

# PLANT LAYOUT OPTIMIZATION IN CRANE MANUFACTURING USING CRAFT: LITERATURE SURVEY

<sup>1</sup>Harshrajsinh.B.Kher, <sup>2</sup>Jalpa Zalawadia, <sup>3</sup>Prashant Khanna  
<sup>1</sup>PG Scholar, <sup>2</sup>Assistant Professor, <sup>3</sup>Assistant Professor  
<sup>1</sup>Industrial Engineering,  
<sup>1</sup>Parul Institute of Technology, Limda, Vadodara, India

**Abstract:** Plant layout is a major factor to increased Productivity. This paper presents a review on different tools for optimizing plant layout. The main aim is to improve existing layout of crane manufacturing industry. After studied of different tools, we are selected CRAFT to improve existing layout of crane manufacturing industry.

**Index Terms – Plant Layout, CRAFT**

## I. INTRODUCTION

Plant Layout is a major factor to increased productivity in any organization. Plant layout is a floor plan of the physical facilities which are used in production. The plant layout consists of mechanical units, machines, material handling devices the path of the product and raw material movement, production flow and the distances between the departments. The main objective of plant layout is to minimize material handling cost; minimize material handling distance, utilization of available resources.

The various tools used for the plant layout optimization are described below.

### A. SLP

SLP is an acronym of Systematic Layout planning .It is a Step by step method which is developed by Muther. In SLP once the appropriate information is gathered, a flow analysis can be combined with an activity analysis to develop the relationship diagram. The space relationship diagram is constructed by combining space consideration and relationship diagram. Based on the space relationship diagram, modifying consideration and practical limitations, a number of alternative layouts are developed and evaluated.SLP is shown in figure.

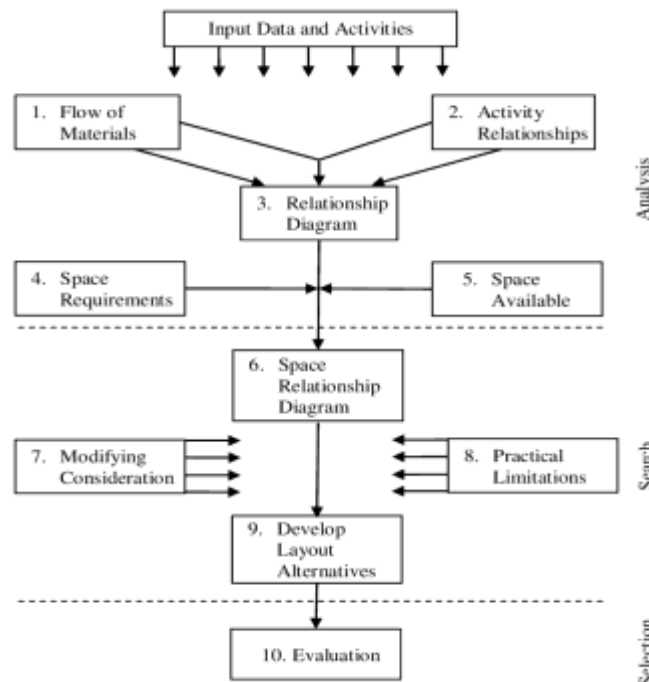


Figure.1 Systematic layout planning procedure

**B.CRAFT**

CRAFT is an improvement type algorithm which is developed by Armour and Buffa. It starts with an initial layout and improves by interchange the pair wise department so that the material handling cost is minimized. The algorithm continues until no further interchanges are possible to reduce the material handling cost. The procedure of CRAFT algorithm is described below:

- Place the initial layout on coordinate system.
- Compute centroid of departments in the initial layout.
- Form distance matrix using the centroid.
- Compute the material handling cost by multiplying flow, distance and cost matrix.
- CRAFT then consider all the possible two ways or three ways department exchanges and identify best “exchanges”.
- Repeat all the steps until minimum material handling cost obtained.

CRAFT has following limitations.

- It cannot handle a change in material flow. It assumes the material flow is deterministic. For different material flow it creates different layout. Each layout is only used for a specific situation.
- The improvement algorithms cannot generally consider a negative “X” relationships.
- Architectural influences and other quantitative factors are very difficult to consider. They are usually ignored.

**C.ALDEP**

ALDEP is constructive type algorithm. It use basic data on facilities and builds a design by placing the departments in the layout. After placing all departments in the layout, a score is obtained. Score is the sum of the closeness rating values of different neighboring departments in the layout. This algorithm is repeated till the maximum layout score obtained based on that the best layout is selected. The input data of ALDEP are Length and width of the layout, total number of departments, area, sweep width, relationship chart and minimum department preference value, number of iteration to be performed and location and size of each restricted area in the layout if present. Selection procedure of ALDEP:

- Randomly select a department.
- Add a department with an important relationship with previous departments. If none, add an unimportant department randomly.
- Continue until all departments are added.

**D.CORELAP**

CORELAP is a computerized constructive type algorithm. It was developed by R.C.Lee and interactive version was developed by James Moore. General approach is to select highest closeness rating department first, and place it at the center of the layout. After the first department is placed, then the having highest closeness relationship with the departments which are already placed is selected and placed in the best adjacent location to the previously placed departments. CORELAP builds the layout from centre. The symbols used in closeness relationship for CORELAP is mention below:

- A = Absolute necessary.
- E = especially important.
- I = Important.
- O = Ordinary closeness OK
- U = Unimportant
- X = Not desirable.

**II. LITRETURE SURVEY**

The literature survey is consisting various research paper which explain the usefulness of different methods for optimizing plant layout. We are going to review on different method for using design or redesign of plant layout which is used for improve productivity or increasing productivity in any industry. The importance of different methods or techniques is explained by various authors in this survey.

Vivek .A .Deshpande et al [1] found problems in existing layout such as material handling cost consume lots of effort, high material handling time. CRAFT is used for improvement of existing layout. They are found less improvement in material handling cost. Further, they are used ALDEP method. By using ALDEP, they are proposed new layout. They are found 23% improvement in existing layout by ALDEP.

Vishnu Narayanan et al [2] used CRAFT for optimize initial layout. They are suggested that production rate and the utilization of machines depend on how well the various machine, production facilities and employee’s amenities are located in the plant.

Annant dhawan et al [3] described Layout determines the way in which materials and other inputs flow through operation. They are used CRAFT for improvement of existing layout. They are present that a good layout keep low cost and reduce unnecessary material handling while maintaining the product flow through the facility. By using CRAFT they are improved 18% material handling cost in existing layout. Also found that distance travelled by material is reduced to 374m from 403m.

Bobby John et al [4] used CRAFT for proposed new layout. The model of the proposed improvement layouts will be molded using ARENA. By using CRAFT, they are reduced material handling cost from 3955 to 3905.

Damir Belic et al [5] described Bloch-Schmigalla method for plant layout optimization.

Olusegun Kazeem Lekan et al [6], M.Vykunta Rao et al [7], Hari Prasad.N et al [8], Vandit Hedau et al [9] described that CRAFT is a best methodology for improvement existing layout. Hari Prasad.N et al [8] used Java program has been developed to design the optimum layout by considering STEP file as input for developing an optimum layout. M.Vykunta Rao et al [7] and Hari Prasad.N et al [8] applied CRAFT in different five periods for improvement of existing layout. Vandit Hedau et al [9] took density based criteria to optimize overall performance of organization layout.

S.Amal et al [10], Vivek .A. Deshpande et al [12], Ranjith R Hombal et al [13], Mr.Virendra Patil et al [14],Dileep Pandalai et al [15] described CRAFT is used for minimizing material handling cost very effectively. S.Amal et al [10] proposed Rank order clustering for part family. Further, the improvement layout analyzed using ARENA Software. Wilson R. Nyemba et al [11] used different techniques as improvement of existing layout such as work study, production planning and control techniques for material handling improvement, processing and assembly introduced to improve production throughput time.

Ameha Mulugeta et al [16] used CRAFT and CORELAP for proposing new layout. This study offers benefit that can be achieved with federated usage of construction algorithm of layout design with improvement algorithm.

Manoj Shanthpure et al [17] designed plant layout in a three stage by using SLP.SLP is an acronym of Systematic Layout Planning. SLP is used for designing small unit of plant layout.

Leonardo et al [18] described CRAFT and BLOCPLAN algorithms for improvement and comparing them. New Layout is suggested by BLOCPLAN algorithm. By using CRAFT, they are reduced 3.5% flow distance, by using BLOCPLAN; they are reduced 6.2% flow distance. By using CRAFT, they are improved 1.15% in material handling cost, while using BLOCKPLAN; they are improved 2.4% in material handling cost.

Raqeyah Jawad Najy et al [19] described different tools of designing or redesigning plant layout, also described limitation of each tools.

### III. CONCLUSION

There are various method used for designing or redesigning plant layout. CRAFT is widely used then other tools. When we have an existing layout for improvement then CRAFT is used. When we have to build new layout then ALDEP, CORELAP and SLP are concerned. For minimizing distanced travelled by materials CRAFT is a major concern. Plant layout design tools helps to minimize throughput production time, minimize investment in equipment and utilization of available resources and utilize existing space most effectively.

### IV. FUTURE WORK

Authors are currently working in Oswal machinery ltd, G.I.D.C, Anand, Gujarat which is crane manufacturing company. The product is different types of crane, which is used in Material handling. The study of different types of plant layout tools have been carried out and now with the help of CRAFT, Optimization of plant layout has been targeted.

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