

Effect of Shear Wall Location On Storey Drift of Buildings Using ETABS

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Abstract— The layout planning is a part of urban development it includes planning of residential houses, commercial complexes, service roads, primary health centers, school...& other amenities sewerage system for whole layout (includes treatment, sewer line, storm water drains), water distribution system. This project includes design& estimation of residential building in plot of layout planned. Designing involves identifying the loads which act upon a structure and the forces and stresses which arise within that structure due to those loads, perform analysis to get moments and shear forces on different elements of the structure and then design the structure for ultimate loads and moments. The loads can be self-weight of the structures, other dead loads, live loads, moving (wheel) loads, wind load, earthquake load, load from temperature change etc. Estimation includes finding the quantities of materials required for the construction of the structure and requirements of labor etc., finally determining the overall cost of the structure before execution of work by using Auto cad. Structural engineers are facing the challenge of striving for the most efficient and economical design with accuracy in solution, while ensuring that the final design of a building must be serviceable for its intended function over its design lifetime. This project attempts to understand the structural behavior of various components in the multi-storied building. Analysis, designing and estimation of multi-storied building has been taken up for Basement+G+2 Building, thereby depending on the suitability of plan, layout of beams and positions of columns are fixed. Dead loads are calculated based on material properties and live loads are considered according to the code IS875-part 2, footings are designed based on safe bearing capacity of soil. For the design of columns and beams frame analysis is done by limit state method to know the moments they are acted upon. Slab designing is done depending upon the type of slab (one way or two way), end conditions and the loading. From the slabs the loads are transferred to the beams, thereafter the loads from the beams are taken up by the columns and then to footing finally the section is checked for the components manually and for the post analysis of structure, maximum shear force, bending moment and maximum story displacement are computed. The quantitative estimation has been worked out. All the drafting was done using Auto cad.

Keywords— Smart Footwear, Blind Navigation, Assistive Wearable Technology, Obstacle Detection, Ultrasonic Sensor, Accessibility

I. INTRODUCTION

Structural analysis means determination of the general shape and all the specific dimensions of a particular structure so that it will perform the function for which it is created and will safely withstand the influences which will act on it throughout its useful life.

Due to concentration and increase of population into urban cities, there is a need to accommodate the influx in urban cities. However, due to rapid increase of land cost and limited availability of land, constructions of Multi-storied buildings is taking part in our daily life. A multi-storied is a building that has multiple floors above ground in the building. Multi-storied buildings aim to increase the floor Area of the building without increasing the area of the land, the building is built on and

hence saving land and in most cases money (depending on material used and land prices in the area). The design process of multi storied building requires not only imagination and conceptual thinking but also sound knowledge of science of structural engineering. In the present study Basement+G+2 building is considered for the analysis of building using Auto cad software.

The project deals with the planning and designing of building of reinforced concrete framed structure using IS 456:2000 code. IS 456:2000 is the basic code for general construction in concrete structures, hence all the structural members are designed using limit state method in accordance with the IS 456:2000 code. The planning of any building in India will recognized by national building code (NBC) [1]. Hence the building is planned in accordance with the NBC.

Load consideration is in accordance with IS 875-part2. Modeling of the building is done and is analyzed to get the deformation, bending moment, shear force and area of steel requirement. Structural members like slab, beam, column and footing are designed manually based on the values of bending moment and shear force obtained

II. METHODOLOGY

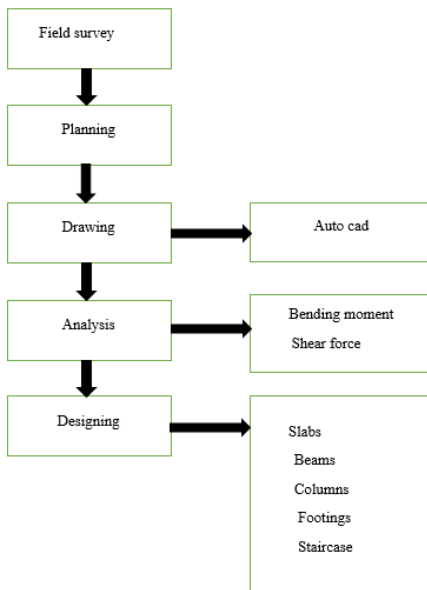


Figure.8 Footing

III. DESIGN OF FOOTING

Data:

Assume SBC of soil = 200 KN/m²
 Reinforcement concrete column size = 200x300
 Axial service load P= 400 KN
 Adopt M20 and Fe415

Step-1 Calculation of load:

Load on column = 400 KN
 Self wt. of footing =- 10% of column = 400 x (10/100) = 40 KN
 Total load = 440 KN
 Factored load = wu = 1.5 x 440 = 660 KN

Step-2 Area of footing:

= load(without factor)
 SBC of soil
 = 440
 200
 = 2.2 m²
 Assuming square footing,
 Size of footing = $\sqrt{2.2}$ = 1.45 m
 Adopt size of footing = 1.5 m x1.5 m

Step-3 Net upward pressure:

Pnu = factored load
 Actual area of footing
 = 660
 1.5x1.5
 = 293.33 KN/m²

Step-4 Bending moment calculations:

Maximum bending moment will be on the face of the column,
 $M = F \times \text{distance of center of gravity}$
 = (area x stress) x (0.65/2)
 = 92.95 KN-m

Step-5 Depth of footing:

required = $\sqrt{Mu / 0.138fckb}$
 = $\sqrt{92.95 \times 10^6 / 0.138 \times 20 \times 200}$
 required = 410.35 mm
 Adopt 420 mm
 Assume cover= 60 mm
 Thus, overall depth = 420+60 = 480 mm

Step-6 Main steel calculations:

$A_{st} = 0.5(f_{ck}/f_y)[1 - \sqrt{1 - \{(4.6 \times Mu)/(f_{ck}bdx^2)\}}]bdx$
 = $0.5(20/415)[1 - \sqrt{1 - \{(4.6 \times 92.95 \times 10^6)/(20 \times 1500 \times 420^2)\}}]1500 \times 420$
 $A_{st} = 623.18 \text{ mm}^2$

$A_{st\ min} = 0.0012 \times 1500 \times 480 = 864\ mm^2$

Use $A_{st\ min} = 864\ mm^2$

provide 10 mm dia@100 c/c in each direction at bottom of footing i.e. 12 nos

Step-7 Check for shear:

The critical section will be at a distance (d/2) from column face

Here, area = $[B^2 - (b+d)^2]$

Shear force = stress x area

$$= 293.33 \times \{1.52 - [(0.2 + 0.42) \times (0.3 + 0.42)]\}$$

$$= 529.05\ KN$$

Shear stress $\tau_v = V/bod$

$$= 529.05/1 \times 0.42$$

$$\tau_v = 1260\ KN/m^2$$

$$\tau_v = 0.00126\ N/mm^2$$

Here b_o – perimeter = $2(l + b) = 2(0.2 + 0.3) = 1\ m$

Permissible shear stress = $0.25\sqrt{f_{ck}}$

$$= 0.25\sqrt{20}$$

$$= 1.11 > \tau_c$$

OK safe.

IV. BUILDING REQUIREMENTS

Doors

Door is a movable barrier secured in a wall opening.

Functions:

They admit ventilation and light.

Controls the physical atmosphere within a space by enclosing it, excluding air draft, so that interior may be more effectively heated or cooled.

They act as a barrier to noise.

Used to screen areas of building for aesthetic purpose, keeping formal and utility areas separate.

Location of Door In Building:

The number should be kept as minimum.

It should meet the functional requirement.

It should preferably located at the corner of the room, nearly 20 cm from corner.

If in a room, more than two rooms are there, they shall be located facing each other.

Windows And Ventilation:

In some parts of country, where temperature and humidity levels permit, natural ventilation through operable windows can be an effective and energy efficient way to provide outside air ventilation, cooling and thermal comfort when conditions permit (e.g., temperature, humidity, outdoor air pollution levels,

precipitations). Windows that open and close can enhance occupant's sense of well-being and feeling of control over their environment. They can also provide supplemental exhaust ventilation during renovation activities that may introduce pollutants into the space.

Ventilation is the intentional introduction of outdoor air into a space and is mainly used to control indoor air quality by diluting and displacing indoor pollutants, it can also be used for purpose thermal comfort or dehumidification.

Ventilation moves outdoor air into a building or a room, and distributes the air within the building or room. The general purpose of ventilation in a building is to provide healthy air for breathing for both diluting the pollutants originating in the building and removing the pollutants from it.

Cabinet

Kitchen cabinet are built in furniture installed in many kitchens for storage of food, cooking equipment and often silverware and dishes for table service. Appliances such as refrigerators, dish washers, and oven are often integrated into kitchen cabinetry. There are many options for cabinets at present. However, most commercial cabinets have sides, backs and bottom are made of a ply wood or particle board.

Flooring

Flooring is the general term for a permanent covering of a floor, or for the work of the installing such as the floor covering. Floor covering is the term to generically describe any material applied over a floor structure to provide a walking surface. Both terms are used interchangeably but floor cover repairs more to loose-laid materials.

Materials almost always classified as flooring include carpet, laminate, tile and vinyl.

The choice of material for floor covering is affected by factor such as cost, endurance, noise insulation, comfort and cleaning effort. Some type of flooring must not be installed below grade, including laminate and hardwood due to potential damage from moisture.

Tiling:

A tile is the thin object usually square or rectangular in shape. A tile is a manufactured piece of hardwearing material such as ceramic, stone, metal, baked clay, or even glass, generally used for covering roofs, floors, walls or other object such as table tops.

Tiles are most often made of ceramic typically glazed for internal users and unglazed for roofing, but other materials are also commonly used, such as glass, concrete and other composite materials. Tiling stone is typically marble, granite or slate. Thinner tiles can be used on walls and then on the floors, which require more durable surface that will resist impacts.

Plumbing:

Plumbing is any system that conveys fluids for a wide range of applications. Plumbing uses pipes, valves, plumbing fixtures, tanks and other apparatuses to convey fluids. Heating and cooling, waste removal and potable water delivery are among the most common users for plumbing, but it is not limited to these applications.

In the developed world, plumbing infrastructure is critical to public health and sanitation. Water pipe is a pipe or tube, frequently made of plastic or metal that carries pressurized and treated fresh water to a building, as well as inside the building.

Electrical System:

Electrical systems in these buildings begin at a step-down transformer provided by the utility company and located within or very close to the building. The transformer reduces the standard line potential to two dual voltage systems, which then pass through master switches and electric meters to record the subscriber's usage.

Lighting in this building is predominately fluorescent. Lamps range in size and wattage, and the available colors can range from warm white to cool white. Different lamps of lamps are used in variety of fixtures to produce different lighting conditions.

Plaster Work:

Plasterwork refers to construction or ornamentation done with plaster, such as a layer of plaster on an interior or exterior wall structure, or plaster decorative molding on ceilings or walls. The process of creating plasterwork, called plastering or rendering, has been used in building constructions for centuries.

Tools and Materials:

Tools and materials includes trowels, floats, hammers, screeds, hawk, scratching tools, utility knives, laths, lath nails, lime, sand, plaster of paris, a variety of cements, and various ingredients to form color washes.

Coats:

Plasters are applied in successive coats or layers on walls and gains its name from number of these coats.

One coat work is the coarsest and cheapest class of plastering, and is limited to inferior buildings, such as outhouses, where merely a rough coating is required to keep out the weather.

Two coat work is often used for factories or ware houses and the less important rooms of residences.

Three coat work is usually specified for all good works. It consists as its name implies, of three layers of materials, and is described as render, float and set on walls and lath, plaster, float and set, or lath, lay, float and set, on lath work. This makes a strong, straight, sanitary coating for walls and ceilings.



Figure. 9 Plastering

Insulation:

Building insulation is any object in a building used as insulation for any purpose. While the majority of insulation in buildings is for thermal process, the term also applied to acoustic insulation, fire insulation and impact insulation. Often an insulation material will be chosen for its ability to perform several of these functions at once.

Paint:

Paint is any pigmented liquid, liquefiable or mastic composition that, after application to a substrate in a thin layer, converts to a solid film. It is most commonly used to protect, color, or provide texture to objects.

Paint can be applied as a solid, a gaseous suspension or a liquid. Techniques vary depending on the practical or artistic results desired.

As a solid, the paint is applied as a very fine powder, then baked at high temperature. This melts the powder and causes its adhere to the surface.

As a gas or as a gaseous suspension, the paint is suspended in solid or liquid form in a gas i.e., sprayed on an object.

Modifications:

Modification requests must be based on practical difficulty in achieving code conformance and should include alternative methods and/or materials that would provide an equivalent level on safety and protection. A self-imposed hard ship generally will not be accepted as a basis.

V. DRAWINGS



Figure. 10 EXCAVATION



Figure. 11 FOOTING



Figure.12 PLASTERING



Figure. 13 BEAMS



Figure. 14 STAIRCASE



Figure. 15 BUILDING

VI. CONCLUSION

This project includes the layout of G+2 residential building using AutoCAD, Construction and Design, Planning.

The layout of the proposed G+2 residential building is based on a plot of size 20 m x 20 m located at Attapur, Mehdipatnam. The ground floor of the building will be used as parking while the remaining 2 floors will be divided into 12 flats. Each flat is of 1BHK configuration. All the drafting was done using AutoCAD.

The design of the entire structure has been completed using Auto cad. The results include the various forces acting on various members as well various schedules for various members. Also using the software we got the concrete take-off as well as the weight of the various reinforcement bars. The foundation has been designed as an isolated footing using soil condition as medium.

The cost estimate for the project has been calculated using Microsoft Excel.

In this report, a design of multistory building for residential purpose is presented. We have successfully completed the planning and designing of multistory (G+2) structure.

The main key features of project are as follows:

Plot size = 20 m x 20 m

Total construction area = 65% of plot size

Total number of 1BHK flats = 12

We can conclude that there is difference between the theoretical and practical work done. As the scope of understanding will be much more when practical work is done. As we get more knowledge in such a situation where we have great experience doing the practical work.

Knowing the loads we have designed the slabs depending upon the ratio of longer to shorter span of panel. In this project we have designed slabs as two way slabs depending upon the end condition, corresponding bending moment. The coefficients have been calculated as per I.S. code methods for corresponding l_x/l_y ratio. The calculations have been done for loads on beams and columns and designed frame analysis by moment distribution method. Here we have a very low bearing capacity, hard soil and isolated footing done.

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