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Improvement of Plant Layout by using 5S technique-An industrial case study

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Abstract: *5S is one of the most widely adopted techniques from the lean manufacturing toolbox. Along with Standard Work and Total Productive Maintenance, 5S is considered a "foundational" lean concept, as it establishes the operational stability required for making and sustaining continuous improvements. The primary objective of 5S is to create a clean, orderly environment- an environment where there is a place for everything and everything is in its place. Beyond this, many companies begin their lean transformation with 5S because it exposes some of the most visible examples of waste it also helps establish the framework and discipline required to successfully pursue other continuous improvement initiatives.*

Keywords: *5S, Continuous improvement, discipline, productivity.*

I. Introduction

5S – A simple, but effective, lean manufacturing methodology that helps organizations to simplify, clean, and sustain a productive work environment.5S is a system to reduce waste and optimize productivity through maintaining an orderly workplace and using visual cues to achieve more consistent operational results. Implementation of this method "cleans up" and organizes the workplace basically in its existing configuration, and it is typically the first lean method which organizations implement.The 5S pillars, Sort (*Seiri*), Set in Order (*Seiton*), Shine (*Seiso*), Standardize (*Seiketsu*), and Sustain (*Shitsuke*), provide a methodology for organizing, cleaning, developing, and sustaining a productive work environment. In the daily work of a company, routines that maintain organization and orderliness are essential to a smooth and efficient flow of activities. This lean method encourages workers to improve their working conditions and helps them to learn to reduce waste, unplanned downtime, and in-process inventory.A typical 5S implementation would result in significant reductions in the square footage of space needed for existing operations. It also would result in the organization of tools and materials into labeled and color coded storage locations, as well as "kits" that contain just what is needed to perform a task. 5S provides the foundation on which other lean methods, such as TPM, cellular manufacturing, just-in-time production, and six sigma can be introduced.

II. Types of 5S

2.1 Sort

The first S, Sort, calls for the elimination of unnecessary items that have collected around work areas. As debris and unused objects build up, productivity often takes a turn for the worse. In unproductive workspaces, frustrations mount when workers find that they are unable to satisfactorily finish the task at hand. Therefore, it is vital to implement a workplace sorting system. The effective visual method of identifying unneeded items is called “Red Tagging”.

2.2 Set in order

Now that your workplace has been sorted, it is time to implement a more comprehensive system of organization. While sorting is an effective method, used by it, it is only a preliminary measure. Set in Order (Seiton) focuses on effective storage and organization methods, with the end goal of developing an environment that resists clutter and aids long-term productivity.

2.3 Shine

Once you have eliminated the clutter in your work area, it is important to thoroughly clean that area and the equipment in it. Leaks, squeals and vibrations involving clean equipment can often be easily detected, but a

dirty workplace tends to be distracting and equipment faults go unnoticed. Clean workplace conditions are also important to employee health, morale, and safety.

2.4 *Standardize*

Cleaning and organization systems implemented without established standards tend to lose effectiveness with time. Allow your employees to participate in the development of standards that improve workplace conditions. Ask for feedback as you find the best way to balance employee morale with production concerns.

2.5 Sustain

This is by far the most difficult S to implement and achieve. People tend to resist change and even the most well structured 5S plan will fail if not constantly reinforced. Fortunately, there are effective methods of sustaining positive growth.

III. Company Information

Name of Industry:- Metalfab Hightech Private Limited,Nagpur.(unit II)
Address: L-2, M.I.D.C., Hingna road, Nagpur (M.S.)
Establishment:-Company was established in year 1981 as M/S.METALFAB INDUSTRIES up to 1995, subsequently later known as M/s. METALFAB HIGHTECH PVT. LTD on Day 17th April 1996. ISO-9001-2000 certified company. The owner of this company is Mr. Hukumchand C. Jain.
Company Client:-BHEL-Bharat heavy electrical limited
L & T – Larson and Turbo
Company Product:-General Fabrication work "I section beam"
Raw Material: - M.S.Plate, M.S.Angle, M.S.Channel etc.
Labor:-50 (2 shift).

3.1 Plant Layout

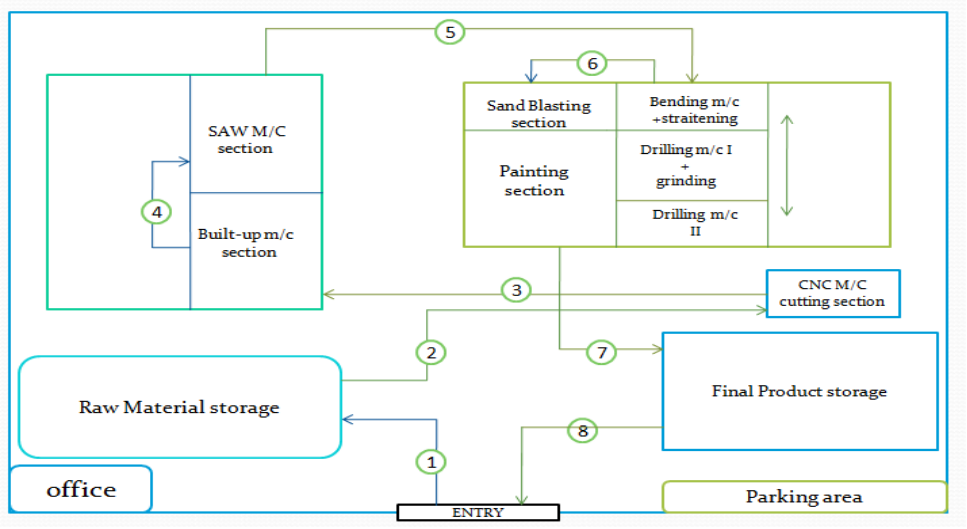


Fig 1.Plant Layout

3.2. Process

This is small industry. In which M.S.Plate is used as raw material and this raw material is converted into the finish good. The process for the I section beam is given below.

1) When raw material comes into the company, it is store in the storage by using fork left (Manually)
2) After stage of storing material the quality inspector check the raw material visually. If any problem found in the raw material then these raw materials send back or salvage it.
3) Then this raw material comes in CNC department where cutting operation perform as per requirement.
4) Built-up Machine fit the beam as per dimension.
5) After that Process next stage is welding for that submerged arc welding is used for welding purpose.
6) After that this product going to straitening department where straitening the beam operation are performed
7) After that this product is going to grinding machine where cleaning the beam is perform.
8) After that this product is going to sand blasting machine where super finishing is done.
9) After that Painting the beam and finally goes to the Final product store area.

3.3 Material flow of I section beam (Before improvement)

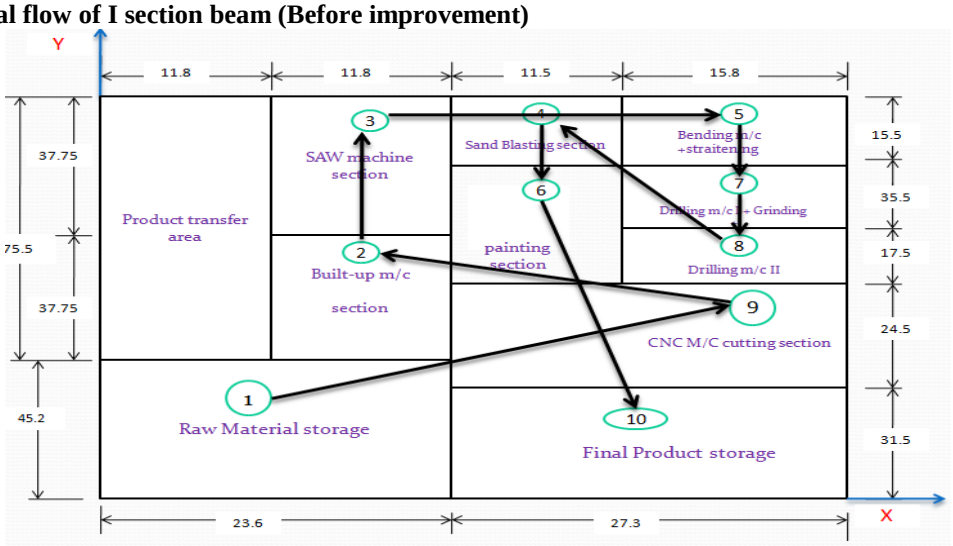


Fig 2. Material flow of I section beam

3.4. Department area

DEPARTMENT	AREA	
Raw material storage	23.6x45.2	1066.72 sq.mt
Material transfer section	75.5 x 11.8	890.9 sq.mt
Built-up machine section	37.75 x 11.8	445.45 sq.mt
SAW Machine section	37.75 x 11.8	445.45 sq.mt
Sand Blasting section	11.5 x 15.5	178.25 sq.mt
Painting section	11.5 x 53	609.5 sq.mt
Bending and straitening section	15.8 x 15.5	244.9 sq.mt
Drilling I and Grinding section	15.8 X 35.5	560.9 sq.mt
drilling II section	15.8 X 17.5	276.5 sq.mt
CNC cutting section	27.3 x 24.5	668.85 sq.mt
Final product storage section	27.3 X 31.5	859.95 sq.mt

Table 1. Department area

MACHINES	AREA	
Built-up Machine	6.5 x 4.8	31.2 sq.mt
SAW Machine	8.2 x 7.6	62.32 sq.mt
CNC Machine	18.8 x 17.6	330.88 sq.mt
Drilling machine I	2.3 x 1.3	2.99 sq.mt
Drilling machine II	4.9 x 1.4	6.86 sq.mt
Plate bending	6.9 x 1.4	9.66 sq.mt

Table 2. Machine area

3.5 Operation Process chart (Before improvement)

Operations	Product-I section beam Material grade-E350BR						
	distance (Meter)	Time (Min)	○	⇨	D	□	▽
Laying raw material from storage							●
Travel to CNC Machine	22.59	4.22		●			
Marking and Cutting		16.4	●				
Travel to built-up machine	19.85	3.35		●			
Await for Beam		3.83			●		
Fit up the Beam		20.14	●				
Checking the beam		1.45				●	
Travel to SAW Machine	37.75	5.15		●			
Welding the beam		26.5	●				
Checking the beam		1.13				●	
Travel to straitening	20.15	3.4		●			
Straitening the beam		31.12	●				
Travel to grinding m/c	18.86	3.2		●			
Grinding the Beam		34.32	●				
Checking the beam		1.4				●	
Travel to Drilling	17.8	3.12		●			
Marking and Drilling(6 hole)		38.81	●				
Travel to Sand blasting m/c	38.5	5.25		●			
Await for Beam		3.64			●		
Superfinishing the Beam		40.42	●				
Travel to paint section	27.86	5.13		●			
Primer and Paint		20.15	●				
Inspection		1.4				●	
Travel to storage	16.89	3.01		●			
Product storage							●

Table 3. Operation process chart

IV. Area Of Study

1) Proper utilization of storage space more prominently.
2) Arrangement of departments in desired sequence.

4.1. Objective of study

Objectives of improve the plant layout are,
1) Minimize waiting time between straitening and grinding the beam .
2) Minimum material handling and related travelling cost.
3) Minimizing travelling distance in material flow.
4) Minimizing total time in process.
5) No backtracking moves.
6) Standard material flow pattern.
7) Better utilization of available space.

4.2 Problem Identification

1) More waiting time between straitening and grinding the beam .
2) More travelling distance and related time in material flow.
3) Material flow pattern is not standard.
4) Backtracking moves.
5) Scrap storage bins are located inside the industry which occupies extra space and material flow become difficult.

V. Comparison Of Existing Layout And Improved Layout

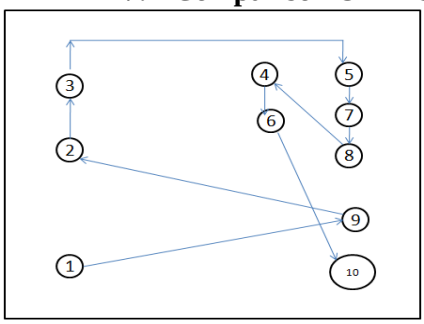


Fig 3 a. Existing material flow

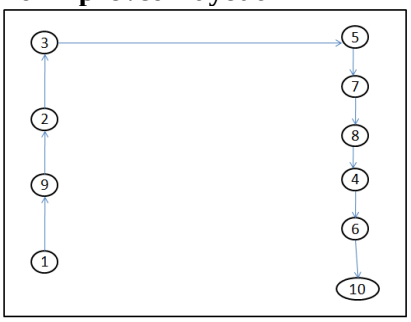
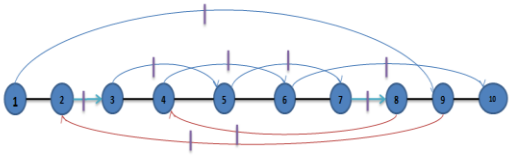


Fig 3 b. Proposed material flow

1. Raw material 2. Built-up machine 3. SAW machine 4.Sand blasting machine 5.Staritening 6. Painting 7.Grinding 8. Drilling machine 9. CNC Machine 10. Product storage

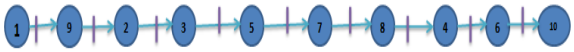
5.1 performances Measure of Material Flow Sequence



Total moves	In-sequence moves	Backtracking moves	Bypassing moves
09	02	02	05

- Percentage of in-sequence moves =2/9 = 0.22= 22 %
- Percentage of backtracking moves = 2/9= 0.22= 22 %
- Percentage of bypassing moves = 5/9 = 0.56= 56 %

Fig 4a. Before Implementation



Total moves	In-sequence moves	Backtracking moves	Bypassing moves
09	09	00	00

- Percentage of in-sequence moves =9/9 = 1.00= 100 %
- Percentage of backtracking moves = 0/9= 0.00= 00 %
- Percentage of bypassing moves = 0/9 = 0.00= 00%

Fig 4 b. After Implementation

VI. Implementation of 5s Techniques

6.1 Sorting Out: Separate the necessary from the unnecessary and get rid of unnecessary

All unneeded tools, parts and supplies are removed from the area. The company layout is fixed according to process but the company does not consist of a systematic arrangement for various material handling and storage.

6.2 Set in Order*:* A place for everything and everything is in its place.

Fig 5. Set in order

6.3 Shine*:* The area is cleaned as the work is performed.

Fig 6. Shine

6.4 Standardize: Cleaning and identification methods are consistently applied.

Fig 7**.** Standardize

6.5 Sustain: 5S is a habit and is continually improved the company culture.

VII. Benefits

1. The production rate will increase due to systematic arrangement.
2. The space utilization will increase.
3. The atmospheric conditions will improve.
4. Clean and hygienic condition is achieved.
5. It is convenient to handle and operate each and every material.
6. Moral support of the operators and workmen's are improved.

7. Storage space is increased within the same area.

VIII. Conclusion

By using "5s"technique improved visibility of problem conditions, improved safety, reduced waste, improved morale, an increased sense of ownership of the workspace, improved productivity, improved quality, improved maintenance, shorter lead times, and a better impression on customers. More fundamentally, a well-implemented 5S program helps the culture develop a new sense of discipline and order that carries over into all activities.

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