Analysis And Design of Commercial Building

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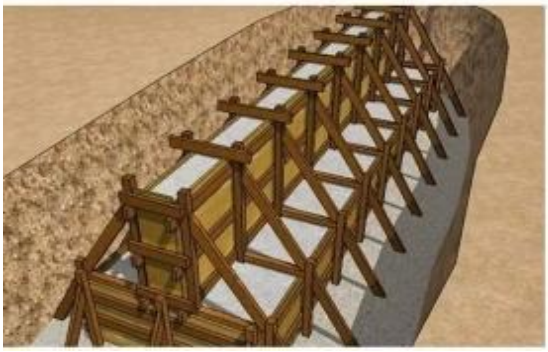
***Abstract*—The primary objective of the project is to gain sufficient knowledge in planning, analysis, and design of building. The main purpose of this project is to satisfy the commercial needs of the people. In this project briefly studying about the planning, analysis and design of commercial building. The plan of the commercial building is done by using AUTO CAD software. The analysis of the structure is done by using STAAD Pro. With reference to IS456:2000 code of practice for plain & reinforced cement concrete. The design of RCC slab, column, beam, footing, staircase, septic tank and water tank is based on limit state design as per IS 456:2000 code book. The analysis of the structure is also done by the Kani's method and compared with the STAAD Pro.**

***Index Terms*— Auto Cad software, Staad Pro, RCC slab, column, beam, footing, staircase, septic tanki.**

I. INTRODUCTION

The term building in Civil Engineering is used to mean a structure having various components like foundation, walls, columns, floors, roofs, doors, windows, ventilators, stairs lifts, various types of surface finishes etc. Structural analysis and design are used to produce a structure capable of resisting all applied loads without failure during its intended life.
The aspect of city planning in the recent years has become much more complicated than it was before. The developments that are taking place in various fields are, either directly or indirectly, insisting on rapid urbanization, thereby causing the problem. Land cost in the cities is touching sky, enforcing the vertical expansion of all types of buildings. In this project analyzed the structure by considering all
appropriate loads as per Indian standards and requirements of building. This will reduce the chance of failure of the structure. An analyzed structure by used STAAD pro. This will reduce the effort and saves the times. This will help in giving accurate results. The scope of our project is done for stability analysis of Commercial building subjected to wind load, seismic load, live load, dead load, the analysis is done for stresses bending moments, deflections, shear force and volume of concrete as per methodology. a Commercial Building G+5 using AUTO CADD and STAAD PRO The main objective of the work is to plan, Design and Analysis.A strip footing is provided for a load-bearing wall. A strip footing is also provided for a row of columns which are so closely spaced that their spread footings overlap or nearly touch each other. A strip footing is also known as continuous footing.

Construction of Strip Footing

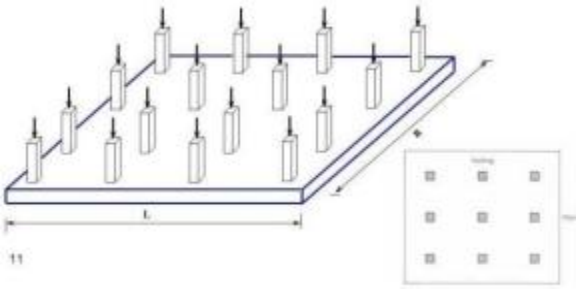


A spread footing (or isolated or pad) footing is provided to support an individual column. A spread footing is circular, square or rectangular slab of uniform thickness.

A combined footing supports two columns. It is used when the two columns are so close to each other that their individual footings would overlap. A combined footing may be rectangular or trapezoidal in plan.

A strap (or cantilever) footing consists of two isolated footings connected with a structural strap or a lever. The strap connects the two footings such that they behave as one unit.

A mat or raft foundation is a large slab supporting a number of columns and walls under the entire structure or a large part of the structure. A mat is required when the allowable soil pressure is low or where the



Deep foundations are founded too deeply below the finished ground surface for their base bearing capacity to be 'affected by surface conditions. this is usually at depths>3 m below ground level.

These are hollow substructures designed to provide working or storage space below ground level. The structural design is governed by their functional requirements rather than from considerations of the most efficient method of resisting external earth and hydro static pressures. They are constructed in place in open-excavations.

Buoyancy rafts are hollow substructures designed to provide a buoyant or semi- buoyant substructure beneath which the net loading on the soil is reduced to the desired low intensity. Buoyancy rafts can be designed to be sunk as caissons, they can also be constructed in place in open excavations.

II. INTRODUCTION TO SUPPORTS

A support can refer to a variety of structures in architecture that includes arches,
beams, columns, balconies, and stretchers. The following are the supports classified below:

FixedSupport

Fixed supports can resist vertical and horizontal forces as well as a moment. Since they restrain both rotation and translation, they are also known as rigid supports. This means that a structure only needs one fixed support in order to be stable

Hinge Support

A Hinged beam support can resist both vertical and horizontal forces but not a moment. They will allow the structural member to rotate, but not to translate in any direction.

RollerSupport

Roller supports are free to rotate and translate along the surface upon which the roller risks. The surface can be horizontal. Vertical, or sloped at any angle. The resulting reaction force is always a single force that is perpendicular to, and away from, the surface

III. INTRODUCTION TO COLUMNS

A column or pillar is a structural element that transmits, through compression, the weight of the structure above to other structural elements below. In other words, a column is a compression member. The term column applies especially to a large round support with a capital and a base or pedestal and made of stone as shown in the figure.

IV. CLASSIFICATION OF COLUMNS

Based on slenderness ratio

The slenderness ratio is the effective length of a column in relation to the least radius of gyration of its cross-section. If this ratio is not sufficient then buckling can occur. Based on slenderness ratio columns can be classified as

I Long column: The length of the column is greater than the critical buckling length. Mechanical failure would typically occur due to buckling. The behavior of long columns is dominated by the modulus of elasticity, which measures a column's resistance to being deformed elastically (i.e. non-permanently) when a force is applied

II Short column: The length of the column is less than the critical buckling length. Mechanical failure would typically occur due to shearing.

III Intermediate column: In between the long and short columns, and its behavior is dominated by the strength limit of the material.

Columns can be classified according to their cross-sectional shape. Common column shapes include as shown in figure:

V. CLASSIFICATION BASED ON SUPPORTS

Fixed a beam supported on both ends and restrained from rotation as shown in figure.

Simply supported a beam supported on the ends which are free to rotate and have no moment a back supported on both ends and resistance as shown in figure. Over hanging - a simple beam extending beyond its support on one end

Double overhanging-a simple beam with both ends extending beyond its supports on both ends. Cantilever - a projecting beam fixed only at one end

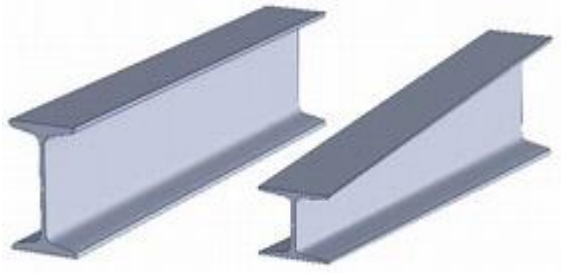
Continuous a beam extending over more than two supports.

Trussed a beam strengthened by adding a cable or rod to form a truss

VI. CLASSIFICATION BASED ON CROSS SECTION OF BEAM

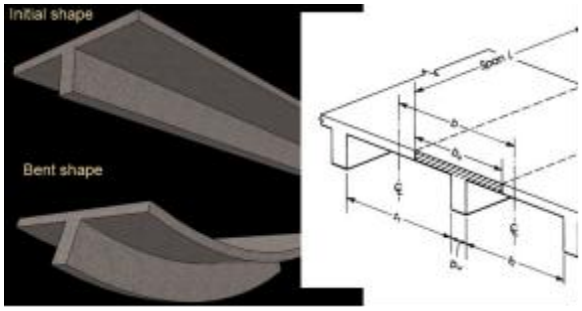
I-Beam

Beam with 'I' cross section. The element of "T" is known as flanges, while the
vertical element is termed as "web". I -beams are usually made of structural steel and are used in construction and in civil engineering The web resists shear forces, while the flanges resist most of the bending moment experienced by the beam



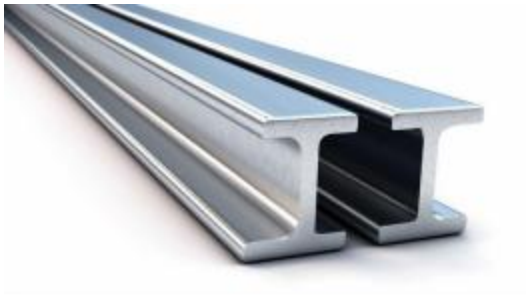
T-Beam

A T-beam used in construction, is a load-bearing structure of reinforced concrete, wood or metal, with a T-shaped cross section at top. The top of the T-shaped cross section serves as a flange or compression member in resisting compressive stresses



(c) C-Beam

The c-beam is type of beam (usually structurally steel), used primarily in building construction and in civil engineering works. Its cross section consist of a wide "web", usually but rot oribatid vertically, and two "flanges" the top and bottom of the web, only striking out on one side of the web. It is distributed from I-beam or H-beam or w-beam type steel cross
sections in that those have flanges on both sides of the web.



VII. CLASSIFICATION BASED ON MATERIAL USED

Timber Beam

Traditional timber framing is the method of creating framed structures of heavy timber joined together with various joints, commonly and originally with lap jointing, and then later pegged mortise and tendon joints. Diagonal bracing is used to prevent "racking", or movement of structural vertical beams or posts.

Concrete beam

A structural member of reinforced concrete place horizontally to carry loads over openings. Usually, beams are designed under the assumption that tensile stresses have cracked the concrete and the steel reinforcing is carrying all the tension.

(c) Steel beam

Steel beams are structural supports which are made from steel, an alloy of carbon and iron which is famous for its strength. Beams are critical to the support of a building, spreading the load of the building laterally to

ensure that it is evenly distributed, so that the building will not be prone to buckling o: sagging. Steel is a popular material for beams for a number of reasons, not least of which is that it is incredibly strong, and can therefore be used in structures which would otherwise be considered structurally unsafe.

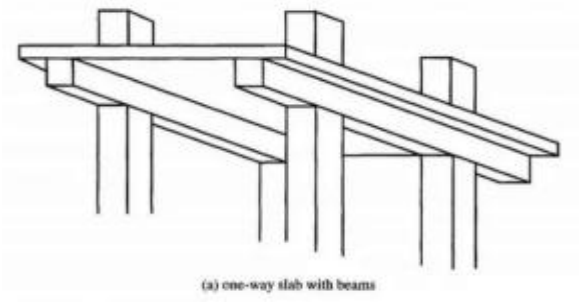
VIII. INTRODUCTION TO SLABS

Slabs are constructed to provide flat surfaces, usually horizontal, in building floors, roofs, bridges, and other types of structures. The slab may be supported by walls, by reinforced concrete beams usually cast monolithic ally with the slab, by structural steel beams, by columns, or by the ground.

IX. CLASSIFICATION OF SLABS

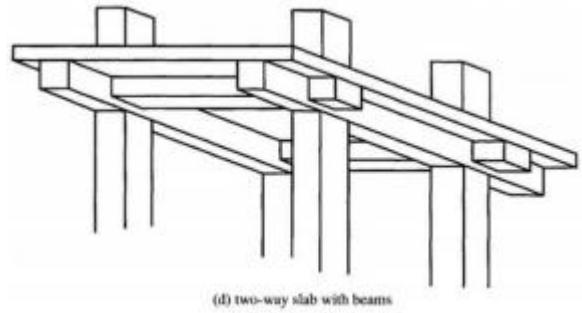
Ø One Way Slab

One way slab is supported on two opposite side only thus structural action is only at one direction. Total load is carried in the direction perpendicular to the supporting beam. If a slab is supported on all the four sides but the ratio of longer span (1) to shorten span (b) is greater than 2, then the slab will be considered as one way slab. Because due to the huge difference in lengths, load is not transferred to the shorter beams. Main reinforcement is provided in only one direction for one-way slabs.



Ø Two Way Slab

Two-way slabs are the slabs that are supported on four sides and the ratio of longer span (1) to shorter span (b) is less than 2. In two-way slabs, load will be carried in both the directions. So, main reinforcement is provided in both direction for two-way slabs.



X. SUPPORT OF AUTO CADD

Auto CAD supports a number of APIS for customization and automation. These include Auto LISP, Visual LISP, VBA, .NET and Object ARX. Object ARX is a C++ class library, which was also the base for: products extending Auto CAD functionality to specific fields, creating products such as Auto CAD Architecture, Auto CAD Electrical, Auto CAD Civil 3D; or Third-party AutoCAD-based application. There are a large number of Auto CAD plugging (add-on applications) available on the application store Auto desk Exchange Apps. AutoCAD's DXF, drawing exchange format, allows importing and exporting drawing information

Concrete Design

By selecting the code IS: 456 2000 for the concrete design we will then define parameters for our design as

1. Clear: Providing clear cover to beams and columns as inputted .04m in our case.

2. FC: This is the Compressive strength of concrete as25000KN/m2
3. FY Main: This is the yield strength of the main reinforcement steel as415000KN/m2
4. FY SEC: The yield strength of secondary reinforcement steel as 415000KN/m2
5. MAXMAIN: The maximum bar size to be provided for main reinforcementas25mm.
6. MAXSEC: The maximum bar size to be provided for secondary reinforcementas25mm.
7. METHOD: To consider minimum eccentricity about one axis at a time this command is selected.
8. MINMAIN: The minimum bar size to be provided for main reinforcementas10mm.
9. MINSEC: The minimum bar size to be provided for secondary reinforcementas8mm
10. MMAG: The factor by which the column design moments will be magnified as 1.5 is

taken in our project.

11. REINF: This command is used for selecting the tied or spiral columns we have used tied

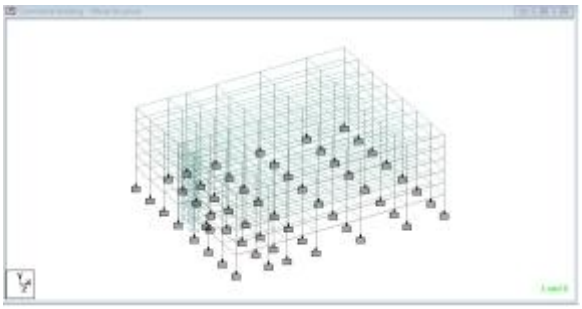
columns.

12. TORSION: This will be selected if we want to have design for torsion.
13. TRACK: The track parameter is selected as per need it gives three different options.

XI. DESIGN BY USING STAAD PRO

The salient features of the structure are
Ø Utility of building
Commercial Building
Ø No of stories G +5
Ø Noofstaircases 2
Ø No of ramps 2
Ø No of rooms 21
Ø No of lifts 4
Ø Type of construction
R.C.C framed structure
Ø Type of walls Brick wall
Geometric details
Ø Groundfloor 4m
Ø Floor to floor height 3m
Ø Height of plinth 1m
Ø Depth of foundation 2m
Materials
Ø Concretegrade M25
Ø Steelgrade Fe415grade
Ø Bearing capacity of soil 180KN/m

XII. MODELING GEOMETRY



Centre Line of the Structure

Conclusions

ØStaad Pro software has become more and more critical in the analysis of engineering and Scientific problems.

ØMuch of the reason for this change from manual methods has been the advancement of computer techniques development by the research community and in particular universities.

ØAs technology and engineering adoptions are advertising new methodology of interlinking and completing the industries via computer applications are created with a similar improvement in hard ware capacities.

ØThis is turn facilities the implementations of more effective and professional engineering

software. As the applications adventure in functionality, one can hope that they will be more affordable to promote their widespread.

ØUsage amongst civil engineering at a globalscale. Taking into account the technological advance, this project has been dealt with using the latest design software

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