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Green Intermodal Terminal Evaluation and a Case Study With CSX Railroad

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Technical Update, July 2009

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PRODUCT DESCRIPTION

There has been a dramatic growth in railroad container traffic due to imports from overseas and the North American Free Trade Agreement (NAFTA). This has led to a substantial increase in emissions from diesel-fueled equipment in railroad yard facilities. State environmental and regulatory authorities are requiring railroads to reduce emissions, especially where railroad intermodal terminals or yards have been identified as major pollution sources. Railroad intermodal container lift equipment has been traditionally powered by diesel-fueled internal combustion engines. The pressure of reducing emissions from rail yards has led several North American railroads to evaluate the European-style widespan electric rail-mounted gantry (RMG) crane.

Results and Findings

The report examines use of widespan cranes (WSC) with electric drives instead of traditional diesel-powered equipment at railroad intermodal terminals.

Challenges and Objective(s)

Railroad companies have traditionally used diesel- or other petroleum-fueled engines to power their equipment. A new approach using WSC technology to power yard equipment is being evaluated to address issues of compliance with new emissions regulations. The limited availability of land at existing railroad yards also was an incentive for railroad operators to support the evaluation of WSC technology.

Applications, Values, and Use

Use of electrical power to operate equipment used to transfer containers to and from railcars may lessen the environmental consequences involved in container handling. Electric WSC technology is justified by increased capacity requirements at existing yards, estimated fuel cost reductions and the volatility of diesel fuel prices, and the high cost of new land acquisition in metropolitan areas, where the yards are located and where increased capacity is most needed.

EPRI Perspective

Further study by the electric industry to better understand the actual operational electric load and power consumption of widespan RMG technology is needed. Results of such a study could be used to better inform railroad customers of their expected costs for operating the new equipment. Additionally, a joint electric and railroad industry emission analysis comparing the traditional intermodal terminal to one using widespan RMG technology could create community support to convert existing operations to widespan cranes for increased air quality and reduced noise at terminals.

Approach

The project team interviewed four railroads regarding their interest in the development and use of the European-style WSC in their intermodal container operations: CSX Transportation's CSX Intermodal (CSXI); Burlington Northern Santa Fe (BNSF)—formerly Burlington Northern (BN); Union Pacific Railroad (UP); and Canadian National Railway (CN). The team also investigated potential suppliers of widespan cranes.

Keywords
Widespan crane
Intermodal facility
Port electrification
Rail electrification
Electric transportation
Gantry cranes

ABSTRACT

Growth in railroad container traffic has led to a substantial increase in emissions from diesel-fueled equipment in railroad intermodal terminals. A new approach using widespan crane (WSC) technology to power yard equipment is being evaluated to address issues of compliance with new emissions regulations. This report investigates use of WSCs with electric drives instead of traditional diesel-powered equipment at railroad intermodal terminals. Four railroads were interviewed regarding their interest in the development and use of WSC technology in their intermodal container operations: CSX Transportation's CSX Intermodal (CSXI); Burlington Northern Santa Fe (BNSF)—formerly Burlington Northern (BN); Union Pacific Railroad (UP); and Canadian National Railway (CN). The project team also investigated potential suppliers of widespan cranes.

ABBREVIATIONS

AASHTO – American Association of State Highway and Transportation Officials

CN – Canadian National Railway

CSX – CSX Transportation

CSXI – CSX Intermodal, a subsidiary of CSX Transportation

SCORT – Standing Committee on Rail Transportation

RMC – Rail mounted cranes

RMG – Rail mounted gantry

Trailer-on-flatcar – The configuration of a loaded highway truck trailer on a flat car using a special "fifth wheel stanchion" to secure the trailer towing pin to the car.

UP – Union Pacific Railroad

WSC – Widespan crane

WRTGC – Widespan rubber tired gantry crane

CONTENTS

FIGURES

TABLES

1

INTRODUCTION

Railroad intermodal terminals that handle containers are an outgrowth of traditional railroad merchandise freight car movements. The railroads began to lose merchandise traffic to over-the-road trucks as the interstate highway system was built. Trucks were able to handle smaller loads on public roads on a door-to-door basis as opposed to railroads that required a special spur track to place a rail car on the customer's property on both ends of the movement. In order to regain some of the traffic lost to trucks, the railroads developed a new service they called "piggy back service." This new effort used a special device to lock the highway trailer to a traditional flatcar, called the "fifth wheel".

The new service was handled by traditional trains on a piecemeal basis, so it took place at a relatively unused part of an existing rail yard. As business grew and developed, more area in the existing facility was made available to handle the new traffic. These yards eventually became known as intermodal terminals.

The dramatic growth in railroad container traffic due to imports from overseas and the North American Free Trade Agreement (NAFTA) led to the continued expansion of intermodal terminals and a substantial increase in emissions from the diesel fueled equipment in railroad yard facilities.

Metropolitan areas with large rail terminals also have high levels of automobile and truck traffic hence their subsequent emissions. Many do not attain the US EPA minimum air quality standards and are required to reduce air pollutants in order to meet them and avoid USEPA fines that can reduce Federal Highway Fund allocations. Where railroad intermodal terminals or yards have been identified as major pollution sources, the state environmental regulatory authorities have begun to press the railroads to reduce their emissions.

Railroad intermodal container lift equipment has been traditionally powered by diesel fueled internal combustion engines. In general, there are two types of lift machines - an overhead gantry type crane (RTG), and a fork lift type vehicle, known as a "side loader". Both types are rubber tired, steerable, and use diesel fueled engines for propulsion and lifting power. (The exception is the rail mounted gantry crane that is constrained to a fixed guide way.) Figure 1-1 and Figure 1-2 show examples of the two types of intermodal loading equipment commonly used at rail yards.

Many of the existing railroad intermodal container terminals have no potential growth capability because they are land-locked. Meaningful traffic growth capability necessitates the implementation of new container handling methods. The additional pressure of reducing emissions from rail yards has led the railroads to evaluate the European style widespan electric rail mounted gantry (RMG) crane.

A new approach to powering yard equipment will be required in order to comply with new regulations and efforts to reduce emissions from both on-road and off-road transportation sources, including equipment involved in container handling. The environmental consequences may be lessened through the use of electrical power to operate much of the equipment used to transfer containers to and from railcars.

Figure 1-1
Example of Mi-Jack rubber tired gantry crane lifter

Operations at railroad and marine intermodal container terminals generally have two things in common. Their spatial configuration is characterized by a linear element (i.e. a railroad or a marine dock), and their vehicles operate on a random arrival/departure path. The loading equipment facilitates the interface between the highway portion of the container movement and the linear feature. The configuration of the truck access to the interface area, and the rate of loading and unloading often determine the type of equipment that is chosen for a particular setting. The almost universally acceptable lift rate of containers and trailers to and from railroad cars is 120 seconds, or two minutes per lift.

Figure 1-2
A Mi-Jack piggy packer (side loader) container lifter

Figure 1-1 and Figure 1-2 show a traditional railroad intermodal terminal with a versatile single stage element to transition between the randomness of the highway arrival/departure mechanism and the linear railroad container car. The nature of the method selected by railroads would seem to dictate an on-board power plant to enable access to the loading area. Railroad companies have traditionally used diesel or other petroleum-fueled engines to power their equipment. The single major drawback to this approach is the requirement of large parcels of land dedicated to storing containers and chassis.

A new approach to powering yard equipment is being evaluated in order to address the issues of compliance with new emissions regulations and limited land availability at railroad intermodal container yards. This effort is especially geared towards equipment involved in the movement of containers. Environmental consequences may be lessened through the use of electrical power to operate much of the equipment that transfers containers to and from railcars. Several North American Railroads are currently testing the European style electric widespan rail mounted gantry crane (shown in Figure 1-3) to explore its potential for successful integration in railroad intermodal yard operations.

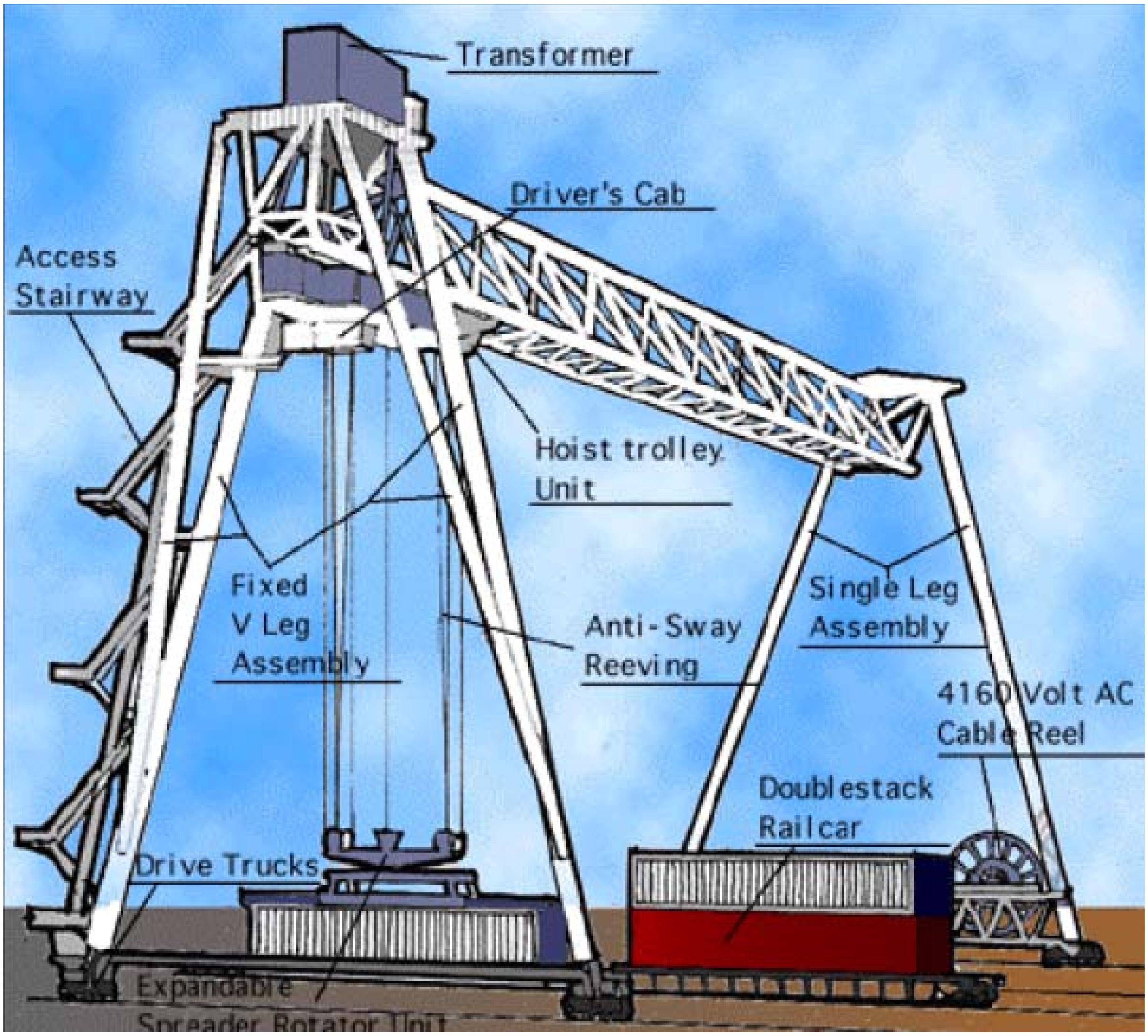

Figure 1-3
The electric widespan rail mounted gantry crane basic components

Objective

The objective of this study is to examine the opportunities to improve upon the current operational method of handling a container from the highway truck terminal entry point to the point at which the container is lifted from the trailer and loaded onto the rail car. This effort examined the use of widespan cranes, or straddle cranes, (WSC) with electric drives instead of traditional diesel-powered equipment. The limited availability of land at existing railroad yards was an additional motive for railroad operators to support the evaluation of WSC technology.

Four railroads were interviewed to obtain information regarding their interest in the development and use of the European style WSC in their intermodal container operations:

- CSX Transportation's CSX Intermodal (CSXI)
- Burlington Northern Santa Fe (BNSF) - formerly Burlington Northern (BN)

- Union Pacific Railroad (UP)
- Canadian National Railway (CN)

An investigation of the potential suppliers of widespan cranes was also conducted. Comments by the railroads interviewed indicated that the Konecrane manufactured WSC is the favored supplier of cranes for North American railroads.

2
ELECTRIC WIDE SPAN CRANE COMPANIES

Gottwald Port Technology, GmbH

Gottwald is based in Dusseldorf, Germany and produces widespan cranes for both ocean ports and inland train-truck terminals. Gottwald's construction method allows for versatile end product for expansion once in the field. The beam is constructed of flanged members and it can be extended for use over additional new tracks without changing the rail guideway or the electrical components, according to Gottwald's sales brochure.

No operating data was available from any source. Railroad contacts indicated that this widespan RMG costs approximately $7.5 million for a single gantry, including the electronics and the standard control system. An optional control system is available that allows the operator to enter a new position or container location into the computer and the crane will automatically move to the desired location and position without further input from the operator.

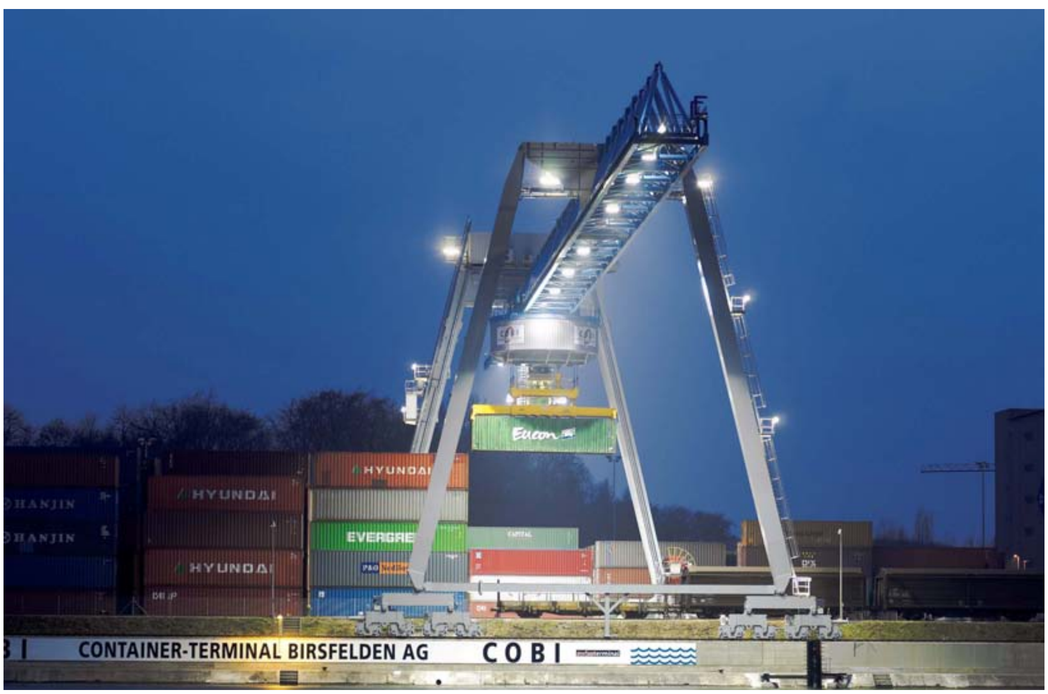

Figure 2-1
Gottwald widespan RMG used in port railroad container operation

Konecranes Group

Konecranes is based in Hyvinka, Finland and also produces widespan cranes for multiple applications. To date, Konecranes is the only widespan RMG that has been purchased by North American railroads.

Konecranes are estimated to cost approximately $4.5 million per unit. In addition to the actual crane unit, there is a system cost for the software control package that is priced according to the customers' needs, typically estimated at $500,000.00 for a complete operating system. Maintenance cost is estimated at approximately $50.00 per hour of operation per unit, and the energy consumption estimated by Konecranes is approximately 2.5kWh per lift cycle. An independent estimate for the maximum electric load per lift is 1 MW. Assuming 30 cycles per hour, at 2.5 kWh per cycle, the energy consumption would be 75 kWh per hr. Thus the load factor at a max load of 1 MW would be 7.5 percent.

Konecranes advertised performance data for the RMGs in BNSF's Seattle intermodal yard are listed as:

- Up to 50 short tons spreader load
- Approximately 150 foot span between legs and 25 foot cantilever
- Stack height of five containers with clearance of one over the stack
- Loaded lifting velocity of ~ 1.6 feet per second (~100 ft/min)
- Trolley traverse velocity of ~ 8 feet per second (~500 ft/min)
- Gantry travel velocity of ~ 13 feet per second (~790 ft/min)
- Trolley rotating speed up to 2 rpm

Figure 2-2
Konecranes first North American RMG in their North SIG Yard

Hans Kuenz GmbH (Kuenz Cranes)

Kuenz Cranes is based in Austria and is in negotiations with My-Jack in the U.S. to build rail mounted cranes for the U.S. market. It is unclear if the partnership has been completed to date. It is expected that the partnership will involve My-Jack, to manufacture the steel crane structural members, and Kuenz to manufacture and supply all the electrical components, including the operating software. No price estimates or system performance data are available.

Figure 2-3
Kuenz intermodal container rail yard crane

Shanghai Zhenhua Port Machinery Co., Ltd. (ZPMC)

ZPMC is based in Shanghai, China, and was the only Asian manufacturer of large widespan crane found in the search. The company website includes illustrations of RMGs. ZPMC describes their rail-mounted gantry crane (RMG) as a specialized yard container handling machine.

The RMG travels on rail using electric yard power, and lifts and stacks containers in the yard area with a 40' telescopic spreader (or twin-lift spreader if needed). It consists of lifting mechanism, trolley traversing mechanism, gantry mechanism and sway-dampening mechanism. It has a travel range of 1,500 feet in either direction. The lifting, gantry and trolley mechanisms are mostly equipped with an AC frequency conversion control system. Normally the lifting mechanism is of the single drum type. No information regarding price or operating data was available.

Figure 2-4
ZPMC electric powered RMG crane

3
RAILROAD USE OF WIDESPAN RAIL MOUNTED CRANES

CSX Transportation

CSX indicated they are interested in changing to electric powered equipment at a new facility because they are conscious of their corporate duty to refrain from negatively impacting the environment even when it may not be clearly economically feasible.

Mr. Paul Hand, Director of Operations, CSX Intermodal (CSXI), was contacted to discuss their proposed Winter Haven, Florida Logistics park. Mr. Hand's assistance included documents related to the proposed Winter Haven park facility. HDR Engineering prepared an evaluation of the anticipated change in truck and vehicular traffic in and around Winter Haven, Florida due to the operation of the proposed logistics park (schematic within Appendix A).[1] In reviewing the HDR study, it became apparent that there was substantial opposition to development of the facility by the Winter Haven residential community. This was substantiated by several newspaper articles describing the opposition of local community groups to the development of the facility.

Additionally, a legislative contingent objecting to what was described as "back room" politics made itself known on a different issue apparently not connected to the Winter Haven logistics development project. However, after a substantial investigation of the entire Winter Haven political and citizen outcry regarding the logistics park development, it became clear that the problem may have had less to do with the logistics park itself, than with a perceived "back room", private agreement to commit a large amount of State monies to the purchase of a CSX rail line for primary use as a commuter rail line to the Orlando region to support continued development of the local recreational economy.

Political vetting used the Winter Haven development as the nominal scapegoat to stop the CSX line sale. In reality, however, there was a committed group opposed to the conditions of the sale and commuter operations on the line, not the sale itself.

The Winter Haven-Commuter Rail Operation issue was addressed in a meeting with Mr. Hand and several other CSX personnel at the Jacksonville, Florida headquarters of CSXI. During this discussion, it became clear that CSX would continue with the development of the Winter Haven logistics park whether the process towards the sale of the CSX commuter rail line continued or was halted by either the State of Florida or CSX Transportation. The discussion was a turning point in the investigation in that it helped prove CSX's commitment to the implementation of WSC RMC technology.

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[1] RAIL TERMINAL FACILITY WINTER HAVEN, FLORIDA
Application for Development Approval (ADA) – Transportation Question 21 Methodology
October 16, 2007, prepared by HDR Engineering, Inc., Kansas City, Missouri.

In 1993, CSX operated a widespan rubber tired gantry crane (WRTGC) in their Cleveland intermodal yard operation. The WRTGC spanned three (3) tracks and was diesel powered. Its design and operating characteristics did not allow access to the center track for a trailer-on-flatcar, thus it was not operationally viable for general use in intermodal operations. It was removed from service in 1996 because it failed to operate effectively and economically.

Winter Haven Logistics Park

CSX and CSXI developed a facility layout plan for the Winter Haven Logistics Park that includes three intermodal and six automotive tracks, each approximately 2,000 feet in length. The facility layout plan is attached as Appendix A. The facility features one mainline run-through track, labeled Mainline Track, with an adjacent Mainline siding track. The current Right-Of-Way boundary is shown as R/W Boundary. The new facility encompasses all the additional trackage, storage and facilities shown on the plan. A Departure Track is the first new track, followed by a Departure/Arrival Track, followed by an Arrival Track, followed by the last track before the intermodal container tracks, the repair-in-place track (RIP). The automotive tracks and storage area are at an angle to the mainline track.

CSXI developed an operating plan and an economic analysis that improved the overall operations of CSXI's intermodal and automotive transportation business units. The operating plan and economic analysis provides for:

- Lower terminal operating costs
  - Reduced crane operating costs attributable to WSC efficiency
- Increased throughput per acre
  - Reduced footprint
- Increased safety
  - Reduced labor per lift
- Environmentally friendly
  - Reduced CO_2
  - Reduced noise
- Reduced costs
  - Standard diesel operations
    - 2 overhead cranes - $1,500,000 ea.
    - 1 side-loader - $900,000 ea.
    - 8 hostler trucks - $40,000 ea.
  - Electric WSC
    - 2 WSC - $4,500,000 ea. + 1 software @ $500,000
    - 2 hostler trucks
  - Standard operations require containers to be moved entirely by hostlers

- Electric operations container handling stacks containers immediately to and from inbound or outbound trucks
- Diesel Operation
  - Diesel fuel cost and efficiency
  - Large footprint required
    - Land cost
  - 8 hostlers
    - Personnel required to operate
  - Standard crane load
  - Current software in-place
- WSC Operation
  - Electric cost and efficiency
    - Estimated average cost: ~2.5 cents per kilowatt hour
  - Small footprint
    - Land cost approximately ½ the land required for diesel operation
    - Stacking operation offers additional land reduction opportunities
  - 2 hostlers
    - Reduced personnel
  - Crane load increased by a factor of two
  - New software required

- Internal Rate of Return on Investment
  - 24% estimated by CSX for Winter Haven logistics operation

Additional CSXI Terminals

CSXI indicated they are actively investigating the retrofit of their Baltimore and Cleveland intermodal yards for implementation of electric powered WSCs. CSXI stated that the Baltimore intermodal facility is their largest intermodal yard and that the Cleveland facility is their second largest. The WSC evaluation for the Winter Haven facility indicated that the economics and productivity associated with this technology were so positive that CSXI was proceeding with financial preparations to request funding for conversion both of these facilities to WSCs.

Emissions

Emissions from traditional diesel intermodal yard operations were estimated using operating data on existing equipment and operations, supplied by CSXI, more specifically historic equipment operating time and projected future operations at the Winter Haven facility. The estimate was then compared with emissions estimates prepared by CSXI's consultant.

Our estimates were based on an existing facility's unit lift operation. The type, size (horsepower), and hours of use for the equipment used in the operation were supplied by CSXI, as well as the total number of annual lifts and the annual fuel consumed at the facility to perform those lifts. The EPA Tier 3 emission rate for the type of equipment (non-road material handling), the equipment horsepower, and hours of operation were used to estimate the emissions.

The emissions per lift using standard diesel equipment were calculated based on the total annual emissions divided by the annual number of lifts. Table 3-1 provides the estimated emissions per lift for each piece of equipment and the overall emissions per lift, by pollutant.[2]

Table 3-1
CSXI standard diesel operations – Emissions per lift

Quantity	Equipment	Pollutant (grams/lift)*			
		HC	CO	NOx	PM
1	My-Jack 200 hp Side Loader	0.8176	3.3287	11.1331	0.6680
2	300 hp RTG Cranes	2.8032	11.4130	38.1705	2.2902
8	150 hp Hostler Trucks	7.0081	33.0823	95.4262	8.3975
Total per Lift		10.6289	47.824	144.7298	11.3557
Note: HC=Hydrocarbons CO=Carbon Monoxide NOx=Nitrogen Oxides PM=Particulate Matter					

The emissions for the electric widespan RMG crane operation as proposed are shown in Table 3-2. The crane itself is considered to be zero-emission onsite. The only emissions generated are due to two hostler trucks that maneuver container chassis and containers-on-chassis before they are handled by the WSCs.

[2] EPA Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, Table A2, EPA420-P-04-009, April 2004.

Table 3-2
CSXI electric WSC RMG operations – Emissions per lift

Quantity	Equipment	Pollutant (grams/lift)*			
		HC	CO	NOx	PM
2	Electric WS RMG Cranes	0	0	0	0
2	150 hp Hostler Trucks	1.7520	8.2706	23.8565	2.0993
Total per Lift		1.752	8.2706	23.8565	2.0993
**Note: HC=Hydrocarbons CO=Carbon Monoxide NOx=Nitrogen Oxides PM=Particulate Matter*					

The total emissions from each operation and the subsequent emissions reduction due to the electric WSC operation compared to the standard CSXI diesel powered operation are shown in Table 3-3.

Table 3-3
CSXI Intermodal Container Operation – Estimated Emissions Reduction due to Electric Widespan Rail Mounted Cranes

Operation	Pollutant (grams/lift)*			
	HC	CO	NOx	PM
CSXI Diesel	10.6289	47.824	144.7298	11.3557
Electric WSC	1.752	8.2706	23.8565	2.0993
Emissions Reduction using Electric WSC	8.8769	39.5534	120.8733	9.2564
**Note: HC=Hydrocarbons CO=Carbon Monoxide NOx=Nitrogen Oxides PM=Particulate Matter*				

The calculated emissions reduction per lift as a percent of CSXI's standard diesel operation emissions is shown in Table 3-4.

Table 3-4
CSXI Percent Emissions Reduction due to Electric Widespan Crane Operation

Operation	Pollutant (grams/lift)*			
	HC	CO	NOx	PM
CSXI Diesel	10.6289	47.824	144.7298	11.3557
Electric WSC	1.752	8.2706	23.8565	2.0993
% Emissions Reduction Using Electric WSC	83.52 %	82.71 %	83.51 %	81.51 %
Note: HC=Hydrocarbons CO=Carbon Monoxide NOx=Nitrogen Oxides PM=Particulate Matter				

The CSXI emissions reduction, as we've calculated, that can be achieved through the use of electric widespan rail mounted cranes instead of traditional diesel powered equipment is an indicator of a range rather than an expected fixed number. Obviously, the calculated emissions estimate for the electric powered WSC operation does not include the stack emissions from the electricity generation, so the estimate is biased by an unknown factor. This is an important point that should not be disregarded when reviewing electric operations. A note must be made here that evaluation of the total emissions (cradle-to-grave) for either electric or diesel operations is beyond the scope of this study, but could provide stakeholders with certain and unarguable facts and figures to support the emissions efficiency of electric powered equipment.

BNSF Railway

BNSF is the first railroad that deployed electric powered widespan rail mounted cranes (RMG) in their Seattle, Washington, Seattle International Gateway (SIG) North Yard. According to BNSF the principal driving factor for implementation of the widespan RMG technology at North SIG Yard was the rising cost of new land for expansion ($15.00+ per square foot) and the anticipated doubling requirements of the facilities capacity. (One acre at $15.00/sq. ft. is equivalent to $653,400.00 per acre. The new facility occupies nearly 13 acres or the land value of nearly $8,400,000.00.) The capacity associated with the widespan crane technology is generally accepted to be twice the capacity of current intermodal yards that employ the standard technology of single track overhead cranes and side-loaders. (If the SIG North Yard had used the RTG and side loader technology to double the capacity, the new value of the land alone would have exceeded $16,000,000.00.) The new WSC in SIG Yard is shown in Figure 3-1 with all three tracks occupied by trains.

Figure 3-1
BNSF Seattle, Washington SIG yard, Konecranes first North American railroad intermodal RMG installation

Initial discussions with BNSF established that they will employ change only where new yard designs will occur. Their position is that electric powered equipment will not be employed simply to reduce emissions output at a container terminal. There must be an expectation in their container forecast that demand will increase beyond the capability of the in-place facility design, implying a possible yard renovation effort which could include a new design allowing the option for productivity improvements using electric powered equipment. In other words, BNSF will have to redesign a yard to implement electric widespan cranes regardless of the initially stated reason for the redesign.

Interviews with BNSF's designated intermodal terminal engineering company (HDR Inc.) provided specific operational parameters expected in a new design that would incorporate the crane span:

- Three operating railroad tracks
- Four container stack lanes
- Five high stack capability (one-over-four)
- Three truck lanes under the RMG cantilever
- 1,500 feet of movement along the track (translation)
- One MW of electric load for this size of crane (approximately)

- Load factor approximately 20%
- Automation capability

During the evaluation it was confirmed that BNSF has four additional facilities in the design stages for conversion from their standard diesel operations to electric WSC operations. The facilities are:

- Memphis, Tennessee (existing)
- Los Angeles, California (existing)
- Gardner, Kansas (new logistics park)
- Joliet, Illinois (new joint operation, logistics park)

The Gardner, Kansas facility, a new logistics facility under design was expected to have as many as eight (8) railroad tracks under the WSC operational scenario. This was the widest span discovered during this investigation. A presentation by Mr. Skip Kalb, Director, Economic Development, BNSF, Ft. Worth, Texas at the 2007 AASHTO SCORT Annual Conference in San Antonio, Texas discussed the Gardner Logistics Center at great length. Mr. Kalb referred questions concerning electric RMG cranes to Mr. Wayne Parsons, HDR Engineering, in Kansas City, Missouri.

Mr. Parsons was contacted and provided several details concerning RMCs. All BNSF WSCs would be procured from Konecranes of Finland. Investigations by both BNSF and HDR determined that the Konecranes company was the most reliable based on scheduled equipment delivery, performance characteristics with regard to marketing claims, and the highest respectability held by European port users with regard to meeting expectations for claims made during negotiations to purchase.

Mr. Parsons stated that BNSF hired HDR to develop facility designs for the completed Seattle, Washington, North SIG Yard; the Joliet, Illinois Logistics Park; and a possible Memphis, Tennessee intermodal yard redesign. No mention was made of the Gardner, Kansas Logistics Park discussed by Mr. Kalb. Mr. Parsons suggested contacting BNSF's Mr. John Hovland, BNSF Operations Department, who could provide detailed operating parameters for the North SIG Yard RMGs. Mr. Hovland was contacted but was not able to provide data concerning the actual operations of the SIG Yard RMGs. However, he stated that BNSF expected to ultimately obtain lift cycle times of two minutes per lift using the WSC technology.

Figure 3-2 and Figure 3-3 show an aerial view of all four new cranes at the SIG Yard. Figure 3-2 shows the length of the tracks, roads and storage ramp to be approximately 1,400 feet long. Figure 3-3 indicates the cranes are equipped with the option to rotate the saddle, as demonstrated by the upper left crane saddle which is oriented 90 degrees to the saddles on the other three units. Employing the option of saddle rotation allows greater container storage density at close proximity to the track.

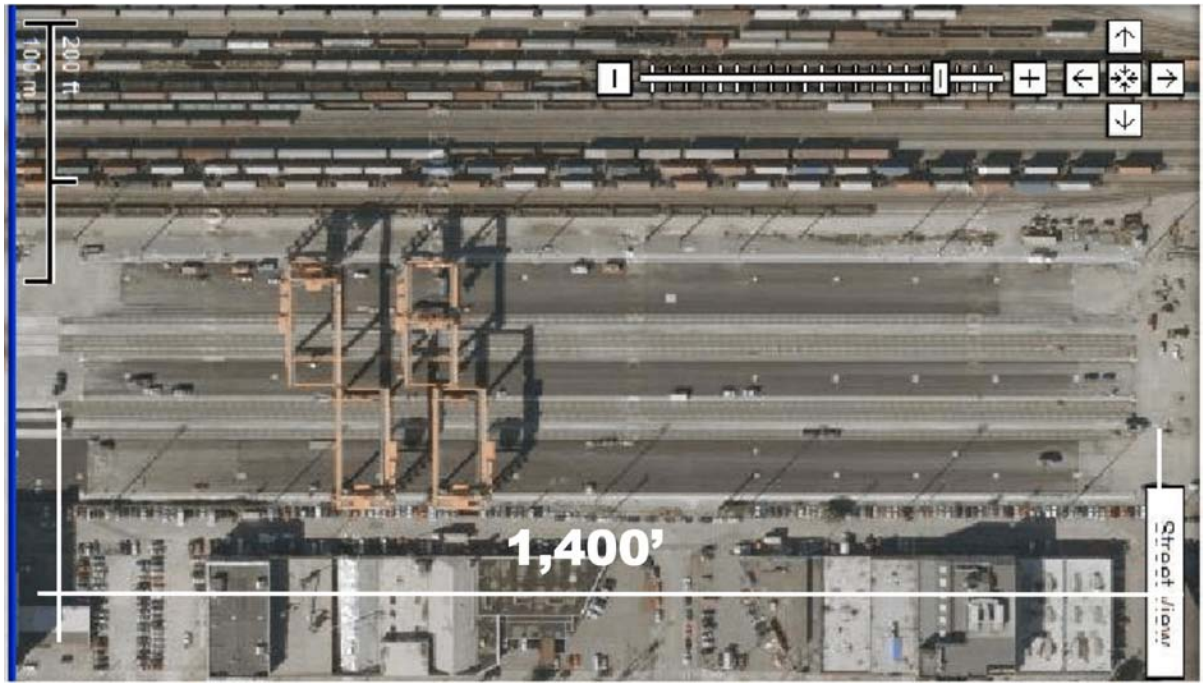

Figure 3-2
Google Earth view of BNSF North SIG Yard

Figure 3-3
Google Earth view of BNSF North SIG Yard RMGs – 90° Rotation Capability of Lifting Carriage

Union Pacific Railroad

Discussions with Mr. Bob Shelton, Facilities Design, Union Pacific Railroad, Omaha, Nebraska provided general indications of UP's expectations for the implementation of WSCs in their intermodal terminals and yards. Mr. Shelton stated that Union Pacific's policy is to implement innovations wherever they would add monetary value to the corporate bottom line. He expressed caution in interpreting this in a strict dollar sense since the avoidance of expenditure is also viewed by senior management as monetary value added.

Mr. Shelton stated that UP expects each container lift and set-off to require approximately two minutes and that at the moment they were uncertain of the exact operational profile after the switch to the widespan crane occurred. In addition to the two minute expected cycle time, they expect that the WSC operation could initially require one additional lift per container to complete the transition of a container from surface roadway to railcar. UP anticipates that within a reasonable timeframe of familiarity and experience with the new operation the additional lift would be eliminated from the operation. Additionally, even with the expected additional lift, the overall efficiency of the operation is expected to be improved due to the reduction of multiple chassis and container moves for storage within the facilities. No quantitative data was provided in support of this statement however.

Two terminals in the Chicago area are presently being designed or will be designed to accommodate widespan electric crane operations. These are the Rochelle facility, which is currently in the design phase, and the new Joliet logistics terminal, which is currently at the development phase, by Centerpoint Properties, LLC. The Rochelle Global III facility covers 1,200 acres and includes a large switching yard to expedite the re-segmenting of trains and blocking of cars. The intermodal terminal features a 720,000 lifts/year capability, a 10-lane gate entrance, and a 7,200 unit container/trailer yard storage capacity at full build out. The Joliet facility does not yet have a specification set, but it includes plans to incorporate the use of widespan electric cranes.

UP anticipates that the Rochelle intermodal facility will be a principal facility that will accommodate the growth in the East-West container traffic.

4
CONCLUSION

The North American Railroads will continue to plan and implement the installation and use of electric widespan RMGs for intermodal rail yards in the foreseeable future. This implementation will increase because of local and state clean air mandates regardless of stated opinions to the contrary. During the course of this investigation, the railroads consistently stated they would not implement the use of WSC technology for the single purpose of reducing emissions.

Retrofits to facilitate the switch from current diesel to electric WSC technology may be expected to have a capital cost of $20 million for four WS RMGs, and the redesign and installation of tracks, roadways, and storage areas. An analysis of the railroad economics involved with implementation of the WSC technology is beyond the scope of this study. In any case each facility will have a different return on investment simply due to the uniqueness of each facility design.

The implementation of electric WSC technology is justified by increased capacity requirements at existing yards, estimated fuel cost reductions and the volatility of diesel fuel prices, and the high cost of new land acquisition in metropolitan areas - where the yards are located and increased capacity is most needed.

The railroads do not universally agree on the operating costs for the WSC technology. Some think it will have a higher operating cost per unit which will be offset by the capacity improvement on one hand, and by the efficiency improvement on the other. One railroad estimates that the operating cost of WSC will prove to be lower than that of the current diesel fueled operations.

All the railroads interviewed agree that WSC technology will be implemented wherever they have a land locked existing intermodal container facility predominantly engaged in the import/export of containers at ocean ports. Other candidate intermodal facilities for implementing WSC technology are major distribution hubs and terminals, such as Chicago, Cleveland, and Kansas City.

Additional study by the electric industry to better understand the actual operational electric load and power consumption of the widespan RMG would promote the development of rate structure adequacy for this expected additional load. The results of this study could also be used to better inform the industries railroad customers of their expected costs for operating this new equipment by better operational profiling. Multiple RMG's should be used sequentially rather than simultaneously, etc. The capability to restrict operations seems to be indicated by the sophisticated operating software applications supplied by the manufacturers of these systems.

A joint electric and railroad industry emission analysis comparing the traditional intermodal terminal to one using the widespan RMG technology would provide an incentive basis for community support to convert existing operations to the use of widespan cranes for increased air quality and reduced noise at terminals.

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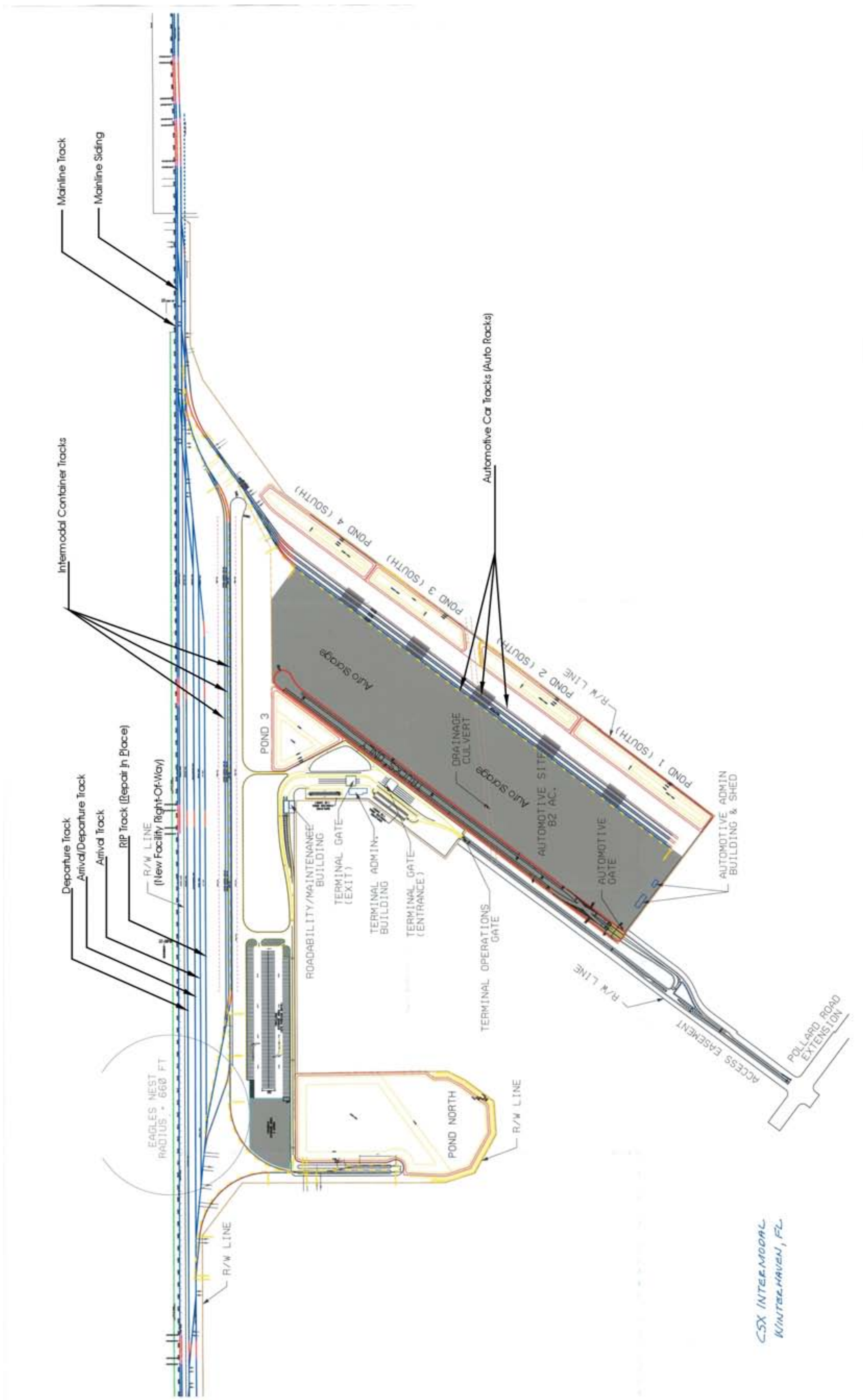
RAIL TERMINAL FACILITY WINTER HAVEN, FLORIDA


Mainline Track
Mainline Siding
Intermodal Container Tracks
Automotive Car Tracks (Auto Racks)
Departure Track
Arrival/Departure Track
Arrival Track
RIP Track (Repair in Place)
R/W LINE
(New Facility Right-Of-Way)
POND 4 (SOUTH)
POND 3 (SOUTH)
POND 2 (SOUTH)
POND 1 (SOUTH)
R/W LINE
Auto Storage
Auto Storage
POND 3
DRAINAGE CULVERT
AUTOMOTIVE SITE 82 AC.
AUTOMOTIVE GATE
AUTOMOTIVE ADMIN BUILDING & SHED
ROADABILITY/MAINTENANCE BUILDING
TERMINAL GATE (EXIT)
TERMINAL ADMIN. BUILDING
TERMINAL GATE (ENTRANCE)
TERMINAL OPERATIONS GATE
R/W LINE
ACCESS EASEMENT
POLLARD ROAD EXTENSION
EAGLES NEST RADIUS = 660 FT
POND NORTH
R/W LINE
R/W LINE
CSX INTERMODAL
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