International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 07 | July 2022 www.irjet.net p-ISSN: 2395-0072

To Analyze and Comparing a G+12 story RCC building using IS-875 (part 3)-2015 and ASCE-07 for basic wind speed of 50m/s using STADD PRO software

Sneha M. Pimpalkar[1], Prof. Kirti Padmawar[2]

[1]*M. tech Student, Structural and construction Engineering Department, Ballarpur Institute of Technology, Maharashtra, India*
[2]*Assitant Professor, Structural and construction Engineering Department, Ballarpur Institute of Technology, Maharashtra, India*

Abstract - *Buildings are constructed for commercial and for residential uses. Buildings provide shelter for people. Due to rapid growth in population and higher rate of growths in industries there is a large demand for land and construction. In design practices, randomly varying phenomenon is a wind which is having significant dynamic effect on structures especially on flexible high rise building. The main objective of this project is to compare Indian Standard code i.e. IS-875 (part 3) 2015 and American standard code (ASCE-7) for basic wind speed and static loading on G+12 storey building using STAAD-Pro software. Analysis will be performed on building to identify the lateral force, intensity, storey drift, displacement, wind load, dead load, and combination of wind load and comparison of results which is obtained from software after assigning data. The main aim of this research is to understand provision of international standards (ASCE-7) and compare it with Indian standard.*

Key Words: **Structural analysis, Intensity, Displacement, Reactions, High rise buildings, Basic Wind Speed, Story drift, Shear force, B.M, IS-875 (part-3) 2015, ASCE-07**

1. INTRODUCTION

In general, wind is considered for design of high rise building, when a building comes in contact with wind both positive and negative pressure will occurs simultaneously. The building must have sufficient strength to resist pressure to prevent wind induced building failure. The wind effect is depend on geographic location and obstruction near the structure; much variation causes due to air flow and also characteristics of building itself like it self-weight. Codal provision is one of the basic and important aspects for an designing purpose, especially for the tall building. Different codes and Standard are affecting design parameter which leads its effect on the specification and cost of building. The structural designing of foreign countries are always remarkable and it is observed that they mostly follow ASCE standards for variety of structures. So comparison of such codes is very much important from point of facilitating good construction practices in developing countries like India.

For design of high rise structures wind load is a critical parameter especially for taller buildings constructed in non-seismic area. For the analysis of wind load most of the countries have developed its own standards and related specification for effective analysis and design of structures. Wind effect on the structure can be classified as "static" and "dynamic". Static effect primarily causes elastic bending and twisting of structure. In this research the structure is analyzed by static method.

1.1 Terminologies used In Wind Load Analysis

- Basic wind speed (Vb**):** it is applicable to 10 m height above mean ground level for different zones of the country. As per ASCE code there is 4 wind zones in America. there are 4 zone for which the basic wind speeds are 47, 56, 65, 76 (m/s) and As per IS code there is 6 wind zones in India (55m/s, 50m/s, 47m/s, 44m/s, 39m/s, 33m/s).

- Terrain Category: it means the characteristics of the surface irregularities of an area which arise from natural or constructed features. it is used for determining a structures exposures to wind as a result of terrain that surrounds it.

- Story drift: It is the lateral displacement of a floor relative to the floor below and the storey drift ratio is the storey drift divided by the storey height. STAAD-Pro computes the storey drift by calculating the average displacement of all the nodes at that level.

- Exposure category: It is used for determining a structure exposures to wind as a result of terrain that surrounds it. ASCE 7 defies three exposure categories (B,C,D). exposure B is defined as "urban and suburban areas, wooded areas, or other terrain with numerous, closely spaced obstruction.

1.2 DESIGN PARAMETER:

Basic wind speed	50 m/s
Terrain category	IV
Wind Zone	II
City	Chennai
Software	STAAD-Pro
Class of building for ASCE	III
Exposure category for ASCE	B

3. RESULT AND DISCUSSION:

1 Load calculations

DL:

Full brick wall load = 18.4 KN/m

Half brick wall load = 12 KN/m

Floor load = 3.125 KN/m

Parapet load = 5 KN/m

LL:

Live load for floor = 5 KN/m

2. Design Speed

Vz = Vb × K1 × K2 × K3 × K4

= 50 × 1.08 × k2 × 1 × 1.30

= 70.2 × K2 m/s

Pz = 0.6 × Vz^2

Wind pressure for ASCE code is calculated by the help of STAAD-Pro software and for IS code it is calculated by manually and after that it is put in software. The building structure is same for both the codes and location i.e. Chennai is also same for construction but the building is analyzed by both Standards parameter and then compared using STAAD-Pro software.

3.1. MODEL

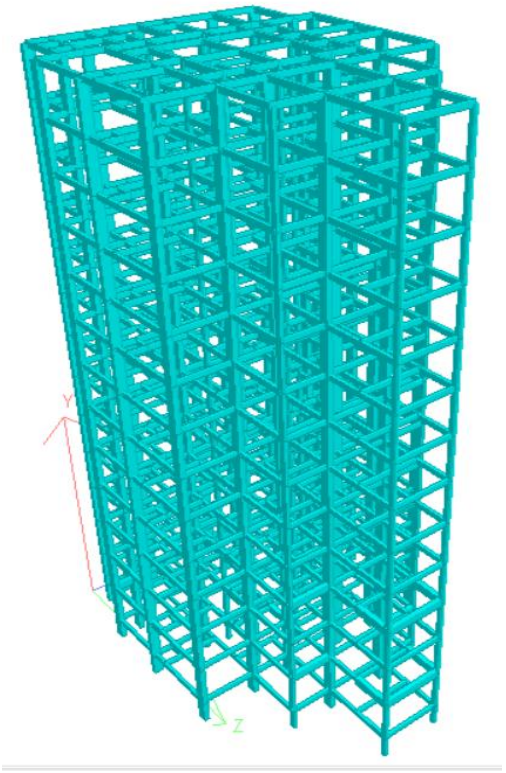

Fig. 3D view of Structure

4. CONCLUSIONS

- **Node displacement:-**

a) Node displacement in x-direction and z-direction is greater in case of Indian Standard as compare to ASCE Standard.

b) Node displacement in Y-direction is smaller for IS Standard as compare to ASCE Standard.

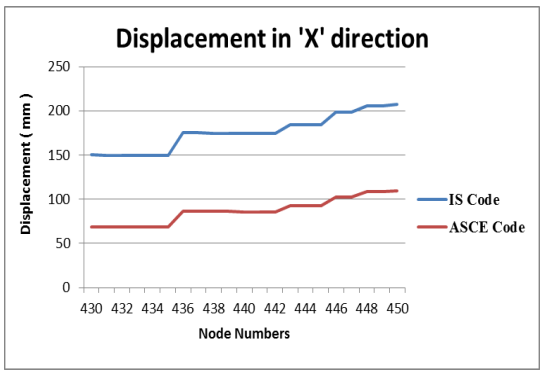

Fig.1: Comparison of Displacement for both Standards

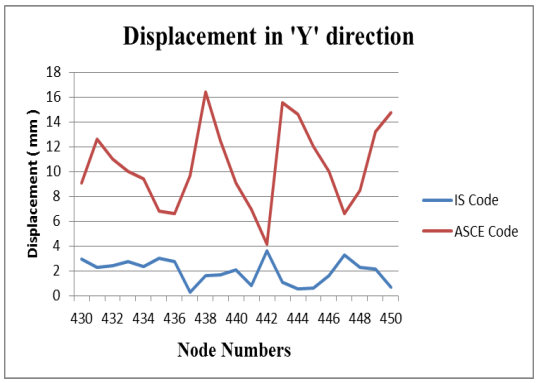

Fig.2: Comparison of displacement in 'Y' direction

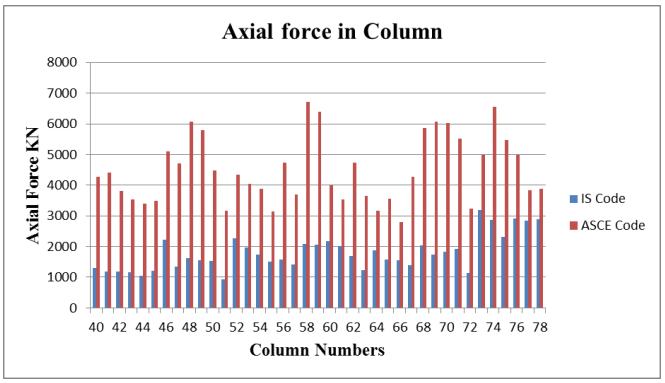

Fig.4: Comparison of Axial Force for both codes

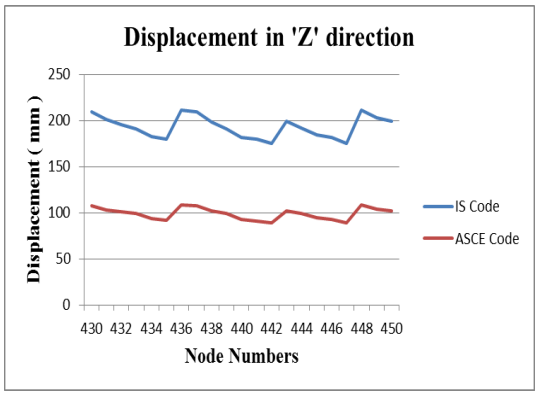

Fig.3: Comparison of displacement in 'Z' direction

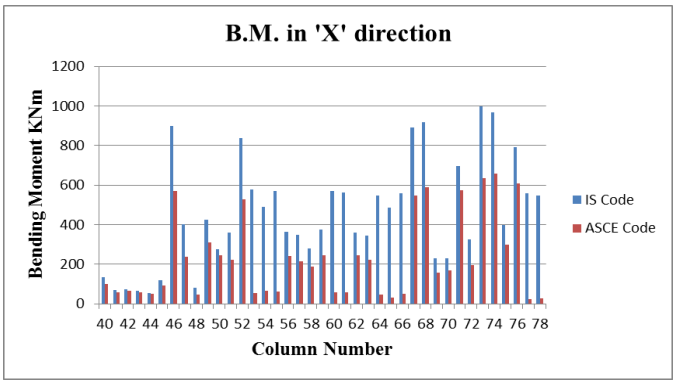

Fig.5: Comparison of B.M in Column for 'X' direction

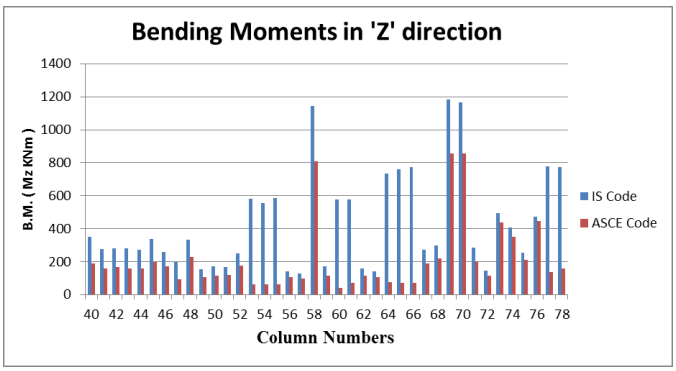

Fig.6: Comparison of B.M in Column for 'Z; direction

- **Node column reaction:-**

a) Axial force in column is greater for ASCE Code where as Bending Moment in column is greater for IS code. Hence column size of IS Code is large as compare to ASCE code.

Column size for IS=1.00m*0.5m (rectangular)

=0.80m (circular)

Column size for ASCE=0.75m*0.40m (rectangular)

=0.45m (circular)

- **Beam forces:-**

a) Shear force and Bending moment in beam is maximum for Indian Standard as compare to ASCE code.

b) Thus forces in all the member for IS code are higher as compare to ASCE code, therefore design is heavy for IS code.

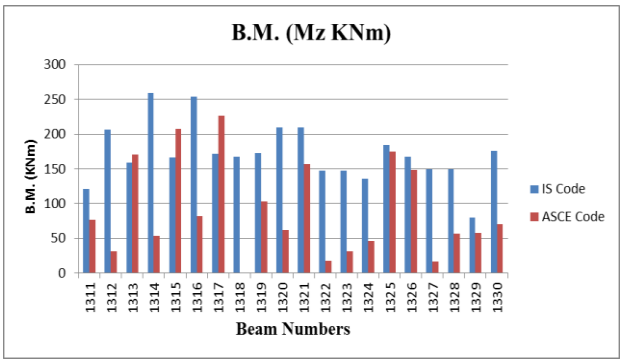

Fig.7: Comparison of B.M. of beam for both codes

- **Story drift:-**

a) Maximum story drift is higher for IS-875 code as compare to ASCE-7 code.

- **Quantity of Concrete & Steel:-**

a) Quantity of concrete required for construction in IS Standard is higher than ASCE Standard.

Quantity of Concrete for IS=1369.4 m^3

Quantity of Concrete for ASCE=1198.3 m^3

REFERENCES

[1] **Shreenidhi H M, Shivaraju G D, Dr. T V Mallesh, S R Ramesh** (Aug. 2019) "codal comparison of IS:875 (part 3)1987 and IS:875(part 3)2015 for wind load analysis of high rise building using ETABS" IRJET, Volume 06, Issue 08, e-ISSN: 2395-0056, p-ISSN: 2395-0072

[2] **Md Ahesan Md Hameed, Amit Yennawar** (march 2018) "A Review-comparative study on wind load analysis using different standards", Volume 7, Special Issue 3, ISSN (online):2319-8753, ISSN(print):2347-6710, Karnataka.

[3] **Kilari Lkshmi Kanth Patrudu** (April-2018) "Comparative analysis for two different wind speeds for a G+10 storey structure" ,IJIRST, Volume 4, Issue 11, ISSN(online):2349-6010 (Aproved by AICTE, New Delhi), Visakhapstnam, Andhrapradesh.

[4] **Sayyed Javad, Hamane Ajay A.** (May-2018) "comparative study of building by IS standard and ASCE standard under seismic forces" IJSR, Volume 7, Issue 5, ISSN (online):2319-7064, Impact factor (2017): 7.296

[5] **Gorakh Vinit, Nishit Kadia, Kiranmoy Samnta**, (October-2018), "comparative study of RCC and Steel structures for different floor heights", IJIRAE, Volume 5, Issue 10, www.ijirae.com

[6] **Shaikh Muffassir, L. G. Kalurkar,** (July-August 2016) "Comparative study onwind analysis of multistory RCC and composite structure for different plan configuration" IOSR-JMCE, e-ISSN: 2278-1684, p-ISSN:2320-334X, Volume 13, Issue 4 Ver.VII, PP 42-49 www.iosrjournals.org

[7] **Chang-Abdulmonem A. Badri, Manar M. Hussein and Walid A. Attia**, (August 2014) "Comparative study of wind tunnel test results to international and Egyptian design codes" ASEM14, Busan, Korea, pp 24-28, manar.m.hussein@gmail.com

[8] **Mustafa M. Wagh and Ankita M. Sukhija,** (Sept. 2016) "A Review on comparative study of composite RCC and steel structure " IJAITE, Volume 1, Issue 5, ISSN:2455-6491

[9] **K. Suresh Kumar** (july 2011) "Commentary on the Indian standard for wind loads", 13th International conference on wind engg., Amsterdam, The Netherland.

[10] **N G Shilu and Dr. H S Patel,** (Oct.-Dec 2011) "Computational tool for wind pressure and forces on a multistory building commercial complex" JERS,Volume II, Issue IV, Pg. 84-87

[11] **Indian Standard 875 (part 3)-1987** "Code of practice for design loads (other than earthquake) for building and structure part 3 wind loads (second revision)." Published by Bureau of Indian Standard

[12] **B. S. Mashalkar,** "Effect of plan shapes on the response of building subjected to wind vibration" IOSR-JMCE journal of Mechanical and Civil Engineering.

[13] **Dr. Krishna, Dr. Krishan Kumar, Dr. N. M. Bhandari** "IS:875 part3 1987 a commentary on Indian standard code of practice for design loads (other than earthquake) for building and structure part3 wind loads

[14] Explanatory handbook on Indian standard code of practice for design loads for building and structure part 3 wind loads bureau of Indian standard.

[15] ASCE 7-05, 2005, minimum design loads for building and other Structural Engineering Institute of ASCE, Reston, VA

[16] **Garber J., Suresh Kumar,** 2006, "A comparison of force balanced and pressure integration techniques for predicting wind induced respons of tall buildings", in proceeding of the ASCE Structure Congress 2006, Extreme wind engineering, St.Louis, USA