International Journal of Research
Available at https://edupediapublications.org/journals

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

Comparison Between Seismic Variation Of Conventional Rc Slab And Flat Slab With Drop For G+15 Storey Building In Different Zones Using Etabs Software

Md. Shahbaz [1], M.Mujahid Ahmad[2]
[1,2] P.G. Scholar, Asst.Professor
[1,2] Department : Civil Engineering
[1,2] Geethanjali College of Engineering and Technology
Email: [1] mdshahbaz8@gmail.com, [2]mujahidcivilhod@gmail.com

Abstract

Consistently a great many buildings are harmed and fallen and a large number of individuals wind up destitute because of the regular disaster Earthquake, which happens with powers at least 3 on seismic scale. In present time, low ascend to elevated structures are developed because of constrained space .Once, this quake happens, its belongings these structures most .Huge property loss and human loss happen. All together, to control this a few safeguards and codes for seismic safe building development are allocated by different nations.

In India, IS 1893-2002 gives the guidelines and safety measures to different kinds building development that are seismic safe. Buildings, for example, Conventional RC Frame structures, are generally by and by .yet because of exceedingly trend setting innovations, beamless slab called Flat slab is being used nowadays .Though flat slab forces many preferred standpoint over conventional buildings when managing seismicity, flat slab are far less conceivably solid to oppose for seismic conditions. In the present work the correlation of Conventional building and Flat slab with Drop in various zones, utilizing ETABS software. In this way, the attributes of a seismic behavior of Flat slab and Conventional RC outline building measures for controlling the idea and plan of these structures and for enhancing execution of buildings amid seismic loading.

In Present work a decent measure of data viewing parameters, for example, Story Displacement, Story Shear, Overturning Moment, Story Drift for Flat Slab and Conventional Slab is given and its variety of these parameters in various zones is likewise point by point utilizing linear static analysis .It is in this manner contrasted and non – linear powerful analysis technique for methodology called Response Spectrum for the previously mentioned parameters, for example, Story Displacement, Story Drift ,Story Shear and Overturning Moment for flat slab contrasted with conventional slab.

Keywords:- Overturning Moment ,Story Displacement Story Drift ,Story Shear.

Introduction

In Urban zones because of shortage of room vertical development has grown, for example, low-ascent , medium and tall buildings. These different sorts of buildings uses outline structures as Conventional RC outline structure and Flat

International Journal of Research
Available at https://edupediapublications.org/journals

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

slab outline structure. Conventional RC outline structure have Conventional slab utilized for the development that achieves a framework where a slab is bolstered by beams and segments .It called be called as Beam – Slab Load Transfer strategy, an equation that is normal practice everywhere throughout the world . The another type of casing structure called Flat Slab, where slab specifically lays on section . This is additionally called as Beamless Slab as there would be no beams in this edge structure.

In multistory shopping centers, workplaces, distribution centers , open network corridors the stylish view is enhanced by utilizing Flat Slab instead of conventional slab . The utilization of Flat slab for private buildings is likewise practically speaking given range not more than 6m. Both conventional and flat slab outline frameworks are exposed to Vertical loads (Gravity loads) and Lateral loads (tremor loads).Lateral loads have impact on tall structures on expanding the height of the building , impacts of horizontal load increments. The impact of Lateral loads are a lot more grounded than vertical loads .These Lateral loads incorporate Wind loads and Seismic loads. The Lateral powers will in general sway the building outline.

In that capacity building outline will in general go about as cantilever. Numerous seismic inclined zones , the buildings are inclined to fall if development isn't tolerated to appropriate measures. Every one of these investigations make to study the impact of quake loads as vital. Diverse tremor happen with various forces, sizes at better places .It is calm basic, to study different seismic angles, for example, story displacement , base shear and so on. Seismic Analysis , is in this way important to study the seismic reaction of building ,plan of building without seismic analysis isn't favored particularly in tremor inclined zones.

BUILDING MODEL STUDY - BUILDING DETAILS

5.1.INTRODUCTION:

This chapter presents the detailing of dimensions of the building model considered .This also presents the Plan view of Flat Slab and Plan view of Conventional Slab .The building model is 16 storey (G+15) building.

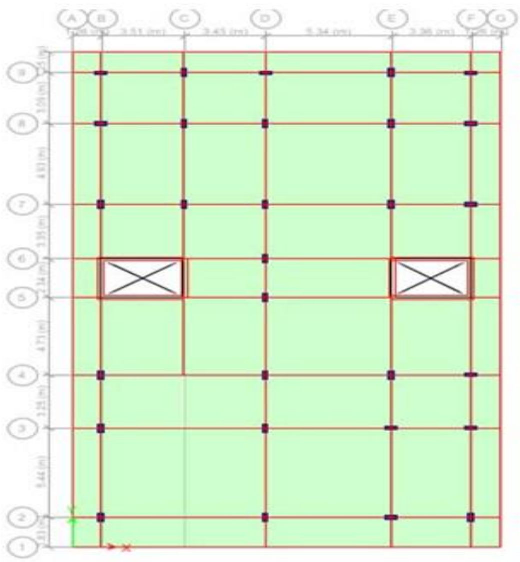
The conventional slab is designed with rectangular beams and columns whereas Flat Slab is designed with circular columns with drop provided .

Table-2: **Detailing Of Building for Conventional Slab**

Table-3: **Detailing Of Building for Flat Slab**

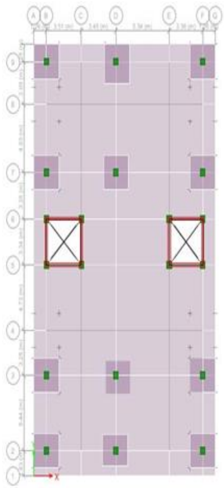
Design Data Of Flat slab Building	Dimensions
Grade of concrete &steel	M20 HYSD Fe 415
Plan Dimensions	18.14 m x 31.21m
No. Of Stories	16 (G+15)
Typical & Base Storey Height Thickness of wall	3m & 3.5 m 230 mm
Circular Column diameter	1200 mm
Column &Middle strip size	1.36mx1.36m & 2.72mx4.24m
Thickness of drop	281mm
Drop dimension	2.5mx 2.5m
Thickness of slab	295 mm

design Data Of Conventional slab Building	Dimensions
Plan Dimensions	18.14 m x 31.21m
No. Of Stories	16(G+15)
Grade of concrete	M 20
Grade of steel	HYSD –Fe 415
Typical & base Storey Height	3m & 3.5m
No. Of Grids In X& Y Direction	6Grids & 9 Grids
Thickness Of Slab	165mm
Wall thickness	230 mm
Beams dimension	230mmx 500 mm
Columns dimension	230 mm x 400 mm



e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

Fig:28:Plan View Of Conventional Slab



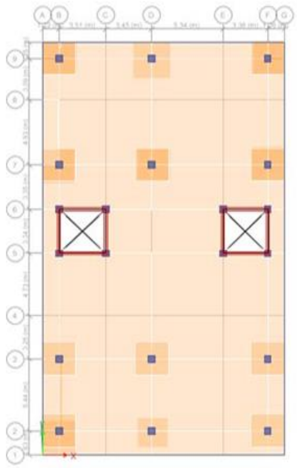


Fig :29: Flat Slab
Fig:30: Flat Slab With Perimeter Beams

FLAT SLAB:

In general frame system consists of columns, beams and slab .but there is a way of undertaking a construction without beams , the frame system consist s of slab and columns only .This type of slab is called Flat Slab . Flat slab is reinforced by re-bars , thus forming RC slab with or without drop, generally retained by columns and slab.

COMPONENTS OF FLAT SLAB :

- Column head
- Drop

3.1.2.1.1.Column Heads

Generally, in Flat Slab the columns are supported with head of wide enlargement called column head or capitals. Column head resists against the negative moment that is transferred to column from at slab – column junction.

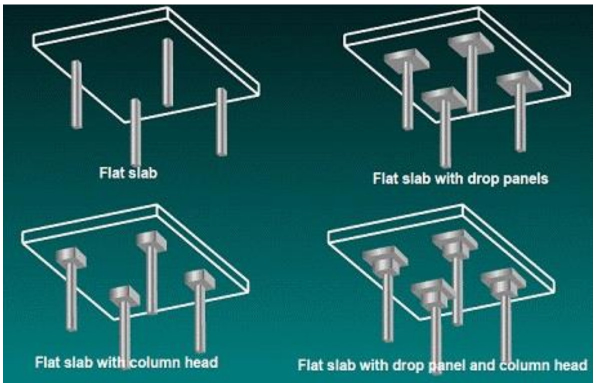
3.1.2.1.2.Drop

The thickened part of slab above columns the heavy loads on column is called Drop. It provides resistance to Punching shear which is predominant at the junction of column and slab.

Flat slab buildings are significantly more flexible than the conventional RC frame buildings during earth quakes. The Flat slab thus satisfies Architectural demand by some highlighting features such as better illumination, simple formwork and maximum vision with optimum use of available space hence leading to an admired concept in field of Structural Engineering.

TYPES OF FLAT SLABS

a) Flat slab having drop panel
b) Flat slab having column head
c) Flat slab having drop panel and column head
d) Flat slab without having drop panel and column head



Types Of Flat Slab

ADVANTAGES OF FLAT SLABS OVER CONVENTIONAL SLABS

Flexibility In Layout Of Room

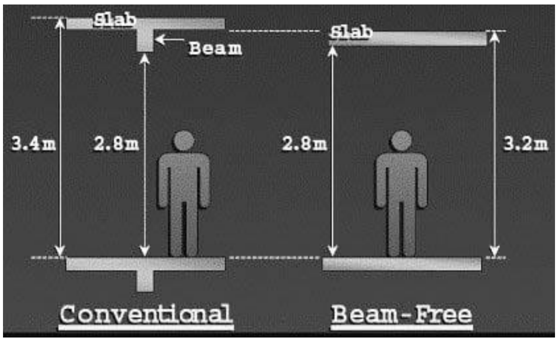
Flat Slabs satisfying architectural demand eases architect work and simplifies it to maximum by provision to introduce partition walls where ever needed , allowing to adopt the type of layout of room as per owner’s requirement. There is benefit that ceiling height is omitted and finish soffit with skim coating.

Decreases The Height Of Building

Since false ceiling height is omitted ,the height of building is lowered ,thus the storey height is decreased than storey height of conventional building .This decrease in storey height further reduces building weight on slabs due to cladding

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

and less no .of partitions .Thus total load on foundation gets reduced as approximately 10% in building height of vertical members is decreased.



3.4.3. Shorter Construction Time

In Flat slab , usage of big table formwork shortens time taken for construction.

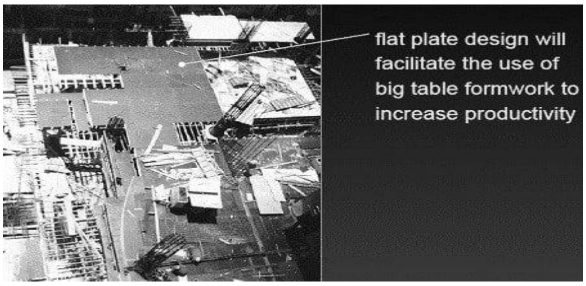


Fig :19: Big Table Formwork Facilitating Shorter Construction Time

Use Of Prefabricated Welded Mesh

Prefabricated welded mesh minimizes the installation time and therefore its usage in Flat slabs makes Flat slab more quickly constructed than conventional RCC slab. Further, these mesh are available in standard size thus providing better quality control of flat slab than Conventional RC slab .

Fig:20: Prefabricated Welded Mesh

Less No. Of Workers –Less Construction Cost

The construction of Flat slab includes standardized structural members and prefabricated sections in design ,thus reducing the number of site workers and increasing quality and quantity of work at site .This eases the construction and achieves higher buildable score.

DISADVANTAGES OF FLAT SLAB :

Flat slabs have some major disadvantages also when compared to conventional RC slab

1. In Flat plate system , there is no possibility of longer spans than 6m.
2. Not suitable supporting brittle (masonry) partitions.
3. Higher slab thickness.

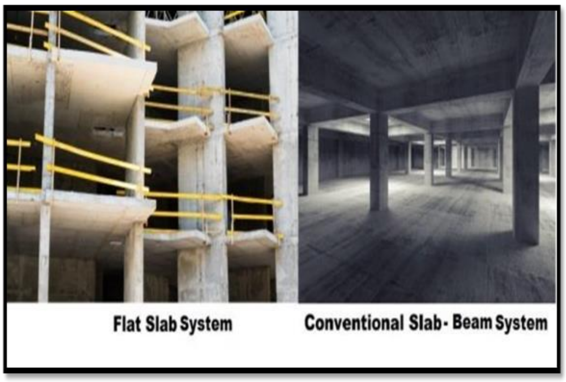


Fig:21:Flat Slab And Conventional Slab

EARTHQUAKES

Earthquake is disaster that has drastic effects on buildings and on lives of human beings are affected .The causes natural and manmade. The various building related factors that cause earthquake are given below.

Deviation Between Design And Response Spectrum :

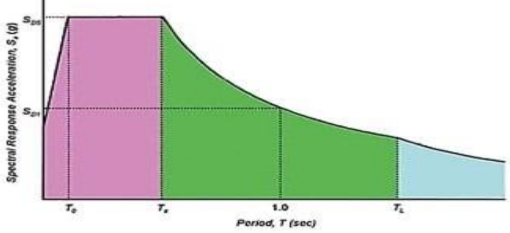


Fig:22: Design Response Spectrum

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

Improper evaluation of anticipated earthquake characteristics used in the earthquake design is the most common and critical factors for the damage of the buildings .However ,it is not only factor since there are certain features of the structure that make a seismic weak point.

Brittle Columns :

It is reported that majority of structures failed during earthquakes are due to column failure. The column may fail due to deterioration of concrete as a result of cyclic loading and insufficient number of ties embedded in the column at the critical locations.

Fig:23: Brittle Failure Of Columns

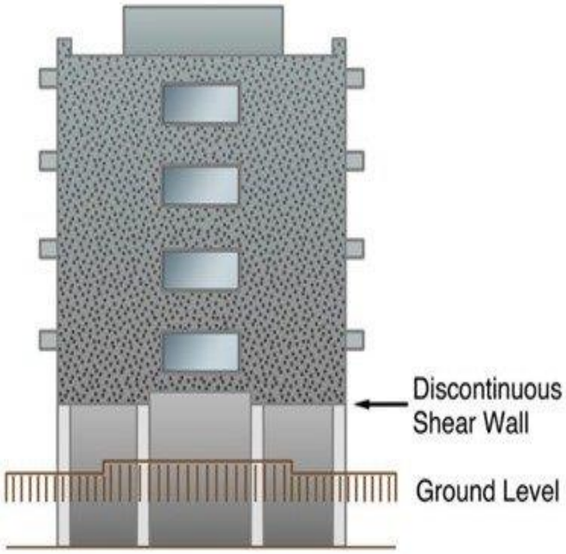
Asymmetric Arrangement Of Stiffness Element In The Plan:

Cores in structure are basic stiffness element and it location with regard to the building would influence the structure during earthquakes and eventually affect the extent of the damage. However ,it is reported that small percentage of failed buildings was due to eccentricities of the core of stair case and elevators.

4.1.4. Flexible Ground Floor :

Flexible ground floor is another factor that contribute to the damage that structure may encounter during the earthquake. When stiffness is abruptly reduced at specific level of the structure, then the stresses on the structure of flexible storey would increase and subsequently fail the structure.

Flexible ground structure is made when this floor is used for commercial purposes and broad spaces need to be provided .



e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

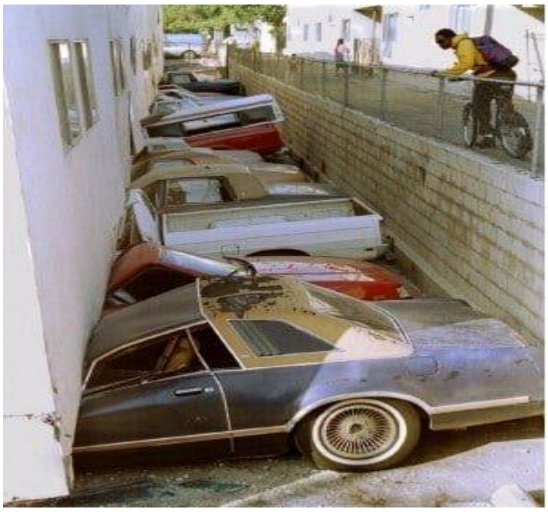


Fig: 24:Flexible Ground Floor Of Multi-Storey Structure Which Would Cause Structural Failure During Earthquake Fig: 25: Soft Storey –Flexible Storey Problems During Earthquakes

Short Columns:

The failure of short columns due to earthquakes is less common compare to ordinary column failure. However, short column may fail in shear in explosive manner and eventually lead to the collapse of the structure .

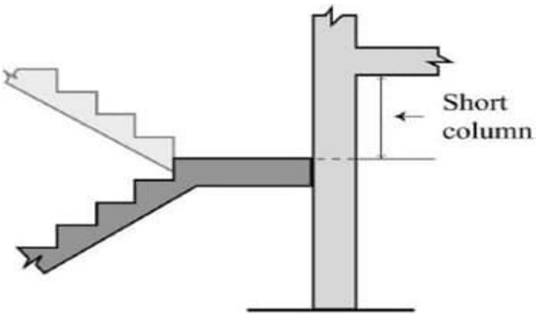


Fig:26:Short Column In A Building

Shape Of Floor Plan :

It is demonstrated that , square shape floor exhibits the best seismic behavior compare with other shapes such as X,I and +.Therefore , the extent of building seismic damage is influenced by the floor shape plan.

Shape Of The Building In Elevation:

It is proven that , structures with regular upper storey show superior seismic response compared with buildings which their upper storey are in the form of setbacks.

4.1.8.Damage Of Structures Due To Previous Earthquakes :

Buildings that suffer from certain type of damages from previous earthquakes would experience the same mode of failure if the repair technique had not been conducted properly .

It is found that ,structures that repaired long time ago would undergo the same damage but in less common in most recent repaired structures .This is because the repairing methods have developed and their effects is more profound.

4.1.9.Reinforced Concrete Buildings With Frame Structural System:

Frame structural system is source of vulnerability in buildings. This is because it undergoes considerable inter-storey drift during seismic excitation. Such large displacement damage infill walls that their repair is substantially costly. So the major point that frame structural system vulnerable is high cost required to repair the damaged infill walls .

4.1.10. Slabs Carried By Columns Without Beams :

Flat slab system is considerably vulnerable structural system and does not have satisfactory resistance against seismic effects. Such structural system is considerably flexible and has low ductility. That is why EC8 prevents the use of flat slabs unless other seismic resistant structures like shear walls and flexible frames are used as well.

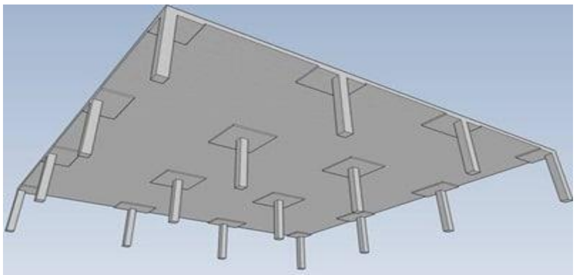


Fig :27: Flat Slab System

4.1. 11.Number Of Storey :

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

It is reported that based on the statistical data that , the vulnerability of structure to earth quake forces increases as number of floors are increased.

It is shown in several earthquakes like those of Bucharest in 1997 and Mexico city that the extent of damage was more severe in high rise buildings (more than three floors) than low-rise buildings.

It is known that presence of masonry infill will not only increase the strength of structure but also improves its stiffness. These improvements are more in low-rise buildings than that of high –rise buildings.

4.1.12. Type Of Foundation:

Type of foundation used influence the degree of earthquake damages in two forms that includes direct form and indirect form. With regard to direct effect of foundation form, it manifests itself into number of characteristics such as Facture of foundation soil, failure of foundation member like foundation –beam failure, ground differential settlement which is the most common method ,soil liquefaction method that rarely occurs but has catastrophic effect and general or partial landslide of foundation soil.

The indirect influence of foundation type include out of plane movements of individual column base in case of isolated foundation which are not connected together, or when beams between foundation are flexible. Therefore, isolated foundation would increase the severity of the earthquake damages.

4.1.13. Location Of Adjacent Buildings In The Block:

The location of the adjacent buildings on the block affects seismic response of the buildings considerably. For example buildings at the corner of the block would experience greater damage and ore sensitive to earthquakes compare with free standing structures.

Factors such as asymmetric distribution of stiffness in building plan and transfer of kinetic energy through poundings are commonly increase the vulnerability of corner structures.

4.1.14. Slab Levels Of Adjacent Structures:

It is found that, the impulse loading that a structure gets from adjacent buildings have considerable influence on the extent of earthquake damages. It is reported that, the extent of damages in structures with different floor level slabs are significantly greater than building with same floor slab level.

This can be clearly observed in Mexico city earthquake which occur in 1985 and Thessalonilki earthquake occurred in 1978.

4.1.15. Poor Structural Layout:

By and large ,poor collaboration between architectural engineer and structural engineer at the conceptual design phase result in poor structural layout .

Examples of poor structural layout includes cutoff of columns , asymmetric arrangements of stiffness elements in plan and elevation ,and irregularities in plan and elevation .

It is reported that around one third of structures collapsed in Athens earthquake occurred in 1999 were due to poor structural layout .

DESIGNING OF CONVENTIONAL SLAB ANF FLAT SLAB :

CONVENTIONAL SLAB DESIGN

Live load =2 KN/m2
Floor Finish =1.5 KN/m2
Fck = 20 N/m2
Fy = 415 N/ mm2
S1 = 6.96x 5.44m
S2 = 5.34x5.44m

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

S3 = 3.36x5.44m

1.S1 = 6.94 X 5.44 m

Effective span = 5440 mm

Assume effective depth

D=5440/26x1.5=139.5 mm

With clear cover of 20 mm and 10 Diameter bars overall thickness of slab .

D= 139.5+20+10/2=164.5 mm

Taking 165 mm

d x=165-20-5=140 mm

d y= 140-10=130 mm

effective spans are

lx =5440+130=5570 mm

l y =6960+140=7090 mm

r =l y/lx=7090/5540=1.275

LOADS ON SLAB

1) Self weight = 25x0.165= 4.13KN/m2
2) Floor finish = 1KN/m2
3) Total Dead Load = 5.13 KN/m2
4) Live Load = 2KN/m2
5) Total Load = 7.13 KN/m2
6) Factored Load = 7.13x 1.5 =10.695KN/m2

DESIGN MOMENTS:-

For strips at mid span , 1m wide direction

SHORT SPAN :

ay = 1/8(r^4/1+r^4)

= 1 x (1.275)^4 / 8 x [1+(1.275) ^4]

ay = 0.09068

ax = 1/8x[(r^2)/(1+r^4)]

= 1 x (1.295^2) / 8 x[1+(1.295) ^4]

= 0.05578

M ux = ax X wu X *l*x^2

= 0.05578 X (10.695) X (5.540)^2

= 18.3095 KNm

Muy = ay X wu X *l*y^2

= 0.09068X (10.695) X (5.54)^2

= 29.765KNm

DESIGN REINFORCEMENT :

Rx = Mux/b(dx)^2

= 18.31x10^6 / 10^3 x 140^2

= 0.9342 Mpa

Ry = Muy/ b(dy)^2

= 29.77x 10^6 / 10^3 x130 ^2

= 1.7615 Mpa

(Pt)x req/100= (Ast)x req/ bXd

= fck /2fy X [1 – (square root of(1-4.518 X Rx))/ fck]

= 20 /2 X 415 [1-0.8864]

= 2.738 10^(-3)

(Ast)x req = 2.7381 X 10^(-3) X1000 X 140 = 383.34 mm^2 /m

Spacing in X-direction

Spacing = (ast)x/(Ast)x

= 1000 X 78.5 / 383.34

= 204.78 mm =205 mm

Put 10mm dia bars @ 205 mm c/c

(Ast)y/bXd = fck /2fy X [1 – (square root of(1-4.518 X Ry))/ fck]

= 20/2 X 415 X [1- 0.7714]

= 5.5 086 X 10 ^(-3)

(Ast)y req = 5.5086 X 10^(-3) X 1000 X 130

= 716.15 mm^2/m

Spacing in Y-direction

(Spacing) y = (ast)y /(Ast)y

= 1000 X 78.5 / 716.151

= 109.6 mm = 110 mm

Maximum spacing for primary reinforcement :

= 3d (or) 300 mm

= 3 X 140= 420 mm (or) 300 mm

In y-direction

= 3 x 130 = 390 mm (or) 300 mm

Providing 10 mm diameter bars @ 200 mm c/c in shorter span
10 mm diameter bars @ 105 mm c/c in longer span

2.S2 = 5.34 X 5.44 m

Effective span = 5340 mm

Effective depth = 5340 / (26 X 15)

= 136.9 mm (or) 137 mm

Cover 20 mm of 10 mm diameter

D = 137 + 20 +10/2 = 162 mm

Provide 165 mm

dx = 165 -20 -5 = 140 mm

dy = 140-10 = 130 mm

effective span = *l*x = 5340 + 140 = 5480 mm

*l*y = 5440 + 130 = 5570 mm

*l*y/*l*x = 5570/ 5480 =1.016 = r

ax = 1 x(r^4) / 8x (1+r^4)

= 1x(1.016)^4 / 8 x [1+(1.016)^4]

ay = 1x (r ^2) / 8 x(1+r^4)

= 1 x (1.016)^2 / 8 x [1+(1.016)^4]

EFFECTIVE LOAD :

Dead Load = 25 x 0.165 = 4.13 KN/m^2

1. Floor finish = 1 = 1 KN/m^2
2. Live Load = 2 = 2 KN/m^2
3. Total Load = 4 .13 +1+2 = 7.13 KN/m^2
4. Wu = 7.13 x 1.5 = 10.695 KN/m^2

SHORT SPAN

Mux = ax X wu X *l*x^2

= 0.06448 X10.695X (5.48)^2 = 20.71 KNm

Muy = ay X wu X *l*x ^2

= 0.06246 X 10.695 X (5.48)^2 = 20.061 KNm

Rx = Mux / b X (dx)^2

= 20.71 X 10^ 6 / 1000 X 140^2

= 1.056 Mpa

Ry = Muy / b X(dy)^2

= 20.061 X 10^6 / 1000 X 130^2

= 1.187 Mpa

(Pt)x req/100 = (Ast)x req/bXd

= fck /2fy X [1 – (square root of(1-4.518 X Rx))/ fck]

Ast = 3.13 X 10^(-3) X 1000 X 140

= 438.19 mm^2/m

(Ast)y/bXd = fck /2fy X [1 – (square root of(1-4.518 X Ry))/ fck]

Ast = 3.55 X 10^ (-3) X 1000 X 130

= 461.4 mm^2 /m

Spacing in X-direction

Spacing = (ast)x/(Ast)x

= 1000 X 78.5 / 438.19

= 179.16mm

Put 10mm dia bars @175 mm c/c

Spacing in y-direction

= 1000 X78.5

____

461.4

= `170.13 mm

Put 10mm dia bars @170 mm c/c

3.S3 =3.36 m X 5.44 m

Effective span = 3360 mm

Effective depth = 3360

____

26 X 1.5

= 86.15 mm

D = 86.15 + 20 +10/2 = 111.15 mm

Provide 115 mm .

dx = 15- 20 -5 = 90 mm

d y = 90 – 10 = 80 mm

effective span (*l* x) = 3360 + 90 = 3450 mm

(ly) = 5440 +80 = 5520 mm

Ly /Lx = r = 1.6

Self weight = 25 X 0.115 = 2.875 KN/m^2

Floor Finish = 1 KN/m/^2

Total dead load = 3.86 KN/,m^2

Live load = 2 KN/m^2

Total load = 5.875 KN/m^2

Factored load Wu = 5.875 X 1.5

= 8.813 KN/m^2

Short span

ax(alpha –x) = 1 x(r^4)

____

8x

(1+r^4)

= 1 X (1.6)^4

____

8 X (1+ 1.6^4)

= 0.10845 =0.11

Long span

ay = 1 X (r^2)

____

8 X (1+r^4)

ay = 1X (1.6)^2

____

8X(1+1.6^4) = 0.04236

ax + ay+ = 0.0557 , 0.09068 - S1panel

= 0.06448, 0.06246 - S2 panel

= 0.10845 ,0.04236 - S3 panel

The coefficients for the negative moments in various continuous edge strips are easily obtained as

ax (-) = 4/3 X ax(-)

slab -1

ax(-) = 4X (0.05578)

____

3

=0.07437ay(-)= 4 X (0.09068)

____

3

= 0.120906 Slab -2 ,ax(-) = 0.0859

,ay (-) = 0.08328

Slab -3

ax(-) = 0.1446

Modeling OF FLAT AND CONVENTIONAL SLABS USING ETABS 2013 VERSION

ETABS

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

ETABS is a structural analysis software .ETABS grows as " Extended Three Dimensional Analysis Of Buildings Software", uniquely to complete reaction of building structures in seismic inclined regions. As conventional book arrangement of analysis couldn't be connected for tall building structures, software created in PCs has tackled this issue to long way .

In addition, in present aggressive and quick creating world , PCs ended up required as every single manual work gets disentangled utilizing PCs that incorporates structuring of buildings.

STEPS TO BE CONSIDERED IN ETABS

Plan

PLAN of building is attracted AUTOCAD and imported to ETABS .Grid System is pursued to imitate plan in ETABS .

Characterizing Of Material

Table:7: Details of materials required for reinforced concrete building :

Type Of Material	Concrete
Code Standard	IS 456-2002
Mix Of Concrete	M20
Reinforcement Type	Rebar
Grade Of Reinforcement	FE -415 HYSD Bars

Defining Of Loads

Table: Defining Of Various Types Of Loads As Per Code

Definition Of Load	Load Type	Coefficient Factor	Code Standard Followed
Dead Load	Dead	1	IS 875-1987PART 1
Live Load	Live	0	IS 875-1987 PART II
Wind Load	Wind	0	IS 875-1987PARTV
Seismic Load	Seismic	0	IS 1893-2002

Defining Of Load Combinations

1.2(DL+LL+EQX)
1.2(DL+LL+EQY)
1.2(DL+LL+EQX+EC)
1.2(DL+LL+EQY+EC)
1.2(DL+LL+EQX+WL)
1.2(DL+LL+EQY+WL)
1.5(DL+LL)

9.1.2. STEPS TAKEN IN MODELLING A BUILDING PLAN

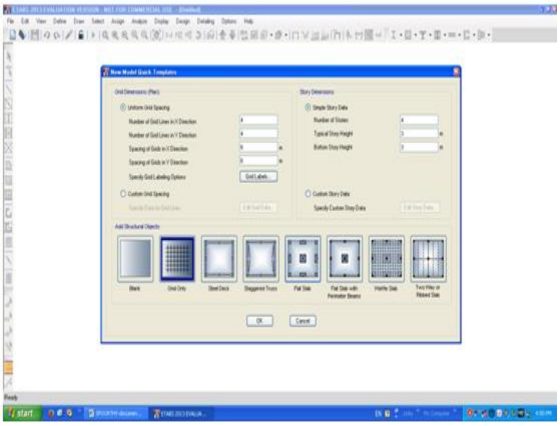
a) New > Open New Model
b) Define > Define Materials Required
c) Draw > Draw The Structural Members –Columns, Beams.
d) Define > Load Patterns
e) Define > Load Combinations
f) Select > Slab Sections > Slab 125
g) Assign > Shell Loads >DL>LL > EQX> EQY
h) Analysis > Check Loads For Warnings
i) Analysis > Set Loads To Run
j) Display > Display Deformed Shapes
k) Display> Storey Plots
l) Design > Concrete Frame Design

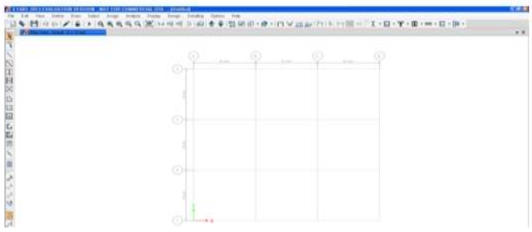
New Model >Open New Model

Define > Grid System

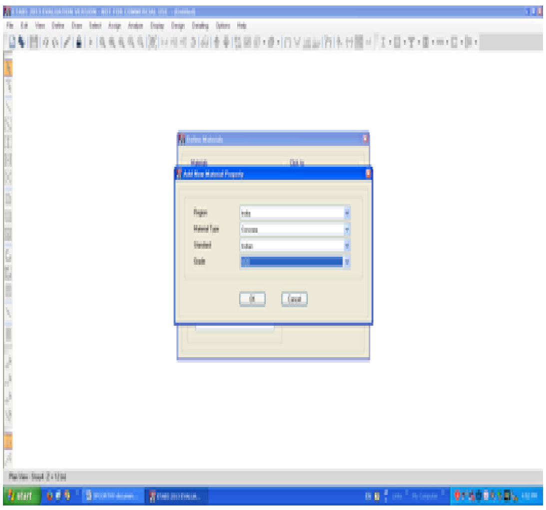
International Journal of Research
Available at https://edupediapublications.org/journals

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

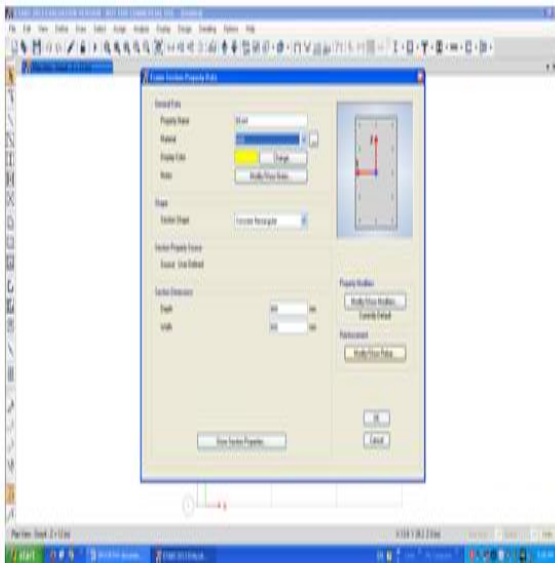




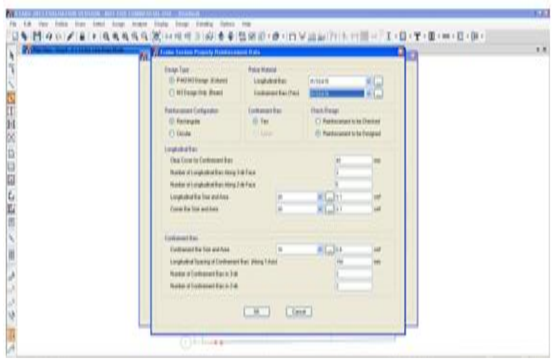
New Material > Concrete



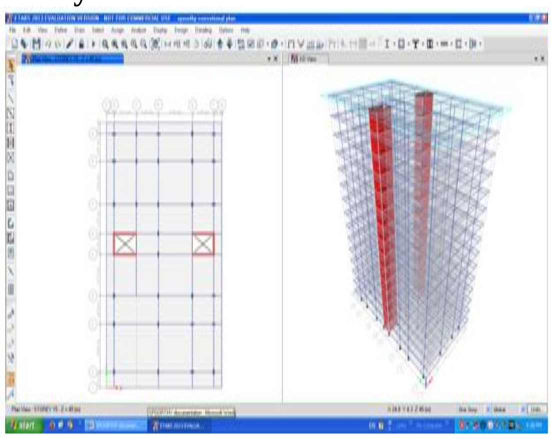
Define > Frame Sections > Beams



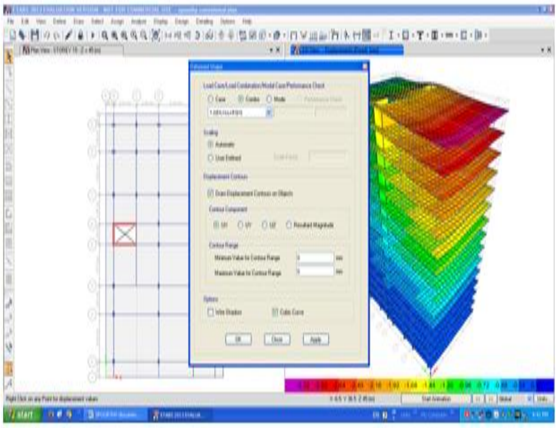
Define > Section Properties >Frame Sections (Column)



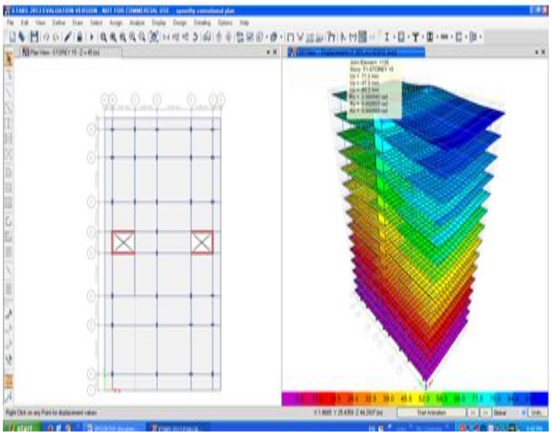
Plan And Elevation View Of Conventional Rc Slab Building Of G+15 Storey



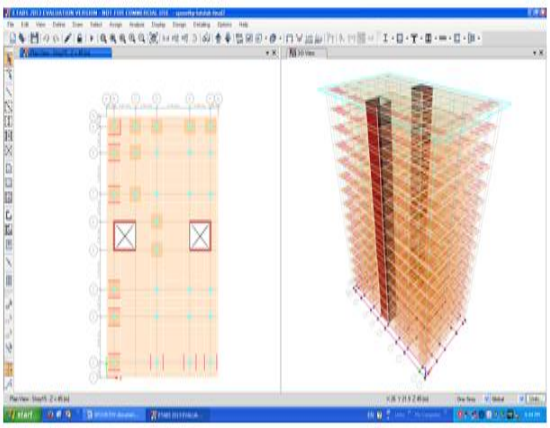
International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018



Storey Displacement Of G+15 Storey Conventional Slab Building For 1.2(DL+LL+EQX)



Plan And Elevation View Of Flat Slab Building Of G+15 Storey



RESULTS AND GRAPHS

The seismic tremor loading fundamentally being dynamic in nature causes the changes of building such parallel displacement ,story drift ,story shear and toppling minute that makes the building to tilt and sway .

The varieties in the parameters, for example, parallel displacement ,story drift ,story shear and upsetting minute for building with Flat slab and Conventional slab gives a general perspective of the adaptability ,defenselessness and appropriateness of buildings with Flat slab and conventional slab to continue and oppose for seismic conditions in different zones (II,III&IV) and furthermore in various kinds of soil conditions (soil-I:Rockor hard soils, soil-II: Medium soils and soil - III: Soft soils)

STOREY DISPLACEMENT

Story displacement is likewise called Lateral Displacement or Sway of building . It is characterized as Displacement taken Lateral way of building because of seismic load and wind load that demonstration Lateral way on building. Sway is straightforwardly relative to tallness and thinness of structure that is story displacement increments as stature of building increments.

Story displacement is minimum at base and most noteworthy at best story as stature of structure increments. From the above outline, it is said that story displacement of flat slab with drop is progressively increments with tallness yet not as much as that of the story displacement of the conventional slab (two-way slab) buildings .

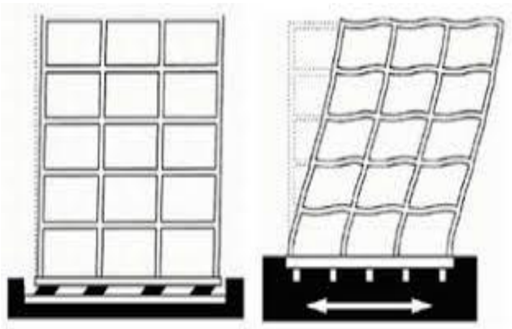


Fig:38: Story Displacement Or Lateral Displacement Or Sway Of Building Due To Earthquake Loading

Story Displacement Of Flabt Slab And Conventional Slab For 1.2(DL+LL+EQX) In X-Direction In Zone II,Zone III And Zone IV For Soil Type I (In mm)

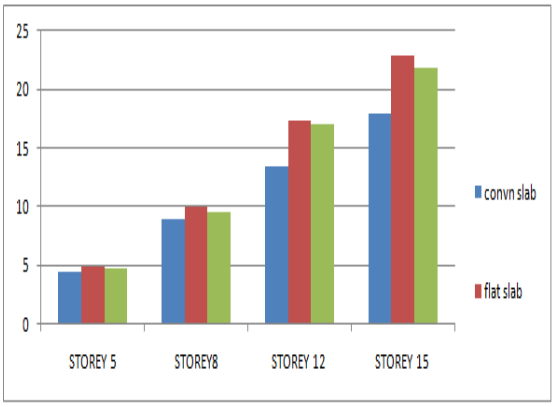


Fig:39: Story displacement Graph Between Flat Slab, Flat Slab With Perimeter Beams And Conventional Slab In ZONE II in soil-I

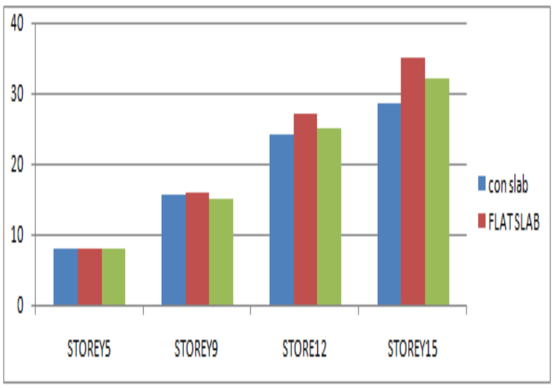


Fig:40: Storey displacement Graph Between Flat Slab, Flat Slab With Perimeter Beams And Conventional Slab In ZONE III in soil-I

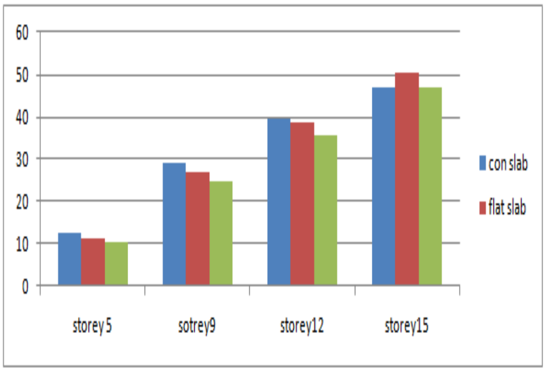


Fig:41: Storey displacement Graph Between Flat Slab, Flat Slab With Perimeter Beams And Conventional Slab In ZONE IV in soil-I

Table:9:Comparison Of Storey Displacement (mm) Values For Soil-I Between Flatslab and Conventional Slabin Zone II,III& IV

Storey No.		Flat Slab			Conventional Slab			FLAT SLAB WITHPERIMETER BEAMS	
	ZONE II	ZONE III	ZONE IV	ZONE II	ZONE III	ZONE IV	ZONE II	ZONEIII	ZONE IV
Storey 2	1.25	1.25	3	1.5	1.5	2.5	1.25	2	2.5
Storey 5	5	5	11.5	4.5	8.5	12.5	4.8	7.8	10.5
Storey 8	10	10	23	9	15.5	25	9.7	15	21
Storey 10	13.13	29	31	11.5	21	29	13	20	29.5
Storey 12	17.5	36	39	13.5	24	40	17	25	36.5
Storey 15	23	47.5	51	18	28.5	47.5	21	32	47.5

STOREY SHEAR AND BASE SHEAR

An aggregate of receptive powers acquired because of activity of seismic powers on building act at segment base of building toward the path inverse to that in which they act .(whole of the parallel load = base shear).As thought of it as does not just follow up on base, in reality it follow up on each story and changes with stature and masses over each story and this responsive power is called as Story Shear .Here ,from

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

above diagrams obviously speaks to that Flat slab display more estimation of variety of story shear than Conventional slab as story shear flat slab is more at base and diminishes continuously towards best story 15.

Story Shear For Flat Slab And Conventional Slab For Load Combination For 1.2(DL+LL+EQX) In ZONES III AND ZONE IV Of Soil Type I In X-Direction (In Newton)

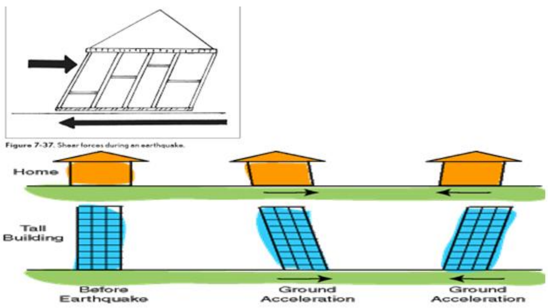


Fig : 42: Individual Building And Multi Storey Building Subjected To Shear Force

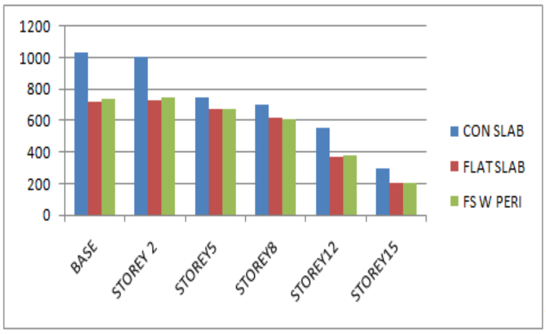


Fig:43: Storey Shear Graph Between Flat Slab, Flat Slab With Perimeter Beams And Conventional Slab In ZONE II in soil-I

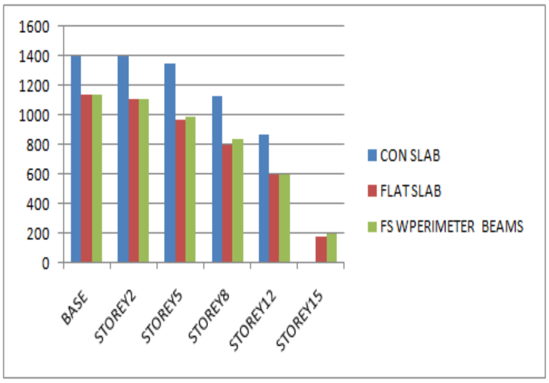


Fig:44: Storey Shear Graph Between Flat Slab, Flat Slab With Perimeter Beams And Conventional Slab In ZONE III in soil-I

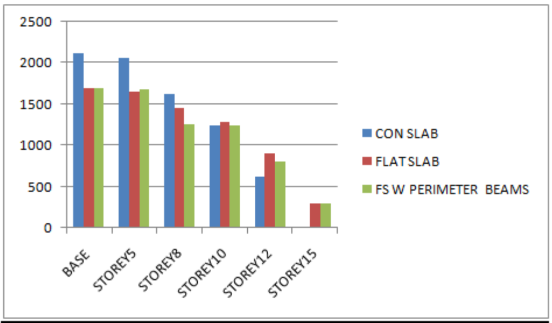


Fig:45: Storey Shear Graph Between Flat Slab, Flat Slab With Perimeter Beams And Conventional Slab In ZONE IV in soil-I

Table:10: Storey Shear (N)Values For Soil-I Between Flat And Conventional Slabs In Zones II,III And IV

Storey .No.		Flat Slab			Conventional Slab			FLAT SLAB WITH PERIMETER BEAMS	
	ZONE II	ZONE III	ZONEIV	ZONE II	ZONEIII	ZONEIV	ZONE EII	ZONE III	ZONE IV
Storey 2	720	1400	1700	1030	1400	2125	740	1140	1700
Storey 5	730	1110	1650	1005	1370	2063	730	1110	1675
Storey 8	675	970	1450	750	1350	1625	670	990	1260
Storey 10	620	800	1280	700	1125	1250	610	840	1240
Storey 12	365	600	900	550	875	6525	375	600	800
Storey 15	200	180	300	0	0	0	200	200	300

OVERTURNING MOMEMT

Overturning moment changes contrarily of square of height of building. Overturning

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

moment is most elevated at base and diminishes with increment in height of building.

Overturning Moment For Flat Slab And Conventional Slab In Zone II, Zone III and Zone IV For Soil Type I In X-Direction For Load Combination 1.2(DL+LL+EQX) In KN-M

Fig : 46: Building Subjected To Overturning Moment

ZONE -3 SOIL-1

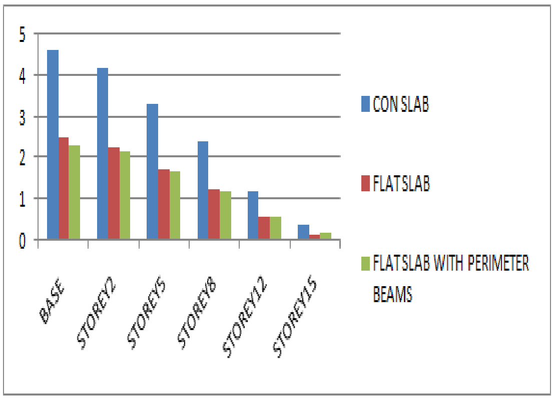


Fig:47: overturning moment Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE III in soil-I

ZONE –IV SOIL-1

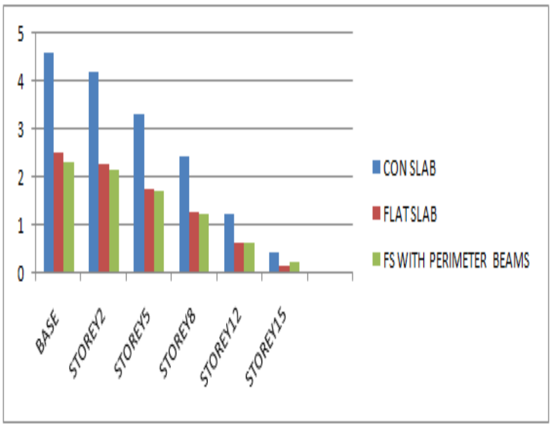


Fig:48: overturning moment Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE IV in soil-I

Zone-II SOIL -1

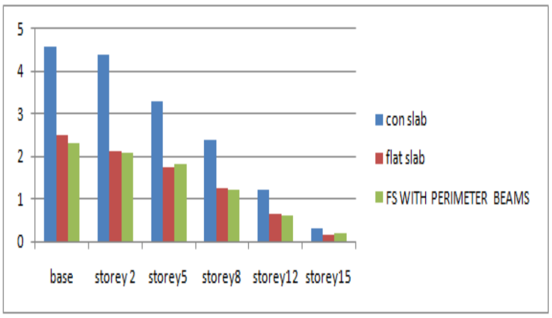


Fig:49: overturning moment Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE II in soil-I

Table:11: Overturning Moment(KN-M) For Soil-I Between Flat And Conventional Slabs In Zone II,III and IV

Storey .No.	Flat Slab			Conventional Slab			FLAT SLAB with PERIMETER BEAMS		
	ZONE II	ZONEIII	ZONEIV	ZONEII	ZONEIII	ZONEIV	ZONE II	ZONE III	ZONE IV
base	2.5	2.5	2.5	4.6	4.6	4.6	2.3	2.3	2.3
Storey2	2.13	2.25	2.25	4.4	4.2	4.2	2.1	2.15	2.15
Storey6	1.75	1.75	1.75	3.3	3.3	3.3	1.8	1.7	1.7
Storey9	1.25	1.25	1.25	2.4	2.4	2.4	1.2	1.2	1.2
Storey12	0.65	0.6	0.6	1.2	1.2	1.2	0.6	0.6	0.6
Storey15	0.15	0.13	0.13	0.3	0.4	0.4	0.2	0.2	0.2

Story DRIFT

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

Story Drift is only proportion of displacement occurred between two successive floors to height of that the building .It is additionally characterized as the Lateral Displacement of single story that happens in multistory building. Story drift shifts as allegorical way and expect greatest at some story in center yet not at best generally story

Story Drift For Flat Slab And Conventional Slab For Zone II, Zone III and Zone IV For Soil Type I For Load Combination of 1.2(DL+LL+EQX)

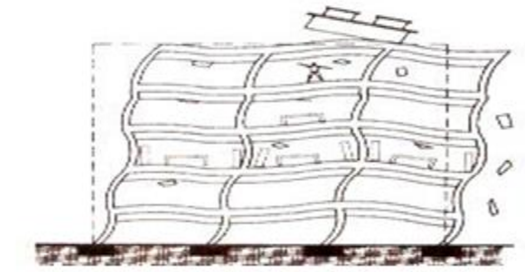


Fig:50 : Building Subjected To Storey Drift

ZONE –II SOIL-1

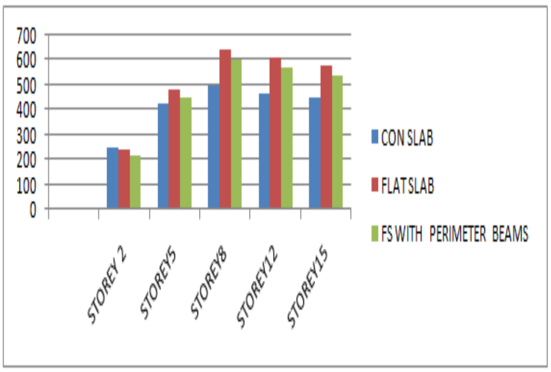


Fig:51: Storey Shear Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE II in soil-I

ZONE I V SOIL-1

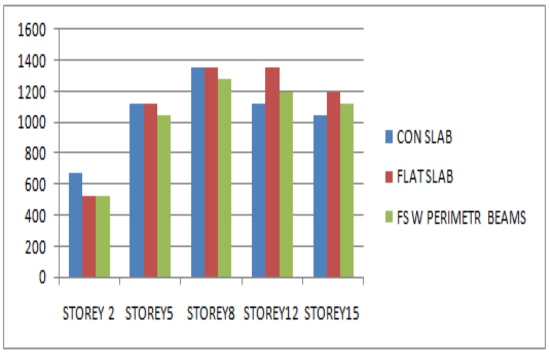


Fig:52: Storey Shear Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE IV in soil-I

ZONE –III SOIL-1

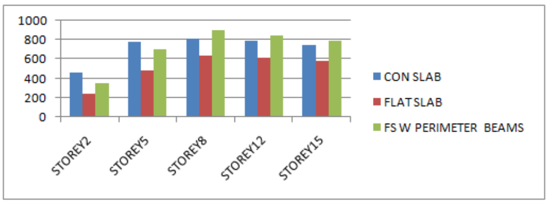


Fig:53: Storey Shear Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE III in soil-I

Table:12: Storey Drift For Soil-I Between Flat Slab, FLAT slab with perimeter beams And Conventional Slab For Zones II,III And IV

Storey. No.		Flat Slab			Conventional Slab			FLAT SLAB WITH PERIMETER BEAMS	
	ZONE II	ZONE III	ZONE IV	ZONE II	ZONEIII	ZONE IV	ZONE II	ZONE III	ZONE IV
Storey 2	240	240	525	250	463	675	220	350	525
Storey5	480	480	1125	430	778	1125	450	700	1050
Storey8	640	640	1360	500	818	1350	600	900	1275
Storey12	610	610	1350	470	793	1115	570	850	1200
Storey15	580	580	1200	450	750	1050	540	790	1125

RESPONSE SPECTRUM :

STOREY DISPLACEMENT :-

SOIL-1 ZONE -2

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

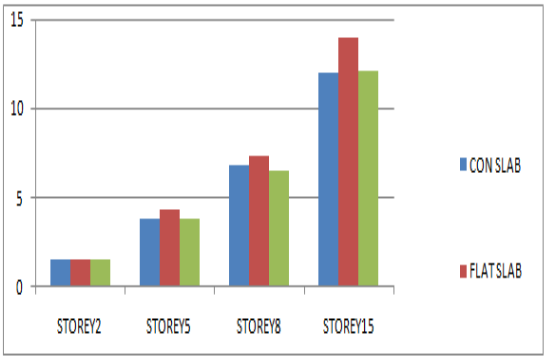


Fig:54: Storey Displacement Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE II in soil-I for response spectrum

SOIL-1ZONE-3

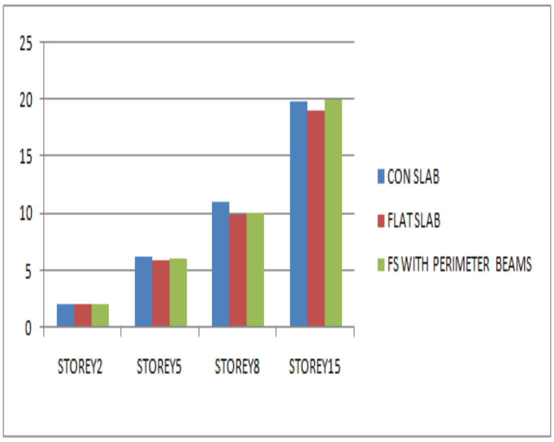


Fig:55: Storey Displacement Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE III in soil-I for response spectrum

SOIL-1 ZONE 4

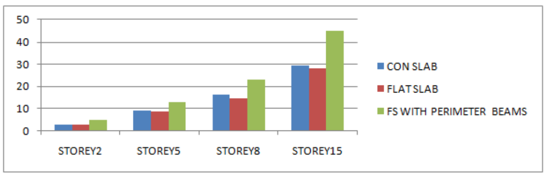


Fig:56: Storey Displacement Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE IV in soil-I for response spectrum

Table:13: Storey Displacement For Soil-I Between Flat Slab, FLAT slab with perimeter beams And Conventional Slab For Zones II,III And IV for response spectrum

Storey no.	Conventional	slab		Flat slab			Flat slab with	Perimeter beams	
	Zone2	ZONE 3	ZONE4	ZONE 2	ZONE3	ZONE 4	ZONE 2	ZONE 3	ZONE 4
Storey 2	1.5	2	3	1.5	2	3	1.5	2.02	5
Storey 5	3.75	6.2	9.3	4.3	5.9	8.7	3.75	6	13.33
Storey 8	6.75	11	16.5	7.3	9.9	14.7	6.5	10	23.3
Storey 15	12	19.8	29.7	14	19	28.5	12.05	19.9	45

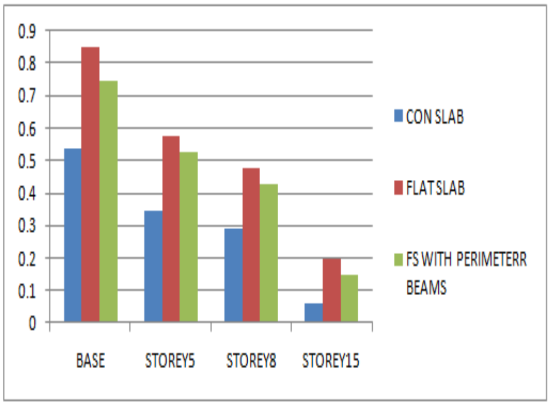
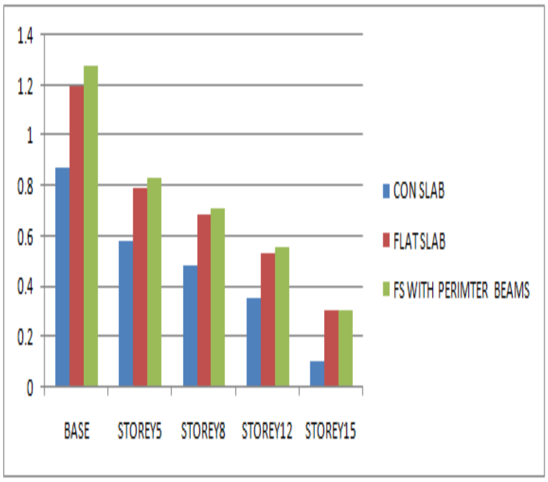


Fig:57: Storey shear Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE II in soil-I for response spectrum

SOIL-1 ZONE -3



e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

Fig:58: Storey shear Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE III in soil-I for response spectrum

Soil-1zone -4

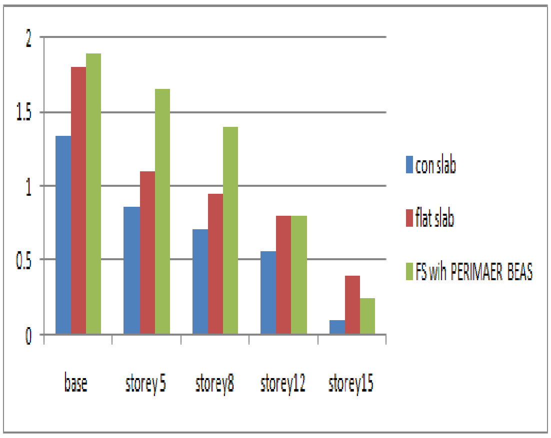


Fig:59: Storey shear Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE IV in soil-I for response spectrum

Table:14 : Storey Shear For Soil-I Between Flat Slab, FLAT slab with perimeter beams And Conventional Slab For Zones II,III And IV for response spectrum

	CONV ENT IONAL SLAB			FLAT SLAB			FLAT SLAB WITH	PERI MET ER	BEA MS
	ZONE 2	ZONE 3	ZONE 4	ZONE 2	ZONE 3	ZONE 4	ZONE 2	ZONE 3	ZONE 4
STOREY2	0.54	0.87	1.35	0.85	1.2	1.8	0.75	1.28	1.9
STOREY 5	0.35	0.58	0.86	0.58	0.79	1.1	0.53	0.83	1.65
STOREY 8	0.29	0.48	0.71	0.48	0.68	0.95	0.43	0.71	1.4
STOREY12	0.1	0.35	0.56	0.33	0.53	0.81	0.25	0.55	0.8
STOREY 15	O.O6	0.1	0.11	0.2	0.3	0.4	0.15	0.3	0.25

soil-1zone -2

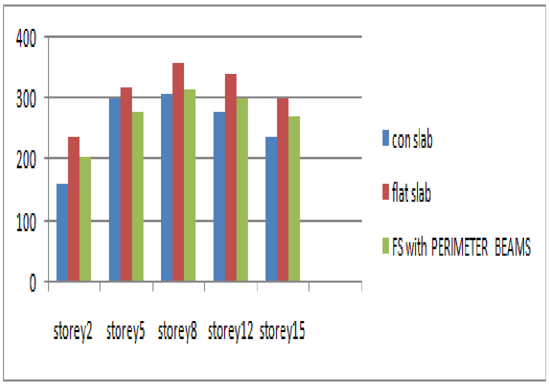


Fig:60: Storey Drift Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE II in soil-I for response spectrum

Soil-1zone -3

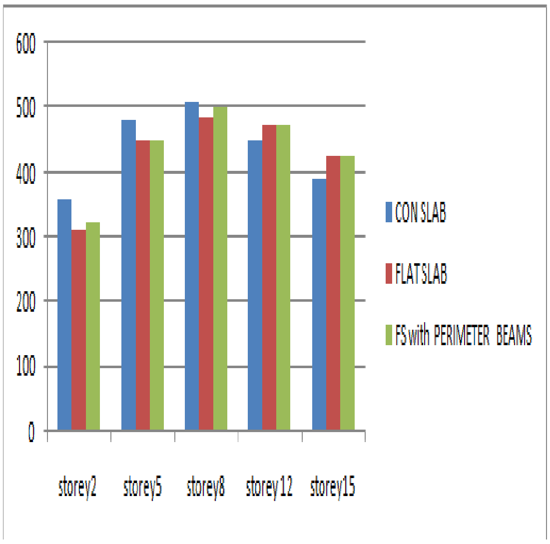


Fig:61: Storey Drift Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE III in soil-I for response spectrum

Soil-1 zone -4

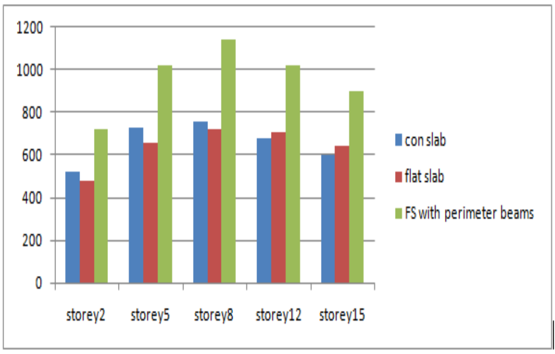


Fig:62: Storey Drift Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE IV in soil-I for response spectrum

Table:15 : Storey Drift For Soil-I Between Flat Slab, FLAT slab with perimeter beams And Conventional Slab For Zones II,III And IV for response spectrum

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 23
December 2018

	CONVENTIONAL SLAB			FLAT SLAB			FLAT SLAB WITH	PERIMETER BEAMS	
	ZONE 2	ZONE 3	ZONE 4	ZONE 2	ZONE 3	ZONE 4	ZONE 2	ZONE 3	ZONE 4
STOREY2	160	360	520	240	313	480	204	325	720
STOREY 5	300	480	728	320	450	656	280	450	1020
STOREY 8	310	510	760	360	485	720	315	500	1140
STOREY12	280	450	680	340	475	710	300	475	1020
STOREY 15	240	390	600	300	425	640	270	425	900

OVER TURNING MOMENT:

Soil-1 zone -2

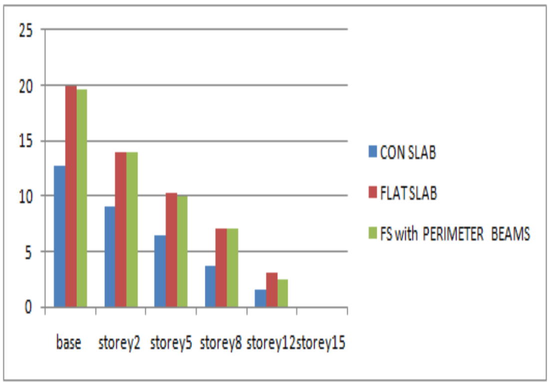
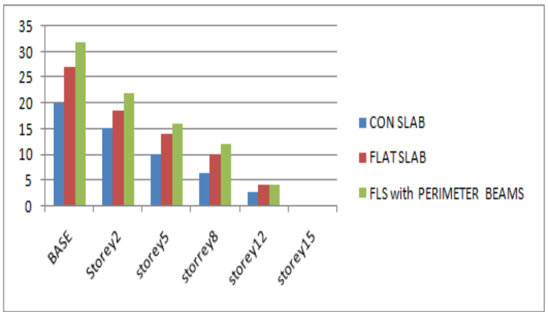


Fig:63: Overturning Moment Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE II in soil-I for response spectrum

Soil-1 zone -3



Soil-1 zone -4

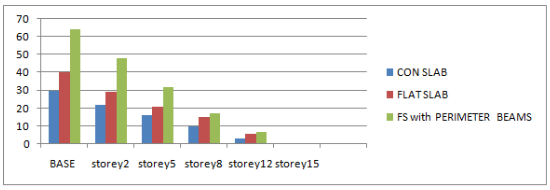


Fig:65: Overturning Moment Graph Between Flat Slab flat slab with perimeter beams And Conventional Slab In ZONE IV in soil-I for response spectrum

Table:16 : Overturning moment For Soil-I Between Flat Slab, FLAT slab with perimeter beams And Conventional Slab For Zones II,III And IV for response spectrum

	CONVENTIONAL SLAB			FLAT SLAB			FLAT SLAB WITH	PERIMETER BEAMS	
	ZONE 2	ZONE 3	ZONE 4	ZONE 2	ZONE 3	ZONE 4	ZONE 2	ZONE 3	ZONE 4
BASE	12.75	20	30	20	27	40	19.6	32	64
STOREY 2	9	14.95	22	14	18.6	29	14	22	48
STOREY 5	6.5	10	16	10.2	14	21	10	16	32
STOREY8	3.75	6.25	10	7	10	15	7	12	17
STOREY 12	1.5	2.5	3	3	4	6	2.5	4	7
STOREY15	0	0	0	0	0	0	0	0	0

Conclusion

The synopsis of the project , is correlation of ordinary building with flat slab building utilizing ETABS 2013 Version software that shows the analysis of Flat and regular Slab buildings exposed to quake loads in different seismic zones (II,III&IV) and for soil-I:Rockor hard soil.

The outcomes are condensed into different charts of examination between flat slab buildings and Conventional slab buildings for various zones (II,III&IV) in three kinds of soils (Rock or Hard soils ,Medium soils and Soft soils)for diverse parameters, for example, Story Displacement(mm), Story Shear(N),Overturning minute (KN-m) and Story Drift(no units).

The outcomes are spoken to in shape rate pretty much when contrasted with each other as indicated by zones bad habit variety and furthermore as indicated by soils variety demonstrating adaptability of Flat slabs contrasted with Conventional slab buildings.

From above Graphs it is closed as underneath :-

1. Storey displacement differs specifically with tallness of building and increments with increment stature of building .Flat slab with border beams show more estimations of those of story displacement of Flat slab and Conventional RC slab.

2. Storey displacement estimations of customary slab for reaction spectrum is most extreme for zone 4 than zone 2 and zone 3 by 59.51%and 23.67% individually.
3. Storey displacement esteems for Flat slab for zone IV is more than zone II and zone III 50.8% and 33.3% individually.
4. Storey displacement esteems for Flat slab with edge beams for zone IV is more than zone II and zone III by 73.2% and 55.7% separately
5. Storey displacement is most extreme for zone IV for Flat slab with border beams at Storey15.
6. Storey shear fluctuates conversely as tallness of building .It's esteem diminishes as stature of building increments and is most elevated at any rate at best story .
7. Storey shear of traditional slab for zone reaction spectrum for zone IV is more than zone II and zone III by 60% and 35.5 % (rate) separately for soil-I
8. Storey shear esteems between Flat Slab for reaction spectrum for zone IV is a greater number of qualities than zone II and zone III by 52.7%and 33.3% (rate) separately for soil-I .
9. Storey shear esteems between Flat Slab with edge beams for reaction spectrum for zone IV is a larger number of qualities than zone II and zone III by 60.5%and 32.6% (rate) individually for soil-I .
10. Storey shear esteems for reaction spectrum is most extreme for zone IV for Flat sla with border beams for story 2

11. Overturning minute differs contrarily as square of tallness and is most extreme at base of slab . Toppling snapshot of flat slab with edge beams slab is higher than Flat slab and Conventional slab.
12. Overturning snapshot of traditional slab for reaction spectrum for zone IV is more than zone II and zone III by57.5%and 33.3% (rate) individually as for soil-I.
13. Overturning minute qualities between Flat Slab for reaction spectrum for zone IV is more than zone II and zone III by half and43.3% individually for soil – I.
14. Overturning minute qualities between Flat Slab with border beams for reaction spectrum for zone IV is more than zone II and zone III by 69.3% and half individually for soil – I.
15. Overturning minute for reaction spectrum is most extreme for zone IV for Flat slab with Perimeter Beams at base .
16. Storey Drift fluctuates as illustrative way with increments of stories .The story drift of flat slab with edge

beams is more than that of ordinary slab and flat slab for reaction spectrum.

17. Storey Drift of Conventional slab for reaction spectrum for zone IV is more than zone II and zone III by 59.2%and 32.89% individually for soil I .

18. Storey Drift of Flat slab for reaction spectrum for zone IV is more than zone II and zone III by 50%and 32.63% individually for soil I .

19. Storey Drift of Flat slab with border beams for reaction spectrum for zone IV is more than zone II and zone III by 72.36%and 56.14% separately for soil I

20. Storey Drift is most extreme for Flat slab with edge beams for reaction spectrum for zone IV at story 8.

21. From outlines of linear static analysis and reaction spectrum analysis for flat slab and ordinary slab and flat slab with border beams demonstrated that Flat slab with edge beams having extraordinary (either most extreme or minimum)variation than flat slab and traditional slab for soil-I

22. Flat slab with edge beams , for reaction spectrum forces less story displacement and story drift than flat slab with border beams of linear static analysis by 5% and 10.5%variation individually .

23. Flat slabs with edge beams for reaction spectrum forces more qualities for story shear and toppling minute that fluctuates conversely with stature (most extreme at base) than those and flat slab with edge beams by 10.5%and 96% for soil – I

24. Overall for the regular slab and flat slab likewise the variety is same as flat slab with border beams when thought about for linear static analysis and reaction spectrum analysis

25. Thus flat slab with edge beams are exposed to increasingly seismic varieties for zone IV of soil-I for reaction spectrum analysis than that of flat slab with border beams FOR zone – IV of soil-I for linear static analysis.

11.2. Future Extent OF THE WORK

1. Comparison of flat slab having drop with flat slab without drop should be possible for various seismic zones

2. Comparison between pre-tensioned and post-tensioned for Flat slabs having Drop with Flat slab without drop should be possible.

3. Comparison of cost of development and estimation of cost and loss analysis of different sorts of structures should be possible.

REFERENCES

[1] IS 875-1997Indian standard code of practice for structural safety of building loading standards.

[2] IS1893-2002Indian standards code of practice for criteria of Earthquake resistance design of structures.

[3] Navya shree K. Sahana. Use of flat slab in high seismic zone volume 3 issued on 08/august 2014

[4] Professor Kavan M.R ,Mohana HS Comparative study of flat slab ad conventional slab for earthquake using ETABS in all zones in INDIA volume2issue 03:june 2015

[5] M. Walker , a study on Earthquakes-that gives earthquake and its effects .

[6].R. Clough,, and J. Penzien, Dynamics of Structures, McGraw-Hill, New York.

[7]1993 Structural Engineers Association of California, Recommended Lateral Force Requirements and Commentary, Structural Engineers Association of California, Sacramento, 1996 .

[8]. A. Williams,. Seismic Design of Buildings and Bridges, Engineering Press, Austin.1998 4. M. Paz,. Structural Dynamics, Van Nostrand Reinhold, New York, 1985

[9]. IS-1893 part 1 2002 criteria for Earthquake resistant Design of structures.

[10]. IS-456-2000 plain and Reinforced cement concrete code of practice.
[11]. Earthquake Resistant Design of Structures (English) 1st Edition by Manish Shrikhande and Pankaj Agarwal.
[12]. T. Ranga Rajan. Equivalent static method ,(paper) 2013.
[13]. http://en.wikipedia.org/wiki/Seismic_analysis (05/11/2015) 9. Griffith M. C., Pinto A. V. (2000):"Seismic Retrofit of RC Buildings - A Review and Case Study", University of Adelaide, Adelaide, Australia and European Commission, Joint Research Centre, Ispra Italy.
[14]. Monavari B., Massumi A., Kazem, A (2012): Estimation of Displacement Demand in RC Frames and Comparing with Target Displacement Provided by FEMA-356, 15th World Conference on Earthquake Engineering, 24th to 28th September, 2012, Lisbon, Portugal.
[15]. Goel R. K. (2008): Evaluation of Current Nonlinear Static Procedures for Reinforced Concrete Buildings, The 14th World Conference on Earthquake Engineering October 12- 17, 2008, Beijing, China.
[16]. Sarkar S. (2010): Design of Earth-quake Resistant Multi-storied RCC Building on a Sloping Ground, Bachelor of Technology Thesis, National Institute of Technology Rourkela.
[17]. BIS, IS 456:2000, Plain and reinforced concrete code of practice‖ Bureau of Indian Standards, Fourth revision.