Fixture Change Over Process on Lean Technique For Improve The Production System In Foundary Unit

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Abstract- *Lean manufacturing began as the Toyota Production System in the Japanese auto industry in the 1970s and 1980s. Its main goals were to eliminate waste, reduce the need for managing large inventories, and provide optimum quality at the least cost by making quality control decisions an immediate part of the manufacturing process.*

This study deals with the improvement of productivity, focusing mainly on reducing the cycle time in a fettling shop of the foundry. The methodology consists of selecting a product or product family to be studied, followed by current process study. Once the existing process is documented, all the assembly tasks involved are timed using time study techniques. The actual cycle time was found to be for greater than targeted cycle time. This was mainly due to the very low Overall Equipment Effectiveness of snag and Robocell machine. Total Productive Maintenance and Single Minute Exchange of Die are the important lean tools which are used to improve the performance of machines by increasing the Overall Equipment Effectiveness.

I. INTRODUCTION

1.1 Flexibility:-

To be able to respond very quickly to changing market demands, you need to be able to produce small lot sizes in an a economical way.

1.2 Bottleneck Capacities:-

Reducing setup times increases the available capacity, Which can be interesting as an alternatives to buying new equipment or installing an extra shift in situations where the market demand increases.

1.3 Cost Reduction:

Since, especially on bottlenecks, the direct production cost is related to machine performance,

1.4 Lean Manufacturing:

Lean manufacturing is a management philosophy derived mostly from the Toyota Production System (TPS) and identified as “Lean”. The term “lean” in the manufacturing context implies identification and elimination of waste in all the processes involved. Lean manufacturing has a comprehensive set of elements, rules and tools that focus on the elimination of waste and creation of value. It aggressively seeks to eliminate all non-value added activity and tries to install a philosophy of continuous improvement.

1.5 Lean tools and techniques:

The lean manufacturing process has a number of tools and techniques which can be used in order to reduce the cost and thus maximise profit. Some of the tools and techniques

Standard Work Combination Chart:

The standardized work combination table shows the combination of manual work time, walk time, and machine processing time for each operation in a production sequence. This form is a more precise process design tool than the Operator Balance Chart. It can be very helpful to identify the waste of waiting and overburden, and to confirm standard work in process.

The standardized work combination table is one of three basic forms for creating standardized work, along with the standardized work chart and job instruction sheet. The purpose of standardized work, according to Kaizen Express from which this form is taken, is to provide a basis for continuous improvement through kaizen.

5S is the base tool for implementing other lean tools in manufacturing. After implementing 5S we can eliminate maximum wastes in the shop floor. Organize the work area:

- Sort (eliminate that which is not needed)
- Set In Order (organize remaining items)
- Shine (clean and inspect work area)
- Standardize (write standards for above)

- Sustain (regularly apply the standards)

Eliminates waste that results from a poorly organize work area (e.g. wasting time looking for a tool).

Total Productive Maintenance:

Total productive maintenance (TPM) is a system of maintaining and improving the integrity of production and quality systems through the machines, equipment, processes, and employees that add business value to an organization.

Pillars of the Total Productive Maintenance are

- Autonomous maintenance
- Planned Maintenance
- Quality Maintenance
- Focused Improvement
- Early Equipment Management
- Training and Education
- Safety, Health, Environment

TPM in Administration

Reinforcement Material

The reinforcement material used in the investigation was Silicon Carbide and Boron Carbide. The grain size of Silicon Carbide and Boron Carbide is 25µm and 50µm.

Composite Preparation

The composite material used for the present research is fabricated by using the stir casting method as it ensured the uniform distribution of the reinforcements. The fabrication procedure followed for making of Al6061/Sic/B_4C composites is presented as follows. In the process of preparing the composites, the aluminium alloy in the form of ingot

II. SINGLE MINUTE EXCHANGE OF DIE (SMED)

In any kind of manufacturing environment major role takes place is waste. Waste can extend from unused raw material to damaged products, and it can carry quite of a financial loss for the company if not treated in an efficient manner. In order to reduce waste, there are several numbers of methods and strategies that companies can use depending on the desired results. One of the most popular methods is Single Minute Exchange of Die or SMED.

SMED was developed by Shigeo Shingo in 1950s Japan in response to the emerging needs of increasingly smaller production lot sizes required to meet the required flexibility for customer demand. The SMED technique is used as an element of Total Productivity Maintenance (TPM) and “continuous improvement process. It is one of the method of a reducing wastage in a manufacturing Process. The phrase "single minute" does not mean that all changeovers and startups should take only one minute, but that they should take less than 10 minutes (in other words, "single-digit minute").

Poka-Yoke (Error Proofing):

Design error detection and prevention into production processes with the goal of achieving zero defects. It is difficult (and expensive) to find all defects through inspection, and correcting defects typically gets significantly more expensive at each stage of production.

HINDUJA FOUNDRIES LIMITED (SPU UNIT)

In the year 1959 in the city of Madras in South India, British Leyland established an enterprise for the manufacture of automobile castings. The jobbing foundry commenced production in the year 1961 and took the first step to drive the nation ahead on the road to progress.

Today, Hinduja Foundries is India’s largest foundry group with the capacity to produce cylinder block and head ranging from 25 kgs to 500 kgs.

From castings for automobiles and tractors to industrial engines, construction equipment and power generation equipment, Hinduja Foundries meets the stringent requirement of diverse segments. It even caters to the exceptionally high standards of Defence applications.

Hinduja Foundries hones its skills by enhancing its developmental capabilities with the most complex castings. The indigenous expertise that drives the organization enables it to keep pace with the constantly changing requirements of the market. At its advanced facilities for tool design and manufacture Hinduja Foundries produces cast iron cylinder blocks, cast iron cylinder heads and cast iron transmission housings. It has won much-coveted quality certifications including ISO 9000, QS 9000 and ISO 14001 certifications that endorse its capabilities

Fettling Process:

Fettling process is the removal of feeders and excess material from a casting or first stage of finishing a casting.

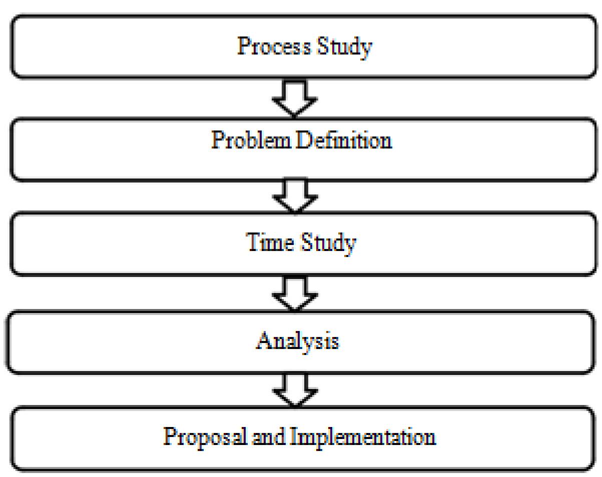
The metal removal is often achieved using manual cutting or grinding. However more emphasis is being placed on automatic fettling, whereby the casting is placed in a machine programmed to remove materials from specific areas. The method of fettling must be taken into account at the initial casting design stage, so that the process is fast and efficient.

Blasting – abrasive particles such as sand, grid or steel shot, are propelled at high velocity to impact the casting surface to remove surface contaminants. It can also be used to provide a uniform surface finish to castings. Propulsion of the abrasive particles is usually achieved using a centrifuge or compressed air nozzles.

III. PROJECT METHODOLOGY

3.1 Methodology of the project:

The methodology of the project is described as a flow chart as shown in figure 3.1.



Time Study:

Work measurement refers to the estimation of standard time for an activity that is the time specific for completing one job by using the predicted method. Standard time can be defined as the time utilized by an average experienced for the job with provisions for delays beyond the operator's control.

A work has to be measured for the following reason

- To identify and eliminate non-value added times
- To install standard times for performance measurement.
- To measure performance against standard

Time study can be simply defined as a technique to estimate the time to be allowed to a qualified and well working at a normal pace to complete specified method.

Data collection:

Data collection points were selected and identified after studying the plant layout and the observing the plant in operation such that minimum interference with work flow could occur. Here the data collected is cycle time for each process station. The cycle time is observed in the detailed category of value added & non value added activities. Value stream mapping is used to demonstrate the current state of the process observed. Value-added flow charts are created to identify and separate value adding activities from non-value adding ones

Fixture change over time:

i) NC grinding machine
Total cycle time = 3860 sec

ii) Robocell machine

Total cycle time = 450 sec

iii) Cycle time NC grinding machine
Total cycle time = 253secManual time = 198sec
Machine time = 55sec

iv) Cycle time Robocell machine
Total cycle time = 329secManual time = 121sec
Machine time = 208sec

3.1.4: Analysis:

After observing the processes at the plant and collecting data, efforts in the analyze phase are focused on investigating the root causes of the problems in the processes. Brainstorming sessions were held to examine process flow charts, pareto chart and cause and effect diagrams are created to identify the root causes of each problem. In the Phase-1 we analyses the data collected to find the key variables which cause process variation, and discovers the causes for low productivity. Alternative ways of improving the process are also evaluated during this phase. The various tools used in Phase-1 are root cause analysis, pareto chart, cause and effect diagram, and Overall Equipment Effectiveness.

3.1.5: Proposal and Implementation:

If there is any improvements after analysis a formal proposal can be done. If it is feasible to implement, it can be implemented as well.

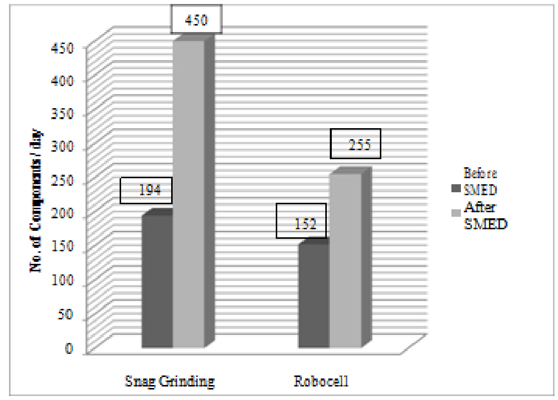
IV. CONCLUSION

From the results and discussions, it is concluded that using lean tools such as Total Productive Maintenance and Single Minute Exchange of Die, it is possible to improve overall equipment effectiveness. This project shows that the current OEE value is 41% and it is raised by 20%.SMED concept is used to divide the internal and external activities of the machining process. Main focus is converting the internal activities into external activities to reduce the cycle time. Finally by implementing the SMED the snag cycle time has been reduced 253 to 137sec and Robocell also reduced from 329 to 269sec.Two different fixtures were used for loading engine blocks of two different models to assist fettling operation. These fixtures are huge in size and it increase the cycle time. Cycle time was reduced by providing a common smaller redesign fixture which could accommodate for both the models. In order to improve the OEE, the fettling machine cycle time, fixture change over and break down timing have been minimized to achieve the target. Fixture changer over time and Fixture problem have been rectified and fabricated.

V. RESULT AND DISCUSSION

5.1 Comparison Between Before SMED and After SMED:-

After the SMED technique was applied to the bottle neck Operation, the total time taken for snag grinding to perform the operation was decreased by 54 percent from 253 sec to 137 sec and for Robocell decreased by 81 percent from 329 sec to 269 sec. The Company Started producing the Number of Components in a snag grinding is increased from **194 to 450 per day** and Number of Components per month increased from 5044 to 11,700 and for Robocell is increased from **152 to 255 per day** and Number of Components per month increased from 3952 to 6630.



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