

The Talk on 6 October 2010 was by Malcolm Tucker, on Movable Bridges in London's Docks.

Edward Sargent introduced Malcolm Tucker, who, as well as being our present Treasurer, has been a member of the group for many years and is a Civil Engineer and an expert in industrial history.

Malcolm explained that movable bridges were needed in the docks, where entrance locks and passages presented obstacles to pedestrian and wheeled traffic. When walking over lock gates or going around the landward side was no longer feasible because of the size of the docks and the interruption of public roads, movable bridges were introduced.

The Dutch used wooden bascule bridges with overhead counterbalances, but they had a limited span which was not sufficient for West Indiamen to pass through. In 1802, when the West India Docks first opened at Blackwall, requiring a span of 45 feet, Ralph Walker used two half swing bridges made of wood. Next, John Rennie at the London Docks installed the first cast-iron swing bridges. He used a long counterweight to counter-balance each leaf when it was swung, rotating on a pivot and a roller track, while the lower parts of the bridge became an arch when the two halves joined. He devised hinged legs that could be lowered by racks and pinions to ensure the arch was firmly seated. But later it was found, by careful attention to the fit of the parts, that a bridge could ease itself down onto fixed arch bearings when the bridge swung closed. It was important that there was a narrow gap around these bearings, curved in plan, while the bridge was being swung, to avoid frictional drag and wear. In the Eastern Dock of the London Docks in the 1820s, the engineer Henry Palmer used a tall central pivot which assisted this action through its geometry. From this time until the early 1850s, cast-iron swing bridges were installed all over country.

Malcolm showed photos he took in 1974 of one such bridge which had spanned the Hermitage Passage in the London Docks since 1820 and which was subsequently stolen by scrap merchants. It was of thick cast iron but not all that strong, and had been much repaired with riveted plates after impact damage. One bridge, at Tobacco Dock, was rebuilt using stronger cast steel when the passage needed widening around 1910.

Malcolm showed a plan of the turntable of Telford's bridge of 1828 at the St. Katharine entrance lock, constructed with precision so it would easily swing. The retracting bridge there of 1829 across the Eastern Dock Passage worked on a different principle, withdrawing longitudinally into recesses in the quays. Each half trundled 22½ feet backwards on wheels and the handrails had to be lifted out because the pit was covered over. A hand wheel drove each leaf through a pinion and rack. A design drawing shows the unusual cast-iron rails that were originally used and which have survived reused as part of the ballast in the all-important counterweight boxes. The half-spans have to work as cantilevers and are a combination of cast iron with wrought iron for strength, modified by the contractor, John Lloyd, who had experience in building early iron cranes. A new motorised bridge on similar principles is now in place to cope with possible high loading from crowds, with the old bridge displayed on the quay.

Wrought-iron bridges were of stronger and thinner, malleable material, more expensive but lighter. Attempts were made to improve the look of early wrought-iron bridges by hiding the rivets. There was a wrought-iron swing footbridge like this, externally resembling a cast-iron bridge, over South Dock of the Surrey Commercial Docks in the 1850s, now preserved in a fixed position across the Norway Dock Passage. Another swing footbridge of 1862 in the Surrey Docks had stays – and it is today on display at the South Dock Passage. A single-leaf retracting footbridge built in the Surrey Docks in 1868 resembled a lattice crane jib on wheels.

The 1860 Grand Surrey Entrance swing roadbridge was of plate girder construction, clear-spanning over 50 feet from a single pivot. It had a curious bottle-shaped elevation, as also did the 80-foot bridge carrying the Silvertown Tramway at the western end of the Victoria Dock (both of these designed by George Bidder). Later swing bridges had a more uniformly curved, hog-backed profile, such as those at each end of the Royal Albert Dock of 1879. There, at the Connaught Passage, a combined rail and road bridge had massive girders of box section, i.e. with two plates side by side.. A major builder of such bridges was Westwood Baillie and Co. of Millwall. Below the bridge, cross girders were placed at ninety degrees across the turntable, which was turned by chains worked by a pair of hydraulic rams – the arrangement has been preserved at Connaught Passage and at Russia Dock Passage in the Surreys, which Malcolm illustrated. A hydraulic jack at the central pivot carried most of the weight while the bridge was turning. The hydraulic machinery was usually supplied by Armstrong's. In the Surreys, the preserved Greenland Entrance footbridge has lattice construction, and the hydraulic gear that worked it is nicely displayed..

In 1929, the new 80-foot passage joining the Millwall and West India Docks was spanned by a steel trussed swing bridge for dock rail and road. Malcolm showed one of the hydraulic jacks that temporarily lifted the bridge so that wedges which supported the bridge in its fixed position could be removed and the bridge then lowered onto the rollers on which it turned. At the King George V Dock, an even heavier swing bridge of 200 feet overall length spanned a 100-foot passage on the diagonal.

Malcolm then moved on to movable road bridges that did not swing. The Glengall bridge of 1867 across the middle of the Millwall Docks retracted longitudinally, being pulled backwards over rollers. Before that could be done, a hydraulic jack had to lift one end over the roadway. A member of the audience told how it was damaged in the War and temporarily replaced by a swinging pontoon made from a barge. It was rebuilt as a footbridge opened in 1964, with a high level walkway and a bascule span, making it independent of the docks. Tower Bridge is the best-known bascule bridge, opened in 1894. Bascules lean inwards slightly and in the docks the span would have to be increased beyond the edges of the quays to prevent tall ships fouling them, which is why this design was not more widely used. The bridge of 1920 that carried Woolwich Manor Way over the King George V entrance had two bascule leaves. "Bascule" is a French word for a see-saw.

In 1893 William Scherzer of Chicago patented the widely used rolling lift bridge, which rolls back like a rocking chair but tilts through a full 90 degrees. There is a water-filled counterweight above the tail. It has electric motors to wind itself back along racks at each side and cogs on the rolling surfaces to hold it in place without slipping. There are two from the 1930s at the London Docks Shadwell Basin and two in the Surrey Docks, none now working, and formerly there were double-leaf examples at Tilbury and the West India Docks.

The present "Blue Bridge" over the entrance lock to the West India Docks at Manchester Road is a bascule bridge of 110 feet span, counterweighted at high level on the Dutch principle, but worked by hydraulic motors upon racks. It was designed in-house by the PLA and completed in 1969.

The vertical lifting bridge for the railway at Deptford Creek was not included in the talk since not within the Docks.

During questions, Edward Sargent said he understood that a number of movable bridges were recommended for listing in the early 1980s, but the Government declined because of the possible impediment to infrastructure improvements.



The retracting footbridge of 1829, St Katharine Docks Eastern Dock Passage, viewed from the south-west from the former 'H' Warehouse in May 1970. Photo Malcolm T Tucker,



Swing road bridge by John Rennie, c.1816-20, at Hermitage Passage, London Docks, now destroyed. (MTT photo 30 03 1974)



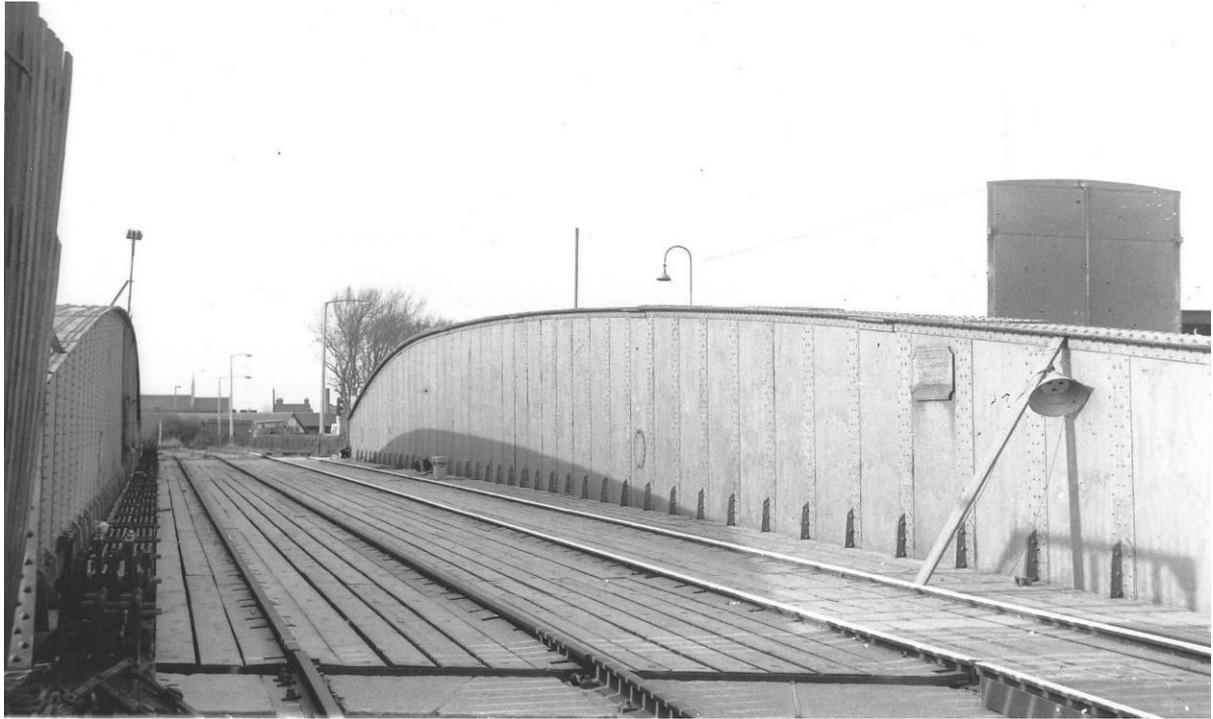
Preserved slewing rams of swing footbridge at Greenland Dock entrance lock, c. 1904. (MTT photo 21.07.1988)



Fragment of edge girder and cross girder of 1895 swing road bridge, St Katharine Docks, demolished 1973 and at one time displayed as a sculpture. (MTT photo 10.10.1981)



Detail of tail of Scherzer rolling lift bridge of c.1939 at London Docks Shadwell Entrance, Glamis Road, Wapping. (MTT photo 03.02.1996)



Combined road and rail swing bridge of 1879, Connaught Passage, Royal Albert Docks.
(MTT photo 29 03.1972)



Double bascule road bridge of 1920 for Woolwich Manor Way, King George V entrance lock
in foreground. (MTT photo 29.03.1972)