Wheel Load Design Calculation Details

Date: 5/1/2014  
Name: Sample Project  
Location: Buffalo Grove  
Engineer: Mike McPhee

Poisson's Ratio  \( \mu = 0.15 \)
Section Width  \( b = 1 \text{ meter} \)
Slab Thickness  \( h = 6.00 \text{ in} \)
Concrete Compressive Strength  \( F_c = 4,000.00 \text{ psi} \)
Modulus of Elasticity  \( E = 3,602,728.70 \text{ psi} \)
Concrete Flexural Strength  \( F_r = 600.00 \text{ psi} \)
Modulus of Subgrade Reaction  \( k = 100.00 \text{ pci} \)
Axle Load  \( P = 10,400.00 \text{ lb} \)
Contact Area  \( C_a = 52.00 \text{ in}^2 \)
Wheel Spacing  

**Radius of Relative Stiffness**

\[
I = \frac{E \cdot h^3}{12(1 - \mu^2) \cdot k}  
0.25  
I = 28.51 \text{ in}  
(724.05 \text{ mm})
\]

**Load Percentage**

<table>
<thead>
<tr>
<th></th>
<th>Wheel Configuration =</th>
<th>Single Axle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Axle</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheel</td>
<td>50.0%</td>
<td>Wheel ( S_d ) = 0.0%</td>
</tr>
<tr>
<td>Wheel ( S )</td>
<td>5.6%</td>
<td>Wheel ( S_d(S) ) = 0.0%</td>
</tr>
<tr>
<td>Wheel ( S_w )</td>
<td>0.0%</td>
<td>Wheel ( S_d(S_w) ) = 0.0%</td>
</tr>
<tr>
<td>Wheel ( S+S_w )</td>
<td>0.0%</td>
<td>Wheel ( S_d(S+S_w) ) = 0.0%</td>
</tr>
<tr>
<td><strong>Adjacent Axle</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheel</td>
<td>0.0%</td>
<td>A = 5,780.39 \text{ lb}</td>
</tr>
<tr>
<td>Wheel</td>
<td>0.0%</td>
<td>(2.58 \text{ tonne})</td>
</tr>
</tbody>
</table>

**Load Contact Radius**

Single Concentrated Load

\[
a = \frac{C_a}{\Pi}  
0.5  
a = 4.07 \text{ in}  
(0.10 \text{ m})
\]
If contact radius \( a \) < \( (1.72 \times h) \) then

\[
b = \begin{cases} 
0.5 \\
1.6 \times a^2 + h^2 - (0.675 \times h)
\end{cases}
\]

**else**

\[
b = a 
\]

**Slab Stress - Interior Loading**

\[
f_b = 2.70 \times (1 + \mu) \times (P / h^2) \times (4.0 \times \log(R / b) + 1.069) \times 10^6
\]

\[f_b = 227.40 \text{ psi}\]

**Interior Safety Factor**

\[
FS = \frac{f_r}{f_b}
\]

Corner = 2.10

Edge = 1.92

\[FS = 2.64\]
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