

# IPRO 307: Intermodal Container Facility Solutions for Chicago Region

Sponsored by: Mi-Jack Products, Inc.

**Goal:** To improve the Harvey, IL Intermodal Facility from 300,000 lifts per year to 1,000,000 lifts per year using the ‘Mi-Jack Pathfinder Accelerated Intermodal Terminal’

## Project Scope:

- Determine number of cranes & buffers needed to go from 300k to 1M lifts/year
- Site layout changes to increase facility efficiency
- Pavement design for truck traffic areas
- Analysis and design of structural system that can support the superstructure
- Sustainable foundation design that spans 5,000 ft of track
- Computer simulations to demonstrate new process
- Meet the requirements set by Mi-Jack
- Provide a cost estimate for facility changes



## Task Groups Breakdown:

- Structural
- Pavement
- Foundation
- Layout
- Mechanical
- Simulations

## Team Composition:

- 11 Civil Engineers
- 2 Mechanical Engineers
- 1 Architectural Engineer
- 1 Aerospace Engineer

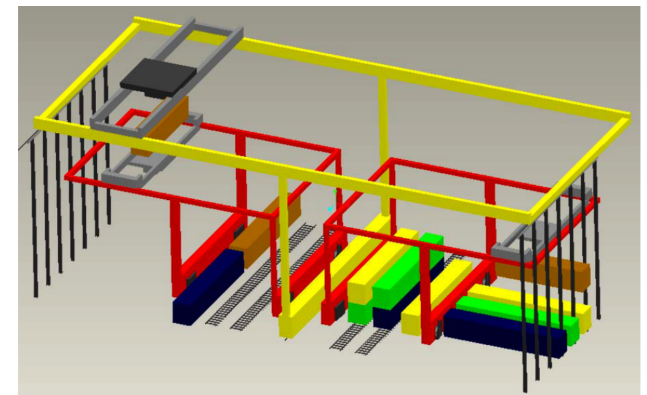
## Overview of Solution:

- Large crane will span 4 sets of tracks
- 3 cranes will complete 3475 lifts a day
- Containers will be rotated and placed perpendicular to tracks
- Double stacked containers, 320 buffers total
- Trackage storage allowing containers to be picked up in 4 days or less

## Cost Summary:

- Structural: \$2.13 Million
- Pavement: \$22 Million
- Site Layout: \$4.2 Million
- Foundations: \$ 162,000

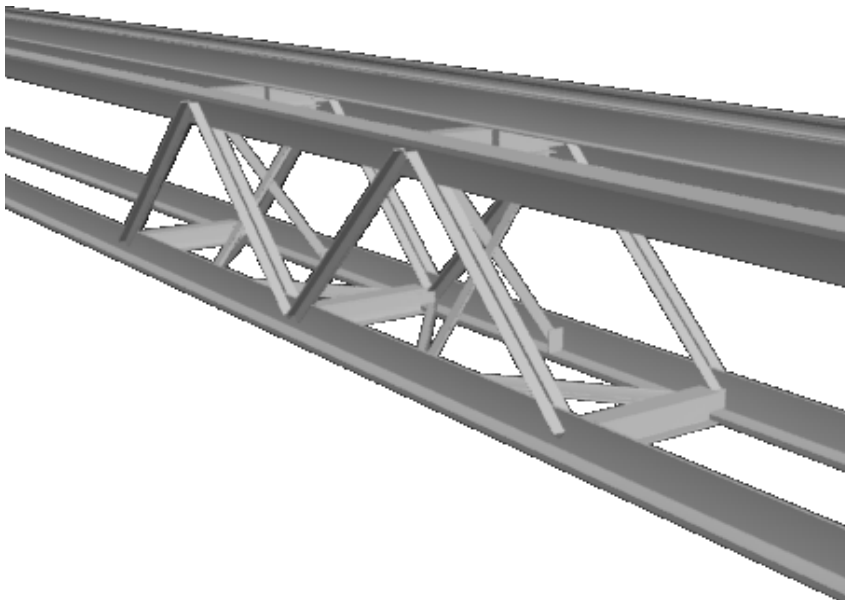
**Total Cost of Improvements: \$28.5 Million**



# IPRO 307: Work Breakdown Structure

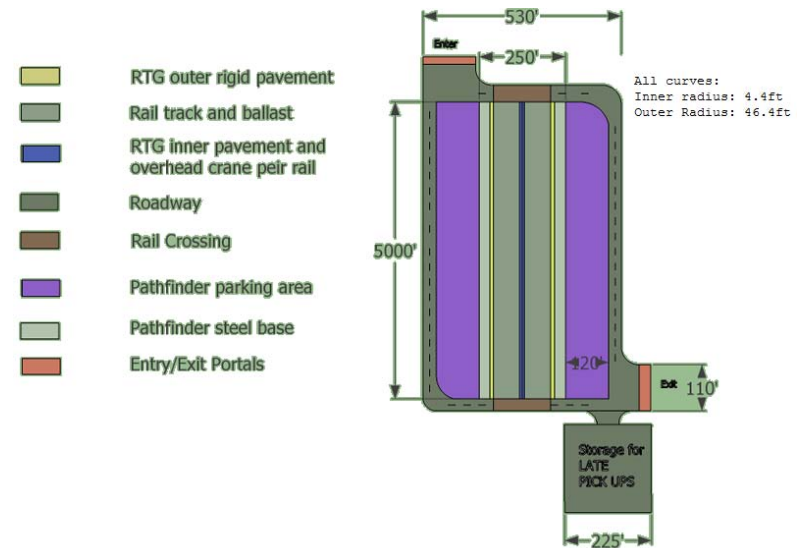
- **Foundations (2 Students):** Designed the required foundations for the pathfinder system, while utilizing a “steel-plate-on-grade” design that required minimal excavation or modification of the existing site.

- **Structural (4 Students):** Performed all structural design and analysis of large gantry crane and pathfinder frame. Utilized computer analysis software such as SAP 2000 to optimize the sizes of all structural members. Checked design against all applicable codes and specifications. Completed 3d computer model of crane truss.



- **Site Layout (3 Students):** Prepared a new layout of the site using the pathfinder technology. Two locations were discussed, and the best was selected based on ease of implementation, cost, minimization of impact to the site, and maximization of efficiency. Existing infrastructure was retained wherever possible.

- **Pavements (2 Students):** Designed the pavements required to withstand the near continuous loading of container trucks traversing around the pathfinder system. Computed ESAL values and calculated storm water drainage requirements.



- **Simulation (2 Students):** Performed analysis of data to determine the optimal number of buffers, number of tracks, and length of tracks required to achieve the desired goal of 1 million lifts per year. Used the “50-30-10-10” assumption: 50% of containers will be picked up by the customer with the first 24 hours, 30% in the next 24 hours, and so on.

- **Mechanical (2 Students):** Analyzed the dynamic forces found in the crane for use by the structural group. Researched similar crane designs to use as baseline for comparison.