Services performance with the process standardization for tire rotation, alignment and balancing

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ABSTRACT

Fred E. Meyers in the book Study of Times and Movements for agile manufacturing indicates that companies that implement standardization to services and production have a yield of 85% increasing productivity with the same resources. The objective of this investigation was the standardization of the service times of the tire rotation, Alignment and Balancing processes, carried out in a service company that sells tires and complementary products, they have three state-of-the-art workstations and two male technicians who meet the requirements to perform the functions inherent to the position they occupy. We normalize the cycles of the operations through measurement techniques and data obtained through collective observation in the jobs to determine the current situation of each of their activities or tasks, time study sheets, the Westinghouse Method and Method of returns to zero, in this way the standard times and supplementary percentages were established. With the established

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proposals to reduce the percentages of the variable supplements of use of muscular force / energy to lift, pull and push a weight of 25 kg from 13% to 1% by the implementation of a hydraulic lifting table bringing it to 5 kg and the reduction from 2% to 0% of the intermittent and loud noise of 95 dB using hearing protectors is reduced to 85 dB and a continuous sound is perceived, total supplements were reduced from thirty-one percent to fourteen percent which leads to have better delivery times with a decrease of 0.722 minutes for the interlocking operation and 0.60 minutes for balancing, having an effective working day of 408 minutes

Keywords: Alignment, balancing, tire rotation, standardization, standard time, Supplements

INTRODUCTION

The standardization of times in the processes currently has become a tool of vital importance since the implementation allows to reduce and control costs when man-aging processes, business competitiveness drives companies to improve the quality of the products marketed, by standardizing the production line and the good performance of the men directly to the production or service process (Javier, 2019) (Sánchez, 2016). A series of recent studies have revealed that the optimal temperature range for our optimal physical and intellectual performance is between 21 ° C and 25 ° C, outside of this spectrum, our performance is reduced by 2% for each degree (Diana, 2020).

For the diagnosis of the company current situation, an analysis of the activities that intervene in each process was carried out and the type of contribution that each one means is interpreted, that is, whether or not it adds value, in such a way that with this tool aims to identify the processes that need to be studied and standardized more quickly according to their contribution rate to the light vehicle value chain (Aguinda, 2017).

Basically, an alignment consists of adjusting the angles of the wheels and the di-rection, in order to balance all the forces of friction, gravity, centrifugal force and impulse, basically in putting the four wheels in the same direction by manipulating the parts of the system steering and suspension to correct the relevant angles, (Santos, 2017) (VENTAGENERADORES, 2017). Dynamic balancing requires that the weight of the assembly be evenly distributed on both sides of the center line of the tire tread (Herrera, 2017) (Molina, 2019), balancing the weight of the rim with the weight of the tire by means of pieces of lead called counterweights. In the Assembly and Disassembly of Tires, equipment is used that as a general rule are connected to a pneumatic point, that is, they work connected to a compressor that generates air (Garnica, 2017). That is why they are called automatic or pneumatic tire changers (due to the use of compressed air) (Zapata, 2017) (Tobar, 2017) (Asturias, 2019). They are intended for conventional car wheels, 4 × 4, mini-bus, etc. with profiles from 10 “to 26” (or from 7 “to 26” with special adapters) (Lemache-Caiza, 2021). Tires, due to various factors such as weather, use or incorrect alignment, cause their wear and tear and that causes poor traction and subsequent problems at a general level throughout the car (Zapata, 2017) (AutoAvance, 2015).

MATERIALS AND METHODS

Applying the collective observation method, the behaviors carried out by the workers

in the execution of the activities are recorded and it is determined that the performance is 60% in the services provided during an effective working day of 331.2 minutes in the processes: Tire rotation (19 vehicles / day), Alignment (6 vehicles / day), and Balancing (17 vehicles / day), the time series data obtained during the first semester of the year 2021 can be observed in Figure 1.

A type 2 sound level meter with a weighting filter is used to measure the noise, in order to calculate the dose normalized to an 8-hour working day. The study con-siders what is stipulated in the Ecuadorian standard NTE INEN-ISO 9612 (Navidi, 2019) (SOCIAL, 1986), "Acoustics. Determination of noise exposure at work. Engineering method "(ISO 9612: 2009, IDT) (ECUATORIANA, 2014), with a measurement strategy based on tasks, numeral 9.3 of the standard. In the three processes two operators take part who transport the tires and tools from one place to another manually lifting weights of 25 kg, they use to offer a high torque output and that the physical effort is minimal, Pneumatic impact pistols model DSS 1 "L Art. No. 0703 780 0 with a noise level of 95 db. (9612:2009, 2009)

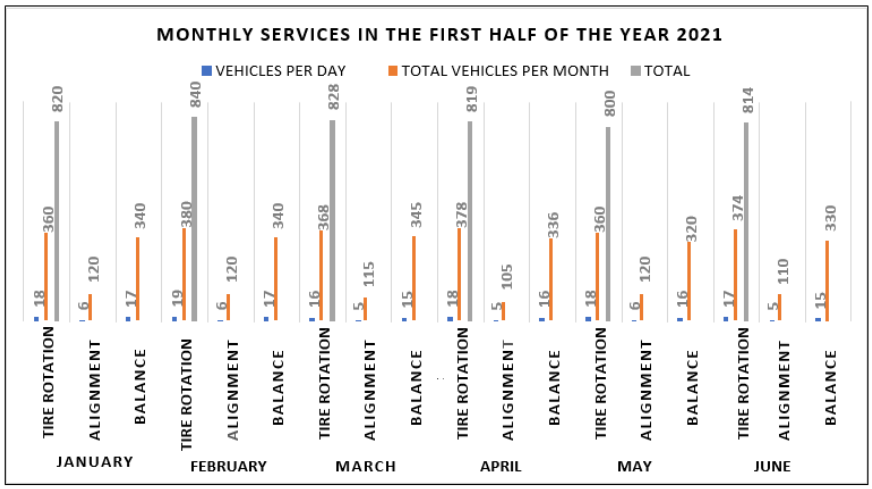

Figure 1: Monthly services in the first half of 2021

The processes to follow are detailed in Figure 2.

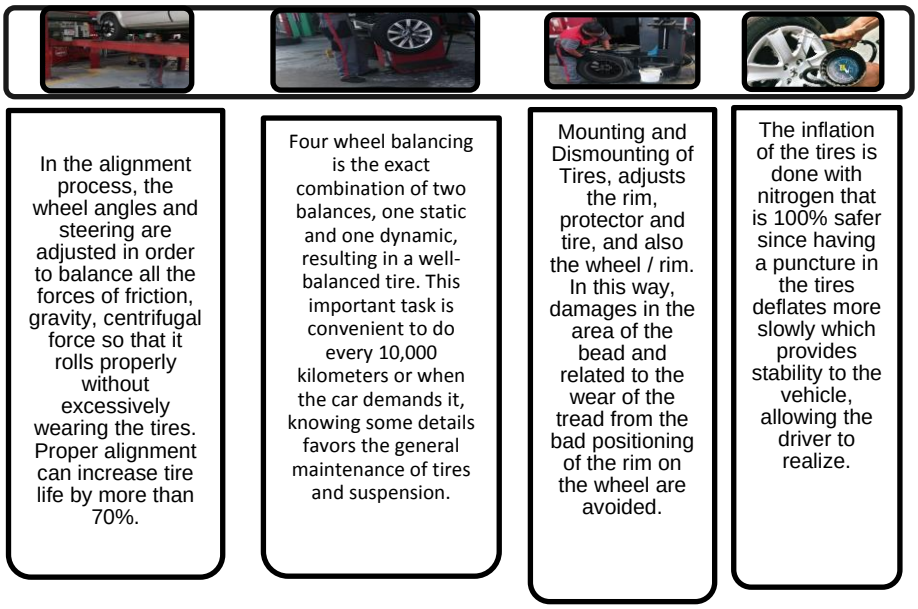

Figure 2: Descriptive model of the specifications of the process under study.

For the year 2021 the forecasts were to provide services to 800 vehicles monthly in the area of tire rotation, alignment and balancing, in the month of May the number of vehicles with which we worked is 800 entering as the lowest of the 1st. of the semester of the year being as planned and the month of February as the month with the highest services of 840 vehicles, Figure 1.

RESULTS AND DISCUSSION

The cycle time that must be observed to obtain a representative average time of each process is determined by statistical formulas that give a total of ten, for the calculation of the percentage of the supplement the table stipulated by the international labor organization is used (Guevara, 2021)and the qualification of the speed by means of the four factors of the Westinghouse method as observed in Table 2.

Table 1: Percentage of Supplements of the three processes

Supplements	Tire totation	Alignment	Balancing
Constan supplements			
For Personal Needs	5%	5%	5%
Basis for Fatigue	4%	4%	4%
Subtotal	9%	9%	9%
Variable Supplements			
For Working Standing	2%	2%	2%

By abnormal posture	2%	0%	2%
Use of Force 25kg	13%	0%	13%
Intense Concentration	2%	2%	2%
Noise	2%	2%	2%
Mental tension	1%	1%	1%
Subtotal	22%	7%	22%
Total supplement	**31%**	**16%**	**31%**

With total supplements of 31%, the effective working day of 331.2 min was determined, which represents 5 hours and 52 minutes for the Tire rotation and Balancing processes; With total supplements of 16%, the effective work day of 403.2 min was determined, which means 6 hours and 72 minutes of effective work in one day for the alignment area as shown in Table 1.

Table 2: Qualification of operator speed by the Westinghouse method

Factors	**Qualification for Tire Rotation**		**Qualification for Alignment and Balancing**	
Ability	B2	+0.08	C1	+0.06
Effort	C2	+0.02	C2	+0.02
Conditions	C	+0.02	C	+0.02
Consistency	B	+0.03	B	+0.03
Cv		**1,15**		**1,13**

The qualification granted by the four factors conceived in the Westinghouse method of each of the operations of the investigation is observed in Table 2. The ability of excellent (B2) in the Wheel process is due to the fact that the operator works with a rhythm 100% in a coordinated manner, Shows speed and smoothness in the execution of tasks, Works accurately without making mistakes and Good (C1) in the remaining processes because the operator needs little vigilance, Works correctly and according to specifications; Good Effort (C2) because the operator is interested in the job, follows the established method and is well prepared; Good Conditions (C) for being exposed to noise of 95 DB and the Excellent Consistency (B).

Applying the quantitative method of timing with return to zero, the values of the time that a trained operator, knowledgeable about the work and developing it at a normal pace, would spend in the execution of the task under study are determined (Guevara, 2021). It is statistically demonstrated that the number of observations 10 satisfy the sampling error (Navidi, 2019), the normal time calculated for the engagement process of 19.60 minutes with the sum of the average time ($\bar{T}$) of the 6 elements and then the result multiplied by the speed rating factor (Cv) of +1.15; 12.62 minutes are used for the Alignment process and 16.43 minutes for Balancing, taking into account in both processes they have 7 elements and the speed rating factor is + 1.13, Equations 2,3 and 4.

$$T_n = \bar{T} * C_v \qquad \textbf{(1)}$$

$$T_{n,tire\ rotation} = 17{,}04\ minutes * 1{,}15 = 19{,}60 \text{minutes} \quad \textbf{(2)}$$

$$T_{n,Alignment} = 11{,}17\ minutes * 1{,}13 = 12{,}62 \text{minutes} \quad \textbf{(3)}$$

$$T_{n,Balancing} = 14{,}54\ minutes * 1{,}13 = 16{,}43 \text{minutes} \quad \textbf{(4)}$$

$$T_s = T_n + \frac{supplements_{tire\ rotation}}{\left(\frac{JT - supplements_{tire\ rotation}}{T_n}\right)} = 19{,}60\ minutes + \frac{31\frac{minutes}{day}}{\frac{480\ minutes/day - 31\frac{minutes}{day}}{19{,}60\ minutes}} =$$

$$T_{s\ de\ Wheel} = \mathbf{20{,}947}\ min/vehicles \quad \textbf{(5)}$$

$$\boldsymbol{T_s = T_n + \frac{supplements_{alignment}}{\left(\frac{JT - supplements_{alignment}}{T_n}\right)}} = 12{,}62\ minutes + \frac{16\frac{minutes}{day}}{\frac{480\frac{minutes}{day} - 16\frac{minutes}{day}}{12{,}62\ minutes}} =$$

$$T_{s\ of\ Alignment} = \mathbf{13{,}06}\ min/vehicles \quad \textbf{(6)}$$

$$T_s = T_n + \frac{supplements_{balancing}}{\left(\frac{JT - supplements_{balancing}}{T_n}\right)} = 16{,}43\ minutes + \frac{31\frac{minutes}{day}}{\frac{480\ minutes/day - 31\frac{minutes}{day}}{16{,}43\ minutes}} =$$

$$T_{s\ of\ Balancing} = \mathbf{17{,}56}\ min/vehicles \quad \textbf{(7)}$$

The results obtained in Equations 5,6 and 7, correspond to the standard times (Ts) of the processes under study, which, having supplements of 31% in the Tire rotation and Balancing processes as a result of the use of the force of 25 Kg and an intermittent and loud noise, make the values increase in each productive cycle and the effective working day of 480 minutes decreases to 331.20 minutes and 403.20 minutes respectively.

CONCLUSIONS

Based on Executive Decree 2393 Art. 55 [17], which establishes as reference levels: criterion time 8 hours, a criterion noise level of 85 dBA and exchange rate of 5 db. Indicating that the decibel level of 95 is exceeded that established for which hearing protection should be used to avoid future injuries to workers and the noise supplement would be 0%.

For the reduction of the 13 percentage of supplement of use the force of 25 kg to 1% and not to harm the health of the workers, it was invested in a cargo car with a final price in the market of $ 63.99 and a hydraulic lifting table 350 kg capacity scissor shape ideal for moving all kinds of loads from one place to another with an elevator value of $ 559.00; the lifting tables are built and designed to raise or lower to the necessary height in these processes.

With the decrease in the percentage of the variable Supplements, the standard time of the wheel process could be reduced from 20.947 minutes to 20.23 minutes with a variation of 0.717 more productive minutes for these seven elements, the standard time of the alignment process in the diagnostic stage was 13.06 minutes with the improvements being reduced to 13.00 minutes with a variation of 0.06 minutes and the balancing process was lowered from 17.56 minutes to 16.96 minutes with a variation of 0.60 minutes, for a total increase of the productive time in one minute and 38 seconds.

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