

Atwoods Distributing LP

Exterior Layout Enhancement



An Oklahoma State University
School of Industrial Engineering and Management
Senior Design Project Report

Developed by:

Eulojio Sanchez

Leah Benator

Yi Siang Chong

Faculty mentor: Dr. Chaoyue Zhao

Date: December 8, 2017



Submitted in partial fulfillment of the requirements of the course, IEM 4913, Senior Design and the Baccalaureate degree requirements of the School of Industrial Engineering and Management at Oklahoma State University

EXECUTIVE SUMMARY

Atwoods Distributing LP in Enid, Oklahoma, is one of two distribution centers (DC) for ranch and home goods. Both DCs in Enid, OK and in Tyler, Texas, service 60 Atwoods stores in Texas, Oklahoma, Kansas, Missouri, and Arkansas. The Enid Atwoods DC recently expanded their exterior facility by adding a concrete slab area of 8.8 acres that includes a new entrance on the southwest corner of the property.

The Atwoods Team has requested the Industrial Engineering and Management (IEM) Senior Design Team (SDT) at Oklahoma State University to use this opportunity to design a new layout that improves the flow of inventory in and out of their DC. Their objectives were to improve the flow of incoming and outgoing trucks, maximize storage capacity of outside product, or “picks”, and improve the overall organization of outside picks.

In the following report, the SDT has provided the Atwoods Team with their methodology, analysis of the current situation, and several solution alternatives. They conclude the report with a list of final recommendations along with an explanation of the value added on how to effectively utilize the expanded area by:

- reducing congestion with new vendor parking lots and a new truck route through the facility
- minimizing forklift travel with an optimized, labeled product layout
- relocating pallets, recyclables, and the propane tank away from the outside picks
- maximizing overnight vendor parking within the bottleneck area outside of the new entrance

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1.0 INTRODUCTION

1.1 BACKGROUND

Atwoods Distribution Center was founded in Enid, Oklahoma by Wilbur and Fern Atwood and is now run by their grandson, Brian Atwood. They have another DC location in Tyler, Texas and together, the Enid and Tyler facilities service a total of 60 stores in Oklahoma, Texas, Missouri, Arkansas, and Kansas. The Enid DC has just finished expanding its outer facility, and now has 8.8 acres of new, paved concrete (as seen in Figure 1) for their growing business. They currently service 30 Atwoods Ranch and Home retailer stores and send out 18-25 Atwoods trucks a day directly from the Distribution Center. The Atwoods Team needs to utilize this new space to stage delivery trucks and store outside products, or outside “picks”.

Their layout prior to expansion utilizes only one entrance/exit on the east side of the facility, adjacent to the loading docks. This creates a highly congested area in front of the docks, causing trucks to idle and wait outside and inside of the facility entrance.

Their outside picks lack systematic organization and have no clear labeling for the forklift drivers. They are often mixed with and blocked by pallets, preventing forklift drivers from accessing their daily orders. Atwoods has their own name for their excessive collection of pallets, “Pallet World”, and would like to relocate this obstruction, along with their recyclables.

Atwoods is seeking to improve the flow of incoming and outgoing trucks by minimizing congestion and truck waiting time. They would also like to maximize outside pick storage capacity and implement a standard, organized system for the layout of the outside picks.

The OSU Senior Design Team (SDT), comprised of Eulojio Sanchez, Leah Benator, and Yi Siang Chong, has developed several solutions to the Atwoods objectives for this project. The SDT has provided Atwoods with a complete high level layout that will provide the following:

- minimized truck waiting times
- maximized storage and organization for outside picks
- alternate locations for Pallet World, recyclables, and truck parking
- minimized forklift travel times
- alternate truck routes from the new entrance to the loading/unloading area and exit

The scope of this project deals with only the outside picks and exterior flow of inventory, including incoming and outgoing trucks and the forklift drivers retrieving outside picks. Figure 1 below shows the currently used space for DC operations in blue and the new added space in green.

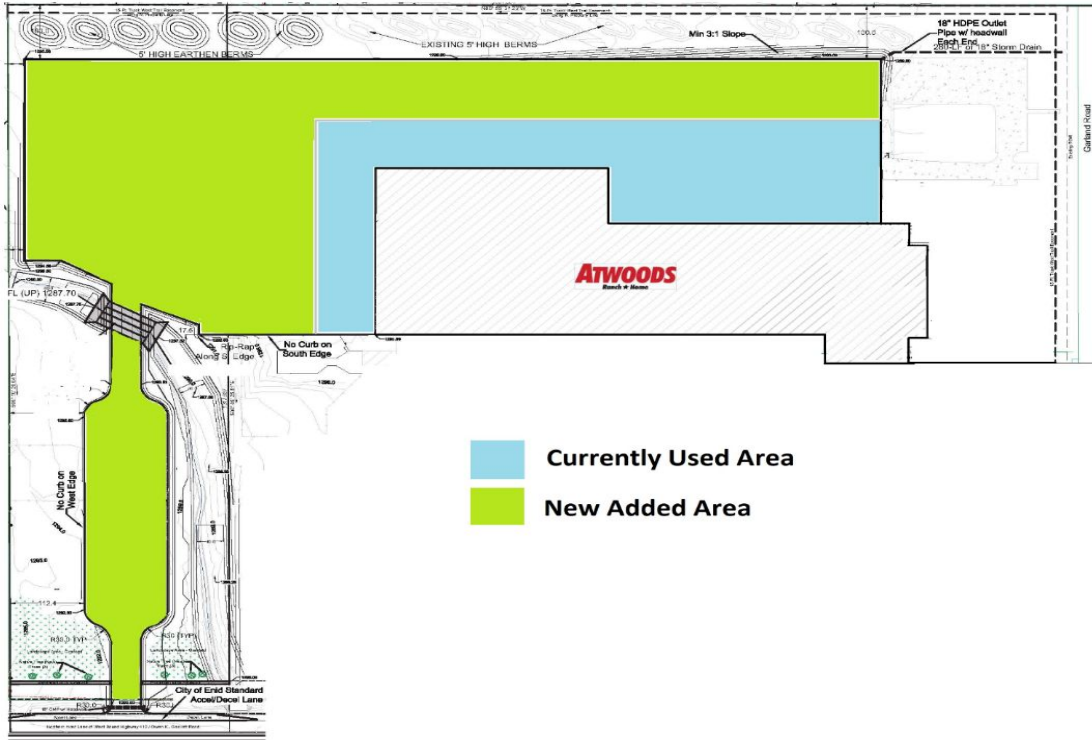


Figure 1: Atwoods Distribution Center in Enid, Oklahoma

1.2 PROJECT OBJECTIVES

The Atwoods team provided the SDT with several objectives for an enhanced exterior layout that include:

- Standardized organization and labeling of outside picks
 - Minimized forklift travel time
 - Reduced inaccurate orders
 - Maximized storage capacity
- Staged vendor and Atwoods parking
 - Reduced truck waiting time
- New truck route through facility
 - Decreased safety risk

1.2.1 Organization of Outside Picks

Currently, the Atwoods facility does not have designated slots for each individual pick. The forklift drivers unload the outside picks wherever there is space on the north side of the warehouse. If a forklift driver is not as experienced, it would take them much longer to find the product for their order using this current system.

There is also no clear, readable labeling of the products from the vantage point of the forklift driver. Occasionally a forklift driver will load the wrong type of pick, resulting in an inaccurate order, because of this lack of signage.

Some of the information that is needed by the forklift driver is:

- Full Name of Product
- Product Color
- Product Number
- Load capacity permitted (to prevent tipping/overloading)

The Atwoods team would like a design of an improved, standardized organization of their outside picks from the SDT.

1.2.2 Staged Vendor and Atwoods Parking

The Atwoods facility lacks official staged parking for vendors waiting to enter the docks and vendors who arrive more than a day before their appointment. The Atwoods team also notified the SDT of requested parking for 10 additional Atwoods trucks to be stored on-site for rare and future needs.

The Atwoods team requested a facility layout design that includes additional parking lots for vendors and Atwoods trucks that will help reduce congestion at the current entrance and exit in front of the loading docks.

1.2.3 New Truck Route

The Atwoods team would also like a new, improved truck route through the facility from the new entrance to the designated exit. The purpose of this route is to direct the trucks to their predetermined destinations within the facility. These routes need to direct truck traffic away from all outside products and trailers within the facility (except for vendor trucks unloading outside picks).

2.0 PROJECT METHODOLOGY

This section presents the approach the SDT used to assess the current situation and develop solution alternatives. Our methodology has been separated into these five phases: Discover, Collect Data, Analyze Data, Develop Solutions, and Evaluate Solution Alternatives.

2.1 DISCOVER

The first phase was the discovery phase. In this phase, the OSU SDT met the Atwoods team and observed the current situation of their facility to clarify the project objectives and answered some of the constraints and questions as seen in **Appendix B**. The steps in this phase were:

Tour the facility

- Meet with CEO Brian Atwood and learn the company history/background
- Meet with Inventory Analyst David Crosby, Logistics Manager Randy Trebilcock, and the CEO's assistant, Dana Kuhlman
- Observe both the interior and exterior operations of the Distribution Center
- View the new exterior expansion
- Examine all outside products within the scope of the project

Observe current processes

- Witness the incoming and outgoing flow of trucks (and the congestion caused by them)
- Watch how the forklift drivers transport product, load and unload product into the trucks or outside storage, and communicate with other drivers
- Observe the general employee behavior/practices within the processes

Document current situation

- Record all details of the facility and operations
- Understand and document the current flow of trucks and inventory
- Create proposal defining SDT objectives for the Atwoods team

2.2 COLLECT DATA

The next phase was the data collection phase, which was similar to the discovery phase, but dealt with more metric-specific questions, such as the trends (order frequency) and truck wait times. Our steps within this phase were:

Define design constraints

- Differentiate between flammable picks and nonflammable picks
- Define permanent and moveable landmarks

Collect product details

- Measure the dimensions of each outside pick
- Measure the dimensions of the average slot size (designated storage location for each pick)
- Collect the sales data for outside picks from all the listed picks as seen in **Appendix C**

Perform time studies of truck congestion and waiting time

- Observe the flow of the trucks within the facility
- Record truck wait time outside and within the facility

Research OSHA trucking regulations

- Determine compliance regulations that are permitted for truck parking
- View different examples of truck parking lot designs
- Research standard truck parking angles, lane width, and parking space dimensions

2.3 ANALYZE DATA

The data analysis phase sought to reveal trends in data and organize it in a logical manner. It included the following steps:

Sort picks

- Organize picks from most frequently ordered to least, based on yearly sales as seen in **Appendix D**
- Organize picks by category
- Determine the most awkward/heaviest picks to transport
- Relocate most frequently shipped products closest to the loading docks in layouts

Create relationship chart

- List all facility landmarks
- Rate each landmark by importance of proximity to every other landmark based on the Atwoods team's ratings

2.4 DEVELOP SOLUTIONS

During the solution development phase, the SDT utilized their data to create optimized facility and product layouts. It included the following steps:

Create facility layout in AutoCAD

- Record the specified measurements of the original layout and include in the new layout design
- Relocate landmarks based on relationship chart in the layout
- Design truck parking lots
- Add dimensions

Create product layouts in AutoCAD

- Create current state layout of product
- Expand product area to utilize the entire north wall of the distribution center
- Create layout outline with slots
- Number slots based on frequency and load size data

2.5 EVALUATE SOLUTION ALTERNATIVES

In the final phase of the methodology, the SDT compared metrics and benefits of the different layout options and truck routes, and determined which combination was best. The steps were:

Compare layout metrics

- Calculate total distance traveled by forklift in each future product layout
- Compare future product layout total distances and benefits
- Compare different truck route benefits

3.0 CURRENT SITUATION

This section describes the current layout and daily operations that occur at the Enid DC. It includes the key observations noted by the SDT and their analysis of the current situation.

3.1 CURRENT FACILITY LAYOUT

Figure 2 below shows the current exterior space utilized in the facility. The major landmarks, Outside Product, Pallets, Propane Tank, Queued Parking, and the Loading and Unloading Docks, are labeled numerically 1 through 6.

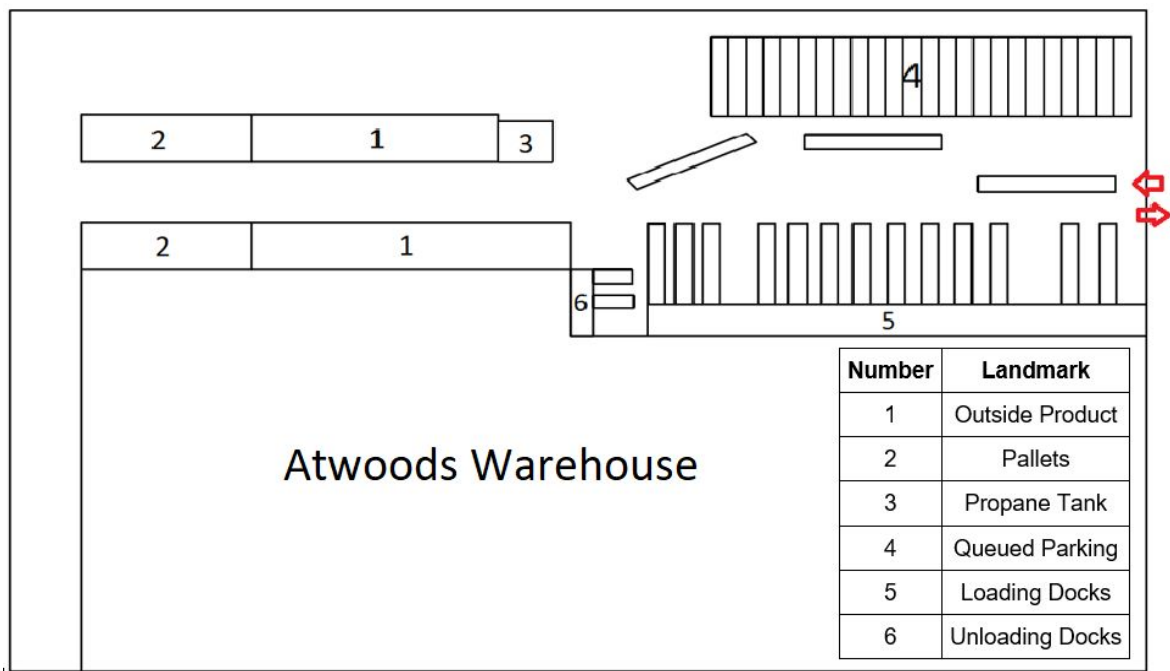


Figure 2: Bird's eye view of current utilized space and congestion

3.2 CURRENT PRODUCT LAYOUT

The current location of outside product, labeled with a “1” in Figure 2, is shown below in Figure 3.

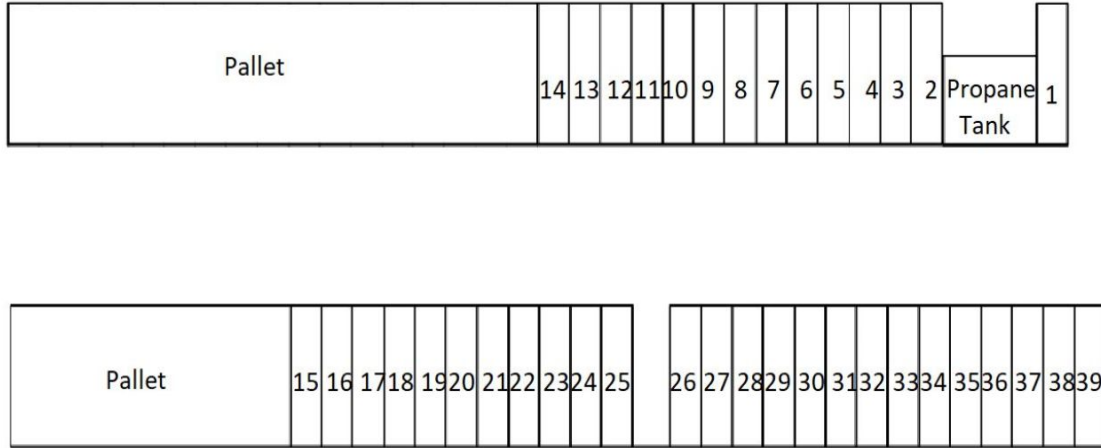


Figure 3: Current layout of product, propane tank, and pallet locations

3.3 KEY OBSERVATIONS

Based on the Atwoods Distribution Center visits and discussions with the Atwoods team, the following sections cover some key observations and data collected about the current situation at the Atwoods Distribution Center.

3.3.1 Congestion

There is a major congestion issue of trucks in front of the loading and unloading docks. Several factors cause this congestion:

- Only one gate for all trucks that are entering and exiting the facility
- Only room for one truck to turn around at a time
- No staged parking for incoming vendor trucks

When the docks are full, inbound trucks are forced to wait outside of the entrance, thus creating a line in front of the gate which can back up traffic onto the highway, causing a potential safety hazard. At the same time, there is a shag driver constantly transporting Atwoods trucks between the loading docks and the queued parking (just north of the docks) and trucks trying to leave the facility.

If only one truck is trying to turn around or park, then all other trucks waiting to leave, waiting to enter, and waiting to transport empty or full Atwoods trucks have to wait on that one truck. These idle, parked trucks create congestion and

consume space that could be used for exiting trucks or outside product storage. The congestion issue is shown in Figures 4 and 5.



Figure 4: Bird's eye view of where congestion occurs



Figure 5: Eye level view of congested area in front of docks

The SDT performed a time study in the data collection phase to record the truck waiting time inside and outside of the facility entrance caused by congestion. The longest time that a truck needed to wait to get to the docks was 12.08 minutes because of the congestion issue. The data collected by the SDT is shown below in Table 1. The waiting time inside and outside of facility, total waiting time, and the average waiting time is shown in minutes.

Table 1: Truck Time Study

Truck	Waiting time (minutes)		Total waiting time(minutes)
	Outside facility	Inside facility	
1	2.08		2.08
2	2.25		2.25
3	4.47		4.47
4	2.87		2.87
5	2.82	9.27	12.08
6	5.73		5.73
7	3.52		3.52
8	2.08	2.30	4.38
9	2.08	4.22	6.30
10	2.70		2.70
11	0.47	2.25	2.72
Average (minutes)	2.82	4.51	4.46

3.3.2 Product Organization

The outside product has no clear, readable labeling for the forklift drivers. There are only small tags attached to each pick. Since most forklift drivers do not dismount the forklift to double check the labeling, there have been instances when drivers make errors that cause inaccurate orders.

Forklift drivers also mistake similar products that are right next to each other. For example, different sized t-posts (officially labeled as “Post Tees” in the Atwoods system) are stacked next to each other and the drivers often mistake the 6 ft posts with the 6.5 ft posts. This wastes time and reduces customer satisfaction (the customer being the Atwoods’ stores). An example of an unreadable small tag for outside products is shown in Figure 6.



Figure 6: Lack of visible labeling on picks

There is a large accumulation of pallets from deliveries that take up space adjacent to the products stored outside as shown in Figure 7. There have been instances when forklift drivers cannot get to certain products because they are blocked by pallets, which delays the loading process.



Figure 7: Pallet World

Sometimes forklift drivers load more than the forklift can effectively handle, which can cause accidents, damaged goods, and wasted time. The probability of a

forklift overloading accident occurring is about 3 out of every 100 loads a forklift driver makes according to the Atwoods Logistics Manager, Randy Trebilcock.

The outside picks have little to no organization, as shown in Figure 8. There are a few large, heavy products placed nearest to the warehouse to rest against the wall and closest to the loading docks because of their awkward load size. The other products are placed randomly (i.e. wherever there was room when a truck was unloaded outside). For example, several similar products are placed in separate locations from each other, because there was no more room in the original location of the product. This increases confusion for the forklift drivers who are trying to locate this product, but who do not know where the other forklift driver placed it.



Figure 8: Picks are placed wherever there is room

4.0 SOLUTION ALTERNATIVES

This section includes the developed solutions and comparisons between the benefits of each solution alternative. The SDT created a high-level facility layout including designs for vendor staged parking, Atwoods storage parking, two options for bottleneck parking, and two options of product layouts. Figure 9 shows the 4 major landmarks.

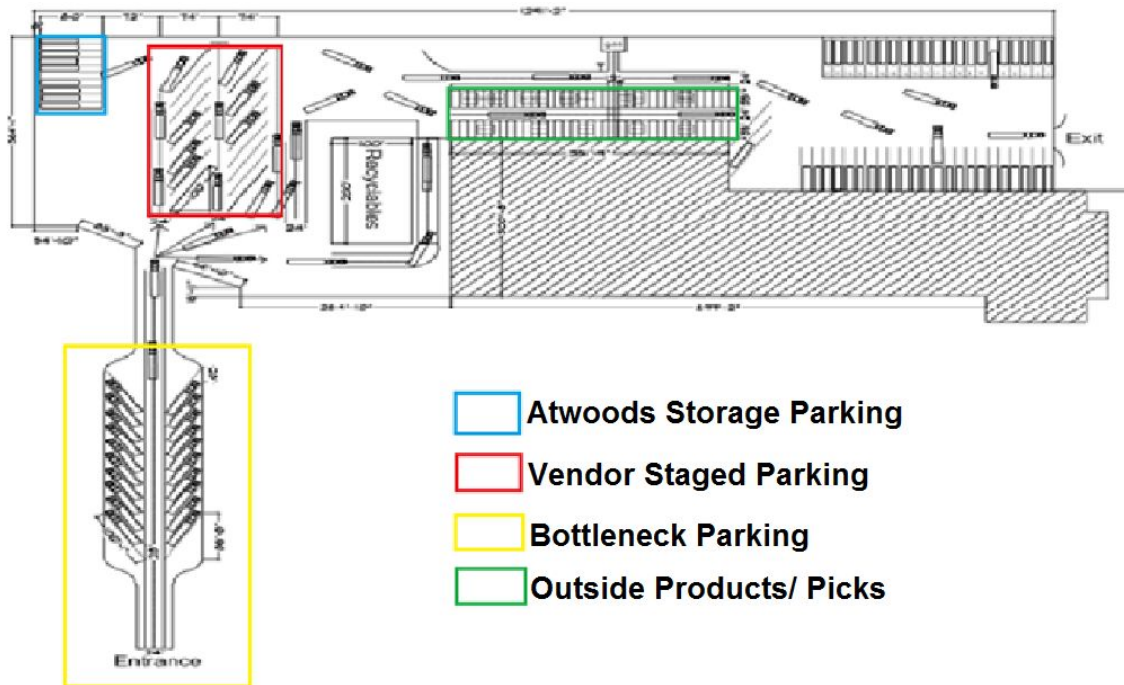


Figure 9: Expansion with landmarks for the Atwoods Distribution Center

4.1 FACILITY LAYOUT AND BENEFITS

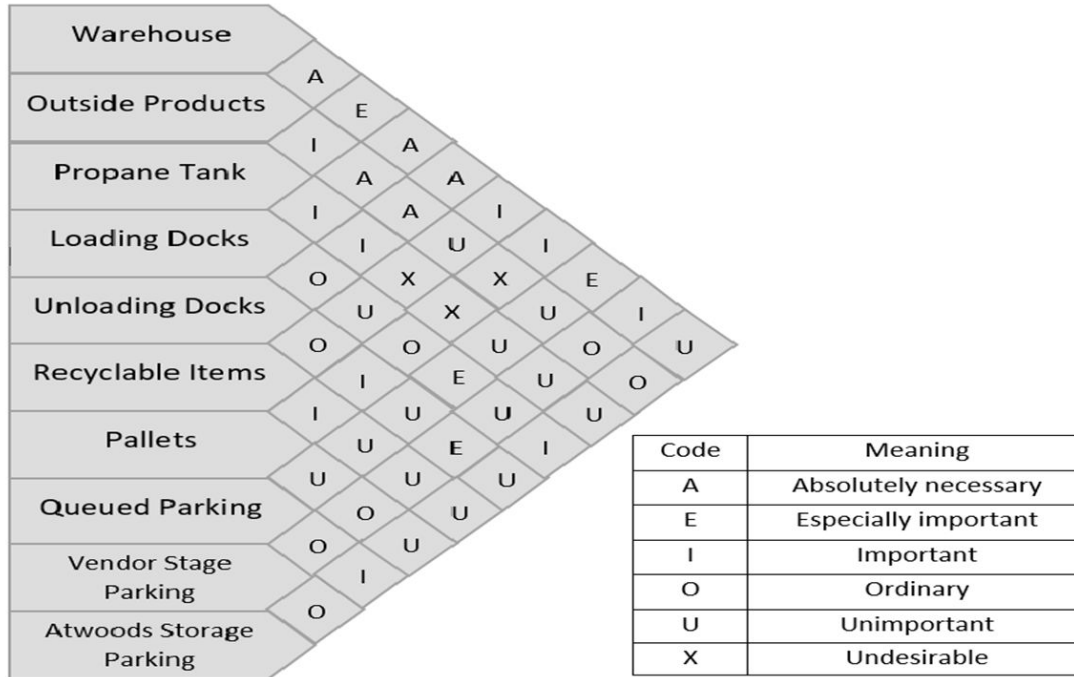
The SDT designed the new facility layout by incorporating the research they found on the design constraints given to them from the Atwoods team (refer to Appendix B). They used industrial engineering tools to effectively organize all of the required landmarks in the new layout (seen in Table 2 below).

4.1.1 High-Level Layout

The SDT and Atwoods team created a relationship chart as seen in Table 2 below to justify their placement of the major facility landmarks. The chart creates

a visual aid that relates every landmark to each other based on how important or unimportant it is for certain landmarks to be next to each other.

Table 2: Relationship Chart



For example, the relationship between the warehouse and the outside products is denoted with the letter “A” for absolutely necessary. By keeping the outside products as close as possible to the warehouse, Atwoods can continue to minimize forklift travel time.

On the other hand, the relationship between the warehouse and the Atwoods storage parking is denoted with the letter “U” for unimportant. The Atwoods storage parking will rarely be visited throughout the year and does not need to take up space around the warehouse that could be used for outside products.

After validation of the relationship chart rankings with Atwoods’ employees Randy Trebilcock and David Crosby, the SDT arranged the 9 landmarks in a high level layout below in Figure 10, based on the relationship chart. They calculated the minimum amount of space required for truck lane widths and 90 degree turns to accurately space out each landmark. Green arrows were used to represent the flow of trucks within the DC.

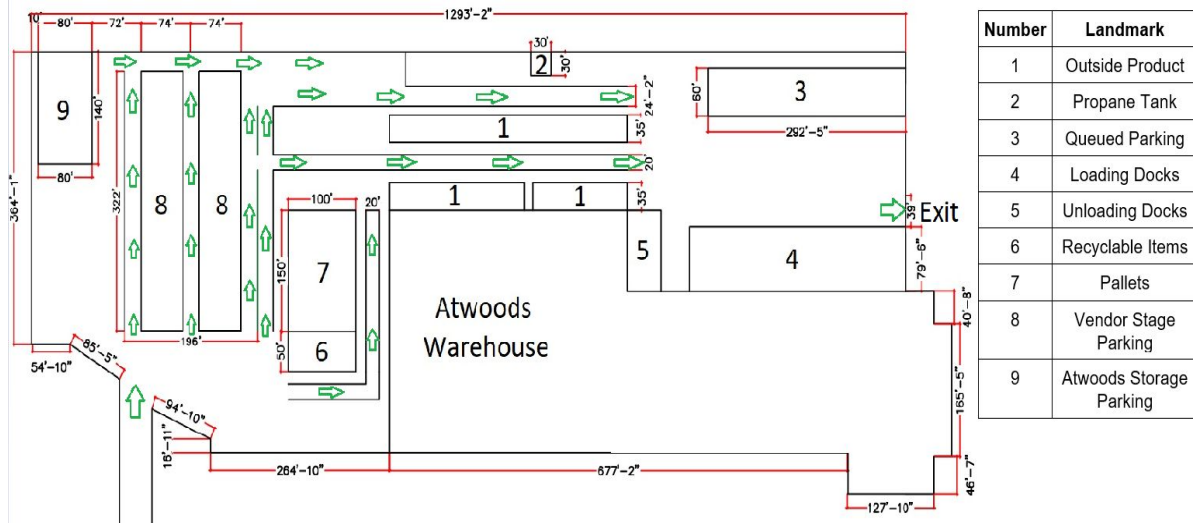


Figure 10: High-Level Layout

Benefits

1. Outside Product
 - a. Placed closest to warehouse to minimize distance traveled by forklifts
 - b. Expanded from 14,332 sq ft to 25,358 sq ft for a total of 77 % increase in storage space
2. Propane Tank
 - a. Relocated closer to north boundary by a light pole to allow access to power (Atwoods' team decision to connect power to the tank)
3. Queued Parking
 - a. Relocated closer to north boundary to give trucks more room to turn around, park, and pull out in front of the docks
4. Loading Docks
 - a. Kept at current location because they are a more permanent landmark
5. Unloading Docks
 - a. Kept at current location because they are a more permanent landmark
6. Recyclable Items
 - a. Relocated to the west of the warehouse (50 ft away from the building because recyclables are flammable)
 - b. Allows for increased storage capacity of recyclables, pallets, and outside product

7. Pallets
 - a. Relocated to the west of the warehouse (50 ft away from the building because most pallets are flammable)
 - b. Allows for increased storage capacity of recyclables, pallets, and outside product
8. Vendor Staged Parking
 - a. Located directly north of the entrance and west of recyclables, pallets, and outside product (this landmark requires the greatest amount of space)
 - b. Redirects vendor trucks early for same-day appointments (when their dock is unavailable) away from the dock area
 - c. Reduced truck waiting time
9. Atwoods Storage Parking
 - a. Located in the far northwest corner of the property (used for storage and rarely visited)
 - b. Kept out of the way of daily operations to help minimize congestion

4.1.2 Detail-Level Layout

This section presents several zoomed-in versions of the facility layout to show the details of the design.

Atwoods Storage and Staged Vendor Parking Design

The parking for storage of Atwoods trailers will be placed farthest away from the warehouse in the northwest corner of the property to keep it out of the way of daily operations. These trailers will only be used sparingly throughout the year or as needed by the Atwoods team, so it is not as crucial to have them close to the warehouse.

The parking for staged vendor trucks is directly north of the entrance and east of the Atwoods truck storage parking lot, to allow for enough space for trucks to pull in, park, and pull out of the lot as seen in **Figure 11**.

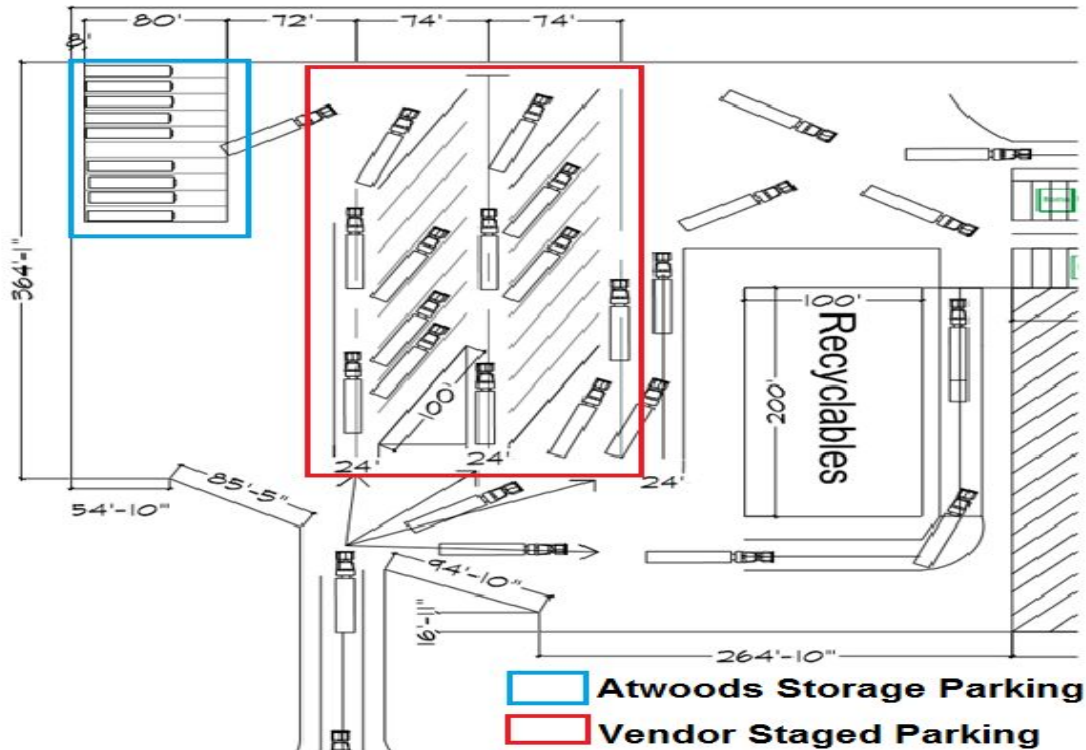


Figure 11: Atwoods and Vendor Parking

The section labeled “Recyclables” consists of Pallet World and all of the recyclables collected throughout the daily operations at the stores and the DC. The SDT took dimensions off of the current area consumed by pallets and recyclables and designed the area to allow for trucks to park in between the warehouse and the recyclables area and to load either the pallets or the recyclables.

4.1.3 Overnight Parking Designs

Figure 12 below shows two different overnight parking designs that the SDT designed for the bottleneck area south of the new entrance.

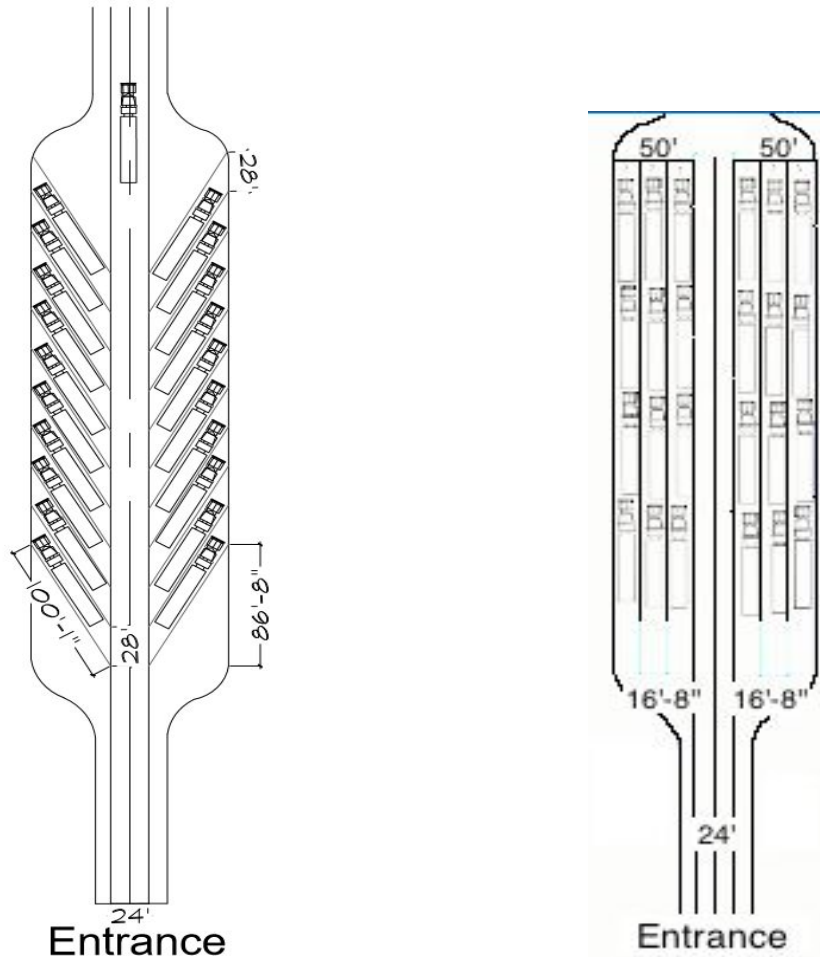


Figure 12: Two layout designs for overnight truck parking

Benefits

The first design on the left is set up so that the trucks can easily pull in and out of the angled parking spaces. This design allows for up to 20 parking spots for trucks and their trailers. It also allows for trucks to arrive at any time before their appointment without having to wait on trucks who have an appointment scheduled after them.

The second design on the right was created to maximize the number of parking spaces (24 total parking spots) and to prevent trucks from exiting back out into the highway once they arrive in the bottleneck parking area. This design is a first-in first-out (FIFO) design, meaning the trucks to arrive first will park in the

closest space to the entrance. The trucks to follow will have to park next to or behind the first truck that arrived even if their appointment is earlier.

OSHA Research

The SDT researched standard OSHA regulations for designing truck parking lots to make sure they addressed every requirement accurately. OSHA regulations regarding spaces are more of a question for the cities in which they are in. There are set standard lines that city parking spaces abide to on public streets, but private businesses are in liberty of having their own set standard for their parking lots, just as long as they are not creating a safety hazard. Depending on the angle and availability of space, they are allowed to make any type of parking spaces for the trucks and trailers.

4.2 PRODUCT ORGANIZATION AND BENEFITS

The SDT created two options for outside product layouts. Both product layouts have a standard slot size for each product of 10.5 ft by 35 ft. These product layouts have increased the outside storage capacity for these outside products as compared to the current layout. After moving the pallets and recyclables to the west side of the facility, the storage space for the outside products increased approximately 77%, from 14,332 sq ft to 25,358 sq ft.

4.2.1 Layouts

Figure 13 shows the first product layout, which was created based on the load size and category. There are eight awkward/heavy products that need to be near the warehouse to minimize the chance of a forklift dropping it. All of the products are separated into 4 different categories: 3 pt equipment, feeding/watering, fencing/wire, and large animal care. These categories are used to organize the different picks (given to the SDT from the inventory analyst, David Crosby).

Within each category, the products will be organized by the most frequently shipped to the least, with the most frequently shipped products closest to the docks. The products are labeled numerically from 1 to 65 (Refer to Appendix E: Product Layout 1).

Figure 13 shows the frequency of forklift travel to the 10 most frequently shipped products.

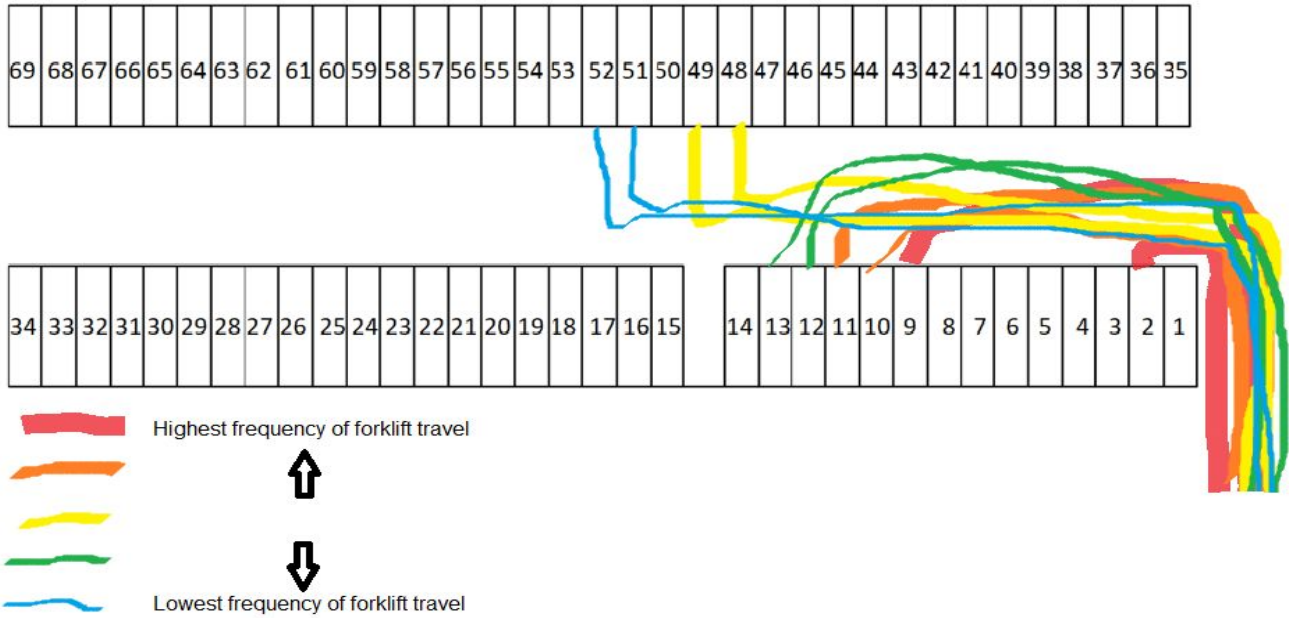


Figure 13: Spaghetti Diagram of Load Size/Category Layout

Figure 14 shows the second product layout. The second product layout was organized based on the load size and product shipping frequency; therefore the picks are now in different locations compared to the previous layout, but the numbers used to label the slots for each pick remain the same (refer to **Appendix F** for this numbered list of products).

There are eight awkward/heavy products that need to be as close as possible to the warehouse. Other than that, all the products are organized by the most frequently shipped to the least frequently shipped. The outside products most frequently visited throughout the year are placed closest to the loading docks to minimize forklift travel time. The products are labeled numerically from 1 to 65 (refer to **Appendix E: Product Layout 2**). The spaghetti diagram shows the frequency of forklift travel to the 10 most frequently shipped products.

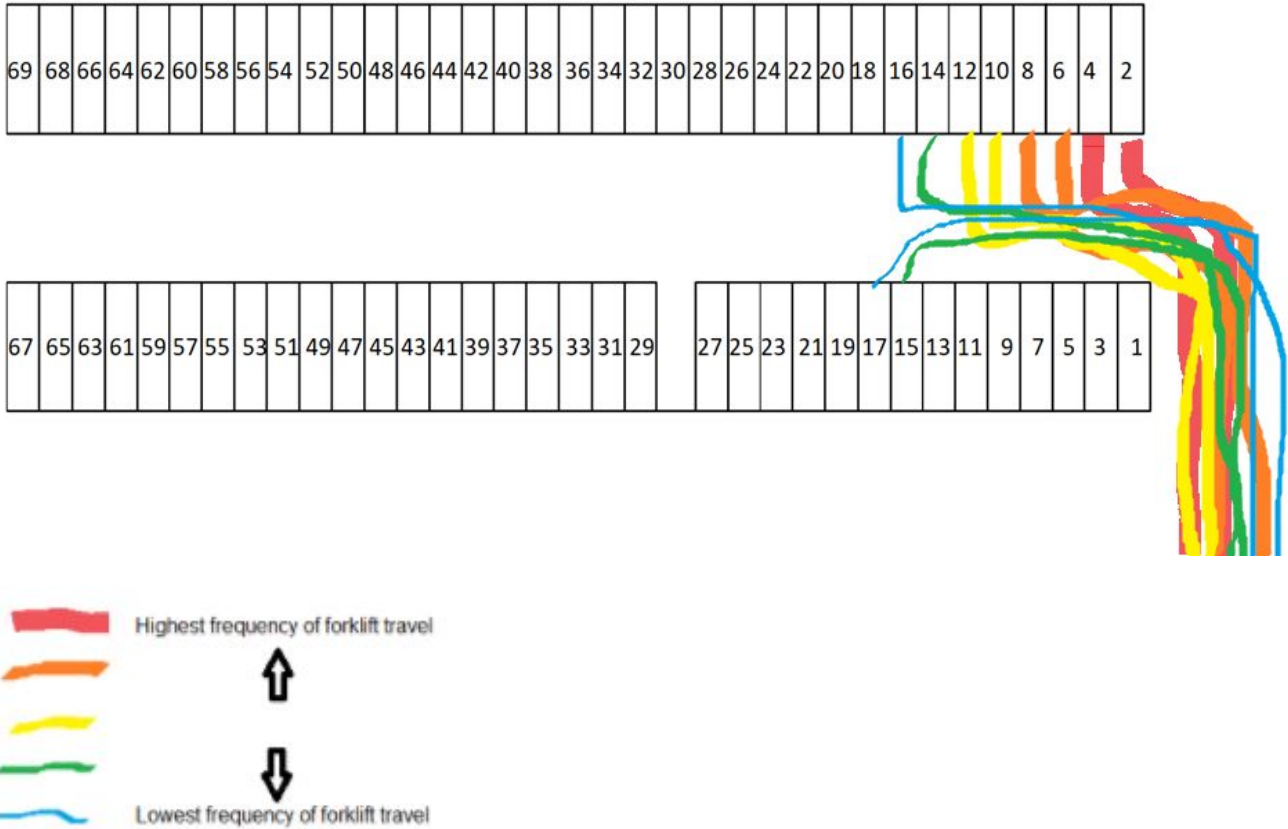


Figure 14: Spaghetti Diagram of Load Size/Frequency Layout

Table 3 below shows the total distance traveled by forklift drivers to pick up the outside products, the average time to pick the outside products, and the cost of labor to pick the outside products.

Table 3: Comparison between Product Layouts (Refer to Appendix F)

Table 4: Product Layout Alternative Benefits

Product Layout	Benefits
Product Layout 1 (Load Size and Category)	<ul style="list-style-type: none"> • Standardized organization with similar products next to each other • Employees can adapt to the product

	layout in shorter amount time
Product Layout 2 (Load Size and Shipping Frequency)	<ul style="list-style-type: none"> • The total forklift distance traveled per year is less than Product Layout 1 • The yearly cost of labor will be less than the Product 1 layout

4.2.2 Labeling Template

The SDT designed a template to provide the forklift driver with the information needed to help them fulfill their pick orders successfully, thereby reducing inaccurate orders. The template uses Gothic font. The product labeling template is shown in Figure 15. The SDT recommend the Gothic font because it is a clear and readable font that can be read from far away (from the seat of a forklift) and it is the same font used on highway signage.

The information that is needed by the forklift driver is:

- Full Name of Product
- Product Color
- Product Number
- Load capacity permitted



Figure 15: Labeling Template

The benefits of having this clear signage for each product includes:

- Increase order accuracy
 - By having the full name of product, forklift drivers will not carry the wrong product. This will help to increase order accuracy.

- Provide a safe environment
 - By having the maximum load that a forklift can carry, drivers will not carry more than the forklift can effectively handle. This will help to reduce accidents, damaged goods, and wasted time.

5.0 FINAL RECOMMENDATIONS

In this final section, the SDT justifies their final recommendations for the Atwoods team to implement an improved exterior layout, including the value added from these improvements.

5.1 FACILITY LAYOUT RECOMMENDATION

The SDT recommended the following “High Level” layout below:

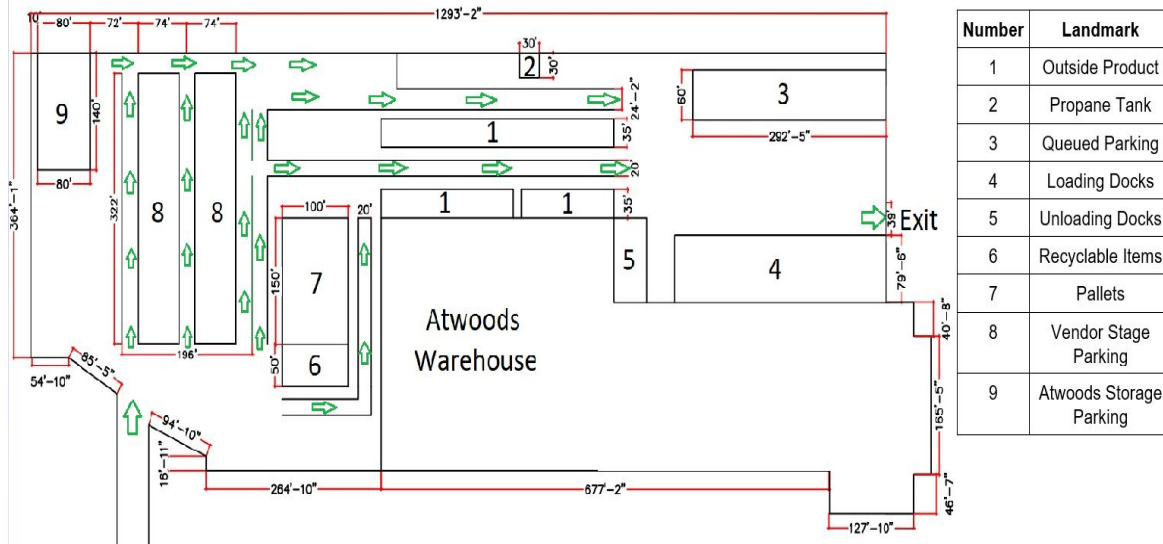


Figure 16: Final Facility Layout Recommendation

For this facility layout to be effective, the Atwoods team needs to invest in some sort of communication tool to communicate with the truck drivers across the facility. Some examples of communication tools that can be used are as follows:

- Intercom (at the entrance) and radio communication with truck drivers
- Clear and readable signage directing trucks to parking lots and docks (electronic billboard that indicates which docks are available and which aren't)
- Employee stationed at entrance to direct trucks to their destination

The SDT also recommends the Atwoods team utilize yield signs and crosswalks for both truck drivers, forklift drivers, and employees on foot (especially for the route to the propane tank for forklift drivers).

5.2 FACILITY LAYOUT VALUE ADDED

The following is the value added from the SDT's design of the new facility layout:

- Standardized path/flow of trucks
- Reduced congestion within facility
 - Designated parking for Atwoods and vendor trucks
 - Decreased truck waiting time outside of the facility by 2.82 minutes
 - Increased space for truck turnaround in front of docks
- Increased space/reduced obstruction for outside picks
 - Relocated recyclables and Pallet World

5.3 OVERNIGHT PARKING RECOMMENDATION

The SDT recommended the following bottleneck parking design below, because it allows the truck drivers more flexibility and maneuverability when entering the facility. Even though this design has 4 less parking spaces, the facility has only ever received up to 8 trucks at a time needing overnight parking (according to Atwoods' Logistics Manager, Randy Trebilcock).

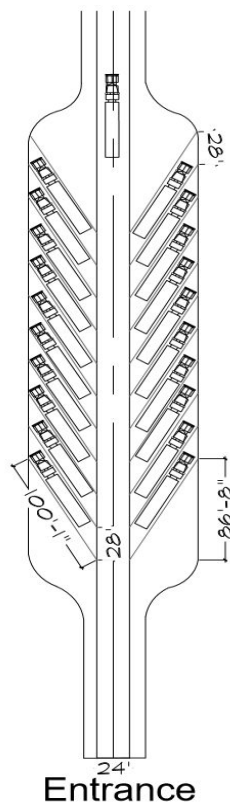


Figure 17: Final Bottleneck Parking Design Recommendation

5.4 PRODUCT ORGANIZATION RECOMMENDATION

The SDT recommended Product Layout 1 (load size and category) with clear, readable signage labeling each of the products. Although the total distance traveled per year is more in this layout than Product Layout 2, this layout has better visualization with similar products placed next to each other (of the same category type). Employees can adapt to the product organization in a shorter amount of time with the first layout option.

5.5 PRODUCT ORGANIZATION VALUE ADDED

- Standardized slot size for all outside products
- Outside products organized in a clear and easy to understand system
- Increased outside storage capacity by 77% for outside products to prepare for future growth

APPENDIX A: PROPOSAL

IEM Senior Design Team (Elite Consulting Group)

Organizational Sponsor:

Name: Brian Atwood
Organization: Atwoods
Distributing LP
E-mail address:
batwood@atwoods.com
Phone number: (580) 2333702

Sponsor/Point of Contact:

Name: David Crosby
Organization: Atwoods
Distributing LP
E-mail address:
dcrosby@atwoods.com
Phone number: (580) 2333702
ext 2112

Name: Randy Treblcock
Organization: Atwoods
Distributing LP
E-mail address:
rtreblcock@atwoods.com
Phone number: (580) 233
3702

Team Members:

Name: Eulojlo Sanchez
E-mail: eulojlo@okstate.edu
Phone: 580-812-0116

Name: Leah Senator
E-mail:
leah.benator@okstate.edu
Phone: 214-564-7271

Name: Yi Slang Chong
E-mail:
yisiang.chong@okstate.edu
Phone: 832-341-3849

Faculty Mentor:

Name: Chaoyue Zhao
E-mail: chaoyue.zhao@okstate.edu
Phone: 405-744-6055

1.0 Background

Atwoods Distribution Center has just finished expanding and now has several acres of space to stage delivery trucks and store outside products. With this new space, Atwoods can improve in many day to day tasks by having a better layout of the facility and better communication tools for their employees. Atwoods would like to see all available opportunities to utilize the space the best way possible.

Based on our visit and our discussions, here are some key observations about the current situation at Atwoods Distribution Center:

- There is congestion at the loading and unloading docks because there is only one gate for all trucks entering and exiting the center. When the docks are full, inbound trucks are forced to wait at the gate (there is no staged parking) while waiting for outbound trucks to depart. These idle, parked trucks create congestion and consume space that could be used for exiting trucks and outside product storage.
- Atwoods has acquired 385,715 square feet of additional exterior space that has potential for better staging of the trucks and separate, designated entrances and exits for trucks. The company also has improvement opportunities in where/how the trucks will be parked and are open to ideas that will create the least amount of wasted space.
- The additional exterior space that won't be used for truck parking can be used to optimize the organization of products outside. The management team stated that forklift drivers currently spend too much time searching for products outside and that would like a method of helping this current problem.
- There is a large accumulation of pallets from deliveries that takes up space adjacent to the products stored outside.
- Sometimes forklift drivers try to carry more than the forklift can effectively handle, which can cause accidents, damaged goods, and wasted time.
- The outside product has no clear, readable labeling for the forklift drivers. There are only small tags attached to each pallet's worth of product. Since most forklift drivers don't dismount the forklift to double check the labeling, there have been instances when drivers make errors that lead to shipping incorrect orders. This causes a slew of wasted efforts and time and reduces customer satisfaction (the customer being the Atwoods stores).

2.0 Project Objectives

Our objectives for this project will be to provide Atwoods with an improved product flow of the outside products, standardized batch sizes for each product on the forklifts, and several different options of layouts for the staged truck parking area. By having more organization of products and better signage to communicate effectively with the DC workers, we aim to reduce non value-added time for a faster, more productive work day.

Our main goals for this project include:

- Utilize the additional new space effectively to:
 - Minimize the congestion/traffic at the loading and unloading docks

- Organize outside products (picks), empty pallets/recyclables ("Pallet World"), and propane tank (for forklifts)
- Standardize the amount of products per forklift
- Add readable signage to reduce incorrect orders

3.0 Anticipated Methodology

Our approach to this project is separated into four different phases, as stated below:

Discover

- Tour the facility
- Observe current processes
- Document current situation
- Ask questions about project objectives

Collect Data

- Perform time studies on forklift drivers and the unloading/loading processes
- Measure distances between products and product destination (wherever the truck is) and vice versa
- Collect details of weight per each outside product
- Measure how much space each outside product utilizes

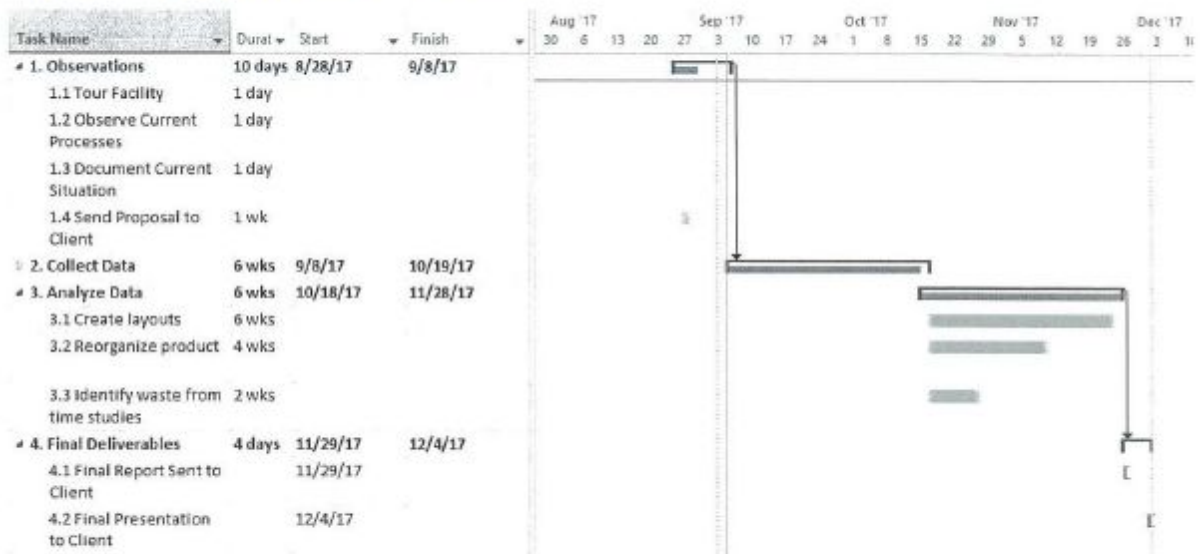
Analyze Data

- Create several layouts that reduce travel time and can maximize truck parking
- Reorganize product by category/distance to destination
- Determine space needed for each outside product/trucks
- Identify waste from time studies of forklift drivers and the unloading/loading processes

Present Deliverables

- Final Report
- Final Presentation

4.0 Anticipated Schedule



5.0 Anticipated Deliverables

We anticipate the following deliverables for the project:

- Weekly Status reports outlining current progress and issues
- Final Report that will include:
 - Several layout plans for potential truck staging
 - Several layout plans for potential product reorganization
 - Recommendations to improve signage visibility for exterior products
 - Standardize forklift batch sizes per outside product
- Final Layout of External Distribution Center
- Final Client Presentation

6.0 Anticipated Benefits

The following list denotes the benefits of our project with Atwoods.

Benefits:

- Minimize the truck congestion and organize the products outside to minimize waiting time within the work (loading and unloading).

- Increase order accuracy and increase customer satisfaction (Atwoods stores) by creating communication tools such as signage to help decrease operator errors.
- Decrease travel time for forklifts and trucks.

7.0 Risks and Risk Mitigation Strategy

Here are the risks and mitigations that we have listed that could affect the outcome of our project.

Risks:	Mitigation Strategy:
<ul style="list-style-type: none"> • Not having the best solution for the new additional exterior space 	<ul style="list-style-type: none"> • Researching and stating facts that can help with finding the best solution
<ul style="list-style-type: none"> • Implementing a solution that might not be followed by associates 	<ul style="list-style-type: none"> • Communicating with associates on how the solutions can help them and the company
<ul style="list-style-type: none"> • Not effectively communicating the mitigation strategy 	<ul style="list-style-type: none"> • Communicating the strategy clearly with Atwoods
<ul style="list-style-type: none"> • Surpassing the budget of the client 	<ul style="list-style-type: none"> • Ensuring we use the most cost effective strategy
<ul style="list-style-type: none"> • Not taking into consideration the environment of the project 	<ul style="list-style-type: none"> • Ensuring we take into consideration what goes on during certain times of the year

Endorsements - Endorsement below acknowledges receipt and acceptance of the proposal of a Senior Design Team from Oklahoma State University's School of Industrial Engineering and Management. Project will be executed on a 'best effort' basis and no warranty is stated or implied. All modifications to this proposal shall be provided, in writing, to all signatories for approval and acceptance.

On Behalf of Client Company (Atwoods)



Brian Atwood

2/11/17
Date

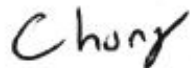
On Behalf of Senior Design Team



Eulojio Sanchez



Leah Benator



Yi Siang Chong

9/11/17

Date of Last Signature

APPENDIX B: RESEARCH QUESTIONS

- Which products are flammable and cannot be touching the DC wall (has to be 50 ft away)?
 - We want to organize the product into groups: have the non-flammable product against the wall of the DC and the flammable product in a group 50 ft away
- Which products are shipped the least/most?
 - We want to organize the groups of product by frequency; the products that are shipped the most will be closer to the trucks and forklifts and the product shipped the least will be farther away
 - Think seasons/weather
- When will electricity be available to the new truck entrance?
 - We want to know when electricity will be available for potential propane tank relocation
- Do you have cameras currently? Where?
 - We want to find out the most effective place to put cameras
- How much/how much weight of each product can a single forklift safely carry without tipping?
 - We want to create operation “run rules” that dictate to the forklift drivers how much they can transport at a time for each product
 - This information will go on the signage that will also tell the forklift drivers which product is in front of the sign
 - This is all to decrease operational errors, increase accuracy with shipping orders, increase safety, decrease damage to goods
- Are there ever any circumstances where outside products are stored/moved inside?
- How many truck parking spots do you want for Atwoods Store trucks?

- How many parking spots do you want for regular staged truck parking? (the vendor trailers)
- Why do you need two separate parking lots for Atwoods trucks and vendor trucks within the facility?
- Do you want to keep parking in front of the docks (maybe pushed back) so trucks can see when their dock is available? Like a small, queued parking lot?
- How do the forklift drivers that deal with the outside picks know what to get each day? Is there a “pick list”? If yes, can you send us a representative pick list for one day’s worth of outside picks? By representative, we are trying to capture a list of most commonly shipped items.
- Where do forklifts go right after they pick up product from outside? Does the product go into the staging lanes right behind the docks? Or does it vary?
- Is there *any* type of organization of outside picks currently?
- Of the 16 scheduled trucks a day, are they all vendor trucks? If yes, then how many Atwoods trucks are there a day? If no, how many of the 16 are Atwoods trucks and how many are vendor trucks?

APPENDIX C: DC 99 PICKS

Item Number	Item Description	Q2 Total Picks	Q1 Total Picks	Q4 Total Picks	Q3 Total Picks	Total Yearly Picks
4939546	WELDED WIRE 48IN X 100FT 14G 2X4	172	195	127	154	648
50690457	FLAGSTONE NATIVE PALLET (GREEN)	58	343	40	99	540
6450023	POST TEE 6FT ORANGE 1.25#/FT.	157	101	147	113	518
6450311	POST TEE 6FT GREEN 1.25#/FT.	126	62	76	80	344
10190010	STALL MAT 4FT X 6FT	95	73	75	99	342
11860051	3 CU FT COMPRESSED PINE SHAVINGS	94	91	66	90	341
760104	BARBED WIRE- 2 PT 12 1/2 CLASS 1	60	121	77	60	318
42340050	KENNEL 10X10X6 GALV CHAIN LINK	84	79	56	88	307
5520598	BUNK CATTLE 10'GALVANIZED POLY	66	42	103	83	294
13380021	WATER BARREL 50 GAL. W/SPIGOT US	111	38	49	57	255
7990090	TANK 110 GAL 34IN Wx51IN Lx20INH	67	35	83	70	255
761608	FENCE 47IN FIELD FENCE 1047-6-12	127	38	36	34	235
760117	BARBED WIRE 4 PT 12 1/2 CLASS 1	49	53	51	43	196
6450001	POST TEE 5 FT GREEN LIGHT DUTY	30	17	53	83	183
13380047	TANK TOTE 275 GALLON FOR LIQUIDS	72	43	29	29	173
7010271	LANDSCAPE RAKE 72 INCH 36 TINES	37	62	25	39	163
7990100	STOCK TANK 300 GAL TUFF STUFF	24	26	68	40	158
5720372	BUNK FEEDER 5' SHEEP/GOAT/CATTLE	45	36	38	32	151
6450036	POST TEE 6 1/2FT ORANGE 1.25#/FT	37	24	41	34	136
7010103	ROTARY MOWER 60 INCH 40 HP GRBOX	54	31	11	34	130
7990074	TANK 40 GAL POLY	28	29	32	39	128
4939559	WELDED WIRE 60IN 100 FT 14 GA2X4	51	28	20	25	124
761682	FENCE 48" SHEEP & GOAT 1348-4-12	44	26	39	15	124
8530201	MINERAL FEEDER - SUPER DUTY	29	22	48	24	123
7010705	TILLER 3 PT 60 INCH GEAR DRIVE	21	52	18	23	114
7000004	40 GAL 3-PT SPRAYERS 5TN	33	73	0	0	106
5720402	LANDSCAPE RAKE 96IN	35	37	17	11	100
760997	WIRE 9 GA 10 LB.GAL.170 FT.	22	27	25	22	96
761700	MAX TIGHT HORSE FENCE 4FTX200FT	31	16	18	30	95
10190015	RUBBER MAT 3 x 4 FT x 1/2 in	15	16	51	0	82
4939588	MAX TIGHT HORSE FENCE 4FTX100FT	39	12	19	10	80
7010190	REAR BLADE 72 INCH (6 FOOT)	26	12	18	17	73
7010718	TILLER 3 PT 72 INCH GEAR DRIVE	13	25	8	18	64
5723863	FEEDER ROUND BALE ECONOMY	1	9	53	0	63

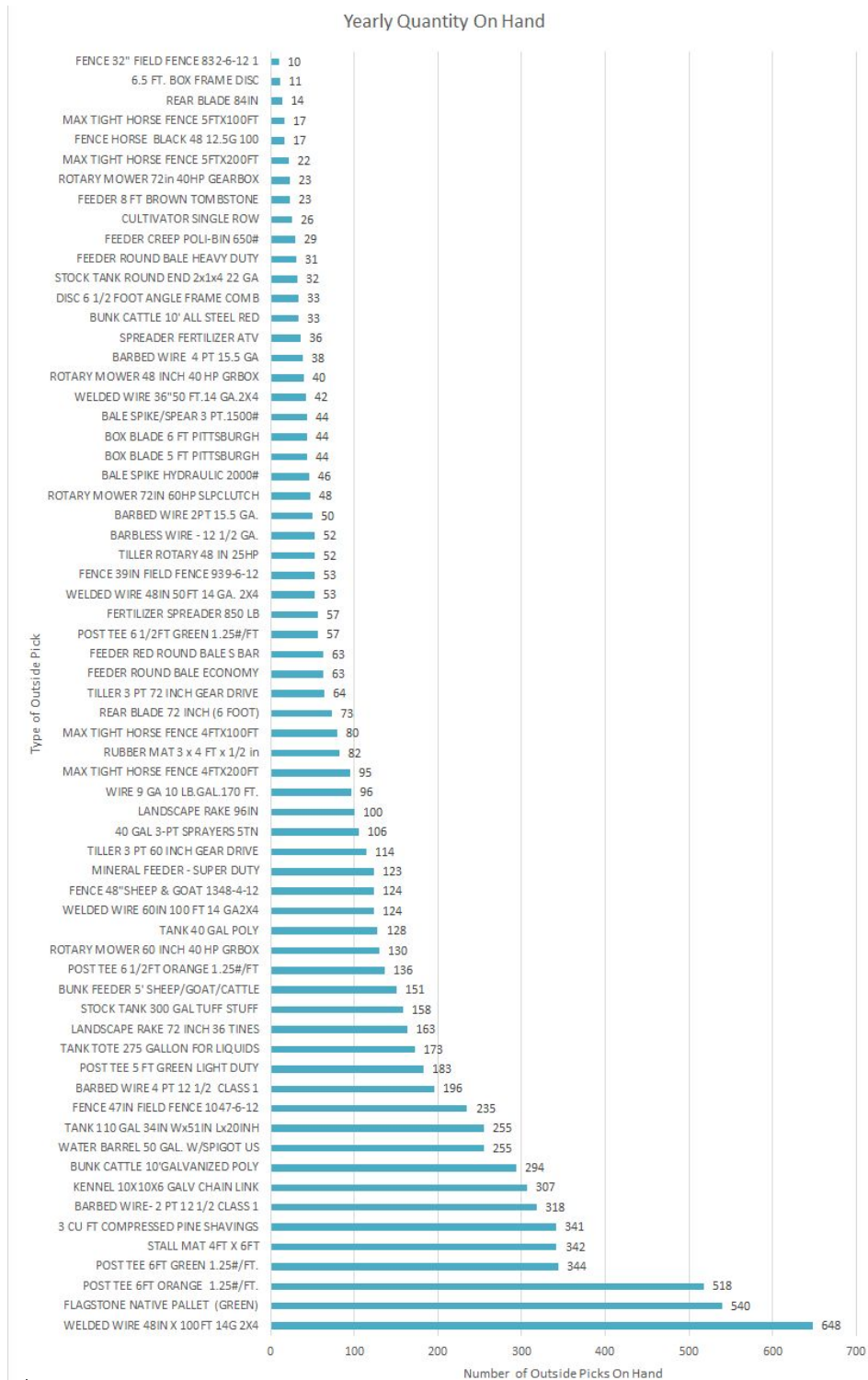
8530199	FEEDER RED ROUND BALE S BAR	2	14	36	11	63
6450324	POST TEE 6 1/2FT GREEN 1.25#/FT	23	19	10	5	57
7010608	FERTILIZER SPREADER 850 LB	9	23	17	8	57
4939041	WELDED WIRE 48IN 50FT 14 GA. 2X4	20	12	4	17	53
761598	FENCE 39IN FIELD FENCE 939-6-12	14	14	13	12	53
7010721	TILLER ROTARY 48 IN 25HP	12	26	4	10	52
760159	BARBLESS WIRE - 12 1/2 GA.	11	18	18	5	52
25830145	BARBED WIRE 2PT 15.5 GA.	10	19	12	9	50
5720495	ROTARY MOWER 72IN 60HP SLPCLUTCH	20	6	5	17	48
13000055	BALE SPIKE HYDRAULIC 2000#	2	8	21	15	46
7010007	BOX BLADE 5 FT PITTSBURGH	14	12	9	9	44
7010008	BOX BLADE 6 FT PITTSBURGH	16	6	10	12	44
8531005	BALE SPIKE/SPEAR 3 PT.1500#	3	8	18	15	44
4939038	WELDED WIRE 36"50 FT.14 GA.2X4	21	2	5	14	42
7010093	ROTARY MOWER 48 INCH 40 HP GRBOX	12	12	3	13	40
4930001	BARBED WIRE 4 PT 15.5 GA	12	12	11	3	38
7010679	SPREADER FERTILIZER ATV	17	5	8	6	36
5830136	BUNK CATTLE 10' ALL STEEL RED	3	9	21	0	33
7010501	DISC 6 1/2 FOOT ANGLE FRAME COMB	6	16	2	9	33
2160278	STOCK TANK ROUND END 2x1x4 22 GA	17	4	4	7	32
5723861	FEEDER ROUND BALE HEAVY DUTY	0	9	20	2	31
5520307	FEEDER CREEP POLI-BIN 650#	11	7	5	6	29
8531000	CULTIVATOR SINGLE ROW	10	6	3	7	26
5723862	FEEDER 8 FT BROWN TOMBSTONE	0	6	17	0	23
7010116	ROTARY MOWER 72in 40HP GEARBOX	5	6	2	10	23
761701	MAX TIGHT HORSE FENCE 5FTX200FT	8	2	7	5	22
25830116	FENCE HORSE BLACK 48 12.5G 100	10	1	1	5	17
4939601	MAX TIGHT HORSE FENCE 5FTX100FT	6	5	3	3	17
5720428	REAR BLADE 84IN	3	1	3	7	14
7010001	6.5 FT. BOX FRAME DISC	4	3	4	0	11
761527	FENCE 32" FIELD FENCE 832-6-12 1	3	2	3	2	10

Dark Green: High Frequently Shipped Products

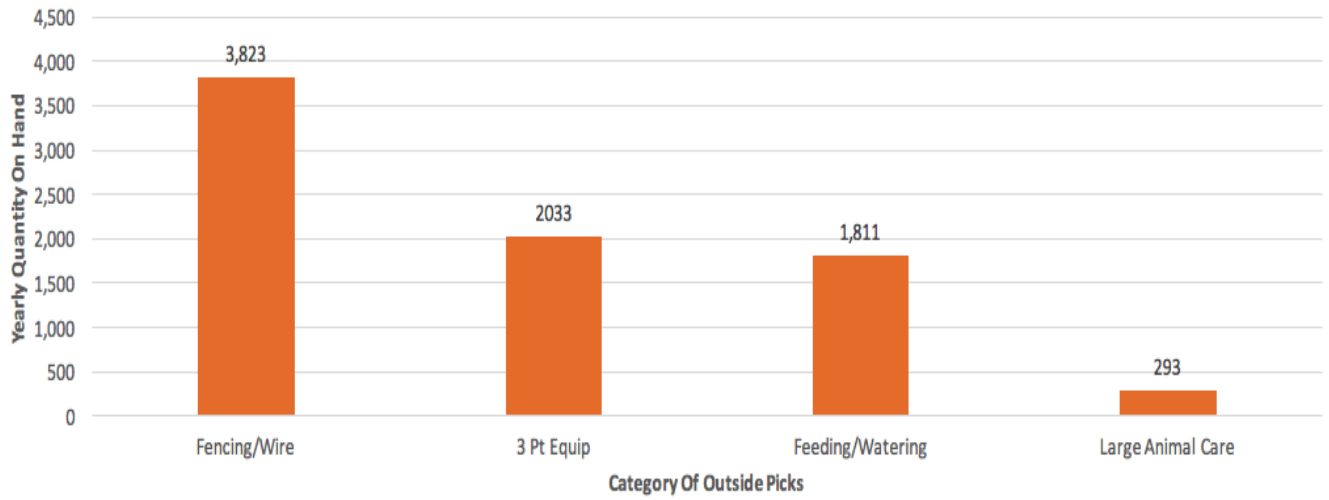
Light Green: Moderate Frequently Shipped Products

Red: Low Frequently Shipped Products

APPENDIX D: DATA VISUALIZATION OF PICKS



Yearly Quantity On Hand Per Category



APPENDIX E: PRODUCT RELAYOUT SEQUENCE

Product Layout 1: Load Size and Category

Slot Number	Item Number	Item Description
1	50690457	FLAGSTONE NATIVE PALLET (GREEN)
2	7010103	ROTARY MOWER 60 INCH 40 HP GRBOX
3	5720495	ROTARY MOWER 72IN 60HP SLPCLUTCH
4	7010093	ROTARY MOWER 48 INCH 40 HP GRBOX
5	7010116	ROTARY MOWER 72in 40HP GEARBOX
6	7010705	TILLER 3 PT 60 INCH GEAR DRIVE
7	7010718	TILLER 3 PT 72 INCH GEAR DRIVE
8	7010721	TILLER ROTARY 48 IN 25HP
9	4939546	WELDED WIRE 48IN X 100FT 14G 2X4
10	6450023	POST TEE 6FT ORANGE 1.25#/FT.
11	6450311	POST TEE 6FT GREEN 1.25#/FT.
12	760104	BARBED WIRE- 2 PT 12 1/2 CLASS 1
13	42340050	KENNEL 10X10X6 GALV CHAIN LINK
14	761608	FENCE 47IN FIELD FENCE 1047-6-12
15	760117	BARBED WIRE 4 PT 12 1/2 CLASS 1
16	6450001	POST TEE 5 FT GREEN LIGHT DUTY
17	6450036	POST TEE 6 1/2FT ORANGE 1.25#/FT
18	4939559	WELDED WIRE 60IN 100 FT 14 GA2X4

19	761682	FENCE 48"SHEEP & GOAT 1348-4-12
20	760997	WIRE 9 GA 10 LB.GAL.170 FT.
21	761700	MAX TIGHT HORSE FENCE 4FTX200FT
22	4939588	MAX TIGHT HORSE FENCE 4FTX100FT
23	6450324	POST TEE 6 1/2FT GREEN 1.25#/FT
24	4939041	WELDED WIRE 48IN 50FT 14 GA. 2X4
25	761598	FENCE 39IN FIELD FENCE 939-6-12
26	760159	BARBLESS WIRE - 12 1/2 GA.
27	25830145	BARBED WIRE 2PT 15.5 GA.
28	4939038	WELDED WIRE 36"50 FT.14 GA.2X4
29	4930001	BARBED WIRE 4 PT 15.5 GA
30	761701	MAX TIGHT HORSE FENCE 5FTX200FT
31	25830116	FENCE HORSE BLACK 48 12.5G 100
32	4939601	MAX TIGHT HORSE FENCE 5FTX100FT
33	761527	FENCE 32" FIELD FENCE 832-6-12 1
34	7010271	LANDSCAPE RAKE 72 INCH 36 TINES
35	7000004	40 GAL 3-PT SPRAYERS 5TN
36	5720402	LANDSCAPE RAKE 96IN
37	7010190	REAR BLADE 72 INCH (6 FOOT)
38	7010608	FERTILIZER SPREADER 850 LB
39	13000055	BALE SPIKE HYDRAULIC 2000#

40	7010007	BOX BLADE 5 FT PITTSBURGH
41	7010008	BOX BLADE 6 FT PITTSBURGH
42	8531005	BALE SPIKE/SPEAR 3 PT.1500#
43	7010679	SPREADER FERTILIZER ATV
44	7010501	DISC 6 1/2 FOOT ANGLE FRAME COMB
45	8531000	CULTIVATOR SINGLE ROW
46	5720428	REAR BLADE 84IN
47	7010001	6.5 FT. BOX FRAME DISC
48	10190010	STALL MAT 4FT X 6FT
49	11860051	3 CU FT COMPRESSED PINE SHAVINGS
50	10190015	RUBBER MAT 3 x 4 FT x 1/2 in
51	5520598	BUNK CATTLE 10' GALVANIZED POLY
52	13380021	WATER BARREL 50 GAL. W/SPIGOT US
53	7990090	TANK 110 GAL 34IN Wx51IN Lx20INH
54	13380047	TANK TOTE 275 GALLON FOR LIQUIDS
55	7990100	STOCK TANK 300 GAL TUFF STUFF
56	5720372	BUNK FEEDER 5' SHEEP/GOAT/CATTLE
57	7990074	TANK 40 GAL POLY
58	8530201	MINERAL FEEDER - SUPER DUTY
59	5723863	FEEDER ROUND BALE ECONOMY
60	8530199	FEEDER RED ROUND BALE S BAR

61	5830136	BUNK CATTLE 10' ALL STEEL RED
62	2160278	STOCK TANK ROUND END 2x1x4 22 GA
63	5723861	FEEDER ROUND BALE HEAVY DUTY
64	5520307	FEEDER CREEP POLI-BIN 650#
65	5723862	FEEDER 8 FT BROWN TOMBSTONE

Product Layout 2: Load Size and Shipping Frequency

Slot Number	Item Number	Item Description
1	7010103	ROTARY MOWER 60 INCH 40 HP GRBOX
2	50690457	FLAGSTONE NATIVE PALLET (GREEN)
3	7010705	TILLER 3 PT 60 INCH GEAR DRIVE
4	4939546	WELDED WIRE 48IN X 100FT 14G 2X4
5	7010718	TILLER 3 PT 72 INCH GEAR DRIVE
6	6450023	POST TEE 6FT ORANGE 1.25#/FT.
7	7010721	TILLER ROTARY 48 IN 25HP
8	6450311	POST TEE 6FT GREEN 1.25#/FT.
9	5720495	ROTARY MOWER 72IN 60HP SLPCLUTCH
10	10190010	STALL MAT 4FT X 6FT
11	7010093	ROTARY MOWER 48 INCH 40 HP GRBOX
12	11860051	3 CU FT COMPRESSED PINE SHAVINGS

13	7010116	ROTARY MOWER 72in 40HP GEARBOX
14	760104	BARBED WIRE- 2 PT 12 1/2 CLASS 1
15	42340050	KENNEL 10X10X6 GALV CHAIN LINK
16	5520598	BUNK CATTLE 10'GALVANIZED POLY
17	13380021	WATER BARREL 50 GAL. W/SPIGOT US
18	7990090	TANK 110 GAL 34IN Wx51IN Lx20INH
19	761608	FENCE 47IN FIELD FENCE 1047-6-12
20	760117	BARBED WIRE 4 PT 12 1/2 CLASS 1
21	6450001	POST TEE 5 FT GREEN LIGHT DUTY
22	13380047	TANK TOTE 275 GALLON FOR LIQUIDS
23	7010271	LANDSCAPE RAKE 72 INCH 36 TINES
24	7990100	STOCK TANK 300 GAL TUFF STUFF
25	5720372	BUNK FEEDER 5' SHEEP/GOAT/CATTLE
26	6450036	POST TEE 6 1/2FT ORANGE 1.25#/FT
27	7990074	TANK 40 GAL POLY
28	4939559	WELDED WIRE 60IN 100 FT 14 GA2X4
29	761682	FENCE 48"SHEEP & GOAT 1348-4-12
30	8530201	MINERAL FEEDER - SUPER DUTY
31	7000004	40 GAL 3-PT SPRAYERS 5TN
32	5720402	LANDSCAPE RAKE 96IN
33	760997	WIRE 9 GA 10 LB.GAL.170 FT.

34	761700	MAX TIGHT HORSE FENCE 4FTX200FT
35	10190015	RUBBER MAT 3 x 4 FT x 1/2 in
36	4939588	MAX TIGHT HORSE FENCE 4FTX100FT
37	7010190	REAR BLADE 72 INCH (6 FOOT)
38	5723863	FEEDER ROUND BALE ECONOMY
39	8530199	FEEDER RED ROUND BALE S BAR
40	6450324	POST TEE 6 1/2FT GREEN 1.25#/FT
41	7010608	FERTILIZER SPREADER 850 LB
42	4939041	WELDED WIRE 48IN 50FT 14 GA. 2X4
43	761598	FENCE 39IN FIELD FENCE 939-6-12
44	760159	BARBLESS WIRE - 12 1/2 GA.
45	25830145	BARBED WIRE 2PT 15.5 GA.
46	13000055	BALE SPIKE HYDRAULIC 2000#
47	7010007	BOX BLADE 5 FT PITTSBURGH
48	7010008	BOX BLADE 6 FT PITTSBURGH
49	8531005	BALE SPIKE/SPEAR 3 PT.1500#
50	4939038	WELDED WIRE 36"50 FT.14 GA.2X4
51	4930001	BARBED WIRE 4 PT 15.5 GA
52	7010679	SPREADER FERTILIZER ATV
53	5830136	BUNK CATTLE 10' ALL STEEL RED
54	7010501	DISC 6 1/2 FOOT ANGLE FRAME COMB

55	2160278	STOCK TANK ROUND END 2x1x4 22 GA
56	5723861	FEEDER ROUND BALE HEAVY DUTY
57	5520307	FEEDER CREEP POLI-BIN 650#
58	8531000	CULTIVATOR SINGLE ROW
59	5723862	FEEDER 8 FT BROWN TOMBSTONE
60	761701	MAX TIGHT HORSE FENCE 5FTX200FT
61	25830116	FENCE HORSE BLACK 48 12.5G 100
62	4939601	MAX TIGHT HORSE FENCE 5FTX100FT
63	5720428	REAR BLADE 84IN
64	7010001	6.5 FT. BOX FRAME DISC
65	761527	FENCE 32" FIELD FENCE 832-6-12 1

APPENDIX F: COMPARISON OF PRODUCT LAYOUTS

Product Layout 1: Load Size and Category

Slot Number	Item Number	Item Description	Total Yearly Picks	Category	Distance (ft)	Frequency* Distance
1	50690457	FLAGSTONE NATIVE PALLET (GREEN)	540	Landscaping	130	70200
2	7010103	ROTARY MOWER 60 INCH 40 HP GRBOX	130	3 Pt Equip	140	18200
3	5720495	ROTARY MOWER 72IN 60HP SLPCLUTCH	48	3 Pt Equip	150	7200
4	7010093	ROTARY MOWER 48 INCH 40 HP GRBOX	40	3 Pt Equip	160	6400
5	7010116	ROTARY MOWER 72in 40HP GEARBOX	23	3 Pt Equip	170	3910
6	7010705	TILLER 3 PT 60 INCH GEAR DRIVE	114	3 Pt Equip	180	20520
7	7010718	TILLER 3 PT 72 INCH GEAR DRIVE	64	3 Pt Equip	190	12160
8	7010721	TILLER ROTARY 48 IN 25HP	52	3 Pt Equip	200	10400
9	4939546	WELDED WIRE 48IN X 100FT 14G 2X4	648	Fencing/Wire	210	136080

10	6450023	POST TEE 6FT ORANGE 1.25#/FT.	518	Fencing/Wire	220	113960
11	6450311	POST TEE 6FT GREEN 1.25#/FT.	344	Fencing/Wire	230	79120
12	760104	BARBED WIRE- 2 PT 12 1/2 CLASS 1	318	Fencing/Wire	240	76320
13	42340050	KENNEL 10X10X6 GALV CHAIN LINK	307	Fencing/Wire	250	76750
14	761608	FENCE 47IN FIELD FENCE 1047-6-12	235	Fencing/Wire	260	61100
15	760117	BARBED WIRE 4 PT 12 1/2 CLASS 1	196	Fencing/Wire	282	55272
16	6450001	POST TEE 5 FT GREEN LIGHT DUTY	183	Fencing/Wire	292	53436
17	6450036	POST TEE 6 1/2FT ORANGE 1.25#/FT	136	Fencing/Wire	302	41072
18	4939559	WELDED WIRE 60IN 100 FT 14 GA2X4	124	Fencing/Wire	312	38688
19	761682	FENCE 48"SHEEP & GOAT 1348-4-12	124	Fencing/Wire	322	39928
20	760997	WIRE 9 GA 10 LB.GAL.170 FT.	96	Fencing/Wire	332	31872
21	761700	MAX TIGHT HORSE FENCE 4FTX200FT	95	Fencing/Wire	342	32490
22	4939588	MAX TIGHT HORSE FENCE 4FTX100FT	80	Fencing/Wire	352	28160

23	6450324	POST TEE 6 1/2FT GREEN 1.25#/FT	57	Fencing/Wire	362	20634
24	4939041	WELDED WIRE 48IN 50FT 14 GA. 2X4	53	Fencing/Wire	372	19716
25	761598	FENCE 39IN FIELD FENCE 939-6-12	53	Fencing/Wire	382	20246
26	760159	BARBLESS WIRE - 12 1/2 GA.	52	Fencing/Wire	392	20384
27	25830145	BARBED WIRE 2PT 15.5 GA.	50	Fencing/Wire	402	20100
28	4939038	WELDED WIRE 36"50 FT.14 GA.2X4	42	Fencing/Wire	412	17304
29	4930001	BARBED WIRE 4 PT 15.5 GA	38	Fencing/Wire	422	16036
30	761701	MAX TIGHT HORSE FENCE 5FTX200FT	22	Fencing/Wire	432	9504
31	25830116	FENCE HORSE BLACK 48 12.5G 100	17	Fencing/Wire	442	7514
32	4939601	MAX TIGHT HORSE FENCE 5FTX100FT	17	Fencing/Wire	452	7684
33	761527	FENCE 32" FIELD FENCE 832-6-12 1	10	Fencing/Wire	462	4620
34	7010271	LANDSCAPE RAKE 72 INCH 36 TINES	163	3 Pt Equip	472	76936
35	7000004	40 GAL 3-PT SPRAYERS 5TN	106	3 Pt Equip	180	19080

36	5720402	LANDSCAPE RAKE 96IN	100	3 Pt Equip	190	19000
37	7010190	REAR BLADE 72 INCH (6 FOOT)	73	3 Pt Equip	200	14600
38	7010608	FERTILIZER SPREADER 850 LB	57	3 Pt Equip	210	11970
39	13000055	BALE SPIKE HYDRAULIC 2000#	46	3 Pt Equip	220	10120
40	7010007	BOX BLADE 5 FT PITTSBURGH	44	3 Pt Equip	230	10120
41	7010008	BOX BLADE 6 FT PITTSBURGH	44	3 Pt Equip	240	10560
42	8531005	BALE SPIKE/SPEAR 3 PT.1500#	44	3 Pt Equip	250	11000
43	7010679	SPREADER FERTILIZER ATV	36	3 Pt Equip	260	9360
44	7010501	DISC 6 1/2 FOOT ANGLE FRAME COMB	33	3 Pt Equip	270	8910
45	8531000	CULTIVATOR SINGLE ROW	26	3 Pt Equip	280	7280
46	5720428	REAR BLADE 84IN	14	3 Pt Equip	290	4060
47	7010001	6.5 FT. BOX FRAME DISC	11	3 Pt Equip	300	3300
48	10190010	STALL MAT 4FT X 6FT	342	Large Animal Care	310	106020
49	11860051	3 CU FT COMPRESSED PINE SHAVINGS	341	Large Animal Care	320	109120

50	10190015	RUBBER MAT 3 x 4 FT x 1/2 in	82	Large Animal Care	330	27060
51	5520598	BUNK CATTLE 10' GALVANIZED POLY	294	Feeding/Wat ering	340	99960
52	13380021	WATER BARREL 50 GAL. W/SPIGOT US	255	Feeding/Wat ering	350	89250
53	7990090	TANK 110 GAL 34IN Wx51IN Lx20INH	255	Feeding/Wat ering	360	91800
54	13380047	TANK TOTE 275 GALLON FOR LIQUIDS	173	Feeding/Wat ering	370	64010
55	7990100	STOCK TANK 300 GAL TUFF STUFF	158	Feeding/Wat ering	380	60040
56	5720372	BUNK FEEDER 5' SHEEP/GOAT/CAT TLE	151	Feeding/Wat ering	390	58890
57	7990074	TANK 40 GAL POLY	128	Feeding/Wat ering	400	51200
58	8530201	MINERAL FEEDER - SUPER DUTY	123	Feeding/Wat ering	410	50430
59	5723863	FEEDER ROUND BALE ECONOMY	63	Feeding/Wat ering	420	26460
60	8530199	FEEDER RED ROUND BALE S BAR	63	Feeding/Wat ering	430	27090
61	5830136	BUNK CATTLE 10' ALL STEEL RED	33	Feeding/Wat ering	440	14520
62	2160278	STOCK TANK ROUND END 2x1x4 22 GA	32	Feeding/Wat ering	450	14400

63	5723861	FEEDER ROUND BALE HEAVY DUTY	31	Feeding/Wat ering	460	14260
64	5520307	FEEDER CREEP POLI-BIN 650#	29	Feeding/Wat ering	470	13630
65	5723862	FEEDER 8 FT BROWN TOMBSTONE	23	Feeding/Wat ering	480	11040
Total Distance Traveled Per Year (ft)						2322456

Product Layout 2: Load Size and Shipping Frequency

Slot Number	Item Number	Item Description	Total Yearly Picks	Category	Distance (ft)	Frequency* Distance
1	7010103	ROTARY MOWER 60 INCH 40 HP GRBOX	130	3 Pt Equip	130	16900
2	50690457	FLAGSTONE NATIVE PALLET (GREEN)	540	Landscaping	180	97200
3	7010705	TILLER 3 PT 60 INCH GEAR DRIVE	114	3 Pt Equip	140	15960
4	4939546	WELDED WIRE 48IN X 100FT 14G 2X4	648	Fencing/Wire	190	123120
5	7010718	TILLER 3 PT 72 INCH GEAR DRIVE	64	3 Pt Equip	150	9600
6	6450023	POST TEE 6FT ORANGE 1.25#/FT.	518	Fencing/Wire	200	103600
7	7010721	TILLER ROTARY 48 IN 25HP	52	3 Pt Equip	160	8320

8	6450311	POST TEE 6FT GREEN 1.25#/FT.	344	Fencing/Wire	210	72240
9	5720495	ROTARY MOWER 72IN 60HP SLPCLUTCH	48	3 Pt Equip	170	8160
10	10190010	STALL MAT 4FT X 6FT	342	Large Animal Care	220	75240
11	7010093	ROTARY MOWER 48 INCH 40 HP GRBOX	40	3 Pt Equip	180	7200
12	11860051	3 CU FT COMPRESSED PINE SHAVINGS	341	Large Animal Care	230	78430
13	7010116	ROTARY MOWER 72in 40HP GEARBOX	23	3 Pt Equip	190	4370
14	760104	BARBED WIRE- 2 PT 12 1/2 CLASS 1	318	Fencing/Wire	240	76320
15	42340050	KENNEL 10X10X6 GALV CHAIN LINK	307	Fencing/Wire	200	61400
16	5520598	BUNK CATTLE 10'GALVANIZED POLY	294	Feeding/Wat ering	250	73500
17	13380021	WATER BARREL 50 GAL. W/SPIGOT US	255	Feeding/Wat ering	210	53550
18	7990090	TANK 110 GAL 34IN Wx51IN Lx20INH	255	Feeding/Wat ering	260	66300
19	761608	FENCE 47IN FIELD FENCE 1047-6-12	235	Fencing/Wire	220	51700
20	760117	BARBED WIRE 4 PT 12 1/2 CLASS 1	196	Fencing/Wire	270	52920
21	6450001	POST TEE 5 FT GREEN LIGHT DUTY	183	Fencing/Wire	230	42090
22	13380047	TANK TOTE 275 GALLON FOR LIQUIDS	173	Feeding/Wat ering	280	48440

23	7010271	LANDSCAPE RAKE 72 INCH 36 TINES	163	3 Pt Equip	240	39120
24	7990100	STOCK TANK 300 GAL TUFF STUFF	158	Feeding/Watering	290	45820
25	5720372	BUNK FEEDER 5' SHEEP/GOAT/CATTLE	151	Feeding/Watering	250	37750
26	6450036	POST TEE 6 1/2FT ORANGE 1.25#/FT	136	Fencing/Wire	300	40800
27	7990074	TANK 40 GAL POLY	128	Feeding/Watering	260	33280
28	4939559	WELDED WIRE 60IN 100 FT 14 GA2X4	124	Fencing/Wire	310	38440
29	761682	FENCE 48"SHEEP & GOAT 1348-4-12	124	Fencing/Wire	282	34968
30	8530201	MINERAL FEEDER - SUPER DUTY	123	Feeding/Watering	320	39360
31	7000004	40 GAL 3-PT SPRAYERS 5TN	106	3 Pt Equip	292	30952
32	5720402	LANDSCAPE RAKE 96IN	100	3 Pt Equip	330	33000
33	760997	WIRE 9 GA 10 LB.GAL.170 FT.	96	Fencing/Wire	302	28992
34	761700	MAX TIGHT HORSE FENCE 4FTX200FT	95	Fencing/Wire	340	32300
35	10190015	RUBBER MAT 3 x 4 FT x 1/2 in	82	Large Animal Care	312	25584
36	4939588	MAX TIGHT HORSE FENCE 4FTX100FT	80	Fencing/Wire	350	28000
37	7010190	REAR BLADE 72 INCH (6 FOOT)	73	3 Pt Equip	322	23506

38	5723863	FEEDER ROUND BALE ECONOMY	63	Feeding/Watering	360	22680
39	8530199	FEEDER RED ROUND BALE S BAR	63	Feeding/Watering	332	20916
40	6450324	POST TEE 6 1/2FT GREEN 1.25#/FT	57	Fencing/Wire	370	21090
41	7010608	FERTILIZER SPREADER 850 LB	57	3 Pt Equip	342	19494
42	4939041	WELDED WIRE 48IN 50FT 14 GA. 2X4	53	Fencing/Wire	380	20140
43	761598	FENCE 39IN FIELD FENCE 939-6-12	53	Fencing/Wire	352	18656
44	760159	BARBLESS WIRE - 12 1/2 GA.	52	Fencing/Wire	390	20280
45	25830145	BARBED WIRE 2PT 15.5 GA.	50	Fencing/Wire	362	18100
46	13000055	BALE SPIKE HYDRAULIC 2000#	46	3 Pt Equip	400	18400
47	7010007	BOX BLADE 5 FT PITTSBURGH	44	3 Pt Equip	372	16368
48	7010008	BOX BLADE 6 FT PITTSBURGH	44	3 Pt Equip	410	18040
49	8531005	BALE SPIKE/SPEAR 3 PT.1500#	44	3 Pt Equip	382	16808
50	4939038	WELDED WIRE 36"50 FT.14 GA.2X4	42	Fencing/Wire	420	17640
51	4930001	BARBED WIRE 4 PT 15.5 GA	38	Fencing/Wire	392	14896
52	7010679	SPREADER FERTILIZER ATV	36	3 Pt Equip	430	15480

53	5830136	BUNK CATTLE 10' ALL STEEL RED	33	Feeding/Watering	402	13266
54	7010501	DISC 6 1/2 FOOT ANGLE FRAME COMB	33	3 Pt Equip	440	14520
55	2160278	STOCK TANK ROUND END 2x1x4 22 GA	32	Feeding/Watering	412	13184
56	5723861	FEEDER ROUND BALE HEAVY DUTY	31	Feeding/Watering	450	13950
57	5520307	FEEDER CREEP POLI-BIN 650#	29	Feeding/Watering	422	12238
58	8531000	CULTIVATOR SINGLE ROW	26	3 Pt Equip	460	11960
59	5723862	FEEDER 8 FT BROWN TOMBSTONE	23	Feeding/Watering	432	9936
60	761701	MAX TIGHT HORSE FENCE 5FTX200FT	22	Fencing/Wire	470	10340
61	25830116	FENCE HORSE BLACK 48 12.5G 100	17	Fencing/Wire	442	7514
62	4939601	MAX TIGHT HORSE FENCE 5FTX100FT	17	Fencing/Wire	480	8160
63	5720428	REAR BLADE 84IN	14	3 Pt Equip	452	6328
64	7010001	6.5 FT. BOX FRAME DISC	11	3 Pt Equip	490	5390
65	761527	FENCE 32" FIELD FENCE 832-6-12 1	10	Fencing/Wire	462	4620
Total Distance Traveled Per Year (ft)						2068826

