Highway 66 Structural Foundation Redesign

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Background

- Two lane automated miniature 10-pin bowling alley
- Customizable themes and furniture
- Standard length: 39' - 9 1/2" (Customized length available)
- Area needed to operate product: 9'-4" x 40'-1 1/2'
- Height Clearance: 8'-2 1/2'
- Prefabricated at QubicaAMF Lowville, NY facility
- +3000 units installed worldwide

Constraints

- Major Dimensions cannot be altered: height of sublane, overall width of lane pair, and length of individual segments
- Load bearing strength should be greater than or close to current design
- 10-15 year product life

Results

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Team Goal</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Structural Material and Labor Cost for (Lane Pair)</td>
<td>Lower by 10%</td>
<td>13.4% cost reduction</td>
</tr>
<tr>
<td>Lower overall structural foundation weight (Lane Pair)</td>
<td>Lower by 6%</td>
<td>13% or 234.61lb reduction</td>
</tr>
<tr>
<td>Lower Cubic Volume for Shipping (2 Lane Pairs)</td>
<td>Lower by 15%</td>
<td>2.4% or 57 ft³ reduction</td>
</tr>
<tr>
<td>Lower Shipping Length (2 Lane Pairs)</td>
<td>Lower by 15%</td>
<td>22% or 152 in reduction</td>
</tr>
</tbody>
</table>

Table 1: Final proposed results of the team goals based on the project objectives.

Preliminary Research

1. 1.25" Oriental Strand Board (OSB)
   - Benefits:
     - 56% initial cost reduction.
     - 13% weight reduction.
     - Standard thickness for OSB
     - Increase maneuverability for installers due to weight.
     - Initial calculations suggest no significant change in load capability.
   - Considerations:
     - Sub-lane height will decrease by 0.125".
     - Lane width reduced by 0.25".
     - Cost reduction will take a hit to correct changes.
     - Side screw splintering.

2. 30mm (1.18") thick Laminated Strand Lumber (LSL)
   - Benefits:
     - 47% initial cost reduction.
     - 9% weight reduction.
     - Commonly used for QubicaAMF full size lanes.
     - Less susceptible to splintering compared to OSB.
   - Considerations:
     - Sub-lane height will decrease by 0.1939".
     - Width of lane reduced by 0.3878".
     - Cost reduction will take a hit to correct changes.

3. 1.375" thick Laminated Strand Lumber (LSL)
   - Benefits:
     - 64% initial cost reduction.
     - Material change will not contribute to further mods.
     - Less susceptible to splintering compared to OSB.
   - Considerations:
     - Sub-lane height will decrease by 0.1939".
     - Width of lane reduced by 0.3878".
     - Decreased maneuverability for installers due to weight.

Graph 1: Weight comparison of all proposed wood dimensions.

Conclusion

- Reduce 1.375" thick OSB to 1.25" thick OSB (Black, Red, Green)
- Increase cross-wise vertical board (196-3751-00B) by ½" (Black)
- Increase Kickback Brackets length by 1/8"
- Increase thickness of Sublane Particle Board material from 1" to 1.125" (Grey)

Table 2: Density comparisons of each proposed wood density.

<table>
<thead>
<tr>
<th>Material</th>
<th>Density (kg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>809.61</td>
<td>700.00</td>
</tr>
<tr>
<td>808.85</td>
<td></td>
</tr>
<tr>
<td>640.27</td>
<td></td>
</tr>
<tr>
<td>640.27</td>
<td></td>
</tr>
<tr>
<td>1.375&quot; OSB</td>
<td></td>
</tr>
<tr>
<td>1.25&quot; OSB</td>
<td></td>
</tr>
<tr>
<td>30mm LSL (30mm)</td>
<td></td>
</tr>
<tr>
<td>30mm LSL (1.375&quot;)</td>
<td></td>
</tr>
</tbody>
</table>