A PROJECT REPORT

ON

"IMPLEMENTATION OF PLANT LAYOUT USING SLP METHOD "

Submitted by

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In partial fulfillment for the award of the Degree

Of

BACHELOR OF ENGINEERING

IN

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UNDER THE GUIDANCE

Of

PROF. ALTAMASH GHAZI

DEPARTMENT OF MECHANICAL ENGINEERING

ANJUMAN-I-ISLAM

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CERTIFICATE

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APPROVAL OF DISSERTATION

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Date: _____

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ABSTRACT

The objective of this thesis is to improve the facility layout of manufacturing firm using Systematic Plant Layout (SPL) or Systematic Layout Planning (SLP) and im- plementation of 5S. This project is conducted at **SANCO VALVES PVT. LTD, GHANSOLI** where various valves like Gate , Globe , Check , Butterfly , Swing check , etc. products are manufacturing company located at New Mumbai. The major problem faced by this firm is inventory control, scrap management, store management, poor utilization of space, poor material handling. There is high flow intensity between the departments which have high interrelationship. This leads to high travelling time which increases the travelling cost which in turn decreases the overall productivity of the company.

An alternative layout is proposed by using the steps in Systematic Plant Layout, which is the systematic way of generating layout alternatives. The proposed layout involves optimizing the departments which have high interrelationship and close to each other. The proposed alternative layout is further evaluated by using Pugh ma- trix. The layout is chosen based on the performance measures which have the most significant improvements in the facility. Later after implementing the modified lay- out 5S is also implemented simultaneously based on the steps as discussed in this thesis to manage the facility.

CONTENTS

List Of Figures :

Chapter 1

Introduction

1.1 Problem Definition:

Sanco Valves Pvt Ltd, New Mumbai a fabricated company is located at Ghansoli. This company produces various types of valves for the industrial use like globe valve, gate valve, non return valves, flow control valves, etc. They also have a workshop located in Silphata where the cast parts are machined and further processed till the finished product not achieved. The valves in this facility are manufactured by going through various processes like raw material handling, marking, machining, drilling, welding, assembly, testing, painting, packing, storing. All the processes are held at different places which causes the increase in material handling time and increase in material flow time from one place to another hence productivity becomes less and cost of operation increases.

Fig 1.1 Sanco Valves Pvt Ltd


IS
IS
IS
IS

1.2 Objective of the study:

> To study the current material flow pattern and the relation between departments of the overall plant layout.

> To develop the alternative plant layout.

> To propose an appropriate and better inventory and scrap storage system.

> To implement the SLP method in the plant.

> To measure the improvements after implementing SLP method

> To increase the efficiency and productivity of the plant.

1.3 Scope of the study:

The scope of this study focuses on the increased productivity and efficiency of the plant and optimizing the plant by reducing its material handling time and cost of operations. The SLP method will be utilized in this case study to understand the relationship between each department and to propose an alternate improved plant layout

1.4 Significance of the study:

An approach from Muther (1973), Systematic Layout Planning (SLP) is used as the improvement method. It uses graphical illustrations and builds up a proximity matrix that represents the closeness of every facility. Flow charts can also be developed showing quantitative relationships. From the above proximity matrix, a trial and error method can be used to generate the layout.

1.5Company Background:

1.5.1Introduction:

Sanco Valves Pvt Ltd is a leading manufacturers and supplier of the industrial valves located In Navi Mumbai India.

We have professional experience of 12 years in valve Industry

At Sanco we take great pride in meeting your industrial valve requirements,
Promptly and efficiently.

We make valves to exacting specifications with utmost Care and quality components. Through continuous process of our products refinement and development, we have Enhanced our product Range, which is listed below.

Sanco is managed by a team of qualified personnel with extensive experience in Valve manufacturing for both up stream and downstream Oil & Gas sectors in India.
Since its inception, Sanco has created its own quality standards employing strict specifications at each stage of product development & manufacturing ensuring
That every component is precise and reliable Sanco aims at consistent quality and total customer satisfaction through rigid Inspection, at Sanco you don't have to pay a premium for quality.

1.5.2Plant layout of the company:

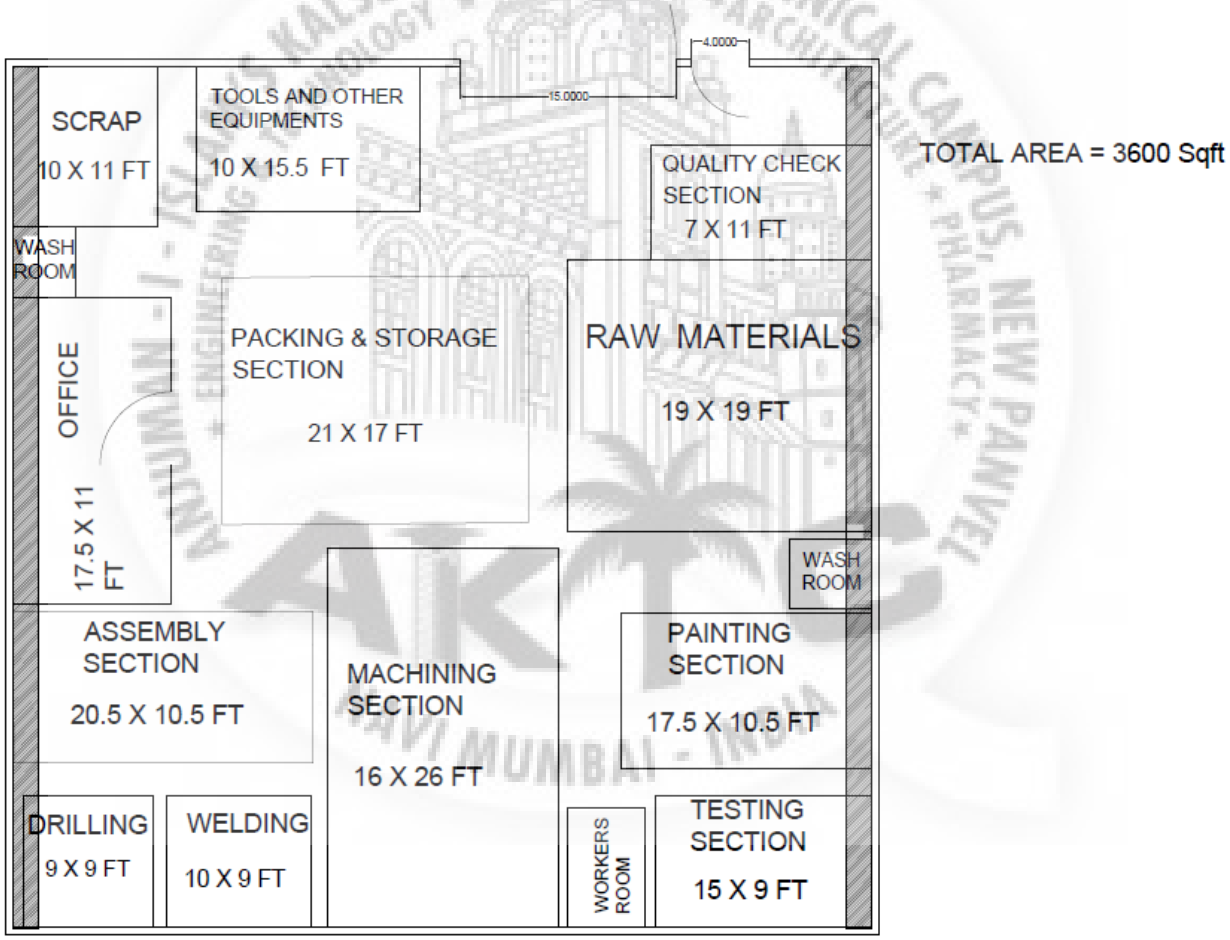


Fig 1.2 Existing Layout

1.6Conclusion:

In the beginning of this chapter, an overview of the facilities layout planning and its importance to existing companies is written to further enhance the importance for using it as the main principle for this project. The objectives are also defined to be linked to the deliverables in this case study. The boundary of this project is also defined based on the statement of problem. Some justifications of conducting this case study and its importance is also discussed.

Chapter 2

Literature Review

2.1 Introduction:

This chapter in the thesis discuss about the different literature review and different methods to identify the process for Systematic Plant Layout and 5S system can be implemented.

2.2 Literature Survey:

Sr. No.	Title and Author	Methodology	Findings
1.	Case study on improvement in plant layout design -Devshri D. Thakre, Uday A. Dabade , 2017	In this study, various solution methodologies like exact procedures, heuristics and meta-heuristics are used to solve the facility layout problems optimally.	From the proposed layout they have observed improved closeness rating between departments, minimum material flow and increase in space utilization.
2.	Plant layouts' analysis and design -Okpala, Charles Chikwenduand and Chukwumuanya, Okechukwu, 2016	In this study, they have compared various types of plant layout designs such as Process, Product, Cellular and Fixed position layout.	This explains the need to have a good designed functional plant layout that will be able to switch from one line of product to another without major alternations.
3.	Efficiency improvement of a plant layout -Vivekanand S. Gogi, Rohit D., Shashi Kiran K., Suhail M. Shaikh, 2014	They have used the string diagram to observe the movements of equipments, materials, workers and essentials.	This paper shows that the choice of which type of facility layout to adopt can have a significant impact on the long-term success of a firm.
4.	Design and improvement of plant layout -Ram D. Vaidya and	In this study, the SLP (Systematic Layout Planning) method is used to solve the problem of material handling of the	It is found that the distance from the raw material storage to the cutting and fabrication sections are reduced and accidents from

	Prashant N. Shende, 2012	rollers and pipe shells.	the objects during transportations are also reduced. Also the minimum material flow helped to increase the productivity of the firm.
5.	A review of procedural approaches available for handling the layout problems -Monika, Ashwini Mor, 2016	In this study, various techniques to solve the layout problems are briefly discussed.	In this paper, five procedural approaches have been analyzed and they are as follows: Apple's plant layout procedure, Immer's basic layout planning steps, Nadler's ideal systems approach, Systematic Layout Planning by Muther, Reed's plant layout procedure.
6.	Design and simulation plant layout using Systematic layout planning -D. Sudhardini, W. Septiani and S. Fauziah, 2017	In this study, SLP method is used to solve the layout problems and they have used the activity relationship diagram in it.	In this paper, they have designed four alternative layouts out of which three are more reliable. Because of which material handling cost has decreased and productivity has increased.
7.	Facility layout design of library using Systematic Layout Planning -Anish I, Arish Ibrahim, 2014	They have used SLP as well as CRAFT and ALDEP computer simulation tools to solve the problem.	It is found that the proposed layout has increased the performance and productivity of library functions and they have simplified the frame work also.
8.	Plant layout design with simulation -Uttapol Smutkupt, and Sakapoj Wimonkasame, 2009	They have use CRAFT technique associated with the Microsoft Visual Basic and a simulation system called Arena to solve the limitation of the technique.	It is found that the limitation of the CRAFT technique is removed by using a simulation system called Arena and it gives the accurate results also to

			solve the problems.
9.	Solving the failure-to-fit problem for plant layout by changing department shapes and sizes -Lin et al, 1996	Apply Artificial Intelligence to Facility Layout Planning.	AI could solve the scenario of failure to fit solutions, when no feasible layouts are generated.
10.	Plant layout optimization of oven manufacturing unit using CORELAP algorithm -M Rajesh, N V R Naidu, P Naveen Kumar, 2011	They have used the CORELAP algorithm to solve the FLP.	This paper consists of implementation of SLP in oven manufacturing industry using CORELAP.

2.3 Review of Literature Survey:

2.3.1 Case study on improvement in plant layout design-Devshri D. Thakre, Uday A. Dabade , 2017

Case study taken in this paper is of one of the MNC. Systematic Layout Planning (SLP) method has been applied which gives solution in terms of minimized travelling distance and reduced material handling. Analysis of previously designed layout and final layout came out of Systematic Layout Planning (SLP) showed that material flow throughout the plant area is reduced by 38.2% and additional 70 square meters of area is created for kitting.

2.3.2 Plant layouts' analysis and design-Okpala, Charles Chikwenduand and Chukwumuanya, Okechukwu, 2016

The paper examined in detail the various types of plant layout, their advantages and disadvantages, the design of a functional plant layout, as well as the numerous benefits of a well designed layout. The paper provided a detailed definition of plant layout; and listed efficient labor utilization, manufacturing and maintenance ease, enhanced productivity, manufacturing flexibility, effective utilization of staff, machines, materials, and equipment, as well as reduction of accidents, hazards, and inventory handling cost as some of the benefits of a well-designed plant layout.

2.3.3 Efficiency improvement of a plant layout-Vivekanand S. Gogi, Rohit D., Shashi Kiran K., Suhail M. Shaikh, 2014

This research paper has provided a good exposure to facility planning and layout designs for the improvement of the efficiency. The study of layout has become extremely important. The most common objective of layout design, that is to minimize distance travelled, is not always suitable for all the manufacturing industries. Congestion in a specific area may have to be tolerated while maintaining minimum separation between facilities.

2.3.4 Design and simulation plant layout using Systematic layout planning-D. Sudhardini, W. Septiani and S. Fauziah, 2017

This research aims to design the factory layout of PT. Gunaprima Budiwijaya in order to increase production capacity. The problem faced by this company is inappropriate layout causes cross traffic on the production floor. The re-layout procedure consist of these three

steps: analyzing the existing layout, designing plant layout based on SLP and evaluation and selection of alternative layout using Simulation Pro model version 6. Systematic layout planning is used to re-layout not based on the initial layout. This SLP produces four layout alternatives, and each alternative will be evaluated based on two criteria, namely cost of material handling using Material Handling Evaluation Sheet (MHES) and processing time by simulation. The results showed that production capacity is increasing as much as 37.5% with the addition of the machine and the operator, while material handling cost was reduced by improvement of the layout. The use of systematic layout planning method reduces material handling cost of 10, 98% from initial layout or amounting to Rp1.229.813, 34.

2.3.5 Facility layout design of library using Systematic Layout Planning-Anish I, Arish Ibrahim, 2014

In this study, layout planning of facilities in a library becomes an inevitable activity which influences the performance and productivity of library functions. The decisions about layout have long-term consequences such that they must be made with careful planning. CRAFT and ALDEP computer simulation tools in Systematic layout planning approach is used and modified to meet the design objectives of library facility layout design which leads to maximum satisfaction to the employees, management, and library users. The framework is simplified such that the application to an existing layout modification can be easily executed. The inclusion of considering cost factors and multi-floor facility problem solving methods to the framework will make it more advanced and advantage tool in the field of layout design.

2.3.6 Plant layout design with simulation-Uttapol Smutkupt, and Sakapoj Wimonkasame, 2009

In this paper, the simulation technique is added to plant layout design to show more information about the design such as total time in system, waiting time, and utilization. To add the simulation to a plant layout design, Microsoft Visual Basic is used to develop a design system based on CRAFT model. Then, it is used to link the design system to a simulation system in Arena. Finally, the simulation system send back overall results to a report system in Microsoft Visual Basic output form. From Arena report, there are so many outputs shown. As a result, Microsoft Visual Basic report is used for getting back important results from Arena to show in VB report.

2.3.7 Plant layout optimization of oven manufacturing unit using CORELAP algorithm-M Rajesh, N V R Naidu, P Naveen Kumar, 2011

They have proposed the plant layout optimization by using CORELAP algorithm. For this study they have try to apply this method in oven manufacturing. By using activity relationship diagram and total closeness rating(TCR) they have proposed different layouts and calculated the layout score for each individual layout and they have considered the layout having the highest score and by applying that they were able to minimize the total surplus area by 8.83%.

2.4 Conclusion:

From the study of the above literature survey it can be concluded that there have been numerous research activities in the area of layout design. There also have been a number of algorithms developed. So we have studied two types of approaches. Algorithmic approach and procedural approach.

Algorithmic approaches usually involve quantitative data(P Naveen Kumar, 2011, Sakapoj Wimonkasame, 2009). The output from this approach often need further modification in order to satisfy detailed design requirement such as departmental shapes, utilities supply, material handling system, work in progress storage, space utilization, etc. but many companies avoid to adopt this approach as their design methodologies because it demands pre-requisites like advance training in mathematical modeling techniques for designer.

Procedural approaches can incorporate both quantitative and qualitative objectives in the design process (D. Sudhardini, 2017, Prashant N. Shende, 2012, Muther, 1973, Apple, 1997). In this approach, the design process is divided into several steps that are then solved sequentially. An experienced designer can give the optimum alternative layout design through this approach.

Systematic Layout Planning (SLP) is a procedural layout design approach. The process is very straight forward. This layout procedure that was developed by Muther in 1973 is very popular and is frequently used. This process requires the facility planner to develop many different charts and diagrams. This can be seen as an advantage of this process since people tend to understand a process more easily if they can visualize it.

Chapter 3

Problem Identification

3.1 Introduction

This chapter discusses about the identification of area where facilities layout planning is to be implemented. Process flow diagram and from-to-chart will be used to determine relations between various departments.

3.2 Flow Of Materials

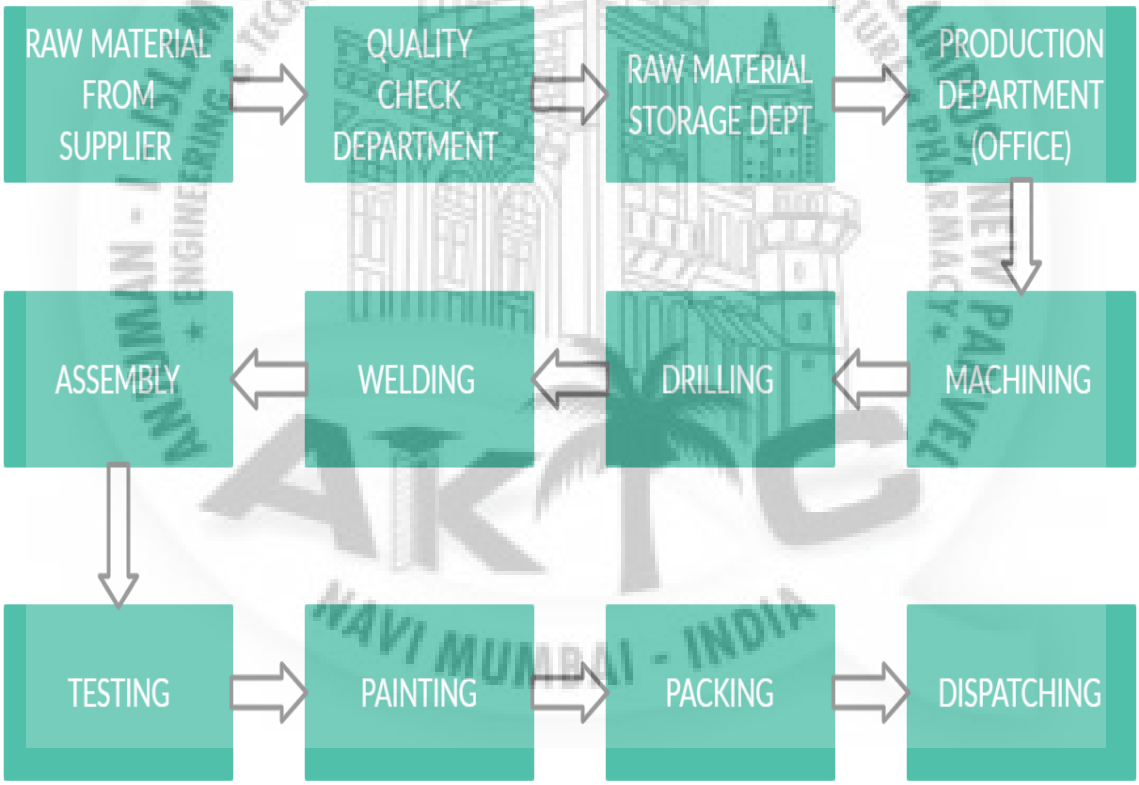


Fig 3.1 Flow Of Materials

3.3 Process Flow Chart

A process flow diagram (PFD) is a diagram commonly used in chemical and process engineering to indicate the general flow of plant processes and equipment. The PFD displays the relationship between major equipment of a plant facility and does not show minor details such as piping details and designations. Another commonly used term for a PFD is a flowsheet.

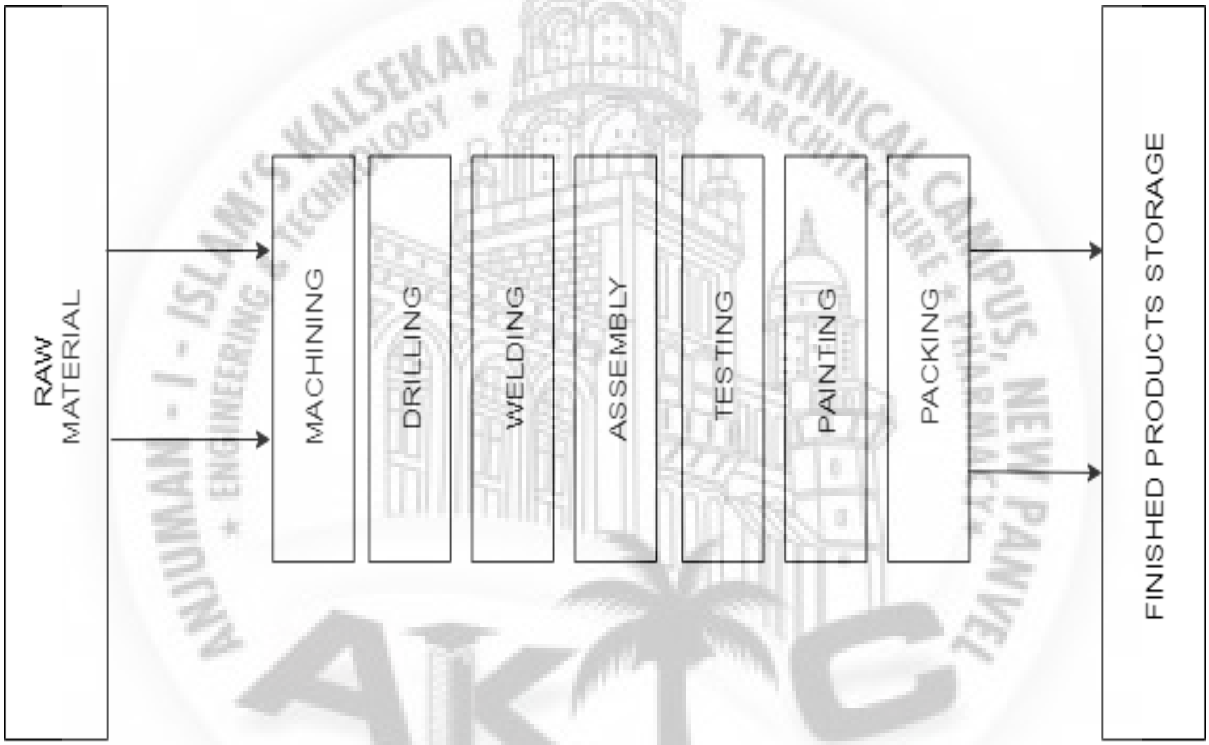


Fig 3.2 Process Flow Chart

3.4 From-To-Chart

The From-To-Chart is a popular tool for material flow analysis. It represents the flow intensity between each process. The more the flow intensity, the more important the relationship between each process.
From the chart, we can see that cutting, fabrication and assembly have the highest flow intensity due to both products also shares the same process as shown in the chart. Painting and testing has lesser flow intensity as there is only one product for each of the process.

Based on the rule of thumb for closeness ratings, „A" represents absolutely necessary relationship and cannot be more than 5 % of the relationships. „E" represents especially important relationship and cannot be more than 10% of the relationships. „I" represents important relationship and cannot be more than 15% of the relationships. „O" represents ordinary relationship and cannot be more than 20% of the relationships. „U" represents unimportant relationship and consists about 50% of the relationships. Lastly, „X" represents undesirable relationship and consists of not more than 5% of the relationships.

3.5 Conclusions

From the analysis, Process flow chart , it is obvious that the layout of the products is a major contribution to the high cost and the high cross-over quantity. This is further justified by the flow of materials where significant flow intensity occurs within processes which are currently located far apart.

We conclude the following problems in the company:

- Improper utilization of work space area.
- Poor placement of machining equipment.
- Problem in material handling causing unnecessary increase production time.
- Several injuries of labors due to improper precautionary measures.

Therefore, in the following chapter, systematic layout planning will be used as a methodology to define analyses and synthesize the current problem faced by the company.

Chapter 4

Methodology

4.1 Introduction

In this chapter, the Systematic Layout Planning methodology is analyzed in detail for different layout alternatives generations. Basically, the SLP methodology literature has a total of 11 steps. First is input data, followed by flow of materials, activity relationships, relationship diagram, space requirements, space available, space relationship diagram, modifying constraints, practical limitation, developing layout alternatives and lastly evaluation.

4.2 Systematic Plant Layout:

The systematic layout planning (SLP) is a procedure used to set the layout of workplace in a plant notice to the logical relationship between workplace with high frequency are placed close to each other. SLP technique applied to optimize the existing layout. The application is expected to make the fastest material flow with the lowest cost and least amount of material handling [10]; [11]. Systematic layout planning consists of four stages as follows:
Stage I: Determine the location where the facility will be built
Stage II: Make overall facility design
Stage III: Determine the design of facility layout in detail (to be done in this paper)
Stage IV: Preparation and installation of design results
The input data required by Systematic Layout Planning are divided into five categories:

P (Product) : The type of product (goods/service) produced.
Q (Quantity) : Volume of each type of goods/ components produced.
R (Route) : The order of operation for each product
S (Service) : Support service, such as locker rooms, monitoring stations, etc.
T (Timing) : In what time the type of component of the product was produced

It is a step-by-step planning procedure allowing users to identify, visualize, and rate the various activities, relationships, and alternatives involved in a layout project based on input data, the flow of materials, activity of relationships and relationship diagrams. The framework of SLP is shown in below Figure.

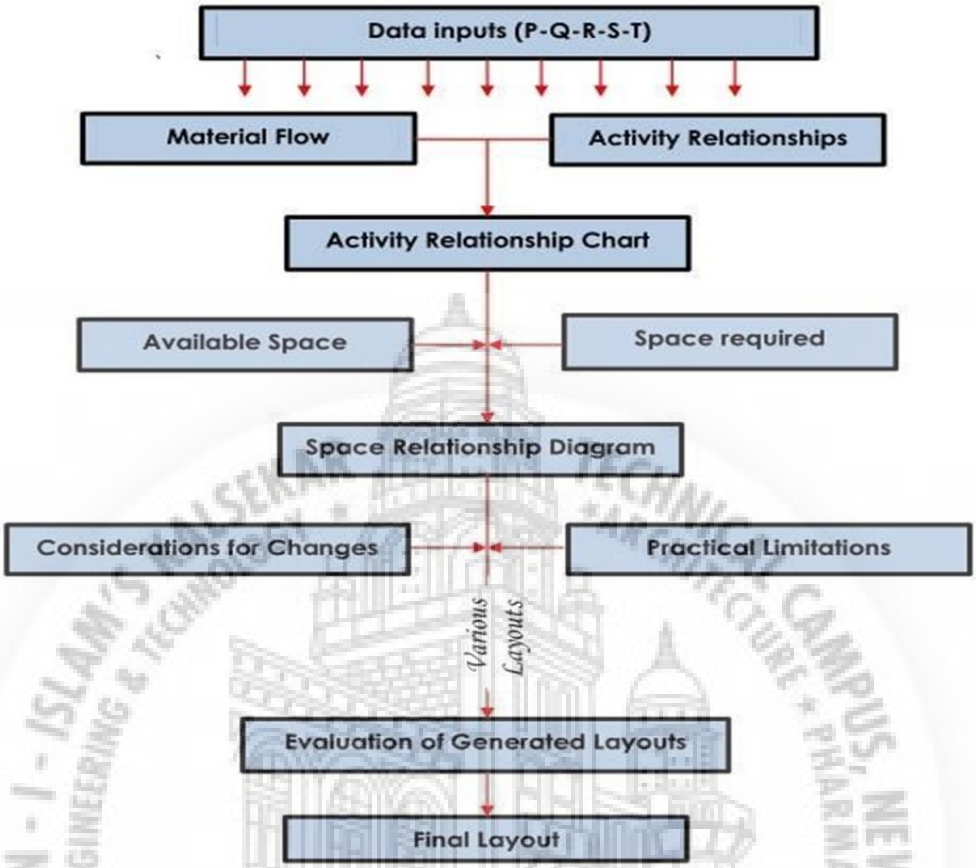


Fig 4.1 Systematic Layout General Procedure

The charts and diagrams that are constructed during this procedure, as well as the function of each, are listed below.

- From-to chart: used to quantitatively measure flows in terms of the amount moved between departments.
- Activity relationship chart: determine the relationship between departments.
- Relationship diagram: positions activities where they are actually located in a two-dimensional space.
- Space relationship diagram: same as relationship diagram, only with the space of each department included.

4.3 Activity relationship diagrame:

Activity analysis is done with the help of constructing an activity relationship diagram and activity relationship chart. An activity relationship chart is a matrix whose elements represent relationship among activities or departments. To represent desirable or undesirable level of closeness between departments letter codes are used. A for absolute necessary, E for especially important, I for important, O for ordinary closeness, U for unimportant and X for undesirable.

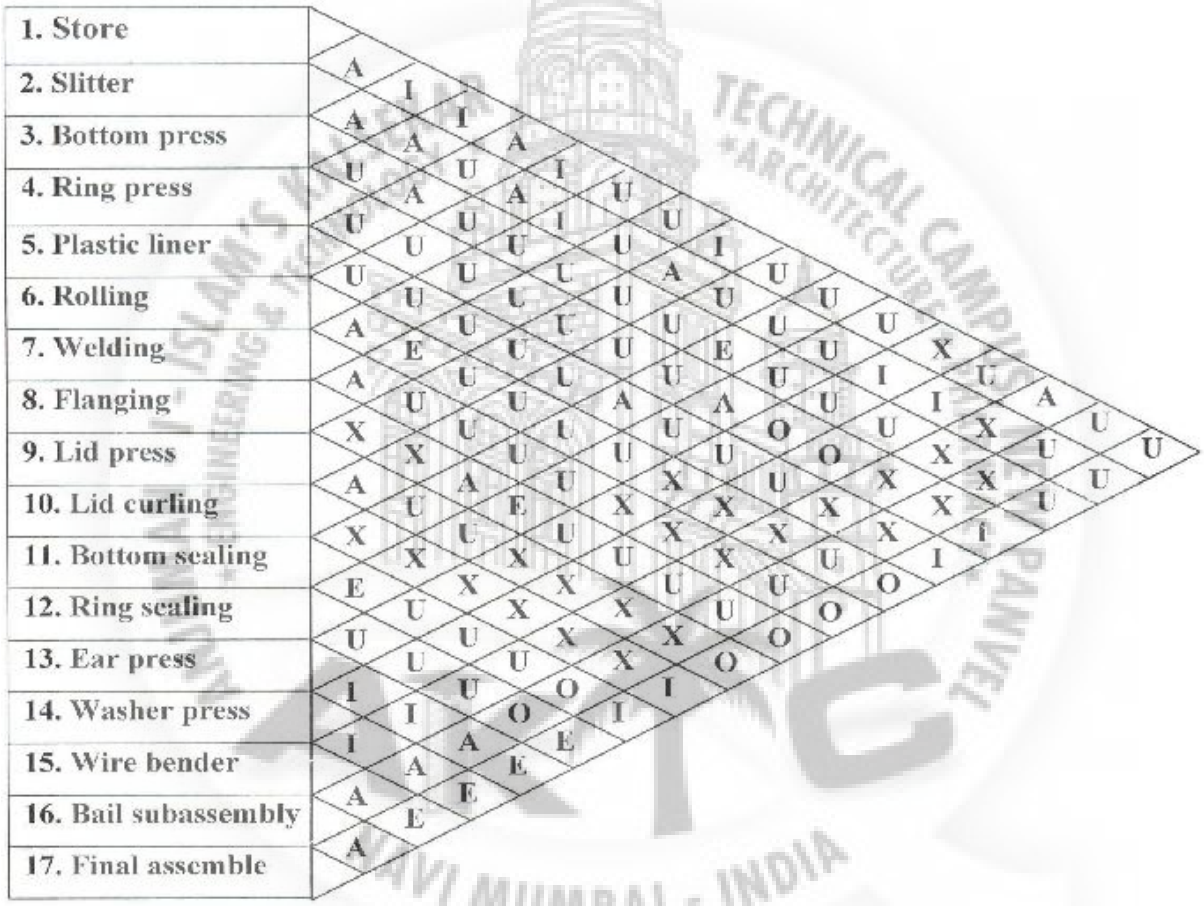


Figure 4.2 Activity Relationship diagram .

4.4 Space Relationship Diagram:

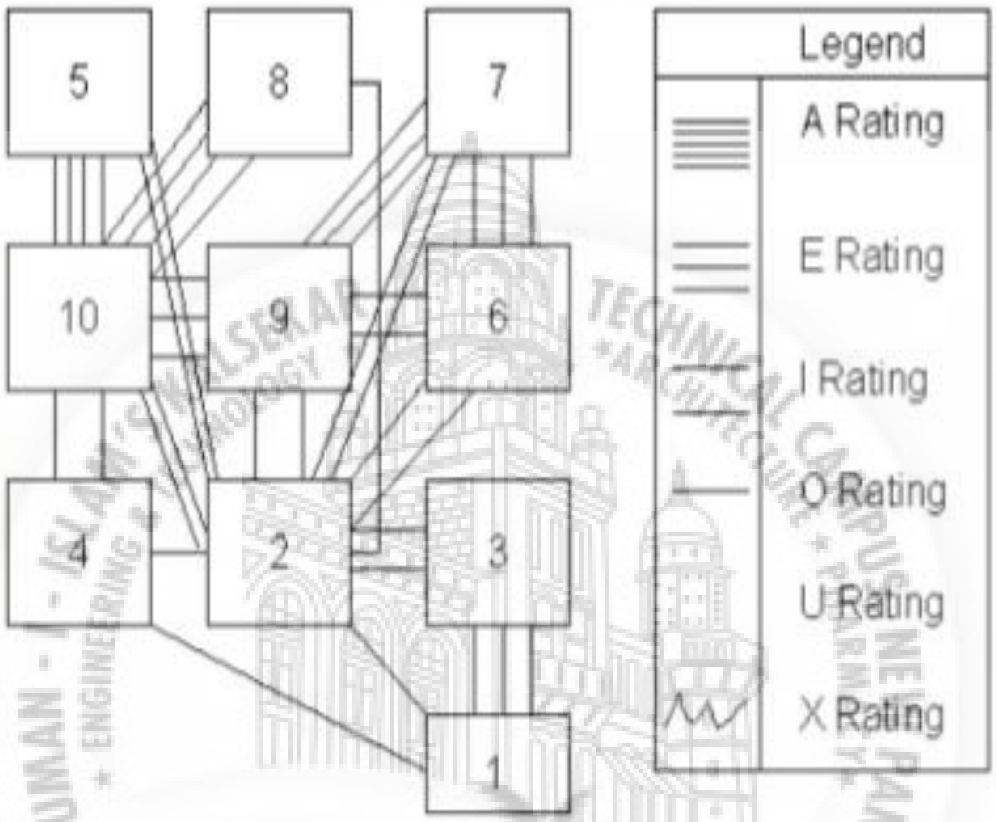


Fig 4.3 Space Relationship Diagram

4.5 Plant layout:

The modern manufacturing factories are designed to have advanced and sophisticated plant layouts. The three basic types of layouts by which production sections are organized in a plant, which are defined by the type of workflow are process layout product layout, fixed-position layout. The fourth type of plant layout which has gained wide acceptance and often regarded as a hybrid layout is called cellular layout. However, some manufacturing companies have a combination of more than one type of layouts; like setting out the area of production by cellular layout, while another section or department will be laid out by process.

4.6 Facility layout planning:

For an organization to have an effective and efficient manufacturing unit, it is important that special attention is given to facility layout. Facility layout is an arrangement of different aspects of manufacturing in an appropriate manner as to achieve desired production results. Facility layout considers available space, final product, safety of users and facility and convenience of operations.

An effective facility layout ensures that there is a smooth and steady flow of production material, equipment and manpower at minimum cost. Facility layout looks at physical allocation of space for economic activity in the plant. Therefore, main objective of the facility layout planning is to design effective workflow as to make equipment and workers more productive.

4.6.1 Facility Layout Objective

A model facility layout should be able to provide an ideal relationship between raw material, equipment, manpower and final product at minimal cost under safe and comfortable environment. An efficient and effective facility layout can cover following objectives:

- To provide optimum space to organize equipment and facilitate movement of goods and to create safe and comfortable work environment.
- To promote order in production towards a single objective
- To reduce movement of workers, raw material and equipment
- To promote safety of plant as well as its workers

To facilitate extension or change in the layout to accommodate new product line or technology upgradation To increase production capacity of the organization.

4.7 Factors affecting Facility Layout

Facility layout designing and implementation is influenced by various factors. These factors vary from industry to industry but influence facility layout. These factors are as follows:

- The design of the facility layout should consider overall objectives set by the organization.
- Optimum space needs to be allocated for process and technology.
- A proper safety measure as to avoid mishaps.
- Overall management policies and future direction of the organization

4.8 The importance of layout

The importance of a layout would be better appreciated if one understands the influence of an efficient layout on the manufacturing function: it makes it smooth and efficient. Operating efficiencies, such as economies in the cost of handling materials, minimization of production delays and avoidance of bottlenecks all these depend on a proper layout.

An ideally laid out plant reduces manufacturing costs through reduced materials handling, reduced personnel and equipment requirements and reduced process inventory.

4.8.1 Economies in Handling

Nearly 30% to 40% of the manufacturing cost is accounted for, by materials handling. Every effort should, therefore, be made to cut down on this cost. Long distance movements should be avoided and specific handling operations must be eliminated. A cynic may say that the cheapest way to handle materials is not to handle them at all. But, in a factory, materials have to be handled; and therefore, it all depends on the layout.

4.8.2 Effective Use of Available Area

Every inch of the plant area is valuable, especially in urban areas. Efforts should therefore be made to make use of the available area by planning the layout properly. Some steps for achieving this end are: location of equipment and services in order that they may perform multiple functions; development of up-to-date work areas and operator job assignments for a full utilization of the labor force.

4.9 Traditional type facilities layout:

Traditionally, three types of layout are considered appropriate for a manufacturing facility – Flowline (Product), Cellular (Group) and Functional (Process)– as shown in Figure. In a Functional Layout, machines with identical manufacturing capabilities are grouped into a single department. The different process-specialized departments, such as Turning, Grinding, Milling, Broaching and Heat Treatment, are located relative to each other in order to increase machine utilization and production flexibility. In contrast, in a Cellular Layout, each department in the Functional Layout could be split and the machines in it allocated among two or more "cells". Each cell is a group of machines from different process departments co-located in a dedicated section of the shopfloor. However, each cell is capable of producing some subset (also referred to as a part family) of the complete product mix produced in the facility. In essence, a Functional Layout has a process focus whereas a Cellular Layout has a part family focus. The Flowline Layout combines the properties of the Functional and Cellular Layouts. All of the machines and support services required to make a single part (or a family of variants of a product) are located in a single department (Wolstenholme et al, 1980).

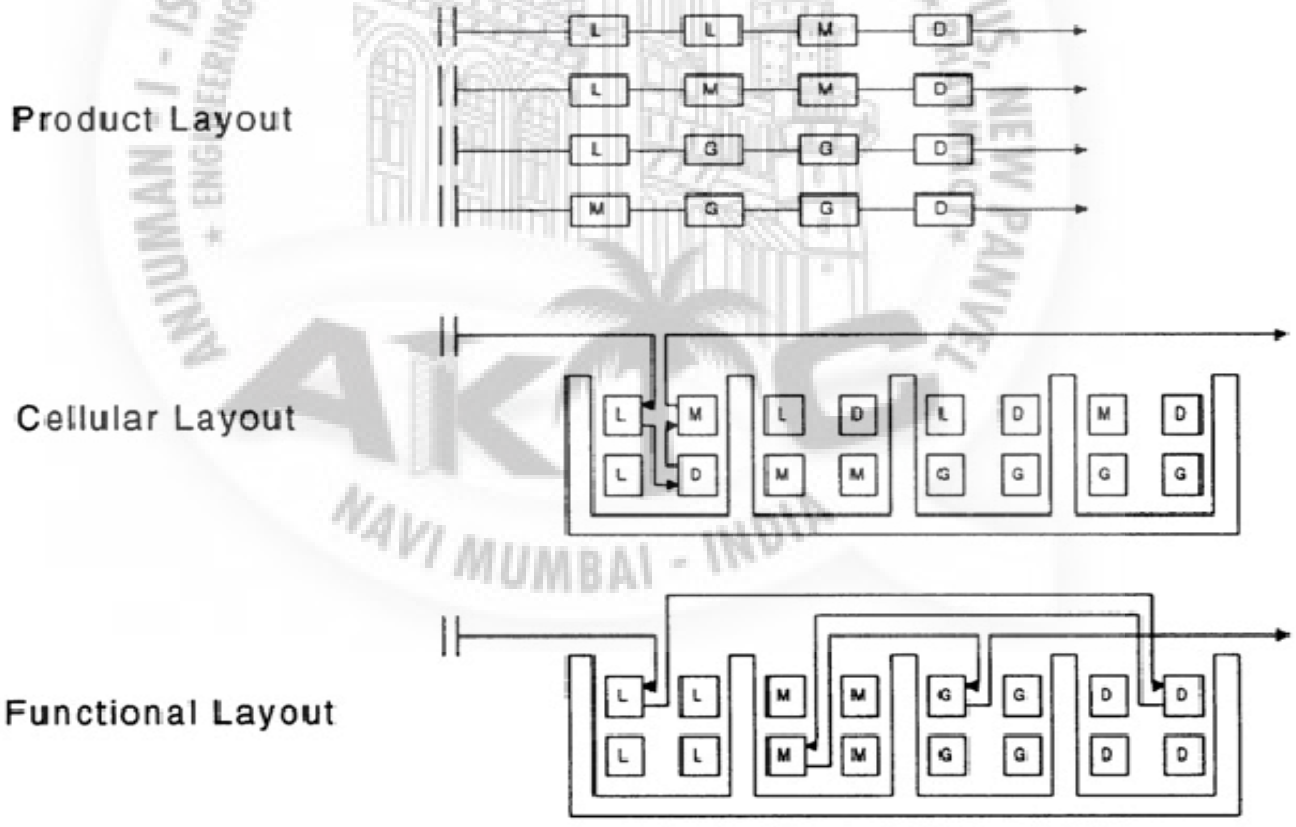


Fig 4.4 Types Of Layout

4.9.1 process [job shop] layout:

Also referred to as functional layout, process layouts are very suitable for applications where the products that are gotten from raw materials and work-inprogress entails high variations while processing the individual operations. The layout which is designed to engender the processing of activities that need many value additions is widely adopted, if the operation's system require large amount of products in small volumes. It is very useful in situations where the production process is structured in batches as the different product are organized to move from an area to another, based on the succession of operations earlier established.

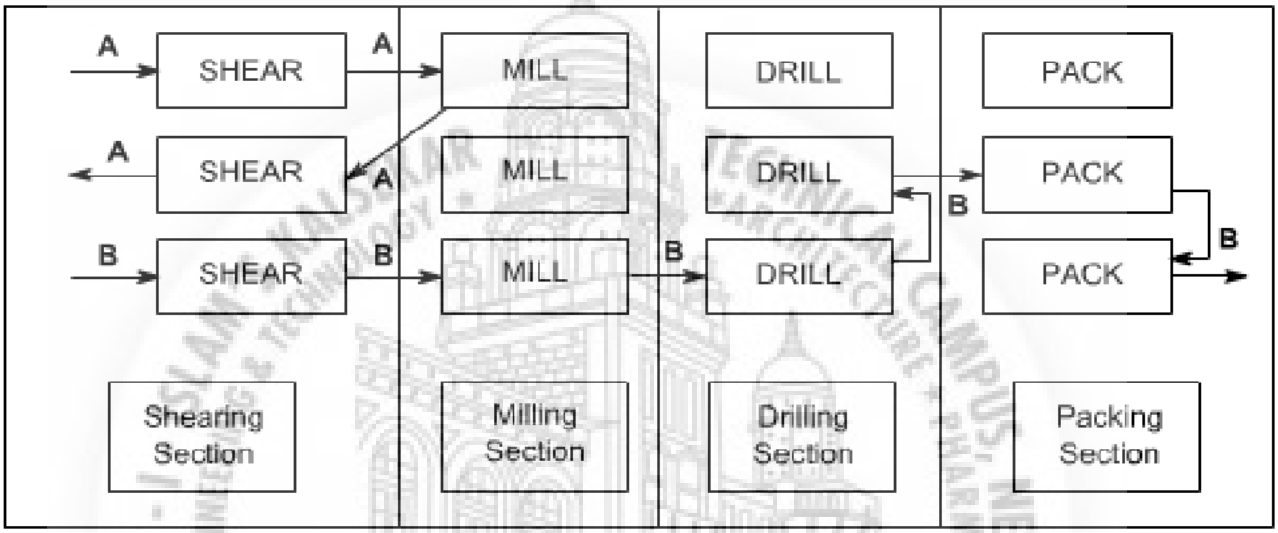


Figure 4.5 Pictorial Representation of Process Layout.

Advantages and disadvantages of process layout:

Advantages	Disadvantages
Reduced overhead cost	High work-in-progress inventory
Increased utilization of machine	Low operations and expensive material handling compared to the product layout
Encourages efficient supervision	Requires constant inspection
High products' variety	High production gap
Enhanced flexibility	Requires highly skilled operators

4.9.2 Product [flow shop] layout:

Also referred to as line layouts, product layouts which has small cycle of manufacturing with reduced material handling is a type of plant layout where machines, equipment, and workers are organized in a line based on the operation's progression needed for a product. Here machines and equipment are grouped together, thereby enabling inventories to flow successively in a clear and easy to control manner from one machine to another as values are being added on them.

A good example of product layout is the vehicle assembly line which entails the movement of nearly all types of similar models in the same operation sequences. The decisions to be made before designing a product layout include the amount of the required cycle time, the number and the arrangement of the various manufacturing processes, how to tackle the time variations for the different processes, and the need to effectively balance the layout.

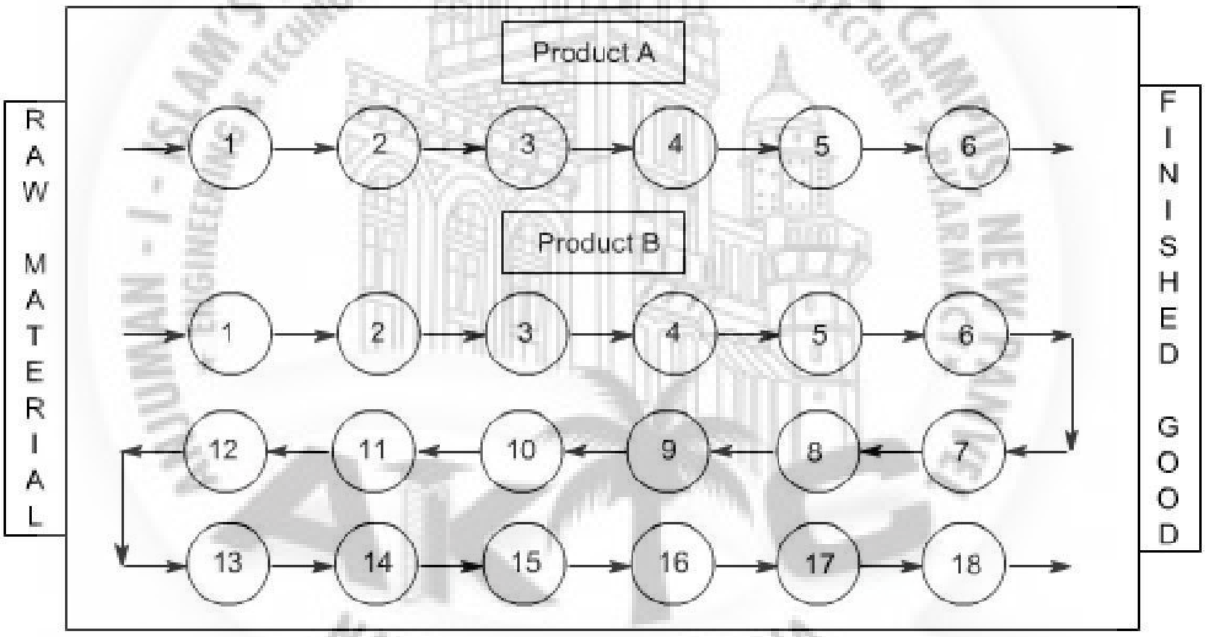


Figure 4.6 Pictorial Representation of Product Layout.

Product layouts are employed to attain a faultless and constant flow of large quantity of raw materials or work in progress through the plant; it achieves an increased volume utilization of equipment and labour. Here continuous flow is achieved as the entire production process is formed to reduce the problems that are associated with unpleasant bottlenecks Transtutors (2015), listed the following as some of the benefits of product layout: "less work in process (WIP) inventory as the flow of material is continuous.

Advantages and disadvantages of product layout.

5 Adantages .	disadvantages
Reduced material handling cost, activities, and throughput time.	Expensive investments in machines and equipment.
Efficient floor space usage.	Breakdown of any machine will lead to serious bottlenecks
Continuous and little amount of work in progress.	Little or no flexibility in manufacturing processes.
Reduced manufacturing cost.	Expensive overhead cost.
Can be easily learnt and managed by unskilled operators.	Monotonous and boring operations.
Simplified sequence of operations.	Changes in product design requires major layout alterations.

4.9.3 Fixed Position Layout:

Fixed position layout is not applicable for small projects or products as it is the plant layout type where the machines, equipment, and workforce are transported to the site of the major product to be produced. It is used in the construction of bulky or fragile projects like bridges, space rockets, ships,

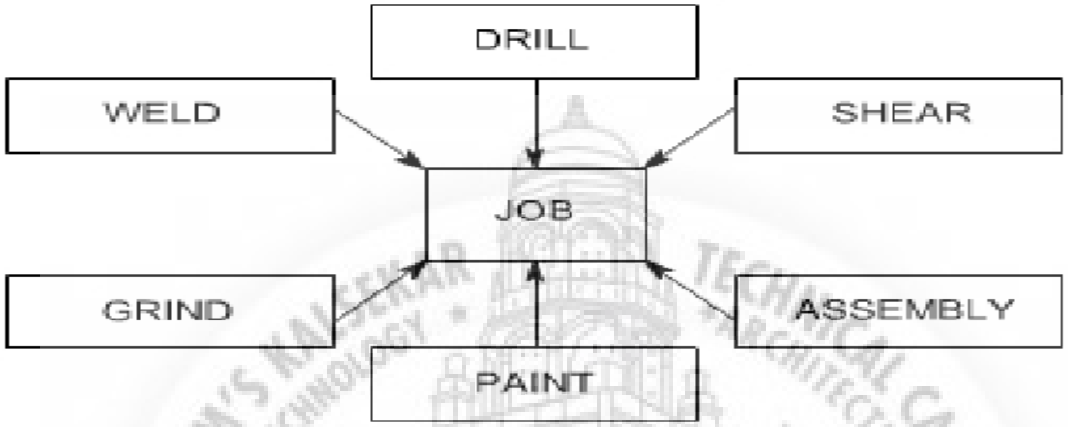


Figure 4.7 Pictorial Representation of Fixed

Advantages and limitations of Fixed Position Plant Layout.

Advantages.	Disadvantages.
Very flexible and can accommodate changes in design and production processes.	Very expensive capital investment.
Saves cost and time involved in incessant movement of work from one location to another	Requires large amount of space for the warehouse close to the plant.
It is very economical as jobs at different levels of completion can be produced concurrently.	Lengthy production period.

4.9.4 Cellular Plant Layout:

Cellular plant layout can be defined as a layout type where machines and equipment are properly arranged in order to enhance the steady and uninterrupted movement of materials and tools, through the process of production without stoppages and time wastage. Levinson and Rerick (2002) observed that it is "only by relating each machine with the others in such a way that production will follow in straight lines without confusion, can the highest economy operation be attained. Cellular Layout does not allow easy accumulation of inventory as materials are immediately processed.

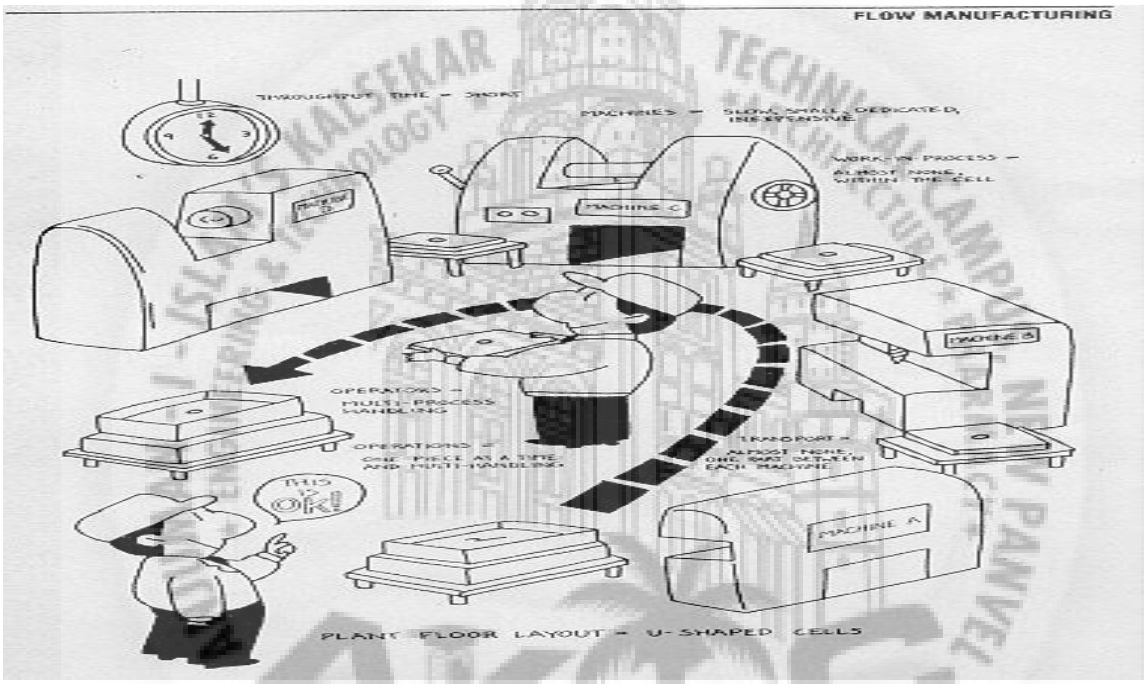


Fig 4.8 Cellular Plant Layout

The importance of the application of Cellular layout is that it makes electronic layout less complicated, thereby allowing for cheap transporting equipment like the conveyors, unlike the functional layout that requires forklifts and very costly automation.

Advantages and Limitations of cellular Plant layout :

Advantages.	Disadvantages.
Shorter lead time.	Not suitable for many variety of products.
Set up time reduction	Applied for low throughput volume.
Reduced work in progress inventory	Increased set up cost
Reduced inventory handling processes	Requires more machines

Chapter 5

Implementation

5.1 Steps To Solve The Problem:

Procedure to re layout the production floor consists of three steps, such as analyzing the existing layout, design the plant layout based on the SLP and the evaluation and selection of alternative layouts using simulation program Pro model . Simulation program used as analytical tools to help systematically designed the layout and to support appropriate decision-making to eliminate some of the problems.

Steps in the re layout and explanation can be seen here:

a. Analysing the existing layout plant to identify the problem on flow of material and operation.

b. Designing plant layout based on SLP approach to increase production capacity and reduce material handling cost.

c. Evaluation and selection of alternatives using Simulation Pro model based on two kinds of criteria cost of material handling and production time.

5.2 Input Data And Activities

5.2.1 Automated Layout Design Program (Aldep)

Now we will examine Automated Layout Design Program (ALDEP).

ALDEP is basically a construction algorithm but it can also be used to evaluate two layouts. The algorithm uses basic data on facilities and builds a layout by successively placing the layout using relationship information between the departments. The basic inputs to ALDEP are:

1. Length and width of facility.
2. Area of each department.
3. Minimum closeness preference (MCP)value.
4. Sweep width.
5. Relationship chart showing the closeness rating. Location and size of any restricted area.

The procedures adopted for using Aldep are:

Step 1: Input the following:

1. Length and width offacility.
2. Area of eachdepartment.
3. Minimum closeness preference (MCP)value.
4. Sweepwidth.
5. Relationship chart showing the closenessrating.
6. Location and size of restrictedarea.

Step 2: One department is selected randomly and placed in the layout.

Step 3: In this step, the algorithm uses minimum closeness required between

departments for the selection of departments to be placed with an earlier placed department. Select the department having maximum closeness rating. If there is no department having minimum closeness preference then any department that remains to be placed is selected.

Step 4: If all the departments are placed in the layout, go to step 5. Else, go to step3

Step 5: Compute the total score of the layout.

Step 6: If the total score required is the acceptable score, then go to step 7, else go to step2.

Step 7: Print the current layout and the corresponding score.

5.3 Prevention of mechanical hazards

5.3.1Introduction To Mechanucal Hazards:

When machine-related mechanical hazards cannot be eliminated through inherently safe design, they must then be reduced to an acceptable level, or the hazards that cause them must be isolated from the workers by guards that allow the minimum safety distances to be respected.

Most of the risks related to mechanical hazards can be reduced to acceptable forces or energy levels by applying a risk reduction strategy. If this is impossible, the hazards must be isolated from people by guards that maintain a safety distance between the danger zone and the people, with the main result being to reduce access to the danger zone.

5.3.2 Risk assessment

In general, any improvement to a machine's safety begins with a risk assessment. This operation includes a risk analysis, followed by a risk evaluation.

5.3.2.1 Risk analysis

A risk analysis has three steps:

1. determining the limits of the machine;
2. determining (identifying) the hazards;
3. estimating the risks.

5.3.2.2 Risk evaluation

The last step in the risk assessment process consists of making a judgement about the estimated risk level. At this step, it is determined whether the risk is tolerable or not. When the risk is considered intolerable, risk reduction measures must be selected and implemented. In order to ensure that the chosen solutions fulfill the risk reduction objectives without creating new hazardous situations, the risk assessment procedure must be repeated once the solutions have been applied.

5.3.2.3 Risk reduction

Once the risk assessment step has been completed, if the evaluation prescribes a reduction of the risk (which is considered intolerable), means to be applied to achieve the risk reduction objectives must be selected.

5.4 Guards :

Guards rank third in the risk reduction hierarchy, after safe design and risk reduction. A guard must not create additional hazards (cutting, trapping, crushing, etc.) or cause the machine's users to divert the guard from its use. The movable components of a guard must be designed so that their dimensions and their weight facilitate their manipulation.

A guard must be designed by taking into account all the environmental constraints or those operating constraints (possibilities of projections of solid or liquid matter) to which the guard is subjected during the machine's entire service life.

A guard must be designed and built in such as way as to offer good visibility of the process and the machine. This type of design limits the dismantling of the guard while allowing the machine to be checked for proper operation or a malfunction to be detected as soon as it appears. The guard can be made of a transparent, perforated or meshed material .

Fig 5.1 Fixed Enclosing Guard

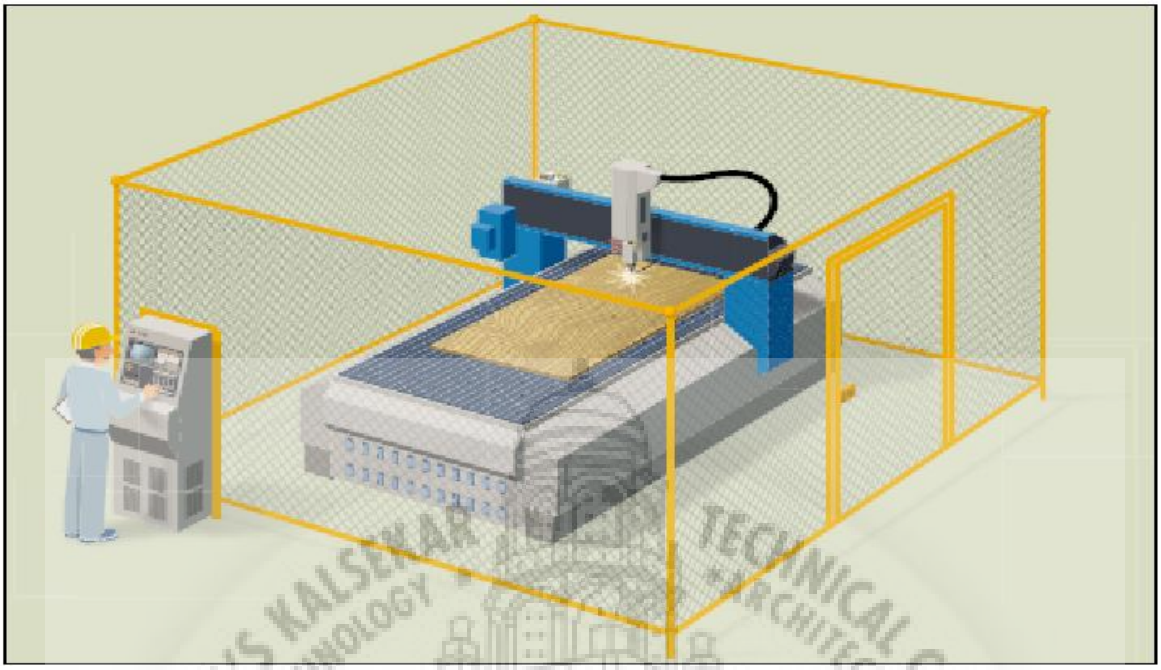


Fig 5.2 Fixed Distance Guard

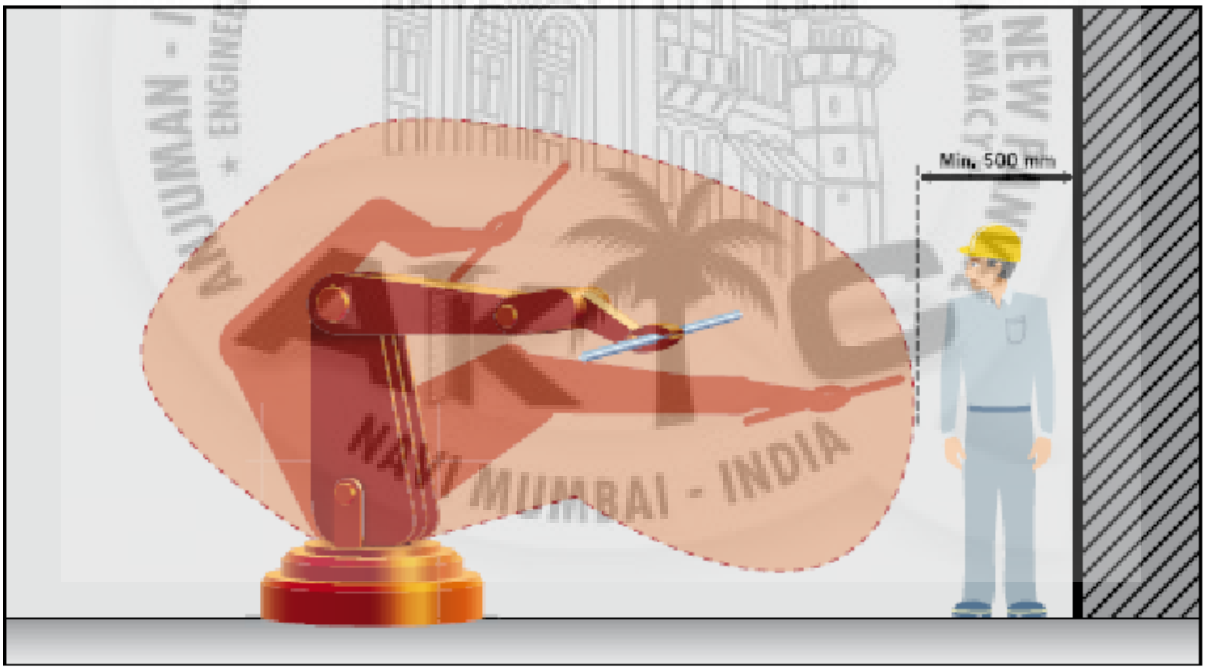


Fig 5.3 Minimum Gap Between Moving Parts And The Guard

Chapter 6

Evaluation

6.1 Existing Layout:

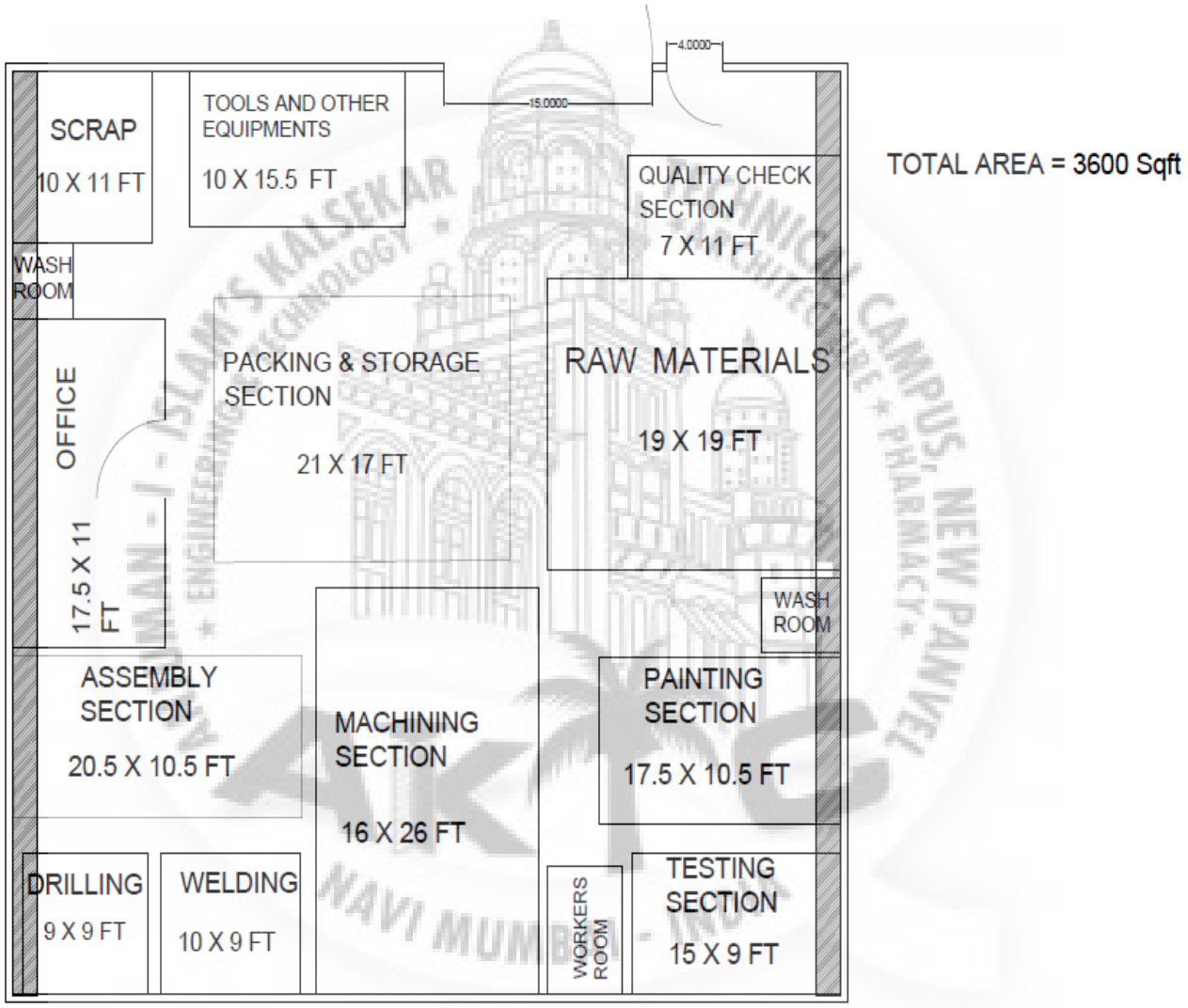


Fig 6.1 Existing Layout

6.2 Space Available:

When performing the detailed layout, it is required to have more accurate shapes adjusted to the reality.

The total available area of the company is 3600 sq.Ft.

The Departments incorporated in sanco valves are :

- Office
- Quality Control Department
- Tools & Other Equipments
- Raw Material Section
- Machining
- Drilling Welding
- Assembly
- Testing
- Painting Section
- Packing Section
- Finished Product Storage Section
- Scrap

6.3 List of Machines Available :

Name of the machine	Qty
Lathe machine centre height 12”	1
Lathe machine centre height 15”	1
Lathe machine centre height 24”	1
Drill machine radial	1
Centre drill machine	1
Welding machine 400 amp	2
Overhead crane (capacity-3 ton)	1
Testing rig	1
High pressure booster pump (2500 psi)	1
Low pressure booster pump (600 psi)	2
OverHead Crane (8 to 14 FPM)	1

6.4 Activity relationship diagrame:

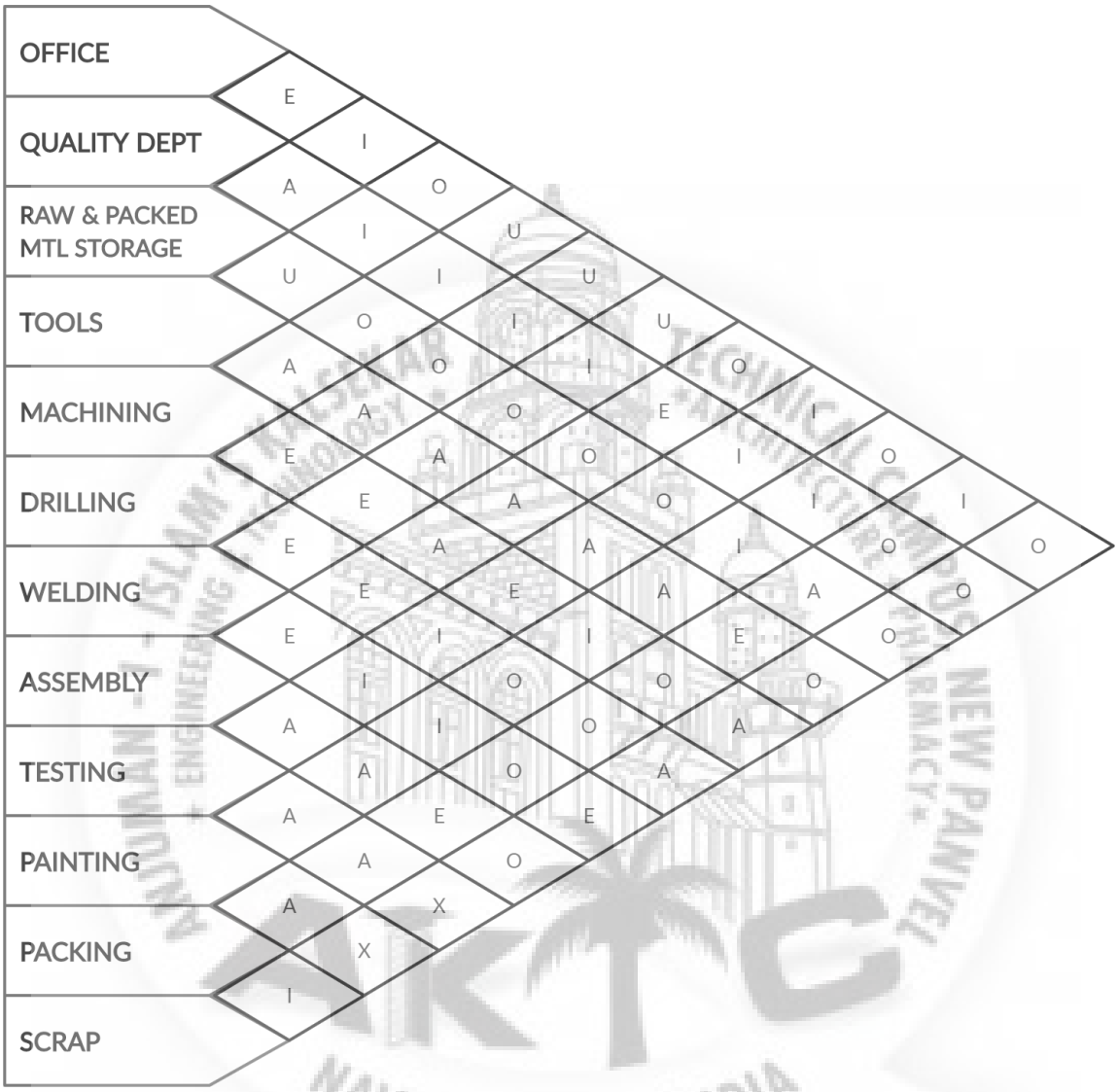
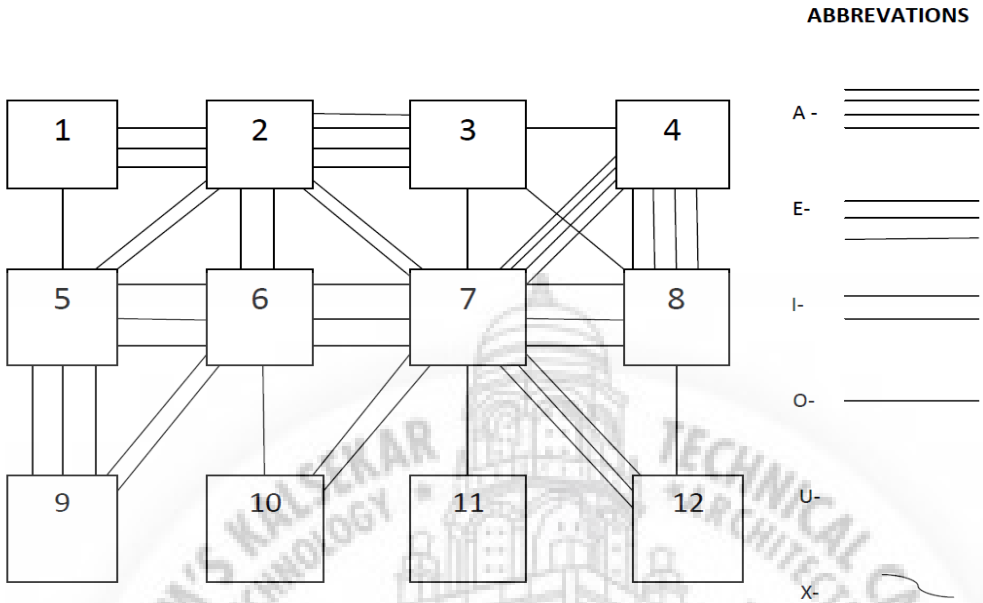


Fig 6.2 Actual Actvity Relationship Diagram

6.5 Space Relationship Diagram



1 – OFFICE

2 – QUALITY DEPT

3- RAW & PACKED MATERIAL

4- TOOLS

5- MACHINING

6- DRILLING

7- WELDING

8-ASSEMBLY

9-TESTING

10- PAINTING

11- PACKING

12- SCRAP

Fig 6.3 Actual Space relationship Diagram

6.6 Develop the Layout Alternatives:

We have used process layout in sanco Valves Pvt Ltd because the process layout was the best suitable layout according to the production carried out in plant .

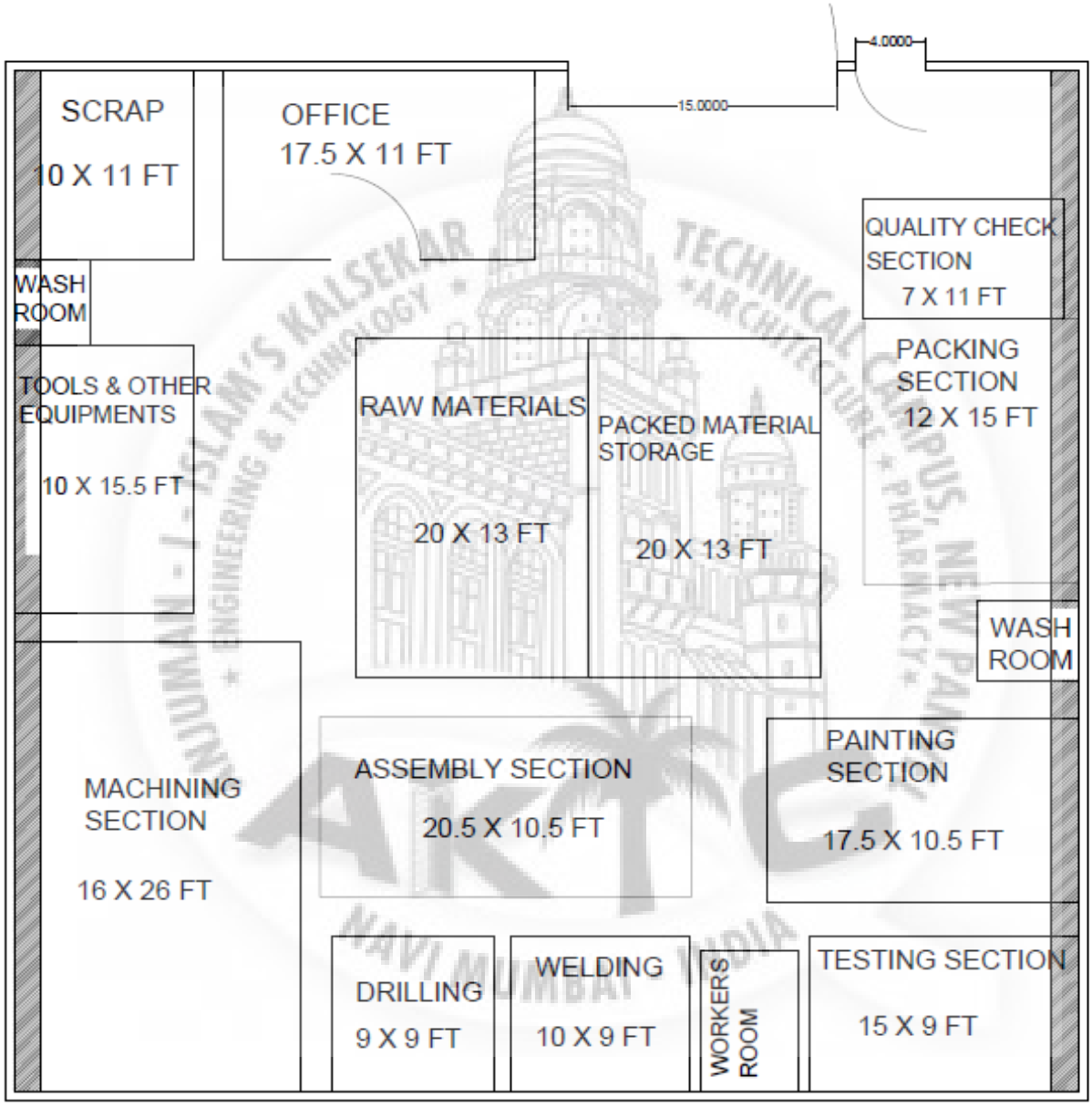


Fig 6.4 Optimised Plant Layout

6.7 Job Travel Time Calculation After Optimising The Layout :

Department		*Time Reqd In Previous Layout*	*Time Reqd In New Layout*	*Reduction in job travel time*
From	***To***	***In Mins***	***In Mins***	***In Mins***
Raw Material	Machining	14	10.5	3.5
Machining	Drilling	10	8	2
Drilling	Welding	6	3.5	1.5
Welding	Assembly	6	4	2
Assembly	Testing	18	15	3
Testing	Painting	12	12	0
Painting	Packing	6	4.5	1.5
Packing	Packed Storage	11	8	3
TOTAL		83	65.5	17.5

After Optimizing previous Layout it has been observed that efficiency of the plant is increased .

This Calculation is based on the Overhead Crane Travel Time.

Overhead Crane used at Sanco Travels 8 to 14 Ft per min (FPM).

6.8Conclusion of evaluation:

- We Have Evaluated Our Results After Implementing The SPL And Selected The Best Possible Layout Design And Implemented In The Industry.
- We Have Used Process Layout For Higher Flexilibilty Of Products And Efficient Utilization Of Available Resourses .
- In optimized layout the distance travelled by the product is reduced upto 25% .

Chapter 7.

Conclusion And Future Scope:

7.1 Results:

7.1.1 By implementing the new layout in the facility-

After implementation of the new layout it is found that the working area is increased by 15% and the storage area for the raw material is increased by 10 %And also the travelling time of the material is significantly reduced by 25% as everything is arranged in order so it is simple to move the material during storage and process.

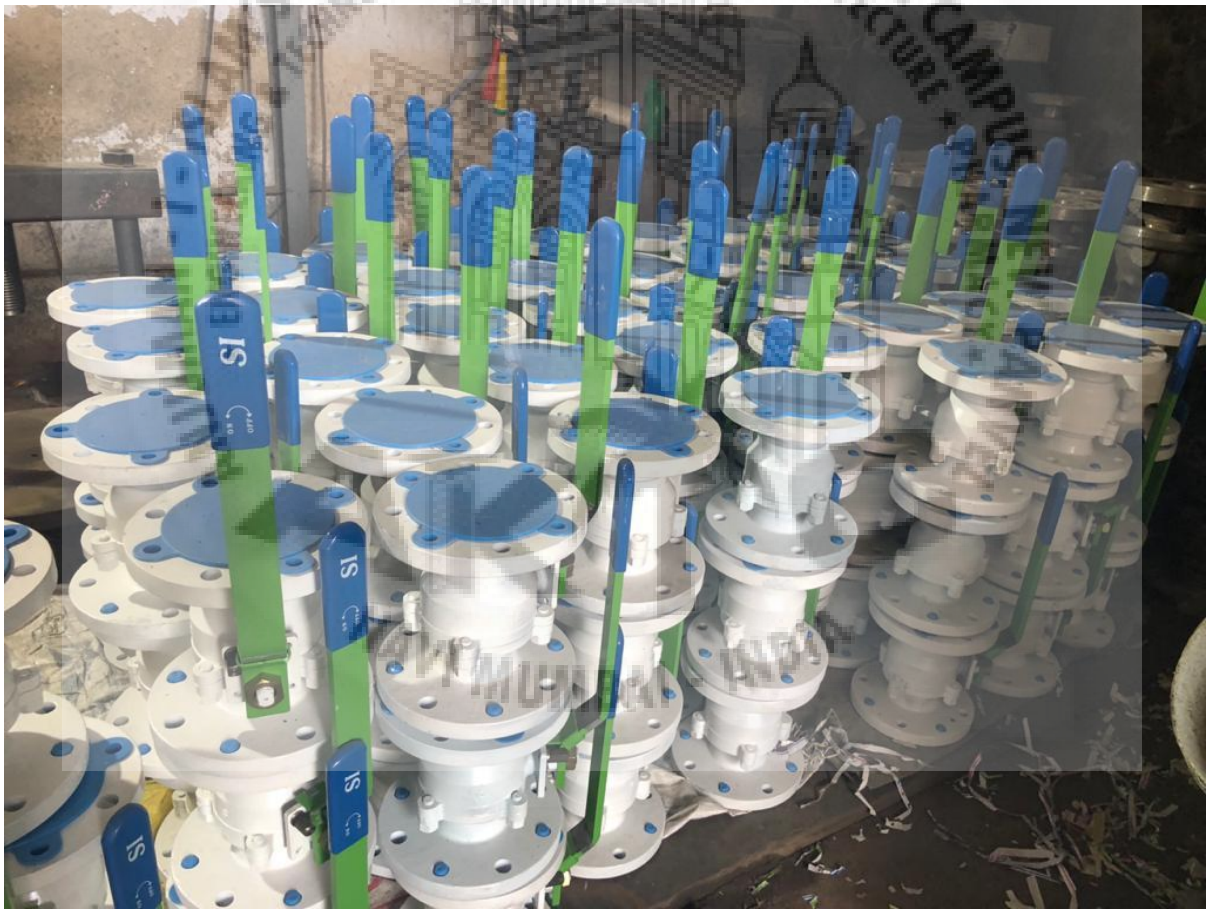


Fig 7.1 After Implementation of SLP

7.2 Conclusion:

From the study and implementation of Systematic Plant Layout in the facility we have seen the following improvements mention above.

The SPL helps us to increase the working area decreases the material handling and travelling time and provides a proper position for each individual item and at last it also helped us to achieve the optimum plant layout.

7.3 Future Scope:

The future development can be carried out by increasing the number of machines so that more productivity, accuracy and efficiency of the product can be achieved.

Making sure that the layout will always help the facility to achieve their requirements. Repairing the old available machine can also help to increase the productivity and it is economical also.

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