Lean Improvement at Sheppard Envelope Manufacturing Company

A Major Qualifying Project Report:

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Abstract

The objective for this Major Qualifying Project was to apply lean process improvement methods, inventory management and financial analysis to a privately held manufacturing company. A review of the state of the art revealed methods to improve many of the processes employed at Sheppard Envelope Manufacturing Company, including warehouse operations and inventory control methods. The methods used include Axiomatic Design for warehouse design, Economic Order Quantity and inventory metric calculations for inventory management database design, Analytical Hierarchy Process for inventory software recommendations and net present value and return on investment analysis for future value of money for implementation of this project. The project results recommend an automated inventory management system and a redesign of warehouse organization, which may result in significant return on investment if implemented. The team concluded that the company could improve bottom line profitably with a small investment in technology and redesign of inventory protocols.

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1.0 Introduction

Based on the expertise and experience of Sheppard Envelope Manufacturing Company's management and the observations of this team from WPI's School of Business, this project has been initiated with the belief that manufacturing thinking can increase Sheppard's long-term profits and success by better utilizing their current resources and exploring inventory and order management options. See Figure 1 for a full outline of the project.

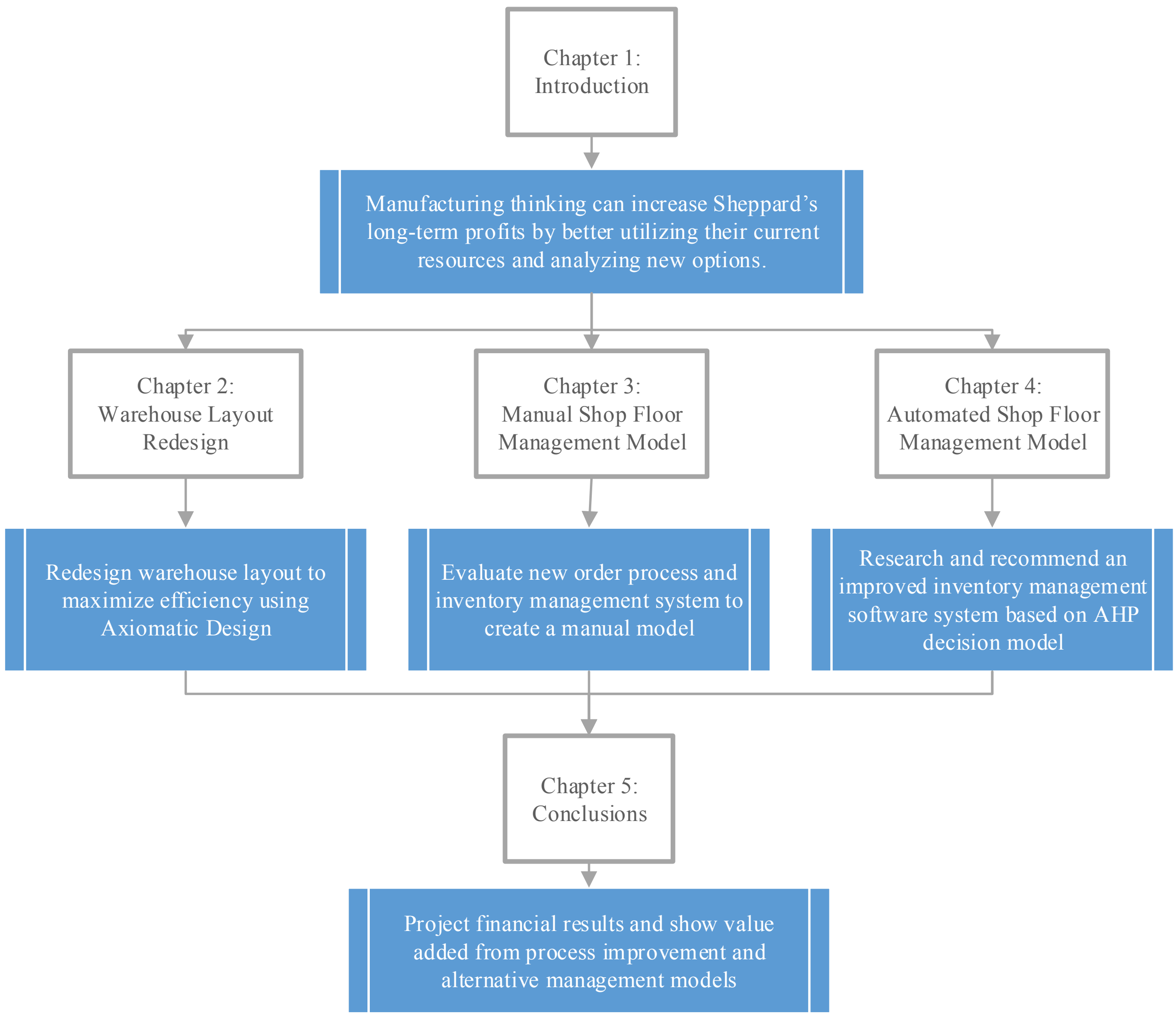

Figure 1: Flowchart Showing MQP Structure

1.1 Areas of Process Improvement

The team began this project by interviewing employees from all parts of the company, collecting their ideas, and observing the current processes of operation. From this data collection, the team identified the following areas of potential improvement:

Potential Areas of Improvement
Inventory Management
Shop Floor Management
Inventory Storage Rack Structure
Forecasting
Employee Incentives
Machine Process Improvement

Table 1: Potential Areas of Improvement for Sheppard

Based on preliminary research, the team met with Sheppard leadership to discuss what impact the team could have for each potential area. After these discussions, Sheppard and the team agreed that improvement of the warehouse layout design, inventory management and shop floor management system would provide the maximum benefit to Sheppard.

1.2 Problem Statement

Electronic and paperless communications have put tremendous pressure on the envelope industry. As a result, Sheppard Envelope Manufacturing Company connected with Worcester Polytechnic Institute's School of Business department for help to improve their processes. A Major Qualifying Project began through evaluations, interviews and observations; the team assigned to Sheppard Envelope identified several problem areas. The methods the team used to recommend potential improvements include value stream mapping, Economic Order Quantity, reorder point level, Analytical Hierarchy Processes, interviews and other techniques.

1.3 Field of Review by Chapter

This project is divided into five chapters as shown in Figure 1. The first chapter contains a general introduction for the premise and rationale of implementing this project. Furthermore, this chapter explores the historical context of Sheppard Envelope Manufacturing Company and the significance of its Worcester location.

The second chapter investigates the organization of Sheppard's warehouse layout. In this chapter, the team applied the Axiomatic Design method to redesign the organization to optimize the system for the shipping team. Axiomatic Design also sought to minimize the necessity to stop manufacturing machines while employees transfer product into the warehouse.

In Chapter Three, the team evaluated Sheppard's current process for managing new orders and existing inventory. The team also created a manual model to track inventory and prompt the production floor to replace stock inventory when the optimal reorder point was reached. Additionally, this model considers the optimal run size to ensure that set up costs are absorbed into the run of each batch. Based on the company's available finances, this model could serve as the company's complete order and inventory management system.

Chapter Four evaluates automated management systems if Sheppard chooses not to utilize the manual model. This chapter used Analytical Hierarchy Process (AHP) to evaluate and recommend software systems for the management of new orders, inventory management and accounting processes. AHP explores various criteria, which are the basis for any decision reached using this process. These criteria are explained in detail in Chapter Four.

The final chapter summarizes the team's recommended actions in the previous chapters and elaborates on the rationale for these recommendations. This rationale includes the cost of implementing each recommendation, return on investment analyses and clarifies the value added by each suggestion. Furthermore, this chapter also defines the total value added to Sheppard if the company was to implement the team's recommendations.

1.4 Envelope Manufacturing in Worcester

Worcester, Massachusetts has been known for envelope manufacturing since the invention of the automatic envelope folding machines. While Edwin Hill first designed an envelope-folding machine in England in 1840, Doctor Russell L. Hawes, a native of Worcester, patented the first successful automatic machine in 1853 (Benjamin, 2002). Hawes was trained as a physician, but studied existing machines and operators to fully understand the ergonomics associated with the envelope-folding machine. His modifications improved daily envelope output by six times (Benjamin, 2002). The success of Hawes' machine later inspired the invention of a single-operator machine.

Five years after Hawes' invention, James Green Arnold developed the next two breakthroughs in envelope technology: the drying chain and the self-gumming mechanism. Arnold partnered with David Whitcomb and Wheeler Swift to continue to develop envelope technology. Shortly after, G. Henry Whitcomb, David Whitcomb's son, joined the Worcester-based firm in 1864. The company was rebranded as G. Henry Whitcomb & Co. a few years after. Swift recruited his brother, Henry, to the firm and the two began inventing new features for envelope machines, including automatic embossers and cutters. By 1871, the Swift brothers invented the Swift Round Table Machine, which cost significantly less than the alternative Reay Machine and increased manufacturing capacity by 30% (Benjamin, 2002).

1.5 History of Sheppard Envelope Manufacturing Company

In 1921, the Sheppard family founded the Sheppard Envelope Manufacturing Company. Their first manufacturing plant was the home of their invention, a state-of-the-art envelope-folding machine. At age 33, Lincoln Spaulding bought the company just as it was approaching stagnation in 1967 with the support of a group of Worcester-based angel investors (Spaulding & Haddad, 2014). After some time, Mr. Spaulding bought out all other investors and remains Sheppard's sole owner. Sheppard, while under previous ownership focused on the greeting card industry, is now renowned in the industry for their high-quality small envelopes and credit card sleeves (Nutt, 1919). The plant eventually moved from its original Worcester location to Auburn, Massachusetts in 2003, where it remains today.

2.0 Warehouse Layout Analysis and Redesign

2.1 Introduction to Warehouse Organization Design

Management of a warehouse and its inventory involves two dimensions. "At first, the management of [inventory] represents the technical warehouse structure" (Ten Hompel, Schmidt, & SpringerLink ebooks - Engineering (2007), 2007). This includes the warehouse itself and its entities such as racks, shelving, forklifts, etc. The next dimension to consider is the management of the finished goods that are stored in the warehouse. This process includes maintaining data specific to the finished goods: production date, product number, product descriptors, location, etc. When combined with an inventory management system (Chapter Three) this system allows for control of inventory levels, product storage and product retrieval. Companies benefit from optimizing these warehouse systems because they reduce the overall transport and handling costs for moving finished goods.

2.1.1 Rationale

The team determined that Sheppard needed to reevaluate how their warehouse was organized. There was no structure to the organization of the stock products by criteria, such as size, type or paper color. With the warehouse layout redesigned to organize products by their turnover rate, Sheppard can potentially save money through reducing handling and labor costs.

2.1.2 Assumptions

Throughout this chapter, the team measured the usage of a finished good based on the quantity of orders as opposed to the annual sales volume, which indicates how often the product is handled. This information was considered to be more important than the quantity of a product sold, as the amount sold does not always correlate with how often an employee needs to retrieve a product from the warehouse. The team also assumed that the warehouse only dealt with the finished goods that were post-production and entering into saleable inventory. The principles of this warehouse layout could later be applied to a broader scope of goods and materials if Sheppard wanted to include their raw materials.

During calculations, the team assumed a vertical distance of zero when goods were placed on the first or ground level of the warehouse. A product placed at this level does not require a forklift for retrieval. The team assumed that all pallets with product were of the standard size of 40” x 48” (Ten Hompel et al., 2007). Finally, at the conclusion of the calculations, the team assumed that for the efficiency of the system, if a finished good requires more than one pallet of space, it would be placed adjacent to the first pallet rather than in the calculated next best location because the next best location may be further from the first pallet than desirable.

2.2 Research

A warehouse layout system allows for companies to efficiently organize their warehouse to access high-turnover items quickly and easily. The most commonly shipped products are placed at the most efficient contact points, such as the first shelf or pallet. By logically ordering the placement of products, a company minimizes the time used to place and retrieve goods, minimizes travel distances by employees and minimizes use of warehouse equipment, such as forklifts. Additionally, a warehouse organized by product usage decreases handling costs and reduces shipping time, especially for popular orders.

When optimizing the allocation of stock products to storage locations, the analyzer must evaluate parameters by which to judge each location. These parameters could be “minimizing transport [distances], maximizing turnover rate, maximizing utilization of the storage capacity, high availability [or access], [or] quick detection and identification of goods in a manual system” (Ten Hompel et al., 2007). Given these clear design goals, the team began researching various design processes to create a better warehouse layout system.

The team chose to use Suh’s Axiomatic Design method to redesign Sheppard’s warehouse organization and operations because it is one of the few methods that explicitly defines the design goals and constraints before developing solutions (Suh, 1998). Many other approaches, such as dimensional analysis and decision theory, use heuristics to estimate an optimal solution. These designs must then be constructed, tested and debugged. This process may cost a company significantly more time and money than using Axiomatic Design and increases risk for inefficient designs. The previously mentioned approaches often return a successful or unsuccessful result with little to no details. Furthermore, Axiomatic Design defines each aspect of the design, therefore one can clearly trace the error if an aspect of the design fails.

The basis of Axiomatic Design is its two axioms. Firstly, the independence axiom states that a system must maintain the independence of the functional requirements. Functional requirements (FRs) are created based on the customer needs (CNs) and defined as the minimal set of independent requirements that completely satisfy the functional needs of the product (Suh, 1998). Examples of customer needs include a low price point to comply with limited budgets or materials with high durability.

Secondly, the information axiom states, of all the designs that satisfy axiom one, the design with the least information content is preferred. Other components in Axiomatic Design include constraints, design parameters and process variables. Constraints are the bounds on acceptable solutions and can manifest as either input constraints or as system constraints. Input constraints are incorporated into the design specifications, whereas system constraints are evaluated when choosing a design solution. According to Suh, design parameters are "the key variables in the physical domain that characterize the design satisfying the functional requirements." Process variables are "the key variables in the process domain that characterize the process that can generate the specified design parameters."

Inventory management is a vital part of warehouse management because it reduces inefficiencies and provides better controls. In industries that have products with shelf lives, such as the envelope industry, it is best to employ a "First In, First Out" (FIFO) system of inventory usage. In systems like this, the oldest product in the inventory is used before the newer stock. A FIFO system provides many advantages to a company. Overall, it helps to reduce the risk of stock expiring while in inventory, minimizing the chance that a company must discard product (Johnson, 2014).

2.3 Methods

The team reviewed the warehouse inventory and conducted interviews to understand the current process and Sheppard's needs. Through these interviews and observations, the team familiarized themselves with the inventory process, how orders were filled, and the process of bringing products into the warehouse and removing them for shipping. To model the results of the current state and the new state, the team used Microsoft Visio®. Furthermore, the team incorporated Axiomatic Design principles to model the best inventory management design process, as explained in the previous section. As part of the Axiomatic Design decomposition process, the team utilized the Acclaro® software to model the interactions of functional requirements with design parameters.

2.3.1 Customer Needs

Based on analysis of Sheppard's current state, the team recognized several customer needs. Firstly, Sheppard must be able to quantify their current available inventory and measure its condition. Additionally, Sheppard required better warehouse organization to ensure that employees could rapidly locate inventory within the warehouse. While Sheppard already used a FIFO process, they also needed a standardized labeling system that included production dates to minimize the risk of expired product. Each customer need that the team identified fulfilled Sheppard's larger goal of serving the customer as efficiently as possible with minimum waste.

2.3.2 Functional Requirements

After identifying the customer needs, the team then used the principles of Axiomatic Design to determine the functional requirements of a new model design. The storage racks in Sheppard's warehouse hold both finished envelopes and raw materials, such as paper and corrugated boxes. The warehouse layout needed to be redesigned for the employees to efficiently access the physical inventory. The highest level FR, $FR_{0,}$ states that employees must be able to access inventory efficiently within Sheppard's warehouse (Table 2).

Functional Requirements	
FR_0	Efficiently manage physical inventory in storage system

Table 2: FR_0: Efficiently Manage Physical Inventory in Storage System

The team measured the effectiveness of a warehouse layout by evaluating the distance traveled by an employee to retrieve or store material. An efficient arrangement would minimize the distance traveled by an employee. The highest turnover inventory items should be the easiest to access and closest to the designated origin of the system. The directions of travel in the warehouse are defined as the X, Y and Z directions based on a Cartesian coordinate system. The goal of these FR is seen in Table 3. The team chose to minimize the travel in the Y direction first because products that are on the first level of the shelves are accessible without use of a forklift and therefore require the minimum amount of time to place or retrieve materials (Figure 2 and Figure 3).

	Functional Requirements
FR_1	Minimize employee distance of travel in Y direction
FR_2	Minimize employee distance of travel in X direction
FR_3	Minimize employee distance of travel in Z direction

Table 3: FR_1-FR_3: Minimize Employee Travel Distance

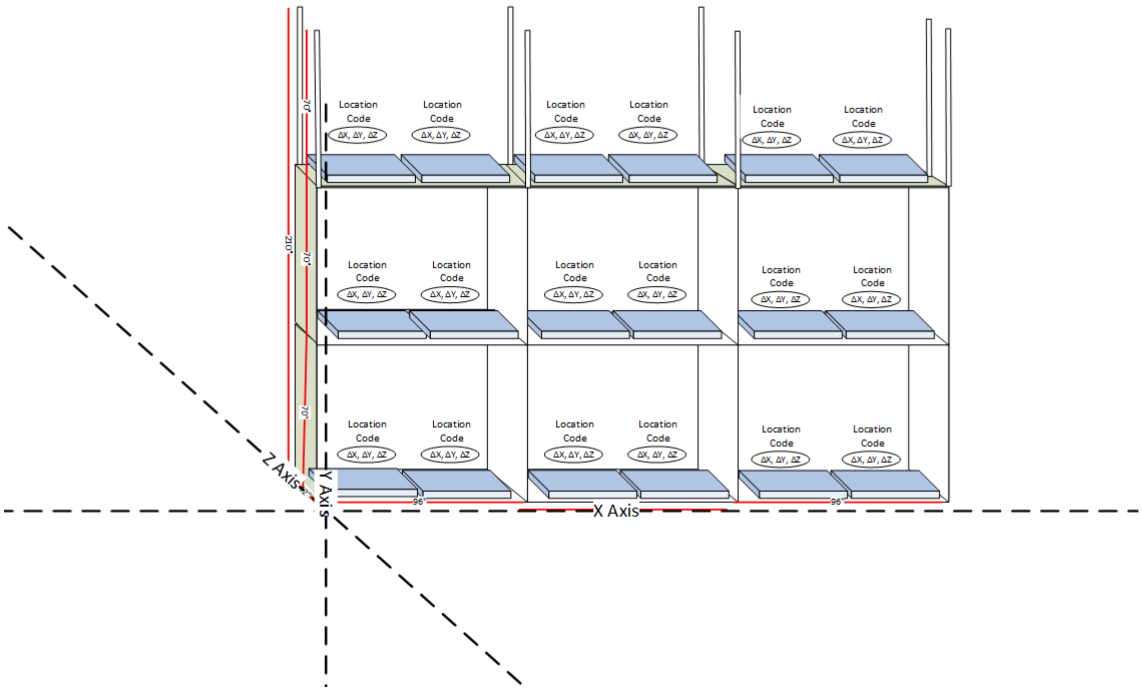

Figure 2: Rack Shelving with Coordinate Overlay

Figure 3: Current Rack Shelving in Sheppard Warehouse

The factors that cause an envelope to become unsellable include paper yellowing, humidity, and gum expiring. Based on the average shelf life of Sheppard's products, the team assumed a general shelf life of two years for all products. Expired products result in an income loss of approximately $3,200 annually (Spaulding & Haddad, 2014). This lost income is based on lost sales profit and does not account for production, labor or holding costs, which would add more to this approximated figure. To minimize the amount of discarded stock product that has already been produced, the team suggested Sheppard implement an effective FIFO policy to ensure that the oldest product is shipped first (Table 4). A FIFO strategy of finished goods retrieval has the objective of avoiding "obsolescence and expiry of single loading units of an article" (Ten Hompel et al., 2007). With this strategy, Sheppard may be able to utilize more finished goods and minimize waste.

	Functional Requirements
FR_4	Use a FIFO inventory policy

Table 4: FR_4: Use a FIFO Inventory Policy

In order to use a FIFO system effectively, employees must be able to identify both the envelope specifications and the production date (Ten Hompel et al., 2007). An effective labeling system allows for the oldest stock to be shipped out first and for expired products to be minimized. The FRs for a FIFO system can be seen in Table 5.

	Functional Requirements
$FR_{4.1}$	Label envelope carton with part number
$FR_{4.2}$	Label envelope carton with production date

Table 5: Second Level $FR_{4.1}$ and $FR_{4.2}$

Lastly, the team needed to choose a point of origin from which to base the Cartesian coordinate system. The inventory system will then minimize distance traveled by employees to access finished goods from this point. This point was optimized based on the user of the system and the location of finished goods (Section 2.3.6). This FR is listed in Table 6.

	Functional Requirements
FR_5	Optimize origin for the shipping clerk

Table 6: FR_5: Optimize the Warehouse Origin for the Shipping Clerk

2.3.3 Relationships with DPs

Based on the functional requirements, the team developed the following design parameters (DPs) to satisfy each requirement individually. These parameters dictated if the team's design fulfilled the requirements of the proposed warehouse management system. The highest level FR in the design allowed for efficient access to inventory; therefore, the highest level DP (see Table 7) required a system to address this need.

Design Parameters	
DP_0	System to efficiently manage physical inventory in a storage system

Table 7: DP_0: System to Efficiently Manage Physical Inventory in Storage System

To satisfy FRs 1-3, the design needed a system that minimized the distance traveled by finished goods. The system minimized travel first in the vertical Y direction to eliminate use of a forklift. DPs 1-3 are shown in Table 8.

Design Parameters	
DP_1	System for minimizing employee distance of travel in the Y direction
DP_2	System for minimizing employee distance of travel in the X direction
DP_3	System for minimizing employee distance of travel in the Z direction

Table 8: DP_1-DP_3: System for Minimizing Employee Distance of Travel

In order to reduce wasted goods and minimize costs, DP_4 (Table 9) satisfied FR_4 by requiring a system be built that implements use of a FIFO strategy for shipments.

Design Parameters	
DP_4	System for using FIFO inventory policy

Table 9: DP_4: System for Use of a FIFO Inventory Policy

As a component of using FIFO in the shipment process, a system for labeling served as DPs to $FR_{4.1}$ and $FR_{4.2}$ (see Table 10). This system includes labels with part numbers and production dates to track necessary product information.

Design Parameters	
$DP_{4.1}$	System to label envelope cartons with part numbers
$DP_{4.2}$	System to label envelope cartons with production dates

Table 10: Second Level $DP_{4.1}$ and $DP_{4.2}$

Lastly, the team needed a system to define the location of the origin, which satisfied FR_5. The origin needed to be located at the point that best suited the shipping employees' needs and duties, which is DP_5, shown in Table 11.

Design Parameters	
DP_5	System to optimize origin for the shipping clerk

Table 11: DP_5: System to Optimize Origin for the Shipping Clerk

2.3.4 Design Constraints

When designing the optimal organization of Sheppard's warehouse, the team needed to accommodate various constraints. These included the physical space of the warehouse, safety and fire code requirements, the positioning of the shelving units and Sheppard's budget for these changes. Sheppard's warehouse provided ample space for the amount of product they typically store, however the team adapted their design to fit the height limit within each pallet's shelf. For example, there are several racks with half the height of a standard rack in Sheppard's warehouse and therefore these shelves cannot hold as much inventory. Furthermore, there is a unit of shelves at the far end of Sheppard's warehouse that stores the forklift and other non-saleable goods. The team eliminated this unit from their design calculations, and thereby limited the useable storage space for Sheppard's raw materials and finished goods.

Based on the fire code, the team was also limited by how high goods could be stacked on the top shelf. This shelf could only hold pallets stacked four boxes high, as anything higher would interfere with the sprinkler system. The team also designed the new organization under the assumption that the shelving units could not be moved. While the units could in fact be moved, the team made this assumption to guarantee that the change cost would remain within Sheppard's budget constraint. Lastly, the team operated with the constraint that additional shelving units could not be added; this was partly due to the cost of purchasing more shelves and partly due to the forklift's need for clearance.

2.3.5 Use of Acclaro®

Acclaro® DFSS is a software tool used for Axiomatic Design ("Axiomatic Design Solutions, Inc.," 2014). The Acclaro® software by Axiomatic Design Solutions, Inc. allows the user to design and redesign matrices to display their parameters. This makes it possible to rearrange the design matrix for square matrices on which the main diagonal is full (Benavides, 2012). Acclaro® displays designs that are coupled or uncoupled allowing for the user to modify the overall outcome.

The significance of a fully uncoupled design matrix indicates that all of the design parameters fulfill the functional requirements of the inventory system independently. This means that Sheppard can change any of the design parameters without affecting any functional requirements other than the one it is intended to affect.

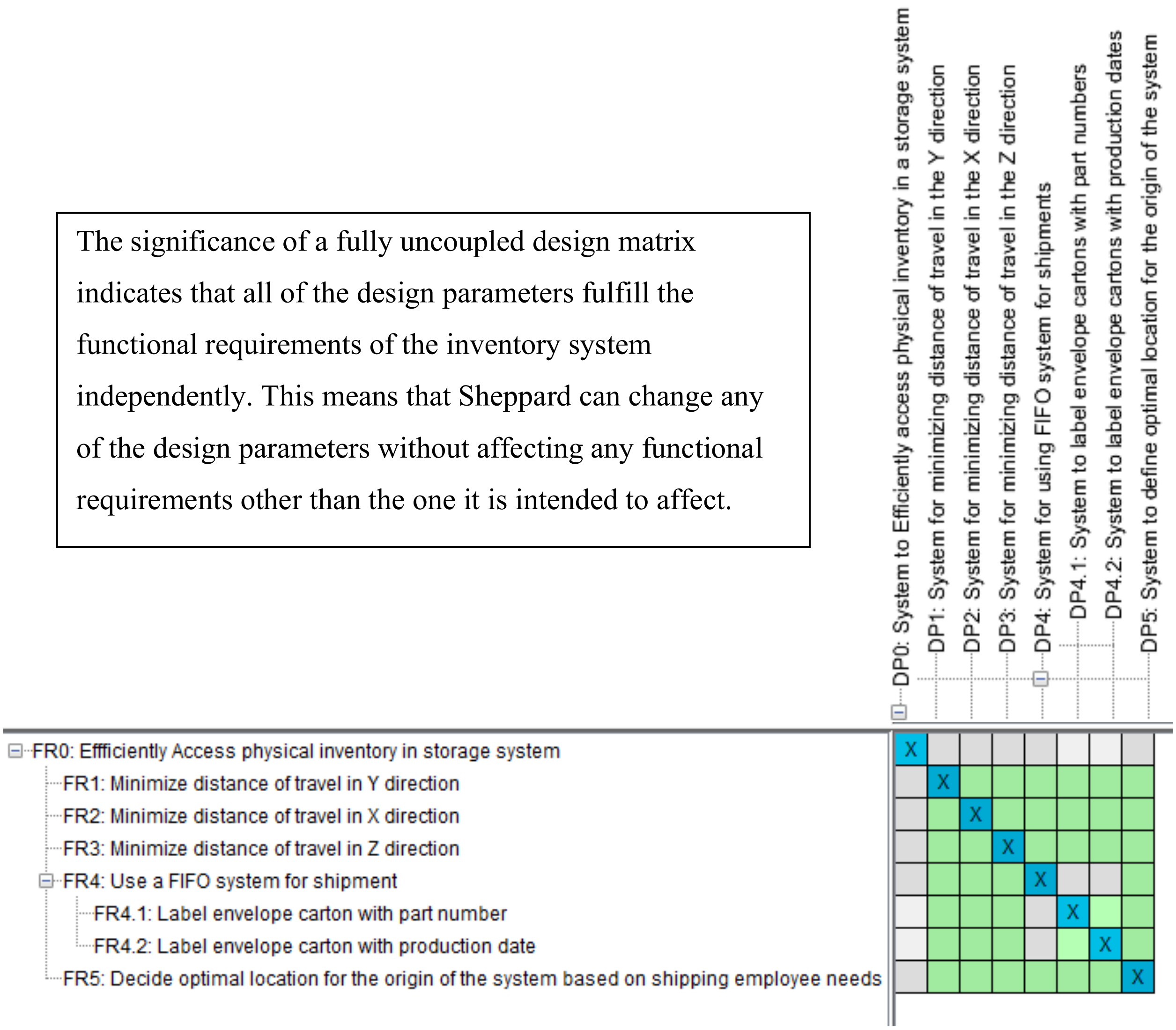

Figure 4: Acclaro® Design Decomposition

The team entered all of the FRs and DPs into Acclaro® to display the interactions and relationships between the two (Figure 4). Once entered into Acclaro®, the team found that the DPs and FRs were uncoupled meaning that they were mutually exclusive. The design was considered independent and exhaustive and the warehouse design could be completed.

2.3.6 Labeling Process

As stated in FR_4, this design needed a proper documentation system to allow for the use of a FIFO system for shipment. The team observed the current labeling process and noted Sheppard's absence of consistency; many boxes of finished goods lacked labels entirely. Sheppard would benefit from this type of organization method because a FIFO system will reduce how often product expires in the warehouse. FIFO relies on consistent documentation to show production date, quantity and the product information. Sheppard also required an adequate product numbering system; therefore, the team created SKU numbers for every stock item that Sheppard sells. The team completed this by identifying the most unique aspects of each product with the given information and assigning related alphanumeric codes. All new SKU numbers are listed in Appendix E.

2.3.7 Identification of an Origin Point and a Queue Cell

To satisfy FR_5 and for Sheppard to have the most efficient warehouse layout organization system, the team needed to select a point of origin. This point is used to determine how far away from the origin each product was placed. The model minimizes the distance traveled in the X, Y, and Z directions from this point based on which employee handles the product. There were two possibilities to place the origin, one optimized for the production employees (Figure 5) and one optimized for the shipping employees (Figure 6).

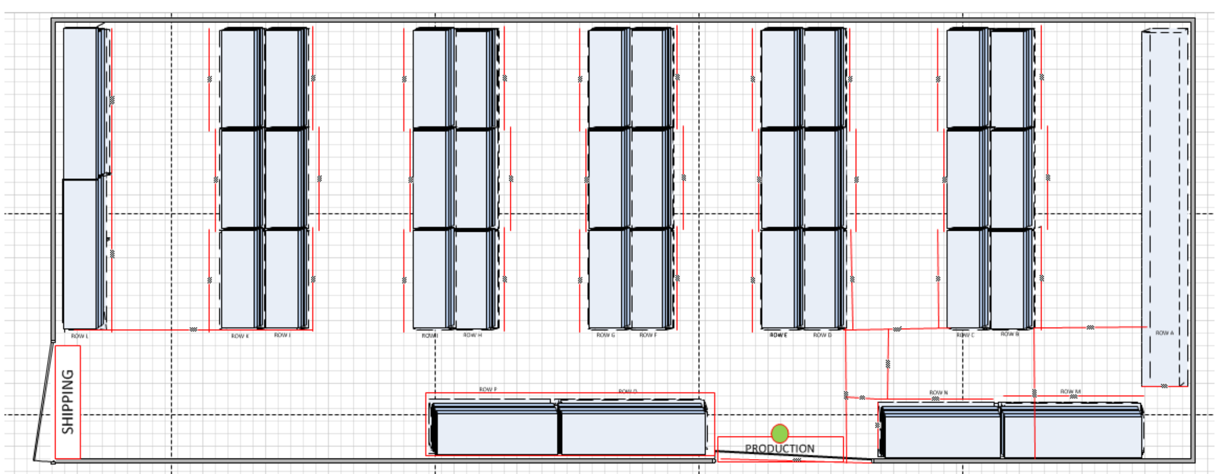

Figure 5: Location of Optimal Origin for Production Employees

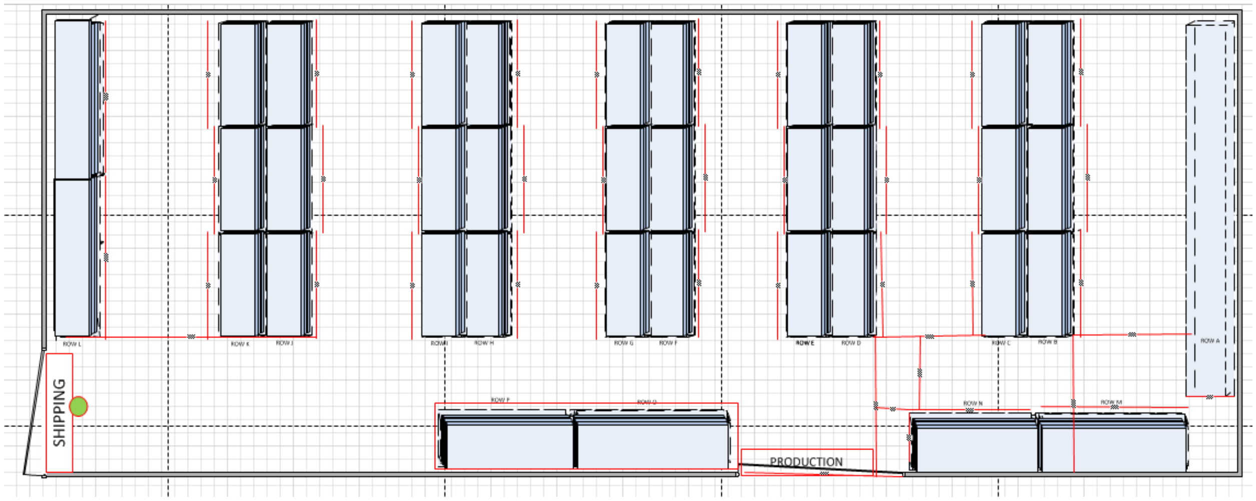

Figure 6: Location of Optimal Origin for Shipping Employees

In order to make this decision, the team interviewed employees at Sheppard including a member of the production team and Edward Haddad, Project Manager of Sheppard. During this interview, the team discovered that throughout the production process, both production and shipping employees spend large amounts of time searching for places to store products in the warehouse as well as searching for stored products to ship. Many items were often placed in arbitrary locations and were therefore difficult to recover. Approximately 15 production employees bring products into inventory while only two shipping employees search for products to be shipped. During the interview, the team learned that production employees waste valuable time by placing products into inventory when their time could be better spent producing goods for shipment, which is a value-adding activity (Spaulding & Haddad, 2014).

To minimize the time production employees spend in the warehouse and maximize the efficiency of the product placement process, the team confirmed during the interview that the best course of action was to implement a queuing cell into the warehouse. A queuing cell would provide production employees with a location to place all finished products and shipping employees would be responsible for placing finished products in the correct locations from the queuing cell. This location is placed optimally for production employees, so that these employees could enter the warehouse and place their finished goods, allowing the production employees to immediately return to the production floor. The shipping employees, who will have a better understanding of the locations of where finished products belong, could then collect these goods from the queuing cell and place them accordingly. This area will also allow for the shipping employees to be the primary organizers of the warehouse since they will be the only ones storing and retrieving the products. With the shipping employees placing the products into inventory, they will know the precise location of every product resulting in a decrease of retrieval and placement time. Figure 7 shows the recommended location of the queuing cell.

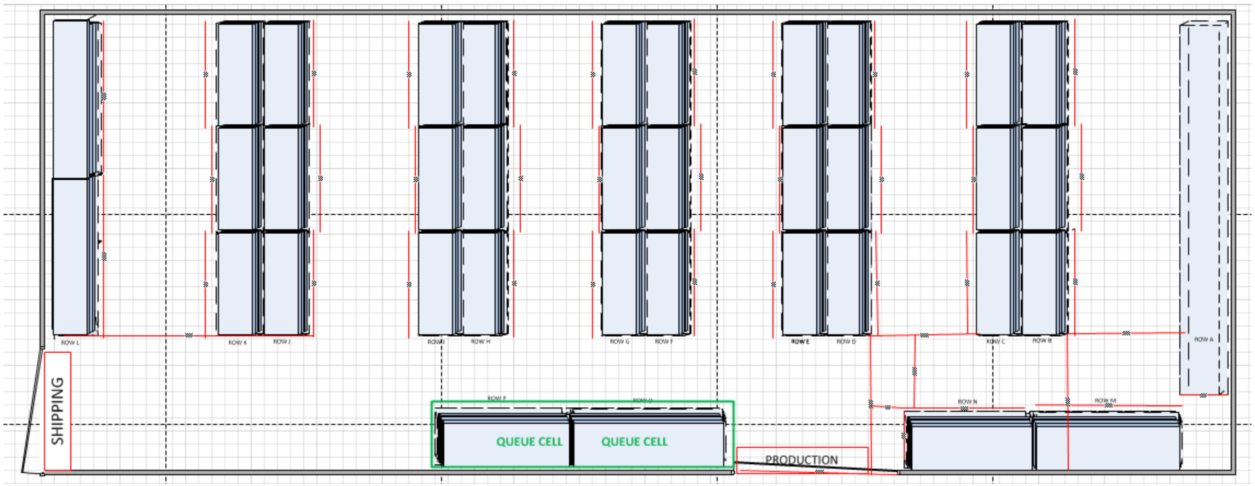

Figure 7: Proposed Queuing Cell Location

Based on the team’s initial research, interviews with the employees and the proposed implementation of a queuing cell, it was decided to base the origin according to the shipping employees’ activities. The main reasoning behind this decision was that the shipping employees are the primary employees that interact with the product. Also, in order for Sheppard to make the most of their production and labor costs, they need the production employees constantly producing envelopes. In the previous system, a production employee would shut the machine off to bring products to the warehouse, cutting down on production time. The location of the origin was determined by finding the central location between the shipping dock and the proposed queuing cell where the shipping employees would interact the most (Figure 8).

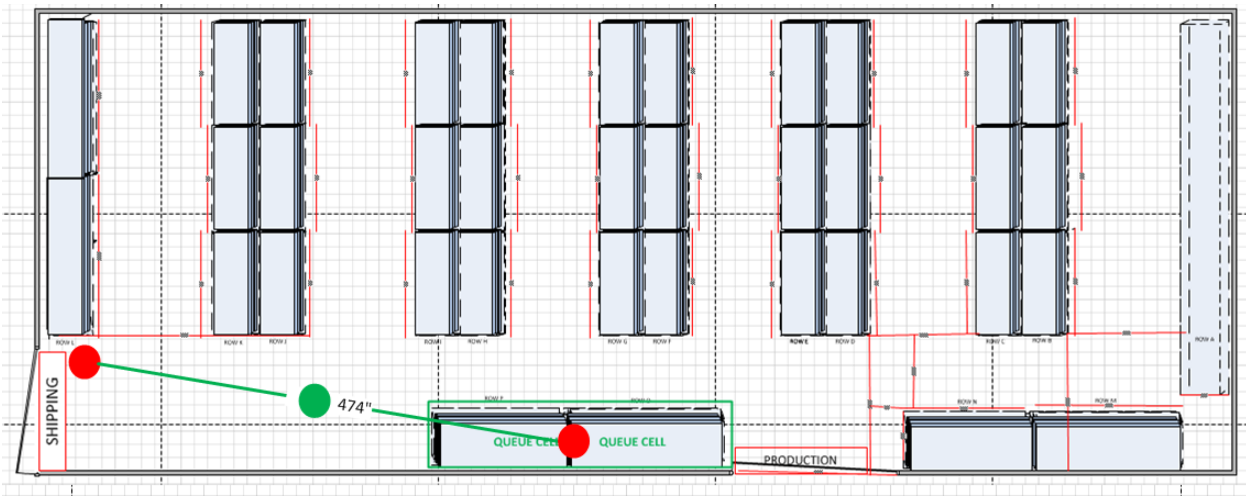

Figure 8: Proposed Queue Cell Origin

To simplify the calculations for identifying the best locations for the finished goods, the origin was placed 135" in the positive X direction to place X = 0 in the first location of Row J (Figure 9). Locations and distances traveled were calculated using this origin point.

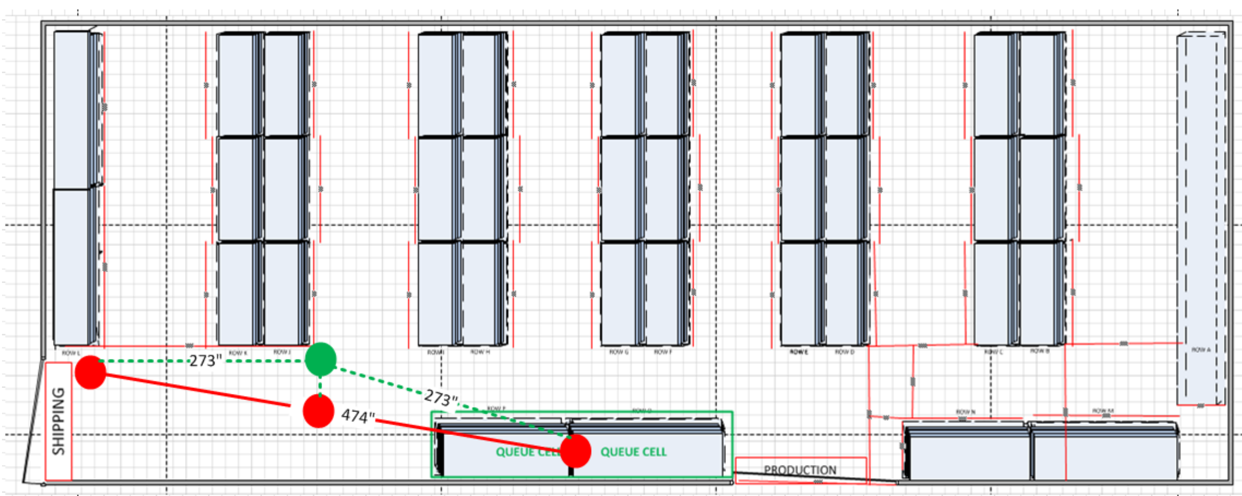

Figure 9: Proposed Queue Cell New Origin

2.3.8 Minimization of Travel Distances by Usage

After determining the origin point, the team needed to determine how to minimize travel to finished goods. The team mapped out the floor plan of the Sheppard warehouse and assigned specific location codes to each location that could accommodate a pallet along with row labels A-P (Appendix B). Each location was determined by the center of the pallet with X, Y and Z Cartesian coordinates.

The team then transferred each location code and distance in each direction in a Microsoft® Excel spreadsheet and calculated the total distance to each location by summing the absolute value of the coordinate. For example, location 002 in Row B has an X distance of 72”, a Y distance of 0” and a Z distance of -743” from the origin. The total distance that an employee would travel to walk to this location from the origin is the sum of the distances; ABS (72) + ABS (0) + ABS (-743) for a total of 815”.

After some analysis, the team discerned that the locations on the ground level were preferred over locations on the second, third or fourth levels of the warehouse racks because they do not require use of a forklift to place or retrieve goods. To ensure all ground locations were preferred over other locations, the team placed a weight of 250, the total number of locations, on the Y direction. This number was determined by analysis of the design model and found that the desired goal was achieved through this addition. For each total distance calculation in the model, the team multiplied the Y coordinate by 250. A full list of locations and distances is provided in Appendix D.

2.4 Results

In order to assist in maintaining FIFO documentation, a proper labeling system needs to be implemented, including labels with production date, product number and the employee that manufactured the product. Based on observations of the current process, the team determined that the best time to label the products is after manufacturing, when the product is boxed. The best system for labeling would be through the use of stickers with a specified template as seen in Appendix A.

2.4.1 Product Placement

One of the most important functional requirements defined through the Axiomatic Design process was the minimization of travel distance for the shipper from the designated origin. The team quantified product usage by deriving the number of orders containing a specific product per year. Based on the analysis of usage and location of a sample of Sheppard’s products, the team reassigned locations to reduce overall travel for shipping employees. The current locations and proposed locations for sample products are located in Appendix C. While this model currently only assigns locations to the sample of products, the model can be applied to all products and could further reduce travel. Lastly, the team reserved Row A to store corrugated boxes due to its location relative to the production floor. This will offer producers convenient access to necessary storage materials used in the final stages of production.

To determine the efficiency of the new location distribution, the team first recorded the current process. From this information, the team gave the current location allocation an overall usage score based on the number of orders that contain a specific product per year and compared it to the future state's usage score. In order to have the most effective warehouse for Sheppard, the team used company information to allocate their highest sold products to the most desired locations. These desired locations are the ones with the lowest distance from the origin, making it the most accessible for the shipping employee.

2.4.2 Value Stream Map

Based on observations, the team created a Value Stream Map displaying the current process Sheppard uses in their warehouse. The goal of a value stream map is to "introduce a lean value stream that optimizes the flow of the entire system" (Lovell, 2001). This diagram can be seen in Figure 11. The current lead time is 33 days, which involves the time in between processes and the time a product waits in the warehouse. Currently the value added time in the system is 120 minutes. The team recognized steps in the process that would be able to reduce the overall lead time. These steps include the addition of the queuing station and the process of having the shipping employees distribute the product within the warehouse to its designated location. The future state value stream map is seen in Figure 12. A legend for the value stream map symbols can be seen in Figure 10. With the new system, the lead time was decreased by 28 days to a total of 5 days and the value added time was only decreased by 28 minutes to a total of 92 minutes. As a result, the updated system will save Sheppard time and money. The money saved relates to the reduced labor time needed to find and package items, which now allow for the shipping employees to do other activities instead of locating products throughout the warehouse.

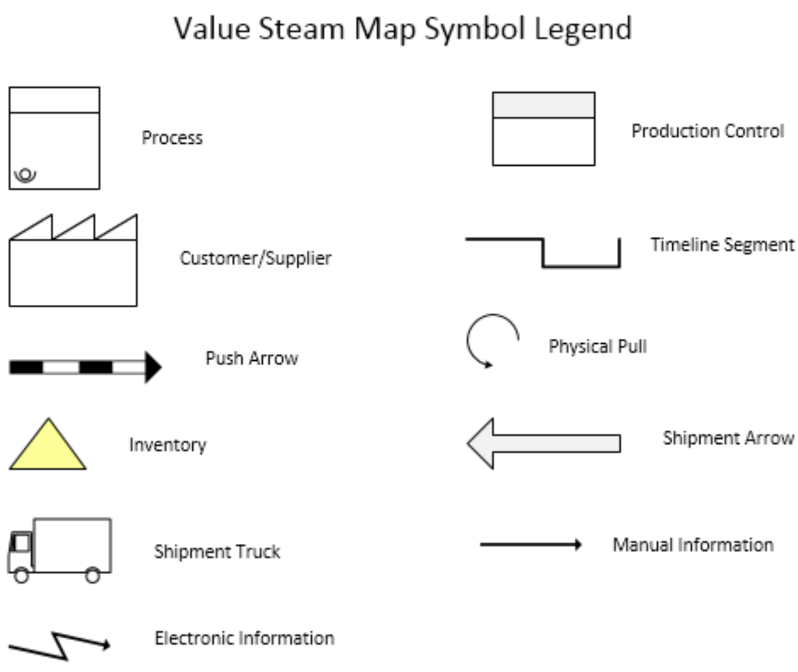

Figure 10: Value Steam Map Symbol Legend

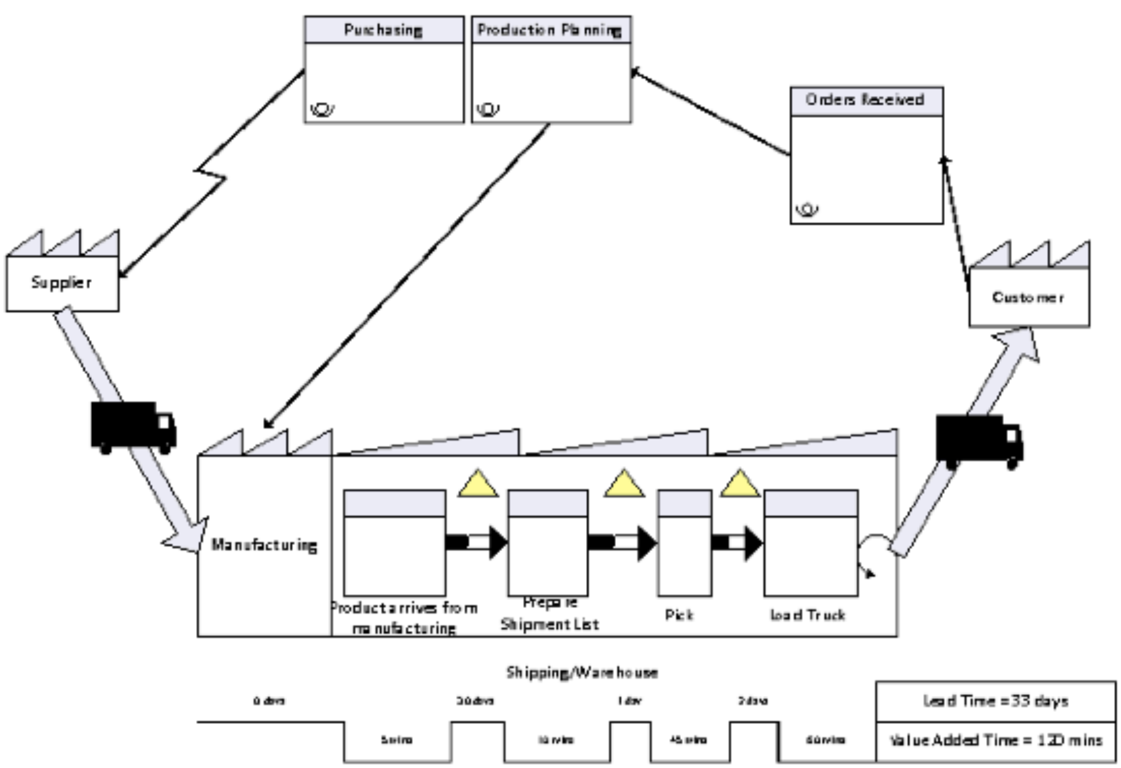

Figure 11: Current State Value Stream Map of Warehouse Processes

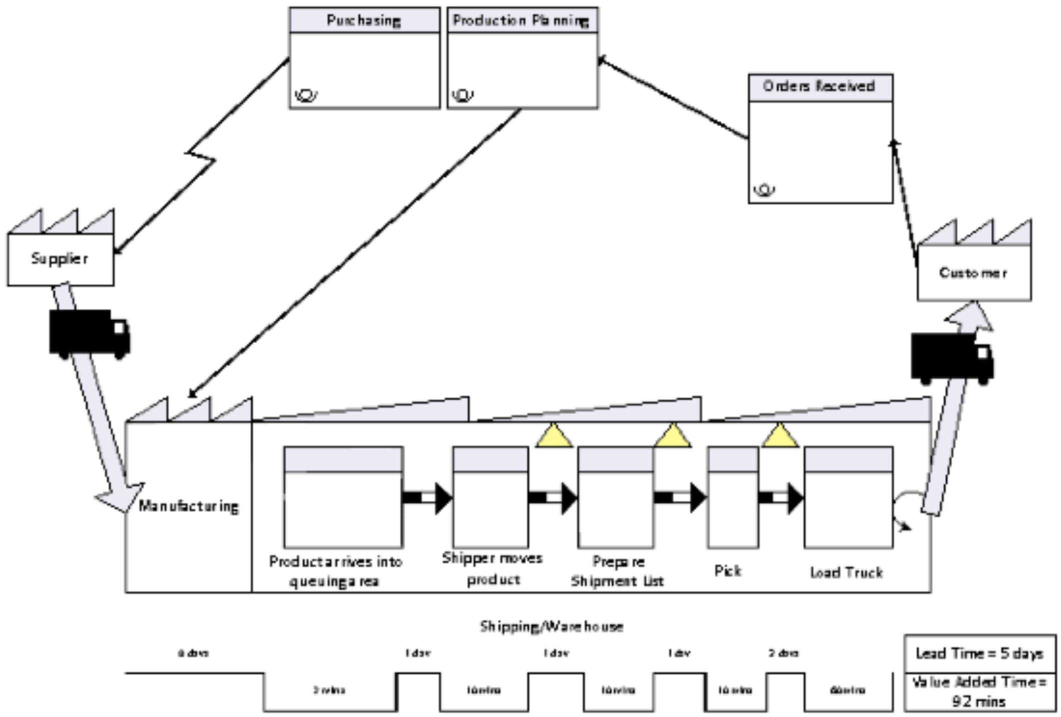

Figure 12: Future State Value Stream Map of Warehouse Processes

Also, within the warehouse, the team noticed that many shelves were being used for other purposes other than stock product. In order to accommodate the extra equipment and corrugated boxes that the envelopes are placed in, the team decided to designate a certain number of shelves within the warehouse for these purposes.

2.5 Conclusion

As the team analyzed Sheppard's current processes within the warehouse facility, numerous inefficiencies in the method of storing products were found. The team chose to use the principles of Axiomatic Design to optimize the layout and then facilitated this design with Acclaro®. This design minimized the distance each product must travel based on frequency of turnover. Furthermore, this design required the implementation of an effective labeling system.

Based on the design feedback, the team recommends that Sheppard implement the model design with all current products held in inventory by adding all product information to the database. Additionally, the model design identifies each location by desirability; the team recommends that Sheppard assign products to optimal locations and move products thusly. Once the products move locations, the team suggests that Sheppard place facility layout diagrams in both the office and production location to provide clarity and preserve consistency throughout the company. The team's next recommendation is the implementation of a standardized labeling system using the provided product label (Appendix A), which will eliminate confusion when identifying products in the warehouse. Lastly, the team recommends that Sheppard employ a queuing point in the warehouse. This queuing point would allow production employees to deposit finished goods in a designated location and quickly return to the production floor. Moreover, this would require shipping employees to store the products, increasing the chance that the organization structure would remain in place due to consistent interaction.

Beyond the benefits of providing control and structure to the warehouse layout, the team found significant financial support for executing these changes. By measuring the change in distance and saved time by moving popular products to closer locations, Sheppard would potentially save $2,805 annually in labor savings for shipping employees, given an average hourly wage of $17.80 ("Industries at a Glance: Paper Manufacturing: NAICS 322," September 19, 2014). This figure accounts for reduced time searching for and retrieving goods for shipment. However, this figure only considers the thirteen products for which previous location distance information was provided.

When this cost is extrapolated to all 318 products in Sheppard's portfolio, the team calculated that Sheppard could save up to $23,000 per year. These savings are from a reduction in labor hours, which could, in turn, be used to increase production capacity. Furthermore, this does not consider the potential savings created by the queuing point. By placing the finished products in the queuing location instead of searching for an open location, production employees will be able to keep their machines operating, and therefore produce higher quantities of envelopes and increase potential revenue.

To even further advance Sheppard's warehouse, physical rack relocation can be considered. This system would alter the racks from their current location to form a more efficient layout. There are several techniques that can be used to determine the best layout for the warehouse space. Some methods include activity relationship charts, from-to charts, fixed location layouts and several others to decide where racks should be placed (Griffin, 2012). Physical rack reallocation would require detailed blueprints with time allotted to removing all products from the warehouse to allow for the racks to be updated. The process to relocate the racks was out of the scope of this project due to the financial restrictions and other focus areas.

3.0 Manual Management System

3.1 Introduction

Primarily, an inventory management system works to organize and categorize both raw materials and finished goods. This system works to gather information in order to produce inventory as a buffer against fluctuations in customer demand and supply instabilities (Viale, 1996). This system stores locational and historical information, which can be used to ensure a First In, First Out process. Storing this information allows sales representatives and employees who use re-order point to simply identify current inventory levels and product availability more effectively. Awareness of these levels allows employees to serve customer needs quickly and efficiently.

3.1.1 Rationale

The team analyzed Sheppard's current management system to determine if improvements could be made, which helped to address one of Sheppard's largest business problems, inventory management. Sheppard stated that their poor inventory management practices were detracting from their ability to serve customers effectively and compete in the industry. Without being able to identify current inventory levels, Sheppard was unable to efficiently quote and serve customers (Spaulding & Haddad, 2014).

The current process for identifying production run size, forecasting demand and managing waste and out of date materials is non-automated and determined by the shop floor manager. The team's goal was to provide Sheppard with a system of managing their inventory to better meet customer needs.

3.1.2 Assumptions

It is assumed that any goods that have entered the inventory system described in this paper have met all dimensional quality requirements, were produced in good quality and are able to be sold to customers. Throughout this paper, finished goods will be considered as any "shippable inventories ready to be delivered to… customers" (Viale, 1996). It is also assumed that the scope of this paper includes only finished stock products and that the design model can be expanded to include other elements of inventory as needed. All numbers presented are rough estimates of company financial information and cannot be accurately calculated until the model is properly implemented.

3.2 Research

Many organizations maintain inventory, which can consist of a company's raw materials, work in process and finished goods. Costs associated with this inventory may include value of goods, cost of space, labor costs, cost of handling the product and deterioration of goods (Müller & Ebrary Academic Complete, 2011). Inventory control assists in minimizing "the risk that inventory [would] be lost through any number of means" (Bragg, ebrary Inc., & Ebrary Academic Complete, 2005). Furthermore, controls provide increased levels of customer satisfaction, efficiency of production and minimize investment in holding inventory while maximizing overall profit. Maintaining accurate inventory measurements involves calculating quantities of orders by product including an Economic Order Quantity (EOQ) and an optimal reorder point (Viale, 1996). These concepts are discussed in Section 3.2.1.4.

An inventory management system and a value-added process for tracking and managing information can be modified and extended to all products in a company's inventory. This system can offer financial and organizational benefits for the company because it shows products' performance and can provide value-added metrics to inform production and manufacturing decisions (Müller & Ebrary Academic Complete, 2011).

3.2.1 Manual System Tracking

For small companies, a manual method of tracking and maintaining inventory may be preferred due to its reduced financial burden. More complex automated systems often require significant financial investment and time to learn operations. While manual database systems are less accurate than automated systems, they provide the benefit of inexpensive simplicity (Joseph, 2014). An inventory management system adds value through its improved efficiency of purchasing and production. Such systems improve customer service, maximize efficiency and company profits and minimize the number of assets tied up in inventory (Viale, 1996).

3.2.1.1 Maximize Customer Service

One of the most important parts of a business is its customers and its relationship with its customers. In any competitive industry, providing a high level of customer satisfaction can increase business. In order to maintain a high level of customer service, an effective forecasting model of product sales needs to be utilized in order to provide customers with quality products at a fast turnaround time (Viale, 1996). By storing an optimal amount of inventory, the company can serve the customer in a convenient timeframe (Slack, Johnston, & Chambers, 2004).

3.2.1.2 Maximize Efficiency

Another advantage to storing an optimal amount of inventory is that it allows operations to "meet unexpected surges in demand" and serve unanticipated customer needs by preparing for and forecasting possible scenarios. Similarly, inventory serves as insurance if there are changes in industry, machine breakdowns or other unforeseeable events that could hinder production (Slack et al., 2004). Identifying the proper amount of inventory to hold and the optimal amount of product to run at one time is crucial for effective inventory management.

For financial and operational reasons, longer run times are generally more beneficial to companies but often produce an abundant amount of inventory. In order to maximize the efficiency of production and ensure best use of resources, including finances, an optimal production size should be determined for each product (Viale, 1996). The optimal production size can be determined using an Economic Order Quantity model as described in Section 3.2.1.4.

3.2.1.3 Minimize Inventory Investment

Economic Order Quantity works to minimize the optimal inventory level while minimizing inventory holding and production run costs. This in turn minimizes the overall investment of the company's capital that is being tied up in inventory, which is often expressed as a percentage of the product's value. This capital is money that could have been used in other parts of the business or invested in other ways. By minimizing the inventory holding costs, this money can be put to a better use (Viale, 1996). The opportunity cost of this inventory is the "return on the capital the organization might have realized if it had been invested in another opportunity rather than inventory" (Coyle, Langley, Novack, Bardi, & Gibson, 2008). Similarly, by managing inventory in a more accurate manner, companies are able to identify product expirations and reduce wasted goods by preparing for these instances. When a company plans for product expirations, they can sell items that were made previously rather than newer items to avoid spoiled goods (Slack et al., 2004).

3.2.1.4 Economic Order Quantity

The Economic Order Quantity model is a common model used in businesses today. This model utilizes operation and financial costs to find the optimal production run size (Megginson & Smart, March 3, 2008). The optimal manufacturing production quantity also includes ordering costs and holding costs of inventory (Law & Oxford Reference Online, 2010). This model assumes that there is a constant demand and that inventory is restored to its original level when supplies are depleted to the designated reorder point (Section 3.2.1.5). Under this model, the cost of inventory includes holding costs, such as storage, space, deterioration, and production costs (Encyclopedia of Small Business). This balance of minimizing both of these costs determines the Economic Order Quantity. Once determined, Economic Order Quantity is implemented per product to ensure cost effective production quantities and minimized inventory levels.

3.2.1.5 Reorder Point

A specific product reaches its reorder point when the inventory level is sufficiently reduced that a new order must be placed in order to prevent shortages of product stock (Russell & Taylor, 2011). The reorder point considers the amount of time needed to produce additional product and demand levels to ensure that enough of the product can be made to meet the demand. Additionally, the reorder point often adds a metric for safety stock of extra products in inventory in the case of unexpected demand, seasonality or unforeseen causes. Calculations in the model are based on a fourteen-day safety stock period determined by Sheppard management.

3.3 Methods

Sheppard's current system labels each carton or pallet of envelopes based on envelope name, size and date manufactured. These cartons are placed in either shelving units in the storage warehouse or in overflow areas on the production floor. Given that various envelopes may be stored in changing locations, it is difficult for employees to locate products quickly. One of the most serious problems with this system arises when a customer calls the office for a specific product and the sales representative needs to take additional time-consuming steps to answer customer questions or tell them the current stock levels and expected shipping dates (Spaulding & Haddad, 2014). The team determined that an inventory management system could significantly improve Sheppard's sales and reorder process.

At Sheppard, an employee decides when a product has a low inventory count, and the manufacturing floor manager of the company then makes the decision of which items to produce and in what amounts (Spaulding & Haddad, 2014). There is no formalized method of determining an optimal level of production, which leads to potential financial losses due to either overproduction and increased inventory holding costs or underproduction and subsequent loss of customer orders.

The employees at Sheppard continually stressed to the team the importance of timely production in a competitive industry. They explained that customers contact many different envelope manufacturing companies to find the best price and/or the fastest turnaround time. In order to meet strict deadlines and be able to allocate time to the production of custom printed envelopes, which account for almost half of Sheppard's profit margin, the company must identify the optimal levels of production and inventory levels for each product (Spaulding & Haddad, 2014). By only producing enough to meet customer needs, labor and production costs will be reduced and time will not be wasted in the overproduction of unnecessary goods.

3.3.1 Inventory Management Model

To help Sheppard calculate these critical metrics, the team developed a manual inventory database model. This model contained all metrics involved in inventory management, including product SKU numbers as determined by the team, product identifiers (type, paper, size, color), quantity on hand, annual demand, fixed setup cost, product list price, holding costs per unit, Economic Order Quantity, daily demand, lead time and reorder point. Appendix F lists this data for the top items from which the database was created. The team created a full database with all available product information and distributed it to Sheppard to use for the manual tracking of additional products.

The team used Microsoft® Access to develop the inventory model because Sheppard recently acquired this software package and is able to use on their network. Additionally, this system provided Sheppard with an interactive form that is usable by general employees, all of whom can perform a variety of production and inventory inquiries in the user interface. Microsoft® Access has a complex system of tables that support the forms; these tables are managed by the office staff to support the accurate tracking of inventory levels.

The team created the inventory management model based on the following information provided by Sheppard: product type, product common name, product size, product paper, quantity on hand, annual demand, fixed setup cost, lead time and list price. Sheppard provided the team with this information on twenty-three products from their extensive portfolio. This product sample includes a wide range of finished goods, from bestsellers to rarely ordered products.

3.3.1.1 Calculation of Metrics

From the given product information, the team calculated important metrics for maintaining manual inventory management tracking, including holding cost per unit, economic order quantity, daily demand rate and reorder point.

In an interview with Sheppard's President, the team determined that holding costs, as given by the company, were approximately 1.5% of the revenue made from each product. This comprises of insurance, spoilage, rent and other expenses (Bragg et al., 2005). Holding costs were therefore calculated as 1.5% of the list price of each product.

Holding cost or carrying cost per unit was determined by the following formula:

$$Holding\ Cost\ per\ unit = list\ price * 0.015$$

Equation 1: Holding Cost Equation

An example of use for this formula could be applied to one of Sheppard's top selling products, the white doorknob hanger in 24 lb. paper with given SKU number DK0200. This product has a list price of $0.07 per unit, therefore the holding cost would be $0.00106 as determined by the following:

$$Holding\ Cost\ per\ unit = \$0.07 * 0.015$$
$$Holding\ Cost\ per\ unit = \$.00106\ per\ unit$$

Equation 2: Holding Cost Equation Example

The team then calculated the Economic Order Quantity in order to allow Sheppard to produce an optimal number of each product. This would allow Sheppard to save money in holding costs, apply saved time to production of other goods and ensure customer satisfaction by meeting demand. Economic Order Quantity is calculated using Equation 3 (Viale, 1996):

$$EOQ = \sqrt{\frac{2 * Annual\ Demand\ Quantity * Fixed\ Setup\ Cost}{Holding\ Cost\ per\ unit}}$$

Equation 3: Economic Order Quantity Equation

An example of use of this formula can be applied to product DK0200, which has an annual demand quantity of 30,500, a fixed setup cost of $1,200 and a calculated holding cost per unit of $0.00105 (Equation 2). This results in an Economic Order Quantity of 262,169 (Equation 4) suggesting that 262,169 units should be produced per run of this particular product.

$$EOQ = \sqrt{\frac{2 * 30{,}500 * 1200}{0.00106}}$$

$$EOQ = 262{,}169$$

Equation 4: Economic Order Quantity Equation Example

This calculation provided Sheppard with the optimal quantity to produce per run in order to minimize production and carrying costs while still meeting customer demand. Without using these formulas, Sheppard would determine their order quantity based on intuition or previous orders, not by using formal metrics. Their method could not guarantee optimal order quantities or a minimization of production costs and carrying costs. Similarly, an interview with Sheppard's Project Manager revealed that often customer orders could not be filled or guaranteed on time to meet customer demand. Use of a calculated equation such as Economic Order Quantity could improve accuracy of producing an optimal order quantity for each product.

Daily demand rate was determined by the formula shown in Equation 5:

$$Daily\ Demand\ Rate = \frac{Annual\ Demand\ Quantity}{365}$$

Equation 5: Daily Demand Rate Equation

This calculation can be applied to the previous example of product DK0200 by considering the given annual demand quantity of 30,500 resulting in a daily demand rate of 84 units as seen in Equation 6.

$$Daily\ Demand\ Rate = \frac{30{,}500}{365}$$

$$Daily\ Demand\ Rate = 84\ units$$

Equation 6: Daily Demand Rate Equation Example

The daily demand rate was then used with the provided lead-time in days to calculate reorder point using the following formula (Viale, 1996):

$$Reorder\ Point = Daily\ Demand\ Rate * Lead\ Time$$

Equation 7: Reorder Point Equation

This equation can be applied to the previous example of product DK0200 by considering the calculated daily demand rate of 84 units per day and the given lead time of 60 days (Equation 8). This results in a reorder point of 5,014, meaning that when the level of inventory reaches 5,014, a new production order should be initiated to meet customer demand.

$$Reorder\ Point\ =\ 84\ units\ *\ 60\ days + Safety\ Stock$$

$$Reorder\ Point\ =\ 5{,}014\ units$$

Equation 8: Reorder Point Equation Example

The reorder point metric provides Sheppard with the ability to determine what inventory level should trigger a production run for that particular product.

3.4 Results

From the calculated Economic Order Quantity and reorder point, the team created a manual model to help Sheppard track their inventory levels and plan stock reorders as efficiently as possible. This model does not account for custom orders, which occur frequently and may alter the stock reorder process.

3.4.1 Design Model

The intent of the designed model was for implementation into Sheppard's inventory tracking practices. By using this model, Sheppard would not only be able to quickly identify how many products are in inventory at a given time, they will also be able to determine when new products need to be manufactured and at what run size. The given and calculated metrics were inputted into a database model and an interactive form was created as a user interface for Sheppard employees.

3.4.1.2 Example of Use

An employee of Sheppard would be able to easily identify all metrics for a product by entering the database model and choosing a product SKU number from the Product ID drop down menu. For an example of this database, product MN0315, Sheppard's best-selling product, the 1.5 x 1.5 miniature envelope in 24 lb. paper is displayed in Figure 13.

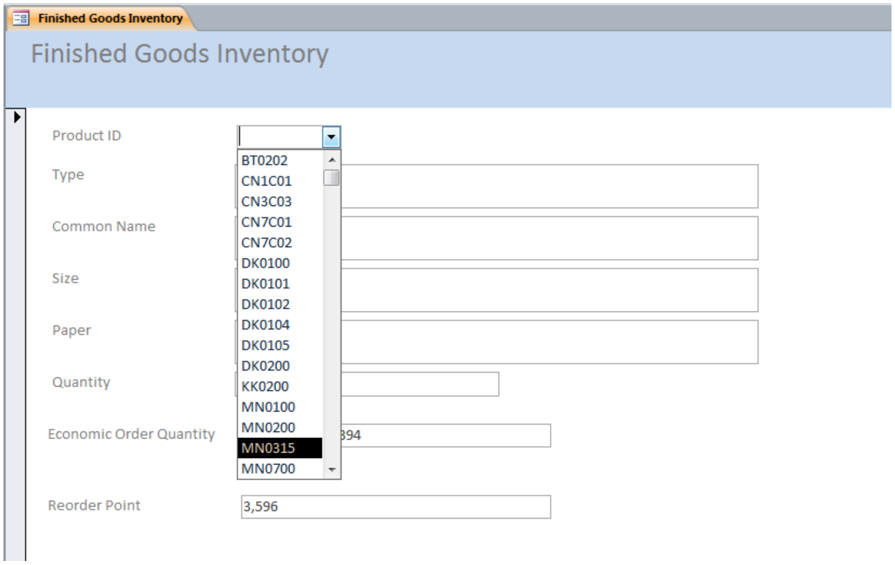

Figure 13: Inventory Management Model: Product ID Dropdown

Once the user selects the Product ID, all other information is automatically loaded into the fields based on the sub-tables of data for reference, which would be updated manually by an employee (Figure 14).

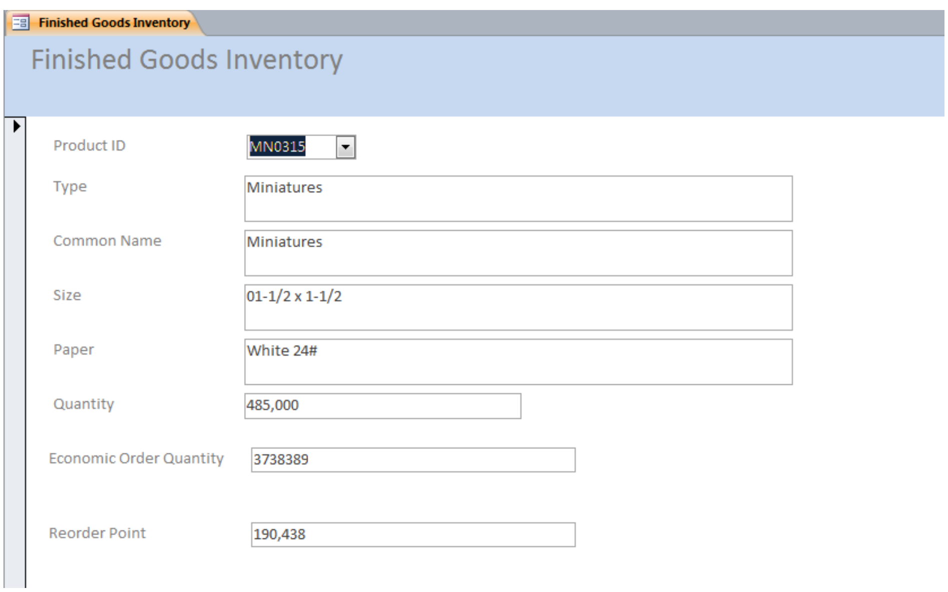

Figure 14: Inventory Management Model: Generated Metrics

The suggested Economic Order Quantity for this product is 3,738,389 because the holding cost is so low at $0.000315 per unit and the product is in such high demand at 2,317,000 annually. If over 3 million products were made at once and held in inventory, holding costs and setup costs would be minimized and customer needs would be met. This level of production is theoretically accurate, however, realistically inconvenient as executing a production run of that size would tie up machines and employees for more time than desired. Therefore, the recommendation would be to increase production of the products that result in higher Economic Order Quantities as much as possible while maintaining realistic operations.

3.5 Conclusion

After analyzing the inventory management and reorder process, the team identified considerable areas for improvement. Mainly, Sheppard lacked a functional inventory management system that provided sales representatives with the necessary information to complete their daily activities efficiently. Furthermore, Sheppard lacked a standardized replenishment method, which led to their inability to react rapidly to changing demands. Based on these observations, the team calculated optimal production run sizes to ensure that Sheppard utilized all equipment on the manufacturing floor to its potential. The team also calculated the optimal reorder point for an example product to demonstrate how appropriate timing of reorders would help Sheppard react to customer demands.

The team recommends that Sheppard utilize the described inventory management model created for use in Microsoft® Access. This model will allow Sheppard to produce more efficiently. Furthermore, the model will reduce the chance that Sheppard is unable to meet demand, as the model will ensure that new orders are created when triggered by the reorder point. The implementation of this or a similar inventory management model will allow Sheppard to track inventory stock levels and optimal levels of production.

In a conversation with Sheppard leadership, they mentioned that they typically accept and fill 10 of the 100 quotes that they distribute. Because of their lack of inventory management, Sheppard employees are not able to fill quotes in a timely fashion and customer service suffers. In a competitive market, the team believes that with more accurate control over inventory management with use of the proposed model, Sheppard will be able to better serve customer needs. For these reasons, the team is assuming an increase in quote retention by anywhere from 5% to 15% meaning that out of every 100 quotes they offer, they will accept and fill 10.5 to 11.5 orders. This is an overall increase of 193 to 579 orders per year. At an average order cost of $90.36, Sheppard could increase revenue by approximately $17,000 to $57,000 annually. When considering initial costs of training employees to use the system, initial data entry setup, labor time and ongoing weekly data entry, the calculations resulted in a 183% to 748% first year return on investment and a 409% to 1427% ongoing return on investment in following years. These numbers are large due to assumptions made that there would be an increase in quote retention of 5% to 15%. Assumptions were made on average order data given to the team based only on 29 products provided by Sheppard. Additional calculations can be performed to apply to all of Sheppard's 300+ products. Full calculations are located in Appendix H.

4.0 Automated Management System

4.1 Introduction

An automated inventory management system is a software system that replaces the job of a manual inventory model in a company. While more expensive to implement, automatic systems are able to save companies 5% to 15% due to increased efficiency and direct cost savings (Agilysys, 2012). Once these systems are established, employees spend less time maintaining the system. Moreover, this type of system streamlines processes such as order creation, order tracking and shipping. By minimizing clerical errors from repetitive data entry, computerized systems also greatly improve data accuracy. Many automatic systems can also be used with barcoding scanners, which further reduces data entry errors and accelerates processes (Bragg et al., 2005). With these features, employees can utilize their time and money more effectively on tasks that cannot be automated, while the software completes menial, easily automated tasks behind the scenes (Hartman, 2005).

4.1.1 Automated System Tracking

Sheppard usually counts inventory once per quarter and the data collected has a high risk of containing errors. However, an automated system allows them to maintain accurate, real-time inventory data. This both reduces the time spent by employees maintaining the inventory and increases the accuracy and reliability of the inventory data. Furthermore, this system allows raw materials to be entered into the system as soon as they arrive at the manufacturing facility; this real-time update informs the company of their supply levels continuously. Then, when the company manufactures stock material, these inventory levels would be updated in real-time as well. Lastly, when a customer creates an order, this can be automatically subtracted from the inventory, allowing the system to provide accurate inventory levels for all materials (Agilysys, 2012).

Automated systems keep records of the products made and sold; therefore, these systems are able to assist companies with forecasting more easily than a manual system. As more data is gathered, many automated programs are able to recommend ideal stock levels for specific products and help determine reorder points on a product-by-product basis. By keeping records of the inventory made versus sold, a company is able to identify product sales trends. The systems are then able to tailor a company's inventory levels since they have identified top selling and unpopular products. The computer's forecast might be more accurate than manual forecasting, because the mathematical models examine more variables. Moreover, the automated nature of this system does not require continual updates and calculations from an employee, therefore saving the company labor costs since the employee's time can now be spent on other tasks (Hartman, 2005).

Many automated systems are able to generate documents for each transaction; possible documents include purchase orders, bills of lading, shipping orders, invoices and account statements, as well as a variety of inventory reports. These are examples of tasks that employees will no longer need to complete manually. Most automated systems are able to store customer and order information, allowing the system to automatically complete the majority of the information on a repeat order. This increases the efficiency of the ordering and shipping processes and saves a company additional labor costs (Conrad).

4.1.2 Rationale

An automated management system provides companies with tools to efficiently maintain manufacturing functions. These systems offer advantages including reducing downtime, reducing the cost of production, minimizing in-process inventory and minimizing the space used (Rao, Patvardhan, & Singh, 2011). Similarly, traditional methods of gathering inventory data involve a large amount of employee labor time and therefore create additional costs to the company. This method is subject to human error because of the risk of entering incorrect data. Data collection by employees is a non-value added task for which the customer is not benefitting directly (Bragg et al., 2005).

Sheppard Envelope Manufacturing Company did not have a shop floor control system in its manufacturing facility, meaning there was no system for employees to track current orders throughout the manufacturing process. Sheppard was unaware of their production run times and was not able to locate a customer's order in the system. This resulted in both a decreased customer experience and a potential loss of money in the production system that they could have been unaware of, including labor hours from checking on orders manually and searching the facility for raw materials. Manual methods are time consuming and subject to human error which an automated management system could alleviate.

4.1.3 Assumptions

The team researched a variety of automated management systems to understand the nature of these systems and the features that were frequently included. From this, the team identified a set of criteria by which the team was able to judge the system. The team also included criteria deemed vital by Sheppard management, regardless of commonality amongst well-known management systems. As pricing was a part of these criteria, the team also assumed monthly fees could be summed for an annual fee. This information helped the team compare systems with repeat fees to those with one-time fees by running a return on investment model. To simplify the decision model, the team also assumed a consistent level of complexity for each criterion; for example, a system that produces complex accounting and forecasting reports received the same weight as a system that produces basic accounting reports.

Based on the team's research of management systems and understanding of Sheppard's needs, the various options found through Capterra, a business software database, were narrowed down to the four software systems that mostly closely matched Sheppard's needs from the initial analysis (Capterra, 2014). When implementing the decision model, the team assumed Sheppard management understood the chosen decision model effectively to understand how each ranking of criteria would affect the importance of these and that Sheppard management understood the qualities of each criterion fully and correctly.

For calculation purposes, an assumption of four users was made for the QuickBooks™ Enterprise package (Section 4.2.1.3) based on company usage and who, at Sheppard, would most likely be interfacing with the system. Finally, all labor wages and financial information used in calculations are based on the 2014 paper manufacturing industry standards ("Industries at a Glance: Paper Manufacturing: NAICS 322," September 19, 2014).

4.2 Research

The team researched a variety of different software packages that could satisfy Sheppard's inventory management needs. These systems included multiple Finale Inventory© products, Fishbowl Inventory©, QuickBooks™ Enterprise, and many other products, which were later eliminated from the team's deliberations. Ultimately, the team used the decision making tool, Analytical Hierarchy Process (AHP) to examine these software options.

4.2.1 Automated Systems

The key to lean and agile manufacturing operations is the consistency and repeatability of shop floor processes. A paperless work management system offers consistent, reliable control over production practices. Therefore, agile shop floor control must be able to adapt to the changes and failures of these components. It needs to be able to respond to external factors such as order variations, vendor changes and product design changes, and to accommodate multiple changing criteria involving cost, quality, time and system flexibility (Chan & Zhang, 2002).

Shop floor systems must be able to balance the fast pace of a manufacturing plant. Machines may fail, employees may make mistakes, orders may change and the system must be able to analyze this information as well as keep up with other events that are continuously developing on the shop floor. A shop floor control system also manages the inventory, specifically during manufacturing. According to Chan and Zhang, a shop floor control system is a system that is "responsible for the coordination of physical flow and information flow in the manufacturing shop floor environment." This type of system gathers information recorded from a shop floor in real time. A shop floor can be classified as a manufacturing floor. Within Sheppard, this is where all the envelope production takes place and is a large component of the value added activities for which the customer is willing to pay. An automated management system can provide the best methods of achieving this type of control.

There are many types of automated management systems available to companies today offering different packages and features at varying purchase levels. The "choice of a suitable system" requires an understanding of the products and features to identify how they would best meet the needs of the company (Ten Hompel et al., 2007).

The following sections discuss the analysis of three major automated management systems available for purchase: Finale Inventory© Small Business, Finale Inventory© Standard Business, Fishbowl Inventory©, and QuickBooks™ Enterprise. Table 12 provides a brief breakdown on the features available with each option.

	Finale Inventory© Small Business Package	**Finale Inventory© Standard Business Package**	**Fishbowl Inventory© Manufacturing**	**Enterprise Advanced Inventory**
Price of System	$99/month	$199/month	$4,395 one fee	$3,000 one fee
Summary Reports	X	X	X	X
WIP Tracking		X	X	X
Inventory Management	X	X	X	X
Work Station Tickets	X	X	X	
QuickBooks™ Integration	X	X	X	X
Cloud-based System	X	X		
Barcoding		X	X	X
Sales and Billing Documents	X	X	X	X
Shipping Documents	X	X	X	X
Inventory Adjustment	X	X	X	X

Table 12: Automated Management System Options Features

4.2.1.1 Finale Inventory©

Finale Inventory© is a cloud-based inventory management system. A cloud-based system can be explained as a system where all information is stored in an online “cloud”. This type of system does not require physical hard drives to store information. A cloud-based system is able to integrate with QuickBooks™, which is an accounting management system common to many small businesses ("Finale Inventory,"). Finale Inventory© can also support barcoding capability and has the ability to be used from mobile devices. Finale Inventory© has a variety of features available for use through their three-tiered pricing system ("Finale Inventory,"). Notable features for the relevant package options are displayed in Appendix K.

4.2.1.2 Fishbowl Inventory©

Fishbowl Inventory© is an add-on automated system designed specifically to link with QuickBooks™. Instead of being cloud-based, the company would store information on their local server. Fishbowl Inventory© is purchased with a one-time payment that is dependent on the number of user licenses the company purchases with the system. Fishbowl Inventory’s© main product suited for manufacturing is Fishbowl Inventory© Manufacturing ("Fishbowl Inventory -

Inventory Management Software," 2014). Appendix L displays the important features of this system.

4.2.1.3 QuickBooks™ Enterprise

QuickBooks™ Enterprise is an advanced version of QuickBooks™ accounting system. It was designed as an enhancement to the basic QuickBooks™ software to provide advanced features for QuickBooks™ users. QuickBooks™ Enterprise has a three-tiered level of packages, the Silver, Gold, and Platinum levels ("QuickBooks Enterprise 2015," 2014). The relevant features of QuickBooks™ Enterprise Platinum are seen in Appendix M.

4.2.2 Analytical Hierarchy Process

Analytical Hierarchy Process (AHP) is one of the most effective decision-making analysis tools due to its ability to "provide solutions to decision problems, where several alternatives for obtaining given objectives are compared under different criteria" (Andrecut, 2014). This method prioritizes and ranks customer needs through multiple criteria such as price, location or size. Furthermore, this method measures the degree of consistency within the process (Bunruamkaew, 2012). The consistency analysis checks to determine that the original preferences were consistent; in essence, this analysis ensures the customer did not alter their interpretation of the various ranking levels (Bunruamkaew, 2012). AHP then uses a hierarchy process and pair-wise comparisons to develop an outcome that best fits the needs of the stakeholder.

When beginning the AHP, one must first determine which qualities are preferred over others. For example, is price of the system more important than if the system has a barcode attachment? Once this is determined, it must then be decided by what degree is this criterion more important than another through a numerical ranking. This ranking system is shown in Table 13.

Scale	Degree of preference
1	Equal importance
3	Moderate importance of one factor over another
5	Strong or essential importance
7	Very strong importance
9	Extreme importance

Table 13: Degree of Preference for AHP Criterion

After each criterion is ranked against every other criterion, this information is normalized within a matrix. The full process is shown in Appendix N. This allows specific criteria to be weighed above others, based on the importance of those criteria to the client. Once all criteria are appropriately weighed, the user calculates how closely a system matches the desired criteria and the inputs are then ranked in the order of their ability to satisfy the requirements. Lastly, the user consults with their client, explains the results and provides guidance to help their client make a well-informed decision.

4.3 Methods

When determining the most suitable automated system for Sheppard, the team completed a process to evaluate the systems based on their characteristics. The team chose AHP due to its uniquely strong focus on the consideration of customer needs within the calculations of the decision process. During an interview with the President of Sheppard and the Project Manager, the team gathered preferred system criteria. This interview also provided the opportunity for Sheppard management to rank each criterion against the others; this information is vital for the calculations in the following sections.

4.3.1 Automated Inventory Management System

The team chose Analytical Hierarchy Process (AHP) as the decision-making process for the automated management system due to its focus on needs of the customer, Sheppard. By consulting with the main stakeholders, the team was able to analyze which specific requirements needed to be addressed first. Through the AHP method, the team concluded which type of system best satisfied Sheppard's needs. AHP uses a hierarchy method to allow for different criteria to be categorized by importance.

4.3.1.1 Analytical Hierarchy Process

To employ AHP based on Sheppard's highest prioritized qualities, the team administered an interview with the President and Project Manager. After Sheppard's leadership determined the rankings of the criteria, each criterion could be added to the pair-wise comparison. This process allows for the weights, which were decided by the degree of preference table, to be factored into the calculations. After completing the first set of calculations, the process could be normalized using the reciprocals of the weights. These steps then allowed for the consistency to be checked resulting in the best choice order of criterion for Sheppard. This process is shown in detail in Appendix N.

4.3.1.2 Analytical Hierarchy Process Requirements

The team used eleven different criterion to evaluate the computerized systems for Sheppard, shown in Table 14.

System Qualities	
Price	Cloud-based system
Ability to generate summary reports	Ability to use barcoding
Ability to track WIP (Work In Process) throughout the plant	Ability to create sales and billing documents
Inventory management capabilities	Ability to generate shipping documents
Ability to create work station tickets	Ability to adjust inventory at time of order
QuickBooks™ integration	

Table 14: AHP Requirements Qualities

Sheppard was interested in obtaining an automatic system for their inventory and shop floor management, but were concerned about the price of the system, so a cheaper price was preferable. Some of the systems that the team reviewed had a monthly price, while others had a one-time fee. In order to accurately compare the systems, the products were compared over both a one-year and three-year period.

Summary reports include, but are not limited to, inventory turnover reports, financial reports, gross sales by product reports, inventory level reports and historical data reports. These reports assist companies with analyzing their inventory data, which allow them to adjust to trends in sales and better the company’s production. Each software system was evaluated on their ability to create these reports.

A system’s ability track work in process (WIP) through a production plant refers to a process where an employee can type in an order number and the system will be able report where that order is in the plant. For Sheppard, this means that the system would be able to indicate if an order was in the cutting or folding department, or if it had already been completed and moved to the warehouse. This criterion was important because a system that supports this will be able to give Sheppard the ability to track stock in the plant and report order tracking to customers whenever needed.

The team considered an automated system to have inventory management capabilities if it had features such as real-time inventory data and the ability to calculate reorder points for individual products. Other inventory management features that are important are the ability to track stock by expiration date and stock location.

Sheppard considers a work order to be a work station ticket, which tells the production floor what to produce next. Sheppard considered this an important requirement for a computerized system because these tickets are vital to their operations. These tickets were previously generated by hand and the ability to computerize this process could save time and money for Sheppard.

Before the team began working with Sheppard, the company had already decided that they were going to purchase QuickBooks™ software to assist with their accounting and finances. Therefore, when searching for a computerized system for Sheppard, QuickBooks™ integration, or the ability for the product to work seamlessly with QuickBooks™, was an important factor to evaluate.

An automated system is cloud-based if all of the information is stored online, rather than on a local server. This can be beneficial because these systems are supported by an outside group of people, meaning that any issues with the system would not have to be solved by Sheppard themselves. Also since all of the information is stored in the cloud, a company will not have to worry about losing their information if something were to happen to their server.

The team considered a system to have barcoding if it supported the ability to integrate with barcode scanners. Barcode scanners allow employees to scan inventory into a specific location, which is beneficial because it reduces the risks of data entry errors. The scanners communicate with the computerized system and automatically add the inventory and its location into the database for accurate inventory management.

Sales and billing documentation includes purchase orders, price quotes, sales orders and invoices. The ability of a system to produce these documents was an important criterion for Sheppard because it could simplify the order making process by reducing the time spent creating manual documents.

Shipping documentation includes anything from shipping labels and bills of lading, to pick, pack, and ship paperwork. These documents make it possible for a company to ship their products and a system's ability to produce these documents would make the shipping process easier and more efficient.

An important criterion for Sheppard was the option for the system to automatically adjust the inventory at the time of order. This means that when an employee enters an order into the system, the system automatically decrements the inventory quantity for the product, so that the inventory only reflects the "available to promise stock," helping to prevent a company from selling product that is already sold to another customer.

4.4 Results

The team used the information gathered from interviewing Sheppard management to run the AHP calculations. After establishing the importance of each of the eleven criteria, the team applied AHP to determine which automated management software system was the best value to satisfy Sheppard's needs.

4.4.1 Results from Interview with Sheppard Management

The interview with the President of Sheppard and the Project Manager allowed the team to rank each criterion against each other. These priorities, in order of importance, are shown in Table 15. The priorities allow for the team to weigh certain criteria more heavily in the final calculations.

Criteria	**Overall Priority**
Inventory Adjustment	0.1997
Work Station Ticket	0.1939
Inventory Management	0.1526
Sales & Billing	0.1292
Shipping Documents	0.1124
Price	0.0812
Summary Reports	0.0661
QuickBooks™ Integration	0.0201
Cloud Based	0.0163
WIP Tracking	0.0155
Barcoding	0.0131

Table 15: Overall Criteria Priority

As evidenced by this table, the President of Sheppard was strongly opposed to the introduction of a barcoding system. The ability to adjust inventory at the time of order and the creation of a work station ticket were the most necessary features of an automated system. Therefore, the team's calculations rewarded systems that offered work station tickets and inventory adjustments, but penalized those that used barcoding machines.

4.4.2 Results from Analytical Hierarchy Process

Sheppard would benefit from an automated system because it would streamline many of their processes and improve their data accuracy. In their current state, when a customer calls to receive a quote for a product, employees must place the customer on hold, walk to the warehouse and manually determine if there is enough of the desired product in stock to fill the order. With an automated system, they would be able to look up the product on their computer and give the customer an answer in seconds. This would improve customer relations and overall quote retention.

Sheppard would also be able to keep more accurate inventory records of their envelopes, paper, and cardboard boxes used for envelope storage and shipping. An automated system would give them real time information about their inventory levels. Implementing an automated system would also help Sheppard determine the correct stock levels to maintain and when they should produce more stock items. An automated system would also allow them to reduce the time that the employees in the front office spend creating quotes and other important documents. It currently takes office employees up to 24 hours to create a quote and order documentation, but with an automated system, that time would be reduced significantly (Agilysys, 2012; Conrad; Hartman, 2005).

For Sheppard to implement an automated system there will be a cost involved, but the time savings, money savings and the overall increased efficiency and streamlining of their processes would outweigh this cost. Since the software systems have both one-time and monthly fees, the team evaluated the options considering a 12-month and a 36-month investment. After analyzing all options, the team ranked the software systems in descending order based on their AHP score; the software with highest score received the best ranking and would meet Sheppard’s needs most effectively. The final results can be seen in Table 16 and Table 17. Finale Inventory© Small Business and Finale Inventory© Standard Business were consistently ranked higher because they supply the criteria that Sheppard desired. There were certain criteria that Sheppard did not prefer and these two systems did not require use of these criteria.

Overall Rankings 12 Months		
Rank	**Software**	**Score**
1	Finale Inventory© Small Business	0.24
2	Finale Inventory© Standard Business	0.21
3	QuickBooks™ Enterprise	0.19
4	Fishbowl Inventory©	0.19

Table 16: Results of 12 Month AHP

Overall Rankings 36 Months		
Rank	**Software**	**Score**
1	Finale Inventory© Small Business	0.54
2	Finale Inventory© Standard Business	0.53
3	Fishbowl Inventory©	0.53
4	QuickBooks™ Enterprise	0.26

Table 17: Results of 36 Month AHP

4.5 Conclusion

Based on the Analytical Hierarchy Process calculations, two of the four systems can be eliminated: QuickBooks™ Enterprise and Fishbowl Inventory©. These can be disregarded because they are consistently the least preferred systems in both the 12 and 36-month calculations. The criteria that greatly affected the final results were price and work station tickets. The price of a 12-month subscription to Finale Inventory© Small Business is $1,188 and Finale Inventory© Standard Business is $2,388, whereas the other two packages are a one-time fee starting above $3,000. Finale Inventory© Small Business is still the overall best choice for 36-months because it has all the features that Sheppard desires and the price was relatively realistic at $3,564. Fishbowl Inventory© became significantly closer in the 36-month calculations because its price stayed the same because of the one-time fee and brought it to a more reasonable comparison to Finale Inventory© Standard Business ($4,395 vs. $7,164 respectively). QuickBooks™ Enterprise was always the lowest in rankings because it did not provide a significant feature that Sheppard required, the ability to make work station tickets.

From the 12-month calculations, Finale Inventory© Small Business narrowly outranks Finale Inventory© Standard Business. In the 36-month calculations, Finale Inventory© Small Business is the most preferred based on the AHP calculations with Finale Inventory© Standard Business and Fishbowl Inventory© very close in the final results. Therefore, the best choice for Sheppard is the Finale Inventory© Small Business package, based on their preferred criteria, preferences and the results of the AHP method. This package will allow for the highest return on investment for the company and will enable them to use the features to advance their company and processes.

With this system, Sheppard will receive a full return on investment and begin generating profit. Other benefits to having an automated system are eliminating labor hours and the cost of non-value added activities. Also, a program such as this allows for a severe reduction in wasted or expired goods with automated use of alerts and tracking. This can save Sheppard approximately $3,200 a year, which was a value given by Sheppard based on past amounts of expired inventory per year. In order to propel Sheppard into the next level of their business and guarantee that their activities are value-added and beneficial to the company, it is crucial that they invest in an automated system, and Finale Inventory© Small Business is the best option to fit their needs.

5.0 Recommendations

The goal of this project was to increase Sheppard's long-term profits and success through manufacturing by better utilizing their current resources and exploring inventory and management options. Sheppard's current process contained inefficiencies in their warehouse layout and lacked a satisfactory management system for their inventory and shop floor. The company was losing sales because they were unable to identify when they could ship finished goods to their customers and they lacked the information to answer questions about product availability.

To address these concerns, the team evaluated Sheppard's warehouse organization and various inventory management options. The team redesigned the warehouse using Axiomatic Design methods to maximize the shipper's efficiency and minimizing the distance traveled for the shipper to access high-turnover products. Next, the team evaluated the production process and inventory levels. From this, the team calculated an appropriate Economic Order Quantity (EOQ) and reorder point to maximize the absorption of production and holding costs. This information allowed the team to create a manual management model for Sheppard to perpetually track their inventory levels. Lastly, the team evaluated automated systems to track inventory. This system, although initially more expensive, would provide the maximum benefit to Sheppard, based on its extensive capabilities and features.

With the completion of this Major Qualifying Project, the team recommends that Sheppard reallocate their inventory to the locations provided in Appendix C. This change, as well as the establishment of a queue cell, will allow production employees to produce more envelopes and shipping employees to locate products more rapidly and therefore ship more efficiently. Furthermore, the team recommends that Sheppard purchase and implement Finale Inventory© Small Business as a new inventory and order management system. The team created a manual management system to serve the same need, however this system does not provide the same value to Sheppard.

5.1 Cumulative Value Added to Sheppard

If Sheppard were to implement all recommendations provided by the team, the company would have the potential to increase their revenue by approximately $75,000 to $110,000 per year. The team calculated this value by summing the revenue from increased production from the reallocated labor due to the warehouse redesign and the gains from purchasing and adopting an automated system. The team did not include the gain from utilizing the manual model, as this option cannot be utilized in conjunction with an automated management system, which satisfies Sheppard's needs best. In the first year, these changes would offer Sheppard a return on investment of 1178% to 1771%; each year after would be a return of 6221% to 9157%. These figures are large due to the low cost of investment options, increased sales and time saving activities.

5.1.1 Value Added from Warehouse Layout Redesign

Due to the customer expectation of rapid shipment, the team redesigned the warehouse layout to move all high-turnover products closer to the origin, or the shipper's location. Changing the layout to meet the structure formed by the Axiomatic Design results would be a better utilization of both the shippers' and the producers' time. The queue cell would allow producers to return to their machines quicker since they would not have to find the proper location for a product, therefore allowing the machines to remain active more frequently. The team did not have enough information to relocate all products within Sheppard's warehouse; therefore all improvement calculations are based on moving the thirteen products for which the team had sufficient information.

5.1.1.1 Cost

Mainly, the cost associated with this recommendation is the labor cost from moving all products to their new locations. To calculate this, the team assigned a number of minutes to walk from the origin to each location and added ten minutes if that location required the use of a forklift. The team calculated that it would take a total of 35 hours of change time and $580 in labor cost, with an average labor wage of $16.59 ("Industries at a Glance: Paper Manufacturing: NAICS 322," September 19, 2014).

5.1.1.2 Gain

When calculating the gain from this change, the team considered two options. In the first option, the team assumed that employees did not work for the hours saved by the new locations and therefore Sheppard would save money due to the elimination of labor costs. Secondly, the team calculated how much more product could be both shipped and produced using the time saved by the new layout. The redesigned layout saves over 117 hours per year for the producer and over 52 hours per year for the shipper. If these employees were not to work these hours or these hours are allocated to other projects, Sheppard would save $2,900 in labor costs in one year, based on a $16.59 wage for the shipping employees and a $17.13 wage for the production employees. Therefore, the return on investment for the first year is 229% and increases each year, since the change cost becomes zero.

However, to show the increase in orders if these employees worked these hours, the team used the miniature envelopes as an example, as they are one of Sheppard's most popular products. The team calculated that it takes 5.5 minutes in total to put away and then ship miniature envelopes. Using this time, Sheppard would be able to ship over 570 additional orders containing miniature envelopes; therefore, assuming Sheppard was able to increase their sales appropriately, Sheppard could increase their revenue by over $52,000. This revenue was calculated assuming Sheppard utilized all saved hours by shipping miniature envelopes at an average order price of $90.36. Additionally, this calculation does not explore production hours saved as the shipper saves less than half the hours of the producer. The team assumed these hours would be partially consumed producing finished goods to satisfy the additional shippable hours.

Beyond the financial benefits of changing this structure, these changes improve the work environment for the shipping employee. Since the high-turnover products will be on locations that do not require the use of a forklift, this will reduce the risk of forklift-related injuries. Furthermore, less use of the forklift will diminish wear and tear on the equipment; therefore it will last longer and need repairs less often.

5.1.2 Value Added from Adoption of Manual Management System

To improve Sheppard's management of inventory, the team created a manual model to track the inventory levels and manage the reordering process of stock goods. It is important to note that this model is unable to track custom orders, which is a significant part of Sheppard's business, since these products are made-to-order and not held in inventory. This model calculates the optimal production run size using an EOQ calculation; producing with these run sizes would maximize the absorption of setup, production and holding costs. Furthermore, this model would update the inventory levels as soon as Sheppard entered a new order into the system. Therefore, Sheppard would continuously know their inventory level and would know their shipping and product availability far more rapidly than their current process.

5.1.2.1 Cost

While this model is freely provided to Sheppard by the team, there are implementation and use costs involved. Firstly, the team calculated that it would take one employee a week to set up the system and enter all of their current product levels into the model. Therefore, set up costs were calculated as a one-time cost of $685. Next, the team calculated that three employees would need to be trained on the use of the model and that it would take them a week to learn the new system; this adds to a training cost of $2,000. Lastly, this system requires manual updating as Sheppard takes new orders. The team assumed that it would require one person to spend four hours a week entering orders into this system. This cost was calculated as an annual cost of $3,400. All costs were calculated with wage at $17.13, as this is the national average for this type of position ("Industries at a Glance: Paper Manufacturing: NAICS 322," September 19, 2014). Based on these costs, the team calculated that Sheppard would need to spend $6,200 in the first year of adopting this system, and $3,400 annually for following years to maintain the data entry.

5.1.2.2 Gain

Based on this system's ability to improve Sheppard's customer service, produce more efficiently and ship more rapidly, the team assumed the adoption of this system could improve Sheppard's quote retention by anywhere from 5% to 15%. Currently, Sheppard wins an order on one quote of every ten they provide. With a 5% to 15% increase, Sheppard would win nearly 200 to 600 more orders and increase their revenue by $17,000 to $57,000 annually, as based on an average order price of $90.36. The detailed calculations for this increase are provided in Appendix H. With this gain, and a cost of $6,200 in the first year, the adoption of this model has 383% to 1780% return on investment in the first year and 409% to 1427% return each year after that.

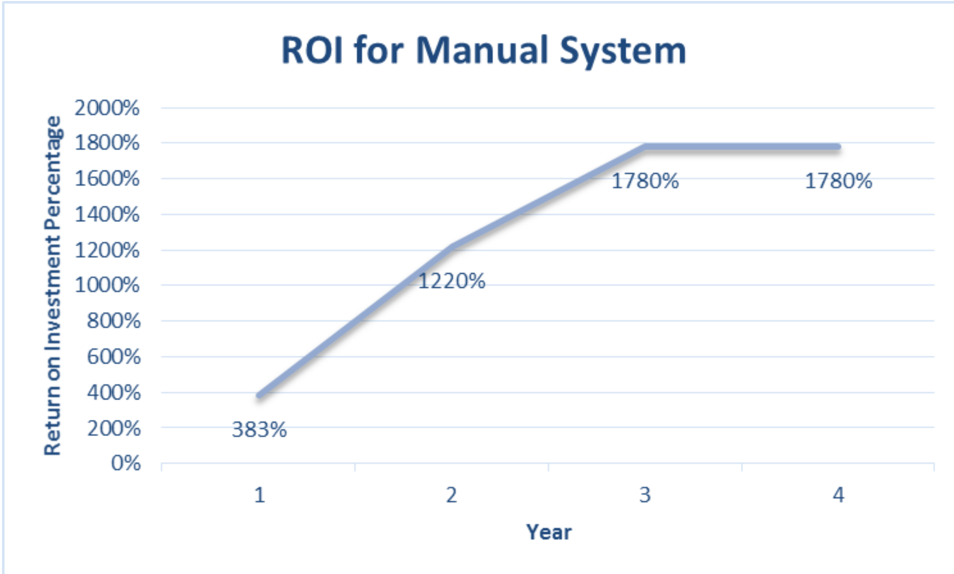

Figure 15: Return on Investment Graph for Manual System

The implementation of an inventory management system would allow sales representatives to have access to an accurate inventory count, therefore they would be able to sell more accurately to the company's ability to produce and ship. Given the expectation of rapid shipping, Sheppard would become more competitive and able to meet this need more effectively, therefore winning more orders.

5.1.3 Value Added from Adoption of Automated Management System

While the team did create a manual inventory model for Sheppard's potential use, the team also researched existing software systems to automate this process. The team recommends the automated system over the manual system because not only does it provide all of the benefits of the manual system, but it is a more effective use of the employees' time. They would no longer have to manually update the system when an order is placed, so they could use their time to increase sales. Additionally, the system updates the inventory automatically when a new order is placed, eliminating room for human error. Lastly, after three years of use, the automated system reduces labor costs significantly, making it less expensive than the manual system.

Based on the AHP decision tool, the team identified Finale Inventory© Small Business as the best option to satisfy Sheppard's needs. This package includes all features preferred by Sheppard, yet excludes the barcoding machinery and WIP tracking, which were the two features that Sheppard indicated were undesirable. Moreover, this option is the least expensive at $99 per month.

5.1.3.1 Cost

The adoption of Finale Inventory© Small Business includes the following costs: cost of the system, training costs and setup costs. The cost of Finale Inventory© Small Business is a monthly fee of $99, which adds to an annual cost of $1,188. The team assumed that five employees would be trained to use Finale Inventory© Small Business and it would take them a week to learn the system; therefore, the training cost is a one-time cost of $3,426. The team assumed it would take one employee a week to set up Sheppard's entire existing inventory in Finale Inventory© Small Business resulting in a set up cost of $685. Due to the automated nature of this system, there is no labor cost to maintain the order entries into the system. With an enduring labor cost of zero due to the elimination of system maintenance, the total cost of adopting Finale Inventory© Small Business is $5,300 in the first year. The only ongoing cost is Finale Inventory© Small Business's monthly fee; therefore, each additional year would have a cost of $1,188.

5.1.3.2 Gain

The team assumed that adopting Finale Inventory© Small Business to manage production and inventory has the potential to increase quote retention by 15% to 25%. The team assumed this would be a higher percent increase than implementing the manual model because of the accuracy and consistency of the automated model. This increase in sales would result in 579 to 965 more orders per year, over 300 more than the manual model. Using the same average order price of $90.36, Sheppard could increase their revenue by $57,000 to $87,000 over current annual revenue. If Sheppard chose to purchase Finale Inventory© Small Business, their return on investment could be 887% to 1545% in the first year and 4304% to 7240% each year after that. In the second year and beyond, this is more than double the return of the manual model. These figures are large because of the small costs involved in implementing compared to a large potential return from assumed order increases.

In calculating the return on investment for implementing Finale Inventory© Small Business, the team assumed that due to the system setup time at Sheppard and the learning curve associated with the software, Sheppard's revenue would increase from year to year. There would only be a

5% revenue increase in the first year of use, and it would increase by an additional 5% each year after, up to year 5 where it would reach its maximum increase of 25%. The team adjusted the calculations to account for the net present value of money; therefore all gains were calculated by multiplying that year's returns by 10% to factor in the change in value of money. As seen in Figure 16, in its first year of implementing Finale Inventory©, Sheppard should expect a return on investment of 429%, and after five years, their return on investment may increase to 8174%.

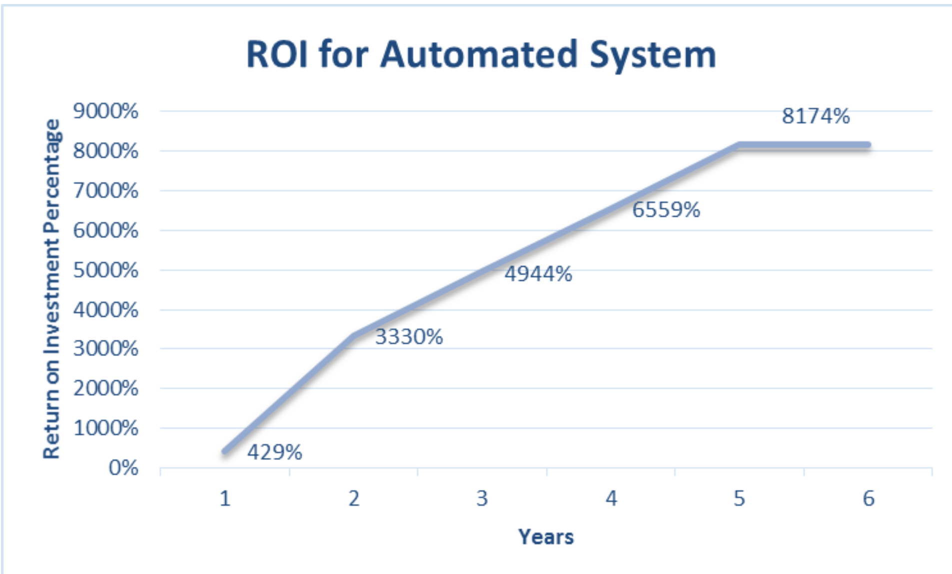

Figure 16: Return on Investment Graph for Automated System

Implementing Finale Inventory© Small Business would benefit not only the employees who previously had to manually count the inventory, but it would also provide the company with opportunities to grow. The system updates all inventory levels automatically when a new order is created, therefore employees would not have to change this, as they would in the manual system. The fee for Finale Inventory© Small Business amounts to $2,200 less than the labor cost to maintain the manual system annually. Moreover, the employees would then have more time to focus on sales and customer service, hence the team's assumption that Finale Inventory© Small Business would allow Sheppard to retain more quotes than the manual system. Lastly, as Sheppard enters more orders, the software will learn customers' ordering habits and develop a forecasting model for both stock and custom orders. This information will allow Sheppard to tailor their inventory levels more effectively.

5.2 Overall Impact

Throughout this project, the team identified Sheppard's major justification for lost sales as Sheppard's shortcomings with maintaining, holding and shipping product promptly. From this, the team focused their efforts on improving Sheppard's operations. Specifically, the team enhanced Sheppard's ability to quantify and track available product, minimize waste by standardizing product labeling and efficiently access product in inventory. With optimized operations, Sheppard can serve the needs of their customers more effectively and efficiently, while minimizing operating costs. This improvement in customer service yields the potential to increase sales revenue, which could offset the cost of implementing the changes proposed by the team.

The team recognized the alternative of investing the cost of implementing the recommendations into an interest-bearing savings account. The team assumes that this alternative will accrue interest at 10% per year. Figure 17 compares the potential cash flows from both alternatives and displays that following the suggested recommendations will result in a higher overall return by month. As shown below the team's recommendation surpasses the investment option in 10 ½ months into the first year. Figure 18 displays the time value of money on a yearly basis showing the significant impact of the team recommendations over seven years.

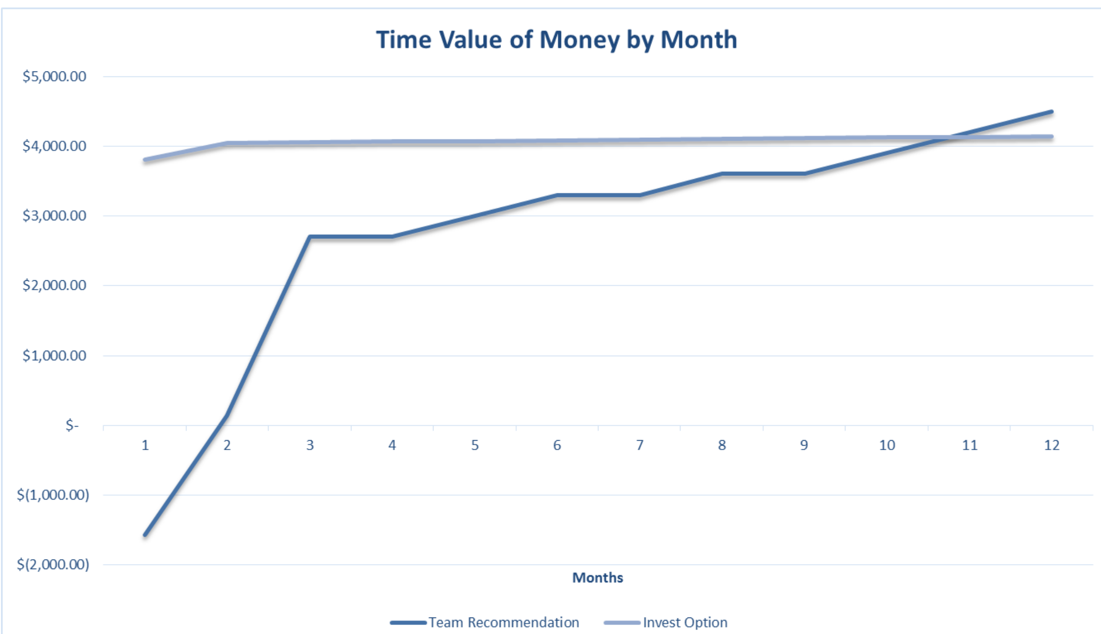

Figure 17: Time Value of Money Comparison by Month

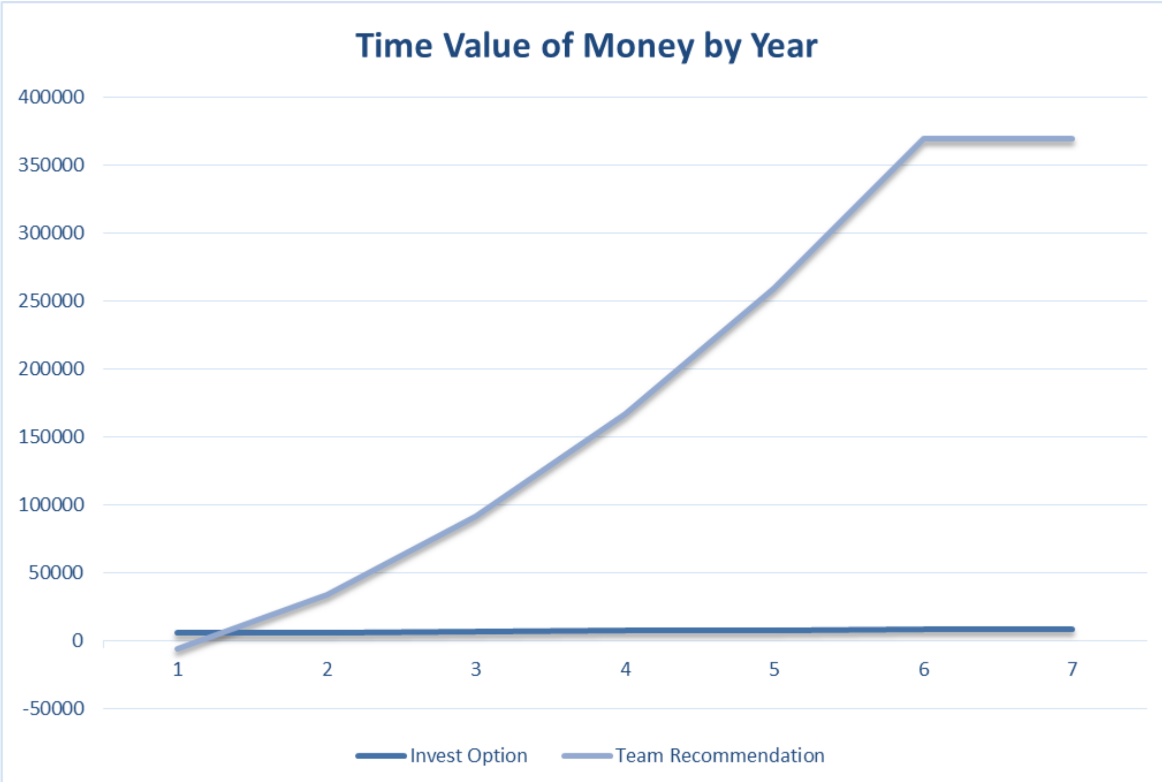

Figure 18: Time Value of Money Comparison by Year

As the team considers the lifelong learning and future education of this project, new insights into the management of inventory could drastically change the recommendations provided. Due to Sheppard's smaller holding levels, research may shift to suggest that different production levels are more adeptly suited to this size of factory. Furthermore, automated management systems may change processes if they are able to better manage small inventories with high setup costs by using a novel method. The team recognizes the need to continue exploring these processes to ensure that the team will continue to have the ability to provide useful recommendations into this type of project.

Appendix

Appendix A: Sheppard Label Template

SHEPPARD ENVELOPE MFG CO Since 1921
BECAUSE QUALITY AND SERVICE MATTER
MADE IN USA

Item Number______________________________

Item Description___________________________

____

Quantity _________________________________

Production Date ___________________________

Sign off #1___________________ Date_________

Sign off #2 ___________________Date_________

Appendix B: Warehouse Facility Floor Plan with Row Assignments

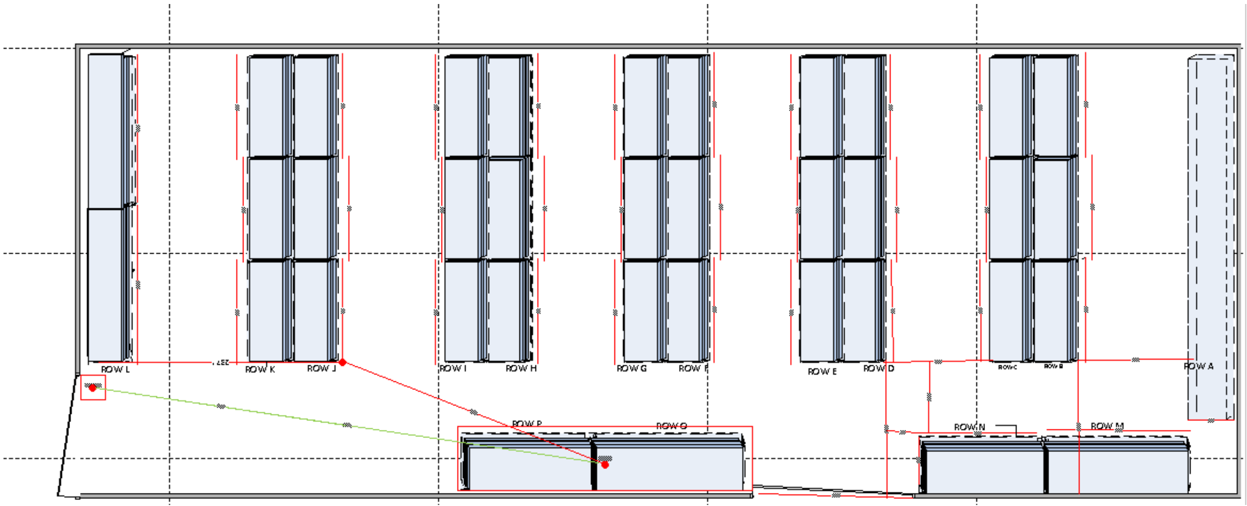

Figure 19: Warehouse Facility Floor Plan with Row Assignments

Appendix C: Current vs. New Locations for Product Placement

SKU	**Common Name**	**Size**	**Previous Location**	**Approx. Time (min)**	**New Location**	**Approx. Time (min)**	**Difference in Time (min)**	**Number of Orders containing product last year**
SL0103	Sleeves	02-1/4 x 3-3/8	021, 022, 141, 142	10	155	2	8.00	600.00
DK0105	Doorknobs	03-5/8 x 6-1/2	197	16	184, 156, 183, 157	3	13.00	400.00
SL0112	Sleeves	02-1/4 x 3-3/8	117, 118	6	136	4	2.00	400.00
SL0113	Sleeves	02-1/4 x 3-3/8	134, 135, 136	4	182	4	0.00	350.00
SL0110	Sleeves	02-1/4 x 3-3/8	146, 155, 156, 157, 158, 159	2.32	158	2	0.32	300.00
BT0202	#09 Bangtail	03-7/8 x 8-7/9	097, 098	8	181	4	4.00	75.00
KK0200	6-3/4 KK	03-5/8 x 6-1/2	099	18	112	6	12.00	50.00
MN0315	Miniatures	01-1/2 x 1-1/2	140,	4	134	4	0.00	50.00
DK0200	Doorknobs	04-3/8 x 6-1/2	187, 188	14	160	2	12.00	30.00
CN3C03	#03 Coin	02-1/2 x 4-1/4	,113	6	114	6	0.00	15.00
MN0800	Miniatures	02 x 2	,145	14	132	4	10.00	15.00
CN1C01	#01 Coin	02-1/4 x 3-1/2	,123	16	098	8	8.00	10.00
MN1501	Square	03 x 3	,198	16	115	6	10.00	5.00

Appendix D: Product Locations in Warehouse

Location Code	Row	Level	X	Y	Z	Distance Walking to it with Weight	Current Product (if known)
001	B	G	24	0	-743	767	
002	B	G	72	0	-743	815	
003	B	G	120	0	-743	863	
004	B	G	168	0	-743	911	
005	B	G	216	0	-743	959	
006	B	G	264	0	-743	1007	
007	B	1	24	70	-743	18267	
008	B	1	72	70	-743	18315	
009	B	1	120	70	-743	18363	
010	B	1	168	70	-743	18411	
011	B	1	216	70	-743	18459	
012	B	1	264	70	-743	18507	
013	B	2	24	140	-743	35767	
014	B	2	72	140	-743	35815	
015	B	2	120	140	-743	35863	
016	B	2	168	140	-743	35911	
017	B	2	216	140	-743	35959	
018	B	2	264	140	-743	36007	
019	C	G	264	0	-701	965	
020	C	G	216	0	-701	917	
021	C	G	168	0	-701	869	Card sleeves
022	C	G	120	0	-701	821	Card sleeves
023	C	G	72	0	-701	773	
024	C	G	24	0	-701	725	
025	C	1	264	70	-701	18465	#9
026	C	1	216	70	-701	18417	
027	C	1	168	70	-701	18369	
028	C	1	120	70	-701	18321	
029	C	1	72	70	-701	18273	3x3s
030	C	1	24	70	-701	18225	
031	C	2	264	140	-701	35965	
032	C	2	216	140	-701	35917	
033	C	2	168	140	-701	35869	
034	C	2	120	140	-701	35821	
035	C	2	72	140	-701	35773	
036	C	2	24	140	-701	35725	

037	D	G	24	0	-557	581	
038	D	G	72	0	-557	629	
039	D	G	120	0	-557	677	
040	D	G	168	0	-557	725	
041	D	G	216	0	-557	773	
042	D	G	264	0	-557	821	
043	D	1	24	70	-557	18081	
044	D	1	72	70	-557	18129	
045	D	1	120	70	-557	18177	
046	D	1	168	70	-557	18225	
047	D	1	216	70	-557	18273	
048	D	1	264	70	-557	18321	
049	D	2	24	140	-557	35581	
050	D	2	72	140	-557	35629	
051	D	2	120	140	-557	35677	
052	D	2	168	140	-557	35725	
053	D	2	216	140	-557	35773	
054	D	2	264	140	-557	35821	
055	E	G	264	0	-515	779	
056	E	G	216	0	-515	731	
057	E	G	168	0	-515	683	
058	E	G	120	0	-515	635	
059	E	G	72	0	-515	587	
060	E	G	24	0	-515	539	
061	E	1	264	70	-515	18279	
062	E	1	216	70	-515	18231	
063	E	1	168	70	-515	18183	
064	E	1	120	70	-515	18135	
065	E	1	72	70	-515	18087	
066	E	1	24	70	-515	18039	
067	E	2	264	140	-515	35779	
068	E	2	216	140	-515	35731	
069	E	2	168	140	-515	35683	
070	E	2	120	140	-515	35635	
071	E	2	72	140	-515	35587	
072	E	2	24	140	-515	35539	
073	F	G	24	0	-371	395	
074	F	G	72	0	-371	443	
075	F	G	120	0	-371	491	
076	F	G	168	0	-371	539	
077	F	G	216	0	-371	587	

078	F	G	264	0	-371	635	
079	F	.5	24	40	-371	10395	
080	F	.5	72	40	-371	10443	
081	F	1	24	70	-371	17895	
082	F	1	72	70	-371	17943	
083	F	1	120	70	-371	17991	
084	F	1	168	70	-371	18039	
085	F	1	216	70	-371	18087	
086	F	1	264	70	-371	18135	
087	F	2	24	140	-371	35395	
088	F	2	72	140	-371	35443	
089	F	2	120	140	-371	35491	
090	F	2	168	140	-371	35539	
091	F	2	216	140	-371	35587	#9 KK
092	F	2	264	140	-371	35635	Doorknobs
093	G	G	264	0	-329	593	6 3/4 KK
094	G	G	216	0	-329	545	6 3/4 KK
095	G	G	168	0	-329	497	#9 KK
096	G	G	120	0	-329	449	#9 KK
097	G	G	72	0	-329	401	#9 Bangtail
098	G	G	24	0	-329	353	#9 Bangtail
099	G	1	264	70	-329	18093	6 1/4 KK
100	G	1	216	70	-329	18045	
101	G	1	168	70	-329	17997	#9 Bangtail
102	G	1	120	70	-329	17949	#9 Bangtail
103	G	1	72	70	-329	17901	#9 Bangtail
104	G	1	24	70	-329	17853	#9 Bangtail
105	G	2	264	140	-329	35593	
106	G	2	216	140	-329	35545	
107	G	2	168	140	-329	35497	
108	G	2	120	140	-329	35449	
109	G	2	72	140	-329	35401	
110	G	2	24	140	-329	35353	
111	H	G	24	0	-178	202	
112	H	G	72	0	-178	250	
113	H	G	120	0	-178	298	#3 coin
114	H	G	168	0	-178	346	
115	H	G	216	0	-178	394	3 1/2 x 6 1/2s
116	H	G	264	0	-178	442	
117	H	.5	120	48	-178	12298	Card sleeves
118	H	.5	120	48	-178	12298	Card sleeves

119	H	1	24	70	-178	17702	1 7/8 x 1 7/8s
120	H	1	72	70	-178	17750	
121	H	1	120	70	-178	17798	#9 Bangtail
122	H	1	168	70	-178	17846	#9 Remittance
123	H	1	216	70	-178	17894	#1 Coin
124	H	1	264	70	-178	17942	
125	H	2	24	140	-178	35202	
126	H	2	72	140	-178	35250	
127	H	2	120	140	-178	35298	
128	H	2	168	140	-178	35346	
129	H	2	216	140	-178	35394	#9 Bangtail
130	H	2	264	140	-178	35442	
131	I	G	264	0	-136	400	
132	I	G	216	0	-136	352	
133	I	G	168	0	-136	304	3x3s
134	I	G	120	0	-136	256	Card sleeves
135	I	G	72	0	-136	208	Card sleeves
136	I	G	24	0	-136	160	Card sleeves
137	I	.5	264	48	-136	12400	
138	I	.5	216	48	-136	12352	
139	I	.5	168	48	-136	12304	2 5/16 x 3 5/8s
140	I	.5	120	48	-136	12256	1 1/2 x 1 1/2s
141	I	.5	72	40	-136	10208	Card sleeves
142	I	.5	24	40	-136	10160	Card sleeves
143	I	1	264	70	-136	17900	
144	I	1	216	70	-136	17852	
145	I	1	168	70	-136	17804	2x2s
146	I	1	120	70	-136	17756	Card sleeves
147	I	1	72	70	-136	17708	
148	I	1	24	70	-136	17660	
149	I	2	264	140	-136	35400	
150	I	2	216	140	-136	35352	
151	I	2	168	140	-136	35304	
152	I	2	120	140	-136	35256	
153	I	2	72	140	-136	35208	
154	I	2	24	140	-136	35160	
155	J	G	24	0	21	45	Card sleeves
156	J	G	72	0	21	93	Card sleeves
157	J	G	120	0	21	141	Card sleeves
158	J	G	168	0	21	189	Card sleeves
159	J	G	216	0	21	237	Card sleeves

160	J	G	264	0	21	285	Card sleeves
161	J	.5	24	42	21	10545	Card sleeves
162	J	.5	72	42	21	10593	Card sleeves
163	J	.5	120	42	21	10641	Card sleeves
164	J	.5	168	42	21	10689	Card sleeves
165	J	.5	216	42	21	10737	Card sleeves
166	J	.5	264	42	21	10785	Card sleeves
167	J	1	24	70	21	17545	
168	J	1	72	70	21	17593	
169	J	1	120	70	21	17641	
170	J	1	168	70	21	17689	
171	J	1	216	70	21	17737	Card sleeves
172	J	1	264	70	21	17785	Card sleeves
173	J	2	24	140	21	35045	
174	J	2	72	140	21	35093	
175	J	2	120	140	21	35141	
176	J	2	168	140	21	35189	
177	J	2	216	140	21	35237	
178	J	2	264	140	21	35285	
179	K	G	264	0	63	327	
180	K	G	216	0	63	279	
181	K	G	168	0	63	231	
182	K	G	120	0	63	183	
183	K	G	72	0	63	135	
184	K	G	24	0	63	87	
185	K	1	264	70	63	17827	
186	K	1	216	70	63	17779	
187	K	1	168	70	63	17731	doorknobs
188	K	1	120	70	63	17683	doorknobs
189	K	1	72	70	63	17635	
190	K	1	24	70	63	17587	
191	K	2	264	140	63	35327	
192	K	2	216	140	63	35279	
193	K	2	168	140	63	35231	
194	K	2	120	140	63	35183	
195	K	2	72	140	63	35135	
196	K	2	24	140	63	35087	
197	L	1	120	0	216	336	Hotel doorknobs
198	L	1	168	0	216	384	3x3s
199	L	1	216	0	216	432	Custom card sleeves

200	L	1	264	0	216	480	Custom card sleeves
201	L	2	120	62	216	15836	Custom card sleeves
202	L	2	168	62	216	15884	Custom card sleeves
203	L	2	216	70	216	17932	Custom card sleeves
204	L	2	164	70	216	17880	Custom card sleeves
205	L	3	120	140	216	35336	
206	L	3	168	140	216	35384	
207	L	3	216	140	216	35432	
208	L	3	264	140	216	35480	
209	M	1	-124	0	-869	993	
210	M	1	-124	0	-829	953	
211	M	1	-124	0	-789	913	
212	N	1	-124	0	-749	873	
213	N	1	-124	0	-709	833	
214	N	1	-124	0	-669	793	
215	M	2	-124	40	-869	10993	
216	M	2	-124	40	-829	10953	
217	M	2	-124	40	-789	10913	
218	N	2	-124	40	-749	10873	
219	N	2	-124	40	-709	10833	
220	N	2	-124	40	-669	10793	
221	M	3	-124	70	-869	18493	
222	M	3	-124	70	-829	18453	
223	M	3	-124	70	-789	18413	
224	N	3	-124	70	-749	18373	
225	N	3	-124	70	-709	18333	
226	N	3	-124	70	-669	18293	
227	O	1	-124	0	-356	480	
228	O	1	-124	0	-316	440	
229	O	1	-124	0	-276	400	
230	P	1	-124	0	-236	360	
231	P	1	-124	0	-196	320	
232	P	1	-124	0	-156	280	
233	O	2	-124	40	-356	10480	
234	O	2	-124	40	-316	10440	
235	O	2	-124	40	-276	10400	
236	P	2	-124	40	-236	10360	

237	P	2	-124	40	-196	10320	
238	P	2	-124	40	-156	10280	
239	O	3	-124	68	-356	17480	
240	O	3	-124	68	-316	17440	
241	O	3	-124	68	-276	17400	
242	P	3	-124	68	-236	17360	
243	P	3	-124	68	-196	17320	
244	P	3	-124	68	-156	17280	

Appendix E: Application of Product SKU Numbers

FINISHED GOODS INVENTORY **30-Jun-14**

SKU	Type	Common Name	Size	Paper	
1. Miniatures					
MN0100	Miniatures	Miniatures	01 x 01	White 24#	*547,000*
MN0200	Miniatures	Miniatures	01-1/4 x 1-1/4	24ww	*271,000*
MN0201	Miniatures	Miniatures	01-1/4 x 1-1/4	K-1 lined	*47,500*
MN0202	Miniatures	Miniatures	01-1/4 x 1-1/4	Tyvek	*107,100*
MN0300	Miniatures	Miniatures	01-1/2 x 1-1/2	Blue, Light	*29,500*
MN0301	Miniatures	Miniatures	01-1/2 x 1-1/2	Canary	*113,000*
MN0302	Miniatures	Miniatures	01-1/2 x 1-1/2	Cream	*20,500*
MN0303	Miniatures	Miniatures	01-1/2 x 1-1/2	Green	*64,000*
MN0304	Miniatures	Miniatures	01-1/2 x 1-1/2	Red	*9,000*
MN0305	Miniatures	Miniatures	01-1/2 x 1-1/2	Gold	*38,500*
MN0306	Miniatures	Miniatures	01-1/2 x 1-1/2	Lite Green	*2,500*
MN0307	Miniatures	Miniatures	01-1/2 x 1-1/2	Ivory	*12,500*
MN0308	Miniatures	Miniatures	01-1/2 x 1-1/2	Lavender	*17,000*
MN0309	Miniatures	Miniatures	01-1/2 x 1-1/2	Metallic silver	*17,000*
MN0310	Miniatures	Miniatures	01-1/2 x 1-1/2	Metallic White	*9,500*
MN0311	Miniatures	Miniatures	01-1/2 x 1-1/2	Pink	*22,000*
MN0312	Miniatures	Miniatures	01-1/2 x 1-1/2	Pink, Hot	*3,500*
MN0313	Miniatures	Miniatures	01-1/2 x 1-1/2	Pink, Pale	*37,000*
MN0314	Miniatures	Miniatures	01-1/2 x 1-1/2	White/blk tint	*15,500*
MN0315	Miniatures	Miniatures	01-1/2 x 1-1/2	White 24#	*485,000*
MN0400	Miniatures	Miniatures	01-1/2 x 2	White 24#	*4,500*
MN0500	Miniatures	Miniatures	01-11/16 x 2-3/4	White 24#	*41,500*
MN0600	Miniatures	Miniatures	01-13/16 x 2-3/4	Black	*8,000*
MN0601	Miniatures	Miniatures	01-13/16 x 2-3/4	White 24#	*5,000*
MN0700	Miniatures	Miniatures	01-7/8 x 01-7/8	White 24#	*240,000*
MN0800	Miniatures	Miniatures	02 x 2	White 24#	*65,000*
MN0801	Miniatures	Miniatures	02 x 2	White 24#	
MN0802	Miniatures	Miniatures	02 x 2	White 24#	*40,000*
MN0803	Miniatures	Miniatures	02 x 2	translucent	*29,500*
MN0900	Miniatures	Miniatures	02-1/4 x 2-1/4	Tissue	*28,000*
MN1000	Miniatures	Miniatures	02 x 3-1/2	White 24#	*24,500*
MN1100	Miniatures	Miniatures	02-1/4 x 2-1/4	White 24#	*54,500*
MN1200	Miniatures	Miniatures	02-1/2 x 2-1/2	24ww	*5,200*
MN1201	Miniatures	Miniatures	02-1/2 x 2-1/2	24ww	*10,000*
MN1300	Miniatures	Miniatures	02-1/2 x 4	24ww	*6,000*

MN1400	Miniatures	Miniatures	02-3/4 x 2-3/4	White 24#	18,000
MN1401	Miniatures		02-3/4 x 2-3/4	White 24#	20,000
MN1500	Miniatures	Square	03 x 3	Linen Ivory	33,600
MN1501	Miniatures	Square	03 x 3	cream	59,200
MN1600	Miniatures	Miniatures	02-1/4 x 4	24ww	16,000
2.Gift Card					
GCGC01	Gift Card	Gift Cards	02-1/4 x 3-3/8	White 24#	20,000
GCGC02	Gift Card	Gift Cards	02-3/8 x 3-1/2	White 24#	55,000
GCBK01	Gift Card	Booklet	02-1/4 x 3-5/8	Green	2,400
GCBK02	Gift Card	Booklet	02-1/4 x 3-5/8	Mushroom	5,000
GCBK03	Gift Card	Booklet	02-1/4 x 3-5/8	Gold	1,000
GCBK04	Gift Card	Booklet	02-1/4 x 3-5/8	White 24#	21,000
GCBK05	Gift Card	Booklet	02-1/4 x 3-5/8	baby blue offset	500
GCBK06	Gift Card	Booklet	02-1/4 x 3-5/8	superfine ultrawht	10,000
GCBK07	Gift Card	Booklet	02-1/4 x 3-5/8	offset red	1,000
GCBK08	Gift Card	Booklet	02-1/4 x 3-5/8	offset yellow	1,000
GCBK09	Gift Card	Booklet	02-1/4 x 3-5/8	Ivory	17,000
GCBK10	Gift Card	Booklet	02-1/4 x 3-5/8	White 24#	
GCBK11	Gift Card	Booklet	02-1/4 x 3-5/8	White 24#	90,000
GCBK12	Gift Card	Booklet	02-1/4 x 3-5/8	Pink	10,000
GCBK13	Gift Card	Booklet	02-1/4 x 3-5/8	Hot Pink 24#	500
GC3D01	Gift Card	#3 Drug	02-5/16 x 3-5/8	Blue	2,000
GC3D02	Gift Card	#3 Drug	02-5/16 x 3-5/8	Green	21,000
GC3D03	Gift Card	#3 Drug	02-5/16 x 3-5/8	yellow	2,500
GC3D04	Gift Card	#3 Drug	02-5/16 x 3-5/8	Red	9,500
GC3D05	Gift Card	#3 Drug	02-5/16 x 3-5/8	White 24#	160,000
GC3D06	Gift Card	#3 Drug	02-5/16 x 3-5/8	White 24#	7,500
GC3D07	Gift Card	#3 Drug	02-5/16 x 3-5/8	Ivory	29,000
GC3D08	Gift Card	#3 Drug	02-5/16 x 3-5/8	Cream	1,000
GC1C01	Gift Card	#1 Coin	02-1/4 x 3-1/2	24ww	18,000
GC1C02	Gift Card	#1 Coin	02-1/4 x 3-1/2	24ww	10,000
GC1C03	Gift Card	#1 Coin	02-1/4 x 3-1/2	24ww	14,000
GC2P01	Gift Card	2-Pay	02-1/2 x 4-1/4	Blue	
GC2P02	Gift Card	2-Pay	02-1/2 x 4-1/4	Canary Yellow 24#	
GC2P03	Gift Card	2-Pay	02-1/2 x 4-1/4	Cherry	
GC2P04	Gift Card	2-Pay	02-1/2 x 4-1/4	Clear Glama	
GC2P05	Gift Card	2-Pay	02-1/2 x 4-1/4	Green	
GC2P06	Gift Card	2-Pay	02-1/2 x 4-1/4	Gunmetal	
GC2P07	Gift Card	2-Pay	02-1/2 x 4-1/4	Old Natural	
GC2P08	Gift Card	2-Pay	02-1/2 x 4-1/4	Pink	

GC2P09	Gift Card	2-Pay	02-1/2 x 4-1/4	24ww	
GC2P10	Gift Card	2-Pay	02-1/2 x 4-1/4	Red	
GC2P11	Gift Card	2-Pay	02-1/2 x 4-1/4	White 24#	*60,000*
GC2P12	Gift Card	2-Pay	02-1/2 x 4-1/4	Ivory	*62,000*
GC2P13	Gift Card	2-Pay	02-1/2 x 4-1/4	White 24#	*10,000*
GC2P14	Gift Card	2-Pay	02-1/2 x 4-1/4	White 24#	*500*
GCGC03	Gift Card	Gift Cards	02-5/8 x 3-5/8	White 24#	*30,000*
GCGC04	Gift Card	Gift Cards	02-5/8 x 3-5/8	Ivory	*19,500*
GCGC05	Gift Card	Gift Cards	02-5/8 x 3-5/8	Ivory	
GCGC06	Gift Card	Gift Cards	02-5/8 x 3-5/8	cream	*17,000*
GCGC07	Gift Card	Gift Cards	02-5/8 x 3-5/8	White 24# (Printed)	*22,500*
GCGC08	Gift Card	Gift Cards	02-5/8 x 3-5/8	White 24# (Printed)	*3,500*
GCGC09	Gift Card	Gift Cards	02-5/8 x 3-5/8	White 24# (Printed)	*10,000*
GCGC10	Gift Card	Gift Cards	02-5/8 x 3-5/8	White 24# (Printed)	*3,200*
GCGC11	Gift Card	Gift Cards	02-5/8 x 3-5/8	White 24# (Printed)	*3,300*
GCGC12	Gift Card	Gift Cards	02-5/8 x 3-5/8	White 24#	*80,000*
GCGC13	Gift Card	Gift Cards	02-5/8 x 3-5/8	#28 Ivory	*44,000*
GCGC14	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*10,500*
GCGC15	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*10,400*
GCGC16	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*10,450*
GCGC17	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*10,500*
GCGC18	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*10,450*
GCGC19	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*8,650*
GCGC20	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*8,700*
GCGC21	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*7,000*
GCGC22	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*9,950*
GCGC23	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*7,500*
GCGC24	Gift Card	Gift Cards	02-5/8 x 3-5/8	Coated	*8,800*
GCGC25	Gift Card	Gift Cards	02-5/8 x 3-5/8	Red	*4,500*
GCGC26	Gift Card	Gift Cards	02-5/8 x 3-5/8	Red	*8,500*
GCGC27	Gift Card	Gift Cards	02-5/8 x 3-5/8	Emerald	*400*
GCGC28	Gift Card	Gift Cards	02-5/8 x 3-5/8	Gold	*1,200*
GCGC29	Gift Card	Gift Cards	02-5/8 x 3-5/8	Jupiter	*2,600*
GCGC30	Gift Card	Gift Cards	02-5/8 x 3-5/8	Opal	*1,600*
GCGC31	Gift Card	Gift Cards	02-5/8 x 3-5/8	Quartz	*1,600*
GCGC32	Gift Card	Gift Cards	02-5/8 x 3-5/8	Silver	*700*
3. Sleeves					
SL0100	Sleeves	Sleeves	02-1/4 x 3-3/8	Blue 24#	*12,000*

SL0101	Sleeves	Sleeves	02-1/4 x 3-3/8	Brite Red 24#	*40,000*
SL0102	Sleeves	Sleeves	02-1/4 x 3-3/8	Blue 24#	*12,000*
SL0103	Sleeves	Sleeves	02-1/4 x 3-3/8	RFID Defender	*75,000*
SL0104	Sleeves	Sleeves	02-1/4 x 3-3/8	RFID Defender	*7,000*
SL0105	Sleeves	Sleeves	02-1/4 x 3-3/8	RFID Defender	
SL0106	Sleeves	Sleeves	02-1/4 x 3-3/8	Canary Yellow 24#	*20,000*
SL0107	Sleeves	Sleeves	02-1/4 x 3-3/8	Cherry 24#	*15,500*
SL0108	Sleeves	Sleeves	02-1/4 x 3-3/8	24ww	
SL0109	Sleeves	Sleeves	02-1/4 x 3-3/8	24ww	*20,500*
SL0110	Sleeves	Sleeves	02-1/4 x 3-3/8	24ww	*180,000*
SL0200	Sleeves	Sleeves	02-1/4 x 3-3/9	orca laminate	*9,500*
SL0111	Sleeves	Sleeves	02-1/4 x 3-3/8	translucent	*22,000*
SL0201	Sleeves	Sleeves	02-1/4 x 3-3/9	Hot Pink 24#	*7,500*
SL0112	Sleeves	Sleeves	02-1/4 x 3-3/8	orca laminate	*62,500*
SL0113	Sleeves	Sleeves	02-1/4 x 3-3/8	tyvek	*74,000*
SL0114	Sleeves	Sleeves	02-1/4 x 3-3/8	fibercraft	*5,500*
SL0115	Sleeves	Sleeves	02-1/4 x 3-3/8	Black	*9,000*
SL0116	Sleeves	Sleeves	02-1/4 x 3-3/8	Gold 24#	*38,500*
SL0117	Sleeves	Sleeves	02-1/4 x 3-3/8	Hot Pink 24#	*42,500*
SL0118	Sleeves	Sleeves	02-1/4 x 3-3/8	Manila	*10,000*
SL0119	Sleeves	Sleeves	02-1/4 x 3-3/8	Lime 24#	*35,000*
SL0120	Sleeves	Sleeves	02-1/4 x 3-3/8	Lime 24#	*1,000*
SL0121	Sleeves	Sleeves	02-1/4 x 3-3/8	Orange 24#	*40,000*
SL0122	Sleeves	Sleeves	02-1/4 x 3-3/8	Purple 24#	*32,000*
SL0123	Sleeves	Sleeves	02-1/4 x 3-3/8	cream	*10,000*
SL0124	Sleeves	Sleeves	02-1/4 x 3-3/8	24ww	*5,000*
SL0125	Sleeves	Sleeves	02-1/4 x 3-3/8	24ww	*15,000*
SL0126	Sleeves	Sleeves	02-1/4 x 3-3/8	24ww	*5,000*
SL0300	Sleeves	Sleeves	02-1/4 x 3-3/11	24 br kr	*15,000*
SL0127	Sleeves	Sleeves	02-1/4 x 3-3/8	cream	*10,000*
SL0128	Sleeves	Sleeves	02-1/4 x 3-3/8	#80 enduro frost	*5,500*
SL0400	Sleeves	Sleeves	02-1/2 x 3-3/4	65#cover	*3,500*
SL0401	Sleeves	Sleeves	02-1/2 x 3-3/4	24ww	*8,000*
SL0402	Sleeves	Sleeves	02-1/2 x 3-3/4	24ww	*90,000*
SL0403	Sleeves	Sleeves	02-5/8 x 3-3/4	#65 cover	*8,000*
SL0500	Sleeves	Sleeves	02-3/8 x 3-1/2	80 blk linen	*22,500*
SL0501	Sleeves	Sleeves	02-3/8 x 3-1/2	24ww	*65,000*
SL0502	Sleeves	Sleeves	02-3/8 x 3-1/2	White 24#	*107,500*

4. A-Sizes and Booklets

AS0100	A-sizes	A-6	04-3/4 x 6-1/2	Cream	*2,000*
AS0101	A-sizes	A-7	04-3/4 x 6-1/2	Ivory	*15,500*
AS0200	A-sizes	A-7	05-1/4 x 7-1/4	80# Soft white	*4,000*
AS0201	A-sizes	A-7	05-1/4 x 7-1/4	Blue, Hot	*2,500*
AS0202	A-sizes	A-7	05-1/4 x 7-1/4	Blue, Light	*1,000*
AS0203	A-sizes	A-7	05-1/4 x 7-1/4	24ww	
AS0204	A-sizes	A-7	05-1/4 x 7-1/4	cherry	
AS0205	A-sizes	A-7	05-1/4 x 7-1/4	Pink, Hot	
AS0300	A-sizes	A-8	05-1/2 x 8-1/8	White	2,100
BK0100	Booklet	Booklet	06 x 9	White 24#	51,500
BK0101	Booklet	Booklet	6 x 9	White 24#	
AS0500	A-sizes	A-10	06 x 9-1/2	Cream	4,600
AS0501	A-sizes	A-10	06 x 9-1/2	White 24#	5,000
BK0200	Booklet	Booklet	06-1/2 x 9-1/2	White 24#	11,500
BK0300	Booklet	Booklet	07 x 10	24ww	11,000
BK0400	Booklet	Booklet	07-1/2bx 10-1/2	28ww	1,500
BK0500	Booklet	Booklet	08-1/2 x 10-1/2	28ww	1,000
BK0600	Booklet	Booklet	8-3/4 x 11-1/2	White 28#	3,500
BK0700	Booklet	Booklet	09 x 12	White 28#	1,500
BK0701	Booklet	Booklet	09 x 12	24ww	12,500
BK0702	Booklet	Booklet	09 x 12	White 24#	500
BK0703	Booklet	Booklet	09 x 12	24# br krt	7,500
BK0704	Booklet	Booklet	9 x 12	White 24#	12,500
BK0705	Booklet	Booklet	09 x 12	Cream 80#	2,900
BK0706	Open End	Booklet	09 x 12	White 28#	500
BK0800	Booklet	Booklet	9-1/2 x 12-1/2	White 28#	25,000
BK0900	Booklet	Booklet	9 x 14-1/2	White 24#	1,350
BK1000	Booklet	Catalog	10 x 13	White 28#	1,200
BK1001		Catalog	10 x 13	orange kraft	22,500
BK1100	Booklet	Booklet	11 X 13-1/2	White 24#	1,500
BK1200	Booklet	Booklet	11 x 17	#28 ww	*2,100*

5. Coins and Open End

CN0C01	Coin	#00 Coin	01-11/16 x 2-1/4	White 24#	*11,600*
CN0C02	Coin	#00 Coin	01-11/16 x 2-3/4	24 BrKr	*7,000*
CN0C03	Coin	#00 Coin	01-11/16 x 2-3/4	golden rod	*16,000*
CN0C04	Coin	#00 Coin	01-11/16 x 2-3/4	Canary	*24,500*
CN0C05	Coin	#00 Coin	01-11/16 x 2-3/4	White 24#	
CN1C01	Coin	#01 Coin	02-1/4 x 3-1/2	White 24#	*80,000*
CN1C02	Coin	#01 Coin	02-1/4 x 3-1/2	24 BrKr	*100,000*
CN1C03	Coin	#01 Coin	02-1/4 x 3-1/2	25 BrKr	*50,000*
CN1C04	Coin	#01 Coin	02-1/4 x 3-1/2	Red	*13,000*

CN3C01	Coin	#03 Coin	02-1/2 x 4-1/4	24 br kr	11,000
CN3C02	Coin	#03 Coin	02-1/2 x 4-1/4	28 br kr	
CN3C03	Coin	#03 Coin	02-1/2 x 4-1/4	24ww	39,000
CN3C04	Coin	#03 Coin	02-1/2 x 4-1/4	24golen rod	23,500
CN4C01	Coin	#04 Coin	03 x 4-1/2	28 br kr	2,500
CN4C02	Coin	#04 Coin	03 x 4-1/2	24 ww	7,000
CN5C01	Coin	#05-1/2 Coin	03-1/8 X 5-1/2	24 BrKr	120,000
CN5C02	Coin	#05-1/2 Coin	03-1/8 X 5-1/2	24 golden rod	20,000
CN5C03	Coin	#05-1/2 Coin	03-1/8 X 5-1/2	24 BrKr	
CN5C04	Coin	#05-1/2 Coin	03-1/8 X 5-1/2	24ww	11,000
CN7C01	Coin	#07 Coin	03-1/2 x 6-1/2	24ww	18,000
CN7C02	Coin	#07 Coin	03-1/2 x 6-1/2	24ww	3,500
CN0001	Coin		2-1/2 x 4	tyvek	4,000
CN7C03	Coin	#07 Coin	03-1/2 x 6-1/2	White 24#	36,000

6. Commercial

CM0100	Commercial		03 x 4-1/2	60 French Parch	10,000
CM0200	Commercial		02 x 3-1/2	24ww	27,000
CM0300	Commercial		02-1/2 x 4	24ww	18,500
CM0400	Commercial		2-1/2 x 7	24ww	11,000
CM0500	Commercial		2-3/8 x 3-1/2	24ww	36,000
CM0600	Commercial		02-5/8 x 3-3/4	#65 cover	9,500
CM0700	Commercial		02-11/16 x 3-15/16	60#linen	12,000
CM0800	Commercial		02-3/8 x 5-1/2	white	8,000
CM0801	Commercial		02-3/8 x 5-1/2	cream	8,000
CM0900	Commercial		02-3/4 Xx 6	24ww	2,500
CM1000	Commercial		02-5/8 x 3-5/8	60 offset	39,000
CM1100	Commercial		03 x 4-1/2	24ww	7,000
CM1101	Commercial		03 x 4-1/2	golden rod	2,500
CM1200	Commercial		03 x 5-1/4	24 ww	23,000
CM1300	Commercial		03-1/4 x 4-1/4	linen	1,200
CM1400	Commercial		3-1/4x 4-1/2	cream	8,000
CM1401	Commercial		3-1/4x 4-1/2	white	8,000
CMCH01	Commercial	Church	03-1/8 x 6-1/4	Blue wove	6,000
CM1500	Commercial		03-1/8 x 3-3/4	70#text	19,000
CM1600	Commercial		03-1/2 x 4-1/2	cream	10,000
CM1601	Commercial		03-1/2 x 4-1/2	24ww	16,000
CM1700	Commercial		03-3/4 x 4	24ww	10,000
CM1800	Commercial		03-3/4 x 4-5/8	60 offset	10,000

CM1900	Commercial		03-3/4 x 4-1/8	24#blue w	*5,000*
CMPS10	Commercial	Passport sleeve	3-3/4 x 5-1/8	RFID Defender	*36,000*
CMPS20	Commercial	Passport sleeve	03-3/4 x 5-1/8	RFID Defender	
CMPS21	Commercial	Passport sleeve	03-3/4 x 5-1/8	#65 cover	*3,600*
CM7W01	Commercial	#7 w/wn	03-3/4 x 6-3/4	24ww	*22,000*
CM2000	Commercial		03-3/4 X 8-1/2	28ww	*29,000*
CM2100	Commercial		03-1/2 x 5-1/2	Ivory	*10,000*
CM2101	Commercial		03-1/2 x 5-1/2	24ww	*22,500*
CM2102	Commercial		03-1/2 x 5-1/2	blue wove	*15,000*
CM2200	Commercial		03-5/8 x 5-1/8	Blue wove	*6,600*
CM6R01	Commercial	6-1/4 Reg	03-1/2 x 6	24ww	*26,000*
CM6R02	Commercial	#6-3/4 Reg	03-5/8 x 6-1/2	Blue wove	*25,000*
CM6R03	Commercial	#6-3/4 Reg	03-5/8 x 6-1/2	24ww	*50,000*
CM6R04	Commercial	#6-3/4 Reg	03-5/8 x 6-1/2	white 24#	*37,500*
CM6R05	Commercial	#6-3/4 Reg	03-5/8 x 6-1/2	Green wove	*2,500*
CM2300	Commercial		03-5/8 x 8-5/8	white 24#	*5,000*
CMTE01	Commercial	Ticket Envelope	03 x 7	White 24#	*5,000*
CM2400	Commercial		03-3/4x 7	White 24#	*25,000*
CM7R01	Commercial	#7-3/4 Reg	3-7/8 x 7-1/2	White 24#	*68,000*
CM2500	Commercial		06-7/8 x 7-1/2	White 24#	*17,000*
CM9R01	Commercial	#09 Regular	03-7/8 x 8-7/8	Blue	*65,000*
CM9R02	Commercial	#09 Regular	03-7/8 x 8-7/8	Green	*1,500*
CM9R03	Commercial	#09 Regular	03-7/8 x 8-7/8	White 24#	*14,000*
CM9R10	Commercial	#09 Regular	03-7/8 x 8-7/9	White 24#	*50,000*
CM9R04	Commercial	#09 Regular	03-7/8 x 8-7/8	White 24#	*10,000*
CM9R05	Commercial	#09 Regular	03-7/8 x 8-7/8	24 br krft	*2,500*
CM9S01	Commercial	#09 Std/wn	03-7/8 x 8-7/8	White 24#	*40,000*
CM9S02	Commercial	#09 Std/wn	03-7/8 x 8-7/8	White 24#	*32,500*
CM9S03	Commercial	#09 Std wn	03-7/8 x 8-7/8	White 24#	*2,500*
CM9R20	Commercial	#09 Regular	03-7/8 x 8-7/8	24 yellow	*37,500*
CM9R21	Commercial	#09 Regular	03-7/8 x 8-7/8	White 24#	*30,000*
CM2600	Commercial		4-1/8 X 5-5/4	linen yel	*4,800*
CM2700	Commercial		04-1/4 x 9	White 24#	*14,000*
CMTR01	Commercial	#10 Regular	04-1/8 x 9-1/2	24ww	*83,000*
CMTR30	Commercial	#10 Regular	04-1/8 x 9-1/3	Green wove	*23,000*
CMSW01	Commercial	#10 std/wn	04-1/8 x 9-1/2	24ww	*100,000*
CMTR02	Commercial	#10 Regular	04-1/8 x 9-1/2	White 24#	*75,000*
CMSW02	Commercial	#10 Std/wn	04-1/8 x 9-1/2	White 24#	*101,500*
CMSW03	Commercial	#10 Std/wn	04-1/8 x 9-1/2	White 24#	*5,000*
CMSW04	Commercial	#10 Std/wn	04-1/8 x 9-1/2	24#ww	*75,000*

CMDW01	Commercial	#10 Dbl wn	04-1/8 x 9-1/2	White 24#	60,000
CMSS01	Commercial	#10 SS	04-1/8 x 9-1/2	White 24#	6,500
CMAT01	Commercial	ATM	04-1/8 x 9-1/2	White 24#	22,500
CMTR03	Commercial	#10 Regular	04-1/8 x 9-1/2	24mohawk Lt grn	23,500
CMTR04	Commercial	#10 Regular	04-1/8 x 9-1/2	24ww	82,500
CMTR05	Commercial	#10 Regular	04-1/8 x 9-1/2	24ww	18,000
CMTR06	Commercial	#10 Regular	04-1/8 x 9-1/2	pink	1,500
CMTR07	Commercial	#10 Regular	04-1/8 x 9-1/3	24 crm wht	11,000
CMTR08	Commercial	#10 Regular	04-1/8 x 9-1/2	White 24#	5,000
CMTP01	Commercial	#10 Policy	04-1/8 x 9-1/2	White 24#	10,000
CMTR09	Commercial	#10 Regular	04-1/8 x 9-1/2	White 24#	18,000
CMTR10	Commercial	#10 Regular	04-1/8 x 9-1/2	White 24#	8,500
CMSW05	Commercial	#10 spec/wn	04-1/8 x 9-1/2	White 24#	5,000
CMSW06	Commercial	#10 spec/wn	04-1/8 x 9-1/2	White 24#	45,000
CMSW07	Commercial	#10 spec/wn	04-1/8 x 9-1/2	White 24#	32,500
CMA201	Commercial	A-2	4-3/8 x 5-3/4	White 24#	10,000
CM2800	Commercial		04-1/2 x 6-1/2	100#text	3,600
CM1P01	Commercial	#11 Policy	04-1/2 x 10-3/8	BrKr 28#	2,500
CM2900	Commercial	#11	04-1/2 x 10-3/8	White 24#	5,000
CM1W01	Commercial	#11 Window	04-1/2 x 10-3/8	White 24#	15,000
CM3000	Commercial		04-5/8 x 6-7/8	brn krt	5,000
CM3100	Commercial		06 X 9	golden rod/spc wn	1,000
CM3101	Commercial		6 X 9	24 ww	51,500
CM3200	Commercial		06-1/8x 9-1/2	offset	2,850
CM3300	Commercial		06 x 11-1/2	White 24#	1,500
CM3400	Commercial		0-1/2 x 3-1/2	24ww	2,000
CM3500	Commercial		6-1/2 x 3-5/8	24ww/printe d	3,000
CM3600	Commercial		8-3/4 x 11-1/2	White 28#	3,500

7. Kost Kut, Bangtail, Doorknobs & Hitchhiker/Wolverine 2-way

KK0100	Kost Kut	6-1/4 KK	03-1/2 x 6	White 24#	56,000
KK0200	Kost Kut	6-3/4 KK	03-5/8 x 6-1/2	White 24#	252,000
KK0201	Kost Kut	6-3/4 KK	03-5/8 x 6-1/2	White 24#	
KK0202	Kost Kut	6-3/4 KK	03-5/8 x 6-1/2	White 24#	10,500
DK0100	Doorknobs	Doorknobs	03-5/8 x 6-1/2	Blue	91,000
DK0101	Doorknobs	Doorknobs	03-5/8 x 6-1/2	Yellow 80#	55,000
DK0102	Doorknobs	Doorknobs	03-5/8 x 6-1/2	Pink	35,000
DK0103	Doorknobs	Doorknobs	03-5/8 x 6-1/2	24 BrKr	

DK0104	Doorknobs	Doorknobs	03-5/8 x 6-1/2	Green	38,000
DK0105	Doorknobs	Doorknobs	03-5/8 x 6-1/2	24ww	83,000
DK0200	Doorknobs	Doorknobs	04-3/8 x 6-1/2	24ww	140,000
DK0201	Doorknobs	Doorknobs	04-3/8 x 6-1/2	golden rod	57,500
BT0100	Bangtail	#09 Bangtail	03-7/8 x 8-7/8	Blue	42,400
BT0200	Bangtail	#09 Bangtail	03-7/8 x 8-7/9	Blue	11,200
BT0101	Bangtail	#09 Bangtail	03-7/8 x 8-7/8	Blue	16,800
BT0102	Bangtail	#09 Bangtail	03-7/8 x 8-7/8	Green	7,000
BT0201	Bangtail	#09 Bangtail	03-7/8 x 8-7/9	White 24#	43,000
BT0202	Bangtail	#09 Bangtail	03-7/8 x 8-7/9	White 24#	107,200
KK0300	Kost Kut	#09 KK	03-7/8 x 8-7/8	White 24#	8,400
KK0301	Kost Kut	#09 KK	03-7/8 x 8-7/8	White 24#	54,000
KK0302	Kost Kut	#09 KK	03-7/8 x 8-7/8	White 24#	105,000
WV0100	Wolverine	Wolverine	04-1/2 x 9-1/2	Blue	
WV0101	Wolverine	Wolverine	04-1/2 x 9-1/2	Canary	
WV0102	Wolverine	Wolverine	04-1/2 x 9-1/2	Pink	
WV0103	Wolverine	Wolverine	04-1/2 x 9-1/2	White 24#	12,500
WV0104	Wolverine	Wolverine	04-1/2 x 9-1/2	White 24#	25,100
			1,250,600		

7.1 Airlines, Church and Boomerang 5A (2-way mortise window)

CH0100	Church	Church	03-1/8 x 6-1/4	20 light blue	20,000
AR0100	Airline ticket	Airline ticket	03-3/4 x 8-1/2	White 24#	
BT0300	Bangtail	Boomerang 5A	04 x 9-1/2	White 24#	17,000
BT0400	Bangtail	Boomerang 5A	04 x 9-3/4	White 24#	

8. Square…*note: less than 3 x 3 see miniatures*

SQ0100	Square	Square	03 x 3	24 ww	13,000
SQ0200	Square	Square	03-1/2 x 3-1/2	24ww	17,500
SQ0300	Square	Square	04 x 4	White 24#	58,000
SQ0400	Square	Square	05 x 5	White 24#	2,900
SQ0500	Square	Square	05-1/2 x 5-1/2	White 24#	9,000
SQ0600	Square	Square	06 x 6	White 24#	15,000
SQ0700	Square	Square	06-1/2 x 6-1/2	White 24#	3,200
SQ0800	Square	Square	07 x 7	White 24#	5,000
SQ0900	Square	Square	07-1/2 x 07-1/2		9,000
					132,600

9. Packaging, Floppy Disk, Padded and Board Mailers

PD0100	Padded	Padded	10-1/2 x 16	28 green
10. Tissue Lined				
TL0100	Tissue Lined	Square	02 x 2	tissue
TL0101	Tissue Lined	Square	02 x 2	tissue
11. Sheeted Stock				
SS0100	Sheeted Stock		17 x 22	24 ww
SS0101	Sheeted Stock		17 x 22	24 ww
SS0102	Sheeted Stock		17 x 22	24 ww
SS0103	Sheeted Stock		17 x 22	24# White
SS0200	Sheeted Stock		17-1/2 x 22-1/2	24# Antique Grey
SS0300	Sheeted Stock		20 x 26	Bristol White
SS0400	Sheeted Stock		22 x 34	24 ww
SS0500	Sheeted Stock		22-1/2 x 34-1/2	
SS0600	Sheeted Stock		23 x 34	color wove
SS0700	Sheeted Stock		23 x 35	
SS0701	Sheeted Stock		23 x 35	White
SS0800	Sheeted Stock		25 x 38	24 ww
SS0801	Sheeted Stock		25 x 38	24 ww
SS0802	Sheeted Stock		25 x 38	80# white
SS0803	Sheeted Stock		25 x 38	60# white
SS0804	Sheeted Stock		25 x 38	Offset opaque
SS0805	Sheeted Stock		25 x 38	70# Starwhite
SS0806	Sheeted Stock		25 x 38	60# white
SS0807	Sheeted Stock		25 x 38	50# White Wove
SS0900	Sheeted Stock		29-1/2 x 35-1/2	20 White
SS1000	Sheeted Stock		34 x 22	White
SS1001	Sheeted Stock		34 x 22	22 gray
SS1002	Sheeted Stock		34 x 22	24 ww
SS1003	Sheeted Stock		34 x 22	24# Antique Grey
SS1004	Sheeted Stock		34 x 22	24# Florescent white
SS1100	Sheeted Stock		35 x 22-1/2	Grey
SS1101	Sheeted Stock		35 x 22-1/2	Ivory White
SS1102	Sheeted Stock		35 x 22-1/2	24# Ivory White