Design for Standardization for Work

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Keywords: Standard work, Standard deviation, Working analysis, Fundamental operation.

Abstract. The standard work (SW) is very important part of management efficiency and cost in aluminum Wheel process. There are many methods of standard work of aluminum wheel process in the world. So we have studied differences of standardization for work. The main goal of this study is to make people in aluminum wheel process understand standardization for work.

Introduction

Aluminum wheels processes most of the business activities include the production, except for expenses and material costs in terms of cost configuration as a high dependence on industrial workforce and labor costs are the largest cost item. Therefore, standardization of the aluminum wheel process management is the most important topic also for improving effective work behavior and work. In this study, it can be increased by improving the efficiency of work, and work in a systematic working and standard / non-standard operations on aluminum wheels step. The workforce streamlining plan is to enable efficient work methods and plant LAYOUT, is useful for a number of enterprise workers standard / non-standard operation and improvement to separate the aluminum to the improvement that can improve the productivity wheel step as well as belonging to the group of producing industry [1].

Theoretical Background

Standard work to the worker, and perform unnecessary actions, such as removing waste action / circulation operation is referred to as standard operation. Typically, it takes action or by subjective speculation, non-scientific objectivity that excludes the calculated data cannot be called a standard work [2].

Determination of standard work

Performance Materials Act

Based on the historical data of the job site as a method to calculate a standard operation from past experience or data is used to estimate and determine the professional experience and correct [3].

PTS(Predetermined Time Standard) Act

Operation is started on the assumption that the base consists of a limited number of operations, and the basic operation time is completely determined by the factors of variation [4].

One method suggested above are determined in real time as a standard because it requires a lot of work and analysis for application to the real difficulty. Therefore, in this study, we propose a simple and easy way to set the standard tasks and time.

Methods

This study was conducted in the following way. First, analysis of the operation unit, Second, the abnormal value and the standard deviation was derived for each operating. Finally, it presents a framework that causes all generated abnormal value. It analyzed the work of each process through a video shot in the field for study. Then we derive the standard deviation and the maximum time value for each unit operation was analyzed. In addition, it presents the cause List Locate the cause

abnormal value in the movie. Finally, we managed to avoid occurrence of abnormal value through them.

Tab. 1 Task Analysis

Cycle No.	Unit operation	Job class	Time(sec)
1	A work	Carriage	5
	B work	Production	10
	……	……	……
	Z work	Carriage	4
……	……	……	……

First, cycle should be able to determine the number of decisions taken in accordance with the observation method. According to the end and then at the start of the operation by the video shot in the field it was derived the operation time of each unit operation.

Tab.2 Time and Standard Deviation

Unit operation / Time Category	A Work	……	Z Work
Average			
Max			
Min			
Standard deviation			

Obtained in one hour using the Table 1 average time of each unit operation was obtained up to time and standard deviation

Tab.3 Cause List

No	Unit Operation	Abnormal Value Cause
1	A Work	Long distance moving
2	B Work	Inadequate working space
3	C Work	The slippery grip

Check the Movie can find the cause of the anomaly. For example, if C work, due to the position that it is difficult to take the handle of the tool or the tool is specified, the operation time is prolonged. Therefore, to the specified location on the tool or the tool handle may take the action such as to wind the band not slippery. It may provide an improvement of this point through the Cause List.

Case study

In this study material final inspection process of aluminum wheel process had be selected as study case. Using proposed study methods to show the abnormal value happened reasons in material final inspection process of aluminum wheel process in the list. Material final inspection process standard operation flow was in the following.

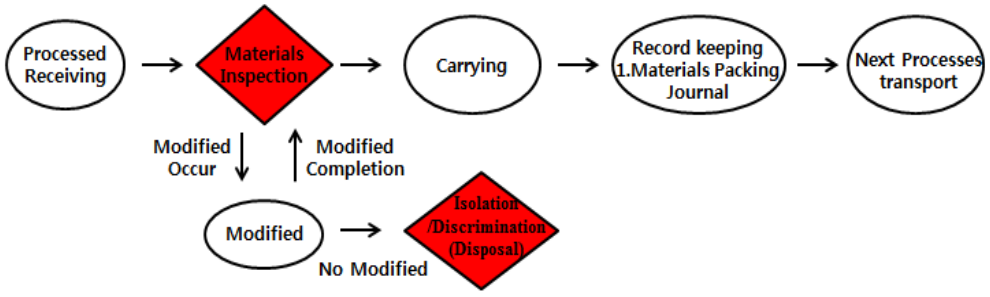

Fig.1 Standard work Procedures of Materials final inspection

In this study material inspect operation of material final inspection process as objection was selected. In material inspect operation totally have 12 operation units. At first we shoot a video of process. Then decide the videos shooting times depend on the observation times. Then following table 4 to analysis the operation units.

Tab. 4 Task Analysis of Materials Final Inspection

Cycle No.	Unit Operation	Job class	Time(sed)
1	Transfer to a workbench	Carriage	1.5
	Remove the air valves hole Stopper	Ready	3.2
	Turn the product	Carriage	0.8
	Touch the rear checksum	Check	3
	Check the spoke side	Check	8
	Hold the tool	Ready	1.4
	Polish	Check	2.5
	While turning check the front	Check	8.2
	Hold the tool	Ready	0.4
	Polish	Check	2.8
	Check the front	Check	5.2
	Hold the tool	Ready	0.6
	Polish	Check	0.9
	Check the front	Check	1.2
	Transfer to conveyor	Carriage	0.8
.....	.....	.....	.....

Tab. 5 Time and Standard Deviation

Unit Operation	Average	Max	Min	Standard deviation
Transfer to a workbench	2.88	3.7	1.5	0.94
Check the front	4.01	10.4	1.2	2.4
Turn the product	1.2	1.6	0.8	0.57
While turning check the rear	3.4	4.5	1.7	0.94
Check the spoke side	8	15.1	3.1	4.71
Hold the tool	0.74	1.4	0.4	0.31
Tool replacement	0.88	1.4	0.5	0.39
Polish	5.75	20.2	0.9	5.1
Remove the air valves hole Stopper	2.52	3.4	1.6	0.81
While turning check the front	8.99	13.7	2.9	3.53
Polish the spoke side	28.1	28.1	28.1	—
Transfer to conveyor	1.02	1.4	0.8	0.23
Waiting	10.13	18.2	4.5	6.37

Using the time calculated from table 4 and decided cycle from table 5 to calculate the average time, maximum time and standard deviation of each operation unit.

Figure 2 is all analysis operation unit scatter diagram which made following the operation time. In this figure, the drop signal of each operation unit was the abnormal value happened operation. For example in the front inspect operation unit has an operation need 10 seconds and remaining operation will be finished in 2 to 7 seconds. In the 10 seconds operation we can divide it into two parts, wasteful operation and collateral operation. But in some operation units we will have the situation that can't judge what this operation is. So it's necessary that we need to shoot a video to check the operation. Using this we can check the unnecessary operation and slow operation and calculate the wasteful operation and collateral operation when the operator operated.

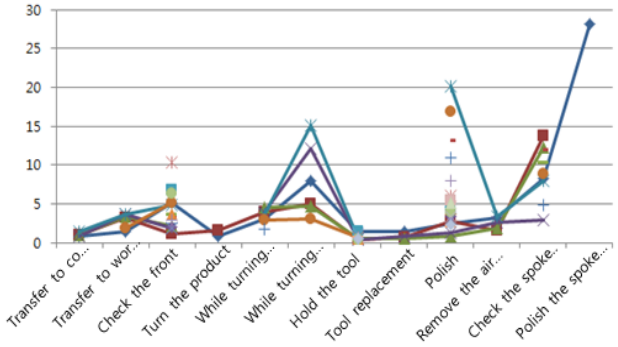

Fig.2 Scatter plot of Unit Operation

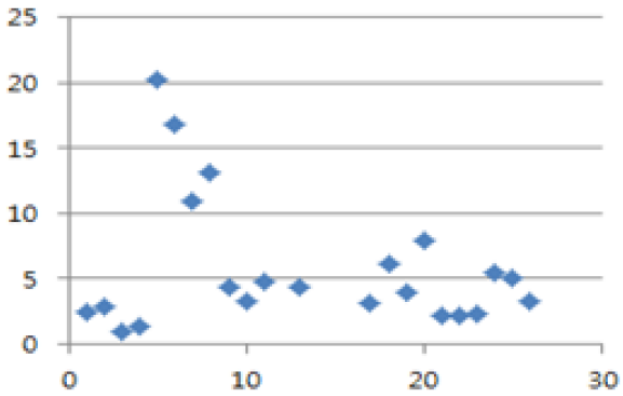

Fig. 3 Scatter plot of Non-standard work (Polish)

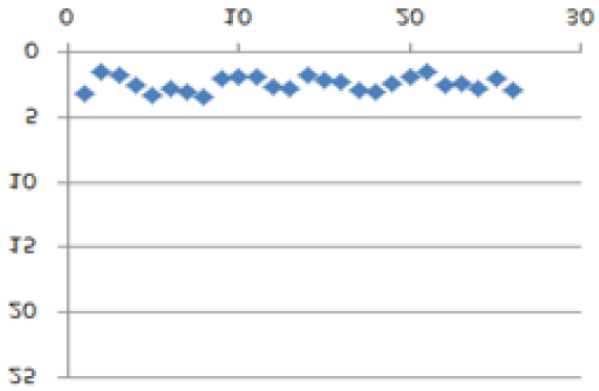

Fig. 4 Scatter plot of Non-standard work (Remove the air valves hole stopper)

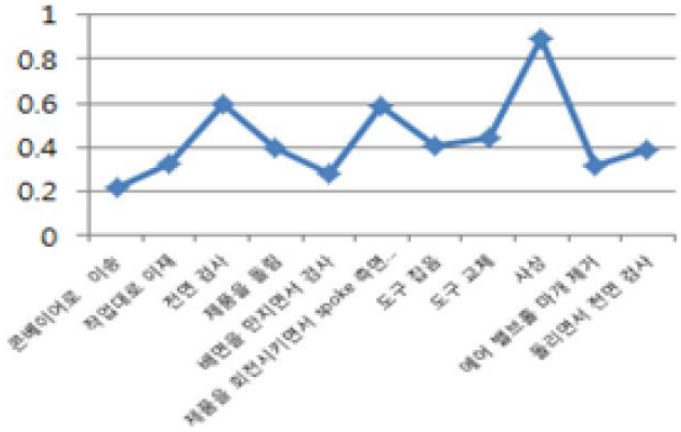

Fig. 5 Scatter plot of Standard deviation (Before)

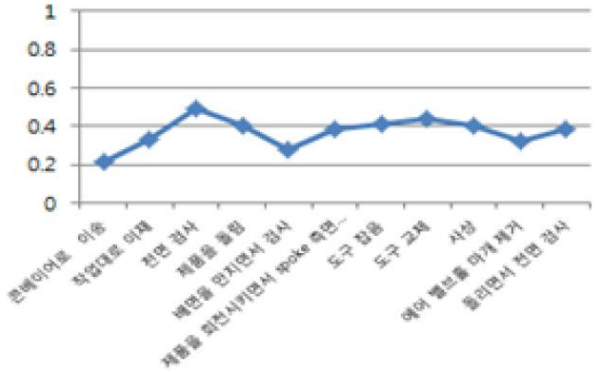

Fig. 6 Scatter plot of Standard deviation (After)

Tab. 6 Classification of standard/non-standard work

Unit Operation	Count	Average		Standard deviation		σ/m		Waste work	Reason
		Before	After	Before	After	Before	After		
Transfer to conveyor	5	1.02	1.02	0.23	0.23	0.22	0.22	X	X
Transfer to workbench	6	2.88	2.88	0.94	0.94	0.33	0.33	X	X
Check the front	16	4.01	3.58	2.40	1.75	0.60	0.49	○	Poor lighting conditions
Turn the product	2	1.2	1.2	0.57	0.57	0.40	0.40	X	X
While turning check the rear	7	3.4	3.4	0.94	0.94	0.28	0.28	X	X
Check the spoke side	6	8	5.2	4.71	2.04	0.59	0.39	○	The handle is slippery
Hold the tool	19	0.74	0.74	0.31	0.31	0.41	0.41	X	X
Tool replacement	4	0.88	0.88	0.39	0.39	0.44	0.44	X	X
Polish	22	5.75	4.15	5.10	1.65	0.89	0.40	○	Tools inaccessibility to modify parts
Remove the air valves hole Stopper	5	2.52	2.52	0.81	0.81	0.32	0.32	X	X
While turning check the front	9	8.99	8.99	3.53	3.53	0.39	0.39	X	X
Polish the spoke side	1	28.1	28.1	-	-	-	-	X	X

Depending on the working time and number of occurrences of the spirit and remove the air valve cap hole appeared in the Cycle of unit operations calculated in the previous step was deriving a scatter plot of unit operations. If compare above figure 3 and figure 4 we can find that Polish? Operation unit as non-standard operation's distribution was bigger than air valve stopper removal as standard operation's distribution. So through non-standard operation's wide distribution wasteful operation/collateral operation was happened. And each operation unit had been divided into standard/non-standard operation and prepared in table 6. Following table 6 we can calculate all operation units' standard deviation distribution diagram of wasteful operation/collateral operation before remove (Figure 5) and after remove (Figure 6). So from the result we can know that when the operators were working, if wasteful operation/collateral operation happened operation units' standard deviation distribution would be wide distributed.

Result

In the aluminum wheel process workers' payment had a relation with working time. So the standard operation used in the aluminum wheel manufacture industry was taken into account by each company. Different companies have different consideration make them have different judgments.

The standardization work of the material, the final test result is represented in the standard work investigated measurement process for the domestic aluminum wheels in this study was considered to be a little more, as shown in Table 6 supplement.

Observe this result the companies should go through collaborative and macroscopic view of endeavor to decide the right standard operation measure methods. Those endeavors not only the result of the companies relevance but also the consumers' benefit would be improved. And finally the benefit will come back to the companies.

Afterward as research project foreign case should be observed and from that standard operation measure methods should be studied.

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