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DESIGN OF STORAGE LAYOUT FOR PROTECTOR MATERIAL (FAST MOVING) WITH CLASS BASED STORAGE METHOD AT RAW MATERIAL WAREHOUSE JEPARA PT DSV SOLUTIONS INDONESIA (SEMARANG BRANCH)

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ABSTRACT

PT DSV Solutions Indonesia Semarang Branch is a 3PL company engaged in warehousing logistics. The current condition is that the protector material storage still uses a randomized storage method and the GR (Good Receiving) method which rearranges the boxes into pallets. The current layout causes a fairly high displacement distance and has an impact on high material handling costs and the size of the blocks on the shelves that make the GR method long. The purpose of this study is to design a storage layout for protector (fast moving) materials using the class-based storage method to determine changes in displacement distance, material handling costs, and work efficiency and performing the GR (Good Receiving) process. Researchers used descriptive qualitative research methods with observation, interviews, and documentation. The results showed the total distance of the initial displacement of the protector material was 16,172,250 m and the Material Handling Cost was Rp 109,971,300 and the GR process did not require rearrangement into pallets. The output of this research is that it can reduce the total distance of moving the protector material and streamline the distance of movement by 56% and streamline the Material Handling Cost by 56%. In the changed GR (Good receiving) method, it can raise the beam on the level 3 shelf, by 1.5m. The material protector storage layout can be said to be efficient using the class-based storage method when compared to the initial storage layout.

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INTRODUCTION

A warehouse that has a layout arrangement that is in accordance with warehouse conditions, has an impact on the efficiency and effectiveness of the processes that occur in the warehouse (Aiba et al., 2022). A good warehouse storage layout will help organize the right warehouse, and the right warehouse management system that will affect the management of the stock of goods in the warehouse. The use of warehouses that are not effective and efficient can be maximized by utilizing a good storage layout. Based on observations, the material protector (fast moving) at PT DSV Solutions Indonesia (Semarang Branch) already has a storage layout, but there are still ineffectiveness and inefficiency in the process. It is said to be ineffective and inefficient because it still uses the randomized storage method. The randomized storage method is that goods are stored and placed randomly which results in difficulty storing and searching for goods, as well as a high distance for moving goods because forklift operators must repeatedly go back and forth to deliver goods into the shelves and remove goods from the shelves. The long distance from inbound to goods storage and goods/rack storage to outbound causes high material handling costs. In the GR (Good Receive) process, it is very time consuming, resulting in less efficient and effective operator work because the GR (Good receiving) process changes the arrangement of the material boxes back into the new pallet, and changes the stack that comes from the supplier to adjust to the shelf capacity.

According to (Hidayat & Putra, 2021) the warehouse storage method in designing its layout consists of 4 storage methods; Randomized Storage, Fixed Storage, Class-Based Storage, Shared Storage. Randomized Storage is a policy of storing goods in a random manner and can cause the search for goods to take longer. In the proposal, the researcher uses the class-based storage method to design the storage layout of the material protector (fast moving). The method is used because it can group goods based on the frequency of movement of goods.

METHODS

Data collection using this qualitative method is supported by facts that occur when conducting research in the field (Abdussamad, 2021). This research was conducted using descriptive qualitative research methods to collect information that is based on facts that occur in the field at the company PT DSV Solutions Indonesia (Semarang Branch). The research locus focuses on where the research was conducted. The research was conducted in the raw material warehouse J storage (unfinished goods). The research location is at PT DSV Solutions Indonesia (Semarang Branch) in Candi Industrial Estate, Jl. Gatot Subroto Blok 16 No.8E, Ngaliyan District, Semarang City, Central Java. In qualitative data collection techniques (Sugiyono, 2018) expresses his opinion that data collection techniques must be carried out in a natural situation without any deliberate setting in order to match the objectives expected by the researcher. The data collection techniques used by researchers are:

1. Observation

   Observations made can see actual conditions that cannot be revealed by informants. In this study, the authors made direct observations and observations and explored facts related to the storage layout of the material protector.

2. Interview

   According to (Sugiyono, 2018), interviews are question and answer activities, discussions and exchanges of ideas between two people to achieve the objectives of a particular topic. Researchers conducted interviews with informants who had been selected.

3. Documentation

Documentation in data collection techniques according to (Sugiyono, 2018) is taking photos or recording information as strong evidence that the phenomenon really exists, and proof that the researcher actually conducted observations and interviews. In this study, the authors recorded interviews with informants, recorded the results of interviews, and took photos with informants and author observation activities.

Data analysis techniques according to (Sugiyono, 2018) are steps in releasing data that has been obtained from observations, interviews and documentation, selecting data, and presenting the data that has been obtained. The data analysis techniques used by researchers are:

1. Data collection

This is usually done regularly for several days or even months. In this case, researchers collected data by observation, interviews and documentation to collect information related to the design of the material protector layout.

2. Data reduction

In this study, the authors summarized a number of information that had been obtained through the data collection process regarding the design of the material protector layout.

3. Data presentation (Data display)

The next process is the presentation of data that has been organized through the data reduction process. Can be interpreted through diagrams, tables, flowcharts, descriptions and so on so that it can be understood. In this study, the authors presented data in the form of descriptions, tables and flowcharts to analyze the design of the material protector storage layout.

4. Conclusion drawing

In the research conducted by the author using data on material receipt and expenditure, the initial layout that has been obtained from valid sources of information, namely through observation, interviews and documentation. The conclusion of this research is a comparison of efficiency and effectiveness between the initial layout and the proposed layout

RESULT AND DISSCUSION

1. Initial Layout of Material Protector Storage

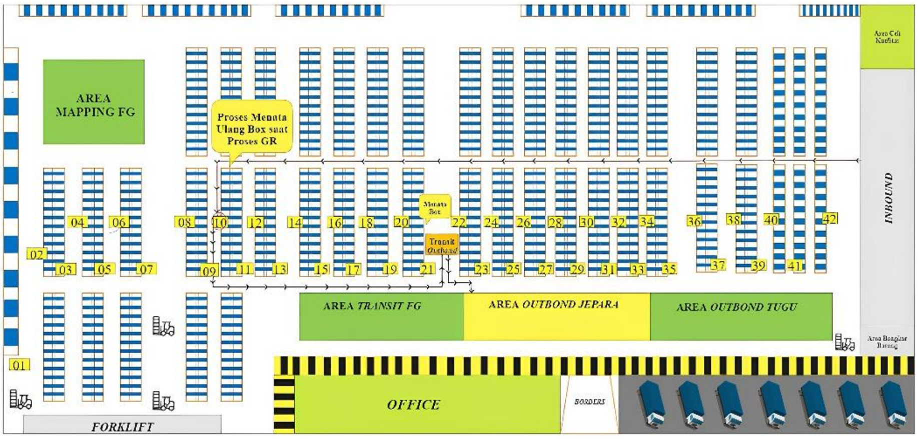

Figure 3.1 Initial Layout
Source: Data processed by researchers, 2024

Figure 3.1 shows the initial layout of the protector storage before the proposal using the class-based storage method. Image This figure shows how the initial layout of the protector material, and the process of its inbound process on its inbound to outbound. When research and observation took place, researchers found problems with the layout of this material protector. The reason is, the material protector which has movement is high, the location is still far from the entrance and exit of goods, and a long process was found in the GR (Good Receive) process.

a. Frequency of Goods Movement

No	Komoditi	Rata-Rata In (Box)	Rata-Rata Out (Box)	Total Frekuensi Perpindahan
1	Protector	52,528	55,287	107,815
2	Wire	31,585	30,870	62,456
3	Cassette R/B (Micro 6p)	22,341	3	22,343
4	Terminal	11,873	11,763	23,636
5	Connector	10,605	10,569	21,174
6	Cover	5,612	5,504	11,115
7	Block	8,270	3,792	12,062
8	Relay	3,609	3,214	6,823
9	Tape	3,424	3,308	6,732
10	Fuse	3,042	2,974	6,017
11	Tube	2,658	41	2,699
12	Grommet	2,399	181	2,580
13	Clip	2,034	212	2,247

14	Base	1,330	14	1,344
15	Silicon	568	518	1,086
16	Hard Tube	613	458	1,071
17	Clamp	544	341	885
18	Twist Tube	394	260	655
19	Twistwrap	225	209	433
20	Bracket	233	221	454
21	Junkan	219	214	434
22	Main R/B	183	136	319
23	Cable Assy	181	83	264
24	Housing Female	147	128	275
25	Bolt	141	122	263
26	Dummy	62	31	93
27	Buchil	45	42	88
28	Housing Male	42	8	50
29	2238frtv 0.09tx25mmx30m Dgy	32	30	62
30	Feeder	28	25	52
31	Busbar	27	12	40
32	8196-1800	24	13	37
33	Battery Cable	21	19	40
34	Aron Alpha	16	13	28
35	39pl Eng Room Main	11	6	17
36	Battery Fl 2p Type	11	5	16
37	Cap	8	7	15
38	Sealed	7	5	11
39	Epdm Sheet	29	5	35
40	Butil	5	5	10
41	Cli	4	1	5
42	Assembly J/C	3	1	4
43	Xagon Nut (M6)	2	2	5
44	Accessories	1	1	3
45	Blind Plug / Dummy Plug 2.5mm	0	0	0
46	Diode	0	0	1
47	Ferrite	0	0	1
48	2403bNon-Tracer (16x17.6)L=110	0	0	0
TOTAL		**165,137**	**130,653**	**295,795**

Table 3.1 Frequency of Goods Movement

Source: Data processed by researchers, 2024

The frequency of movement of the protector material per month generated by summing the average in with the average out is 107,815 boxes. The average in goods interprets the average monthly entry of protector material into the warehouse, which is 52,528 boxes. While the average out of goods interprets the average monthly expenditure of goods from the warehouse, which is 55,287 boxes. From the table data above, it can also be interpreted that the material protector is the material with the highest frequency of movement when compared to other materials.

b. Distance of Material Protector Movement in the Initial Layout

The calculation of the initial displacement distance of the protector material is the total value of the inbound distance to the shelf, and the distance from the outbound transit area to the outbound area. The calculation of the total displacement distance is by multiplying the total displacement frequency by the displacement distance of the protector material. (Alfatiyah et al., 2021b) argue that to calculate the distance traveled is done by measuring the distance between the range of entry points and exit points with the storage point of the material.

It is known that the distance of the protector material from the inbound to the shelf is 90 m and the distance from the outbound transit area to the outbound area is 60 m. The distance of material protector movement is 150 m.

Total Distance of material protector movement = Total frequency of material protector movement x Distance of material protector movement
= 107,815 x 150 m
= 16.172.250 m

Then the total displacement distance of the initial layout of the material protector per month is 16,172,250 m.

c. Material Handling Cost Calculation

To calculate and determine the cost of material handling is to calculate the components involved such as fixed costs, variable costs, and machine (forklift) costs (Alfatiyah et al., 2021b).

Jenis Forklift *(Fixed)*	Counterbalance Forklift
Merk *(Fixed)*	Toyota
Tipe *(Fixed)*	RRE160
Bahan Bakar *(Variable)*	Electric
Jumlah (Mesin)	1
Charger *(Variable)*	13,5 kWh

Table 3.2 Forklift Specifications
Source: PT DSV Solutions Indonesia (Semarang Branch), 2024

In order to find out the total cost of material handling in the initial layout, it can be obtained from the Fuel Price x Total Moving Distance.

Total OMH initial layout = Fuel Price x Total Distance Moved.
= Rp 6.80 x 16,172,250
= IDR 109,971,300

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Thus, the total OMH required to move the material protector in the initial layout is IDR 109,971,300.

d. Initial GR (Good Receive) Process of Material Protector

Warehouse staff/operators perform GR (Good Receive) which is treated by rearranging the goods per pallet to fit the rack size. This happens because the initial pile of protector material arrivals from the supplier amounted to 5 stacks, while the rack column area can only accommodate 3 stacks. The process of re-stacking the protector material into a new pallet should be eliminated so as not to make the GR process long.

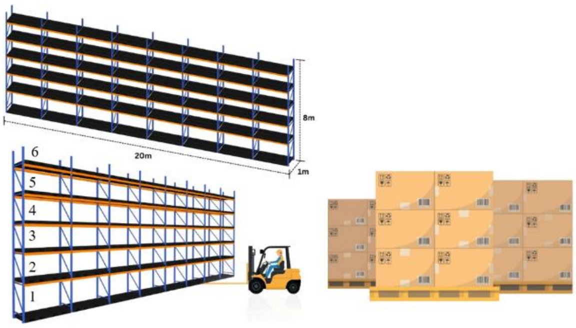

Figure 3.2 Initial size of rack beams and box stacks
Source: Data processed by researchers, 2024

Figure 3.2 shows an illustration of the initial pile of material that will be put into the rack. The pile of material on the pallet still consists of 3 stacks and measures 1m high, 600cm wide when doing the GR process and is about to be put away.

2. Class Division Using the Pareto Principle (Class-Based Storage Method)

No	Comodity	Total Displacement Frequency	Cumulative Frequency	Cumulative Percentage	Class
1	Protector	107,815	107,815	36,44%	A
2	Wire	62,456	170,271	57,56%	
3	Cassette R/B (Micro 6p)	22,343	192,614	65,11%	
4	Terminal	23,636	216,250	73,10%	
5	Connector	21,174	237,424	80,26%	B
6	Cover	11,115	248,539	84,02%	
7	Block	12,062	260,601	88,10%	
8	Relay	6,823	267,424	90,40%	C
9	Tape	6,732	274,156	92,68%	
10	Fuse	6,017	280,173	94,71%	
11	Tube	2,699	282,872	95,63%	

No	Comodity	Total Displacement Frequency	Cumulative Frequency	Cumulative Percentage	Class
12	Grommet	2,580	285,452	96,50%	
13	Clip	2,247	287,699	97,26%	
14	Base	1,344	289,043	97,71%	
15	Silicon	1,086	290,129	98,08%	
16	Hard Tube	1,071	291,200	98,44%	
17	Clamp	885	292,085	98,74%	
18	Twist Tube	655	292,740	98,96%	
19	Twistwrap	433	293,173	99,11%	
20	Bracket	454	293,627	99,26%	
21	Junkan	434	294,061	99,41%	
22	Main R/B	319	294,380	99,52%	
23	Cable Assy	264	294,644	99,61%	
24	Housing Female	275	294,919	99,70%	
25	Bolt	263	295,182	99,79%	
26	Dummy	93	295,275	99,82%	
27	Buchil	88	295,363	99,85%	
28	Housing Male	50	295,413	99,87%	
29	2238frtv 0.09tx25mmx30m Dgy	62	295,475	99,89%	
30	Feeder	52	295,527	99,90%	
31	Busbar	40	295,567	99,92%	
32	8196-1800	37	295,604	99,93%	
33	Battery Cable	40	295,644	99,94%	
34	Aron Alpha	28	295,672	99,95%	
35	39pl Eng Room Main	17	295,689	99,96%	
36	Battery Fl 2p Type	16	295,705	99,96%	
37	Cap	15	295,720	99,97%	
38	Sealed	11	295,731	99,97%	
39	Epdm Sheet	35	295,766	99,99%	
40	Butil	10	295,776	99,99%	
41	Cli	5	295,781	99,99%	
42	Assembly J/C	4	295,785	99,99%	
43	Xagon Nut (M6)	5	295,790	99,99%	
44	Accessories	3	295,793	99,99%	
45	Blind Plug / Dummy Plug 2.5mm	0	295,793	99,99%	
46	Diode	1	295,794	99,99%	

No	Comodity	Total Displacement Frequency	Cumulative Frequency	Cumulative Percentage	Class
47	Ferrite	1	295,795	100.00%	
48	2403bNon-Tracer (16x17.6)L=110	0	295,795	100.00%	
	Total	**295,795**			

Table 3.3 Grouping by class
Source: Data processed by researchers, 2024

The researcher used the pareto principle to classify the goods. This principle reads differently for each class. Class A is about 20% of the total SKU (Stock Keeping Units) will provide about 80% of the frequency of picking/moving goods from the warehouse. Class B is about 30% of the total SKU (Stock Keeping Units) will provide about 15% of the frequency of picking/moving goods from the warehouse. Class C is about 50% of the total SKU (Stock Keeping Units) will provide about 5% of the frequency of picking/moving goods from the warehouse.

3. Calculating the Moving Distance of Material Protector Proposed Layout

The proposed layout of the material protector will calculate the distance to move the material protector with the proposed layout. Where the location will be closer to the exit and entry of goods in the Jepara Raw Material Warehouse.

Total distance of material protector movement = Total frequency of material protector movement x Distance of material protector movement

= 107,815 x 65 m

= 7.007.975 m

Then the total displacement distance of the proposed layout on the material protector per month is 16,172,250 m.

4. Calculation of Material Handling Cost of Proposed Layout

The proposed layout using the class-based storage method has a total movement distance of 7,007,975m. The displacement distance of the material protector is calculated by summing up the distance from the inbound to the storage area, and from the storage area to the outbound. Then the OMH can be calculated as follows:

OMH = Fuel Price x Moving Distance

= Rp 6.80 x 7,007,975 m

= IDR 47,654,230

Thus, the total OMH required to move the material protector in the proposed layout is IDR 47,654,230.

5. GR Process (Good Receive) Material Protector Proposed Layout

By eliminating the process of looking for new pallets for the process of re-stacking protector material into new pallets, it is expected to make the GR process faster. After the GR process is carried out, the goods will be put away according to the predetermined location. This will certainly make the process of moving the material protector (fast moving) faster. so it was changed by changing the size of the rack beam, so that warehouse staff did not need to rearrange the protector material box on the pallet.

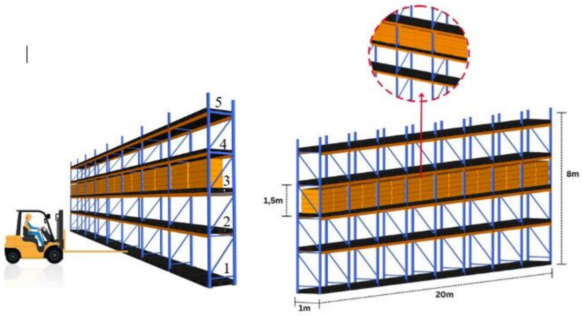

Figure 3.2 Proposed beam size and box stack
Source: Data processed by researchers, 2024

Figure 3.2 shows an illustration of the proposed rack and beam material protector. The rack already consists of 5 levels that have a length of 20m, width of 1m, and height of 8m. It is known that the area per one column has a height of 1.3m, width of 1m, and length of 2.5m. But what is different lies in level 3, because the beam size has been changed, by increasing the size of level 3 by 1.5m. Figure 4.8 shows an illustration of the proposed pile of material that is put into the rack. The pile of material on the pallet already consists of 5 stacks when doing the GR process and which are about to be put away.

6. Proposed layout

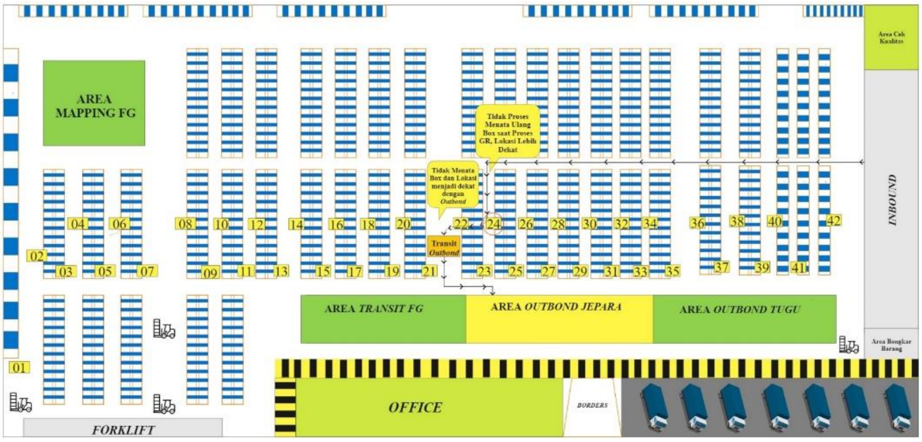

Figure 3.3 Proposed Layout
Source: Data processed by researchers, 2024

In the figure it can be seen that the proposed layout shortens the distance from inbound to the storage rack, the GR and picking process does not require rearrangement into other pallets, and the distance from the storage area to the outbound area is shorter. Initially, the material protector storage was on shelf 10, and in the proposed material protector storage will be on shelf 22 of the Jepara Raw Material Warehouse. Inbound to the storage area and storage area to the outbound area can be said to be directly connected.

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7. Comparison of Material Protector (Fast Moving) Storage Layout Optimization before and after design.

Comparison		
Category	**Before**	**After**
Material Protector Storage Method	Randomized Storage	Class-Based Storage
Displacement Distance	16.172.250 m	7.007.975 m
Material Handling Cost	Rp 109.971.300	Rp 47.654.230
GR (Good Receiving) Method	Rearrangement into new pallets	Does not require rearrangement into new pallets

Table 3.4 Comparison of Material Protector (Fast Moving) Storage Layout Optimization
Source: Data processed by researchers, 2024

CONCLUSION

1. The initial layout of the material protector (fast moving) is not optimal because it was originally placed far from the entrance and exit of goods. The material protector at that time did not use the Randomized Storage layout method which caused the storage of the goods to be mixed and the storage was far from the entrance and exit of the goods which resulted in a less efficient and effective movement distance because it was at a distance of 16,172,250 m per month and material handling costs reached Rp 109,971,300 per month.
2. Based on the frequency of displacement of the material protector layout with the class-based storage method, the material protector is classified based on the pareto principle. With the proposed layout using the class-based storage method, the total displacement distance generated becomes 7,007,975 m per month and produces a displacement efficiency of 56% and material handling costs become Rp 47,654,230 per month and reduce material handling costs by 56%.
3. Methods in the GR (Goods Receiving) process that have changed. Originally the process was to re-stack into pallets, after the proposal was made it did not require a rearrangement process anymore.

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