THE MEGA-AGE

RESOLVING THE YARD CHALLENGE

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We inhabit the 'mega-age'. With its mega-ships and consolidated shipping lines, this era has shifted the focus from building new terminals to re-equipping existing terminals in order to improve efficiency and productivity. To avoid becoming a bottleneck, the yard needs to be equipped with the right solutions so that it can deliver the required increases in capacity and productivity while providing a cost efficient service for both waterside and landside operations. This is the yard challenge of the mega-age.

The consequences of mega-ships and bigger, but fewer calls on the quay operations has been widely discussed in the industry, yet less attention has been paid to the impact on yard operations, which for many terminals is an even bigger challenge. No matter the size of the terminal, many terminals experience the challenge of the terminal becoming too small. The cascading effect of ships will bring 13-16K TEU vessels into several new trades as more mega-ships than ever before will be delivered during 2018.

Due to the mega-age, a typical terminal today is an existing terminal that is exploring how to automate the yard in order to accommodate and handle more containers, while keeping the terminal fully operational during project execution.

AUTOMATIC CANTILEVER STACKING CRANES

Based on the experience we've gained from several terminals around the world, automated cantilever stacking cranes have proven to be a very efficient solution for reaching the required yard capacity and productivity targets. The cantilever stacking cranes are able to handle wider blocks, which means up to 20% more storage capacity within a given space/stacking height compared to yards with RTG operation.

Higher motion speeds, fast automatic positioning/landing and better scheduling capabilities make automatic and unmanned cantilever stacking cranes more productive than RTGs. Automatic cantilever stacking cranes allow flexible deployment of the capacity. This increases peak production capacity since all cranes can efficiently be used for landside and waterside operation as needed. The blocks typically have two cranes, but in the case of longer blocks, even more cranes can be deployed. The cranes can also move to the adjacent block on the same rail-track to make capacity available where it is needed.

Every terminal is different, and when it comes to where to place the blocks equipped with automatic cantilever cranes in an existing operation, there are several options. In some cases, space is the factor that drives the decision. If the freedom of choice is bigger, the rule of thumb is that due to their high performance the cantilever stacking cranes should be placed at the areas with high container flow. Thus, if the bottleneck of the terminal is at the delivery of containers to the quay, the cantilever stacking crane blocks should be placed close to the quay. If the issue is congestion and long waiting times for road trucks, these blocks should be placed closer to the terminal gate.

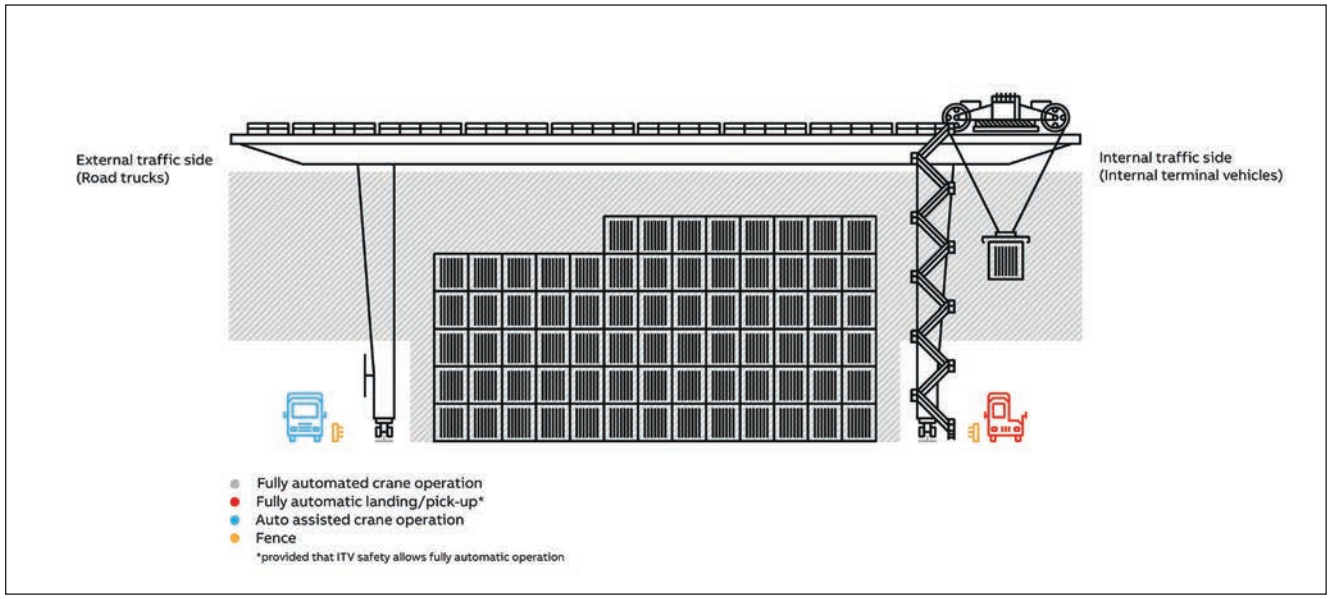


Figure 1: Container handling with automatic cantilever stacking cranes. Fully automatic operation and auto assisted operation. Fences prevent people entering the automated stacking area.

THE PROCESS

From the process point of view, operations based on cantilever stacking cranes are very similar to RTGs: The vehicles get instructions and drive to a specified block and bay, close to the crane that will perform the pick-up or set down of the container. The crane does not gantry long distances since the vehicles will be sent to the right position when they check-in at the gate and/or get the work order from the TOS.

When a vehicle approaches a block, the TOS dispatches the work order to the crane based on information about the vehicle location monitored, e.g. with RFID or a real-time location system (RTLS). In the case of external trucks, the TOS schedules a work order based on the truck "checking-in" at the terminal gate, and on the location of the target block at the yard. Ideally, the crane is in the right position ready to perform the pick-up/landing when the vehicle arrives to minimize the waiting time. In case the vehicle does not arrive at the crane within the estimated time frame, the crane requests remote assistance for manual intervention.

The truck driver can verify that he has arrived at the right position from a screen attached to the crane which displays the registration plate. The crane also verifies that the vehicle to be handled matches with the work order with RFID or MatchMaker (2D bar code reading system for automatic verification of the container-vehicle match at hand-off).

In the case of automated stacking cranes, intelligent automation based on distributed intelligence will handle the coordination and work split between the cranes. The list of work orders from the TOS are processed through an application included in the crane automation system. This application is similar to an equipment control system, and enables decisions on the sequence of the work orders based on defined criteria such as time, priority, or energy consumption criteria to be made.

PROVEN AND SAFE

Major parts of the cantilever stacking crane operation can be automated, and in some cases, fully automated. On the internal side, the pick-up can be made fully automatic, since there is no twistlock handling. Set-down of the container is typically remote operator assisted below the pre-defined safety height. If the automation system is equipped with a truck supervision function that ensures that the vehicle is in the right position and does not move during the landing of the container, it is also possible to perform the set-down of the container fully automatically.

When deploying automatic cantilever stacking cranes it is significantly easier to implement safety, according to the valid safety standards without interfering in the process. As illustrated in Figure 1, the vehicles are outside of the crane at all times, and never need to cross the crane's gantry rail. This ensures safety, and allows a high level of automation, reaching high productivity.

IMPACT ON INFRASTRUCTURE

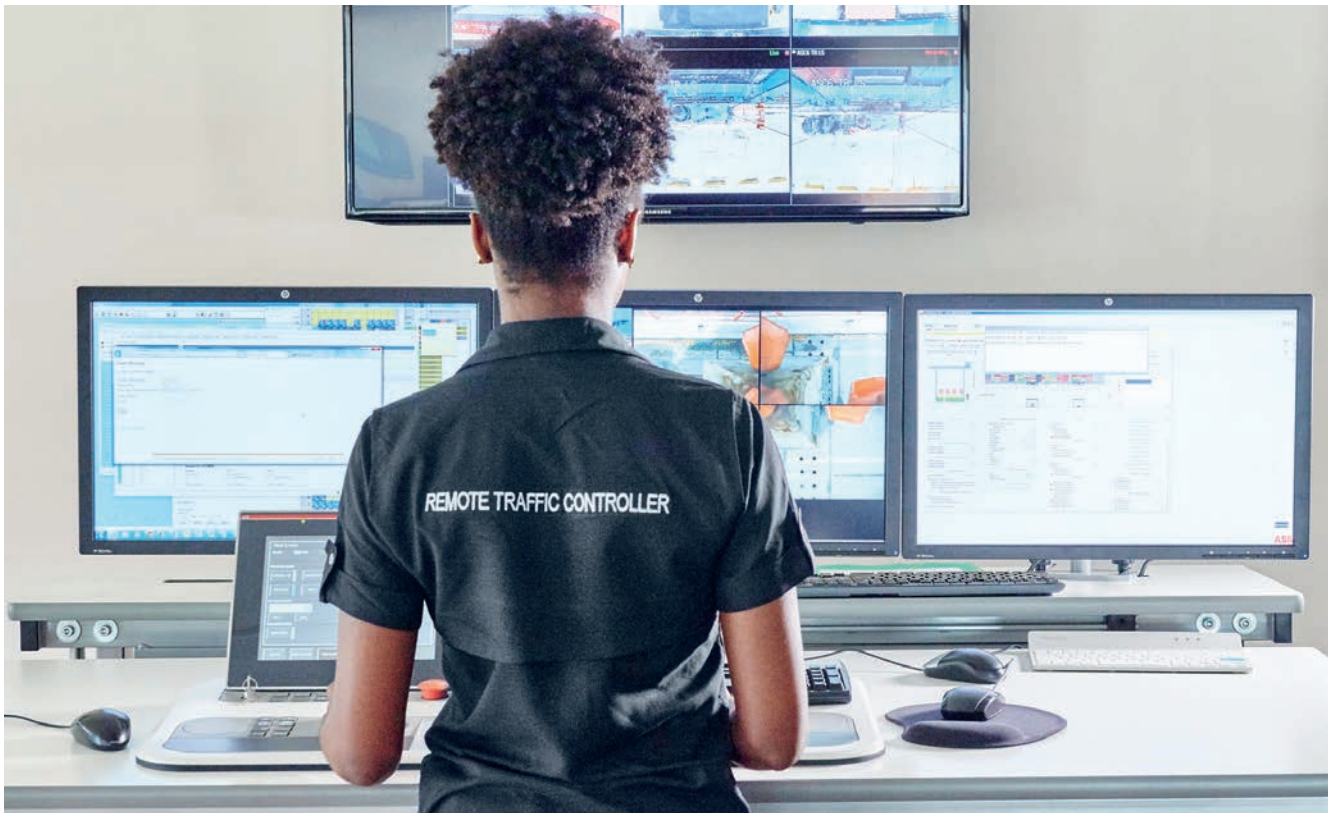
In existing terminals, an important question is what the impact of adding automatic cantilever stacking cranes on IT infrastructure and the TOS will be.

The good news is that the impact on both IT infrastructure and the TOS is very limited. There is no need to upgrade/change the TOS due to the introduction of automatic cantilever stacking cranes.

RTGs are often equipped with a VMT for the driver to select work instructions. The TOS submits the work orders within a certain range in the yard based on the configuration made by the dispatchers in the control room. The RTG drivers will coordinate and split the work orders among themselves. In the case of automated stacking cranes, intelligent automation based on distributed intelligence handles the coordination and work split between the cranes as explained earlier in this paper. This means that the TOS still submits the work orders as it did in the case of RTGs, and the application in the crane automation system will take care of the coordination between the cranes.

On the IT infrastructure side, adding automatic cantilever stacking cranes in RTG operations requires only adding switches and servers for running the above mentioned application and handling the vehicle identification and dispatching.

There are sometimes concerns raised about ground requirements resulting in costly civil works. With the available sensor technology container locations can be measured relative to the crane which allows operation on challenging ground conditions without impacting productivity or stacking precision. This means that in many cases, no piling or limited piling is required. Thus the total cost of the civil work can be kept reasonable and it will not significantly affect the project execution time and return on investment calculation.



The control room of Manzanillo International Terminal (MIT) in Panama. The remote traffic controllers handle multiple tasks in addition to supervising the automatic cantilever stacking cranes.

EXAMPLES

The following examples highlight the strategies that are worth considering for terminals seeking solutions for upgrading their yard operations in terms of capacity, productivity and safety.

MIT, PANAMA

Manzanillo International Terminal (MIT) in Panama moves cargo on from big ships to feeder ships serving the Caribbean region. 70-80% of their volume is transshipment, and the increased capacity of ships passing through the canal requires the terminal to be prepared for bigger volumes.

To ensure yard capacity, MIT needed to find a solution to increase yard capacity and improve efficiency and space utilization without having to replace all the existing RTG cranes. The focus was to improve service to the landside truck operations.

In 2015, MIT added six automatic cantilever stacking cranes to their existing RTG operation, allocating 15% of the yard space to the cantilever crane operation. The outcome has met all expectations and MIT reports that the stacking cranes representing only 8% of the total fleet perform 25% of all the moves in the entire operation.

The fully automatic cycle of the cantilever stacking cranes allows the remote operators/traffic controllers to handle multiple tasks, such as planning in TOS, in addition to supervising the cranes. This makes their role more versatile.

ASIAN TERMINALS

Asian terminals, where automated cantilever stacking cranes have been in operation since 2002 provide a good example of deploying automatic cantilever stacking cranes on a larger scale.

When operations have been shifted to new port areas, automation, especially automatic cantilever stacking cranes, have been gradually introduced. For instance in Korea, in Busan and Incheon, five terminals today have over 180 automatic cantilever stacking cranes, delivered in 14 batches, in operation.

The cantilever stacking cranes have delivered high productivity, fast integration and short ramp up time to full production. For instance Sun Kwang's terminal in Incheon shifted from their RTG terminal to the new terminal equipped with automatic cantilever stacking cranes in just one day, and doubled the handled container volume in six months after opening of the new terminal.

Now we also see a new pattern. A number of brownfield terminals in the Asia region have adopted a step by step approach in increasing the yard capacity and productivity. Projects where as few as four automatic cantilever stacking cranes were installed in an existing RTG operation have already been completed and more are under delivery.

Today the automated cantilever stacking cranes can be said to be a preferred yard equipment in high productivity terminals with about 700 units in operation/under delivery worldwide.

ABOUT THE AUTHOR

Björn Henriksson is the Global Technology Manager at ABB Ports. He has long and versatile experience on container terminal automation and electrical systems through the various positions he has held over the years within R&D, engineering and commissioning, including several management positions. Björn Henriksson joined ABB in 2001 via ABB's Executive Trainee program and has a Master of Science degree in Electrical Engineering from Royal Institute of Technology in Stockholm (KTH), Sweden.

ABOUT THE ORGANIZATION

ABB Ports develops and delivers intelligent terminal automation solutions and services to make container terminals safer, greener and more productive. The solutions include automation and remote control for all types of container handling cranes, and complete OCR and electrical systems. With the track-record of the largest installed base, ABB's systems help to optimise container handling from ship to gate in greenfield installations and in existing terminals.

ENQUIRIES

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