Railroad Bridges on The River Rouge

Presented By: Nathan Holth

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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
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).
Rolled iron and steel comes in several basic forms, including beams, bars, angles, rods, channels, and plates.
Before the ability to roll larger and stronger beams arrived, iron and steel elements were often riveted together to form larger and stronger beams. Such beams that are formed from smaller elements are built-up, sometimes called “fabricated” as well.
A metal truss bridge is a bridge whose main structure comes from a triangular framework of structural steel or iron.
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.
If the trusses run beside the deck, with no cross bracing above the deck, it is called a pony truss bridge.

If cross-bracing is present above the deck of the bridge, then the bridge is referred to as a “through truss.”
Trusses may run under the deck: these are called simply Deck truss bridges.
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.
Metal girder bridges are often called plate girder bridges. The were common on railroads and some states built them on highways frequently as well. They generally date from 1900 on.
Similar to truss bridges, the girders can be beside the road or below. Typically metal girders do not have overhead bracing, and those with girders beside the roadway are usually considered through girders.
Bridges may be movable, which means they are designed to open to make way for boats. Movable bridges are defined by the way they move. The actual structure type may vary, including metal truss, girder, and stringer.
Overview: The swing bridge is the oldest of the common movable bridge designs. In these, the movable span turns on a pier 90 degrees to open a channel for the boats. They fell from favor because their central pier limited the width of the channel.
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.
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.
The Strauss Bascule Bridge Company was run by famous Chicago engineer Joseph Strauss.

Commonly known for being Chief Engineer of the Golden Gate Bridge, although University of Michigan professor Charles Alton Ellis did most of that work.
This is an drawing 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.
Original interior of a 1920 heel-trunnion bascule machinery room.
A period drawing showing the trunnion design of a Strauss bascule.
An excellent example of a typical Strauss heel-trunnion bascule bridge, as designed by famous engineer Joseph Strauss.
Michigan Central Bridge

Bridge in raised position.
Michigan Central Bridge

Difficult-to-access views of the bridge.
The Detroit Historical Society holds a detailed set of historical and construction photos.
The bridge replaced a previous pin-connected through truss swing bridge shown here.
The bascule was built in the raised position. Shown here is substructure and counterweight frame construction.
Here the bascule leaf erection is shown with the swing bridge to the left.
The construction crew is shown posing for photographs.
Operation of the swing bridge shortly prior to its removal. Railroad traffic was maintained throughout construction.
Removal: The swing bridge was placed onto barges by pumping water out of barges to raise them up to carry the bridge.
Abt Bascule Bridges

A movable type patented by Hugo A.F. Abt of the American Bridge Company.

Counterweight kept above the tracks so bridge could be erected in raised position while traffic continued on a former bridge.

First example: Wabash Railway over Rouge River, 1922
Abt Bascule Bridges

- **Leaf**
- **Frame**
- **Stationary Pin**
- **Counterweight Frame**
- **Counterweight**
- **Counterweight Operating Link**
- **Inclined Track and Toothed Rack**
- **Bridge Tender House**
- **Frame**
- **Pin**
- **Operating Link**
  - (Motor Carriage To Leaf and Rocker Link)
- **Motor Carriage And Pinion**
- **Trunnion**
- **Rocker Link**
Bascule Bridge

- Stationary Pin
- Leaf
- Counterweight Frame
- Counterweight
- Inclined Track and Toothed Rack
- Frame
- Motor Carriage And Pinion
Port Huron’s Abt bascule bridge provided unique photo angles not open to the public on the Wabash Bridge.
The bridge’s motor carriage provides power and moves along a track as the bridge is opened and closed.
Overview of the machinery on the motor carriage.
Abt Bascule Details

Drive shaft sends power to the pinion and the roller train and motor carriage move on track.
Surface of counterweight showing access hatches likely for adjusting the weight of the counterweight. Photo Courtesy Bach Steel
Stationary pin at top of counterweight frame. The counterweight rotates around this point. Photo Courtesy Bach Steel.
Link pins provide rotation for the link. A link is a beam that transfers the motion/energy to the parts of the bridge that move.
The actual bascule leaf (truss span) rotates around the main trunnion shown here.
Abt Bascule Bridges

Manitowoc County, WI
Demolished 2011

San Joaquin County, CA

Beaumont, TX
Demolished 1969

Only eight of this type were ever built. Two have been demolished.
Abt Bascule Bridges


1972 Photo Credit: Craig Gardner

Michigan has three of the six surviving Abt bascule bridges!

Photo Credit: Rick McOmber

Michigan has three of the six surviving Abt bascule bridges!
Completed for Wabash Railroad in 1922 by the American Bridge Company of New York, NY. Steel fabricated at the Gary Works in Indiana. First Abt bascule ever built!

162 foot Abt bascule span, 180 foot overall length. Designed for Cooper’s E50 Loading.
This series of photos shows the newly completed bridge being raised. The previous bridge is still present here.

The previous bridge was a 180 foot metal pin-connected Pratt through truss center pier swing bridge. It appears to have been a very lightweight railroad bridge.
The bridge was also used by Baltimore & Ohio, Detroit & Toledo Shore Line, Pere Marquette, and Pennsylvania RR. A 3 day count shows 113 trains in 24 hours, or a train every 13 minutes.
Erected in raised position, with the lower part of the deck left out so trains could continue to cross the river. Closure time to lower bascule, install deck, and switch to new bridge: only 7.5 hours!
This view shows the original configuration of the motor carriage. Although installed with two 100HP motors, only one was needed to operate the bridge.
The bridge’s counterweight is 1,000 tons, and has interchangeable 2,500 pound concrete blocks for adjustments.
A remarkable railway bascule bridge, in which the counterweight and the bridge span swing on different axes, is now in operation across the Rouge River, where the tracks of the Pennsylvania and Wabash railroads lead into Detroit, Mich. The structure, called the “cross-rotating” type of bascule, is said to be the only one of its kind in the world. One of its extraordinary features is the motor house, which travels up and down an inclined track, following the movement of the counterweight, and which actually forms part of the weight itself.

The ordinary bascule operates simply as a lever with a counterweight to balance the bridge proper. Weight and bridge both swing on the same axis.

The counterweight of the Rouge River bridge, on the other hand, swings in a quarter circle on a pivot just beneath the apex of a tall triangular steel frame, while the bridge proper is pivoted at the base of the frame. Bridge and counterweight are connected by jointed girders.

When the bridge is down, the counterweight is suspended in a horizontal plane, where it is locked against movement by racks and cogs of the incline. When the bridge is raised, the counterweight swings downward in a half circle, while the motor house moves down the incline in front of it.

Less Power Needed

This arrangement is said to require less power for operation than the ordinary bascule and is quicker in opening and closing the bridge. A 100-horsepower electric motor opens and closes the bridge in 90 seconds.

An extra motor is provided for use in case of a breakdown. A gasoline engine that will open the bridge in eight minutes is also available.

Concrete blocks, each weighing 2500 pounds, make up the 1000-ton counterweight. The movable span is 162 feet long. In the powerhouse is mechanism that prevents operation of the bridge until all signals are set.

Source: Popular Science, January 1923
This bridge also attracted the attention of Popular Mechanics.

Photo Credit: Rick McOmber

The other three Abt bascule bridges are all in Michigan!
Abt Bascule Bridges


The other three Abt bascule bridges are all in Michigan!

Photo Credit: Richard H. Scheel
When the bascule span was completed, the old swing bridge was slid over, a new approach span installed, and the bascule open to traffic… with a closure to trains of only 7.5 hours!
Located in Detroit, this is a stone-faced concrete arch bridge, built in 1896. The oldest known concrete bridge (RR or HWY) in Michigan!
Built by Thomas J. Kennedy and designed by the W. H. Ashwell and Company. Berea stone and Amhurst buff stone used to face the bridge. Built for Mich Central RR and owned by NS today.
This concrete bridge does not have rebar rods inside, instead solid or riveted steel beams strengthen the concrete. This is called Melan reinforcing after Josef Melan, the Austrian inventor of this process. A deteriorated bridge above reveals this design.
All this information is thanks to one little news article, which also noted the 110 foot length bridge was the longest Melan arch at the time.

Courtesy Jen Klaus from the journals of her great grandmother, Elizabeth Jacquemain Kennedy
Conclusion/Questions

Photo Credits/Sources:
- HistoricBridges.org
- Historic American Engineering Record
- Randy Mulder
- Upper Peninsula Regional Digitization Center
- Toronto Public Library

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