ANALYSIS & DESIGN OF HIGH RISE STEEL STRUCTURE

Submitted in partial fulfillment of the requirements

of the degree of

MASTER OF TECHNOLOGY

in

CIVIL ENGINEERING

by

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DECLARATION

I, **SANJEET KUMAR (11512270)**, hereby declare that this submission is my own work and that to the best of my insight and conviction, it contains no material beforehand distributed or composed by other individual or office. No material which has been acknowledged for reward of some other degree or certificate of the college or other organization of higher learning with the exception of where due affirmations have been made in the content. It was arranged and displayed under the direction and supervision of **Mr. ASHFAQ MALIK** (Assistant Professor).

Date: **SANJEET KUMAR**

Place: **11512270**

CERTIFICATE

This is to certify that **SANJEET KUMAR** under Registration No. **11512270** has prepared the desertation report titled "**ANALYSIS & DESIGN OF HIGH RISE STEEL STRUCTURE**" under my direction. This is a bonafide work of the above competitor and has been submitted to me in fractional satisfaction of the prerequisite for the honor of Masters of Technology in Civil Engineering.

Signature of Supervisor
Mr. ASHFAQ MALIK

Assistant Professor
School of Civil Engineering

ACKNOWLEDGEMENT

The fulfillment and elation that go with the effective finishing of any errand would be fragmented without specifying the people whose steady direction and support made it conceivable.

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SANJEET KUMAR

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ABSTRACT

In these few decades use of software in structures in rapidly increases, as soon as software came in structure analysis the continuous updates and new software starts giving more better and accurate results then previous.

E-tabs in use for 30 years, & it is used to modal Bhuj Khalifa like tall structures. It is very accurate while giving wind effects as well as seismic, dead and impose loads etc. It'll provide result better then Staad-pro if we talk about seismic effects. It'll give a clear view of 2D and 3D diagram side by side so we can understand better what is going on and how members are behaving and changes as well. The best part it'll suggest the size and lodes bearing values where we have to make changes.

In this we are going to model a typical structure by using E-tabs and then analyse and design the structure with wind loads, seismic load, impose load, dead load etc. & going to make a stable structure which can bear all type of loads with-out effecting the life span of the structure and with-out any waste of materials or product like concrete structures, with less time and money. The structure or modal is more challenging because the C.G. of the building will not lie on its own axis it is a step structure so the maximum load is going to concentrate at only end, so by providing different members and shear walls and after so many changes we have to make it stable so that it can take all kind of loads with-out effecting any of its property.

The structure is constructed 78 x 78m space and the total height of the structure is 50 story that is 175m from the ground, ground floor is of 3m height and the typical story height is 3.5m each. The structure is varying from floor to floor and the C.G. is not lying at its center.

KEYWORDS: Geometry of Building, Building Height, Ground Conditions, E-tabs.

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ABBREVIATIONS

Notation	Abbreviation
IS	Indian Standard
ACI	American Concrete Institute
BMC	Batch Mix Concrete
BSSC	Building Seismic Safety Council
FEM	Finite Element Method
SPSW	Steel Plate Shear Wall

NOMENCLATURE

Sr. No.	Nomenclature	Notation
1.	Design horizontal seismic coefficient	A_h
2.	Dead load	Dead
3.	Live load	Live
4.	Earthquake load for X-direction	eqx
5.	Earthquake load for Y-direction	eqy
6.	Wind load x-direction	windx
7.	Wind load y-direction	windy
8.	Linear static for wind in x-direction	wx
9.	Linear static for wind in y-direction	wy
10.	Response spectrum y-direction	rx
11.	Response spectrum x-direction	ry
12.	Dynamic base shear	V_b
13.	Fundamental natural time period	$T_{x,y}$

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CHAPTER 1

INTRODUCTION

1.1) BACKGROUND

Steel is a metal which is found in earth, due to its tensile nature it is widely used in construction. And with high temperature of heat it can be melted in order to provide a different shape without losing any property.

Steel structures are making a great job in the role of typical structure and they are also very good in.

1.2) PROPERTY

Steel is very good in tension so it is using as bar in concrete structures to provide tensile strength and concrete itself a brittle material so it is good in compression and with this the life span of the structure also increases. Also they are very good in absorbing heat also so the expansion and contraction will also be taking while constructing. Stress strain curve will help to understand the toughness of the material and bearing from elastic to plastic deflection.

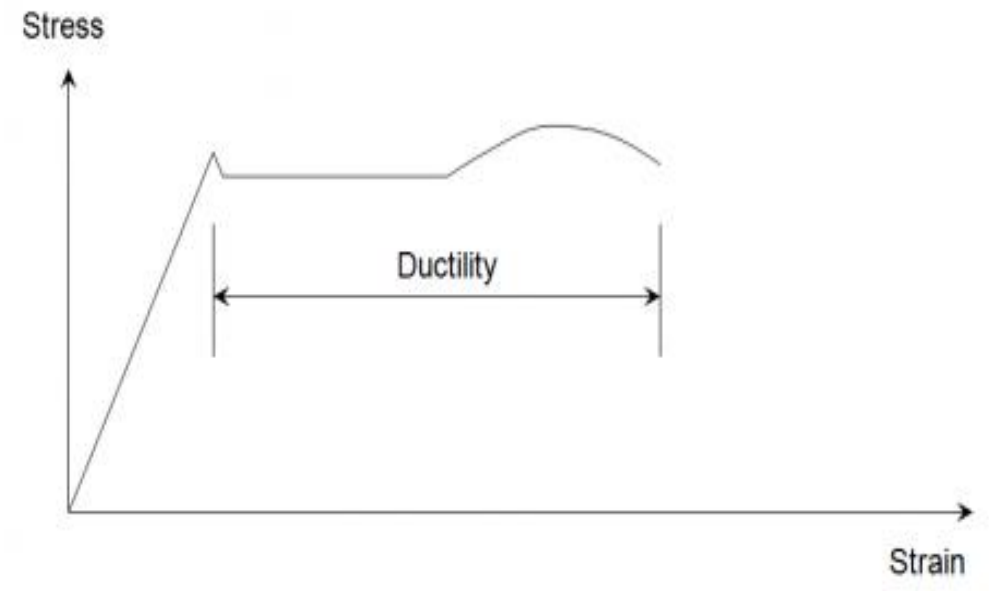


Fig (1) Stress strain curve

1.3) HISTORY

Our civilization is started when the first life put steps on this earth and by every passing years our technology and knowledge is getting improve and better now we have lot more option to build more economical, precise and long durable life structure without effecting environment they are called eco friendly structure or green structures.

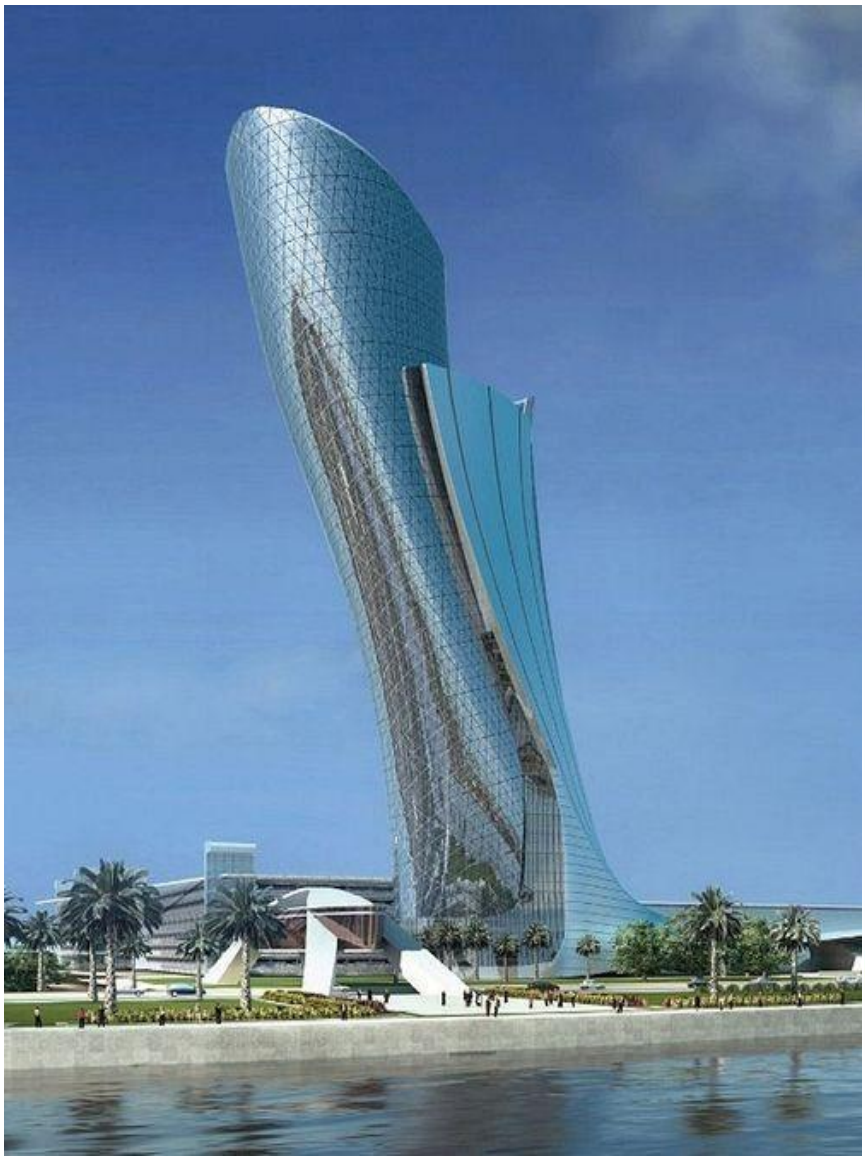
Steel is nearly 4000 years old from the date of 1800 BC. In steel the percentage of carbon in alloys is up to 2.1% of its weight & the property vary as the percentage is increases or decreases.

Fig (2) preparation of steel

1.4) GENERAL

Construction with steel is better than the concrete structures it is easy to place and give faster and better result and more durability against natural disasters. It is simply can join by bolt joint, welded joints etc. So it can act as one. Retrofitting work is also very easy for steel structures and they are very good in tension as well as compression.

Multi-story building when having a sudden collapse is called dynamic action. Dynamic analysis of multi-story building when the C.G. of the structure is not lies on its axis. An irregular steel structure when under go to seismic and dynamic analysis the changes of the structure, and how to rectify and can design to with stand to the lodes with-out effecting the property of structure.



General information	
Type	Commercial offices; Hotel
Location	Abu Dhabi, United Arab Emirates
Coordinates	24.418637°N 54.434692°E
Construction started	September 2007
Topped-out	2010
Owner	Abu Dhabi National Exhibitions Company
Height	
Roof	160 m (520 ft)
Technical details	
Floor count	35
Floor area	53,100 m^2 (572,000 sq ft)
Design and construction	
Architect	RMJM Dubai
Main contractor	Al Habtoor Engineering Enterprises

Fig (3) Capital Gate (Abu dhabi)

1.5) OBJECTIVES OF STUDY

- To prevent life from any hazards.
- To increase the life span of the structure by making effective modal so that loads will not effects the life span of structure.
- Constructing multi-story building so that less area can be occupied by more people.
- Effective and economical structure.
- Reducing wind and seismic effects as much as possible.

1.6) SCOPE OF THE STUDY:-

Dynamic analysis of 50-Story irregular structure using E-Tabs, and designing the effective design with stand to the dynamic and seismic loads applied to it by member to member. For specially analysis of seismic and dynamic action the E-tabs is very good and the values of this software is more accurate then Staad-pro.

Dynamic analysis of structure will give us the final result of the disaster with stand the structure or can bear. Steel members are easy to transport and can get faster result then concrete. Concrete structures are very typical there we have to go for the every cheque possible and then we get a final result in case of high rise we have to care full that mix design was good, vibration should be not more not less, pumping, type of super plasticisers used etc. & when the disaster occur if single member will fail then whole structure will come down & there will be irreplaceable loss can happen. After failure it will create more problem to environment it will hard to dump so most of the cases people dump this chemical or concrete waste to water body's & the water get polluted, if it is used to fill the open space the it'll effect the ground water so out of that we can only see the waste of time, money as well as resources. Steel structure easily can be deign by using codes (for India IS 800) and if any disaster will occur to any specific member then it can be easy to replace and it'll not completely collapse. The life span of the structure is also grater.

CHAPTER 2

LITRATURE REVIEW

2.1) PREVIOUS RESEARCH PAPERS:-

i. **Kai Hu et al. (2012)** study of high rise structures with oblique columns.

Table 1. Main structural indicators

Main structural indicators		ETABS	SAP2000	SATWE
Period(s)	T1	2.6535 (0.83+0.17+0.00)	2.6384 (0.79+0.21+0.00)	2.7237 (0.85+0.15+0.00)
	T2	2.2572 (0.20+0.77+0.03)	2.3039 (0.26+0.74+0.00)	2.2533 (0.15+0.83+0.02)
	T3	2.0052 (0.01+0.16+0.83)	2.053 (0.05+0.95+0.00)	1.7964 (0.01+0.02+0.97)
	T4	0.88728 (0.68+0.32+0.00)	1.974 (0.00+0.01+0.99)	0.9188 (0.69+0.30+0.01)
	T3/T1	0.76	0.78	0.66
	T3/T2	0.89	0.89	0.8
Overturning moment (ratio) of columns (kN-m)	X	946900 (32.10%)	1545632 (52.86%)	1347282 (57.91%)
	Y	592700 (24.80%)	1324125 (54.77%)	1353829 (51.80%)

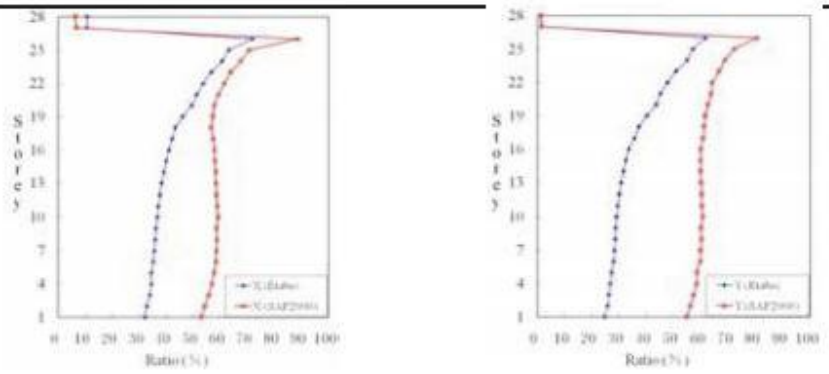


Fig. 3. Overturning moment ratio of columns (a) X Direction; (b) Y Direction

Fig (4) Over turning moment graph

It can be effortlessly observed from the assumption that the anxiety conveyances figured by these two projects are generally equivalent. In the mean time, because of the slanted sections, incomplete chunks need to transmit and adjust the drive what's more, distortion amongst slanted and right sections, and after that bear a bigger in-plane load under gravity. This demonstrates, for complex structures, it is important to take the chunks push examination at debilitate positions. By far reaching examination of these two projects, ETABS has some propelled capacities in preprocessing, for example, consequently line limitation and region units division; while MIDAS/Gen has prevalent post-preparing capacities which could join direct and shearing stresses and figure the important tractable worry of sections.

ii. **A.DEYLAMI & J.ROWGHANI-KASHANI et al**. In this paper the entire strides of divider configuration was depicted and it was found that one can plan the SPSW, just by having the base shear of divider. At last the progressions of web plate thicknesses in SPSW were assessed. Gotten comes about demonstrate that as moving towards bring down stories in a building, the web plate thicknesses will increment. The contrasts between web plate thicknesses are decreased at lower stories of a building. The patterns of changes in web plate thicknesses are about the same in all the three structures.

iii. **A.K. Al-Tamimi et al** This paper displays an approach for correlation of various development materials in three diverse structures. As per our information accumulation, which depends on material testing, the properties of the three diverse solid examples coordinate with the ones utilized for the plan. Along these lines, the outcomes got from the information gathering are all legitimate. Thus, the qualities were utilized as a part of the plan programming, for example, (ETABS, SAFE, ACI LIFE 365) to acquire sensible outcomes in regards to volume of solid, cost, carbon impression, and manageability over the long haul. To guarantee that our outcomes were exact and the correlation was reasonable, the outer elements were killed, and in this manner the tried environment was settled for every one of the three contemplates. The examination between the diverse materials was done through two distinct parameters: (Basic outline, solid volume, relative cost, and relative impression) and ACI LIFE 365 which relies on upon the blend outlines and cost of the materials. Taking everything into account, the general outcomes uncovered the unmistakable varieties between the diverse development materials. Henceforth, the high quality cement turned out to be the most economical, strong, down to earth, and cost productive. This review plainly indicates how diverse development materials can be thought about in light of particular criteria to pick the most maintainable and savvy material in the development business.

CHAPTER 3

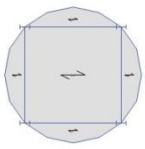
BUILDING DETAIL, LOADS & LOAD COMBINATIONS

3.1) GENERAL:-

The building is high rise steel structure of grid spacing 6m each side of the axis and 50 story of height 174.5 m tall office type building. The building construction site is "Surat" (Gujrat) Seismic Zone III wind speed is 44m/s

The structure is steel structure the design process is quite different from the general RCC buildings the process is time consuming if we go to the accuracy like taking auto selecting system where we define the bunch of steel members under that name and then proceed to design.

TOP VIEW OF STRUCTURE



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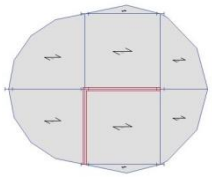

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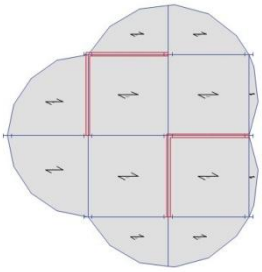

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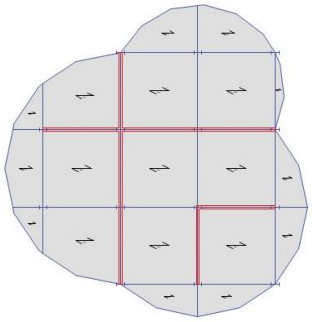

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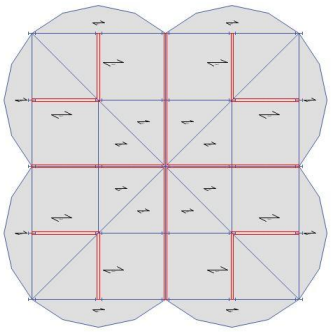

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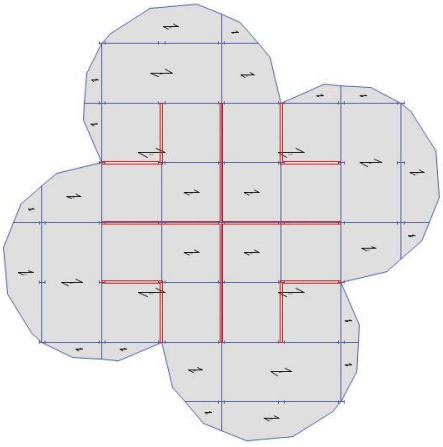

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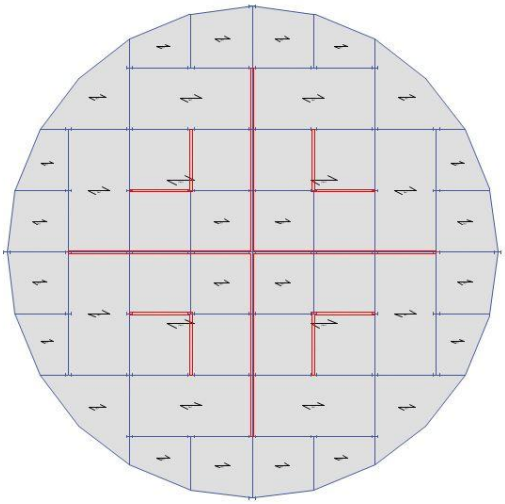

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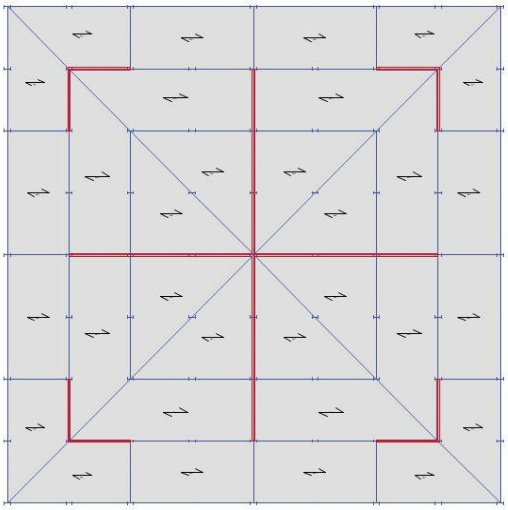

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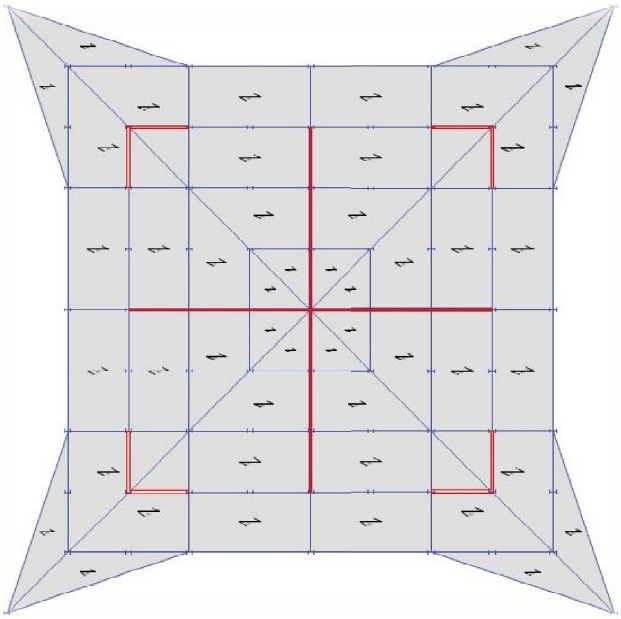

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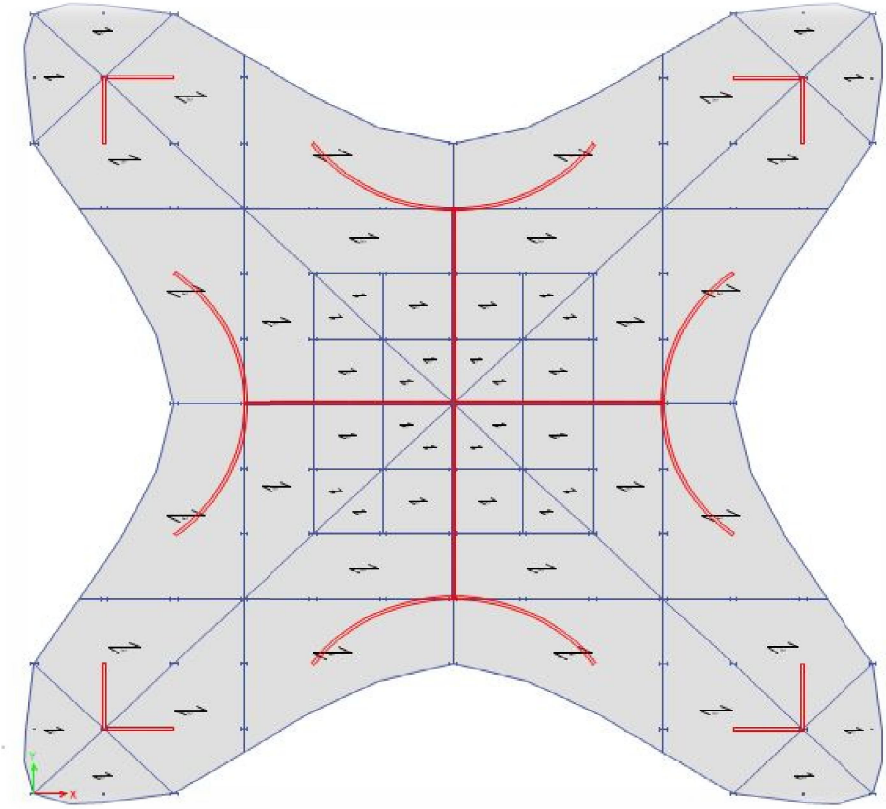
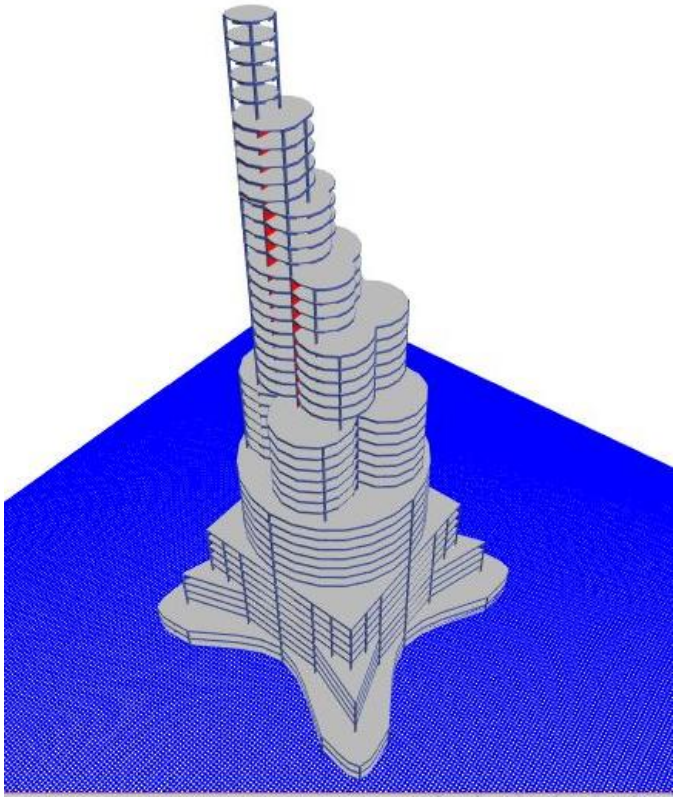
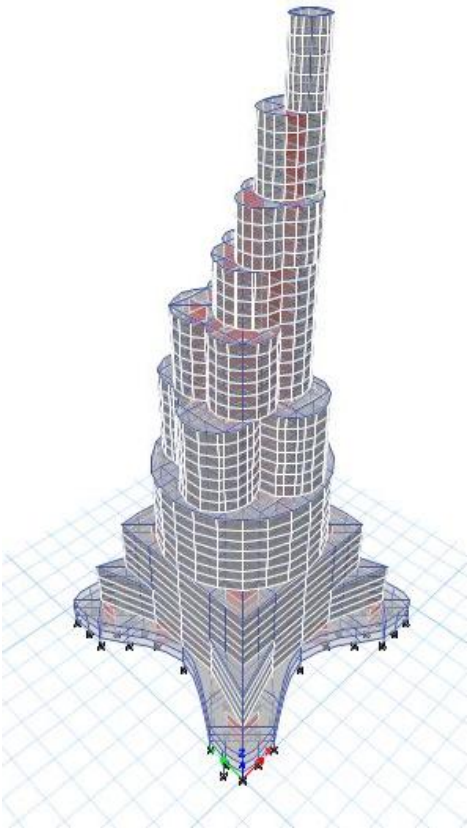


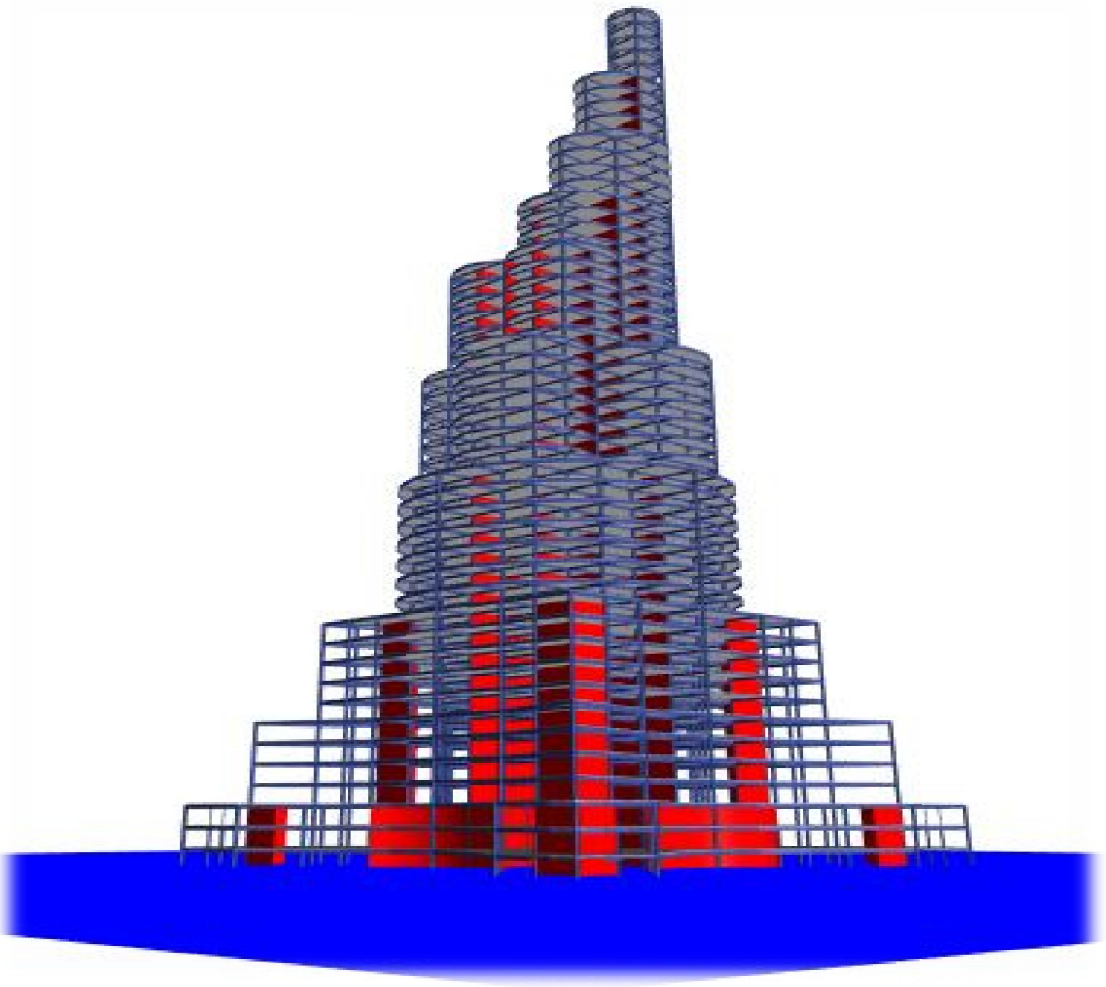
1-3

Fig (5)

<u>3D VIEW OF STRUCTURE</u> Fig (6)







No. of section	6194
Type of section	Auto select list
Soil type	Hard soil
Seismic zone	III
Wind speed	44m/s
No. of Story	50 Story
Bottom height of story	3m
Typical story height	3.5m
Distance between grids	6m
Type of shear wall	Shell thin
Slab type	Deck slab

Table (1) Details of the structure

3.2) DEFINITION:-

3.2.1) DEFINITION MATERIAL:-

The steel structure first has to define the material.

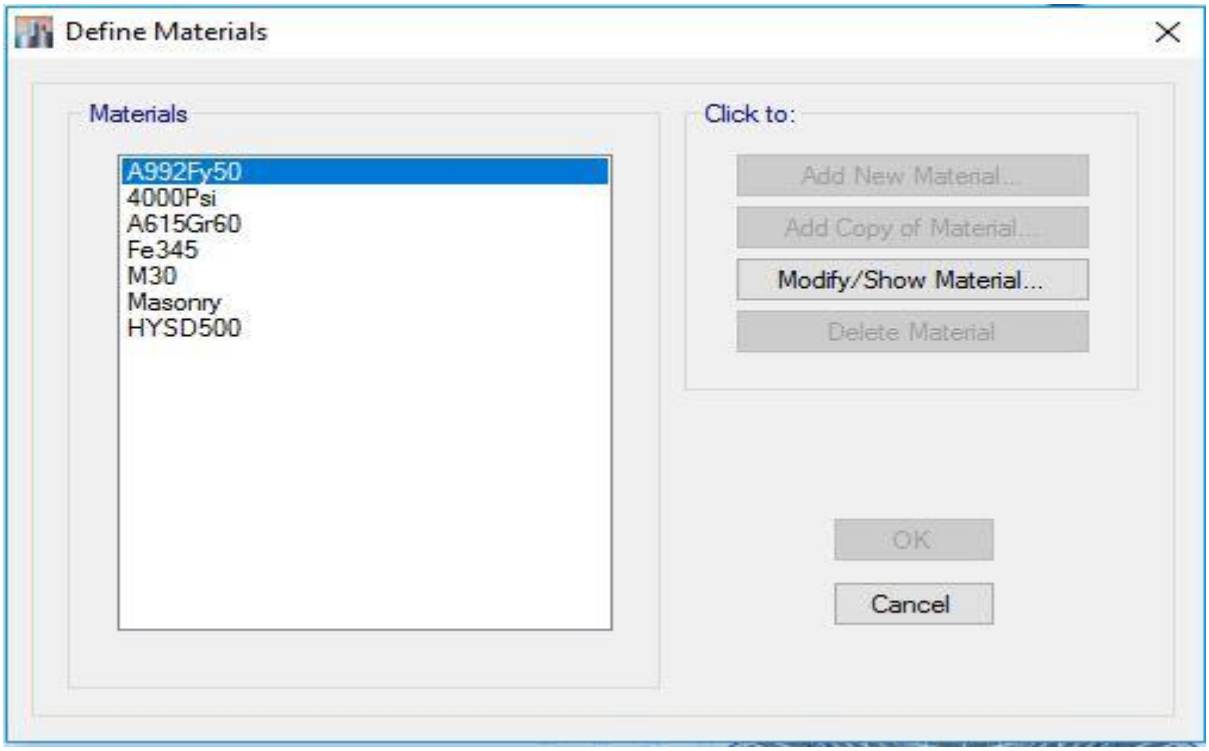


fig (7) Define materials

The first three are the default materials based on American codes and the remaining are what we define in the property of the structure or depending on the material available to complete the task

i) Fe345 for steel

ii) M30 Concrete

iii) Masonry for brick work

iv) HYSD500 for bars

3.2.2) <u>SECTION PROPERTY DEFINITION</u>:-After defining the material now it's time to define property of the material from the given property (all selection must done under the respective code we are using for design).

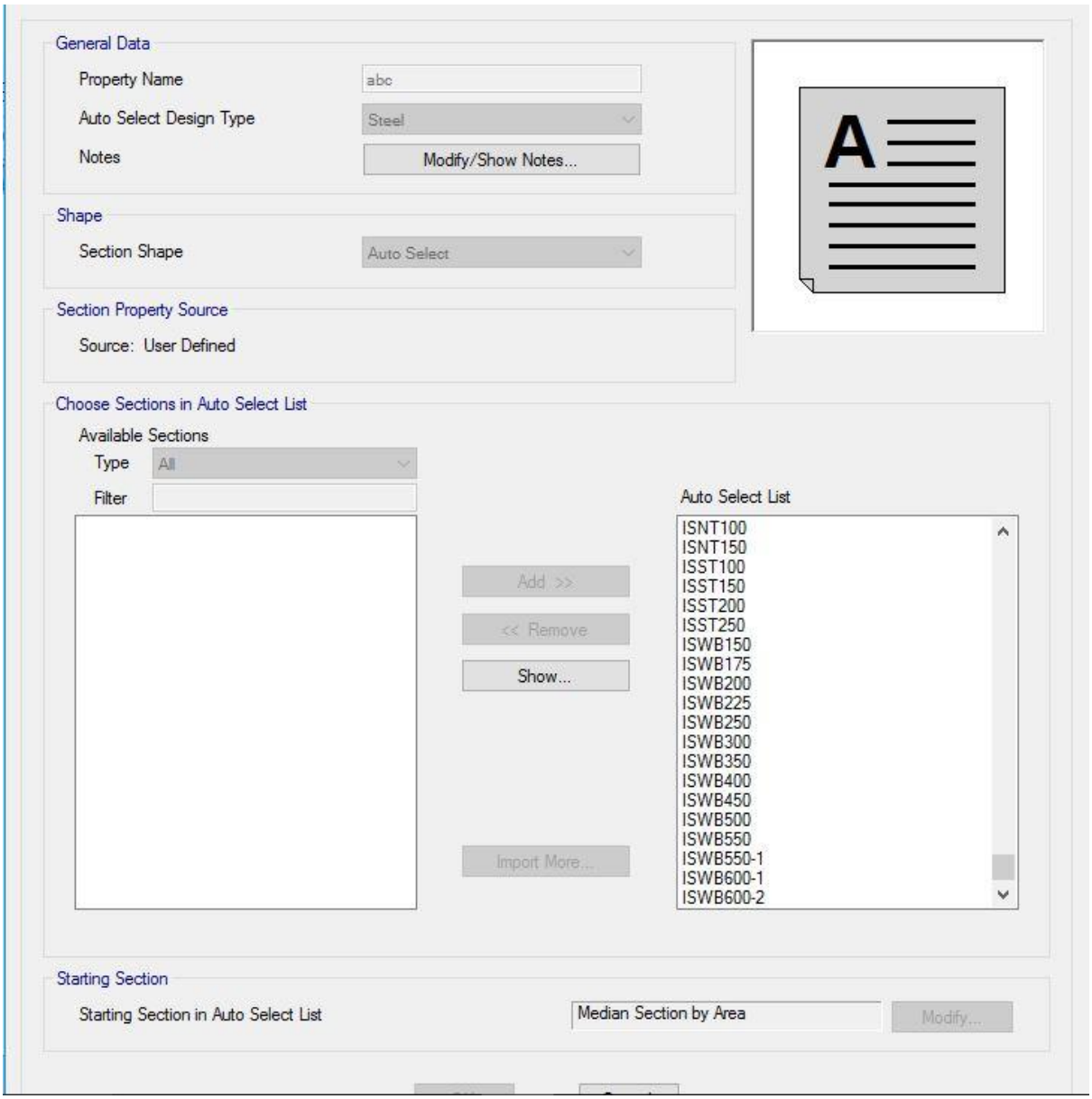


Fig (8) Property definition

In the property define the auto select list is choose, the all sections are define under the same name and the most adequate member is provided to resist against the applied force. First it'll provide the very basic or initial member in the group then after analysis the members or sections are swap by the adequate member. It looks easy but the process of swapping take too much time then we expect for me it take approx 48 days.

3.2.3) DECK SLAB:-

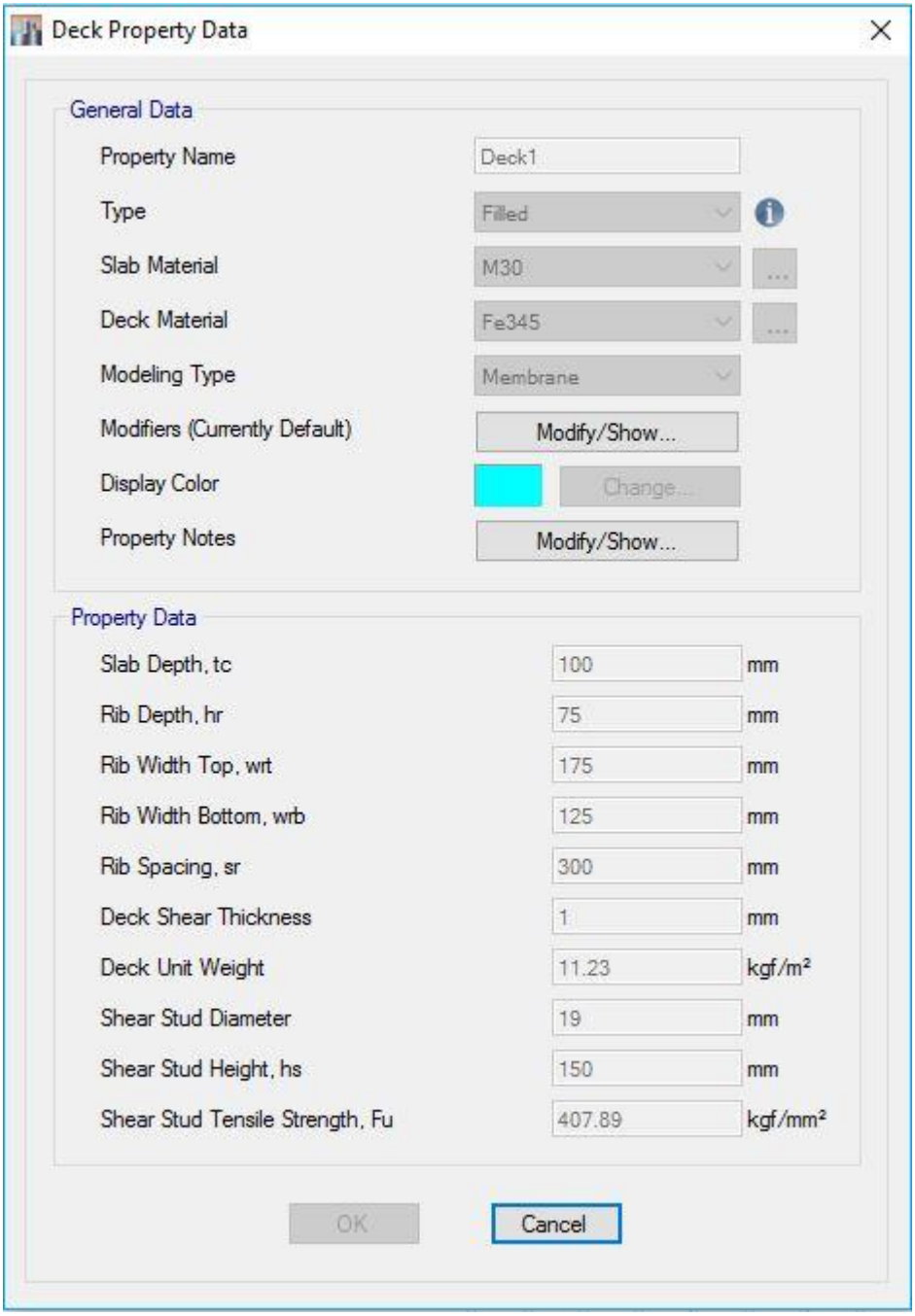


Fig (9) Deck Slab

Defining the Deck slab property contain the material used in it for filling is concrete M30 & the deck material is Fe345 steel property and at the end the depth of the slab 100mm

3.2.4) SHEAR WALL:-

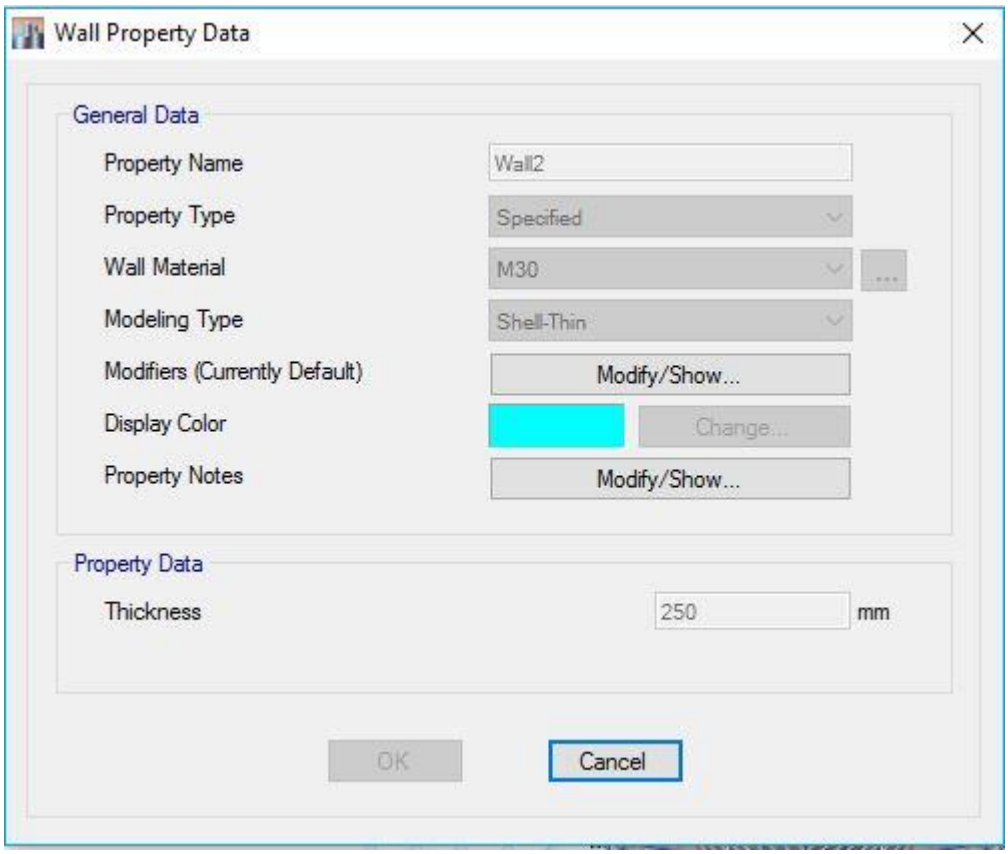


Fig (10) Wall Property

The shear wall property is define in the define section for shear wall we are going to provide in structure the material used for wall is M30 and the type of the wall is shell thin.

3.2.5) DIAPHRAGM:-

In order to act such loads like wind & earthquake at mid of the span diaphragm is assign. It provide the center of the structure to act those loads at the center of the surface.

3.3) ASSIGN THE PROPERTY:-

After all the defining process the model is ready to assign the sections. For assigning the sections or property which is previously defined, go to the select window and then select the frame sections like beams & columns and assign from the assign window the auto select list which we generated earlier. After the assign right click on any member to see the property define and the loads applied etc.

Same process is continued with all the other things like deck slab & shear wall, first select them and assign the property.

When the section property is assign the program will automatically pick the least strength material in the group and assign throughout for the very first analysis. After the first analysis

is completed depending on the stress and loads the remaining members are assigning automatically.

3.4) DEFINE LOADS:-

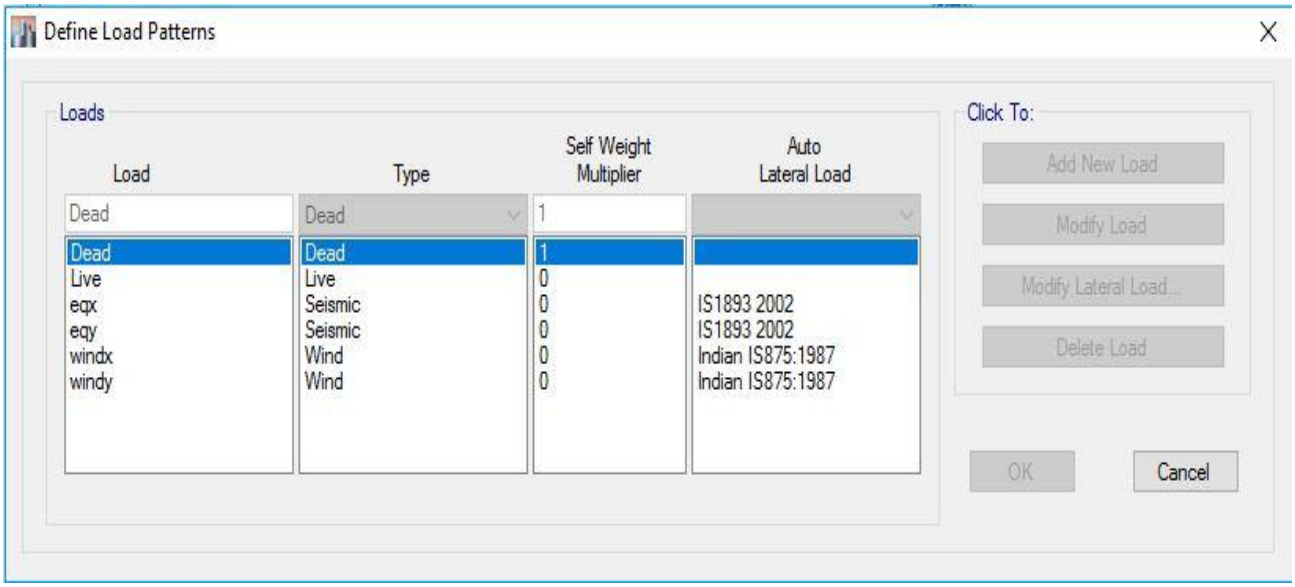


Fig (11) Define loads patterns

3.4.1) DEAD & LIVE LOAD:-

Dead & Live load is by default in the load patterns is defined. All we have to do is just assign the extra dead load that part I'll cover in assigning the loads.

3.4.2) SEISMIC LOAD:-

The seismic load is define from two direction

i) Earthquake in x-direction

Selecting the code with respect to design the structure that is IS1893-2002 for the seismic design now after adding the loads modifying the lateral loads and uncheck the all y-direction and the values of the property should be change like time period zone etc.

ii) Earthquake in y-direction

Same process should be continued here also the only difference will take place is uncheck the all x-direction column and the remaining values will be same as in previous.

3.4.3) WIND LOAD:-

Wind load also be define for two directions that is

i) Wind in x-direction

Select code for the wind to design the structure that is IS875 Part3-1987 add the load now click on modify lateral load for the defining the speed of the wind at the particular place and the terrain factor etc and check the shell object.

ii) Wind in y-direction

Repeat the process same for the y-direction no changes at all.

3.5) ASSIGN THE LOADS:-

Now assign the loads what we just defined.

3.5.1) DEAD & LIVE LOAD:-

The members dead load is automatically pick by the program, only extra loads we have to assign by our side loads like wall partition load, flooring load, sealing loads etc.

To assign such loads first select the slab and now go to assign window to assign them uniformly under dead load that is 3.14KN/m^2. And for the live load that is 3KN/m^2.

Now the dead load like members load and the wall loads can be applied on the frames to do that first select the entire beam except the top floor beams and then the dead load is applied under distribution column that is 6KN/m^2 & for the top floor the load will be 1KN/m^2 for slab.

3.6) MASS SOURCE DATA:-

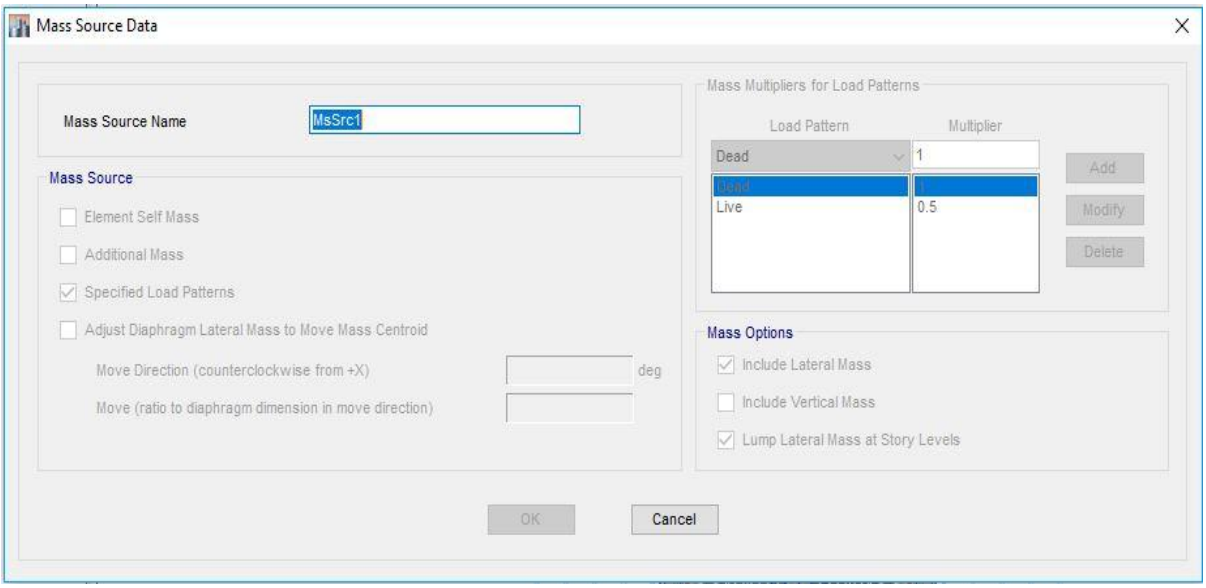


Fig (12) Mass Source Data

In the define window define mass source check the specified load patterns and add loads like dead with multiplier 1 and the live load multiplier 0.5.

3.7) MODAL CASE DATA:-

Modal case data allows to maximum number of modes for floors. The maximum number of modes for this structure is 100

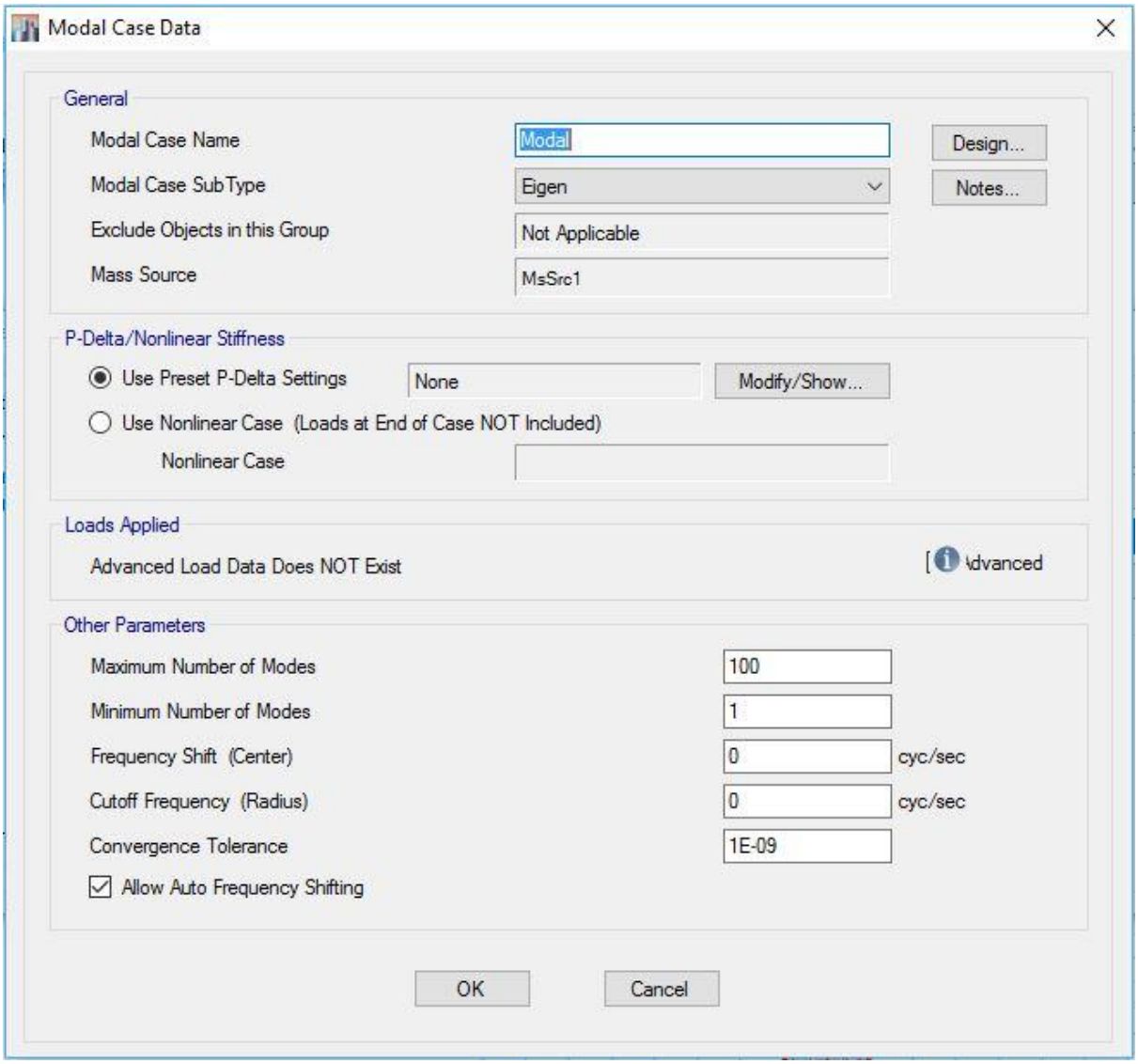


Fig (13) Modal Case Data

3.8) DYNAMIC FORCES:-

3.8.1) DEFINE FUNCTION:-

To assign the dynamic loads or to define it firs we have to define the functions from the define window select the respected code and the graph and value is display for the zone we are defining the function for response spectrum.

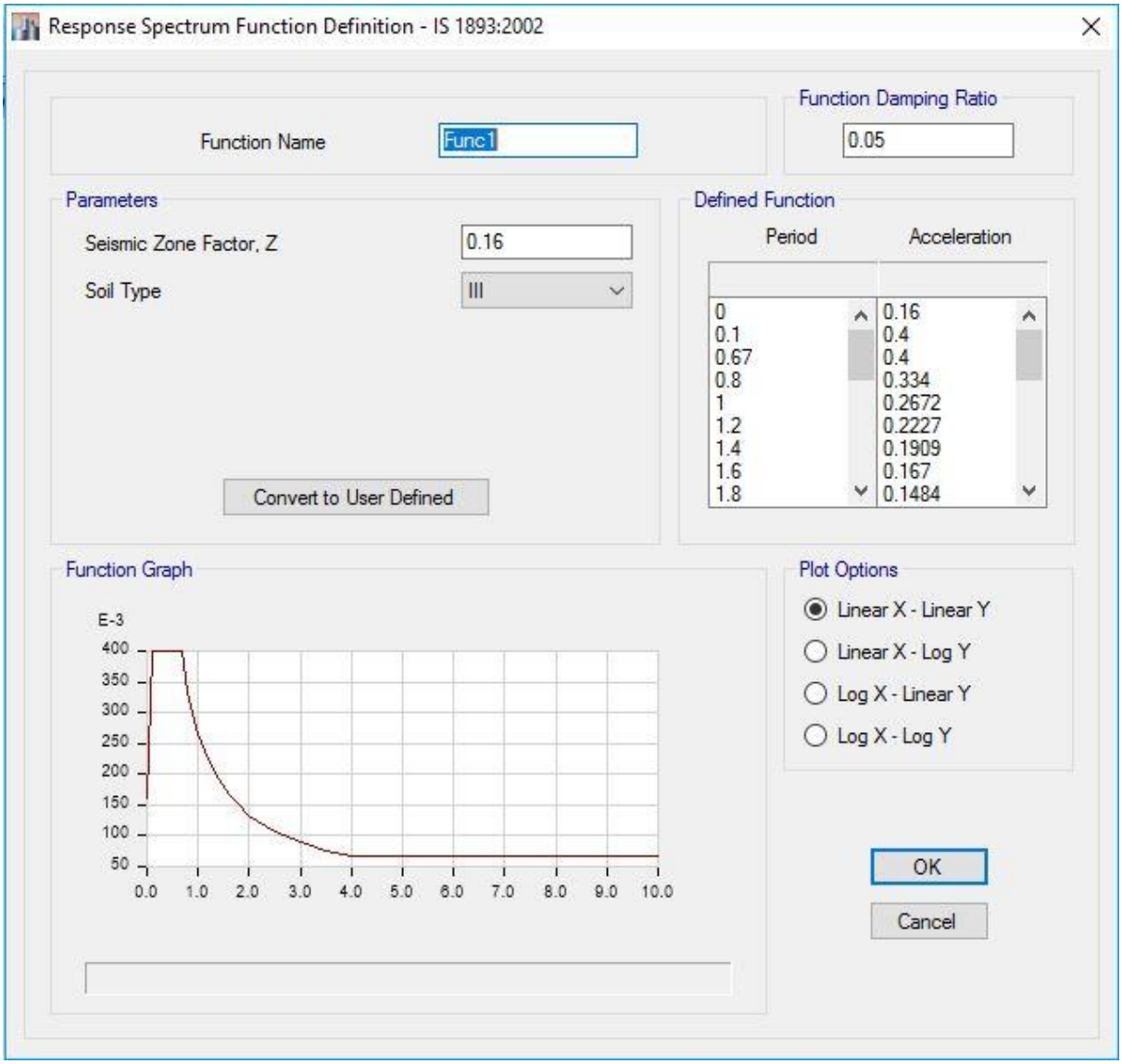


Fig (14) Response Spectrum Function

3.8.2) <u>DEFINE RESPONSE SPECTRUM FOR SEISMIC</u>:-

Open the define window & click on “load case” then go to add new case and name it as “rx” (response spectrum for x-direction) change the load case type to Response Spectrum, now go to loads applied and click add to define change load name U1, function u defined previously in functions & the scale factor 1000, same process will be carryout for the “ry” for y-direction.

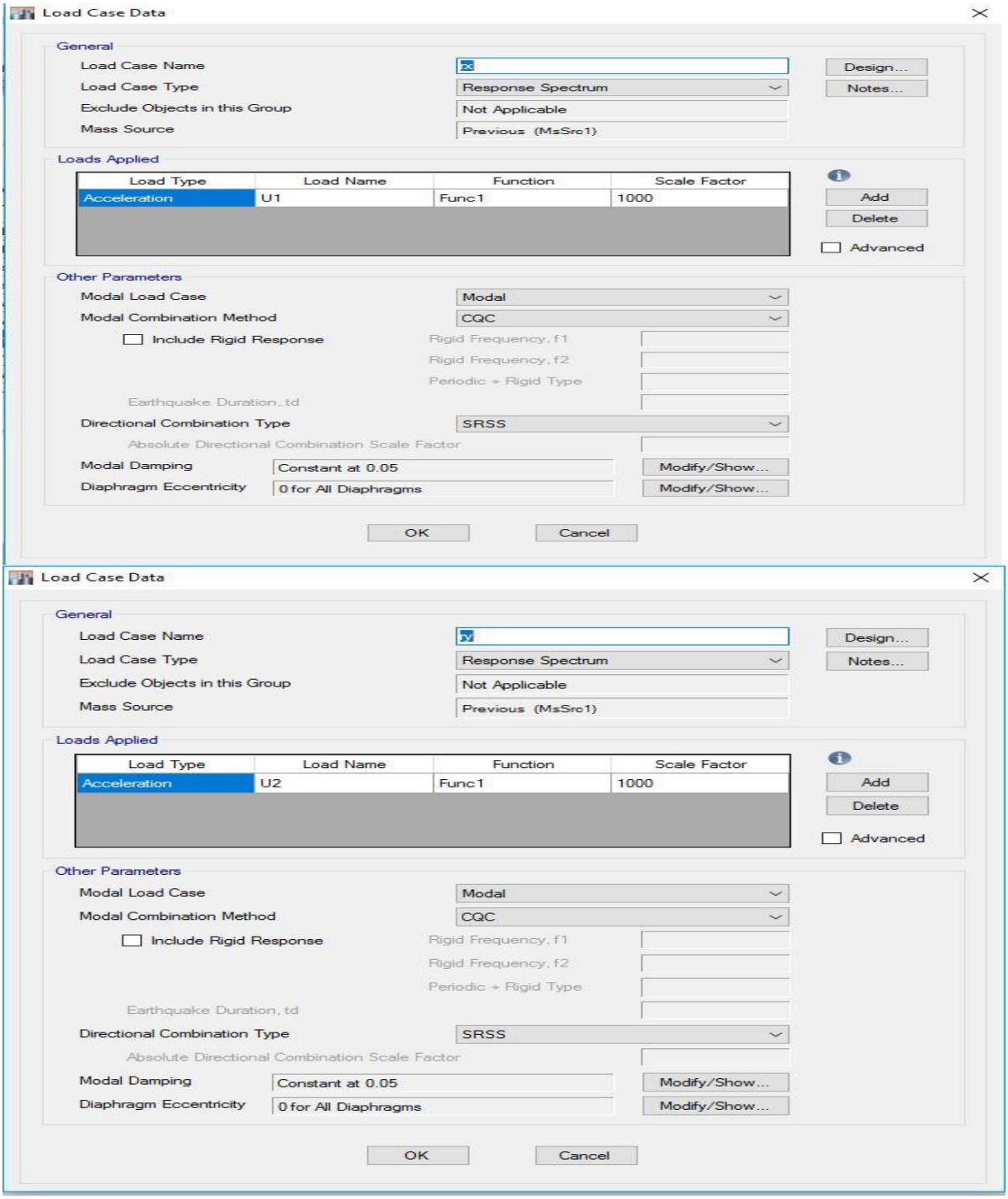


Fig (15) Response Spectrum for Seismic (x,y)

3.8.3) <u>DEFINE LINEAR STATIC FOR WIND</u>:-

Define response spectrum for wind also carry the same procedure as we discuss in the case of defining the seismic response spectrum. To define them add new case and name it as "wx" (for x-direction) load case type is "Linear Static" then select the add in loads apply and only select the "windx" from the load name "windy" for the y-direction in next case.

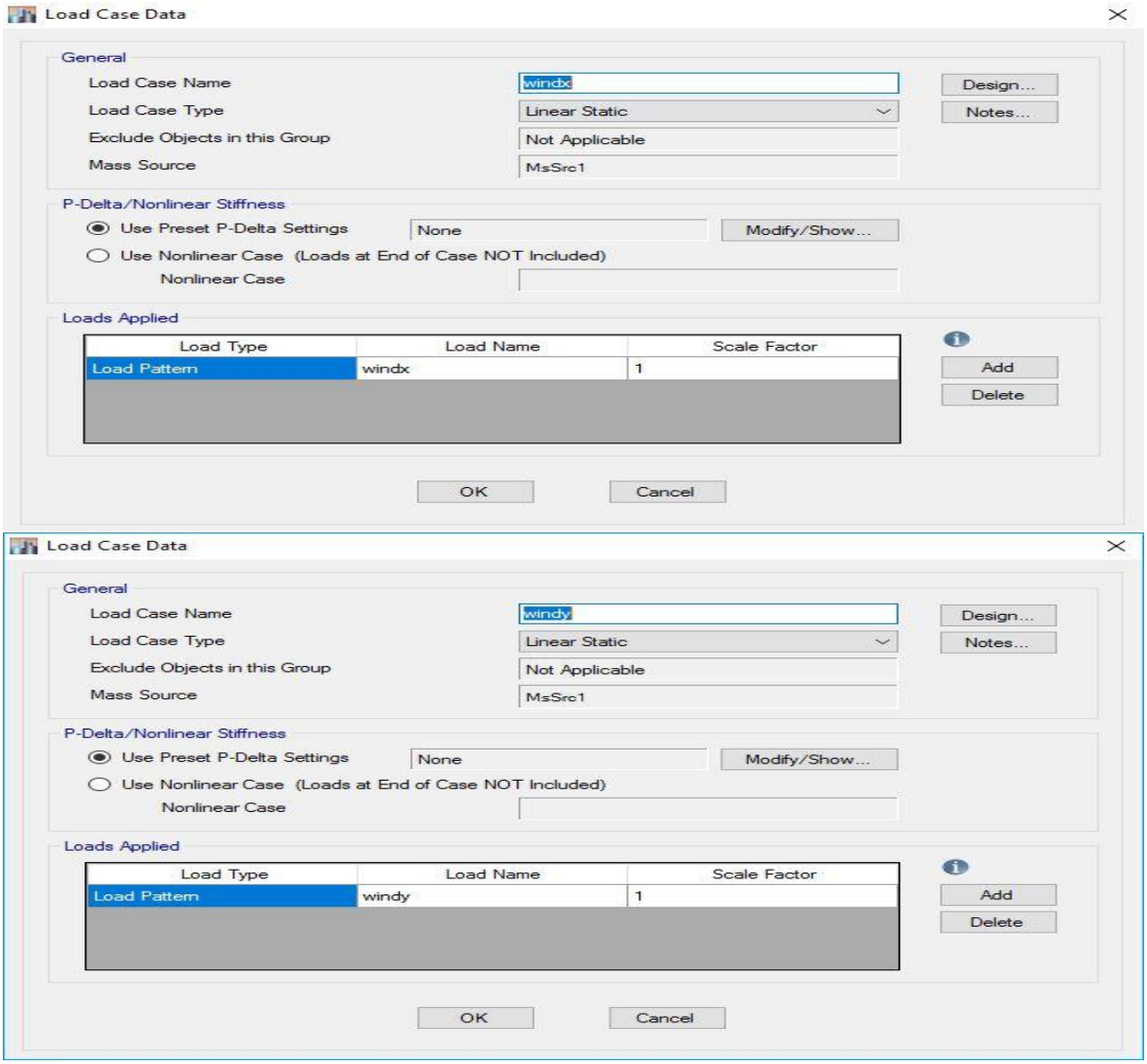


Fig (16) Linear Static for Wind (x,y)

3.9) LOADS COMBINATION:-

- 1.5*dead
- 1.5*dead + 1.5*live
- 1.2*dead + 1.2*live $\pm$ 0.6windx
- 1.2*dead + 1.2*live $\pm$ 0.6windy
- 1.2*dead + 1.2*live $\pm$ 0.6wx
- 1.2*dead + 1.2*live $\pm$ 0.6wy
- 1.5*dead
- 1.5*dead + 1.5*live
- 1.2*dead + 1.2*live $\pm$ 0.6windx
- 1.2*dead + 1.2*live $\pm$ 0.6windy
- 0.9*dead + 1.5*rx
- 0.9*dead + 1.5*ry
- 1.0*dead

- 1.0*dead + 1.0*live
- 1.5*dead
- 1.5*dead + 1.5*live
- 1.2*dead + 1.2*live ± 1.2*windx
- 1.2*dead + 1.2*live ± 1.2*windy
- 1.2*dead + 1.2*live ± 1.2wx
- 1.2*dead + 1.2*live ± 1.2wy
- 1.5*dead ± 1.5*windx
- 1.5*dead ± 1.5*windy
- 1.5*dead ± 1.5wx
- 1.5*dead ± 1.5wy
- 0.9*dead ± 1.5windx
- 0.9*dead ± 1.5windy
- 0.9*dead ± 1.5wx
- 0.9*dead ± 1.5wy
- 1.2*dead + 1.2*live ± 1.2eqx
- 1.2*dead + 1.2*live ± 1.2*eqy
- 1.5*dead ± 1.5*eqx
- 1.5*dead ± 1.5*eqy
- 0.9*dead ± 1.5*eqx
- 0.9*dead ± 1.5*eqy
- 1.2*dead + 1.2*live + 1.2*rx
- 1.2*dead + 1.2*live + 1.2*ry
- 1.5*dead + 1.5*rx
- 1.5*dead + 1.5*ry
- 0.9*dead + 1.5*rx
- 0.9*dead + 1.5*ry

CHAPTER 4

ANALYSIS OF THE STRUCTURE

4.1) GENERAL:-

The analysis of the structure will give the behavior of the property under the loads applied, this is also called a check point where we have to go through different check to ensure the stability of the structure for different-different loads.

The analysis of the structure will allow you to study the structure under various loads like moments, deflection, story drift, torsion, overturning etc. to analyze the structure go to analyze window and click the "Run Analysis".

4.2) CHECK MODEL:-

Model check is 1 of essential part of the model. It check the model throughout for any defect. To run the model check simply click to analyze window and click check model, a new window will open select all the box and run the process it'll tell us if any miss fortune or any defect happen while modeling the structure.

4.3) RUN ANALYSIS:-

To run the analysis of the structure click on analyze window and click on run analysis (it can be done after particular loads for better understand or after all forces generated). It'll take few min. to show the result.

4.4) CHECK FOR STORY DRIFT:-

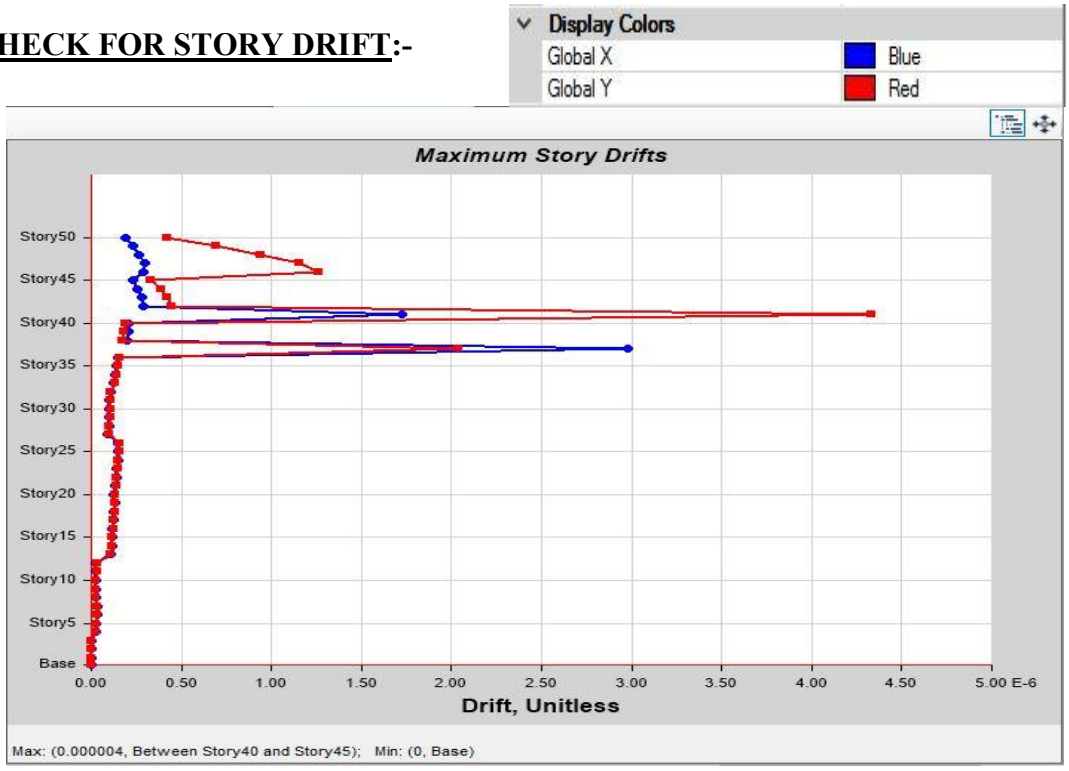


Fig (17) Maximum Story Drift

4.5) MAXIMUM STORY DISPLACEMENT:-

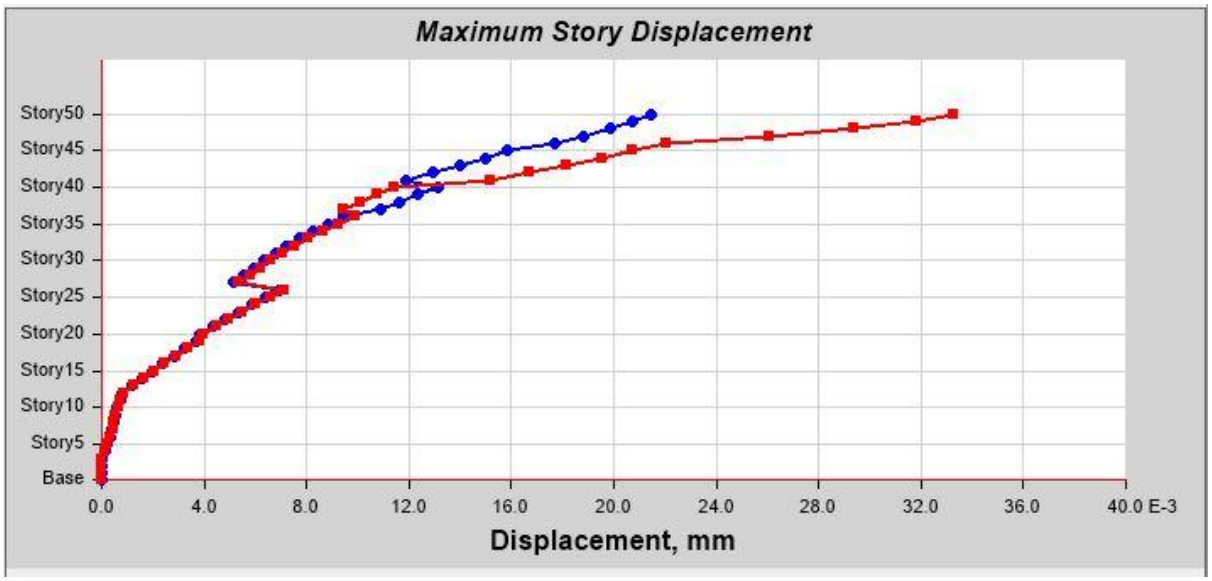


Fig (18) Story Displacement

4.6) OVERTURNING MOMENT:-

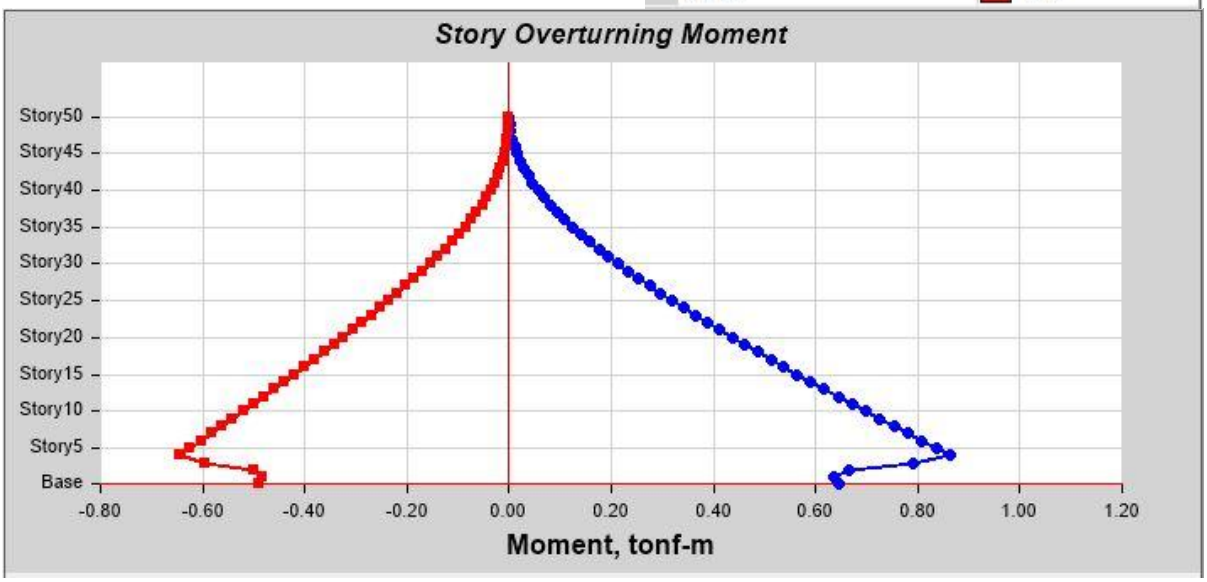


Fig (19) Overturning Moment

4.7) DISPLAY:-

Display option shows the various deformation graph & table for the loads. Go to the display window & and click on story response plot for the graph of the deformation and for the whole details. In the display option show table window will show the analysis tabular form for the values at every story and for each and every loads that we applied.

Changes can be made after unlocking the model for the better result every time when we run analysis.

CHAPTER 5

DESIGN & DETAILING

5.1) GENERAL:-

The design of the building will design the each and every member we selected and shows the members will pass or not and design them once the design is done the modal is ready for detailing.

Form the design option we can design the any kind of frames like “Steel, Composite Beam, Composite Column, Concrete frames can be design it can also design shear wall and the connections design for steel frame.

5.2) DESIGN STEEL FRAME:-

5.2.1) VIEW/REVISE PREFERENCE:-

To design the steel structure start from the steel frame design and click on view/revise preference and see the all details and code preference and also can be overwrite them.

5.2.2) DESIGN LOAD COMBINATION:-

The design combination is combination of loads for which we are going to design the building majorly like seismic loads or wind loads. The major problem in the high rise building is wind loads.

For my model the dominating load is wind loads so if we design for the wind load then it will automatically give stability to rest of the loads we applied. These are the few load combination for wind load design.

- 1.2*dead + 1.2*live $\pm$ 0.6*windx
- 1.2*dead + 1.2*live $\pm$ 0.6*windy
- 1.2*dead + 1.2*live $\pm$ 0.6*wx
- 1.2*dead + 1.2*live $\pm$ 0.6*wy
- 1.2*dead + 1.2*live $\pm$ 0.6*windx
- 1.2*dead + 1.2*live $\pm$ 0.6*windy
- 1.2*dead + 1.2*live $\pm$ 1.2*windx
- 1.2*dead + 1.2*live $\pm$ 1.2*windy
- 1.2*dead + 1.2*live $\pm$ 1.2*wx
- 1.2*dead + 1.2*live $\pm$ 1.2*wy
- 1.5*dead $\pm$ 1.5*windx
- 1.5*dead $\pm$ 1.5*windy
- 1.5*dead $\pm$ 1.5*wx
- 1.5*dead $\pm$ 1.5*wy
- 0.9*dead $\pm$ 1.5*windx

- 0.9*dead ± 1.5*windy
- 0.9*dead ± 1.5*wx
- 0.9*dead ± 1.5*wy

5.2.3) START DESIGN/CHECK:-

This option deal with design as well as check for the defined members previously it will directly go for the design but for my members I choose the "Auto select" (as we discuss previously) so it will go for check for each and every member 1 by 1 & swap the most adequate member to that section. After the check it'll design the building and shows the no. of members failed in check & stress/capacity check, repeat the process until it shows all members pass.

After the design process click on the verify analysis vs. design check to see the member that is swap from the analysis sections.

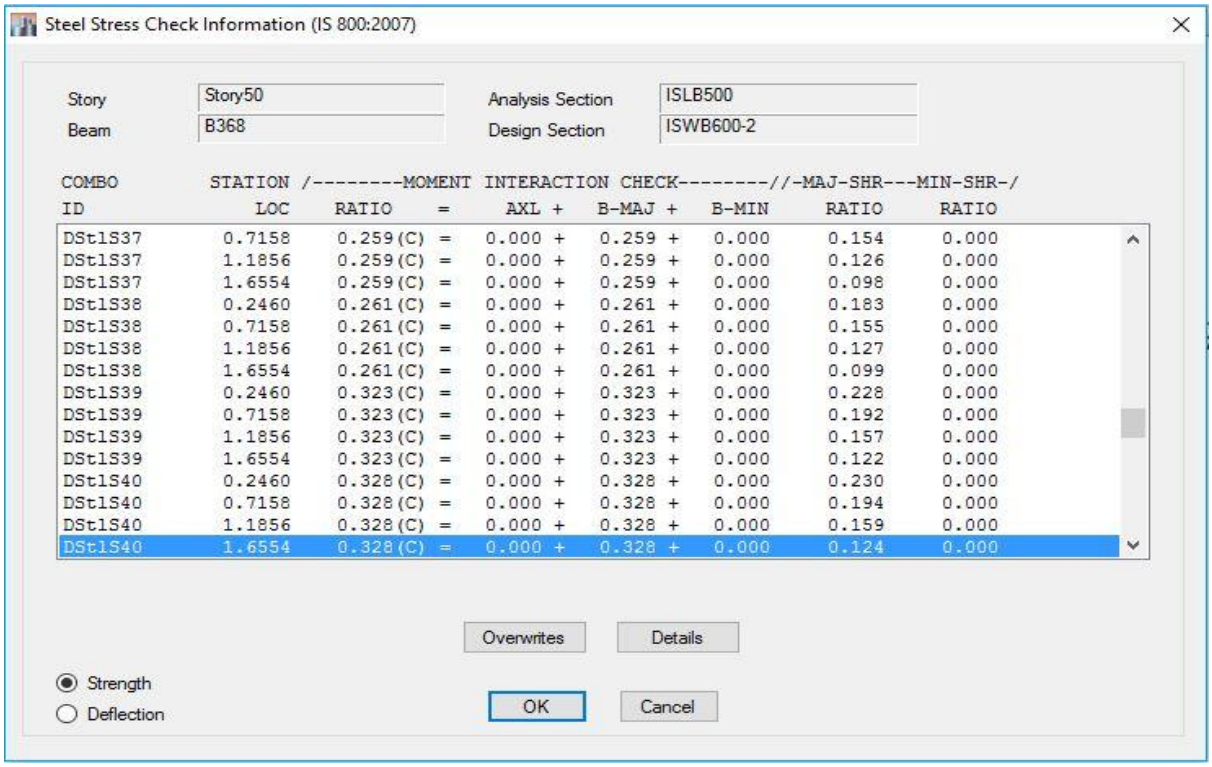


Fig (20) Stress check information

Here you'll find the design section is different from the analysis one.

After all section pass make auto select section null for no further changes.

5.3) DETAILING:-

Detailing will give us the detailed design of the structure & drawing just go to the start design and click on it the software will automatically generate the word file of values and drawing of every section and slab.

After done detailing go to the file & click on create report for creating report file for the design structure.

CHAPTER 6

CONCLUSION & FUTURE SCOPE

6.1) CONCLUSION:-

In this model the steel structure is can be build with so many changes like bracings and the connection and lateral bracings also using column bracing for load transfer which reduces stress and increases bearing capacity of the section or more accurately structure. The structure also requires more triangular section at the joints of members for transferring loads.

For 50 stories structure the no. of sections used,

- ISHB150-1
- ISHB150-2
- ISHB150-3
- ISHB200-1
- ISHB200-2
- ISHB225-1
- ISHB225-2
- ISHB250-1
- ISHB250-2
- ISHB300-1
- ISHB300-2
- ISHB350-1
- ISHB350-2
- ISHB400-1
- ISHB400-2
- ISHB450-1
- ISHB450-2
- ISJB150
- ISJB175
- ISJB200
- ISJB225
- ISLB75
- ISLB100
- ISLB125
- ISLB150
- ISLB175
- ISLB200
- ISLB225
- ISLB250
- ISLB275

- ISLB300
- ISLB325
- ISLB350
- ISLB400
- ISLB450
- ISLB500
- ISLB550
- ISLB600
- ISLB600-1
- ISMB100
- ISMB125
- ISMB150
- ISMB175
- ISMB200
- ISMB225
- ISMB250
- ISMB300
- ISMB350
- ISMB400
- ISMB450
- ISMB500
- ISMB550
- ISMB600
- ISWB150
- ISWB200
- ISWB225
- ISWB250
- ISWB300
- ISWB350
- ISWB350
- ISWB400
- ISWB450
- ISWB500
- ISWB550
- ISWB550-1
- ISWB600-1
- ISWB600-2

These are the no. of beams which I have been used in the structure by auto selection method the whole structure is circulating around these sections only.

The structure stands to the overturning moment story drift & the modal participation mass ratio like results that given in IS1893-2002. The structure is good enough to stand in seismic & wind load also because of its circular or semi-circular surface but due to its C.G. issue it must design for wind load.

6.2) FUTURE SCOPE:-

i. The work can be further extended for the better idea of modeling and for more accuracy.

ii. It can also construct in high seismic zone because of its model and can be add more stories.

iii. This structure is steel structure so after its age or collapse it can also be recycled.

iv. The model can be use as residential, hotels as well as office type structure.

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vi. IS1893-2002 Criteria for Earthquake resistance design of structure.

vii. IS800-2007 for steel structure design.

viii. IS875 part-1 for dead load applied.

ix. IS875 part-2 for live load application.

x. IS875 part-3 Criteria for design of wind load.