Comparison of Analysis and Design of G+6 Building with IS code and American code

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Abstract - This work provides a comprehensive summary of comparison of analysis and design of building in IS code and American code. Each country has its own building and structure design codes which provide the guidelines to wisdom structural engineers for the design of different structural components like beam, column and slab, etc. National building and structures design codes have been developed in various countries to prescribe standards for the design and construction of various structure. Various countries have diversity in topographical, geographical and climatic conditions. RC building design is mainly depends on these factors. Comparative study of different country codes is important for the engineers to understands the change in guidelines of codes for the countries in world when engineer wants to relocate from one nation to another. The primary goal of design codes is to assure appropriate structural safety by establishing specific minimum requirements for design reinforcement. Therefore, understanding of the key characteristics shared by code and variances between different codes of practice is required to provide a global platform for structural design. In this study, numerous scholars from around the world to compare the RC building design regulations. The review analysis demonstrates that work has been done by utilizing different nation codes. For numerous buildings components including beams, columns and slabs. Comparative work has been done in terms of load comparisons such as wind load, seismic load and strength characteristics.

keywords: Comparison, IS code, ACI code, building, STAAD Pro.

I. Introduction

Building codes are set of regulatory requirements that set minimum standards for fitness and safety in construction so that people can live in secure structures. A code is a book that contains a scheme of laws. The minimum permissible safety limit for both buildings and non-buildings is specified in a document called a code of buildings and structures. These codes are based on the engineering expertise, experimental research and particular situations and behavior. The codes are regularly updated to reflect recent findings and frequently emerging trends. The codes provide some uniformity across various designers. This review is concerned with study of comparison of loads factors, load combinations, nominal loads and design parameters like column, beam with different country building codes.

Structural design is a careful assessment of strength, stiffness and stability of structure. Different nations structural design codes give engineers information and guidelines for designing different structural components. In structural analysis and design the application of various design methodologies and codes yields a variety of outcomes that affect the structures behavior, costs and durability. Comparison of various building regulations will assist in creating the most efficient and cost-effective building design. The main goal of structural analysis and design is to create a structure that can withstand all applied loads without failing for the duration of that structures specified life. It examined those nations where more than one code is used for structural design, helping to identify which code has a greater level of safety and accuracy than another. Around the world, research is being done in this area to lower the obstacles that prevent design engineers from relocating to and working in any nation. Here, a few recent codal provisions advancements and their research consequences are discussed.

An overview of the Design code

- IS 456-2000

This Indian Standard was finalized by Bureau of Indian Standards, after the draft confirmed by the Cement and Concrete Sectional Committee had been permitted by the Civil Engineering Division Council. An Indian Standard code of practice for the general structural usage of plain and reinforced concrete is IS 456-2000 Plain and Reinforced Concrete Code. The most recent update to this standard was made in 2000 and confirmed in 2005. The limit state design methodology is applied in this code. India is the intended market for it. It provides in-depth details on the many different components of concrete. The revision was undertaken in order to keep pace with the field of concrete technological advances and to incorporate additional changes and upgrades. In India, IS 456 is regarded as the holy book for civil engineers.

- ACI 318

International Building Code (IBC) and Building code criteria for structural concrete and comments (ACI-318) are two international codes that were published by the United States of America. The fundamental guide for designing concrete buildings in the USA is called ACI 318, and it encompasses design elements and concrete structural construction. In addition, the specification includes the resistance factors, design resistance, and load factors. The IBC approved the code, making it an official document. ACI 318 code is revised every three to four years in accordance with advancements in the engineering industry. Precast and prestressed concrete as well as reinforcing and prestressing steel are both covered by the code. Additionally, during the past thirty years, the resistance elements have grown by 10% to 15%.

II. State of Development

Bakhoum et al. [1] The authors studied the building design codes from the USA, ACI, Europe, and Egypt are taking into account. The loads and resistance (strength) of the section under flexural and compressive axial loading are two characteristics that are compared. Steel and concrete structures both are compared. Differences are shown in the safety factor that is used to calculate the resistance of various sections, and they also impose actions in various design rules. After analyzing the values specified in various codes, significant differences in live load intensities were discovered. The greatest sectional dimensions and the heaviest steel reinforcing values are often produced under Egyptian specifications. The axial capacity determined by EC3 for steel columns is greater than AISC-360-10 and ECP203-2007 by a percentage ranging from 1.6% to 45%. Landingin et al. [2] In this study, using the three seismic codes of the Philippines, Eurocode 8, and the American code for typical residential frames of normal occupancy, seismic provisions were compared. The analysis and comparison of a four-story regular and irregular building frame using various national codes. For the horizontal load action with load combinations, the NSCP 2010 response spectrum and seismic factors were taken into account. Each RC frame structures five sample columns have been studied. Lateral force analysis and response spectrum analysis were executed using SAP2000 software. Analysis and designs result demonstrates that EC8 regulations have been determined to be safer. Ng et al. [3] considered BS 8110 and EC2 and compared by following both concrete cube strength and cylinder strength for beams reinforced with mild steel or high yield steel and concluded similar values. Minor variations are cause by steel reinforcement requirements and it was determined that any of the codes may be adopted.

Shenbagam and Arunachalam [4] In this paper, a work is carried out to find the cost design of RC tension with different conditions by means of the Artificial Neural Network. Indian and European standard specifications were used in the design of the RC tension members and these standards were addressed. According to both codes the design tension members satisfy the strength and serviceability conditions. The area of formwork and the cross-sectional dimensions of the tension members for various grades of concrete and steel are taken into account as variables in the design model. The results are obtained by the example of design. It is stated that the suggested ideal design model produces logical, trustworthy and useful designs. Arunachalam et al. [5] presented comprehensive study of Standards of Indian (IS 456:2000), European (EC2-1992) and American (ACI 318) codes of practice are critically analyzed for RC column design. Limit state method was used to construct all RC rectangular columns with the instructions of Indian, European and American codes of practice. A bar chart is used to compute and compare the total cost of the columns. When the Indian code of practice is used, it is seen that the overall cost of the column is lower. Karthik and Koti [6] compared the study of dynamic loads is performed on the high-rise structures by using different International Standard Codes i.e., Indian, American and European and it is concluded that the structure studied for IS 1893:2016 gives better values for the structural parameters taken into account. The difference in values is caused by the independent constants, loads, and load combinations of their respective International Standard codes. These structures can be designed in such a way during the design process that they serve their service period without any issues and are made safe and durable.

Nwoji and Ugwu [7] compared the usage of BS 8110 with Eurocode 2 in the design of structures, highlighting the respective benefits and drawbacks of each under several criteria, including loading, analysis, user convenience and technological innovation. To achieve this, the two codes were used for study and design of the primary structural components of reinforced concrete buildings. Using the two codes, a modest medium-rise structure was loaded and examined. To determine the envelopes for the shear force and bending moment, analysis was done using CSI start tedds. It was discovered that Eurocode 2 provided greater internal supports moments. The Eurocode 2 values fell short in the case of maximum span moments and shear force values. In conclusion, employing Eurocode 2 has comparative advantages to BS 8110 in that it is more thorough, logical, and well-organized. Nigerian engineers should implement the new Eurocodes, which are said to be the most technologically sophisticated codes in the world. Goud et al. [8] written a thorough review of the literature on the design strength of materials, concrete, the stress-strain curve for steel, the partial safety factor, confined concrete and the restrictions on the grade of steel reinforcement and concrete that can be used, according to Indian Standards, American Standards, European Standards, New Zealand Standards, and Japanese Standards. The IS code makes no mention of how high-grade concrete affects material qualities or stress block specifications. The material characteristics that determine concrete strength, curing temperature in relation to concrete strength, and tensile strength of concrete are not appropriately discussed with regard to time. Only New Zealand has concrete strength values that are 20N/mm2 and 70N/mm2 respectively for seismic environments. The IS codes requirements are more in line with New Zealand norms. According to the aforementioned specifications, the acceptable concrete strength ranges from 20 MPa to 50 MPa, and the recommended steel strength ranges from 420 MPA to 500 MPA. There are several benefits to using high strength concrete and steel while building, including enhanced structural strength, decreased cross-sectional strength, more durable materials, and hence significant cost savings.

Jawad [9] studied a comparative analysis of the structural building codes' design specifications from a safety and financial standpoint. The adoption of three renowned structural construction regulations is the ACI 318M-02, BS8110:1985 and Euro Code2:1992. The structural elements strength design criteria of these codes have been compared. Safety provisions, flexural design, shear design, and column design are all compared. Extensive design models and criteria of the studied codes have been displayed throughout this study. Despite having essentially, the same ideas, these scripts have several subtle differences. The findings of the comparison demonstrate that EC2 is more lenient than ACI Code in terms of partial safety factors and strength design. Design engineers will quickly learn, after reading this paper, that switching between codes is not a challenging task. Nandi and Guha [10] The article discuss and compared the design of reinforced concrete structures from an economic point of view using three distinct well-known structural building codes, including IS, BS, and EC. Despite the fact that the three codes' steel standards differ, the quality of concrete they assess is the same. They discovered that the area of steel for a slab is more according to the IS code than the BS and EC codes, the area of steel for a beam is greater according to the EC codes than IS and BS, the area of steel for a column is greater according to the BS codes than IS and EC, and the area of steel for a foundation is less according to the IS codes than the BS and EC. Izhar and Dagar[11] This study compares the design specifications for several building components such beams, slabs, and columns utilizing RC building design regulations from various nations. The many codes investigated include EC2, ACI 318, IS 456:2000, BS 8110, and A23.3. Analysis of the Staad reports for various codes is done, and graphical representations are used to show the differences in the average tensile reinforcement for beams, average shear reinforcement for beams, average longitudinal reinforcement for columns, and average longitudinal and transverse reinforcement for slabs.

S. Karthiga et al. [12] In this article, a study is performed by using STAAD.PRO.V8i software to provide the G+10 analysis and design for seismic forces utilising four international building codes: IS1893, Euro Code 8, ASCE7-10, and British Code. A pushover study was performed in SAP2000 after the building's design to evaluate the structures seismic performance. After investigation, it was shown that the IS code provides the most shear with the least amount of displacement compared to other standards. Franklin and Mensah [13] In this paper the PROKON 32 programmer is used to study and design the beam element of a four-story structure using two well-known international building codes, EC2 and BS8110. Examining the bending moment diagram for the essential continuous beam span before and after the 10%, 20%, and 30% redistributions was the focus of both codes. At all levels of moment redistribution, it was discovered that the negative bending moment at the internal support is lower for BS8110 than EC2 by around 0 to 8.5%, however in the case of the maximum span moment, the EC2 values are lower than BS8110 by about 4.5% to 9% for moment distribution up to 20%. The BS8110 often outperformed the EC2 by 2.4% to 5.4% for the upper limit of shear force at supports, but less than 2.5% for the lower limit of shear force. Alone and Awchat [14] The author has considered a example and studied on seismic analysis of high rise building system using STAAD Pro V8i software with utilization of Indian Standard code (Ground+ 3Basements+50 Storey RCC) and concluded that because of the asymmetrical geometry of the structure, modes are not resisting 90% of the load as they successfully fulfil the X axis after 300 iterations of analysis. In this instance, a cutoff mode must be included, and it is necessary to determine whether or not the stiffness of the building has to be increased.

Taie et al. [15] In this article, a comprehensive study of few standard codes is performed. The codes of countries like Egyptian, Syrian and Arabia Saudi were studied and comparison of the geotechnical requirements, concrete materials, and load correction factors. The majority of national codes were heavily influenced by the codes and standards of the ACI, the UK, and Germany. Additionally, a case study was used to analyze and compare international codes (American (ACI) and European (EC)). The use of EC code is spreading around the world. Eurocode offers the customer additional freedom to utilize their own standards (national annex). A building model was constructed and analyzed using the STAAD Pro and SAFE softwares for three sites (Mosul, Baghdad, and Basrah) in order to determine the most suitable foundation design to be utilized in Iraq and the variations when applying the American and European codes. The two softwares combined loads were for EC and ACI codes. The outcomes were quite comparable. The foundation design for the Mosul site should be either spread or continuous. The best option is a raft for the Baghdad site, and raft and piles for Basrah. Engineers and designers relied on the ACI and British codes and standards since Iraq lacks a national code. An Iraqi code is crucial because it will raise the economic worth of structures while also enhancing their quality and safety throughout design and construction. Adhav et al. [16] The paper describes the case study and design compared with various nations standards (Indian, American and European). Graphical representation of comparison of bending moment, shear force on various floors is shown and when comparing design to total amount of steel needed for a building, EN and ACI provide a greater design than IS code. Dagar et al. [17] In this article, an overview is given of the various studies made researchers based on different nations standard codes and noted that rare guidelines are compared between codes. Sayyed and Hamane [18] studied to examine the seismic analysis of several high-rise building forms using various international codes. There are now two well-known structural construction regulations in use that are Indian standard and American Standard and concluded that seismic data like ground acceleration facts for various timings.

Shah and Chalotra [19] In this paper the RC frame building is compared with the IS code NBC standards. On the basis of loading comparisons, including live load, dead load, wind load, and different characteristics for various building elements, including beam, column, and slab, comparative work has been developed. Additionally, load combination and load factor are contrasted. The design capabilities for several architectural design regulations are compared in this comparison building models with G+8 storeys and a regular design are taken into consideration for analysis in the current study. In the ETABS software, the analysis of the model is carried out using an equivalent static technique. Rajeev et al. [20] in this article a comprehensive analysis of seismic design and results of OMRF buildings with the various country standards (Indian, European and British codes). Design options for six four-story, typical ordinary moment-resistant frame structures with and without seismic loading conditions were considered. Additionally, it has been shown that the Indian code offers a 19% and 26% higher displacement capacity for WoEQ loading than the British and Euro codes, respectively, for large displacement capacities without strength and stiffness deterioration. The analysis comes to the further conclusion that one should have a uniform design and details provisions for the same degree of hazard at various locations on Earth. Itti et al. [21] In this paper with respect to the seismic design and analysis of the Ordinary RC moment-resisting frame (OMRF), Intermediate RC moment-resisting frame (IMRF), and Special RC moment-resting frame (SMRF) is done. This study compares the Indian Code (IS) and International Building Codes (IBC). The analytical findings for the model structures are then compared and examined, noting any noteworthy variations. In particular, design base shear, lateral loads, drifts, and area of steel for structural members for all RC structures in both codes are examined in this study as variances in the findings achieved utilizing the two codes.

Shah et al. [22] In this article Pre- Engineered Building is designed and a comparative study is done by using Indian code and American code in terms of weight required per frame. A graphical representation is performed in weight and bay spacings. American code resulted lighter section as compared to Indian code because of lower factor of safety. Adhikari et al. [23] In this paper the Himalayan arc nations are the nations that were chosen for the purpose of this research's investigation of various seismic codes. There is a model of RC building in Nepal which is studied by four distinct structures. NBC 105, the Nepal Buildings Code, IS 1893-1, the Indian Code, BNBC 1993: 2014, and GB 50011: 2010, the Bangladesh Code, were all used for the analysis. It is seen that China code gives bigger value as compared to other nations codal provisions. It is because of the higher values of China code in the design Horizontal seismic force coefficient, absolute displacement and base shear as compared to another codes. Sabnis and Shahezad [24] The research basically compares two distinct codes for a conventional industrial steel building: AISC LRFD and IS codes IS800: 2007 (LSM), IS 875: 1987 part (I, II, and III). The analysis between many factors that have the same loadings are studied. It is a case analysis for an industrial building according to reviews and other case studies that demonstrate the experimental and analytical research done in this area. Singh and Khose [25] In this article a case study is done of the seismic performance of a structure constructed with ductile RC frames and built in accordance with four important codes: ASCE7 (United States), EN1998-1 (Europe), NZS 1170.5 (New Zealand), and IS 1893 (India). The Displacement Modification Method (DMM) and ASCE-41 recommendations are used to assess the test building's functionality. While IS 1893 yields the lowest design base shear for a given danger, Eurocode 8's design base shear is comparable to NZS 1170.5. Panchal and Dwivedi [26] In this paper a structure of G+6 storey is studied and design in various seismic regions of India by using STAAD.Pro software. Hanumesh and Gowda [27] In this article made a comparative study of High-rise structure of G+40 for combined effect of earthquake and wind load using software. From soil type I to soil type III, the maximum overturning moment increases. The calculated figure indicates that soil type III under various earthquake zones has the highest overturning moment. Subramanian, N. [28] In this paper a study of crack width and controlling by codal provision of is done of the flexural RC members and highly suggests that according to ACI code formulae for crack width control Indian code should be examined. Sai Kiran, G. [29] In this article a case is analyzed of Comparing Design Processes for Pre-Engineering Buildings (PEB) with various country codes. The IS codes deflection limitations are greater than the MBMA deflection restrictions. Shirsath and Rathi [30] A comparative study of steel concrete composite structure with RCC structure is done. Analysis is drawn between the Storey Displacement graphs of the RCC and Composite Structure. While the composite construction has a storey displacement of 13.56 mm, the RCC structure has a storey displacement of 17.33 mm. It is evident that composite structures are more durable than RCC structures.

Pradeep et al. [31] In the present work, an RCC structure supported by a single column is designed and analyzed. Between RCC single column and RCC multi column structures, costs are determined. In this study, structural modelling, stress, bending moment, shear force, and displacement design concerns are discussed. STAAD Pro is used to analyze the results. Bari and Das [32] The article compare various seismic analysis clauses that are included in various national building codes. BNBC 2010 seismic characteristics have been investigated and compared to BNBC 1993. The building's height has been shown against the base shear/weight ratios. According to the analysis in this study, BNBC 1993 has the least base shear of all the codes.

Objectives of the Research

- To study and understand guidelines of different International standard codes i.e., Indian Standards (IS) and American Concrete Institute (ACI).
- The most important objective of this study is to compare the various design processes used for the RC structure such as beam and column according to IS and ACI code
- To assign the structures loading values and other parameters that correspond with the appropriate Country code.
- To create a building structural model with software.
- To distinguish between building analysis and design using American Concrete Institute (ACI) and Indian Standards (IS)
- Comparison of result between Indian and American Standards.

III. COMPARATIVE STUDY OF IS AND ACI CODE

The present study compares the design requirements of the various building components, like the beam and column adopting RC building design regulations from the IS and ACI codes. The comparison of guidelines will enable the construction of high-rise structures that are both affordable and sustainable. Comparative study is the better aid to engineers in learning about the similarities and differences between the codes.

Tables are used to illustrate and highlight the variations between key parameters.

Parameters	IS code	ACI code
Loading combination	a) 1.5 DL +1.5 LL b) 1.5 DL l+1.5 WL c) 1.2 DL+1.2 LL+1.2 WL	U= 1.4(D+F) U= 1.2(D+F+T) +1.6(L+H+0.5(L_r or S or R) U= 1.2D+1.6(L_r or S or R) +(L or 0.8W) U=1.2D+1.6W+L+0.5(L_r or S or R) U= 1.2D+E+L+0.2S U= 0.9D+1.6W+1.6H U= 0.9D+E+1.6H
Elastic modulus for concrete and steel	E_c =5000 $\sqrt{fck}$ N/mm^2 Es=200x 10^3 N/mm^2	E_c =57000$\sqrt{f_c}$psi E_s =29x10^6 psi
Max Concrete strain	0.0035	0.003
Provisions for grade of concrete	Min=20Mpa Max=80Mpa	Min = 17Mpa Max = No limits
Provisions for grade of reinforcement steel	Min=250Mpa Max=500Mpa	Min=420Mpa Max=550Mpa
Mu limit	Mu limit = $0.138 f_{ck} bd^2$	Mu limit = $\varphi fybd^2(1-0.59\frac{\rho f_y}{f_c'})$

Table 1 Different parameter for IS code and ACI code.

Beam Parameters

IS and American codes are used to study and compare the numerous key factors used in beam design, such as span to depth ratio, maximum or minimum tensile steel, minimum shear reinforcement, and spacing.

Parameters	IS 456	ACI 318
Span to depth ratio	Cantilever - 7 Simply supported - 20 Continuous - 26	Cantilever – 8 Simply supported - 16 Continuous -18.5 (end) 21 (interior)
Mini. Tensile for flexure $\frac{Ast}{bwd}$	$\frac{0.85}{fy}$	$\frac{0.25fcr}{fy}$ Or $\frac{0.25\sqrt{fck}}{f_y} \geq \frac{1{\cdot}4}{f_y}$

Maxi. Tensile Steel for flexure	0.04bD	Net tensile strain in extreme tensile steel ≥0.005
Maximum shear reinforcement $\frac{A_s}{bwSv}$	$\frac{0 \cdot 4}{0 \cdot 87fy}$	$\frac{0.9\sqrt{fck}}{16fy} \geq \frac{0.33}{fy}$ When applied shear is greater than 0.58 concrete strength $\frac{0.062\sqrt{fcr}}{fyt} \geq \frac{0 \cdot 32}{fyt}$
Spacing of mini. spacing	0.75d≤ 300mm	0.5d ≤ 600mm and 0.25d ≤ 300mm when, $V_S > \frac{bw\,d\sqrt{fc}}{3}$

Table 2 Beam parameters for IS code and ACI code.

Column Parameters

Compared the values for the major crucial factors needed for column design, including slenderness ratio, short column condition, axial load calculation method, maximum or minimum longitudinal reinforcement, dimension, and spacing of lateral connections.

Parameters	IS 456	ACI 318
Slenderness ratio	$\frac{l_{ex}}{b}$ or $\frac{l_{ey}}{D}$	$\left(\frac{l_e}{D}\right)$crit = 7.21(2- $\frac{M_1}{M_2}$)
Co-ordinates for interaction curve	$\frac{P_u}{f_{ck}bD}$ and $\frac{M_u}{f_{ck}bD^2}$	$\frac{P_u}{f_{ck}Ag}$ and $\frac{Mu}{f_{Ck}AgD}$
Condition for compression members	Slenderness ratio < 12- short column > 12 – long column	Slenderness ratio < 22- short column > 22 – long column
Diameter of Lateral Ties	Should not be less than i) dia. of main bar/4 ii) 6mm whichever is less.	Should not be less than 0.3inch
Spacing of lateral ties	Should not be greater than i) 16xdia of main bar ii) 300mm whichever is less	Should not be greater than i) 16xdia of main bar ii) 48xdia of ties iii) 16inch
Check for biaxial bending	$\left(\frac{M_{ux}}{M_{ux^1}}\right)^{\alpha_n} + \left(\frac{M_{ux}}{M_{uy^1}}\right)^{\alpha_n} \leq 1$	$P_n > P_u$ Where, $\frac{1}{P_n} = \frac{1}{P_{nx}} + \frac{1}{P_{ny}} - \frac{1}{P_0}$

Table 3 Column parameters for IS code and ACI code.

Methodology

The following fundamental technique was used to conduct the investigation. First, a G+6 structure was developed. The building was modelled in STAAD.Pro. V8i and then examined according to the specifications for each international standard. The building primary structural components, the columns and beams, were created in accordance with the relevant criteria.

Modelling and Data Used:

In this study a G+6 building is analyzed and design by IS and ACI code to compare the structure by keeping some parameters as common. Comparison graphs are plotted for beam and columns by considering a critical section.

Structural data of the structure:

Parameters	Values
Material used	M25 & FE500
Ht. of each storey	3m
Density of concrete	25 KN/m^3
Column size	600mm x 600mm
Beam size	300mm x 600mm
Purpose of Structure	Residential Building
No. of Storey	G+6

Model:

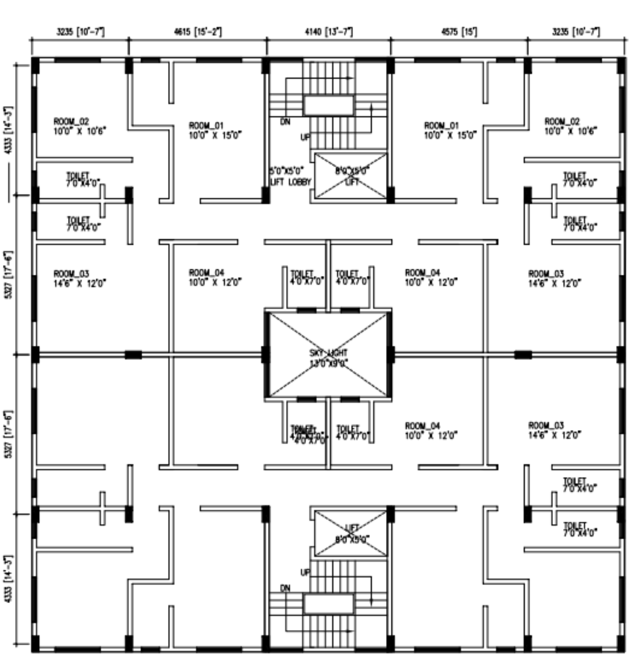

Figure 1: Structural Floor Plan

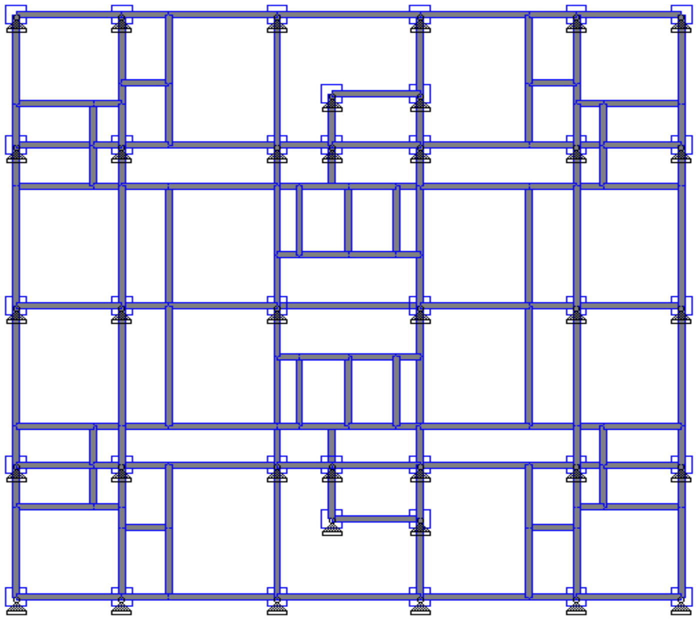

Figure 2: Beam Column layout of Model

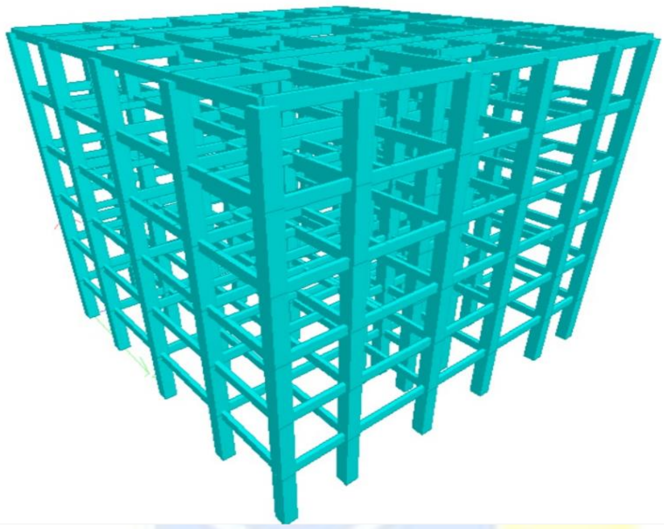

Figure 3: 3D Rendered View of the Structure

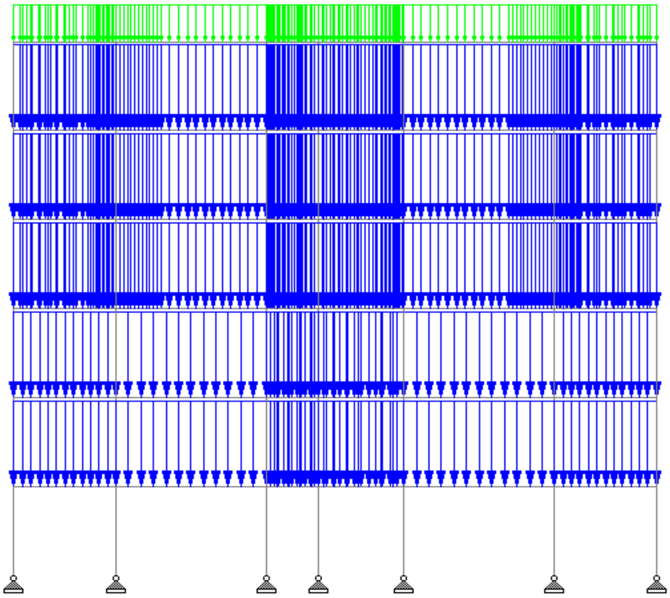

Figure 4: Wall Load

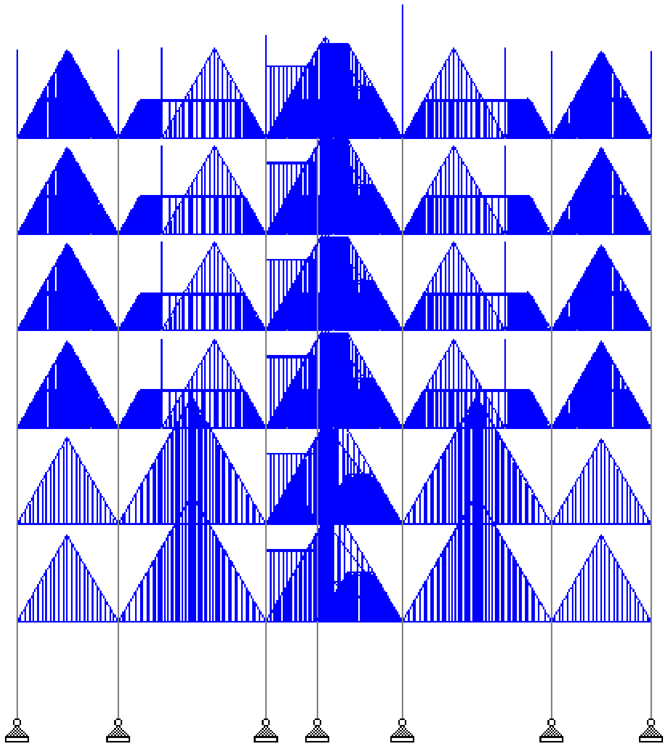

Figure 5: Live Load

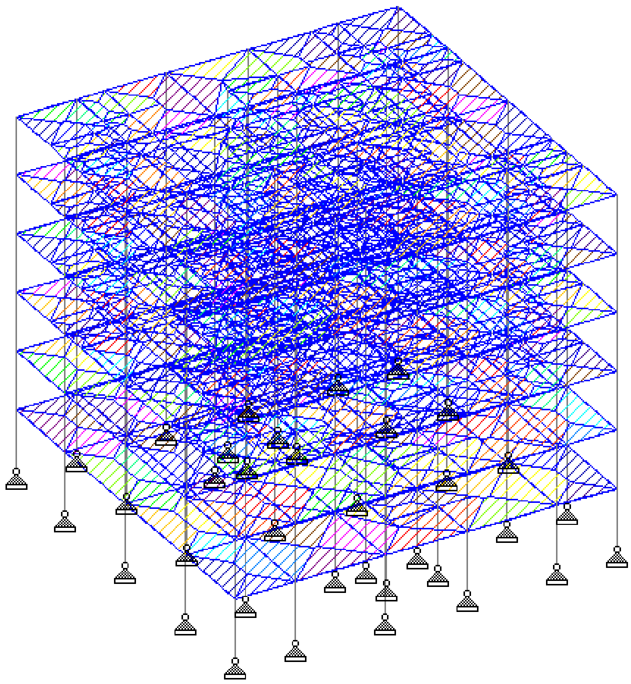

Figure 6: Dead Load

Result and Discussions:

Analysis of the Staad results for IS and ACI codes is done, and graphs are used to show the variation between the average longitudinal reinforcement needed for columns and the average tensile reinforcement necessary for beams. Fig. 7 illustrates the variation in the average tensile reinforcement for the critical beam.

S.No	Parameter	IS456	ACI 318
1	Beam No.	1624	1624
2	Size	300 x 300 mm	300 x 300 mm
3	Area of Steel Required	3742.122 mm^2	3292.815 mm^2

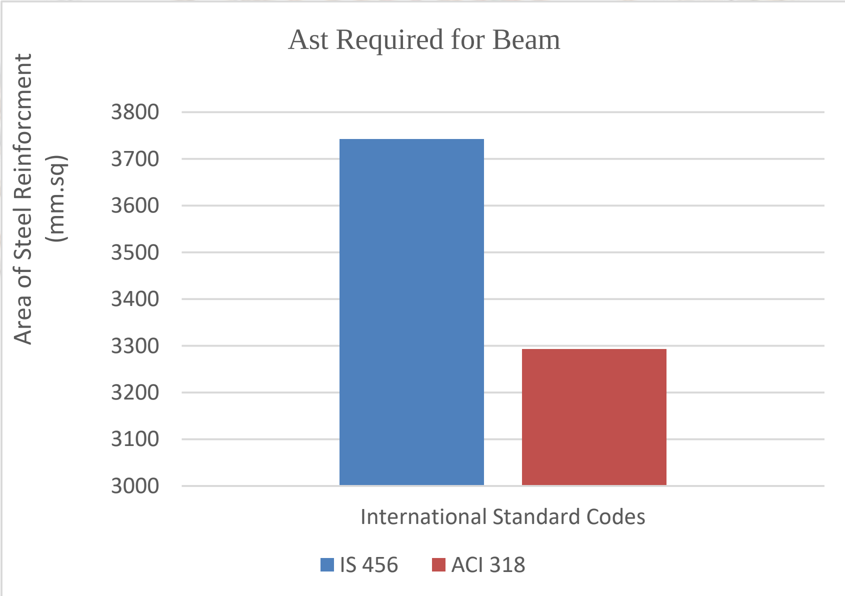

Figure 7: Variation of Ast of Beam for IS and ACI codes

The difference in average longitudinal reinforcement in column for IS and ACI codes is represented in figure 8.

S.No	Parameter	IS456	ACI 318
1	Column No.	1125	1125
2	Size	600 x 600 mm	600 x 600 mm
3	Area of Steel Required	2521 mm^2	3600 mm^2
4	Area of Steel (%)	0.75	1.00
5	Bar Size	12mm	12mm
6	Bar No.	24	32

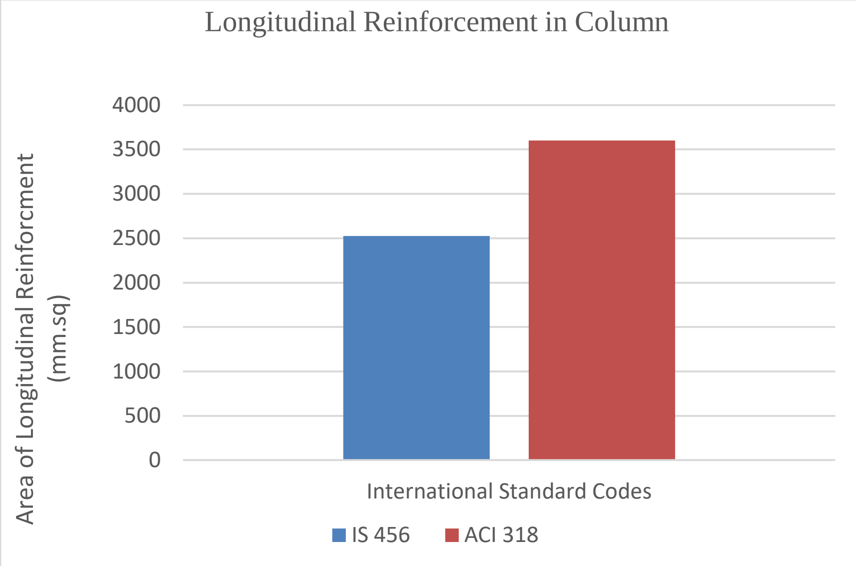

Figure 8: Variation of Longitudinal reinforcement in column for IS and ACI codes.

IV. CONCLUSIONS

The results of this study have led to the conclusions listed below:

- The building codes under consideration have many of the same concepts, however they differ in several specifications.

- When comparing design to total amount of steel needed for a building, ACI provide a greater design than IS code.

- Based on design methodology, IS and ACI are often not that dissimilar from one another. They provide close to identical responses and provide opportunities for safer and more cost-effective concrete buildings.

- Because of the different parameters like the stress block diagrams for steel and concrete vary, a difference in the area of reinforcement is seen. The variation in results from the maximum strain in steel and concrete being calculated differently under various codes, which also affects the formula used to determine the area of reinforcement.

- Although it is clear that the differences in values are caused by the independent constants, loading, and load combinations of their respective International Standard codes, despite the values obtained during the study of the structure for various structural parameters relating to the structure.

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