

L.L. Bean Distribution

The Monogramming Department



A Case Study

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Title:

L.L. Bean Distribution: The Monogramming Department

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Abstract:

At the L.L. Bean Distribution Center in Freeport, Maine, an increase in competition for outdoor products has led L.L. Bean to increase its product line and increase the amount of monogramming for products. As the popularity of customization has grown, the monogramming department has grown and is pushing the limits of its boundaries. Aside from department growth becoming an issue, monogramming faced another hardship: the building was designed for “no-exceptions processing” and monogramming was an exception. This added a complication as to how the work would flow through the building and from the picking department to the packing department. The rapid growth and growing demand made the monogramming management realize that the department was ready for a process improvement. As this all began, the department received word from upper-level management that a mandatory 12% budget decrease was to be expected for the upcoming fiscal year. The supervisor realized that by eliminating overtime, the department can cut their budget by 12%. Without overtime, the department will need to process 49,000 orders per forty-hour work week. Monogramming currently employs thirty operators (each operator runs two machines) and eight support personnel, responsible for materials handling. The department’s performance is based on total hours to complete weekly work volume.

Given the area maps and process flows, you must determine how many hours it would take to process 49,000 units by the current layout in a forty-hour work week. To meet budget requirements, you must increase productivity and decrease cost per unit. The material flow patterns will be re-engineered to decrease the operator’s travel time. Your assignment is to develop a new layout for the area that improves material flow.

The Company

L.L. Bean began in the basement of Leon Leonwood Bean's home in 1912. Tired of aching feet from the heavy hunting shoes available at the time, Leon sat down and stitched the first "Maine Hunting Shoe." He sold 100 pairs of this new, lightweight boot to fellow outdoorsmen through the mail, only to receive 90 pairs back after the stitching gave way. This was the genesis of the 100% satisfaction guarantee that has made L.L. Bean so famous today. Leon repaired all ninety shoes and returned them to the original owners with the promise that they would last a lifetime and meet all satisfaction requirements that the company had. And thus began L.L. Bean, now a major outdoor clothing supplier.

Today, L.L. Bean survives with a retail store in Freeport, Maine and major sales coming through the seasonal catalogs. The mail-order industry continues to grow providing people the comfort of shopping from their own homes via telephone, mail-order forms, or the world-wide web. L.L. Bean recently opened eight retail stores in Japan and watches happily as these stores become more and more popular. Several factory stores are spread throughout New England with a few others in Oregon, and Delaware. As the L.L. Bean phone representatives place as many as 180,000 orders a day, the customers of L.L. Bean have confidence that they will be treated with value, and honesty; qualities which have made L.L. Bean famous.

The Distribution Center

The heart of all the action at L.L. Bean is the Distribution Center located in Freeport, Maine. While the retail store is a fabulous place to visit and purchase merchandise, the majority of L.L. Bean's sales are through the catalog and the on-line ordering system. Once an order is placed, the representative processing the order uploads it to the main system to let the distribution center know how, where and when the order should be shipped. In 1996, realizing that business was growing too rapidly to expand the current distribution center, L.L. Bean opened the new Order Fulfillment Center, or OFC. The building was designed for "no-exceptions processing" to speed the process of filling orders for the customers. This meant that every order would be processed the same way: pick waves would be formed, the items would be picked from the shelves, sent to the main tray sorter, and down to packing chutes to be packaged appropriately and shipped. L.L. Bean has contracted FedEx to work inside the new OFC to even further speed the process of packing and shipping customer orders.

A Growing Marketplace: Monograms

As with most industries, the competition for the sale of outdoor products increased rapidly in past decades. This increase forced L.L. Bean to expand its product line. The business has grown from a single line of Maine hunting shoes to a wide array of products ranging from dog beds to pajamas, to luggage and travel wear. To further differentiate their services from that of their competitors, L.L. Bean began monogramming book packs and luggage. A monogram consists of a set of letters forming words or initials sewn on an L.L. Bean product. The monogram can be a maximum of ten letters per line, subject to the area in which the monogram is to be sewn. As the popularity of the monogramming customization grew, L.L. Bean responded by expanding the number of products that could be monogrammed. Today, customers can have Christmas stockings, towels, polo shirts, boat and tote bags, director's chairs, and personal organizers monogrammed, as well as many other items.

Monogramming costs \$5.00 per line and the monogramming can be completed at either the distribution center or the retail store, both in Freeport, Maine. Customers can request a monogram when ordering on-line or over the phone. L.L. Bean's Monogramming department started with a few Meistergram single-head sewing machines in the Personalized Services department of the Distribution Center. As the customization popularity grew, the department became too large for the area in which it began. With the creation of the new OFC, the monogramming department was able to purchase new machines and increase its capacity. Within two years, the demand for service caused the monogramming department to grow to a total of sixty machines (with the hope of acquiring more) and pushed the limits of its boundaries once more.

Aside from department growth becoming an issue, Monogramming faced another hardship: the building was designed for "no-exceptions processing" and monogramming was an exception. This added a complication as to how the work would flow through the building and from the picking department to the packing department.

The rapid growth and growing demand made the Monogramming management realize that the department was ready for a process improvement. As this all began, the department received word from upper-level management that a mandatory 12% budget decrease¹ was to be expected for the upcoming fiscal year. The supervisor of the area took action on this and began working with internal consultants to re-engineer the process in the monogramming department.

¹ The numbers in this document have been modified to protect the privacy of L.L. Bean.

Monogramming Process Details

Attached in *Appendix A* you will find the process flow maps for the current monogramming process. It is important to detail how the products arrive to the department. Product arrives in the monogramming department from the Picking department or the high-bay area.

Items arriving from the Picking department consist of the most popular 25% of the products L.L. Bean sells; these items are hand-picked from the low-bay shelves. The pickers place the items they pick from the shelves into shopping carts by assignment. An assignment can be anywhere from 6 units to 56 units depending on how the pick wave has been dispatched.² Once the picker has completed picking three assignments, he or she loads these by boxes onto a “pick truck.” A pick truck is simply a cart approximately six feet long and three feet high. The pick trucks can hold about six assignments and are valuable because they offer vertical space for staging items.

The high bay area holds the other 75% of L.L. Bean’s products as well as storing the cases of product shipped to the OFC from vendors. These items arrive in cases of anywhere from 24-56 units of the same product. During peak seasons, case lots can flood the area. Case lots are different from low-bay picks because they do not come prepped to the area. Therefore, a primary process occurs in the monogramming department to prep these case lot items for sewing. The people responsible for this process are called support personnel and they simply scan the sku (stock keeping unit) on the side of the box to print the tags, open the case, debug the items in it, tag each one using tagging guns, and load by case onto a pick truck to be transferred to the staging area. The tags are the tools for the monogramming operators to do their job; simply by scanning the tag the appropriate monogram will appear on the screen to be sewn. Items picked from low-bay are tagged as they are picked, but not de-bagged at that time.

The monogramming operators receive this work from the staging area, which is to the west of the processing area. During peak times this area can be filled with as many as 61 pick trucks filled with items waiting to be monogrammed. Each pick truck holds an average of six assignments and each assignment has an average of 12 units in it.

It is important that the difference between the three types of monograms be known. The Meistergram monogram sewing machines are made to hold a “hoop.” This hoop is similar to a

² The student should use the average number of units per assignment (twelve) in any calculations of the solution.

quilting hoop which holds the material very tightly between two round, plastic circles. The hoop has two extension arms, which attach to clamps on the machine when the garment is ready to sew. These arms hold the hoop in place as the needle moves up and down through the fabric. Because the hoop is tight, it holds the material very taut, ensuring a better sewn product. The rigidity of the hoops and the importance of getting the material tight and secure around the hoop, has required L.L. Bean to perform this process on a machine called a "Hoop Master." This is simply an arbor press that allows the operator to press a foot pedal to lower the primary hoop onto the secondary hoop without putting pressure on the operator's wrist. The process of finding the center of the fabric, putting the hoop on the Hoop Master and then applying the hoop was very time consuming. Approximately 5% of all orders must be processed on machines using the hooping clamp.

Since most of the products being monogrammed are backpacks, and luggage is made from rigid material anyway, L.L. Bean developed a clamp that would allow the operator to load the product directly onto the machine. These are referred to as "regular clamps." The clamps were developed to save operators' time and increase productivity in the area. Approximately 90% of all orders are processed on machines with regular clamps.

Finally, L.L. Bean developed the "special clamp" design, which is simply a smaller version of the regular clamp. The special clamp is used on tiny monograms, such as the ones on shirt pockets, sleeves, and on the personal organizer. Both the regular and special clamps require the same process to load the machine. The operator must pull the item taut, and press the hydraulic foot pedal to open the clamp. With the product still taut, the operator then positions the item so that it is centered between the two clamps and releases the foot pedal, closing the clamps and holding the item in place. Approximately 5% of all orders are sewn on the special clamps. Certain machines are set up to sew different types of clamping styles. Interchanging the type of clamp on a machine is not impossible, but it is time consuming, so most machines stay set up with one type of clamp for the day.

The operator must at this point decide what type of clamp to use for the product. If the operator is unsure, he/she can consult the specification book to find out. If the item is a regular clamp item, which is what the operator will work at most of the time, then he/she must sew the item at the workstation. When they have finished monogramming all regular clamp products in that assignment, they will gather the special clamp items and bring them to the cluster that is equipped to handle these items. Because it is such a small percentage of the daily work volume, there are generally four machines set up for the hooping and four for the special clamping.

If there are no hoop items, then the operator must simply make sure the garments from the first items are folded and placed in a polybag, then they are free to begin monogramming the next assignment. It is important that assignment integrity is maintained throughout the process. The assignment must stay together for tracking at any time before shipping to the customer. Thus, if a customer complains of a lost order, L.L. Bean will know where it is at any time. Monogramming operators work on only one assignment at a time. They are also required to verify (by sku number) that the assignment is complete and accurate.

Finally, once an entire pick truck has been processed, the operator must bring the truck to the "outgoing" staging area. From this area, a support person will come to take the truck with its assignments to the proper location. For customer orders of just a single item (called "singles") the product is moved to singles pack and ship. For customer orders of two units or more, the items are taken back to the originating shelf where they can be recombined with the other units in the order.

Department Layout Description

The current layout of the monogramming department is presented in an AutoCAD drawing in Appendix A, Figure A-1. There are several basic forms represented on the drawing. All Meistergram machines are labeled by number and in some cases a question mark. The question mark represents a new machine that had not yet been marked with its proper number. Each set of two machines is called a “cluster;” and each cluster is set up in either an L-shape or with machines back to back. These machine set-ups are arbitrary to the type of cluster.

The square boxes shaded with diagonal lines are the prep tables for each of the operator’s machine clusters. A larger, un-shaded rectangle represents an ergonomically safe table; one with adjustable height. Any other rectangular shape on the drawing represents a table with stationary legs. The area of tables on the east side of the drawing represents the preparation area for the case lots which come down from the high bay pick area as described above. Once these cases have been debugged they must then be loaded onto pick trucks and brought to the staging area in front of the control desk on the west side of the monogramming department. The area in front of this group of tables provides room for staging cases on pallets as the support personnel bring the material up from the high bay. Other important features of this area are the printer, where the support person must print the tags to be put on the case lot items. This is essential to the case lot prep area.

The layout is based on the small squares, which represent the support columns of the building. Each of these is thirty feet square from its neighbors.

As mentioned in the process description, certain machines perform certain functions. Machine numbers 19, 25, 26, and 27 perform the hooping function. Machine numbers 13, 14, 15 and 16 perform the special clamping function. These machines can also be converted to regular clamping machines when product volume requiring their function is low. All other machines have regular clamping capabilities. Appendix A details the material flow through the area with flow maps for each material type. The following table clarifies where each function is currently performed and the route the products take while in the monogramming department. (It should be noted that material flow lines are drawn using the clearest flow path, not necessarily the shortest route. These flow paths represent typical operator flow patterns.)

Because assignments are processed by unit, some operators end up making several return trips between their own cluster and hooping machines. This way of processing is shown on

the chart by the rotation back and forth between a regular clamp cell to a special clamp zone (9) and a hoop clamp zone (9). For this reason certain cells are processed certain ways. The percentage column of Table 1 shows the average number per day of orders that are processed in this manner. Management wishes to improve the efficiency of this process in order to increase productivity.

Table 1: Typical Routing Mix for Monogramming Department.

Type of Material Flow	Sequence of Zones to Process	Map of Illustration	Percentage of Total Orders Processed this way
A	1 - 9 - 6 -	1	12%
B	3 - 6 - 3 - 6 - 3 - 6 - 9 -	2	13%
C	10 - 6 - 10 - 6 - 9 -	3	14%
D	4 - 6 - 4 - 6 - 9	4	10%
E	2 -	5	5%
F	4 -	5	6%
G	8 -	5	8%
H	5 - 6 - 9 -	6	12%
I	7 - 9 -	7	13%
J	11 -	7	7%

Approximately 6 assignments/truck/hour, 12 units per assignment, and 2 trucks

Case Requirements

With L.L. Bean's competition increasing, top-level management has requested a twelve percent budget cut in the monogramming area. After agonizing over which operators will need to be laid off, and how much of a hit to productivity will result, the supervisor realizes that by eliminating overtime the department can cut their budget by 12%. Without overtime, the department will need to process 49,000 orders per forty-hour work week. Monogramming currently employs thirty operators (each operator runs two machines) and eight support personnel, responsible for materials handling.

The department's performance is based on total hours to complete weekly work volume. The standard time study rate for traveling with a load through an obstructed path is 280 feet per minute.³

Task 1: From the area maps (*Appendix A*), and the table below detailing processing times for each zone, determine how many hours it would take to process 49,000 units by the current layout in a forty-hour work week.

Table 2: Standard Setup Processing and Prep Times in Monogramming Department

Zone	Type of Zone	Set-up Time At that Zone ⁴	Processing Time at that Zone ⁵	Prep for Shipment ⁶
1	Regular Clamp	0.581	1.085	0.484
2	Regular Clamp	0.581	1.085	0.484
3	Regular Clamp	0.581	1.085	0.484
4	Regular Clamp	0.581	1.085	0.484
5	Regular Clamp	0.581	1.085	0.484
6	Hoop	2.403	1.422	0.605
7	Regular Clamp	0.581	1.085	0.484
8	Regular Clamp	0.581	1.085	0.484
9	Special Clamp	1.474	0.232	0.484
10	Regular Clamp	0.581	1.085	0.484
11	Corporate Sales	0.562	1.104	0.484

Note: All times are in Standard Allowed Minutes.

³ See Appendix B for the derivation and source of this travel standard.

⁴ Set-up tasks include de-bagging the item and organizing the assignment in a logical sewing sequence.

⁵ Process tasks include loading the machine and sewing the customer order.

⁶ Prep for shipment tasks include bagging the item and disposing into a cart to bring to shipping area.

Task 2: The assignment is to meet budget requirements by increasing productivity and thus decreasing cost per unit. This will be done in two ways. Management has employed a team of Industrial Engineers who will be re-evaluating the methods used by the department in order to increase the efficiency of the processing methods. Methods re-design is expected to lead to an 11.15% decrease in productivity. The other way that the productivity will be increased, to save budget, is that the material flow patterns will be re-engineered to decrease the operator's travel time. Your assignment is to develop a new layout for the area that includes improved material flow. Travel time should be decreased by about 70% to meet budget requirements. This new layout should keep in mind:

- 5% of all orders are to be processed using a machine capable of sewing hooped items.
- 5% of all orders are to be processed using a machine capable of sewing special clamp items.
- Material flow will remain as outlined in the area maps.
- Machines Clusters may be thought of as zones or departments. Travel time can be reduced by redesigning the layout of these zones.

References

- Duncan, Malcolm, and Joseph H. Quick. Work-Factor Time Standards. New York: McGraw-Hill Book Company, Inc., 1962.
- Heragu, Sundaresh. Facilities Design. Boston: PWS Publishing Company, 1997.
- Chang, Yih-Long. QSOM: Quantitative Systems for Operations Management: Version 2.0. Englewood Cliffs, NJ: Prentice Hall, 1991.

Appendix A: Area Maps

The first map of this section shows the breakdown of zones within the Monogramming department. These zones can be treated as units to be moved together in forming the final solution through a software package or any other means. Zone 6 houses the special clamp machines and Zone 9 houses the hoop clamp machines.

Maps 1 through 7 detail the path the material will follow depending on the type of assignment or pick truck that the operator is processing. These maps are important because they will be the tools that determine the base standard for the total travel time of the current layout. By measuring the length of the travel path on the map and converting it to feet using the scale given, the student can determine how long an operator spends traveling while processing that type of material flow.

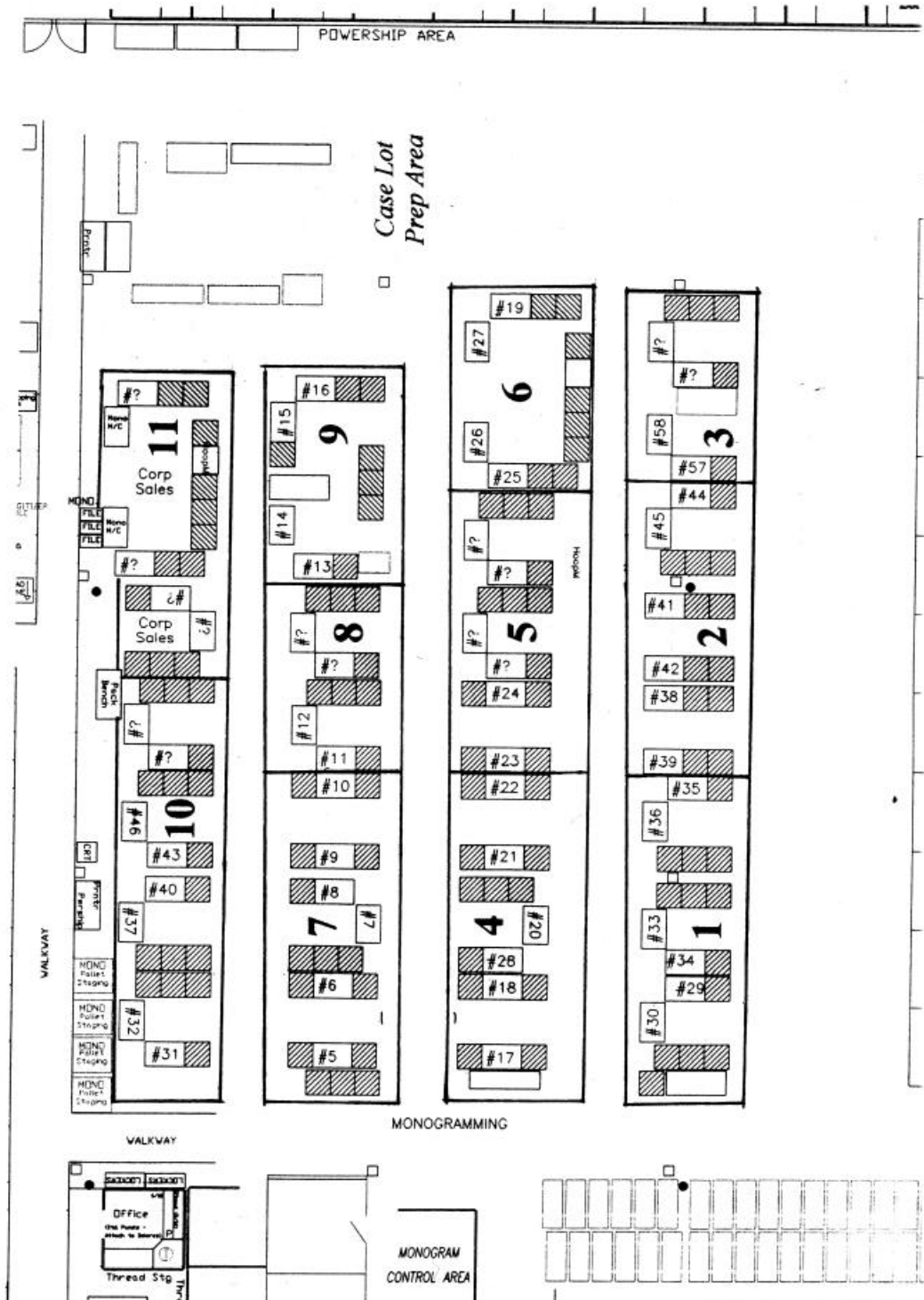
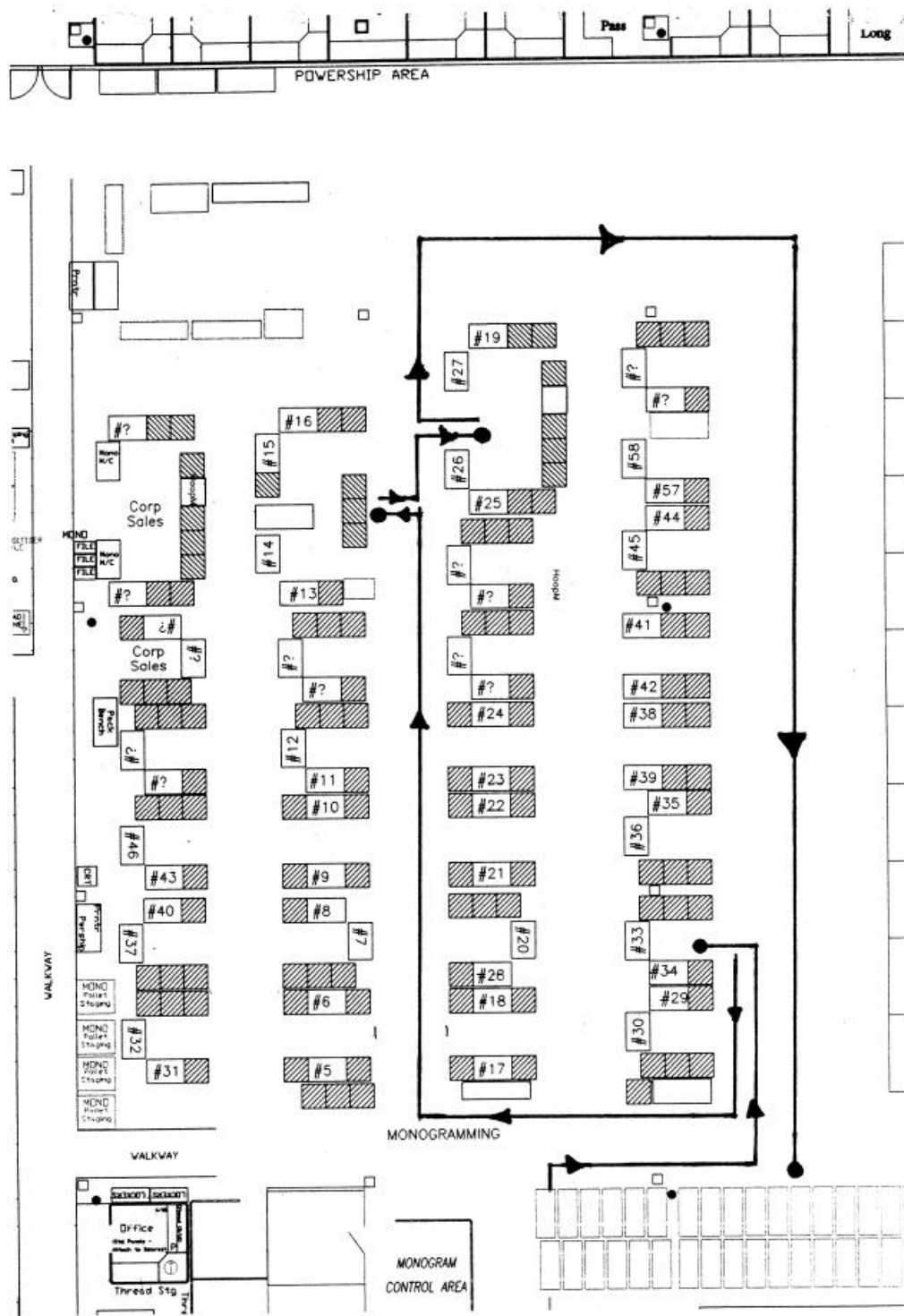


Figure A-1

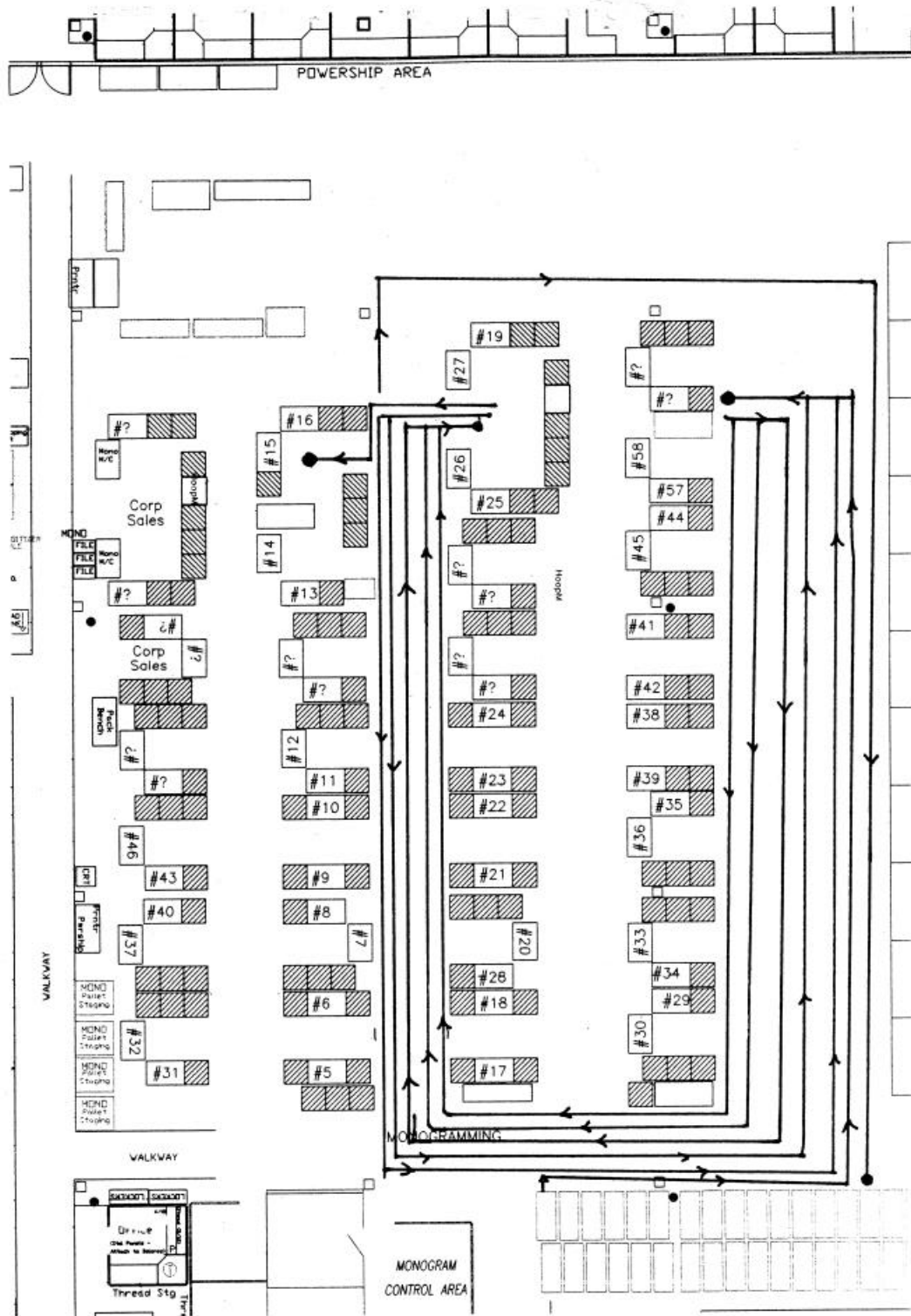
Area Map 1

Area Map 1: Type A Material Flow



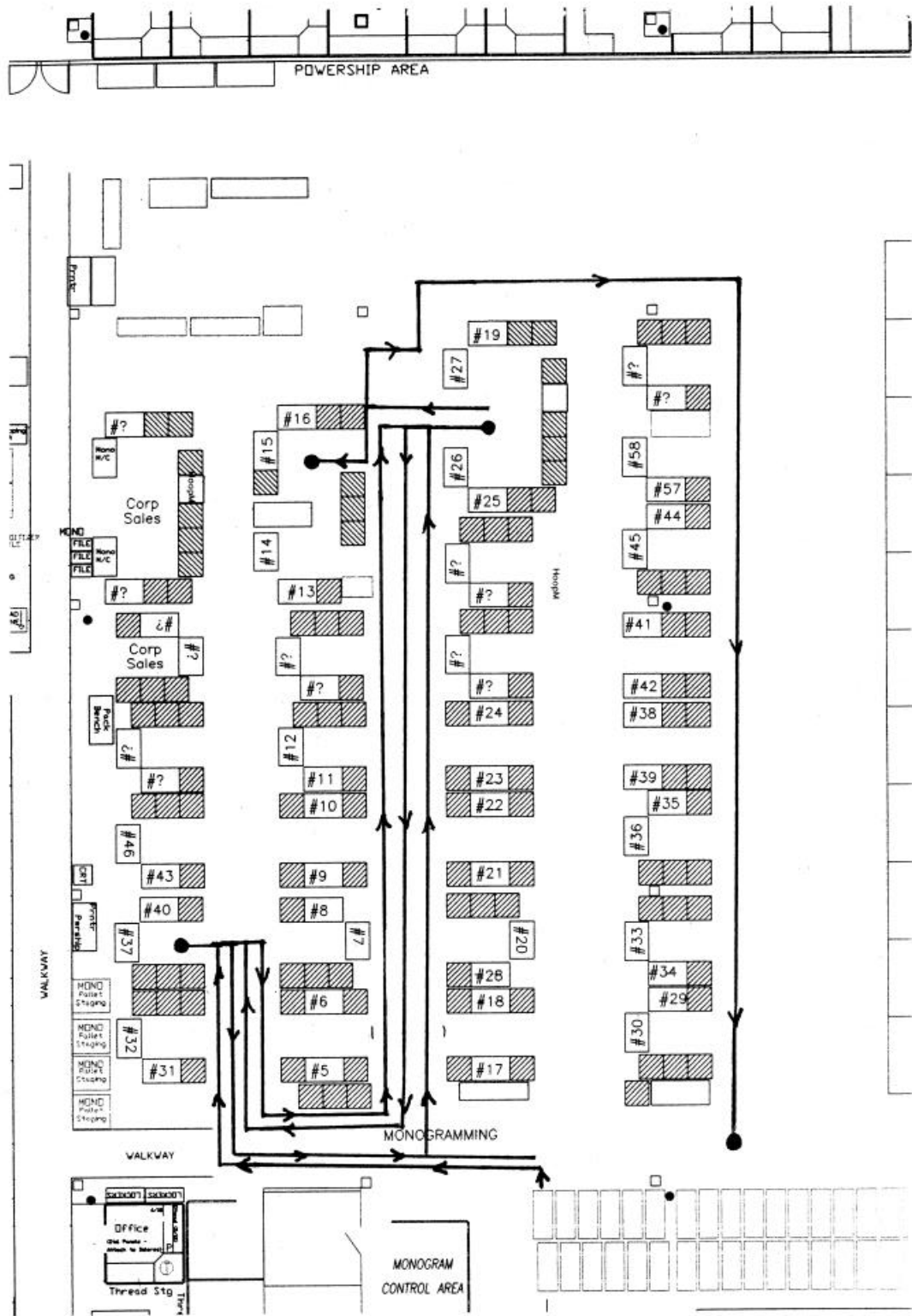
Area Map 2

Area Map 2: Type B Material Flow



Area Map 3

Area Map 3: Type C Material Flow



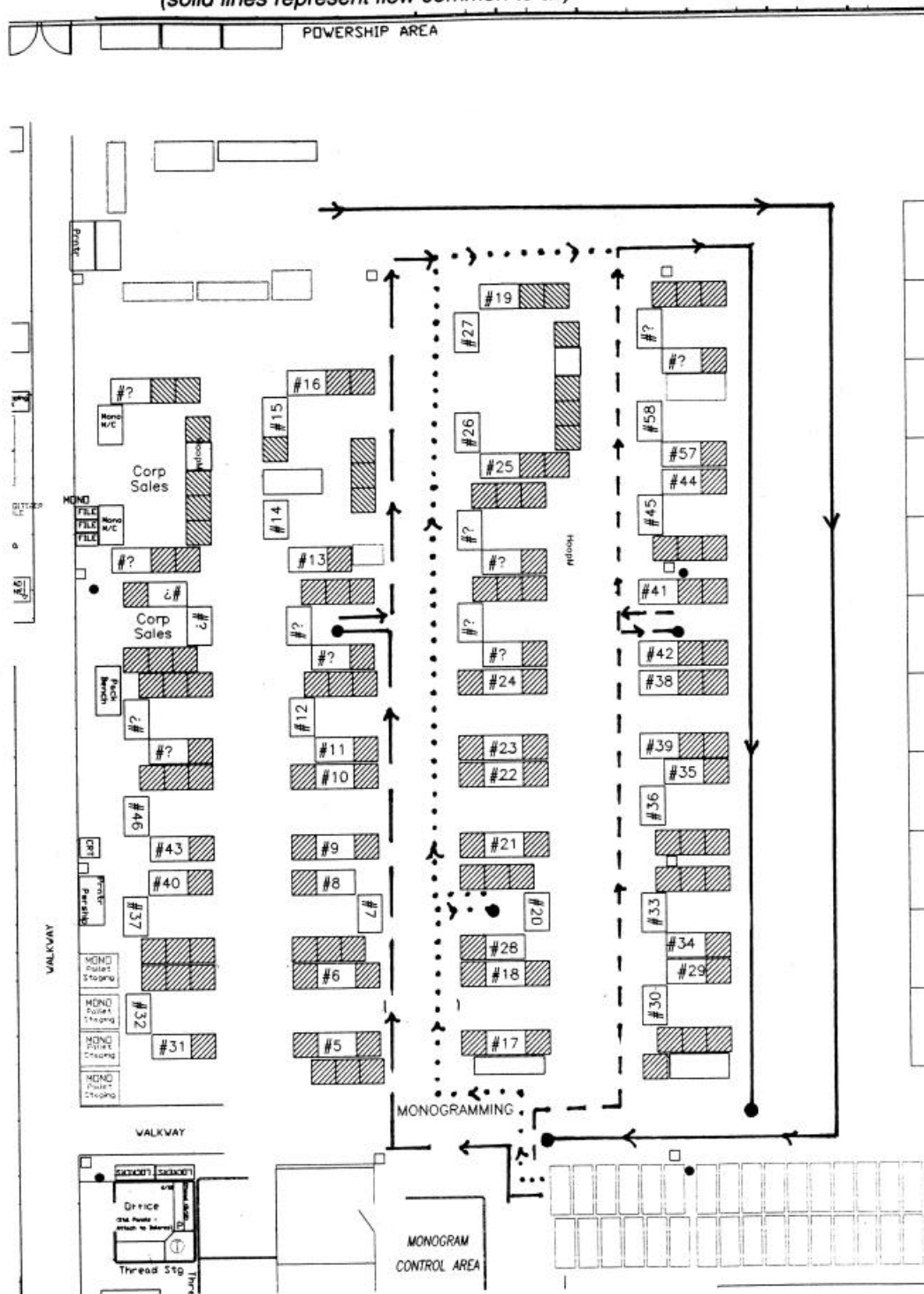
Area Map 4

Area Map 4: Type D Material Flow



Area Map 5

Area Map 5: Type E Material Flow (short dashes)
 Type F Material Flow (dots)
 Type G Material Flow (long dashes)
 (solid lines represent flow common to all)



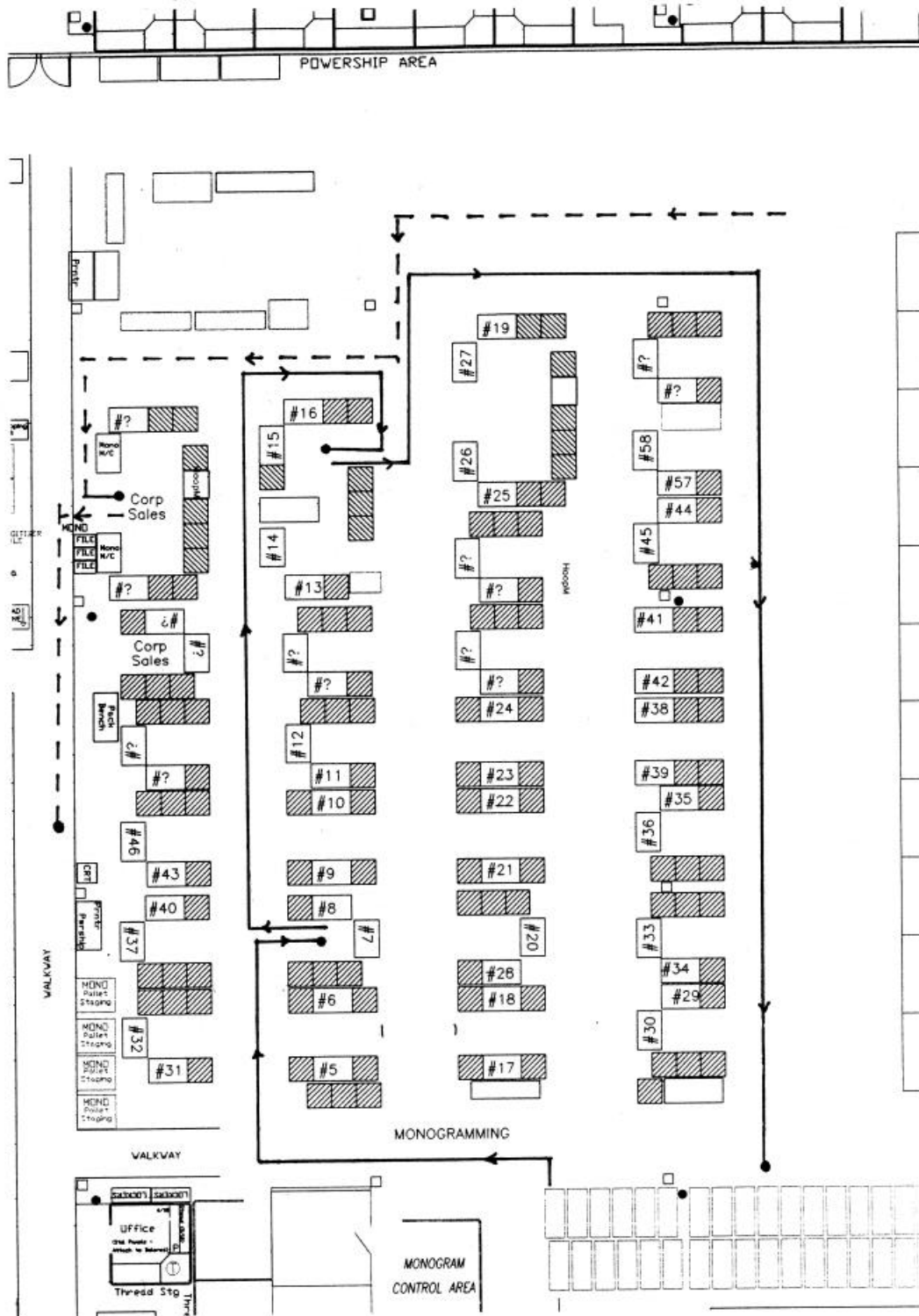
Area Map 6

Area Map 6: Type H Material Flow



Area Map 7

Area Map 7: Type I Material Flow (solid line)
Type J Material Flow (dashed)



Appendix B: Derivation of Travel Standard

Following traditional travel and work method standards, the Travel Standard in this example (280 feet per minute) was derived.

- This derivation was based on a thirty-inch body advancing pace.
- The fact that there were obstacles or walking handicaps classifies the walk as **restricted**.
- When relocation distance is greater than 61 inches the standard is computed as: **120 units + 100 units per pace**.
- The 120 units are a standard which represents starting and stopping time.
- Arbitrarily choose a walk of 37 feet. The calculations for that walk are as follows:
 - 30 inches per pace = 2.5 feet per pace
 - 37 feet/2.5 feet per pace = 14.8 paces = 15 paces
 - 120 units + (100 units * 15 Paces) = 1320 Work-Factor Time Units
 - 1 Work-Factor Time Unit = 0.0001 Minutes
 - 1320 Work-Factor Time Units = 0.132 Minutes
 - 37 feet per 0.132 Minutes = **280 feet per minute**