Comparative study on Analysis and Design of footing using Indian standard code and Euro standard under seismic forces

Swati S Kale1, Prof. Shilpa Samrutwar 2
1 PG Student of Civil Department
BIT Bamni, Maharashtra, India.
2 Assistant, Professor of Civil Department
BIT Bamni, Maharashtra, India

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Abstract - *Construction is a vital part of every developing country in this era. Every country has specific design codes which provide the standards to engineers of the design of various structural components like the beam, column, slabs and foundation. Analysis and design reinforcement concreted building of every country is based on their geographical location. seismic forces are one of the major natural forces causing huge damage to lives and economy. So that one can understand the difference and can appropriate for the best guideline for safety to lives and economy. In today's world of globalization, and engineering must be efficient enough to understand and handle different code, in this project a comparative study is presented for analysis and design of footing using Indian standard code and Euro standard under seismic using Staad pro.In this project a G + 10 RCC building frame with numbers of bays in X and Y are three, is used along with size of beam 300 X 400 mm & size of column 400 X 500 mm, with M20 grade of concrete & Fe415 grade of steel. Here the building is situated in zone number 4 which is highly seismic zone. To analysis the structure linear static analysis method is used. After the application of load that is dead load, live load, earthquake load from the building towards the footing is analysis and compared for various parameters such as soil settlement, punching shear, deformation in STAAD FOUNDATION and the results are computed in the form of tables and graphs.*

Key Words: Staad-Pro, Share Stress, Pad Footing, Indian code, Euro Code etc.

1. INTRODUCTION

The primary requirement of humans on planet earth is food, clothing and shelter. Prehistoric men and women used to live on trees but steadily they started developing the shelters for protection against natural calamities like rains, cold, wind etc. and also from attack against wild animals. Soon humans grew in knowledge and they started living together, forming communities to ensure additional security and man became a social animal. Now these communities developed and started exploding forming villages which later on transformed into cities and became the commercial centers of a region. Soon within these commercial centers, land for horizontal expansion became extinct. The social animal started expanding vertically constructing multi-storied structures. These multi-storied edifice were susceptible against natural hazards like earthquake which was life threatening for the residents. With the advancement in engineering practices, researchers developed systems which reduced the effects of seismicity on the engineered structures.

Foundations:

Foundations are required primarily to carry the dead and imposed loads due to the structure's floors ,beams ,walls , columns, etc. and transmit and distribute the loads safely to the ground. The purpose of distributing the load is to avoid the safe bearing capacity of the soil being exceeded otherwise excessive settlement of the structure may occur.

Foundations failure can produce catastrophic effects on the overall stability of a structure so that it may slide or even overturn . such failures are likely to have tremendous financial and much attention is paid to the design of this element of the structure.

Foundations Types:

There are many types of foundations which are commonly used , namely strip , pad and raft . The foundations may bear directly on the ground or be supported on piles . The choice of foundation type will largely depends upon (1) ground condition (i.e, strength and type of soil) and (2) type of structure (i.e, layout and level of loading) Pad footings are usually square or rectangular slab and used to support a single column . The pad may be constructed using mass concrete or reinforced concrete depending on the relative size of the loading.

Foundation Design:

Foundation failure may arise as a result of (a) allowable bearing capacity of the soil being exceeded , or (b) bending and/or shear failure of the base. The first condition allows the plan-area of the base to be calculate , being equal to the design load divided by the bearing capacity of the soil, i.e. Ground pressure = design load /plan area < bearing capacity of soil Since the settlement of the structure occurs during its working life , the design loadings to be considered when calculating the size of the base should be taken as those for the serviceability limit state (i.e, 1.0Gk + 1.0Qk). The calculations to determine the thickness of the base and the bending and shear reinforcement should , however , be based on ultimate loads (i.e, 1.4Gk + 1.6Qk). The design of a pad footing only will be considered here.

Pad Footing:

The general procedure to be adopted for the design of pad footings is as follows:

1. Calculate the plan area of the footing using serviceability loads.
2. Determine the reinforcement areas required for bending using ultimate loads.
3. Check for one way and two way shear.

Necessity of Research:

During a major earthquake the inherent ductility of the structure is not enough to prevent the catastrophic failure. So there is a need of such a strong and durable foundation that provides additional ductility to the structure preventing the primary structural members from a vast damage. To make foundations more efficient and strong and to understand the accuracy of different country codes for analysis and design of pad footing for various soil condition the research had been done.

2. LITERATURE REVIEW

Paper [1] shows a building code, is a set of rules that specify the minimum standards for construction objects such as buildings and non- buildings structures. Buildings must conform to the code to obtain planning permission, usually from a local council. The main purpose of building codes are to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structure. The buildings code becomes law of a particular jurisdiction when formally enacted by the appropriate governmental or private authority. Building codes are generally intended to be applied by architects, engineers' constructions and regulators but are also used for various purposes by safety inspectors, environmental scientists, real estate developers, subcontractors, manufacturers of building products and materials, insurance companies, facility managers, tenants and others. Structure design is the methodical investigation of the stability, strength and rigidity of structural. The basic objective in structural analysis and design is to produce a structure capable of resisting all applied loads without failure during its intended life. The primary purpose of a structure is to be transmit or support loads. If the structure is improperly designed or fabricated, or if the actual applied loads exceed the design specifications, the device will probably fail to perform its intended function, with possible serious consequences. A well-engineered structure greatly minimizes the possibility of costly failures Different countries follows different methodologies in building design thus there are many design codes that are built across the world. Comparison between these buildings codes will help to form a most effectively and economical building design. Comparison has been made between various codes such as European code, Indian code, American code, Japanese code, and British standard.

T The aim of paper [2] is to study the effect of soil settlement under different types of footings for multistory Buildings. Soil settlement sometimes occurs under the foundations due to bad soil compaction, water pipe leakage, soil erosion and excavation on neighboring site. Also the similar effect might occur due to columns damages happened by explosion. Settlement effect on the moment and shear in beams and footing was studied. Also the effect of columns load and maximum base pressure under footing was studied. Building with dimensions 16*16 meters with four spans in both ways was assumed for studing in this paper, the building has three stories. Software STAAD.ProV8i was used in the analysis, finite elements are used to represent the slabs and footings. The soil subgrade reaction was used to represent soil in software. Four types of footings were taken in this study which are spread footing, spread footing with tie beam, contineous footing and raft footing. Two settlement positions in the building was studied, the first one is under the internal footing and the second one is under exterior footings. The effect of tie beam dimension increasement and settlement in part of spread footing were studied also. The study clearly show that, the continuous footing is a very good selection because it shows a very good response against settlement, keep the settlement within allowed values and has lower cost than the raft footing. The study recommends to avoid using spread footing with or without tie beam. Tie beam dimension increasement has little effect to improve spread footing. Also,the study recommends suitable values of additional saftey factors for column and beam design when settlement is expected.

Paper [3] the current practice in Indian refinery sector is to design the piles and their arrangements according to the provisions of Indian standards. Indian standard adopts the "working stress design approach" which has been in extensive use till date for the design of gamut of foundations, viz. isolated footings, raft foundations, pile foundations, etc. with a global factor of safety. However, internationally a new design concept, limit state design approach as per Eurocode has gained popularity in recent times. Eurocodes are a well-established benchmark for many countries all over the world. Eurocodes lay emphasis on soil–ground interactions, besides just superstructure and explain the design of soil– ground interactions in such a way that limit states may be reached for pile groups as well. Recent designs of pile and pile group arrangement in Indian parlance using the European standards have shown encouraging signs of savings in terms of reduced number of piles required. This paper presents a comparative study of the number of piles required for a pipe rack structure in a refinery complex using Indian standard and Eurocodes. This paper further gives the quantitative idea of possible savings in materials that can be attained using the advanced code and attempts to explore the reason for the same. The possible savings in carbon footprint during refinery construction due to this material saving have also been attempted.

Paper [4] Tests were performed to measure shear strength by punching five (5) isolated footings of reduced size and supported on granular matter. Footings were squared,450 mm by side and 80 mm thick, reinforced with bars, 6.3 mm in diameter and 3.5 slenderness (a/d). Estimation of failure loads predicted by three codes (ACI-318-14,Eurocode-2, and BS-8110) were made to analyze parameters' influence that, according to each norm, affect shear strength by punching. Results show that the methodology of one of the codes analyzed is more conservative than the others.

Paper [5] shows R.C. buildings, frames are considered as mainstructural elements, which resist shear, moment and torsioneffectively. These frames are subjected to variety of loads, where lateral loads are always predominant. Infrastructures of Gulfcountries are always remarkable as they mostly follow EUROstandards for construction development. In view of the demandof such codes across the developing countries like India, anattempt is made to compare EURO standards with Indianstandards using structural software.

In paper[6] the proposed study an attempt is made to understand the effect of soil interaction on the performance of building frames resting on isolated footing. The purpose of this study is to describe and investigate different approaches of considering Medium hard clay type of soil is used for this SSI study. The interaction approach is incorporated in the analysis using Conventional analysis (NIA model - Non interaction analysis) and Soil-structure interaction analysis (LIA model - linear interaction analysis). ANSYS CivilFEM is used for developing these models. The effect of SSI on various structural parameters i.e. natural time period, base shear, roof displacement, beam moment and column moment and axial force are studied and discussed. The comparison is made between the approaches of conventional and liner interaction modeling. The study reveals that the SSI significantly affects the response of the structure.

Paper [7] shows Seismic Analysis of building is very much important in the present scenario. Post-earthquake study of the structures reveals an idea about the behaviour of the structure to seismic forces and their damage. Numerical Analysis is a powerful tool in the analysis of structures which predict the possible settlements and deflections related to seismic loads so as to design the structure safely. In addition it is seen that the interaction of soil and foundation plays a major role in the damage/response of structure. Foundation is that part of structure to transmit loads from structure in to the sub-soil. In order to study the effect various type of foundation in the behaviour of building to seismic forces, a thirteen storey structure is modeled in ANSYS 16. The structure is resting on three layers of soil such as sand, clay and stiff clay. Three types of foundation such as raft, pile and under reamed pile are considered for the comparison of the study keeping all other parameters constant. On comparing the values of total lateral deflection of the building it is found that the structure with raft foundation shows maximum lateral deflection, than pile foundation and minimum is with the under reamed pile foundation. The settlement of footing is also observed. The settlement obtained under raft foundation concrete is greater than that of pile foundation. The soil settlement under pile foundation is slightly higher than that of under reamed pile foundation.
paper [8] shows R.C. buildings, frames are considered as mainstructural elements, which resist shear, moment and torsioneffectively. These frames are subjected to variety of loads, where lateral loads are always predominant. Infrastructures of Gulf countries are always remarkable as they mostly follow EUROstandards for construction development. In view of the demandof such codes across the developing countries like India, anattempt is made to compare EURO standards with Indianstandards using structural software.
Paper [9] presents design concepts of Eurocode 7 and 8 with regard to simple foundation design. Design methodology of Eurocode 7 is compared with that of BS 8004:1986. A simple design example of a pad foundation is used to compare Eurocode 7 and BS design methods. Seismic performance of the pad foundation of different dimensions is then analysed using PLAXIS dynamic code. The results of the dynamic analyses show that the seismic design of simple foundation needs to be performance-based. Keywords: British Standards, comparison, design concept, Eurocode 7, Eurocode 8, improvement, SLS, spread foundation, ULS, worked example.

In paper [10] progress of preparing the next generation of Eurocode 7 the Evolution Group EG 7 ´Pile Design´ of TC250/SC7 has focused on the evoultion of Design of piles according to Eurocode 7 in the period 2011 to 2015. Based on the results of this period of collaboration and bringing together European experiences in pile design the expected evolutions for the section ´Pile Foundations´ of the upcoming EC7-3are presented in this contribution whereby several issues are still subject of ongoing dicussions and developments. It is obvious that especially the design of pile foundations is still related to national experiences resulting from diffferent geological conditions, different methods of soil investigation, different type of piles commonly used as well as a wide field of different calculations methods often related to the soil conditions/investigations and the pile type used. Nevertheless there is epecially for pile design a realistic chance to achieve a further harmonizaton of the design principles even if the exploration and calculation methods might differ still in future.. Paper [11] Working Stress Design Approach (WSDA) has been used extensively to design Footing, Raft and pile foundations with a global safety factor. A new design concept, Limit State Design Approaches (LSDA), following the Eurocode 7 has become popular in recent years. A comparison study between a working stress design approach with a factor of safety equal to two and the Ultimate Limit State (ULS) using Eurocode 7 design approaches with Serviceability Limit State verification (SLS) is done to evaluate the most economic design approach. This is done by calculating the number of piles to support a building of a characteristic vertical permanent load of 60 MN and a characteristic vertical variable load of 20 MN on 18 m bored piles with adiameter of 0.5 m founded on a multi-layer system of silty clay and silty sand and spaced at 3 meter centres. A simulation of three pile load tests using Finite Element Method PLAXIS Software were used in this study to determine the characteristic value of pile resistance and demonstrate pile foundation design using static pile load tests following the Eurocode7.
Paper [12] shows size of the buildings increases, the complexity in analyzing it rises and the use of software packages become inevitable. Therefore, needs to high rise buildings are felt to be indispensable. In this study, an example of 20 – story structure building is modeled as a case study, then using some software packages, the model which gave sufficient ductility,drift and rebar percentage were considered as the most efficient as well as conservative model. Project planning involves two important objectives. The first objective is to perform the analysis and design of the present high rise building using STAAD Pro Vi8 as well as ETABS v17. The building will be analyzed for different load combinations according to the relevant Indian standard codes. The second objective of this study is to analyze the seismic performance and design the above-mentioned structure using seismic code provisions of Europe, New Zealand, USA, and India. The stability of the structure under such diverse environments is studied and analyzed. The obtained result indicates that the IS 1893-2002 requires the maximum rebar percentage for the chosen beam and column among the utilized codes, hence is the most conservative as well as uneconomical code of practice to adopt, whereas ASCE 318M-02 requires smaller story drift and more specifically, more secure than the other implemented codes.
Paper [13] shows the progress of preparing the next generation of Eurocode 7 the Evolution Group EG 7 ´Pile Design´ of

TC250/SC7 has focused on the evoultion of Design of piles according to Eurocode 7 in the period 2011 to 2015. Based on the results of this period of collaboration and bringing together European experiences in pile design the expected evolutions for the section ´Pile Foundations´ of the upcoming EC7-3are presented in this contribution whereby several issues are still subject of ongoing dicussions and developments. It is obvious that especially the design of pile foundations is still related to national experiences resulting from diffferent geological conditions, different methods of soil investigation, different type of piles commonly used as well as a wide field of different calculations methods often related to the soil conditions/investigations and the pile type used. Nevertheless there is epecially for pile design a realistic chance to achieve a further harmonizaton of the design principles even if the exploration and calculation methods might differ still in future. Sukanta K. Shill, Md. M. Hoque , Md. Shaifullah [14] An experiment on the punching of isolated RC column footing through the base slab, comparison of test result to established different codes for punching shear calculation is presented in the paper. The principal aim of this study is to investigate the punching shear behavior of an isolated column footing using brick aggregate as coarse aggregate. Consequence, a RC model footing was constructed on a stabilized soil and tested the footing under field condition. The test result yields that the experimental punching shear capacity is greater than all the theoretical punching shear capacities obtained by using different codes of practices. It can be concluded that the punching shear calculation formulae proposed by BNBC 2006, as well as ACI 318, 2002 code are very conservative, whereas the punching shear calculation formulae proposed by CEB-FIP MC, 1990 and Eurocode2 are less conservative in predicting the punching shear resistance of footing. Keywords— Footing, Punching Shear, Field condition, Stabilized soil, Brick aggregate. In [15] Reinforced building, frames are major parts since it opposes Shear force, Bending moment ,torsion and furthermore subjected to variety of loads in which seismic loads are dominating. Developing nations like India we need to adopt some standards. The BIS recommended IS 456:2000 and IS 1893(Part-1)2002 likewise European standard recommended EC2 and EC8 for Design of concrete structures and Design of earthquake resistant structures respectively. An attempt is made to compare Indian standard and Euro standard in "ETABS 2016" Seismic plays gigantic part on life and property since the impact on structures is colossal, so it's essential to design the structures in the most ideal approach to withstand these impacts. Different seismic codes determines distinctive parameters so than clearly it's performance differs as per different codes. Hence, it is important to do a comparison in order to assess which building performs better' Paper [16] shows the exam concentrates on relationship of International measures. The picked benchmarks are Eurocode, IBC (American Society of helper Engineers). The investigation in like way energizes in understanding the govern contributing included substances which impel poor execution of Structure amidst the shake, while in travel to accomplish their pleasing secure lead underneath destiny seismic tremors.The shape isolated is symmetrical, G+10, Special RC minute resting portray (SMRF). Appearing of the structure is finished by staad capable. V8i programming. Day and age of the structure in each the bearing is taken from the thing and as demonstrated by the three measures 3 models are made. The Lateral seismic powers are found out physically. The Lateral seismic powers are figured by ground unsurprising with different codes in X and Z bearing and are related with the Center of gravity of the shape. The illustrative consequences of the variation structures are then tended to graphically and alive and well, it's miles taken a gander at and isolated looking any essential separations. Paper [17] examination concentrates on investigating sorts inside the outcomes got using the three codes i.E. Eurocode and IBC (ASCE) .A close research is done the extent that Base shear, Displacement, Axial load, Moments in Y and Z heading for picked parcels what's more separating Displacement, Axial load, Moments in Y and Z bearing Floor able of different codes for same picked portions. Joined through relative research of Displacement, shear Y, Torsion and Moment Z of picked sections on each floor for various general codes[18].

Conclusion based on Literature Review

Various researchers investigated on concept of using different country codes to design the structure safely and economically, using various parameters such as dimension of footing soil condition, climatic condition, punching shear, soil structure interaction etc. As per the literature review both the codes are reliable according to situation of ground.

3. OBJECTIVE OF RESEARCH WORK

1. Design and analysis of footing using STAAD FOUNDATION and comparing with manual calculation.
2. To understand the accuracy of different country code for analysis and design of footing for soil condition under seismic forces.
3. To correlate between the predicted structural failure loads of isolated column footing through the implementation of code provision.
4. To design and analysis the economic and durability of the structure.
5. Comparing the parameters according to various codes.
6. To compare the performance of footing by Indian standard code and euro standard code.

4. METHODOLOGY

Step 1: Fix the Dimensions
To create a model for the analysis in software dimensions is necessary for the given requirements.
Step 2: Load Calculations and Load Combinations
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
Step3: Analysis and Design footing using STAAD FOUNDATION Software There are commonly three broad stages in foundation design:

1. A preliminary design, which provide an initial basis for the development of foundation concepts and costing.
2. A detailed design stage, in which the selected foundation concepts is analyzed and progressive

refinements are made to the layout and details of the foundation system. This stage is desirably undertaken collaboratively with the structural designer, as the structure and the foundation act as an interactive system.

3. Final design phase, in which both the analysis and the parameters employed in the analysis are finalized.

Step 4: Design as Per Indian Standards and Euro Standard
Step 5: Compare the behavior of isolated column footing for different soil condition in terms of various parameters by analyzing the models for static forces and evaluate the analysis results.

Seismic analysis:

Seismic analysis is a major tool in earthquake engineering which is used to understand the response of buildings due to seismic excitations in a simpler manner. In the past, the buildings were designed just for gravity loads and seismic analysis is a recent development. It is part of structural analysis and a part of structural design where earthquake is prevalent.

Once the structural model has been selected, it is possible to perform as analysis to determine the seismically induce forces in the structure. There are different methods of analysis which provide different degree of accuracy. The analysis process can be categorized on the basis of three factors:

a. Type of external load applied.

b. Behavior of structure/structural element.

c. Type of structural model selected.

Analysis methods:

Seismic analysis is a subset of structural analysis and the calculation of the response of a building structure to 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 towave bake and forth during an earthquake (or even a several wind strom). This is fundamental mode and is the lowest frequency of building response most building, however higher modes of response, which are uniquely activated during earthquake.

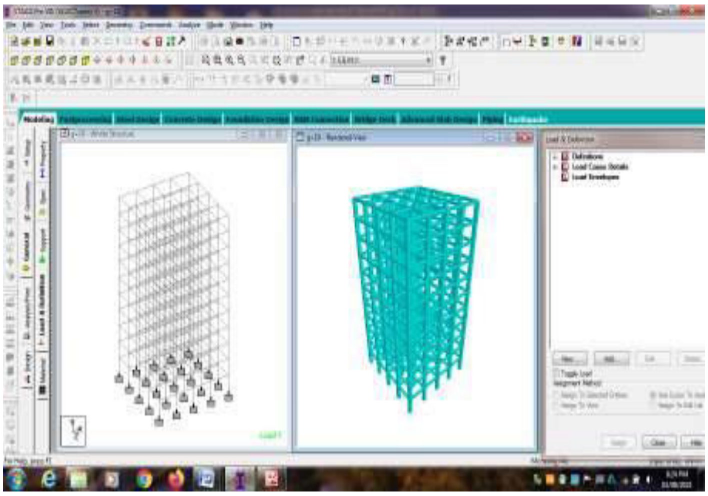

Figure 4.1: 3-D Modeled Building

The above figure 4.1 shows G +10 Simple Building model In STAAD pro. With beam size 300 X 400 mm and column size 600 X 600 mm this reinforced concrete building having M20 grade of Concrete and Fe500 high density steel

Details of the Models

Column and Beam Sizes for Modeling of Building

Sr. No.	Element	Notation
1	Column	C1
2	Beam	B1

Assumed Data for Models

Building = G + 10 Storey

Slab Thickness = 150 mm

Live Load = 3 kN/m2

Floor Finish = 1.5 kN/m2

Concrete Grade = M20

Concrete Density = 25 kN/m3

Steel Grade = Fe500

Steel Density = 7850 kN/m3

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

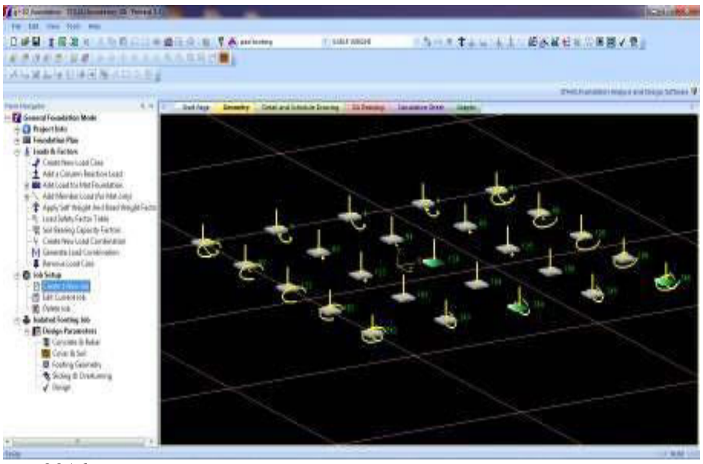

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Figure 1: Position of Footing 124, 244, 246

5. RESULT AND ANALYSIS

This section present the result of the analytic work carried out using linear equivalent static analysis. The paper presented a simple approach to calculate the dimension [depth] for an isolated square footing under concentric loading. Observations were limited to square footing and columns with concentric loading. The study is focused to carry out the advantage of seismic design of multistory building with pad footing using different country codes with simulation tool, STAAD Pro and STAAD FOUNDATION at global level with ease of use.

Comparative tables generated from this study can be helpful to the designers for the various regions under consideration also it will provide conclusion which will be helpful for the designer of the region to understand the effect of various country code on the structure for various load combination.

Table 5.1 comparison of footing no 124 using software and manual design for hard soil

Comparison of pad footing No. 124				
HARD SOIL				
	Maunnal		Staad foundation	
FOOTING NO 124	**IS**	**EURO**	**IS**	**EURO**
WIDTH OF FOOTING	2.95m	2.9m	2.85m	2.85m
LENGTH OF FOOTING	2.95m	2.9m	2.85m	2.85m
DEPTH OF FOOTING	850mm	700mm	805mm	605mm
R/F ALONF SHORTER SPAN	12mm@100mm c/c	12mm @70m m c/c	12mm @95m m c/c	12mm@75m m c/c
Ast short	3336.38 mm²	4685.47 mm²	3256m m²	4250mm²
R/F ALONG LONGER SPAN	12mm@100mm c/c	12mm @70m m c/c	12mm @95m m c/c	12mm@75m m c/c
Ast short	3336.38 mm²	4685.47 mm²	3256m m²	4250mm²
R/F ALONG LONGER SPAN	3065KN	3065K N	3064.13 9KN	3064.139KN
Ast long	400 KN/m2	400KN/ m2	400KN/ m2	400KN/m2

Table 5.2 comparison of footing no 124 using software and manual design for medium soil

Comparison of pad footing No. 124				
MEDIUM SOIL				
	Maunnal		Staad foundation	
FOOTING NO 124	**IS**	**EURO**	**IS**	**EURO**
WIDTH OF FOOTING	4.5m	4.15m	4.2m	4.15m
LENGTH OF FOOTING	4.5m	4.15m	4.2m	4.15m
DEPTH OF FOOTING	1060m m	700mm	955mm	755mm
R/F ALONF SHORTER SPAN	12mm @100 mm c/c	12mm @70m m c/c	12mm@ 95mm c/c	12mm@75mm c/c
Ast short	5654.8 8 mm²	6705.0 7 mm²	4813mm²	5611mm²
R/F ALONG LONGER SPAN	12mm @100 mm c/c	12mm @70m m c/c	12mm@ 95mm c/c	12mm@75mm c/c
Ast short	5654.8 8 mm²	6705.0 7 mm²	4813mm²	5611mm²
R/F ALONG LONGER SPAN	3065K N	3065K N	3064.139 KN	3064.139KN
Ast long	200 KN/m2	200 KN/m2	200 KN/m2	200 KN/m2

Table 5.3 comparison of footing no 244 using software and manual design for hard soil

Comparison of pad footing No. 244				
HARD SOIL				
	Maunnal		Staad foundation	
FOOTING NO 124	**IS**	**EURO**	**IS**	**EURO**
WIDTH OF FOOTING	2.50m	2.50m	2.35m	2.35m
LENGTH OF FOOTING	2.50m	2.50m	2.35m	2.35m
DEPTH OF FOOTING	650mm	600mm	655mm	455mm

R/F ALONF SHORTER SPAN	12mm @90mm c/c	12mm @70mm c/c	12mm@ 125mm c/c	12mm@85mm c/c
Ast short	3141.6 mm²	4039.20mm²	2092.768 mm²	2990.715mm²
R/F ALONG LONGER SPAN	12mm @90mm c/c	12mm @70mm c/c	12mm@ 125mm c/c	12mm@85mm
Ast short	3141.6 mm²	4039.20mm²	2092.768 mm²	2990.715mm²
R/F ALONG LONGER SPAN	2076KN	2076KN	2076.879 KN	2076.879KN
Ast long	400 KN/m2	400KN /m2	400KN/ m2	400KN/m2

Table 5.4 comparison of footing no 244 using software and manual design for medium soil

Comparison of pad footing No. 244				
MEDIUM SOIL				
	Maunnal		Staad foundation	
FOOTING NO 124	**IS**	**EURO**	**IS**	**EURO**
WIDTH OF FOOTING	3.5m	3.5m	3.45m	3.40m
LENGTH OF FOOTING	3.5m	3.5m	3.45m	3.40m
DEPTH OF FOOTING	750mm	600mm	805mm	605mm
R/F ALONF SHORTER SPAN	12mm @90mm c/c	12mm @70mm c/c	12mm@ 115mm c/c	12mm@100mm c/c
Ast short	4398.24 mm²	5654.88 mm²	3332.70 mm²	3675.359mm²
R/F ALONG LONGER SPAN	12mm @90mm c/c	12mm @70mm c/c	12mm@ 115mm c/c	12mm@100mm c/c
Ast short	4398.24 mm²	5654.88 mm²	3332.70 mm²	3675.359mm²
R/F ALONG LONGER SPAN	2076KN	2076KN	2076.879 KN	2076.879KN
Ast long	200 KN/m2	200 KN/m2	200 KN/m2	200 KN/m2

6. CONCLUSION

The foundation is the member of the structure which is the due thereof essential part to allow the transmission of loads from the structure to the soil, such a members helps the soil to resist these loads for that same it will not suffer and its behavior to ideal for condition to which will be submitted. Therefore, the foundation comes to from basic of the structure and of hence that the behavior of building or the civil work is presented correctly

Due to the importance of the foundation, this is forced to meet certain geometrical parameter, pressure, conformation, that responds to the characteristics of soil and loads of the structure. Therefore the design of the foundation is not something that is performed in and intuitive manner, but which must satisfied design methodology to evaluate from the shape of the foundation to the depth to that is desired to construct the structural member , as well as the natural characteristics of the soil .

1. 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.
2. Euro code is slightly better than IS code to design with reference to depth of footing
3. Result of IS code is economical than Euro code with reference to area of steel required.
4. 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.

Future Scope

1. The design and analysis will be done with respect to soil structure interaction.
2. The design and analysis will be done for zone IV AND V for soft soil.
3. Design of different types of footing for different country codes will be studied.

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