Norway's Gift to Chicago

By Peter Kocsis, S.E., P.E.

Lake Street Bridge, Chicago IL.

Of the immigrant engineers who helped build the bridges of the United States, those from Norway played a role far out of proportion to their numbers. None had a more brilliant bridge career than Thomas G. Pihlfeldt. Born at Vadsø in 1858, he attended school in Trondhjem, Hammerfest and Christiana. For his technical training he attended the famous polytechnic institutes at Dresden and Hanover. After completing his studies, he immediately came to Chicago, arriving here in August, 1879. In spite of his fine technical training, the only work he could find was that of machinist. After a few years, he was able to find work as a draftsman and designer with several private firms. It was not until September of 1889 that he entered the Bureau of Maps in the public works department of the city of Chicago. There he began a career which was to last over 51 years. In 1894, he was transferred to the bridge division of the Engineering Bureau, and in 1896 became principal assistant to the city bridge engineer. In 1901, he was elevated to the office of chief engineer of bridges, and held that position until he died in 1941.

Thomas G. Pihlfeldt, 1858 - 1941.

The history of Chicago's bridges is intimately connected to the history of Chicago. Pihlfeldt's contribution is spanning Chicago's rivers and thereby solving the chief transportation problem of the growing metropolis. For over a century the Chicago River was the only "street" in the settlement that grew up on its shores. The only way to cross the river was by boat or canoe. The need arose for a more convenient way to make the crossing. In 1829, a ferry was put in operation at the site of the present Lake Street Bridge. The ferry was a rope-operated scow. The costs for crossing: 6.5 cents for a man, 12.5 cents for a man and his horse.

In 1833, Chicago was incorporated as a town, and in 1834 a primitive movable bridge was built at Dearborn Street. By 1849 there were bridges at Clark, Wells, Randolph and Kinzie Streets. In March of 1849, all these bridges were carried away by a flood which wrecked most of the shipping in the main and south branches of the river. With increased shipping, the primitive bridges of the 1830s and 1840s were no longer acceptable. The new bridges were swing bridges, which served very well-for a time. The swing bridges had a pier in the center of the river. Vessels passed on either side of the pier. This worked for small sailing vessels, but these were being replaced by steam-driven ships which were wider. The swing bridge with its center pier could no longer be used.

In 1891, a "jackknife" bridge was built at Weed Street. This bridge was supported from a pile foundation near the shore. There was no center pier. The bridge consisted of two parts with a hinge in the middle, and folded up like a jackknife to allow ships to pass. Due to the large number of joints, it required frequent repairs and became expensive to maintain. Thomas Pihlfeldt described the jackknife bridge as a "combination folding bed and mouse trap."

A vertical lift bridge was considered as another choice of a bridge without a center pier. One was built at Halsted Street over the south branch of the river, but it proved very expensive. (As will be shown later, for longer spans the vertical lift is the more economical choice.)

Another type of movable bridge without a center pier was developed William Scherzer. This is known as a rolling lift bridge, because the movable span rolls over a track. It was a big improvement over the other bridges considered; however, it still was not desirable because, as the leaf moves, the moving weight applies a rocking action to the foundation.

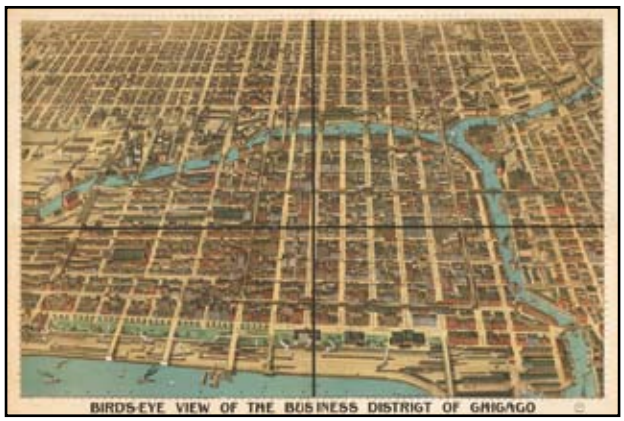
In 1899, the City of Chicago made a study of movable bridges throughout America and Europe. After a thorough study of the various types of movable bridges, the trunnion bascule was selected. In this type of bascule, the entire dead load of the leaf is supported on a shaft called a trunnion. As the bridge leaf rotates from fully closed to fully open (and back down), the center of gravity always remains at the trunnion thus eliminating the rocking action of the rolling lift bridge.

The first Chicago-type bascule was erected at Clybourn Avenue (now Cortland Street). This bridge was opened to traffic in May, 1902. It was new to America, and became a model for others. The work of construction was completed under the supervision of Pihlfeldt. The distance center to center of trunnions is 128 feet, with a clear channel width of 100 feet between pier protection on each side of the river.

The Division Street Bridge was the first to be wholly designed and built under Pihlfeldt's supervision. It opened to traffic June, 1904, and provided a 160-foot clear opening across the river. First a cofferdam was built surrounding the area in which the substructure would be built. Water was pumped out of the cofferdam. Then the concrete substructure was built 23 feet below the water level, and supported on piles driven to solid rock and cut off 21 feet below the water level.

Pihlfeldt's next bridge of importance was the double-deck, double leaf bascule across the river at Lake Street. This bridge carried elevated trains on the upper deck. The lower deck carried street cars (later buses), cars, trucks and also a sidewalk on each side of the roadway. This was the first bascule in Chicago to be built on cylindrical caissons which were supported on solid rock. The caissons were built inside a steel sheet pile cofferdam. The finished bridge provided a

195-foot clear width. The construction of this bridge presented almost insurmountable difficulties because the elevated train traffic had to be maintained on the old bridge. By shutting off the traffic on the lower deck, it was possible to remove the sidewalks and their brackets, relocate the pier protection and build the cofferdams. Temporary supports were placed for the existing bridge. With that done, the foundations could be built. During all of the construction, the elevated trains kept running.



Bird's-eye-view of the business district of Chicago, c.1898. Courtesy of Library of Congress, Geography and Map Division.

The outstanding success of the Lake Street Bridge construction encouraged Pihlfeldt to go ahead with the work of replacing the swing bridge at Wells Street. This was also a double deck swing bridge which carried street traffic, including street cars, on the lower deck and Northwestern train tracks on the upper deck. It was required to build the new bascule in such a way that the full volume of traffic could be maintained over the existing swing bridge with a minimum of inconvenience to the public. Construction of the cofferdams was accomplished by stopping traffic between the hours of 1 a.m. and 4:45 a.m. for a period of two weeks for each dam. To erect the superstructure, floor beams, stringers and bracing were omitted in two panels with the leaves in the open position. Vehicles and trains could continue to operate, passing through what was part of the new bridge. The old bridge was placed in the open position, and the ends of the old bridge supported by timber bents which had been placed there in advance. The old steel members were now cut and placed on barges. While the old bridge was being cut away, the missing members of the new bridge were put in place. Both leaves of the new bridge were lowered, and met at the center with less than ¼ inch total error! Tracks were put in place, and trains began running after an interruption of only 59 hours. Installation of electrical equipment completed the work. The new bridge had an over-all length of steel structure from abutment to abutment of 385 feet, with a clear channel of 220 feet. The Lake street bridge together with the Wells street bridge clearly demonstrate a learning curve: On the Lake street bridge, the elevated trains came through in three days, but weeks passed before the street level was finished. On Wells street, both levels were opened in seventy two hours. Pihlfeldt considered the erection of the Lake Street and Wells Street bridges his greatest achievements. Engineers came from Russia to see one bridge built on top of another and the burning out of the old one. A quote from Pihlfeldt: "The men in the drafting room said 'The Old Man is getting daffy' When it worked they said, 'That was simple.'"

The bascule is not the only type of bridge which Pihlfeldt successfully designed and constructed. The war department required a movable bridge over the Calumet River at Torrence Avenue in Chicago. The required channel width was 200 feet. With the river at a skew of about 50 degrees with the street, the clear span between masonry would be 310 feet. The weight of a vertical lift bridge including counterweights would be about

6,100,000 pounds. The total weight of a bascule with a clear span of 310 feet would be at least 12,000,000 pounds. It would be very difficult to design the machinery to handle such a huge mass. The vertical lift bridge was clearly the right choice. The design and construction of this vertical lift bridge gave Pihlfeldt great gratification. He was not only the master of the bascule bridge, but also master of the vertical lift bridge.

Pihlfeldt is sometimes incorrectly thought of as the inventor of the bascule. This idea is entirely without any basis of fact, and Pihlfeldt stated out right that he did not invent the bascule. He pointed out that the bascule developed down through the centuries, starting with the hinged leaf over a castle moat many centuries ago. A quote from Pihlfeldt: "I invent the bascule? Cain and Abel played on a bascule." (Meaning a teeter-totter.) Philfeldt continues: "All that I can claim credit for is being constantly on the alert, traveling around the country when need be, to watch every improvement in bridge building in every city and apply that new thing, bettering it, usually, on the next bridge built by the city of Chicago. We have designed and constructed forty-nine river bridges in Chicago and maintain them in daily operation. I say 'we' because I could do nothing without the loyal and efficient staff of 100 men in the division: engineers, draftsmen, mechanics, electricians and operators, and without the readiness of city engineers and commissioners above me to accept new ideas."

From 1901 until his death in 1941, Pihlfeldt was the guiding force in the development of the Chicago bascule bridge. He supervised the design and construction of 35 movable bridges and 20 fixed bridges and viaducts, a truly impressive record.

At the time of Pihlfeldt's death, Loran D. Gayton said, "The adoption of many of these developments by various engineers throughout this and other countries is the finest testimony to his high standing in his profession."

He also played a major role in carrying out the Chicago Plan, devised by Daniel Burnham, and also the straightening of the Chicago River.

Besides all his engineering work, Mr. Pihlfeldt was also active in engineering and social organizations: Western Society of Engineers, Chicago Norwegian Technical Society, Norwegian American Technical Society (President), King Oscar Lodge, No. 855, A.F. and A.M. (32nd degree Shriner), Chicago Norwegian Club (President 1922-1924) and a life member of the Edgewater Athletic Club. His recreational activities were chess, golf, motoring and travel.

Because of Mr. Pihlfeldt's great contribution to the engineering field, King Haakon VII of Norway decorated him with the Order of St. Olav. This award is given as a reward for distinguished services rendered to the country and mankind. The presentation was made on June 8, 1932 by Olaf Bernts, Norwegian Counsel in Chicago at a banquet given by the Norwegian-American Technical Society at the Norwegian Club.▪

I greatly appreciate the help of the following in providing me with the information to write this article. Kim Holland of the Norwegian-American Historical Association; Harald Bakke, engineer; "Saga in Steel and Concrete", a book by Kenneth Bjork (1947); Vesterheim Norwegian-American Museum; Archives of the Chicago History Museum (Chicago Historical Society); Sons of Norway.

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