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Analysis of Short Columns Support in RC Building Resting on Sloping Ground

Haider Abdulazeez Ibrahim
M.Tech, Structural Engineering,
Department of Civil Engineering,
College of Engineering, Jawaharlal Nehru Technological University Hyderabad, TS, India,
University of Technology, Baghdad, Iraq.

Dr.N.V.Ramana Rao
Professor,
B.E (OU), M. Tech (IIT Delhi),
Ph.D (UK), Post Doctorate (UK),
College of Engineering, Jawaharlal Nehru Technological University Hyderabad, TS, India.

ABSTRACT:

In this Study, A software ETABS v 9.7.4 program had been used to modelled a multi- storey reinforced concrete building with different plan shapes regular (Rectangular shaped) and irregular (U –shaped) and each shape has three different configurations like (setback building, step back building and set-step back building) and plane dimension (40 x 54) m with nine storeys resting on plan and on sloping ground (26.57°) with fixed length of short columns support for each models, the models have been conducted and analyzed in the ETABS program for comparing and investigating the changes in the columns structural behavior and the irregularity effect in plan and elevation on sloping ground. The result of the analysis for the short columns support (shear force and bending moment) have been studied and compared in different configurations structure models and it was presenting in graphical and tabular form.

INTRODUCTION:

One of the major contributors to structural damage during strong earthquake is the discontinuities and irregularities in the load path or load transfer and the important feature in building configuration is its regularity and symmetry in the plane and elevation. Buildings on hill slope are highly irregular and asymmetric in plan and elevation. The lateral load such as earthquake is to be classified as live horizontal force acting on the structure depending on the building's geographic location, height, shape and structural materials.

A building with an irregular configuration may be designed to meet all code requirements but it will not perform well as compared to a building with a regular configuration.

METHODOLOGY:

Software ETABS v 9.7.4 program had been used to study the changes of the columns support structural behavior in different shapes of R.C Building on plan and on sloping ground under the lateral loads effect such as earthquake load, According to IS 1893:2002, which effect in the direction of the ground motion component.

ABOUT THE STRUCTURE:

Two configurations: Rectangular shaped and U –Shaped and for each configuration, a three shapes have been modeled:

a.Setback building
b.Step back building
c.Set-step back building

BASIC DATA FOR BUILDINGS MODEL:

- Plan Dimension : (54 x 40) m
- Height of each storey : (3) m
- Number of storeys : 9 storeys
- Length of each bay(in X-direction) : (6)m
- Length of each bay(in Y-direction) : (5)m
- Dimension of Column : (600 X 600) mm
- Dimension of Beam : (230 X 495) mm

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- Slab Thickness : (150) mm
- Walls Thickness : (230) mm thick brick masonry wall
- Grade of the concrete : M 25 ,M30
- Grade of the steel : Fe415
- Type of Soil : Type II, Medium Soil
- Seismic Zone : II
- Building Frame Systems : Ordinary RC moment-resisting
- Live Load on Typical Floor : (2.0) KN/m2
- Wind speed : (44) m/s
- Support : Fixed (short columns with fixed length)

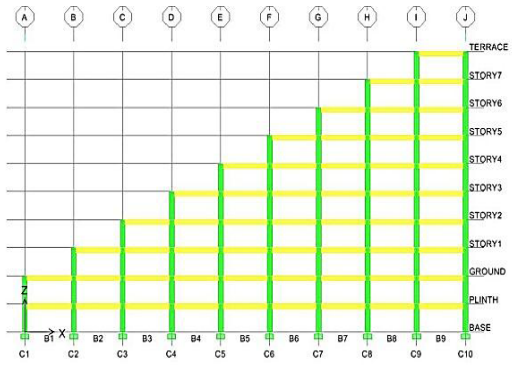

Figure 1 Side View of 9th storeys setback building.

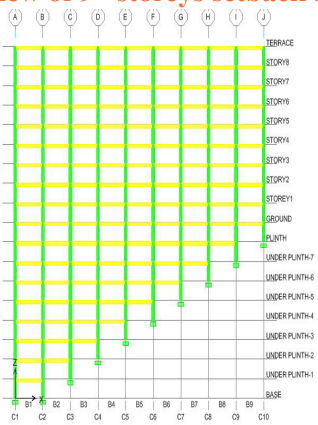

Figure 2 Side View of 9th storeys step back building.

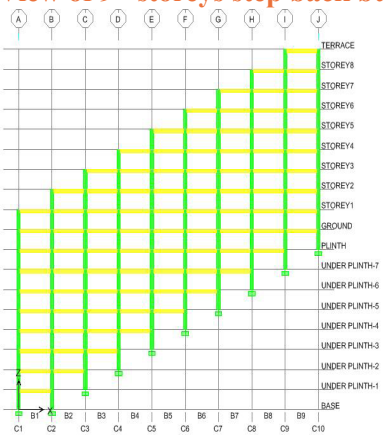

Figure 3 Side View of 9th storeys set-step back building.

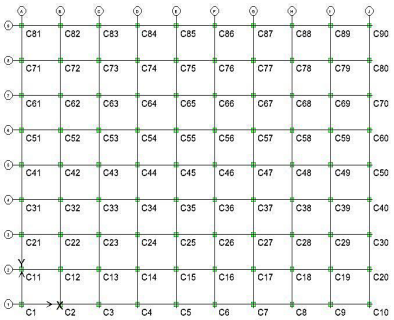

Figure 4 Top View of in Rectangular Shaped building with Columns Number.

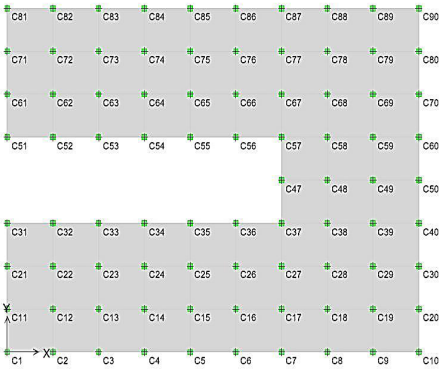

Figure 5 Top View of U -Shaped building with Columns Number.

LOADS AND FACTORES CALCULATIO:

Calculating the loads and factors values which are using in the software ETABS v 9.7.4 program:

A.Live Load: Live load for the Residential building in each storey = (2) kN/m2 as per IS: 875 (part 2) – 1987

B.Dead loads: Dead loads which include Slabs, beams, columns, Floor finish and Wall Load are taken as prescribed by the IS: 875 -1987 (Part-1) Code of Practice Design Loads (other than earthquake) for Buildings and structure.

C.Seismic Loading: In the present work the building is located in Hyderabad which comes under -zone-II, Response reduction factor- 3, Importance factor- 1, Soil Type- medium, using the IS 1893 (Part-1) -2002 the following are the various values for the building considered.

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ANALYZING:

A software ETABS v 9.7.4 program had been used for Modelling a multi- storey RC Buildings with different plan shapes (Rectangular & U –shaped), and each shape has three different configurations (setback building, step back building and step-set back building, all the models is support with fixed length short columns. And the Analysis Result for short columns support (shear force and bending moment) have studied and compared on plan and on slope

RESULT AND DISCUSSION:

The analysis results have been carried out using for the R.C short columns support in different shapes building on plan ground (0o) and on sloping ground (26.57o) and the results have been presented in graphical and tabular as follows:

COLUMN FORCES:

Column forces (bending moment and shear force) were obtained from the analysis results of ETABS programes for the interial common columns (C2, C3, C4, C5, C6, C7, C8 and C9) with the X-direction between different shapes 9th storeys buildings

COLUMN BENDING MOMENT:

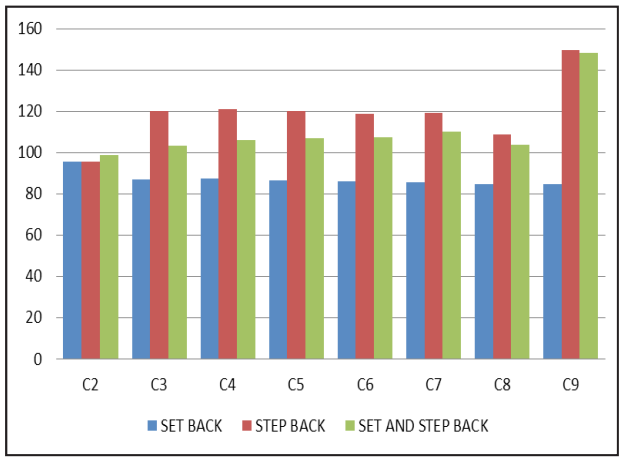

Figure 6 Columns Bending moment (KN.m) for 9th Storeys Rectangular shaped buildings

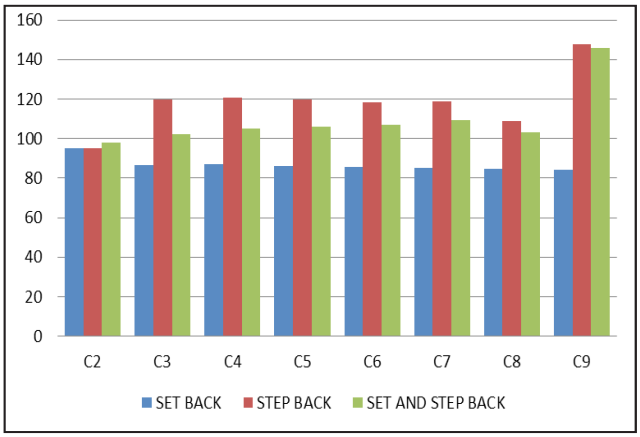

Figure 7 Columns Bending moment (KN.m) for 9th Storeys U-shaped buildings

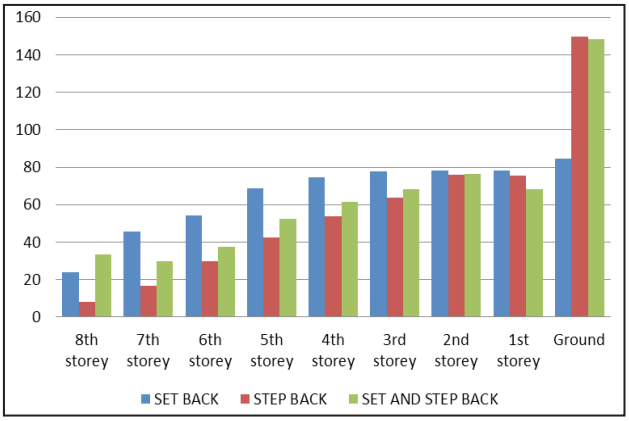

Figure 8 Column Bending moment (KN.m) for Column (C9) in Rectangular shaped buildings with 9th Storey

SHEAR FORCE:

Columns Shear force (KN) for 9thStoreys Rectangular shaped buildings has obtained from the analysis results as below:

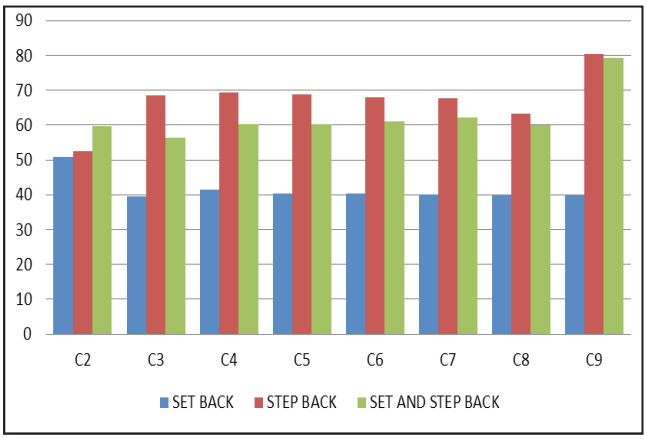

Figure 9 Columns Shear force (KN) for 9th Storeys Rectangular buildings

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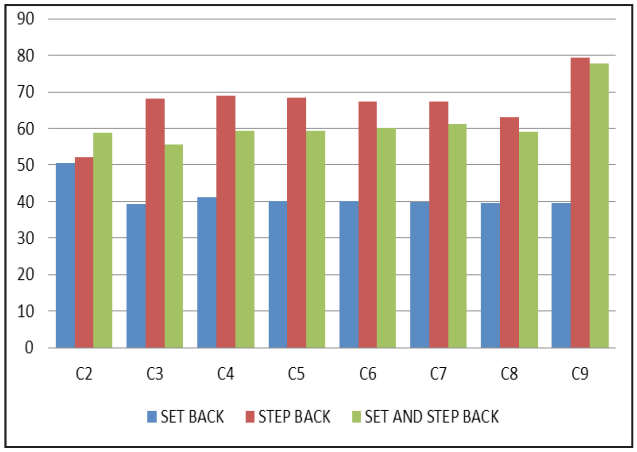

Figure 10 Columns Shear force values (KN) for 9th Storeys U-shaped buildings

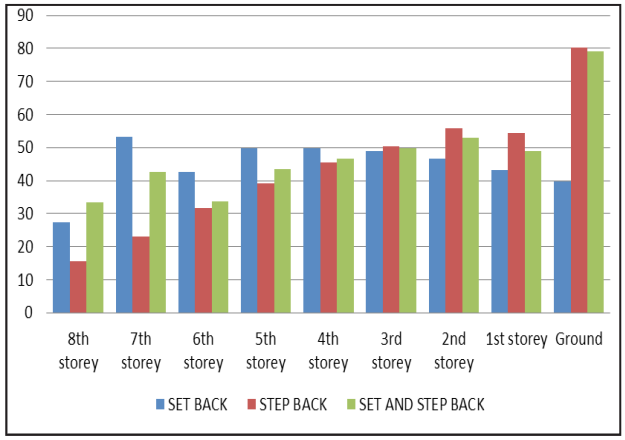

Figure 11 Column Shear force (KN) for Column (C9) in Rectangular shaped buildings with 9th Storeys

CONCLUSION:

The following conclusions from this study are:

1.The bending moment and shear force values for the short columns supports on sloping ground were more than the same short columns supports on plan ground. A special attention should be given to these columns for design and detailing.

2.In setback building short columns support attract less action forces as comparing with the same short columns support in other configurations on sloping ground and it would not suffer more damages due to the earthquake load action.

3.in set-step back building short columns support attract less action forces as comparing with the same columns support in step back building .

4.In step back building, the development of the shear force and bending moment for the short columns support were more than the same columns support in other configurations .

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Author 1:

Haider Abdulazeez Ibrahim,
M.Tech, Structural Engineering, Department of Civil Engineering, College of Engineering, Jawaharlal Nehru Technological University Hyderabad, TS, India, University of Technology, Baghdad, Iraq.

Author 2:

Dr.N. V. Ramana Rao,
Professor, B.E (OU), M. Tech (IIT Delhi), Ph.D (UK), Post Doctorate (UK), College of Engineering, Jawaharlal Nehru Technological University Hyderabad, TS, India.