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A STUDY ON DESIGN OF SAFETY HIGH RISE BUILDING

[1]Manoj kumar, M.tech Civil Engineering, Institute of Technology and Management Lucknow
[2]Mr. Ashish kumar, Assistant Professor, Department of Civil Engineering, Institute of Technology and Management Lucknow

Abstract: In order to stay up with the rapid pace at which the world is evolving, a student of civil engineering has to have a comprehensive understanding of structural components and the dangers that are associated with them before beginning a project and maintaining that knowledge throughout its whole. High-rise buildings are becoming more common across the world for a number of reasons, including the scarcity of land in densely populated areas and their significance in today's major cities and capitals. High-rise buildings, as opposed to low-rise structures, have a great number of structural components and sections, and as a result, they need exceptional structural stability for both their design and their safety. As a direct result of this circumstance, an effort has been made to get further knowledge about the procedure that must be followed while creating a high-rise safety structure using the limit state approach. The basic structures of the project are built out of reinforced concrete, which is one of the building materials employed. Following much consideration, the Limit State Method was decided to be the most appropriate course of action (of collapse and serviceability). When the structure is stressed to its breaking point and begins to fall apart, the structure's stability and strength are shown. A floor system that distributes floor loads to either one of the plane frames or both of them is one of the structural components that are characteristic in multi-story buildings. There is a possibility that this shift in weight will take place in either direction. The design study incorporates the footings, columns, beams, and slabs into the overall structure.

Index Terms **- Tall Buildings, Simplified Model, Structural Stability, Structural Systems High Rise Buildings**

I. Introduction

The construction of buildings is the Building construction is a subfield of engineering that concentrates on the building of structures, such as houses and other residences. Apartment complexes are a good illustration of this concept. A place that is contained by walls and has a roof, as well as supplies for satisfying the essential necessities of human beings, such as food and clothes, might be considered to constitute a house. One definition of the term "home" As more time passed, people started settling down to make their homes in huts made out of branches of trees [1]. Caves, treetops, and tree hollows provided protection from predatory animals, adverse weather conditions, and other natural hazards for early people who chose to make their homes in such areas. In more recent times, people's dwellings have progressed from caves and huts to more aesthetically pleasing houses. In the past, humans lived in these types of dwellings. Home for affluent people is often a mansion that has been renovated to a very high standard.

A important indicator of the level of socioeconomic development in a county is the quantity and variety of buildings found there. As a result of the fact that individuals spend around two-thirds of their lives inside their houses, it is only normal for people to want to reside in places that are as pleasant as is humanly feasible [2]. These are some of the reasons why individuals are willing to go to the utmost lengths possible and invest their hard-earned money and savings in the purchase of real estate. These days, the expansion of a county's socioeconomic landscape often includes a sizeable portion dedicated to the building of new residences

[2]. The design work, as well as the planning and layout of the buildings, and any other components of the structures, are the responsibility of engineers and architects. Every day, innovative strategies for the building of homes are created, with the goals of making the process more time and money efficient while simultaneously satisfying the needs of the community [3]. Draughtsmen are responsible for the drawing work that goes into constructing a structure. They work under the direction of engineers and architects to ensure that their work is accurate. The draughtsman is responsible for knowing his profession, being able to follow the instructions given by the engineer, and being able to design the necessary drawing of the building, site plans, and layout plans, among other things, in accordance with the specifications [4]. In addition, the draughtsman is responsible for being able to design the necessary drawing of the building, site plans, and layout plans. Investment projects in high-rise structures, often known as towers, indicate a component of a nation's economic might and serve as a reflection of the country's characteristic. Several nations have the goal of advancing their status, and one way they hope to do this is by encouraging the development of detailed plans for the construction of high-rise investment projects that would boost both their reputation and their economic might [5]. In nations such as Malaysia, Hong Kong, the United States of America, the United Kingdom of Great Britain and Ireland, Japan, etc., supporting such initiatives is a significant component of their success. The preparation of thorough feasibility studies is followed by the making of a variety of significant and important investments. This is done to ensure that the projects in question bring about the anticipated economic and political benefits for the investors [6]. These studies were carried out by conducting in-depth research into several elements, including architectural design, town planning, marketing, and finances. It is the most significant rationale that supports technical improvement by striving to employ the most up-to-date techniques and materials. The progression of a country may be accomplished by careful planning, economic growth, and urban development. Each of these elements affects the nation's ability to attract new sources of investment money. At the close of the 20th century, some nations made progress by formulating comprehensive plans to create high-rise investment projects and defining several rules and criteria to assure their success. These proposals featured investment high-rises. Most Arab Gulf, Hong Kong, and Malaysian countries have started these measures to improve the country [7]. These methods entail feasibility studies, which investigate all the aspects and circumstances that determine the project's viability and the investors' success. These methods assure project success. The first examples of high-rise architecture may be found in ancient Rome, in the form of wooden residences with up to four stories. The global distribution of high-rise structures is seen in Figure 1.2

Figure 1.2 High rise buildings worldwide

II. The Design Process

The process of design incorporates a number of components, including conception, technical skill, appropriate design norms and bylaws, as well as creativity and judgement. Codes of practise are compiled by engineers who have years of experience in the field and extensive knowledge. Even while they are useful, engineers must not allow them to replace their own judgement and the knowledge they have gained during their careers.

First, the building is designed so that it can fulfil its functional requirements, and then, and only then, are concerns about its safety and its serviceability brought into the picture. As a consequence of this, there are two primary approaches to the design of

buildings:

Design that is Functional: To be considered effective, a building must first and foremost serve the main purpose for which it was constructed, which is to accommodate the requirements of the audience for whom it was designed. It is important to ensure that the rooms and halls are the right size, that there is enough ventilation, that there are unobstructed sightlines in the theatre and in the community hall, that there is adequate water supply and drainage, and so on.

As was said before, structural design incorporates elements of both art and science into its overall process [8]. A robust structure that can safely take the pressures of the design and fulfil the prescribed function when it is put into working settings must be constructed with economy and beauty in mind so that it can last for the length of the service life that is intended for it. It is possible to achieve this without endangering the structure's structural integrity.

It consists of the following steps:

a) Structural Planning
b) Determination of Loads
c) Analysis
d) Member Design
e) Drawing, Detailing and Preparation of Schedule.

III. Safety Features of Tall Building

The construction industry's most pressing concern is ensuring that high-rises are safe for occupants. During building, each of the applicable safety standards and design requirements have to be adhered to. The unexpected fall of the World Trade Center towers has inspired a re-examination of the way egress systems are planned for high-rise buildings. The existing layout specifies a certain number of stairways, their widths, and the distances between them, all of which are dependant on the assumed weight and activity level of the building's occupants [9]. Each level of a high-rise building has an escape system that is sized to meet the number of people who will be living there, so that a partial or staged evacuation may take place. When a group discussed the need of designing the simultaneous evacuation of huge buildings, concerns were expressed about the appropriateness of depending only on stairways to evacuate large numbers of people from a substantial height. Future buildings may be impractical if they are designed to allow for simultaneous evacuation in line with the present methods for exit design, which would need large floor space for the staircases, making them unworkable [10]. If future buildings must be designed to allow for simultaneous evacuation, this will happen. As a result, if we want to construct tall buildings in the future, we need to find a structure that is ideal in terms of design, construction, appearance, and architecture, and we need to be very careful about any potential issues that may arise in the process. This will allow us to construct safe tall structures.

IV. Structural Stability

When designing a structure, one of the most important things to keep in mind is ensuring that the structure will be stable under all types of loading circumstances. When subjected to loading, all structures go through a number of form changes. When a load is applied to a structure that is stable, the resulting deformations are often not very significant, and the action of the load produces internal forces that have the tendency to restore the structure to its shape before the application of the load. When loads are applied to an unstable structure, the resulting deformations are often significant and have a tendency to keep growing continuously for as long as the loads are being applied [11]. A building that is not stable, on the other hand, will not produce any internal forces that have the propensity to return the structure to the shape it was in when it was first built. Unstable structures often go way all at once and fully when they are subjected to weight. The designer of the structure is responsible for ensuring that the proposed structure will, in fact, result in a configuration that is stable [12]. If this is not the case, the designer has failed in their responsibility.

V. Structural Systems

A structure may be stabilized for horizontal load by a number of different structural systems. This section and Figure 1.2 address some of them; for further information on them, see. All of the other systems evolved from the traditional closely connected frame [14]. All of these structural methods include placing as much load-bearing material as is practically possible around the perimeter of the structure in order to achieve the highest possible level of flexural stiffness. In all structural systems, determining the location of the primary vertical components might potentially aid reduce lateral load tensile stresses. This eliminates the potential for vertical strain as well as foundation uplift [13]. When it comes to specific kinds of structural systems, outside vertical pieces have to have their own weight.

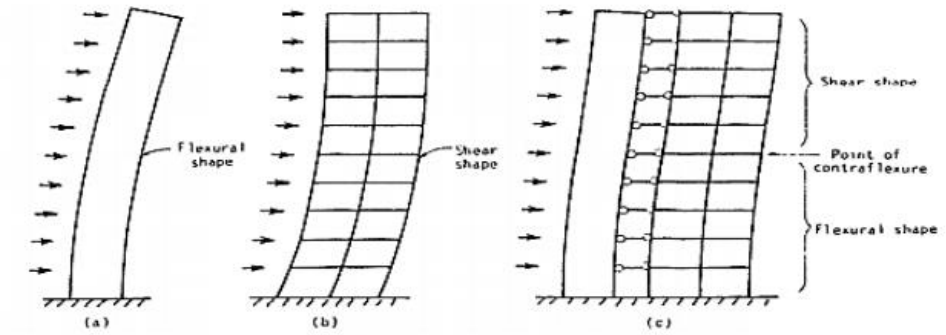

Figure 2.4: Deformation shapes of a tall building. a) Bending deflection, b) Shear deflection and c) Total deflection [34].

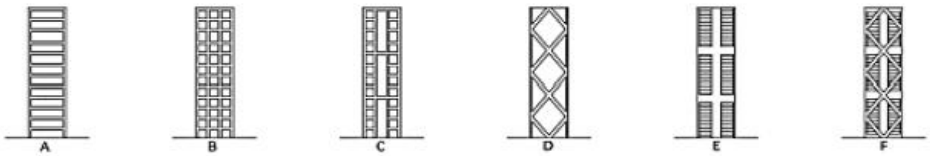

Figure 1.2 Different Structural Systems, where A) represents framed tube system, B0 bundled tube system, C) a tube in tube system, D) diagonalised system E) a core and outrigger system and F) a hybrid system

In the following sections, explanation are given of the structural systems-

- ✓ Framed tube structures
- ✓ Bundled tube
- ✓ Tube in tube
- ✓ Diagonalised- and rigid frame
- ✓ Outrigger system
- ✓ Hybrid structure

VII. Conclusion

In this study, both static and dynamic processes resulting from wind and seismic activity were analysed nonlinearly and statically in order to perform a static and nonlinear analysis of the fundamental definitions of high-rise structures, as well as their safety features, design challenges, and structural stability, among other things. Both published books and the public domain provide concise explanations of a variety of structural systems. These summaries may also be found in the public domain. In this study, we also explore simplified models and the design of a seismic energy base. There are many different ways in which the results of this review might be beneficial to future efforts. It is anticipated that research conducted in this field will have a significant influence on the architectural profession as well as academic institutions as a result of the growing interest in environmentally responsible design, which includes energy efficient building. To aid academics and practitioners, new and emerging systems may be updated on a frequent basis. High-rise buildings are becoming increasingly lightweight, and researchers must pay greater attention to serviceability issues such floor vibration, lateral sway, and occupant comfort. The next generation of sustainable mega structures and skyscrapers need innovative structural technologies.

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