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Bread Factory Layout Design using BLOCPLAN

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Abstract. The aim of this research is to design a proposed layout for bread production facilities that can minimize the moving distance and material handling costs. This study used the BLOCPLAN method as the design method. The BLOCPLAN method is a facility layout design method based on a hybrid algorithm and supported by the BLOCPLAN 90. With this method, 20 alternative layouts are obtained, then the researcher chooses 3 layouts that had the greatest proximity value. Layout 13 produced a smaller total displacement distance and material handling costs, namely 56.40 meters at the cost of 489.62 rupiah, in one transfer of raw material. The initial layout of the bakery factory had a displacement distance of 68 meters and a material handling cost of 590.28 rupiah in one transfer of raw material. For this reason, layout 13 becomes a proposed layout for use by a bread production facility. In addition, the layout of the bread production facilities and production time can also be more efficient than before.

Keywords: BLOCPLAN method, bread factory, layout design

1. Introduction

In this research, we designed the facility layout in the bread factory. This research aims at minimizing the displacement distance of raw materials and material handling cost from the layout of the bread production facility. There are far distances between facilities that have a high level of adjacency. This problem causes the distance for the transfer of raw materials and material handling costs to be large. Therefore, the researchers conducted a layout redesign of the bread production facilities using the BLOCPLAN method, as has been done by Z. Ulfauzi in improving the layout of the LNG terminal by using the BLOCPLAN algorithm [1].

This facility layout design is also used to improve the production floor in order to increase the production capacity of building materials [2]. The facility layout design using the BLOCPLAN method is also used to create a terminal layout for liquefied natural gas [1]. The BLOCPLAN method has also been combined with the ALDEP method to find the best material handling costs from the rubber factory production floor [3]. The BLOCPLAN method is also used to improve the production process at company X [4]. Layout design with the BLOCPLAN method has also been used to optimize the production process facilities in apple processing to improve productivity and sustainability of SMEs [5].

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The purpose of this research is to provide a layout that can estimate the distance and cost of displacement. The method used is the BLOCPLAN method. This method was chosen because it is easy to use and in accordance with existing data.

2. Method

The research methodology at this time is that we conducted field observations regarding the mismatch of the initial layout of the production facility and collect the data needed to solve the problem. The data includes product manufacturing time, floor area data, machines used, and the proximity of each room. Then, we create an operation process chart and activity relationship chart in order to know the flow of material transfer and the steps in the process of making bread products, and the degree of proximity of each room [6,7].

Processing using the BLOCPLAN method requires floor area data and an activity relationship chart. If there is a room that is fixed or cannot be changed, it can be used as additional input data. The BLOCPLAN method can produce a maximum of 20 alternative layout iterations [8]. Layout alternatives to be selected can be considered from Adjacency Score, R Score, and Real-Dist Score. After that, Researchers must find the smallest material handling cost of the selected layout alternatives [5].

3. Results and Discussion

3.1. Initial Layout

The initial layout of the bread production facility is shown in Figure 1 where you can see several rooms that are far apart, like the jam dough room with the assembly room.

3.2. Transportation Equipment Fee

The means of transportation used at this bakery are human labor. So it takes human transportation equipment costs to know the cost of each movement and the total material handling cost as a whole. The cost for human transportation is 8.68 rupiah per meter.

3.3. Initial Layout Material Handling Cost

Material handling costs in one frequency of raw material movement obtained from the initial layout with human transportation equipment costs are shown in Table 1.

Table 1. Initial Layout Material Handling Cost

From	To	Materials	MHC	Distance(m)	Total Cost
Raw Material Warehouse	Jam Batter Room	Jam Making Ingredients	Rp 8,68	5,95	Rp 51,65
	Bread Dough Room	Bread Making Materials	Rp 8,68	2,75	Rp 23,87
Jam Batter Room	Assembly Room	Jam Dough	Rp 8,68	12,95	Rp 112,41
Bread Dough Room		Bread Dough	Rp 8,68	9,75	Rp 84,64
Assembly Room	Development Room	Finished Bread Dough	Rp 8,68	6,64	Rp 57,64
Development Room	Baking Room	Finished Bread Dough	Rp 8,68	5,01	Rp 43,49

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From	To	Materials	MHC	Distance(m)	Total Cost
Baking Room	Waiting room	Bread	Rp 8,68	10,55	Rp 91,58
Waiting room	Cut and Pack Room	Bread	Rp 8,68	8,8	Rp 76,39
Cut and Pack Room	Finished Bread Warehouse	Bread	Rp 8,68	5,6	Rp 48,61
			Total	68	Rp 590,28

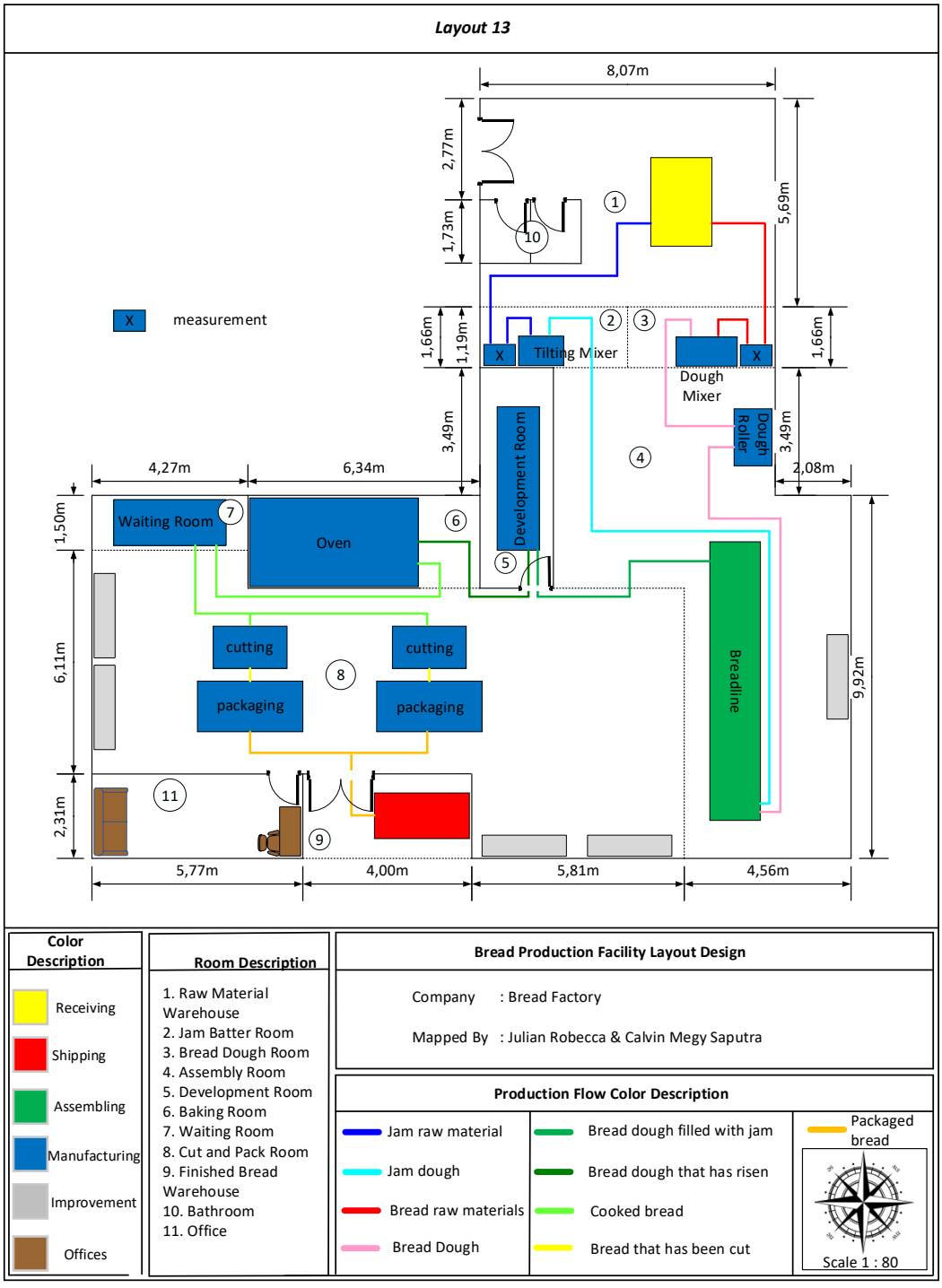

Figure 1. Initial Layout

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3.4. BLOCPLAN

The input needed in processing using the BLOCPLAN method is the floor area data from each room and an activity relationship chart [9]. After that, if there is space placement that is fixed or does not want to be changed, it can be an additional input. The spaces that have been fixed in this bakery include office space, bathroom, raw material warehouse, and finished bakery. Where each of these rooms has reasons such as for example the office space is not moved because it is not included in the production floor. Input floor area, activity relationship chart, and fixed room data is shown in Figures 2-4.

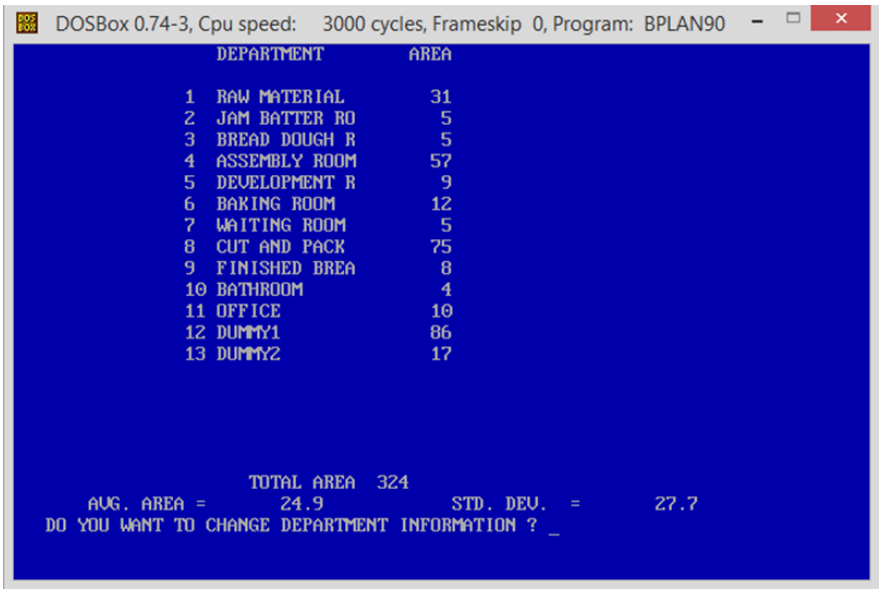

Figure 2. Input Floor Area

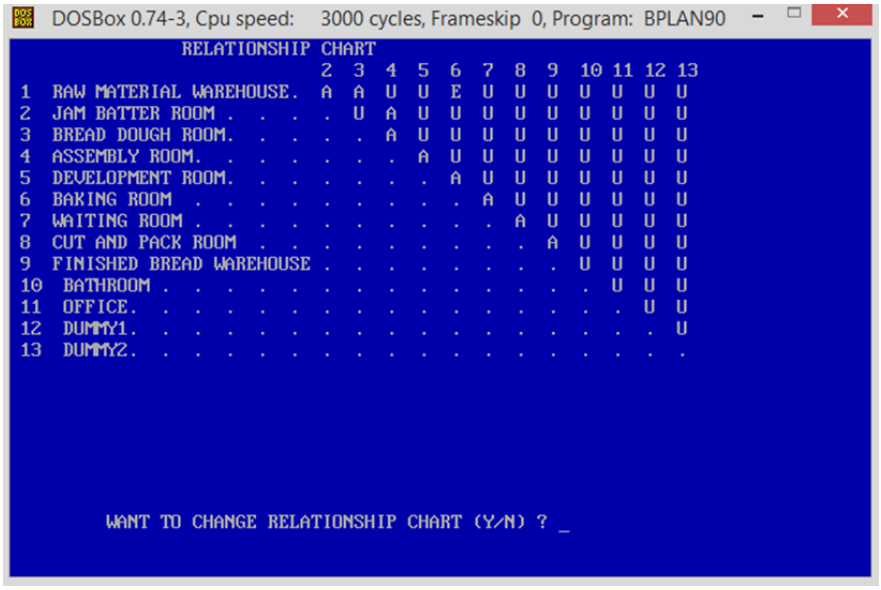

Figure 3. Input Activity Relationship Chart

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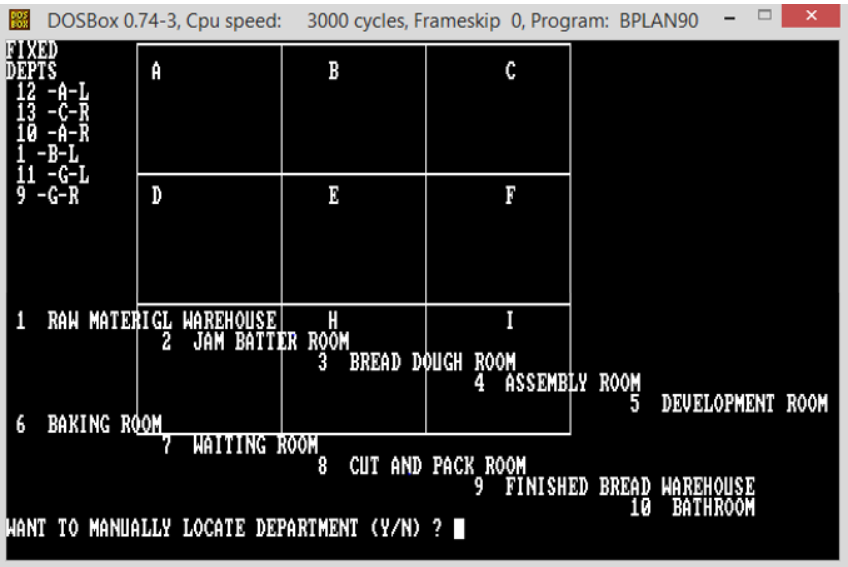

Figure 4. Fixed Room Data Input

Blocplan software processing produces 3 scores, namely Adjacency Score, R Score, and Rel Dist Score. Details of the processing results of the three scores are shown in Table 2.

Table 2. BLOCPLAN Software Processing Results.

Layout	*Adj Score*	*R Score*	*Rel-Dist Score*
1	0,79 - 8	0,72 - 13	872 - 15
2	0,74 - 14	0,66 - 18	942 - 20
3	0,74 - 14	0,66 - 20	906 - 18
4	0,79 - 8	0,66 - 19	927 - 19
5	0,79 - 8	0,69 - 16	878 - 16
6	0,74 - 14	0,71 - 14	739 - 10
7	0,68 - 19	0,72 - 12	805 - 13
8	0,74 - 14	0,74 - 10	698 - 8
9	0,89 - 2	0,83 - 2	624 - 3
10	0,68 - 19	0,69 - 15	827 - 14
11	0,79 - 8	0,67 - 17	901 - 17
12	0,84 - 4	0,79 - 5	619 - 2
13	0,95 - 1	0,83 - 1	647 - 4
14	0,79 - 8	0,76 - 8	677 - 7
15	0,79 - 8	0,75 - 9	758 - 12
16	0,89 - 2	0,81 - 4	618 - 1
17	0,84 - 4	0,74 - 11	725 - 9
18	0,84 - 4	0,82 - 3	658 - 5
19	0,84 - 4	0,77 - 6	663 – 6
20	0,74 - 14	0,77 - 7	751 - 11

The researcher chooses 3 alternative layouts that have the greatest Adjacency Score value because based on the level of closeness, the three layouts have a high or good value [7]. After adjusting and calculating the material handling costs of the three alternative layouts, only

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layout 13 has the smallest displacement distance and material handling cost. Because reducing costs is the main goal of material handling planning. The results obtained are similar to those of research to make alternative designs for plant layouts resulting in shorter displacement distances [10].

3.5. Proposed Layout

The layout 13 generated from the BLOCPLAN processing can be seen in Figure 5. The changes that occur in layout 13 are only on the production floor so that the location of the office and bathroom has not changed or is still in accordance with the initial layout of this bakery

3.6. Material Handling Cost Proposed Layout

The calculation of material handling costs in one frequency of raw material movement obtained from layout 13 is smaller than the material handling cost that is owned by the initial layout of the Bread Factory. The calculation of material handling costs is shown in Table 3.

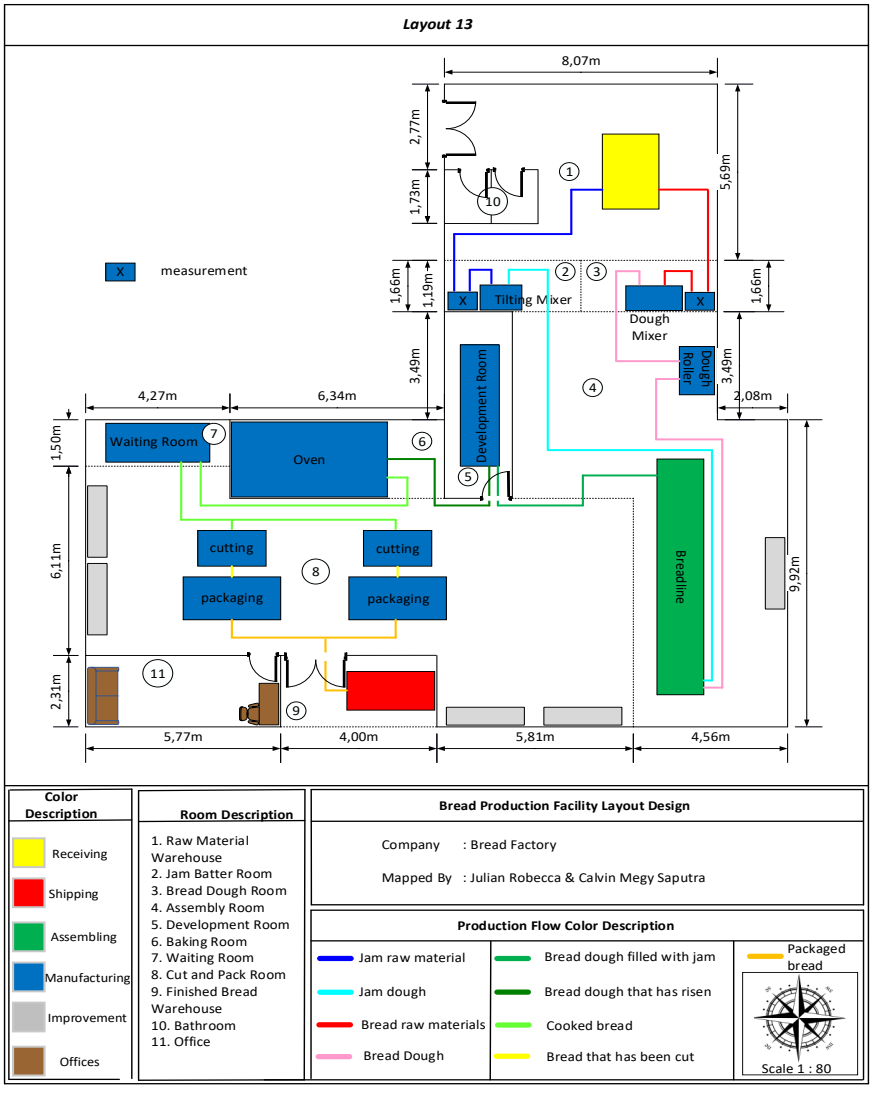

Figure 5. Layout 13

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Table 3. Material Handling Cost Layout 13.

From	To	Materials	MHC	Distance(m)	Total Cost
Raw Material Warehouse	Jam Batter Room	Jam Making Ingredients	Rp 8,68	4,94	Rp 42,86
	Bread Dough Room	Bread Making Materials	Rp 8,68	4,94	Rp 42,86
Jam Batter Room	Assembly Room	Jam Dough	Rp 8,68	10,05	Rp 87,25
Bread Dough Room		Bread Dough	Rp 8,68	6,55	Rp 56,87
Assembly Room	Development Room	Finished Bread Dough	Rp 8,68	7,60	Rp 65,96
Development Room	Baking Room	Finished Bread Dough	Rp 8,68	5,13	Rp 44,56
Baking Room	Waiting room	Bread	Rp 8,68	5,05	Rp 43,85
Waiting room	Cut and Pack Room	Bread	Rp 8,68	9,47	Rp 82,22
Cut and Pack Room	Finished Bread Warehouse	Bread	Rp 8,68	2,67	Rp 23,18
			Total	56,40	Rp 489,62

4. Conclusion

It can be seen the initial layout of the bread production facility. There are several rooms that are not next to each other. Therefore, the total distance traveled as far as 68 meters and the material handling cost resulting from the displacement distance is 590.28 rupiah in one frequency of transfer of raw materials for making bread products. Besides, the 13 alternative layout has the smallest total displacement distance and material handling cost, namely as far as 56.40 meters at the cost of 489.62 rupiah in one frequency of moving raw materials or materials for making bread products. Thus, layout 13 can be a proposed layout that can be used by bread production facilities to minimize distance and material handling costs.

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