Projector Test Screen

Slides Ready

International Railroad Bridge, Sault Ste. Marie

Presented By: Nathan Holth

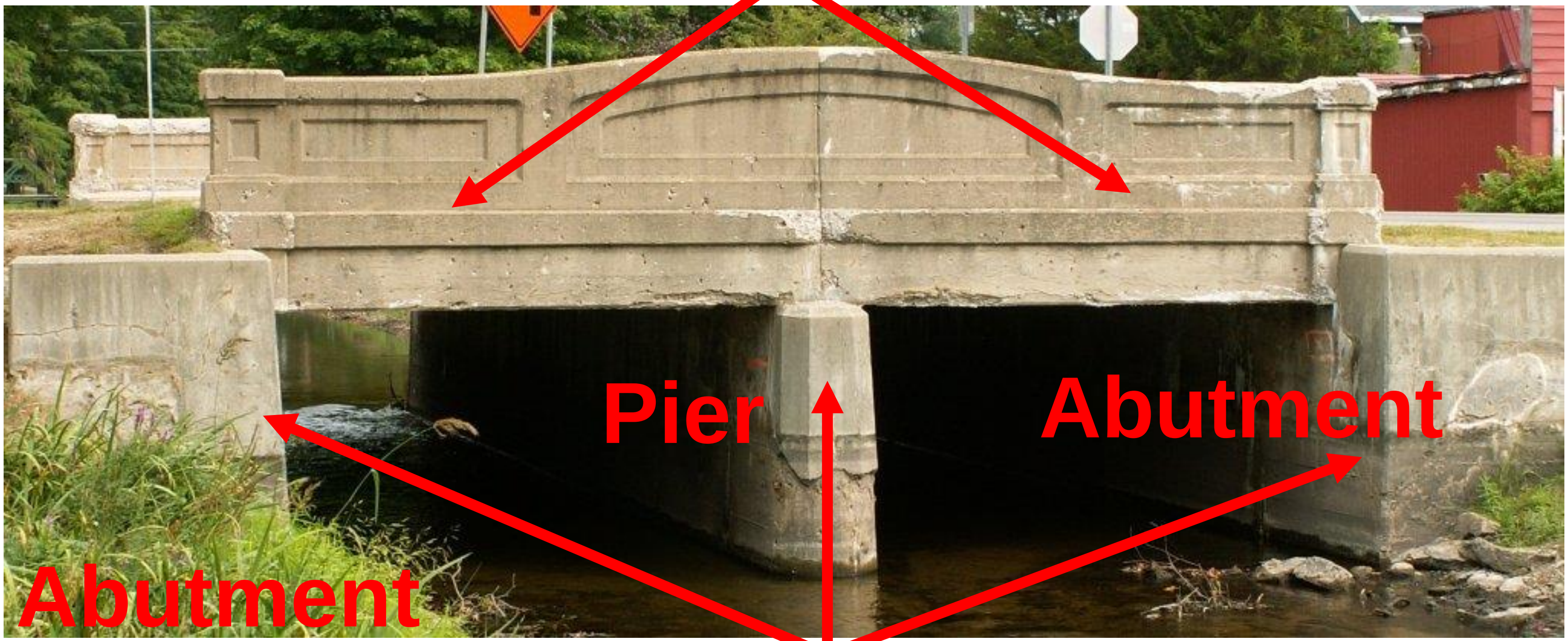
Introduction: About Me

- Website created and maintained by me.
- Photos, Advocacy, & Documentation
- 32 States
- 4 Canadian Provinces
- 4475 Bridges Listed Currently
- 14 Years

- I work in the office and also handle historic bridge matters.
- Steel Fabricator
- Restoration/Relocation of Historic Bridges &
- Hot Rivets

Bridge Structure Basics

Superstructure



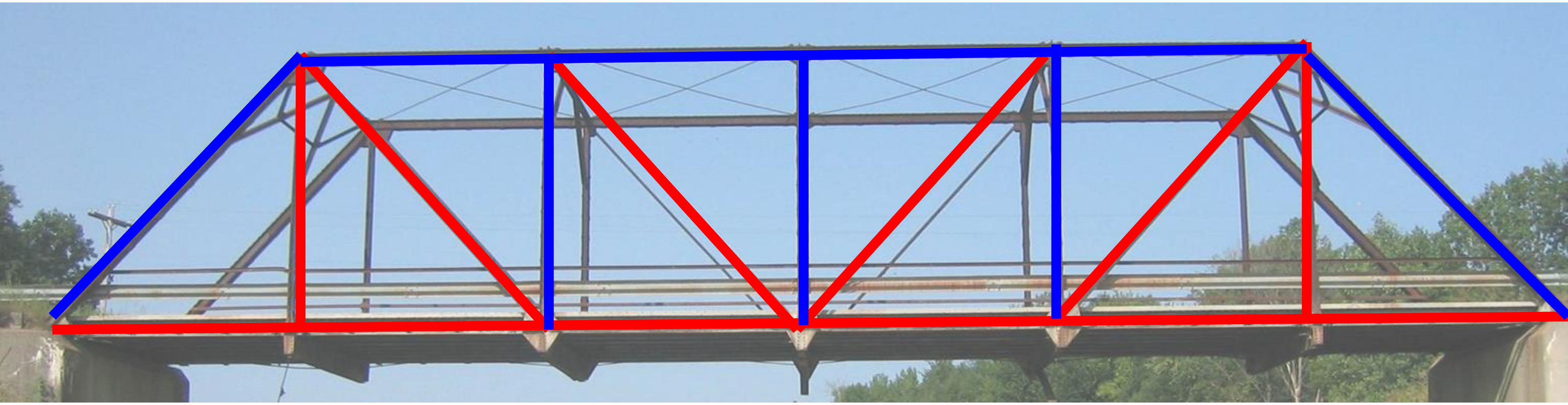
Substructure

The part of the bridge that spans the obstacle is the superstructure. The part of the bridge that holds the superstructure up is the substructure (piers and abutments)

Truss Bridge Forces

Compression

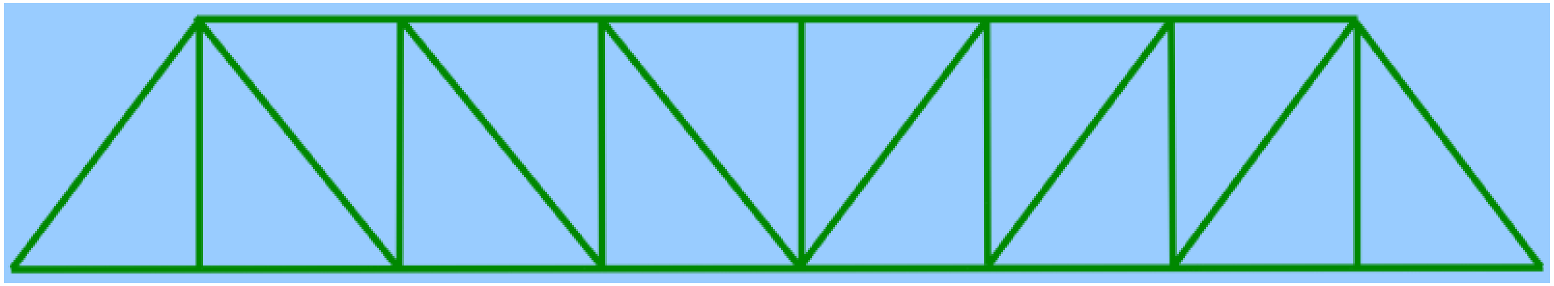
Tension



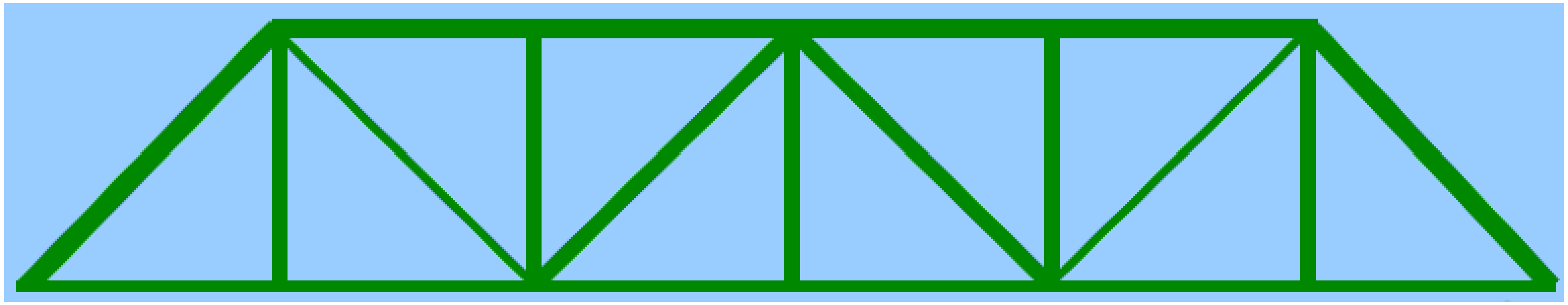
The parts of a truss bridge experience forces in the form of tension (stretching apart) and compression (squeezing together). Engineers often picked different types of materials and designs for the different parts of a bridge based on these forces. An example is shown above.

Truss Configurations

Pratt



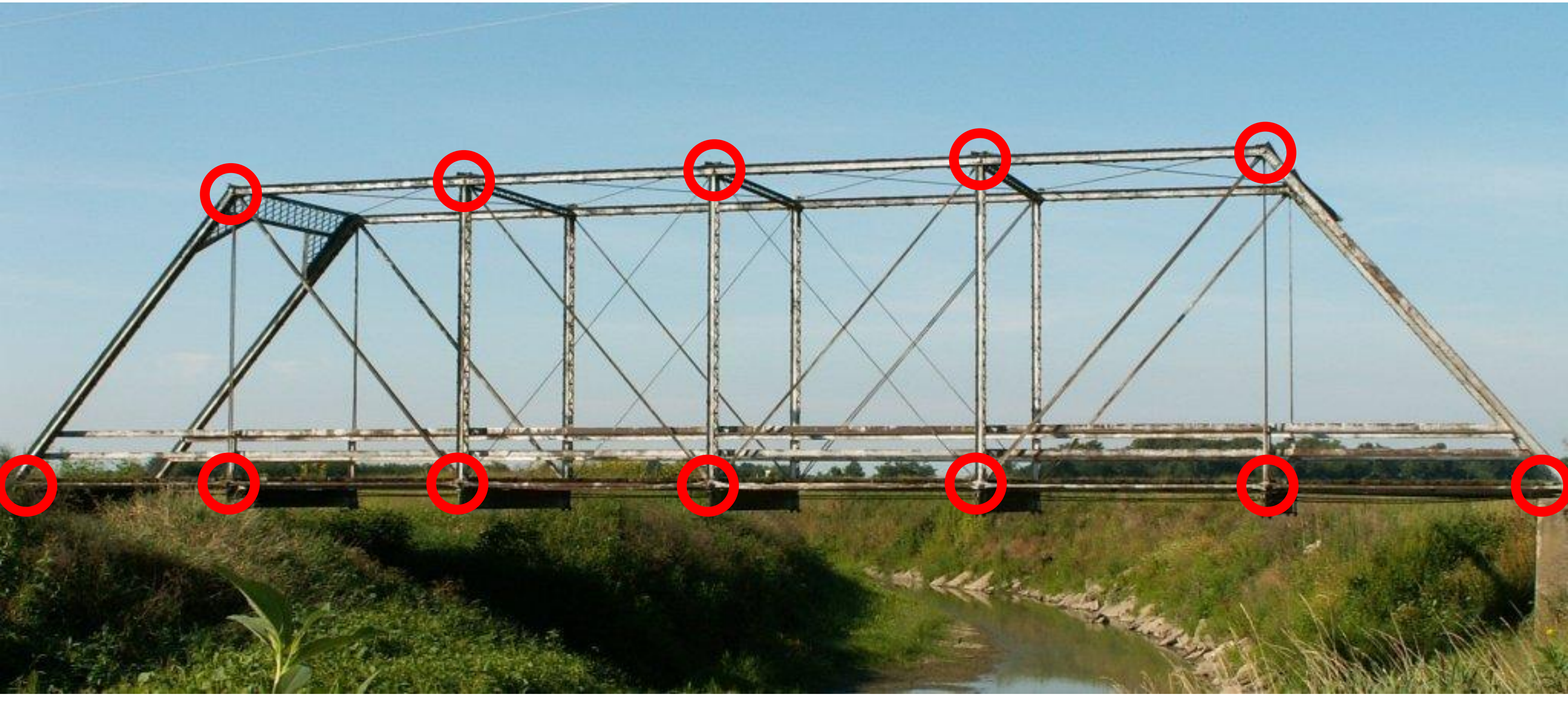
Warren



The two most common truss configurations are shown above.

Truss Bridge Connections

The pieces of the framework of a truss bridge are held together by **connections**, sometimes also called joints. Most connections on historic bridges are either riveted or pinned, but can also be bolted or welded.



International RR Bridge

1960
Vertical
Lift
Span

1913
Bascule
Span

1887
Fixed
Truss
Spans

1895
Swing
Span

Overall, this is one of Michigan's most well-known and historically significant railroad bridges. The four most significant parts of this complex, 1 Mile long bridge is shown above from south to north.

International RR Bridge

From North (Canada) To South (USA)

1895 through truss swing span. New addition in 1895.

1887 Fixed camelback through truss spans. Nine spans total. Originally 10 spans until southern span replaced by larger bascule span.

1913 Bascule Span. Replaced one original 1887 fixed camelback span at the north end of this section, and one lattice truss spans at south end.

1959 Vertical Lift Span. Replaced an original 1887 swing span.

International RR Bridge

Bridge is owned by Sault Ste. Marie Bridge Company, a subsidiary of the Wisconsin Central Ltd, which is itself a subsidiary of Canadian National Railway

1886: The Beginning

This photo from 1886 shows the construction of the bridge piers.

Swing Basics

Closed **(Chicago)**

Open **(Grand Haven)**

Overview: The swing bridge's movable span turns on a pier 90 degrees to open a channel for the boats. They fell from favor in the 20th Century because their central pier limited the width of the channel.

Swing Basics

Offshore Pier
(Sault Ste. Marie)

Bobtail (Chicago)

Appearance: Some bridges may have the swing pier of the bridge offshore, which increased channel width. Other examples may be shorter at one end which will also have a counterweight, and are known as bobtail swing bridges. These are uncommon.

ca. 1895-9 Swing Span

When the bridge was first built in 1887, a canal was not present here. The addition of this Canadian canal resulted in construction of this swing span ca. 1895 at the northern end.

ca. 1895-9 Swing Span

Views showing bridge open and closed.

ca. 1895-9 Swing Span

Swing pier with rack and pinion system leading to machinery room overhead.

ca. 1895-9 Swing Span

Swing pier with rack and pinion system leading to machinery room overhead.

21st Century Repairs

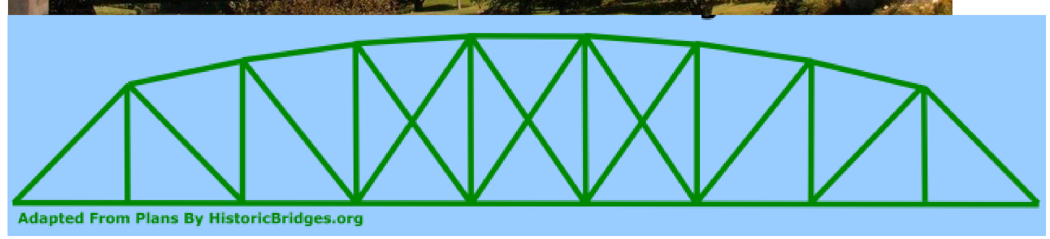
The bridge continues to carry traffic, but some alterations have been made to strengthen the spans.

Truss Configurations

Parker

Overview: Charles H. Parker modified the Pratt design to create what became known as the Parker truss configuration. This design allowed one to use less materials to get the a similar load capacity. The downside was the more complex design.

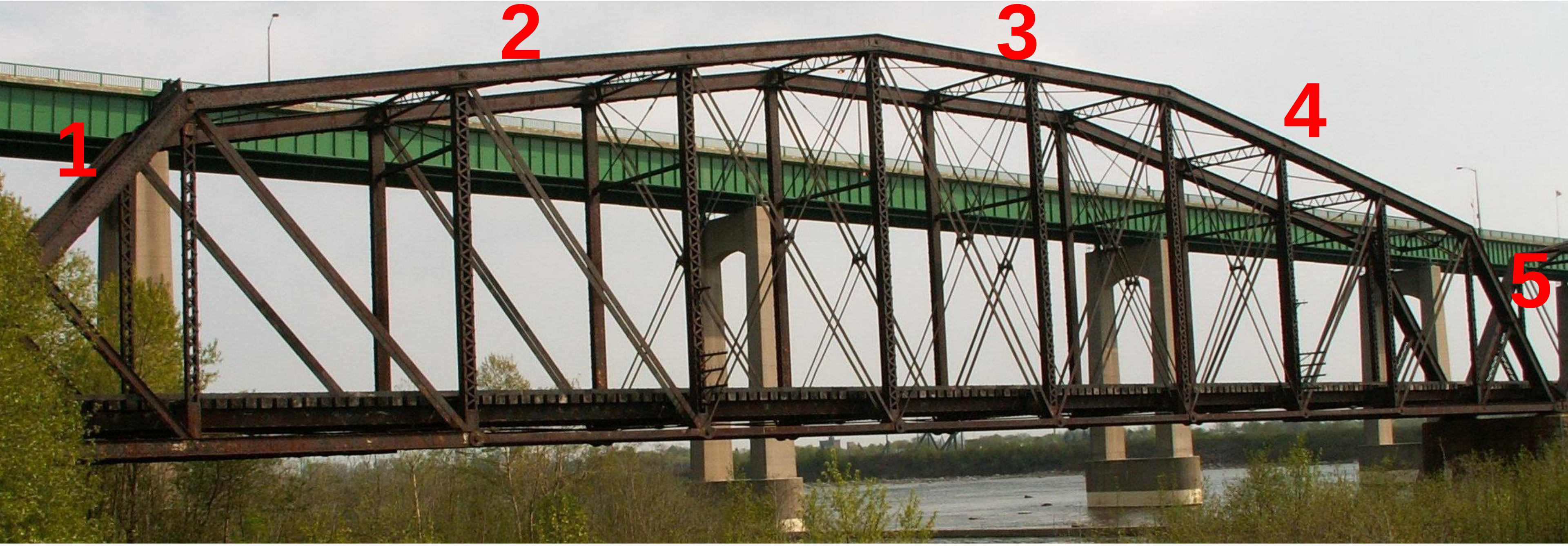
This one is next to I-96 In Portland, Michigan!



Appearance: Characterized by an arch-shaped (polygonal) top chord, with diagonals that follow the Pratt configuration.

Truss Configurations

Camelback



Overview: Some bridges that appear to be simple Parker truss bridges but have exactly five sections of top chord are referred to more specifically as a Camelback truss.

Appearance: Characterized by exactly five different angled sections of top chord, with a Pratt layout of the diagonals.

Camelback Truss Spans

The bridge originally included ten fixed Camelback through truss spans. In 1913, the southernmost span was removed.

Camelback Truss Spans

The most significant surviving part of the original 1887 construction, these spans were built by the Dominion Bridge Company of Montreal (Lachine).

Dominion Bridge Company


DOMINION BRIDGE CO.,

(*LIMITED.*)

Works at Lachine, P. Q.
Job Abbott, President and Engineer.

Works at Toronto, Ontario.
Phelps Johnson, Manager and Engineer.

STEEL EYE BARS,

Plates, Channels, Beams, Angles and Rivets.

STEEL AND IRON RAILWAY AND HIGHWAY PLATE

AND

Truss Bridges, Viaducts, Roofs, Turn-Tables and Structural Metal Work.

Refer to G. T. Ry.; C. V. Ry.; T. G. & B. Ry.; G. B. & L. E. Ry.; Central Ontario Ry.; S. E Ry.; Q. C. Ry.; Q. & L. St. J. Ry.; I. C. Ry.; W. & A. Ry.; Canada Atlantic Ry ; Ont. & Quebec Ry.; Canada Pacific Ry.; Dept. of Railways and Canals, Ottawa and municipal authorities at numerous points in Canada. Capacity of both works, 15,000 tons yearly.

☞ Special Rates for American Designs for Export Trade. ☜

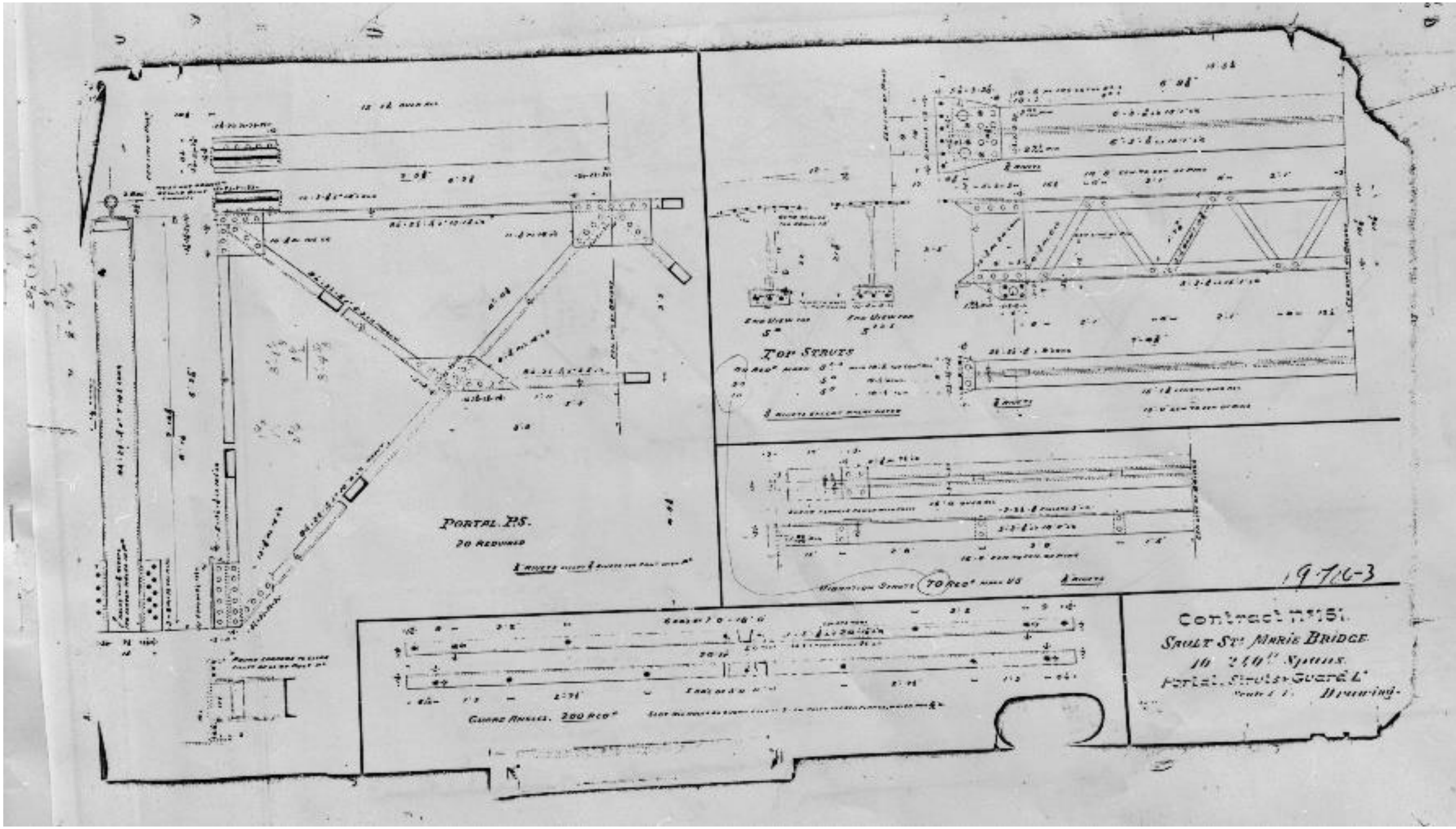
President and Chief Engineer's Office :

Room No. 1, Windsor Hotel, Montreal, P. Q.

1885 Advertisement

The President and Engineer for Dominion Bridge Company was Job Abbott.

Dominion Bridge Company



Original plans for the bridge included details like this drawing for the portal bracing.

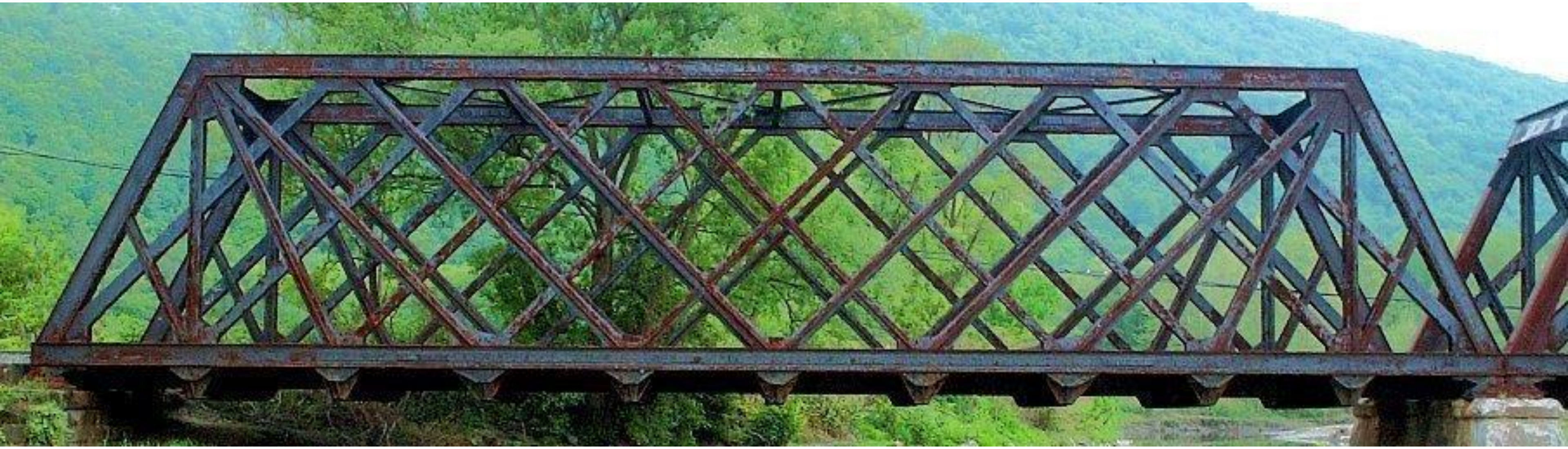
Dominion Bridge Company

These spans can be considered a notable surviving bridge all on their own due to their length, number of spans, and age.

21st Century Repairs

The bridge continues to carry traffic, but some alterations have been made to strengthen the oldest spans.

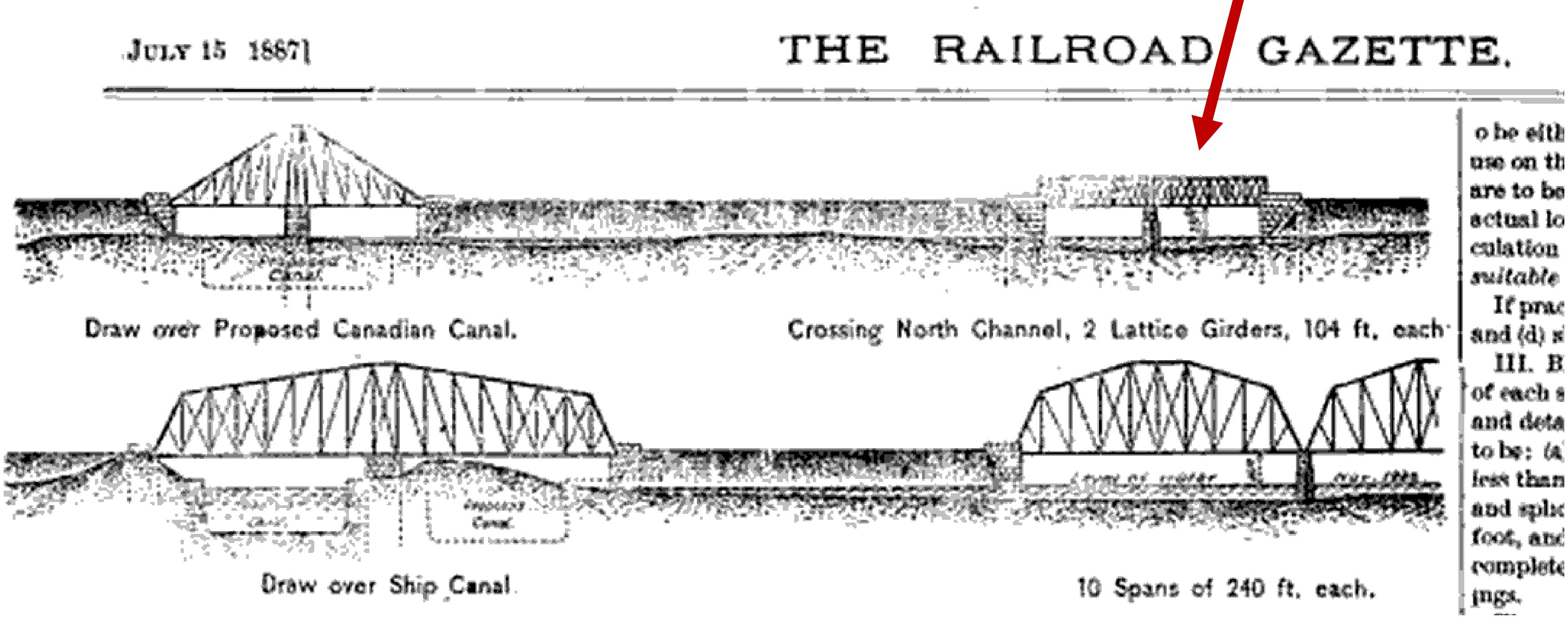
Lattice Truss



Overview: An adaptation of Warren truss technology that tends to show up on railroad bridges and with riveted connections. This category includes any multi-intersection Warren, generally beyond Double-Intersection (ie triple, quadruple, quintuple)

Appearance: Multiple Warren trusses offset and superimposed on each other, forming a lattice pattern.

Lattice Truss Spans

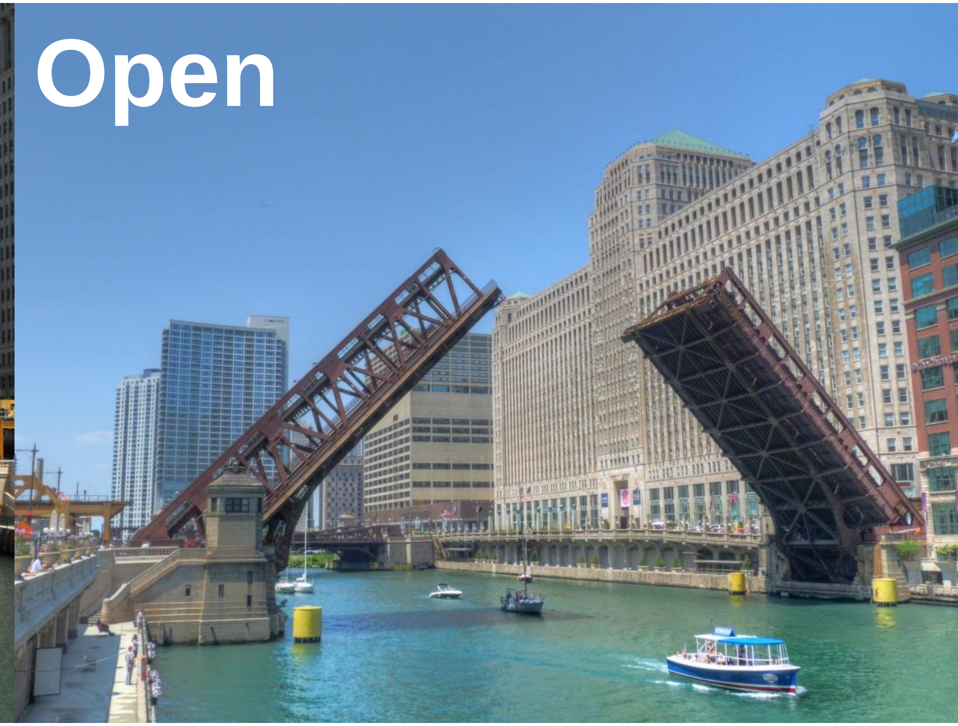


The bridge originally included two 104 foot lattice truss spans (also called lattice girders). These were replaced, presumably in 1913.

Lattice Truss Spans

Little is known about these spans and why their design differed from the Camelback spans. These two European-style 110 foot lattice pony truss bridges in Bruce County, Ontario are rare examples of the same type.

Bascule Basics



Overview: Bascule literally means “seesaw.” A bascule bridge operates by rotating up to open the channel. Counterweights provide the balance to make this motion possible. Offering good channel clearance, they are a popular type of movable bridge.

Bascule Basics

Double Leaf Highway Bridge

Single Leaf Railroad Bridge

Because they are more stable, railroads almost always built single leaf bascule spans rather than the double-leaf type more common with highway bridges, where each leaf is a structurally independent cantilever functioning like holding your arm out.

Bascule Span

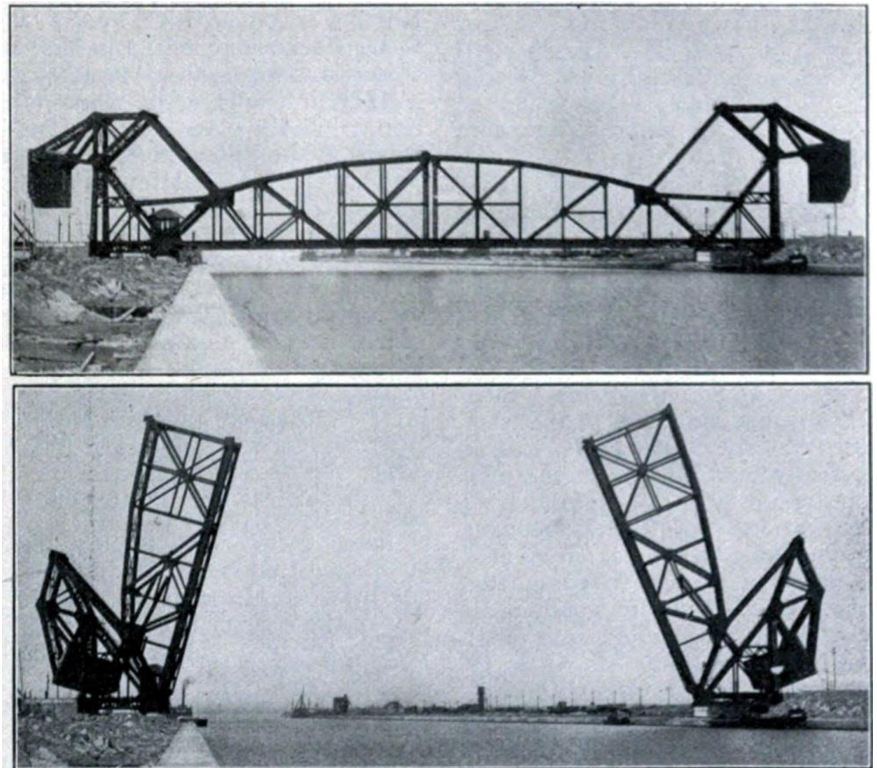
Double Leaf Highway Bridge With Cantilever Function

The International RR Bascule is a double leaf bascule that functions as a simple single span truss when closed, not as two independent cantilevers. Compare how the railroad bridge has a deeper (taller) truss in the center of the span.

Bascule Span

The bascule span replaced one Camelback truss span and the two lattice truss spans in 1913.

Bascule Span



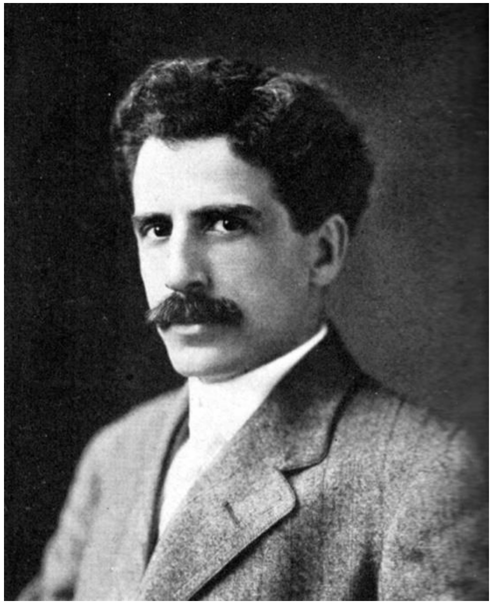
It is the only surviving example of a type only built twice. (the other was in California.) It was also the longest bascule span in the world when completed in 1913 with a 336 foot span.

Long Beach, CA Bridge

The California example (Over Cerritos Channel in Long Beach) no longer exists, and was built later in 1923-4 with some truss design differences.

Joseph Strauss

The bascule was designed by the Strauss Bascule Bridge Company, run by famous Chicago engineer Joseph Strauss. He invented special locks at the center of the span which turn it into a simple truss when closed.



The Strauss Trunnion Bascule Bridge

has been adopted for the world's largest bascule bridge structures because of its simplicity, economy in first cost and operation, and its efficiency under the most severe operating and traffic conditions.

Strauss Heel Trunnion Bascule Bridge over the Calumet River at South Chicago. Movable Span, 235 feet. Double Track. Designed by the Strauss Bascule Bridge Co. for the Baltimore & Ohio Railway Co. F. L. Stuart, Chief Engineer; J. E. Greiner, Consulting Engineer; W. S. Bouton, Engineer of Bridges.

This Strauss Trunnion Bascule Bridge is the longest Single-Leaf Bascule Bridge in the World.

Strauss Heel Trunnion Bascule Bridge over the United States Ship Canal at Sault Ste. Marie. Movable Span, 336 feet. Single Track. The only double-leaf bascule acting as a simple span for live load. Designed by the Strauss Bascule Bridge Co. for the Canadian Pacific Ry. Co. P. B. Motley, Engineer of Bridges; C. C. Schneider, Consulting Engineer.

This Strauss Trunnion Bascule Bridge is the longest Double-Leaf Bascule Bridge in the World.

The Strauss Bascule Bridge Co.

Main Office, CHICAGO, U. S. A.

NEW YORK
SEATTLE

MONTREAL
WINNIPEG

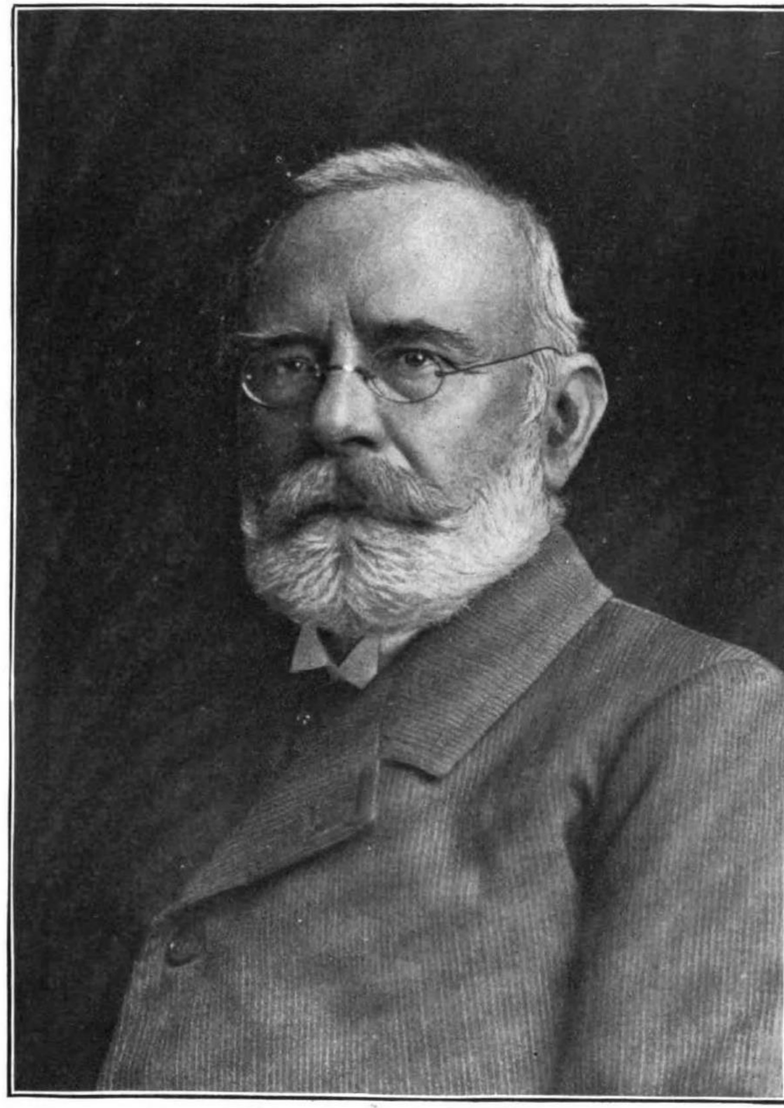
C. C. Schneider

Charles Conrad Schneider, a noted bridge and mechanical engineer was the consulting engineer for the bascule bridge project.

Other works:
Niagara Canyon Railroad Bridge, British Columbia (Vancouver Island)

Washington Bridge (Over Harlem River), New York City

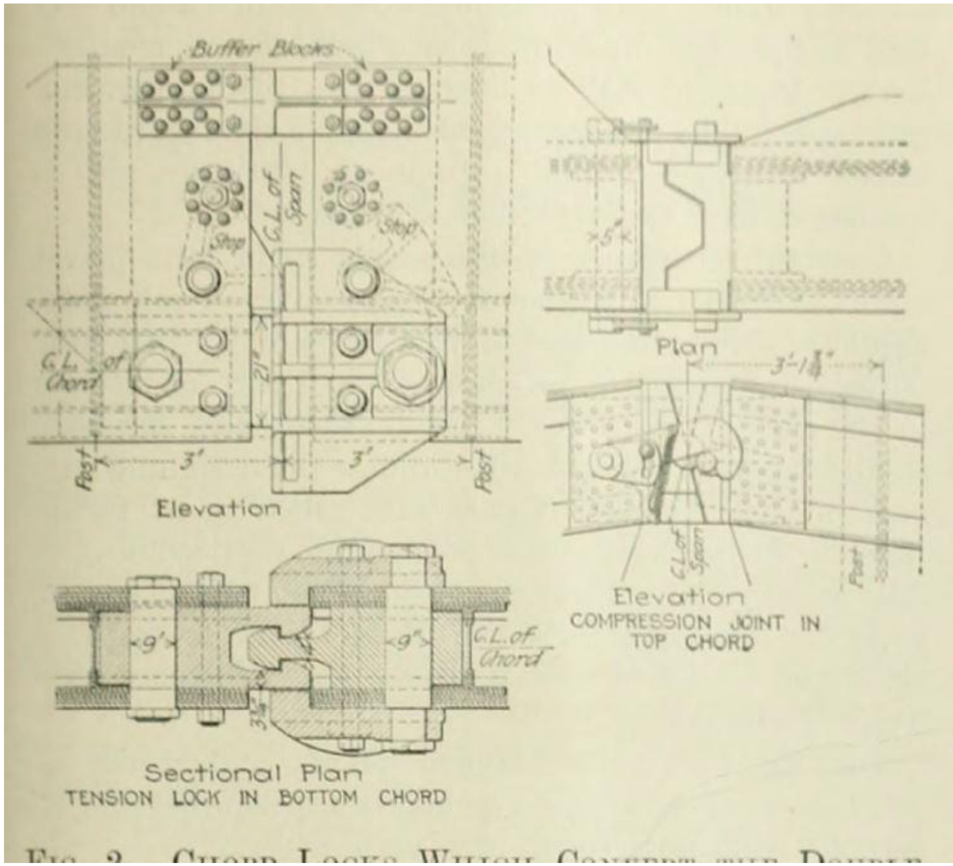
2nd Quebec Bridge, Member of Gov. Board of Engineers.

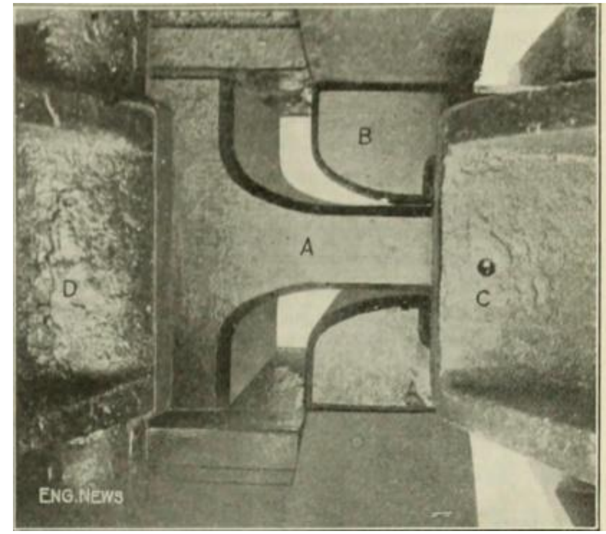


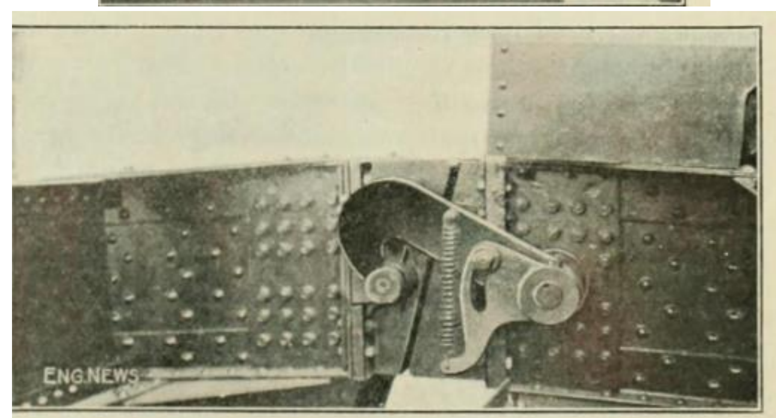
CHARLES C. SCHNEIDER,
Vice-President, in Charge of Engineering Department, American Bridge Company, New York.

Photo. by Holden.

Bascule Span

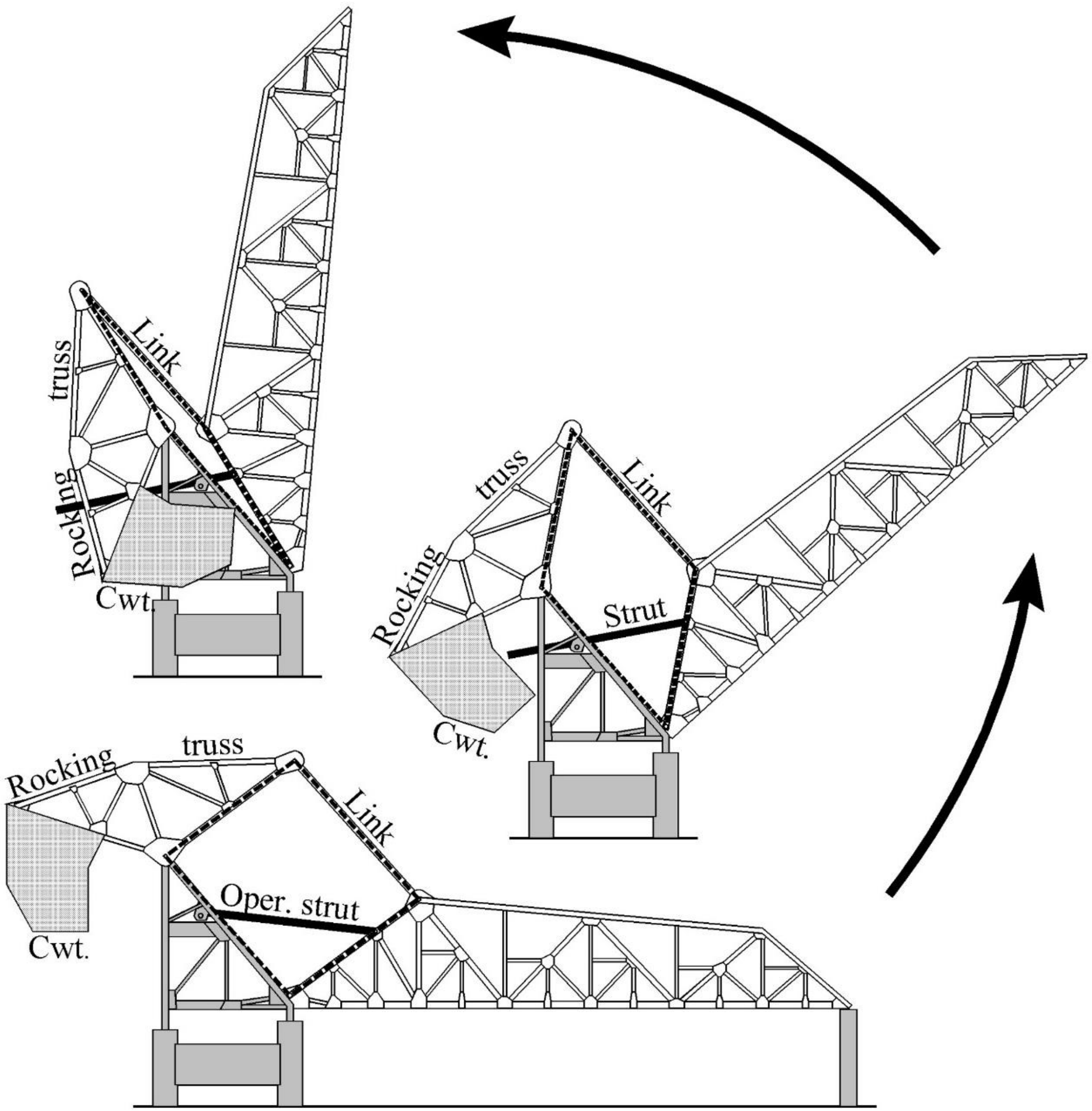






Engineering News drawings and photos showing the unique upper and lower locks at the center of the span.

Bascule Span



The bascule is also one of the earliest examples of Joseph Strauss' "heel trunnion" type of bascule, where there are two axels (trunnions) around which rotation occurs, one for the leaf, the other for the counterweight.

Bascule Span

Each bascule leaf weighs 400 tons.

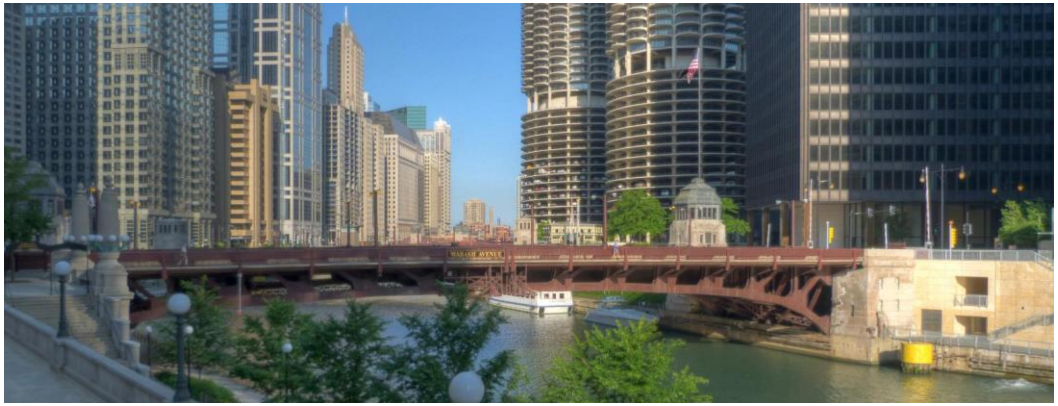
The 336 foot span was the largest in the world when completed.
(426 feet between counterweight ends)

336 Ft. Span Comparison

1917 Market St. Bridge, Chattanooga, TN: 358.8 Feet

1940 Erie Ave Bridge, Lorain, OH: 330 Feet

1930 Wabash Ave Bridge, Chicago, IL: 269 Feet



Bascule Span

In October 1941 one bascule leaf dropped into the canal as a train crossed. The locomotive and tender went off the collapsed span into the water, killing Engineer Hazel Willis and Conductor Dave Monroe.

Bascule Span

Cause is unclear, reportedly triggered by weight of train. It interrupted critical iron ore transportation during the wartime period by blocking the largest canal. Sabotage was ruled out. Bridge was repaired and reopened.

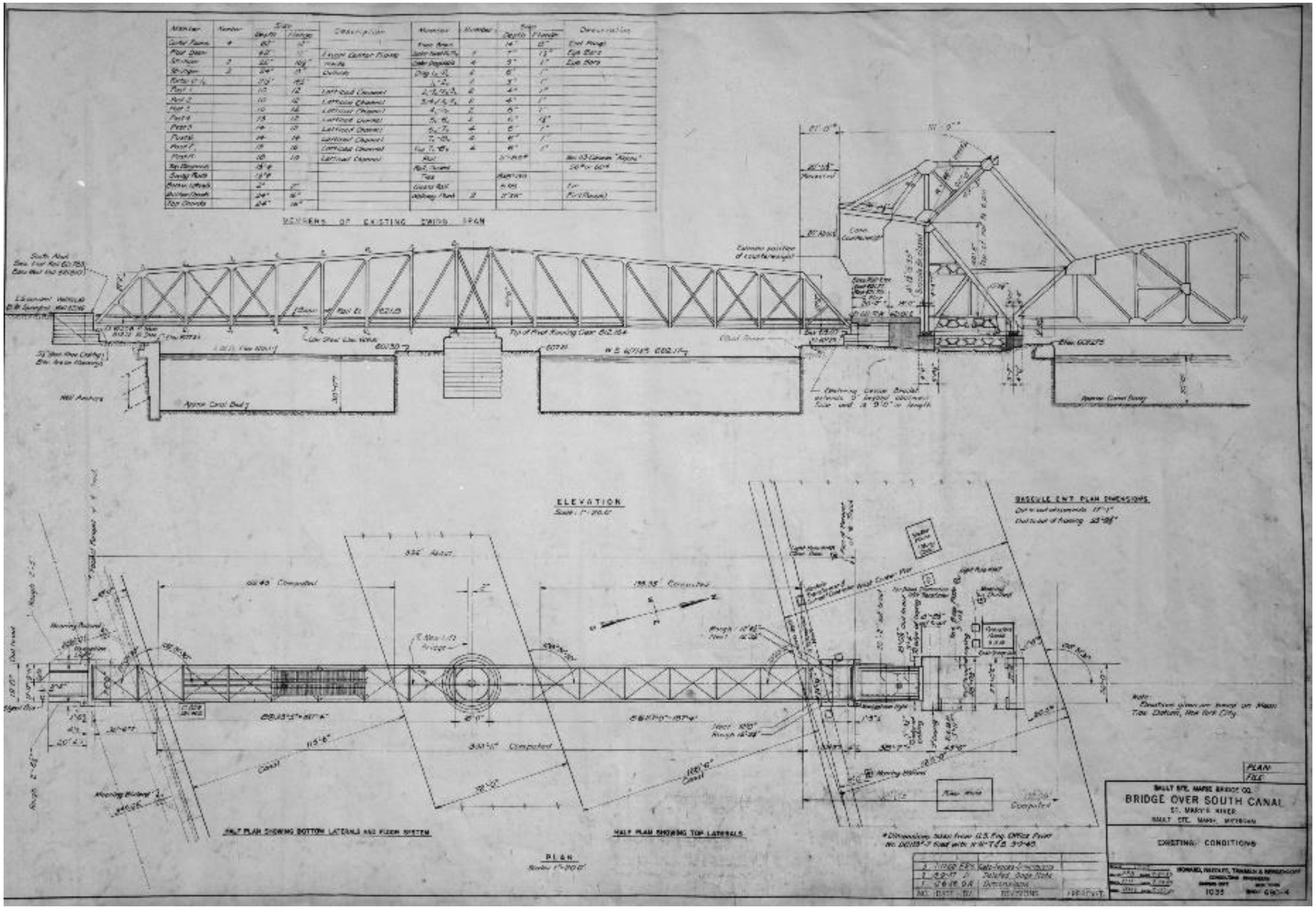
1887 Swing Span

The bridge originally included one swing span at the south end of the bridge. This was replaced in 1959 with a vertical lift span.

1887 Swing Span

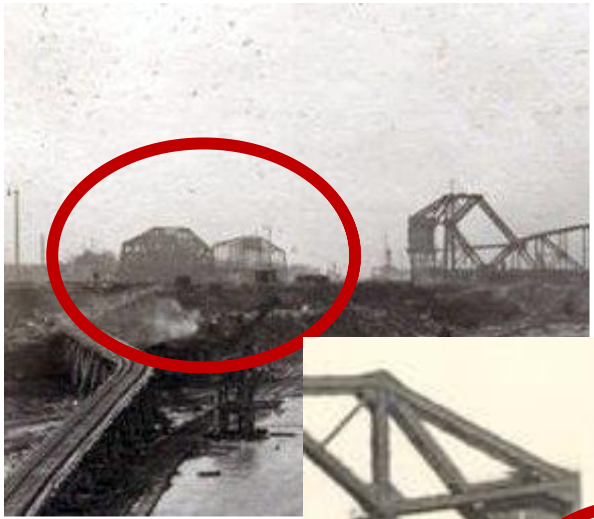
This photo shows the span being constructed.

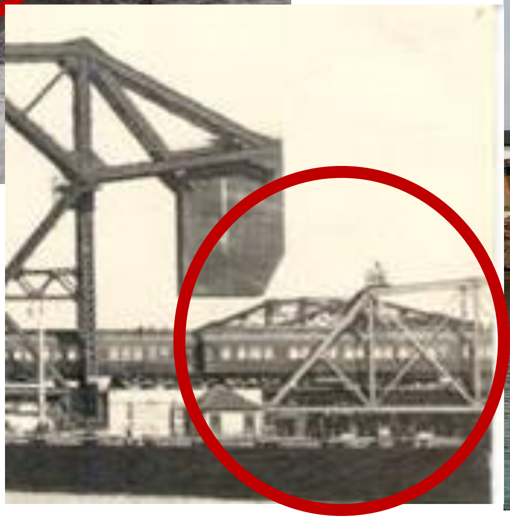
1887 Swing Span



Plans for replacing the bridge in the 1950s included a drawing of the swing span.

1887 Swing Span





Historical photos from this period show two swing spans visible. One of them is likely an emergency swing dam that no longer exists, but may have been like one in Canada.

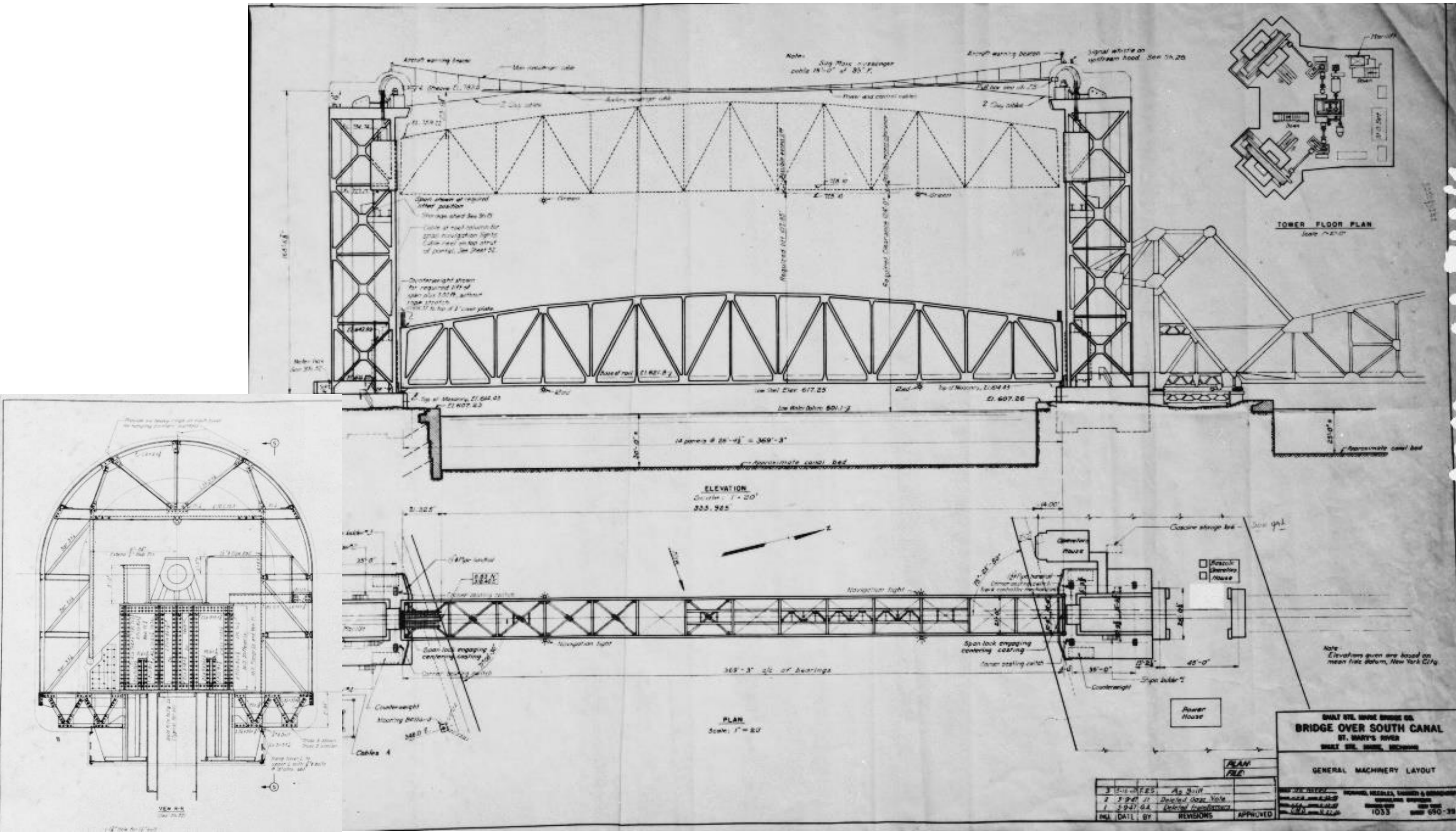
Vertical Lift Basics

Overview: Vertical lift bridges raise the bridge superstructure directly up, to provide the clearance for boats to pass. They can clear the entire channel, but there is always a limit to the available clearance they provide.

1959 Vertical Lift Span

The 1959 vertical lift bridge is a contrast to the late 19th and early 20th century spans.

1959 Vertical Lift Span

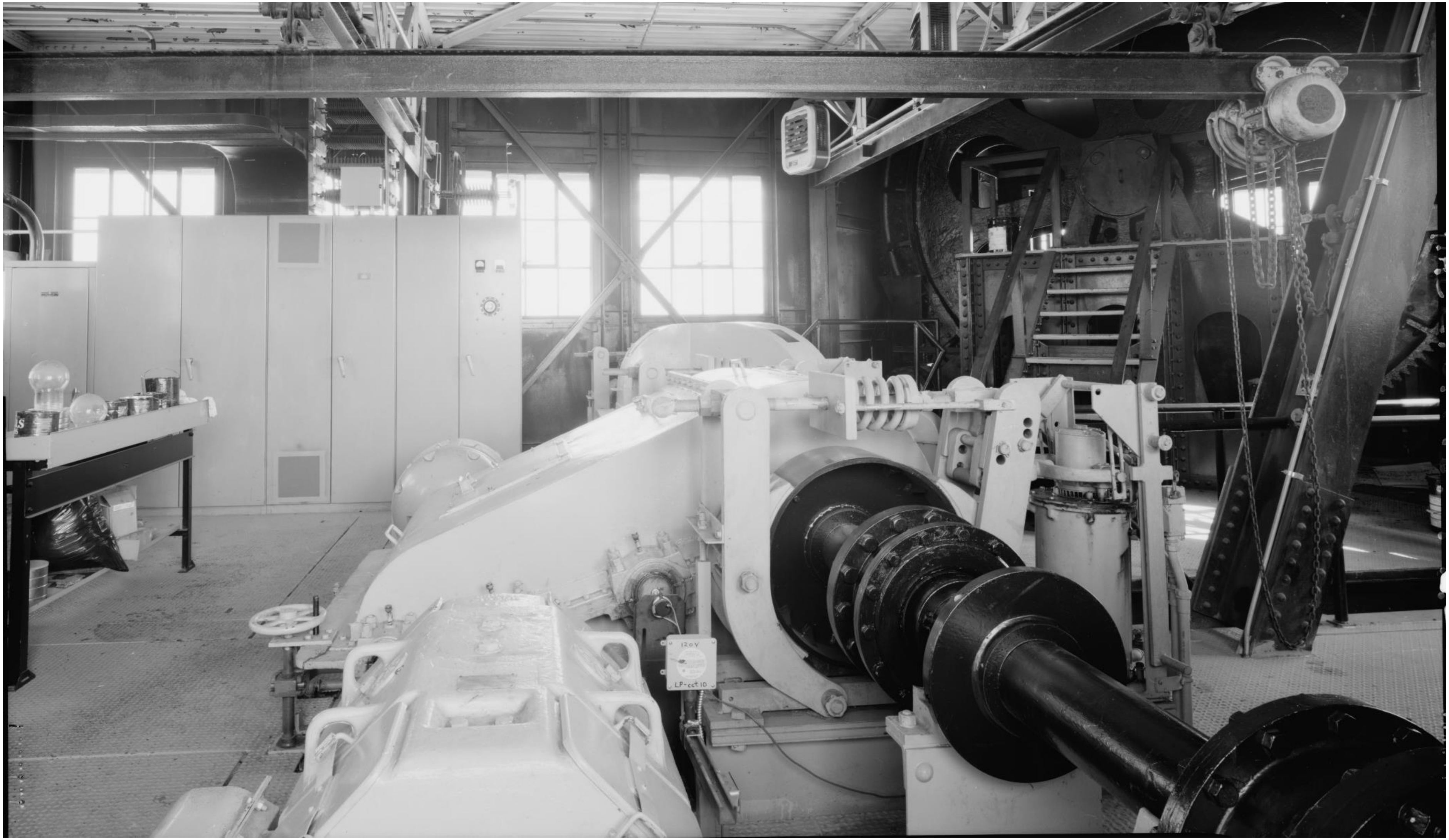


Original plans for bridge construction.

1959 Vertical Lift Span

View of machinery room.

1959 Vertical Lift Span



View inside machinery room.

Conclusion/Questions

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- **HistoricBridges.org**
- **Historic American Engineering Record**
- **Randy Mulder**
- **Upper Peninsula Regional Digitization Center**
- **Toronto Public Library**

Email: nathan@historicbridges.org