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# Review on Base Isolation to Seismic Excitation

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**ABSTRACT:**In this review paper the behaviour of isolated bridge to seismic excitation is presented. In past earthquake, most of damages of the bridges occurred due to failure of the bearing and structure. In the present study it has been found that the isolation bearings reduce the seismic response of the structure as compare to non-isolated bridge.

**KEYWORDS:** Bridge, Seismic, base isolation

## I. INTRODUCTION

Seismic isolation is old design idea but damaging point of view it is very important to place in the structure. One of the goals of seismic isolation is to shift the fundamental frequency of the structure away from the dominant frequencies of the earthquake ground motion. The other purpose is to provide an energy dissipation that is it is use to reduce the transmitted acceleration into the superstructure. A verity of isolation devices including elastomeric bearings, sliding bearings, roller bearing has been developed.

There are many cases of damage of bridges but from past earthquake is the major case of bridge failure all over the world. The failure of bridges during the seismic excitation will seriously hamper the relief & rehabilitation was bridge may damage or collapse due to the earthquake due to their structural simplicity. The fundamental period of vibration of majority of bridges is in range of 0.2 to 1.2 seconds for every rigid structure or small structures like normal bridge with short piers and abatements the time period is often extremely small for such structure the response is almost same as the ground acceleration. The seismic forces on the bridges can be reduced if the fundamental period of the bridge is lengthened or the energy dissipating capacity is increased. Therefore the seismic isolation is treated as the best alternative for earthquake resistant design of bridges. Figure 1 shows a typical isolated multi span continuous deck bridge in which special isolation device is used in place of conventional bridge bearings. These bearings protect the substructure by restricting the transmission of horizontal acceleration and the seismic energy through damping.

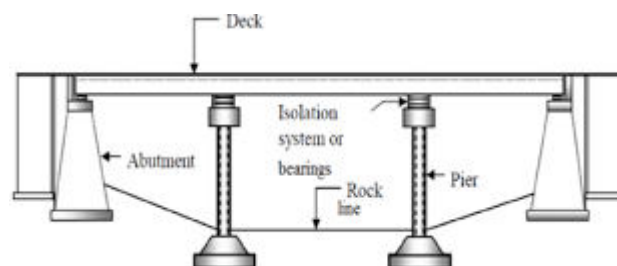
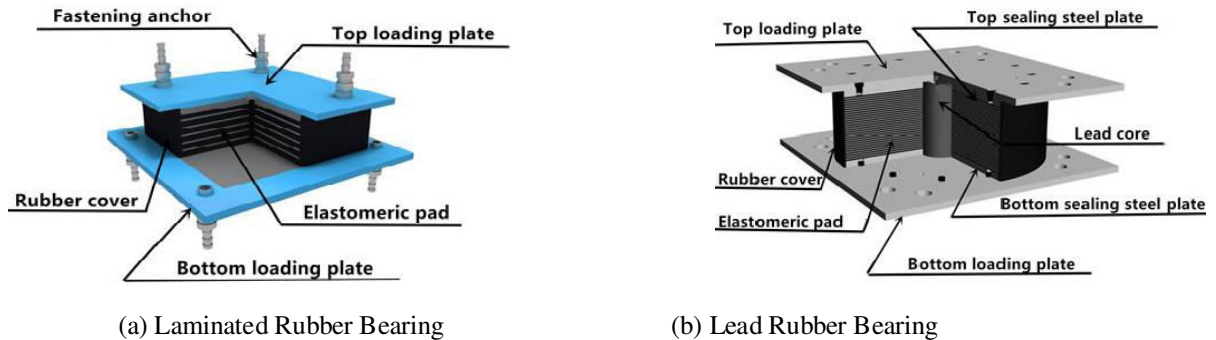


Figure 1. Seismically Isolated Bridge

**1.1 Seismic isolation system:-**There are two basic isolation system that is elastomeric bearings and sliding bearings. The elastomeric bearings with low horizontal stiffness to avoid resonance with the excitation. In other hand the sliding isolation system is based on the concept of sliding friction. From these two systems the elastomeric bearings are able to shift the vibration period and damping to the structure.

**1.2 Elastomeric bearing: -** The laminated rubber bearing (LRB) is most commonly used for base isolation system. The basic components are shown in Figure 2.



**Figure 2. Isolation System**

The important features of LRB system are parallel action of linear spring and damping generally LRB exhibits high vertical stiffness. The operates by decoupling the structure from the horizontal components of earthquake ground motion by placing a layer of low horizontal stiffness between structure and the second category of elastomeric bearings is lead rubber bearings (Robison 1982) as shown in Figure 2(b) this system provides the combined features of the vertical load support, horizontal flexibility, restoring force and damping in single unit. These bearings are similar to the laminated rubber bearing but central lead core is to provide an additional means of energy dissipation. This bearing widely used in New Zealand and also referred as N-Z system. The absorbing capacity by lead core reduces the lateral displacements of the isolator.

The first building in the world to be built using lead rubber bearings for seismic isolation was the William Clayton building (Megget 1978) in Wellington, New Zealand, designed c.1978. it has a four storey ductile moment resisting frame, the inter storey drift calculated for isolated building were about 10mm, and were uniform over the building height. For the comparison, the maximum drift for the non isolated model was 52mm per storey for the top two storeys. An overall deflection ductility factor of only  $\mu = 1.6$  was required for the isolated building, whereas  $\mu = 7.6$  would have been required for the non isolated condition.

Lead rubber bearing has also been used in rapidly growing number of bridges in New Zealand, Italy, Japan, USA and elsewhere. These bearing have a wide range of applications where they are likely to lead not only to less damaged structures in earthquakes, but also sometimes cheaper construction. Design procedures are well established, including methods of design graphs (e.g. Skinner et al. 1993) and design codes (e.g. FEMA, 1997).

Further developments in seismic isolation are going on as described by Robinson (2000), for the both rubber and lead rubber bearing, consisting of a centre drive to the top and bottom of the bearings. The centre drive allows a greater displacement to height ratio and it provides increased damping capacity at large displacements.

## II. RELATED WORK

The parameter that are mostly considered in the study include time period of the structure, damping and yield characteristics of the isolator. Seismic isolation has been successfully used several countries using the elastomeric bearings. Seismic isolation bearings can also be used in retrofitting the bridges these are used to replace vulnerable support bearings by width the bearings

## III. CONCLUSION

From the present study following conclusions are drawn

1. For the given period the damping the LRB is more effective in reducing the pier force.
2. Bearing are the more effective in reducing the deck displacement
3. An isolated bridge significantly reduces the girder force.
4. As it allows a greater displacement to height ratio and it provides increased damping capacity at large displacements thus providing some of the additional damping needed for resisting near fault fling.
5. Based on the present study a general conclusion cannot be drawn it require more investigation



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