INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

IJARIIT

ISSN: 2454-132X
Impact factor: 4.295
(Volume 5, Issue 3)
Available online at: www.ijariit.com

Experimental investigation of earthquake resisting stadium designed with damper

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ABSTRACT

The Structures such as buildings, bridges, and towers are prone to collapse when natural phenomena like earthquake occurred. Therefore, many design codes are reviewed and new technologies are introduced to resist earthquake energy especially on building to avoid collapse. The tuned mass damper and hydraulic dampers etc. are one of the earthquake reduction products introduced on structures to minimize the earthquake effect. This study aims to analyze the effectiveness of tuned mass damper by experimental works and finite element modeling. The comparisons are made between these two models under harmonic excitation. Based on the result, it is proven that installing tuned mass damper will reduce the dynamic response of the frame but only in several input frequencies. At the highest input frequency applied, the tuned mass damper failed to reduce the responses. In conclusion, in order to use a proper design of damper, a detailed analysis must be carried out to have sufficient design based on the location of the structures with specific ground accelerations.

Keywords— *Dampers, Structure, Finite elements*

1. LITERATURE REVIEW

1.1 Historical background

The scientific study of earthquakes is comparatively new. Until the 18th century, few factual descriptions of earthquakes were recorded, and the natural cause of earthquakes was little understood. Those who did look for natural causes often reached conclusions that seem fanciful today; one popular theory was that earthquakes were caused by air rushing out of caverns deep in the Earth's interior.

The earliest earthquake for which we have descriptive information occurred in China in 1177 B.C. The Chinese earthquake catalogue describes several dozen large earthquakes in China during the next few thousand years. Earthquakes in Europe are mentioned as early as 580 B.C., but the earliest for which we have some descriptive information occurred in the mid-16th century. The earliest known earthquakes in the Americas were in Mexico in the late 14th century and in Peru in 1471, but descriptions of the effects were not well documented. By the 17th century, descriptions of the effects of earthquakes were being published around the world - although these accounts were often exaggerated or distorted.

Akhaveissy et al (2014) carried out an analytical study on nonlinear two-dimensional fibre finite element models to predict the behaviour of unreinforced masonry walls. The results of the model obtained in terms of max shear force are appropriate with the experimental results.

Anil Baral and Yajdani (2015) studied the effect of storey drift due to the presence of a shear wall in the building. Shear wall highly influences the forces acting in the Structural member. Proper positioning of shear wall results in effective and efficient performance of the building during earthquakes.

Ashish and Charkha (2012) investigate that the drift increases with the height of the building and reduces for the top floor.

2. METHODOLOGY

The detailed methodology used in this project is,

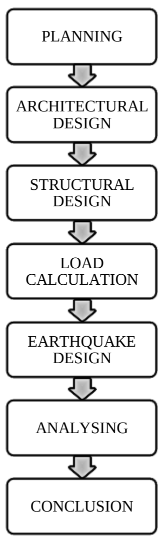
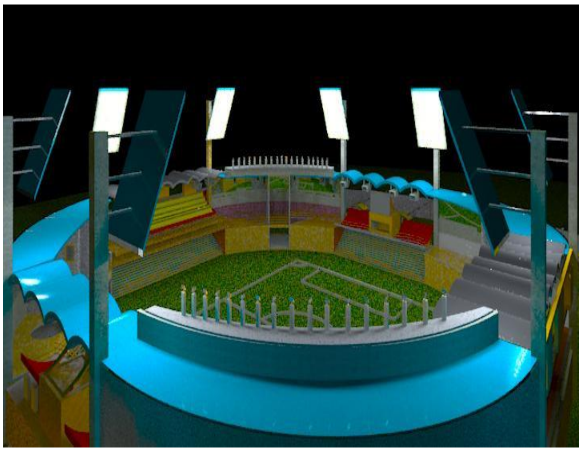
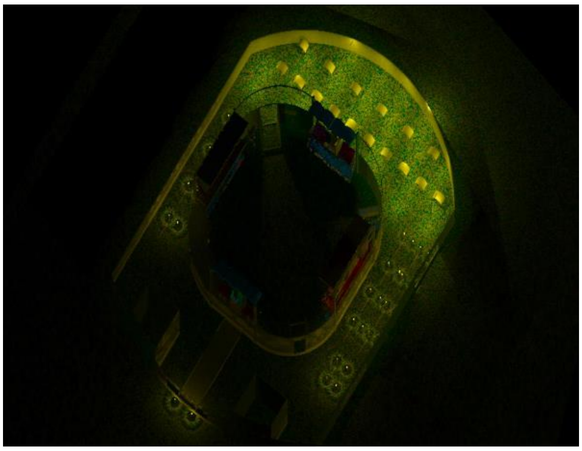


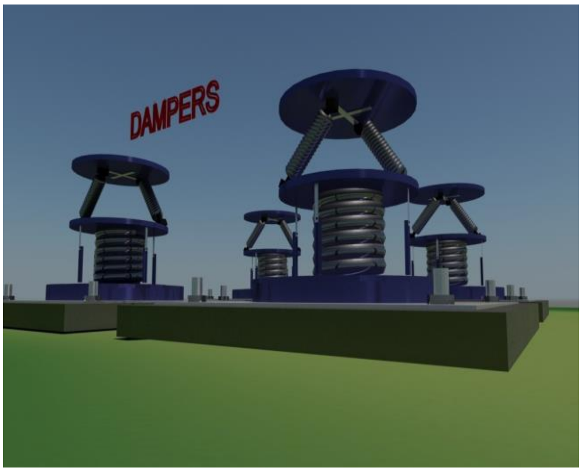
Fig. 1: Methodology

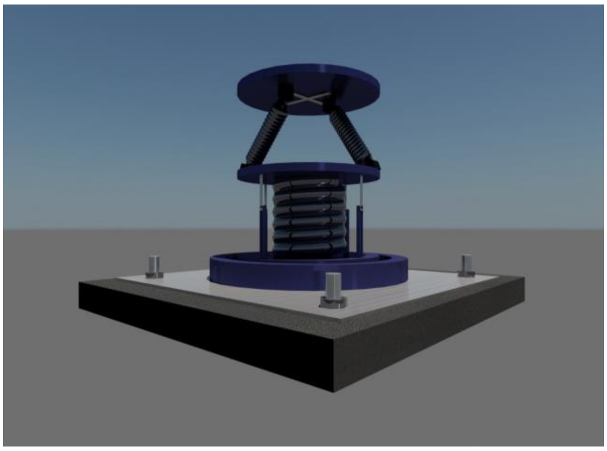
3. ARCHITECTURAL DESIGNS OF STADIUM



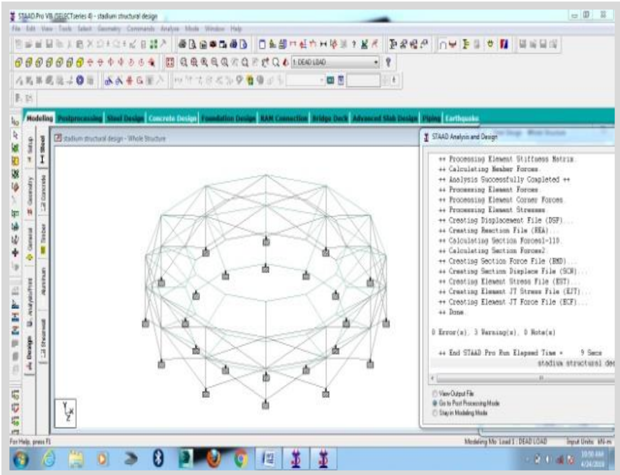


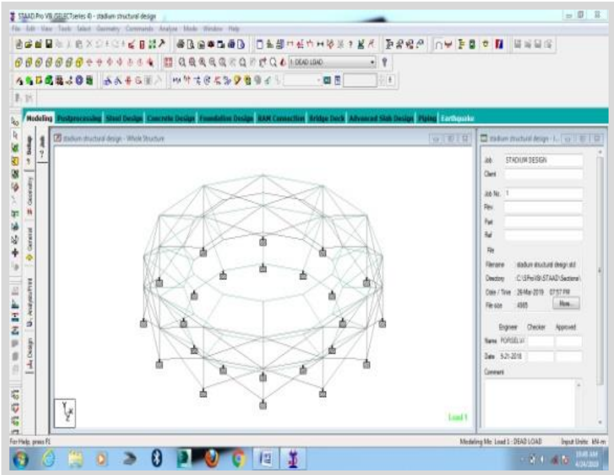
4. DAMPERS MODEL

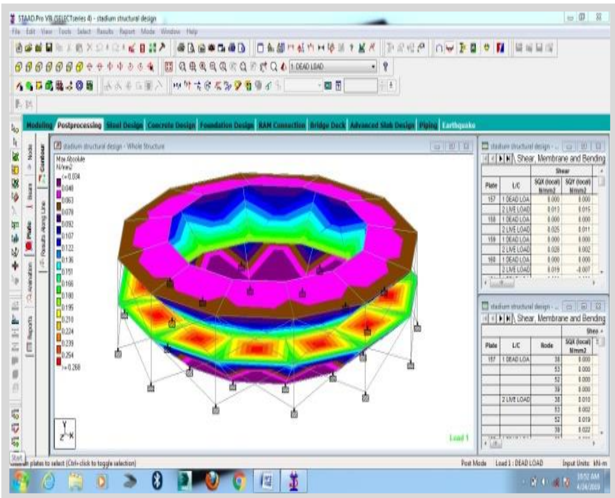


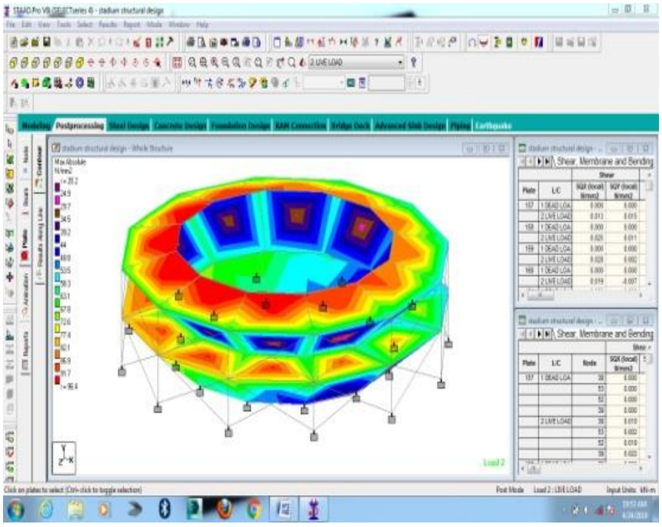


5. STRUCTURAL DESIGNS OF STADIUM









6. DAMPER WORKED MODELS AND RESULTS

6.1 Dual homogeneous dampers

Introducing the dual homogeneous dampers in structural elements it absorbs three-dimensional forces like active passive and regional earth pressure specially designed for footings

6.2 List of major components

- Hydraulic Shock Absorbers
- Single Spring Mass Dampers
- Mild Steel Plates
- Bearing Plates
- Connecting Elements

6.3 Dual homogeneous hydraulic dampers

The dual homogeneous dampers in structural elements it absorbs three-dimensional forces like active passive and regional earth pressure specially designed for footings

7. RESULTS

7.1 Compression test

A compression test is any test in which a material experience opposing forces that push inward upon the specimen from opposite sides or is otherwise compressed, “squashed”, crushed, or flattened. The test sample is generally placed in between two plates that distribute the applied load across the entire surface area of two opposite faces of the test sample and then the plates are pushed together by a universal test machine causing the sample to flatten.

Table 1: Compression test

S no.	Mass of the Damper(kg)	Mass added(kg)	Total mass (kg)	Total weight/ force	Final length of the spring	Initial length of the spring	Compression of the spring (m)
1	30	50	80	20.863	0.29	0.3	0.001
2	30	100	130	30.530	0.27	0.3	0.003
3	30	150	180	45.365	0.26	0.3	0.004
4	30	200	230	60.360	0.24	0.3	0.006
5	30	250	280	80.254	0.21	0.3	0.009

7.2 Damper compression test result

A compressed sample is usually shortened in the direction of the applied forces and expands in the direction perpendicular to the force. A compression test is essentially the opposite of the more common tension test.

8. CONCLUSION

This project we carried out for the experimental investigation of earthquake resisting stadium designed with dampers it can be capable of stability of maximum loads and earthquake loads in the structure we have to investigate and carried out the critical load and find analytically and experimentally proved.

In this study we can analysis of structure theoretical and practically proved by experimental study. The objective of this study is to produce concrete column and beams casting as per the high performance concrete grade as per the bonding strength by using raping materials with construction materials. The load test results showed that the load carrying capacity of the dampers and earthquake resisting of the dampers. We proved as theoretically and practically by using experimental study on earthquake resisting stadium design with dampers.

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