ANALYSIS AND DESIGN OF A G+10 RESIDENTIAL BUILDING WITH DIFFERENT PLAN CONFIGURATIONS

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ABSTRACT

There are many buildings being constructed all over India. Software designs started to play a crucial role in building planning and architecture. With the growing need of multi-storied buildings, the importance of E-Tabs is rapidly growing. So, we are concentrating in creating a G+10 residential building in E-Tabs and also manual calculations which will help in analyzing the building completely minimizing the errors and working efficiently in a less span of time. This helps us to locate errors and rectify them, thereby reducing the effort that has to be put. Multi-storied buildings are very commonly seen in cities. E-Tabs has a very interactive user interface which helped us in designing the building.

1.INTRODUCTION

ETABS is a sophisticated, yet easy to use, special purpose analysis and design program developed specifically for building systems. ETABS features an intuitive and powerful graphical interface coupled with unmatched modeling, analytical, design, and detailing procedures, all integrated using a common database. Although quick and easy for simple structures, ETABS can also handle the largest and most complex building models, including a wide range of nonlinear behaviors necessary for Performance based design, making it the tool of choice for structural engineers in the building industry.

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1.1History and Advantages of ETABS

Dating back more than 40 years to the original development of TABS, the predecessor of ETABS, it was clearly recognized that buildings constituted a very special class of structures. Early releases of ETABS provided input, output and numerical solution techniques that took into consideration the characteristics unique to building type structures, providing a tool that offered significant savings in time and increased accuracy over general purpose programs. As computers and computer interfaces evolved, ETABS added computationally complex analytical options such as dynamic nonlinear behavior, and powerful CAD-like drawing tools in a graphical and object-based interface. Although ETABS 2015 looks radically different from its predecessors of 40 years ago, its mission remains the same: to provide the profession with the most efficient and comprehensive software for the analysis and design of buildings. To that end, the current release follows the same philosophical approach put forward by the original programs, Namely:

- Most buildings are of straight forward geometry with horizontal beams and vertical columns. Although any building configuration is possible with ETABS, in most cases, a simple grid system defined by horizontal floors and vertical column lines can establish building geometry with minimal effort.
- Many of the floor levels in buildings are similar. This commonality can be used to dramatically reduce modeling and design time.
- The input and output conventions used correspond to common building terminology. With ETABS, the models are defined logically floor-by-floor, column-by-column, bay-by-bay and wallby- wall and not as a stream of non-descript nodes and elements as in general purpose programs. Thus, the structural definition is simple, concise and meaningful.
- In most buildings, the dimensions of the members are large in relation to the bay widths and story heights. Those dimensions have a significant effect on the stiffness of the frame. ETABS corrects for such effects in the formulation of the member stiffness, unlike most general-purpose programs that work on centerline- to-centerline dimensions.
- The results produced by the programs should be in a form directly usable by the engineer. General-purpose computer programs produce results in a general form that may need additional processing before they are usable in structural design.

1.2 Design Settings

ETABS offers the following integrated design postprocessors:

- Steel Frame Design
- Concrete Frame Design
- Composite Beam Design
- Composite Column Design
- Steel Joist Design

- Shear Wall Design
- Steel Connection Design

The first five design procedures are applicable to frame objects, and the program determines the appropriate design procedure for a frame object when the analysis is run. The design procedure selected is based on the line object's orientation, section property, material type and connectivity. Shear wall design is available for objects that have previously been identified as piers or spandrels, and both piers and spandrels may consist of both shell and frame objects. Steel connection design will identify which beam-to-beam and beam-to column locations have adequate load transfer capacity using the standard connections specified in the connection preferences. Steel connection design also includes sizing and design capacity checks for column base plates. For each of the first five design postprocessors, several settings can be adjusted to affect the design of the model:

- The specific design code to be used for each type of object, e.g., AISC 360-10 for steel frames, EUROCODE 2-2004 for concrete frames, and BS8110 97 for shear walls.
- Preferences for how these codes should be applied to a model.
- Combinations for which the design should be checked.
- Groups of objects that should share the same design.
- Optional "overwrite" values for each object that supersede the default coefficients and parameters used in the design code formulas selected by the program. For steel and concrete frames, composite beam, composite column, and steel joist design, ETABS can automatically select an optimum section from a list you define. The section also can be changed manually during the design process. As a result, each frame object can have two different section properties associated with it:
- An "analysis section" used in the previous analysis
- A "design section" resulting from the current design The design section becomes the analysis section for the next analysis, and the iterative analysis and design cycle should be continued until the two sections become the same. Design results for the design section, when available, as well as all of the settings described herein, can be considered to be part of the model.

1.3 Detailing

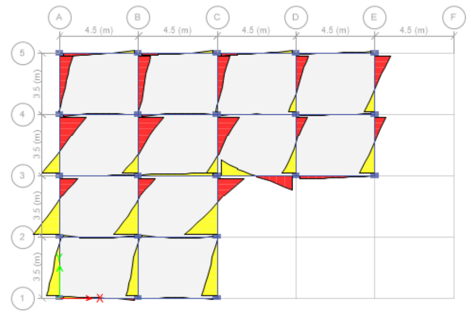
ETABS offers the ability to produce schematic construction documents for buildings. Preferences may be set for the size and layout of drawings; dimensioning units and label prefixes; and reinforcing bar sizes for beams, columns and shear walls. Generated drawings, accessible on the Detailing tab of the Model Explorer window, can include:

- Cover Sheets
- General Notes
- Beam & Column Sections
- Floor Framing Plans
- Column Schedules
- Beam Schedules
- Connection Schedules
- Column Layout
- Wall Layout
- Wall Reinforcement Plans & Elevations

1.4 Wind and Seismic Lateral Loads

The lateral loads can be in the form of wind or seismic loads. The loads are automatically calculated from the dimensions and properties of the structure based on built-in options for a wide variety of building codes. For rigid diaphragm systems, the wind loads are applied at the geometric centers of each rigid floor diaphragm. For semi-rigid diaphragms, wind loads are applied to every joint in the diaphragm. For modeling multi tower systems, more than one rigid or semi-rigid floor diaphragm may be applied at any one story. The seismic loads are calculated from the story mass distribution over the structure using code-dependent coefficients and fundamental periods of vibration. For semi-rigid floor systems where there are numerous mass points, ETABS has a special load dependent Ritz-vector algorithm for fast automatic calculation of the predominant time periods. The seismic loads are applied at the locations where the inertia forces are generated and do not have to be at story levels only. Additionally, for semi-rigid floor systems, the inertia loads are spatially distributed across the horizontal extent of the floor in proportion to the mass distribution, thereby accurately capturing the shear forces generated across the floor diaphragms.

ETABS also has a very wide variety of Dynamic Analysis options, varying from basic response spectrum analysis to nonlinear time history analysis. Code-dependent response spectrum curves are built into the system, and transitioning to a dynamic analysis is usually trivial after the basic model has been created



2. REVIEW LITERATURE

*P***rashanth.P, Anshuman.S, Pandey.R.K, Arpan Herbert (2012),** may conclude that E-TABS gave lesser area of required steel as compared to STAAD-PRO. It is found out from previous studies on comparison of STAAD results with manual calculations that STAAD-Pro gives conservative design results which is again proved in this study by comparing the results of STAAD-Pro, ETABS and Manual calculations (refer below table). Form the design results of column; since the required steel for the column forces in this particular problem is less than the minimum steel limit of column (i.e., 0.8%), the amount of steel calculated by both the software is equal. So comparison of results for this case is not possible.

Maison and Neuss(1984), Members of ASCE have performed the computer analysis of an existing forty four story steel frame high-rise Building to study the influence of various modelling aspects on the predicted dynamic properties and computed seismic response behaviours. The predicted dynamic properties are compared to the building's true properties as previously determined from experimental testing. The seismic response behaviours are computed using the response spectrum (Newmark and ATC spectra) and equivalent static load methods.

Maison and Ventura (1991*),* Members of ASCE computed dynamic properties and response behaviours OF THIRTEEN-STORY BUILDING and this result are compared to the true values as determined from the recorded motions in the building during two actual earthquakes and shown that state-of-practice design type analytical models can predict the actual dynamic properties.

Arlekar, Jain & Murty(1997), said that such features were highly undesirable in buildings built in seismically active areas; this has been verified in numerous experiences of strong shaking during the past earthquakes. They highlighted the importance of explicitly recognizing the presence of the open first storey in the analysis of the building, involving stiffness balance of the open first storey and the storey above, were proposed to reduce the irregularity introduced by the open first storey.

Awkar and Lui (1997), studied responses of multi-story flexibly connected frames subjected to earthquake excitations using a computer model. The model incorporates connection flexibility as well as geometrical and material nonlinearities in the analyses and concluded that the study indicates that connection flexibility tends to increase upper stories' inter-storey drifts but reduce base shears and base overturning moments for multi-story frames.

Balsamoa, Colombo, Manfredi, Negro & Prota (2005), performed pseudodynamic tests on an RC structure repaired with CFRP laminates. The opportunities provided by the use of Carbon Fiber Reinforced Polymer (CFRP) composites for the seismic repair of reinforced concrete (RC) structures were assessed on a full-scale dual system subjected to pseudo dynamic tests in the ELSA laboratory. The aim of the CFRP repair was to recover the structural properties that the frame had before the seismic actions by providing both columns and joints with more deformation capacity. The repair was characterized by a selection of different fiber textures depending on the main mechanism controlling each component. The driving principles in the design of the CFRP repair and the outcomes of the experimental tests are presented in the paper. Comparisons between original and repaired structures are discussed in terms of global and local performance. In addition to the validation of the proposed technique, the experimental results will represent a reference database for the development of design criteria for the seismic repair of RC frames using composite materials.

Vasilopoulos and Beskos(2006), performed rational and efficient seismic design methodology for plane steel frames using advanced methods of analysis in the framework of Eurocodes 8 and 3 . This design methodology employs an advanced finite element method of analysis that takes into account geometrical and material nonlinearities and member and frame imperfections. It can sufficiently capture the limit states of displacements, strength, stability and damage of the structure.

Bardakis & Dritsos (2007), evaluated the American and European procedural assumptions for the assessment of the seismic capacity of existing buildings via pushover analyses. The FEMA and the Euro code-based GRECO procedures have been followed in order to assess a four-storeyed bare framed building and a comparison has been made with available experimental results.

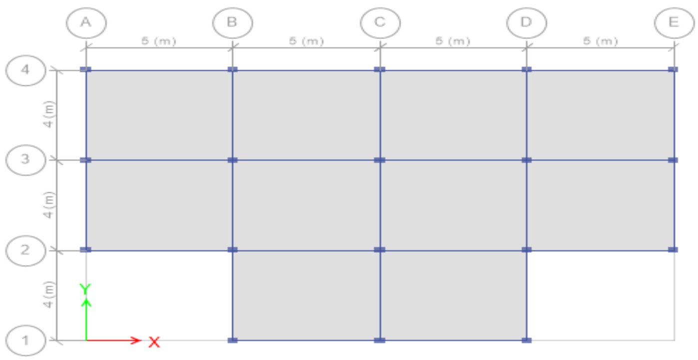
Mortezaei et al (2009), recorded data from recent earthquakes which provided evidence that ground motions in the near field of a rupturing fault differ from ordinary ground motions, as they can contain a large energy, or ‘‘directivity” pulse. This pulse can cause considerable damage during an earthquake, especially to structures with natural periods close to those of the pulse. Failures of modern engineered structures observed within the near-fault region in recent earthquakes have revealed the vulnerability of existing RC buildings against pulse-type ground motions. This may be due to the fact that these modern structures had been designed primarily using the design spectra of available standards, which have been developed using stochastic processes with relatively long duration that characterizes more distant ground motions. Many recently designed and constructed buildings may therefore require strengthening in order to perform well when subjected to near-fault ground motions. Fiber Reinforced Polymers are considered to be a viable alternative, due to their relatively easy and quick installation, low life cycle costs and zero maintenance requirements.

Ozyigit (2009), performed free and forced in-plane and out-of-plane vibrations of frames are investigated. The beam has a straight and a curved part and is of circular cross section. A concentrated mass is also located at different points of the frame with different mass ratios. FEM is used to analyse the problem frames both as an effective shear resisting system at design level and as a retrofitting measure against horizontal earthquake loading.

3. DESIGN AND ANALYSIS DATA

3.1 Structure Data

This chapter provides model geometry information, including items such as story levels, point coordinates, and element connectivity



3.1.1 Story Data

Table 1 - Story Data

Name	Height mm	Elevation mm	Master Story	Similar To	Splice Story
Story10	3000	30000	Yes	None	No
Story9	3000	27000	No	Story10	No
Story8	3000	24000	No	Story10	No
Story7	3000	21000	No	Story10	No
Story6	3000	18000	No	Story10	No
Story5	3000	15000	No	Story10	No
Story4	3000	12000	No	Story10	No
Story3	3000	9000	No	Story10	No
Story2	3000	6000	No	Story10	No
Story1	3000	3000	No	Story10	No
Base	0	0	No	None	No

3.1.2 Grid Data

Table 2 - Grid Systems

Name	Type	Story Range	X Origin m	Y Origin m	Rotation deg	Bubble Size mm	Color
G1	Cartesian	Default	0	0	0	1250	ffa0a0a0

Table 3 - Grid Lines

Grid System	Grid Direction	Grid ID	Visible	Bubble Location	Ordinate m
G1	X	A	Yes	End	0
G1	X	B	Yes	End	5
G1	X	C	Yes	End	10
G1	X	D	Yes	End	15
G1	X	E	Yes	End	20
G1	Y	1	Yes	Start	0
G1	Y	2	Yes	Start	4
G1	Y	3	Yes	Start	8
G1	Y	4	Yes	Start	12

3.1.3 Point Coordinates

Table 4 - Joint Coordinates Data

Label	X mm	Y mm	ΔZ Below mm
1	0	12000	0
2	5000	12000	0
3	0	8000	0
4	5000	8000	0
5	10000	8000	0
6	15000	8000	0
7	20000	8000	0
8	10000	12000	0
9	15000	12000	0
10	20000	12000	0
11	0	4000	0
12	5000	4000	0
13	10000	4000	0
14	15000	4000	0
15	20000	4000	0
16	15000	0	0
17	5000	0	0
18	10000	0	0

3.2 Properties

This chapter provides property information for materials, frame sections, shell sections, and links.

3.2.1 Materials

Name	Type	E MPa	v	Unit Weight kN/m³	Design Strengths
A615Gr60	Rebar	199947.98	0.3	76.9729	Fy=413.69 MPa, Fu=620.53 MPa
M25	Concrete	25000	0.2	24.9926	Fc=25 MPa

Table 5- Material Properties - Summary

3.2.2 Frame Sections

Table 6 - Frame Sections - Summary

Name	Material	Shape
B 230*300	M25	Concrete Rectangular
C 230*350	M25	Concrete Rectangular

3.2.3 Shell Sections

Table 7- Shell Sections - Summary

Name	Design Type	Element Type	Material	Total Thickness mm
Slab 125	Slab	Membrane	M25	125

3.2.4 Reinforcement Sizes

Table 8 - Reinforcing Bar Sizes

Name	Diameter mm	Area mm²
10	10	79
20	20	314

3.3 Loads

This chapter provides loading information as applied to the model.

3.3.1 Load Patterns

Table 9 - Load Patterns

Name	Type	Self Weight Multiplier	Auto Load
Dead	Dead	1	
Live	Live	0	
FF	Superimposed Dead	0	
EQ X+VE	Seismic	0	IS1893 2002
EQ X-VE	Seismic	0	IS1893 2002

EQ Y+VE	Seismic	0	IS1893 2002
EQ Y-VE	Seismic	0	IS1893 2002

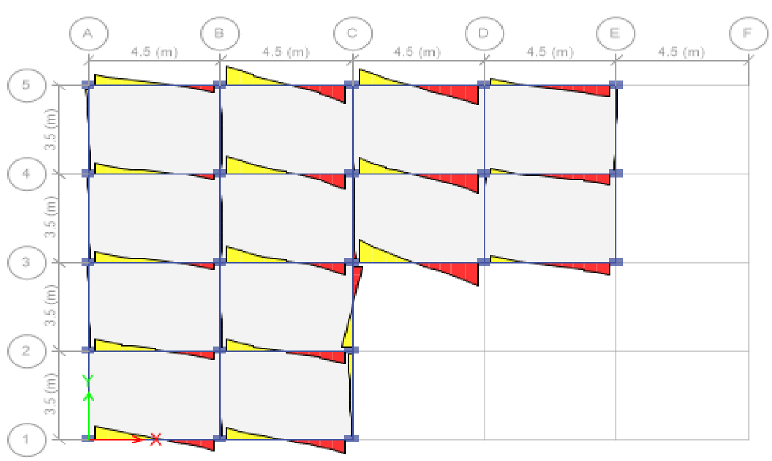
3.3.2 Auto Seismic Loading

Table 10 - Auto Seismic - IS 1893:2002 (Part 1 of 2)

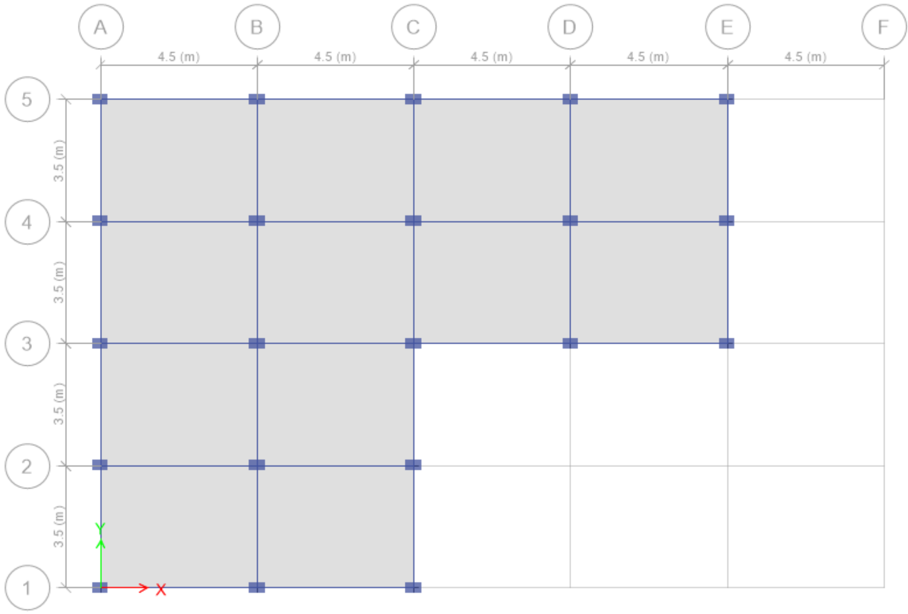
Load Pattern	Type	Direction	Eccentricity %	Ecc. Overridden	Period Method	Ct m	Top Story	Bottom Story	Z Type	Z	Soil Type	I
EQ X+VE	Seismic	X + Ecc. Y	5	No	Program Calculated		Story10	Base	Per Code	0.16	II	1
EQ X-VE	Seismic	X - Ecc. Y	5	No	Program Calculated		Story10	Base	Per Code	0.16	II	1
EQ Y+VE	Seismic	Y + Ecc. X	5	No	Program Calculated		Story10	Base	Per Code	0.16	II	1
EQ Y-VE	Seismic	Y - Ecc. X	5	No	Program Calculated		Story10	Base	Per Code	0.16	II	1

Table 11 - Auto Seismic - IS 1893:2002 (Part 2 of 2)

R	Period Used sec	Coeff Used	Weight Used Kn	Base Shear kN
5	2.393	0.009092	9248.0783	84.0793
5	2.393	0.009092	9248.0783	84.0793
5	2.758	0.007889	9248.0783	72.9622
5	2.758	0.007889	9248.0783	72.9622



4. RESULTS FOR L SECTION BUILDING



4.1 Concrete Frame Design as per IS 456:2000

Table 12

Item	Value
Multi-Response Design	Step-by-Step – All
# Interaction Curves	24
# Interaction Points	11
Minimum Eccentricity	Yes
Additional Moment	Yes
Gamma (Steel)	1.15
Gamma (Concrete)	1.5
Pattern Live Load Factor	0.75
D/C Ratio Limit	1

Table 13

Story	Label	Unique Name	Design Type	Design Section	LLRF	LMajor	LMinor	KMajor(Sway)	KMinor(Sway)	KMajor(Braced)	KMinor (Braced)
Story10	C1	271	Column	Program Determined	1	0.9	0.9	2.332188	1.606548	0.854392	0.726871
Story10	C2	281	Column	Program Determined	0.980781	0.9	0.9	2.332188	1.342836	0.854392	0.645233
Story10	C3	291	Column	Program Determined	1	0.9	0.9	2.332188	1.606548	0.854392	0.726871
Story10	C4	301	Column	Program Determined	0.842915	0.9	0.9	1.806879	1.342836	0.773635	0.645233
Story10	C5	311	Column	Program Determined	0.773112	0.9	0.9	1.806879	1.342836	0.773635	0.645233
Story10	C6	321	Column	Program Determined	0.962228	0.9	0.9	1.806879	1.606548	0.773635	0.726871
Story10	C7	331	Column	Program Determined	0.768909	0.9	0.9	1.806879	1.342836	0.773635	0.645233
Story10	C8	341	Column	Program Determined	0.765334	0.9	0.9	1.806879	1.342836	0.773635	0.645233
Story10	C9	351	Column	Program Determined	0.958146	0.9	0.9	1.806879	1.606548	0.773635	0.726871
Story10	C10	361	Column	Program	0.8429	0.9	0.9	1.806879	1.342836	0.773635	0.645233

				Determined	15						
Story10	C11	371	Column	Program Determined	0.773112	0.9	0.9	1.806879	1.342836	0.773635	0.645233
Story10	C12	381	Column	Program Determined	0.962228	0.9	0.9	1.806879	1.606548	0.773635	0.726871
Story10	C13	391	Column	Program Determined	1	0.9	0.9	2.332188	1.606548	0.854392	0.726871
Story10	C14	401	Column	Program Determined	0.980781	0.9	0.9	2.332188	1.342836	0.854392	0.645233
Story10	C15	411	Column	Program Determined	1	0.9	0.9	2.332188	1.606548	0.854392	0.726871
Story10	C16	421	Column	Program Determined	1	0.9	0.9	2.332188	1.606548	0.854392	0.726871
Story10	C17	431	Column	Program Determined	0.970744	0.9	0.9	1.806879	1.606548	0.773635	0.726871
Story10	C18	441	Column	Program Determined	1	0.9	0.9	2.332188	1.606548	0.854392	0.726871
Story9	C1	272	Column	Program Determined	0.926366	0.9	0.9	2.71143	1.78728	0.891146	0.772957
Story9	C2	282	Column	Program Determined	0.769086	0.9	0.9	2.71143	1.448166	0.891146	0.683921
Story9	C3	292	Column	Program Determined	0.93158	0.9	0.9	2.71143	1.78728	0.891146	0.772957
Story9	C4	302	Column	Program Determined	0.673215	0.9	0.9	2.043508	1.448166	0.8191	0.683921
Story9	C5	312	Column	Program Determined	0.625146	0.9	0.9	2.043508	1.448166	0.8191	0.683921
Story9	C6	322	Column	Program Determined	0.749732	0.9	0.9	2.043508	1.78728	0.8191	0.772957
Story9	C7	332	Column	Program Determined	0.620891	0.9	0.9	2.043508	1.448166	0.8191	0.683921
Story9	C8	342	Column	Program Determined	0.617347	0.9	0.9	2.043508	1.448166	0.8191	0.683921
Story9	C9	352	Column	Program Determined	0.744174	0.9	0.9	2.043508	1.78728	0.8191	0.772957
Story9	C10	362	Column	Program Determined	0.673215	0.9	0.9	2.043508	1.448166	0.8191	0.683921

Table 14- Concrete Column PMM Envelope

Label	Story	Section	Location	P kN	M Major kN-m	M Minor kN-m	PMM Combo	PMM Ratio or Rebar %
C1	Story10	C 230*350	Top	76.5038	40.1012	18.0322	DCon2	1.58 %
C1	Story10	C 230*350	Bottom	84.652	-34.9216	-17.6448	DCon2	1.36 %
C2	Story10	C 230*350	Top	131.1575	60.2099	-2.6231	DCon2	1.68 %
C2	Story10	C 230*350	Bottom	139.3057	-52.2436	2.7861	DCon2	1.35 %
C3	Story10	C 230*350	Top	75.8706	35.8417	-20.2876	DCon2	1.56 %
C3	Story10	C 230*350	Bottom	84.0188	-30.3393	19.4822	DCon2	1.28 %
C4	Story10	C 230*350	Top	194.4863	32.7445	19.3464	DCon2	1.08 %
C4	Story10	C 230*350	Bottom	202.6346	-31.0755	-21.1822	DCon2	1.13 %
C5	Story10	C 230*350	Top	92.2843	3.3204	0.9762	DCon26	0.8 %
C5	Story10	C 230*350	Bottom	97.1732	-3.7112	-0.4067	DCon26	0.8 %
C6	Story10	C 230*350	Top	138.2868	4.6692	-33.6798	DCon2	1.51 %
C6	Story10	C 230*350	Bottom	146.435	-5.4379	32.792	DCon2	1.44 %
C7	Story10	C 230*350	Top	94.1708	1.8834	5.9933	DCon26	0.8 %
C7	Story10	C 230*350	Bottom	99.0597	-1.9812	-6.429	DCon26	0.8 %
C8	Story10	C 230*350	Top	94.4645	1.8893	-0.2734	DCon26	0.8 %
C8	Story10	C 230*350	Bottom	99.3534	-1.9871	1.0478	DCon26	0.8 %
C9	Story10	C 230*350	Top	139.6161	-2.7923	-34.2951	DCon2	1.52 %
C9	Story10	C 230*350	Bottom	147.7643	2.9553	33.3955	DCon2	1.44 %
C10	Story10	C 230*350	Top	169.5951	-24.7137	22.1036	DCon2	0.96 %
C10	Story10	C 230*350	Bottom	177.7433	28.3823	-22.5564	DCon2	1.17 %

C11	Story10	C 230*350	Top	92.2843	-3.3204	0.9762	DCon26	0.8 %
C11	Story10	C 230*350	Bottom	97.1732	3.7112	-0.4067	DCon26	0.8 %
C12	Story10	C 230*350	Top	138.2294	-4.6427	-33.6593	DCon2	1.51 %
C12	Story10	C 230*350	Bottom	146.3776	5.4555	32.8447	DCon2	1.44 %
C13	Story10	C 230*350	Top	77.1576	-40.7404	18.1341	DCon2	1.6 %
C13	Story10	C 230*350	Bottom	85.3059	34.873	-17.6128	DCon2	1.36 %
C14	Story10	C 230*350	Top	131.2662	-60.2949	-2.6253	DCon2	1.68 %
C14	Story10	C 230*350	Bottom	139.4145	52.3284	2.7883	DCon2	1.35 %
C15	Story10	C 230*350	Top	75.8956	-35.8418	-20.3363	DCon2	1.56 %
C15	Story10	C 230*350	Bottom	84.0438	30.3702	19.5763	DCon2	1.29 %
C16	Story10	C 230*350	Top	77.6658	34.9734	23.9493	DCon2	1.7 %
C16	Story10	C 230*350	Bottom	85.814	-29.34	-23.9061	DCon2	1.54 %

4.2 Rules

Joint shear stress ratio is only determined for a station

a) if the station has a beam-column joint (top of the column),

b) if the frame is a ductile or intermediate moment resisting frame,

c) if the column above is a concrete column when it exists,

d) if all the beams framing into the column are concrete beams

e) if the connecting member design results are available, and

f) if the load combo involves seismic load.

Dimensions of the Beams At the Joint

	Beam Section	Concrete f_{ck} MPa	Rebar f_y MPa	Width b mm	Depth h mm	Rebar A_s (Top) cm²	Rebar A_s (Bot) cm²
Beam 1	B 230*300	25	413.69	230	300	0	0
Beam 2	B 230*300	25	413.69	230	300	0	0

Beam Capacities and Angles (Overstrength factor = 1.00 , γ_c = 1.5 , γ_s = 1.15)

	Capacity +veM kN-m	Capacity -veM kN-m	Cos(Angle) Ratio	Sin(Angle) Ratio
Beam 1	0	0	1	0
Beam 2	0	0	0	-1

Column Moment Capacities About the Axes of the Column Below (Over=1, γ_c = 1.5, γ_s = 1.15)

	AxialForce (Major)Pu kN	Capacity +veMmajor kN-m	Capacity -veMmajor kN-m	AxialForce (Minor)Pu kN	Capacity +veMminor kN-m	Capacity -veMminor kN-m
Column Above	0	0	0	0	0	0
Column Below	0	0	0	0	0	0

Sum of Beam and Column Capacities About the Axes of the Column Below

	SumBeamCap Major kN-m	SumColCap Major kN-m	SumBeamCap Minor kN-m	SumBeamCap Minor kN-m
Clockwise	0	0	0	0
CounterClockwise	0	0	0	0

Beam-Column Flexural Capacity Ratios

	(1.1)B/C	(1.1)B/C	Col/Beam	Col/Beam

	Major	Major	Minor	Minor
Clockwise	0.000	0.000	N/N	N/N
CounterClockwise	0	0	N/N	N/N

5. CONCLUSIONS

From our results obtained from the analyses outputs, the elements are in accordance to our objectives of the study which are:

1. The way forward will be to conduct studies on different shapes and geometrical configurations and to see the variations as the study we conducted only included irregular L shape, and T shape configurations.
2. Various important results like bending moments, shear force, and deflection results are compared for the irregular configurations.
3. In this project along with the analysis results, the design values are included for both the unsymmetrical configurations.
4. In design we considered only the flexure, shear, Beam column capacity ratios for both the irregular L shape, and T shape configurations.
5. Analysis of the structural integrity of these buildings in withstanding the design earthquake loadings was conducted and was judged to be safe

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