

# **Optimum design of mat foundation**

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## **Abstract**

Optimum design of mat foundation for residential buildings is presented in this research. In the time being there are two important alternatives available for mat foundation analysis and design. The first is "structural" alternative is the superstructure and mat combined into one structural model (mega structure). This alternative creates the ideal behavior of all structural components for superstructure-mat interaction. The second approach "geotechnical" is to model the mat and subgrade "soil" in one analysis problem. The shortcoming of the structural alternative is that the subgrade reaction must be assumed or modeled mathematically beforehand. The shortcoming of geotechnical alternative is the lack of ability to model superstructure interaction effects directly.

The work done was based on a modern approach offers the potential for modeling both the mega-structure (superstructure and mat) and geotechnical "subgrade - soil" component quite accurately to overcome the shortcoming of the other approaches explained above. In addition this approach considered the rigidity of superstructure (flexural stiffness of each floor) and rigidity of mat directly within one ideal 3-D soil structure interaction model.

To implement the model, available commercial software "STAAD-PRO" based on finite element analysis has been used. A complete 3-D model was proposed for superstructure, mat foundation and subgrade "soil". The soil/subgrade modeled as 3-D solid finite element elastic material connected to the mat foundation. The mat foundation modeled as 3-D finite plate element. Both soil and concrete material of mat were presented by modulus of elasticity and Poisson's ration. The supper structure was modeled as a multi story building consisting of 2 to 15 stories with different column spacing varies from 3 to 7 meters.

The numerical results are studied outlined into charts to investigate relationship between thickness of mat foundation and each of acting loads (number of stories), column spacing, subgrade material (type of soil), soil pressure, total and differential settlement.

Optimum design of mat foundation thickness based on type of soil, maximum allowable settlement, differential settlement, soil bearing capacity and recommendation of American Concrete Institute "ACI" can be obtained by using developed curves and charts.