LONDON BRIDGE
Spanning manmade channel between Lake Havasu
City mainland and island at McCulloch Blvd.
(Relocated from the Thames River, London, England)
Lake Havasu City
Mohave County
Arizona

HAER No. AZ-57

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Department of the Interior
1849 C Street, N.W.
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Location: Spanning manmade channel between Lake Havasu City mainland and island at McCulloch Blvd., Lake Havasu City, Mohave County, Arizona.

Date of Construction: 1824-1831; relocation-reconstruction 1968-1971.

Architects: John Rennie and his son Sir John Rennie, original architects.

Builders: Jolliffe and Banks, original contractors; Robert Beresford, relocation-reconstruction builder.

Present Owner: Lake Havasu City, Arizona

Present Use: Pedestrian and vehicular bridge.

Significance: London Bridge is more significant for its fascinating history and the people involved with its construction than for its technological innovation. Completed in 1831, it had a long and useful tenure carrying heavy commuter traffic ina nd out of the city's southernmost end. In 1967, the city of London elected to demolish the famous but deteriorating bridge and put its stones up for sale. McCulloch Properties of Arizona, needing a tourist attraction to spur growth for their new Lake Havasu City, soon purchased it for over $2.4 million. The following year, ten tons of its original stone were removed and transplanted to the Arizona desert for reconstruction. The new bridge itself is actually a concrete structure, but the original London Bridge facing stones and the 1902 balustrade and corbels give it an authentic appearance. It is situated along the shores of the manmade Lake Havasu in the midst of what has become a popular vacation area, in part due to its presence there. It is also a testament to the creativity of the founders of Lake Havasu City, Robert P. McCulloch and C.V. Wood, who were responsible for bringing the London Bridge, in Wood's words, "from the oldest English-speaking community in the world...to the youngest English-speaking city."

Historian: Katherine Larson, HAER
May 1999

Sources: Jackson, Peter. London Bridge. Lake Havasu City, AZ: McCulloch Properties, Inc. in association with Cassell & Co. Ltd. of London, 1971.

Reyburn, Wallace. Bridge Across the Atlantic: The Story of John Rennie. London: George G. Harrap & Co., 1972.

London Bridge, which originally spanned the Thames River in London, England, was commissioned in 1823 to replace the failing 1176 London Bridge, which in turn had replaced a series of wooden bridges infamous for falling down in the popular children's song. The old London Bridge, despite a 1760s renovation, had become unsafe. The constant "mill-race"[1] water pressure, along with damage caused by ice in the winter of 1814, was rapidly eroding the old foundations, causing periodic collapses. At the same time, the heavy traffic on the bridge called for widening it further. It was eventually determined that the foundations could not sustain additional weight, and a new bridge was needed. Between 1821 and 1824, Parliament considered numerous plans for a new London Bridge before selecting Scottish engineer John Rennie's design in July, 1824.

John Rennie was already well-known as a bridge builder and engineer, noted for his careful research, inventive genius, and his many significant commissioned works. As a youth, Rennie had apprenticed with miller and industrial engineer Andrew Meikle, inventor of the threshing machine. He completed three years of scientific study at the University of Edinburgh while working as an engineer during holidays, and then worked with James Watt designing mills to hold Watt's steam engines. Bridge design was a large part of his work, but he continued to tackle a wide variety of engineering tasks in a constant quest to improve building methods. He perfected the invention of ball bearings, which he used in his swing bridges and other projects, a gantry system for construction, and even a "diving bell," which replaced cofferdams as a means of constructing masonry bridge foundations below water level.[2] By the time of his design for London Bridge, Rennie had designed numerous structures, including Waterloo and Southwark bridges, and was offered a knighthood by the Prince Regent at the opening of the former in 1817 (which he declined). Unfortunately, he died in 1821, before his proposal for London Bridge was approved by Parliament. His place was taken by his son, also named John Rennie, who made the working drawings and became the sole superintendent and engineer of the construction for the new London Bridge, which was to be constructed adjacent to the old.

The first stone of the new bridge was laid by John Garratt, Lord Mayor of London on June 15, 1825. This ceremony was conducted inside a massive cofferdam, 45' below high water, where the riverbed floor was covered with red carpeting. Several streets were altered or rerouted so that the bridge created a new grand entrance to the city. King William IV and Queen Adelaide presided over the opening of the completed London Bridge six years later in 1831, at which time they knighted Sir John Rennie for his work.

Constructed of over 130,000 tons of granite, Rennie's bridge had five large arches and spanned a 900' wide section of the Thames. John Rennie, in his original plans, had specified that the underwater masonry be hard Leeds sandstone, and the rest "the best grey granite" from Aberdeen, Cornwall, and Devon quarries. His son fulfilled that request. The central arch spanned 150'; the pair of arches flanking it, 140'; and the end arches, 130', with 24' center piers and 22' side piers. The roadway was 45' wide, and

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[1]Peter Jackson, London Bridge (Lake Havasu City, AZ: McCulloch Properties, Inc. in association with Cassell & Company, Ltd. of London, 1971), p. 71.

[2]Wallace Reybum, Bridge Across the Atlantic: The Story of John Rennie (London: George G. Harrap & Co. Ltd., 1972), pp. 38-40.

the total width was 56'.[3]

Over the next 130 years, the London Bridge carried both vehicular and pedestrian traffic. However, it soon appeared inadequate for handling the heavy traffic that crossed it. The London Bridge railroad station was completed five years after London Bridge opened, which ushered in the age of the commuter. All railroad passengers using the station had to cross the bridge to get to the city. The resulting congestion prompted calls for widening the bridge as early as 1852,[4] but a satisfactory plan for doing so was not approved until 1902. In that year the bridge was widened by 14' with granite bracket supports, which made the tops of the spans almost flush with the original piers. A new balustrade was built on each side to replace the old parapets, and the overhanging bracketed sections carried foot traffic on both sides, enabling the widening of the roadway over the old sidewalks. There were now four full traffic lanes crossing the bridge instead of two. The closely-spaced brackets, which resemble curved dentils, remain a prominent aspect of the bridge's appearance today.

As early as 1832, it was observed that parts of the London Bridge were beginning to settle, giving the entire bridge a slight downstream tilt. Engineers at the time had pronounced the bridge perfectly safe. However, it suffered for 130 more years under the weight of constantly increasing traffic, which grew even worse with its 1902 widening and the introduction of automobiles. By the 1960s, cracks had begun to appear, demanding immediate attention. At the same time, a wider six-lane bridge was needed and it was soon deemed impractical to place more strain on the deteriorating bridge by widening it a second time. The city of London accepted a proposal for a new concrete London Bridge and put the old London Bridge up for sale in 1967.

The situation was soon noticed by developer Robert P. McCulloch, chairman of McCulloch Oil Corporation, and his associate C.V. Wood, who were transforming what they had named Lake Havasu City from a desert waste into a resort. Lake Havasu, part of the Colorado River, was formed by the construction of Parker Dam in 1938, and the U.S. Government built an airstrip on a lake peninsula during World War II. The otherwise-unsettled area, known as Site Six, became a recuperation center for wounded servicemen, but was abandoned following the war. While looking for a good inland location to build an outboard-motor testing site for one of his subsidiary companies, Robert McCulloch happened upon Lake Havasu in the late 1950s and soon imagined building a new city there. Good fishing waters and the health benefits of an arid climate added to its appeal. McCulloch Properties, a development-building subsidiary of McCulloch Oil, purchased 26 square miles of shoreline property from the state of Arizona for less than $1 million in 1964. C.V. Wood, president of McCulloch Oil, was assigned the task of creating the city plan. Both men possessed talents in engineering, design, planning, and financial administration, and conceived of the city as having a leisure-industry economic base.

In search of ideas for attracting residents, tourists, and businesses to their remote venture, city founders McCulloch and Wood had done extensive research into the transformation of quiet Anaheim, CA into a tourist haven after the Disneyland theme park opened there in 1955. The two saw in London

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[3]Reyburn, pp. 134, 137.

[4]Jackson, pp. 105, 113.

Bridge an opportunity to make this famous historic landmark the centerpiece of their planned resort and attract businesses and tourists to their community. This coincided with the city of London's desire to sell the bridge as an entity instead of merely selling off its stones for other uses.[5] McCulloch Properties, Inc. bought the London Bridge for $2,460,000 in 1967 and hired British civil engineer Robert Beresford to oversee the demolition, moving and reconstruction of the bridge.

The demolition of the old bridge and construction of the new bridge were undertaken simultaneously and in such a way as to permit traffic across the parts of the bridge not being worked on. A gantry was constructed to lift out the old stones and place the new facing stones on the concrete bridge. Steel rods were driven through all the arch stones of the old bridge to suspend them from the gantry so that individual stones could be lifted out without collapsing the rest of the arch. Each stone block was carefully numbered as it was removed.

The stones were shipped by boat to Long Beach, CA (where U.S. Customs exempted them from fees because they were classified as "a large antique") and then transported by truck to Lake Havasu City. In a formal ceremony reminiscent of the original construction, Sir Gilbert Inglefield, Lord Mayor of London, laid the first foundation stone on September 23, 1968. Beresford used copies of the original Rennie plan during the reconstruction, but also made use of the site's desert location. Carefully shaped sand mounds beneath each arch served as the needed molds during the construction, which took place on completely dry land. The bridge was not long enough to span any portion of the existing waterways in the area, so it was decided that a new waterway would be created for it at the juncture of the old airfield peninsula, making the peninsula into an island. This mile-long channel beneath the London Bridge, known informally as Little Thames, was not dredged until the bridge construction had been completed.

The London Bridge, despite its carefully-constructed and authentic appearance, is not a full reconstruction of the original structure. Of the 130,000 tons of stone that made up the old bridge, only 10,000 tons were salvaged and shipped to Arizona. The bridge itself is essentially a concrete-arch structure, with the old London Bridge granite stones used for facing. Some of the stones themselves are not complete original blocks; instead they are parings of the old facing stones that have been applied to the concrete surface like tiles. The corbeled balustrades have been fully preserved, however, and the bridge as a whole looks "real" to most observers.

The bridge was finished in 1971 and rededicated, again in the Lord Mayor's presence, on October 10 of that year. It carries traffic to and from the newly created island where the city's airport is located on the site of the old military airstrip, so that tourists arriving by air cross it as their first approach to the city. As McCulloch and Wood had hoped, London Bridge became a major tourist attraction and remains the centerpiece and symbol of Lake Havasu City, which was incorporated in 1978.

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[5]Reyburn, pp. 143-147. According to Reyburn, there is no truth to the story that McCulloch, like many people, thought that London Bridge was actually the more picturesque Tower Bridge and was thus disappointed when he realized he'd bought the wrong bridge; however, he admits that in light of this widespread mistaken identity, "more than a few tourists who go there are going to feel let down."