

Chicago's Movable Bridges—

A Perfect Balancing Act of Gear-Driven Splendor

Jack McGuinn, Senior Editor



Every spring and fall, a flotilla of pleasure craft rely on Chicago's string of downtown movable bridges for access to and from Lake Michigan. (Photo by David M. Solzman)

Chicago has been known as many things over the years—"Hog Butcher to the World," "The City That Works," "The Windy City" and "The City of Big Shoulders" among them.

Although perhaps lesser known, add "City of Bridges" to the list.

But we're not talking about traditional, stationary bridges. Rather, we're talking trunnion bascule bridges—or draw bridges—that span the Chicago River along many of the Loop's downtown intersections.

Although Chicago's first trunnion bascule bridge is the Cortland Street Bridge, built in 1902, the crown jewel of the city's movable bridge system is the Michigan Avenue Bridge at the intersection of Wacker Drive and Michigan Avenue. Begun in 1917 and completed in 1920, the bridge was conceived by renowned city planner and architect Daniel Burnham—he of "make no little plans" fame—and designed by transplanted Englishman and Chicago Plan colleague Edward

H. Bennett. Burnham envisioned the Michigan Avenue Bridge in part as a means of encouraging more development of Michigan Avenue north of the river, which had been neglected due to a lack of speedy access from its more populated area to the south. Reminiscent of the meeting of the eastern and western railroads in the previous century, the bridge dedication was celebrated by cannon fire, marching bands, blaring fog horns from the ships below and thousands of Chicagoans.

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But before the first (Cortland Street) bridge was built, the city's public works department went to work to realize Burnham's vision.

"The department of public works commissioned a study in 1898 to look at the suitability of different types of bridge structures to implement on a large scale in the city," says Dan Burke, assistant chief engineer bridges for Chicago's department of transportation. "And they studied and looked at several different existing technology models from around the world, which led to a new take on bridge concepts. It was a combination and further cultivation of existing technologies for the time." And so was born what is now internationally known and duplicated as the "Chicago Style" bascule bridge.

The city now boasts 35 operational movable bridges—the most of any city on the planet. Burke estimates that the bridges along the Chicago River are drawn up and down approximately 200 times a year. (At the busy 24/7 Calumet Harbor on the southeastern edge of the city, however, he says the number is 5,000 to 10,000.) The busiest times on the river are in the spring and fall, at the beginning and end of Chicago's boating season on Lake Michigan just east of the river. Indeed, the migration of pleasure craft out to Lake

Michigan in the spring and their return in the fall for winter dry docking is a Chicago tradition.

The bridge design is an engineering—and gearing—rarity in that it is driven by an intricate and yet almost primitive

counterweight functions. As the opening is initiated, the two sections, or leaves, of the bridge open at the center and remain so until lowered to the original position. The two rising leaves are actually a portion of Michigan Avenue, which is why it is

known as a double-leaf, double-deck trunnion bascule; most other bridges in the system have only one leaf. The opening and closing time of the bridge is about eight minutes.

To appreciate how the bridge works, simply look at a playground seesaw. Weight being about equal, notice how each child on either end acts as a counterweight and you'll have an idea of how a movable bridge works. The steel and roadway (leaf) construction are of equal weight with its concrete-and-steel counterweight, thus providing a delicate yet precise balance, one to the other.

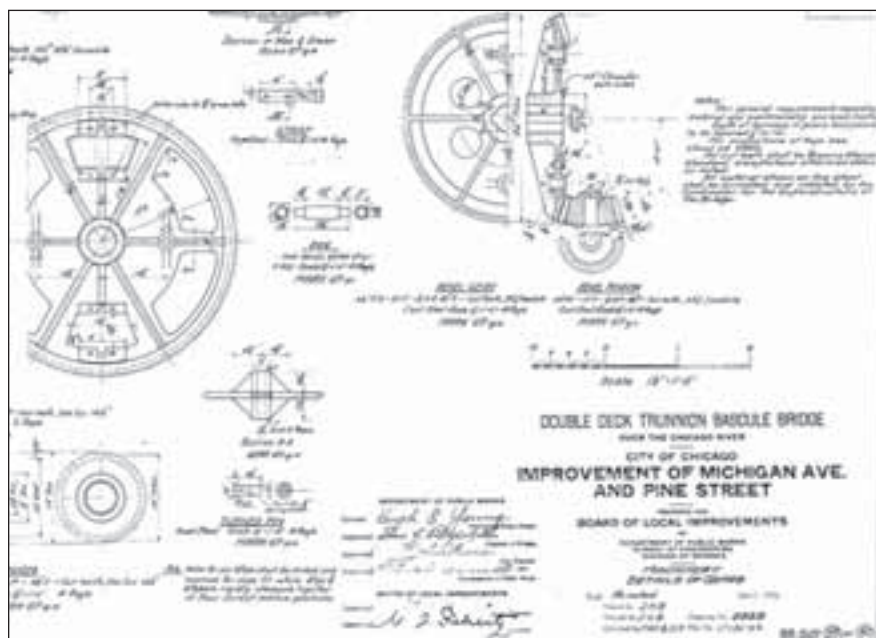
As mentioned, relatively little power is required to operate a bridge of this type. The Michigan Avenue bridge is powered by four 75–100 horsepower DC motors, two for each leaf or street

portion. In what today is still considered an engineering marvel, those four motors drive the trunnion—or axle—which in turn activates a gear set of increasing size to power the bridge. The last in the series—the bull gear—has the largest

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Cortland Street Bridge—the first movable bridge built in Chicago (1902) and a national historic civil engineering landmark. (Photo courtesy of City of Chicago)



Detail of a 1918 schematic of the Michigan Avenue Bridge specifying "minor changes and additions" to the original design. (Drawing courtesy of City of Chicago.)

system employing gears, counter weights, and electric motors. Not unlike today, (electric) energy was costly in those days, and so the bridges were designed to run on relatively small energy output, to be complemented by the gear and

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teeth of the set and actually rotates the rack and in turn powers the raising and lowering of the bridge sections. The result, says Burke, "is a simple concept executed on a very large scale."

Specifically, he says, "(The gears) are open-gearing gear trains with a combination of spur and interlocking pinion gears. The trunnion is the axis of rotation on the bridge."

For those looking for an up-close view of the Michigan Avenue Bridge, a designated Chicago landmark, there now exists the recently opened McCormick Tribune Bridgehouse & Chicago River Museum. The Beaux Arts-style bridgehouse—replete with four bas relief sculptures depicting key historic events in the city's history—is located at the northwest corner of Michigan Avenue and Wacker Drive. The museum is open from June 1 to September 30th, 10 a.m. to 5 p.m.; closed Tuesday and Wednesday. Admission is \$3, and children under five are admitted free. Groups of 20 and up welcome @ \$2 per person. 

For More Information:

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A look at the gear set that powers the Cortland Street Bridge. (Photo courtesy City of Chicago.)