IPRO 307

Intermodal Container Transport

Final Report

May 1st, 2009

I. Team Information

There are twelve students in this semester's IPRO 307. Below is information regarding everyone's Major, Needs/Expectations for the IPRO and their Strengths that they will bring to the IPRO.

	Name	**Major**	**Needs/Expectations, Strengths**
1	William Cabrera	Mechanical Engineering	*Needs/Expectations*: To be challenged and use original design. Incorporate what he knows as a mechanical engineer to design, test and validate the group proposals. *Strengths:* Organization, intelligence, communication.
2	Nicole Dennis	Civil Engineering	*Needs/Expectations*: Learn more about Intermodal Transportation and learn a new skill. *Strengths:* Project Management industry experience and good team player.
3	Cordell Jackson	Engineering Management	*Needs/Expectations:* To be challenged, stay focused and works effectively with the group to accomplish goals. *Strengths:* Works well with teams, responsible, leadership.
4	Karolis Kozys	Civil Engineering	*Needs/Expectations*: Would like to get good engineering experience and learn more about railroad systems. *Strengths:* Good team player and industry work experience.
5	Thomas Montgomery	Architecture	*Needs/Expectations*: Learn about Intermodal Transportation and achieve goal as a group. *Strengths:* AutoCAD and design skills.
6	Vaiibhav Patel	Biomedical Engineering	*Needs/Expectations:* To learn more about the transportation industry. *Strengths:* Team orientated and good time management.
7	Malarva Rathakrishnan	Civil Engineering	*Needs/Expectations:* Successfully create a professional level project. *Strengths:* Always prepared and extensive experience in research.

8	Ali Razeq	Civil Engineering	*Needs/Expectations*: To work in a group to accomplish large scale project. *Strengths:* Leadership, communication and computer skills.
9	Richard Rokita	Aerospace and Mechanical Engineering	*Needs/Expectations*: Hope to learn new project skills and work with a schedule. *Strengths:* Team player when needed and does not procrastinate.
10	Jorge Rueda	Civil Engineering	*Needs/Expectations*: Achieving goals as a group. *Strengths:* Team and time management skills.
11	Paul Skopek	Civil Engineering	*Needs/Expectations*: To obtain engineering design experience. *Strengths:* Work experience in the industry and a good team player.
12	Cody Snyder	Civil Engineering	*Needs/Expectations*: To learn how the planning / design process works with real projects. *Strengths:* Knowledge in logistics, economic/planning and spatial visualization/mapping.

Advisors:
Laurence Rohter
Peter Mirabella

II. Purpose and Objective

Chicago is the third largest intermodal freight hub in the world. As a result, there is need for efficient routing of trains throughout the Chicago area. One aspect of railroad transport that directly affects the overall efficiency of the rail system is how easily accessible train intermodal yards are for trucks going to and through the intermodal yards. With this in mind, the overall purpose and objective of IPRO 307 is to improve the truck flow in and around an intermodal facility at Harvey, IL which is owned by Canadian National (CN) lines. CN is one of the six major railroads that serve the Chicago area. The intermodal facility at Harvey is surrounded by a network of highways including Interstates 80, 57, 294, 94 and 65. Interstates 294 and 80 cross directly overhead of the intermodal yard. In order to make truck flow around the intermodal yard more efficient, IPRO 307 will look into the addition of ramps and frontage roads, including a ramp that would be based off of interstates 80/294. A ramp connecting the major interstate to the

intermodal facility would allow for easier access to the intermodal facility by trucks, thereby bettering the efficiency of the intermodal facility as a whole.

III. Abstract

Chicago is a key rail hub, and congestion and infrastructure currently are major issues. Canadian National (CN) rail lines converge in Chicago from five directions. It has taken a CN Freight train longer to go from the North to the South side of Chicago than it does from Chicago to Winnipeg, Canada (approx. 860 miles).

To alleviate this problem, CN has purchased the EJ&E right of way, which will reduce congestion in the Chicago-area rail network by taking CN trains off the central Chicago lines and moving them to an arc around Chicago. As part of these changes, CN is expanding and modernizing its intermodal yard in Harvey, IL.

Currently there is poor traffic flow into and out of the yards. Trucks carrying intermodal containers in and out of the yard must use 159th St and Halsted St to reach the highway, driving through narrow streets and residential and business neighborhoods.

This IPRO attempts to improve the truck flow in and around this intermodal facility by designing a new entrance for trucks entering and exiting the yard. The design incorporates direct access from Interstate 294/80, which passes directly over the yard, allowing easy access to the yard and eliminating noisy truck traffic from neighborhood streets. In addition, frontage roads were studied as part of the solution, serving as a spark for community development.

IV. Background

Intermodal freight is the movement of containers and trailers by rail, truck or water carriers is the fastest growing segment of the US freight rail industry. It stands as one of the most utilized ways to transport large shipments of cargo across the country. Most of this intermodal traffic is moved in containers. As mentioned above, Chicago is the third largest intermodal port in the world and as a result, there are currently 19 intermodal yards in the Chicago region. These 19 intermodal yards allow for approximately 700 miles of loading and unloading tracks over 2200 acres of land. Unfortunately, these intermodal yards often waste space and provide an influx of traffic to the surrounding area. As a result, intermodal yards can be inefficient, costing money to both rail road and trucking companies.

As a result of how fast intermodal freight is growing, container movement through intermodal freight is expected to double within 10 years. Instead of trying to expand the intermodal yards to allow for the increased amount of freight, the current approach is to make improvements to the intermodal yards that can optimize performance with low cost and positive environmental

benefits. Additionally, solutions are being explored that can utilize current transportation systems and stimulate industrial development.

IPRO 307 is sponsored by Mi-Jack Products based in Hazel Crest, IL (http://www.mi-jack.com). Mi-Jack Products is the largest manufacturer and operator of intermodal equipment and produces products that increase the efficiency of intermodal yards around the country. Because of the interest Mi-Jack Products have in the efficiency of intermodal yards, the company could benefit from proposals provided by IPRO 307 on improving accessibility to the intermodal yard.

V. Team Values Statement

All team members are expected to:

- Treat all other team members with respect.
- Be on team for meetings.
- Come prepared to meetings.
- Present information either as PowerPoint presentation or in handout form.
- Provide updates weekly on their project tasks.
- Actively participate within the team.

VI. Methodology

1. Define the problems:
    a. Propose improvements to increase the accessibility to the intermodal and industrial areas that leverage off of the existing high quality circulation system. Specifically the addition of suitable ramps and frontage roads and other "truck side" facilities.
2. Describe how your team will go about solving the problems:
    a. The group will be divided into sub-groups with two major areas of focus.
        i. One subgroup will focused on the development of a 3D walk-through model of the propose connection to the intermodal site.
        ii. The second subgroup will focus on the Community Impact of the project on the surrounding region.
3. Explain how the potential solutions will be tested:
    a. The potential solution will be tested through a series of designs and visualizations covering the large area of interest.
    b. There are two main solutions to focus on:
        i. A 3D Model and a regional impact plan. The 3D Model will be created to allow a user to do a "walk-through" through the project site.

ii. The Community Impact of the project will be presented on a site plan of the region presenting the gathered data for the area including: truck routes, environmental impact, zoning, etc.

4. Describe how results of research and testing will be conducted:
    a. With the use of the 3D Model we will be able to show the user group how the design will work. The 3D Model will be used to show the experience of the truck driver as they are driving through the connection ramp and frontage road into the intermodal yard.
        i. Multiple testers will "walk-through" the 3D Model to identify problems or successes with the design. They will have to be either users or people familiar with the intermodal freight and transportation industry to provide constructive feedback on the project.
    b. The Community Impact will be tested via a review process at each stage of the research. For this we will be taking a standard plan of the region and incorporating the necessary data to show the regional impact of the project, specifically the traffic flow of the region.
5. Define how analysis of the test results will be conducted:
    a. Results of the visuals will be discussed within our team and with outside industry advisors. This will help up us gather feedback on the feasibility issues of the project.

6. Explain how the IPRO deliverable reports will be generated:
    a. The deliverables will be assigned to teams and/or individuals. They will then be submitted to iGroups for peer review and final submission.
    b. Individual research and presentations will be prepared and presented at specific dates established by the group. They will be reviewed and discussed by the group as a whole.
    c. Assignments of deliverables will be decided by the IPRO group as a whole.

VII. Expected Results

There are two major expected results for this IPRO. The first expected result is a 3D "walk-through" model of the connection to the intermodal site and the proposed route through the intermodal site. This 3D Model will be created with AutoCAD. The second result is a large-scale site plan of the region surrounding the intermodal site to show the impact on the project. This site plan will be developed from data collected on the traffic congestion, environmental issues and other related issues. For the community impact to be relevant the team will need to conduct research on the relevant issues to create a substantial data base. The community impact site plan will also be created with AutoCAD. These results will be challenging since none of the

team members have used AutoCAD extensively enough to know 3D modeling**.** The students will have to do independent research to learn the necessary AutoCAD skills to produce**.**

VIII. Results

The IPro 307 team was able to create solutions to solve the issues around the intermodal yard. The team created the following deliverables:

- Four new proposals for truck access into the yard.
- The noise impact that creating another access route will on the community.
- The impact on traffic patterns of creating another access route.

Option 1 - Two One Way Frontage Roads

This option requires two frontage roads, one on each side of I-80. It would require a bridge that goes over I-80 to allow east-bound trucks to enter and leave the yard. The problem encountered with this option is that there is not enough room on the north side of the interstate for a frontage road. Also, there is limited space for on and off ramps onto these roads.

Option 2 - Frontage Road Utilizing Center Ave

This option is to use the empty space on the north and south sides of I-80 just past the intermodal yard to put a set of exits and entrances onto Center Avenue. Heading westbound on the 294 trucks will use the exit at Halsted Street to an off ramp onto Center Ave. Trucks will travel north on Center to enter the Intermodal Yard. A westbound entrance ramp will be constructed from Center. Eastbound trucks will exit onto Center Ave and they will enter along the Halsted exit back onto the highway.

Option 3 - Convert 171st Into a Two Way Frontage Road

This option requires converting 171st into a two way frontage road using the existing ramps at Halsted Street. The problems this presents is that the road may need to be expanded. Also, this road passes under tunnels that would need to be expanded as well. Another issue is that of on/off ramps.

Option 4 - Ramp Directly Into Yard

This option is similar to option 1 but has no frontage roads. Unlike option 1 this option only requires space for the on/off ramps and the piers that go along with it. There is limited space in the area; therefore this option may be the best fit for a ramp directly into the yard.

Noise Level Analysis

In order to ensure that noise regulations were not violated in our options, a traffic noise analysis was performed with the help of a simulation from the Federal Highway Administration. Using predicted traffic values and comparing these values with current traffic numbers, it was found that sound levels would actually decrease on 159th street and stay the same on the highway. The sound levels from the highway did not change due to the fact that the highway has so much traffic already that the small increase did not affect the noise levels. Overall, with the fact that

noise levels would not increase on 159th or the highway, we know that we would not be violating sound regulations by implementing our designs.

From the noise studies, noise levels were calculated for current traffic data. It can be seen that on the north side of the highway, there are buildings that are in the red shaded areas. These buildings are a mix of commercial and residential, thereby violating FHWA noise regulations. In the south, residential buildings can be clearly seen in the blue region, again violating FHWA noise regulations. Further research needs to be performed in order to verify that these areas are actually in violations as the simulation that was used to calculate noise levels did not take certain variables into consideration. These variables include the height of the highway and the effect of crash barriers, which are located on both sides of the highway, on the noise levels. If the noise data are correct however, it may be in the best interest for the citizens that occupy the buildings in the regions to construct sound barriers on the highway. Sound barriers can effectively decrease the noise created by traffic.

In the future, to better understand traffic noise, actual field testing may be done. A device that can measure noise levels can be taken to the highway and raw data can be obtained. From the raw data, it can be seen what the noise levels actually are around the highway and if it does indeed violate and FHWA noise regulations. Furthermore, it may be beneficial to obtain or borrow a copy of the advanced FHWA traffic noise simulation. In this simulation, variables such as height and crash barriers can be adjusted, as well as a large number of other variables. A copy cost $695 but all state Department of Transportation's receive the simulation free of charge. It may be possible to go to an office and see if they may give access to the simulation.

The link to the table of contents for the simulation is here: http://www.fhwa.dot.gov/environment/noise/tnm/index.htm. A link to the program that was used in IPRO 307's noise model is: http://www.fhwa.dot.gov/environment/noise/tnm/tn_ver25lu.htm

IX. Challenges

There were many challenges that our team faced during the duration of our project. We had many different members apart of our team that specialized in many different things. Some of the members were not familiar with using the tools we needed to accomplish our goals. Our team faced software learning curves when we were trying to utilize AutoCAD to its full potential. We were finally able to work together and create a three dimensional walk-through using AutoCAD. We also were challenged with using GIS files and data to create accurate data involving the traffic patterns and updated traffic patterns after the ramp was in place. Another issue that we dealt with was having members work in parallel rather than work sequentially. This means that sometimes we would wait for others to finish their work before we started any new tasks. This was important because we finally learned to research simultaneously and work more efficiently. This was demonstrated when we working on the ramp design and the yard layout parallel to generating a walkthrough using AutoCAD. Working in parallel in this situation allows easy transition between steps and allows us to reach our goals within our deadlines.

X. Recommendations

For future IPro semesters, there are many recommendations from our team would suggest. Based upon the research we completed some of our recommendations include:

- Visiting the actual Harvey intermodal yard would be beneficial and give the team more of a sense of how the yard is operated.
- The cost of completing the project can be calculated and presented in the research to help select the most optimal solution based on cost and results.
- Displaying the effect of the ramp within the yard and displaying the yard layout and making improvements to the yard layout if advantageous.

These are future recommendations for the IPro's, which will hopefully help the teams incorporate their research and improve the intermodal yard even further. This can also provide a new agenda for the IPro to expand upon the previous data collected from this IPro.

XI. Project Budget

Pizza for Team Building Event:	$ 100.00
Drinks for Team Building Event:	$ 20.00
Printing/Office Supplies	$ 100.00
Maps	$ 50.00
Total:	$ 270.00

XII. Schedule of Tasks and Milestone Events

Task	Start Date	End Date	Team Members Needed	Hours Needed
Research Acquisition of EJE by CN	1/22/2009	1/27/2009	1	3
Research Local Intermodal Yards	1/22/2009	1/29/2009	1	3
Research Intermodal Yard Process	1/27/2009	2/3/2009	1	3
Research Blue Island Intermodal	1/29/2009	2/3/2009	1	3
Research I-294/I-57 Connection	1/27/2998	2/3/2009	1	3
Project Plan	1/27/2009	2/6/2009	2	5
Research Texas Highway System	1/29/2009	2/10/2009	1	3
Dolton Through Traffic Model	1/29/2009	2/10/2009	1	3
Midterm Review	2/24/2009	3/9/2009	2	6
GIS Truck Map	2/10/2009	4/2/2009	1	10
Create Regional Tag for Project Area	4/2/2009	4/23/2009	2	2
Abstract/Brochure	4/20/2009	4/27/2009	1	3
Exhibit / Poster	4/20/2009	4/27/2009	2	4
3D Model of Intermodal Improvements	2/10/2009	5/1/2009	3	100
Community Impact Visual	2/10/2009	5/1/2009	6	60
Final Oral Presentation	4/27/2009	5/8/2009	3	10
Final Report	4/27/2009	5/8/2009	3	8
Deliverables CD	5/7/2009	5/8/2009	1	0.5

			Slack Time	15
Bold=IPRO Deliverable				
			Total Hours	244.5

XIII. Individual Team Member Assignments

Current Team Members and Completed / In Progress Tasks

	Name	**Tasks**
1	William Cabrera	Team scheduler, keeps track of necessary submittal dates and which individuals are responsible for each project task.
2	Nicole Dennis	Proposed Tri-State I-294/I-57 Interchange project research. Has participated as a Minute Taker and Agenda Maker/Team Leader. Assisting with the Project Plan deliverable.
3	Cordell Jackson	Blue Island Intermodal Yard proposal research and has participated as both a Minute Taker and Agenda Maker/Team Leader.
4	Karolis Kozys	Assisting in the creation 3D walk-through model of yard connection design and yard route design.
5	Thomas Montgomery	Researching zoning information and community impact/regional planning for the project area.
6	Vaiibhav Patel	Researched local intermodal yards at Crete and Beecher, IL. Assisting with the Project Plan deliverable and has participated as a Minute Taker.
7	Malarva Rathakrishnan	Dolton through traffic (Union Pacific RR) research.
8	Ali Razeq	Assisting in the creation 3D walk-through model of yard

		connection design and yard route design.
9	Richard Rokita	Researching the mechanical design and limitations as well as processes inside intermodal yards. Has participated as a Minute Taker and Agenda Maker/Team Leader.
10	Jorge Rueda	Creating a regional tag for the project region.
11	Paul Skopek	Has researched CN acquisition of EJ&E railroads and the resulting new connections for CN railroad.
12	Cody Snyder	GIS Truck mapping system and research on the Texas Corridor.

After initial research has been completed the team has acquired a greater understanding of the project and the required deliverables. In order to successfully produce the deliverables the team has decided to create two subgroups: Yard Design and Community Impact.

Yard Design

Leader: Cordell
Members: Paul, Cordell, Ali, Richard, Malarva, Karolis
Purpose: Successfully design the connections from I-294 to the intermodal yard using frontage road and design the traffic flow through the intermodal yard. The final deliverable for this subgroup will be a 3D walk-through model of the final intermodal yard design.

Community Impact

Leader: Will
Members: Nicole, Cody, Vaiibhav, Thomas, Jorge, Will
Purpose: Research and collect data on the following: zoning, truck routes, interstate interchanges, environmental assessments and traffic flow. The final deliverable will be a map of the project site and surrounding area showing the large-scale impact the project will have on the surrounding region.

XIV. Designation of Roles

Teamwork is an important part of the process required to achieve our final goal. The necessary skills needed to become a leader for a project in the future will be learned during the various tasks assigned in this IPRO. To implement this learning process the assigned meeting role positions will be rotated through every member of the group each meeting session. Please refer to the below information for specific details regarding designation for roles.

Assigned Meeting Roles:

- Minute Taker: Each meeting time the Minute Taker position rotates between IPRO team members.

- Agenda Maker: The Agenda Maker is assigned to the person who had taken minutes at the previous meeting and rotates between IPRO team members same as the Minute Taker.
- Time Keeper: This position is assumed by the Agenda Maker for the meeting they are running.

Assigned Status Roles:

- Weekly timesheet collector / summarizer: This position is responsible for collecting weekly timesheets from each member of the team and updating everyone with a summary report. This position has not yet been filled.
- Master Schedule Maker: William Cabrera is responsible for collecting schedules from all the team members and developing a master schedule, this will tell the team when members are available and how to contact them.
- iGroups: This position is responsible for organizing the team's iGroups account and ensuring that it is used properly. This position has not yet been filled.