THE DEVELOPMENT OF HOW TO SET PLANT LAYOUT USING CRAFT METHODS WITH VBA ON MICROSOFT EXCEL

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Abstract - The purpose of this research is to develop methods for plant layout design. It is well know that layout design, when there are more departments, the probability of the schemes plant layout and number of time calculate cost will be greater too. Such as in this paper, the possible pattern equals 190 patterns (duplicate pattern not included). So in this paper, the researchers develop Visual Basic for Application (VBA) coding on Microsoft Excel programs can help find patterns of plant layout with transport cost as low as possible and also reduces repetitive calculation errors.

Index terms - Plant Layout Design, CRAFT Methods, VBA, Transportation Cost.

I. INTRODUCTION

Currently, industry in Thailand is highly competitive in terms of production capacity and the cost of production. Especially in terms of costs, the business has competitive advantage in selling price. The entrepreneurs try to reduce the cost of production in every way. One of them is the plant layout design, the implementation of an industry to focus on placement of equipment or materials use in production because it is directly involved with the cost incurred and efficiency of the production process. If the placement of equipment or materials in the proper position. It can help to reduce the cost of production is also increasing its production capabilities.

One method to form plant layout optimal is Computerized Relative Allocation Facilities Technique methods (CRAFT) (Armour G. C., Buffa E. S.,1963), work to improve the existing layout or initial layout by interchange 2 or 3 department to get the most suitable factory layout. The conditions to interchange department, which department switching positions must have equal areas or adjacent border and excluding duplicate layout. In calculating and arranging plant layout with this hand, the designer will be calculate and compared repeatedly depend on a number of department in layout, so there is a probability that the error occurs because of person. The researcher bring VBA on MICROSOFT EXCEL to help calculate and compare iterations, make users simplify and calculation time down.

II. CRAFT METHODS WITH EXCEL

CRAFT is an algorithm developed to optimize the factory layout. The aim is to find the lowest Transportation Cost (TC) between departments (Kiran, 2016), according equation (1). This research focus on initial layout in Table 1. show width and length of 20 department, respectively. The plant layout width is 60 meters and length is 90 meter, which layout pattern (duplicate pattern not include) is = 190 pattern. Table 2. Represents product flow between departments including TC occur. Show in Table 3.

Table.1 Initial layout data show the dimension of each department

Department	W*	L**	Area	Department	W	L	Area
A	27	9	243	L	30	18	540
B	27	6	162	M	21	18	378
C	9	27	243	N	6	27	162
D	29	6	162	P	24	9	216
E	27	6	162	R	9	27	243
F	6	27	162	S	45	15	675
G	3	27	81	T	24	24	576
H	3	27	81	U	24	15	360
j	3	27	81	V	9	27	243
k	18	12	216	W	27	15	405

W* = Width, L =Length**

$$\text{Minimize } C = \sum_{i=1}^{n}\sum_{j=1}^{n} f_{ij}\, c_{ij} d_{ij} \qquad (1)$$

Where, C is total TC occur in layout
fij is material/product flow from department i to department j
cij is material handling cost from department i to department j
dij is center to center from department i to j with rectilinear distance measure

Table.2 From-to chart show product flow between department in hundreds of unit load per trip

From-to	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W
A		1.2	0.8	0	0	0	0	0	0	0.6	0.8	0	0	0.8	0	0	0	0	0	0
B	1.2		0.8	16.3	0.3	0	9.3	0	0.8	0.9	0	0	0	0	0	0	0	0	4.6	0
C	0.8	0.8		0	0	1.3	0	0	2.1	2.6	0	0	0	8.7	0	0	0	0	9.1	0
D	0	16.3	0		0.6	3.8	0.5	0	1.3	0	0	0.7	0	0	0	0	0	1	10.5	0
E	0	0.3	0	0.6		0	1.5	0.9	0	0.6	0	0	0	0	0.9	0	0	0	0	0
F	0	0	1.3	3.8	0		4.1	0	0	0	0	0.3	0	0	0	0	0	0.7	0	0
G	0	9.3	0	3	1.5	4.1		16	0	1.1	0	0	0	0.6	0	0	0	1.1	0	2.5
H	0	0	0	0	0.9	0	16		0	0	0	0	0.4	0	0	0	0	0	3	2.23
J	0	0.8	2.1	1.3	0	0	0	0		0	0	0	0	3	0	0	3	0	0	0
K	0.4	0.9	2.6	0	0.6	0	1.1	0	0		0.3	8	0	12.4	1.6	0	0	0	3.5	0
L	0.8	0	0	0	0	0	0	0	0	0.3		1.5	0	8	0.8	1.5	3.5	0.9	0	0
M	0	0	0	0.7	0	0.3	0	0	0	8	1.5		0	0	1.1	0	11	0	5.6	0
N	0	0	0	0	0	0	0	0.4	0	0	0	0		5	0.4	5	0	0.4	0	0
P	0.8	0	8.7	0	0	0	0.6	0	0.5	12.4	0.2	0	0.5		6.5	0	0	.6	0	0
R	0	0	0	0	0.9	0	0	0	0	1.6	0.8	1.1	0.4	6.5		0	3.5	0	0	0
S	0	0	0	0	0	0	0	0	0	0	15	0	0.5	0	0		10	0	0	0
T	0	0	0	0	0	0	0	0	5	0	3.5	0	10	0	3.5	10		0	5	0
U	0	0	0	1	0	0.7	1.1	0	0	0	0.9	0	0	0.6	0	0	0		3.2	0
V	0	4.6	9.1	10.5	0	0	0	5	0	3.5	0	3.6	0	0	0	0	5	3.1		0
W	0	0	0	0	0	0	2.5	22.3	0	0	0	0	0	0	0	0	0	0	0	

Table.3 From-to chart show material handing cost in bath per trip

From-to	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W
A		.015	.015	0	0	0	0	0	0	.026	.014	0	0	.015	0	0	0	0	0	0
B	.015		.012	.015	.026	0	.015	0	.015	.015	0	0	0	0	0	0	0	0	.015	0
C	.015	.012		0	0	.017	0	0	.015	.015	0	0	0	.015	0	0	0	0	.015	0
D	0	.015	0		.018	.015	.015	0	.018	0	0	.02	0	0	0	0	0	.015	.015	0
E	0	.026	0	.018		0	.015	.015	0	.026	0	0	0	0	.015	0	0	0	0	0
F	0	0	.017	.015	0		.015	0	0	0	0	.015	0	0	0	0	0	.015	0	0
G	0	.015	0	.015	.015	.015		.015	0	.017	0	0	0	.016	0	0	0	.015	0	.015
H	0	0	0	0	.015	0	.015		0	0	0	0	.015	0	0	0	0	0	.015	.015
J	0	.015	.015	.018	0	0	0	0		0	0	0	0	.015	0	0	.015	0	0	0
K	.026	.015	.015	0	.026	0	.017	0	0		.012	.015	0	.015	.012	0	0	0	.015	0
L	.014	0	0	0	0	0	0	0	0	.012		.015	0	.015	.012	.015	0	0	.015	0
M	0	0	0	.02	0	.015	0	0	0	.015	.015		0	0	.015	0	.015	0	.015	0
N	0	0	0	0	0	0	0	.015	0	0	0	0		.016	.026	.012	0	0	0	0
P	.015	0	.015	0	0	0	.016	0	.015	.015	.015	0	.016		.015	0	0	.015	0	0
R	0	0	0	0	.015	0	0	0	0	.012	.012	.015	.026	.015		0	.015	0	0	0
S	0	0	0	0	0	0	0	0	0	0	0	0	.12	0	0		.12	0	0	0
T	0	0	0	0	0	0	0	0	.015	0	0	.015	0	0	.015	.012		0	.015	0
U	0	0	0	.015	0	.015	.015	0	0	0	0	0	0	.015	0	0	0		.012	0
V	0	.015	.015	.015	0	0	0	.015	0	.015	.015	.015	0	0	0	0	.015	.015		0
W	0	0	0	0	0	0	.015	.015	0	0	0	0	0	0	0	0	0	0	0	

From Figure.1 show an overview, plant layout design methodological with CRAFT methods. The need to have information on the initial layout, material/product flow, and material handing cost interdepartmental for consider TC occur in layout. The goal is lowest cost in layout or cannot improve that. Then CRAFT in EXCEL get all required data, such as dimension of each department, the program will be converted size into a grid. Create a grid along the length and width of the department, show the placement on output display. This paper define grid size as 1 meter x 1 meter and program started at cell position in EXCEL is cell (1, 1). Show in Figure.2 and Figure.3

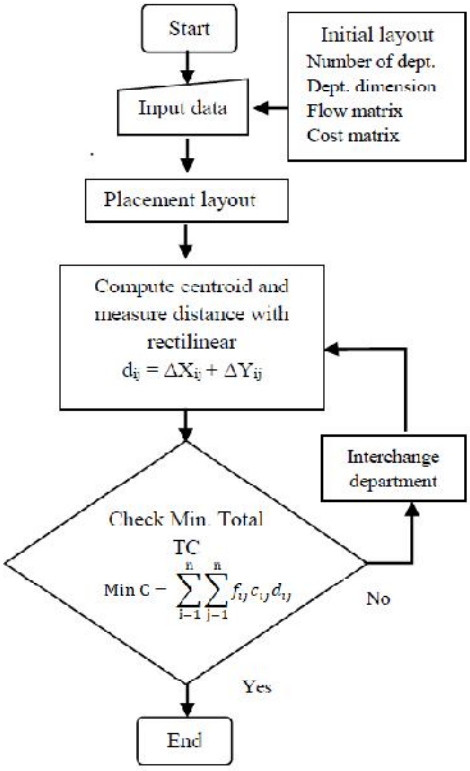


Figure 1: Overview CRAFT methods

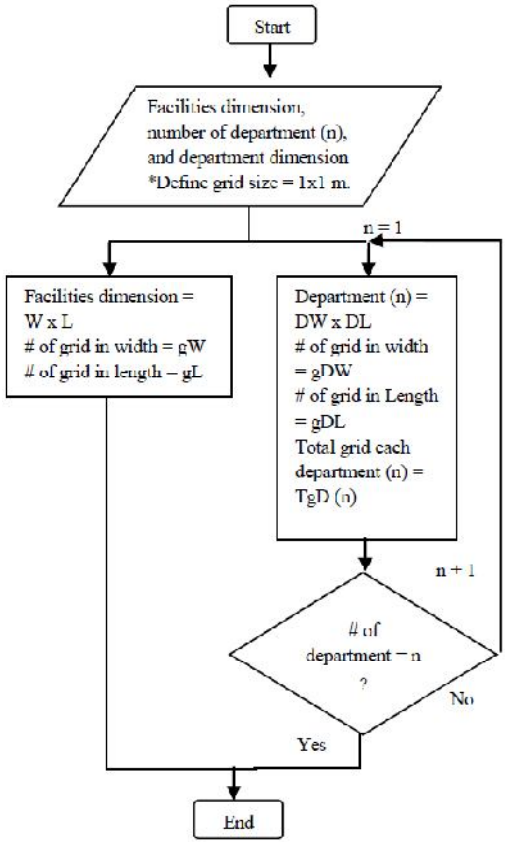


Figure 2: Flow process convert layout and department data into a grid

Figure.4 shows the procedure for determining the centroid of each department function.When calculating, the program will store the result into centroid matrix. Continuation of the procedure to find the centroid point. Figure.5 is flow chart show function for measure rectilinear distance between the centers of department, and keep the result into distance matrix, in order to compute TC.

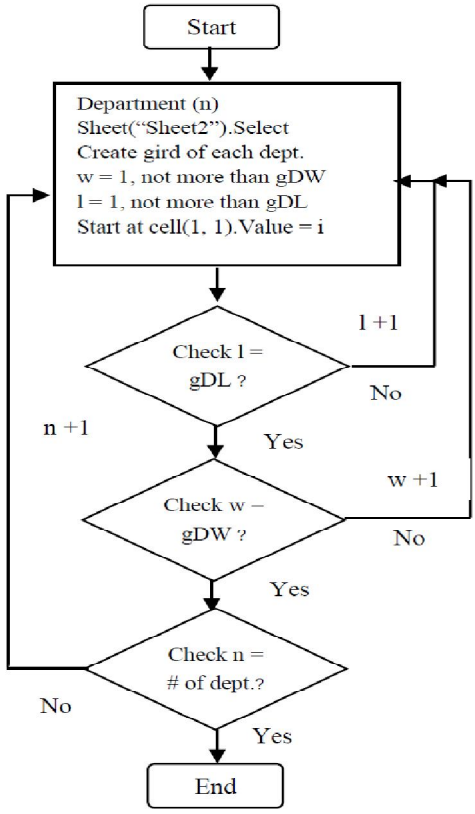


Figure 3: The positioning of any department in layout follow grid by grid function

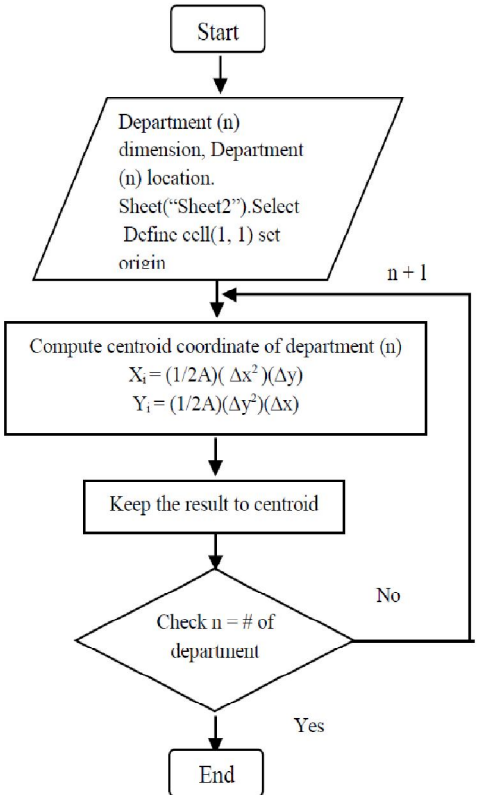


Figure 4: Calculating centroid function

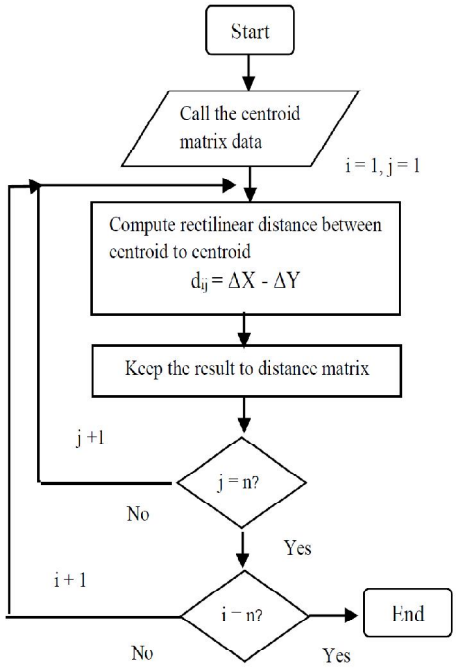


Figure 5: Calculating rectilinear distance function

CONCLUSION

This paper report some procedure to coding VBA with EXCEL for develop CRAFT layout design. Which is in the process of development to have the most completely. It is expected that the research, when successful, this research is very beneficial to students and researchers, including those affiliated with the plant layout design.

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