Bascule Bridge

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***Abstract*- An unbalanced bascule bridge having an unbalanced bridge span including a pair of longitudinal girders with a low tensional stiffness interconnected at a pivoting end by a torsionally rigid cross-girder and interconnected along a longitudinal expanse of the longitudinal girders by a steel frame which forms a closely spaced lattice for supporting a relatively thin, lightweight concrete roadway deck. The bascule bridge span is raised and lowered by an actuator assembly including a plurality of hydraulic cylinders pivotally mounted on support columns and corresponding piston rods which apply a torque to the cross-girder through crank-plates welded to the cross-girder and pivotally interconnected to a base. The cross-girder isolates the longitudinal girders from all support and reaction forces while raising and lowering the bascule bridge span. The heel of the bridge leaf is supported on the pivot pier, also called the bascule pier. A few double leaf bascule acts as single-span truss bridges, notably the railroad bridges. William scherzer is generally credit with developed the rolling lift type of bascule bridge. Counterweight may be located above.**

INTRODUCTION

The word bascule is French word for" sea saw". the word was applied to balance bridge that pivot on a longitudinal centre line. Bascule bridge strictly applies only to those bridges that consists of single moving element, which pivots about a horizontal line near its centre of gravity so that the weight on one side of pivot about a horizontal line near its centre of gravity so that the weight on one side of the pivot axis nearly balances the weight on the other side .the balance s usually not exact. f the bias is toward keeping the bridge closed, it is referred to a span heavy. If the bias is toward keeping the bridge open, or causing it to open, it is called counterweight heavy. Many ridges pivot about a horizontal axis , but do not take the configuration of sea saw ; these bridges are generally called bascule bridge as well, and accepted usage allow the term to encompass all the variable types that pivot in the same manner. The deck section or span of bascule bridge that moves is referred to as a "leaf," which moves in similar manner .the deck section or span," but the term applies to a movable bridge section ,such as full swinging bridge or lifting portion of vertical lift bridge. The term span also applies to any length of a double leaf bascule or fixed bridge between supports, such as in "a three-span continuous bridge." The first bascule bridge were probably intended for protective purposes, as indicated previously .many of these early bridges pivoted on a shafts, called a trunnion. Trunnions also supported medieval cannons so that they could be pivoted up or down to adjust the range.The outer end of the bascule span, or a leaf, is called the toe of the leaf. The inner end, at the part of the leaf nearest the pivot point adjacent to the approach span or abutment, is called the heel of the leaf. (Shown in fig.).The heel of the bridge leaf is supported on the pivot pier, also called the bascule pier.

BASCULE BRIDGES

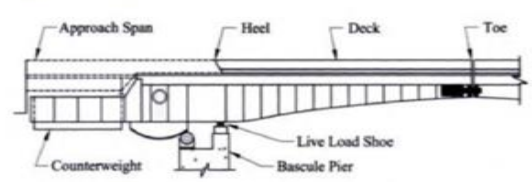


FIG. Elevation of Typical Bascule Bridge Leaf.

The simplest type of Bascule Bridge is called a "simple trunnion" type and consists of a bridge leaf with a counterweight rigidly attached to the near portion of the main support member. Almost all double leaf bascule bridge act as a cantilever, under dead and live load, with each leaf stabilized in the lowered position by resting on the live load on the bridge.

CONSTRUCTION

SIMPLE TRUNNION

A Simple trunnion on a horizontal bascule bridge consists of a unitary rigid displacement structure supported on a horizontal pivot. Sometimes the pivot shaft is stationary, and the bridge pivot around it. More often, the pivot shaft is fixed to a bascule bridge span, which is true arrangement, and the end of the trunnion is supported in sliding or antifriction bearing. If a simple trunnion bascule bridge is constructed at a low elevation above the water, a watertight pit, providing space for the counterweight end of the span as it opens ,must be inclined the bascule pier.

fig. double leaf rolling lift bascule bridge

ROLLING LIFT

William scherzer is generally credit with developed the rolling lift type of bascule bridge. his four- track bridge for metropolitan west side elevated railroad, built in 1893 over the Chicago river near van buren street in Chicago.The rolling lift bridge is translates away from the channel as it rotates open, does have to open to as great an angles as other type of bascules to provide the same clearance over a navigable waterway. the rolling lift movable bridge type that's ride on a curved track as it open and closes is generally reoffered to as a "scherzer type" whenever it is built.

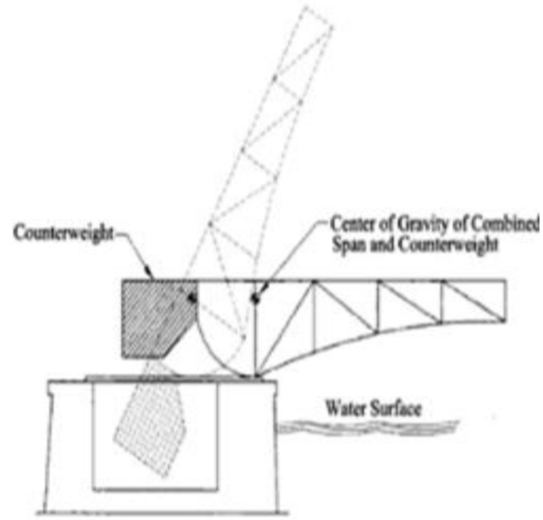


fig. scherzer rolling lift bascule bridge

A variation on the rolling lift type bascule bridge was developed by Theodore real, in which the bridge left is supported on a pair of wheels that ride on tracks. The real bascule bridge was advertised as having an advantage in that the support wheels were lifted of the track when the bridge was fully seated and in position to carry traffic. The split counterweight alongside the roadway are particularly prevalent on railroad bascule, which go to extreme length with single leaf span, in some cases exceeding 200ft.placing the counterweight outside the superstructure allows them to reach below the roadway when the bridge is open. Without requiring complicated roadway joint or long cantilevered rear decks on the bascule spans.

COUNTER WEIGHT

The counterweight is connected to the bascule leaf by link, so that counterweight and bridge leaf operate together .the connection is usually arranged so that the span and counterweight remain exactly parallel to lines running from the centerline of the main trunnions to the centerline of the counterweight tunnions. The typical Dutch draw is a double leaf bridge, but is common mainly in Europe. There are very few large double leaf heel trunnion bascule bridge in U.S. known to author. The trunnion type of Bascule Bridge is usually single leaf, with the heel end hinged on bearing mounted on the bascule pier and toe end supported by simple bearing at the rest pier. The trunnions at the heel of the bascule leaf are referred to as the main trunnion. The counterweight of a true heel of the trunnion bascule is supported by simple bearings at the rest pier. The trunnion at the heel of the bascule is supported on a separated rigid structure and connected to the bascule leaf only by the links. The trunnions that support this counterweight are called counter trunnions. The connections linkage is called upper link pins.Counterweight may be located above the bridge or below the deck of the bridge. There are two common designs of Bascule Bridge. One is the fixed-trunnion bascule design, which is where the bridge rotates around a large axial called a trunnion to rise. This bridge type is sometimes called the 'Chicago bascule' as this type was developed and perfected there and is used for many of that city's river crossings. Joseph Strauss was a key person who worked on improving the trunnion bascule bridge.

Another form of Bascule Bridge is the Scherzer rolling lift, also known as a Rolling Bascule Bridge. The city of Joliet, Illinois has a number of this structure type. The Scherzer rolling lift bridge essentially rolls or rocks like a simple rocking chair on a track to raise

WORKING

Bridge lifts are available at no charge, 24 hours a day, 365 days a year.The requirements of the City of London (various powers) Act 1971 and certain other conditions need to be met.Any vessel with a mast or superstructure of 30ft (9m) or more wishing to enter or leave the Upper Pool of London can ask for a Bridge Lift.

BRIDGE OPERATION

30 minutes before the booked Bridge Lift time, the bridge and control room will be staffed and a listening watch set on VHF channel 14.

Tower Bridge will call the vessel expected as soon as they are staffed and no later than30 minutes before arrival. The ship is to call Tower Bridge at the same time to confirm ETA.

Vessels are to keep Tower Bridge advised of their progress and advise whether or not the vessel will be swung before approaching the Bridge. Tower Bridge will keep vessels advised of any machinery problems, when the traffic is being stopped and the Bridge is lifting.

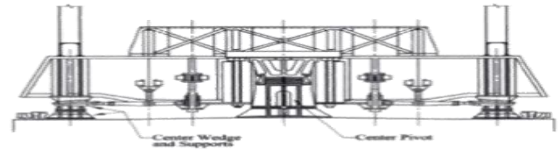


fig. working of bascule bridge.

N.B. It is very important that vessels arrive at the pre-booked time of a Bridge Lift. Ships can expect no more than five minutes leeway on booked time during road traffic busy times. During late night/early morning lifts more leeway on arrival/departure time may be available but ships should be aware that staff are only called in for the booked times and that any changes to times require Emergency Services to be advised as a matter of urgency.Note that the staff is likely to have closed down 15 minutes after the last scheduled lift.

BRIDGE LIFT HEIGHT

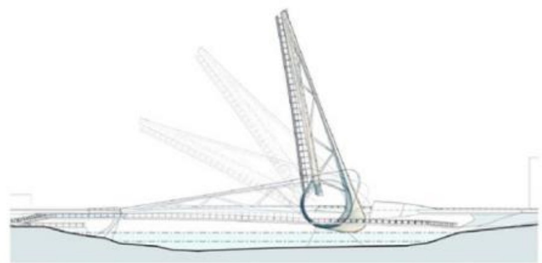
The Bridge will be lifted by the Bridge Driver to a nominal height dependant on the type and size of vessel requiring passage. This is to reduce lifting and lowering times as much as possible. Should Master or Pilots be concerned that the bascules are not high enough they should call Tower Bridge on VHF and request bascules are lifted further. If Pilotsapproaching the Bridge are concerned with the handling of their vessel or the prevailing conditions they should make this clear to Tower Bridge as soon as they make contact.

Should vessels change sailing or arrival times, Tower Bridge must be told as soon as possible to ascertain whether a new slot is possible and to cancel any previous arrangement. The security control at Tower Bridge is staffed 24 hours.The bridge is 800 feet (244 m) in length with two towers each 213 feet (65 m) high, built on piers. The central span of 200 feet (61 m) between the towers is split into two equal bascules or leaves, which can be raised to an angle of 83 degrees to allow river traffic to pass. The bascules, weighing over 1,000 tons each, are counterbalancedminimize the force required and allow rising in five minutes.The two side-spans are suspension bridges, each 270 feet (82 m) long, with the suspension rods anchored both at the abutments and through rods contained within the bridge's upper walkways. The pedestrian walkways are 143 feet (44 m) above the river at high tide.[6] The original raising mechanism was powered by pressurized water stored in several hydraulic accumulators. Hydraulics [›][clarification needed]The system was designed and installed by Sir W. G. Armstrong Mitchell & Company of Newcastle upon Tyne.

Water, at a pressure of 750 phi, was pumped into the accumulators by two 360 hp stationary steam engines, each driving a force pump from its piston tail rod. The accumulators each comprise a 20-inch ram on which sits a very heavy weight to maintain the desired pressure. In 1974, the original operating mechanism was largely replaced by a new electro-hydraulic drive system, designed by BHA Cromwell House. The only components of the original system still in use are the final pinions, which engage with the racks fitted to the bascules. These are driven by modern hydraulic motors and gearing, using oil rather than water as the hydraulic fluid.

Some of the original hydraulic machinery has been retained, although it is no longer in use. It is open to the public and forms the basis for the bridge's museum, which resides in the old engine rooms on the south side of the bridge.

To control the passage of river traffic through the bridge, a number of different rules and signals were employed. Daytime control was provided by red semaphore signals, mounted on small control cabins on either end of both bridge piers. At night, colored lights were used, in either direction, on both piers: two red lights to show that the bridge was closed, and two green to show that it was open. In foggy weather, a gong was sounded as well. If a black ball was suspended from the middle of each walkway (or a red light at night) this indicated that the bridge could not be opened. These signals were repeated about 1,000 yards (910 m) downstream, at Cherry Garden Pier, where boats needing to pass through the bridge had to hoist their signals/lights and sound their horn, as appropriate, to alert the Bridge Master. The bascules are raised around 1000 times a year.[15] River traffic is now much reduced, but it still takes priority over road traffic. Today, 24 hours' notice is required before opening the bridge. In 2008, a local web developer created a Twitter feed to post live updates of the bridge's opening and closing activities. A computer system was installed in 2000 to control the raising and lowering of the bascules remotely. Unfortunately it proved less reliable than desired, resulting in the bridge being stuck in the open or closed positions on several occasions during 2005, until its sensors were replaced.



ADVANTAGES OVER OTHER BRIDGE TYPES

Less material may be required than other bridge types, even at spans they can achieve, leading to a reduced construction cost Except for installation of the initial temporary cables, little or no access from below is required during construction, for example allowing a Waterway to remain open while the bridge is built above May be better able to withstand earthquake movements than can heavier and more rigid bridges.

DISADVANTAGES COMPARED WITH OTHER BRIDGE TYPES

Considerable stiffness or aerodynamic profiling may be required to prevent the bridge deck vibrating under high winds The relatively low deck stiffness compared to other (non-suspension) types of bridges makes it more difficult to carry heavy rail traffic where high concentrated live loads occur Some access below may be required during construction, to lift the initial cables or to lift deck units. This access can often be avoided in Cable-stayed bridge construction.

RECENT DEVELOPMENTS IN BASCULE BRIDGE

Several decades of early development led top more complicated versions of Bascule Bridge to avoid shortcomings, addressing particularly the need of low level simple trunnion bascule for watertight pits. The conventional wisdom came to be that these more complicated types of Bascule Bridge should be avoided. Modern standard practice is to design and construct mainly simple trunnion bascule bridges. The articulated counterweight bascule, overhead and under deck, is almost a thing of the past.

For a few owners who want to minimize delays to traffic over a bridge. Who are wiling to pay for quality design and construction to maximize the life span of such a bridge, the operational advantages of the leaf scherzer type rolling Lift Bridge is too great to be ignored. Single leaf scherzer bascule, with their direct load bearing at the mail girder rather than relying on trunnions, continues to be favored for railroad bridges. The real bascule, on the other hand, is considered obsolete, and it is unlikely that any more of this type will be built.

CONCLUSION

On working on this project we concluded that Bascule Bridge is a bifunctional bridge which provides connections between two roads over the river. The bridge is movable and can be opened when it sense the ships of a particularly range. This facilitates the users requirement.

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