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REVIEW OF BRICK MASONRY ON EARTHQUAKE PERFORMANCE OF STRUCTURE

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ABSTRACT - Earthquakes are natural trouble under which disasters are mainly caused by damage or collapse of structure and other man-made structures. When earthquake occurs natural period of vibration is more in heavy loaded building and less in light loaded building. If the building is light weighted, i.e. steel is less then economy of structure is also achieved. Hence it is necessary to find out natural/fundamental time period when mass changes i.e.(change in brick type).This is necessary because IS 1893:2002 do not incorporate effect of mass in formula which they have mentioned for brick in filled structure.

Key Words*: *Time period of structure, Steel economy, IS 1893:2002.

I. INTRODUCTION

Earthquake damage depends on many parameters, intensity, duration and frequency content of ground motion, geologic and soil condition, quality of construction, etc. In this research work different types of bricks are taken with different frequencies. There are Red Brick is 18 kN/m³, Flyash is 10 kN/m³ and Siforex Brick is 8 kN/m³.This brick masonry is designed with different types of plan with changing their mass quantity. For analysis of structure SAP software is used. During earthquake dynamic action caused on building. The structure will moves in all direction and generating force vary with time and location. The force sustained by the structure during earthquake shaking is proportional to the mass. It is referred to as inertia force. A large number of reinforced concrete and steel buildings are constructed with masonry infills. Masonry infills are often used to fill the void between the vertical and horizontal resisting elements of the building frames. Infill wall gives more strength and rigidity of structure.

The Scope of this project to calculate Fundamental natural period of structure with respect to variation of different size and different type of structure with using different densities of bricks. The general objective of this paper calculate time period by analytical method and using SAP software. Prepare various plan in SAP with respective their dimensions.

Objective 1) To verify effect of mass of structure on time period. 2) To study how economy of structure gets affected due to different brick densities.

II. LITURATURE REVIEW

Seismic analysis is major activity in earthquake analysis which used to understand the natural period of building due to seismic movements. Following is the literature review of some papers giving more information about their contribution in decision making and conceptual evaluation.

Joseph Hardwick, Jonathan Little [1] This paper presents there are study of seismic performance of brick structure. sound engineering principles, modeling and physical testing, which could become the benchmark guide for adobe type of construction. There are comparing the clay brick and mud brick based on preliminary tests that have been carried out and shows how the research can be applied in practice.

Matthew J. DeJong [2] This paper presents masonry structures are vulnerable to earthquakes, but their seismic assessment remains a challenge. This dissertation develops and improves several strategies to better understand the behavior of masonry

structures under seismic loading, and to determine their safety. The primary focus is on historic arched or vaulted structures, but more modern unreinforced masonry structures are also considered.

Nilesh v prajapati [3] In this Research work objective is to show that natural time period is also a function of number of floors and not only the height of the building, which is not mentioned in IS 1893:2002.The design of structures subjected to natural hazards such as earthquakes and typhoons demands safety of structures which is governed by the natural frequencies and the amount of damping in each mode of vibration. The dynamic behavior of structures is governed by the fundamental natural frequency and the amount of damping exhibited by each mode of vibration.

Siamak Sattar , Abbie B. Liel[4] This paper present that quantifies the effect of the presence and configuration of masonry infill walls on seismic collapse risk. Seismic performance assessments indicate that, of the configurations considered (bare, partially-in filled and fully-in filled frames), the fully-in filled frame has the lowest collapse risk and the bare frame is found to be the most vulnerable to earthquake-induced collapse. Depending on the infill configuration, the median collapse capacity varies by a factor of 1.3 to 2.5. The results for fully-in filled frames are likely upper bounds for collapse capacity, since they do not account for column shear failure, which may be significant in some cases. The presence of masonry infill also significantly changes the collapse mechanism of the frame structure, leading to a first-story mechanism in most cases. Results are similar for structures of varying heights (4 and 8 stories).

Dr.Anand S. Arya [5] This paper present that the seismic retrofitting consists in upgrading the strength of an existing structure with the aim to increase it's a capacity to withstand future earthquakes. The seismic evaluation and strengthening of the existing reinforced concrete buildings and provides a method to assess the ability of an existing building to reach an adequate level of performance related to life safety of occupants. Therefore, the emphasis is on identification of unfavorable characteristics of the building that could damage either part of the building or the entire structure.

P.P. Chandurkar [6] in this study shear walls, is considered as major earthquake resisting member. Structural wall gives an effective bracing system and offer good potential for lateral load resistance. So it is important to determine the seismic response of the wall or shear wall. In this study main focus is to determine the location for the shear wall in multi storey building.

Prof. S.S. Patil [7] This study gives seismic analysis of high rise building using program in STAAD Pro. with considering different conditions of the lateral stiffness system. Analysis is carried out by response spectrum method. This analysis gives the effect of higher modes of vibration and actual distribution of force in elastic range in good way. These result include base shear, Storey drift and storey deflection are presented.

III. RESEARCH METHODOLOGY

In methodology calculation of natural period of structure is calculated by using analytical method and software analysis SAP. SAP is the software which used by structural analysis. The structural analysis carried out based on the Limit State Method. There are design of all structural members Slab, Beam, Column, Footing. There are three types of structure are taken with different frequency and shape. Design of all parts of building by analytical method and also calculate steel quantity of structure. By using analytical method the natural period of all structure is same by the reference IS 1893:2002. Density of Red Brick is high so steel quantity of is also get more. Density of Siforex Brick is low so the steel quantity is get lower than other bricks masonry structure. In IS 1893:2002 clearly mention the fundamental natural period of vibration (Ta), in seconds, of all other buildings, including moment – resisting frame building with bricks infill panels.[8]

$$Ta = 0.09\ h / \sqrt{d}$$

Where , h = Height of building in meter. d = Base dimension of the building at the plinth level, in meter, along the consideration of the lateral force. When earthquake is done natural period of vibration is more in heavy loaded building and less in light loaded building. If the building is light weighted i.e. steel is less and economy of structure is also achieved .

RESULTS

In this paper, the analysis and design of three type of building such as Square, L, C shape with different brick and densities. so, here the results are time period calculate by analytical method is same in all type of masses. but it compare with software analysis time period is varies with different masses. Here the also calculation of steel quantity of structure. If the building is heavier i.e. steel quantity is more and building is light weighed so economy of structure gets achieved. Light structure is more suitable during seismic vibration.

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SQUARE SHAPE BUILDING

MATERIAL CONSUMPTION	RED BRICK	FLYASH BRICK	CIFOREX BRICK	SAVING IN %FLYASH BRICK	SAVING IN %CIFOREX BRICK	SAVING IN COST IN RS.FOR FLYASH BRICK	SAVING IN COST IN RS.FOR CIFOREX BRICK
TOTAL STEEL QUATITY (Kg)	1225.32	1181.67	1128.27	3.56	5.47	2182.5	4852.5
CONCRETE QUATITY (m3)	28.95	20.81	17.66	28.11	38.99	44932.8	62320.8
TIME PERIOD (sec)	0.22	0.22	0.22				
TIME PERIOD BY SAP ANALYSIS (SEC)	0.32	0.28	0.24				

C SHAPE BUILDING

MATERIAL CONSUMPTION	RED BRICK	FLY ASH BRICK	CIFOR EX BRICK	SAVING IN %FLYASH BRICK	SAVING IN %CIFOR EX BRICK	SAVING IN COST IN RS.FOR FLYASH BRICK	SAVING IN COST IN RS.FOR CIFOREX BRICK
TOTAL STEEL QUATITY (Kg)	9600.2	9291.56	9090.38	3.21	5.31	15432	25491
CONCRETE QUATITY M^3	194.834	164.346	142.88	15.64	26.66	168293.76	286786
TIME PERIOD (SEC)	0.218	0.218	0.218				
TIME PERIOD BY SAP ANALYSIS (SEC)	0.36	0.3	0.26				

L SHAPE BUILDING

MATERIAL CONSUMPTION	RED BRICK	FLY ASH BRICK	CIFOR EX BRICK	SAVING IN %FLYASH BRICK	SAVING IN %CIFOR EX BRICK	SAVING IN COST IN RS.FOR FLYASH BRICK	SAVING IN COST IN RS.FOR CIFOREXBRICK
TOTAL STEEL QUATITY(Kg)	5438.69	5284.86	4725.34	2.82	13.11	7691.5	35667.5
CONCRETE QUATITY(m3)	106.78	98.55	89.976	7.7	15.73	45429.6	92758.08
TIME PERIOD (sec)	0.369	0.369	0.369				
TIME PERIOD BY SAP ANALYSIS (sec)	0.32	0.26	0.22				

IV. CONCLUSION

Main conclusions from the study of general structural behavior of masonry include

From the results it has seen that time period from analysis varies with respect to calculated time period (natural/ fundamental) using formula mentioned in IS1893:2002 for infill wall RC structure.

It is also conclude that different bricks which are available in market affect construction cost as well as performance of structure in terms of natural /fundamental time period Td.

It is conclude that, more study is required, which will helps in calculating the fundamental time period of structure where effect of mass is considered.

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