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CHANGEOVER TIME REDUCTION USING SMED TECHNIQUE OF LEAN MANUFACTURING

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ABSTRACT:
In a long run, low volume and high variety product manufacturing fast changeover time plays an important part in maximizing the capability of our equipment .With the increasing demand for more product variants and short delivery times from customers it is necessary to have short lead times in production. This is where Single Minute Exchange of Die (SMED) application is abundant. This paper represents the Case study of changeover time reduction using SMED technique of Lean manufacturing. Machines having utilization less than 80% was defined as critical and were chosen for SMED Application. The result has shown that, SMED can significantly reduce the changeover time.

Keywords: Change over Time, SMED, Time Study.

1. INTRODUCTION:
As we know that, Changeover Time is a period required to prepare a device, machine or system for it to change from producing last good piece of last batch to producing first good piece of the new batch. It is important to note that, Setup and Changeover are sometimes used interchangeably; in other cases Setup is viewed as component of changeover. In that usage, it refers to the part of changeover that is focused on configuring a machine for different product type. A smaller literature [1] concerns with concept of Lean, Changeover time, Various Tools and techniques within Lean system .During the last decade, the need for shorter setup times is increasing across all types of industries.

Changing market demands, due to the transition from a sellers' to a buyers' market as well as globalization of markets far beyond national borders, put high demands on flexibility and costs. Three key reasons why set-up times need to be reduced can be identified, as described in the following sections [2].
(i) Flexibility and inventory reduction: The market demands more product variants. The real challenge in this lies in the combination with decreasing order/delivery sizes. Also, customers want short delivery times and a high delivery reliability. The most efficient way to accomplish this is to have short lead times in production. Otherwise, the only solution is having inventories of end product, which have to be large and are costly.
(ii) Bottleneck capacity: Every manufacturing plant has its bottleneck Capacities that barely can, or cannot, meet market demand. When sales increase and production has to increase even by a small amount, people tend to make the obvious, though expensive, decision: we have to buy an additional machine or create an additional shift. These solutions are expensive. What is often a better approach is to examine first whether the available capacity is being fully utilized. A large amount of production time is lost due to changeovers. A typical situation is 50% production and 50% set-up. This means that if you can reduce set-up time, you create extra production capacity. Bottlenecks are therefore the first priority for setup time reduction.
(iii) Cost minimization: The obvious formula for profit (profit = market price – costs) demonstrates easily that if you want to maximize profit (the goal of all business activity), the only thing that you can work on is Cost reduction. This must be a continuous goal. As a major portion of the cost of a product is determined by the manufacturing cost, especially the equipment cost, it is critical that equipment performance is monitored well. Only then is it possible to maximize the equipment effectiveness, and so minimize direct production cost.

2. THE SMED CONCEPT: The Single-Minute Exchange of Die (SMED) concept took its step at Toyo Kogyo's Mazda plant in Hiroshima, Japan when its author, Shigeo Shingo conducted a production efficiency improvement study in 1950. SMED is the acronym for Single-Minute Exchange of Die. The term refers to the theory and techniques for performing setup operations in less than ten minutes. Although not every setup can literally be completed in single-digit minutes, this is the goal this is the goal of the system. Even where it cannot, reduction is still tremendous improvement.
Types of Setups:

i). External Setup - Setup done while the machine is running, e.g., tools and dies preparation before setup or returning of tools and die after setup is done.
ii). Internal Setup - setup done while the machine is off, e.g., installation or replacement of new die.

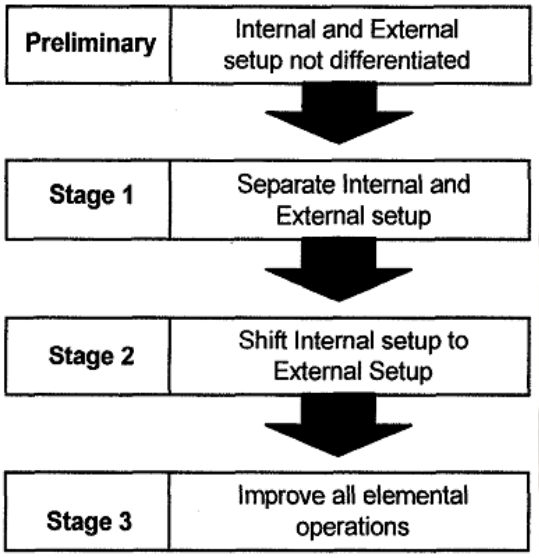


Figure SMED Conceptual Stages

3. Typical Case Study of SMED Application:

Historical Data Collection of machine utilization:
Past Year (2010-11) data collected for to know Machine utilization. The graph reveals the % of Machine utilization and % Setup of machines for Year 2010-11.

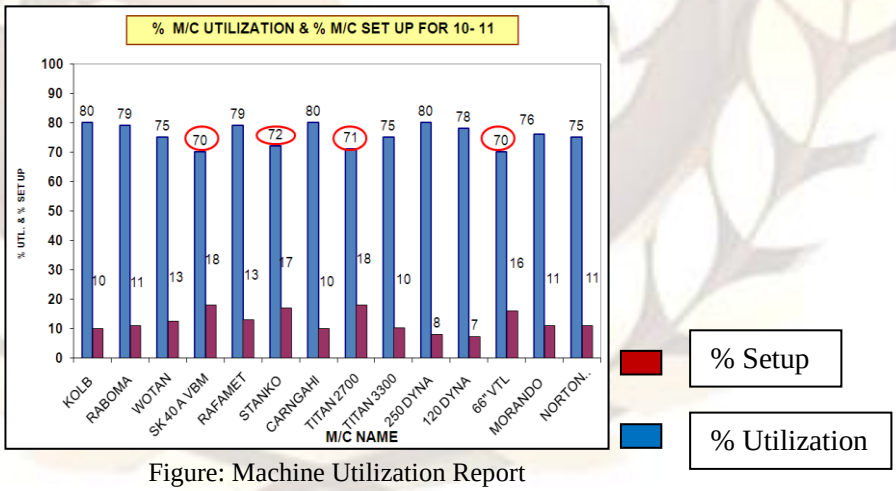


Figure: Machine Utilization Report

APPROACH TO SMED:

1. Create SMED Structure: The first approach is to create a SMED structure that is necessary to make engine run. A committee is needed to be formed with departmental managers as Head. SMED is driven by core team composed of Industrial and production engineers focusing on critical areas.
2. Continuous Training and Education: Prior to using SMED training to be given to key team members by a Lean expert consultant for to educate them on SMED.

3. Problem Identification:

Figure1 shows SK40AVBM, STANKO VBM, TITAN2700 and 66"VTL are having maximum setup time (i.e. having machine utilization less than 80%). Ideally, machine utilization should be 80%. So these machines are identified as critical and need to be focused. Only critical machines were selected since to convert everything all at once is practically difficult.

Current Changeover Time Study: By using traditional Time Study technique of Industrial Engineering current Changeover Time Study on critical machines were taken. Figure below shows the results of existing changeover time.

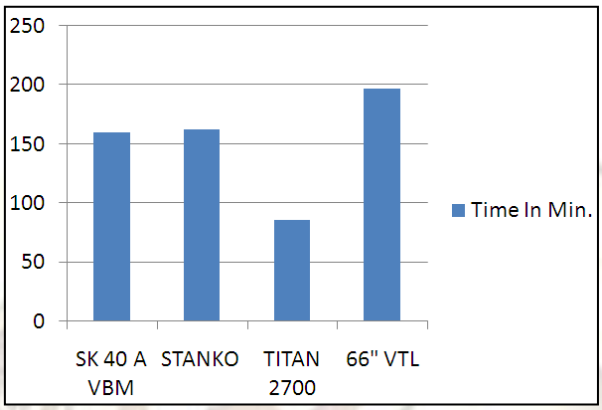


Figure: Existing Changeover Time

4. SMED Application:

The SMED application began by identifying the setup elements of the focus areas. As the principle stated, the group used the following steps:

i) Identify setup elements and separate external elements from internal elements.
ii) Shift internal elements to external elements.
iii) Prepare improvement projects for conversion, simplification of both internal and external elements.
iv) Implement SMED improvement Projects.

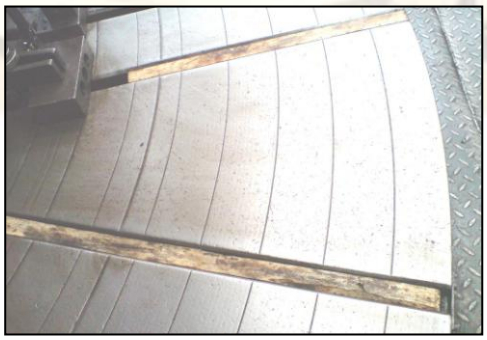
From the results of time study analysis we have noted some issues which were common for all machines and also their contribution is maximum in total changeover time. These issues are listed as below with their % of contribution with respect to Total Changeover time:

a) Cleaning of Chuck (10%)
b) Clamping of Chuck (20%)
c) Setting of Jack (Height) (25%)
d) Waiting by 2nd operator while 1st operator is working (10%)
e) Availability of Crane, Lifting Tackles, Chain, Tools etc. (10%)

5. Improvement Process:

Various improvement activities are as below:

1. The time in Cleaning of chuck is minimized by using wooden strips in T Slots of chuck as shown in photograph



Photograph: T Slots covered by Wooden Strips

2. The time in Clamping of chuck is minimized by using Pneumatic Studder with its Adaptor Nut instead of manual clamping or declamping of chuck nut, bolts. as shown below

Photograph: Adaptor Nut of pneumatic Studder

3. Setting of Jack height for fixing the next job on Fixture plate or Chuck is made offline while machine is busy with previous job. Thus, offline setup activity of Jack will cause reduction in changeover time. Photograph below shows a typical 'Support Guide Stand' prepared for offline height setting of Jack.

Photograph: Offline Height Setting of Jack

4. Waiting by 2nd operator while 1st operator is working is eliminated by grouping the activities in Sequential and Parallel categories.
Thus, idle operator time can be eliminated.
5. Availability of Crane, Lifting Tackles, Chain, Tools etc. is made by making a special tool kit or trolley for temporary storage of these items on each machine in advance before the next setup. Thus, waiting time, handling time and transportation time can be eliminated. Photograph below shows a typical 'SMED Trolley' prepared for temporary storage of necessary tools of next setup.

Photograph: SMED Trolley

Project Results:

The application of SMED produced remarkable results in the focus areas. Figure below shows the change over time on the critical machines and hence impacted an increase in machine utilization. Results showed a change over time reduction of near about 50% per machine.

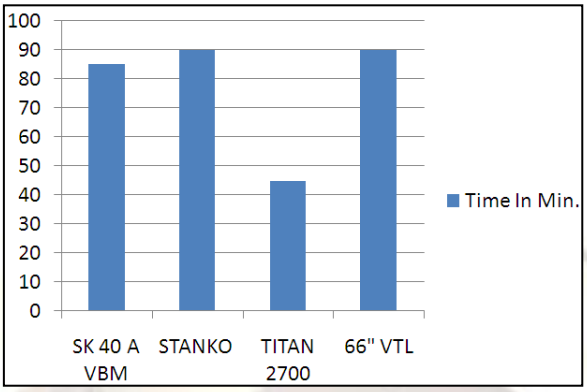


Figure: SMED Driven Changeover Time

CONCLUSION:

It is evident that production flexibility is going to improve with the application of the SMED . SMED had reaped us of benefits in terms of capital avoidance because of the additional capacity we gained from the reduction of change over time. Thus, We can able to face Changing market demands and global competition. Lastly, SMED is a process and not merely a program because a program has a beginning and an end. Therefore, constant sustaining and improvements through SMED must be continuously implemented.

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