Summary

Already at the early stages of terminal planning and design the span and stacking height of the used RTG play an important role. The dimensions determine not only the pavement foundation strength that is required by the expected loads from the RTG and the stacked containers, also components like drainage systems, lighting equipment are positioned accordingly.

The assignment was to develop a tool that allows the terminal designer to base his selection of the dimensions on a complex equilibrium of actors in stacking yard design such as throughput and storage capacity, ability to cope with peak situations, operational cost and initial investments. This tool, however, is not based on time consuming and expensive simulation software, because this requires detailed input that is not present during the early design stage.

The number of required shuffle moves derived as a function of the amount of containers present underneath an RTG, and the average gantry travel distance was derived as a function of the length of stack it services. The approach is to model the entire stacking yard as if it were one long continuous stacking lane in which the stack length that is serviced by one RTG is determined by the number of RTG's in operation. The time it takes an RTG to perform one move, consisting of picking a container, placing it onto a truck and return to the initial position, is calculated using the RTG manufacturer data.

In combination with the derived equations, the effective capacity of an RTG including gantry travel, trolley travel and hoisting is then calculated which yields a solution for the required amount of RTG's dependent of the operational data during average and peak situations. This solution is calculated for each of the 9 RTG span and stacking height combinations which, combined with operational costs, provides the designer with a solution that complies with the operational demands and required storage capacity with the least costs.

The described tool is then applied on a test case with an annual throughput of 1.900.000 TEU of import containers, from which a terminal lay-out is derived. This lay-out is then presented as a terminal design, which can be seen from the top view.

Tools such as the one described in this report have the potential to reduce the time it takes to design a terminal, eliminate some RTG span and height combinations in terminal design and examine future terminal expansions. The focus of future research should therefore lie on expansion, fine tuning and validation of such tools, which are not based on simulation.