Optimizing Sample Warehouse Layout At PT BIJ: Comparative Study Of Dedicated And Class-Based Storage

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Abstract. PT. BIJ is an analytical laboratory services company, therefore PT. BIJ needs a good warehouse to be able to accommodate the samples it has PT. BIJ experienced problems with sample storage. Therefore, it is necessary to improve the sample storage system to make it easier to find samples to be analyzed. Using the Dedicated Storege and Class Base Storage methods will help provide grouping for each type of sample and place the samples in the right place so that the sample travel distance is shorter. The results of the research carried out can be obtained that the initial travel distance is 262.98 meters, while the proposed dedicated storage distance is 163.19 meters and the proposed basic class storage distance is 149.95 meters, so there is the largest percentage difference of 42.89%. So it can be concluded that using the class base storage method is better than the dedicated storage method.

Keywords: Warehouse Optimization, Dedicated Storage , Class Base Storage

1. Introduction

In the current era of development, more and more industries are developing in Indonesia, so they require support or encouragement from disciplined management to be able to compete in the industrial world. Where many factors become a reference in a business, one of which is an effective and efficient warehouse layout [1]. A warehouse is a temporary storage place for raw materials, process materials and finished materials [2]. If you just organize it without designing a good warehouse layout, you will experience difficulties in the operational process of an industry [3]. at PT. BIJ experienced problems with sample storage where samples were only placed in empty places. Therefore, it is necessary to improve the sample storage system to make it easier to find samples for analysis.

For this reason, it is necessary to arrange storage locations in the warehouse so that the warehouse becomes an effective and efficient storage place. The dedicated storage and class base storage methods will help organize products by placing a product in a good and correct storage location[4]. This placement is based on a comparison of the activities of each product with the space requirements required by that product, then the product order is obtained from largest to smallest. The aim of this method is to improve the layout of the finished product warehouse which makes it

easier to store, arrange and retrieve finished goods in the warehouse[5]. Dedicated storage or what is also known as a fixed storage location (fixed slot storage), uses a specific location or storage area for each item being stored. This is because a storage location is assigned to a specific product [6]. Class-based Storage Method This storage location rule is between the dedicated storage and randomized storage rules. Class-based storage is based on Pareto's law by taking into account the level of storage activity [7].

PT. BIJ is a company that works in the service sector, some jobs in the company will get a sample of the results of the work that has been done, therefore the company needs a room or storage warehouse to store the samples obtained from the work that has been done[8]. PT. BIJ stores samples in the warehouse for a predetermined time, therefore it requires a storage place for these samples. This company has 4 types of samples, namely Container Samples, Local Samples, Export Samples and Import Samples. In the storage warehouse, a layout that suits the needs of the samples in the warehouse has not been implemented so that storage is not optimal. The samples in the warehouse looked messy, there were several samples that were mixed together in inappropriate places and it was difficult to find the samples when taking them.

Given these conditions, companies need appropriate sample inventory management[9]. The method used to help Dedicated Storage and Class Base Storage. Dedicated Storage is a method that is often referred to as specific and permanent storage because the location for each item has been determined[10]. Meanwhile, Class Base Storage Class Based Storage is a method of storing goods by dividing items into classes based on the similarity of certain criteria such as type of material, type of movement, percentage of items and others[11]. The number of storage locations for a product must be able to meet the maximum storage space requirements for the product. The storage space required is the cumulative of the maximum storage requirements for each type of sample if more than one type of sample is to be stored[12].

2. Methods

Data collection is based on research, namely measurements, direct observation and also based on interviews with workers who work at PT BIJ. The data required for this research relates to the size of the storage warehouse, type of goods (sample), item data (sample), storage shelf capacity and material handling equipment used [13]. By using 2 methods, namely dedicated storage and class base storage to increase mileage in the PT BIJ sample warehouse. This method was chosen because it is a suitable method for use in PT BIJ sample storage warehouse and is able to group samples according to the type of sample so that it can make finding samples easier.

2.1 Throughput

Throughput is a dynamic measurement of activity or storage, which indicates the flow in storage. The term throuhput is used as a measure of the amount of storage and retrieval activity that occurs per time period[14].

$$\text{Tj} = \frac{Average\ Sample\ in}{Freight\ Capacity} + \frac{Average\ Sample\ out}{Freight\ Capacity}$$

2.2 Space Requirement

Space Requirement is the space requirement or space of each item to be stored in the warehouse, with the Space Requirement will facilitate the division of places and tell how many storage sample racks are needed to store goods[15].

$$\text{Sj} = \frac{Average\ Sample\ in\ x\ Long\ storage\ time}{Sample\ Rack\ Capacity}$$

2.3 Comparison between Throughput and Space requirements

Purposed is to divide the products or goods stored into several parts, namely high, low and medium activity. With this division, it will be easier to plan the layout in the

warehouse based on a comparison of throughput and space requirements, besides that it will make it easier to group goods according to specifications[16].

$$T/s = \frac{\text{Throughput}}{\text{Space Requirement}}$$

2.4 Class Formation

Class formation is carried out based on throughput which shows the frequency of items in the warehouse in order to obtain a position to place samples using the class base storage method. Classes are formed using the Pareto approach by calculating the percentage of interest[17].

2.5 Travel Distance Calculation Results and Comparison Results Method

is the final calculation which calculates the results of the existing mileage and calculates the results of comparing the distance traveled by the two methods used. [18]

$$\text{Travel Distance} = \frac{T}{s} \; X \; Sj \; X \; Distance$$

$$\text{Comparison Results Method} = \frac{\text{Original Layout} - \text{Proposed Layout}}{\text{Original Layout}}$$

3. Results and Discussion
Data collection

Data collection The data collection process was carried out by means of interviews and direct observation, the following data was obtained:

Table 1 Sample Date And Storage Shelf Capacity

		Data Perusahaan			
No	Name	Average Incoming Sample	Time Save	Total Sample At warehouse	Capacity Sample Rack
1	Container Sample	1120 Sample	3 Bulan	3360 Sample	16800
2	Local Sample	9182 Sample	3 Bulan	27546 Sample	16800
3	Import Sample	1216 Sample	6 Bulan	7296 Sample	16800
4	Export Sample	4288 Sample	6 Bulan	25728 Sample	16800

The data above is data obtained from the company which can be known from this data. The number of samples in PT BIJ's storage warehouse is very large, therefore improvements are needed in the sample storage warehouse. By using dedicated storage and class base storage methods, we are able to perfect the existing storage system at PT BIJ. which by using this method the samples in the warehouse will be grouped according to the existing types and will make it easier for employees to find samples to be analyzed.

Data processing

Throughput Calculation

Based on the results of calculating samples entering and leaving PT BIJ's finished goods warehouse, it shows that the throughput is 84.23 times. This means that the total transfer trip activities for storage and retrieval that occurred within a month's time period was 84.23 times.

Table 2 Calculation Througput

Calculation Througput

No	Name	Average Incoming Sample	Average Samples out	Througput
1	Container Sample	1120	1400	6,72
2	Local Sample	9182	8811	47,98
3	Import Sample	1216	1792	8,02
4	Export Sample	4288	3776	21,50
	Total Througput			84,23

Calculation of Space Requirements

The sample warehouse has an area of 35 M^2 with a length of 7 M and a width 5 M which will be divided into 6 storage shelf slots. The calculation of space requirements on the storage shelf for each sample is carried out by rounding up to ensure that no samples lack storage space.

Table 3 Calculation of Space Requirements

Calculation of Space Requirements				
No	Name	Average Incoming Sample	Space Requirement Teoritis	Space Requirement Sj
1	Container Sample	1120	0,2	1
2	Local Sample	9182	1,64	2
3	Import Sample	1216	0,43	1
4	Export Sample	4288	1,53	2

Comparison between Throughput and Space requirements

After getting the results of calculating the frequency of receipts and expenditures (throughput) and slot requirements (Space Requirement), a calculation will be carried out for the ratio Tj and Sj. The sample with the largest T/S ratio value will be placed in the slot with the smallest distance, the product with the second largest T/S ratio value will be placed in the slot with the second smallest distance, and so on. Technically, this placement method aims to reduce the operator's travel distance from the I/O point to the storage rack.

Table 4 Comparative Calculations Tj And Sj

Comparison between Throughput and Space requirements				
No	Name	Sj	Througput	Results
1	Container Sample	1	6,72	6,72
2	Local Sample	2	47,98	23,99
3	Import Sample	1	8,02	8,02
4	Export Sample	2	21,50	10,75

Formation of Classes Based on Class Storage Methods

Table 5 Formation of Classes Based on Class Storage Methods

No	Sample Type	Througput	Percentage Througput	Amount Sample	Percentage Sample	Code
Formation of Classes Based on Class Storage Methods						
1	Local Sample	47,98	57%	9182	58%	A
2	Export Sample	21,50	26%	4288	27%	B
3	Import Sample	8,02	10%	1216	8%	C
4	Container Sample	6,72	8%	1120	7%	D

Travel distance calculation

The table below shows the distance between the exit door and the sample storage shelf which is calculated directly when in the sample storage warehouse. And the proposed storage rack spacing table, taking into account the comparison results of throughput and storage, results are obtained as in the table.

Table 5 Original Mileage

No	Name	T/s	Sj	Distance	Mileage
Original Mileage					
1	Container Sample	6,72	1	1 Meter	6,72
2	Local Sample	23,99	2	4 Meter	177,53
3	Import Sample	8,02	1	4 Meter	38,10
4	Export Sample	10,75	2	1,5 Meter	45,16
	Total Mileages				267,51

Table 6 Proposed Mileage of Dedicated Storage

No	Name	T/s	Sj	Distance	Mileage
Proposed Dedicated Storage Mileage					
1	Container Sample	6,72	1	4 Meter	26,88
2	Local Sample	23,99	2	1,5 Meter	71,97
3	Import Sample	8,02	1	4 Meter	32,09
4	Export Sample	10,75	2	1,5 Meter	32,26
	Total Mileages				156,10

Table 7 Proposed Mileage of Class base Storage

| No	Name	T/s	Sj	Distance	Mileage
Proposed Base Class Storage Mileage					
1	Container Sample	6,72	1	4 Meter	26,88
2	Local Sample	23,99	2	1 Meter	47,98
3	Import Sample	8,02	1	4 Meter	32,09
4	Export Sample	10,75	2	2 Meter	43,01
	Total Mileages				149,95

From the results of the comparison table above, it can be concluded that the two methods are able to provide closer distance changes and can shorten the activity time that occurs in the warehouse and save energy expended. Using this method can make it easier for employees to find and place similar samples on designated storage shelves.
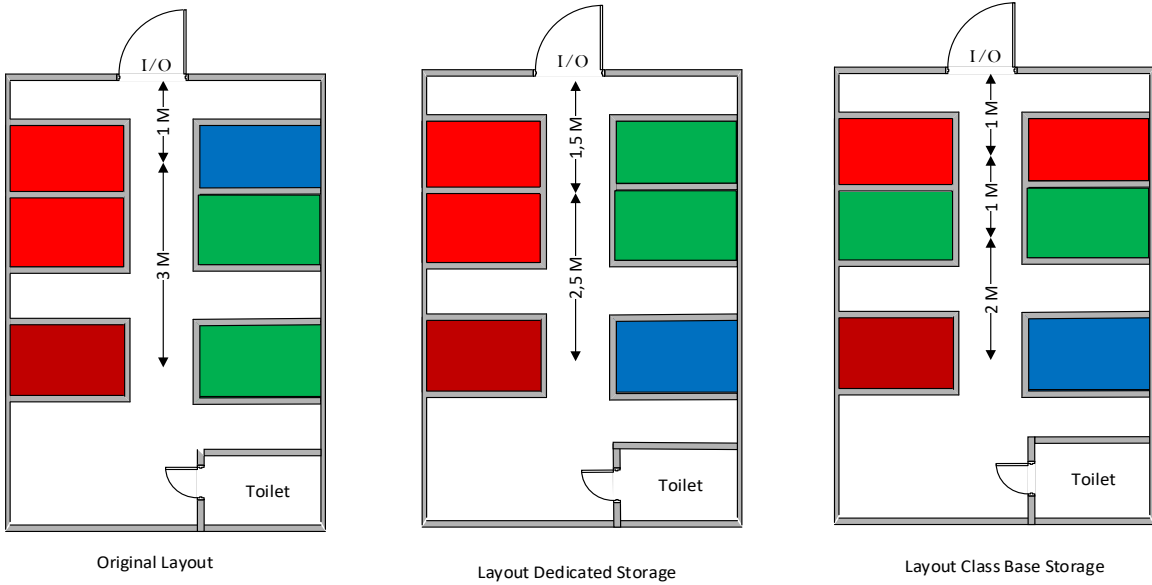
Figure 1. Original And Proposed Warehouse Floor Plan Images

Information :

🟩 = Local Sample Place

🟥 = Import Sample Place

🟦 = Container Sample Place

🟥 = Export Sample Place
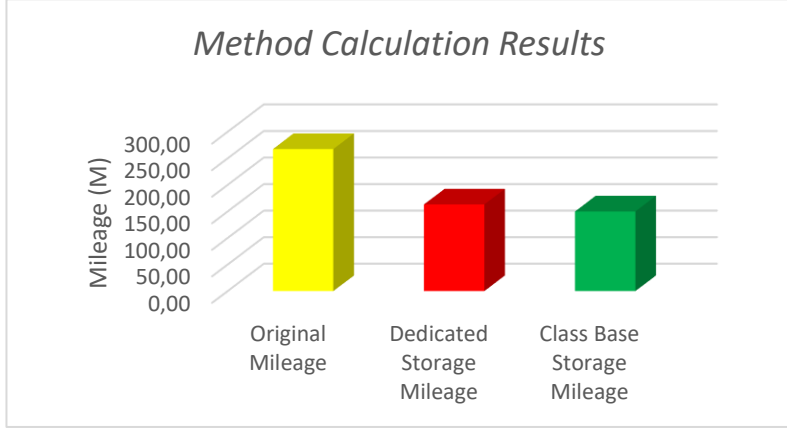
Figure 2 Method Calculation Results

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Table 8 Method Calculation Results

Method Calculation Results			
Layout	Total Distance	Difference	Percentage Difference
Original Layout	262,98		
Usulan Dedicated Storage	163,19	99,79	37,95%
Usulan Class Base Storage	149,95	113,03	42,98%

4. Conclusion

In the research that has been completed, several results have been achieved, namely the initial total distance traveled was 262.98 meters. The distance traveled by the proposed Dedicated Storage method is 163.19 meters. The distance traveled by the proposed Class Base Storage method is 149.95 meters so there is a decrease of 37.95% for the Dedicated Storage method and 42.98% for the Class Base Storage method so that the comparison between the two methods is has the best improvement is the Class Base Storage method.

The suggestion given is that by using the class base storage method, PT BIJ's sample storage warehouse is able to shorten the sampling distance in the warehouse and also group samples according to their respective types and make it easier to find certain types of samples to be taken for analysis.

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