IPRO 307: Intermodal Container Facility Innovations for the Chicago Area- Focus on Kankakee County

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Pete Mirabella
Vice President
Introduction

What were our goals?

• To design an intermodal facility utilizing the ATMS system
• Unlike past projects— for a wholly “new” facility, Possibly on a Greenfield Site
• To plan parallel transportation enhancements in the Kankakee area

What is an Intermodal Facility?

• Truck to Train and Train to Truck
  • ATMS – A Proprietary Design with Limited Release

Our tools...

Architects, Civil, Architectural, Aerospace & Mechanical Engineers.
  – Google SketchUp
  – Google Earth
  – Auto Desk Products
Kankakee County is located in central Illinois. The current population of Kankakee County is 113,449 people with 60% of the population residing in Bourbonnais and Kankakee townships. Kankakee County has the 18th largest population in the state. The county has a total area of 677 square miles which is ranked 28th in the state out of 102 counties.

Kankakee County’s 10 top employers are as follows:

- Riverside Medical Center
- Shapiro Developmental Center
- Northfield Square Mall
- Provena St. Mary’s Hospital
- Cigna Healthcare
- Baker & Taylor (Publisher)
- CSL Behring L.L.C (Medical)
- Kankakee Community College
- Olivet Nazarene University
- Sears Logistics Services, Inc.

Three railroads pass through Kankakee County which are shown below:

Norfolk Southern Railroad
Canadian National Railroad
Union Pacific Railroad
Kankakee Beaver and Southern
Interstate 57
There were 4 sites that were chosen as possible locations for the Intermodal Facility:
- 2 In-City Locations
- 2 Out-of-City Locations
(Capstone) Criteria for In-City Location

- Located in Kankakee, Il
- Requires total of 90 Acres
- Would only contain the Intermodal Facility
- Have to locate sites with Industrial Zoning
- Minimize Impact with residential areas
- Would be located approximately 30 miles from I-55 and I-65
In-city Location 1

- Currently a small NS storage yard
- Would have to purchase 45 acres of additional land
- Will accommodate for a 5000 ft ATMS
In-city Location 2

- Currently used for agriculture purposes
- Zoned for Industrial

- Will accommodate for 8000 ft ATMS
- Located on NS Railroad
Criteria for Out-of-City Location

- Requires a total of 3,500 acres
  - Compared to UP facility North of Joliet
- Close to Kankakee, Il
- Would contain the following:
  - Intermodal Facility
  - Residential Area
  - Industrial Area (Warehouses)
    - 20 One million sq ft facilities
- Would require the rezoning of Agricultural Zone to Industrial, Commercial, and
Out of City Location 1

- South of Bonfield, IL
- 44 Miles from Roselawn, IN (I-65)
- 13 Miles from Kankakee (I-57)
- 17 Miles from Dwight (I-55)
- Located on NS Railroad

Out of City Location 2

- West of Momence, Il
- 22 Miles from Roselawn, IN (I-65)
- 11 Miles from Kankakee, Il (I-57)
- 43 Miles from Dwight, Il (I-55)
- Located on NS Railroad
REZONING PROCESS FOR KANKAKEE COUNTY

APPLICATION
BASE FEE: $600
PER ACRE: 0-50 $30 PER ACRE
51-100 $20 PER ACRE
101+ 10$ PER ACRE
3500 ACRES SITE
$600 + $10*3500 = $35,600

INCLUDES

NATURAL RESOURCE INVENTORY
LAND EVALUATION & SITE ASSESSMENT
BASE FEE: $400 FOR 0-5 ACRES
$15 FOR EACH ADDITIONAL ACRE
$400 + $15*3495 = $52,825

ECOCAT
ECOLOGICAL COMPLIANCE ASSESSMENT TOOL
DETERMINE IF PROPOSED ACTION IS IN THE
VICINITY OF ANY PROTECTED NATURAL RESOURCES
FREE OF CHARGE

APPLICATION CHECKLIST
SITE/PLAT PLAN
PLAT OF SURVEY/FLOODPLAIN SURVEY
AERIAL PHOTOGRAPH
NATURAL RESOURCE INVENTORY REPORT
ECOCAT REPORT

APPROXIMATE TOTAL COST = $100,000
COST PER ACRE = $28

REZONING PROCESS FOR WILL COUNTY

APPLICATION
3500 ACRES SITE
$15,325 + $15*3000 = $60,325
NATURAL RESOURCE INVENTORY
$400 + $15*3495 = $52,825
APPROXIMATE TOTAL COST = $125,000
COST PER ACRE = $35

REZONING PROCESS FOR LAKE COUNTY, IN

APPLICATION
3500 ACRES SITE
$400 + $15*3495 = $52,825
NATURAL RESOURCE INVENTORY
$400 + $15*3495 = $52,825
APPROXIMATE TOTAL COST = $150,000
COST PER ACRE = $42

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>COST/ACRE</th>
</tr>
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<tbody>
<tr>
<td>KANKAKEE</td>
<td>$28</td>
</tr>
<tr>
<td>WILL</td>
<td>$35</td>
</tr>
<tr>
<td>LAKE, IN</td>
<td>$42</td>
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</table>
Dimensions of the warehouse:
Area 1,000,000 ft\(^2\)
L 2,000 ft x W 500 ft x H 25 ft

Dimensions of the loading gate:
H 8.5 ft x W 8 ft
50 ft span, 3 gates can be placed between 2 structural columns.

Assumptions:
• Location: Midway Airport Outdoor Design Conditions
• Zone 5 of ASHRAE Recommendation Guide.
Heat Loss Charts

(Calculated for the worst weather condition, $T_{outside}=-1.6^\circ F$)

Percentage of Heat loss

Semi-Heated Warehouse

- Skylights: 37%
- Walls: 8%
- Gates: 5%
- Roof: 47%

Initial Construction cost: low
Maintenance cost: high

Natural gas cost: 47,000 $

Total Heat Loss: 12,032,734 Btu/hr

Conditioned Warehouse

- Skylights: 40%
- Walls: 7%
- Gates: 5%
- Roof: 39%

Initial Construction cost: high
Maintenance cost: low

Natural gas cost: 20,000$

Total Heat Loss: 8,656,231 Btu/hr

Initial Construction cost: low
Maintenance cost: high

Natural gas cost: 47,000 $

Total Heat Loss: 12,032,734 Btu/hr

Initial Construction cost: high
Maintenance cost: low

Natural gas cost: 20,000$

Total Heat Loss: 8,656,231 Btu/hr

Initial Construction cost: low
Maintenance cost: high

Natural gas cost: 47,000 $

Total Heat Loss: 12,032,734 Btu/hr

Initial Construction cost: high
Maintenance cost: low

Natural gas cost: 20,000$

Total Heat Loss: 8,656,231 Btu/hr
Future Avenues

Bike.  Shop.  Live.  All year 'round.

The Pathway to the Future

Provides a safe environment for exercise, while connecting the residents to shops and the Intermodal Facility.

Housing for 1200 families

With access to the Pathway to the Future.

A Community for Work and Play.
Previous Intermodal Facility Designs have not included the residential component.
(Proposed) Site Bird’s Eye View
Typical 2 Bdrm (968 SF)
Typical 1 Bdrm (968 SF)
Typical 3 Bdrm (1078 SF)
Pathway to the Future

Bike. Shop. Live. All Year Round.
(Capstone) Construction

Crude
• Polycarbonate panels
• Brick 4” w/o ins.
• Concrete floor

Better
• Double glazing low e
• Concrete 8” w/ ins.
• Super ins. floor

Orientation of pathway: North/South

Model simulated on IES software
Solar Heat Gain Calculations

**Winter Conditions** (Crude and Better construction unventilated)

**Summer Conditions** (Crude and Better construction unventilated)
Proposal

Better Construction:

For Winter (Green line),
• Scheduled ventilation during night (~2 hours).
• Use of electronic sensors to activate ventilation when needed during day.

For Summer (Orange line),
• Vents fully open 24 hours/day.
• Operable louvers mounted on the bottom of the side doors to force natural ventilation.
LED Pathway Lighting

- Operation Temperature: -40 F up to 85 F
- Less energy consumption
- Up to 50,000 hours of operation
- Dimmable up to 20%
- 5 year Warranty

LED LR6-DR1000 Luminaire installed every 20 ft

**Performance Summary**
- Utilizes Cree TrueWhite® Technology
- Delivered Light Output = 1,000 lumens
- Input Power = 12.5 Watts
- CRI = 90
- CCT = 2700K or 3500K
- Dimmable to 20%
- Five Year Warranty
Transportation Enhancements
(Capstone) Kankakee Connector

Proposed Peotone Airport
Proposed Illiana
Proposed Kankakee Connector
## Comparison

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Option 2</th>
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<tbody>
<tr>
<td>• Length of 13.3 miles</td>
<td>• Length of 15.5 miles</td>
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<tr>
<td>• Runs through Kankakee</td>
<td>• Runs outside of Kankakee (to the south)</td>
</tr>
<tr>
<td>• Runs on along existing NS track</td>
<td>• Necessary acquisition of land (approx. 659 acres)</td>
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<tr>
<td>• 16.4 miles south of Illiana</td>
<td>• 19.2 miles south of Illiana</td>
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<tr>
<td>• 3 possible exits</td>
<td>• 4 possible exits</td>
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RECOMMENDED
Combination of Option 1 & 2

3 level (Hi-speed, Freight, Highway)
2 level (Freight, Highway)
1 level (Highway)
1 level (Freight)
2 level (Hi-speed)
1 level (Hi-speed)
3D Viaduct Model
Top Level: High Speed Passenger Rail allows passengers the best view of surroundings, and has the lightest vehicle weight.

Middle Level: Intermodal Railroad

Lower Level: 4 Lane Expressway for Cars and Trucks, 2 Lanes under Viaduct and 2 Lanes outside ground level to facilitate street interchanges and frontage roads.
2 level model
High Speed Rail / IL Passenger 110mph; Freight 90mph
### Aerodynamic Drag of a High Speed Freight Train

<table>
<thead>
<tr>
<th>Velocity (mph)</th>
<th>Aero Drag (lbf)</th>
<th>Total Drag (lbf)</th>
<th>Total Drag (.84% Grade) (lbf)</th>
<th>Total Weight of Train (lbf)</th>
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<tbody>
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<td>8000 ft Train</td>
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<tr>
<td>60</td>
<td>116,820</td>
<td>34,459,132</td>
<td>465,883,132</td>
<td>55,440,000</td>
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<td>262,845</td>
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<td>466,315,132</td>
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<tr>
<td>10000 ft Train</td>
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<tr>
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<td>145,165</td>
<td>42,571,132</td>
<td>578,827,886</td>
<td>65,840,000</td>
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<tr>
<td>90</td>
<td>326,622</td>
<td>43,003,132</td>
<td>579,259,886</td>
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</tbody>
</table>

...not much
Stack Train Coupler Force -- *big issue*

**Coupler Force 8000 ft Train**

Enclosed Area: 1,046,875,000 lbf·ft
105 cars “pull”

**Coupler Force 10000 ft Train**

Enclosed Area: 648,437,500 lbf·ft
135 cars “push-pull”

With Distributed Power

*more & better…*