THE IMPACT OF LAYOUT CONFIGURATION ON THE EFFICIENCY OF THE CONTAINER TERMINAL

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Introduction

International sea-freight container transportation has grown significantly over the last year and container terminals have undertaken heavier tasks and more important roles to achieve better service quality in the supply chain. The quality of service they can provide depends on their operating policies and the design of the terminal layout. Basically the efficiency of the Container Terminal depends on the layout configuration which provides high performance of the material handling equipment, proper arrangement of buffer zone, optimum traffic route etc. Crane crashing and collision of prime movers also can be minimized with a proper Container Terminal layout. Murty (2007) has summarized some of the problems regarding layouts based on designs and the importance of maximizing the quay crane rate. Vis and Koster (2003) give a comprehensive review of literature on container terminal planning and operations. Up to now what appears to be lacking is research in addressing the problem of impact of the layout on the Container Terminal efficiency. This paper presents simplified container terminal layout to minimize transportation time and enhance the impact of the layout on container terminal efficiency.

Methodology

For the purpose of study, number of layouts were taken in to account and they were compared in order to achieve more efficiency for relevant requirements such as the size of the sea port, number of containers to be transported. A schematic diagram of a selected layout is given in Figure 1.

Considering that all the Quay Cranes (QCs) and the blocks in the yard area are represented by nodes, the distances have to be traveled were calculated. Hence the time taken to overall transportation of containers in a particular ship could be calculated. Also we considered about the traffic congestion in transportation and a layout was developed with bidirectional paths, additional pickup and drop off stations. Thereafter a layout with some traffic rules and without traffic rules was designed in Arena 10.0. Then the impact of the layout on the efficiency of the Container Terminal was investigated with the consideration of traffic congestion.

Figure 2 is the arena simulation model for the layout considering the traffic congestion.

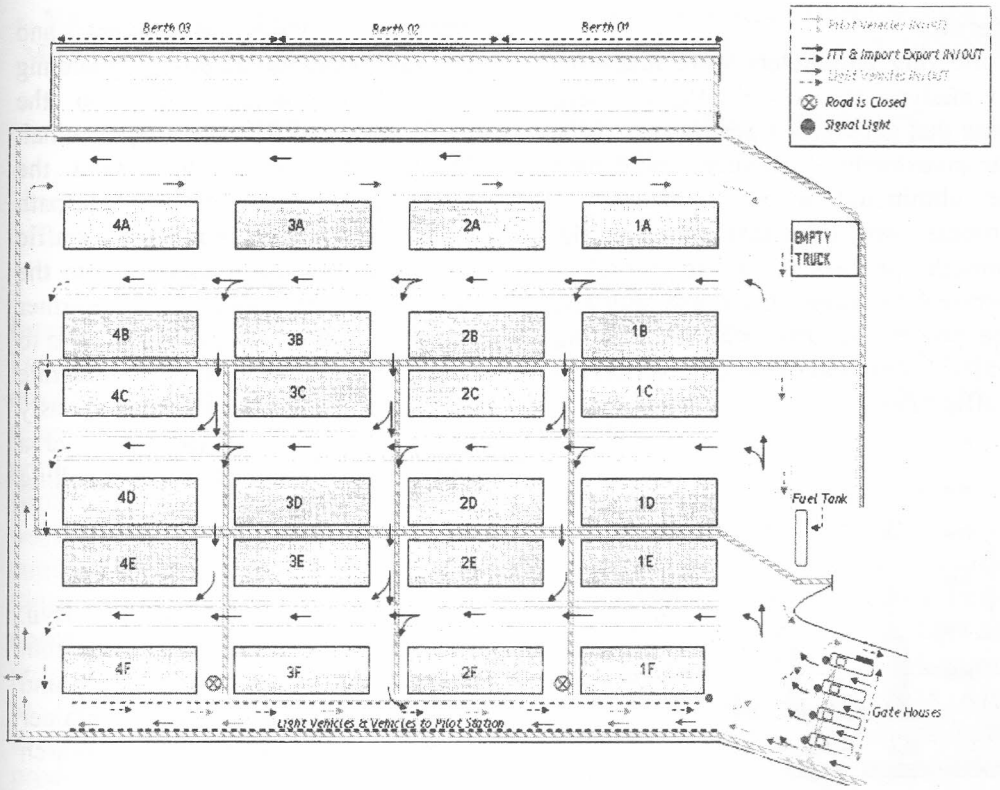

Fig 1. Layout of the tested container terminal

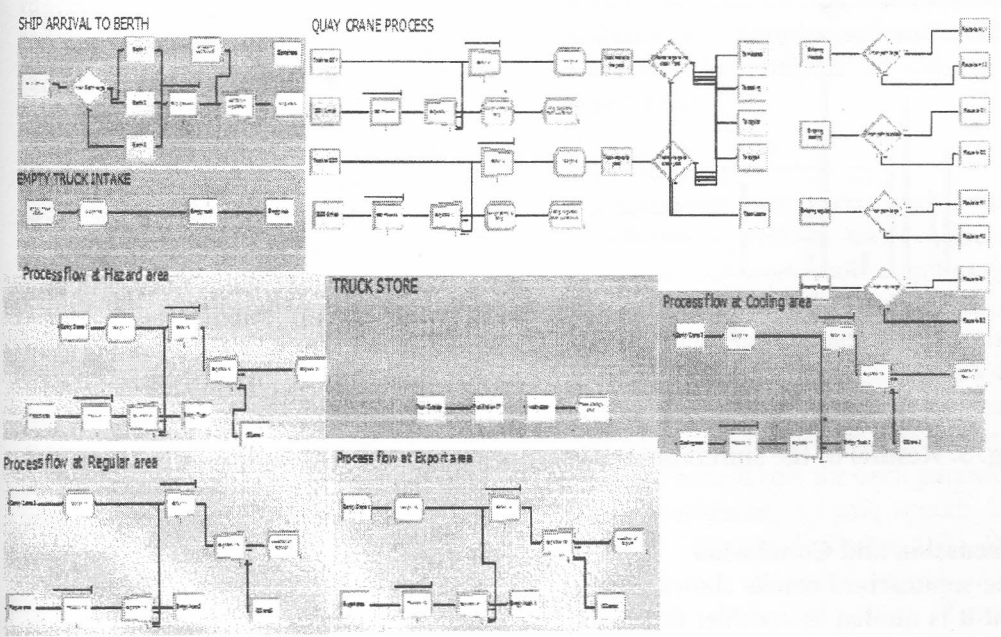

Fig 2: Arena simulation model result

Results

Following parameters were measured to analyze the model: Value added time that generates a positive return on the investment of resources and cannot be eliminated without impairing a process, wait time that interrupts the smooth process flow at container terminal for empty truck and ship and the processing time with considering traffic rules and without considering traffic rules.

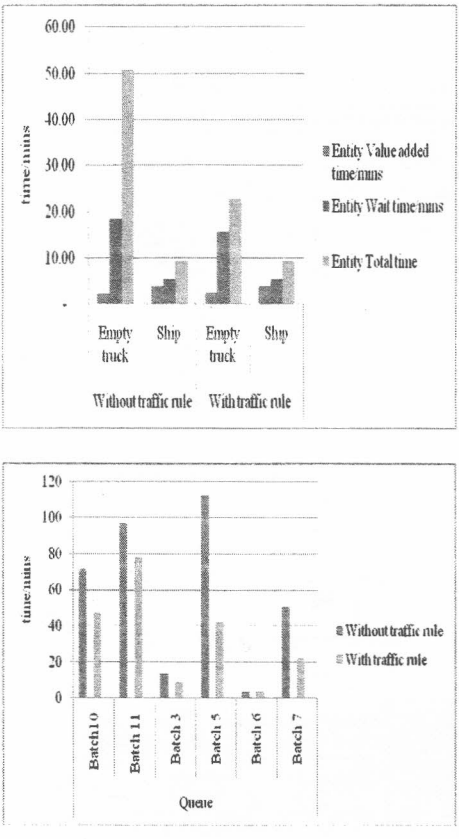

Fig. 3. Results of the simulations

Discussion and Conclusion

The summarized results shows (Fig 3) that it is needed to consider the traffic congestion and minimum distance paths to achieve the high productivity of the container terminal. Traffic rules, material handling equipment and careful loading/unloading planning have a significant effect on the performance of the container terminal. For the efficiency of the layout, the next alternative shortest possible path is to be considered and then the traffic congestion can be reduced due to the availability of more paths. Further research on this area can be proceed to find the successful way to integrate loading and unloading simultaneously which leads to a small storage area and less requirement of marshalling area.

References

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