

Warehouse layout and workflow designing at PT. PMS using systematic layout planning method

Tamimi Zakirah¹, Riyan Emeraldi¹, Handi Octavianus M.¹, Daliansyah Danil², Tota Pirdo Kasih²

¹ Industrial Engineering Department, Faculty of Engineering, Bina Nusantara University, Jakarta, Indonesia 11480

² Professional Engineer Program Department, Faculty of Engineering, Bina Nusantara University, Jakarta, Indonesia 11480

Corresponding author: tkasih@binus.edu

Abstract.

PT. PMS, a company which has specialization in offshore and onshore services has many equipments to support their service operation. The equipment has been classified into four divisions, Diving, ROV, Cleaning and Painting. The problems observed in PT. PMS warehouse were their disorganized warehouse system which has no fixed layout design. For the purpose of improvement, a new warehouse layout design was proposed in this study to solve the problem. The method of modified Systematic Layout Planning (SLP) has been used to design an efficient warehouse layout. Step by step layout procedure has been done. It consists of Activity Relationship Chart and Activity Relationship Diagram that have been discussed. It is proved from this study that SLP method provides an effective method in layout designing, even in the service company that has many equipments to be stored in an efficient manner.

Keywords: Systematic Layout Planning, Warehouse Layout, Activity Relationship Chart, Activity Relationship Diagram

1. Introduction

Nowadays, the warehouse activities are becoming the main focus in the manufacturing or service companies, to ensure the effective receiving, storing, handling of goods and material in an efficient manner. One of the most important things in warehouse is the way to utilize the available space. That is why it is important to design an efficient warehouse layout because many goods or equipment will have direct and indirect effect of the efficiency in commodity circulation stream, or affect the receipt time of goods. This will have a significant influence to the service level of enterprise in consequence. Therefore, the way to design warehouse with the system should be strictly carried out according to certain rules [1]. Ideal warehouse layout should provide the convenient of good (equipment) location, loading and unloading equipment, adequate space in for a safety concern, sufficient parking space and



the existence of fire extinguisher. The most utilize method in designing an efficient layout is Systematic Layout Planning (SLP).

SLP firstly introduced by R. Muther in 1961, is a method which organize the sequence of planning procedure consists of identifying material flow, determining relationship between each division, determining how a space must be utilized, considering the practical limitation, until the alternatives involved in a layout project [2]. SLP is generally applied widely both in production systems and service systems [3]. However, most of the practical utilization of SLP has been applied for plant layout as found in references [2], [4-7].

PT. PMS is a company which has specialization in offshore and onshore services. PT. PMS has a lot of equipment to support their service activities. According to both specializations, PT. PMS divides equipment function into four divisions: Diving, Remotely Operated Underwater Vehicle (ROV), Cleaning and Painting Division. PT. PMS stores their equipment in a warehouse located at JatiBening, Bekasi with the size of 40 meter x 25 meter. Based on site observations on current warehouse, there were no fixed layout and sequential workflow system in warehouse operation. As a result, many inefficient activities occurred during loading and unloading movement inside the warehouse.

PT. PMS has a plan to build a new warehouse on an empty land in the area at Cinangka, Depok, 45 km away from the current warehouse. This empty land has size 51.5 meter x 59 meter. Thus, this present study deals on how to design an effective warehouse layout and the sequential workflow by using SLP method for new warehouse in Cinangka, Depok.

2. Research Methodology

Before designing a layout, there are things should be considered such as input, process and output. It is useful to create a structure of the project in order to obtained properly result and without deviated from the purpose. The following is explanation about what are the input, process, and output in this project.

2.1. Input

First thing to be considered when creating an input is identifying and knowing what PT. PMS needs in a warehouse and how the warehouse is supposed to be. In this case, the inputs are relationship closeness between each division, efficient utilization of space, workflow smoothness and the existence of evacuation system and fire extinguisher. Besides that, PT. PMS need a warehouse with a space for workshop to test the equipment and service area to maintain the equipment.

2.2. Process

Second, a thing to determine when creating a process is how to design a layout using correct method. Systematic layout planning has been chosen for the method, because it consists of step-by-step planning procedure which involved the Activity Relationship Chart (ARC), Activity Relationship Diagram (ARD), additional system which involved of 5S method (sort, straighten, shine, standardize, and sustain) and standard operating procedure (SOP), and Facility Design Layout.

2.3. Output

Finally, the output from the process is the new warehouse layout with sequential workflow procedure.

2.4. Systematic Layout Planning

Systematic Layout Planning (SLP) is the most suitable method to design warehouse layout along with workflow. SLP is used as reference to make the sequence of how this research was completed. Figure 1 represents SLP procedure in this work that has been modified from the reference [5].

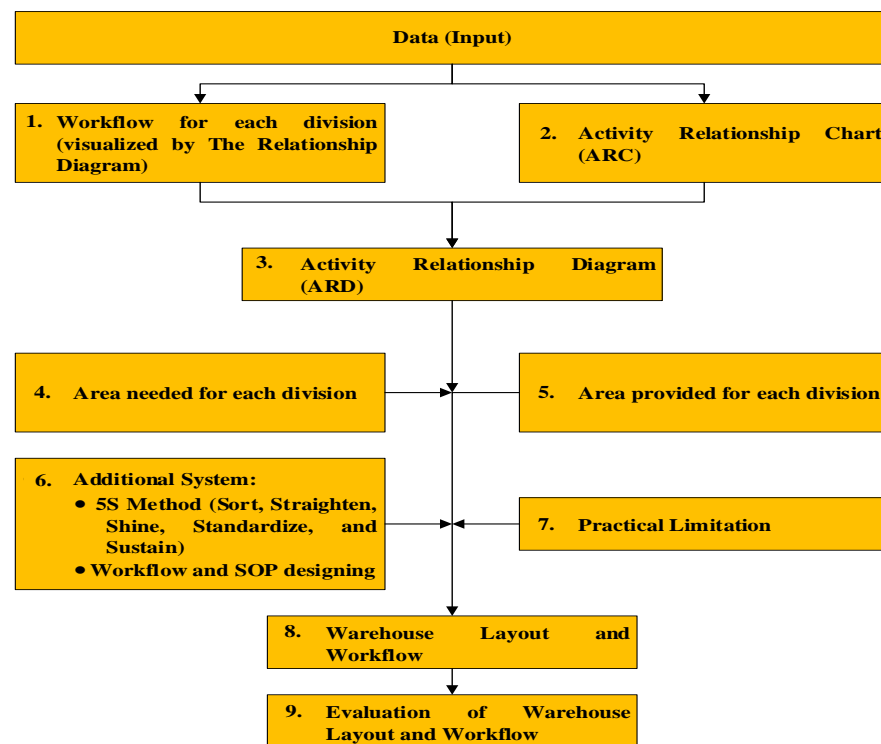


Figure 1. Modified SLP procedure used in designing new warehouse layout

3. Result and Discussion

In JatiBening Warehouse, there are no fixed warehouse layout and fixed workflow. Inside this warehouse, there is a partial roofed warehouse, which usually used to store equipment from ROV and diving division. Part of roofed warehouse has 20 m in length and 12 m width, a quarter part of total warehouse area. In current condition, operators only use the free space to store all equipment and have no sequential workflow. Thus, it makes JatiBening warehouse become disorganized and takes 6 hours to store all equipment (based on forklift renting time). The current warehouse (JatiBening warehouse) layout can be seen at Figure 2.

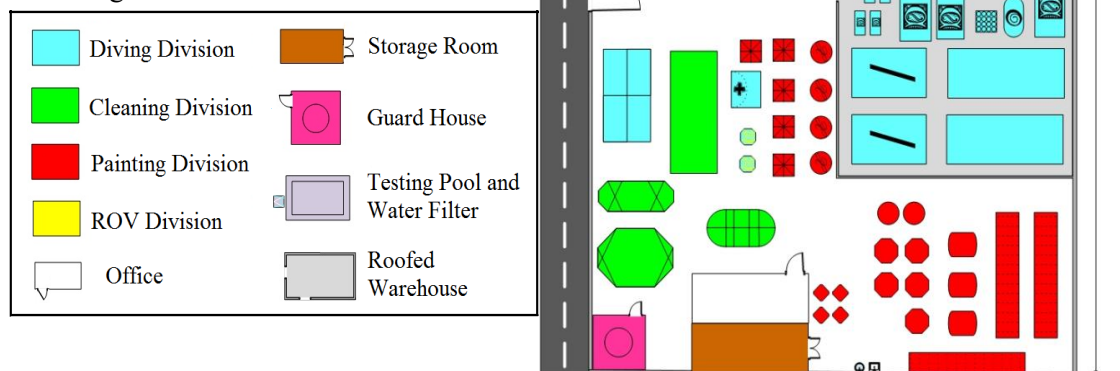


Figure 2. Current layout in JatiBening Warehouse

Data have been considered from what PT. PMS needs inside a warehouse. PT. PMS needs a warehouse which has equipment grouping per division, efficient utilization of space, workflow fluency, evacuation system and fire extinguisher, workshop, and service area. Moreover, a warehouse should be comfortable for visitor. So it should have toilet, parking area, and smoking area. In the future PT. PMS might buy new equipment so there should be an empty space to store it.

Knowing the current problem, where PT. PMS doesn't have sequential workflow that causes the time needed to store all equipment to 6 hours, the workflow is made as follows. Workflow is a flow of equipment movement. There are loading flow and unloading flow. Unloading workflow is the movement which represents equipment entered the warehouse. Loading workflow is the movement which represents equipment out from warehouse. In this case, an area named "Pool" has been proposed to make the inspection process of equipment before transferred to the trailer become easier. The diagram of the proposed loading workflow can be seen in Fig. 3.

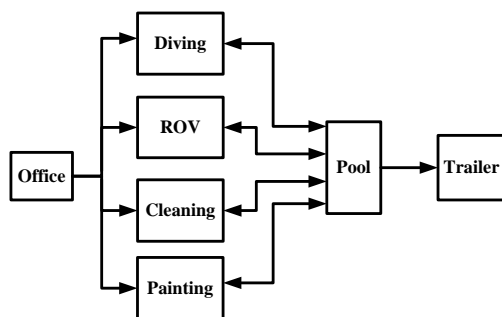


Figure 3. Loading Workflow diagram

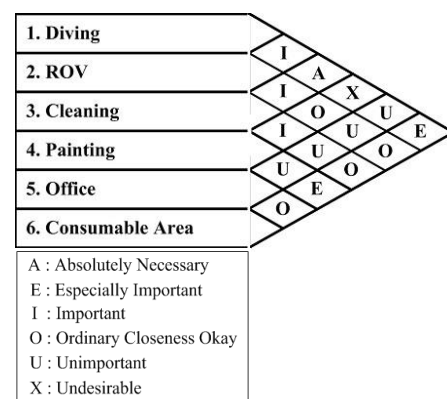


Figure 4. Activity Relationship Chart

From Activity Relationship Chart can be known, aside from four main grouped divisions, there are another two divisions: Office and Consumable Area that has been proposed. Office worth to organize documents related to the warehouse activity. Consumable Area used to store partial equipment from Diving and Painting Division. After determining all division, Activity Relationship Chart (ARC) was made to consider the closeness relationship value between each division. Figure 4 describes the ARC for each division.

After ARC was made, Activity Relationship Diagram (ARD) can be made to visualize ARC. ARD also represent all relations between each division. Figure 5 represents the graph of ARD.

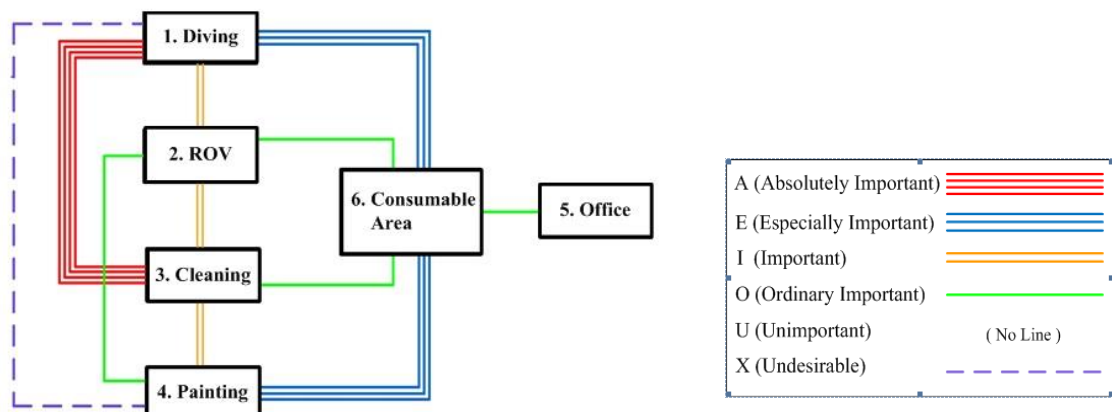


Figure 5. Activity Relationship Diagram

From the result of ARC and ARD, the space requirements for each division will be calculate. Each division needs area to store the equipment. In order to create these areas, calculation is needed for each division. It was done by multiplying the dimension of equipment with equipment's quantity. Table 1 shows the result of area needed for each division.

The area provided for each division can be calculated after calculating the area needed for each division. Calculation was done by giving the space between equipment. The space between equipment given a allowance of 60cm follows the principle of room design for the circulation zone which has a size of 61 cm, this allowance is given so that the operator can pass the alley safely [8]. The space between the divisions and the rooms are given a allowance of 1m, the allowance is adjusted to the dimensions of the forklift that has a length 5m and width 2,5m. Table 2 shows area provided for each division which is based on adjusting the amount of equipment with a number of allowances so that humans and forklift can pass the road between the alleys.

Table 1. Space of area needed

Division	Area Needed
ROV	78 m ²
Diving	134 m ²
Cleaning	43 m ²
Painting	84 m ²
Office	12 m ²
Consumable Area	Not available

Table 2. Space provided for each division

Division	Area Provided
ROV	208 m ²
Diving	351 m ²
Cleaning	105 m ²
Painting	234 m ²
Office	20 m ²
ConsumableArea	24 m ²

Moreover, additional Systems was determined to symbolize each area and to create the smoothness of the workflow so an additional system is proposed using the 5S Method and creating Standard Operating Procedure (SOP). The 5S Method applied when additional stickers for each equipment and creation of the division's symbol by painting the surface of warehouse area were proposed in this study. Figure 6 shows the example of the proposed sticker for division ROV and Figure 7 shows the symbolization used in cleaning division.

DIVISI ROV
ROV SUPER MOHAWK II
0.9 m x 1.4 m
290 kg

Figure 6. Example sticker for ROV division

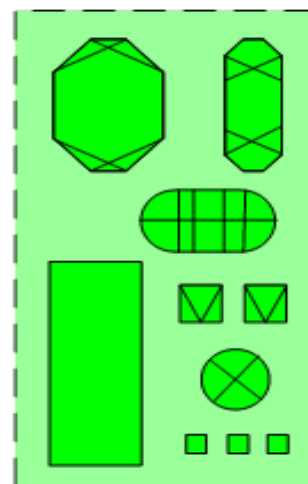


Figure7. Symbolization for cleaning division area

Another system that has been added was the creation of Standard Operating Procedure (SOP) for loading workflow.

The practical limitation to design layout is as follow: extra space was made for new equipment because some equipment from old warehouse will be stored in the new one.

After determined all of sequence above, new warehouse layout was made. From 3000 m² space, only 2588 m² space would be used for new warehouse building. On the warehouse layout, there are tracks for forklifts in order to make the movement easier. Each track has width started from 3.5 m to 4 m. Pool, consumable area, service area, workshop, smoking area, extra space, loading area, parking slots, toilet, janitor room, evacuation route, and fire extinguisher were proposed in new warehouse layout. Figure 8 shows warehouse layout for empty land in Cinangka.



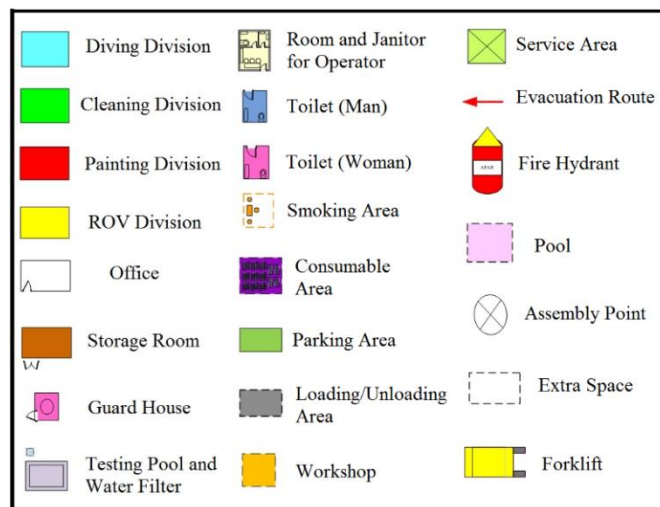


Figure 8. Proposed New Warehouse Layout

Besides designing a new warehouse layout, loading workflow chart was made. This chart was made to create sequential workflow. Based on interview, it was also learned that 6 hours of use was adjusted to forklift renting time. Without target and sequential workflow, operator can leave their work for unimportant reason. With sequential and fixed workflow, equipment loading and unloading could be faster. Here is the example of the sequences of loading SOP for Painting division:

- Warehouse operator (Head of warehouse) receives “Equipment Loading Warrant” from transporter (with trailer).
- Head of warehouse matches the warrant and the list of equipment which will be loaded.
- Head of warehouse checks the list of equipment which will be loaded.
- After crosschecking was complete, head of warehouse receives “Equipment Loading Document” from Painting Division which agreed by operational manager (from main office)
- Head of warehouse commands the equipment loading
- Equipment from painting division will be stored to pool and will be checked by head of warehouse.
- After rechecking is done, head master gives transporter stamp as approval (Equipment ready to out from warehouse)
- From pool, equipment load to trailer
- Head of warehouse give transporter a permit to leave the warehouse.
- Transporter leaves the warehouse.

With the warehouse layout becoming neater and more efficient after several improvements such as the placement of goods in accordance and by implementing the workflow that has been made. After that the Standard Operating Procedures can be created and show a workflow chart. At the workflow chart can be known the total time to load equipment for the proposed new warehouse layout is 200 minutes, so the time to complete the loading of the equipment is reduced from 6 hours (360 minutes) to 200 minutes. Means that the efficiency of completion time for loading equipment is 44%.

4. Conclusion

Systematic Layout Planning Method or SLP provides a suitable method for designing an efficient layout because it considers relationship value and material workflow precisely. As a result, an efficient warehouse layout and sequential workflow can be designed.

Also, the warehouse layout was customized based on the PT. PMS needs, which has Pool area, consumable area, service area, workshop, smoking area, extra space, loading area, parking area, toilet, janitor room, evacuation route, and place for fire extinguisher. New standard of procedure for equipment loading also was made in order to minimize working hours of loading activities. As a consequence, the finishing time for equipment loading has been improved 44%, even though the area of the new warehouse is bigger than the current warehouse.

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