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Setting Time Reduction in Drum Brake Assembly for Improving Productivity

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ABSTRACT

In today's competitive world, customer demands are very high. People who can give more with fewer resources sustain while others are scared out. Organization focuses more on delivering product or services which satisfies the customer demand (in terms of quality, performance, and timeliness) and meeting this at the lowest cost is the challenge. Productivity has nowadays turning into an everyday wristwatch word. It is vital to the benefit of manufacturing firm and intended for the profitable progress of the nation. Higher productivity indicates to delivering a product at the shortest achievable time by way of least expenses on input exclusive of sacrifice quality as well as least amount waste resources. Setting Time Reduction is the method of dropping changeover time that is start from last good piece of previous run to opening good piece of subsequent run. Seeing as setup performances add no profitable shape, fit or Function towards the manufactured goods, they are with meaning non-value addition. In our research work based on loss hour's potential stages to be corrected are identified. Also, improvements for loss hour reduction will be recommended by modifying the stages thus loss hours can be reduced.

Key words: Drum Brake Assembly; Setting Time Reduction; Productivity; quality; performance

1. INTRODUCTION

Project requires a multi-disciplinary background theory in order to analyse and study the scope for the proposed objectives. For improving productivity initially, a study on the factors that affect productivity should be carried out. Some background in different industrial engineering concepts, latest manufacturing techniques and problem solving tools are necessary to understand this project as the project uses them extensively.

Carl R. Schultz [1] explained mechanism of reducing the firm's standard cycle time when machine breakdown occurs without increasing in capability or engineering more rapid processing time which able to repeatedly be accomplished during an inventory of standby parts. He also stated that maintaining inventory of standby parts which reduces the mean time for repairing that resultant could improved availability of machinery as well as reducing cycle times. Pearn et al. [2] studied learning along with forgetting effect and difficulty for development of family job in particular mechanism for reducing overall finishing period in the entire job. The setting period occur when mechanism starts. Three replicas are introduced as well as evaluated to examine impact of knowledge as well as disregard. Stevenson [3] reviewed common approaches for highlighting the significance of a Production Planning and Control performance strategy.

Ali Allahverdi [4] defines set-up time as attaining equipments, location, work in process of materials, return tools, clean up, set the necessary jigs as well as fixtures, adjusting tools plus checking materials within the manufacturing process. Ahmed naufal et al. [5] did a case study by implementing *kanban* in Malaysia based firm which helped significantly in reducing lead time of 40% a day. Hari G. et al. [6] decreases the lead time in such a way that they find *takt time* of product then focuses on the operation which

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is having cycle time higher than takt time and by Cause and effect and why-why analysis, collects a data then design a new fixture to reduce setup time and also make a SOP and implement a 5S.

Renu Yadav et al. [7] used a *VSM* technique by mapping the whole process and propose layout changes to reduce transportation time. Method study concept like Parallel activities and combine concept are being applied to reduce process time. Premaratne Samaranayake [8] finds out that Production scheduling and manufacturing planning and control (MPC) too can help reduce waiting time. C. Rosera et al. [9] explains about Bottle neck machine in multi-work station and they give the idea of Bottleneck walk to determine Bottleneck machine, After that bottleneck must be connecting arrows point towards each other. Then circling bottleneck by means of red box visualizes the decision. Afzal H. Alad et al. [10] point out those typical purposes of PPC System comprises the planning material supplies, demand administration, capacity development as well as scheduling in addition to sequencing of Process.

Our research work describes the concentrates on the background theory of the tools and techniques that have been utilised in this project. In our study based on loss hour's potential stages to be corrected are identified. Also, improvements for loss hour reduction will be recommended by modifying the stages thus loss hours can be reduced.

2. SETTING TIME

Industrial sectors faces and problem for decreasing of cost as well as efficiency Challenges within their products Operations. For withstanding in today's Globalization world, Manufacturers require to discover the behaviour to decrease manufacturing time as well as cost so as to get better operating performance as well as quality of the product. Our research work deals by reduction in set-up period by Single Minute Exchange of Die (SMED).

2.1. Keys to Reduce Your Setting Time

2.1.1. Observation

Because of the expectation with every process, the first movement is observation. The position requests to be observed along with documentation. It permits a baseline to be recognized in order that the intensity of development could be resolute and also offers raw information that would be utilised with the process. The most excellent method to employ at this stage is videotaping however it must be handling sensitively. Staffs normally not experienced with regular troubles at the same time as they carry out the significance of process set up period reduction. The tape permits the set up to be repeated as numerous times since it is essential to analyze with get better process.

2.1.2. Defining

In the step is to recognize those steps during the practice which are interior or outside. Interior set up fundamentals are those which can single be carry out while the mechanism is not functioning. Outside set up fundamentals are those which can be carry out by means of the machine operation.

2.1.3. Separating

The set up process at the present wants to be altered so that everything was defined as exterior in the preceding step is now done even as the device is running. Perhaps the most effectual thing to perform at this stage and the process development is to improve the checklist of everyday jobs so as to have to be carrying out besides tools with the intention of gathering as the device is running. Manufacturing industries discover with the aim of this easy process saves them an astonishing measure of time although don't bother about doing it and perhaps since it is also observable. Two other regions to focus on at this stage are

purpose to check with tooling transportation. By doing a purpose check on the tool earlier than it is loaded into the mechanism and the tool can be renovated if somewhat doesn't work properly prior to production stops. By improving tooling transportation furthermore allows the tool transportation in the machine prior to the requirement with stimulated into the function further efficiently.

2.1.4. Shifting

In this stage attempt has to find ways to change element which are at presently interior to exterior. Each interior element requires to be questioned to identify with whether it has to continue interior. By unleashing your creativeness as well as difficulty solving ability, huge advantages can be prepared in this area. Perhaps the most excellent way to create the most impact at this stage for looking at the set up as if you are considering it for initial time. You have to keep away from each and every one cost old behaviours as well as attitudes attainment in the method of development.

2.1.5. Streamlining

Large enhancements should have been attained by the time accomplishing in this point that there is still opportunity for additional. Each element in this set up that is internal and external requires to be examined to observe if there is any approach to permanently remove it otherwise decrease the time along with effort it takes. One method often used to make more efficient set ups are through applying parallel operations. Doing equipments in parallel may indicates that a work that took 10 minutes by means of single person get 4 minutes with two. The economy generally appears from removing the walking from one ending of device to other otherwise the walking starting one region of the device to other. In this instance the whole amount of labour utilized and period engaged or both are to be reduced. Still if the work obtained with 6 minutes by means of two people it would possibly still be significance doing this way for the reason that the profits of the device could create in the additional 4 minutes so as to it is now offered to run.

3. PROCESS FLOW

The flow for process and steps concerned in making a brake assembly are shown in Figure 1.

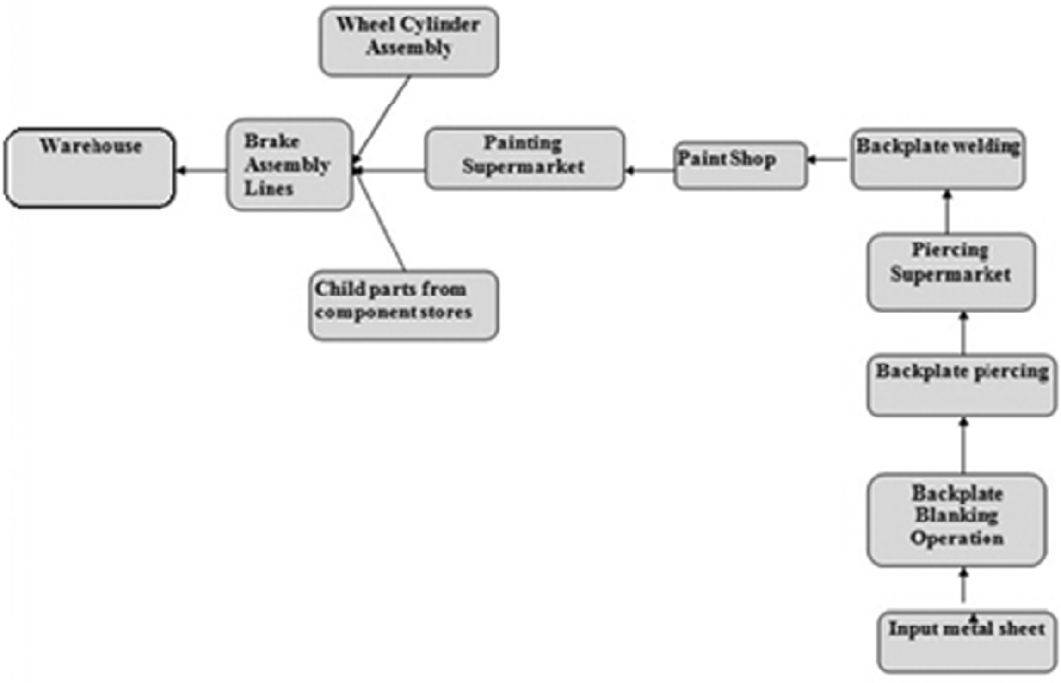

Figure 1: Flow for the process and steps concerned in making a brake assembly

First the plate undergoes pressing and blanking, after which the plate goes for welding. Once welding is completed it further goes for painting, after drying and inspection plate than moves to the assembly.

The processes identified before final assembly are press shop, welding and painting. The schematic of the process mapping is shown in Figure 2.

It is also observed that a significant amount of inventory is held between the different processes. The amount of inventory held between each process is shown in the map**.** This has to be reduced.

3.1. Press shop

Pierced back plates are sent for welding from the press shop.

From the above information it can also be inferred that the products and cells alignment needs to be modified. This is one major finding where we need to focus.

3.2. Welding

The process prior to painting is welding. It is observed that there are 3 welding cells for the 4 different models that are in line 3.Models D and B go through cell 4, model a goes through cell 5 and model C goes through cell 8. Also the changeover time is observed to be very high (45 minutes).

3.3. Painting

Painting is a fully automated process. Here the back plates are fitted in a hanger which moves along a conveyor for a time span of 150minutes.

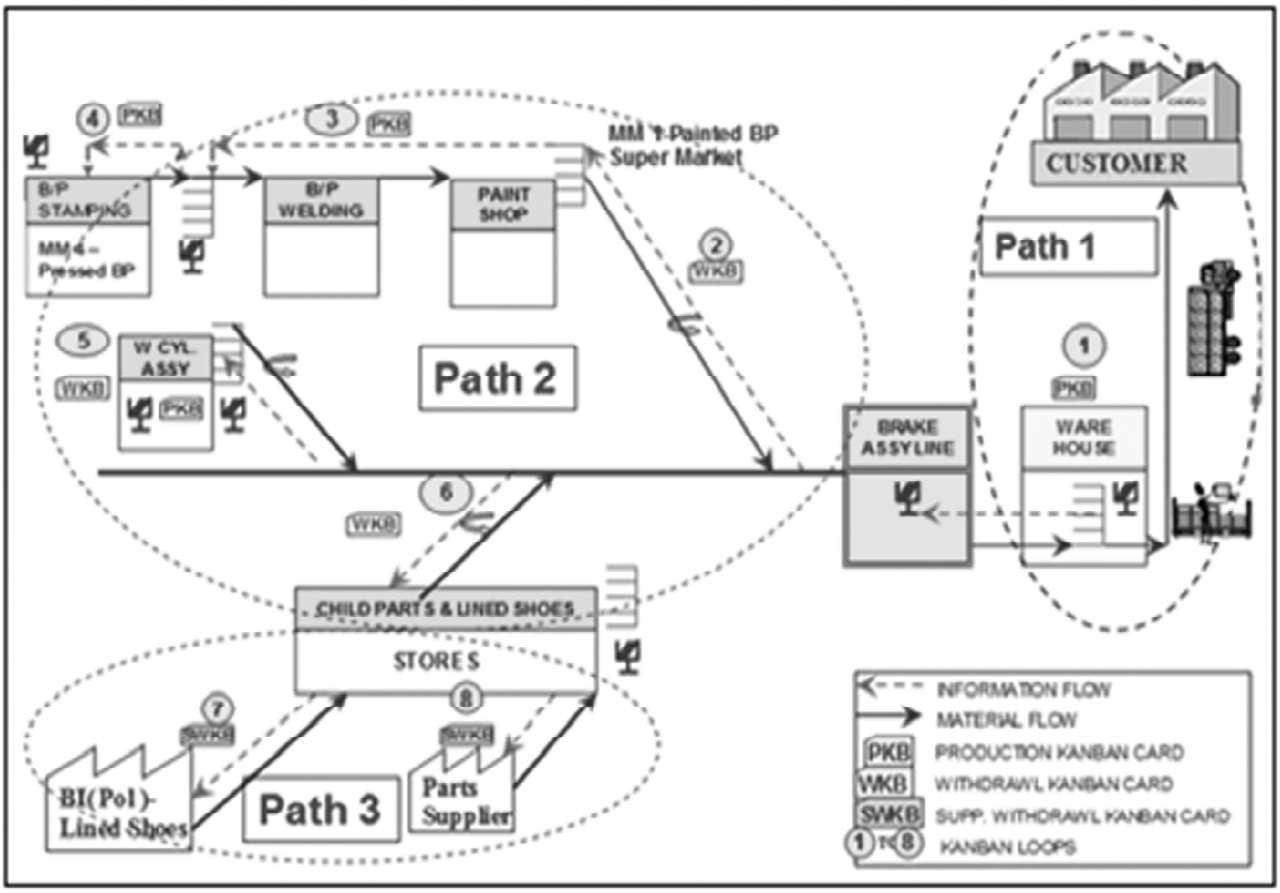

Figure 2: Schematic of the process mapping

3.4. Assembly and packing

The line is a automatic set up, the conveyor takes the plates to different assembly stations where in values are added, after visual inspection the product goes for packing and then to Stores.

4. PRINCIPLE OF DRUM BRAKE

The operational theory of drum brakes engages a set of shoes or else pads to facilitate to produce friction against a drum linked to the rotary wheel. The back plate offers a base for another part. It connected with axle along with solid face intended with wheel cylinder and brake shoes as well as variety of hardware. Drum of brake has normally prepared with particular kind in cast iron with the intention of heat conductive as well as wear resistants.

Various drum brake parts are shown in Figure 3.

The crescent formed pieces are namely with Web along with contains holes as well as slots in dissimilar forms of returning the springs and hold down hardware with parking brake connections along with personality adjusting elements.

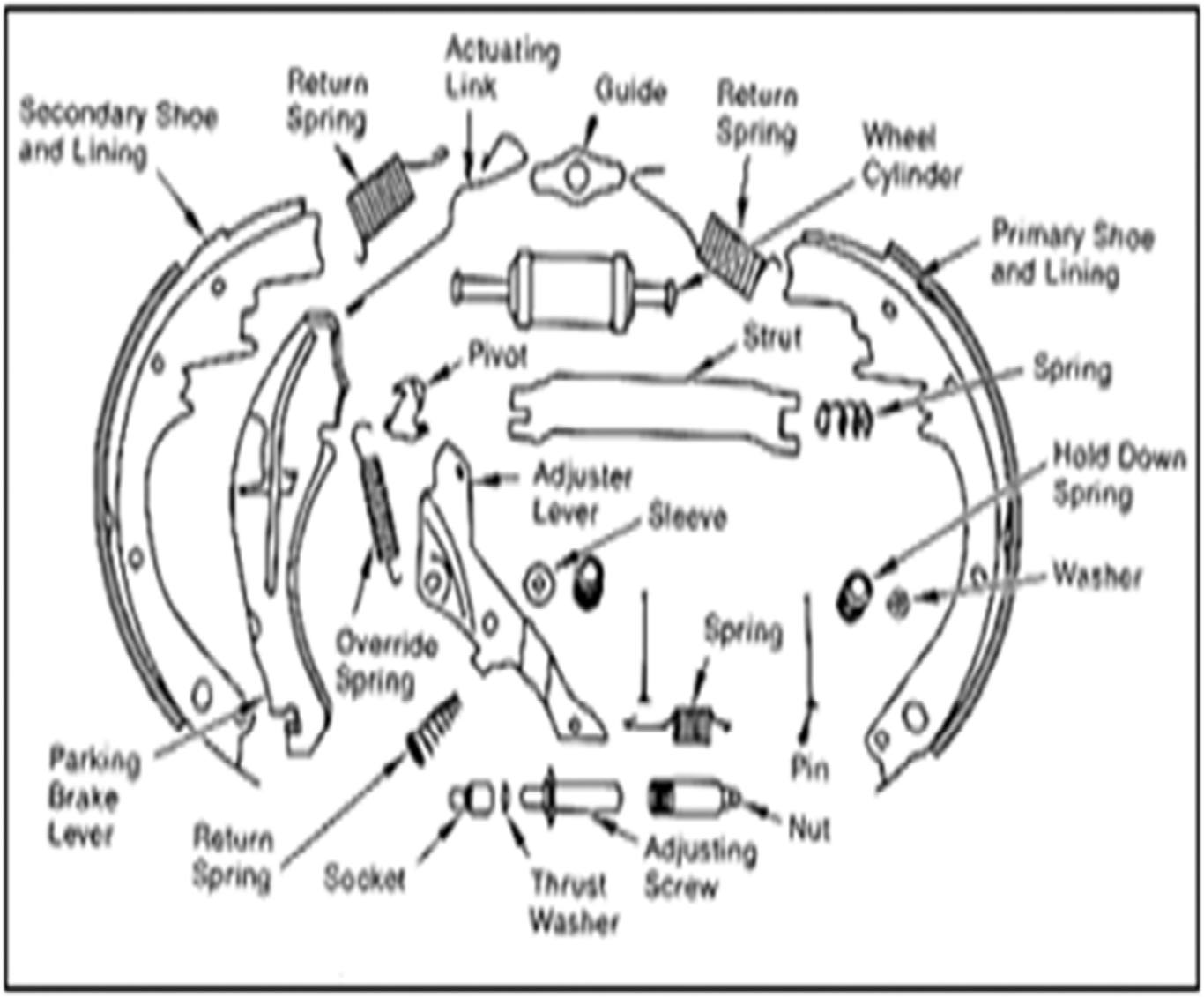

Figure 3: Various drum brake parts

4.1. Method in Observation of Setting Time in Drum Brake Assembly

There are 14 cells in welding area. Each cell contain 4 to 5 machine. By using this operation to record the setting time for each product separately.

Stop watches are used to record the time and recorded separately for each product. The setting time for 22 products of different customers is recorded. The observed setting time of different products-Process Matrix are listed in Table 1.

5. RESULT AND DISCUSSION

Calculation has been made by taking the present setting time with proposed time as the following formulas and tabulated in Table 2.

Table 1
Observed setting time of different products-Process Matrix

Sl. No.	*Cell No*	*Product*	*PROCESS (PS)*											*Present setting Time in Min*	*Proposed setting Time in Min*
			PS1	*PS2*	*PS3*	*PS4*	*PS5*	*PS6*	*PS7*	*PS8*	*PS9*	*PS10*	*PS11*		
1	1	A	9	-	14.5	-	-	-	-	-	-	-	-	14.8	6.6
2	4	B	-	14	-	14	-	-	-	-	-	10.1	-	14	8.8
3		C	-	15.5	-	14.3	-	-	-	-	-	-	-	15.5	8.8
4	8	D	9.2	-	-	14.3	-	-	-	-	-	-	-	14.3	7.8
5		E	9.2	-	-	14.1	-	-	-	-	-	-	-	14.1	6.8
6		F	9	-	-	13	-	-	-	-	-	-	-	13	5.6
7	7,	G	9.2	14.7	-	15.3	-	-	-	-	-	-	-	23.8	6.9
8	9,	H	-	15.8	-	15.7	-	-	-	-	-	-	-	15.8	4.3
9	11	I	11.4	14.3	-	14.3	-	-	-	-	-	-	-	25.7	13.9
10	,	J	8.8	15.8	-	14.2	-	-	-	-	-	-	-	24.7	8
11	13	K	8.2	-	-	14.3	-	-	-	-	-	-	-	# value	5.6
12		L	11.4	14.3	-	14.5	-	-	-	-	-	-	-	25.7	13.9
13		M	10.4	-	-	14.7	9.5	-	-	-	-	-	-	14.7	6.8
14	12	N	-	-	-	14.7	9.5	-	-	-	-	-	-	14.7	3.1
15	,	O	-	-	-	14.5	-	-	-	-	-	-	-	14.5	5.6
16	14	P	-	-	-	14.2	-	-	-	-	-	-	-	14.2	4.6
17		Q	-	-	-	14.2	-	-	-	-	-	-	-	14.2	6
18		R	-	-	-	15.3	-	-	-	-	-	-	-	15.3	5.6
19		S	-	-	-	15	-	-	-	-	-	-	-	13.3	4.8
20		T	-	-	-	15	-	-	-	-	-	-	-	15	4.3
21	2	U	-	-	-		11	31.5	8.6	14.8	14.5	-	-	31.2	14
22		V	-	-	-		-	31.2	-	-	-	-	15.5	31.2	14

[Note: PS1-Tube Flaring; PS2-Shield Welding; PS3-Hot Riveting; PS4-Cold Riveting; PS5-Projection Welding; PS6-Boring SPM; PS7-Oil Slinger; PS8-Insurance Weld; PS9-LCV Shield Welding; PS10-Nut Welding; PS11-Metal Inert Gas Welding]

Table 2
Present setting time with proposed time Calculation values

Product	*Production in Nos.*	*Minimum Qty of Change over*	*No. Of change over per yr*	*Setting Time in hrs*		*Savings of hrs per yr*	*Savings of operator cost per yr in Rs*
				Present	*Proposed*		
A	53200	300	177	44	20	24	1829
B	4000	300	13	7	3	4	328
C	4000	300	13	7	3	4	289
D	5600	100	56	14	8	6	472
E	124000	300	413	171	34	136	10333
F	240770	300	803	205	56	149	11319
G	114000	300	380	82	36	46	3522
H	289360	300	965	233	110	123	9341
I	102240	300	341	81	44	37	2797
J	25900	300	86	35	9	27	2017
K	45150	300	151	65	18	47	3561
L	256400	300	855	225	62	164	12410
M	28400	300	95	23	9	14	1036
N	70200	300	234	57	27	29	2216
O	42000	300	140	31	11	20	1503
P	373000	300	1243	300	117	183	13378
Q	30000	300	100	24	8	16	1199
R	47630	300	159	40	16	24	1836
S	80370	300	268	67	19	48	3609
T	82000	300	273	65	14	51	3855
U	12500	100	125	31	14	16	1236
V	64000	300	213	55	20	34	2605
Total						1204	91190

No. Of change over per year = Volume/minimum Qty for changeover

Savings time in number of hours per year = present setting hrs–Proposed setting hrs

Savings of operator per year = saving of hours x operator salary

The salary for operator per hour is Rs. 76.

In model A the present setting is 14.8 min and in hrs is 0.25 the proposed is 6.7min in hrs is about 0.11 the total volume produced of model A is 53200/yr and no of changeover per yr is 177 so that we calculate this to operator salary by calculating the total change over multiplied to total hrs so we save 29 hrs in yr operator salary for and hr is 76 Rs it is multiplied with the saving hrs the saving amount will be 1829 Rs/yr and for model B the present setting is 31.8 min and in hrs is 0.53 the proposed is 12.3min in hrs is about 0.21 the total volume produced of model A is 53200/yr and no of changeover per yr is 13 so that we calculate this to operator salary by calculating the total change over multiplied to total hrs so we save 4 hrs in yr operator salary for and hr is 76 Rs it is multiplied with the saving hrs the saving amount will be 328 Rs/yr and the highest saving is done with model P the amount is around 13878 Rs/yr likewise we calculated the remain product with same procedure and in total we save an amount of 0.91lakhs / annum for the company.

6. CONCLUSION

Setting point in time is significant indicator of the lead time. The ability of any industries is established with how to make flexible changes between products or else services to meet up consumer demand. During the flexibility is required more to distribute the product or else services prompt on every time. For decreasing the set up time into zero can be costly. Hence why are the major industries functioning so enthusiastically to decrease set up times? May be they observe reimbursement other than rising ability. Lean manufacturing is a difference on the subject matter of effectiveness based on optimizing run and it is a current illustration of the returning idea in human history and in total we save an amount of 0.91lakhs / annum for the company.

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