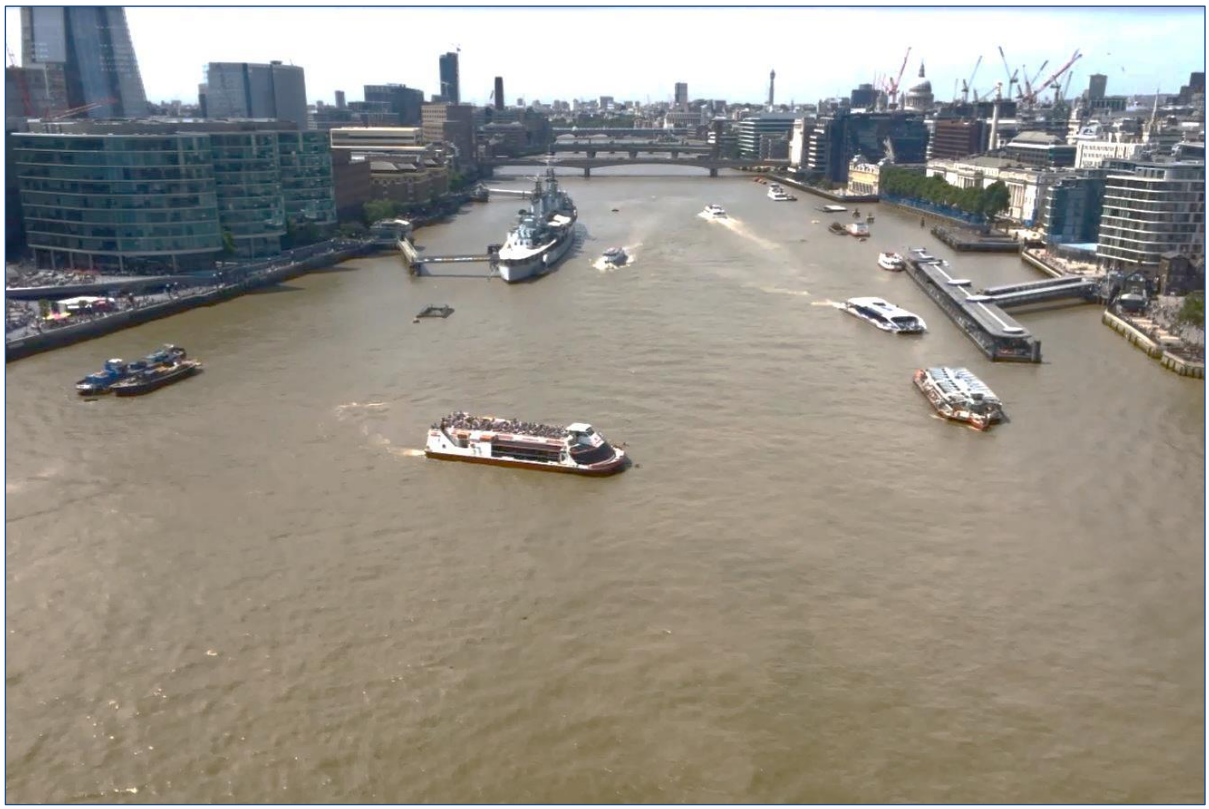
PORT OF LONDON AUTHORITY & TRANSPORT FOR LONDON

ASSESSMENT OF VESSEL TRAFFIC CAPACITY ON THE RIVER THAMES IN CENTRAL LONDON



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ASSESSMENT OF VESSEL TRAFFIC CAPACITY ON THE RIVER THAMES IN CENTRAL LONDON

Prepared for: Port of London Authority & Transport for London

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Cover image: view from Tower Bridge towers London Bridge - 3rd July 2015, source: Marico Marine.

EXECUTIVE SUMMARY

Introduction

The River Thames in Central London is one of the most complex, and at times busiest, waterways in the world. Over the next 20 years the river will see considerable change to the types and numbers of vessel traffic users coupled with the construction of several major infrastructure developments. This change will require careful, strategic management to ensure that the safety of navigation is not compromised and that the waterway does not become overly congested.

This study was jointly commissioned by the Port of London Authority and Transport for London as part of the evidence base for the Thames Vision project with the goal of "*planning for the river's future, so that we can make the most of its potential for the benefit of all*". This study focuses on identifying how capacity in Central London can be maximised to support the growth of vessel traffic.

Capacity was defined in two categories; the Level of Service and the Level of Safety. The Level of Service describes the capacity of the system to support free flowing traffic and avoid congestion (navigation capacity) and the availability of sufficient pier berths (pier capacity). The level of safety is a measure of navigational risk.

Thames Traffic Model

The assessment of capacity was achieved through further development of the Thames Traffic Model following research undertaken in 2011-2012 as part of the Central London Traffic Study. The Thames Traffic Model is an innovative simulation of real vessel traffic enabling robust quantitative modelling of the behaviour of vessels on the Thames. The model was optimised for peak operational periods (July and August 2014), when passenger vessels and recreational traffic are at their greatest. This enabled accurate characterisation of vessel collision risk in Central London based on a variety of parameters including vessel speed, type, and location.

Capacity for Navigation

The capacity for navigation was measured using an approach adopted from road transportation, namely Level of Service (LOS). Translated to Central London the LOS for navigating vessels was determined. The Navigation LOS utilises the principle that as the density of traffic increases, the utility of the waterway decreases and congestion develops. Navigation LOS was split into the following categories:

- LOS A - there is unobstructed navigation with an empty waterway;
- LOS B - the waterway is below capacity with free navigation;

- LOS C - vessel traffic is near or at capacity, some congestion is developing; and
- LOS D - the waterway is over-capacity with a breakdown in the free flow of vessel traffic showing congestion, queueing and a reduction in vessel speeds.

The results of the analysis show that there is considerable capacity available on the Thames for much of the day, however in certain locations, and at certain times, there are significant increases in vessel density causing the river to exceed navigational capacity. This phenomenon has been described as "bunching", where a waterway can develop from being empty to overcapacity in a very short time. **Figure 1** shows the proportion of the peak operating period where Navigation LOS of certain levels is reached in different sections of the river. LOS C and D are reached regularly during peak operational hours in Section 2 (Westminster Bridge to Charing Cross Rail Bridge), Section 3 (Charing Cross Rail Bridge to Waterloo Bridge) and Section 7 (London Bridge to Tower Bridge).

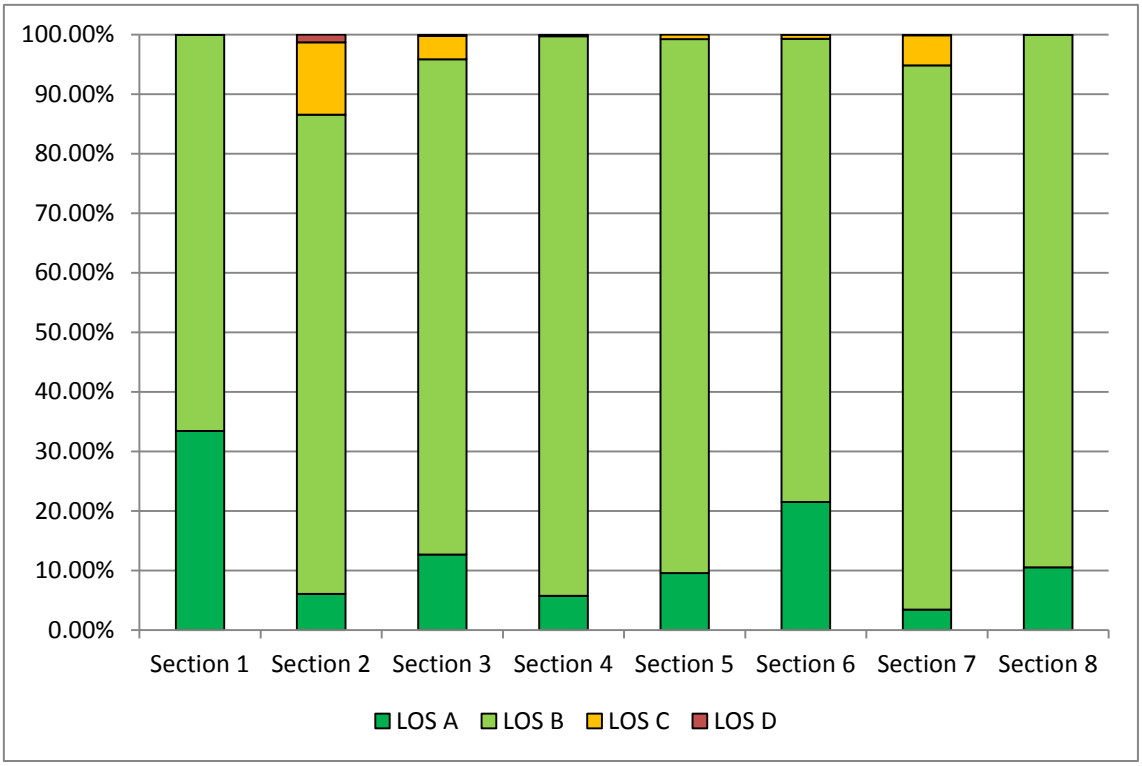

Figure 1: Distribution of Level of Service between 10:00 and 20:00.

On average, navigation capacity is reached somewhere in the system when 18.1 minutes of vessel movement occurs in any one minute period (note this does not equate to the number of transiting vessels as many vessels frequently berth alongside piers). The analysis shows that capacity is exceeded with one specific section reaching LOS D with only one additional transiting vessel per minute. This small difference suggesting an inherently unstable system during peak capacity times which is brought about by the non-linear nature of traffic flow based on the "bunching" principle

mentioned above. On only one occasion was capacity concurrently exceeded in two sections of the river simultaneously, emphasising the significance of bunching as a limit to capacity.

Pier Capacity

Pier capacity in London is dictated by the available number of berths and the numbers of vessels wishing to use them. The number of vessels berthing or waiting to berth each minute at each pier was determined for three weeks of data. **Figure 2** shows that there are available berths on average for much of the day; even during the worst hours capacity is not reached for 90% of the time. The exception is Embankment Pier and Bankside Pier with considerable demand exceeding the current availability of berthing space. Furthermore, new berths may be required to support additional services during peak hours, or steps should be taken to better utilise the 90% of the day with available capacity.

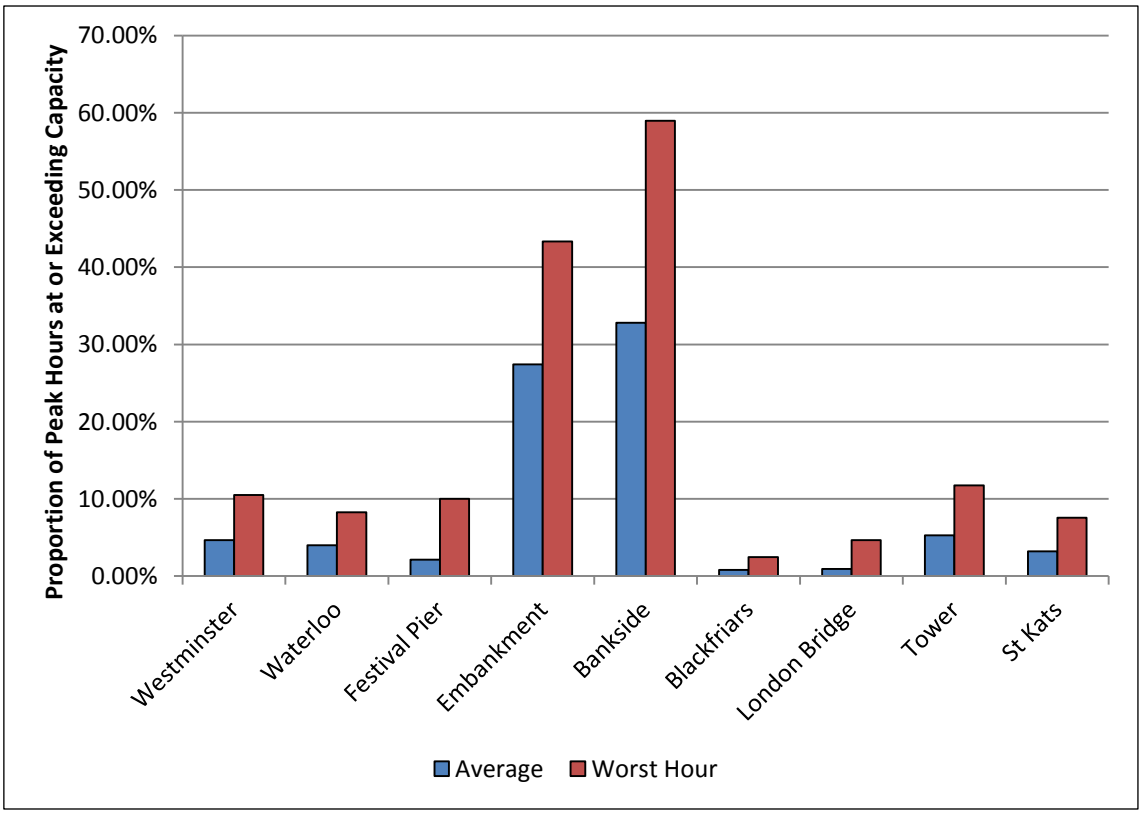

Figure 2: Proportion of time at or exceeding capacity.

Level of Safety

The Thames Traffic Model was refined and adapted to also calculate collision risk for vessel navigating in Central London. The Level of Safety was measured by estimating the probability of a major incident occurring using the model. **Figure 3** shows the distribution of risk across the study area. The greatest risk is determined to be adjacent to Tower Pier and *HMS Belfast* where vessels

berthing at Tower Pier encounter vessels transiting past the pier – through traffic. Other localised hot spots were identified in the vicinity of Westminster/London Eye, Bankside Pier and Coin Street Moorings.

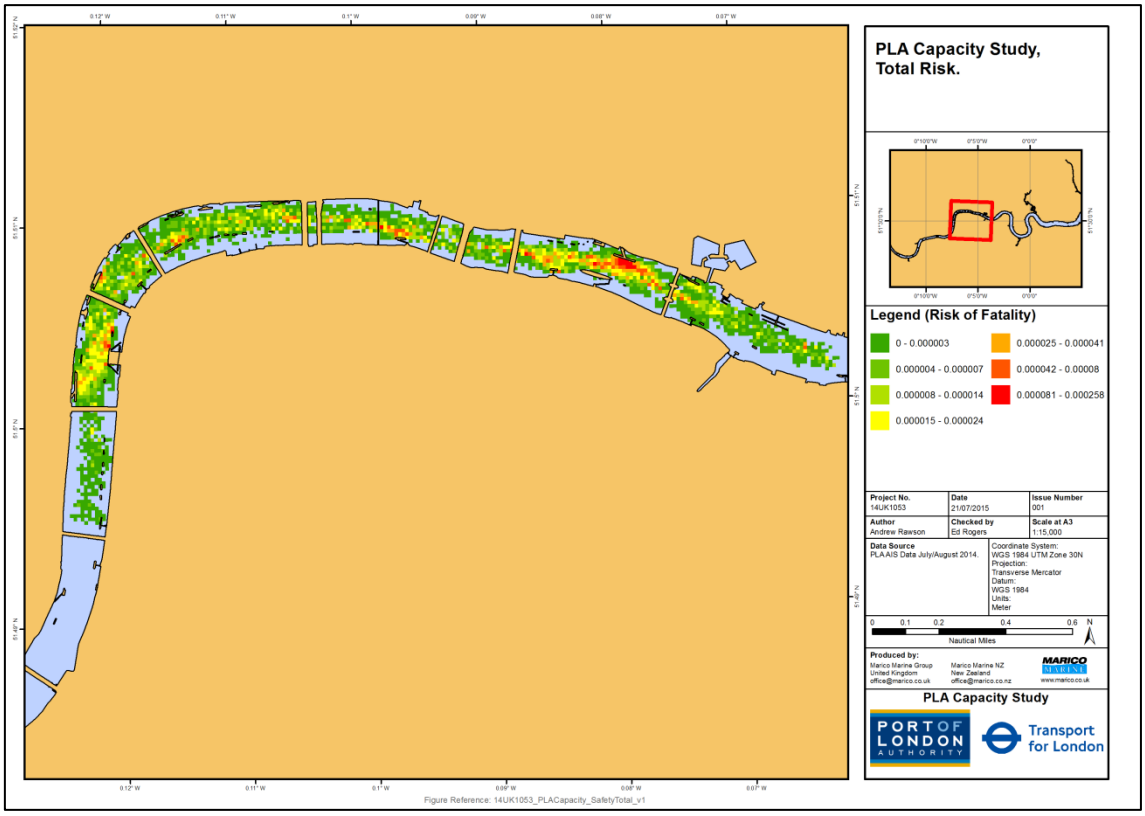

Figure 3: Total risk across study area.

Anticipated Future Demand

The current and anticipated demand for new services was also considered. In the next 10 years there are expected to be a significant increase in passenger journeys which may require up to the equivalent of nine additional passenger services to meet this demand. Furthermore, projects such as Thames Tideway Tunnel will place other demands for freight transportation (note the scope of this study explicitly excluded Thames Tideway Tunnel vessel activity).

Factors which Impact Capacity

A number of current activities and predicted changes in navigation on the river Thames will limit the capacity for new vessel traffic; their impacts were modelled and discussed. These include:

- Analysis of the impact of closing bridge arches showed the likelihood of a collision almost doubled in the vicinity of the bridge, equating to a 4% increase in the total likelihood of a collision over the whole study area;

- "Bunching" was shown to be a major limiting factor for navigation capacity. Vessel traffic could more than double even during peak times without current capacity being exceeded if steps were taken to smooth the flow of traffic;
- The impact of mooring cruise ships at *HMS Belfast* was analysed and shown to increase the likelihood of a collision adjacent to Tower Pier by between 15% and 30%, which equates to approximately 5% across the whole study area. Half of this increase is associated with transfer vessels between the cruise ship and Tower Pier;
- Without changes to the management of navigation, general increases in vessel traffic would have a significant impact upon both safety and level of service. A 20% increase in vessel traffic would result in a 50% increase in the likelihood of a collision. The same increase in traffic would double the proportion of time that capacity is reached or exceeded; and
- A potential reduction in the quality of skippers could increase risk if steps are not taken to increase the numbers of experienced masters to meet the demands of new services.

Measures to Increase Capacity

To cope with this increase in demand, a number of measures to increase capacity were considered. These were:

- Improving the design of passenger and freight vessels to reduce risk;
    - If towed barge freight vessels were replaced by pusher tugs, a reduction in the likelihood of collision involving these vessels by between 4% and 17% could be expected;
    - For passenger vessels, replacing the less manoeuvrable tunnel boats and single screws with twin screw equivalents would reduce the likelihood of a collision by 2% but the risk of a serious collision by between 5% and 14%; and
    - Improving the survivability of all passenger vessels to modern standard could also yield a 17% reduction in the risk of a serious collision on the Thames.
- A freight movement on average encounters 4 other vessels during a 40 minute transit through Central London and has a higher than average potential consequence. If rescheduled to occur at night these encounters would be reduced significantly;
- The removal of Coin Street Moorings would increase the navigable waterway by 30%, reducing congestion. Safety would also be improved, at the maximum benefit the collision risk in this section could be reduced by 43%;
- If speed limits were reduced from 12 knots to 10 knots or 8 knots, the risk of serious collisions would decrease by 9% and 26% respectively. However this risk would be negated by the loss of capacity which would require additional services to be implemented and consequently risk would increase with little benefit being evident;

- An analysis of current timetables revealed that they are unrealistic for peak summer periods and contribute to the "bunching" of vessel traffic. Efforts to better manage timetables between operators would both improve capacity and reduce risk;
- Vessel queuing for free berths at piers occurs regularly on the river and has both service implications and safety implications. Detailed analysis at Embankment Pier showed that a vessel was unable to berth due to insufficient capacity on average 11 times per day and account for 4% of all encounters in this reach of the river. These impacts could be reduced by designating pier holding areas or increasing berth numbers;
- Altering passage plans of services to enforce clockwise navigation would significantly reduce risk but would also make a number of services untenable; and
- Improved pier management could also be implemented to reduce the conflicts at piers and improve the efficiency of the Thames.

Recommendations

Following a review of the analysis completed as part of this study, the following recommendations were developed:

1. Timetables should be collaboratively developed between all operators, London River Services and the Port of London Authority as it serves as the most potent traffic control measure to smooth traffic flow. The development should use modelling to reduce the timetabling conflicts between operators that result in multiple vessels in the same reach at the same time (bunching) or requiring pier berths at the same time;
    a) The timetable should be realistic, reflecting the actual loading times and transit times of vessels. If vessels are regularly unable to keep to their timetable, a review would be required;
    b) Delays on services, including those delays caused by vessels belonging to the same company, should be measured and used to inform annual reviews of timetables; and
    c) Timetables should be strictly enforced, particularly at piers, to prevent service schedules coming into conflict.
2. Pier capacity should be increased before any new services are agreed. In particular, Embankment Pier and Bankside Pier most regularly reach capacity at current traffic levels and should be extended to reduce congestion. Extensions at other piers would also be required before the system could support additional services;
3. Passenger Boat operators should be encouraged to modernise their fleets, both in terms of manoeuvrability and survivability. A reduction in the numbers of heritage Class V vessels using the Thames in Central London would significantly reduce the total risk. In order to progress such

a recommendation, review current MCA Passenger Boat Certifications including "Grandfather Rights". This would constitute a long term goal for natural turnover of the current fleet. This process could however be expedited through a "scrap and build" policy, although this would require significant funding and support;

4. Freight operators should be encouraged to utilise more manoeuvrable pusher tugs rather than articulated tug and tows where operationally possible. The Thames Tideway Tunnel expansion of freight operations may serve as an impetus for this action;
5. Alternatives to mooring cruise ships alongside *HMS Belfast* should be considered. Vessels moored here have significant impacts on both traffic flow and safety in this section of the river;
6. Whilst a cruise vessel is moored alongside *HMS Belfast*, bunkering activities of the cruise ship should be avoided outside of peak hours of vessel activity on the Thames;
7. Any infrastructure project impacting on the authorised navigation channel, either directly or in-directly, should only be consented on navigation related grounds if it can be proved to have no effect on the Level of Service (navigation and/or pier) as well as the Level of Safety in Central London as per the requirements of the PLA's River Works License system;
8. Schedule as many freight movements as feasibly possible to occur outside of peak passenger operational hours where the impacts on navigation are much more significant;
9. Consider the removal of Coin Street Moorings to improve both traffic flow and safety;
10. Where possible schedule routine works, for example bridge arch closures, to occur outside of peak summer months. This will not be possible for all closures, such as following an incident or major inspections however each arch closure has a significant impact on navigation;
11. Consider if designated holding areas to mitigate the impacts of vessel traffic waiting for a free berth at piers should be implemented. A holding area would be a marked section of river where vessels should wait until a berth is available without obstructing other navigating vessels;
12. Improve the sharing of information between operators by making each operator's passage plan available for all masters. This would improve the situational awareness of current masters, and support the training of new masters who would be more informed of the intentions of other vessels without requiring several years of experience to develop such an understanding;
13. Review the criteria employed by London River Services for allocating berths to Party Boats on busy passenger piers in order to minimise the potential for disrupting timetabled vessels berthing;
14. Port of London Authority should review its available powers if a greater ability to enact change is required. Collaboration with operators and London River Services may also be required to progress these recommendations; and

15. Capacity should be reviewed by the Port of London Authority at regular intervals and when significant projects arise, to assess the changes in level of service and level of safety as a result of policy decisions and review whether any further actions should be taken. Furthermore, it is recommended that this initial capacity assessment should be reviewed within three years to compare the changes in service and safety to the forecasted gains of those recommendations from this report which have been enacted by the Port of London Authority.

Summary

The analysis presented in this study has shown that capacity in Central London is not being effectively utilised. At present the system is prone to localised and dramatic increases in vessel traffic which cause bottlenecks limiting capacity in the river as a whole. The Level of Safety was found to be the greatest limitation on the capacity for additional traffic. Whilst the Level of Service and pier capacity having significant scope for improvement, it would be more challenging to increase services without increasing risk. If action is taken in line with the recommendations of this report, a 20% increase in capacity by 2020 to meet forecast demand would be achievable without an increase in current risk levels.

There is significant scope to increase the capacity of Central London for river traffic. This report identifies a number of recommendations which should be considered to support this growth without compromising the efficiency or safety of the Thames.