*Proceedings of the 2015 Winter Simulation Conference*
*L. Yilmaz, W. K. V. Chan, I. Moon, T. M. K. Roeder, C. Macal, and M. D. Rossetti, eds.*

# Simulation Of Stockyard To Improve Throughput: Case Study Of An Indian Steel Industry

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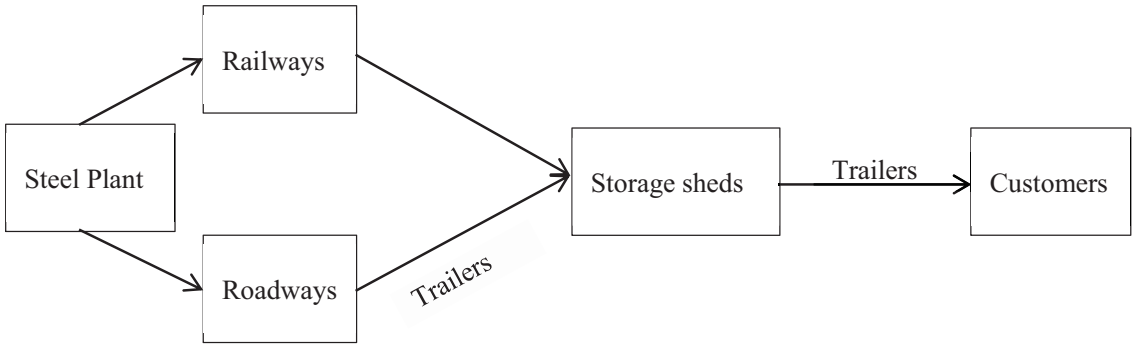
## ABSTRACT

A steel plant's stockyard for storing finished goods was facing the pressure of increased materials inflow due to production expansion. Major problems included the increasing number of material trailers and limited storage space. A study was carried out to assess the feasibility of the stockyard and its infrastructure to handle the increased load of storage and handling of materials. The tool used for the study was simulation modeling supplemented with time study of the various processes. Various scenarios were modeled using QUEST Simulation Software and what-if analysis was done on them for assessing the impact. The study helped to identify the required changes in the infrastructure (cranes, storage locations) to achieve higher throughput which helped to save outage costs and customer penalty in future. Apart from this, changes in the road layout, placement of traffic signals (inside stockyard) and location of parking space were also proposed for improving stockyard safety.

## 1 INTRODUCTION

The finished goods of a 10 MTPA (Million Tonnes Per Annum) steel plant are distributed through a stockyard located in North India for its customers in the zone. It handles approx. 3.5 MTPA of steel finished goods (FGs). The product portfolio ranges from long bars to coils and sheets. Majority of material in the stockyard arrives by rail logistics and rest comes by road on trailers. The material arriving in railway rakes are unloaded in the open yard using mobile cranes and then transferred to the respective storage sheds using trailers. The material coming through road is directly unloaded into the shed with the help of overhead cranes. Based on customer requirement the material is dispatched from the storage sheds through road on trailers. The material flow diagram can be shown as below:



The upstream facility of this stockyard got an increase in the production capacity due to which the amount of incoming material was going to increase. **The capability of the stockyard to handle the increased load was a major concern for the team working over there as this being a strategic location would be a critical area of concern. So, it was decided to conduct a simulation study to assess the capability of existing system to handle the increased load.** Various scenarios were enlisted for the what-if analysis through brainstorming session in the team to come up with cost effective infrastructure.

## 2 METHODOLOGY

Discrete Event Simulation (DES) methodology was used for this problem as the stock build up and its usage is in discrete quantities at definite time interval. The primary reason for using simulation as a tool for tackling this logistics was large number of variables (i.e. it was a high scale problem) and their variation were very difficult to capture using any deterministic analysis. Further the nature of data was discrete and the numbers of system states were finite so we preferred DES over continuous simulation. The methodology started with data collection, followed by data analysis, model building, model validation and result and analysis. Actual data was fitted using curve fitting models using STATSTICA and further used to generate the data for simulation. The software used for DES was Delmia QUEST V-22. The software is best fitted for heavy industry like steel due to its features like overhead cranes, easy layout feeding etc.

The variables considered for output evaluation were: Stockyard Throughput, Storage Shed Utilization, Crane Availability and Trailers Movement. Safety being a major concern, we also identified certain locations prone to trailer blockages and placing traffic signals to avoid any mishap. This proved to be a unique application of simulation for safety.

## 3 RESULTS AND CONCLUSIONS

The model was run for various scenarios and options derived out by the team working there. The summary of the result is as follows:

i. The stockyard is capable to handle more material to take care of capacity enhancement of upstream process without much higher investment.
ii. There are some storage sheds which need to be renovated to accommodate variety of products and the cycle time of operation can be enhanced by the usage of better material handling equipment and practices
iii. The availability (%) for each of the storage shed indicates that the system is capable to handle a continuous material arrival and no evacuation for 4 days.
iv. Certain changes in operation practices need to be done to accommodate the higher number of trailer movements in future.
v. Vehicle In and Vehicle Out time (VIVO) is not going to be affected due to proposed increase of throughput. It is going to be better than industry average even in future.
vi. Regression and interpolation results show the potential of throughput to be at higher level.
vii. There are certain points in the stockyard which are expected to have higher probability of congestion of traffic. These places needed to be taken care through traffic signals, safety stewards, two way roads, etc to avoid any mishap.

This case study shows the use of DES in a heavy industry like steel for assessing the adequacy of the logistics operation. It serves as a decision making tool for the management for evaluating the options before implementation in a mega industry like this and thus saving large amount of money. From literature survey it turns out that application of DES for Steel industry logistics is an emerging research area and industries have started to embrace it now.