Intermodal Container Transport System Solutions for Chicago

IPRO - 307

ILLINOIS INSTITUTE OF TECHNOLOGY

Introduction

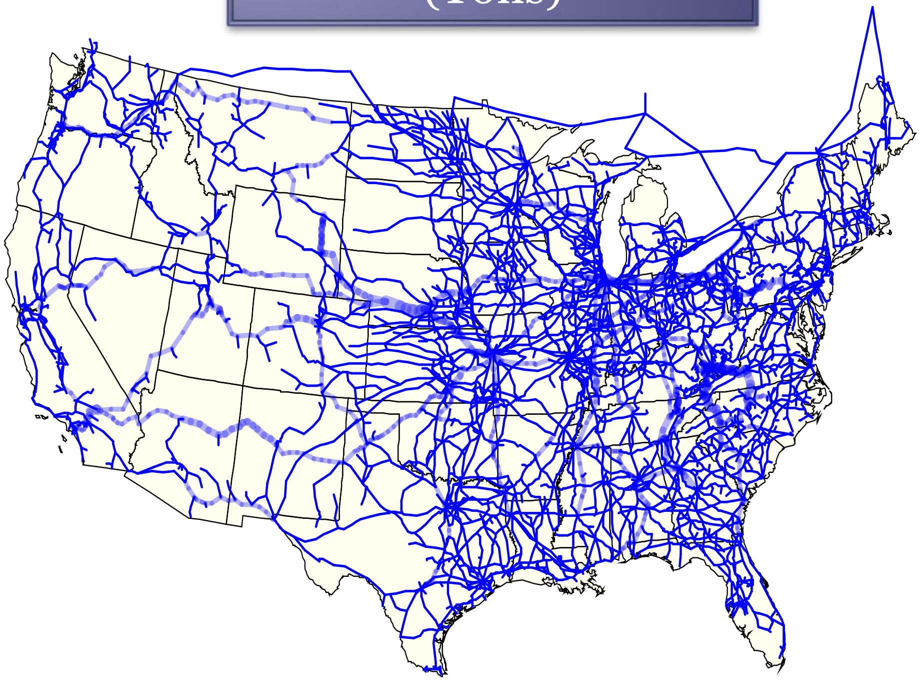
THE NEED:

- 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

Rail Freight Density (Tons)

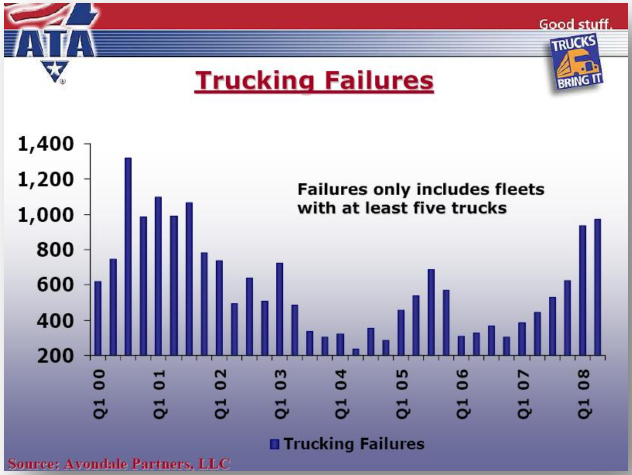


Introduction

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

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 with out increasing pollution"
  - Improve Slip Seating
  - Maximize Land Capacity
  - Utilize New Technologies to Improve Efficiencies

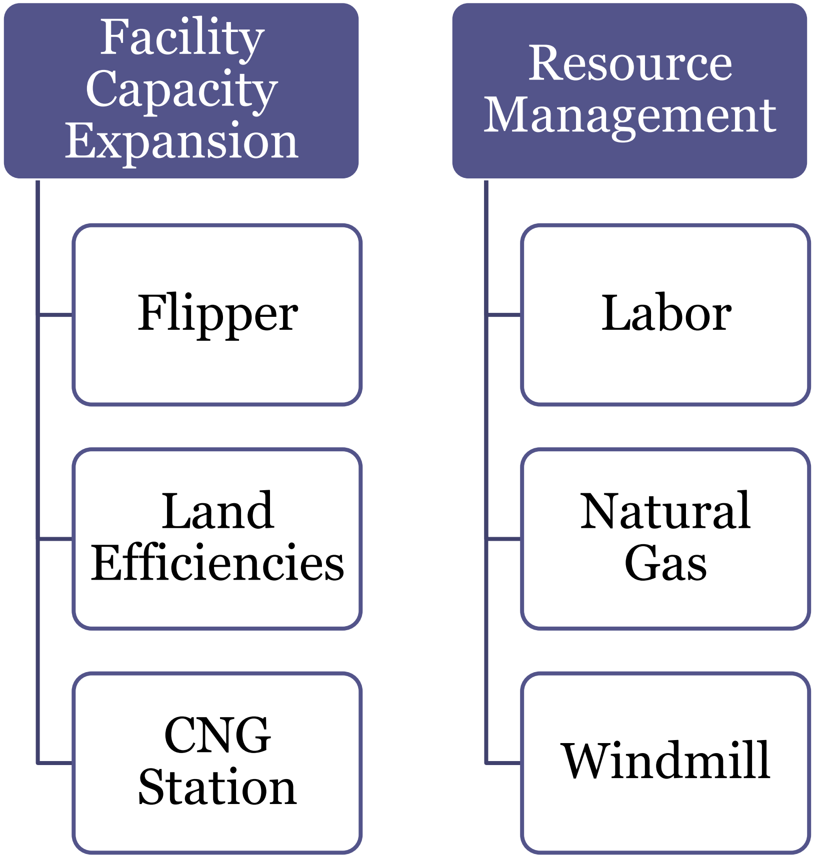
Team Development & Performance

VALUES & MISSION:

- Ethics Test
  - “What Permits Do We Need”
  - “Increase capacity with out increasing pollution”
- Communication
  - Honest Feedback

ORGANIZATION:

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



Responsibilities

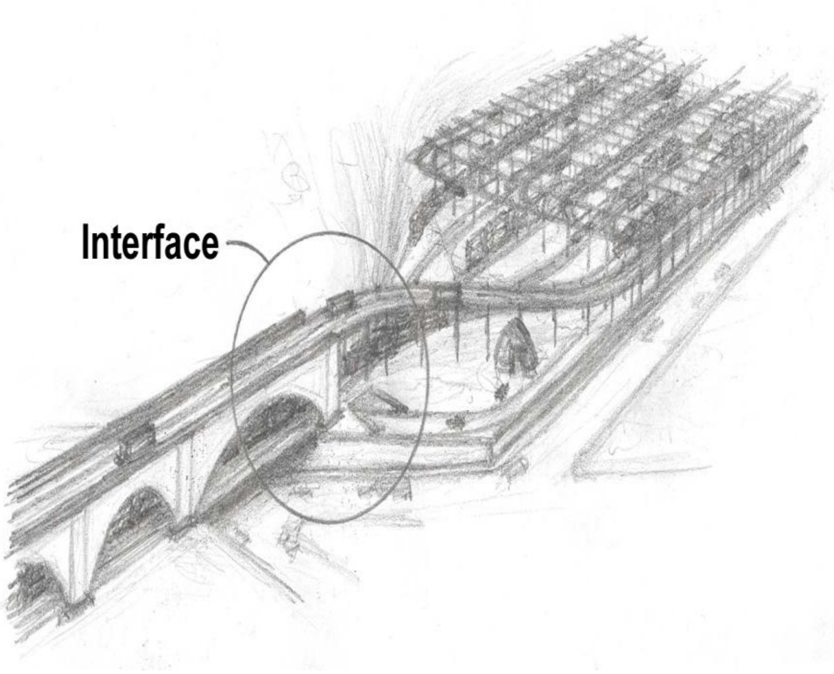
Name	Major	Task Responsibility
Xavier Alacron	Civil Engineering	Sub-Group 2 Team Leader; CNG station design, along with safety and efficiency improvements.
Kwong Cheung	Civil Engineering	Research and collection of data for transportation nationwide
Michal Kaska	Mechanical Engineering	Sub-Group 1 Team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

History

Since Fall 2004

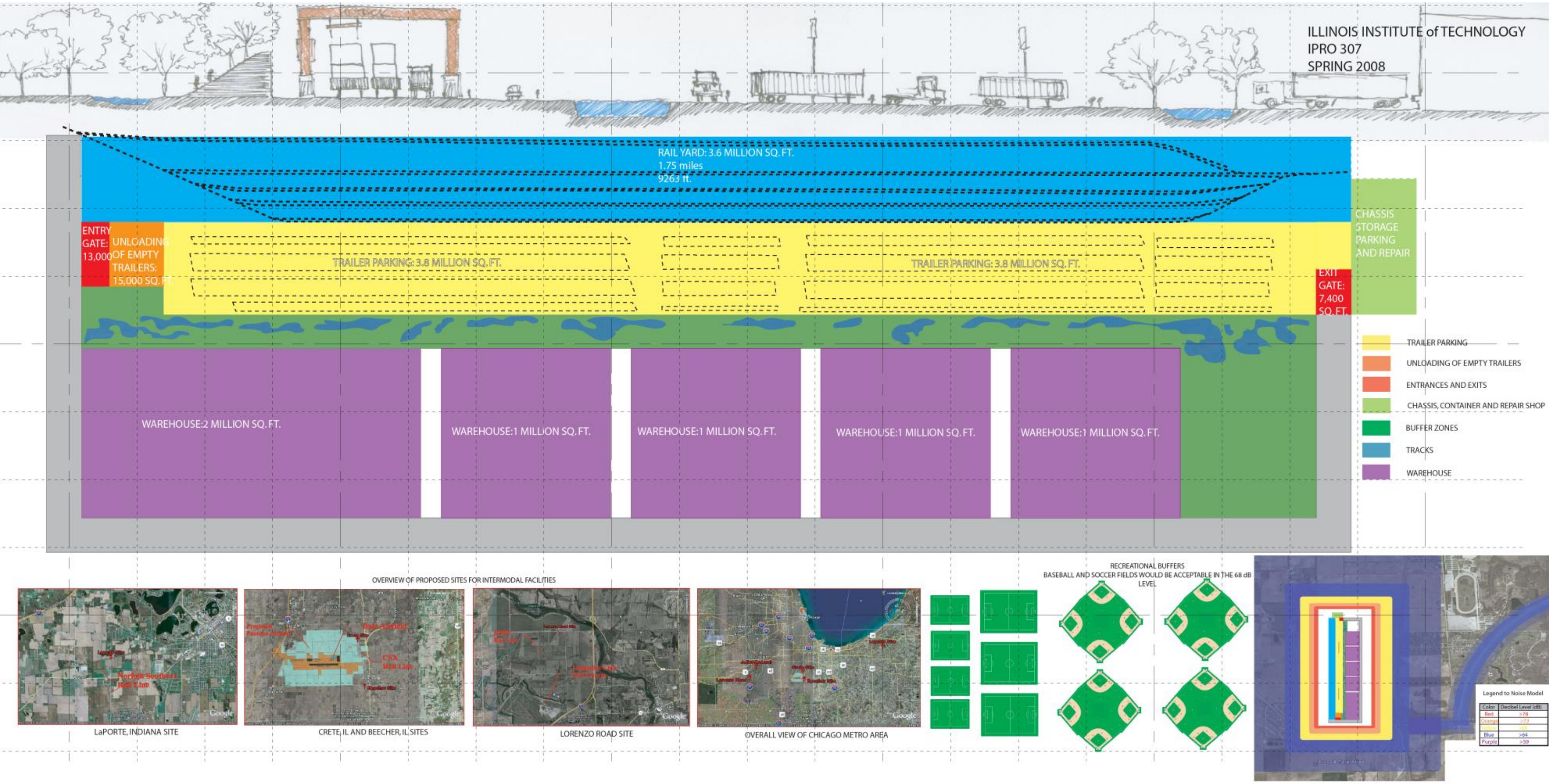
Automated Shipping Containers

Grid-Rail (GRAIL) Over Head Lattice Concept



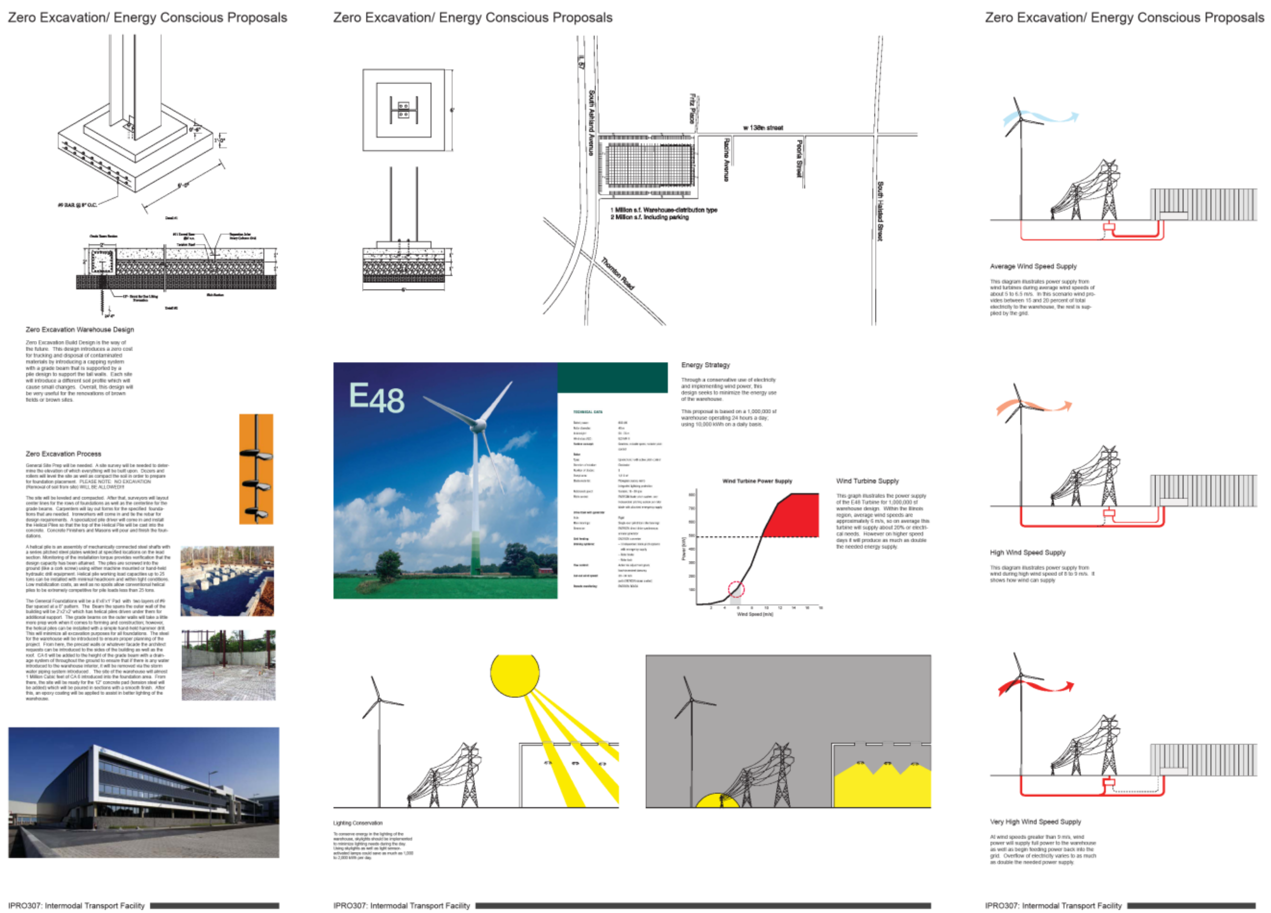
Inter-Yard Structure Concept

Buildout



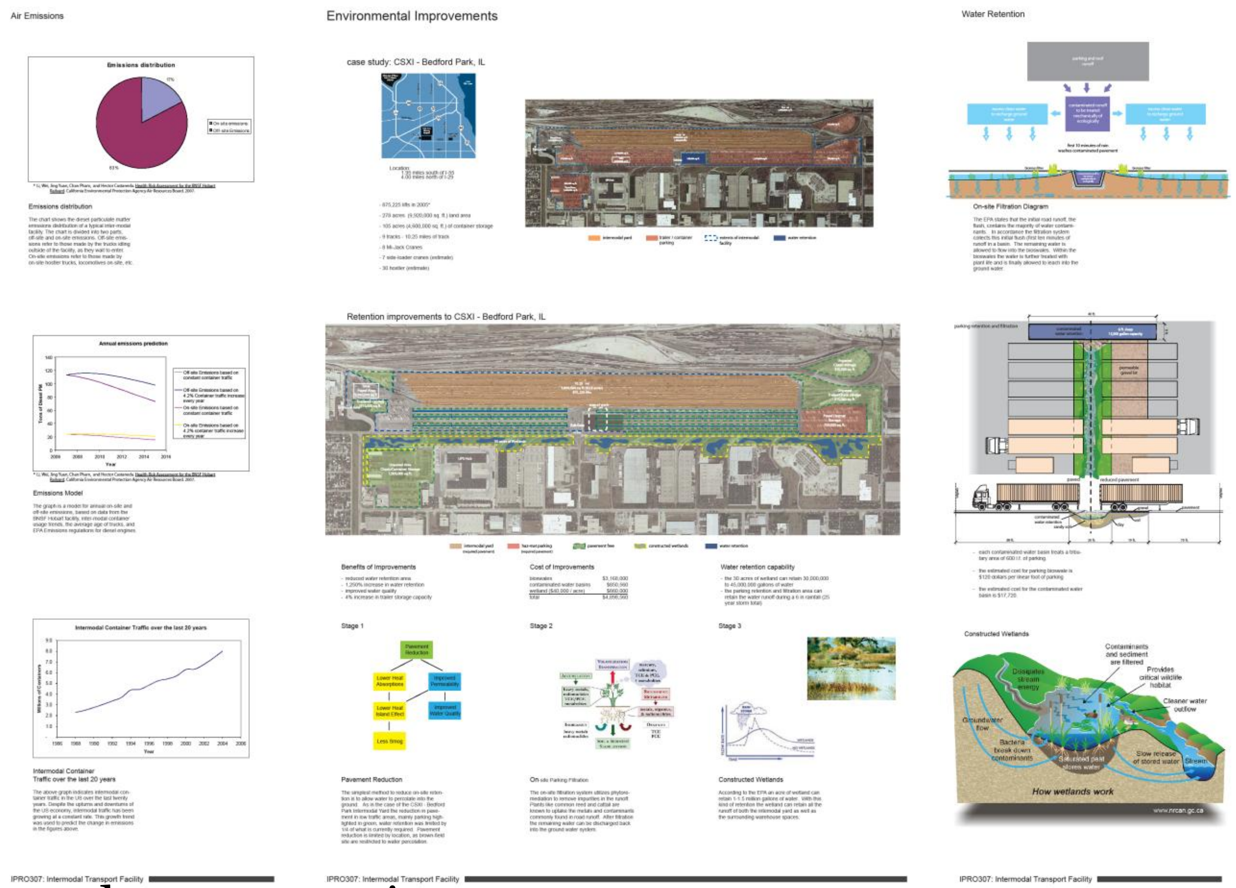
- Recommended environmentally friendly intermodal design
- Uses grid structure with quantifiable layout

Warehouse and Energy Solutions



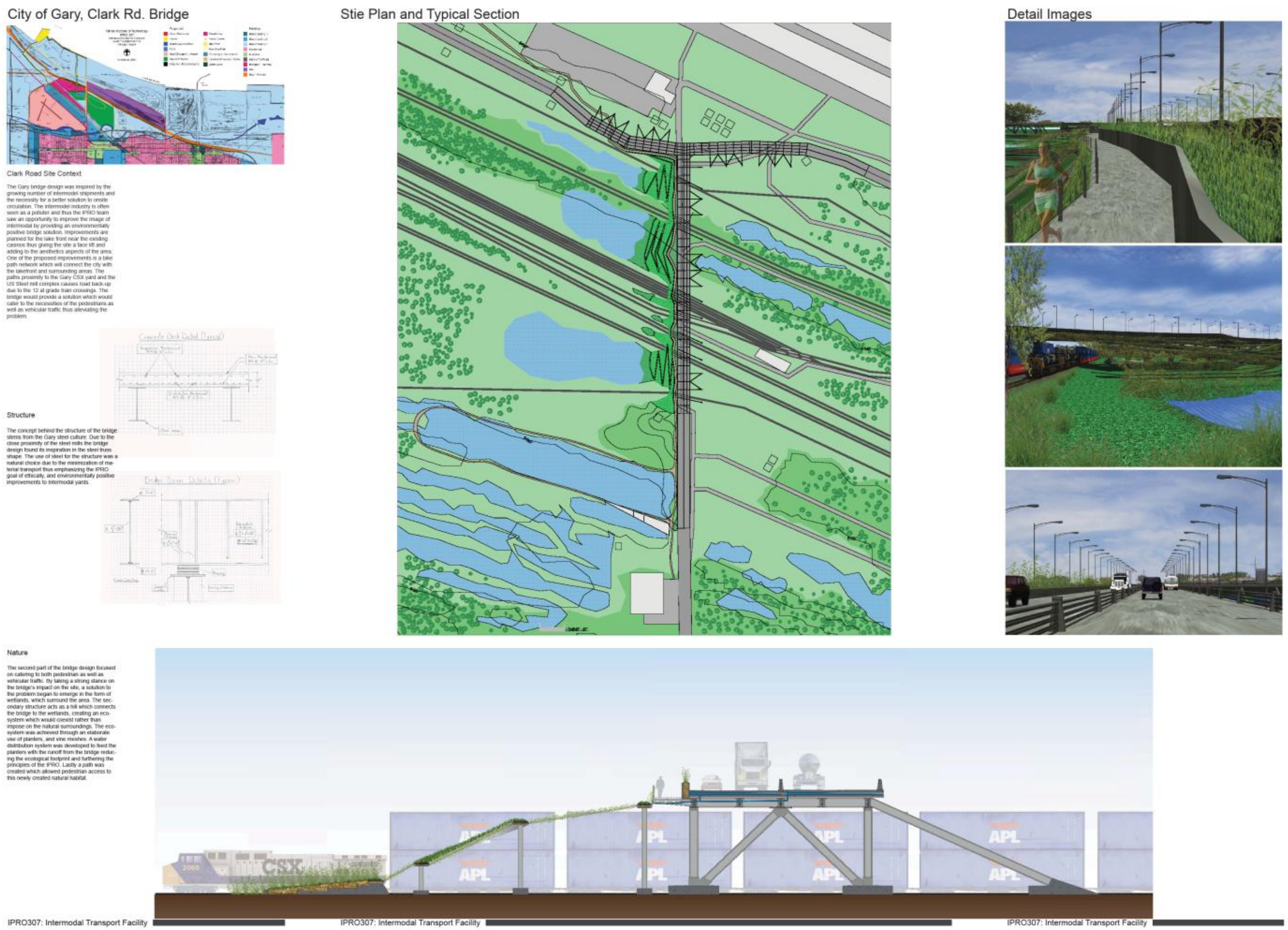
- Zero excavation-no dirt is moved offsite due to possible contaminations
- Energy reducing features including wind power, skylights and light sensors

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

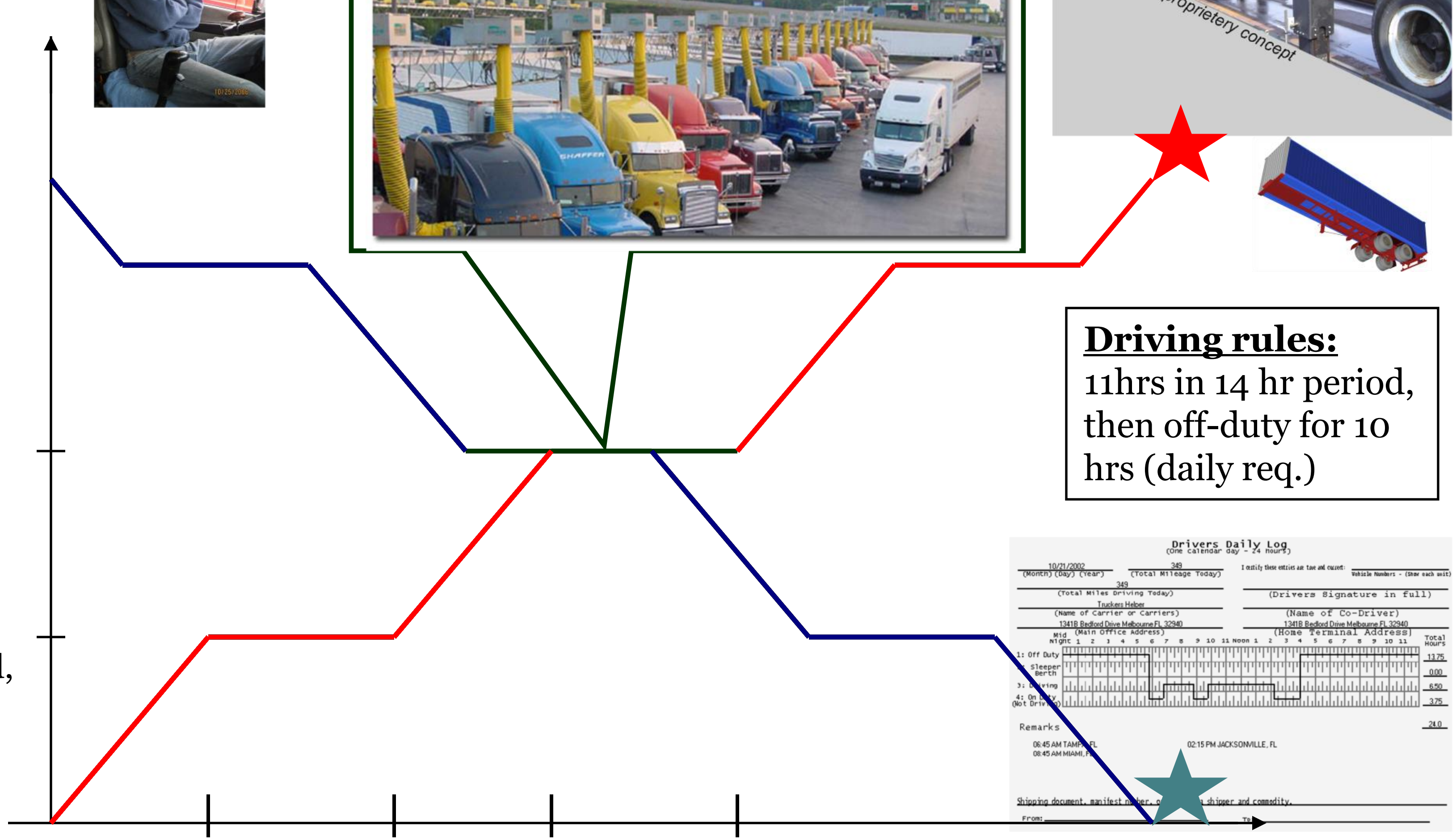
Preliminary Investigation

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.)

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

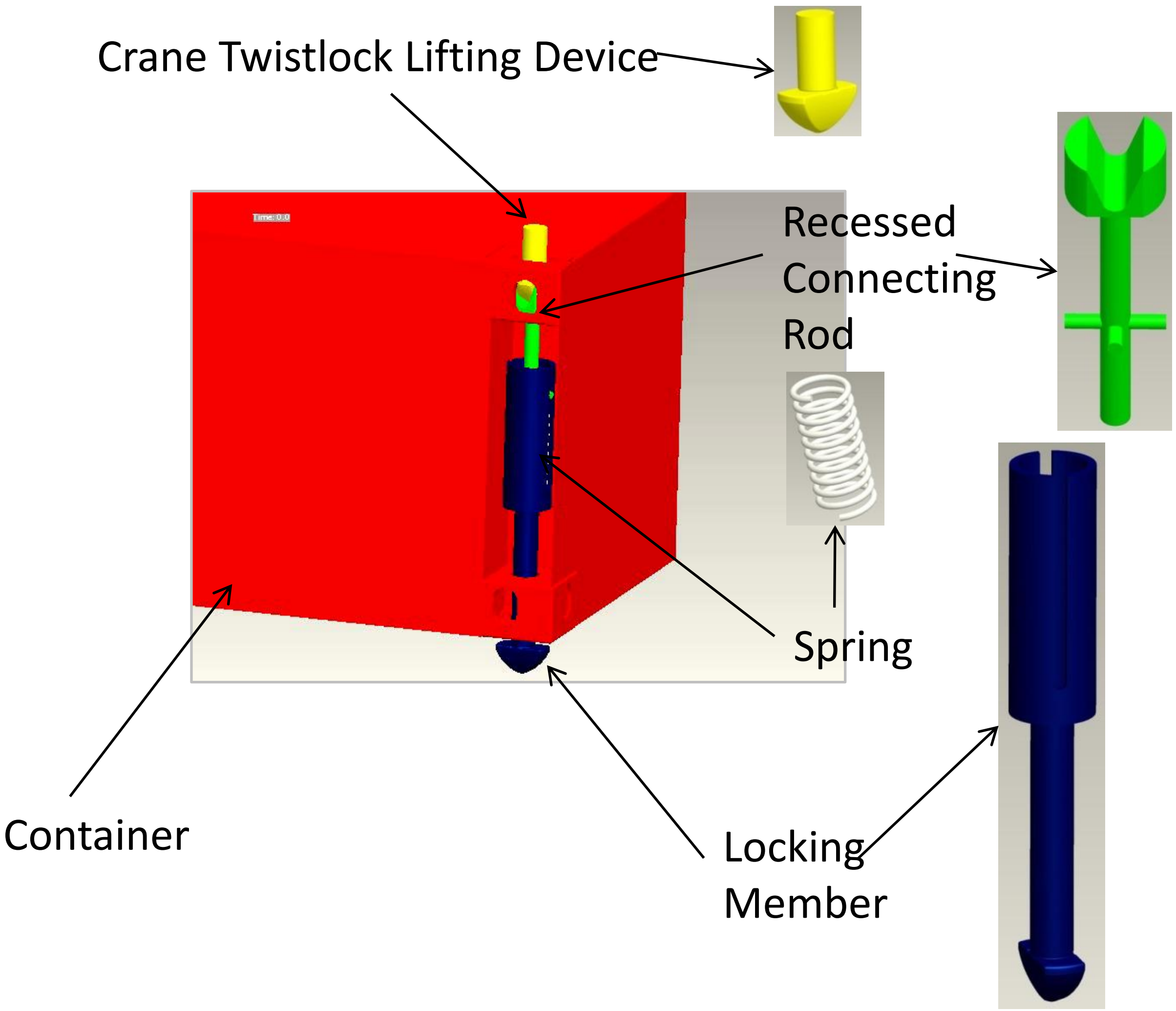
Trucker
- Unaided

Flipper
- Container Release from chassis

Final Transfer
- Crane
- Rail

Reduces Idle Time

IBC



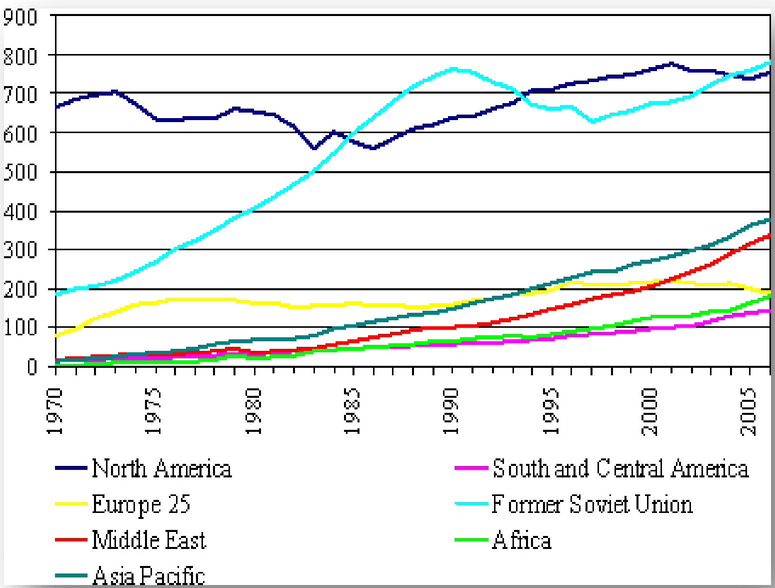
- Reduced Labor Costs
- Improved Traffic Flow

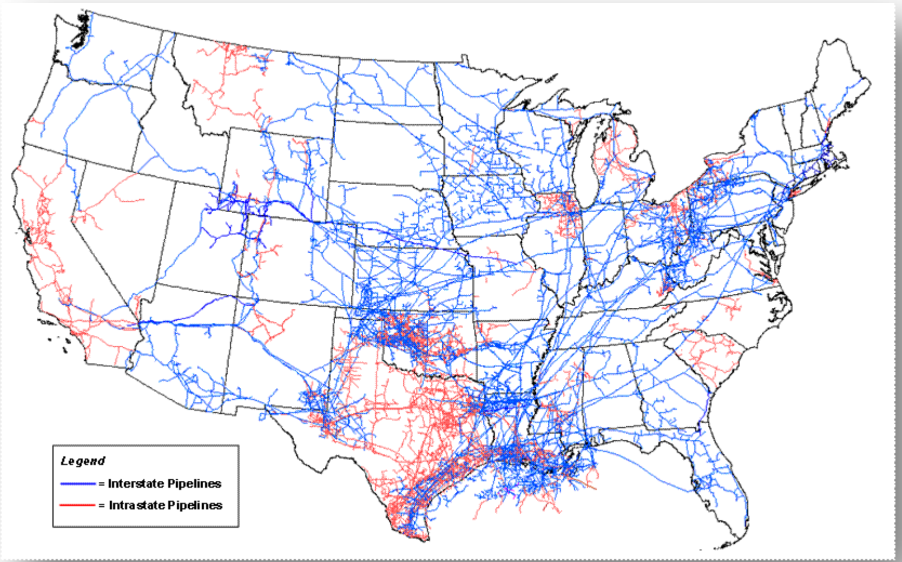
Inter-Box Connecter

Natural Gas

- Environmentally Friendly
- Availability
  - Energy Independence
- Minimizes Disruption

Other Fuels:
- Diesel
- Bio Fuel





Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System

CNG Station

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

Gas Inlet → Gas Meter → Compressor Module → Priority Panel → Storage Cascade

Priority Panel → Dispenser

- LNG vs. CNG
- Utilizes Parking Space
- Generates Income

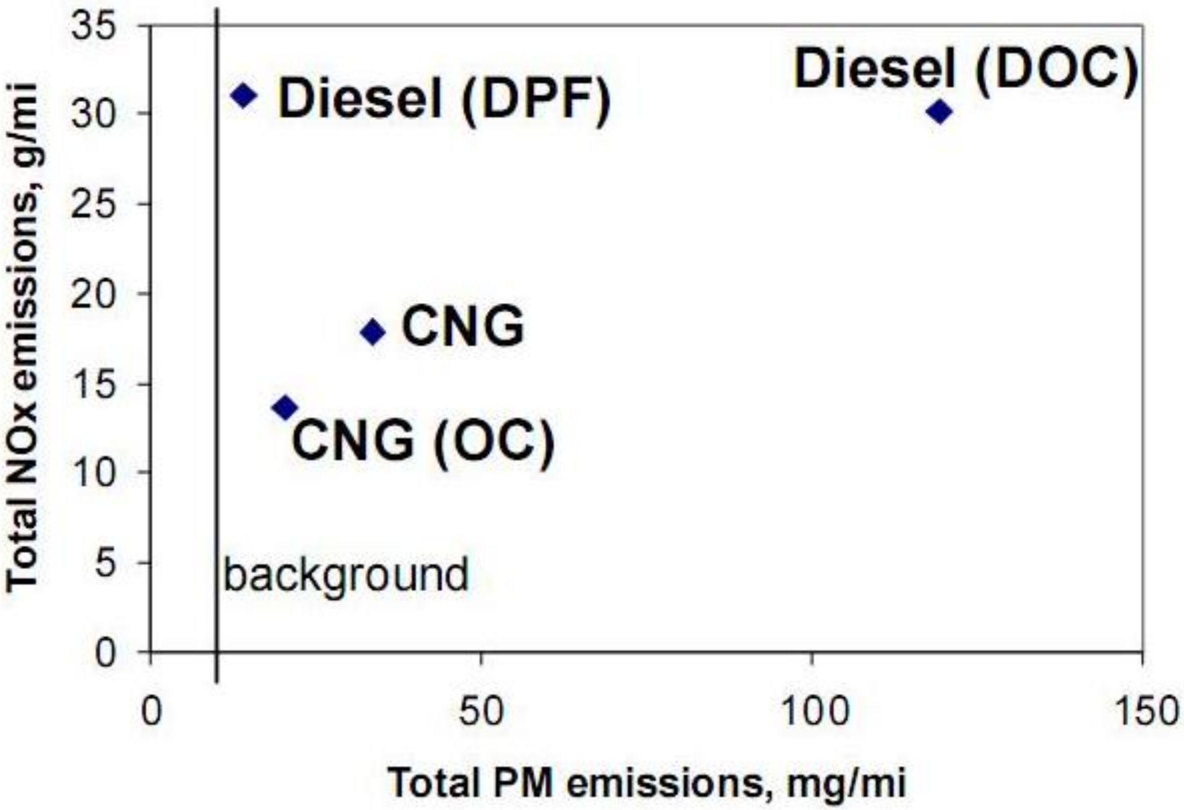
CNG Engines

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

Wind Energy → Turbine → Electrical Energy → Battery Buffer → Inverter

Inverter

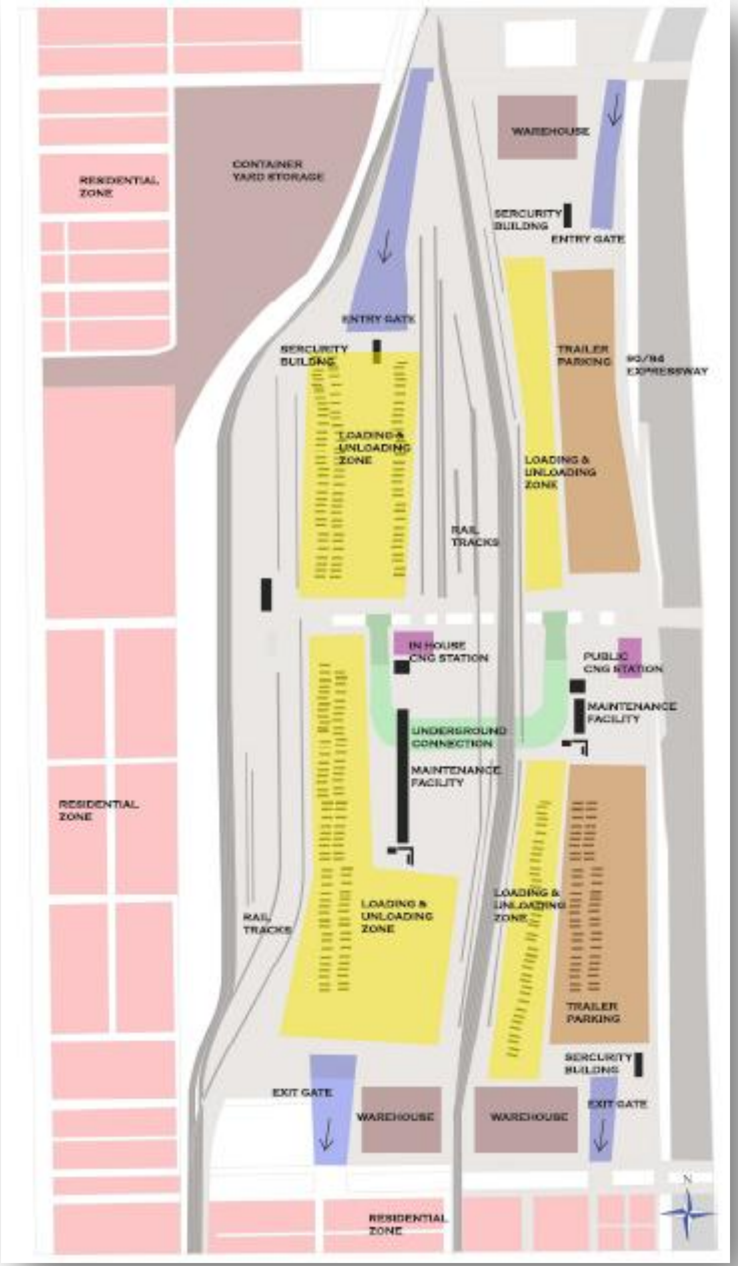
- Fixture Dawn-Dusk
- Compressor

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

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Questions?