JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Analytical Study and Design of Foundation by Using Indian Standard and Euro Standard Under Action of Seismic Forces

[1]Abhijit Narnaware, [2]Amey Khedikar
[1]Research Scholar, [2]Assistant Professor
[1]Departmenrt of Civil Engineering,
[1]Tulsiram Gaikwad Patil College of Engineering and Technology, Nagpur, India
[1]abhijitnarnaware358@gmail.com, [2]amey.khedikar@gmail.com

Abstract : — Construction is very important aspect in every developing country. Also every country has specific Country Codes which provide the Construction standard to engineer of the design of various structural component like the Beam, Column, Slab & Foundation. Analysis and Designing of any structural Component or object is based on their geographical location. The major natural forces cause damage to structure like building is seismic forces also it damages lives and economy. Engineers must be efficient enough to handle and understand the different codes and apply their knowledge to design the structure which is long spanned & economical. In this project analytical study is presented for understanding and designing the footing using Indian standard Code and Euro standard code under action of seismic forces with help of Stadd pro.

The G+10 storey building is modeled in STAAD PRO V8i software and design of pad footing is done. The structure is resting on two types of soil i.e, hard and medium soil. An attempt is made to compare EURO standard with INDIAN standard using structural software STAAD FOUNDATION. In order to study the effect of various types of foundation in the behavior of building to seismic forces.

***Index Terms— Isolated* footing, stadd pro v8i, Indian standard code, Euro standard code**

I.INTRODUCTION

Designing and modeling of any structure crosses most of the two engineering disciplines. There is the structural engineer who designs the structure and the geotechnical engineer who is concerned with the geotechnical aspects of the soil. The strength of building and foundation are two things to be considered while analyse the behaviour of the structure . Foundation is basic part of structure that transmit loads from structure in to the sub-soil. The objective of this paper is to study the types of foundation their analysis and design according to different country codes and soil condition under seismic forces.

India is divided into different seismic zones. As per IS 1893:1984 Code India is divided from Zone I to Zone V. But as per IS 1893:2002 Code is has been divided from Zone II to Zone V. Zone I has been discarded.

1.1 Load calculation

Load calculations are carried out based on various Indian Standards such as IS: 875(Part – 1)-1987 for Dead loads (Unit weight of Building materials), IS: 875(Part –2)-1987 for Imposed loads and IS: 1893(Part 1)-2016 for Seismic loads , and Euro Standard code

1.2 Model formulation

Assumed Data for Models
Building = G + 10 Storey
Slab Thickness = 0.15 m
Live Load = 3000 N/m^2
Floor Finish = 1500 N/$m^{2.}$

Sr. No.	Element	Notation	Size (m)
1	Column	C1	0.6 X 0.6
2	Beam	B1	0.3 X 0.4

TABLE 1 : SIZE OF ELEMENT

Concrete Grade = M20
Concrete Density = 25000 N/m^3
Steel Grade = Fe500
Steel Density = 7850 N/m^3
Seismic Zone = II , III
Zone factor, Z = 0.1, 0.16
Importance factor, I=1.00
Response reduction factor, R=3.00
Damping factor = 0.05

. The load cases considered in the seismic analysis are as per IS 1893 – 2016.

Seismic Zones	II	III	IV	V
Seismic intensity	Low	Moderate	Severe	Very Severe
Z	0.1	0.16	0.24	0.36

Table 2 : Zone Factor, Z
(As per IS1893:2002 Clause 6.4.2)

II. METHODOLOGY

2.1 Provisions of Design Codes

Ensuring that Established the security by the codes against possible failure due to punching shear is based on the shear force acting in the critical section is greater than or equal to the reduced shear strength of the concrete. For the study's experimental analysis, strength reduction factors for the material were taken as one (1.0) in each regulation.

2.2 Seismic analysis

In earthquake engineering seismic analysis is a tool which is used to understand building response due to seismic excitations in a regular manner. In few decades back, the buildings had designed just for gravity loads while seismic analysis is a recent development. It is part of structural analysis and design where earthquake relevant.
The structural model has been selected, it is possible to do analysis to find the forces in the structure induced due to earthquake. There are various methods of analysis which provide different degree of accuracy. The analysis process can be categorized on the basis of three factors:
Type of external load application
Structure/structural element causing different behavior
Selected structural model

2.2.1 Analysis methods

Seismic analysis is a one of the part of structural analysis and the structural comments such as building response calculation of earthquake. It is the part of the process of structural design earthquake engineering or structural assessment in region where earthquake are prevalent . A building has the potential to wave bake and forth during an earthquake (or even a several wind storm). This is fundamental mode and is the minimum frequency of building response most building, however higher modes of response, which are precisely activated during earthquake.

2.2.2 Linear Analysis

The linear static analysis can only used for regular structure with limited height. In general, linear procedures are applicable when structure is expected to remain elastic for the level of ground motion or result is in nearly uniform distribution of nonlinear response through the structure. Linear analysis consists of two method i.e. Equivalent static analysis (Static) and Response spectrum analysis (Dynamic). The significant difference between linear static and linear dynamic analysis is the level of force and their distribution along the height of structure.

2.2.2.1 Equivalent Static Analysis:

The equivalent static analysis procedure is essentially an elastic design technique. It is, however, simple to apply than the multi-model response method, with the absolute simplifying assumptions being arguably more consistent with other assumptions absolute elsewhere in the design procedure. The equivalent static analysis procedure consists of the following steps:
Estimate the first mode response period of the building from the design response spectra.
Use the specific design response spectra to determine that the lateral base shear of the complete building is consistent with the level of post-elastic (ductility) response assumed. Distribute the base shear between the various lumped mass levels usually based on an inverted triangular shear distribution of 90% of the base shear commonly, with 10% of the base shear being imposed at the top level to allow for higher mode effects.

2.2.2.2 Non-Linear Analysis

Nonlinear analysis is classified as nonlinear static analysis and nonlinear dynamic analysis. The static analysis is done by using Pushover analysis method while dynamic is done by using Time history analysis method.

2. Characteristic Strengths of Reinforcement

Characteristic strengths of reinforcement are given in BS4449, BS4482 and BS4483 and are as shown in Table 4. Design may be based on the appropriate characteristic strength or a lower value if necessary to reduce deflection or control cracking.

DESINATION	SPECIFIC CHARACTERISTIC STRENGTH N/M^2
HOT ROLLED MILD STEEL	250 X 10^6
HIGH YEILD STEEL	460 X 10^6

TABLE 3: STRENGTH OF REINFORCEMENT

2.4 BS 8110-1:1997

In ULS design of the whole or any part of a structure each of the combinations of loading given in Table 3 should be considered and the design of cross-sections based on the most severe stresses produced

Load Combination	Load Type					
	Dead		Imposed		Earth And Water	Wind
	Adverse	Beneficial	Adverse	Beneficial		
Dead And Imposed	1.4	1.0	1.6	0	1.4	-
Dead And Wind	1.4	1.0	-	-	1.4	1.4
Dead Wind And Imposed	1.2	1.2	1.2	1.2	1.2	1.2

Table 4: Load combinations and values of ¾$_f$ for the ultimate limit state

III. FORMULATION OF PRESENT WORK

For the analysis following load combinations specified by the IS 1893: 2016 are used. The basic load combinations given by the code as per clause 6.3.4.1 are as follows

LOAD COMB 201 1.5(DL + LL)

LOAD COMB 202 1.2[DL+IL+(ELX+0.3ELZ)]

LOAD COMB 203 1.2[DL+IL-(ELX-0.3ELZ)]

LOAD COMB 204 1.2[DL+IL+(ELZ+0.3ELX)]

LOAD COMB 205 1.2[DL+IL-(ELZ-0.3ELX)]

LOAD COMB 206 1.5[DL+(ELX+0.3ELZ)]

LOAD COMB 207 1.5[DL-(ELX-0.3ELZ)]

LOAD COMB 208 1.5[DL+(ELZ+0.3ELX)]

LOAD COMB 209 1.5[DL-(ELZ-0.3ELX)]

LOAD COMB 210 0.9DL+1.5(ELX+0.3ELZ)

LOAD COMB 211 0.9DL-1.5(ELX-0.3ELY)

LOAD COMB 212 0.9DL+1.5(ELZ+0.3ELX)

LOAD COMB 213 0.9DL-1.5(ELZ-0.3ELX)

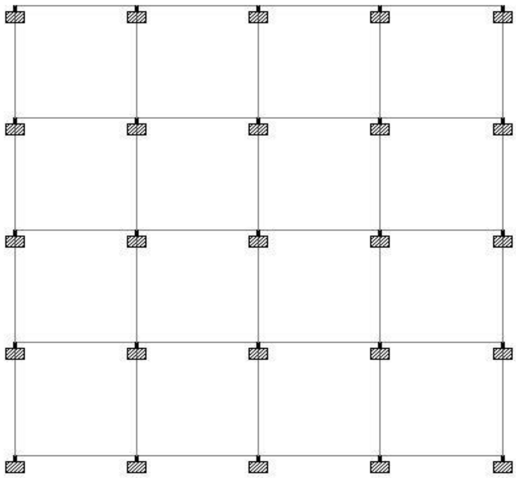


Figure 3.1: Typical Plan of Modeled Building

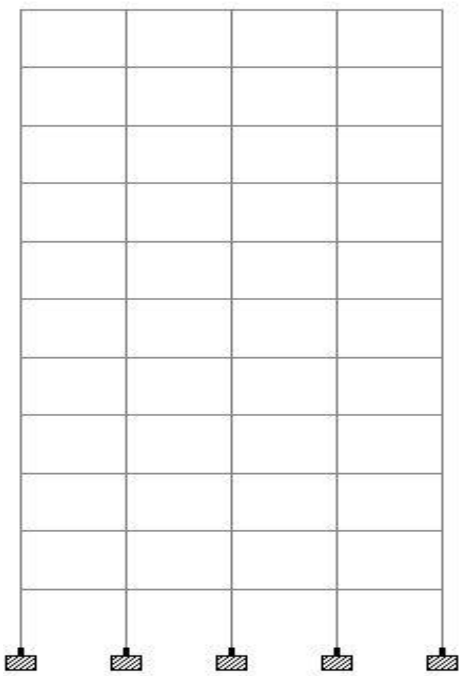


Figure 3.2: 2D Plan of Modeled Building

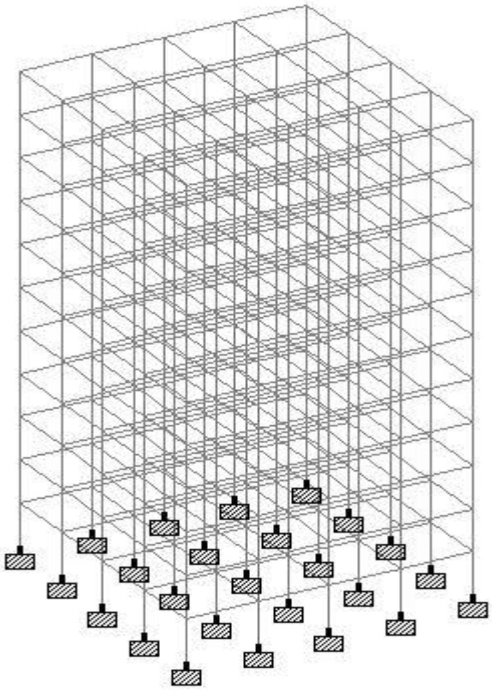
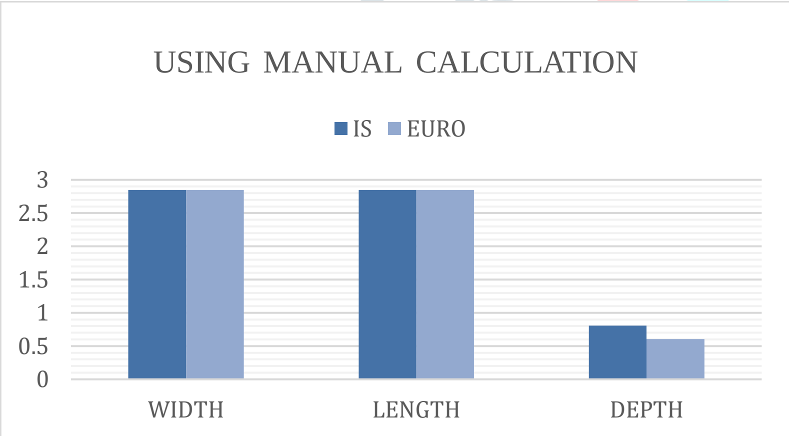
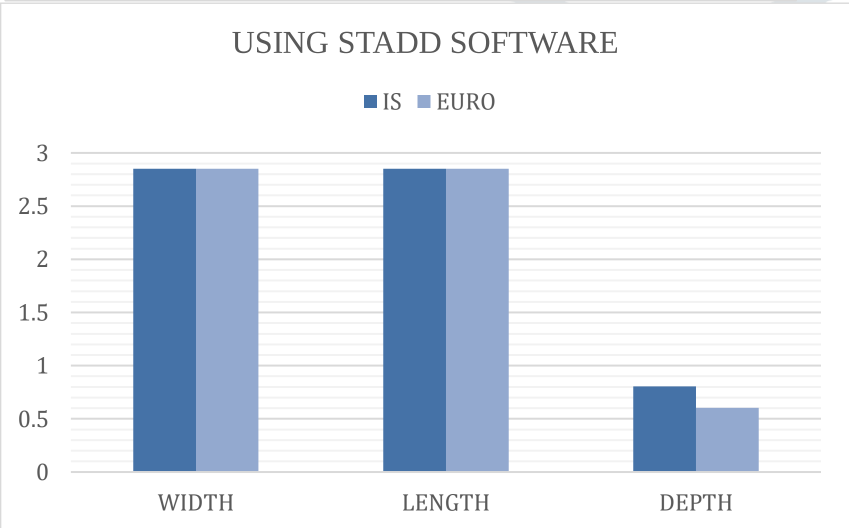


Figure 3.2: 3D Plan of Modeled Building

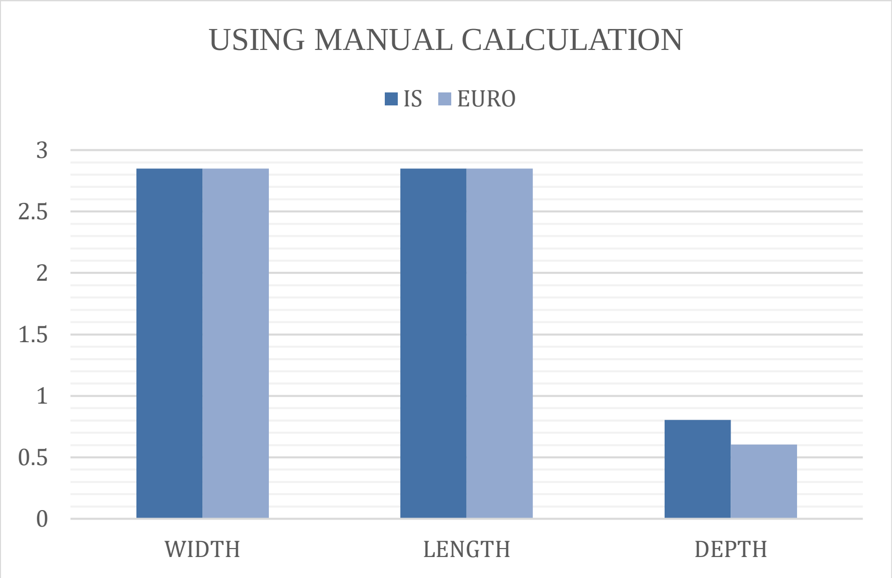
IV.RESULTS

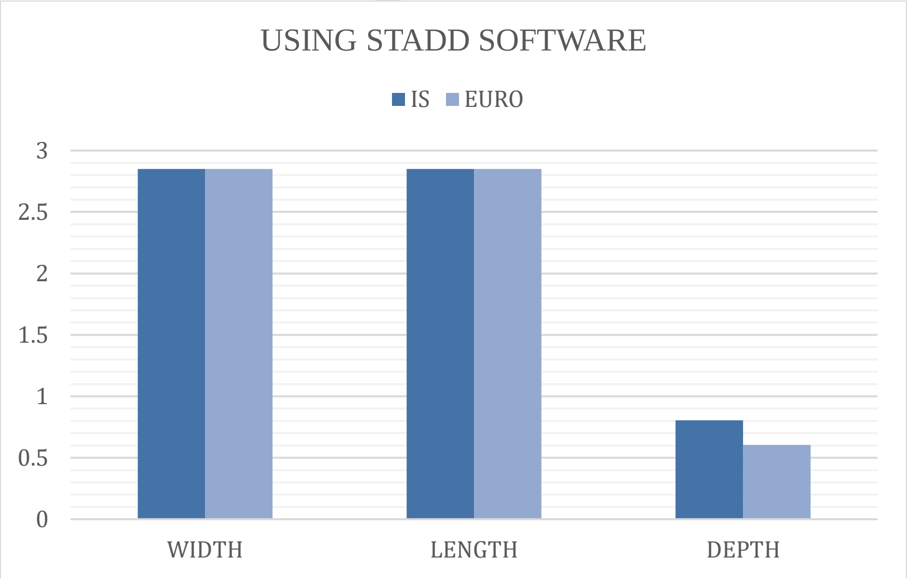
1. FOR HARD SOIL





2. FOR MEDIUM SOIL





V. CONCLUSION

- It can be observed from the results and comparison that variation in values of depth of footing is according to the codes and soil condition.
- Euro code is slightly better than IS code to design with reference to depth of footing.
- Result of IS code is economical than Euro code with reference to area of steel required.
- The depth of footing in Euro code is less than IS code.
- According to the climatic condition and soil condition both the code are reliable and economic.

VI. REFERENCES

[1] Dr. V.L. Shah & Late Dr. S .R. Karve, "Illustrated design of Reinforced concrete Buildings"

[2] Dr. V.L. Shah & Late Dr. S. R. Karve, "Limit State Theory And Design Of Reinforced Concrete", Structures Publication

[3] Duggal S.K., "Earthquake Resistant Design Of Structures", Oxford University

[4] EURO CODE 2: Design Of Concrete Structures

[5] IS 456:2000: Code Of Practice For Plain And Reinforced Concrete

[6] IS 1893 (Part-1):2002: Criteria For Earthquake Resistant Design Of Structures

[7] Richard Fenwick, David Lau,Barry Davidson, "A Comparison Of The Seismic Design Requirement In The New Zealand Loadings Standards With Other Major Design Codes"

[8] Joseph E. Bowles, RE., S.E.; "Foundation analysis and design "; 5th Edition, McGraw-Hill International editions, 1997.

[9] A. Lu´evanos Rojas, A mathematical model for dimensioning of footings rectangular, ICIC Express Letters, Part B: Applications, vol.4, no.2, pp.269-274, 2013.

[10] A. Lu´evanos Rojas, A mathematical model for dimensioning of footings square,International Review Civil Engineering, vol.3, no.4, pp.346-350, 2012.

[11] A. Lu´evanos Rojas, A mathematical model for the dimensioning of circular footings, Far East Journal of Mathematical Sciences, vol.71, no.2, pp.357-367, 2012.

[12] M.S.Shetty (1892) , Concrete Technology, S.Chand & Company Ltd.

[13] V.N.S.Murthy(2007), Advanced Foundation Engineering, CBS Publishers & Distributors Pvt. Ltd

[14] Draft Indian Standard Guidelines for Criteria For Earthquake Resistant Design Of Structures: Part 1 –General Provisions For All Structures And Specific Provisions For Buildings [Sixth Revision of IS 1893 (Part1)]

[15] Surabhi A. Bambal, P.G. Scholar, M.A. Banarase, Asst.Professor, "Review on Comparative Study on Analysis and Design of Multistoried Structure using Different Codes", International Journal of Research in Engineering, Science and Technologies (IJRESTs), Vol:1,No.:8, Dec 2015.