Given:

All spacings are set to 16" o.c., all support members are 2" nominal and all sheathing and decking is to be installed with strength axis perpendicular to supports (Three-Span Condition). Therefore:

\[
\text{Width}_{\text{Support}} = 1.5 \text{ in} \quad \text{SW} = 0.25 \text{ in}
\]

\[
l_1 = 16 \text{ in}
\]

\[
l_2 = l_1 \quad \text{Width}_{\text{Support}} = 14.5 \text{ in}
\]

\[
l_3 = l_2 + \text{SW} = 14.75 \text{ in}
\]
Design Roof Decking:

Dead Load: Assume 5/8 inch decking

Plywood, rigid insulation, and felt and gravel:

\[ D = 3 \cdot \frac{5}{8} + 4 \times 2 + 6.5 = 16.375 \text{ psf} \]

Wind Load:

- 152 psf upward on corners
- 101 psf upward on edge strips
- 60.2 psf upward on interior
- 24.5 psf downward on all parts

Roof Live Load:

\[ L_0 = 20 \text{ psf} \]

\[ A_{\text{plan}} = 4 \cdot 8 = 32 \text{ ft}^2 \]

\[ R_1 = 1 \quad R_2 = 1.0 \]

\[ L_{R} = L_0 \cdot R_1 \cdot R_2 = 20 \text{ psf} \]

Downward Load Cases:

Dead Load Only:

\[ w_D = D = 16.375 \text{ psf} \]

Dead plus Roof Live:

\[ w_{D+L} = D + L_R = 36.375 \text{ psf} \]

Dead plus 0.6*Wind:

\[ w_{D+W} = D + 0.6 \cdot 24.5 = 31.075 \text{ psf} \]

Dead plus 3/4 of (Roof Live plus 0.6*Wind):

\[ w_{D+Lr+W} = D + 0.75 \cdot (L_R + 0.6 \cdot 24.5) = 42.4 \text{ psf} \]
Estimate Controlling Downward Load Case:

<table>
<thead>
<tr>
<th>Load Case:</th>
<th>Load (psf):</th>
<th>C_D:</th>
<th>Load/C_D:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. w_D</td>
<td>16.375</td>
<td>0.9</td>
<td>18.19</td>
</tr>
<tr>
<td>2. w_D_Lr</td>
<td>36.375</td>
<td>1.25</td>
<td>29.1</td>
</tr>
<tr>
<td>5. w_D_W</td>
<td>31.075</td>
<td>1.6</td>
<td>19.42</td>
</tr>
<tr>
<td>6a. w_D_Lr_W</td>
<td>42.4</td>
<td>1.6</td>
<td>26.5</td>
</tr>
</tbody>
</table>

Therefore, for downward loading use:

\[ w_{D_{Lr}} = 36.375 \text{ psf} \quad C_{D_{down}} = 1.25 \]

Upward Load Cases: ***Use the most extreme case of 152 psf upward.***

7. 0.6*D + 0.6*W  \[0.6*W-0.6*D \text{ upward}] 

\[ w_{D_{W_{up}}} = 0.6 \cdot (152 \quad D) = 81.375 \text{ psf} \]

Therefore, for upward loading use:

\[ w_{D_{W_{up}}} = 81.375 \text{ psf} \quad C_{D_{up}} = 1.6 \]

Required Bending Strength (Three-Span Condition):

Downward Loading:

\[ w_b = w_{D_{Lr}} \]

Therefore:

\[ [F_{b \cdot s}] = \frac{w_b^2}{120 \cdot C_{D_{down}}} = 62.08 \text{ lb-in ft} \]

Upward Loading:

\[ w_b = w_{D_{W_{up}}} \]

Therefore:

\[ [F_{b \cdot s}] = \frac{w_b^2}{120 \cdot C_{D_{up}}} = 108.5 \text{ lb-in ft} \]
Required Shear Strength (Three-Span Condition):

Downward Loading:
\[ w_s : = w_{D,Lr} \]

Therefore:
\[ \left[ F_s (lb/Q) \right] : = \frac{w_s l^2}{20 C_{D,down}} = 21.098 \frac{lb}{ft} \]

Upward Loading:
\[ w_s : = w_{D,W_up} \]

Therefore:
\[ \left[ F_s (lb/Q) \right] : = \frac{w_s l^2}{20 C_{D,up}} = 36.873 \frac{lb}{ft} \]

Required Bending Stiffness Capacity (Three-Span Condition):

\[ \Delta_r : = \frac{1}{180} = 0.089 \]

Nonplaster Ceiling, Load Case: D + L

FBC 2007, Table 1604.3

Downward Loading:
\[ w : = w_{D,Lr} \]

Therefore:
\[ [EI] : = \frac{w l^4}{1743 \Delta_r C_{D,down}} = 8.89 \times 10^3 \frac{lb \cdot in^2}{ft} \]

Upward Loading:
\[ w : = w_{D,W_up} \]

Therefore:
\[ [EI] : = \frac{w l^4}{1743 \Delta_r C_{D,up}} = 1.554 \times 10^4 \frac{lb \cdot in^2}{ft} \]
Design Exterior Wall Sheathing:

Wind Load:

- 59.7 psf inward/outward on all walls
- 70.4 psf upward on roof joist edge strips
- 57.6 psf upward on interior portion of roof joists
- 19.4 psf downward on roof joists

Therefore: \( w = 0.6 \times 59.7 \quad \text{and} \quad C_D = 1.6 \)

Required Bending Strength (Three-Span Condition):

\[
[F_b] = \frac{w \cdot l_1^2}{120 \cdot C_D} = 47.76 \text{ lb-in/ft}
\]

Required Shear Strength (Three-Span Condition):

\[
[F_s (lb/Q)] = \frac{w \cdot l_2}{20 \cdot C_D} = 16.231 \text{ lb/ft}
\]

Required Bending Stiffness Capacity (Three-Span Condition):

\[
\Delta = \frac{l_1}{240} = 0.067 \quad \text{Brittle Finish, Load Case: W} \quad \text{FBC 2007, Table 1604.3}
\]

Therefore:

\[
[EI] = \frac{w \cdot l_3^4}{1743 \cdot \Delta \cdot C_D} = 9.119 \times 10^3 \text{ lb-in}^2/\text{ft}
\]
Summary:

Required Bending Strength (controlled by upward wind load on roof decking):

\[
[F_{bs}] = 108.5 \, \frac{\text{lb-in}}{\text{ft}}
\]

Required Shear Strength (controlled by upward wind load on roof decking):

\[
[F_s(\text{lb/Q})] = 36.87 \, \frac{\text{lb}}{\text{ft}}
\]

Required Bending Stiffness Capacity (controlled by upward wind load on roof decking):

\[
[EI] = 15540 \, \frac{\text{lb-in}^2}{\text{ft}}
\]

Therefore, use Table 4A in the PDS 2004 (P. 17-18) in order to select a panel that meets these requirements:

***Use OSB with a span rating of 24/0:

\[
[F_{bs}] = 300 \, \frac{\text{lb-in}}{\text{ft}} > [F_{bs}] = 108.5 \, \frac{\text{lb-in}}{\text{ft}}
\]

\[
[F_s(\text{lb/Q})] = 130 \, \frac{\text{lb}}{\text{ft}} > [F_s(\text{lb/Q})] = 36.87 \, \frac{\text{lb}}{\text{ft}}
\]

\[
[EI] = 60000 \, \frac{\text{lb-in}^2}{\text{ft}} > [E] = 15540 \, \frac{\text{lb-in}^2}{\text{ft}}
\]

This panel was selected from Table 4A in the PDS 2004 (P. 17-18), but its nominal thickness and section properties are designated in Table 5 and 6 of the PDS 2004 (P. 23), respectively:

\[t_{\text{nominal}} = .375 \, \text{in}\]
\[A = 4.5 \, \frac{\text{in}^2}{\text{ft}}\]
\[I = .053 \, \frac{\text{in}^4}{\text{ft}}\]
\[S = .281 \, \frac{\text{in}^3}{\text{ft}}\]