CSX terminals on the automation train

CSX Intermodal Terminals is partway through a major programme to implement systems and process automation across its network of terminals, some of which will eventually feature semi-automated cranes

With the coal market in decline, CSX Corporation (CSX) and its subsidiaries are making huge investments in transforming into the "CSX of Tomorrow", focusing heavily on intermodal growth and automation initiatives, among other pillars. As part of this, CSX Intermodal Terminals, Inc. (CSXIT) is developing new technology-enabled terminals, designed specifically for efficient container handling, and redeveloping others to make them more efficient.

This effort is not just hardware and infrastructure upgrades – CSX has fundamentally rethought the way it handles containers across its entire network. Over a decade ago, it started planning for a hub-and-spoke network centred around a new hub in Ohio that enables its intermodal service to be much more competitive with trucking.

The Northwest Ohio Intermodal Facility (NWOH), featuring widespan gantry cranes (WSCs) and shuttle carriers, is one of the most visible parts of CSX's evolving intermodal strategy, and it is also something of a technology incubator. It was designed in consultation with Hamburg Port Consulting, and operates a host of new technology, including the Intermodal Pro (IPro) TOS from Tideworks Technology, DGPS positioning systems, and an automated gate system.

Since NWOH opened in 2011, the WSC concept has been implemented at new intermodal terminals in Winter Haven, Florida and Columbus, Ohio. Stacking rubber-tyred gantry cranes (RTGs), which are different from the smaller "production RTGs" that handle trains but do not stack containers, have also been introduced at several other intermodal terminals. CSXIT will shortly begin work on its new "Carolina Connector" intermodal hub in North Carolina, which is set to be one of the largest facilities in the network when completed.

Big and small

There are 34 terminals in the CSX core network (which excludes on-dock rail at marine terminals and facilities run by a third party), ranging in size from small operations that handle fewer than 20,000 containers annually, to the NWOH hub that is being developed to handle over 2M/year.

Gary Van Tassel, director of operations planning and network design at CSXIT, said that while not every facility will be the same in terms of its equipment and systems, it wants all its terminals to standardise their operations on three integrated pillars: the terminal configuration, process automation, and systems automation. Systems implemented within these pillars must be replicable across different-sized terminals in an economically viable way – whether they handle 20,000 or 2M containers.

Two of the main systems CSXIT is implementing are the Tideworks IPro TOS and its own XGate automated gate system. Rolling out a TOS across 34 terminals alone is an enormous undertaking, but CSXIT has come up with a way to drastically cut the implementation period.

CSXIT worked closely with Tideworks to develop a single version of IPro that it can roll out at any terminal, regardless of its size or style of operation. The TOS project began with NWOH, and a lot of functionality had to be developed specifically for its WSC and transhipment style of operation. The next two terminals to use WSCs, Columbus and Winter Haven, had different equipment configurations, and Tideworks again wrote different code for each.

CSXIT realised that continuing on this route would have led to too many different versions of IPro to develop and manage in a sustainable manner. To avoid this challenge, CSXIT worked with Tideworks to standardise functionality for three basic terminal layouts – Widespan Crane, Conventional (production RTGs and reach stackers) and Hub (WSCs plus shuttle carriers for horizontal transport) – that cover all 34 sites. IPro itself was then developed with multiple configurations to effectively run each of the types of operations.

Within IPro, functionality including Traffic Control (Tideworks' system for equipment dispatch and optimisation) and the supporting algorithms is set up for each type of operation. For example, in Conventional layout, IPro is set up to run a reach stacker or production RTG operation, whereas within the WSC module, all of the supporting configurations are designed to optimise overhead stacking cranes, which includes WSCs and RTGs.

The software still has to be configured for each terminal, but CSXIT has only one version of IPro to support and maintain. The TOS is now operating at 19 terminals, and CSXIT has got the average implementation period down to just six weeks. No fewer than two weeks are allocated to planning for the roll-out, which includes "re-defining the operations at the terminal to the degree necessary to fit the system", said Van Tassel. Rather than trying to change the system to fit each operation, CSXIT uses the TOS to drive standardised terminal processes.

As part of the process, terminal managers are engaged to cooperatively develop the new operational specifications, and work with the integration team to configure the system. Subject matter experts are brought in from a similar terminal to be on site at go-live, but CSXIT takes a very disciplined approach to getting terminals to adapt quickly. It goes into each installation with an expectation that "there is no going back", and the integration team spends no more than a week on site for the go-live.

This approach has worked for CSXIT. Van Tassel said the first week can be tricky, but most terminals fully use the system as it was designed after around one month, when they have had time to see the value of its "mission based" approach to planning. "It's not ideal, but we really try to let them come to those conclusions on their own. We can only show them the way, we can't adapt for them," he added.

At the gate

The gate is another area where CSXIT has been very successful at scaling technology to benefit its operation. The company made it an objective to maximise the benefit of technology to identify and inspect containers entering and exiting by using systems that collect data automatically. It also wants to move progressively to an environment where truckers use mobile apps to arrange and manage their visit to a terminal.

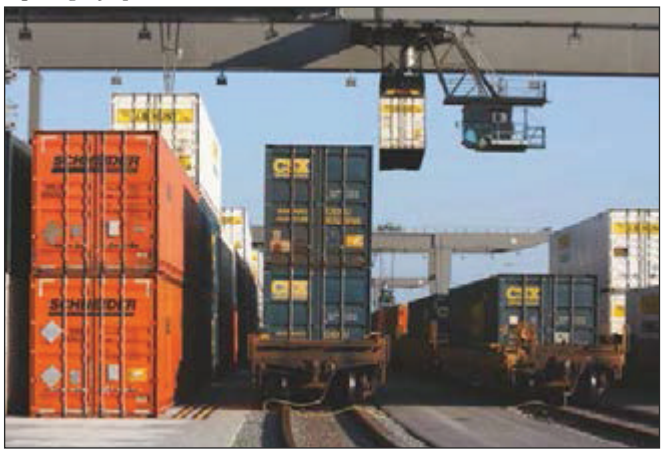
The gate project required a lot of consolidation; over the years, CSXIT had implemented nine different gate systems (including some in-house developments), and needed to rationalise. XGate consists of the Gate Operating Software (GOS), developed using a contract developer, integrated OCR components from ABB, Windows-based computers, and a pedestal that CSXIT developed itself. There is some integration with Tideworks software, but CSXIT supports most of the hardware and software for XGate with its own IT resources.

Getting involved in hardware, software and even pedestal construction at this level is not something most marine terminals look to do, but Van Tassel said many of the gate systems designed for marine applications require too much infrastructure, and are too expensive for its smaller terminals in particular – some kiosks alone can run to US$40,000. CSXIT's approach also enables it to avoid the costs of ongoing support that many of these systems require.

XGate confirms the trucker's job by scanning a barcode, identifies the truck and container automatically, and takes damage inspection images of equipment. The damage inspection images are stored independently for a period of one year, in case there is a claim.

CSXIT is now focused on

Removing inter-box connectors on double-stack rail cars is done manually, requiring safety zones around workers that 'walk the train'



further developing mobile apps to fully leverage its investment in hardware and software. Van Tassel said there is a good opportunity to improve the whole gate process for both CSXIT and the truckers, through apps that deliver value to both. For example, drivers could use apps to update terminal visits or manage equipment swaps at the terminal. Completing these processes through an app does not require an exception management process, and truckers get the benefit of a shorter visit, with automatic entry and exit at the terminal.

One area where CSXIT's journey with terminal automation is taking a different path to the port sector is the use of GPS technology to capture container position data throughout the yard. Many marine terminals are very focused on equipment and systems that capture this data automatically, without the driver needing to push a button. Van Tassel said CSXIT is no longer pursuing this technology for UTRs (terminal tractors), and is only applying it in specialised applications such as shuttle carriers and stacking RTGs.

While the yard inventory might not be 100% accurate, UTR and truck drivers working at the smaller sites can typically manage with equipment that is out of position by one or two yard slots. Where it is using WSCs or stacking RTGs, however, CSXIT needs a fully accurate inventory generated by the crane's positioning system, particularly as it moves towards semi-automated crane operations, and it is these terminals where CSXIT is implementing GPS systems to manage container inventory.

Going robotic

CSXIT is now preparing to introduce semi-automated crane control and automated horizontal transport at some of its hub facilities. In particular, it is looking to have WSCs gantry and long travel automatically, with the final hoist and load position motions controlled by a remote operator. This is likely to be implemented to some degree at all of its rail mounted WSC facilities.

Taking the driver off the crane requires addressing safe working around the machine. CSXIT does not allow people to access the stacking areas under cranes at all, but they are required elsewhere in the crane working area, mainly on the rail tracks, where removing inter-box connectors (IBCs) on double-stack rail cars must be done manually. Marine terminals have well-developed systems for controlling access to interchange zones and reefer racks under ASCs, but these are tightly defined areas. IBC work effectively requires a moving safety zone that runs the length of a train, and this is a more difficult challenge. Some North American marine terminals are currently grappling with how to put safety zones around workers that 'walk the train' (or travel in a pickup truck along its length), stopping to remove the IBCs.

Van Tassel believes CSXIT has developed an efficient solution by designing a work process that tightly controls the working area, while allowing the necessary redundant safety systems to operate at the sensor level.

CSXIT (and other rail terminal operators) are using a small vehicle called an IBC Cart that is narrow enough for two-way traffic between processing tracks, allowing IBCs to be removed from its platform. This allows the work to be performed safely by one person without them getting off the vehicle. Fitted with a GPS receiver, the IBC Cart can be tracked and its location used to create a safety exclusion zone over which a crane trolley cannot pass.

Van Tassel said the beauty of the system is the "halo" of its safety exclusion zone only shrouds the rail car that is being worked. The worker is protected without creating an overly large exclusion zone that disrupts the operation elsewhere.

While CSXIT is happy with its system for handling IBCs, Van Tassel said it is looking for a way to address signal shadowing issues under WSCs as it moves to semi-automation. When signals are lost or interrupted, the position of the halos can be inaccurate. An operator on the crane can drive around an IBC Cart effectively, but this will be far more difficult if the machine is remotely operated. CSXIT is now talking to suppliers about options for a secondary triangulation system, including radar.

Marine terminal lessons

CSXIT's path to semi-automated equipment can be instructive for marine terminals looking to make a similar transition. CSXIT is well placed to adopt crane automation today, because it started with the systems and process automation first – drivers control the load, but gantry crane moves are already selected and optimised by Tideworks' Traffic Control, while other systems select the crane travel path for each particular job. For the hub terminals in particular, taking the driver off the crane requires little if any change in the operational procedures at the terminal.

CSXIT is also looking to apply automation more widely, to RTGs and shuttle carriers. It actually has more RTG than RMG terminals, but these are a different challenge. Van Tassel said the whole RTG environment is much more difficult – some of the fundamental concepts from RMG facilities, such as using cantilevers to create zones where processes can be decoupled, do not apply to RTGs. "At this stage, nobody has been able to answer the most fundamental questions about how it would work," he added.

If a system requires a lot of infrastructure to be built around a standard RTG, it quickly loses the cost and flexibility advantages of a rubber-tyred operation. This includes ground and electrical work for mains power and data connections. To be viable at its smaller terminals in particular, any automation system on RTGs must be able to operate over a wireless connection, which is still a challenge in a terminal environment.

It is certainly not one that CSXIT wants to give up on, however. "Over half of our intermodal terminals will be stacking RTGs," Van Tassel concluded. ❑

CSXIT is implementing widespan gantry cranes at its largest terminals