Centre Heave - Inputs

- **x** = 3.5125 m, distance from centre of footing (0 < x < L/2) - Nominal
- **L** = 12 m, overall length of footing
- **B** = 1 m, take unit width of footing
- **W** = 10 kN/m, edge line load applied to footing
- **T** = 0 kN/m, centre line load applied to footing
- **w** = 6.5 kPa, uniform load applied to footing
- **Y** = 0.075 m, 0.7 * characteristic surface movement
- **Δ** = 0.012 m, design deflection limit
- **m** = 5, exponent (refer AS2870)
- **k** = 1000 kPa/m, modulus of subgrade reaction

Centre Heave - Calculations

\[ \omega = 8.17 \text{ kPa} = \frac{w + (2W + T)}{L} \quad \text{uniform pressure} \]
\[ t = 1.741 \quad \text{solved numerically at x=L/4} \]
\[ C = 0.756 \quad \text{solved numerically at x=L/4} \]
\[ f_c = -0.001 = C^{m+1} \cdot \frac{m}{(m + 1)} - C^t \cdot \frac{t}{(t + 1)} \cdot \frac{\Delta}{Y} - \omega \cdot \frac{k \cdot Y}{(k \cdot Y)} \quad \text{equation to solve for} \ C \]
\[ \delta_0 = 0.0111 = C^t \cdot \frac{Y}{(Y)} - C^t \cdot \Delta \]
\[ M_x = 45.0 \text{ kNm} = W \cdot B \cdot (L/2 - x) + (w \cdot B / 2) \cdot (L / 2 - x)^2 \quad \text{CL/2<x<L/2} \]
\[ CL = 9.07 \text{ m} = \text{Total length of slab in contact with ground} \]
\[ A_{4.1} = 0.1005 \]
\[ A_{4.2} = -0.1708 \]
\[ A_{4.3} = 0.0728 \]
\[ M_{x,\text{req}} = 42.6 \text{ kNm} = M_x - k \cdot B \cdot (A_{4.1} + A_{4.2} + A_{4.3}) \quad 0<x<CL/2 \]
\[ M^\# = 42.6 \text{ kNm/m} = \text{if}(x>=0, \text{if}[x<=C \cdot L / 2 , \text{M}_{x,\text{req}} , M_x , \text{na}]) \quad \text{ULS moment @ x} \]
\[ A_{5.1} = 779.2 \]
\[ A_{5.2} = 0.620 \]
\[ A_{5.3} = -0.351 \]
\[ A_{5.4} = 0.073 \]
\[ A_{5.5} = 0.000 \]
\[ E\delta = 437.6 \text{ kN/m}^3 = A_{5.1} - k \cdot B \cdot (A_{5.2} + A_{5.3} + A_{5.4} + A_{5.5}) \]
\[ A_{6.1} = 1773.0 \]
\[ A_{6.2} = 1.037 \]
\[ A_{6.3} = -0.407 \]
\[ A_{6.4} = 0.054 \]
\[ E\Delta = 1089.5 \text{ kNm}^2 = A_{6.1} - k \cdot B \cdot (A_{6.2} + A_{6.3} + A_{6.4}) \]
\[ E\text{I}_{\text{required}} = 90.791 \text{ kNm}^2/m = E\Delta / \Delta \quad \text{required stiffness} \]
\[ t_{\text{next}} = 1.704 = \log(E\delta / E\Delta , [2 \cdot x / L]) \quad \text{resolve for} \ t \]
## Centre Heave - Summary

<table>
<thead>
<tr>
<th>Dist x from centreline m</th>
<th>Moment M# kNm/m</th>
<th>Free soil heave mm</th>
<th>Footing Movement mm</th>
<th>Soil Pressure kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>76.5</td>
<td>0.0</td>
<td>11.1</td>
<td>11.1</td>
</tr>
<tr>
<td>1.20</td>
<td>72.6</td>
<td>0.0</td>
<td>11.7</td>
<td>11.7</td>
</tr>
<tr>
<td>2.40</td>
<td>61.1</td>
<td>0.8</td>
<td>13.5</td>
<td>12.7</td>
</tr>
<tr>
<td>3.60</td>
<td>40.8</td>
<td>5.8</td>
<td>16.2</td>
<td>10.3</td>
</tr>
<tr>
<td>4.80</td>
<td>16.7</td>
<td>24.6</td>
<td>19.5</td>
<td>0.0</td>
</tr>
<tr>
<td>6.00</td>
<td>0.0</td>
<td>75.0</td>
<td>23.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

### Centre Heave

**Design Bending Moment kNm/m**

![Graph](https://via.placeholder.com/150)

- **Distance from centre of footing, x (m)**
- **Design Bending Moment kNm/m**

- **M**