EXPERIMENTAL INVESTIGATION ON MASONRY STRUCTURE WITH AND WITHOUT HORIZONTAL MESH ON SHAKE TABLE

Project Reference No.: *47S_BE_1273*

College ***:*** *K S School of Engineering and Management, Bengaluru*
Branch ***:*** *Department of Civil Engineering*
Guide(s) ***:*** *Mr. Manjunath B & Mr. Prashanth M*
Student(S) ***:*** *Mr. Chandan K*
Ms. Nida Manzoor Teli
Mr. Charan C S
Mr. Pavan S

Keywords:

Masonry structure, Horizontal mesh, velocity, displacement, Acceleration

Introduction:

Due to the poor seismic performance, strengthening of masonry structures is always a significant problem worthy to study. It has been proven that the bearing capacity of existing masonry buildings can be enhanced greatly with efficient strengthening measures.

It is well known that masonry buildings suffer a great deal of damage during earthquakes, leading to significant loss of lives. Almost 75% of the fatalities, attributed to earthquake in last century, is caused by collapse of buildings of which the greatest portion (more than 70%) is due to collapse of masonry buildings. A majority of the tenements in India are Unreinforced Masonry (URM) buildings that are weak and vulnerable even under moderate earthquakes. On the other hand, a cursory glance through the literature on earthquake resistant structures reveals that a bulk of research efforts is on RC structures.

These experimental results show that acceleration velocity displacement is higher in reinforced masonry structures compared to unreinforced masonry structures.

Objectives:

1. To study the journal publications and to construct the scaled masonry structure with and without horizontal reinforcement on shake table.
2. To construct the scaled model of masonry structure without horizontal reinforcement on shake table.
3. To construct the scaled model of masonry structure with alternative horizontal reinforcement on shake table.
4. To test both scaled masonry structure with and without horizontal mesh to find the seismic behaviour properties like acceleration, velocity and displacement with respect to time.
5. To study the seismic behaviour of scaled masonry structures by comparing the results of both with and without horizontal mesh on shake table.

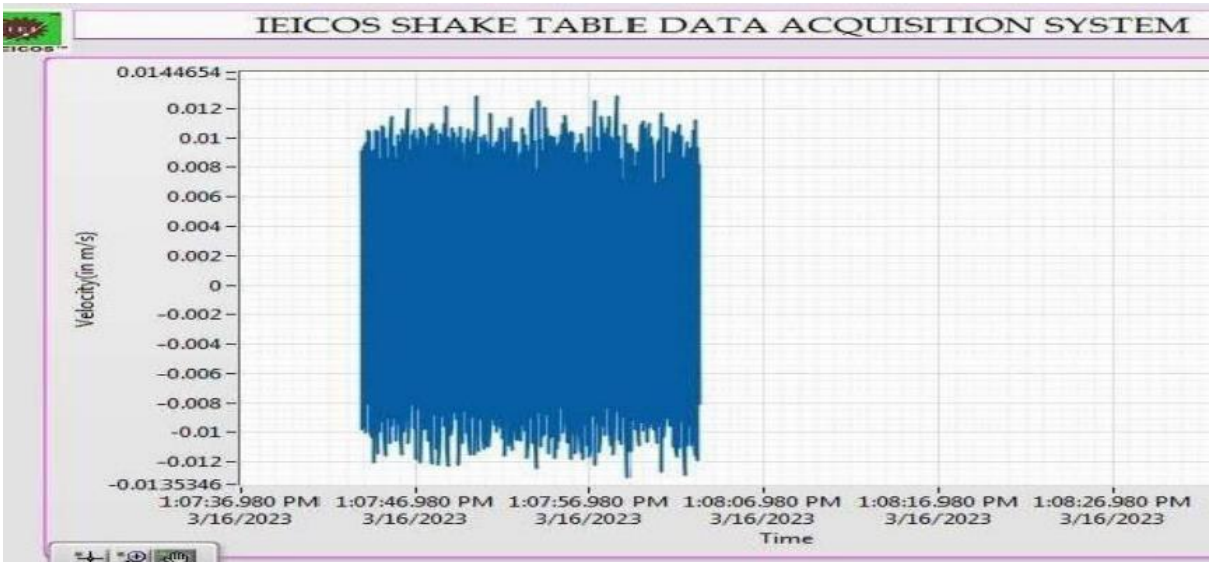
Methodology:

1. To study the various literatures and works done on masonry structures by referring to reputed journals.
2. To construct the scaled masonry structure of size 3ftx3ft on shake table using blocks of size 150mmx200mmx400mm and cement mortar of proportion 1:3 without horizontal mesh.
3. To construct the scaled masonry structure of size 3ftx3ft on shake table using blocks of size 150mmx200mmx400mm and cement mortar of proportion 1:3 with alternative horizontal mesh
4. Testing the specimens on shake table for different frequencies and to collect the data of Acceleration, Velocity and Displacement.
5. The collected data of both the models are analysed and compared and the results are discussed.

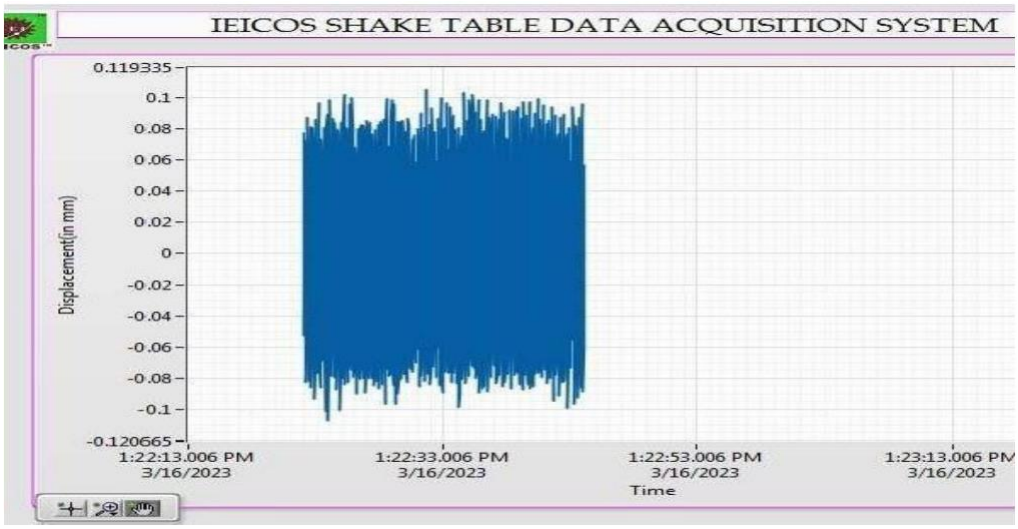
Conclusion:

The tests are conducted and results obtained are as follows. The walls are constructed with a dimension of 3feet x 3feet and curing was done for 28 days. Sensors are placed on the four sides of wall and horizontal loads are applied to the bottom of structure with help of frequencies to check the velocity, displacement and acceleration with respect to time. The test results of reinforced and un-reinforced masonry structures are shown below. From the results its observed that the compressive strength of mortar for 1:3 for 7days 20.50N/mm2 and for 28 days 40 N/mm 2 this gives the mortar strength. Seismic test was conducted on scaled masonry structure without reinforcement (horizontal mesh) and curing was done for 28 days the test results has shown below.

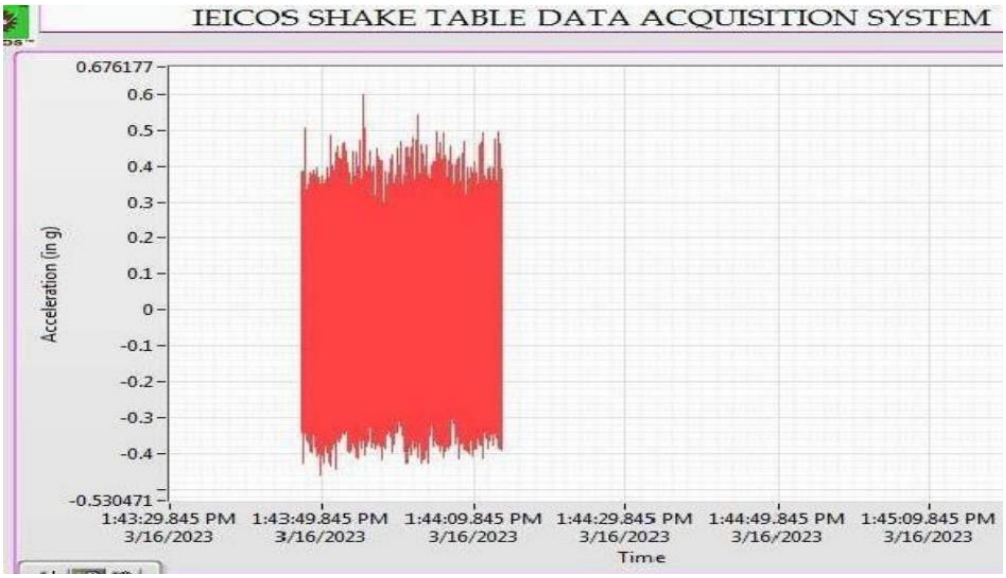
Without Horizontal Mesh



Graph for frequency 5 V v/s T CH1

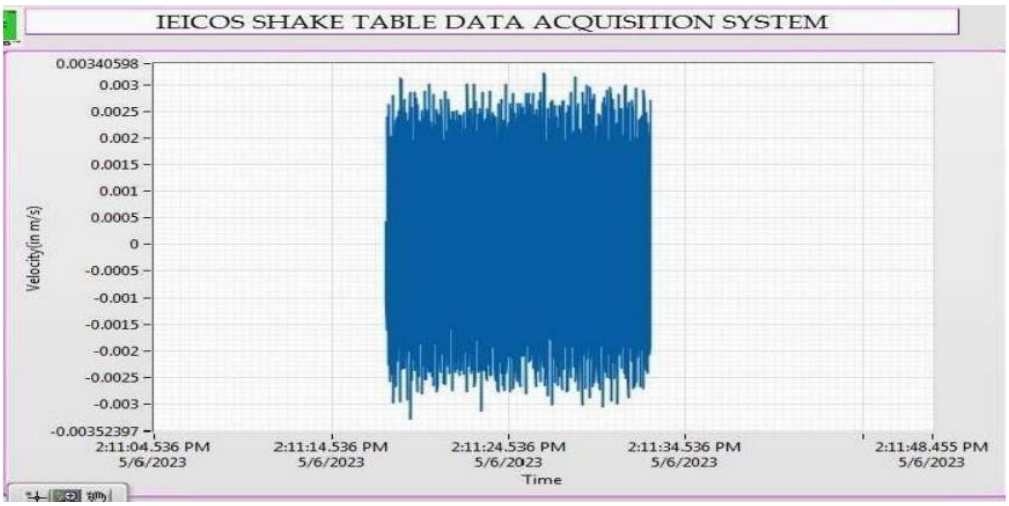


Graph for the frequency 10 DP v/s T CH1

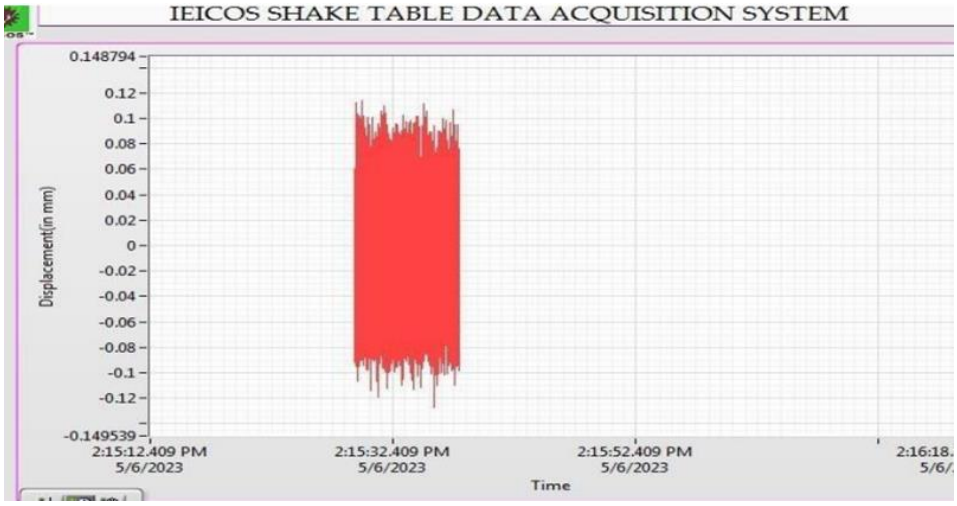


Graph for the frequency 15 A v/s T in CH 2

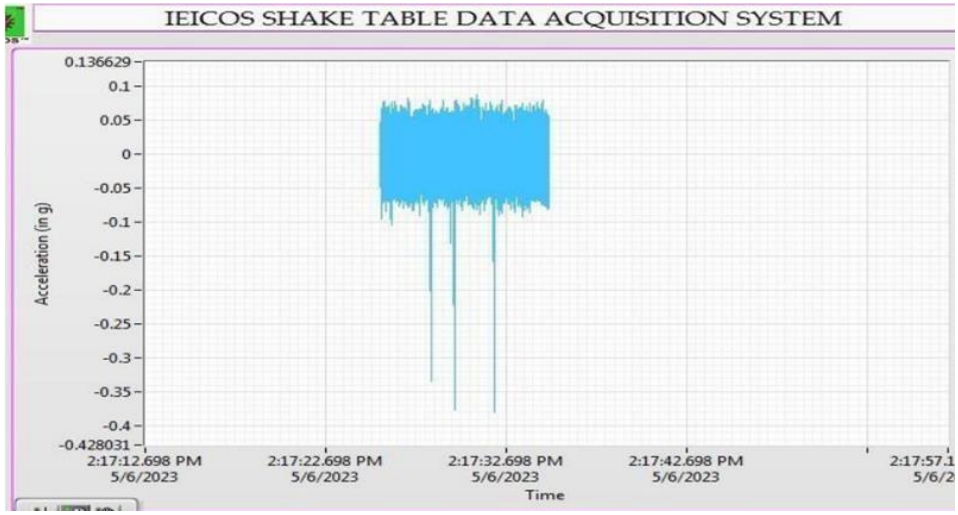
With Alternative Horizontal Mesh



Graph for the frequency 5 V v/s T in CH 1



Graph for the frequency 10 Dp v/s T in CH 2



Graph for the frequency 15 V v/s T in CH 4

The test results of reinforced and unreinforced masonry structures are shown below:

Frequency		Without Horizontal Mesh			With Horizontal Mesh		
		Velocity (m/s)	Displacement (mm)	Acceleration (g)	Velocity (m/s)	Displacement (mm)	Acceleration (g)
Frequency 5	CH1	17.74%	76.19%	26.83%	82.86%	23.81%	73.17%
	CH2	18.89%	56.41%	12.73%	81.11%	43.59%	87.27%
	CH3	18.75%	85.82%	22.61%	81.25%	14.18%	77.39%
	CH4	1.65%	62.20%	11.50%	98.35%	37.80%	88.50%
Frequency 10	CH1	17.65%	75.96%	17.9%	82.35%	24.04%	82.10%
	CH2	10.23%	57.64%	18.0%	89.77%	42.36%	82.00%
	CH3	25.00%	85.71%	26.25%	75.0%	14.29%	73.75%
	CH4	10.00%	60.11%	32.63%	90.0%	39.89%	67.37%
Frequency 15	CH1	18.75%	80.04%	14.48%	81.25%	19.96%	85.52%
	CH2	20.97%	58.04%	18.33%	79.03%	41.95%	81.67%
	CH3	21.43%	85.00%	23.39%	78.57%	15.00%	76.61%
	CH4	5.00%	72.05%	27.15%	95.0%	27.95%	72.85%

Innovation in the project:

This project contributes to the application of horizontal reinforcement in masonry structures to carry more loads and resist effect from seismic waves. Cost effective and reducing displacement and acceleration due to seismic loading.

It may provide valuable insights for architects, engineers, and urban planners in designing of masonry structures with enhanced vibration control capabilities by adding horizontal reinforcements.

Scope for future work:

1. In the future, we could easily use reinforced masonry structure for all residential buildings. It will be stronger and stiffer than normal masonry structures.
2. The reinforcement also gives good bonding between mortar and blocks. It will be more helpful to structure.
3. With the help of horizontal mesh, we can eliminate vertical reinforcement in the structure. The appearance also becomes good.
4. If vertical meshes are used in future, we can construct G+4 structure.