



# A Review on Design & Fabrication of Road cum Railway Swing Bridge

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## ABSTRACT

*This study deals with the basic concepts and steps involved in the design and analysis of a swing bridge. There are different types of movable bridges used worldwide in field of bridge construction, while Swing Bridge can be a better alternative from the point of view of safety as well as economy. As we all know now day's waterway transportation is quite famous and very useful to shorten the distances. Generally when we talk about water way transportation we assume about a ship crossing the river or a bridge over it for vehicular traffic, but assume if both can be achieve at a same time and same location. Main purpose of this study is to provide information about the swing bridge and promote its use in construction of bridges.*

**Keywords-** *Swing bridge, type, centre bearing, rim bearing, design, calculation, load, rotation, construction.*

## 1. INTRODUCTION

A swing bridge is a movable bridge that has as its primary structural support a vertical locating pin and support ring, usually at or near to its center of gravity, about which the turning span can then pivot horizontally as shown in the animated illustration to the right. Small swing bridges as found over canals may be pivoted only at one end, opening as would a gate, but require substantial underground structure to support the pivot. Rail-cum-Road Swing Bridge is defined as, "The Bridge in which rails are embedded in a concrete slab road pavement which is rested on deck of the bridge and this deck can rotate about its vertical axis with suitable mechanism". In foreign countries like France, Germany the waterway is mostly used by the people for daily transportation, for them it is very useful technique. Also highly populated country like India having the largest rail network throughout the world, and due to rapid development, the roadways are also used heavily by the people in low traffic density area. So there is a need of two separate bridges for convenience but by providing this technique we can save the money as well as increase the aesthetical appearance of the area. A bridge is a structure built to span a physical obstacle (such as a body of water, valley, road, or rail) without blocking the way underneath. It is constructed for the purpose of providing passage over the obstacle, which is usually something that is otherwise difficult or impossible to cross. The technology of rotating construction is an unusual building method caused by the surrounding topography and site of the bridge construction. The rotating construction divides the bridge into two rotating systems on each side of the bank or mountain. Then, the rotating system is separated from the temporary supports and rotated from the bridge axis to the butt at the proper time. Several bridges have been built using rotating construction worldwide.

## 2. TYPES OF MOVABLE BRIDGES

Various types of movable bridge are available, but three of them are significantly desirable and practical are discussed in the following sections and number of special types of movable bridge will be discussed as well:

- Bascule bridge
- Swing bridge
- Vertical lifting bridge
- Special types of movable bridge Transporter Bridge Folding Bridge Pontoon Bridge



### 3. METHODOLOGY

When the Rail cum Road Bridge is in its original position then it works as a roadway bridge and at the time of railway transportation it is necessary to swing the bridge at a certain angle to connect railway tracks. So, as above explanation the main challenge is to swing the bridge at certain angle and that problem of swing the bridge can be solve by two major mechanisms to swing the bridge, one is Rack and pinion method, and second one is hydraulic system.

#### **Rack and pinion method**

In Rack and pinion method, the linear motion of rack is converted into circular motion of pinion, which helps to swing the bridge. The whole assembly of rack and pinion system is placed on the pier, which is at the center of the bridge. It's the most suitable system of power transfer. As there is no any difficulties so this system is very economical. The mechanism is very simple, so the maintenance cost of this system is very low. But the power requirement for this system is more, which is not suitable as point of economical view.

#### **Hydraulic System**

The second method is a hydraulic system. By using the hydraulic power the bridge can be swing. The Swing Bridge has two identical hydraulic systems, one in each pivot pie. The two systems can operate independently or simultaneously. The operator has independent control of each system. Each hydraulic system consists of lift and slew actuators, fluid Transmission lines, savior and a power pack which contains pumps and control valves. The hydraulic system is used by various accumulators, which are as follows: Hydraulic Accumulator Towers Raised weight Air-filled accumulator Compressed gas (or gas-charged) closed accumulator Spring type Metal bellows type

#### **Functions of accumulator**

- In the case of piston-type pumps accumulator to absorb pulsations of energy from the multi-piston pump.
- Accumulator helps protect the system from fluid hammer.
- Accumulator protects system components, particularly pipe work, from both potentially destructive .
- The additional energy that can be stored while the pump is subject to low demand so, the designer can use a smaller capacity pump.
- Accumulator can maintain the pressure in a system for periods when there are slight leaks without the pump being cycled on and off constantly
- Accumulator helps to maintain change in pressure due to the temperature changes.

#### **Centre bearing swing bridge**

- In this type, span of the bridge is totally dependent on central pivoting pier.
- To prevent the bridge span from failure under unbalanced loads i.e. wind load, balance wheels are provided which rolls on a large-diameter circular track concentric with the pivot bearing.
- The design is based on the fact that the centre bearing supports all of the dead load when the span is in its open position. The live load is usually supported by centre and end lift devices which are
- Actuated when the span is returned to the closed position.
- Rotation of the span is provided with the help of machines which are operated manually.

#### **Rim bearing swing bridge**

- In rim bearing swing bridges, a minimum of two longitudinal spanning members are required to support the super structure.
- Tapered rollers are also provided because the distance travelled by the outer end is longer than that travelled by the inner end of the roller, for the provided angle of bridge rotation.
- In case of rim bearing mechanism when the bridge is fixed or in its closed position, it supports both dead load and live load. Rim bearings are quite handful for wide and heavily-loaded swing bridges.
- Load is transferred by the drum girder to a tapered tread plate which is supported by tapered rollers.

Rotation of the span is achieved in the same manner as it was for the centre-bearing & swing bridge.

### 4. MACHINERIES IN SWING BRIDGE

It's important in Swing Bridge to select proper machines to swinging the bridge. Some of the swing bridge machineries may operate fast such as rim bearing. When standing on moving span or under it on the pier, its need to avoid the crush between a moving and stationary pivot of the bridge. The swing bridge are divided into three classes according to machinery on center pier of the bridge. They are as follows,



- Center bearing
- Rim bearing
- Combination of both

- **Center bearing**

This type of bearing required less power for working. It has smaller number of parts and is also less expensive to construct and maintain. Most important advantage of this type of bearing is that, it is not affected by irregular settlements of pier. They are mostly adopted for single span and single track bridges.

- **Rim bearing**

On the other hand the rim-bearing type gives a greater turning surface and balancing the bridge better while turning. It gives a better distribution of loads, and hence a less wear of turning parts. Rim bearing required additional power in turning as compared with the center-bearing type. They are mostly adapted to long single-track, and all double , or four- track bridges.

- **Combination of both**

By combining the two types of the machines it is possible to overcome the limitations of each of them. Combination of these two machines can improve the working of bridge. The opening of a swing bridge involves four operations as follows, Turning or opening the bridge. When brought back the ends must be "set up" or raised. The bridge must belocked. The rails must be aligned with those on the fixed track. The bridge is "set up" and locked by hydraulic power, while the rotation of the bridge is carried out by electric power. It is largely used, especially in America and is said to be simpler and to assure morecertainty of operation.

## 5. ADVANTAGES & DISADVANTAGES

### Advantages

- As this type requires no counterweights, the complete weight is significantly reduced as compared to other moveable bridges.
- Where the channel is wide enough for separate traffic directions on each side, the likelihood of vessel-to-vessel collisions is reduced.
- The central support is often mounted upon a berm along the axis of the watercourse, intended to protect the bridge from watercraft collisions when it is opened. This artificial island forms an excellent construction area for building the moveable span, as the construction will not impede traffic.

### Disadvantages

In a symmetrical bridge, the central pier forms a hazard to navigation. Asymmetrical bridges may place the pivot near one side of the channel.

Where a wide channel is not available, a large portion of the bridge may be over an area that would be easily spanned by other means.

A wide channel will be reduced by the center pivot and foundation.

When open, the bridge will have to maintain its own weight as a balanced double cantilever, while when closed and in use for traffic, the live loads will be distributed as in a pair of conventional truss bridges, which may require additional stiffness in some members whose loading will be alternately in compression and tension.

If struck from the water near the edge of the span, it may rotate enough to cause safety problems (see [Big Bayou Canot rail accident](#)).

## 6. CONCLUSION

The rail cum road Swing Bridge is more convenient for two different ways of transportation like railway and roadway. Construction of two conventional bridges required large area as compared to rail-cum-road Swing Bridge. The analysis and design required less time as compared time required for design and analysis of conventional bridges. This bridge also swing in particular angle hence it can be also convenient for waterways transportation. At last it is concluded that Swing Bridge is the best alternative for the short span rivers and canals and also suitable for large spans if carefully designed. It is more preferable than that of Bascule Bridge. Accidents and many failures caused in these types of bridges are because of the improper operation and functioning and also improper designing. If during the time of construction and designing proper



designing is done also if material chosen for the bridge serves all properties there is no chance of failure for a long duration.

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