PARAMETRIC STUDY OF PILE RAFT FOUNDATION FOR MULTI-STOREY BUILDING WITH DIFFERENT STRUCTURAL SYSTEM FOR SOFT SOIL CONDITION

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Abstract—Sub structure is an important part of any multi storey building as it gives stability to the super-structure. Foundation is designed as per the reactions coming from the super structure. Therefore, as the structural system changes, base reactions are changed and it affects the foundation design. In this study, analysis and design of pile raft foundation in SAFE 2012 for multi-story (G+10, G+15 and G+20) buildings with different structural systems for soft soil conditions has been carried out and comparison has been made. Here, three types of structural systems - simple frame, frame with shear wall and frame with bracing have been taken. By the comparative study, we have concluded that for the frame with shear wall, the cost of foundation is maximum than other two systems. For frame with bracing, the cost is more than that of simple frame.

Keywords—Pile Raft foundation, Structural system, soft soil

1. INTRODUCTION

Foundation is that part of structure which transfers the super structure load to the sub-soil and gives stability to super structure. Pile Raft foundations are combined foundations supporting with several pile. Pile Raft foundation is used when the load coming on foundation is high and the soil pressure is exciding the safe bearing capacity. In soft soil the safe bearing capacity are less therefore pile raft foundation is required.

In multi-story buildings, different structural system are used for resisting the lateral loading. The base reactions of building are changed as structural system is changed. So, these factor affect the foundation reactions hence affecting foundation design.

2. MODELLING:-

A. Analysis of super-structure:

For the research study, three commercial R.C.C building of G+10, G+15, G+20 storey situated in Ahmedabad of plan dimension 25m x 22.5m is selected. Data of Building are given in table number 1 and 2.

As shown in Figure1 to 4 G+10 storey with simple frame, Frame with shear wall, Frame with Bracing model of super-structure is prepared in ETABS.

Fig. 1. G+10 storey Simple Frame

Fig. 2. G+10 storey Frame with bracing

Fig. 3. G+10 storey Frame with shear wall

Fig. 4. Building Plan

Table: 1 Data

<table>
<thead>
<tr>
<th>Concrete Grade</th>
<th>M40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Grade</td>
<td>Fe415</td>
</tr>
<tr>
<td>Story height</td>
<td>3m</td>
</tr>
<tr>
<td>Depth of Slab</td>
<td>150mm</td>
</tr>
<tr>
<td>Spacing between frames</td>
<td>5m along x and 4.5m along y-directions</td>
</tr>
</tbody>
</table>

Table: 2 Loading On Building

| Live Load | 4.5 kN/m², 1.5 kN/m² on terrace |
| Floor Finish | 1 kN/m², 2 kN/m² on terrace |
| Wall       | 230mm thick on outer beam and 115mm thick on intermediate beam |
| Earthquake Load as per IS 1893:2002 Part I |
| Wind load as per IS 875 Part III |
Same for G+15 and G+20 storey building are also prepare. Building design is checked for different size of frame element and optimum dimension for beam and column had been found out. After analysis the base reaction crated in ETABS are imported in SAFE.

B. Analysis of sub-structure:

After importing the reactions from ETABS file modelling of pile raft foundation has been done in SAFE for soft soil. For soft soil Modulus of subgrade reaction (k) 15000 kN/m3, Safe Bearing capacity of soil 170 kN/m2 and pile spring value is taken as 150 kN/mm are taken.

Pile design is not done in SAFE so it carryout manually for the reaction coming on pile.

After modeling done model run for analysis and depth of the foundation is check for punching shear ratio. Punching shear ratio is ratio of maximum calculated shear to maximum shear capacity.

3. RESULT:-

4. CONCLUSION

From the Study done so far it is found out that
For Simple Frame and Frame with Bracing structural system concrete quantity remains the same as there is not much change in vertical reaction but steel quantity required in frame with bracing system is around 3 to 10 % more due to change in pressure.

In system of frame with shear wall, due to large pressure below the shear wall there is a need to increase the number of pile to relieve the pressure below the shear wall so the quantity of concrete required for this system is higher. Also as the pressure is higher, the reinforcement required is also more than the other two systems.

As number of pile increase the soil reaction on raft foundation is decreased.

REFERENCES