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Comparative study of lateral load on R.C framed Building in critical earthquake and wind zone

Amit N. Burange[1], Suraj M.Barelikar[2]

PG Scholar, Assistant Professor
Civil Engineering department
JSPM's Imperial College of engineering and research, Wagholi, Pune.

***Abstract*— Earthquakes occurred in recent past have indicated that if the structures are not properly designed and Constructed with required quality may cause great destruction of structures. This fact has resulted in to ensure safety against earthquake forces of tall structures hence, there is need to determine seismic responses of such building for designing earthquake resistant structures by carrying seismic analysis of the structure.**

***Keywords*— R.C frame, Earthquake, Response Spectrum, story drift, story displacement & Better solution.**

I.INTRODUCTION

The lateral loads used in seismic design are highly unpredictable. Actual forces that action structures during earthquakes are much higher than the design forces. It is recognized that neither the complete protection against earthquakes of all sizes is economically feasible nor design alone based on strength criteria is justified. The basic approach of earthquake resistant design should be based on lateral strength as well as deformability and ductility capacity of structure with limited damage but no collapse. Thus, the design philosophy shall include provisions to provide minimum standards to maintain public safety in an extreme earthquake and safeguard against major failure sand loss of life. The design assumes significant amount of inelastic behavior to occur in the structure during earthquake.

The code IS 13920; 1993 entitled Reinforced Concrete Structures Subjected to Seismic Forces-Code of Practice is based on this approach. This standard covers the requirements of lateral strength designing and detailing of monolithic reinforced concrete buildings so as to give them adequate toughness and ductility to resist severe earthquake shock without collapse. Thus, the ductility of a structure is in fact one of the most important factors affecting its seismic performance and it has been clearly observed that the well-designed and detailed reinforced structures behave well during earthquakes and the gap between the actual and design lateral force is narrowed down by providing ductility in the structure .Earthquake load acting on a structure depends on epicenter distance and depth of hypocenter below earth surface and the energy released during an earthquake. For easier understanding, it can be said that the line of action joining hypocenter to the center of mass of structure indicates direction of load vector. The most determinant effect on a structure is generally caused by lateral component of earth quake load. As compared to gravity load effect, earthquake load effects on buildings are quite variable and increase rapidly as the height of building increases. For gravity loads, structure is designed by considering area supported by a column and spans of beam; whereas for earthquake loads, design is a function of total mass, height. It is likely that low and midrise structures, having good structural form can carry most of earthquake loads. The strength requirement is a dominant factor in the design of structure. As height increases the rigidity (i.e. the resistant to lateral deflection) and stability (i.e. resistant to overturning moments) of structure gets affected.

Wind is a phenomenon of great complexity because of the many flow situations arising from the interaction of wind with structures. Wind is composed of a multitude of eddies of varying size sand rotational characteristics carried along in a general stream of air moving relative to the earth's surface. These eddies give wind its gusty ortur bulent character. The gustiness of strong winds in the lower levels of the atmosphere largely arises from interaction with surface features. The average wind speed over a time period of the order of ten minutes or more, tends to increase with height, while the gustiness tends to decrease with height. Wind induced motion of buildings is concerned with human response to vibration and perception of motion .At this point it will suffice to note that humans are surprisingly sensitive to vibration to the extent that motions may feel uncomfortable even if they correspond to relatively low levels of stress and strain. Therefore, for most tall buildings serviceability consideration govern the design and not strength issues

II. LITERATURE REVIEW

A) Jaswant N. Arlekar, Sudhir K. Jain and C.V.R. Murty(1997) This paper highlights the importance of explicitly recognizing the presence of the open first store in the analysis of the building. The error involved in modeling such buildings as complete bare frames, neglecting the presence of in fills in the upper storey's, is brought out through the study of an example building with different analytical models. This paper argues for immediate measures to prevent the in discriminate use of soft first storey's in buildings, which are designed without regard to the increased displacement, ductility and force demands in the first storey columns. Alternate measures, involving stiffness balance of the open first storey and the storey above, are proposed to reduce the irregularity introduced by the open first storey. The effect of soil flexibility on the above is also discussed in this

OMER MOHAMAD AMINE (2000) This topic covers various aspects of seismic design of reinforced concrete structures with an emphasis is on Design for regions of high seismicity. Because the requirement for greater ductility in earthquake-resistant Buildings represents the principal departure from the conventional design for gravity and wind loading, the Major part of the discussion in this chapter will be devoted to considerations associated with providing Ductility in members and structures. The discussion in this chapter will be confined to monolithically cast Reinforced concrete buildings. The concepts of seismic demand and capacity are introduced and elaborated On. Specific provisions for design of seismic resistant reinforced concrete members and systems are presented in detail. Appropriate seismic detailing considerations are discussed. Finally, a numerical example is presented where these principles are applied

B) K.VANDANA REDDY, DIVAYA KAMATH(2011)

The loads are calculated namely the dead loads, which depend on the unit weight of the materials used (concrete, brick) and the live loads, which according to the code IS:875-1987 is around 2kN/m2.loads are obtained, the component takes the load first i.e the slabs can be designed. Designing of slabs depends upon whether it is a one-way or a two-way slab, the end conditions and the loading. From the slabs, the loads are transferred to the beam. The loads coming from the slabs onto the beam may be trapezoidal or triangular. Depending on this, the beam may be designed. Thereafter, the loads (mainly shear) from the beams are taken by the columns. For designing columns, it is necessary to know the moments they are subjected to. For this purpose, frame analysis is done by Moment Distribution Method. After this, the designing of columns is taken up depending on end conditions, moments, eccentricity and if it is a short or slender column

Most of the columns designed in this mini project were considered to be axially loaded with uni axial bending. Finally, the footings are designed based on the loading from the column and also the soil bearing capacity value for that particular area. Most importantly, the sections must be checked for all the four components with regard to strength and serviceability

C) M.D. KEVADKAR, P.B. KODAG :(2013)The structure in high seismic areas may be susceptible to the severe damage. Along with gravity load structure has to withstand to lateral load which can develop high stresses. Now a day, shear wall in R.C. structure and steel bracings in steel structure are most popular system to resist lateral load due to earthquake, wind, blast etc. The shear wall is one of the best lateral load resisting systems which is widely used in construction world but use of steel bracing will be the viable solution for enhancing earthquake resistance. It's find out the effective lateral load system during earthquake in high seismic areas. The performance of the building is evaluated in terms of Lateral Displacement, Storey Shear and Storey Drifts, Base shear and Demand Capacity (Performance point). It is found that the X type of steel bracing system significantly contributes to the structural stiffness and reduces the maximum inter story drift, lateral displacement and demand capacity (Performance Point) of R.C.C building the shear wall system

D) Mohit Sharma , Dr. Savita Maru (2014) Analysis and design of buildings for static forces is a routine affair these days because of availability of affordable computers and specialized programs which can be used for the analysis. On the other hand, dynamic analysis is a time consuming process and requires additional input related to mass of the structure, and an understanding of structural dynamics for interpretation of analytical results. Reinforced concrete (RC) frame buildings are most common type of constructions in urban India, which are subjected to several types of forces during their life time, such as static forces due to dead and live loads and dynamic forces due to the wind and earthquake.

III OBJECTIVES

1. Analysis with the help of case study for a building located in zoneIII. For that earthquake and wind load are considered and results are obtained on this basis.
2. Response spectrum and time history analysis will be performed for same zone
3. The output will be compare for the performance.

IV METHODOLOGY

a) Equivalent Static Method
b) Time History Method
c) Response Spectrum Method

Response Spectrum Analysis:

The response spectrum represents an envelope of upper bound responses, based on several different ground motion records. For the purpose of seismic analysis, the design spectrum given in figure 1 of IS: 1893 (Part 1): 2002 is used. This spectrum is based on strong motion records of eight Indian earthquakes. This method is an elastic dynamic analysis approach that relies on the assumption that dynamic response of the structure may be found by considering the independent response of each natural mode of vibration and then combining the response of each in same way. This is advantageous in the fact that generally only few of the lowest modes of vibration have significance while calculating moments, shear and deflections at different levels of the building. Following procedure is generally used for the spectrum analysis:

Following procedure is generally used for the spectrum analysis:

- Select the design spectrum.
- Determine the mode shapes and periods of vibration to be included in the analysis.
- Read the level of response from the spectrum for the period of each of the modes considered.
- Calculate participation of each mode corresponding to the single-degree-of-freedom response read from the curve.
- Add the effect of modes to obtain combined maximum response.
- Convert the combined maximum response into shears and moments for use in design of the structure.
- Analyze the building for the resulting moments and shears.

Wind analysis: The basic wind speed (Vb) for any site shall be obtained IS 875 and shall be modified to get the sign wind velocity at any height (Vz) for a chosen structure.

$$Vz\ z = Vb\ k1\ k2\ k3 \quad \text{……(1)}$$

Where, Vz = design wind speed at any height z in m/s,

Vb = Basic wind speed in m/s,

k1 = probability factor (risk coefficient),

k2 = terrain roughness and height factor and

k3 = topography factor

The basic wind speed map of India, as applicable at 10 m height above mean ground level for different zones of the country selected from the code. The design wind pressure at any height above mean ground level shall be obtained by the following relationship between wind pressure and wind velocity.

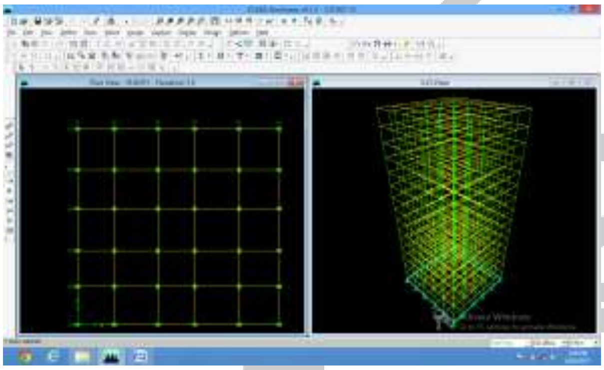
$$Pz = 0.6\ Vz^2 \qquad \ldots\ldots(2)$$

Where, Pz = wind pressure in N/m2 at height z

Vz = design wind speed in m/s at height z

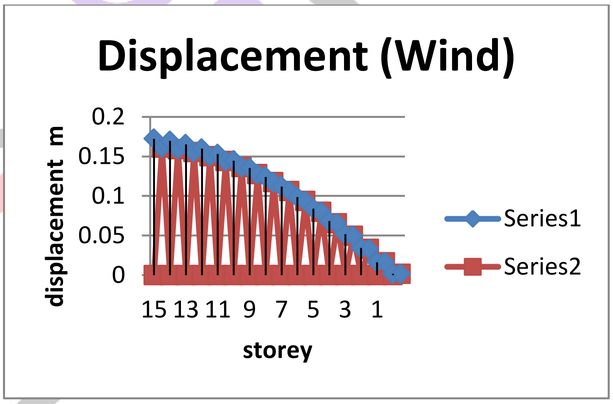
V Problem Statement

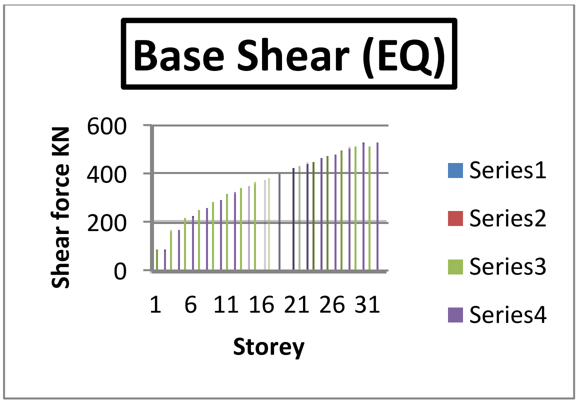
A building constructed G+6 having plan dimension is follows
Ht. of each floor = 4m
Size of all beams = 300*450mm
Sizes of all columns =600*600 mm
Thickness of slab = 120mm
Thickness of wall = 230mm



1. The dead load = 15.53KN
2. Parapet Load = 6.55KN

STORY	LOAD	UX	UY
STORY15	SPEC1	0.0281	0.0001
STORY15	SPEC2	0.0001	0.0272
STORY14	SPEC1	0.0276	0.0001
STORY14	SPEC2	0.0001	0.0267
STORY13	SPEC1	0.0268	0.0001
STORY13	SPEC2	0.0001	0.026
STORY12	SPEC1	0.0257	0.0001
STORY12	SPEC2	0.0001	0.025
STORY11	SPEC1	0.0244	0.0001
STORY11	SPEC2	0.0001	0.0238
STORY10	SPEC1	0.0229	0.0001
STORY9	SPEC1	0.0212	0.0001
STORY9	SPEC2	0.0001	0.0208
STORY8	SPEC1	0.0194	0.0001
STORY8	SPEC2	0.0001	0.019
STORY7	SPEC1	0.0174	0.0001
STORY7	SPEC2	0.0001	0.017
STORY6	SPEC1	0.0152	0.0001
STORY6	SPEC2	0.0001	0.015
STORY5	SPEC1	0.0129	0.0001
STORY5	SPEC2	0.0001	0.0127
STORY4	SPEC1	0.0105	0.0001
STORY4	SPEC2	0.0001	0.0104
STORY3	SPEC1	0.0079	0
STORY3	SPEC2	0	0.0079
STORY2	SPEC1	0.0052	0
STORY2	SPEC2	0	0.0052
STORY1	SPEC1	0.0025	0
STORY1	SPEC2	0	0.0025
PLINTH	SPEC1	0.0002	0
PLINTH	SPEC2	0	0.0002





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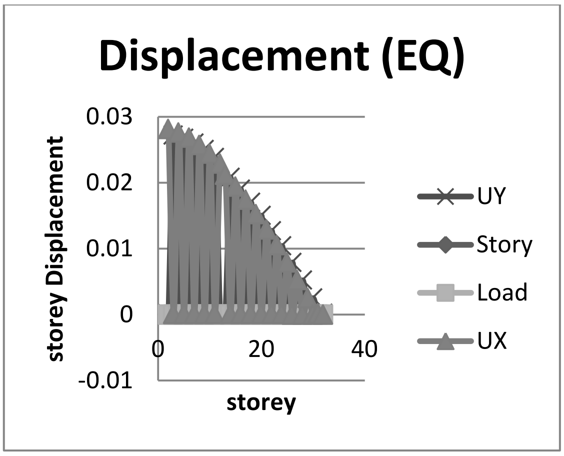

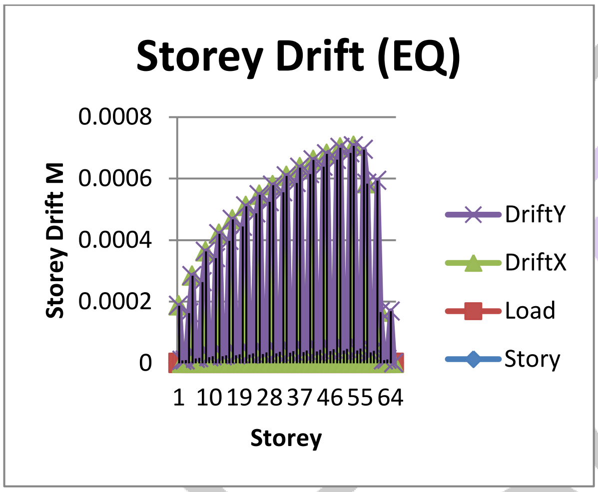

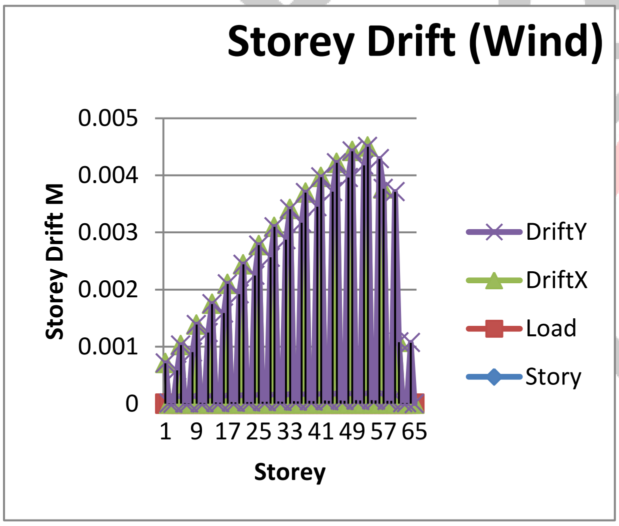

CONCLUSION

1. In these analyses it can be concluded that when story drift, base shear and story displacement in X & Y direction will be story height increase with as per direction of load.

2. When the direction load will be change then in the lateral direction its constant value or its very small value.

3. After considering effect of wind Load and earthquake load on the performance of building it found that for this structure earthquake is more critical than wind.

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