IJSTE - International Journal of Science Technology & Engineering | Volume 4 | Issue 1 | July 2017
ISSN (online): 2349-784X

A Study of Advanced Bus Stand

N. T. Wadhai
M. Tech Student
Department of Civil Engineering
G. H. Raisoni Academny of Engg, & Tech Nagpur

D. P. Telang
Assistant Professor
Department of Civil Engineering
G. H. Raisoni Academny of Engg, & Tech Nagpur

Abstract

An Earthquake is a phenomenon that results from by the sudden release of stored energy in the crust that propagates Seismic waves. The seismic activity of an area refers to the frequency, type and size of earthquake experienced over a period of time. At the Earth's surface, earthquakes may occurred by a shaking or displacement of the ground and sometimes tsunamis, which may lead to loss of life and destruction of property. The word Earthquake is used to describe any seismic event whether a natural phenomenon or an event caused by humans that generates seismic waves. Most naturally occurring earthquakes are related to the tectonic nature of the earth. Such earthquakes are called tectonic earthquakes.

Keywords: Seismic zone, Importance factor, Advance bus design, Reduction factor, Response Spectrum method

I. INTRODUCTION

India is divided into different seismic zones. As per IS 1893:1984 Code India is divided from Zone 1 to Zone 5. But as per IS 1893:2002 Code it has been divided from Zone 2 to Zone 5. Zone 1 has been discarded.
The important factors that affect the magnitude of earthquake forces are-

A. Seismic zone factor, Z:

India has been divided into four seismic zones as per IS 1893 (Part 1): 2002 for the Maximum Considered Earthquake (MCE) and service life of the structure in a zone. Different zone have different zone factor. Figure 1.1 shows seismic zone map of India. India is divided into four seismic zones. There are three types of soil considered by IS 1893 (Part 1): 2002 i.e. soft medium and hard soil.

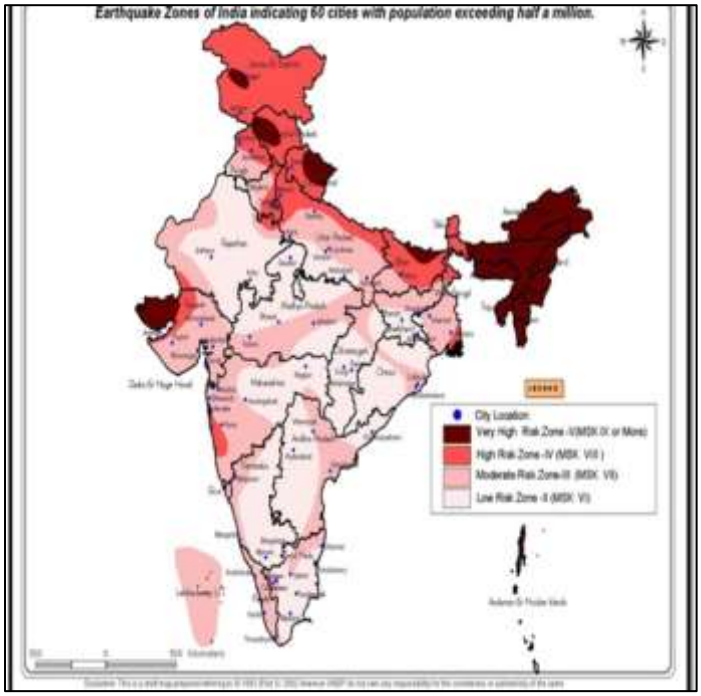

Fig. 1: Different Earthquake Zones of India

B. Importance factor, I:

Importance factor depends upon the functional use of the structures, characterized by hazardous consequences of its failure, post-earthquake functional needs, historical value, or economic importance. Elevated water tanks are used for storing potable water and

intended for emergency services such as firefighting services and are of post-earthquake importance. So importance factor is 1.5 for elevated water tank.

C. Response reduction factor, R:

Response reduction factor depends on the perceived seismic damage performance of the structure, characterized by ductile or brittle deformations. R values of tanks are less than building since tanks are generally less ductile and have low redundancy as compared to building. For frame confirming to ductile detailing i.e. special moment resisting frame (SMRF), R value is 2.5.

D. Structural response factor, (Sa/g):

It is a factor denoting acceleration response spectrum of the structure subjected to earthquake ground vibrations, and depends on natural period of vibration and damping of the structure.

E. Characteristics defining a Bus Stop

1) Location of Bus Stops:
A key element in improving bus transit efficiency is stop location. Stop locations can be with respect to a signal: nearside, far side, or mid-block. BRT systems with active signal priority and queue jumpers should place stops at the far side, allowing for effective use of these measures. It also clears the bus through the intersection with minimal delay. If the stop was on the near side, queue jumpers would be not be used, and the bus would have to merge with queue traffic on the curbside lane for the stop. Consequently, the bus would be delayed by at least one signal cycle. Mid-block stops are not commonly used; however their location has no advantage and disadvantage in terms of signal priority and queue jumpers. Effective stop location helps to minimize travel time of passengers, which is essentially the goal of BRT.
2) General Layout:
The bus stations have been designed to cater to varying demand along the corridor. The bus station could contain one or two bus bays based on the passenger demand. The bus bays are separated by a utility area between them to facilitate easier overtaking. The utility area is proposed to have facilities such as telephone booths, mobile charging points, and newspaper and snack vending machines. Circulation Patterns: The circulation inside the bus shelter has been designed to accommodate maximum passengers during peak hours, to avoid queuing outside the bus shelters and reduction in dwell times. The bus station circulation has been made compatible to accommodate off-board ticketing, with provision of turnstiles at the entry and exit points.

II. LITERATURE SURVEY

A. G. Saad, F. Saddik& S. Najjar (2012)

Current building codes lack explicit recommendations on how to simulate the seismic performance of high-risebuildings with multiple underground stories. Designers are typically basing their analyses on subjective engineering judgment and experience. Some model and analyse the buildings cropped at the ground floor level, others include a partial number of basement floors, while a few include all the underground floors.
This paper studies the seismic behaviour of reinforced concrete buildings with multiple underground stories. It seeks to provide recommendations on the number or percentage of underground stories to be accounted for in the analysis of reinforced concrete shear wall buildings.

B. Anirudh Gottala, Kintali Sai Nanda (2015)

They carried out comparative study of static and dynamic seismic analysis of a multistorey building. A multi-storied framed structure of (G+9)pattern is selected. Linear seismic analysis is done for the building by static method (Seismic Coefficient Method) and dynamic method (Response Spectrum Method) using STAAD-Pro as per the IS-1893-2002-Part-1. A comparison is done between the static and dynamic analysis, the results such as Bending moment, Nodal Displacements, Mode shapes are observed, compared and summarized for Beams, Columns and Structure as a whole during both the analysis.

C. Deepankar Choudhury, T. G. Sitharam and K. S. SubbaRao (2004)

Earthquake-resistant design of earth retaining structures like retaining walls, earth dams and foundations are very important problems to minimize the devastating effect of earthquake hazards. In this paper a comprehensive review for different methods to calculate seismic earth pressures and their point of applications is shown. Numerical example shows the merit of a displacement based analysis over force-based analysis by considering a permissible displacement of the wall. Modification of IS code for seismic design of retaining wall is proposed. Merits and demerits of several design and analytical procedures for earthen dam and foundations under seismic conditions are provided in this paper.

D. Sayed Mahmoud and Waleed Abdallah Saudi Arabia (2014)

They have done a research on response analysis of multistory RC buildings under equivalent static and dynamic loads according to Egyptian code. The objective of this research is to assess the seismic performance of an existing shear wall residential building located in Cairo. Both dynamic response spectrum (RS) and equivalent static force (ESF) methods are used in the seismic analysis. The design RS curve suggested by the Egyptian Code (EC) for seismic design is utilized to perform the dynamic analysis. The response analysis of the building under the acting seismic loads has been performed using ETABS, universal finite element analysis software for dynamic analysis. The results of the study show significant differences in building's responses obtained using ESF and RS analysis methods. It has been found that the application of static method in a specified direction results in responses in the same direction. However, the applications of dynamic RS method induces response in both directions regardless the direction of loading.

E. C. Navarro (1992)

This paper extends to other types of structure the simplified methodology proposed by constantopoulos et al. (1979) for the seismic design of tunnels. As a practical example, a large structure of reinforced concrete of box shape and totally embedded in soil, is analyzed. The dynamic pressure acting on wall, roof and floor due to body and surface waves are considered in the analysis. A set of seismic load combination hypotheses are proposed to account for the different polarization planes of the seismic waves. The influence of neighboring buildings can be taken into account considering the new soil stress states that they produce.

III. METHODOLOGY

A. General

An earthquake can be measured in terms of magnitude and intensity. For that seismologists use two fundamentally different but equally important types of scales. The original force or energy of an earthquake is measured on a magnitude scale. The Richter scale is a well known example of a magnitude scale. The second type of scale measures the intensity of shaking occurring at any given point on the Earth's surface. These scales are referred to as intensity scales. The Mercalli intensity scale, which measures the effects of the seismic waves, is an example of a commonly used intensity scale.
The main objective of this study is to carry out the analysis of g+4 and underground parking bus stand building against earthquake as per Indian standard codes of practice IS 1893(Part 1):2002. The earthquake loads on the building are calculated assuming the building to be located at Nagpur. The member forces are calculated with load combinations for Limit State Method given in IS 456: 2000 and the members are optimized for the most critical member forces among them. The building is subjected to self weight, dead load, live load as per IS 875(Part 1, Part 2):1987.

B. Methodology

The earthquake load is considered as per IS:1893 (Part I):2002,for the zone II and medium soil with importance factor 1.0 and Reduction factor 3.
Seismic zone factor Z for Zone II =0.16
Scale factor = (Z/2)*(I/R)*g
The seismic load is calculated as per IS 1893(Part 1):2002.The building is analyzed in two principal horizontal directions.
Fundamental time period of building are calculated as per IS 1893(Part 1):2002 by using Response spectra method.
Seismic coefficient $A_h = (S_a/g)*(Z/2)*(I/R)$
Base shear $V_B = A_h * W$
For medium soil sites
$Sa/g = 1+15*T \quad 0.00 \leq T \leq 0.10$
$= 2.5 \quad 0.10 \leq T \leq 0.55$
$= 1.36/T \quad 0.55 \leq T \leq 4.00$

IV. MODELING

The building considered in the present report is G+5 and underground parking storied R.C framed building. Complete analysis is carried out for dead load, live load & seismic load using ETAB 2016 software. Response spectrum method of seismic analysis is used. All combinations are Considered as per IS 1893:2002.

Fig. 2: Typical plan of building plan

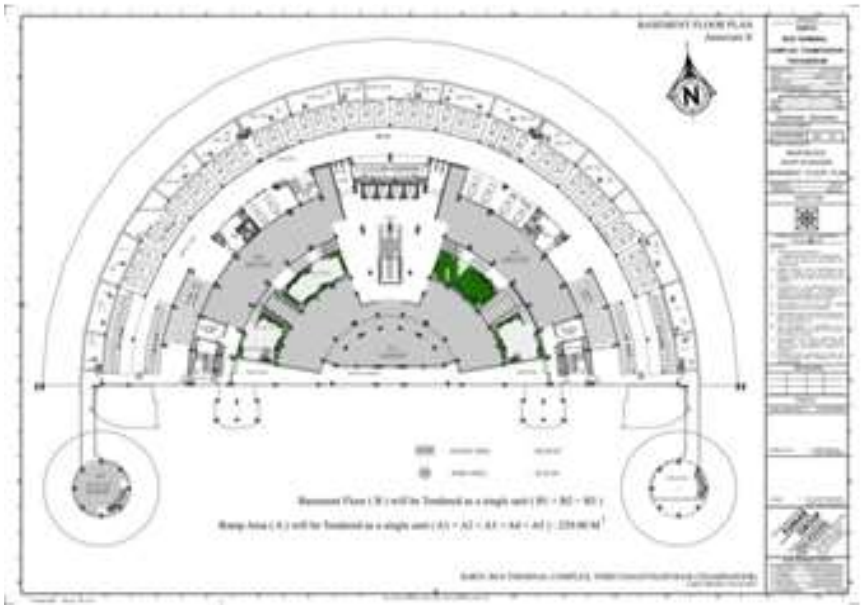
Fig. 3: Basement plan

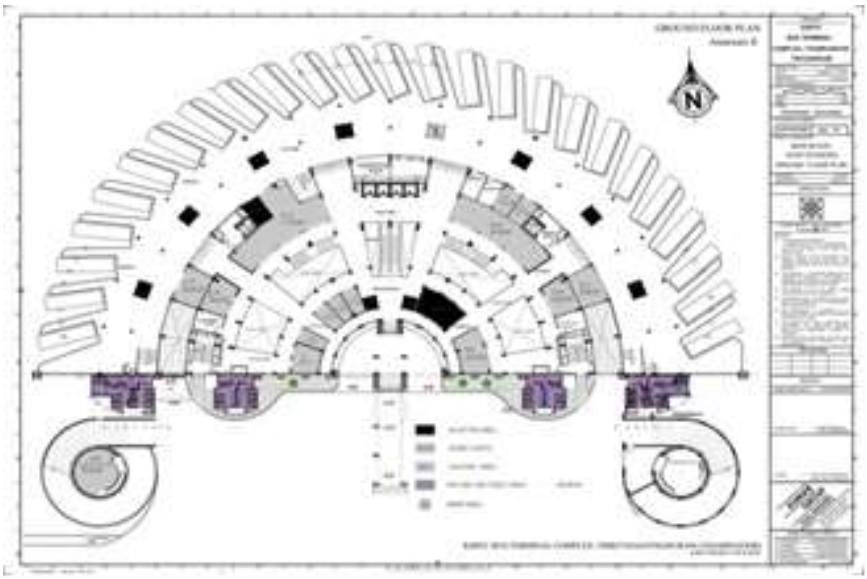
Fig 4 Ground floor plan

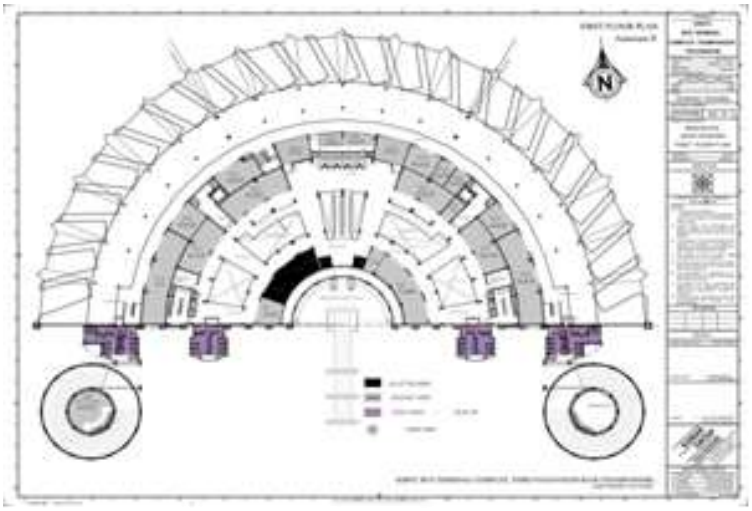

Fig. 5: first and second floor plan

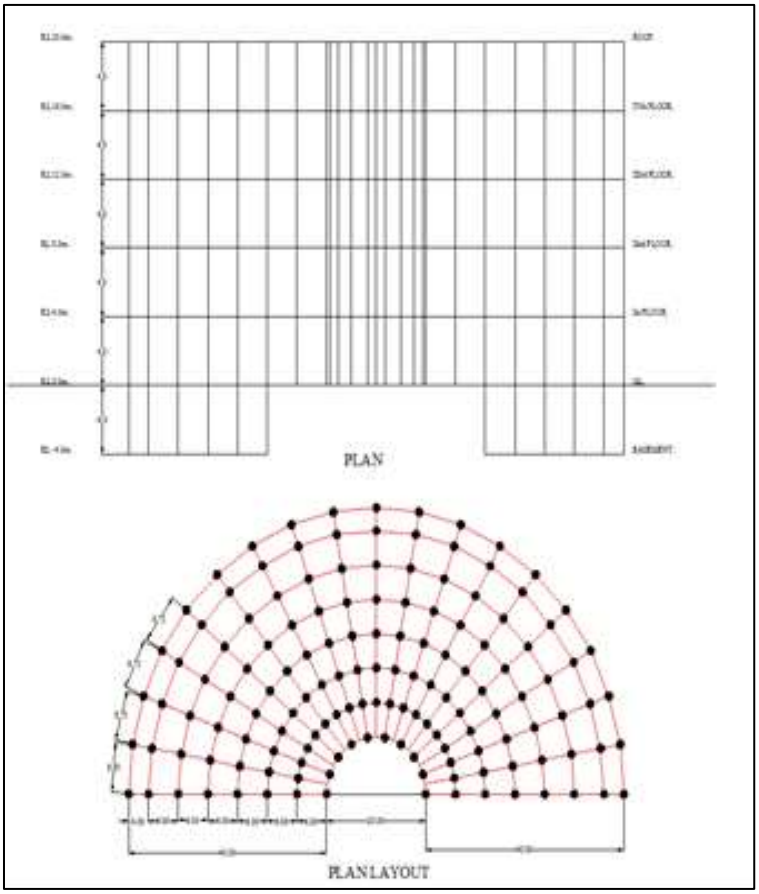

Fig. 6: Centre line plan of building

V. CONCLUSIONS

1) The displacements are found to be more in structure with cross shaped column as compared to circular column.
2) The frequency of found to be more in circular column structure as compared to cross shaped column.
3) The beam shear is found to be more in structure with circular column as compared to cross shaped column.
4) The beam Torsion is found to be more in structure with circular column as compared to cross shaped column.
5) The beam Bending moment (sagging) is found to be less in structure with circular column as compared to cross shaped column.

REFERENCES

[1] G. Saad, F. Saddik & S. Najjar, "Impact of Soil Structure Interaction on the Seismic Design of Reinforced Concrete Buildingswith Underground Stories." American University of Beirut, Lebanon 2012
[2] Anirudh Gottala, Kintali Sai Nanda Kishore and Dr. Shaik Yajdhani "Comparative Study of Static and Dynamic Seismic Analysis of a Multistoried Building" International Journal of Science Technology & Engineering, Volume 2, Issue 01, July 2015.
[3] Choudhury D., Sitharam T.G. and Subba Rao K.S. 2004. Seismic design of earth retaining structures and foundations, Current Science, 87(10), 1417-1425.
[4] Sayed Mahmoud and Waleed Abdallah Saudi Arabia "Response Analysis of Multi-Story RC Buildings under Equivalent Static and Dynamic Loads according to Egyptian Code ", International Journal of Civil and Structural Engineering Research, ISSN 2348-7607 (Online), Vol. 2, Issue 1, pp: (79-88), Month: April 2014 - September 2014.
[5] C.Navaro(1992) " Seismic analysis of underground structures" Earthquake engineering ,Tenth world conference 1992 Balkema, rottardam, ISBN 9054100605.