Iron Ball- Concrete Bowl Unit for Earthquake Prevention

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ABSTRACT

Base isolation by Iron Ball Concrete Bowl for earthquake prevention. This idea deals with the prevention of the structure from the earthquake waves or seismic waves by isolating the base of the structure by using Iron ball concrete bowl . Usually the structure is laid on the ground with proper foundations. But in this technique the base of the structure i.e., just above the foundation is being isolated. So that it might not be affected by seismic waves. This technique utilizes Iron ball concrete bowl which can be made according to the structure load they need to hold from the structure. This Iron ball concrete bowl unit is attached to the base of the structure and by this way base of the structure is being isolated. Isolation with the help of a Iron ball concrete bowl can be effective in many ways as it can reduce up to 80 to 85% of the risk, i.e. being developed by the seismic waves and prevent the structure from damage. In this paper, the present behavior of the Iron ball concrete bowl is being analyzed and discussed. On the basis of authors study the modernization of the whole picture has been described in the paper. The results of the extensive mathematical and scientifical analysis, minimizes the damage from the disaster and protecting the superstructure from the heavy damage and saving many lives.

1. INTRODUCTION

In the field of civil engineering; the earthquake is the major cause of the damage of the structure. Mostly the structures which lie in the seismic zone areas are usually affected by the earthquake due to the seismic waves which are being developed at the time of the natural disaster which further leads to the seismic deformation in the earth crust or follows some deformation in the tectonic plates[1]. The seismic waves are the energy waves that travel through the earth's layer, and are a result of an earthquake, exploration or a volcano that imparts low frequency acoustic energy. The energy waves when produced demolish the structure or weakens its foundation which would further lead to the failure of the structure. For this, base isolation also known as seismic base isolation or base isolation system is one of the most popular means for protecting a structure against the seismic waves or the earthquake forces. It is the

collection of the structure elements which should substantially decouple a structure from its base on which it is resting thus protecting a building a non-building structure integrity. Base isolation is one of the most powerful and advanced tool of the civil engineering pertaining to the passive structural vibration control technologies. In this paper we will go through the advanced technology of isolating the base and preventing the structure from the demolition. The basic idea of working of the isolation unit is to restrain all the inertial forces which the building undergoes. Major working of this whole unit has been explained further in the paper.

keywords:- Base isolation, Spring System, P- waves, Plate tectonics, Seismic waves, Retrofit,calamity, concrete-bowl

2. SEISMIC NATURE OF WAVES

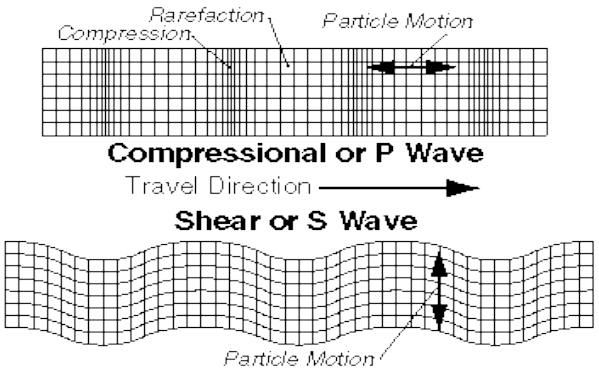
2.1 Introductory nature of seismic wave

Seismic waves are waves of energy that travel through the Earth's layers, and are a result of an earthquake, explosion, or a volcano that imparts low-frequency acoustic energy. Many other natural and anthropogenic sources create low amplitude waves commonly referred to as ambient vibrations. Seismic waves are studied by geophysicists called seismologists. The second type of deformation,dynamic motions, are essentially sound waves radiated from the earthquake as it ruptures. While most of the plate-tectonic energy driving fault ruptures is taken up by static deformation, up to 10% may dissipate immediately in the form of seismic waves. The mechanical properties of the rocks that seismic waves travel through quickly organize the waves into two types. Compression waves, also known as primary or P waves[2], travel fastest, at speeds between 1.5 and 8 kilometers per second in the Earth's crust. Shear waves, also known as secondary or S waves, travel more slowly, usually at 60% to 70% of the speed of P waves. P waves shake the ground in the direction they are propagating, while S waves shake perpendicularly or transverse to the direction of propagation (shown in fig1).

Earthquakes create various types of waves with different velocities; when reaching seismic observatories, their different travel time help scientists to locate the source of the earthquake hypocenter.[3] In geophysics the refraction or reflection of seismic waves is used for research into the structure of the Earth's interior, and man made vibrations are often generated to investigate shallow, subsurface structures.

Figure1. *S Wave*

2.2 Seismic Deformation



When an earthquake fault ruptures, it causes two types of deformation: static; and dynamic. Static deformation is the permanent displacement of the ground due to the event. The earthquake cycle progresses from a fault that is not under stress, to a stressed fault as the plate tectonic motions driving the fault slowly proceed, to rupture during an earthquake and a newly-relaxed but deformed state. Typically, someone will build a straight

reference line such as a road, railroad, pole line, or fence line across the fault while it is in the pre-rupture stressed state[4]. After the earthquake, the formerly stright line is distorted into a shape having increasing displacement near the fault, a process known as elastic rebound. Shown in figure2.

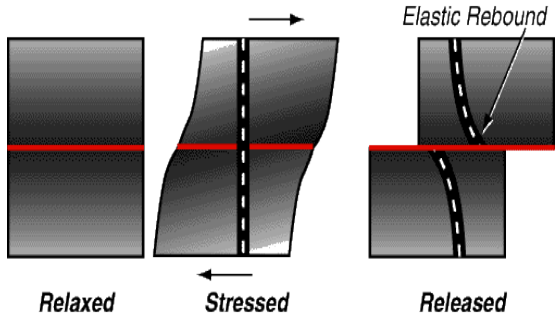
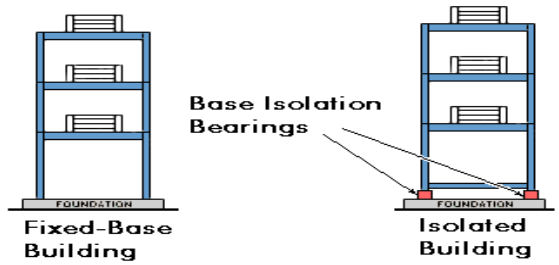


Figure2.*Tectonic plates*

3. BASE ISOLATION SYSTEM



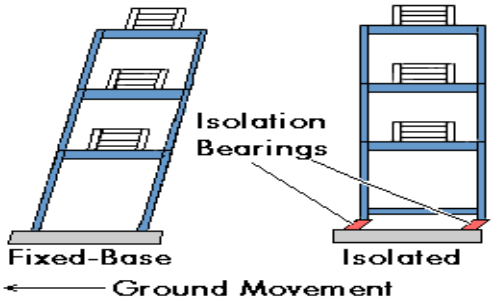


Figure3. *Base isolation system*

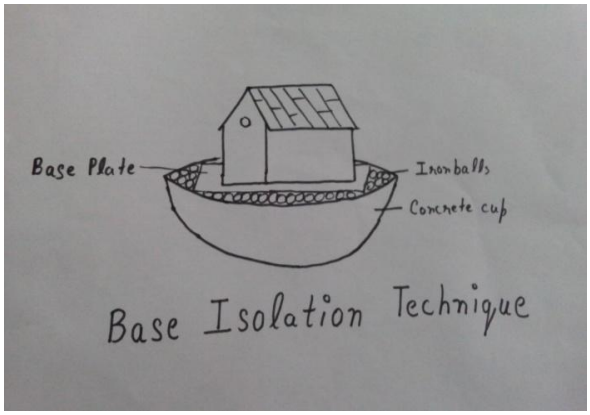
3.1 Introduction to the base isolation system

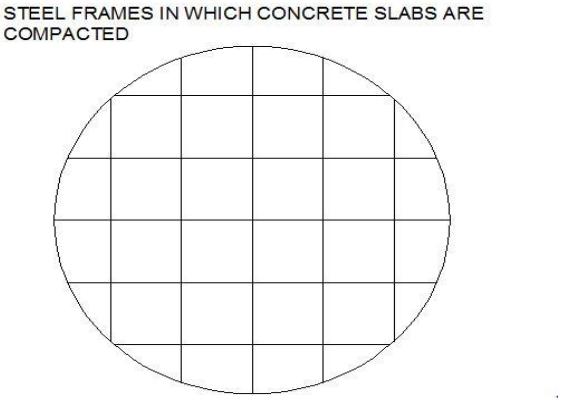
Base isolation is one of the most important means of protecting a structure (superstructure + substructure) against seismic forces. In this, various types of structural elements gathered together and decouple a superstructure from its substructure lying on the ground which shakes due to the seismic waves, thus protecting a building integrity.[5] It is one of the most powerful tools of earthquake engineering pertaining to the passive structural vibration control techniques. Base isolation includes, isolating the base by Iron ball concrete bowl which are being designed and installed beneath the structure which works at a time of calamity.[6] Base isolation system consists of isolating units with isolation components where isolating units are the basic elements of a base isolation system which are intended to provide the targeted decoupling effect to building or non-building structure where the isolation components acts as the connection between isolation units and their parts. By their response to an earthquake impact, all isolation units may be divided into two basic categories: shear units and sliding units. As shown in figure3.

4. IRON BALL CONCRETE BOWL ISOLATION SYSTEM

To prevent the structure from damage, the author's have worked on the iron ball concrete bowl isolation system and have come out with a design known as iron ball concrete bowl. In this technique, a concrete bowl is being established on the earth crust with proper foundation. The concrete used is of high grade and compressive strength is also high. Now in this concrete bolw the friction less iron balls are being placed depending upon the volume of the semi-circle. The diameter of each ball is 1/20 times the diameter of the semicircular arch. There balls are filled up to the top. And the base of the super structure is being placed on these balls on which the structure is being

laid. This base of the super structure is not being joined with the ends of the bowl outer ring. The base is being laid on the wooden frame.





5. CONCLUSION

The paper looks into a new dimension of using Iron ball concrete bowl base isolation technique and also improving the futuristic vision of the society. The structure would be able to maintain its balanced form and also it would reduce the seismic waves intensity which are being produced at the time of earthquake or in other approach this system can be proved a much better way than single spring base isolation system. This system can be used for heavy loads. Thus this paper has come up with an exhaustive research and advancement of the base isolation techniques by using IRON BALL CONCRETE CUP Technique . The technique has major potential to reduce the impact of uncertainties related to seismic conditions and save ourself. At last " Initial implementation of the new technology coincided with the romantic era of earthquake engineering and public relations associated with the dreams of 'beating the quake' "[7].

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