Minimization of Galvanized Steel Expedite Costs

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***Abstract*— The ability of a company to deliver a product or service to the customer on-time and efficiently using the required resources is critical to success. CST Storage partnered with the Department of Industrial and Systems Engineering at Northern Illinois University to address the issues regarding their fulfillment of orders and added expedite costs. For CST Storage to make and distribute tanks for consumer use, raw steel is sent to galvanizers to be treated and cleaned. The company is falling behind in their orders due to poor organization of their work tasks as well as their materials on hand. In order to catch up with customer orders and still maintain a schedule, this galvanization process is being expedited at the expense of CST Storage. This additional cost is one that can be avoided with the right plan of action. This project has studied the causes of galvanized steel expedite costs, as well as researched and designed a new Kanban system to assist management in the implementation of process changes that can deliver CST improved results of fulfilling on-time orders with a reduction in expedite costs.**

Keywords- Kanban, Galvanized Steel, Manufacturing

I. INTRODUCTION

CST Storage is a division of CST Industries that sells and manufactures tanks for storage. CST industries consists of CST Storage, CST Covers, and Vulcan Tanks with the headquarters stationed in Kansas City, Missouri. The tanks that are made for CST Storage hold industrial liquids, grain, food, water, wastewater, oil, gas, coal and much more. There are five manufacturing plants located in Illinois, Texas, Tennessee, Kansas and England. We will be focusing on CST Storage located in DeKalb, Illinois. The company makes all their tanks to custom orders and ships them all over the world. Over one hundred and twenty-five countries have been delivered tanks across the globe, making them a global leader in industrial storage solutions. For CST to easily ship the tanks anywhere, they are shipped as kits with all the pieces for the customer to put together.

II. PROBLEM DESCRIPTION AND SCOPE

In the last year, CST Industries has experienced a delay in the proper order sizes of galvanized steel parts for their tanks, resulting in spending over half a million dollars on expedited steel. When parts are not available when the order is to be shipped, there is a two-week lead time: one week to order more raw material and the second week to manufacture the parts in the plant. Once the parts are on hand, they must be galvanized. There are three main options for galvanizing parts: 1 day, 3 day, and standard. These are not for shipment but rather how much time it takes the galvanizer to coat the parts and get them back to the customer. Expediting costs occur at the galvanizer, when the galvanizer is rushed to do their job. Once these parts are shipped back to CST, they are then packaged and sent to their customers.

Currently, there is no safety stock levels purposely held at the facility. Even if only a few parts are needed, they will make an entire batch (size is predetermined by the manufacturing process) and keep the extras until they need them again. This can create unnecessary costs. If they overproduce, they must pay to store parts that they may not use again.

III. PROJECT OBJECTIVES

The goal of this project is to reduce steel expedite costs. We intend to find what parts would be most beneficial for the company to keep safety stock for. Since our main objective is to decrease the number of expedited galvanized parts, we want to keep on hand what is sold the most frequently so that CST and the plant workers are not waiting on these parts at any point. To accomplish this, we will analyze what the company has sold and look for the most popular parts or "high-runners". Initially, we were informed that web trusses and ladder brackets are the most common parts that are sold in the tanks historically. Many of the remaining parts are engineered to each specific tank and will not likely be sold again, unless another customer asks for that specific size of tank. Since we are just focused on the galvanized parts, we only looked at the data for the parts being sent to the various third-party galvanizers in Joliet, Dixon and Rockford.

IV. METHODS

To determine what parts are should be in the Kanban system, the team needed to find the demand data. In September 2019, CST switched ERP systems and most data before that date was not available. The only remaining data available was the daily load tally's that are recorded when a truck is sent to the third-party galvanizers. Information on the load tally's includes part number, work order number, quantity, weight, location, and priority status. The team

assumed this data to be used as the demand data since no other data could be found. This data was then used for the data analysis phase and calculating the stock level calculations as well.

A. *Data Analysis*

In the beginning of this project, there was no signal or identification that there were low or no parts. It was discovered when workers went to package a part only to find they did not have enough or any of the part they needed. We were having difficulties finding demand data, so we investigated the parts that were galvanized in the last year. Shipment data from 2019 was analyzed to determine the companies order behaviors. When looking at this data, we found that the top 10 parts sent to be galvanized the last year made up 67.91% of the overall galvanized parts. Figure 1 shows the breakdown of the higher quantity parts shipped to the galvanized over the span of a year.

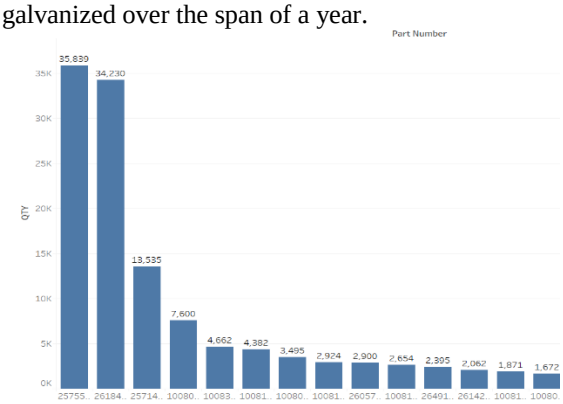

FIGURE 1: TOP GALVANIZED PARTS

We were able to recognize that the top 5 expedited parts were among the top 10 galvanized parts from the last year.

B. *Stock Equations*

Equation (1) was used to calculate the safety stock levels, where a Z value of 1.29, or 90% confidence level was used, σ_d represents the weekly standard deviation of demand and LT is the lead time to manufacture the part. The lead time was assumed to be three weeks for most parts since most parts require one week for raw material to be ordered and received, one week to manufacture, and one week to be sent out to the galvanizer to be galvanized.

$$SS = z\sigma_d\sqrt{LT} \tag{1}$$

The safety stock equation calculates the stock to have on hand that will act as a buffer to accommodate for the fluctuations in demand. Equation (2) was used to calculate the reorder points. Equation (2) is similar to (1), but with the addition of $\bar{d}$, which is the average weekly demand, multiplied by the lead time, three.

$$R = \bar{d}LT + z\sigma_d\sqrt{LT} \tag{2}$$

The reorder point is the point at which the planning department should order the production of more products. At the reorder level, there is enough product in stock to accommodate for the average weekly demand for the duration of the lead time and the safety stock. The safety stock acts as the buffer should the demand increase during the reorder process.

V. RESULTS AND CONCLUSIONS

After our research, discussions and calculations, we found the most popular parts for CST and their appropriated safety stock levels. Without having the funds to find our own storage devices, we leave the company with appropriate safety stock levels, reorder points and cue cards for their own Kanban system. We will also leave suggestions for storage at a future time. Assuming their current storage is similar to the other storage solutions we have found, we calculated the amount of storage shelves and baskets that will safely hold their safety stock. The cue cards will be green, yellow and red with each part number, part location and batch quantity on the card. The cards will be laminated and either have two holes punched it them with ring clips attached or magnets attacked on the back. With this, CST will be able to attach them to their appropriate storage shelves or baskets to have as a visual cue to replenish safety stock as necessary. We suggest that they assign one worker the job of checking the safety stock once a week and reporting any shortages to the planning department. The planning department will then make reorders as necessary. The safety stock levels are to be recalculated every six months as the company's order will change and our calculations may not always be appropriate for their sales levels.

TABLE 1. STORAGE NEEDS AND COST

Part	Monthy Average	Safety Stock	Reorder Point	Batch Size	Batch Max Inventoy	Actual Storage Needed	Cost
257553-000	2984	1782	4353	400	8000	14	$3,892
261847-000	2853	2000	4284	600	7800	6	$1,668
257148-000	1103	1046	1854	600	3600	2	$384
1008054-000	583	860	1317	600	2400	1	$192
1008346-000	389	598	875	300	1500	1	$210
1008141-000	365	302	706	300	1200	1	$210
1008055-000	291	70	595	420	840	1	$192
1008140-000	244	234	476	250	750	1	$192
260577-900	242	698	616	600	1200	5	$1,050
1008139-000	181	300	475	300	900	1	$210
						Total:	$8,200

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