A new concept in handling mega-ships Part II

Frans Koch, *CEO,*
Koch Consultancy Group, Goes, the Netherlands

In Port Technology International Edition 65, Frans Koch presented his NGICT- (New Generation Integrated Container Terminals) concept as solution to increase the number of quay cranes on one ship and to improve the productivity of each quay crane by a higher performance in stack operations.

The article brought him many reactions from across the industry, and Frans now wishes to provide further explanation about other possibilities within the system. In this second part of the article, Frans concentrates on the transfer between AGV (automatic guided vehicle) and OHBC (overhead bridge crane) directly behind the STS-cranes at deep-sea terminals.

The transfer location

First of all, it is important to see that the location where a transfer usually takes place can be shifted approximately 100 metres towards the quay. At the current modern automated container terminals, stack lanes are perpendicular to the quay, and the transfer between AGV and RMG takes place a great distance from

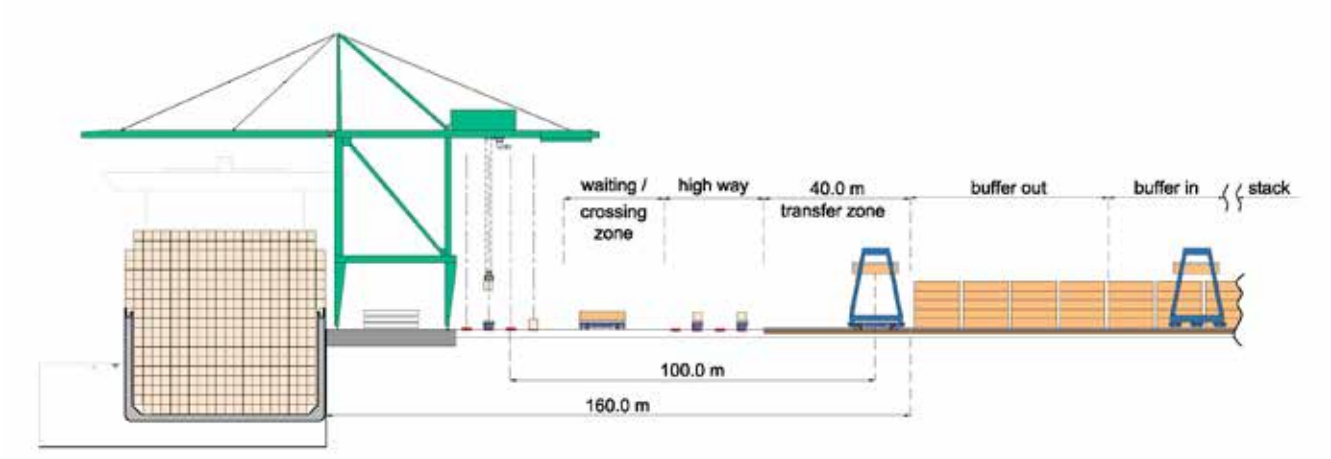

Figure 1

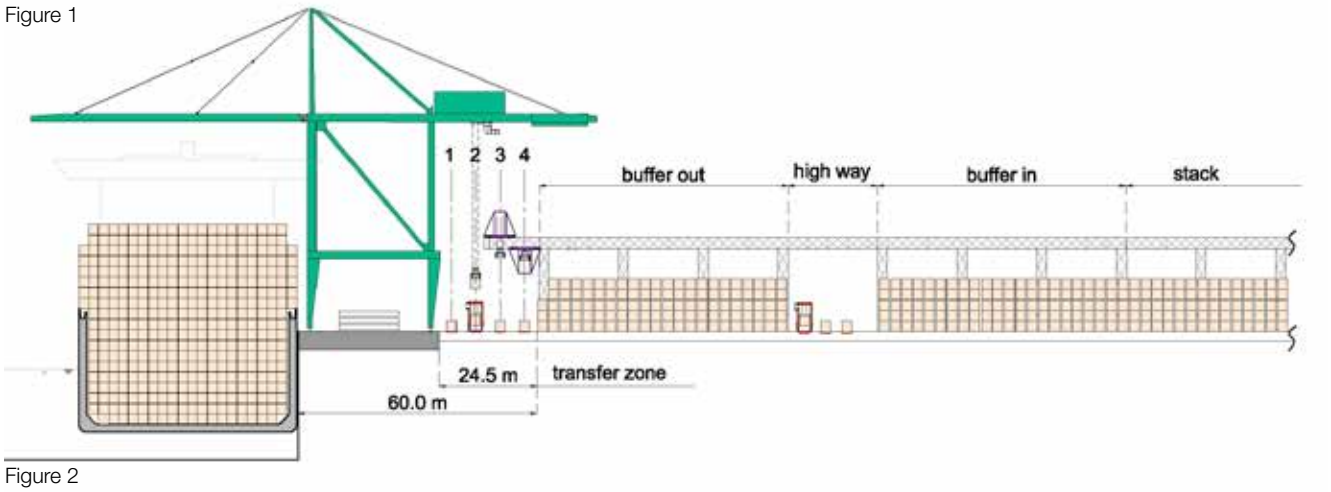

Figure 2

the back-reach of the STS cranes (see figure 1).

Both the turning radius of the AGVs (and lift-AGVs) as well as the great number of AGVs per STS-crane require a distance of about 100 metres perpendicular to the quay in order to transport and distribute the containers between the STS-cranes and the stack area. The transfer zone itself, where the AGV turns out of the driving track to get underneath the reach of the RMG, requires about 40 metres.

In the NGICT-concept the stack operations will be carried out by OHBCs. The support structure can be built underneath at the back-reach of the STS cranes (see figure 2).

The 'I' in 'NGICT' stands for 'integration' between the stack area and the STS area.

Due to this positioning, the stack area becomes much bigger and the transport area becomes much smaller which results in a higher stack capacity and an important reduction of travel distance for each container.

The STS cranes, after the twistlock is removed, let the containers down in one of the 4 transfer tracks. The current laser technology prevents the risk of collision between the moves of the STS-cranes and the moves of the OHBCs.

Without any changes in the dimensions of the current STS cranes, and based on the bay-layout of the current vessels, it is possible to place 55% to 60% of all containers directly in between the support structure in transfer track 3 and 4 (figure 2) within the reach of the OHBCs.

Should ship designers and terminal designers know each other's wishes, this percentage could be much higher, which would be profitable for both shipping companies (shorter berth time) and terminal operations (faster process and less devices).

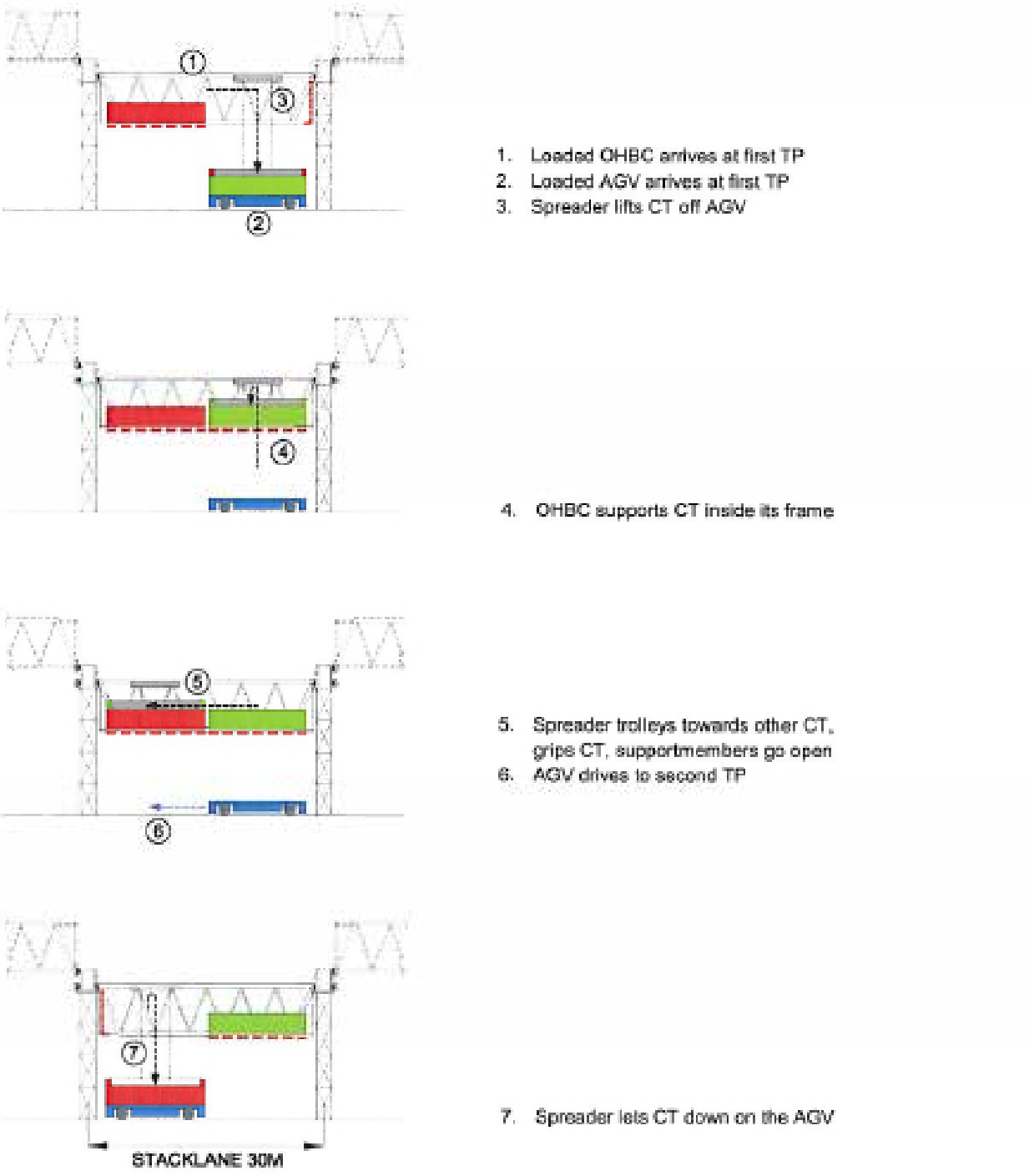

Figure 3

The other 40 to 45% of the containers which would otherwise touch the cantilever must be placed in transfer track 1 or 2. Transporting these containers from transfer track 1 or 2 over a very short distance to transfer track 3 of 4 can be done by the current AGVs (or lift-AGVs or by a future two-directional AGV, or even by current shuttle carriers.

In this comparison the fastest way will be by shuttle carriers which have the advantage of an uncoupling in the process in relation to both STS crane and the OHBC as well.

Advantages of OHBC

Besides the advantages of the OHBC opposite to RMGs which have been explained in the first article, it is very interesting to consider the transfer zone between AGV and OHBC in more detail. Striking first of all is the reduction of space occupation. (In figure 1 the stack area begins at 160 metres from the quay. In figure 2 that is 60 metres).

Therefore the number of AGVs per STS-crane could be cut down by approximately 75% (simulations will determine the exact number). Secondly, what also must be mentioned is the reduction of travel duration at the transfer point itself. To enter the reach of the RMG, the AGV has to turn off its track, and after transfer of the container turns back on its track again which requires approximately 60 seconds (exclusive time for placing a container on a rack and lifting the container by a RMG). The transfer between AGV and OHBC takes place in the transfer track itself without any time loss for extra horizontal transport at all.

Thirdly, both 'upper' and 'under' OHBC can carry two 40ft containers at a time within its frame (with one spreader) which makes it possible that two AGVs can be unloaded and loaded in one and the same stack lane within 120 seconds. This process is analyzed in figure 3.

Productivity of OHBCs

The productivity of OHBCs depends on the vertical and horizontal distance per cycle. In general, a well designed layout with two OHBCs, one 'upper' and one 'under' per stack lane, are able to follow the productivity of one STS-crane together. During the period the STS-crane is transferring in transfer track 3 and 4, the workload will be distributed over the two stack lanes on either side of the cantilever which results in a higher productivity potential.

So, in case 4, QCs are working on one ship, the containers will be distributed over 2 stack lanes directly and 4 stack lanes indirectly which gives a total of 6 stack lanes.

In the case of 5 QCs that will be a total of 7 or 8 stack lanes and in case of 6 QCs it will be 8 or 9. Because of the fact that the productivity of 2 OHBCs is more than double the productivity of an RMG, and from that point of view there is no need to spread the workload over a greater number of stack lanes as usually happens.

Transport of containers parallel to the quay

By transfer between STS cranes and OHBCs, as described before, there are fewer possibilities in regard to positioning a certain container in the designated stack lane.

Transportation of containers parallel to the quay is a must for all terminals but the quantity and intensity and the most favourable position to do that depends on unique factors which apply to each terminal.

For terminals with 0% transshipment and 100% hinterland by trucks, it is not important for import containers which stack lane a container will be found, provided each stack lane has one or two of even more truck transfer points. For export containers on such a terminal, it is necessary to distribute the containers, parallel to the quay in order to get the buffer-out corresponds with the stowplan of the ship.

An obvious position for a distribution road parallel to the quay will be on a short distance behind the buffer-out stack (see figure 2). For terminals with a substantial quantity of transshipment the transport of containers parallel to the quay will be much more. In that case the distribution road should be designed as a sort of 'highway' consisting out of sufficient number of tracks.

The transport itself can be executed by very simple one-directional AGVs or shuttle carriers. The advantages in respect to the current AGVs (and lift-AGVs) in such a highway are:

- The distribution of containers parallel to the quay takes place outside the "nerve-centre" of the terminal without deadlocks and without risk of congestion
- All moves take place in one straight transfer line parallel to the quay without turnarounds
- No deadlocks can occur because traffic crosses take place on two levels (AGV on ground level and OHBC on high level)
- Because of no turnings, the travel distance becomes shorter which results in time saving as well
- The number of AGVs can be reduced significantly
- Faster processing in the STS-area results in shorter berth time

The influence of call-sizes

As stated before, the highway parallel to the quay should be situated close behind the buffer-out stack. The most favourable distance from the quay could be determined by the quantity of the average call-sizes (see figure 2).

Conclusion

In this part II of handling mega-ships the focus has been restricted to the logistic advantages of the NGICT-system in the transfer zone between STS-area and stack area. In landside transfer zones between stack area and truck area, the NGICT-system offers important advantages as well which will be explained in a future part III.

About the author

Frans Koch, founder of the Koch Consultancy Group (1994), forms together with his son Mathé, the general manager of the team of engineers and architects in the Netherlands who constitute Koch Consultancy Group. Both Frans and Mathé are both registered designers and hold a PMSE in structural engineering.

About the organisation

KOCH Consulting Group
Engineers & Architects

Koch Consultancy Group consists of Raadgevend Ingenieursburo F. Koch B.V., Allant Architecten B.V. and Koch Projectmanagement, a local multidisciplinary organisation of consultants, architects and engineers. Its portfolio concentrates on projects in favour of industry, harbour and marine structures, civil works, buildings, energy production plants and wind turbines.

Enquiries

Mr Frans Koch
Managing Director / CEO

Email info@kochadviesgroep.nl
Tel: +31 (0) 113 213030
Fax: +31 (0) 113 213122
www.kochadviesgroep.nl
www.ngict.eu.