Streamlining Warehouse Operations with Lean Six Sigma

Mitch Millstein, CFPIM, C.P.M., CQM, CQE
Supply Velocity, Inc.
mitch@supplyvelocity.com
(314) 406-4962

March 2010

Copyright: Supply Velocity, Inc.

Abstract
Given the low margin nature of most distribution businesses, it is imperative to maintain the lowest possible labor costs. This paper will show how to use Lean and Six Sigma tools to minimize the labor required to pick, pack and ship orders from a warehouse.

Background
This distribution company embraced Lean as part of their company's strategy to constantly reduce costs and improve customer service. They began their journey by applying Lean and Six Sigma tools to their primary operation, warehousing, picking, packing and shipping packaged goods to customers.

This project used 3 Lean Six Sigma Tools:
- Spaghetti Maps
- Pareto Analysis
- 5S Visual Management

Visualizing the Problem with Spaghetti Maps
A Spaghetti Map is a simple Lean tool to help visualize extra movement of people within a process. It establishes baseline performance, shows the need for improvement and provides insight into how to redesign the layout of a work-area. They can sometimes be combined with time studies to break down each step and its duration.

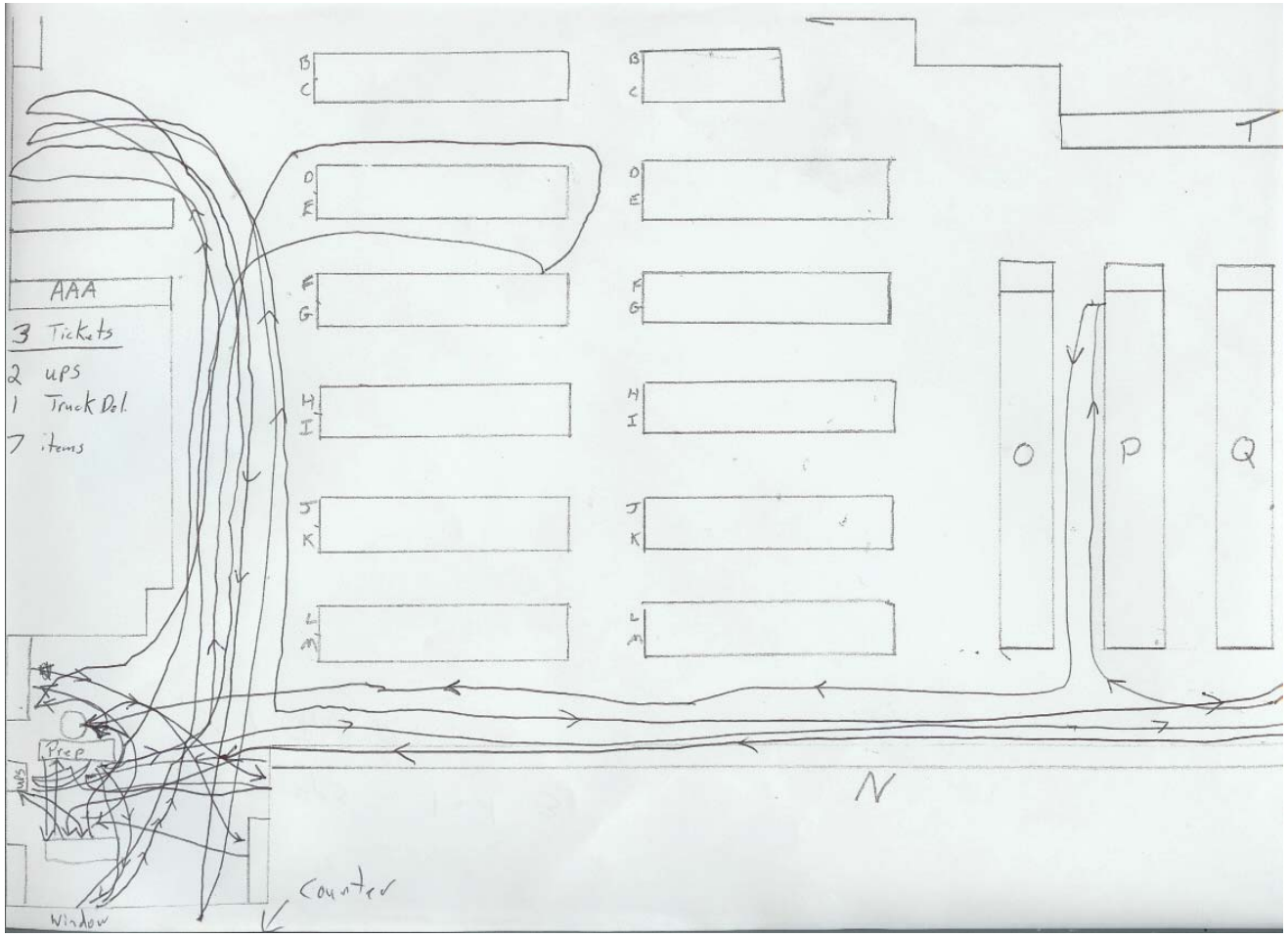
The Lean Team at this Distributor began the project by creating a Spaghetti Map of the current state. What you see on the page below (Overall Warehouse View) is 3 orders with a total of 7 items being pulled, packaged and shipped. This Map shows how the warehouse attendant had to travel to get these 7 items. For these 3 orders he travelled all over the warehouse, covering from one end to the other and almost all 4 corners. This is a lot of movement for 7 items.

The Pack & Ship Area Spaghetti Map is of 8 orders being packaged and prepared for shipment (via UPS). This Map is a close-up of the Pack & Ship Area. It tells shows something different. Here we see repetitive and un-necessary movement. One table is for packaging, a different table has the UPS computer, a different table has the internal ERP system computer (that closes the order and moves it to the invoice queue) and yet another table has the ticket printer. Finally, they stored boxes about 25 feet from the packaging area. Each order required a separate trip to box storage.

Clearly the Spaghetti Diagram makes the case that this warehouse could be improved; reducing the labor required to pick, pack and ship orders.

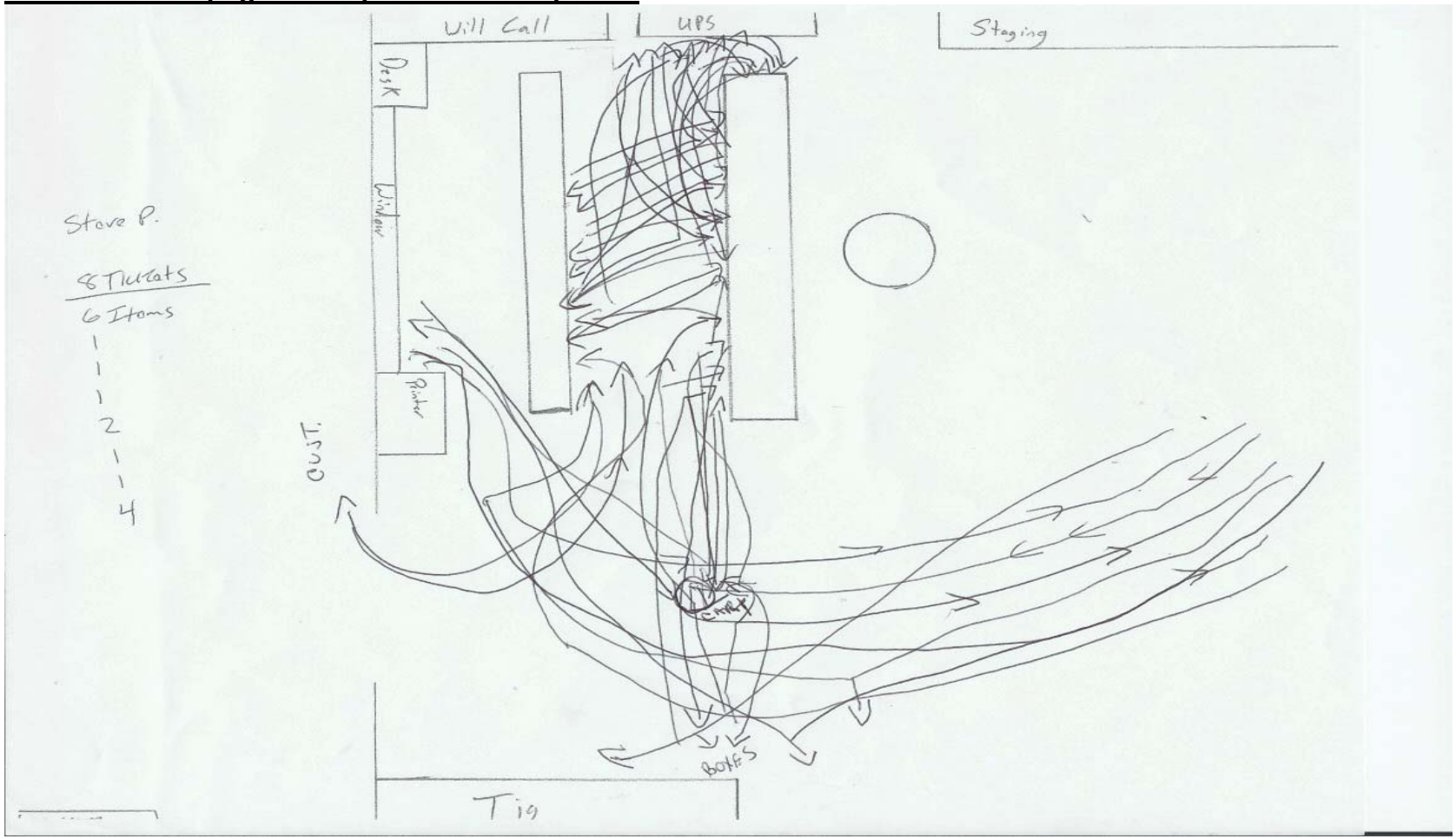
Copyright: Supply Velocity, Inc.

Current State Spaghetti Map – Overall Warehouse View



Copyright: Supply Velocity, Inc.

Current State Spaghetti Map – Pack & Ship Area



Copyright: Supply Velocity, Inc.

Using Pareto Analysis to Make Improvements

We next moved to using a Six Sigma tool, Pareto Analysis, to analyze how to reduce the move-time required to pick, pack and ship an order. Pareto Charts were developed in the late 1800's by an Italian Economist, Vilfredo Pareto. He used this analysis to determine that wealth was skewed to a small portion of the population. In his time, 80% of the land in Italy was owned by 20% of the families in Italy. From Vilfredo we derived the Pareto Principal or 80/20 rule. This is commonly used in sales, with 80% of sales generated by only 20% of customers.

We created a Pareto Table for the number of times an item was on an order. Quantity or Sales $ was not important for this project as we were concerned with reducing move-time. Therefore, how many times a warehouse attendant had to go to that item to pick it, was the critical metric.

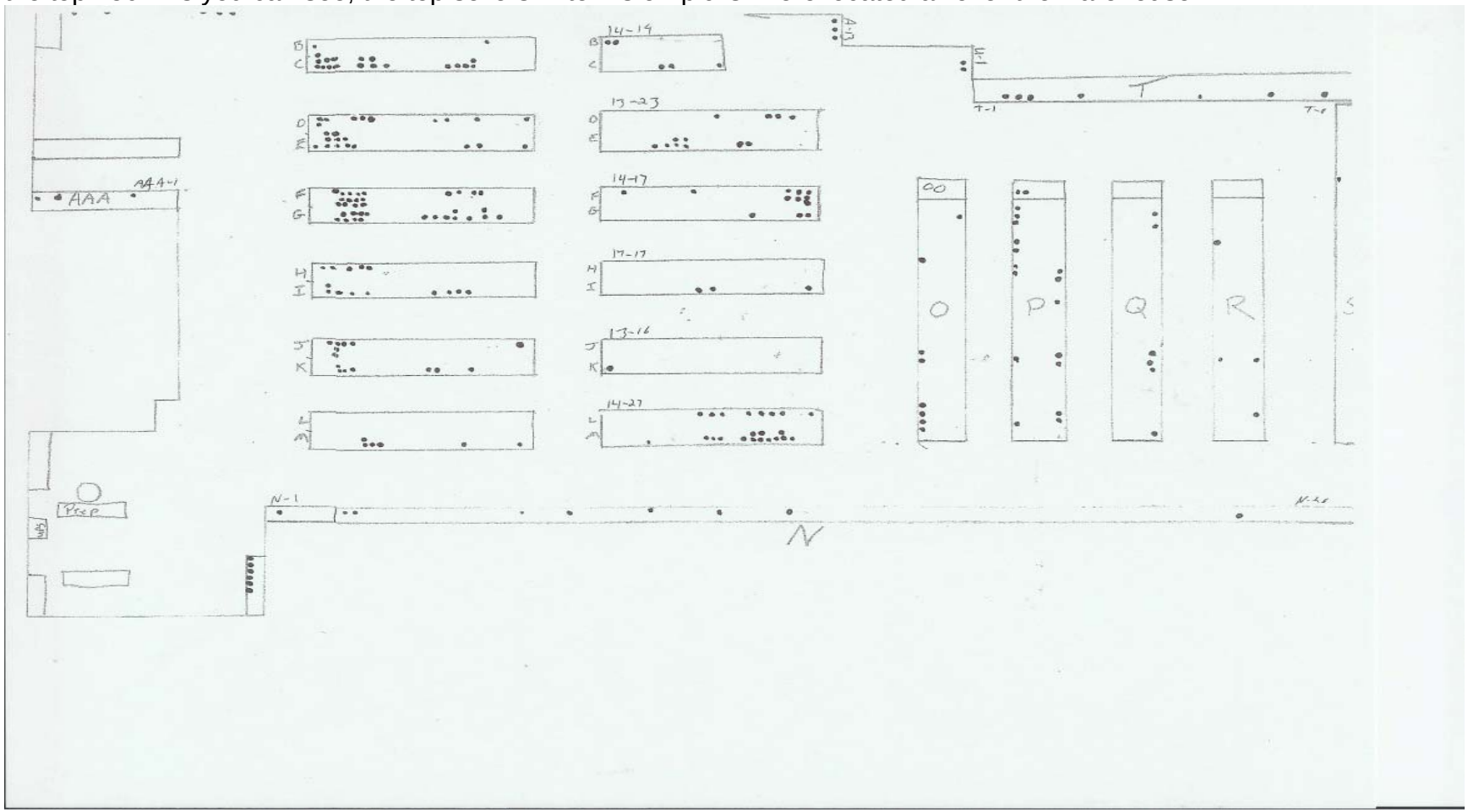
Item	Orders	% of Total	Cum %
CK-932-442	476	1.08%	1.08%
CK-70S6-035-44	433	0.98%	2.06%
AR-25-501181-9	432	0.98%	3.04%
WEM-WM823309	330	0.75%	3.79%
TWE-1140-1102	297	0.67%	4.46%
AR-25-501331-0	263	0.60%	5.06%
NS-115-035-45	258	0.58%	5.64%
HOR-04-0270-00	255	0.58%	6.22%
TUN-3327GT2	251	0.57%	6.79%
STI-KK008	248	0.56%	7.35%
TWE-1340-1100	227	0.51%	7.87%
TWE-1240-1120	222	0.50%	8.37%
MLR-000068	215	0.49%	8.86%
JAC-0744-0504	207	0.47%	9.33%
VIC-0330-0006	200	0.45%	9.78%
SAI-20160	197	0.45%	10.23%

This table shows the items that make up the top 10% of "picks". There were about 6000 items kept in this warehouse. Sixteen items accounted for 10% of all picks! The concentration of the top items was much higher than 80/20. It was actually 80/10, with 10% of the items accounting for 80% of the picks.

Copyright: Supply Velocity, Inc.

Top Item Location

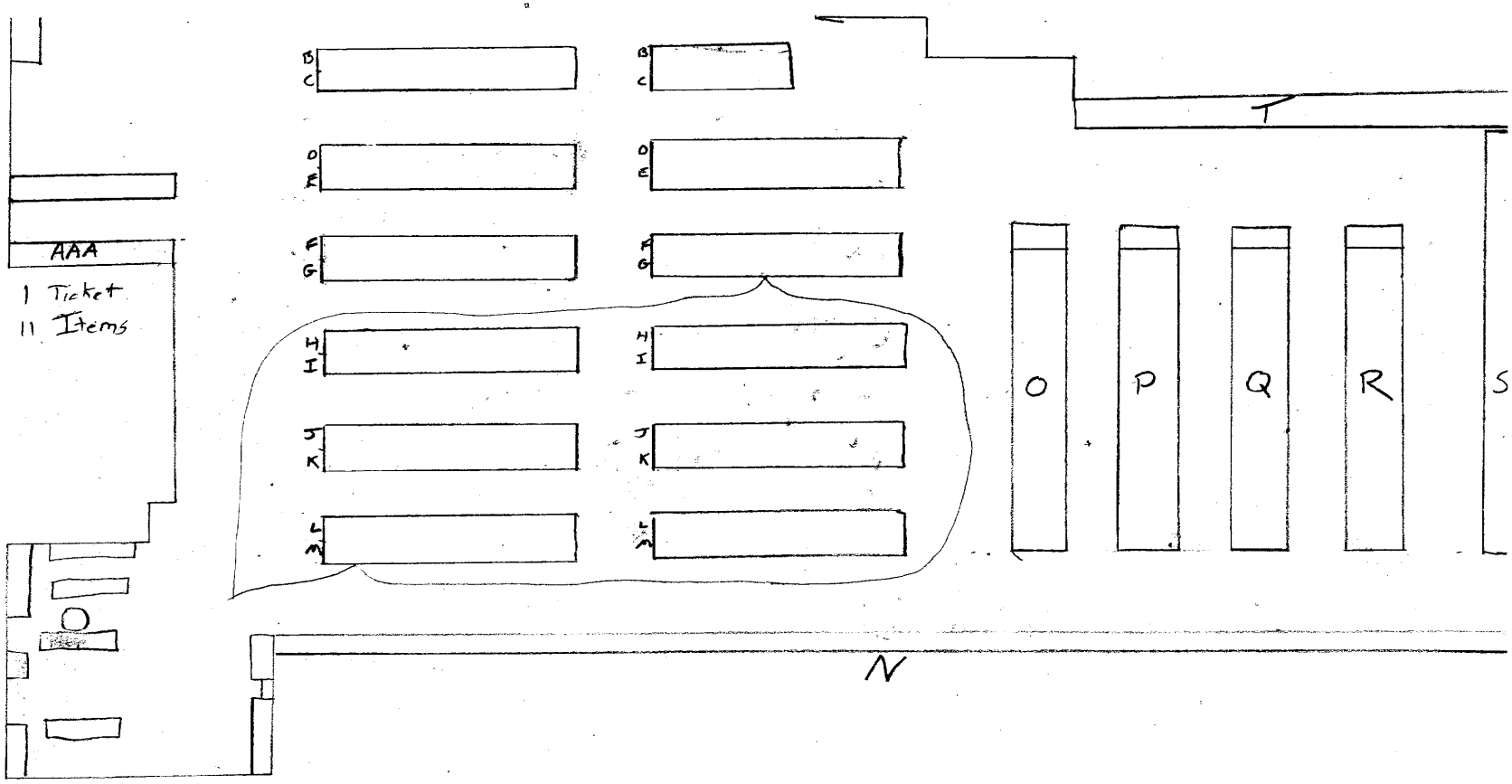
The team then mapped the location of these top 500 items. This was very manual work and they therefore started with the top 250. As you can see, the top sellers in terms of "picks" were located all over the warehouse.



Copyright: Supply Velocity, Inc.

Spaghetti Map - After

The top 500 items were all moved as close as possible to the Pack & Ship Area. Many of the smaller items were moved right into the Pack & Ship area on shelves next to the packing table. As shown below, picking 11 items took much less movement and time than where this team started.

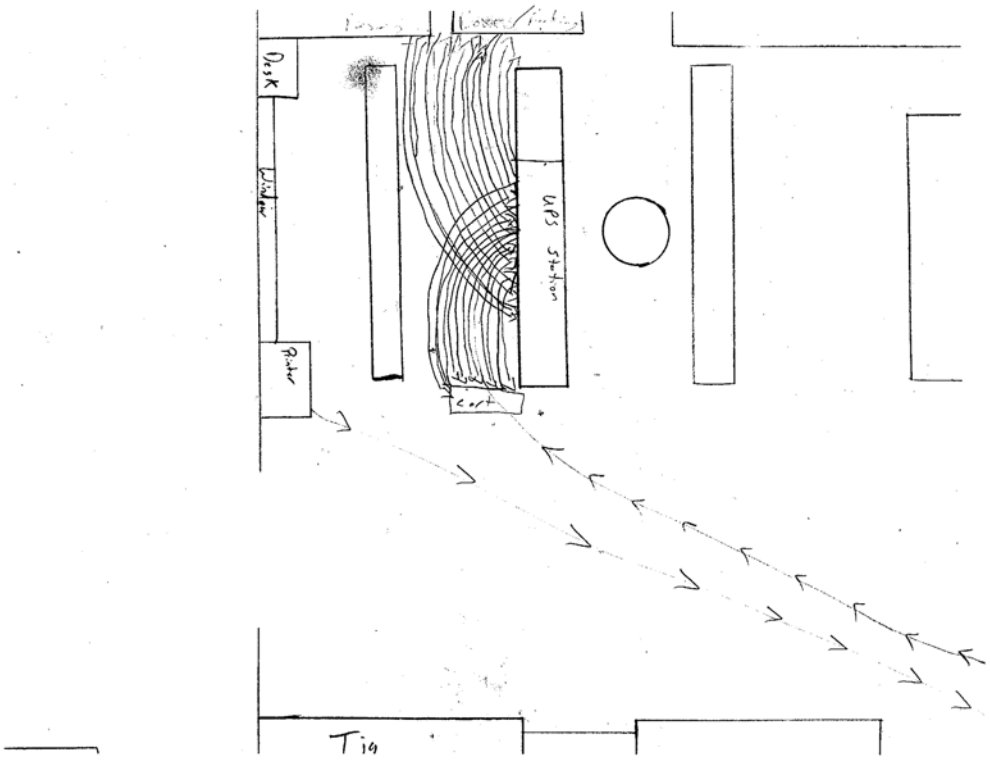


Copyright: Supply Velocity, Inc.

Incorporating 5S Visual Management to Re-Layout the Pack & Ship Area

We also used 5S Visual Management tools to re-layout the Pack & Ship Area. The boxes were moved right next to the packing table. The ERP and UPS computers were put on the same table. Everything was as close as possible.

The result was minimal movement to pack and ship products to customers.



Control Plan

Every 6 months the Vice President of Operations reruns the pick-velocity report, and maps out the location of top 500 items. As items fall off the list they are moved further back in the warehouse. As items move onto the top 500 list they are moved as close as possible to the Pack & Ship Area.

Copyright: Supply Velocity, Inc.