4 New Bridge Options

4.1 Alignment

There are three possible locations for siting a new bridge close to the proposed alignment of the Quietways 14 route as shown on Figure 5 below.

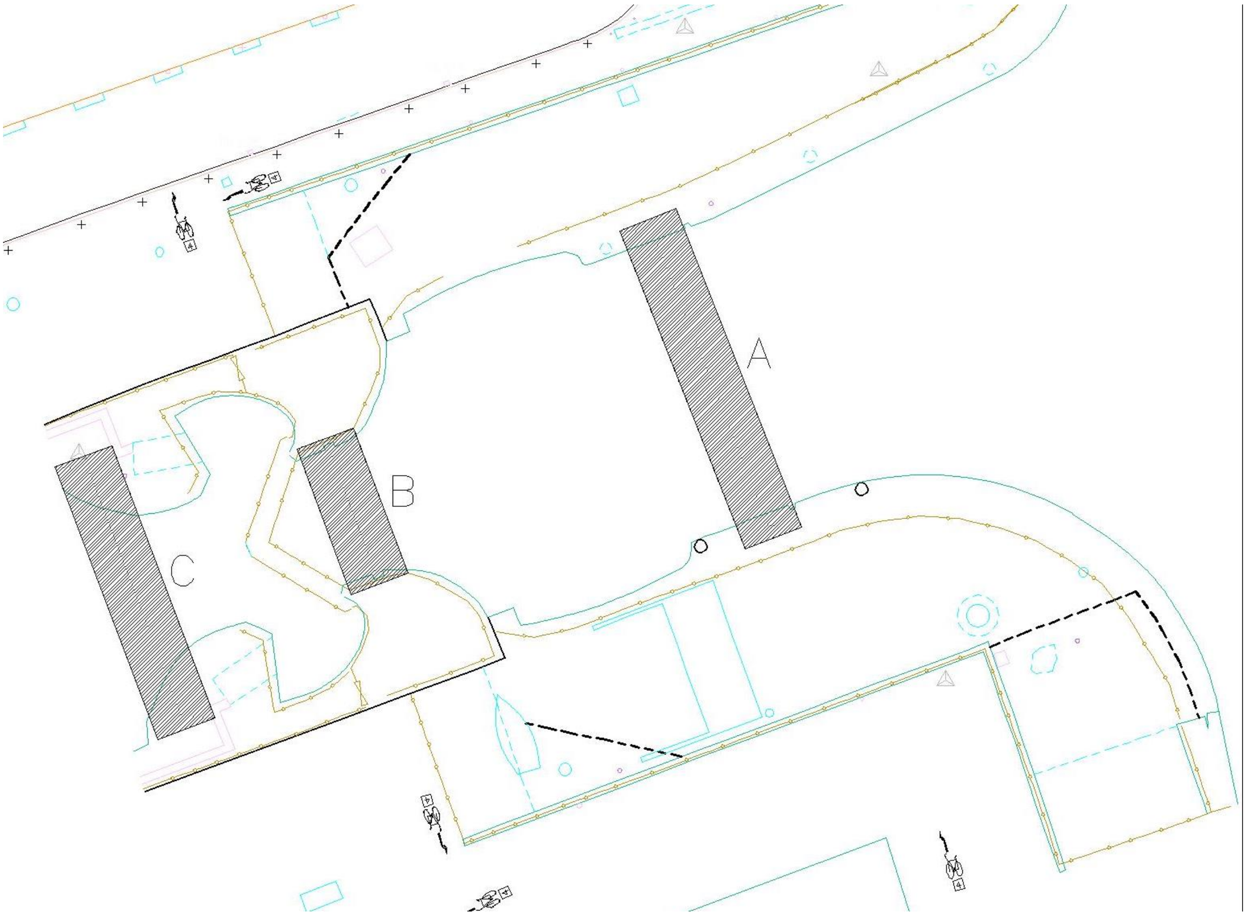

Figure 5 – Possible alignments for new bridge

Position A – Near the mouth of the dock. The bridge in this position would need to span a minimum of 15.5m between river walls although this would need to increase to over 20m in order to position the foundations behind the river walls. The foundations for any bridge at this location will need to be piled to sound material level as the material behind the river wall is fill and we do not want to exert any further pressure on the wall in this location.

This alignment would be the minimal deviation for the Quietways route which runs close to the river on either side of the dock.

Position B – At the narrowest part of the dock where the clear distance between the dock walls is 6.6m. This would minimise the span of the bridge however would need to ensure that there is no conflict with the opening or maintenance of the lock gates. The lock wall at this location appear to be mass concrete although there are no record drawings which show the make up of these elements so further investigation works will need to be undertaken if we want to incorporate these in the new bridge as foundations.

Position C – This is within the envelope of the lock system that leads to the dock. The clear span at this location varies from 7m to 13m. The concrete structure on which the bridge would land houses the hydraulics for the lock gates for which easy access needs to be maintained. It is therefore unlikely that this position will be acceptable to the Harbourmaster's team. Furthermore the bridge would need to remain open throughout the lock cycle which would result in it being unusable to pedestrians and cyclists for a large amount of time.

4.2 Approaches

There are various steps and changes in level in the vicinity of the lock gates or where a new bridge may be sited which will need to be addressed to allow cyclists access to the bridge. These will need to be made of a similar width to the bridge.

4.3 Materials

To keep the weight of a new bridge to a minimum we have considered a new bridge formed from steel or Glass Reinforced Plastic. We have not pursued the use of stainless steel to any great extent because of the high cost of it and the relatively small gauge sections generally available, however when a final design is selected this can be reviewed considering whole life costs.

The use of weathering steel was also considered however it is not recommended for use in coastal areas, or regions within a couple of miles of the sea. The Thames at this location is saline, so weathering steel should be avoided.

4.4 Discounted Options

We considered all types of moving bridge, both modern and traditional when developing our options for the new bridge. We did not develop some options beyond first consideration because they would not, in our consideration, be viable. The solutions rejected were

i) Lifting Bridge – These require significant sub structures and mechanical equipment. Uneconomical for this size of structure;

ii) Traditional Bascule Bridge – The amount of substructure required for a traditional bascule bridge, similar to Tower Bridge at this location makes it unfeasible.

4.5 Options Description

4.5.1 Position A – Swing Bridge

A cable stayed swing bridge stiffened using a pair of cable stays to minimise bending and displacement in the main span. The single stay will have sufficient load to remain taught at all times and will be of sufficient size to be robust. A simple deck structure uses main longitudinal beams to support the deck which could either be formed using a stiffened steel plate or alternatively using cross beams with a timber deck spanning between them. These two alternatives would both be of similar weight, however the all steel option would be more stiff which has benefits to the use and operation of the structure.

The balance of the bridge will be achieved by including a counterweight above deck level in the back span.

The two planes of cable stays are supported by a pair of steel pylons which are linked together at deck level. Above the deck they are simple hollow sections with a fin plate at the top to connect the stays to. Introducing a single pylon along with a single plane of cables on the bridge was investigated but discounted when the additional width and extra torsional stiffening that would be necessary for the deck.

The nose of the deck would be supported on a pair of wheels that would run up a shallow ramp as the bridge returns to its closed position to support the nose when pedestrians use the bridge. The bridge could be operated either electrically or hydraulically if easier to maintain along with the existing operating system.

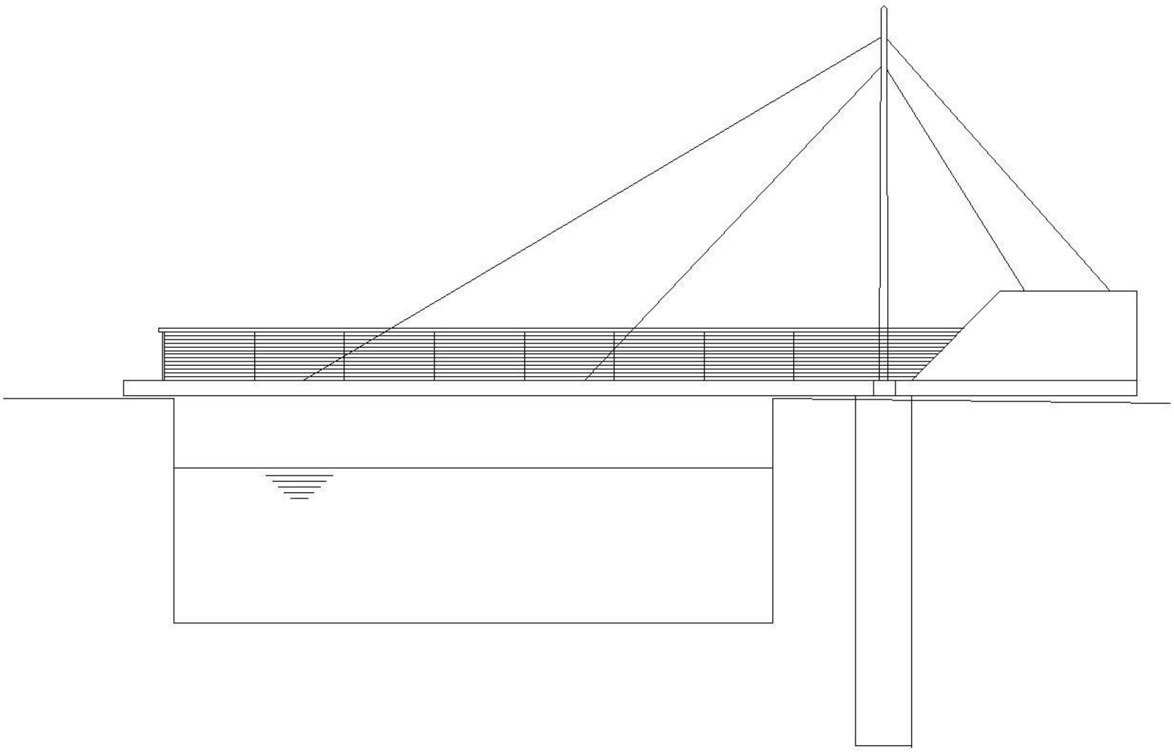

Figure 6 – Cable stayed swing bridge

The requirement to keep the channel clear of sub structure will increase the cost of this option because the need for a balancing back span extends the bridge over the river walk where it is not necessary for access reasons. Effectively building 5m of bridge that is not required for access.

4.5.2 Position A – Rolling Bascule Bridge

This form of structure is often seen in dock environments where deep substructures can cause problems. The bridge is formed from a 1.5m deep truss in which the top chord also acts as the handrail. The deck needs to be kept as light weight as possible to minimise the energy required to raise the deck.

The lifting is brought about through a winching cable that pulls down at the back of the counterweight leg at the rear of the deck, or alternatively could be by a hydraulic ram fixed to the pivot point of the structure if more economical.

It is necessary to install a high grade steel surface for the bridge to roll on as it is raised or lowered.

It would save a significant amount of weight if this bridge was fabricated out of Glass Reinforced Plastic, however the costs and the risks associated with that are excessive at this time.

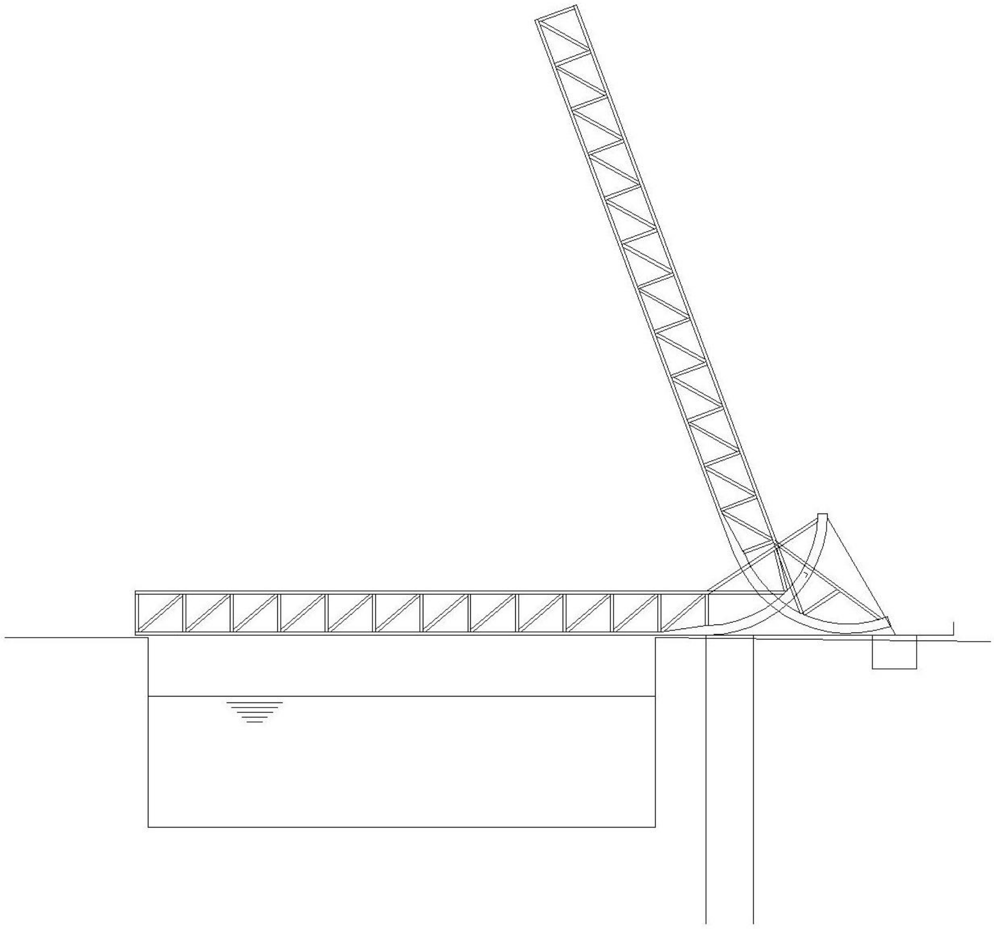

Figure 7 – Rolling bascule bridge

4.5.3 Position A – Dutch Style Bascule Bridge

There is a Dutch style bascule bridge in South Dock already, on nearby Rope St. This again provides a bascule bridge solution efficiently without requiring very large sub structures. The high level counterweight offers an efficient means of raising the bridge without requiring significant mechanical force. The footbridge would be much narrower than the road bridge at only 3m wide.

Figure 8 – Rope Street Bridge

4.5.4 Position B – Roll Out Bridge

Over the shorter span close to the lock gates it is possible to use less traditional forms of moving bridge such as a roll out or launched span. This can be formed from a truss section approximately 1.5m in depth to allow the top chord to act as the parapet rail.

When the bridge is in position over the dock the bridge is simply supported on a roller at the leading edge of the bridge and rollers set into the bridge foundation on the other side of the dock. To open the bridge the truss is retracted by a rack and pinion mechanism and is supported on the wheels set in to the bridge foundation and a set of wheels set at the back of the truss which resist the moment introduced when the bridge loses support at its leading edge.

The loads place on the substructure by this bridge are minimised, hence it is assumed that the bridge could be built on the existing quay gate structure with perhaps steel plates to spread localised forces as necessary.

This is preferred to the option of moving the bridge through a hydraulic ram beneath the deck which would be susceptible to high waters in the dock.

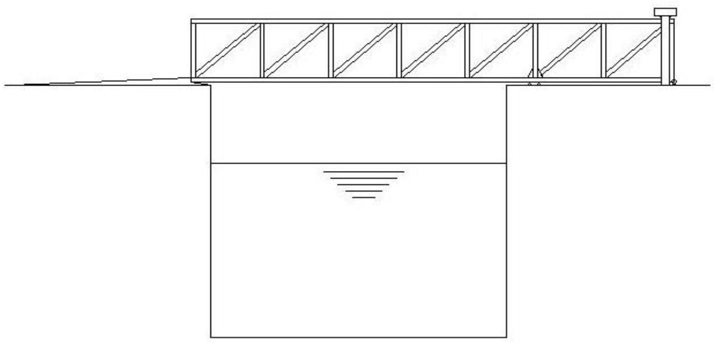

Figure 9a – Bridge in closed position

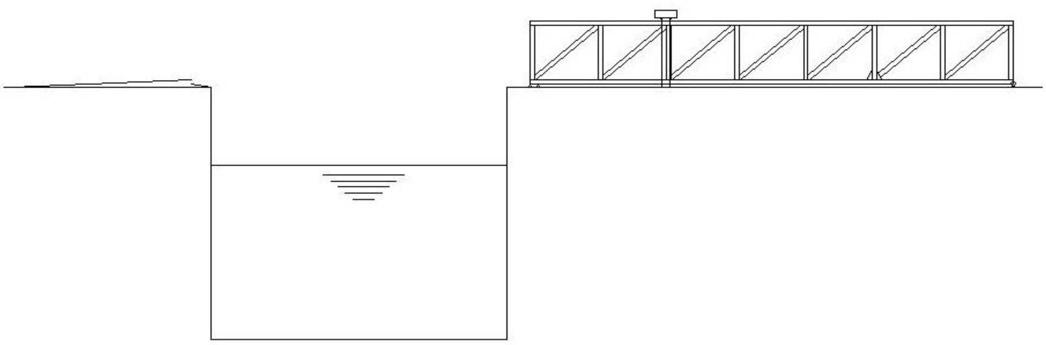

Figure 9b – Bridge in open position

We have investigated adapting the lock gates opening equipment to link the opening of the gates to the opening of the bridge however this would be difficult and is likely to increase the weight and cost of the new bridge.

6 Conclusions and Recommendations

Not surprisingly the smallest of the new bridge options (*Position B – Roll Out Bridge*) is the most economical. At the location where the quay is narrowest there is a limit placed on new bridges by the operation of the adjacent lock gates which makes the proposed ‘roll out’ bridge the most practical option, minimising the amount of enabling works required. We have assumed in our pricing that the existing quay gates concrete structure, which appears to be substantial, can support the relatively light loads applied by the new bridge. If there is no further development in finding the details of the existing quay gates structure we made need to undertake some investigative works to determine the capacity of these elements.

A further benefit of the ‘roll out’ structure is that in the event of a mechanical malfunction it will be easy to introduce a manual override to allow the bridge to be retracted and not interfere with operation of the quay.

From a controls perspective it would be easiest and best to add a wider walkway to the top of the existing lock gates. The requirement for this to be 3m wide does make this a high risk solution because of the additional weight being applied to the lock gates, for which we have no details. If there is any flexibility in the required width of the bridge this could become a more attractive option because of the increased likelihood that the lock gates can accommodate the new structure without significant strengthening and adapting.