AUTOMATION IN INTERMODAL TERMINALS

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Intermodal terminals are moving towards semi-automation and/or full automation despite some elements of automation already existing in most ports, mainly in the stack operations.

The desire to automate exists in the intermodal world as it does in the port industry and the challenges of operating a terminal are very much the same in both industries.

The reason intermodal terminals are behind in introducing automation is manual interaction of personnel at the loading operation is still common. Some of the essential tasks which need to be performed by manual labour are the handling of the Inter Box Connector (IBC) between the two tiers of container on a rail car, the rail car inspection or maintenance taking place in the terminal at the processing or loading track. Furthermore, there are restrictions in regard to the rail operation as a suspended load is never allowed to be moved above people, locomotives and trucks.

All these exemptions from an unmanned operation, which exists in a container stack, make it impossible to fence off the operation area in an intermodal yard for automation in the way it has been done in container stacks.

WHAT SHOULD AN AUTOMATED INTERMODAL TERMINAL LOOK LIKE?

When looking at intermodal operation in North America typically we see a so-called wheeled operation layout. This implements a crane purely lifting containers between chassis and rail cars without any ground stack. The benefit of such an operation is that due to the low dwell time of containers in the terminal there is the fast availability of containers to be pick up by road trucks.

However, there is a downside, namely the need for space to park all the pre-loaded chassis at the terminal and the hustler operation required to move the chassis between the loading position underneath the crane and the parking position for road truck pick up.

Operating an intermodal yard where the crane handles the train loading, the ground stacking and the truck loading is the ideal case for automation with the most financial benefits.

A more detailed description of this operational standard can be found in the below PTI technical paper.

Stack Operations in an Intermodal Rail Terminal Using RTGs

STEPS OF AUTOMATION

Automation at an intermodal terminal can be implemented in various steps. A very low degree of automation has already been done for many years. This step still sees an operator on the crane and the automation element does the horizontal movements of the crane (gantry and trolley movements) in an automated move based on the position information provided by the Terminal Operating System (TOS). Positioning the spreader onto the container and observing the environment is still in the operator's responsibility.

Talking about real automation means moving the crane operator from the crane cabin

to a Remote Operator Station (ROS) inside the terminal building. This means that the automation system needs be able to adhere to the operational rules like not moving a load over persons, equipment, or locomotives.

To make this step productive the positioning of the load must be a part of the automation as well. Here, as a first step, the automated landing of the spreader or of a loaded container can be limited to the stacking operation.

The automated functionality can then be extended to automated landing on rail cars and chassis. The challenge on the chassis loading is to observe the truck driver during the loading step. Here a so-called supervised move is practical. A supervised move means that the crane automation system performs the loading operation fully automated but an operator at the ROS station needs to observe the operation by means of camera views.

The ROS operator then needs to press a push button for the crane to execute the move. In this situation the ROS operator observes the truck driver being at a safe position and can react to any signs given from the truck driver. In addition, voice communication using microphone and speakers are available.

The same applies to the rail car operation to check the upper container being properly separated from the lower container.

Observing the crew working on the ground is essential to safeguard their operation on the ground. Furthermore, recognising equipment like IBC cars, locomotives, rail car spotters, rail car maintenance, etc. and personal or equipment locator system is required.

This system feeds the position and the predicted movements of these 'obstacles' to the crane automation system to avoid a suspended load moving over.

Further information, such as the blue flag signals (indication that a rail track is locked out from the rail operation) needs to feed into the automation system.

WHAT IS THE BENEFIT OF AUTOMATION IN AN INTERMODAL TERMINAL?

One of the challenges all container terminals are facing is unpredictable traffic especially from the road. Also, within a given day there a typical peak hours and low traffic hours.

With the flexibility given from operating the cranes from an ROS station the staffing of these ROS stations can be changed depending on demand. Automation allows unmanned operation in the stack to do housekeeping fully automated.

Eliminating time required for shift changes and breaks will contribute between four and six hours a day additional productive crane time.

From the operator perspective working in an office environment versus sitting in a crane cab is a significant improvement and takes away the hazard of climbing the crane at any weather and temperature conditions in order to change crews. Furthermore, the seating position in a crane cab with always looking down and bending the back with the vibration of the crane is a health issue for the crane operator.

CHALLENGES IN AN AUTOMATED OPERATION

At a port, implementing an automated operation may be complex because of the multitude of operations like ship loading, horizontal transport to the stacking area and the way to load trucks or trains. This may be even more complex in an Intermodal operation. The big benefit at port facilities is that these operational steps are usually organized by one common TOS system.

In the Intermodal world such TOS systems are mainly based on the operation described at the start of this article. Therefore, upgrading the TOS to enable an automated operation might be the most challenging part. As an intermediate solution, creating a middlewear (software providing services to software applications beyond what is available in the TOS) taking care of sequencing and optimizing moves might be considered.

The key to an efficient operation is to minimize the crane idling time. Therefore, the software solution either a sophisticated TOS system or a capable middlewear is essential to overall productivity.

Organizational steps and rules are also part of the changes involving automation. Here for example making the time of a truck from the check in gate to the crane predictable helps the TOS to reduce trucker dwell time.

USE CASE

A use case of a terminal doing approximately 500.000 moves a year, converting from a conventional terminal operation to an automated terminal shows the possible savings:

- By changing from wheeled operation to stacking underneath the crane saves approximately 75% of hustler trucks.
- Implementing ROS operation improves crane-operating time by at least 20%, saving of one crane in the CAPEX and OPEX.
- Implementing automation and ROS capability enables to work two cranes with one ROS operator.
- ROS operation enables one operator to move all cranes during low traffic hours.

This is a very high-level view on cost savings. What needs to be equally considered is the improvement in safety for the operator no longer climbing the crane, working in an upright sitting position and the social interaction with co-workers.

References of automated intermodal operations: CSX Winter Haven, FL; CSX Fairburn, GA; GCT Vancouver, BC; and BASF Ludwigshafen, Germany.

ABOUT THE AUTHOR

Walter Leiler has been with Kuenz for more than 30 years. From 2001 until 2004 Leiler was based in Raleigh, NC, and was involved in establishing the branch office there for the company. He returned to Raleigh in 2019 to cover the North American crane market. He has been in sales and project management for 20 year and was project manager for automation projects including CTA Hamburg, GCT Vancouver and CSX Transportation.

ABOUT THE ORGANIZATION

Kuenz was founded in 1932 by Hans Kuenz who succeeded in creating a significant and successful mechanical engineering company in a very short period of time. The company started out manufacturing tower construction cranes, the focus later shifted towards manufacturing container cranes, followed by hydro power equipment. Kuenz is one of the oldest and most prestigious mechanical engineering companies in the western region of Austria.

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