Summary

At a container terminal containers are being transported from a stack to a quay crane and vice versa. When designing a terminal optimizing the occupancy rate of the quay crane or cranes is critical for the maximum terminal throughput capacity as a whole. A method of doing this is by creating an AGV-Buffer near the quay crane.

In this paper the influence of several aspects of implementing the AGV-Buffer is looked at. For this a literature review is made in order to view what aspects are relevant and what aspects are less relevant in order to dimension the AGV-Buffer near the quay crane. An analysis is made of the automated container terminal and how to simulate the specific problem. The main objective is to view the relation between the occupancy rate of the quay crane and the amount of spots needed in the AGV-Buffer.

The model itself is a simplification of reality (see Figure 1). The quay crane is loading the segment of a vessel until it is full. The quay crane gets the containers from an AGV, which is in the AGV-Buffer. The AGV gets the container from a stack and drives to the AGV-Buffer.

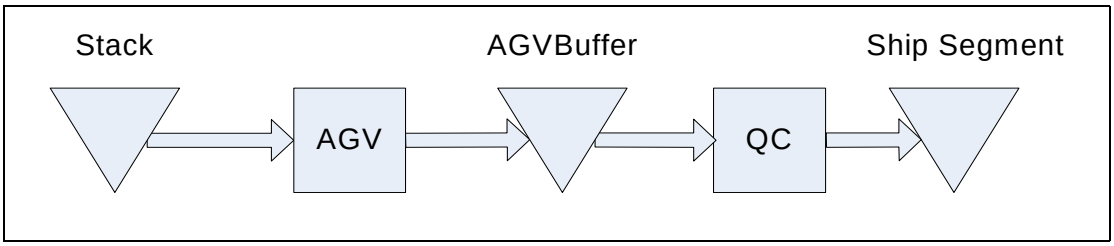

Figure 1: Scheme of the loading process of the model

The assignment is to look at the influence of stochastic within the system at the occupancy rate of the quay crane when loading a vessel using an AGV Buffer. At first a Programme Description Language (PDL) of the specific part of the terminal is created. The PDL is universal, so it can be implemented in numerous software packages. The simulation platform used for the model is Borland Delphi, combined with a tool called TOMAS ("Tool for Object oriented Modelling And Simulation"). The model has 2 control strategies: the first in which the cycle times of the quay crane can be predicted in advance, so the filling of the AGV-Buffer can be done, taking the quay crane cycle time into account (QC-cycletime Dependent). The second in which the cycle times cannot be predicted in advance and the filling of the AGV-Buffer is done by keeping a constant number of AGVs active (Buffersize Dependent).

Several experiments are done with the model:

Sensitivity Analyses in order to rule out the chosen start values of the random seed on the outcome of the experiments;
The results of "loading by number" in contrast with the results of random loading;
The results of the "Buffersize Dependent" in comparison with the results of the "QC-cycletime Dependent";
The results of the distribution settings in which AGV travelling times can be predicted better compared with a situation in which shortest AGV travelling time and longest AGV travelling time are more extreme and therefore further apart.

The results show some insight on the impact of the AGV-Buffer depending on how a specific container terminal can be modelled.