Vol. 5, Issue. 9, 2018, ISSN 2349-0780

Seismic Analysis Of Buildings On Different Types Of Soil With And Without Shear Wall: A Review

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Abstract- Civil engineering is always deals with constructing different types of structures with ensuring safety, durability and serviceability. Now days "earthquake "is phenomena that affects the structures with their safety and serviceability. The amount of damage that earthquake can done to structures is depend on Type of building, Type of soil, Technology used for earthquake resistance, and last but not the least Location of building. Effects of earthquake is largely depend on type of soil in which foundation of building is done because earthquake changes the motion of ground that results the failure foundation. So it is important to study the behaviour of different soil at the time of construction of structures. Also earthquake can resisted by various technologies used in building, one of these are shear wall. It improves the structural performance of building subjected to lateral forces due to earthquake excitation. This study focuses on behaviour of different types of soil at the time of earthquake occurrence and shear wall impact on structures.

Keywords- earthquake, shear wall, soil.

I. INTRODUCTION

Earthquake is moving phenomenon of soil or we can say that vibrations which disturb the earth surface due to waves inside the surface of earth is termed as earthquake. Earthquake can damage the structures which are not constructed according the earthquake consideration. A large number of building designed in India according to static and permanent loads but earthquake is an occasional loads. Present time in India approximately more than 60% area is under earthquake prone zone. So it is important to design the structures according to seismic forces. Earthquake damages the substructure and superstructures. Substructures is the lower part of buildings i.e.; foundation of buildings and superstructures is the part of buildings that rests above the ground level. It is important to understand the behaviour of substructures due to seismic loads (soil-foundation interaction) and behaviour of superstructures due to seismic loads (beam, column, slab, beam-column joint etc.).

Shear wall is generally defined as vertical member of building that is able to resist shear, moment and axial load at the same time that is induced by all lateral loads and gravity loads. The main function of shear wall is to increase the rigidity for horizontal load resistance thus shear wall is a structurally efficient solution to strengthen and stiffen a building.

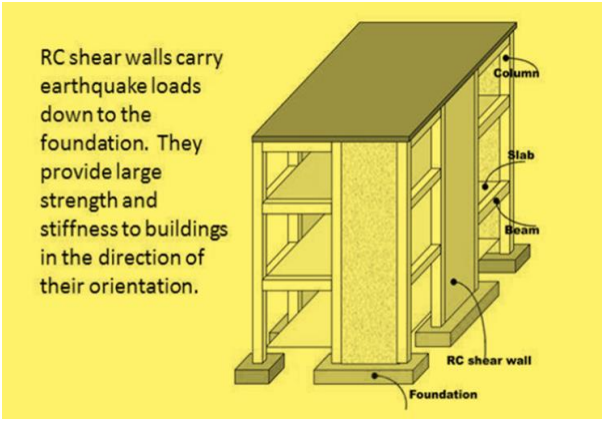

Fig 1: Shear wall

This study focuses on behaviour of buildings in different types of soils i.e. hard, medium, and soft with and without shear wall. The amount to which the response of building changes the characteristics of seismic motions observed at level of foundation is depends on the relative mass and stiffness property of soil and substructures. So behaviour of building in different types of soil is an important factor that should be considered at the time of design of buildings.

II. REVIEW OF LITERATURE

1. "Behavioural Study Of Expansive Soils And Its Effect On Structures" by Verma s. K. And Maru s. et al, 2013.

"In the past, considerable interest has been developed in the problems of expansive soil and its effect on the structures, but comparatively very little has been studied to understand its behaviour and effect on the structures. A number of reports about the characteristics, behaviour, stabilization and effects on structures of expansive soil have been published over the years but no comprehensive review has been published specially during the last decade. Thus the aim of this paper is to present a review on characteristics, behaviour, stabilization of expansive soil and its effects on the structures. Up to certain extant its nature and mechanics is understood and tried to stabilized by different techniques. Mainly this soil is stabilized with lime and fly ash and with the addition of certain chemicals gives very good performance even in the adverse conditions. But very little work has been done on its effects and remedial measures on the structures. The study will give technical overview and useful information to the engineers and researchers who will work for the betterment of research activities in this field in future."

2. Seismic Behaviour of Buildings on Different Types of Soil" by Ketan Bajaj and Jitesh T Chavda et al, 2013.

"Buildings are subjected to different earthquake loading and behaves differently with diversification in the types of soil condition, such as dense soil, medium and soft soil. Different soil properties can affect seismic waves as they pass through a soil layer. When a structure is subjected to an earthquake excitation, it interacts with the foundation and soil, and thus changes the motion of the ground. It means that the movement of the whole ground structure system is influenced by type of soil as well as by the type of structure. As the seismic waves transfer from the ground which consist of alteration in soil properties and performs differently according to soil's respective properties."

3. "Seismic Behaviour of Shear Wall Framed Buildings" by Er. Raman Kumar Sidhu et al, 2014.

"It is well recognized that the incorporation of lateral load resisting systems in the form of shear walls, bracing systems etc. improve the structural performance of buildings subjected to lateral forces due to earthquake excitation. The seismic behaviour of buildings is strongly affected by the arrangement of shear walls, the rigidity of floors and the connections of floors to the walls. Shear walls are normally arranged in such a way that they resist lateral loads most effectively. Therefore, in the present study the structural behaviour of the buildings with shear walls at different locations has been investigated and compared in terms of storey drift, average displacement and member forces induced in the various members of the buildings.Two reinforced concrete framed regular buildings with different locations of shear walls situated in seismic zone v have been analysed in this study. Ten-storeyed and fifteen-storeyed buildings were taken with four different locations of shear-walls i.e. at central frame, external frame, internal frame, and combined external and internal frames."

4. "The Influence Of Soil Conditions On The Seismic Forces In Rc Buildings" by Mr. Rahul Sawant and Dr. M. N. Bajad et al, 2015.

"This study focuses on a review of the influence of soil conditions on the seismic forces in RC buildings. The aim of this study is to gain understanding the effect of the local site conditions on the seismic forces in building. The study helps in creating awareness about the importance of the local site conditions, such as proximity to the source of earthquakes (faults) and the local geological and topographical features in the earthquake resistant design of buildings. The current Indian code of practice for seismic analysis IS 1893:2002, specifies seismic zones to consider different levels of intensity of ground shaking, There are also maps of the principal tectonic features and lithological formations. This paper shows the soil condition effects studied by the various researchers."

5. "Study Of Structures In Black Cotton Soil" by U.g.fulzele, V.r.ghane et al, 2016.

"In Civil Engineering aspects Black Cotton Soil is giving hazardous Problems to engineers. With the rapid development in Soil improvement, construction technique and social need various constructions of structure are taking place. The possibility of good construction sites to build structures on Black Cotton Soils is difficult due to their poor strength and deformation characteristics. This study discussed Black Cotton Soil problems their remedies, precaution taken and covers the guidelines to construct the structure in Black Cotton Soil."

6. "Effect Of Numbers And Positions Of Shear Walls On Seismic Behaviour Of Multi-Storeyed Structure". By Kasliwal N. A , Rajguru R. S et al, 2016.

"Tall buildings are the demand of present situation. As the height of structure increases, lateral forces due to wind or seismic become predominant. The major portion of these shall be resisted by the structural elements. Out of different structural systems, moment resisting frames and shear wall frames are two principal structural systems used in reinforced concrete buildings to resist wind and earthquake forces. This paper deals with the Dynamic linear Response spectra method on multi-storey shear wall building with variation in number and position of shear wall. Dynamic responses under prominent earthquake, this paper highlight the accuracy and exactness of shear wall"

7. "Comparitive Seismic Behaviour Analysis Of Structure With Shear Wall At Different Locations" by Sumanth G, Mr.Vasantha.D et al, 2016.

"In this paper publishers stated that due to the lack of space it becomes necessary to construct high raised buildings so as to cater and fulfil the needs of the people as per living standards. As such, it should be analysed properly and then designed such a way that the structure should be safe and stable. Multi-storied

buildings are generally preferred because it saves the cost of land in the restricted places and where the place is limited. . Shear walls are vertical elements of the horizontal force resisting system. Shear walls are constructed to counter the effects of lateral load acting on a structure. In residential construction, Shear walls are straight external walls that typically form a box which provides all of the lateral support for the building. When shear walls are designed and constructed properly, and they will have the strength and stiffness to resist the horizontal forces. In building construction, a rigid vertical diaphragm capable of transferring lateral forces from exterior walls, floors, and roofs to the ground foundation in a direction parallel to their planes. This study aims at comparing various parameters such as storey drift, storey shear, and displacement of a building under lateral loads based on strategic positioning of shear walls. The effect of shear wall location on various parameters is to be compared. The static and response spectrum method is used to obtain the overall performance level of a structure."

8. **"Seismic Behaviour Of RCC Frame Structure Considering Soil Structure Interaction" by Prashant Patil,Abhishek Chaskar, and Pradeep Landage et al, 2017.**

"Generally, there is a common design practice for dynamic loading, in which it is assumed that the building is fixed at it bases, but in reality the soil medium allows movement to some extent due to its property to deform. Therefore, this may decrease the stiffness of the structure and hence may increase the natural periods of the system. Thus, this behaviour of soil and structure affecting the total response of the structure is called as soil structure interaction."

III. CONCLUSION

Analytical investigations have been carried out to study the behaviour of structure founded on different types of soil with and without shear wall. Based on this work following conclusions can be drawn.

1. The natural time period of structure increases when soil structure interaction is considered on base isolated structure.
2. Effect of soil structure interaction is predominant for soils with soft and medium strata.
3. As the number of storey increases in the building the base shear and displacement are increases.
4. Structures with shear wall is more effective than conventional structures.
5. The stability of structures can be increased by knowing the soil condition and providing the suitable remedy.
6. Location of shear wall affects the seismic behaviour of structures.
7. Expansive soil can be strengthen by stabilization of this soil.
8. Foundation of building is designed according to the type of soil properties.
9. Soft soil is least suitable for buildings construction where as hard soil is more suitable for building construction.
10. In case of soft soil, soil structure interaction has been recommended as the height of building increases.
11. The performance quantities like displacements, acceleration and base shear are affected due to soil structure interaction.
12. Lateral deflection of buildings with shear wall is less than buildings without shear wall.

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