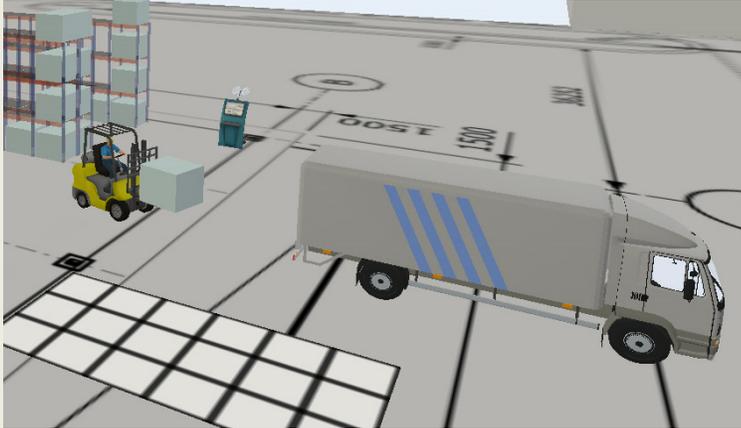


**RAW MATERIALS
WAREHOUSE**CUSTOMER: **MDR / Sadara**WEBSITE: www.sadara.com

LOCATION: Al Jubail, KSA

YEAR: Feb - Mar 2014

SOFTWARE: Flexsim

SERVICES:

- ✓ Simulation/Feasibility Study
- ✓ Analysis & Consulting
- ✓ Visualization / 3D Animation

THE CHALLENGE:

Our client was planning a raw materials warehouse with about 4500+ pallet positions as well as an outdoor storage yard for containers and other goods. The warehouse will serve on one hand to store spare parts for the production units in the complex as well as raw materials, consumables and master batches that come frequently and in high volumes.

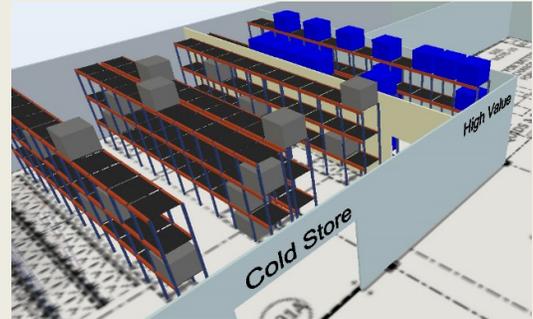
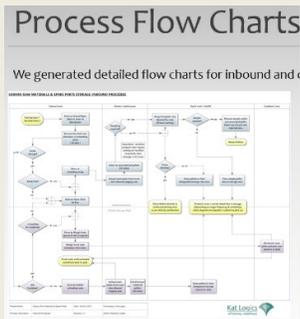
The production units do not have much storage space for raw materials and empty containers, thus the on time delivery shall be secured by the raw material warehouse acting as buffer in case of long lead times as well as uncertainties in the supply chain. The client had already a warehouse design from the master planners as well as a draft list of more than 200 different product types to be stored. The product list had the input of the production units in terms of estimated annual demand and chemical composition etc.

THE OBJECTIVES:

- *Layout of racking & workspace for inside / outside storage (within space constraints)*
- *Physical storage locations (racking zones) for products*
- *Location and layout of staging area(s) definition for outbound deliveries*
- *Recommended equipment requirements (additional racking, mobile equipment, etc.)*
- *Recommended workforce requirements (shifts, inbound vs. outbound)*
- *Expected traffic flows & volumes for inside storage, outside storage & staging areas*
- *Recommendations on delivery and routing throughout the site*

THE APPROACH:

First we had to liaise with all production units to fill in additional information in the product list: how are the products packed, how many SKU's/weight per pallet position, delivery lead time, inbound and outbound frequency, whether quarantine & sampling is required as well as expected shrinkage and return handling. From that we derived the safety stock levels and number of pallet positions required. We generated a detailed process flow map for the warehouse operations before starting to program the material flow into the simulation model of the warehouse. When importing the product data into the model as well as the suggested layout, we already spotted a few inconsistencies, such as: products in wrong zone (e.g. needed cooling or were high value), products in larges boxes not fitting into racks, certain racking shelves in suboptimal location or wrong rack type (e.g. drive in rack for spares). We clarified and rectified those issues and then optimized the racking to optimize the traffic flow and putting slow-turning spares into the back and fast-turning master batches in the front premium area.



THE SOLUTION:

We let the simulation run over a period of 3 months and monitored the maximum vs. the actual racking space utilization for each warehouse zone. Though the client initially feared running over capacity, we could prove that there is still a lot of space available (as per the current estimates). We therefore suggested to install less racks initially and keep more space for ground storage and handling. We tested dedicated inbound and outbound handling areas, which proved to be sufficient in their buffer size.

Next step was to analyze the utilization of resources such as forklifts (with parameters for speed, charging time, maintenance etc.), delivery trucks within the complex (including routing). We could tell the optimal number of equipment to be leased from the 3rd party logistics provider during the start-up phase. We also optimized the delivery frequency and tours within the complex and reduced the number of tours by more than 30% by smoothing the delivery profile. Overall we could save the client more than 15 vehicles, like forklifts, reach trucks and flatbed trucks, which also reduced the number of operators and drivers to hire.

The potential savings discovered through the simulation model was several million USD for the period of first 2 years.

