IJMTARC – VOLUME – IX – ISSUE – 33, JAN - MAR, 2021

ISSN: 2320-1363

DESIGN AND ANALYSIS OF A MULTISTOREY BANK BUILDING

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Abstract: The essential steps of any construction advancement and organizing are drafting, dismembering, and arranging the design. In the currently extended lengths of improving science and development, examining and arranging of construction has been made basic by using ETABS programming. ETABS programming makes underlying originators make their work basic and decreases time fundamental for organizing. The endeavour going to be done is the plan of a multi-story building which will be used as a private. The construction plan has been drafted using the AutoCAD programming by the need and available zone. The super development for instance the design plot has been penniless down and arranged using the ETABS programming. In the current endeavour, the G+5 building considers examination and plan for both gravity and even (wind) stacks as indicated by Indian standards. By using the item building can be inspected and we can check for any failure in the assessment and update them, with the objective that we can thwart dissatisfactions after the turn of events. By using the yield building can be created by the arrangement.

INTRODUCTION

Improvement is a man-made arrangement with a rooftop and dividers standing in a general sense everlastingly in one spot. Plans show up in an arrangement of shapes, sizes, and works, and have been changed all through history for a wide number of regions, from building materials open to characteristic conditions, to show up expenses, ground conditions, unequivocal usages, and fun reasons. To all the in each useful sense, certain grip the term building investigates the fast chart of plans. Movements serve a few necessities of society – essentially as the protected house from the environment, security, living space, assurance, to store things, and to satisfactorily live and work. A filling in as a guaranteed about house watches out for a genuine division of the human living space (a place of comfort and prospering) and the outside (a see that every so often may be unforgiving and toxic). As far back as the central calm accommodation artful culminations, structures have similarly advanced toward winding up being things or materials of creative verbalization. Of late, energy for reasonable getting sorted out and constructing sharpens has decently changed into a deliberate piece of the framework technique for various new plans. A piece is a level two dimensional planar partner locale having thickness little veered from its other two assessments. It gives a working level surface or a covering cover in plans. It overall trades the stack by bowing a few heading. Maintained strong pieces are used in floors, roofs, and dividers of plans and as the decks of stages. The floor philosophy of an improvement can take various plans, for instance, in situ solid pieces, ribbed areas, or pre-tossed units. Pieces may be reinforced on the strong piece, steel bars, dividers, or unquestionably over the zones. Strong pieces continue essentially as

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flexural people and the layout takes after that of pieces.

STANDARD SYSTEM

The associate pieces in a typical multi-story building join a story structure that trades the floor loads to a technique of plane edges in one of the two headings. The floor structure besides goes positively as a stomach to trade commensurate loads from wind or shivers. The lodgings contain shafts and allocate conflictingly fortifies or even upheld strong shear dividers. As the stature of the course of action increases past ten stories (tall plan), it ends up crucial to diminish the greatness of the progress for both courageousness and economy

Since strong floors are on an extremely fundamental level more sensible, have less vibration regardless rather more scratched spot and robustness to fire, the standard fondness is to make them act either with profiled steel decks correspondingly besides with steel territories to give a lightweight floor structure. As such square work dividers may be taken out with covering and shades or blinds to decrease the weight. The fluctuating kinds of floors used in steel-limited plans are as shown by the going with:

Strong regions reinforced by open-web joists

Single heading and two-way invigorated strong pieces kept up on steel shafts

Strong piece and steel shaft composite floors

Precast strong piece floors.

Steel redesigns or decks are reliably joined to the joists by welding and strong pieces are poured to complete everything. This is likely the lightest sort of strong floors. For structures with light stacking.

These are on a very basic level heavier than a gigantic piece of the altogether even more cutting edge lightweight floor progressions and they put aside a more undeniable chance to grow, hence stigmatizing the conceivable augmentation of speed brand name in steel improvement. This floor structure is embraced for fundamental loads. One way pieces are used when the longitudinal reach is in any event on different events the restricted capacity to center. Single way pieces, the restricted capacity to the center is the course wherein loads get traded from a bang to the pieces. Appropriately the standard supporting bars are given along this heading. Regardless, temperature, shrinkage, and dispersing steel is given along the more drawn out bearing.

The two-way strong piece is used when the viewpoint level of the pack for example longitudinal reach/get surpass is under 2 and the part is kept up along the total of the four edges. The central help continues with running in both the course. A standard cross-area of a limited piece floor with supporting steel shafts. Moreover showed is the condition when the steel piece is encased in cement for fire security.

PLAN UNDER LATERAL LOADS

Starting late there has been a basic augmentation in the degree of tall plans, both private and business, and the forefront coast is towards taller and substantially more lamentable new turns of events. Subsequently, the effects of commensurate loads like breeze loads, shake powers and effect controls, etc, are

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moving importance and all around, each facilitator is looked at with the issue of giving exceptional quality and strength against sidelong loads. This is another improvement, as the past headway originators routinely expected for the vertical loads, and as a speculated everything considered, checked the last technique for sidelong loads as well. Generally, those improvements had sufficient quality against sidelong loads in light of different bundles and bound capacity to center and cross shafts, and no change in the arrangement was required.

As of now, the condition is striking and a conspicuous insight of the effects of level weights on a course of action and the lead of various zones under these stacks is fundamental. Shear dividers are especially addressed out of accomplice dividers weaved in the plane of the divider because of wind, shake, and various forces. The term 'shear divider' is truly overpowering other than dividers act more like flexural people. They are by and large given in tall new turns of events and have been found goliath use to keep an essential bit from all out to the front of plans under seismic forces. It is reliably fitting to go along with them in overhauls worked in zones subject to experience seismic shiver of expansive force or high breezes. Shear dividers for wind are outlined as brief strong dividers. The system of these dividers for seismic forces requires phenomenal examinations as they should be guaranteed about under accentuated troubles. Shear dividers are all things considered made of concrete or workmanship. They are customarily given between zones, in flights of stairs, lift wells, washrooms, utility shafts, etc tall plans with level pieces should ceaselessly have shear dividers. Such headways meander from connects with shafts have close to no impediment even to help even loads. From the most prompt early phase, shear dividers were used adhered fortified strong designs to spot wind powers. These came into general practice additionally as late as 1940. With the introduction of shear dividers, strong improvement can be used for tall plans moreover. Regardless, the most fundamental property of shear dividers for the seismic outline, as not really indistinct from imagining wind, is that it should have pivotal versatility under reversible and rehashed over-irritates. In figuring everything out shear dividers, we should endeavor to lessen the winding adaptable concerns considering level loads whatever amount as could sensibly be ordinary by stacking them with however much gravity controls that it can safely take. They should be correspondingly laid to keep an essential division from tensional nerves.

KINDS OF LOADS

The plans are familiar with both vertical and level loads. At the key chart set up the whole of the pieces of plans are foreseen vertical burdens as it's been said. Ideally, a gifted system should not need an advancement in the degrees of people when the effect of for all intents and purposes indistinguishable weight is other than interweaved. Such facilitators are known as 'staggering free' coordinators and maybe clear to achieve.

WIND LOADS

A mass of air moving at a specific speed has a captivating centrality to 1/2MV*V, where M and V are the mass and speed of air being made. Unquestionably when a check like improvement is met in its way, a piece of the extraordinary enormity of air being made gets changed over to anticipated centrality of weight. The certified force of wind weight relies upon various parts like the edge of a repeat of the breeze, savagery of the joining zone,

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impacts of readiness highlights, i.e., state of the unforeseen development, and so on and level deterrent of the plan. Adjoining these, the best plan wind weight relies upon the length of the effects and the likelihood of event of an uncommon breeze weight. Regardless, for a tremendous piece of the unforeseen developments, the breeze weight, picked in the code (Indian Standards, I.S 875-1964) are all through adequate.

In each tall and slight turn of events (not basic in India) streamlined weakness may make. This is an unavoidable aftereffect of the course that amidst a breeze storm the advancement is continually struck by effects and starts vibrating in its fundamental mode. On the off chance that the centrality ate up by the arrangement is past what the imperativeness it can scatter by head damping, the abundance of the vibration continues making till disillusionment happens. An obvious report kept up through air stream tests is consistently focal in these cases. Some basic pieces of information about stunning breeze stacks on the game plan have been by Davenport.

SEISMIC QUAKE LOADS

A seismic shudder (despite called a shudder, shake, or shiver) is the outcome of a sudden appearance of centrality in the Earth'scrust that makes seismic waves.
Shakes are surveyed utilizing experiences from seismometers. The resulting size is the most wonderful scope on which seismic shudders more critical than around 5 are kept an eye on the whole globe. Degree 3 or lower shakes are throughout appropriately unimportant or sensitive and sizes 7 and over perhaps cause affirmed wickedness over more basic areas, subordinate upon their importance. The best shakes on basic occasions have been of importance truly more than 9, regardless of the course that there is no prerequisite to the conceivable degree. The latest epic seismic tremor of size 9.0 or more fundamental was a 9.0 size shake in Japan in 2011 (as of October 2012), and it was the best Japanese seismic shudder since records started. The force of shaking is outlined on the changed Mercalli scale. The shallower a shake, the more underhandedness to structures it causes, all else being the same.

SIMILAR LOAD RESISTING UNITS

Right when everything is said in done sheer divider structures, undoubtedly some other plan, is expected to fulfill in the head associate and working necessities. The accomplice necessities are:

Quality

Faithfulness

Strength

The made arrangement ought to be adequately solid to withstand the whole level weights without abundance bendings or shirkings and ought to be under the best-demonstrated bothers.
The sidelong avoiding of the working under most incredible weight is to be controlled to a guaranteed about the line. Driving social event of trustees 435 sponsorships a redirection cutoff of 1/500 of the stature for tall plans. The experience that plans proposed to fulfill this standard attestation the solace of the occupation and the endurance of the improvement with everything considered. Three kinds of units are for the most part utilized for restricting the sidelong loads.

These are:

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Lodgings

Shear dividers

Chambers

Unfaltering edges have been utilized in the past for tall plans are so far utilized around unequivocal statures. In any case, they are not amazingly significant for level loads and are being eliminated by sheer dividers and chambers for taller new developments.

ETABS

Over the most recent 30 years, TABS and ETABS have set the overall guidelines in partner assessment and diagram. They structure the starting considered the brand name properties of an improvement's numerical model, consequently permitting the graphical production of an arrangement's

The most recent contrast in ETABS proceeds in that show, joining assistant part communicating that is utilized once dependably (Columns, Beams, Bracings, Shear Walls, and so forth), rather than the conventionally hid putting together activities that usage terms, for example, focus, individuals, and so on Furthermore, it offers unmistakable changed cutoff focuses concerning the strategy, assessment and outline of the partner framework in a beneficial, quick and direct way. The client can without a thoroughly staggering stretch make a model, apply such a store to it, and after that misuse, the upheld farthest reaches of ETABS exaggerate out a beginning or craftsmanship appraisal and plan. ETABS is the methodology, regardless of whether you are arranging a reasonable 2D bundling or playing out an astonishing appraisal of a sporadic skyscraper that uses non-direct dampers for between story skims control.

ZONES OF APPLICATION

- Analysis and plan of building structures with an essential framework containing sections, oddities, pieces, shear dividers, and bracings.

- Easy and changed time of gravity and level weights (seismic and wind loads) when secluded and other FE general examination programs

Central center interests

- Graphic information and changing for clear and lively model age

- 3D model through framework perspectives and rises

Sharp model age utilizing the chance of Similar stories

- Easy changing through the Move, Merge, Mirror, and Copy course

- Accuracy in assessments by utilizing Snaps (end, reverse, center, and so forth)

- 3D axonometric perspective of the model, plan to see, rise to see, rise progress see, custom view depicted by the client

- Graphic commitment of cross parts of any check and material (Section Designer)

- Copy and Paste the math of a model to and from accounting pages

- Export of the model math to .dxf reports

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- Integration with STEREOSTATIKA for away from of model evaluation and plan of RC structures as per Greek Code

- Integration with SAP2000 for 3D assessment and design of partner parts including ranges, dams, tanks, and plans

OBJECTIVE

The standard purpose of assembly of this evaluation is to see different limits that affected the level pieces. Evaluation and Design of Multi Storeyed Residential Building using ETABS.The ETABS stays for expanded 3D appraisal for building structure. This depends on the strength association and kept part based programming. The evaluation and strategy are done to fulfill the total of the checks as shown by Indian measures. At long last information, the base is set up for different head reactions.

LEVEL OF WORK

The appraisal is executed for the Analysis and Design of Multi Storied Residential constructions using ETABS. The improvement is isolated for both gravity and even loads (seismic and wind loads). The individual accomplice isolates are anticipated most discernibly horrible weight blends.

LITERATURE REVIEW

Youssef (2001) has made a Seismic framework and evaluation of underground unexpected turns of events. Underground workplaces are a standard piece of the progression of present-day society and are used for a wide blend of livings, including metros and rail lines, streets, material supervising, and sewage and water transportation. Underground stations worked in zones subject to shudder improvement should withstand both seismic and static stacking. When in doubt, underground workplaces have encountered a lower speed of mischief than surface frightening new turns of events. After an unobtrusive, very few underground redesigns have encountered significant hurt in propelling expansive shakes, accounting for the 1995 Kobe, Japan seismic shiver, the 1999 Chi-Chi, Taiwan shudder, and the 1999 Kocaeli, Turkey tremor shiver. This report shows a diagram of the current status of seismic assessment and a game plan for underground new turns of events. This report portrays approaches used by engineers in assessing the shake sway on an underground strategy. Deterministic and probabilistic seismic danger evaluation approaches are delineated. The improvement of fitting ground headway limits, including top invigorating, target response spectra, and ground progress time accounts, is speedily depicted.

M. Kutanis (2002) has followed shudder evaluation of building structures with foundation move in midtown Adapazarı. The head objective of this assessment is to investigate the effect of foundation versatility and derrick on the seismic response of building structures designed in midtown Adapazari, where gigantic geotechnical impacts occurred in the midst of the shiver. To play out the appraisal, the pivotal data about the earth conditions at the site was gathered from soil assessment reports that were empowered by various government affiliations, neighbourhood open bodies, and private assistants. The geotechnical show joined a nonlinear depiction of the earth material under the pack foundation. This foundation model could suit both lift and plastic yielding of the earth material. The superstructure was viewed as a common R/C method structure

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familiar with the E-W part of the 17 August 1999 Marmara seismic shake recorded at SKR station in Adapazari. The makers played out the assessment using the nonlinear PC program Drain-2DX.

Kiyoshi has followed seismic assessment of kept up strong startling new development. Open rectangular solid edges are the most solid advancement part seeing that usable space is concerned. In any case, because of the suitable farthest reaches of evaluations, an accommodating square against indistinct force can't be ordinary basically especially in multi-saw levels of progress. The crucial norm of the staggering variable evaluation is to sensible commensurate shear at any one story to the invalidating segments of the story. This undertaking is made in the degree to the D-values, improvement coefficients, of the parts.

Evaporate Fajfar (2000) has sought after A Nonlinear Analysis Method for Performance-Based Seismic Design. A fittingly quick nonlinear procedure for the seismic assessment of structures (the N2 framework) is presented. It joins the weakling evaluation of a multidegree-of-freedom (MDOF) show with the response range examination of a practically identical single-level of-flexibility (SDOF) structure.

MODELING OF THE STRUCTURE GENERAL

R.C moment resisting frame structure having G+5 storey is analysed for garvity and latral load (earth quake and wind loads). The effect of axial force, out of plane moments, lateral loads, shear force, storey drift, storey shear and tensile force are observed for different stories. The analysis is carried out using ETABS and data base is prepared for different storey levels as follows.

MODELLING OF R.C MOMENT RESISTING FRAME STRUCTURE

In this present study G+5 Bank building is considered. The constriction Technology is R.C.C frame structure and slabs. The modelling is done in ETABS as follows.

- The structure is divided into beam and column elements.
- The nodes are created as plan architect plan and node are connected through beam command, columns also connected.
- Boundary conditions are assigned to the nodes wherever it is required. Boundary conditions are assigned at the bottom of the structure i.e., at ground level where restraints should be against all movements to imitate the behavior of structure.
- The material properties are defined such as mass, weight, modulus of elasticity, Poisson's ratio, strength characteristics etc. The material properties used in the models.
- The geometric properties of the elements are dimensions for the section.
- Elements are assigned to structure.
- Loads are assigned to the joints as they will be applied in the real structure.

The model should be ready to be analysed forces, stresses and displacements

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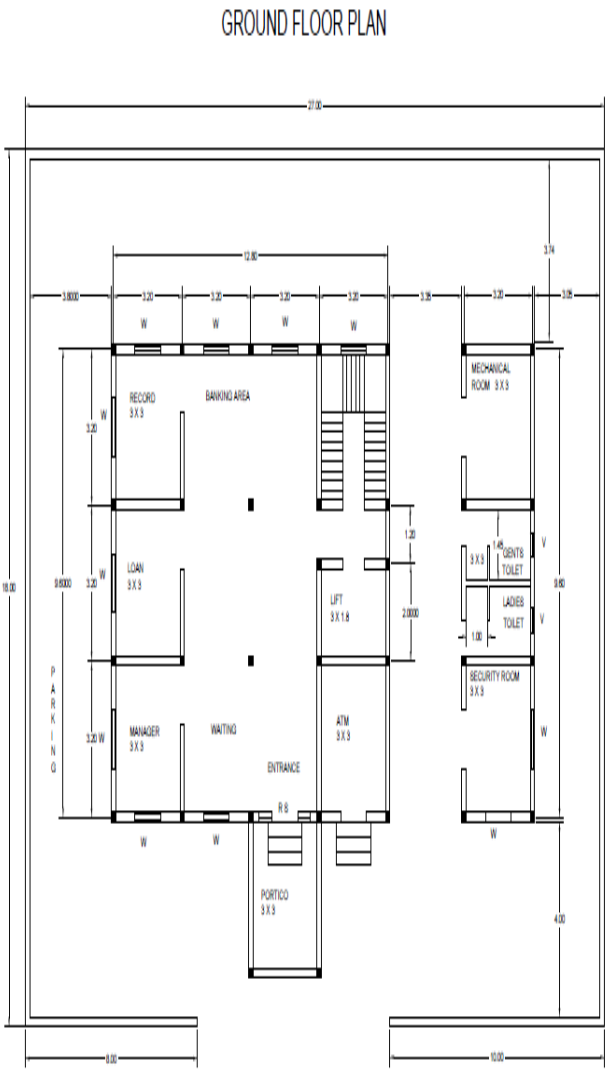

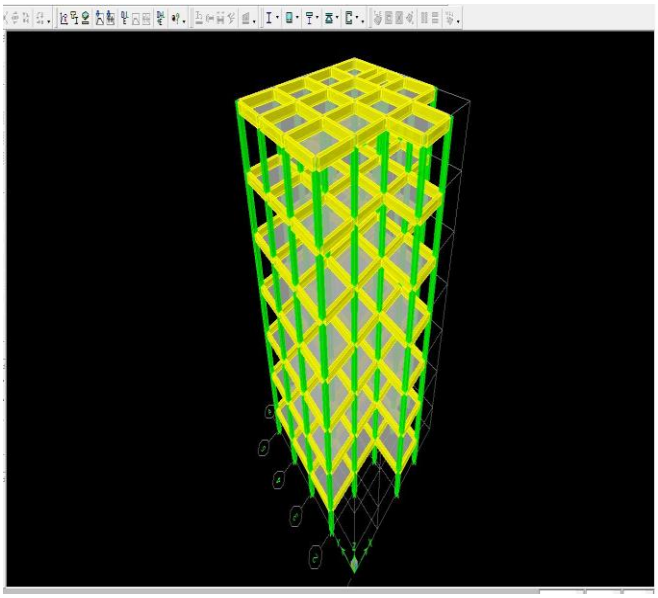

Fig: 3D view of the structure

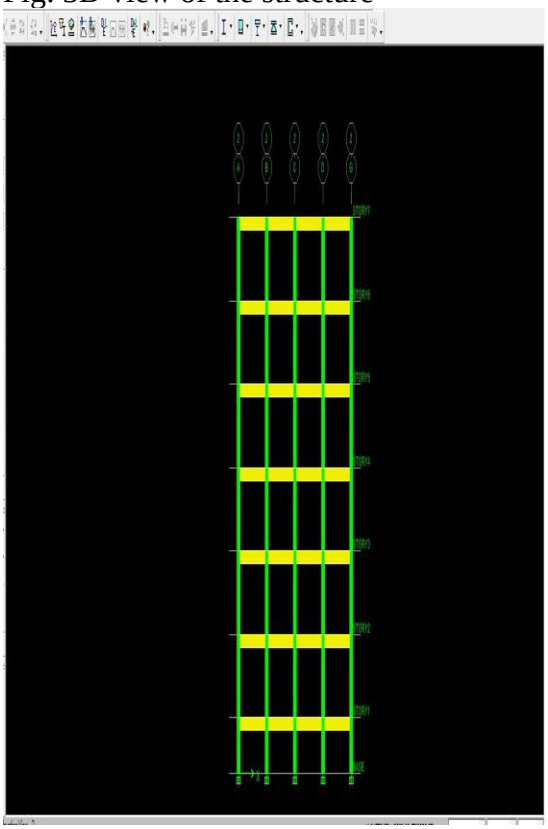

Fig: Elevation of the structure

ANALYSIS AND RESULT

GENERAL

Structure having G+5 storey is analysed for garvity and latral loads (sesimic and wind load). The effect of axial force, out of plane moments, lateral loads, shear force,

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storey drift, storey shear and tensile force are observed for different stories. The analysis is carried out using ETABS and data base is prepared for different storey levels as follows.

LOAD CASES AND LOAD COMBINATIONS

In this present work consider both gravity and lateral load case (SESIMIC AND WIND). The load combinations as per the Indian standards are considered. The primary load cases and the load combinations are shown following tables respectively.

DESIGN WIND SPEED (Vz)

The basic wind speed (V_b) shall be modified to include the following effects to get design wind velocity at any height (V_z) for the chosen structure

- Risk level
- Terrain roughness, height and size of structure and
- Local topography.

It can be mathematically expressed as follows:

$$V_z = V_b K_1 K_2 K_3$$

Where

V_Z = design wind speed at any height z in m/s;

K_1 = probability factor (risk coefficient)

K_2 = terrain, height and structure size factor and

K_3 = topography factor

BASIC WIND SPEED AT 10 m HEIGHT FOR SOME IMPORTANT CITIES/TOWNS

City/Town	Basic Wind Speed (m/s)
Agra	47
Ahmadabad	39
Ajmer	47
Almora	47
Amritsar	47
Asansol	47
Aurangabad	39
Bahraich	47
Bangalore	33
Barauni	47
Bareilly	47
Bhatinda	47
Bhilai	39
Bhopal	39
Bhubaneshwar	50
Bhuj	50
Bikaner	47
Bokaro	47
Bombay	44
Calcutta	50
Calicut	39
Chandigarh	47
Coimbatore	39
Cuttack	50
Darbhanga	55
Darjeeling	47
Dehra Dun	47
Delhi	47
Durgapur	47
Gangtok	47
Gauhati	50
Gaya	39
Gorakhpur	47
Hyderabad	44
Imphal	47
Jabalpur	47
Jaipur	47
Ja.mshedpur	47
Jhansi	47

City/Town	Basic Wind Speed (m/s)
Jodhpur	47
Kanpur	47
Kohima	44
Kurnool	39
Lakshadweep	39
Lucknow	47
Ludhiana	47
Madras	50
Madurai	39
Mandi	39
Mangalore	39
Moradabad	47
Mysore	33
Nagpur	44
Nainital	47
Nasik	39
Nellore	50
Panjim	39
Patiala	47
Patna	47
Pondicherry	50
Port Blair	44
Pune	39
Raipur	39
Rajkot	39
Ranchi	39
Roorkee	39
Rourkela	39
Simla	39
Srinagar	39
Surat	44
Tiruchchirrappalli	47
Trivandrum	39
Udaipur	47
Vadodara	44
Varanasi	47
Vijaywada	50
Visakhapatnam	50

DESIGN WIND PRESSURE

The design wind pressure at any height above mean ground level shall be obtained by the following relationship between wind pressure and wind velocity.

$$p_z = 0.6\, V_z^2$$

Where

- P_z = Design wind pressure in N/m^2 atheight z, and
- V_z=design wind velocity in m/s at height 2.

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NOTE - The coefficient 0'6 (in SI units) in the above formula depends on a number of factors and mainly on the atmospheric pressure and air temperature. The value chosen corresponds to the average appropriate Indian atmospheric conditions.

Wind Load on Individual Members

When calculating the wind load on individual structural elements such as roofs and walls, and individual cladding units and their fittings, it is essential to take account of the pressure difference between opposite faces of such elements or units. For clad structures, it is, therefore, necessary to know the internal pressure as well as the external pressure. Then the wind load, **F,** acting in a direction normal to the individual structural element or cladding unit is

$$F = (C_{pe} - C_{pi})\, AP_a$$

Where

C_e = external pressure coefficient,

C_i = internal pressure- coefficient,

A = surface area of structural or cladding unit, and

P_d = design wind pressure element

Fig: *Bending moment Diagram*

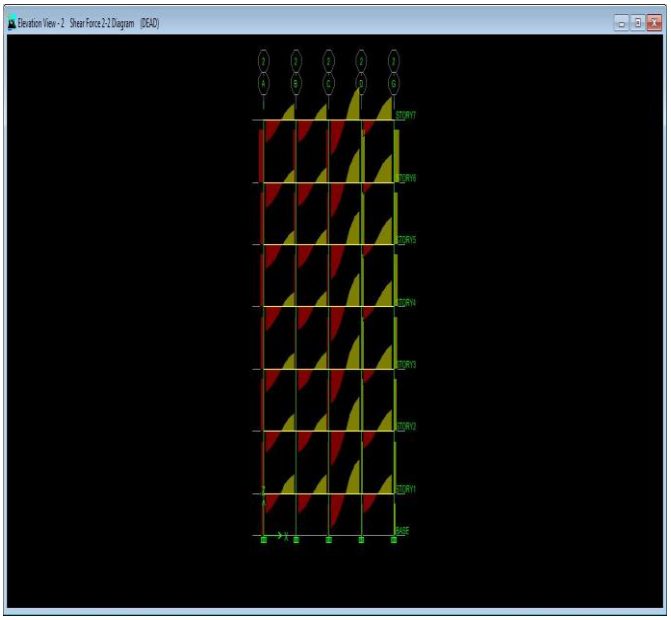
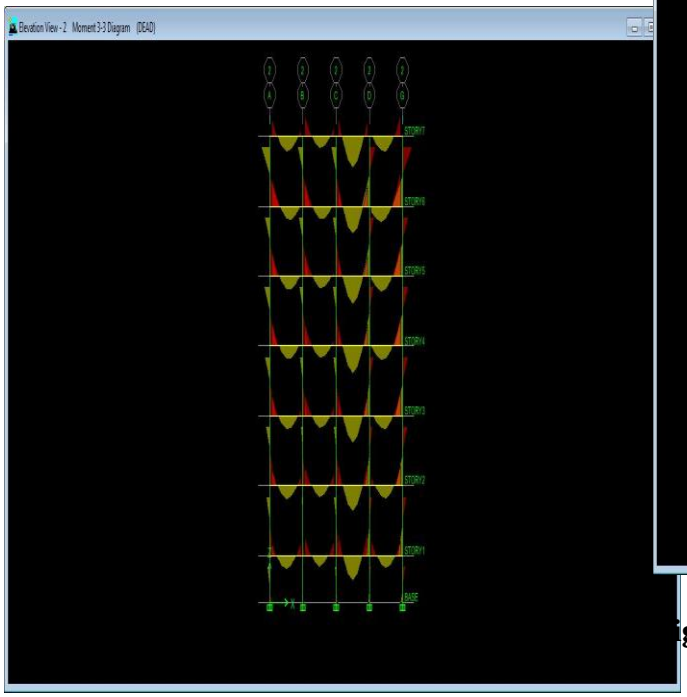
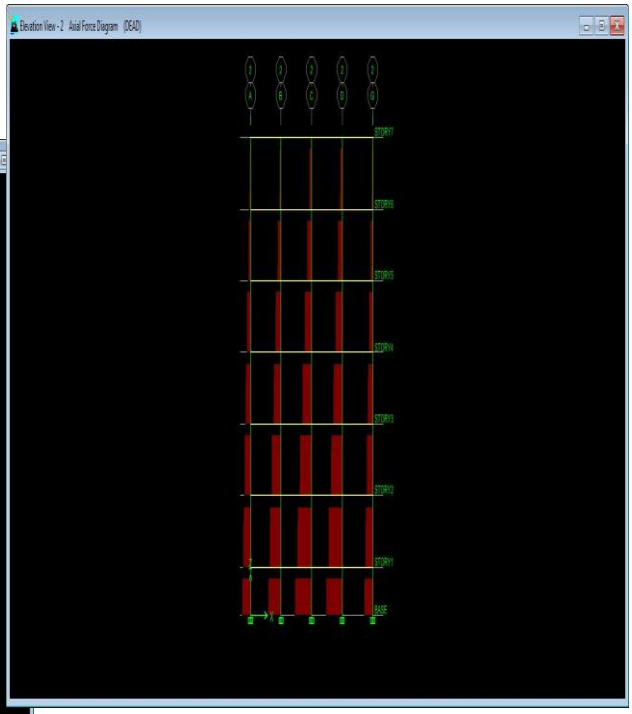


Fig: Shear Force moment Diagram





g: Axial Force Diagram

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CENTERS OF CUMULATIVE MASS CENTERS OF ROGIDITY

Story	Diaphragm	MassX	MassY	XCM	YCM	CumMassX	CumMassY	XCCM	YCCM	XCR	YCR
STORY7	D1	259.03	259.03	6.589	7.453	259.0287	259.0287	6.59	7.45	7.13	7.52
STORY6	D1	367.02	367.02	6.626	7.419	626.0467	626.0467	6.61	7.43	7.13	7.5
STORY5	D1	367.02	367.02	6.626	7.419	993.0647	993.0647	6.62	7.43	7.13	7.49
STORY4	D1	367.02	367.02	6.626	7.419	1360.0828	1360.083	6.62	7.43	7.13	7.48
STORY3	D1	367.02	367.02	6.626	7.419	1727.1008	1727.101	6.62	7.42	7.13	7.47
STORY2	D1	367.02	367.02	6.626	7.419	2094.1188	2094.119	6.62	7.42	7.1	7.45
STORY1	D1	359.95	359.95	6.62	7.42	2454.0731	2454.073	6.62	7.42	7.03	7.41

BUILDING MODES AND TIME PERIOD

MODE NUMBER	TIME PERIOD (SECOND)
1	1.9309
2	1.4671
3	1.3254
4	0.6652
5	0.5043
6	0.4486
7	0.3850
8	0.2927
9	0.2611
10	0.2587

STOREY DRIFT ENVELOPS

Storey	Direction	Max drift
Storey 07	X	0.00121
Storey 07	Y	0.00222
Storey 06	X	0.00129
Storey 06	Y	0.00236
Storey 05	X	0.00136
Storey 05	Y	0.00249
Storey 04	X	0.00141
Storey 04	Y	0.00261
Storey 03	X	0.00145
Storey 03	Y	0.00271
Storey 02	X	0.00145
Storey 02	Y	0.00274
Storey 01	X	0.0012
Storey 01	Y	0.00222
Plinth	X	0.00054
plinth	Y	0.00071

Conclusions

Design for Flexure:

Maximum sagging (creating tensile stress at the bottom face of the beam) and hogging (creating tensile stress at the top face) moments are calculated for all active load cases at each of the above mentioned sections. Each of these sections are designed to resist both of these critical sagging and hogging moments. Where ever the rectangular section is inadequate as singly reinforced section, doubly reinforced section is tried.

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Design for Shear:

Shear reinforcement is calculated to resist both shear forces and torsional moments. Shear capacity calculation at different sections without the shear reinforcement is based on the actual tensile reinforcement provided by ETAB program. Two-legged stirrups are provided to take care of the balance shear forces acting on these sections.

Beam Design Output:

The default design output of the beam contains flexural and shear reinforcement provided along the length of the beam.

Column Design:

Columns are designed for axial forces and biaxial moments at the ends. All active load cases are tested to calculate reinforcement. The loading which yield maximum reinforcement is called the critical load. Column design is done for square section. Square columns are designed with reinforcement distributed on each side equally for the sections under biaxial moments and with reinforcement distributed equally in two faces for sections under uni-axial moment. All major criteria for selecting longitudinal and transverse reinforcement as stipulated by IS: 456 have been taken care of in the column design of ETABS

BIBLIOGRAPHY

We have used a number of books and code as a reference for carrying out this project work. Some of the books (s) that we refer are mentioned below.

INDIAN STANDARD CODE

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- IS CODE 875-1987 PART II
- IS CODE 875-1987 PART III
- DESIGN AIDS TO IS -456-2000 (SP 16)
- ARRANGEMENT OF REINFORCEMENT USING SP 34

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