ABSTRACT

This thesis is concerned with the modeling, simulation and optimization of logistics support facilities for four specific problems in two integrated steel plants (a new coastal integrated steel plant and another old integrated steel plant). More specifically, in the first problem, we have used mathematical and simulation models for the design and operation of the raw material logistics system of a coastal sponge iron plant. This is a part of the new integrated steel plant. The second problem deals with the use of simulation and highway design models for the design of the internal logistic system of the new integrated steel plant. The third case deals with the improvement of the steady state average output of a steel melting shop of the old steel plant through improved internal logistics, facility augmentation, and changes in operating practices. The fourth and the last problem presented in this thesis deals with the use of simulation, work systems improvement and scheduling to improve the hotmetal distribution in the old integrated steel plant.

With the use of the models developed for the raw material logistic system for the coastal sponge iron plant, the annual procurement plan, the monthly ship scheduling, the daily barge scheduling decisions have improved. The optimum barge mix obtained led to improved economics of logistics. The study of the total internal logistics of the new steel plant revealed many logistic bottlenecks which would have otherwise gone unnoticed till the plant operations. Suggested measures for the removal of these bottlenecks have been accepted for implementation. A simulation model and a stagewise debottlenecking strategy was used to increase the average daily production of the steel melting shop of the old steel plant. This increased the output from 27.7 heats per day to 36 heats per day. In the study of the hotmetal distribution problem of the old integrated steel plant, with the help of simulation models, we identified the causes of the problems as (i) bunching of casts at the blast furnace, and (ii) high unloading time for open top ladles at the LD#1 steel melting shop. A software for scheduling of blast furnace cast and movement of ladles has been developed to solve the blast furnace cast bunching problem. Methods improvement has been used to reduce the open top ladle unloading times at LD#1. These studies have improved the logistic systems, and helped in building the confidence of the management in both the plants on modeling and simulation application to logistics systems improvement.

For the purpose of presentation, this thesis is divided into six chapters. The first chapter gives an introduction to the thesis, a brief survey of literature and brief descriptions of the problems studied. The next four chapters present the four problems. In the sixth and last chapter of this thesis, we have presented our conclusions and discussed some problems that have scope for further applied research. The list of references cited in the body of the thesis is given at the end of the chapters.

Keywords : logistics, raw materials, internal movement, steel plant, modeling, simulation, improvement.