Is yard automation getting easier?

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Introduction

ABB, formerly ASEA, has been actively supplying cranes and related equipment for over 100 years and has delivered electrical and automation equipment to more than 1,200 cranes of all types and in all parts of the world.

ABB has and will supply automation and electrical equipment to a number of demanding automation projects, such as CTA, Hamburg, Euromax/Rotterdam, Hanjin and PNC in Korea and Kaohsiung and TPCT in Taiwan.

Close to 200 automatic RMGs around the world are operating with electrical and automation equipment supplied by ABB. Another 150 are in various stages of project execution or commissioning.

ABB has extensive experience from working with a number of different crane manufacturers and TOS suppliers, and recent RMGs have been manufactured by ZPMC in Shanghai.

Our focus is on utilising proven, but at the same time, state-of-the-art technology to facilitate safe, cost-effective and highly productive handling of containers for terminal operators.

Yard automation examples

Automatic stacking cranes (ASC or ARMG) are becoming standard products. The challenge today is in choosing the right concept and the best method for conducting overall control of operations. The level of automation must be optimised from a number of standpoints:

- Investments
- Operational costs
- TOS (Terminal Operating System)
- Export/import vs. transshipment
- Vehicle separation
- Environmental impact
- Other matters

CTA, Hamburg (end-loading with AGVs)

Euromax and CTA/Hamburg are the most advanced terminals in the world.

Figure 1. End loading with AGVs at CTA/Hamburg.

Figure 2. Side-loading with Internal Transfer Vehicles (ITVs), Kaohsiung, Taiwan.

The blocks are end-loaded, which requires that the containers and workloads be properly distributed over the yard in order to achieve high productivity (see Figure 1).

Interfaces between automatic cranes and vehicles, and just-in-time waterside delivery place stringent demands on the software (TOS) controlling operations.

The time to in which it takes to reach full operation is long, as thorough testing must be performed to attain the specified performance, which is a flawless interaction between the QCs, ARMGs and AGVs. This is due to the required 'handshaking' between them.

Kaohsiung, Taiwan (side-loading with ITVs)

This type of operation is the most popular in Asia, such as in Korea and Taiwan.

The combination of side-loading and use of manned tractors and chasses for waterside operations reduces the required sophistication of the TOS. Here as well, a just-in-time concept is employed, but because manned vehicles are utilised, the sophistication of the software is much lower (see Figure 2).

Other (end-loading with manned shuttle carriers)

Two terminals using manned shuttle carriers (ShCs) between the docks and blocks are now in operation in Belgium and the US, and additional projects are being planned in Germany, Spain, the US and other locations.

With this design, a container is grounded both on the dock and in the transfer zone for the block – no just-in-time arrival is required for interaction between the cranes and the shuttle/straddle carriers.

Consequently, the overall requirements on the software are lower and the period for operational testing relatively short.

Concept comparison

The increasing popularity of the end-loading concept with shuttle carriers seems to be based on the fact that it does not score negatively for any of the evaluated parameters (see Table 1).

Maintaining manually operated vehicles can also be seen as an advantage when dealing with labour issues. However, new concepts for AGVs with which containers can be grounded on a fixture or cassette have the potential to revive interest.

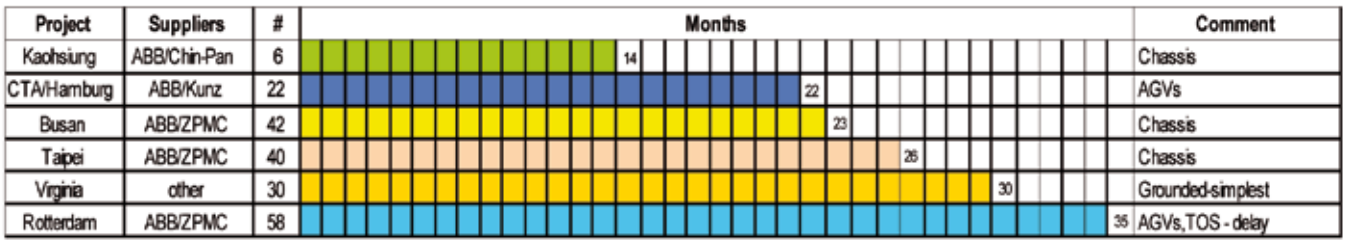

Figure 3. Months from contract signature to handling of first ship.

TABLE 1: LOADING COMPARISON CHART

	End-loading & AGVs	Side-loading & ITVs	End-loading & ShCs
Investment	-	+	0
Operational costs	+	--	0
TOS complexity	--	+	0
Manning	+	--	0
Operational flexibility	-	+	0
Environment	+	-	0

Delivery times for automated projects

The time from contract signing to handling of the first ship in commercial operation is depicted in Figure 3 for some significant projects:

As can be seen, the span is large and the correlation between system complexity and delivery time is not obvious.

Summary

Yard automation is presently utilised with the following:

- Export/import and transshipment ports
- End-loaded and cantilever type RMGs
- A wide range of crane sizes
- Interfacing all kinds of vehicles, AGVs, shuttle/straddle carriers, ITVs, external forklifts
- All practical rail and weather conditions
- Interfaces to various TOS systems
- Safety requirements in all parts of the world
- Several other applications

A trend that will make life easier for terminal operators is that the scope can now be increased from delivery of an RMG to that of a functioning block. This can include the landside and waterside transfer zones, access control for reefers, card readers, etc.

Conclusions and recommendations

Some recommendations can be made based on the above and from other automation projects underway in Europe:

- Work with experienced suppliers
- Maintain the project team
- Involve operations early in the project
- Test the TOS before going into operation
- Work up front with customers (shipping lines and truckers)
- Optimise the operational testing

By adhering to these terminal operators can introduce automation while minimising both risks and investments. Actually, detailed studies show that investments can be even lower than for manually operated terminals.

Examples:

- Straddle-carrier operation for a transshipment port – Introduction of yard automation and high stacking will result in lower investments due to far-better utilisation of land and lower costs for civil works
- RTG operation compared with auto-cantilever RMG – Due to the higher performance of automatic CRMGs, fewer cranes are needed, which more than compensates for the higher cost per crane, including rails and civil works

When applying the recommendations above, delivery time for an automated terminal (from order to first commercial vessel) can be within the range of 15 to 20 months, or even shorter.

ABOUT THE COMPANY

ABB Crane Systems' main mission is the efficient and optimised handling of containers, bulk materials and steel products in ports, power plants and steel mills. The productivity and quality of the installations are improved in a cost-effective way by applying total solutions based on knowledge of the customer's processes.

ENQUIRIES

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