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UNIQUE AUTOMATED HANDLING SYSTEM IN ALTENWERDER INTERMODAL TERMINAL

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Introduction

Altenwerder intermodal terminal (Also known: CTA - Container Terminal Altenwerder) belongs among the most advanced intermodal terminals not only in the largest German port - Hamburg, but also in whole Europe. Technical and technological equipment enables automated intermodal transport units (ITU) reloading, therefore it is one of the most modern terminals in the world. It is located on the southern arm of the Elbe River next to the Kohlbrand Bridge.

Terminal capacity (reloading turnover) is 3 million TEU per year. Surface terminal capacity is 33 thousand TEU (of which 3 thousand TEU - for isothermal ITU). Quayside, with a length of 1 400 meters, allows anchoring and reloading of four "Post-Panamax" container ships with the use of 15 gantry cranes (one of them is adapted for inland vessels reloading) [1].

Handling with intermodal transport units (containers)

Reloading of containers in Altenwerder intermodal terminal takes place in several phases which are carried out in various service areas [1]:

- Containers reloading from container ships with the gantry cranes utilisation on AGV (AGV - Automated Guided Vehicles) trucks,
- Containers movement into designated blocks movers with the AGV trucks utilisation,
- Containers reloading in designated blocks movers with the ASC (ASC – Automatic Stacking Cranes) cranes utilisation,
- Containers reloading in the railway terminal with the Semi-automated Gantry Cranes utilisation.

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The actual loading/unloading of containers from ships, both marine as well as those designed only for inland waterways, is performed by semi-automated gantry cranes on a wharf edge. Cranes are equipped with the main reloading equipment (spreader), which realises the containers movement from a container ship on a special storage platform (with two positions), located on this crane. Moreover, their removal is performed fully automatically. Crane is operated just by one person (crane operator). He performs the containers reloading from ship on a gantry crane storage platform [2].

Each gantry crane is equipped with this storage platform, containers are gathered on it, and then they are moved by automated spreader from it and reloaded onto the prepared AGV trucks in the storage area. This automated technology saves considerable time while containers are reloaded on the wharf edge and at the same time, increases the safety of a work. This method of reloading is about 30-40% more efficient than current reloading systems with gantry cranes with a manual operation [2].

Semi-automated Gantry Cranes in Altenwerder intermodal terminal are shown in Figure 1.

Fig. 1 - Semi-automated Gantry Cranes [1]

Another important handling device for containers movement from Semi-automated Gantry Cranes is AGV - Automated Guided Vehicle (There are 85 AGVs in operation in terminal currently). The containers movement from wharf edge into a predetermined block is provided with their help, there are in a total 26 blocks in the terminal. Drive and safe movement of vehicles is ensured by laser detectors to detect the presence of obstacles in the driving lane [2].

The actual reloading process begins by furnishing ship for the unloading. At this moment, the particular gantry crane and containers movers are assigned to the ship. Each container contains the information where it should be reloaded, and it is forwarded to the automatic container carrier that transports this container to its destination. The mover's driving lane consists of straight sections, which are supplemented with curves with an angle of rotation 90° [1].

The development of navigation and control system is very closely associated with the operation of AGVs. Integrated communication system is able to handle more than 250 instructions simultaneously and constantly communicates with the control system. The navigation system includes passive transponders embedded into the terminal road infrastructure. When the AGV moves through this transponder, it is possible to determine its exact location in the coordinate system.

ASC (Automatic Stacking Cranes) allow the further significant acceleration and improvement of containers reloading in the terminal. These cranes ensure the transport and reloading of containers within the terminal area on the reloading area, which is divided into 26 blocks (including 3 blocks allowing the storage of isothermal containers). Each block has a width for storage of 10 containers and length for storage of 37 containers. Each block is operated by two gantry cranes ASC. Every day, 3 625 road freight vehicles and 810 wagons are handled in the CTA terminal [1].

Cranes are automatically controlled, achieve short time cycles of individual operations and are characterised by high precision of focus on the container position. A fully automated system of stacking can flexibly change a lift height and performs containers stacking from one up to five layers.

The railway terminal with 6 tracks with a useful length of 700 m, which is served by four rail gantry cranes, is available for the connection of the CTA terminal to the railway network. Containers are transported by terminal movers (there are 200 container movers including 15 terminal tractors in operation in CTA terminal) to this part of terminal [2].

These performances led the terminal operator to a higher system of automation of reloading procedures and thus to an introduction of Automated Guided Vehicle. Technical and technological improvements and automation of reloading operations support the high labour productivity while minimising of operating costs and guarantee the short period of containers storage in the terminal.

Automatic Stacking Cranes and Automated Guided Vehicle in Altenwerder intermodal terminal are shown in Figure 2.

Fig. 2 - Automatic Stacking Cranes and Automated Guided Vehicle [1]

Conclusion

World trade liberalisation and intensification of international division of labour are the current trends in world trade. In connection with the world trade development, also the importance of maritime transport is growing. Maritime transport is involved in a significant way to global transport of goods. Containerisation of cargo introduction became an important step in the maritime transport development and allowed it more effective. The degree of general cargo containerisation still increases and in the world's major ports has already on average exceeded the limit of ninety percent.

The existence of high-quality connections with the hinterland, sufficient reloading capacity, infrastructure and the most modern technology, providing quick and efficient operation process with container consignments in the terminal, as well as good connections in terms of maritime transport are prerequisites for successful port (intermodal terminal in the port) integration into the transport chain.

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