Parametric study of closed grid floor system

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Abstract - Generally for grid slab analysis, it is assumed that although slab is directly supported on beam-grid, bending of beam-grid has no effect on slab. An attempt has been made to consider the effect of same by considering actual behavior. Different parameters like slab depth, depth of grid-beam and spacing of grid-beam are considered for study. Charts are prepared for slab bending moment, planar forces and grid-beam bending moment, axial forces. The parametric study is done by ABAQUS 6.14 software.

Key Words: Grid floor, waffle slab, Stress values

1. INTRODUCTION


Akash R. Patel and Atul N. Desai[7] analysed grid floor using abaqus in which a slab was divided into number of panels and change in stress values was studied.

2. RESEARCH GAP

Past researches have focused on stress values and have compared various methods of analysis. Akash R. Patel and Atul N. Desai tried to analyze floor considering floor and to be different part and then providing boundary conditions and interaction properties. This paper will try to analyse floor as a monolithic structure and compare various results. This paper will aim to compare moment as well as axial load.

3. MODEL DESCRIPTION

Different panel sizes of 3600x3600, 4000x4000, 4400x4400 and 4800x4800 having beam size of 400 mm have been considered for analysis. 3 beam depths have been considered to be varying from L/17 to L/15. Also 3 different slab size of 80 mm, 90 mm and 100 mm have been considered.

Data mentioned below have been considered for parametric study of models:

Beam width=0.4 m, M -20 grade concrete, E concrete= 22360.67977 N/mm², μ=0.2, ρ concrete=25KN/m³,

Total load=1.5(DL+LL) and LL= 5 KN/m² on slab and

Boundary condition is considered to be fixed on all edges.

Results for 4800x4800 mm bay have been discussed in this paper. Similar trend was observed for 3600x3600 mm, 4000x4000 mm and 4400x4400 mm bay size.

Number of models prepared as listed below and then their results were plotted on chart to facilitate result comparisions:

<table>
<thead>
<tr>
<th>Panel size (mm)</th>
<th>Bay arrangement</th>
<th>Beam size (mm)</th>
<th>Slab thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3600x3600</td>
<td>3x3</td>
<td>730,780,830</td>
<td>80,90,100</td>
</tr>
<tr>
<td></td>
<td>4x4</td>
<td>970,1030,1090</td>
<td>80,90,100</td>
</tr>
<tr>
<td></td>
<td>5x5</td>
<td>1200,1280,1360</td>
<td>80,90,100</td>
</tr>
<tr>
<td></td>
<td>6x6</td>
<td>1440,1530,1620</td>
<td>80,90,100</td>
</tr>
<tr>
<td>4000x4000</td>
<td>3x3</td>
<td>800,850,900</td>
<td>80,90,100</td>
</tr>
<tr>
<td></td>
<td>4x4</td>
<td>1060,1130,1200</td>
<td>80,90,100</td>
</tr>
<tr>
<td></td>
<td>5x5</td>
<td>1320,1400,1490</td>
<td>80,90,100</td>
</tr>
<tr>
<td></td>
<td>6x6</td>
<td>1580,1680,1780</td>
<td>80,90,100</td>
</tr>
<tr>
<td>4400x4400</td>
<td>3x3</td>
<td>880,930,980</td>
<td>80,90,100</td>
</tr>
<tr>
<td></td>
<td>4x4</td>
<td>1160,1230,1300</td>
<td>80,90,100</td>
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<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>6x6</td>
<td>1720,1830,1940</td>
<td>80,90,100</td>
</tr>
<tr>
<td>4800x4800</td>
<td>3x3</td>
<td>950,1000,1050</td>
<td>80,90,100</td>
</tr>
<tr>
<td></td>
<td>4x4</td>
<td>1250,1330,1410</td>
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<tr>
<td></td>
<td>5x5</td>
<td>1560,1660,1760</td>
<td>80,90,100</td>
</tr>
<tr>
<td></td>
<td>6x6</td>
<td>1860,1980,2100</td>
<td>80,90,100</td>
</tr>
</tbody>
</table>
4. RESEARCH METHODOLOGY

For obtaining results, stress values of slab and grid on top and bottom faces were noted down. Then moments were calculated using formula obtained from theory of plates:

\[ F = \frac{\sigma_{\text{top}} + \sigma_{\text{bottom}}}{2} \times t \]

\[ M = \sigma_{\text{diff}} \frac{t^2}{6} \]

\[ M = \sigma_{\text{diff}} \frac{t^2}{6} \]
CONCLUSIONS

1. Axial force and bending moment values in slab increase with increase in slab thickness.
2. Gradual decrease in axial force and moment is observed in slab with increase in beam depth.
3. In slab, axial forces and moment in corner panel decreases with increase in number of bays.
4. In slab, axial forces and moment, in central plate increases with increase in number of bays.
5. Non-linear change in moment is observed with increase in number of bays for a central plate.
6. Beam goes from compression to tension with increase in slab thickness.
7. For studied number of bays, it was observed that beam was found to remain in compression even with increase in slab thickness.
8. Due to boundary conditions considered to be rigid on edge of slab, beam was found to remain compression.
9. On considering simply supported slab i.e. one edge simply supported, it was found that same beam undergoes tension with change in boundary conditions.

REFERENCES


BIOGRAPHIES

ViveK B. Kothari is a student of structural engineering department in BVM engineering college.

Atul N. Desai is Associate professor in BVM Engineering college having vast experience of more than 30 years in teaching field and guided more than 40+ master thesis.

Dr. Vishal A. Arekar is an Assistant professor in BVM Engineering college having experience of more than 7 years in teaching field and has guided more than 15+ master thesis.