

# THE BRIDGES OF

Houston's bridges, like the bayous they cross, pass through the city largely unnoticed. Though the bayous drain Houston, provided the impetus for its founding, and, in the form of the Ship Channel, contribute mightily to its economy, only in a few places, or during an exceptional rainstorm, does anyone take much notice of them. The same can be said for the bridges that tie the bayous' banks together. Unlike New York, or San Francisco, or even Fort Worth, Houston does not mention its bridges much.

But Houston's bridges are worth looking at, and not just because they play a vital role in the city's infrastructure. The variety of the bridges to be found in the city is remarkable, and many of them are exceptional in their own right. Some are historic, offering up suggestions of an older Houston. Some are superlative feats of engineering. And some are simply handsome structures.

Houston's best collection of bridges is to be found spanning Buffalo Bayou. The city's other waterways are too narrow, and their development too recent, to justify many notable bridges. But Buffalo Bayou was the heart of Houston from the very beginning. Ships traveled its length up to the confluence with White Oak Bayou that marked the Allen Brothers' original townsite, a fact that called for bridges tall and wide enough to clear boats. By 1891, there were already five bridges — all carrying rail lines — across the lower stretch of the bayou. Today there are 18, all but six of them road bridges, and one tunnel.

It may be too simple to say that to understand Houston, one must first understand its bayous, and that to understand its bayous, one must understand the bridges that cross them. But in a city as laced with water as Houston, bridges matter. They're a physical reminder of what's required to knit such a sprawling community together. What follows is a selective trip down Buffalo Bayou, from White Oak to Galveston Bay, with some of its more interesting bridges.

## Main Street Viaduct

When completed in 1912, the Main Street viaduct was by far Houston's largest bridge. Heading north from downtown, it crosses Buffalo Bayou, two rail lines, and White Oak Bayou before returning to ground level. It was the rail-road tracks that determined the bridge's profile: To clear the trains that run along the bayou's edge, the roadway must rise ten yards. Seen at first glance from downtown, the bridge looks like a hill, an illusion aided by the fact that the

University of Houston Downtown's main building fronts onto the bridge, its primary entrance 30 feet above grade.

The best view of the bridge, though, is from the banks of Buffalo Bayou. The bridge uses concrete arches to clear the bayous, even though concrete bridges were something of a novelty in 1912, and a steel bridge might have been less expensive. But the use of arches, a form long considered the most attractive for bridges, and the careful detailing of the

## McKee Street Bridge and Elysian Viaduct



Photo By Christy Speller



Photo By Christy Speller

## Wayside Bridge and Marcario Garcia Bridge

Highway 90 crosses Buffalo Bayou on a pair of swooping bridges, the Wayside bridge carrying southbound traffic and the Marcario Garcia bridge carrying northbound traffic. While ships are rare, Buffalo Bayou is still navigable here, requiring the bridges to span a 60-foot wide channel and have 30 feet of clearance over high water. That clearance is accommodated by the bridges' shape. The two are plate girder bridges, supported by four parallel beams of sheet steel that run from one bank to the other. To widen the roadway, a fifth girder was

later added to each bridge; because they're welded, not riveted, these newer girders stand out. The tops of the girders are curved along their length to follow the roadway's vertical curve; the bottoms are curved in the same direction but more sharply, making the girders deeper at the supports and providing more clearance over the channel. This shape, first developed in Europe in the 1940s, is both structurally efficient and attractive; the Highway 90 bridges are particularly well-proportioned examples of their type.

Next to the curves of Wayside and

# BUFFALO BAYOU

BY CHRISTOF SPIELER

bridge show that this was meant to be a monument.

The bridge's status is confirmed by a 1912 map entitled "Houston: A modern city" that grants the bridge its own vignette. In the picture, the bayou is busy with boats. But even as the image was being created, the dredging of the Ship Channel, and the associated movement of docks downstream, was underway. When the boat traffic dwindled, this section of Buffalo Bayou lost status, and the

later bridges built to cross it here have none of the monumentality of the Main Street viaduct.

*Good views are from Allen's Landing Park and from the jail on the north side of the bayou.*



Photo By Christof Spieker



Photo By Christof Spieker



Photo By Christof Spieker

Past Fannin, Buffalo Bayou enters a landscape of vacant lots and unused park land. Passing by on U.S. 59, one can see two bridges.

The first, the McKee Street bridge, built in 1931, is small but remarkable. Under the road deck, it's a standard concrete beam bridge. Above, it's something else altogether. Unlike in a standard bridge, the beams extend through the

deck to form walls between the roadway and the sidewalk. The beams change height along the length of the bridge, rising as high as a person at the supports but disappearing into the sidewalk in mid-span. This shape actually expresses how the beam carries the weight of the bridge and its traffic. It's not necessarily an efficient design — even if it uses less concrete than a straight beam bridge

would, the extra labor involved in the construction more than eliminates any cost benefit — but it's an endearing one. No other bridge on the upper part of the bayou is as visually interesting.

The building of the McKee Street bridge linked this corner of downtown to the industrial area to the north. But the bayou wasn't the only barrier here; the rail yards that parallel the bayou still iso-

lated the neighborhoods further north. Crossing both the bayou and the yards required a much bigger bridge.

The Elysian viaduct, almost a mile long, was that bridge. Built in the mid-1950s, it was the first long elevated structure in Houston, foreshadowing the freeways to come. It is a series of fairly short spans, supported on steel girders that are deeper top to bottom at the supports than at mid-span. To allow Interstate 10, which travels east-west like the bayou and rail lines, to pass underneath, some of the viaduct's supports were moved to intersect the girders in what had been mid-span, leaving the deeper sections where the supports had once been dangling in mid-air. It's a strange counterpart to the structural expressiveness of the McKee Street bridge.

*The best view of the bridges is from McKee Street and the adjacent park.*

Marcario Garcia run a pair of bridges carrying pipelines. Here, the engineers simply fit the bridge around the clearance envelope, creating a rectilinear counterpart to the nearby highway bridges. In terms of economics and structure, the pipeline bridges are perfectly acceptable. But they lack the grace and urban impact of the highway bridges, which transcend their utilitarian surroundings.

*All four bridges are visible from Zoltowski, just off Clinton Drive.*



Photo By Christof Spieker



Photo By Christof Spieker

**Railroad Truss Bridge**

Photo By Christ Spieker



Photo By Christ Spieker

Just before it enters the Port of Houston turning basin, Buffalo Bayou passes under a Union Pacific railroad bridge. While the trains that pass over it are up-to-date, carrying chemicals from Pasadena or containers bound for Latin America, the bridge itself looks like a bit of a relic. And it is. This is a steel truss bridge, one that rests on a pivot point at its center so it can rotate to let shipping through.

Movable bridges — drawbridges, lift bridges, and swing spans such as this one — were once quite common. Along

ivers, in ports, and over delta channels, they were an inexpensive way to cross a navigable waterway without tall piers or lengthy approaches. But the demands of modern traffic won't allow a highway to be interrupted for every passing ship, and highways, railroads, and larger ships have reduced the use of small waterways. Many American moving bridges have been fixed into place. And many have been demolished for fixed replacements.

The truss bridge, too, seems to be on its way out. Once, it was the standard American bridge. Railroads and highways

**610 Ship Channel Bridge**

Photo By Christ Spieker

Photo By Christ Spieker

**Jesse Jones Bridge**

Outside the Loop, the Ship Channel widens and the docks give way to huge chemical plants. Locked gates and guardhouses do a good job of keeping the public away from the water. Thus, the second largest bridge over Buffalo Bayou — the Jesse Jones Bridge, which carries four lanes of Beltway 8 across the channel — is one of the hardest to see.

The lack of a view is a shame, because this is, in fact, a bridge of some note. It is a concrete box girder: thin concrete walls forming two parallel tubes, each supporting one half of the roadway. At 750 feet between supports, it's the longest span concrete bridge in

the United States; the girders are 48 feet deep top to bottom at the supports and 15 feet deep at mid-span. The bridge was built by extending each half of the span out from the supports section by section until they met in the center. This is a technically demanding technique, one that requires the bridge to carry significantly different forces while under construction than when complete. Though this had been done in Europe, the construction of the Jesse Jones Bridge marked the first time it was attempted in the United States using American equipment.

*The Jesse Jones Bridge can be glimpsed from the Baytown Freeway, where it appears as a foreshortened white arch. From the Beltway itself, there's not much to look at; all of the structure is below the roadway.*

**Fred Hartmann Bridge**

Photo By Christ Spieker

Thanks to the fact that it took three years longer than planned to complete, and came in \$27 million over budget, the Fred Hartmann Bridge has probably gotten more attention than any other bridge in Houston. Still, it's a major technical achievement. Its 1,250-foot main span is longer than any other in Texas, and with eight lanes and generous shoulders, it's the widest cable-stayed bridge in the world.

The first large American cable-stayed bridge, in Luling, Mississippi, was built in 1983. Since then, there have 11 bridges

used them by the dozen to cross rivers, roads, and rail lines. Made up of small, standardized parts, a truss bridge could be shipped easily and erected quickly. They made efficient use of materials and were simple to design.

But the perfection of concrete beams and plate girders eventually replaced them, and the rising cost of labor sealed their fate. Trusses take a lot of man-hours to build, and their maintenance is equally labor-intensive. Virtually no new truss bridges have been built in over 30 years.

By old standards, this Buffalo Bayou

bridge is nothing extraordinary: it's one in a long line of truss bridges that have crossed the bayou, a moderate span with a straightforward design and a well-tested turning mechanism. But that's what makes it notable — it's an uncommon survivor of a common type.

*The bridge can be seen from the tour boat dock in the Port of Houston or from Hidalgo Park on the south side of the bayou.*

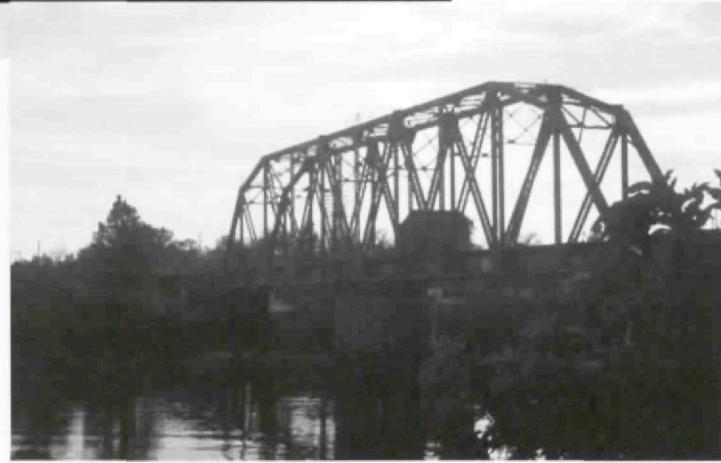


Photo By Christy Speller

The completion of the Ship Channel brought ocean-going ships far up Buffalo Bayou. At the Turning Basin, a small river becomes a 500-foot-wide channel, and bridges must be scaled up to match. The Coast Guard requires 175 feet of clearance over the channel. Because of the volume of ship traffic, movable bridges are out of the question here. To make the required clearance at a 5 percent grade (which is steep enough to cause trucks to slow down), a two-thirds of a mile approach is required on each side.

The first bridge to cross the channel was the 610 Ship Channel Bridge, built around 1970. The bridge is on 610 between I-10 and the Baytown Freeway.

Docks line the channel here; to give ships enough space to maneuver, the bridge had to span 630 feet, which isn't exceptional by bridge standards, but is still large. Texas Highway Department engineers produced a workable, though hardly elegant, solution by making the bridge a pair of triangles. On either side of the bayou, the triangles balance on one point, while the side opposite that point forms the roadway. The triangles extend 100 feet over the water, leaving a 430-foot gap that was filled with a plate girder. This structure, two triangles and a girder, is repeated six times to create the roadway's 153-foot width.

The result is ungainly. The struts seem too thin, the girders too deep, and

the whole assembly a bit jury-rigged. In elevation, the girders have a curved top, to match the vertical curve of the roadway, but a straight bottom. While this corresponds vaguely to the forces on the girders, it looks odd. The approaches, meanwhile, consist of precast girders supported on rows of thin columns with heavy cross-bracing. It's as if a highway engineer took a simple highway overpass and made it taller and wider, adding a little bit here and there to make it work.

*The bridge is best seen from the Port of Houston's harbor tour; it can also be seen from Brady's Island to the west and the Manchester Public Wharf to the east.*



Photo By Christy Speller



Photo Courtesy HNTB Corporation



Photo Courtesy HNTB Corporation



Photo Courtesy HNTB Corporation

started in the United States with spans of over 1,000 feet. Of those, nine are cable-stayed.

The idea is simple: suspend the roadway, section by section, from towers using diagonal cables. No temporary supports are required, and on a two-tower bridge such as the Hartmann, the two halves are completely independent until they meet in the middle of the span. In fact, the western half of the Fred Hartmann Bridge was completed before the eastern half was even started, allowing one set of equipment to be used for

both sides. That's a major advantage, and a large part of the reason for the popularity of the cable-stayed design.

Another reason is clearly visible from miles around: cable-stayed bridges are instant landmarks. They just look cool. The double diamond shape of the Hartmann's towers allows the cables to form a canopy above the roadway. From the driver's viewpoint, they splay outwards, filling the windshield, standing out in yellow against the sky. Crossing this bridge is an event.

*The Baytown bridge is on Route 146 between Baytown and LaPorte. An excellent view of the bridge is from a marina in Baytown, just to the east of the bridge.*

*(Information for this story was provided by W. Johnson, City of Houston Public Works; J. C. Liu, Texas Department of Transportation Houston district; and the Harris County Toll Road Authority.)*



Photo By Christy Speller