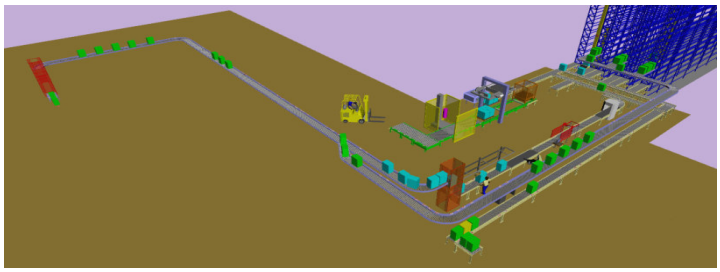
Computer Modeling Helps Define Project Scope for Pharmaceuticals Supplier

Scope of Work

The work described in this paper included developing a computer simulation model of a proposed system (revised conveyor, relocated labeling, ASRS, and palletizing), a final report and a 3-D animation of the proposed system. This document focuses on activity on the conveyor and in the ASRS.



Simulation of Proposed System

Model Development Process

HK Systems follows a structured approach to simulation model development and verification that ensures the model is a valid representation of the system and includes an appropriate level of detail both in statistical accuracy and in animation for debugging, validating and presenting model results. The model is written in the AutoMod 12.1 simulation language and includes detailed representations of the system equipment and controls.

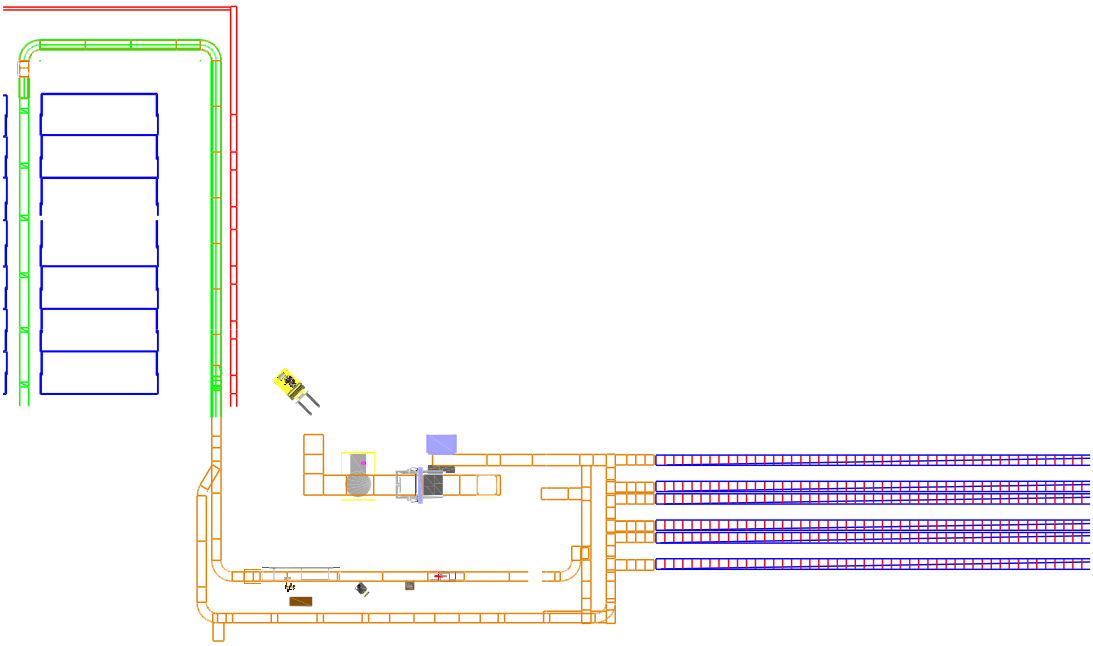
Simulation Objectives

The purpose of the simulation analysis is to:

- Design a simulation model to reflect the proposed layout
- Evaluate the performance of the proposed system with current and projected production rates
- Identify any bottlenecks caused by controls, equipment, or operating procedures

System Layout

The following layout drawing is a plan view of the equipment configurations in the simulation model.



Equipment Configurations

Summary of Results

A computer simulation model was developed for a proposed ASRS and palletizing system for the Finishing area for an industry-leading Pharmaceutical component manufacturer. The model was run using standard cartons at current peak volumes from June 2007 and also at those volumes compounded annually by 7% over a 5 year horizon. Minor revisions were made to the proposed layout in an iterative fashion and all experiments were repeated with the results presented in a written report. Baseline experiment of current peak volume showed that a proposed 3-aisle ASRS with a single-shuttle SRM can meet the required throughput – generating a total of 84.5 moves/hour in and 94.1 moves/hour out of the ASRS (within 2% of expected). The average SRM utilization was 59.2%. The ASRS buffer inventory peaked at 2922. Finishing Work-In-Process (WIP) activity was excluded due to the long-term nature of storing this product. If the Finishing WIP was to be stored in the ASRS, a buffer capacity of 7500 would be required. There was no congestion on the conveyor downstream from the print booths. The average time for a carton to be stored in the ASRS upon induction from the print booths was 8.3 minutes with a maximum time of 59.0 minutes. An associate is required to arrive at the manual pickup location every 20.9 minutes, on average, to deliver 16 cartons of WIP product. An average of 3.8 pallets/hour were generated at the dock, representing 34,058 cartons during the month. A total of 876 Finished Goods (FG) lots were generated on average with an average size of 37.7 cartons.

A second experiment of projected peak volume showed the revised proposed layout with a single-shuttle SRM can meet the required throughput but with some constraints identified. The activity generated was 118.6 moves/hour in and 131.1 moves/hour out of the ASRS (within 2% of expected). The average SRM utilization was 81.1% with a peak utilization of 100%. However, 6.3% of the hours were highly utilized (over 97%). The ASRS buffer size peaked at 4032 (1946.2 average). Additionally, the conveyor line from induction to the upper level ASRS inbound area filled to capacity at times. An average of 2.4% of the hours encountered more than 20 cartons on the conveyor outside of the print booths. The average time for a carton to be stored in the ASRS upon induction after the print booths was 15.9 minutes. The longest time a carton had to wait to be stored was 113.6 minutes. An associate is required to arrive at the manual pickup location every 14.9 minutes, on average. An average of 5.3 pallets/hour were generated at the dock, representing 47,896 cartons during the month.

A third experiment was run as a duplicate of the second experiment with one additional parameter; the labeling communication and application time was reduced from 35-40 seconds to 5 seconds. This was due to labeling being identified as the bottleneck and the anticipation that the proposed system will be able to improve the communication time. The throughput numbers were relatively unchanged from the second experiment. The primary difference was the congestion on the conveyor and increased peak SRM utilization. The print conveyor congestion was negligible. The average time for a carton to be stored in the ASRS upon induction after the print booths was 9.3 minutes. The longest time a carton took to get stored was 98.8 minutes. The average SRM utilization was 81.0% with a peak utilization of 100%. About 8.9% of the hours were highly utilized (over 97%). This reveals that after labeling, the SRMs become the constraint during peak hours. A proposed solution would be to add a second shuttle to the SRM to increase throughput during peak conditions.

The iterative experiments revealed very few changes between the original proposed layout and the revised layout. Moving the Finished Goods divert point upstream results in less inbound congestion. This results in the average ASRS buffer size to increase between 300 – 400 cartons (to about1950). However, the peak buffer size decreases by about 400 cartons (to about 4000). This is due to activity in and out of the ASRS being more balanced since there is less inbound congestion (i.e. not as many “peaks” and “valleys”).