



VCU

Virginia Commonwealth University
VCU Scholars Compass

Capstone Design Expo Posters

College of Engineering

2016

Highway 66 Structural Foundation Redesign

Devyn Borum

Virginia Commonwealth University

Joshua Clarke

Virginia Commonwealth University

Lorenzo Dingcong

Virginia Commonwealth University

Korey Smith

Virginia Commonwealth University

Follow this and additional works at: <https://scholarscompass.vcu.edu/capstone>



Part of the [Mechanical Engineering Commons](#), and the [Nuclear Engineering Commons](#)

© The Author(s)

Downloaded from

<https://scholarscompass.vcu.edu/capstone/87>

This Poster is brought to you for free and open access by the College of Engineering at VCU Scholars Compass. It has been accepted for inclusion in Capstone Design Expo Posters by an authorized administrator of VCU Scholars Compass. For more information, please contact libcompass@vcu.edu.

Team Members: Devyn Borum, Joshua Clarke, Lorenzo Dingcong, Korey Smith

Faculty Adviser: Dean Lewis F. Bost, MBA

Sponsor: QubicaAMF

Sponsor Advisor: Brian Nelson, Mechanical Engineer

MECHANICAL AND NUCLEAR



Highway 66 Structural Foundation Redesign

CAPSTONE DESIGN EXPO 2016

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 3/8"
- 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

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

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

Preliminary Research

1.25" thick Oriental Strand Board (OSB)

- | Benefits | Considerations |
|---|---|
| <ul style="list-style-type: none"> ➤ 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. ➤ ANSYS analysis backs up preliminary calculations. | <ul style="list-style-type: none"> ➤ 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. |

30mm (1.18") thick Laminated Strand Lumber (LSL)

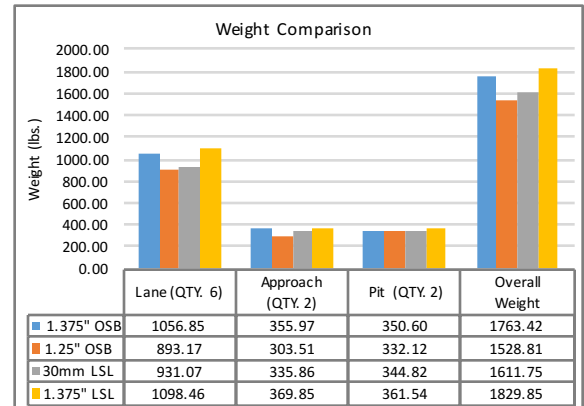
- | Benefits | Considerations |
|---|---|
| <ul style="list-style-type: none"> ➤ 47% initial cost reduction. ➤ 9% weight reduction. ➤ Commonly used for QubicaAMF full size lanes. ➤ Less susceptible to splintering compared to OSB. | <ul style="list-style-type: none"> ➤ Sub-lane height will decrease by 0.1939". ➤ Width of lane reduced by 0.3878". ➤ Cost reduction will take a hit to correct changes |

1.375" thick Laminated Strand Lumber (LSL)

- | Benefits | Considerations |
|---|---|
| <ul style="list-style-type: none"> ➤ 64% initial cost reduction. ➤ Material change will not contribute to further mods. ➤ Less susceptible to splintering compared to OSB. | <ul style="list-style-type: none"> ➤ 4% increase in weight. ➤ Decreased maneuverability for installers due to weight. |

Material Densities					
	1.375" OSB	1.25" OSB	LSL (30mm)	LSL 1.375"	Sublane Plywood
Densities (kg/m ³)	640.27	640.27	808.85	809.61	700.00

Table 2: Density comparisons of each proposed wood density.



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 1/4" (Black)
- Increase Kickback Brackets length by 1/8"
- Increase thickness of Sublane Particle Board material from 1" to 1.125" (Grey)

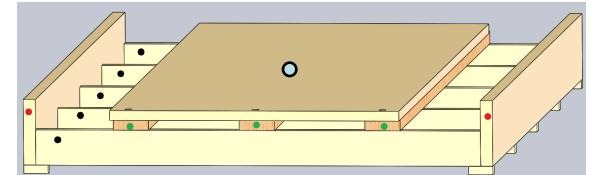


Figure 1: Full assembly of a lane section with modified thickness.



VCU School of Engineering

Make it real.

VIRGINIA COMMONWEALTH UNIVERSITY