A PROJECT REPORT

ON

"OPTIMIZATION OF PLANT LAYOUT"

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfilment of the Requirement for the Award of

BACHELOR'S DEGREE IN
MECHANICAL ENGINEERING

BY

SAYED AKBAR ALI SADIQUE ALI	**16DME168**
MALPEKAR MOHASEEN MUBARAK	**16DME158**
THANGE YASEEN SALEEM	**16DME182**
SHAIKH SOHAIL RIYAZ	**16DME178**

UNDER THE GUIDANCE OF
PROF. JALAL AHMED KHAN

DEPARTMENT OF MECHANICAL ENGINEERING
Anjuman-I-Islam's Kalsekar Technical Campus
SCHOOL OF ENGINEERING & TECHNOLOGY
Plot No. 2 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

2018-2019

AFFILIATED TO

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CERTIFICATE

This is certify that the project entitled

"OPTIMIZATION OF PLANT LAYOUT"

submitted by

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is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Mechanical Engineering) at ***Anjuman-I-Islam's Kalsekar Technical Campus, Navi Mumbai*** under the University of MUMBAI. This work is done during year 2018-2019, under our guidance.

Date: / /

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I would like to take the opportunity to express my sincere thanks to my guide **JALAL AHMED KHAN**, Assistant Professor, Department of Mechanical Engineering, AIKTC, School of Engineering, Panvel for his invaluable support and guidance throughout my project research work. Without his kind guidance & support this was not possible.

I am grateful to him/her for his timely feedback which helped me track and schedule the process effectively. His/her time, ideas and encouragement that he gave is help me to complete my project efficiently.

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At last we must express our sincere heartfelt gratitude to all the staff members of Mechanical Engineering Department who helped me directly or indirectly during this course of work.

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Project I Approval for Bachelor of Engineering

This project entitled ***ÖPTIMIZATION OF PLANT LAYOUT¨*** by ***SAYED AKBAR ALI SADIQUE ALI, MALPEKAR MOHASEEN MUBARAK, THANGE YASEEN SALEEM, SHAIKH SOHAIL RIYAZ*** is approved for the degree of ***Bachelor of Engineering in Department of Mechanical Engineering.***

Examiners

1. .....
2. .....

Supervisors

1. .....
2. .....

Chairman

.....

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

Facilities layout is a systematic and functional arrangement of different departments, machines, equipments and services in a manufacturing industry. It is essential to have a well developed plant layout for all the available resources in an optimum manner and get the maximum out of the capacity of the facilities. The efficiency of production depends on how well the various machines, services production facilities and employee's amenities are located in a plant. This project aims to study and improve the current plant layout and are analysed designed by using string diagram. An Attempt is made to simulate the current and proposed factory layout by using inventor software. Efficiency of the current proposed plant layout are calculated..

Plant layout planning includes decisions regarding the physical allocation of the economic activity centers in a facility. An economic activity center is any entity occupying space. The objective of plant layout planning is a more effective work flow at the facility, allowing workers and equipment being more productive. Facilities layout is a systematic and functional arrangement of different departments, machines, equipments and services in a manufacturing industry.

Keywords: Plant layout, Optimization.

Contents

List of Figures

Chapter 1

Introduction

In the 21st century business world, companies are exposed to continuous challenges. One of it is to equip organizations with the ability to compete in a global marketplace. Schonberg states that world class performance is dedicated to serving the customer. Thus, to keep track of performance, organizations must develop measures of performance. The current trend in the industry, which is experiencing very competitive era like many others is striving hard to reduce manufacturing costs, improve quality and customer satisfaction.

Materials handling equipment and the facilities it operates can contribute to as much as 70 percent of the total cost of the manufactured product. Facilities layout design is part of facilities planning. It is the arrangement of work space which, in general terms smoothest way to access facilities that have strong interactions. The main concern with the plant facility layout planning is to reduce the cost of materials handling as poor materials handling can generate business problems. The

best material handling is no handling. Subsequently, a good layout will enable the manufacture of the product economically in the required volume and variety. Other objectives can be stated as effective utilization of manpower, space and infrastructure, as well as providing overall wellbeing and morale of the work.

Today s manufacturing industry is facing problems that have been growing and complexity over the last several years. As a result, there is an immediate need for procedures or techniques in solving various problems encountered in today's manufacturing arena without extended shutdown's or expensive modifications (Clark,1996). Based on the above facts, it is obvious that layout optimization is crucial to any facility planning. If not tackled in the early phases, it can generate logistics implications for the company involved.

1.1 Purpose

Malmo steel pvt ltd various props and channels Equipment Company located in at Taloja. The products are manufactured by going through various processes. The plant suffers from poor utilization of workspace, poor material handling and safety hazards. Also, placement of raw materials hinders manufacturing Processes which have high interdependency are not located close to each other. This causes high travelling time for the operator

Figure 1.1: Poor Utilization of Space

1.2 Project Scope

In response to the above problems, the need for facilities layout optimization is essential to achieve the manufacturing goals of the company. This thesis proposes to use Systematic Layout Planning (SLP) as the infrastructure for layout optimization for better production. The factory performance improvements are in terms of cycle time reduction, productivity increase, reduction in travelling cost and reduction in travelling distance.

1.3 Project Objectives

1.3.1 Objectives

a. To study the current flow pattern and relation of overall plant layout

b. To develop a new plant layout.

c. To propose an appropriate material storage system.

d. To study and identify problems at work area.

e. Study the current flow pattern and relation of overall plant layout developing a new plant layout

.

Chapter 2

Literature Survey

2.1 Efficiency Improvement of a Plant Layout Vivekanand s Gogi1 , Rohith D2 , Shashi Kiran K3 , Suhail M Shaikh4

This research paper has provided a good exposure to facility planning and layout designs for the improvement of the efficiency. The choice of which type of facility layout to adopt can have a significant impact on the long-term success of a firm. This decision, therefore, should not be considered lightly, but only after a through analysis of the operational requirements has been completed. A major issue to be addressed in facility layout decisions in manufacturing is: How flexible should the layout be in order to adjust to future changes in product demand and product mix. 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. Instead of criterion of

minimizing total distance travelled, one may wish to minimize the total distance of the material travelled.

2.1.1 How to overcome the problems mentioned in Paper

a. calculate space availability on shop floor.

b. To determine idle time, working time of particular operation required on shop floor .

c. Redesigning the plant layout and implementing them.

2.2 Optimization of Assembly Line and Plant Layout in a Mass Production Industry-A Literature Survey Parminder Singh*, Manjeet Singh**

In the growing global competition, optimization is the key for survival of any business organization. Among different functions in an organization, optimization plays a vital role in minimizing the wastages which automatically result in productivity improvement. This can be done starting from stage of manufacturing processes, material handling and implementation of proper plant layout. This can be done by usage of suitable techniques augmented with fitting algorithms for decision making. Process optimization is the discipline of adjusting a process so as to optimize some specified set of parameters without violating constraints. The most common goals

are minimizing cost, maximizing throughput and efficiency. This is one of the major quantitative tools in industrial decision making. This paper provides a comprehensive review of discrete event simulation publications with a particular focus on applications in manufacturing. The literature is classified into three general classes of manufacturing system design, manufacturing system operation, and simulation language/package development. The current review contributes to the literature in three significant ways: (1) It provides a wide coverage by reviewing papers; (2) It provides a detailed analysis of different aspects of the literature to identify research trends through innovative data mining approaches as well as insights derived from the review process; and (3) it updates and extends the existing classification schemes through identification and inclusion of recently emerged application areas and exclusion of obsolete categories. The results of the literature analysis are then used to make suggestions for future research

2.2.1 How to overcome the problems mentioned in Paper

a. Get the required information such as inputs, data required for optimization and selecting the Algorithm for optimization.

b. Draw a layout diagram which acts as the initial layout for the algorithm in design software like AUTO CAD.

c. Convert the line diagram into a STEP file format.

d. Calculate the relation between machines in the initial layout.

e. Calculate the distance between the machines in the layout using available information in STEPfile.

f. Calculate the Part flow matrix, which used as input to the CRAFT Algorithm.

g. The initial layout cost is calculated using Part flow matrix, distance matrix.

h. The optimization of cost for initial layout is done by the replacement of the machines.

i. The final result of the program is a layout with optimized cost.

2.2.2 Reasons to use this Technology

a. The quality of work life provided for employee convenience, safety and comfort; facilitate the organizational structure must be the basic priority.

b. Requirement of building and site constraints such as utilizing existing space most effectively

c. Requirement of building and site constraints such as utilizing existing space most effectively

2.3 Optimization of Assembly Line and Plant Layout in a Mass Production Industry-A Literature Survey Parminder Singh*, Manjeet Singh**

In this paper, ongoing engine reconditioning process layout of an automobile industry are studied and a new layout is developed based on the systematic layout planning pattern theory to reduce engine reconditioning cost and increase productivity Since it is an automobile assembly plant, the company has both processes as well as product layouts. The number of equipment and travelling area of material in engine reconditioning have been analysed. The detailed study of the plant layout such as operation process chart, activity relationship chart and the relationship between equipment and area has been investigated. The new plant layout has been designed and compared with existing plant layout. The new plant layout shows that the distance and overall cost of material flow from stores to dispatch area are significantly decreased. The implementation of proposed model will help in the overall improvement of production performance of the engine reconditioning unit of the corporation. The proposed model based on SLP is found to be effective in solving the above- mentioned problems. The production rate increased by 283.34distance are considered to improve existing layout but there are many other parameters to analyse the layout that may be worker number, the area required, equipment required. Due to Lack of opportunity and practical limitations above two parameters

are used in our calculation. The problem of existing layout is the large comparative distance between several departments that's Optimization of Plant Layout and Implementation of 5S 13 AIISET (0944) - B.E (Mechanical Engineering) forced to travel a long distance and impedes the smooth material flow and leads to higher cost. In our proposed layout, the position of various departments is altered with various others based on activity relationship chart. It is expected that this proposed model will mostly be preferable while setting up a new plant implementation and will help in the overall improvement of production performance of the engine reconditioning unit of MSRTC

Chapter 3

Project Planning

3.1 Assumptions and Constraints

a. List and describe each functional work centre.

b. Obtain a drawing and description of the facility being designed

c. Identify and estimate the amount of material and personnel flow among work centers

d. Use structured analytical methods to obtain a good general layout.

3.2 Project Management Approach

a. Gather input data.

b. Identify flow of material/information.

c. Create a string diagram.

d. Determine space requirements

e. Quantify space availability

f. Create a space relationship diagram

g. Identify modifying considerations

h. Apply practical limitation

i. Developing layout alternatives

j. Evaluation of final design

3.3 Project Timeline

MONTHS	ACTIVITY
AUGUAST	Visited in plant and observe all the constraints
SEPTAMER	Analysis the number of man powers and floor space
OCTUBER	Determine the number of time for each operation
NOVEMBER	Study the literature survey and select SLP method
DECEMBER	Gathering the data inputs for SLP method
JANUARY	Design the existing layout
FEBRUARY	Design the new existing layout
MARCH	Select optimize design

Chapter 4

Technique Used To Implement Plant Layout

4.1 Systematic Layout Planning

The systematic layout planning (SLP) is a tool used to arrange a workplace in a plant by locating areas with high frequency and logical relationships close to each other.The process permits the quickest material flow in processing the product at the lowest cost and least amount of handling.

4.1.1 Gather input data

Product : Prop-mate.

a. Prop plate *2unit

b. Inner tube *1unit

c. Outer tube *1unit

d. Prop nut *1unit

e. Prop key *1unit

f. Prop key tie *1unit

g. Collar *1unit

4.1.2 Identify flow of material/information

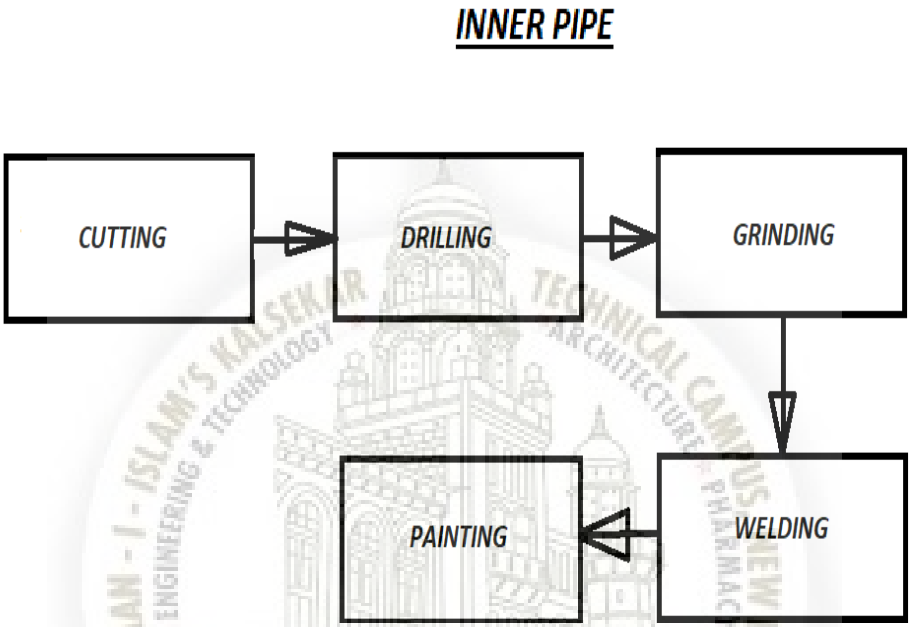

Figure 4.1: Inner Pipe

Inner pipe is a single unit which is first cut in cutting machine to reduce the length. it is further proceeded to drilling machine for drilling hole of same size then after it is taken to grinding machine for removing the chips and making surface smooth. Also it has two plate which are welded on one side of the pipe and finally assembly is taken in painting section

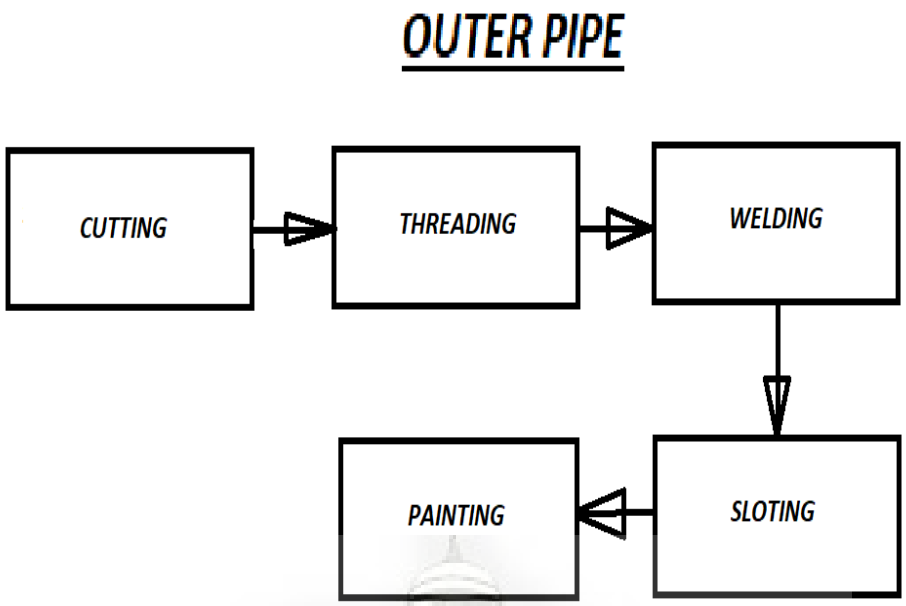

Figure 4.2: Outer Pipe

The outer pipe is similar to inner pipe the outer pipe first cut in cutting machine. The only difference between outer and inner pipe is after cutting it is proceeded to threading operation instead of drilling machine. Further it is slotted and whole assembly taken into welding section and welding plate and final paint the whole assembly.

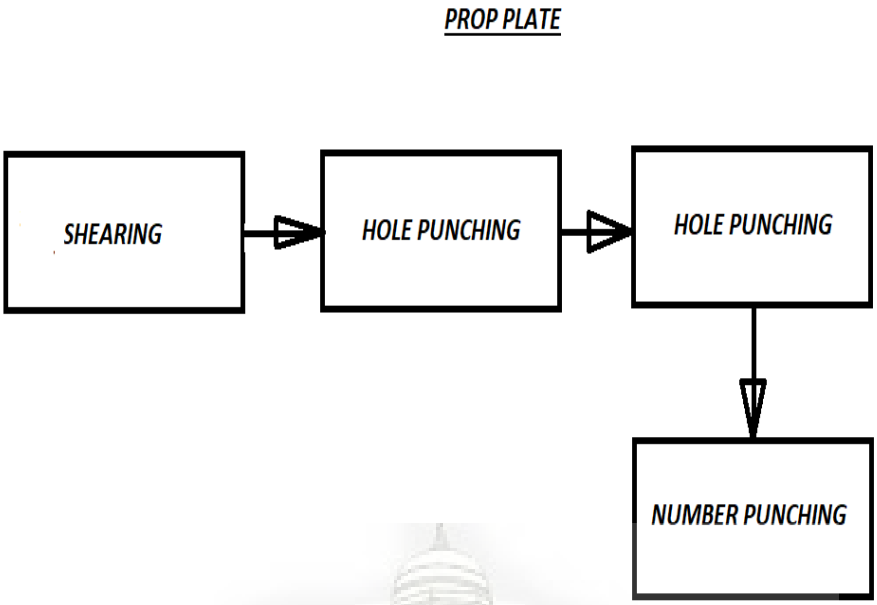

Figure 4.3: Prop Plate

First of all sheet is cut into number of plates of 18mm length then punching operation is done in to different press machine for different sizes of holes. After that number is punched.

4.1.3 Create a string diagram

String diagram is one of the useful and simplest techniques of method study. It can be defined as a scale model on which a thread is used to trace the path or movements of man and materials during a specified sequence of events. It can also be stated that string diagram in a special form of flow diagram. As a thread is used to measure distance, it is necessary that the string diagram should be drawn up to scale. The same is not necessary in case of flow diagram. At this point, the space requirements are applied to space available. The purpose of space relationship diagram is

to combine establish special constraints with the activity relation ship

4.1.4 Quantify space availability

During this step, a square footage is assigned to each activity. The space assigned to each activity is predicated previously in the space requirements step. The total available space at the plant is reviewed. The area is divided at first approach to estimate the space required for each department. When performing the detailed layout, it is required to have more accurate shapes adjusted to the reality.

4.1.5 Determine the space requirement

MACHINE DIMENSIONS		
DESIGNATION	INFERENCE	DIMENSIONS (L*B)
PM1	PRESS MACHINE1	1.25*1.25
PM2	PRESS MACHINE2	1.5*1
PM3	PRESS MACHINE3	0.9*0.9
PM4	PRESS MACHINE4	1.2*1.2
PM5	PRESS MACHINE5	1.25*1
PM6	PRESS MACHINE6	1.1*1
PM7	PRESS MACHINE7	1.1*1
CM1	CUTTING MACHINE1	2.4*1.9
CM2	CUTTING MACHINE2	2.4*1.9
TM	THREADING MACHINE1	2.4*2
WM1	WELDING MACHINE1	5*1
WM2	WELDING MACHINE2	5*1
PAINT1,2,3	PAINTING MACHINES	5*2.5
MD	DRILLING MACHINE	2.7*3
GM	GRINDING MACHINE	1.2*1.2

Figure 4.4: Space Utilised

4.1.6 Identify modifying considerations

By analyzing all the constraints on the shop floor we arrived at the conclusion of modified string diagram by which we have successfully utilized space in proper way which may help in less material handling

4.1.7 Apply practical limitation

There were many pillars on the shop floor which can not move also dispatch section which was fixed. The implementation of modified layout was tough because of ongoing production which cannot be kept on holding basis.

4.1.8 Evaluation of final design

By using SLP method we have choose second plant layout which gives proper utilization of space for shop floor and material storage to and also give effective production and less material handling by which proper manpower can be utilized.

Chapter 5

Existing Layout

5.1 Sting Diagram

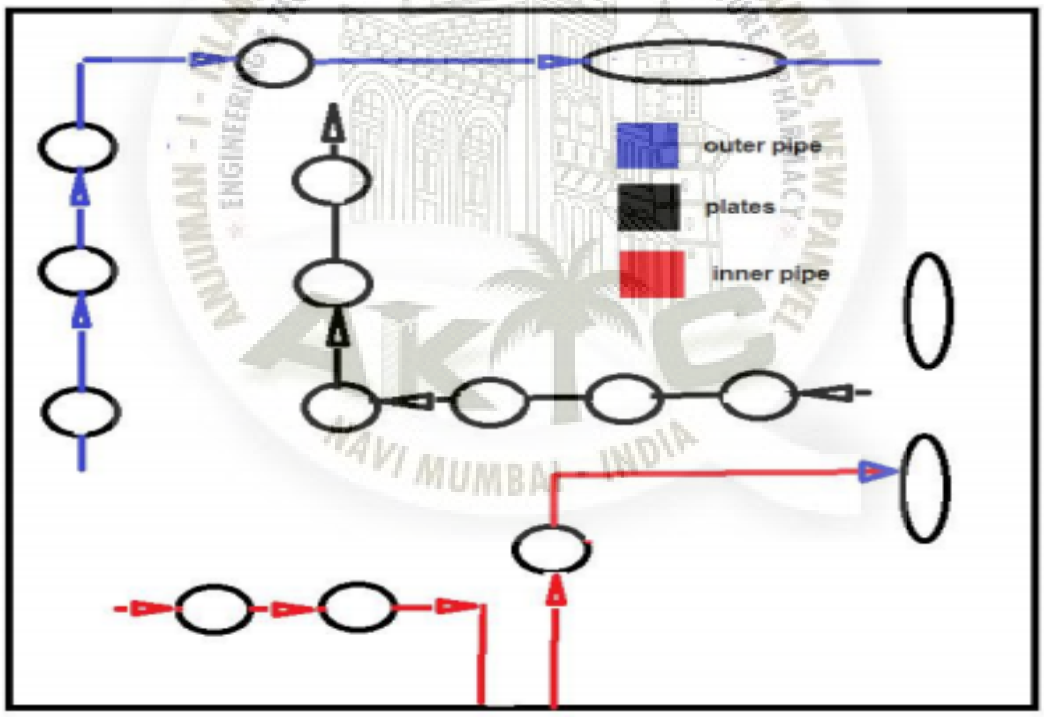

Figure 5.1: Sting Diagram Of Existing Layout

It can also be stated that string diagram in a special form of flow diagram. As a thread is used to measure distance, it is necessary that the string diagram should be drawn up to scale. The same is not necessary in case of flow diagram. At this

point, the space requirements are applied to space available. The purpose of space relationship diagram is to combine establish special constraints with the activity relationship]String diagram is one of the useful and simplest techniques of method study. It can be defined as a scale model on which a thread is used to trace the path or movements of man and materials during a specified sequence of events.

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relationship

5.2 Existing Layout Of Plant

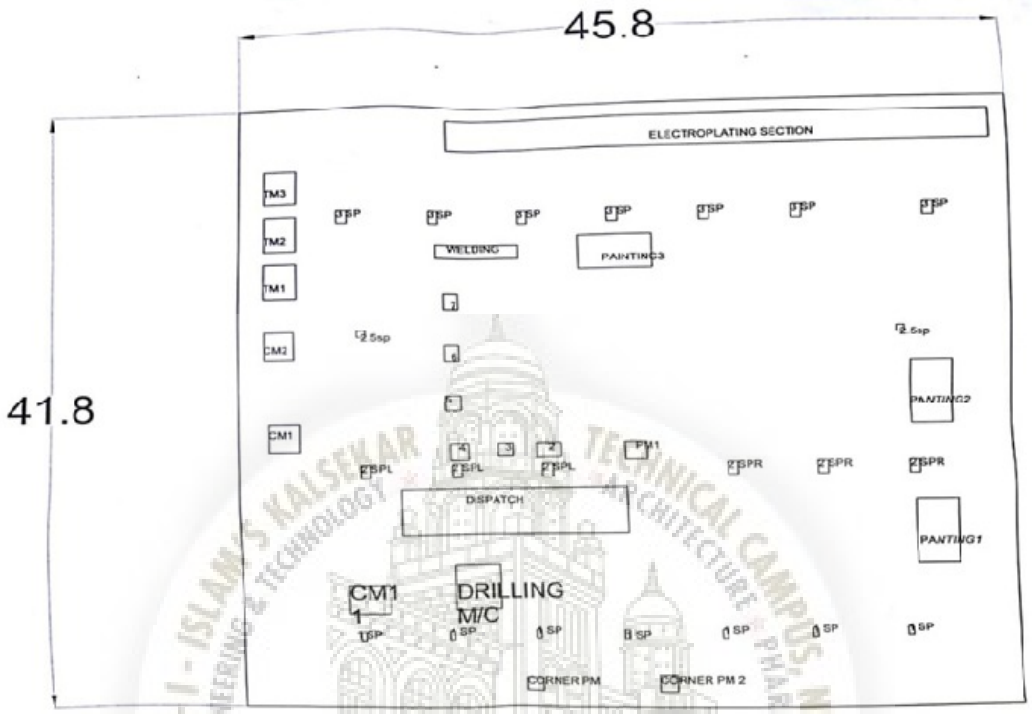


Figure 5.2: Existing Layout Of Plant

Plant layout is the most effective physical arrangement, either existing or in plans of industrial facilities i.e. arrangement of machines, processing equipment and service departments to achieve greatest co-ordination and efficiency of 4 M's (Men, Materials, Machines and Methods) in a plant.

In this case there were many constraints on the shop floor,the pillars cannot be moved also the dispatch section was fixed.initially there was not proper arrangement of materials everything was mesh up. process on shop floor was time consuming because of poor material handling.The adequacy of layout affects the efficiency of subsequent operations.

Chapter 6

Modified Layout

6.1 Sting Diagram

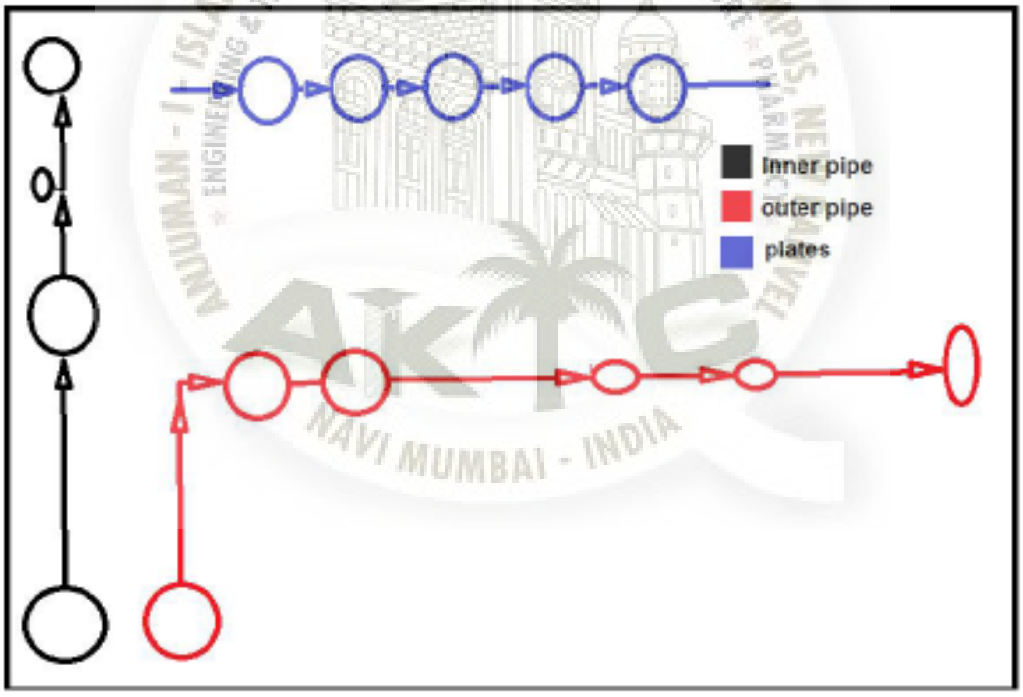


Figure 6.1: Sting Diagram Of Modified Layout

By analyzing all the constraints on the shop floor we arrived at the conclusion of modified string diagram by which we have successfully utilized space in proper way which may help in less material handling. Also from this modified layout the material handling activity has

reduced to a great extent

6.2 Modified Layout Of Plant

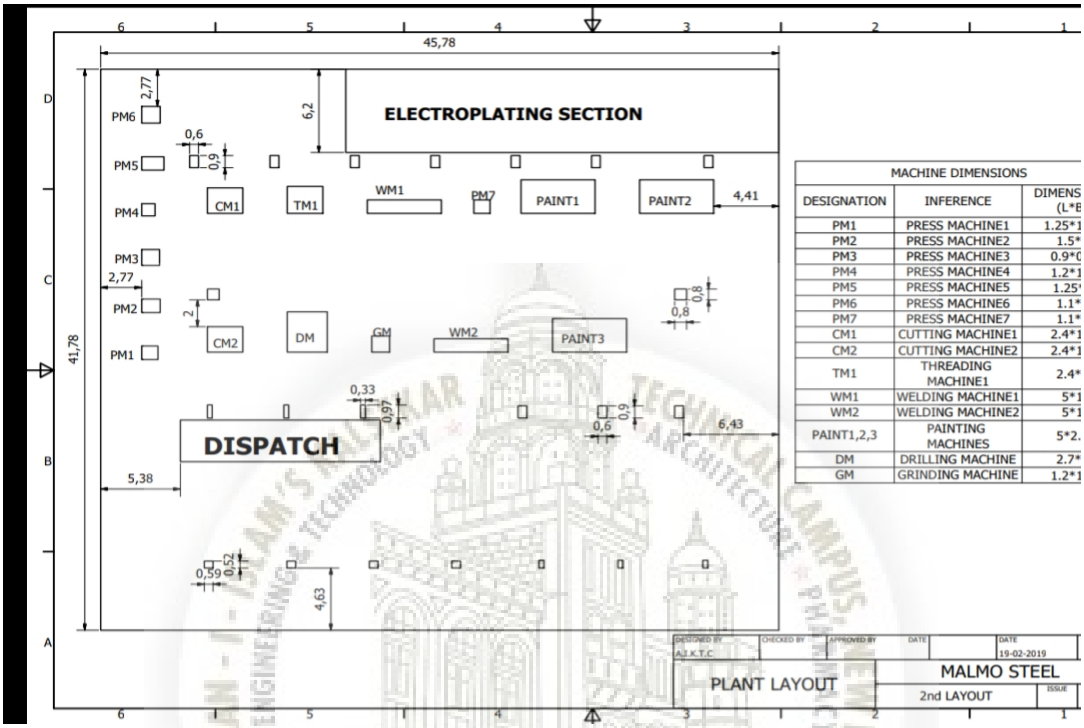
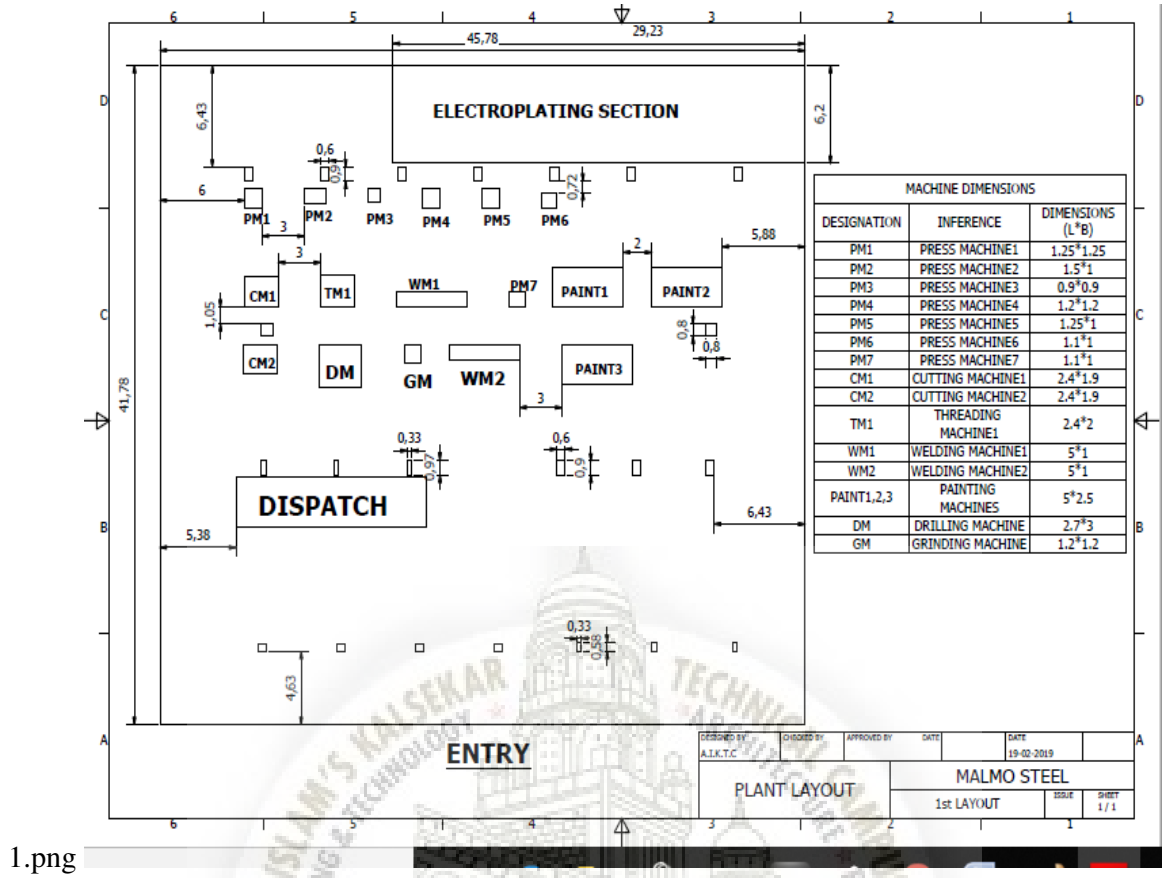


Figure 6.2: Modified Plant Layout 1

As we know that plant layout is important either existing or new. By considering all the factors of the existing layout we have gone through different research papers and we have proposed different layouts.In this Layout we have designed taking the press machines as major factor,as the press were arranged in L shaped arrangement in existing layout also movement of material from one machine to another needed man power.During start of the process only the first machine remains engaged while the other presses remains idle for some short duration.The layout was rejected because of the entry movement and assembly space was too less .



1.png

Figure 6.3: Modified Plant Layout 2

The strategy of making this layout was to occupy the space as much as we can and reducing the material handling time. As the product prop mate consist of three elements the inner pipe ,outer pipe and the prop plate so here we decided to design three different manufacturing lines for three different elements.Here also we came across several problems.The first problem that we noticed that the movement of raw material to its first operation was taking too much time due to which the time of production increased. There was no particular storage for the elements coming from three different manufacturing lines due to which the layout failed and got rejected.we talked to the experienced persons working in that organisation about the issues we came across and developed alternate solutions. .

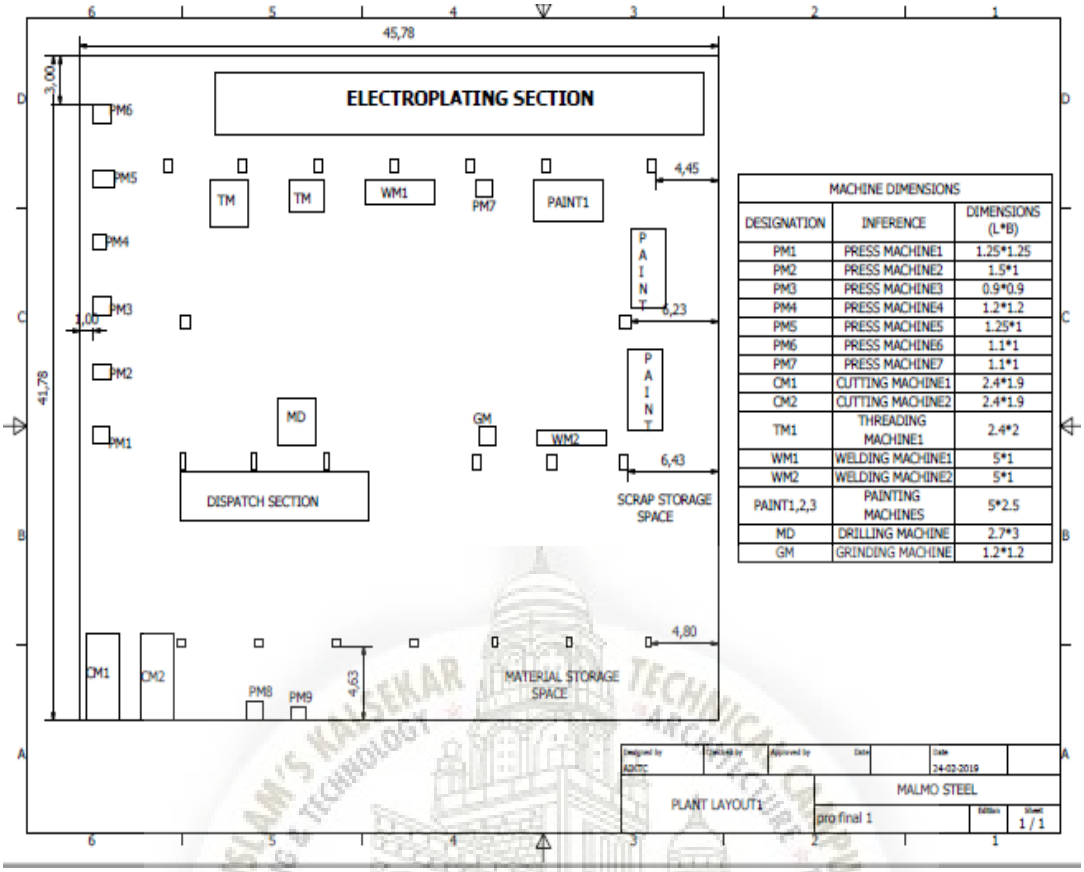
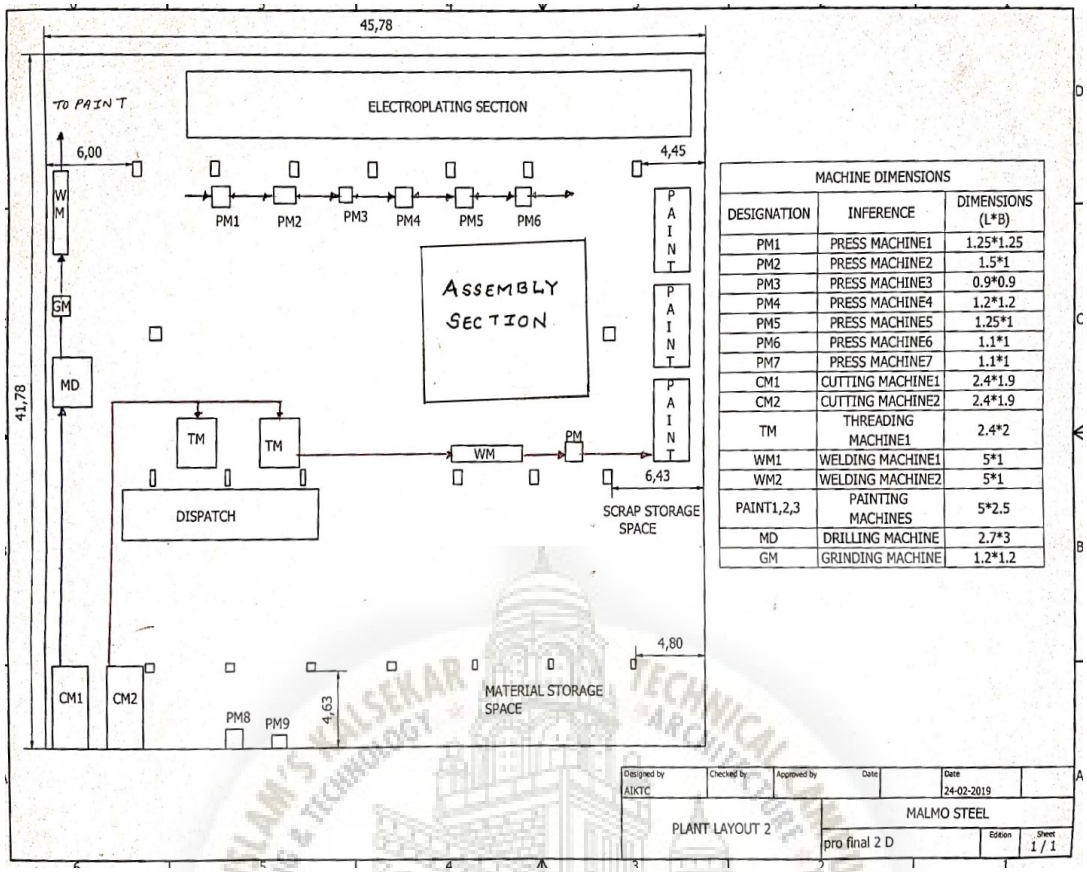


Figure 6.4: Modified Plant Layout 3

Due to space compactness and other issues we came across in previous layout we proposed one more layout.This layout we designed by considering the storage space for the three different elements and many other factors.The overall design was good but the only reason why this design failed because of less space for the movement of forklift in the prop plate manufacturing line.The workers told us the problems they were facing on the shop floor and suggested their views regarding processes.The supervisor of shop floor suggested to move the manufacturing line of press machines so that the movement of forklift is possible.In this design the movement of the manufactured prop plate was unable because of which we skip this layout and tried for new one. .



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PAINT1,2,3	PAINTING MACHINES	5*2.5
MD	DRILLING MACHINE	2.7*3
GM	GRINDING MACHINE	1.2*1.2

Figure 6.5: Final Plant Layout

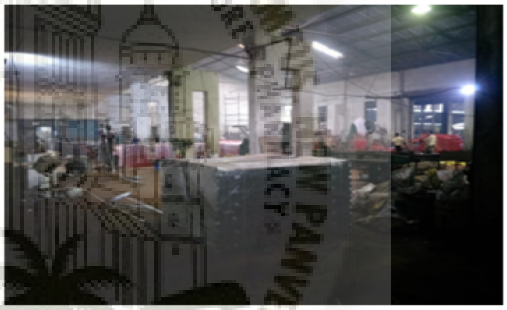
We talked to different persons working in the organisation about the three different manufacturing lines for three different elements and we got suggestions for the same.We came with a new proposed design in which we shifted the manufacturing line of prop plate .The issues related to movement of forklift was also solved in this design Also, material handling time of the overall process was also reduced.We have done theoretical calculations on this layout and achieved results of manufacturing extra products at the same given time.This layout was better than the previous layouts and can help the organisation to a greater extent by reducing the production and increasing productivity.

Chapter 7

Screenshots of Project

7.1 SECTION C

SECTION A



SECTION B

SECTION C

In industry there is three section A,B,C respectively. But in section A and B are use for other production like gym equipment and only section C is use for production of prop and prop plate. All machine for production of products are placed in C section some machine are place in B

section but we will manage into C section. .

Figure 7.1: Machine pictures

Cutting is the separation or opening of a physical object, into two or more portions, through the application of an acutely directed force.there are two cutting machines. Two threading machines and one electroplating machine.Threading is the process of creating a screw thread. There are many methods of generating threads, including subtractive methods (many kinds of thread cutting and grinding, as de-

tailed below); deformative or transformative methods (rolling and forming; molding and casting); .

Figure 7.2: Modified Machine places

These are the modified machine places which mark on the white chawk and all machines places like this after examination we find that this plant layout to be optimized.

Chapter 8

Conclusion and Future Scope

8.1 Conclusion

This work dealt with multi-objective optimization of plant. The experimental results showed there was significant improvement in space utilized compared to initial plant conditions. It was found that on shop floor material handling was reduced and company's overall optimization has improved.thats why we select final layout which give more 4m (Money,Man,Machine,Material) utilization.and the industry grow and expand by producing optimize product.

8.2 Future Scope

- If the organization plan new product in the future the layout of shop floor can be changed.
- This layout is for prop-mate and they give optimized result for production of

prop mate but for other product this layout may be not so much efficient

- section A has more area in future if production requirement increases than it will move to section A
- If other product are manufacture at the same time of prop-mate process than the production time of prop-mate will be increase.

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