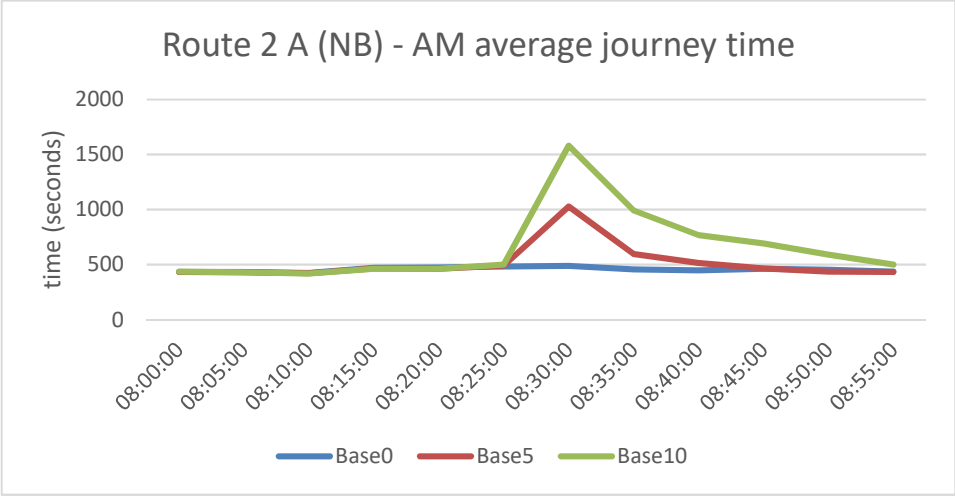
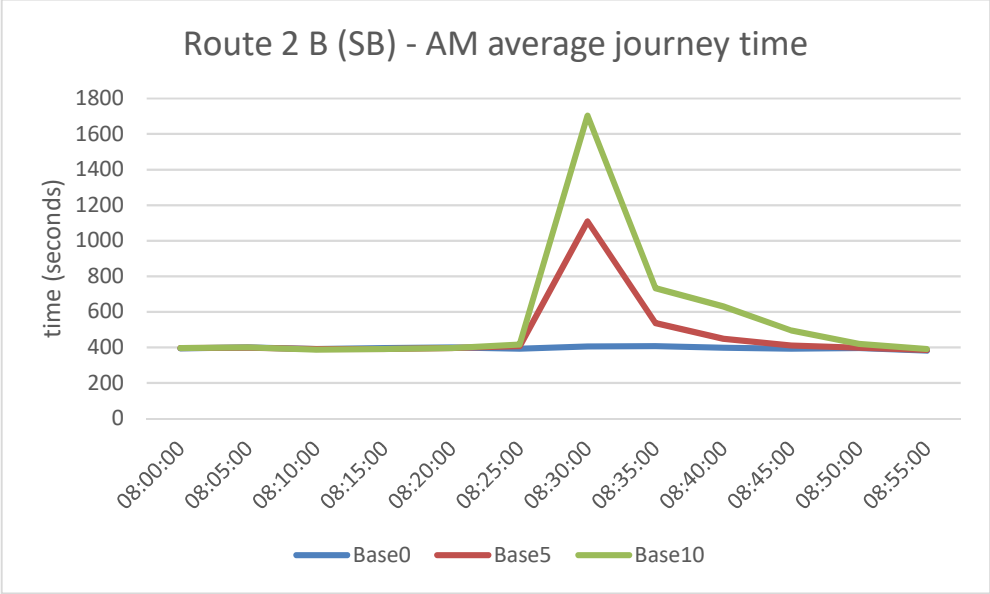


Figure 3 - Route 2B - AM average journey time by 5 minute interval



2.4.4 These figures present the average journey times for vehicles crossing A47 Bascule Bridge for each 5 minute interval within the peak. This demonstrates that the lifting of the Bascule Bridge (at around 08:30) results in a significant increase journey time.

2.4.5 Figure 2 shows that on Route 2A (northbound), average journey time increases from around 500 seconds (8 minutes, 20 seconds) and peaks at 1000 seconds (16 minutes 40 seconds) when there is a five minute lift, and 1500 seconds (25 minutes) when there is a ten minute lift.

2.4.6 Figure 3 shows that on Route 2B (southbound), normal journey time is around 400 seconds (6 minutes 40 seconds), whereas peak journey time is around 1100 seconds (18 minutes 20 seconds) with a five minute lift and over 1600 seconds (26 minutes 40 seconds) with a ten minute lift.

2.4.7 It should further be noted that the analysis of average journey times by 5 minute intervals conceals the variability of journey times that will be experienced for vehicles within each 5 minute time interval.

2.4.8 Journey time reliability is an objective of the Scheme as it is key issue for road users[1] and in ensuring effective and efficient infrastructure around the Port of Lowestoft, an issue which is recognised by Government as important for port connectivity[2]. It was also heavily referenced in the consultation with businesses undertaken in advance of the OBC (Document Reference 7.4, PINS Reference APP-110). Relevant quotes include, on p12:

> *With regards to our customers they will be able to reach us more quickly and, most importantly, more reliably*
>
> *Not having to factor in the extra time that is needed just to travel a couple of miles would be a great benefit.*

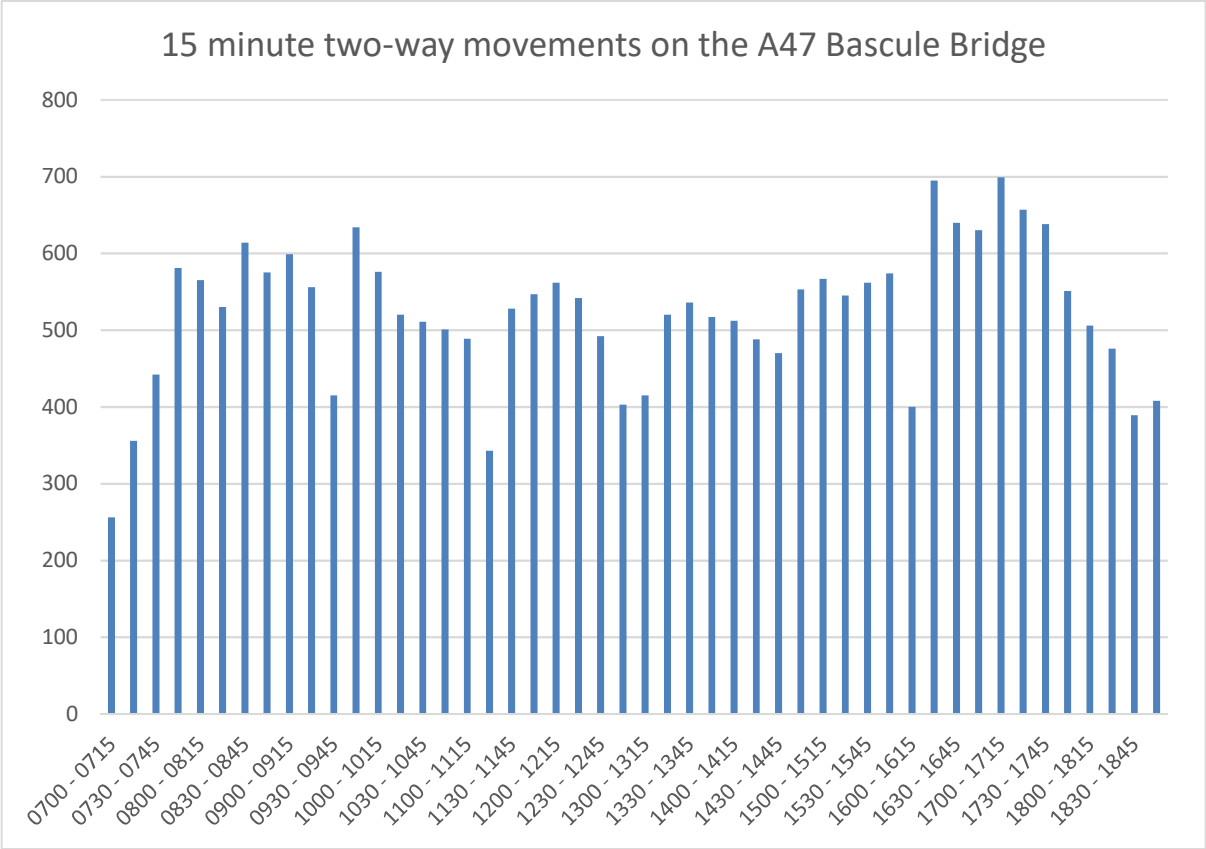
2.4.9 Consequently, a central premise of the proposed restriction on Scheme bridge lifts in the peak hours (the effect of which is explained in section 3) is to ensure journey times through Lowestoft are more reliable at these times of the day.

2.5 Effect of bridge openings, based on traffic survey data

2.5.1 The Applicant has manually classified traffic survey data which covers the period 07:00-19:00 on the A47 Bascule Bridge in 15 minute intervals on 14 July 2016. The 2-way flows across the bridge are presented in Figure 4. The bridge openings on that day were at 09:39, 11:20, 12:59, 14:31, 16:11 and 18:02.

[1] As recognised by the Government in Highways England's route strategy for the East of England, as noted in paragraph 4.6.4 of the Case for the Scheme (APP-091).
[2] As noted in paragraph E.S.9 of the Case for the Scheme.

Figure 4 - 15 minute two-way movements on the A47 Bascule Bridge

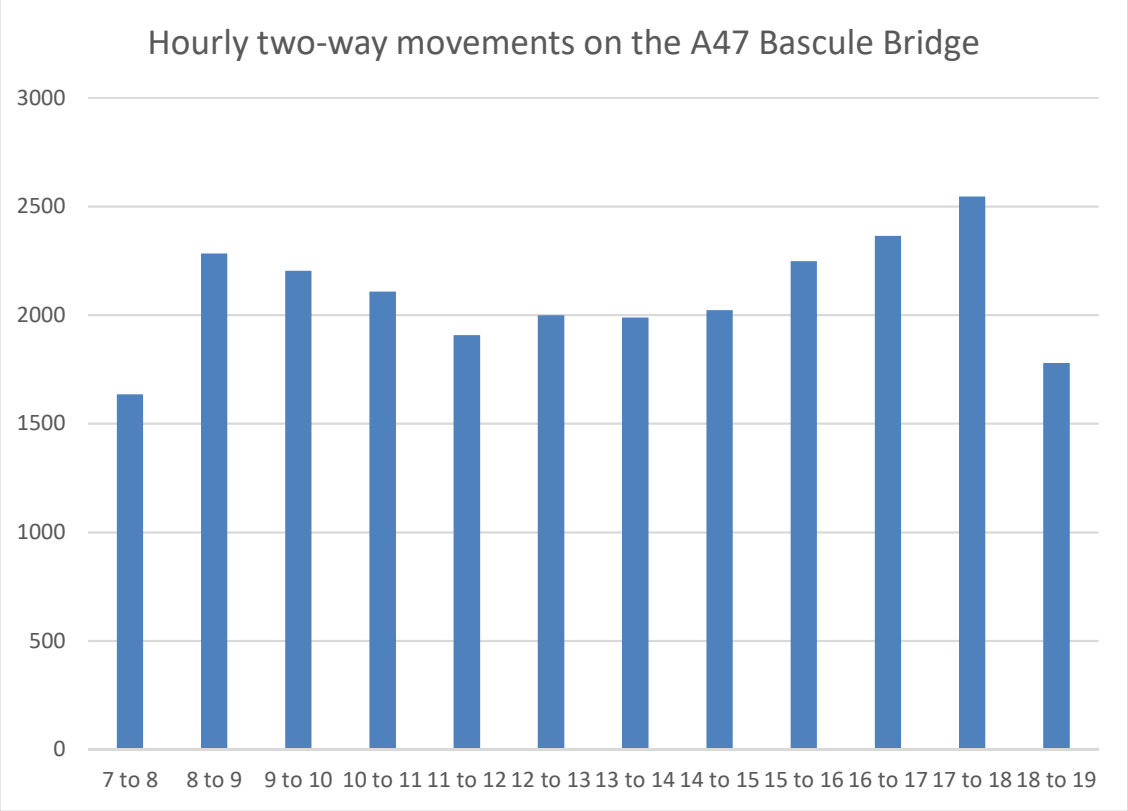


2.5.2 The effect of the bridge openings at 09:39, 11:20, 12:59, 14:31, 16:11 and 18:02 are illustrated in Figure 4. This highlights a reduction in flows in the 15 minute window in which the bridge opening occurs, and a 'rebound' in the 15 minutes thereafter, which aligns with the modelled effect of a bridge opening as described above.

2.5.3 It is also noted from Figure 4 that while there is a degree of 'shouldering' of traffic flows at the peak periods, interpeak period flows are within 25% of the peak flows, indicating that while the focus of the operational transport assessment has been during the peak hours, in accordance with guidance, operational assessments of the interpeak hours may not be dissimilar to the peak periods.

2.5.4 This is shown most clearly where the 15 minute time periods are aggregated in to hour periods, as shown in Figure 5 below.

Figure 5 - Hourly two-way movements on the A47 Bascule Bridge



3 Impact of Scheme Bridge Liftings

3.1 Introduction

3.1.1 This section draws on information presented in the TA to set out why traffic modelling undertaken by the Applicant confirms that a peak hour restriction on lifting the Scheme bridge is beneficial.

3.2 Scheme Bridge Lifting Scenarios

3.2.1 The Transport Assessment considered a number of bridge opening scenarios, as described in Table 7.1 and reproduced in Table 3 below.

Table 3 – Bridge Lift Scenarios

DM_2022	**DM** – Mutford Bridge Open; A47 Bascule Bridge Open
DM_2022_5MIN	**DM** –Mutford Bridge Open; A47 Bascule Bridge Lifted (5 mins)
DM_2022_10MIN	**DM** –Mutford Bridge Open; A47 Bascule Bridge Lifted (10 mins)
DS_2022_SC-5	**Scenario 5** - Mutford Bridge Open; Scheme Lifted (6 mins); A47 Bascule Bridge Lifted (5 mins) (bridge lift offset of 1.5 minutes westbound)
DS_2022_SC-5a	**Scenario 5a** - Mutford Bridge Open; Scheme Lifted (6 mins); A47 Bascule Bridge Lifted (5 mins) (as Scenario 5 with bridges lifted simultaneously)
DS_2022_SC-6	**Scenario 6** - Mutford Bridge Open; Scheme Lifted (6 mins); A47 Bascule Bridge Lifted (10 mins)
DS_2022_SC-7	**Scenario 7** - Mutford Bridge Open; Scheme Lifted (10 mins); A47 Bascule Bridge Lifted (10 mins)
DS_2022_SC-8	**Scenario 8** - Mutford Bridge Open; Scheme Open; A47 Bascule Bridge Open
DS_2022_SC-9	**Scenario 9** - Mutford Bridge Open; Scheme Open; A47 Bascule Bridge Lifted (5 mins)
DS_2022_SC-10	**Scenario 10** - Mutford Bridge Open; Scheme Open; A47 Bascule Bridge Lifted (10 mins)

3.2.2 The average opening time for A47 Bascule Bridge is between 5 and 6 minutes. However, for the purpose of the scenario testing, lifts of 0, 5 and 10 minutes have been tested for the A47 Bascule Bridge, and for 0, 6 and 10 minutes for the Scheme Bridge.

3.3 Average Journey time Comparisons

3.3.1 The impacts of a lifting the Scheme Bridge under the various scenarios described in Table 3 above is described in detail in Section 7.5 of the Transport Assessment.

3.3.2 Scenario 5 and Scenario 9 are both based upon a 5 minute lift of A47 Bascule Bridge with Scenario 5 based on a 6 minute lift of the Scheme Bridge and Scenario 9 with the Scheme Bridge remaining open to traffic.

3.3.3 A comparison of the average journey times between Scenarios 5 and 9 show modest reductions in peak journey times as a result of the Scheme bridge remaining open.

3.3.4 Similarly, a comparison between results of the journey times for Scenario 7 and 10 (both assuming a lift of A47 Bascule Bridge of 10 minutes with a 10 minute lift of the Scheme Bridge in Scenario 7 and the Scheme Bridge remaining open in Scenario 10), show savings in average journey times of around 10%.

3.4 Journey Time Variability

3.4.1 As noted in the preceding section, in respect of the effects of opening the A47 Bascule Bridge, it is important to note that the comparison of average journey times is based upon analysis of journey times for all vehicles across the peak hour, and conceals the variability of times for individual journeys and variability experience by vehicles over the peak period.

3.4.2 An indication of the variability of journey times can be demonstrated by an analysis of journey times for each 15 minute period.

3.4.3 Figure 6 and Figure 7 present the AM peak journey times for Scenarios 7 and 10 respectively across the modelled hour between points A and B as shown in Figure 1.

Figure 6 - Journey Times AM peak (Northbound A to B)

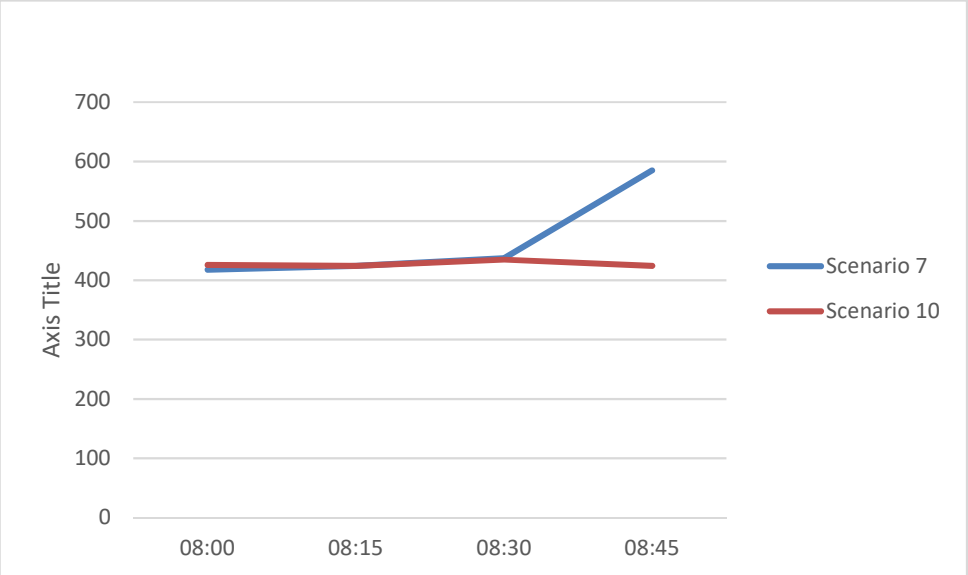
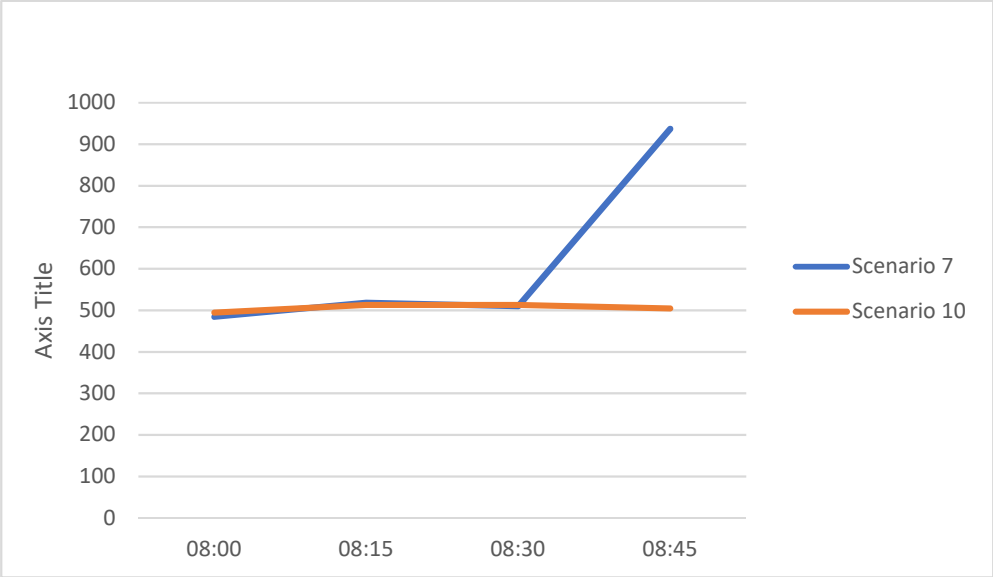


Figure 7 - Journey Times AM peak (Southbound B to A)



3.4.4 The above figures demonstrates that the impact of the Bridge closure on journey times following a 10 minute lift of the Scheme Bridge at 8.30 AM. This shows a significant increase in journey times in Scenario 7 after 8.30. The average journey times across the hour therefore continue to conceal the significant variation in journey times following a bridge lift in the AM Peak.

3.4.5 Figure 8 and Figure 9 present the PM peak journey times for Scenarios 7 and 10 across the modelled hour between points A and B as shown in Figure 1.

Figure 8 - Journey Times PM peak (Northbound A to B)

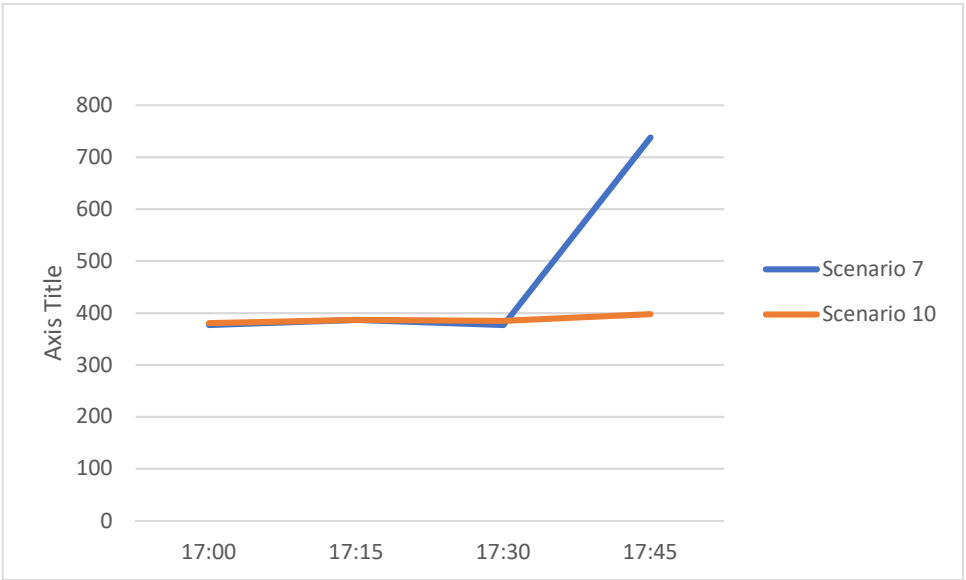
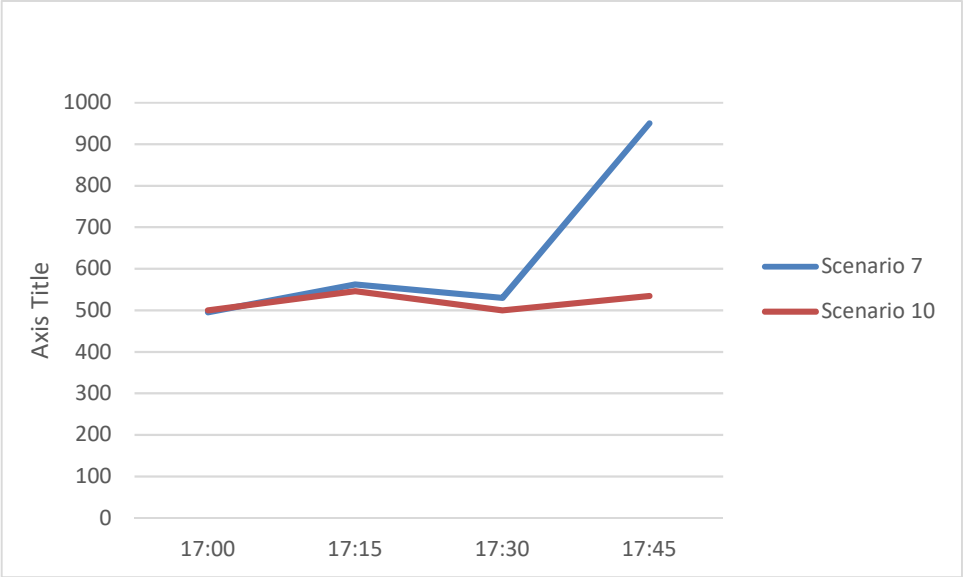


Figure 9 - Journey Times PM peak (Southbound B to A)



3.4.6 The above figures highlight the impact of the Bridge closure on journey times following a 10 minute lift of the Bridge at 17.30. This shows a near doubling of journey times in Scenario 7 in both directions after 17.30. The average journey times across the hour therefore continues to conceal the significant variation in journey times following a bridge lift in the PM peak.

3.4.7 A further indication of the impact of the Scheme lifting on journey time variability can be illustrated from an analysis of the range of predicted journey times from the VISSIM model.

3.4.8 The peak journey times presented in Figures 6 to 9 above are based on an average of 20 runs of the VISSIM microsimulation model. Microsimulation takes into account day to day variability, for example through the use of monte-carlo simulation to release individual trips onto the network. This means that, no single model run will be identical and reflects the day to day variability that will typically occur in practice.

3.4.9 Figure 10 and 11 show the range of predicted journey times for the 20 model runs for the AM peak period between 08.45 and 09.00 for northbound and southbound journeys respectively (i.e. between points A and B as shown in Figure 1)

Figure 10 - Distribution of Journey Times 08:45 to 09:00 (Northbound A to B)

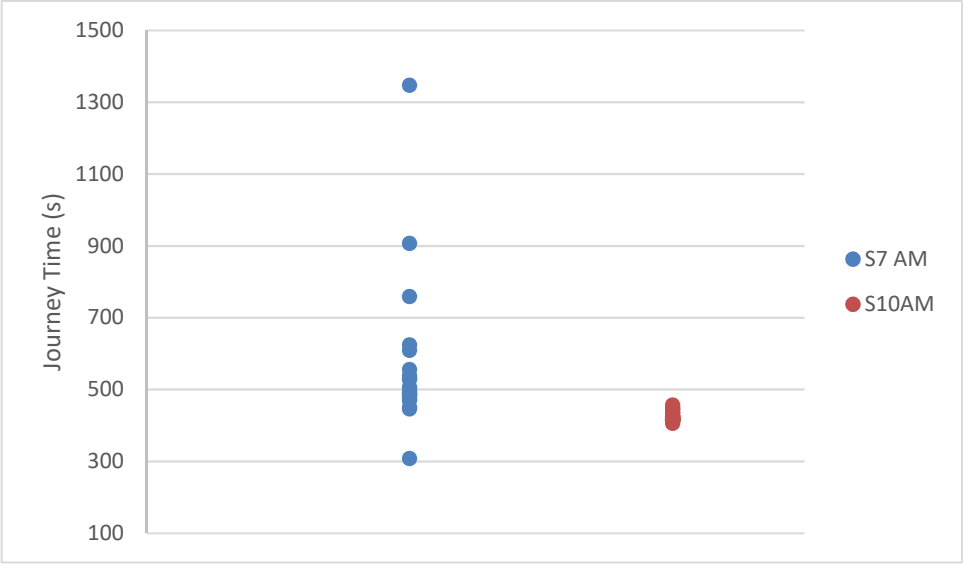
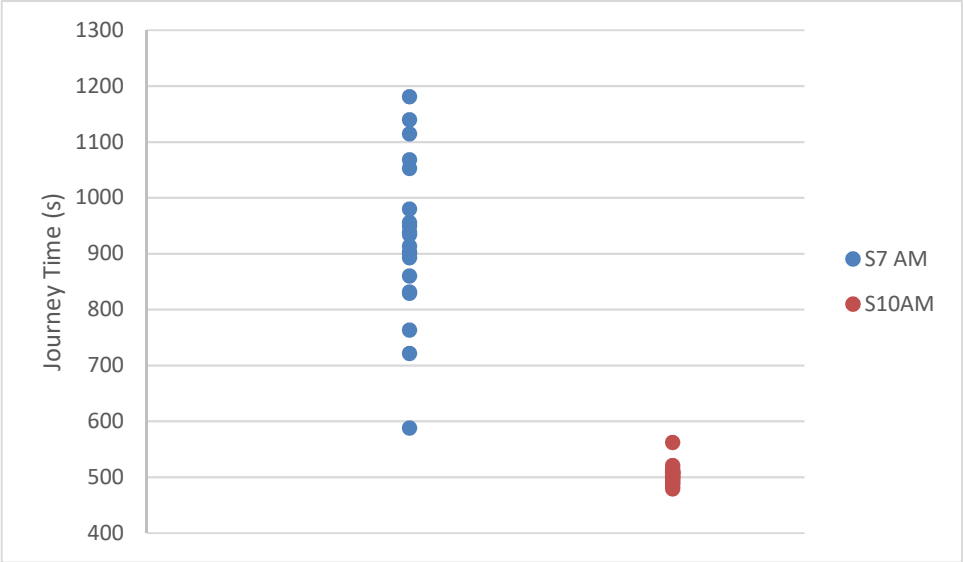


Figure 11 - Distribution of Journey Times 08:45 to 09:00 (Southbound B to A)



The above figures demonstrate the significant range in journey times over the 20 model runs in Scenario 7 (when the Scheme bridge is lifted for 10 minutes in the AM Peak). For example in the northbound direction, journey times range between 300 and 1350 secs. By contrast, journey times for Scenario 10 with the Scheme Bridge open to traffic, show little or no variation ranging between 400 and 475 sec.

3.4.10 Figure 12 and Figure 13 show the range of predicted journey times for the 20 model runs for the PM peak period between 17.45 and 18.00 for northbound and southbound journeys respectively.

Figure 12 - Distribution of Journey Times 17:45 to 18:00 (Northbound A to B)

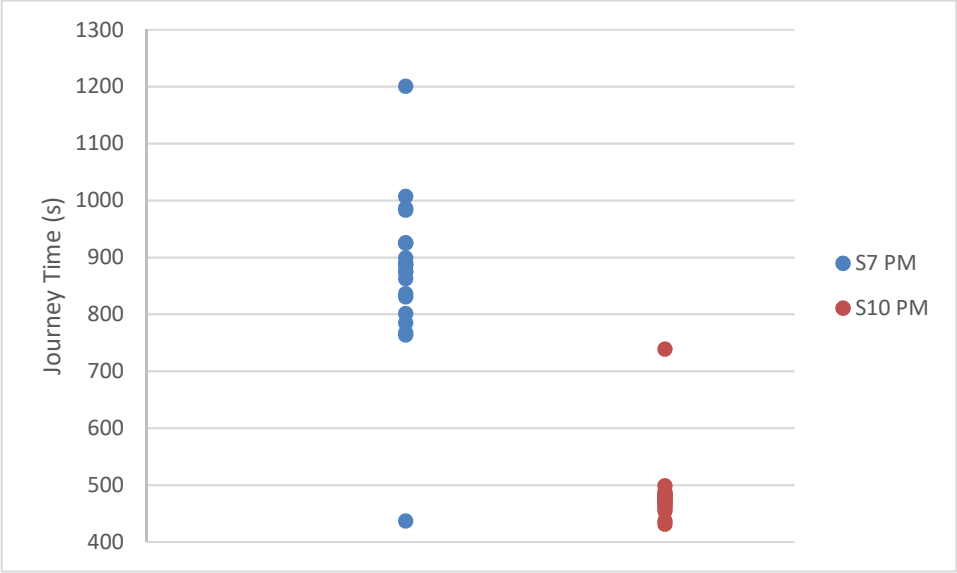
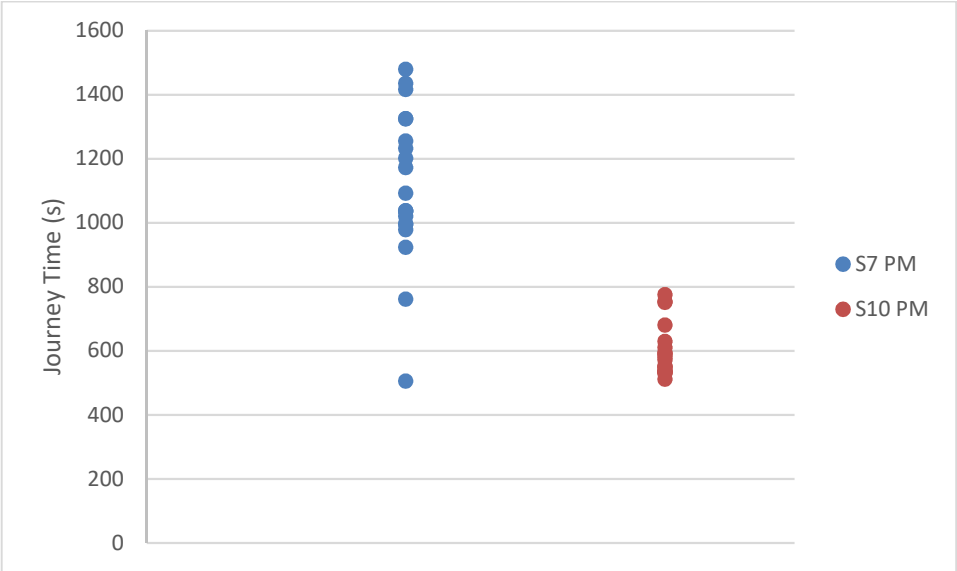


Figure 13 - Distribution of Journey Times 17:45 to 18:00 (Southbound B to A)



3.4.11 The above figures demonstrate that the PM journey time variability is similar to the AM peak with Scenario 7 experiencing a significant range in journey times with journey times for Scenario 10 much less variability.

3.4.12 As a final point it should be noted that the journey analysis presented in Figures 10 to 13, based upon the 20 model runs, are based upon an average of all vehicles making the journey between the specified origin and destination within the 15 minute time

period. This analysis has highlighted the variability with respect to each of the 20 model runs. This conceals the variability in journey times associated with each individual journey that takes place within the time period. This means that the range of journey times predicted for scenario 7 is based upon the 20 seed runs, which each presented an average value for all journeys, will be greater.

3.5 Summary

3.5.1 Based on the VISSIM Modelling and review of traffic count data it is possible to evidence that currently a lift of the Bascule Bridge lift in peak traffic hours causes significant variability in journey time reliability within those peak hours with those drivers caught in such a lift experiencing significant delay.

3.5.2 As explained in the Port Impacts Paper, the current average duration of an A47 Bascule Bridge opening is 5 minutes, and if port activity increased, it is likely that the duration of bridge openings would also increase (as well as being more frequent). Accordingly this report has presented the effect of 10 minute lifts of the Scheme bridge on average journey times and journey time variability in the peak hours. This confirms that lifting of the Scheme bridge in peak hours would have a similarly undesirable effect on journey time reliability.

3.5.3 It is therefore concluded that increased port activity and by consequence longer and more frequent bridge lifts, would cause traffic conditions in Lowestoft to significantly deteriorate. This would undoubtedly seek to ultimately undermine the growth in port activity which remains heavily reliant on adequate capacity in the highway network.

4 Effect of bridge lifts on the Economic Assessment of the Scheme

4.1 SATURN Model

4.1.1 As explained in the Economics Report (Document Reference 7.3, PINS Reference APP-106) the economic assessment is based on the outputs of the SATURN model which are input into economic appraisal software[3] to estimate the economic benefits of the Scheme, which is itself explained in the Transport Assessment.

4.1.2 The modelled time periods were: AM Peak (08:00 – 09:00); Average interpeak (10:00-16:00) and PM Peak (17:00 – 18:00). Economic benefits are calculated over a 60 year period.

4.1.3 For the purpose of a robust Economics Report, it was assumed that the operation of the Scheme bridge would mirror that of the A47 Bascule Bridge. The bridges are each therefore assumed to lift once every hour during each time period, AM, interpeak, and PM, with the A47 Bascule Bridge assumed to open for 5 minutes and the Scheme bridge for 6 minutes.

4.1.4 Consequently, this means the Economics Report overestimates the number of times the Scheme bridge would need to open as it takes no account of the fact that the Scheme bridge is located to the west of the majority of quays in the Port, and it provides a significantly higher air draft than the existing A47 Bascule Bridge.

4.1.5 With the draft Scheme of Operation in place, and considering the scale of peak hour bridge lifts this would permit, the Applicant considers that the economic assessment is robust.

4.2 Increased Port activity

DM and DS scenarios

4.2.1 It is important to note that the economic benefits of the Scheme arise from comparing a no-Scheme (Do Minimum (DM)) and a Scheme (Do Something (DS)) world. The only variable in that comparison is the presence or otherwise of the Scheme[4].

4.2.2 Any other variable that could be considered relevant would need to be applied to both the DM and DS scenarios, meaning that if one wanted to test a higher level of port activity in the DS scenario, i.e. the Scheme bridge lifted more frequently, that same change would need to be applied to the DM scenario. That would mean that in the DM scenario the A47 Bascule Bridge would similarly need to be modelled to open more frequently.

[3] TUBA captures user benefits, COBA-LT captures safety benefits
[4] TAG Unit M1 Principles of Modelling and Forecasting (2014), para 2.2.1 “Assessment of any [transport]…intervention … requires an appreciation of expected future benefits and disbenefits. … these benefits and disbenefits … need to be estimated by comparing two forecasts – one excluding the intervention, the other including the intervention and no other changes. In the transport context, these two forecasts are called the without-scheme [or Do Minimum] forecast and with scheme [Do Something scenario] forecast respectively.”

4.2.3 A such the economic assessment of the Scheme would not vary significantly in such a scenario because the relative performance of the DM and DS scenarios would be similar.

DM Scenario

4.2.4 The Applicant has investigated further a DM scenario with an increased level of port activity, with a doubling of bridge openings on both the A47 Bascule Bridge and the Scheme bridge (which include a cumulative 10 minutes and a 12 minute lift per hour respectively, two 5-minute openings and two 6-minute openings) to understand the potential impact this could have on the Scheme economics (the Benefit Cost Ratio (BCR) and Value for Money category). Running this scenario produces the following results.

	One opening	Two openings
Initial present value of benefits (PVB)	298.26	291.08
Present value of costs PVC	80.47	80.47
Initial BCR	3.71	3.62
Wider impacts – reliability	23.07	23.07
Adjusted PVB	321.33	314.15
Adjusted BCR	3.99	3.90
Value for money category	High	High

Table 4: Comparison of Scheme benefits with increased port activity

4.2.5 The effect of an increased opening regime on the Scheme benefits (estimated through TUBA) only drops the Present Value of Benefits (PVB) by approximately £7m over a 60-year appraisal period (if all other costs and benefits remain the same). This marginally lowers the Initial and Adjusted BCRs and would not alter the Value for Money Category from High.

4.3 Simultaneous bridge lifts

4.3.1 As noted in the preceding section, the Port Impacts Paper explains that in certain circumstances, to mitigate navigational risk, both the A47 Bascule Bridge and Scheme bridge may be lifted simultaneously.

4.3.2 The frequency and duration of such a simultaneous lift would, in effect, reduce the number of crossing points across the lake to one (assuming Mutford Lock remained open to traffic) for the duration of the lift. Such an event would be materially no different to the current DM situation when the A47 Bascule Bridge opens and is closed to traffic (there is one lake crossing point). The difference would occur when the bridges re-open to traffic (which is the situation for the vast majority of the day and 60 year appraisal period), as in the 3-bridge DS situation, the traffic network recovery time would be much improved, compared to the 2-bridge DM scenario, and the capacity of the highway network crossing the lake will be approximately a third

greater. It is therefore clear that simultaneous bridge lifts in the 3 bridge DS scenario, would still offer significant traffic benefits compared to 2 bridge DM scenario.

5 Conclusions

5.1.1 The Ports Impact Paper has set out the anticipated volume of vessels that may be affected by a peak hour restriction both in current levels of port activity, and if that was to increase.

5.1.2 This paper has demonstrated that peak hour A47 Bascule Bridge lifts cause significant operational issues on the highway network today, specifically in terms of journey time reliability, a key concern of businesses and an important objective for the Scheme. The Applicant considers therefore that to avoid the similar disruption to road users during the peak traffic hours which would occur should the Scheme bridge be opened in peak hours, Scheme bridge lifts should be managed to the extent they do not give rise to unacceptable navigational risks.

5.1.3 The Applicant would further note that it is not seeking to impose any restrictions on movement of commercial vessels outside peak hours; notwithstanding the fact that as shown in Figure 5 above, interpeak flows do not vary significantly from peak flows and as such further restrictions would clearly be beneficial from a traffic management perspective.

5.1.4 Discretionary peak-time bridge openings by the Harbour Master would still be permitted in certain circumstances that could give rise to navigational risk, such as if a vessel is tidally restricted or at any time in the incidence of an emergency, and these provisions are very similar to those set out in the 1969 Order which governs (in law) how the A47 Bascule Bridge should be operated when vessel movements are sought outside the core permitted hours.

5.1.5 The Applicant has set out how the economic assessment of the Scheme with regard to bridge lift scenarios, including more frequent lifts of the Scheme bridge (including simultaneously with the A47 Bascule Bridge) anticipated to arise through the provisions in the draft Scheme of Operation remains robust.

5.1.6 Finally, the Applicant notes that Highways England supports the peak hour restrictions in the Scheme of Operation considering they would secure the maximum relief to the Strategic Road Network when it is most needed (Document Reference SCC/LLTC/EX/53).