THE STUDY OF PRODUCTION SYSTEM RE-ALLOCATION IN SAFETY SHOES MANUFACTURING COMPANY

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Abstract

This paper discussed systematic approach for the re-allocation of production line in Safety Shoes Co. Ltd., in Thailand. The production system can be classified in to 2 main production lines base on the shaping processes. The first one is traditional production line and the second one is called STROBEL production line. The main objective of this study is to reduce the traveling distance and time to transport raw materials and Work in Process (WIP) circulating in the factory. After several rounds of data collection, the research team analyze system layout by modifying the Simplified Systematic Layout Planning (SLP) technique to make it more suitable to the scope of the study and timeframe. From the analysis, the new layout design could help reduce the traveling distances for about 36% of that of the traditional method, and about 33.5% of that of the STROBEL method. The results are being proposed to the executives of Safety Shoes Co., Ltd. for their considerations.

Keywords: plant layout**,** production system re-allocation, relationship diagram

Introduction

These days, the manufacturing industry has become more competitive than over the past decade. Every organization has to improve and adjust their operating system in order to survive the global challenges. In manufacturing organizations, to improve their system might mean to reduce the excess costs that come from the wastes in production line. One of the techniques that is wildly used in the manufacturing industry is “Planning Layout Techniques” that can be applied to reduce the cost that may occur when the facility layout is not designed in an effective way. This inefficiency may be the cause of problems such as, longer traveling distance than necessary, not very well planned storage area and losses of Work in Process (WIP) inventories.

The system layout and reallocation is important because after the factory had first planed its layout and launched their operations a while, the unexpected problems, result from many factors such as workers, machines and the environment, may occur. As a result, many manufacturing companies have to reallocate their production layouts to be more suitable and effective.

In Thailand, nowadays, the sales figure of safety equipments has become relatively high when compared to other production industry because safety has become a topic of main concern in every business. Not only to reduce the number of accidents and injuries at their work site, but many manufacturing companies were also forced to comply with the industrial safety standards by their customers. In addition most of the safety equipments are required for the comfortable work and can be used to protect the assets of the company.

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This paper discusses about the problems that occurred in the Safety Shoes Co., Ltd production layout. Further, system reallocation techniques were discussed in order to improve their existing layout to make it more suitable and to increase the efficiency of production lines.

Safety Shoes Co.Ltd.

Safety Shoe Co., Ltd is a leading manufacturing company that produces and distributes safety shoes under the Pangolin Trademark. Currently, they have a production capacity of 500,000 pairs per annum. These safety shoes are produced under four different models, which are Direct PU injection outsole; Direct PVC injection outsole; Direct vulcanized rubber outsole and Cementing outsole.

The above products share most of the production facilities except the shoes shaping and the outsole processes. The shoes shaping process was separated into two different production lines, which are traditional shaping line and STROBEL shaping line. The outsole process was separated in to 4 main lines according to the types of shoes, as aforementioned. Figure 1 shows the production department of Safety Shoes Company that starts from cutting department and ending at the packing department.

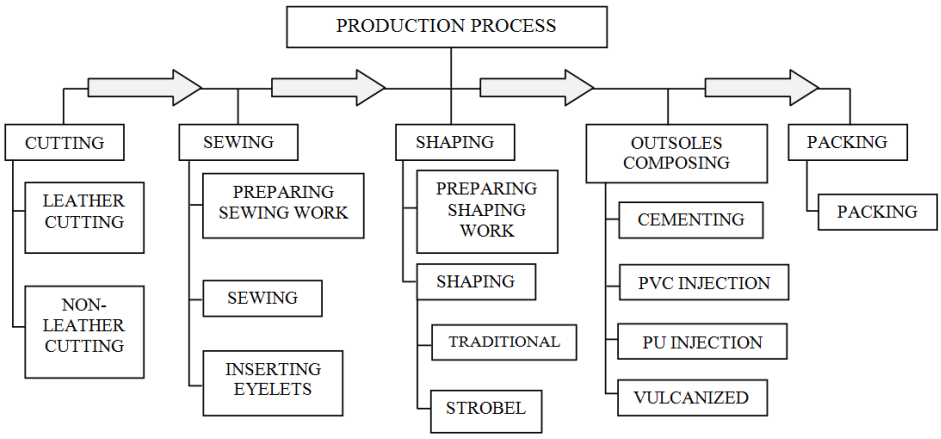


Figure 1: Safety Shoes Co. Ltd. Production process

Methodology

According to Tompkin, et al., the Muther's Simplified Systematic Layout Planning (SLP) is one of the most practical and organized technique in reallocating the layout of manufacturing facility. It involved with 10 steps which are:

1. Flow of materials
2. Activity Relationship
3. Relationship Diagram
4. Space Requirements
5. Space Available
6. Space Relationship Diagram
7. Modifying Considerations
8. Practical Limitations
9. Develop Layout Alternatives

10. Evaluation

In this study, the research team utilized three prominent tools from Muther's SLP techniques. They are as follows:

1. Relationship Chart
2. Flow process chart
3. Flow Process Diagram

Data Collection Process

Primary Data is collected by conducting the interview of factory manager and staff who are responsible for each production process. The information gather are such the daily production rate, production capacity of each department, number of workers in each production stage, the methods applied to transport or handle the materials, work in process and finished goods inventory levels. Further, the related problems occurred in the factory were also recorded.

Secondary Data is the document that the company gave to us such as the production process chart and responsibility in each department, the size of the plant, the detailed of machine that use in the production lines, organization information and product description in each type.

Data Analysis

After the primary and secondary data were collected, they were analyzed to find problems inherited in the former layout of the factory. As shown in Figure 2, the former layout has a complicated material handling that could cause the loss in transfer of Work in Process (WIP). Figure 3 illustrates the flow of materials according to the former layout of the company. Note that the analysis of the paper focuses more on the traveling distances between production stations.

After the data were collected, in the preliminary analysis as shown in Table 1, it was found that the traveling distances of both production methods (traditional and STROBEL) are about the same. Even though the production line of STROBEL appears to be a little smoother than the traditional production line, but with a closer examination, the production flow was not smooth and can be difficult to operate. Therefore, the STROBEL layout should be modified to reduce the waste of time caused by the long traveling distance.

The next step is to utilize the relationship chart and relationship diagram as shown in Figure 5 and Figure 6. The relationship diagram shows the relationship of the overall activities on the production line. It helps in identifying relationship of activities and the importance of each activity. Also, it helps reallocating the most appropriate location for each station.

After the relationship diagram was attained, the highest priority activities that should be put together were the ones from the absolutely necessary relationship, and then the lower priority activities can located farther away.

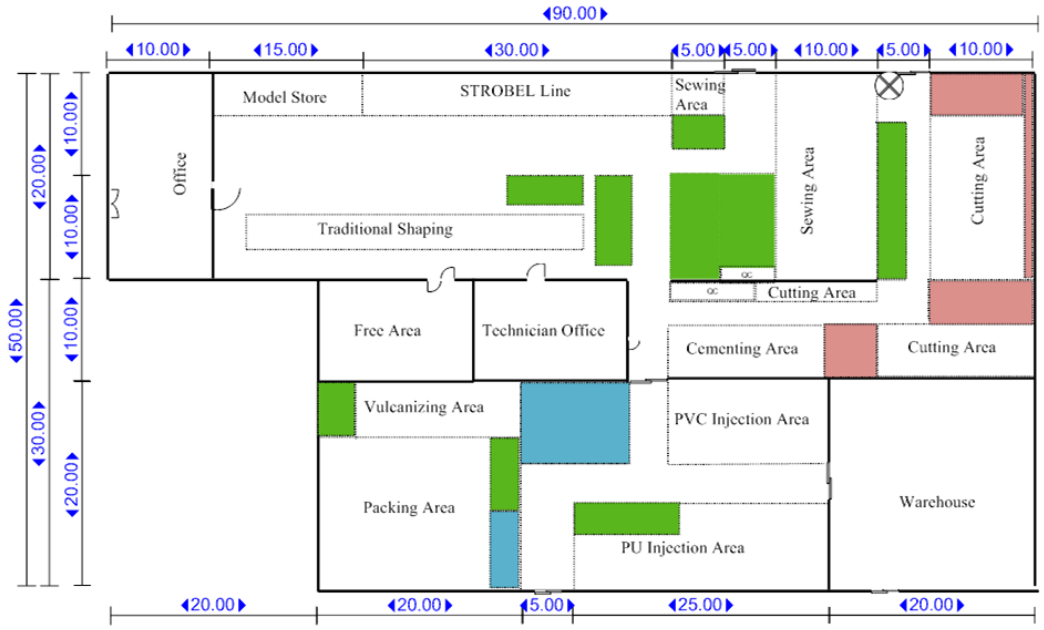


Figure 2: Former Layout of Safety Shoes Factory

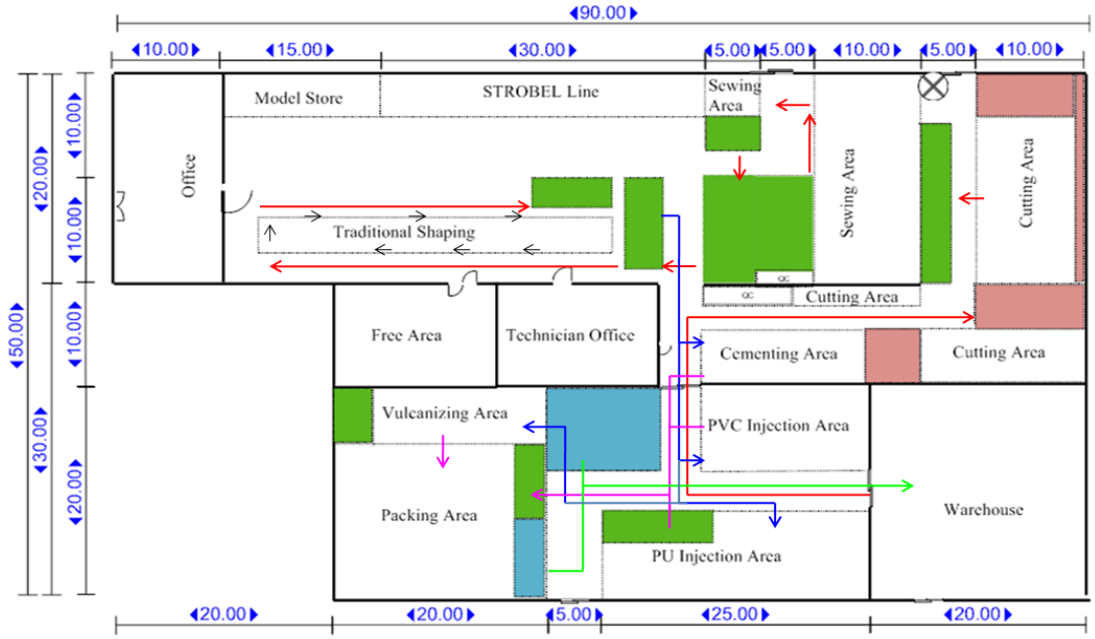
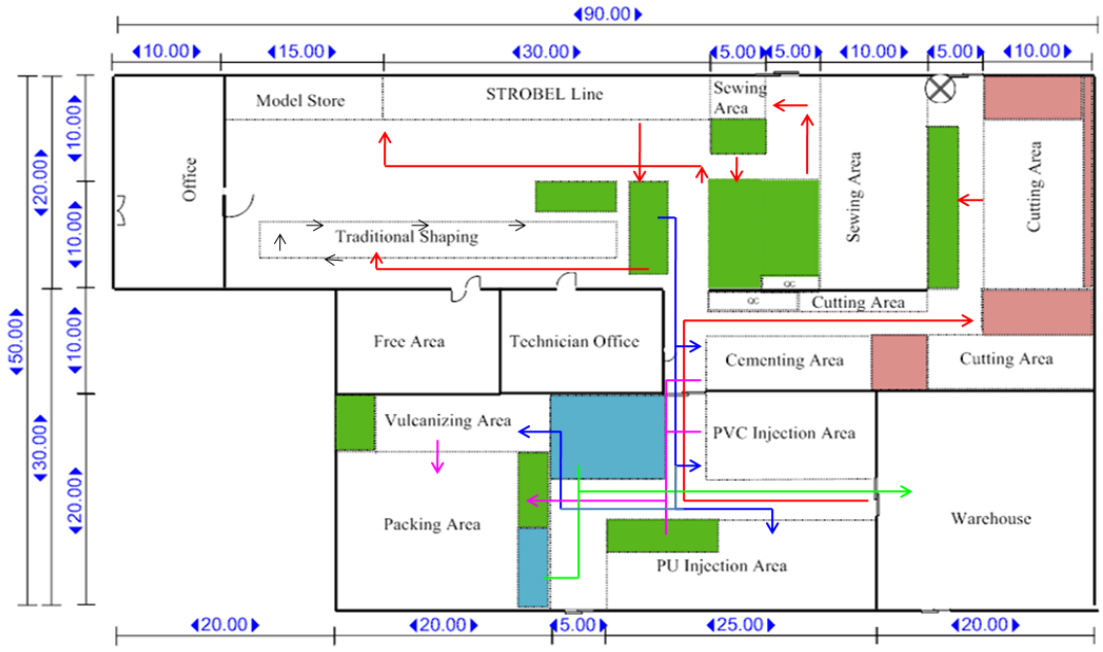


Figure 3: Flow Process Diagram of Former Layout in Safety Shoes Factory (Traditional Shaping method)



LINE	DESCRIPTION
	Raw-materials to Uppers
	Upper to outsole processes
	Shoes to Packing Area
	Finished goods to Store

PRODUCT/ DISTANCE (m.)	TRADITIONNAL METHOD	STROBEL METHOD

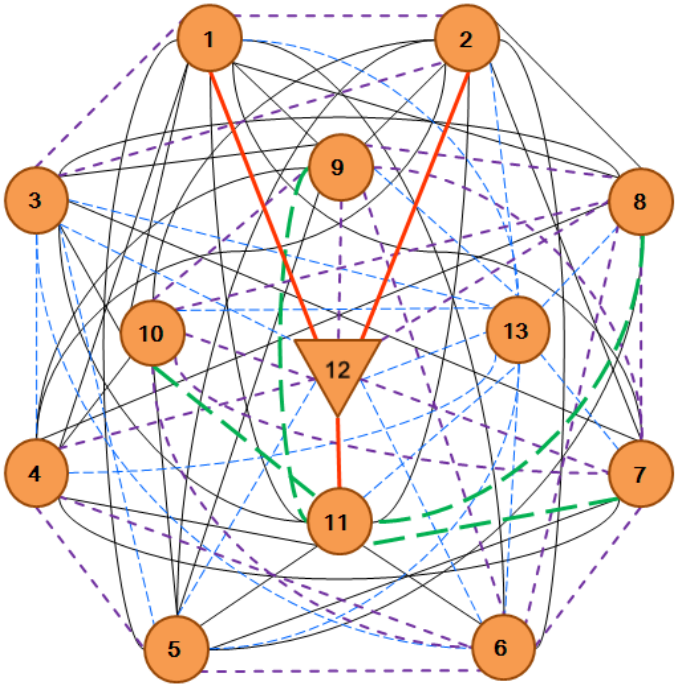
Figure 4: Flow Process Diagram of Former Layout in Safety Shoes Factory (STROBEL Shaping Method)

Table 1: Material Traveling Distance of Traditional and STROBEL Method of the Former Layout

PU Injection	294	289
PVC Injection	282	277
Cementing	281	281
Vulcanized	280	275


1. Leather Cutting
2. Other Material Cutting
3. Sewing
4. Preparing Mat. for UPPER
5. STROBEL Method
6. Traditional Shaping
7. Cementing
8. PVC Injection
9. PU Injection
10. Vulcanizing
11. Packing
12. Store in Warehouse
13. Technician Office

Figure 5: Relationship Chart of the Safety Shoes Production Activities



Line	Type of relationship	No. of line
	Absolutely Necessary	3
	Especially Important	4
	Important	21
	Ordinary Closeness	18
	Unimportant	32
Total		78

Figure 6: Relationship Diagram of the Safety Shoes Production Activities

Production System Re-Allocation

In addition to the constraints from the above relationship diagram, the factory manager and production staff suggested the following constraints to be concerned when re-allocating the production facility:

- The fixed structure and area of the factory are fixed as former layout.
- PVC and PU departments cannot be re-allocated as they are continuous processes. There will be technical problems if the two departments are moved to the new area.
- Warehouse cannot be re-allocated as there is the second floor space inside the warehouse area.
- The technician office and office cannot be moved.
- Each department would require about the same size of working area as before.

After taking all criteria into consideration, the newly allocated production plan are as shown in Figure 9 and Figure 10.

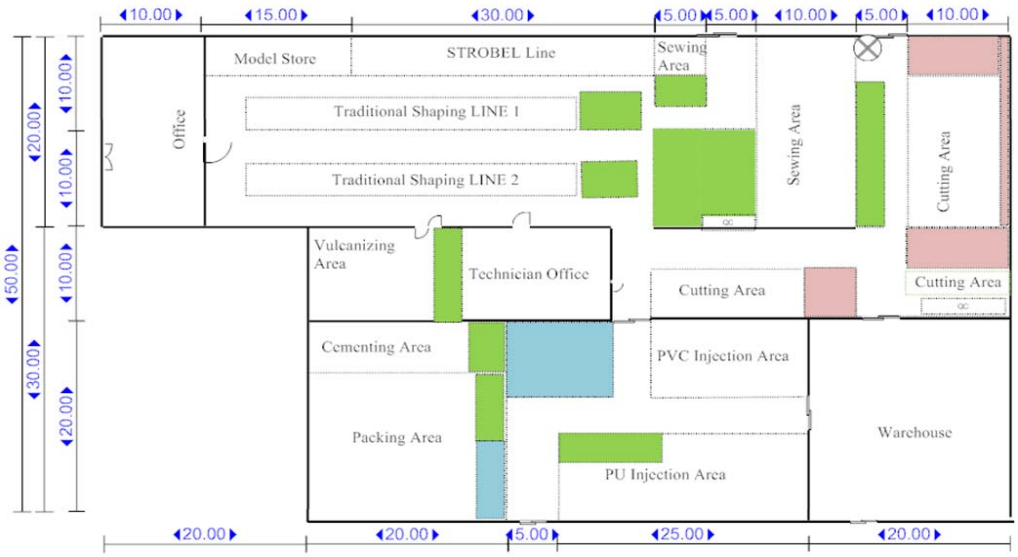


Figure 9: The New Design

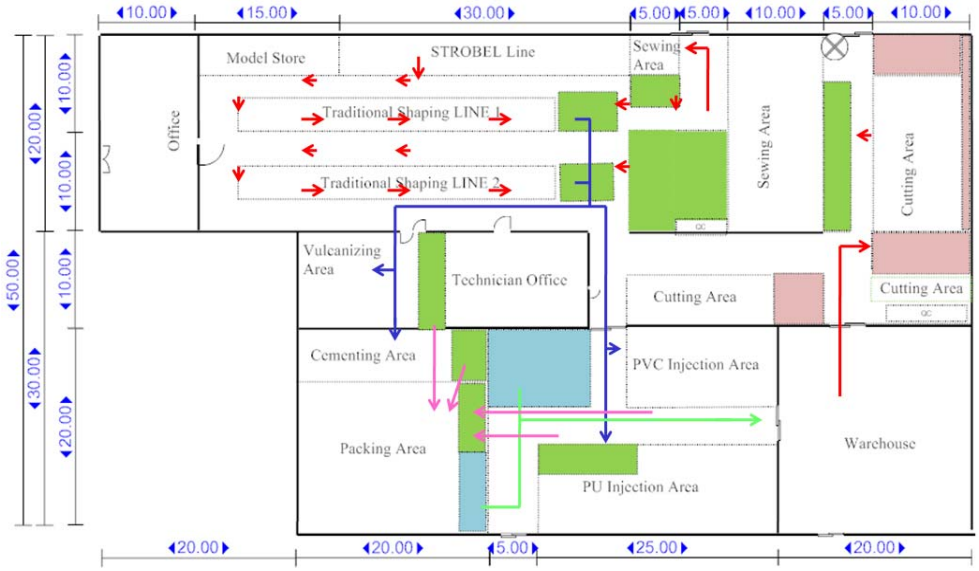


Figure 10: The Flow Process Diagram of the New Design

The Results

As shown on Figure 9, in this re-allocated production facility design, a warehouse was added at another side of the factory in order to allow the easily transfer of raw materials to the cutting area. Moreover, the cementing area was moved closer to the packing area to replace the former vulcanizing area. The cutting area was moved to the left. Then, the other cutting area and raw material quality checking area were moved nearer to the warehouse.

According to the new design, the flow of production was separated in to two paths. Each path has two types of product. The first path has cementing outsole parts and vulcanized outsold parts. The second path has PVC outsole parts and PU outsole parts. The new paths can reduce the confusions among flow processes in the production lines. From the Tables 2 and 3, it is clearly shown that the traveling distances are significantly reduced when compared to the former layouts. By reducing the travelling distances, the company could reduce the transportation costs, labor costs. Moreover, the new design makes the flow of production process become smoother and more convenient to work with.

Table 2: Materials Traveling Distances of the Traditional Method

Product	Former Layout	New Re-layout Planning
PU Injection	294	189
PVC Injection	282	171
Cementing	286	183
Vulcanized	280	169

Table 3: Materials Traveling Distances of the STROBEL Method.

Product	Former Layout	New Re-layout Planning
PU Injection	289	194
PVC Injection	277	176
Cementing	281	188
Vulcanized	275	174

Conclusion

Re-layout planning is one of the methods that can be used to improve the productivity in the production or manufacturing factory with a low cost of investment. The improved production process can help reduce the unnecessary time and costs that may come from waiting time for materials, long travelling distance. It can also help increase efficiency of machines and workers.

The system re-allocation that was modified by using the above technique can help reduce the total flow distance dramatically in all types of products. Moreover, the paths of product flow are separated in to two lines, in each line for two types of products. This separation helps reduce the overlapping of the flow.

The results in study were obtained from the analysis. The new design has not been implemented in real situation due to the short period of time to study and some limitations in the re-location process of the department. To fully utilize the re-layout planning, it is suggested that more studies should be conducted in order to apply the layout that matches all the criteria and limitations.

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