HISTORIC ILLINOIS ENGINEERING RECORD

EWING AVENUE (92ND STREET) BRIDGE

HIER No. CK-2017-8

Location: Spans Calumet River at Ewing Avenue/92nd Street, Chicago, Cook County, Illinois

USGS Quadrangle: Lake Calumet Quadrangle, Illinois – Cook County
7.5 Minute Series

Present Owner: City of Chicago

Present Use: Vehicular Bridge

Significance: The Ewing Avenue Bridge represents the "second-generation" of the Chicago type trunnion bascule bridge with improvements executed in the design of the counterweights and a new rack-and-pinion assembly patented by bridge engineer Alexander von Babo in 1911 (namely, the use of an internal rack, instead of an external rack that extended along the truss superstructure's upper chords). The use of more aesthetically-pleasing pony trusses in its superstructure, which was novel at the time, quickly became preferable to the higher and more industrial-looking through trusses used on previous "first generation" bridges. It is visually similar to the Washington Street, Grand Avenue, and Chicago Avenue bridges, all built within a year of each other, but like many bridges outside the Loop, it featured wood-frame bridge houses. Bridges such as the one at Ewing Avenue are structurally and aesthetically similar to those built in Chicago's Loop, reflecting the new focus on civic beauty for bridges according to City Beautiful ideals.

PART I. HISTORICAL INFORMATION

A. Physical History

1. Dates of construction: 1912-14 (opened August 11, 1914)
2. Designers: John Ericson, City of Chicago Engineer, Thomas Pihlfeldt and Alexander von Babo, City of Chicago Bridge Engineers.
3. Original and subsequent owners: City of Chicago

4. Builders: Ketler-Elliott Company of Chicago (superstructure); Byrne Brothers Dredging & Engineering Company (substructure)

5. Original plans and construction:
The Ewing Avenue Bridge over the Calumet River was built as a double-leaf counter-balanced trunnion bascule span. Each leaf of the steel superstructure had two riveted steel pony trusses placed at a distance of 39'-6" center to center. The bridge had a span of 228'-0" from center to center of trunnions and an overall length of 347'-0". Its 60'-0" width included a 36-foot-wide roadway decked with creosoted wood blocks. The roadway widened out to 48 feet in width on the approaches and was flanked by wood-plank 9'-6" sidewalks. The bridge provided a clear channel of 200 feet in width and a vertical clearance of 18'-4" for the passage of vessels. The bridge foundation was comprised of reinforced concrete piers resting on wood piles.[1]

The substructure abutments and anchor piers were both of reinforced Portland cement concrete. They rested on foundation piles driven to about 29.5 feet, and 39.2 feet below city datum, respectively. The foundation piles beneath the river piers were driven to about 40.9 feet below city datum.[2]

Like all Chicago-type bascule bridges, it was designed to rotate around a fixed trunnion located at the center of gravity of the movable span or leaf. Each leaf was originally operated by two 75 horsepower electric motors. The gearing for each leaf consisted of a patented rack and pinion system mounted internally within the rear end of the truss, driven by two separate driven train and direct current motor units.

The Ewing Avenue Bridge featured the novel use was the use of counterweights consisting almost entirely of concrete instead of cast and pig iron as in former designs, which was intended to reduce the cost. Additional new features were planned for the bridge's machinery, as its operating struts were to be eliminated so that the movable parts could be arranged as compactly as possible. These advantages related to both the counterweight and the machinery "were made possible by a peculiar shape of the tail ends of the main trusses and by a new arrangement of the girders supporting the movable leaves."[3]

As it raised or lowered, the movable leaf rotated on two fixed axles or trunnion bearings. Supporting the trunnion bearings was a special concern because the entire weight of the leaf concentrated on two bearings as it opened, but the supports had to allow space for the path of the large counterweight rigidly fixed to the rear end of the truss. Trunnion bearing supports in the Ewing Avenue Bridge followed the basic structural system developed by Chicago bridge engineers Alexander von Babo and Thomas Pihlfeldt. This system relied on several large girders to carry the loads to the

1 Chicago Department of Public Works Annual Report, 1914: 149.

2 DPW Annual Report, 1913: 255, 273.

3 DPW Annual Report, 1909: 139.

concrete counterweight pit. Along each side of the counterweight pit, a longitudinal girder extended from the front wall to the back wall. Across these two longitudinal girders ran a transverse or "cross" girder that supported the trunnion bearings.

Operation of the Ewing Avenue Bridge was controlled from two operators' houses cantilevered from the northwest and southeast sides of the structure. From a vantage point in the upper level of each house, the bridge tender controlled the electric motors, center-lock mechanism, and mechanical and pneumatic brakes that slowed the speed of the movable leaf as it reached the fully open or fully closed position. The modest wood-frame bridge houses were sheathed in wood, had one-over-one wood-sash windows, and likely had hip roofs.

6. Alterations and additions:
The Ewing Avenue Bridge received its first major overhaul in 1931-32 at a total cost of $92,232, paid for by funds from the bond issue of September 30, 1930, which provided for the reconstruction of nine existing bridges. Work included the re-decking of the movable span and approaches with wood planks and sandstone blocks, respectively. Approximately 150 tons of additional counterweight was required to balance the heavier floor. The work also included the installation of four new electric gates and full interlocking of electrical equipment and signals.[4] In May 1933, considerable repairs were undertaken on the truss members, sidewalk, and railing on the north side of the west leaf due to a collision of the S.S. "U.S. Gypsum" with this bridge. The cost of the repair was $6,559.54.[5]

In 1957, the Ewing Avenue Bridge was one of many converted to one-man operation as part of a cost-savings measure by the City.[6] The bridge was re-decked in 1958, which involved the replacement of all 128 stringers and the rebuilding of all floor beams. The sidewalks and hand railings were replaced at that time. All four anchor columns were replaced in 1960 at a cost of $600,000. The bridge's rack and pinion was rehabilitated in 1967 at a cost of $145,000. In 1971, pile clumps and fenders were replaced at a cost of $16,600 and four submarine cables were replaced at a cost of $90,000. A damaged cord section was repaired in 1975 at a cost of $70,000. Pneumatic concrete pit repairs were made in 1980 at a cost of $150,236.[7]

The Department of Public Works' Historic Bridges Master Plan of 1985 noted these general alterations to the bridge: "The streetcar lines and supports were removed at an unknown date. The original hip roof bridge houses have been replaced/rebuilt with flat roof paneled bridge houses. High strength bolts have replaced rivets and numerous patch plates are found throughout the bridge."[8]

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4 DPW Annual Report, 1931; 233; DPW Annual Report, 1932: 240, 244.
5 DPW Annual Report, 1933: 204.
6 DPW Annual Report, 1957: 12.
7 City of Chicago Department of Public Works, "Historic Bridges Master Plan," 1985.
8 City of Chicago Department of Public Works, "Historic Bridges Master Plan," 1985.

In 1991, the Ewing Avenue Bridge underwent a major $5.4 million project that was completed in January 1992.[9] Work included reconstruction of the roadway deck and sidewalks as well as rehabilitation of structural steel and its mechanical and electrical systems. The work involved was described in a report produced by the Chicago Department of Public Works in 1990:

"The existing bridge deck, sidewalk stringers, floorbeams, and lateral bracing will be replaced. Deteriorated components of the main trusses, machinery girders, anchor columns, and counterweight boxes will be replaced. The abutments, enclosure walls and pit walls will be repaired. The existing fixed roadway decks will be replaced. The bridge house will be reconstructed. Approach sidewalks southeast of the bridge and the west sidewalk, northwest of the bridge will be replaced, and deteriorated sections of the retaining wall near the Great Lakes Dredge and Dock driveway will be reconstructed. New sidewalk parapets and railings will be installed.

"New pile clumps, and fender systems will be built to protect the bridge from collisions, reducing the channel width to 170'. Machinery gear trains and main drive motors will be reconditioned. Center locks will be rehabilitated. New pit pumps, wiring and conduits, and navigational lights will be installed. Approximately 100' of the approach roadway on both sides of the bridge will be resurfaced."[10]

The Ewing Avenue Bridge has been rehabilitated over the years to accommodate increased traffic and maintain safety standards through roadway/sidewalk re-decking and the replacement/repair of deteriorated steel structural parts. Although the steel superstructure retains its original configuration, new steel plates and high strength bolts are found throughout the bridge. The wood-frame gable-roof operator's houses have been heavily altered/rebuilt with flat rooflines and their wood cladding and one-over-windows appear to be non-original, as are the metal pipe sidewalk railings.

B. Historical Context

<u>Chicago's Early Movable Bridges</u>

Chicago's first movable bridge was built in 1834 over the main branch of the Chicago River at Dearborn Street. This wooden drawbridge was operated by chains and provided a sixty-foot opening for the passage of vessels. In 1840, a pontoon swing bridge was erected at Clark Street. This early bridge type had a movable span that rested on a pontoon in the water and then swung to one side to provide passage. During the 1840s, variations of the pontoon bridge were erected at Wells, Randolph, and Kinzie Streets. All of these early bridges were destroyed during devastating winter floods that swept Chicago in 1849.[11]

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9 "Ewing Avenue Bridge Reopening," *Chicago Tribune* (January 7 1992).
10 Chicago Department of Public Works, Ewing Avenue Bridge Rehabilitation over the Calumet River, 1990.
11 Chicago Department of Public Works Annual Report, 1901: 86.

Chicago's first iron swing bridge was built at Rush Street in 1856, marking the start of a new era in bridge construction in the city.[12] The swing bridge quickly became Chicago's predominant type of movable bridge during the second half of the nineteenth-century. This type of bridge was supported on a permanent pier located in the center of the waterway. When open, the structure rotated horizontally around the center pier and was aligned parallel to the river banks, creating a channel on each side of the pier for passage.

Although swing bridges represented an advance over earlier ferries and pontoon bridges, they were far from ideal—especially when the Chicago River was used more extensively for shipping. Chicago's waterways were increasingly plied with ever-larger lake vessels that were unable to pass the swing bridges' obstructionist mid-channel piers, and collisions between boats and bridges were commonplace. Even after the bridges changed from hand to steam power operation, they were slow to operate. Moreover, since swing bridges offered minimal barriers to approaching vehicles other than roadway gates, horse-drawn teams were in danger of falling into the water whenever they opened.

The City of Chicago experimented with a variety of movable bridge types during the 1890s in a quest to find alternatives to the swing bridge. The first attempt was made in 1891 with construction of the so-called "jack-knife" or folding bridge at Weed Street, which was a movable bridge without center pier.[13] Each leaf of the bridge was hinged at two places and in the raised position, the hinged leaves folded against the supporting towers on each bank. A second jack-knife bridge was installed at Canal Street in 1893. However, the jack-knife design was never widely used and eventually abandoned since the numerous joints required for its operation necessitated frequent and expensive maintenance.

In 1894, another type of movable bridge—the vertical-lift—was built over the South Branch of the Chicago River at Halsted Street and designed by Kansas City-based engineer John Alexander Low (J.A.L.) Waddell. Operated on the same theory as an elevator, the bridge had a 130-foot-long steel truss span weighing 280 tons, which was lifted vertically between two towers that rose 155 feet above the river level.[14] It was operated by steam hoisting machinery located on top of the lift span at its center. However, its $237,000 cost was enormous in comparison to other bridges and it required constant repairs. As a result, the vertical-lift, like the jack-knife design, was never a popular bridge design in Chicago and only one other such bridge was constructed along the Chicago River.[15]

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12 Ibid: 87.

13 DPW Annual Report, 1891: 162. The jack-knife bridge design used at Weed and Canal Streets was patented by a Captain Harmon.

14 "The Halsted St. Lift Bridge over the Chicago River." *Engineering News* (19 April 1894) 320-321.

15 The vertical lift proved considerably more popular for railroad use, especially after Waddell and his new partner, John L. Harrington, brought the design to maturity with a series of refinements after 1907. The South Halsted Street vertical lift bridge was replaced by the current bridge at this location in 1932-24. The vertical lift bridge built by the Pennsylvania Railroad in 1914 along the South Branch of the Chicago River near 18th Street is extant.

Chicago was at the cutting edge of bascule bridge technology during the 1890s, as engineers experimented with and patented a number of different types. Bascule bridges operated on the same principal as medieval drawbridges. The modern bascule bridge is constructed of steel, machine-driven, and defined by a movable span, or leaf, balanced by a counterweight on the other side of the axis. The axis can be stationary, where the leaf rotates about a fixed trunnion (trunnion bascule), or moving, where the leaf rocks or rolls along a track (rolling-lift bascule).

Bascule bridges represented a great improvement over swing bridges. They were rapidly operated, allowed for a clear channel of navigation, and could be built close together since they swung vertically rather than horizontally. Bascule spans were also safer than swing bridges since the open leaf served as its own barrier to approaching vehicles. Bridges of this type may be either single-leaf, where the entire leaf over the waterway is raised on one side of the waterway, or double-leaf, where leaves on either side of the waterway are raised simultaneously.

Chicago's first bascule bridge was a Scherzer rolling-lift design, built near Van Buren Street in 1895 for the Metropolitan Elevated Railroad. Invented by William Scherzer, this type of bridge was raised by gears that engaged a drive rack at the rear of the span, forcing this section downward. As the forward end rose, the span rolled back (similar to the runners on a rocking chair) on a tread plate instead of rotating around a fixed axis. The Scherzer Rolling Lift Bridge Company—located in Chicago's Monadnock Building—designed thirteen vehicular bridges for the City of Chicago between 1895 and 1907 as well as several railroad bridges. The City paid an average of $18,000 to purchase the design and plans for each of these structures, which added a considerable sum to the total cost.[16] Another major objection to the Scherzer rolling-lift bridge design was that its rolling mechanisms necessitated massive foundations that not only lessened the width of the river channel but also proved incompatible to some river banks.[17]

Despite the introduction of three new movable bridge types—the jack-knife, Waddell vertical-lift, and Scherzer rolling-lift—as of 1895, all but five of Chicago's 50 movable bridges were still swing bridges.[18] Although some of these swing bridges were operated by steam, the majority relied upon hand power. In 1897, the U.S. Army Corps of Engineers conducted a survey of the Chicago River, which illustrated how swing bridges served as obstacles to navigation and prevented the latest 432-foot vessels from continuing along the waterway.[19] The survey's findings were presented to the Western

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16 The 1908 DPW Annual Report includes a table listing all Chicago bridges, along with the cost paid for royalties (if any) and the total cost of each structure. Other Scherzer bascule bridges were erected at Van Buren Street (1895), North Halsted Street (River, 1897), Taylor Street (1900), and Cermak Road (1906). Today there are only two extant Scherzer rolling-lift bridges in Chicago: the Cermak Road Bridge a railroad bridge built for the Pennsylvania Lines over the Sanitary and Ship Canal (1901; expanded 1909-10).

17 Thomas G. Pihlfeldt, Assistant Engineer for the City of Chicago, voiced this objection in the 1895 *DPW Annual Report*, p. 88.

18 DPW Annual Report, 1895: 48.

19 G.A.M. Liljencrantz, "Obstructive Bridges and Docks in the Chicago River*," Journal of the Western Society of Engineers* (June 1898) 3.

Society of Engineers in June 1898 by G.A.M. Liljencrantz, District Engineer of the Army Corps of Engineers' Chicago District, an arm of the U.S. War Department that had recently become the powerful federal ally of industries shipping on the Chicago River. In Liljencrantz's report, "Obstructive Bridges and Docks in the Chicago River," he strongly argued against the further construction of swing bridges with mid-channel piers.[20]

Toward the end of the nineteenth-century, declining water-borne trade highlighted the Chicago River's problems. In 1900, the City's Bridge Commissioner reported that, "There has been a decrease in the number of vessels entering the Chicago River during the year of 6.5 per cent as compared with the year 1899, and of 17.3 per cent as compared with the year 1898. The cause of this falling off in navigation is no doubt to be found in the fact that the large boats that rapidly take the place of older ones cannot successfully navigate the river owing to the obstructions met with transportation tunnels and center-pier bridges."[21]

This situation finally forced government officials, industries, and navigation interests, such as the Lake Carriers Association, to demand the removal of swing bridges from the narrow, winding Chicago River. The River and Harbor Act of 1899 gave the Secretary of War authority to order bridges removed, and imposed his approval as a necessary step in constructing bridges over navigable waterways. The stage was set for the Army Corps to clear swing bridges from the river. When presented with petitions from navigation interests concerning the removal of obstructions along the waterway, the Army Corps held public hearings, which typically resulted in the Secretary of War's order that a bridge be removed.

"First Generation" Chicago-type Trunnion Bascule Bridge Design: 1900-10

Faced with the need to replace the vast majority of its swing bridges in the coming years, Chicago's bridge engineers decided to develop their own bascule bridge design. The decision was attractive as it allowed the City to avoid royalty payments on patented designs, as noted by the City's Bridge Commissioner in 1900: "The most important work done in this Division is the development and preparation of plans for bascule bridges of a new design. By this action the city is saved large sums of money which otherwise would have to be paid for royalties on patented bridges, and I am safe in saying that the city will have better and cheaper bridges."[22] The predominant patented design used by the City for vehicular bridges at that time was the Scherzer rolling-lift, with thirteen erected between 1895 and 1907.

In 1899, the City's Bridge Division undertook an extensive study of the most advanced movable bridge designs in the United States and Europe to determine which type was most suitable to the conditions of the Chicago River and its branches. Under the leadership of City Engineer John Ernst Ericson, a distinguished civil engineer, four classes of movable bridges were studied: swing bridges, vertical-lift, rolling-lift, and

20 Liljencrantz, 27.
21 DPW Annual Report, 1900: 34.
22 Ibid.

trunnion bascule.[23] After an extended investigation, the trunnion bascule type was selected as the one that could most fully meet Chicago requirements, both from a practical and an economical point of view. Ericson, together with Assistant City Engineer Thomas G. Pihlfeldt and their colleagues in the Bridge Division, then developed three complete bascule bridge designs, differing in appearance, method of mounting, etc., but all involving the main feature—that of revolving on a fixed trunnion.[24]

These designs were submitted to an independent Board of Consulting Engineers, which was appointed by the Commissioner of Public Works and consisted of three well-known engineers: E.L. Cooley, Ralph Modjeski and Byron B. Carter. The Board selected and recommended the design designated as No. 3, with some modifications, which were subsequently carried out.[25]

The *Annual Report of the Department of Public Works* for 1900, which includes a detailed account of the process involved in developing the new Chicago-type trunnion bascule bridge, does not identify its designers by name. However, an article in the July 21, 1900 issue of *Engineering Record* noted that City Engineer John Ericson credited Edward Wilmann, City Bridge Engineer, along with Karl Lehman, Alexander von Babo and Thomas Pihlfeldt, Assistant City Engineer, for providing valuable assistance in developing the three initial designs. An article on the Chicago-type bascule bridge published in the July 28, 1900 issue of *Engineering Record* stated that, "The plans were prepared by Mr. John Ericson, city engineer,…"[26]

The Chicago type bascule bridge, as developed by City engineers from 1899 to 1900, rotated around a fixed trunnion located at the design center of gravity of the movable span or leaf. Bridges could have one or two leaves. In opening, the bridge rotated about this shaft and raised its leaves to a nearly vertical position, giving a completely clear and unobstructed passage for river vessels. Such a bridge was raised or lowered by the operation of curved racks attached to the tail ends of each truss arching above the

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[23] John Ernst Ericson (1858-1927), a native of Sweden, graduated from the Royal Polytechnic Institute in Stockholm in 1880 and immigrated to the United States the following year. He worked as a draftsman for the City of Chicago from 1884-86 and assistant engineer of the Sanitary District of Chicago for two years. In 1893 he was appointed Assistant City Engineer of Chicago, and in 1897 he was promoted to the post of City Engineer, a position he retained until at least 1913. During his employment with the City of Chicago, Ericson supervised the construction of many important public works projects, including those for water tunnels, water cribs, and pumping stations. Biographical information on Ericson taken from the following sources: Clark J. Herringshaw, *Clark J. Herringshaw's City Blue Book of Current Biography: Chicago men of 1913* (Chicago: American Publishers Association, 1913); *Notable Men of Chicago and Their City* (Chicago: Chicago Daily Journal, 1910) 119; and *Prominent Democrats of Illinois* (Chicago: Democrat Publishing Company, 1899) 172-73.

[24] Thomas G. Pihlfeldt (1858-1941) was a Norwegian immigrant with German engineering training who had been with the City of Chicago's bridge division since 1894. For information on Philfeldt see: Kenneth Bjork. *Saga in Steel and Concrete: Norwegian Engineers in America* (Northfield, Minnesota: Norwegian-American Historical Association, 1947), 121; "Pihlfeldt Dies at 82," *Chicago Daily News* (January 23, 1941).

[25] DPW Annual Report, 1900: 88. The final report of the Board of Consulting Engineers was published in: "The Chicago Type of Bascule Bridge," *Engineering Record* 42 (July 21, 1900) 50-52.

[26] "The Chicago Type of Bascule Bridge," *Engineering Record* (July 21, 1900); "The Lift or Bascule Type of Movable Bridges." *Engineering Record* (July 28, 1900) 73.

roadway. The pinions that engaged the racks were operated by an electric motor and machinery, generally located below the roadway and controlled by an operator located in a small house near the river bank. This gearing action was aided by massive fixed counterweights at the rear of the bridge that descend into watertight pits along the river bank. When the bridge was open or opening, the trunnions in each leaf supported the entire dead weight of the structure.[27]

The selected trunnion bascule design No. 3 became the model for nearly every subsequent movable bridge constructed in Chicago. The trunnion bascule had many advantages. Its fixed center of gravity required less massive foundations than the Scherzer rolling-lift, it had a minimum of moving parts, and because its leaves were almost perfectly balanced, and the bridge could be opened and closed quickly. The trunnion style also featured a locking mechanism to prevent tipping upward when in the closed position.

A total of eight "first generation" trunnion bascule bridges were built in Chicago between 1902 and 1909 according to the design developed by City Engineers. They included the bridges at Cortland Street (formerly Clybourn Place; North Branch), 1902; East Division Street (North Branch Canal), 1903; Ninety-Fifth Street (Calumet River), 1903; West Division Street (North Branch), 1904; North Western Avenue (North Branch), 1904; Archer Avenue (South Branch), 1906; North Avenue (North Branch), 1907; North Halsted Street (North Branch), 1908; and Kinzie Street (North Branch), 1909.[28] All of these bridges had tall through-trusses braced over the roadway as well as modest, wood frame operator houses. The construction of the earliest of these "first generation" bridges was made possible by the City of Chicago's authorization in April 1900 of $850,000 for new bridges.[29]

"Second Generation" Chicago-type Trunnion Bascule Bridge Design: 1911-30

Despite the spurt of new bridge construction in the early 1900s, as of 1908 twenty-nine of Chicago's 51 vehicular bridges remained swing bridges, with many still operated by hand power.[30] In that year, bridge engineer Thomas G. Pihlfeldt highlighted the dilapidated condition of swing bridges along the Chicago River's north and south branches, noting that their removal should take precedence over swing bridges along the main channel, many of which were comparatively new structures and in fairly good shape.[31]

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27 A detailed description of the City's Design No. 3 for a trunnion bascule bridge is included in the *DPW Annual Report* for 1900: 88-89.

28 The Archer Avenue and Kinzie Street bridges were single-leaf bridges, while the others were all double-leaf. Today, only three bridges remain from this initial group of first generation Chicago-designed trunnion bascule bridges. They are to be found at Cortland Street, West Division Street (River), and Kinzie Street.

29 DPW Annual Report, 1900: 21. "Mayor's Veto Is Upheld," *Chicago Tribune* (April 5, 1900).

30 Donald N. Becker, "Development of the Chicago type Bascule Bridge," *American Society of Civil Engineers* Transactions, Vol. 109 (1945) 1008.

31 DPW Annual Report, 1908: 210.

It was not until a $4.6 million bond issue passed in the fall of 1911 that funds were made available for 26 new bridges.[32] This next group of "second generation" bascule bridges, completed between 1913 and 1930, incorporated a number of design improvements that distinguished them in appearance from "first generation" bridges. The later bridges featured the use of pony trusses, rail-height trusses, or deck trusses, all of which were lower in height than the more industrial looking through trusses used on "first generation" bridges. Post-1910 bridges also featured the use of two, rather than three, trusses.

These aesthetic improvements were made possible by new engineering features for movable bridges that were outlined in a set of "General Specifications" prepared by the Bridge Division in 1912, which were discussed in the DPW Annual Report of that year:

> "Since the adoption of the City type as a standard design, constant effort has been made to perfect the details structurally, mechanically and artistically…During July, after a full discussion of the specifications in use for designing our bascule bridges, new General Specifications were prepared and approved. These became effective in August and were published for the use of the bridge division. They cover the design and detailing of the structural parts and machinery of movable city bridges, and also for plate girders….The type of roadway floor has been changed to creosoted wood blocks so as to provide a more permanent flooring."[33]

One of the most significant aspects of the new design exhibited by "second generation" bridges was the internal rack patented in 1911 by Alexander von Babo, the city's Engineer of Bridge Design, which differed from the external rack that previously extended along the truss superstructure's upper chords.[34] Von Babo explained in his patent application that a rack contained internally within the trusses, used in conjunction with a transverse trunnion girder to support the trunnions, allowed space for a larger dimension counterweight of a less costly material and allowed placement of the operating machinery and gear trains directly alongside the movable truss. In addition, it "avoided use of unsightly circular racks above the top chords or beneath the bottom chords."[35]

Von Babo's patented design, which changed the location of the rack and pinion, eliminated the need for three trusses to support each leaf. After 1910, all bridges built by the city featured the use of two trusses, which made a striking difference in their appearance.

Another feature of bridge design standardized with the group of second generation bridges completed between 1911 and 1930 was the positioning of the center of gravity in the movable leaves. Ideally, the front and rear portions of a bascule leaf balanced perfectly around the trunnion, and required only the motive force needed to overcome

32 DPW Annual Report, 1912: 238. "Bonds Win; Court Acts Lose," *Chicago Tribune* (Nov. 8, 1911).
33 DPW Annual Report, 1912: 240.
34 Becker, 1010.
35 U.S. Patent No. 1,001,800, received August 29, 1911, Alexander F.L. von Babo, 1.

friction to open and close. In early practice, City Engineer John Ericson feared that a perfectly balanced bridge might become unbalanced on hot days when the timber decking dried out and would rise unexpectedly. To avoid this possibility, the first bascules had their center of gravity just ahead of the trunnions and had to be raised fourteen inches before they became balanced. Since this required heavier motors and more substantial front piers for the trusses, Thomas G. Pihlfeldt, Engineer in Charge of Bridges, convinced Ericson that the structure could be exactly balanced by building pockets into the counterweight into which cast iron or lead plates could be placed to account for weight changes caused by the weather.[36] Bridges built after 1910 incorporated Pihlfeldt's counterweight pockets, which also served as a means to re-balance bridges in later years, when more durable concrete and steel grid decks replaced the original wood ones.[37]

Significantly, the 1912 DPW Annual Report also noted that, "Special attention has been given to the architectural treatment of the new bridges and the architects of the Chicago Plan Commission have collaborated with the Bridge Division in this work.[38] This was a reference to the efforts of Edward H. Bennett through his work as consulting architect to the Chicago Plan Commission. This quasi-public agency was established by Mayor Fred A. Busse following the publication of the 1909 *Plan of Chicago*, a document that Bennett co-authored with Daniel H. Burnham and which famously ignited interest in downtown beauty in cities nationwide.

The Illinois Chapter of the American Institute of Architects and the Chicago Municipal Art League also submitted designs to municipal officials for the artistic treatment of city bridges.[39] As plans were readied in 1911 to replace numerous downtown swing bridges with new bascule spans, these and other arts groups announced their intention to weigh-in on their designs, as reported by the *Chicago Tribune*:

> "An active campaign for architecturally beautiful bridges in place of the dilapidated structures soon to be replaced by the city was inaugurated yesterday. James Wilson Pattison, secretary of the Municipal Art League, and W.M.R. French, director of the Art Institute, struck the first blows on behalf of several organizations who will interest themselves in the matter…
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> "The whole trouble with Chicago bridges," said Mr. Pattison yesterday, "is that they are all stock pieces of engineering. It never seemed to occur to anybody to ornament them. A bridge which is at once sturdy and stanch and beautiful to boot is what we want here—

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36 *Chicago Daily News* (October 15, 1936).

37 Matthew Sneddon, "Chicago Avenue Bridge." HAER No. IL-144, 1999. HABS/HAER Collection. Library of Congress, Washington, D.C.: 8.

38 DPW Annual Report, 1912: 241.

39 The DPW Annual Report for 1912 noted on p. 240: "For the Chicago Avenue Bridge, the Illinois Chapter of the American Institute of Architects submitted designs for its architectural treatment and these plans were adopted."

something graceful in shape and form and which is as strong and useful as if built in the old methodical way. There ought to be some art deliberately thrust upon Chicago."[40]

George W. Maher was the chairman of the Municipal Art Committee of the Illinois Chapter of the AIA, which developed a policy pertaining to all matters of municipal beautification, including bridge design. Other prominent architects on this committee included Hubert Burnham, Elmer C. Jensen, Earl H. Reed, Jr., Leon E. Stanhope, and M.J. Schiavoni. *The Economist,* Chicago's weekly business magazine, reported in 1916 that due to this Committee's urging, "the bridge department will recommend terra cotta for the construction of all future bridge tower houses. This is a considerable step in advance, as these tower houses, heretofore constructed of wood, galvanized iron or metal, have for the most part been unsightly, so that matte gazed terra cotta as material for them will be a distinct artistic improvement."[41]

Persistent efforts by these various art and architectural organizations resulted in extensive revisions to the type and shape of trusses, the configuration and façade of operator houses and pit walls, and the ornamental detailing of sidewalk railings, light fixtures and other ornamental metal elements.[42] For example, the Washington Street and Grand Avenue Bridges, both completed 1913, were the first bridges in Chicago's central business district to feature curving pony trusses, which quickly became preferable to the higher and more industrial-looking through trusses used on previous "first generation" bridges. Pony trusses continued to be used on bridges well into the 1940s.

However, Bennett and other civic arts groups considered the use of both deck trusses and rail-height trusses aesthetically preferable to pony trusses since they were located beneath the roadway, allowing the ornamental handrails of each bridge to be easily seen. In fact, such bridges were depicted in the 1909 *Plan of Chicago*. The Jackson Boulevard Bridge was Chicago's first vehicular bridge to feature deck trusses, thereby conforming to Bennett's design criteria, which also included the design of Beaux Arts style limestone or terra cotta-clad bridge houses with octagonal plans, classical detailing, and mansard roofs. Such artfully-designed bridges were intended to enhance civic beauty while playing a pivotal role in facilitating traffic circulation, both important goals of the *Plan of Chicago*. The most visually impressive of the "second generation" trunnion bascule type is the classically-styled Michigan Avenue Bridge, which was based on the contemporary Alexander III Bridge in Paris. It features gracefully arched deck trusses, integrated embankments, and four monumental Beaux Arts style bridge houses, each embellished with sculptural reliefs highlighting moments in Chicago's history.

History of the Ewing Avenue Bridge

Plans for a new double-leaf trunnion bascule bridge over the Calumet River at Ewing Avenue were initially prepared in 1908 and called for a clear opening of 172 feet between river piers. These plans were discarded the following year due to recommendations of

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40 "Want Grace in New Bridges," *Chicago Tribune* (May 7, 1911).
41 "West Madison Street," *The Economist* (January 29, 1916).
42 Joan Draper, *Chicago Bridges* (Chicago: City of Chicago, 1984) 8.

the Harbor Commission for a clear opening of 200 feet between river piers. The 1909 DPW Annual Report identified the swing span at 92nd Street as one of several such bridges located at important river crossings that were badly deteriorated and in need of immediate repair. New plans prepared in that year called for two leaves with two main trusses each. The distance from the centers of trunnions was to be 228 feet and from the centers of the river piers 208 feet. The width of the bridge was intended to be 52 feet, consisting of one roadway 36 feet wide and two sidewalks eight feet wide.[43]

A new feature planned for the bridge was the use of counterweights consisting almost entirely of concrete instead of cast and pig iron as in former designs, which was intended to reduce the cost. Additional new features were planned for the bridge's machinery, as its operating struts were to be eliminated so that the movable parts could be arranged as compactly as possible. These advantages related to both the counterweight and the machinery "were made possible by a peculiar shape of the tail ends of the main trusses and by a new arrangement of the girders supporting the movable leaves."[44]

Plans for this bascule bridge were finally completed in 1911, spurred by passage in that year of a $4.6 million bond issue that provided badly needed funds for new bridge construction. The 1911 DPW Annual Report noted that in construction and appearance the Ewing Avenue Bridge "will be similar to the bridge designed for Indiana Street."[45]

In 1912, plans for the Ewing Avenue Bridge were changed due to the decision to use creosoted wood blocks (a solid layer of planks just above the sub-planks) rather than Shuman pavement on the bridge deck. As the wood blocks were heavier than Shuman pavement, the number of stringers and floor beams on the movable leaves were increased, and additional counterweight was added to balance the increased weight of the bridge floor. Changes were also made to the design of the approaches and the machinery enclosures. It was decided to build the retaining walls of the filled approaches at the property lines, rather than the roadway curbs, as was typical, and to eliminate any wooden sidewalk construction. The machinery and pit room enclosures originally designed of timber were instead fabricated with light structural steel frames carrying thin curtain walls of cement plaster.[46]

A temporary bridge was constructed just northeast of Ewing Avenue in July 1912, allowing uninterrupted traffic across the Calumet River while the new span was under construction. It was comprised of the span from the old swing bridge which was placed upon a new center pier. The old center pier was removed in August 1912 and the dredging of the channel was cleared to a minimum depth of 22 feet below city datum the following month.[47]

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43 DPW Annual Report, 1909: 138-139.
44 DPW Annual Report, 1909: 139.
45 DPW Annual Report, 1911, p. 232. Indiana Street was the historic name for present-day Grand Avenue.
46 DPW Annual Report, 1912: 246.
47 DPW Annual Report, 1913: 253.

Byrne Brothers was awarded the contract for the substructure, construction of which began on October 7, 1912. The retaining walls were largely completed by the end of that year. The contract for the substructure was largely completed by December 11, 1913. Construction of the bridge superstructure began October 28, 1913.[48] The east leaf was lowered to a horizontal position for the first time April 14, 1914. East-bound street cars began using the new bridge June 27, 1914. The pavement on the south side of both approaches was then placed and the new bridge opened to team traffic August 8, 1914, using the south roadway exclusively until the west-bound streetcars began using the new bridge August 11, 1914, thus transferring all street traffic from the temporary to the new bridge without interrupting traffic at any time. Removal of the temporary swing bridge began on August 21, 1914 and was completed by September 28 of that year.[49]

The Ewing Avenue Bridge is identical in appearance to the Grand Avenue Bridge and also similar in appearance to the Chicago Avenue, Washington Street, and Webster Street bridges, all of which were built 1913-14 with two riveted pony trusses that differed greatly from the high and more industrial looking through trusses exhibited by "first generation" bridges. These post-1910 "second generation" Chicago-type trunnion bascule bridges incorporated improvements in the design of their counterweights and a new rack-and-pinion assembly patented by bridge engineer Alexander von Babo in 1911 (namely, the use of an internal rack, instead of an external rack that extended along the truss superstructure's upper chords). This group of four bridges, built within a year of each other, exhibited the same gearing, including rack dimensions, pitch radius, distance from trunnion to pinion, and gear sizes, as well as motor and drive train arrangements at the rear end of the truss, with unconnected units mounted on each truss of the leaf, with either unit able to fully operate the leaf in the event one of the units failed. Although the distance of bridge spans and leaf weights differed, all were driven by direct current motors that ranged from forty to fifty horse power each.[50]

<u>"Third Generation" Chicago-type Trunnion Bascule Bridge Design: 1932-49</u>

In 1930, the *Chicago Tribune* announced that a movement "to keep the city's new bridges in harmony architecturally with the Michigan Avenue Bridge and the new Wabash Avenue structure gained ground in the city hall yesterday as officials considered means to prevent the construction in the future of unsightly spans across the river." The announcement was spurred by a 1930 proposal by Richard W. Wolfe, the Commissioner of Public Works, to construct five new downtown bridges, including one at State Street. Interest in the artistic design of bridges remained evident at this time as the Tribune also reported that, "Under a state statute, works of art in public places and designs of all city buildings, bridges, lamps and other public structures must be approved by the Municipal Art Commission as to their design and location." Members of this quasi-public Commission in 1930 had been appointed by the late Mayor William Dever and included

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48 DPW Annual Report, 1913: 255, 273.
49 DPW Annual Report, 1914: 149-150.
50 Snedden, 7.

real estate developer Potter Potter Jr., meatpacking scion Cyrus McCormick Jr., architect Jarvis Hunt, landscape designer Jens Jensen, and artist Thomas A. O'Shaughnessy."[51]

From an architectural point of view, the period between the Great Depression and World War II constitutes the "third generation" in bridge design. Movable bridges built in the 1930s and 1940s followed established structural and architectural models, but featured simpler ornamental details. These bridges reflect the desire of design engineers to project a more contemporary image as well as the dire state of the economy, which encouraged streamlining.[52] The use of pony trusses on some bridges followed long-established models. The more prominent downtown bridges, such as the one at State Street, featured the use of gracefully arched rail-height trusses partially located beneath the roadway, a design long advocated by civic art groups. The bridge houses of this period feature stripped-down silhouettes, flattened rooflines, and no ornamental references to the classical past. Especially notable are the monumental bridge houses at Lake Shore Drive and North Ashland Avenue, the latter of which features distinctive Art Deco style bas-reliefs with allegorical figures representing the Chicago River.

"Fourth Generation" Chicago-type Trunnion Bascule Bridge Design: 1952-67

The "fourth generation" trunnion bascule bridges erected in Chicago during the 1950s and 1960s were sleeker and technically more sophisticated than their predecessors. For example, they featured automated control from a single bridge house, as well as railings that were primarily functional, rather than ornamental. Downtown bridges of this period were typically designed with gracefully arched deck or rail-height trusses. Bridge houses of this era exhibit the influence of International style modernism with their cubic form, banded windows, flat roofs, and smooth, unadorned wall planes clad in smooth limestone or granite. Examples include bridges at Congress Parkway, 1956; Van Buren Street, 1956; 95th Street, 1958; Harrison Street, 1960; and Dearborn Street, 1963.

"Fifth Generation" Chicago-type Trunnion Bascule Bridge Design: 1976-84

Chicago's "fifth generation" trunnion bascule bridges featured all-welded box girders that extended above-deck to railing height. This was innovative as previous vehicular bridges in Chicago used riveted trusses. Fifth generation examples include the bridges at Loomis Street (1977), Columbus Drive (1982) and Randolph Street (1984). The Loomis and Randolph Street Bridges replaced Scherzer rolling-lift designs. The Columbus Street Bridge was the first at its site, which was half-way in-between the Michigan Avenue and Outer Drive Bridges. It was a vital link in a larger improvement project to extend Columbus Drive, which then dead-ended at Monroe Street, northward from Monroe to Grand Avenue. This massive structure was the largest in Chicago upon completion, measuring 269 feet long and 111 feet wide between trunnions. Its trunnions were set back from the river, allowing pedestrians to walk beneath it at river level. The Columbus

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[51] "Officials Seek to Prevent Building of Ugly Bridges," *Chicago Tribune* (September 13, 1930).

[52] Draper, 20.

Drive and Randolph Street bridges were both granted a design award by the American Institute of Steel Construction shortly after their completion.

PART II. ENGINEERING INFORMATION

A. Description of Bridge Structure:
The Ewing Avenue Bridge over the Calumet River is a double-leaf counter-balanced trunnion bascule span. Each leaf of the steel superstructure has two riveted steel pony trusses placed at a distance of 39’-6” center to center. The bridge has a span of 228’-0” from center to center of trunnions and an overall length of 347’-0”. Its 60’-0” width included a 36-foot-wide steel deck roadway. The roadway widened out to 48 feet in width on the approaches and was flanked by 9’-6” sidewalks with pipe hand railings. The bridge provides a clear channel of 200 feet in width and a vertical clearance of 18’-4” for the passage of vessels.

The Ewing Avenue Bridge remains movable and the leaves are operated by electric motors. The gearing for each leaf consists of a patented rack and pinion system mounted internally within the rear end of the truss, driven by two separate driven train and direct current motor units. As each leaf rises or lowers, it rotates around two fixed axles or trunnion bearings located at the center of gravity. The entire weight of each leaf is concentrated on two bearings as it opens, and the supports allow space for the path of the large counterweight rigidly fixed to the rear end of the truss. Trunnion bearing supports in the Ewing Avenue Bridge follow the basic structural system developed by Chicago bridge engineers Alexander von Babo and Thomas Pihlfeldt between 1908 and 1913. This system relies on several large girders to carry the loads to the concrete counterweight pit. Along each side of the counterweight pit, a longitudinal girder extends from the front wall to the back wall. Across these two longitudinal girders runs a transverse or “cross” girder that supports the trunnion bearings.

The bridge has two wood-frame bridge operator’s houses that are cantilevered from the northwest and southwest sides of the structure. From a vantage point in its upper level, the bridge tender can control the electric motors, center-lock mechanism, and mechanical and pneumatic brakes that slow the speed of the movable leaves as they reach the fully open or fully closed position. The modest, flat-roofed bridge houses are sheathed in wood and feature horizontal strips of modern one-over-one windows beneath the roofline.

B. Site

1. General Setting and Orientation: The Ewing Avenue Bridge, located about eight miles southeast of Chicago’s central business district, carries vehicular and pedestrian traffic over the Calumet River. North of the river, Ewing Avenue becomes South Lake Shore Drive (U.S. 41), providing a transportation corridor between downtown Chicago and the southeast side and the northwest Indiana areas. It is located within a heavily industrialized are that once featured the United States Steel Mill, South Works, before its closure in the 1980s. The Calumet River is an important

navigational corridor connecting Lake Michigan with Lake Calumet and the Port of Chicago. Other nearby Calumet River crossings are located at 95th, 100 and 106th streets.

PART III. SOURCES OF INFORMATION

A. Architectural Drawings:
Chicago Bureau of Engineering, "Ewing Avenue Bridge – General Plan and Profile," drawing no. 35644, May 1975.

B. Bibliography:

1. Primary and unpublished sources:

Becker, Donald N., "Development of the Chicago type Bascule Bridge." *American Society of Civil Engineers Transactions*, Volume 109, 1945: 995-1046.

Bjork, Kenneth. *Saga in Steel and Concrete: Norwegian Engineers in America*. Northfield, Minnesota: Norwegian-American Historical Association, 1947: 121.

"Bonds Win; Court Acts Lose," *Chicago Tribune*, Nov. 8, 1911.

Chicago Daily News, October 15, 1936.

Chicago Department of Public Works. *Annual Reports of the Board of Public Works.* Chicago, varying publishers, 1891 to 1967.

City of Chicago Department of Public Works, "Historic Bridges Master Plan," 1985.

Chicago Department of Public Works. 92nd Street/Ewing Avenue Bridge, 1984.

Chicago Department of Public Works, Ewing Avenue Bridge Rehabilitation over the Calumet River, 1990.

"The Chicago Type of Bascule Bridge," *Engineering Record*, July 21, 1900.

"The Halsted St. Lift Bridge over the Chicago River," *Engineering News*, April 19, 1894: 320-321.

Herringshaw, Clark J. *Clark J. Herringshaw's City Blue Book of Current Biography: Chicago men of 1913*. Chicago: American Publishers Association, 1913.

"The Lift or Bascule Type of Movable Bridges." *Engineering Record*, July 28, 1900: 73.

Liljencrantz, G.A.M., "Obstructive Bridges and Docks in the Chicago River." *Journal of the Western Society of Engineers*, June 1898: 3.

"Mayor's Veto Is Upheld," *Chicago Tribune* (April 5, 1900).

Notable Men of Chicago and Their City. Chicago: Chicago Daily Journal, 1910: 119.

"Officials Seek to Prevent the Building of Ugly Bridges," *Chicago Tribune*, September 13, 1930.

"Pihlfeldt Dies at 82," *Chicago Daily News*, January 23, 1941.

Prominent Democrats of Illinois. Chicago: Democrat Publishing Company, 1899: 172-73.

Sneddon, Matthew, "Chicago Avenue Bridge." HAER No. IL-144, 1999. HABS/HAER Collection. Library of Congress, Washington, D.C.

U.S. Patent No. 1,001,800, received August 29, 1911, Alexander F.L. von Babo, 1.

"Want Grace in New Bridges," *Chicago Tribune*, May 7, 1911.

"West Madison Street," *The Economist*, January 29, 1916.

2. Secondary and published sources:
   Draper, Joan. *Chicago Bridges*. Chicago: City of Chicago, 1984.

C. Likely Sources Not Yet Investigated: Original plans for this bridge and those of later alterations may be on file at the Chicago Department of Transportation Office. The construction permit may be on file at either CDOT or the U.S. Army Corps of Engineers' Chicago office.

PART IV. METHODOLOGY OF RESEARCH

A. Research Strategy: The research strategy focused on identifying detailed information about the Ewing Avenue Bridge from primary source materials, such as the City of Chicago Department of Public Works Annual Reports, historic photographs, and contemporary engineering articles, as well as published books and reports.

B. Actual Research Process: Research focused on reviewing City of Chicago Department of Public Works Annual Reports from varying years, which are on file at the Harold Washington Library's Municipal Reference Department. Research also relied upon contemporary newspaper articles found via proquest and included a review of the online catalogs of various repositories to identify other print and photographic materials related to this bridge.

C. Archives and Repositories Used: Burnham and Ryerson Libraries and its Historic Architecture and Landscape Image Collection; Harold Washington Library's Municipal Reference Collection; James Parker Collection at the Daley Library, University of Illinois at Chicago; Chicago History Museum and its Chicago Bridges Collection and Department of Public Works Photo Collection.

D. Research Staff

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PART V. PROJECT INFORMATION

This documentation project was undertaken to mitigate the adverse effects of the demolition and replacement of the Chicago Avenue Bridge over the North Branch of the Chicago River. This mitigation was proposed in Section 6.0 (page 7) of the Chicago Department of Transportation's Section 106/4(f) report. CDOT proposed, as a mitigation measure for the demolition of the bridge, that the City of Chicago "develop a Bascule Bridge Preservation Plan in order to maintain a representative sample of these types of structures." This report is part of a larger Bridge Preservation Plan undertaken in 2016-17, which identified and documented surviving bascule bridges in Chicago, grouped them by important categories such as age and bridge sub-type, ranked bridges according to importance, and provided recommendations on which bridges are the best and most important for the City to preserve.