



## **Company Information**

<b>Company Name</b>	VPI Windows- Division of JELD-WEN	<b>Date Submitted</b>	11/22/2021
<b>Project Title</b>	Design of Material Handling Device for Large Windows (JELDWEN_WINDOW)	<b>Planned Starting Semester</b>	Spring 2022

## **Senior Design Project Description**

### **Personnel**

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

<b>Discipline</b>	<b>Number</b>	<b>Discipline</b>	<b>Number</b>
Mechanical	5	Electrical	
Computer		Systems	
Other ( )			

### **Company and Project Overview:**

JELD-WEN is one of the world's leading manufacturers of reliable windows and doors. Our extensive product offering encompasses windows, exterior doors, interior doors, and related building products that are sold globally through multiple distribution channels, including retail home centers, wholesale distributors and building products dealers.

JELD-WEN was founded in 1960, and currently operates 117 manufacturing facilities in 19 countries located primarily in North America, Europe, and Australia. Headquarters are in Charlotte, North Carolina. In April of 2019 JELD-WEN completed the Acquisition of VPI Quality windows, a market leading vinyl window manufacturer for mid-rise multi family, institutional, hospitality and commercial projects. VPI was located exclusively in Spokane, Washington. In May of 2021, JELD-WEN added to the VPI business a manufacturing facility in Statesville, NC to grow the brand and serve the growing customer base in Eastern US.

VPI Product examples:



**THE WILLIAM STATES LEE  
COLLEGE OF ENGINEERING**

envision window  
& door series



endurance  
window series



bellevue narrow  
door series



**Project Requirements:**

VPI East is has begun its first production line for commercial windows. The handing of the product from the end of the line onto the trailer for customer delivery is problematic as the units are large and heavy. Concerns are ergonomic, safety, product quality and ability to meet Takt Time.

Current state:

At the end of the line these large units are then moved onto repurposed glass skid, tied onto the skid for stability and moved using an electric pallet jack 90% of the time, and forklift 10% of the time when the weight of the windows exceeds electric pallet jack capacity. (~1000-2000 lbs.)

However, forklift is not optimal as it bounces when going over lading ramp.

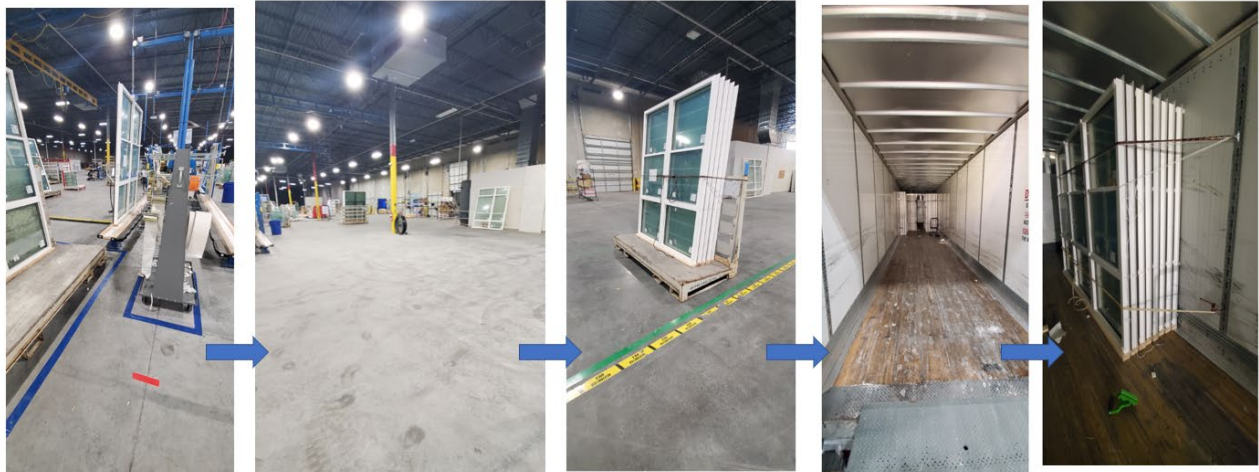
*Unit Sizes:*

Ranges from 29.5" wide by 69" tall to 156.52" wide by 144.32" tall. There is different configuration of windows, so some may be ~150" wide and 98" tall.

Weight ranges from 80lbs to 400+ lbs. Most of the weight is in glass, which as a rule is about 38lbs per full size pane of glass.

Once the units make it to the trailer for loading, they are manually moved onto the trailer using 2–4-man lifts using gravity handles if needed.

Once on the trailer the units must be manually tied down for transport, requiring someone inside the trailer for a period of time. Current time to load one unit is 10 minutes.



Unit is rolled from end of production line onto Rack.

Rack is moved approximately 50 feet to loading dock.

Staged for loading

Multiple associates must lift heavy unit to station into trailer.

Stabilized for transit with tie downs.

**Expected Deliverables/Results:**

- Develop a transportation system that will cut reduce time from end of line until ready to ship by minimum of 50%.
- Develop a transportation racking system that is safe and sturdy, protecting product quality and easy to move.
- Design/prototype must meet all OSHA and JELD-WEN safety standards (to be provided up front).
- Develop ergonomic method for loading the heavy units onto the trailer.
- Develop a system of stabilizing the units on the trailer that does not require an associate to be in the trailer for an extended period of time tying knots.

**Disposition of Deliverables at the End of the Project:**



- Working prototype of solution.
- Full design, drawings, specifications, and testing of solution approach fully documented and handed over to JW engineering and site operations team.

**List here any specific skills, requirements, specific courses, knowledge needed or suggested (if none please state none):**

- Finite Element Analysis (FEA)
- CAD (Computer Aided Design)
- Ergonomics and Human Factors
- Machining: Metal fabrication, Machining, and Welding
- Takt Time vs. Cycle time