Planning tools for maritime shipping

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3-D rendering of a virtual offshore terminal. © Fraunhofer CML

As global flows of goods continue to rise, the demand also rises for available port-related capacity and the logistics that goes along with it. This is true for new seaports in planning and existing ones, too. The biggest challenge of all: the large number of influences that have to be factored in – from roadways and dockside or gantry cranes, truck gates or rail transshipping facilities to lay times or container capacities, and from legal regulations to deadlines. Reliable decision-making calls for a capability to compare and assess different variations with preset key

figures, such as space requirements, the number of ground slots needed or CO2 emissions. For these requirements, researchers at the Fraunhofer Center for Maritime Logistics and Services CML in Hamburg have come up with the "Toolbased Rapid Planning Environment," or ToolbaRPlannEr for short. This modular software system can efficiently work through complex planning tasks for seaports, port terminals, logistics areas and transshipment centers in the hinterland – so-called hinterland hubs.

Strolling through 3-D plans where simulations are used to identify bottlenecks

"The ToolbaRPlannEr consists of three components. The planning environment is composed of a multi-touch table with the aid of which variations can be planned and assessed in 2D and visualized in real-time in 3D. A library of maritime building blocks was also created in connection with this. Because the building blocks are reusable, the variations can be planned much more quickly," explains Dipl.-Ing. Robert Rauer of CML. "Users can shift future buildings, facilities, roadways or even material flows at will. The future operator can also take a virtual tour of these fields in the planning environment." The defined software interface permits exchange with simulation software to assess what was once static planning based on a dynamic simulation. This helps pinpoint possible bottlenecks in the process. It also prevents media fragmentation – and thus double-entry of data – while accelerating the planning process. The third component of the system is the ship simulator. With the aid of this tool, local conditions of the harbor basin are virtually coordinated with navigational requirements. Because all three units are interlinked through a database, each unit can access the library of maritime building blocks.

Concepts for tomorrow's "green" container terminals

The possibilities of this system are extremely flexible: For instance, CML staff drew up a concept study for a "green" container terminal in the year 2030. After they modified a few of the parameters, they were able to demonstrate that fuel consumption - and thus emissions as well - could be reduced by around 12 to 15 percent. As CML employee Claudia Bosse explains, "Our idea is to use electric drive for liftable, driverless transport vehicles and multi-trailer units that can transport several containers at a time. We've also relocated things such as railway tracks for direct transshipment using a new, rail-guided gantry crane to a lower level of the terminal."

The system was also used to plan a terminal for off-shore wind power plants. A problem with the erection of wind parks is that work is impeded by severe weather and rough seas, so there are only narrow time windows available for the work required. The bulk of the available time is consumed simply transporting the components themselves. That's why charge times in harbor should be made as effective as possible. Ships and plants, material and staff must be available immediately as soon as weather conditions permit construction work on a wind park to proceed. What this means is: storage areas and lodgings at or in the immediate vicinity of the harbor, and direct ship access for heavy transports of large components for the wind turbines. "Taken together, these factors generate a very specific layout for this terminal. And what virtual planning can accomplish can be seen particularly in the handling requirements for large components, and in the ways we can represent and describe them. Visualizing travel distances and turning circles also helps us update existing terminals," Bosse points out.

Virtual reality accelerates construction of special ships

Another example of the potentials of virtual planning is the construction

of special ships. Engineers must develop nearly everything from scratch, from the bridge to the engine room. Often many of the subsystems - such as the ship's drive, ventilation, cooling or fire-extinguisher systems - are housed in tight quarters. These must be accessible and easy to operate at the same time. Developers at the Fraunhofer Institute for Computer Graphics Research IGD in Rostock use ergonomics simulation software to make the ship come to life as a 3D model on the computer. This way, shipbuilders can evaluate new ship designs, preventing errors before they arise, and most importantly designing demanding superior special ships more quickly than before.

Other topics are factory planning for maritime production facilities and measurement systems that can be used to monitor structures and provide early notice of any errors or faults identified. These exhibits by the four Fraunhofer Institutes can be visited at SSM 2012 (Hall B6, booth 317) from September 4-7 in Hamburg.

More information: At the SMM 2012, shipbuilding, machinery & marine technology international trade fair, 4 to 7 September 2012 in Hamburg, four Fraunhofer Institutes will be exhibiting solutions that make it easier to plan and build seaports, terminals and ships – Hall B6, booth 317.

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