www.ijraset.com
IC Value: 45.98
Volume 5 Issue III, March 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Dynamic Analysis of a Tall Structure under Seismic Zone Considering Different Sloping Ground Conditions

Deependra Raghuvanshi[1], Rashmi Sakalle[2]
[1]PG Scholar, [2] Associate Professor, Department of Civil Engineering
Truba Institute of Engineering and Information Technology Bhopal M.P, India.

Abstract: buildings may be considered as asymmetric in plan or in elevation based on the distribution of mass and stiffness along each storey, throughout the height of the buildings. Most of the hilly regions of India are highly seismic. A building on hill slope differs in different way from other buildings. In this study, 3d analytical model of g+14 storied buildings have been generated for symmetric building model and analysed using structural analysis tool "staad pro vi8". To study the effect of varying slopes of ground, the plan layout is kept similar for both buildings on plane and sloping ground. The analytical model of the building includes all important components that influence the mass, strength, stiffness and deformability of the structure. To study the effect of slopes during earthquake, seismic analysis zone –v using linear dynamics (response spectrum method) has been performed

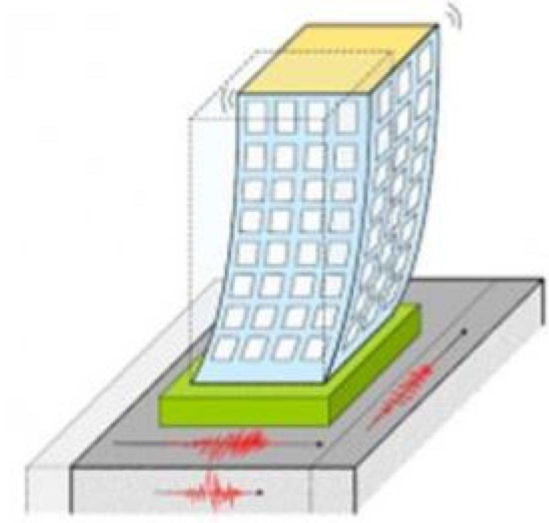
***Keywords*; Staad.Pro, Joint Displacement, Structural Analysis, Bending MMENT, Tall Structure**

I. INTRODUCTION

Earthquakes occur when energy stored in elastically strained rocks is suddenly released. This release of energy causes severe ground shaking in the area near the source of the earthquake and sends wave of elastic energy called seismic waves throughout the earth. Most natural earthquake are caused by sudden slippage along a fault zone. The elastic rebound theory suggests that if slippage along a fault is stuck such that elastic strain energy builds up in the deforming rocks on either side of the fault when the slippage does occur the energy released causes an earthquake. When an earthquake occurs, the elastic energy is released and sends out vibration that travels throughout the earth. These vibrations are also called seismic waves. The study of how waves behave in the earth is called seismology. The source of an earthquake is called the Focus, which is an exact location within the earth were seismic waves are generated by sudden release of stored elastic energy. The epicenter is the point on the surface of the earth directly above the focus.

North and north eastern parts of India have large scales of hilly region, which are categorized under seismic zone IV and V. In this region the construction of multistory RC framed buildings on hill slopes has a popular and pressing demand, due to its economic growth and rapid urbanization. This growth in construction activity is adding increase in population density. While construction, it must be noted that Hill buildings are different from those in plains i.e., they are very irregular and unsymmetrical in horizontal and vertical planes, and torsionally coupled. Since there is scarcity of plain ground in hilly areas, it obligates the construction of buildings on slopes. Shillong Plateau earthquake (M8.2) of 1897 and the Kangra earthquake (M7.8) of 1905 was the major of several devastating earthquakes to occur in northern India. An estimated of more than 375,000 population were killed in epicentral region, and over 100,000 buildings were destroyed by the earthquake. Similarly in recent earthquakes like Bihar-Nepal (1980), Uttarkashi (1990), Sikkim (2011), and Doda (2013) affected many buildings on hill slopes. India having a great arc of mountains consisting of the Himalayas defines the northern Indian subcontinent. These were formed by the ongoing tectonic collision of the Indian and Eurasian plates where housing densities of approximately 62159.2 per Sq Km are around as per 2011 Indian census. Hence there is a need to study on the seismic safety and design of these structures on slopes.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)



A. Staad.Pro

STAAD PRO Vi8 is the present day driving plan programming in the market. Many plan organization's utilization this programming for their project configuration reason. The creative and progressive new STAAD PRO Vi8 is a definitive coordinated programming bundle for the auxiliary examination and outline of structures. Fusing 40 years of persistent innovative work, this most recent STAAD PRO Vi8 offers unmatched 3D question based demonstrating and perception devices, blazingly quick straight and nonlinear expository power, complex and complete outline abilities for a extensive variety of materials, and adroit realistic showcases, reports, and schematic drawings that permit clients to rapidly what's more, effectively unravel and comprehend examination and configuration comes about. From the begin of outline origination through the production of schematic drawings, STAAD PRO Vi8 coordinates each part of the building configuration process. Formation of models has never been less demanding - natural drawing charges take into consideration the fast era of floor and height confining. Computer aided design drawings can be changed over straightforwardly into STAAD PRO Vi8 models or utilized as formats onto which STAAD PRO Vi8 items might be overlaid. The best in class STAAD PRO Vi8 Fire 64-bit solver permits greatly substantial and complex models to be quickly broke down, and underpins nonlinear displaying methods, for example, development sequencing and time impacts (e.g., crawl and shrinkage). Outline of steel and solid edges (with mechanized enhancement), composite pillars, composite sections, steel joists, and concrete and stone work shear dividers is incorporated, similar to the limit check for steel associations and base plates. Models might be sensibly rendered, and all outcomes can be indicated straightforwardly on the structure. Complete and adjustable reports are accessible for all investigation and configuration yield, and schematic development drawings of encircling arrangements, timetables, subtle elements, and cross-segments might be created for cement and steel structures.

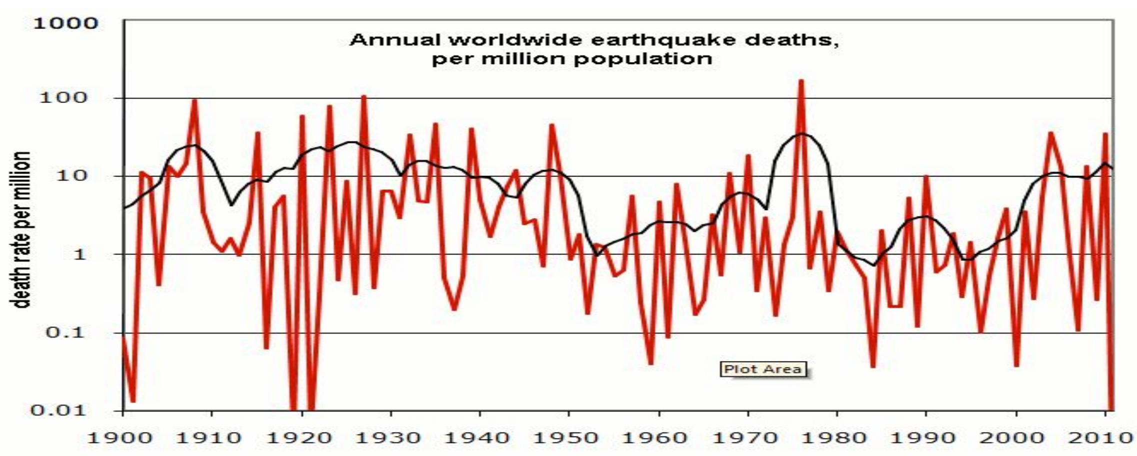


figure: 1.2

Volume 5 Issue III, March 2017
ISSN: 2321-9653

Hill buildings are different from those in plains, they are very irregular and unsymmetrical in horizontal and vertical planes, and torsionally coupled. Hence, they are susceptible to severe damage. When affected by earthquake ground motion. Past earthquakes [e.g. Kangra (1905), Bihar- Nepal (1934 & 1980), Assam (1950), Tokachi-Oki-Japan (1968), Uttarkashi-India (1991)], have proved that buildings located near the edge of stretch of hills or sloping ground suffered severe damages. Such are lateral forces under the action of earthquakes. Buildings have mass and stiffness varying along the vertical and horizontal planes, resulting the center of mass and center of rigidity do not coincide on various floors. This requires torsional analysis.

Little information is available in the literature about the analysis of buildings on sloping ground. The investigation present in this paper aimed at predicting the seismic response of RC buildings with different configuration on sloping and plain ground.

II. OBJECTIVE

The object of the present work is to compare the seismic behavior of multi-storey buildings having horizontal irregularity with that To regular building of similar properties in terms of
To determine the effect of slopeson building with same loading and geometry
To determine the variation in joint displacement
To check the rise or fall in the values of B.M. ,S.F., AXIAL FORCE.

A. Problem Formulation and Analysis

For this purpose four multi-storey building plans are considered that are symmetric. For the comparison, parameters taken are lateral displacement and storey drift. All the buildings are analyzed for zone V. Details of the frames are as follows: Building is a regular building of 14 stories with a symmetrical plan configuration of square shape provided with 16x16 bays and is considered whose centre of mass coincides with centre of rigidity. Building-II, building-III and building-IV are regular buildings of 14 stories having same geometry and property but are created as per different slopes.

Physical properties of the columns and beams
Member Size Columns for all floors 450mm x 450mm
Beams for all floors 300mm x 450mm

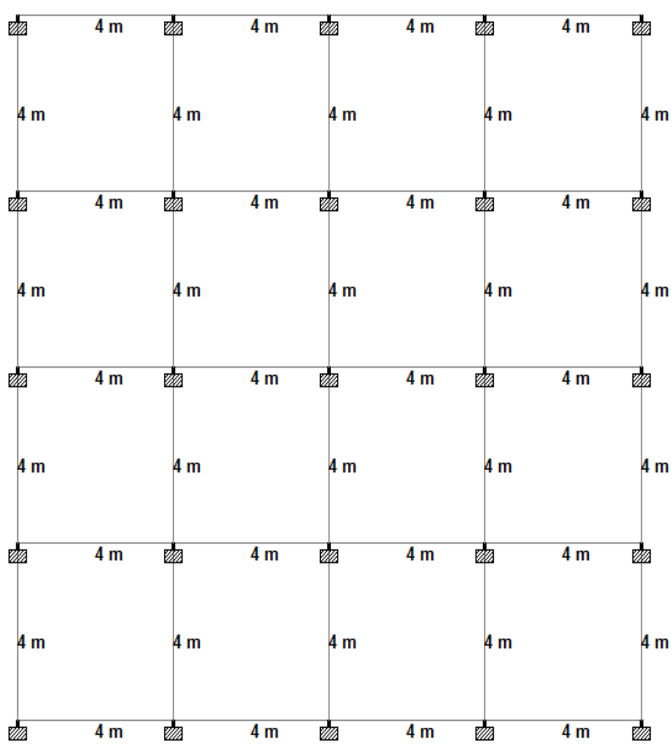


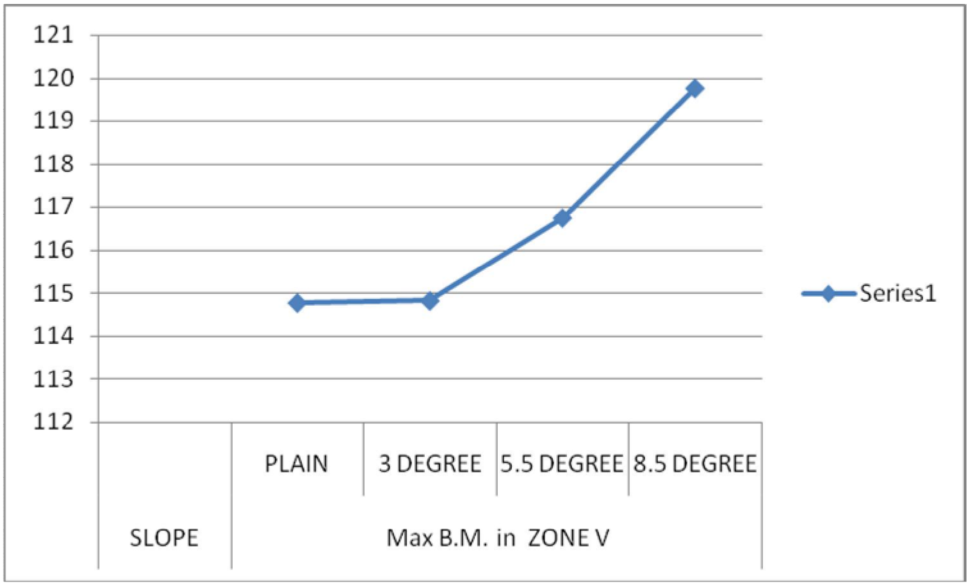
fig:1 plan

Volume 5 Issue III, March 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

III. ANALYSIS AND RESULTS

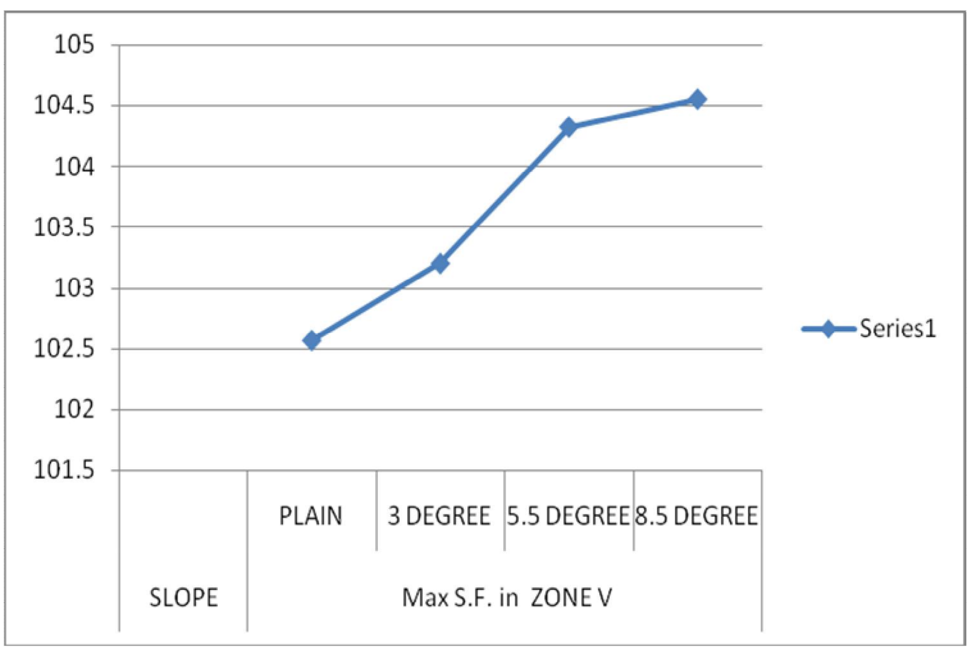
A. Max .B.M

	Max B.M. in ZONE V			
	PLAIN	3 DEGREE	5.5 DEGREE	8.5 DEGREE
SLOPE	114.783	114.83	116.75	119.76



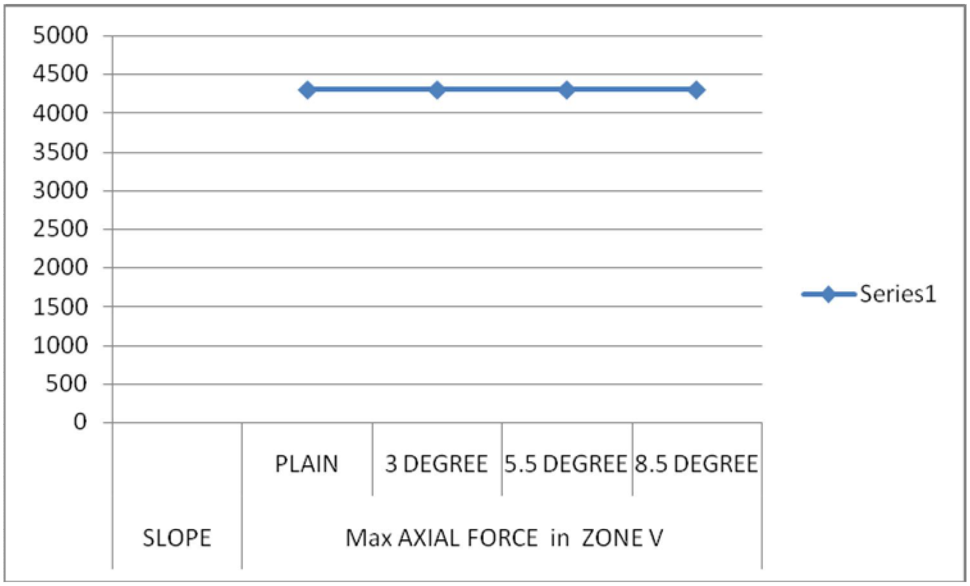
B. Max s.f.

	Max S.F. in ZONE V			
	PLAIN	3 DEGREE	5.5 DEGREE	8.5 DEGREE
SLOPE	102.565	103.2	104.32	104.55



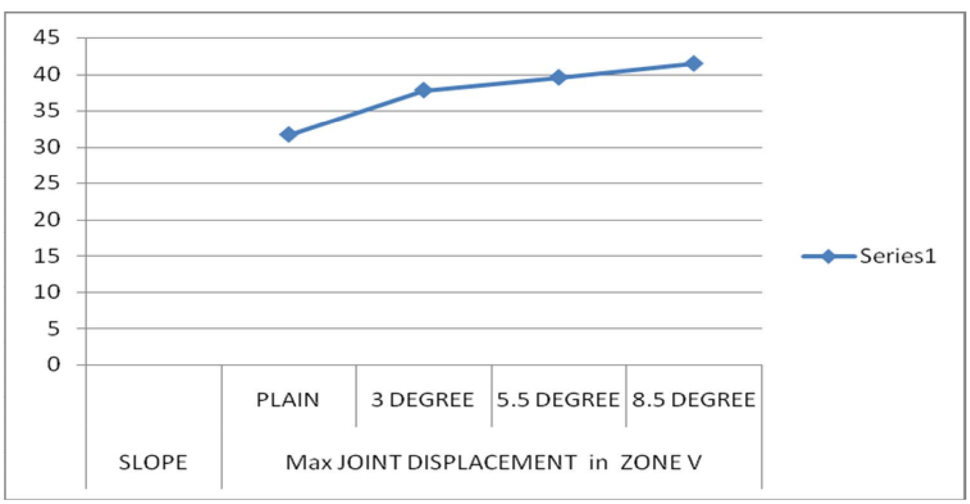
C. Max Axial Force

	Max AXIAL FORCE in ZONE V			
	PLAIN	3 DEGREE	5.5 DEGREE	8.5 DEGREE
SLOPE	4300.715	4300.715	4300.715	4300.715



D. Max Joint Displacement

	Max JOINT DISPLACEMENT in ZONE V			
	PLAIN	3 DEGREE	5.5 DEGREE	8.5 DEGREE
SLOPE	31.661	37.8	39.55	41.45



IV. CONCLUSION

In this study we concluded that using same seismic zone one can have different forces due to terrain conditions

1) Here the bending moment is increasing as we are increasing the slope of ground
2) Here the shear force is showing increment in its value due to increase in sloping angle
3) Here axial force doesn't shows variation due to sloping angle
4) Here joint displacement is also increasing on increasing slopes.
5) Therefore it can be concluded from the study that as we are increasing the sloping angle the values and forces are al increasing.

REFERENCES

[1] Agarwal.P. and Shrikhande. M., 2006 "Earthquake Resistant Design of Structures" Prentice-Hall of India Private Limited, New Delhi, India.
[2] Arlekar N.J., Jain K.S., and Murthy C.V.R, 1997 "Seismic Response of RC Frame Buildings with Soft First Storeys" Proceedings of the CBRL Golden Jubilee Conference on Natural Hazards in Urban Habitat, New Delhi.
[3] Applied Technology Council, 1996: "Seismic Evaluation and Retrofit of Concrete Buildings", ATC-40, Volume 1.
[4] Brick infills in RC frames: "E-Conference Proceeding", January 28, 2002.
[5] IS: 1893 (Part-I) – 2002 "Criteria for Earthquake Resistant Design of Structures", Part 1 – General provisions and buildings, fifth revision, Bureau of Indian Standards, New Delhi.
[6] Krawinkler H. and Seneviratna G.D.P.K, 1998: "Pros and Cons of Pushover Analysis of Seismic Performance Evaluation".
[7] Kanitkar R. and Kanitkar V., 2004 "Seismic Performance of Conventional Multi-storey Buildings with open ground storey for Vehicular Parking", Indian Concrete Journal.