Intermodal Container Transport
System Solutions for Chicago

IPRO - 307
Introduction

THE NEED:
- Transportation of Tonnage
  - Truck, 69%
  - Rail, 13.3%
  - Rail Intermodal, 1.3%
- Demand, Tonnage is Up
- Environmental

THE VALUE:
- Reducing:
  - Trucks on highways
  - Carbon footprint
Introduction

PROBLEM:
- Supply, Trucking Fleet is Down
  - 2007, -2.6%
- Company Failures
- Hard Life Style
- Lack of Transportation Capacity
- Land Limits

OBJECTIVES:
- +50% Capacity = +50% Pollution
- “Increase capacity without increasing pollution”
  - Improve Slip Seating
  - Maximize Land Capacity
  - Utilize New Technologies to Improve Efficiencies

PROJECTION: +50% Demand in 10yrs
Capacity needs to improve in order to meet the demand
Team Development & Performance

VALUES & MISSION:
- Ethics Test
  - “What Permits Do We Need”
  - “Increase capacity without increasing pollution”
- Communication
  - Honest Feedback

ORGANIZATION:
- Two Teams
  - Assign Responsibilities
    - Not Tasks
- Peer Review
  - Utilize Diversity
  - Discussions

Facility Capacity Expansion
- Flipper
- Land Efficiencies
- CNG Station

Resource Management
- Labor
- Natural Gas
- Windmill
## Responsibilities

<table>
<thead>
<tr>
<th>Name</th>
<th>Major</th>
<th>Task Responsibility</th>
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<tbody>
<tr>
<td>Xavier Alacron</td>
<td>Civil Engineering</td>
<td>Sub-Group 2 Team Leader; CNG station design, along with safety and efficiency improvements.</td>
</tr>
<tr>
<td>Kwong Cheung</td>
<td>Civil Engineering</td>
<td>Research and collection of data for transportation nationwide</td>
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<tr>
<td>Michal Kaska</td>
<td>Mechanical Engineering</td>
<td>Sub-Group 1 Team Leader; In charge of emission mandates, wind turbine implementation, and project management.</td>
</tr>
<tr>
<td>Irina Magdel</td>
<td>Civil Engineering</td>
<td>CNG distribution and storage research.</td>
</tr>
<tr>
<td>Linh Nguyen</td>
<td>Architecture</td>
<td>In charge of obtaining permit requirements for construction of wind turbine.</td>
</tr>
<tr>
<td>Bradley Suik</td>
<td>Mechanical Engineering</td>
<td>Development of the &quot;flipper&quot; for yard truck traffic improvement.</td>
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<tr>
<td>Daniel Fuentes</td>
<td>Architecture</td>
<td>Site analysis - zoning and habituation - to increase yard capacity.</td>
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<tr>
<td>Andrew Kedzuch</td>
<td>Architecture</td>
<td>Wind turbine assembly and circuit design as well as intermediary with Zero Energy IPRO.</td>
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<tr>
<td>Plamen Marinov</td>
<td>Mechanical Engineering</td>
<td>Design of new locking mechanism or coupling device for joining stacked containers together.</td>
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<tr>
<td>Christopher Brewin</td>
<td>Mechanical Engineering</td>
<td>Wind turbine assembly and installation; CNG engine conversion research for yard equipment.</td>
</tr>
<tr>
<td>Krzysztof Slomiany</td>
<td>Mechanical Engineering</td>
<td>In charge of emission mandates, wind turbine implementation, project management, master schedule maker</td>
</tr>
<tr>
<td>Tomasz Lis</td>
<td>Architecture</td>
<td>Expansion process for the facility; 'leveling floor space' concepts and design</td>
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History
Since Fall 2004
Automated Shipping Containers

Grid-Rail (GRAIL) Over Head Lattice Concept

Inter-Yard Structure Concept
- Recommended environmentally friendly intermodal design
- Uses grid structure with quantifiable layout
- Zero excavation - no dirt is moved offsite due to possible contaminations
- Energy reducing features including wind power, skylights and light sensors
Environmental Improvements

- Improved water retention
- Site specific improvements
- Improvements in air quality based on current standards
Bridge Design

- Meets needs of people and cars
- Two sided concept based design
Project Work
Preliminary Investigation

Norfolk Southern Yard Visit:
- Gathered Hard Data
- Discussed Future Projections
  - 5yr Plan
- Observed Processes
- General Yard Layout
- & Functions
Trucking Time-space Diagram

Driving rules:
11hrs in 14 hr period, then off-duty for 10 hrs (daily req.)

Location

Los Angeles
2,018 miles

Denver
1,006 miles

Grand Island, Nebraska
604 miles

Chicago

Time (hr)

11 hr
21 hr
32 hr
42 hr
67 hr
Flipper

Independent Container Removal

- Improves Machinery Time Management
  - Live Lift (Ideal)
    - Next best thing
  - Improved Slip Seating
    - Live in your own bed
  - Speeds Up Yard Processes

Trucker
- Unaided

Flipper
- Container Release from chassis

Final Transfer
- Crane
- Rail

Reduces Idle Time
- Reduced Labor Costs
- Improved Traffic Flow
Natural Gas

- Environmentally Friendly
- Availability
  - Energy Independence
- Minimizes Disruption

Other Fuels:
- Diesel
- Bio Fuel
CNG Station

Benefits:
• Road Tax - License
• No Interference
• Availability
• Rebates

• LNG vs. CNG
• Utilizes Parking Space
• Generates Income
CNG Engines

RATIONALITY:
- Cost
- Cleaner emissions
- Made in the USA
- On site refueling
- Simplicity
- Future

PROCEDURE:
- Engines
- Fuel system:
Windmill

Integration:
- Light Towers
  - Power Lights
  - 100ft

Collaboration:
- Zero Energy Lab
  - Implementation
  - Grid Interconnection
  - Wind Velocity Test
Land Capacity

• Improved Traffic Flow
  ▫ 50% Yard Expansion
  ▫ Added Entrance / Exit
  ▫ 2 Proposals

• Land Limitations
  ▫ Vertical vs. Horizontal Growth
  ▫ Austell Facility
    • (1/2 Traffic & 2x Size)

Floored Parking:
  ◦ Not feasible
  ◦ Cost & Strength

Don’t Miss Our Model
Conclusions

“Increase capacity with out increasing pollution”

Flow capacity can be increased through innovation and growth with out damaging the environment and its resources.

- Flipper, IBC, CNG Station, CNG Engines, Windmills

FUTURE WORK:

- Look into Solar Power
- Monitor Lighting Opportunities
- Develop Ideal Site Conditions
Accomplishments

- IBC Model
  - 3D in PRO-E
  - Animation
- Flipper Model
  - Physical Model
  - 3D cutting software
- Working Windmill
  - Collaboration with Zero Energy
- Over 17 Presentation
  - Peer Reviewed
- CNG Proposal
  - Station & Engine
- Land Expansion Proposal (x2)

IMPACTS:
- Environmental
  - Energy Independence
  - Pollution Particulate
- Community
  - Traffic
- Market
  - Supply & Demand
  - 10yr Projection
- Norfolk Southern
  - Land Expansion
Thanks To:

Mijack (Sponsor)
- Norfolk Southern
- Zero Energy Lab

Advisors:
- Laurence Rohter, P.E.
- Peter Mirabella
- Professor Sid Guralnick