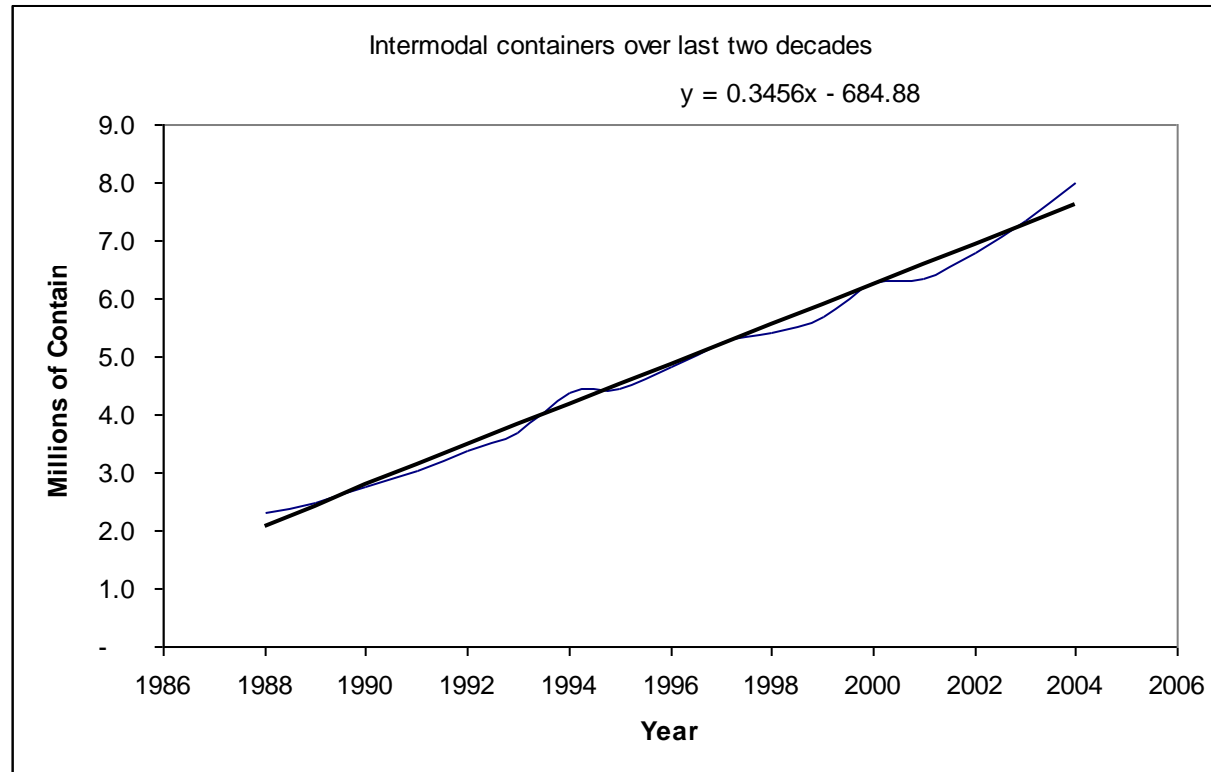


# IPRO 307: Environmentally positive impact solutions for intermodal yards



# Intermodal container traffic over the past two decades



18 Million Containers Worldwide

# Problem

- Find environmentally positive solutions to lessen the impacts caused by necessities of intermodal yards
- Due to increase in intermodal travel we want to reduce the community impacts of intermodal yards and stay in front of the problem by anticipating complaints

# Objective

- To design solutions for general and site specific settings
- Provide a means of distributing our solutions to the public as the sponsor requested



# Project Management

- A project plan was updated and used to track objectives to be completed throughout the semester
- Assignments were divided among individuals who had knowledge in the area or showed interest in learning about the area
- Meeting minutes were used to help guide action items for the following meetings
- Our project had no monetary budget

# Project Management

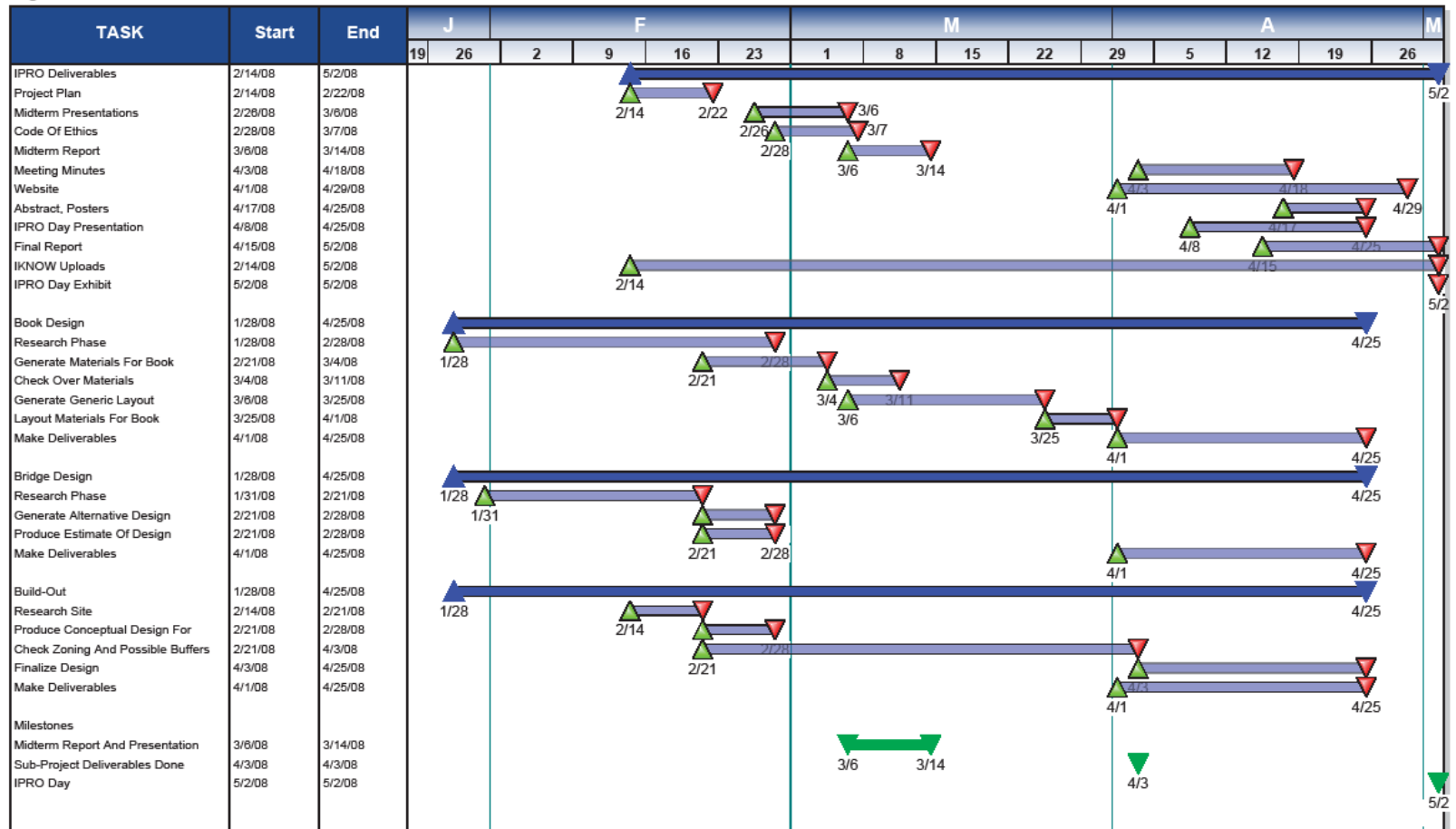
- Time sheets were not used because status reports were given twice a week by students during meetings
- Individual progress was also followed through the use of iGroups where work would be uploaded on a regular basis for others to review and critique
- Group meetings were handled by rotating leadership and secretarial responsibilities
- The group unanimously preferred this set of procedures and found it very effective



# Project Plan

## IPRO 307

Page 1 of 1



# Ethics

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- Entire project was based on ethical thinking
- Took into consideration not just the clients needs but also community and environmental needs
- Referenced different studies and used real world and local data as a basis for all of our designs



# Ethics

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- Recognized the limits of our designs
- Designs were thorough but not complete, they are not ready to be implemented as none of the project team is certified in the correct areas
- Reallocated work as needed due to a missing group member

# Results and Solutions

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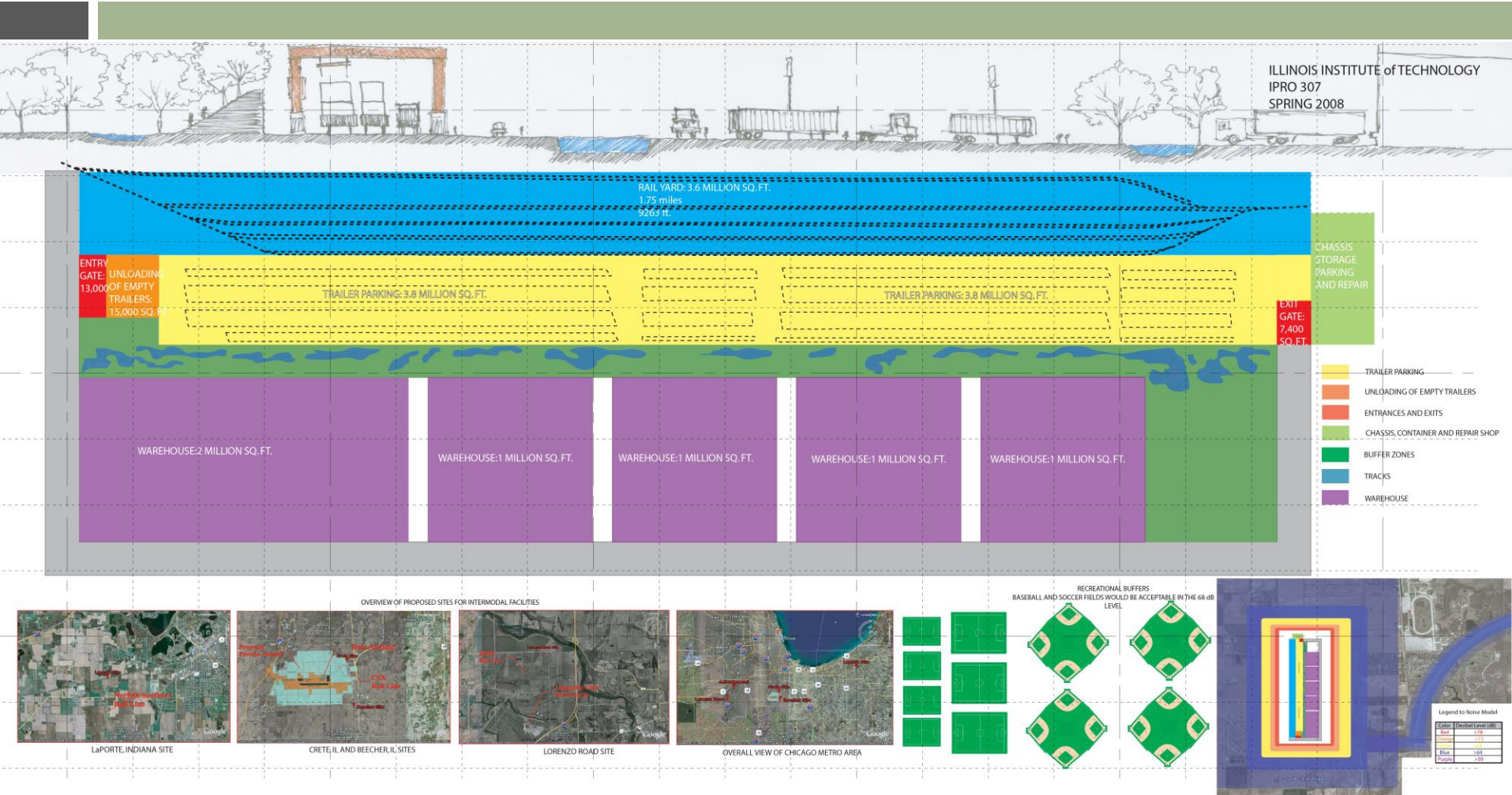
Our solutions to the problem came in 4 main areas:

- Build-out solution for a typical intermodal yard
- Zero excavation warehouse design
- Air, water and energy solutions
- Context sensitive bridge design

These are presented in two methods:

- Website
- Posters

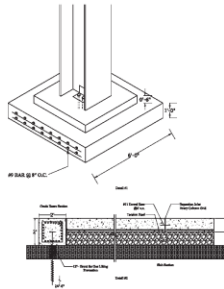
# Buildout



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

# Warehouse and Energy Solutions

### Zero Excavation/ Energy Conscious Proposals



## Zero Excavation Warehouse Design

Zero Excavation Build Design is the way of the future. This design introduces a zero cut for trucking and disposal of contaminated materials by introducing a capping system with a grade beam that is supported by a pile design to support the fill walls. Each site will introduce a different soil profile which will cause small changes. Overall, this design will be very useful for the renovations of brown fields or brown sites.

### Zero Excavation Process

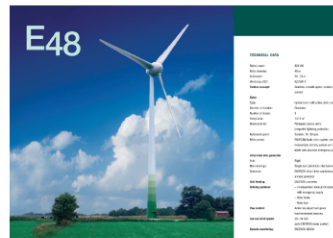
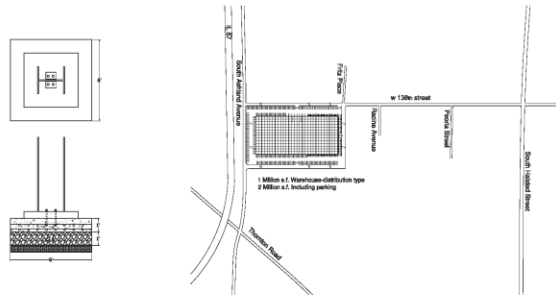
The site will be leveled and compacted. After that, our center lines for the rows of foundations as well as the grade lines. Carpenters will lay out forms for the spigots as that are needed. Ironworkers will come in and do design requirements. A specialized pile driver will come the Helical Pile so that the top of the Helical Pile will coincide. Concrete Piers and Masons will pour columns.

A bulletin of an assembly of mechanical engineers in seven prairie north states issued a specific technical section. Identifying all the installation tools provides the reader with a list of equipment that can be used to ground like a lock screw using either machine made hydraulic test equipment, hand pipe working tool case or a hydraulic test equipment. The bulletin also lists low mobilization costs, as well as on-site tools and supplies to be extremely competitive for pipe loads and the General Foundations will be a first in the field. The bulletin is a 10 page document. The bulletin is available at a cost of \$1.00 per copy. The bulletin is available at a cost of \$1.00 per copy. The bulletin is available at a cost of \$1.00 per copy.



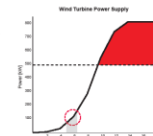
IPRO307: Intermodal Transport Facility

### Zero Excavation/ Energy Conscious Proposals



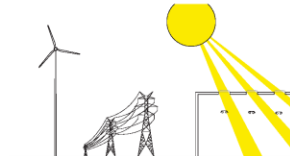
Energy Strategy

This proposal is based on a 1,000-warehouse operating 24 hours a day using 10,000 kWh on a daily basis.



Wind Turbine Supply

This graph illustrates the power sup-  
ply of the E-68 Turbine for 1,000,000 sq  
ft warehouse design. Within the Wind  
region, average wind speeds are  
approximately 6 m/s, so an average  
turbine will supply about 20% of en-  
ergy needs. However on higher speed  
days it will produce as much as does  
the needed energy supply.



### Lighting Conservation

To conserve energy in the lighting of the greenhouse, skylights should be implemented to minimize lighting needs during the day. Using skylights as well as light sensor-actuated lamps could save as much as 1.0 to 2.000 kWh per day.

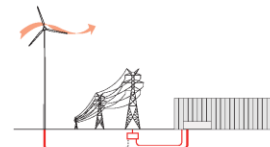


### Zero Excavation/ Energy Conscious Proposals



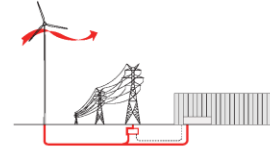
Average Wind Speed Supply:

This diagram illustrates power supply for wind turbines during average wind speed about 5 to 6.5 m/s. In this scenario wind provides between 15 and 20 percent of total electricity to the warehouse, the rest is supplied by the grid.



High Wind Speed Supply

This diagram illustrates power supply for wind during high-wind speed of 8 to 9 mph shows how wind can supply



Very High Wind Speed Supply

At wind speeds greater than 9 m/s, wind power will supply full power to the warehouse as well as begin feeding power back into grid. Overflow of electricity varies to as much as double the needed power supply.

I/PRO307: Intermodal Transport Facility

IPRO307: Intermodal Transport Facility

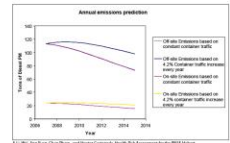
- Zero excavation-no dirt is moved offsite due to possible contaminations
- Energy reducing features including wind power, skylights and light sensors

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

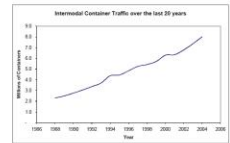
**Emissions distribution**

Category	Percentage
On-site emissions	87%
Off-site emissions	13%

The chart shows the direct particulate matter emissions distribution of a typical inter-modal facility. The chart is divided into two parts. Off-site and on-site emissions. Off-site emissions refer to those made by the trucks idling outside of the facility, as they wait to enter. On-site emissions refer to those made by on-site hauler trucks, locomotives on-site, etc.



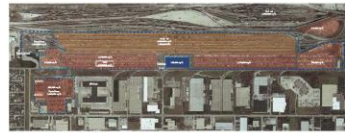
The graph is a model for annual on-site and off-site emissions, based on data from the EPHF Hubert facility, inter-modal container usage trends, the average age of trucks, and EPA emissions regulations for diesel engines.



The above graph indicates intermodal container traffic in the US over the last twenty years. Despite the upturn and downturns of the US economy, intermodal traffic has been growing at a constant rate. This growth trend was used to predict the change in emissions in the figures above.

Locations:  
 10 miles south of I-25  
 4.5 miles north of I-27

- 475,225 sq ft in 2000\*
- 278 acres (4,500,000 sq ft) land area
- 105 acres (4,800,000 sq ft) of container storage
- 4 tracks - 10.25 miles of track
- 8 M-Jack Cranes
- 7 side-loader cranes (onfeeder)
- 30 frontier (onfeeder)



- reduced water retention area
- 1,250% increase in water retention
- improved water quality
- 4% increase in trailer storage capacity

Ironore	\$3,168,000
contaminated water basins	\$950,500
worked (5,400,000 / acre)	\$960,000
<b>Total</b>	<b>\$4,258,500</b>

- the 30 acres of wetland can retain 30,000 to 45,000,000 gallons of water
- the parking retention and filtration area can retain the water runoff during a 6 in rainfall

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marketing and cost model

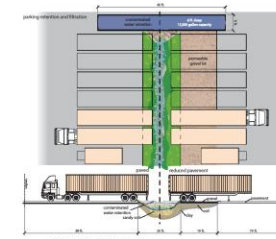
marketing and cost model for a specific technology

marketing and cost model for a specific technology

Real Time estimation of value

marketing and cost model for a specific technology

The EPA states that the initial road runoff, *flush*, contains the majority of water contaminants. In accordance with the Wetland system, this initial flush first lets rainwater runoff in a basin. The remaining water is allowed to flow into the bioswales. Wetland bioswales treat the water in further treatment with plant life and is finally allowed to reach the receiving water.



The diagram illustrates the following processes in a wetland:

- Groundwater flow:** Indicated by arrows entering the wetland from the left.
- Discharges stream energy:** A stream enters the wetland from the top left.
- Contaminants and sediment are filtered:** Labeled with an arrow pointing to the central wetland area.
- Provides aquatic wildlife habitat:** Labeled with an arrow pointing to the central wetland area.
- Cleaner water outflow:** A stream exits the wetland to the right.
- Slow release of stored water:** Indicated by arrows showing water moving from the wetland into the stream on the right.
- Backflow break down contaminants:** Labeled with an arrow pointing to the central wetland area.
- Saturated peat stores water:** Labeled with an arrow pointing to the bottom of the wetland.

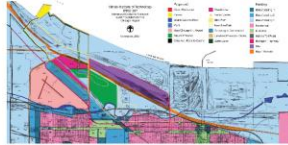
**How wetlands work**

www.7ecan.gc.ca



# Bridge Design

City of Gary, Clark Rd. Bridge



Clark Road Site Context

The Gary bridge design was inspired by the growing number of intermodal shipments and the necessity for a better solution to create a more vibrant downtown. The Gary City team saw an opportunity to improve the image of intermodal by providing an environmentally positive bridge solution. Improvements are planned for the lake front near the existing casinos thus giving the site a face lift and adding to the aesthetics aspects of the area. One of the proposed improvements is a lake path network which will connect the city with the lakefront and surrounding areas. The patha previously to the Gary City and the US Steel steel complex causes road back-up due to the 12 of grade train crossings. The bridge would provide a solution which would cater to the necessities of the pedestrians as well as vehicular traffic thus alleviating the problem.

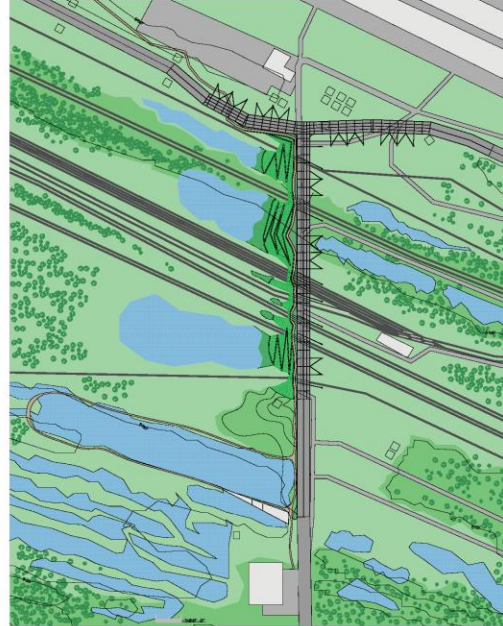
### Structure

The concept behind the structure of the bridge stems from the Gari steel culture. Due to the close proximity of the steel mills the bridge design found its inspiration in the steel truss shape. The use of steel for the structure was a natural choice due to the minimization of material transport thus emphasizing the IFSD goal of efficiency, and environmentally positive improvements to intermodal yards.

Nature

The second part of the bridge design focused on catering to both pedestrians as well as vehicular traffic. By leaving a strong sense of the bridge's original design, the designers tackled the problem began to emerge in the form of wetlands, which surrounded the area. The secondary structure acts as a rail which connects the bridge to the wetlands, creating an eco-system which would succeed rather than impede the natural wetland environment. This system was achieved through an elaborate use of planters, and steel meshes. A water distribution system was developed to feed the planters with the runoff from the bridge restoring the ecological balance and furthering the project's PRPC. Lastly a path was created which allowed pedestrian access to this newly created natural habitat.

### Stie Plan and Typical Section



### Detail Images



- Meets needs of people and cars
- Two sided concept based design

# The Team





# The Team

- Buildout
  - Matthew Allen
  - Renee Bartosik
  - Anthony Carfang
  - Arnold Ibardaloza
  - Joseph Russell
- Warehouse Design
  - Daniel Fuentes
  - Matt Schulz
  - Jac Selinsky
- Bridge Design
  - Lukas Janulis
  - Marek Wisniewski
- Environmental Improvements
  - Algirdas Bielskus
  - Sebastian Jaromin
  - Ryan Maas
- Website
  - Matthew Allen
- Other
  - Tom Lis
- Advisors
  - Laurence Rohter- PE IIT
  - Peter Mirabella- MiJack

# End Products

- Posters
- Website <http://omega.cs.iit.edu/~intermodal>
- Technical Presentations
  - Chuck Allen-Norfolk Southern Rail Road
  - John Bosca-Riverdale
  - Jim Kvaderas-Canadian National



# Recommendations

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- Investigate more into alternate energy including solar power
- Dynamic braking solutions
- Full brown site development
- More research to further improve warehouse design