ENGINEERING FOCUSED IN HUMAN RESOURCES CASE STUDY OF A MTM APPLICATION IN A WORKSTATION

Novaski, Olivio
State University of Campinas, UNICAMP – Faculdade de Engenharia Mecânica, FEM/DEF – Brasil
novaski@fem.unicamp.br

Sugai, Miguel
State University of Campinas, UNICAMP – Faculdade de Engenharia Mecânica, FEM/DEF – Brasil
sugai@fem.unicamp.br

Barbosa, João
State University of Campinas, UNICAMP – Faculdade de Engenharia Mecânica, FEM/DEF – Brasil
001852@apollo-11.fem.unicamp.br

Abstract. *The purpose of this paper is to present the benefits and dvantags of a MTM aplication for human resources and for the company. Ergonomics improvements and reduction of time production are ilustrated in a case study of a MTM aplication in a workstation realized in a multinational industry localizaded in Campinas*

Keywords*. Methods-time Measurement, Ergonomics, time reduction, human resources*

1. Introduction

There is a high differential for a production planner having an accurate time data for each workstation. When the time is calculated professionally, allows a correct definition of the takt (rhythm) of the production and consequently is possible to balance the production line and find the correct capability of the same. Nowadays, few things are said about Scientific Administration, but the solutions of evaluate the operation's time lies exactly in the work of Taylor (Taylor, 1970) and Gilbreth, the pioneers in these studies. With the basis founded on time and methods, it was possible to develop the studies about synthetics times, currently known as MTM (Methods–Time Measurement). Probably MTM is the most known pre-determined time system in the world (Meyers, 1999).

2. MTM - Methods-Time Measurement

MTM is a system of time and motion study developed in 1948 by Maynard, Stegemerten and Schwab. MTM "Analyzes any manual operation or method into the basics motions required to perform it and assigns to each motion a predetermined time standard which is determined by the nature of the motion and the conditions under which it is made (Maynard, 1970). The system is most recognized for its consistency and reliability (Prabhu and Baker, 1986).

This technique is used in a very intensive way among European industries, especially in Germany and Sweden (EPIC, 2002). In Brazil its use is unexpressive and few companies are successful on its application. The opinion of many Brazilians managers is against this method (Priemer, 2002), but it is possible to find some companies using MTM. There is, for example, a multinational company from Germany, where the use of the MTM is crucial to the production managers. A wide research has been done there for a comprehension of the full potential of this method. This paper will present a case study of a MTM application in a workstation and then perform the MTM potential.

3. Case Study

Initially, from a client's solicitation, the takt (rhythm) to manufacture the products needs to attend him. To hit the mark, the MTM was applied to know precisely the takt of the production line. This is defined by the constraint of the production, (Goldratt, 1996) which in this case was higher than the necessary to provide the client. The initial time of workstation was 18,34 seconds and to attend the client it was necessary be on 9 seconds. Then, to attend this client, it would be possible taking one decision in two possibilities: the first would be the construction of a new assembly line as same as the original, duplicating the operator, machines and tools. The second possibility would be make improvements on the workstation constraint point aiming a 9 seconds operation time.

The second alternative was chosen and the time reduction occurred after a deep assessment of critical points in the workstation. A MTM team (MTM engineers trained) developed this analysis of workstation with MTM method to have the correct time of the operation and used software that models the workstation.

3.1 Description of the workstation

This case study refers to a workstation of a pressing bearing and steel plate in machine frame, showed in figure 1. The sequence of tasks is presented below:

Figure 1: Overview of the workstation

1. The operator gets a machine frame from left side and places it in the device;
2. He gets a steel plate in the box with his right hand and a bearing with his left hand, simultaneously, and puts then over the machine frame;
3. After that, he sets a hydraulic press in motion;
4. Then, the operator gets the pressed machine and puts it over the conveyor belt.

When the time of operation was firstly calculated with MTM, it was 18,34 seconds. The MTM team accepts this task and first, developed a list of the critical points described below:

1) Defective vision of device – small range of vision and reflections light to operator because of aluminum bar.

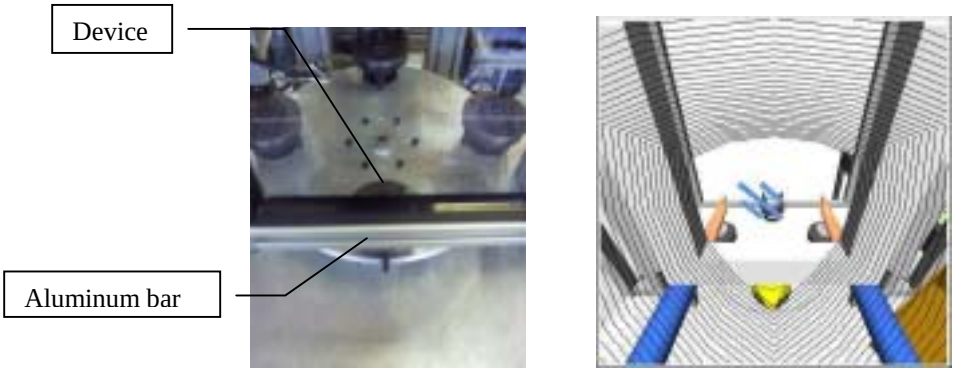

Figure 2: Defective vision by aluminum bar – photograph e computer modeling

2) Device out of reach: the operator needs to stretch his arms to put or reach something.

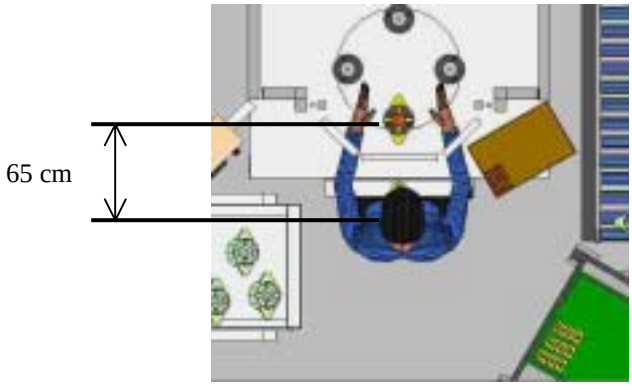

Figure 3: Top vision of workstation, pointing the high device distance.

3) Machine frame beyond of reach: The operator must give a step side to reach a machine frame. He loses time and gets ergonomics problems.

Figure 4: Back view of the operator – the green area represents the limit of operator reach

4) Steel plates beyond of reach.

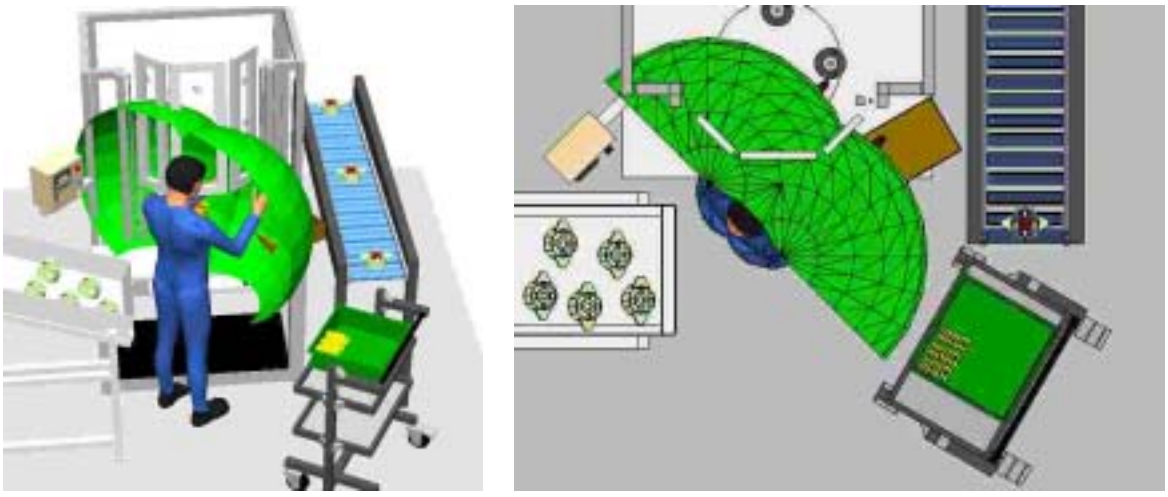

Figure 5: Steel plates out of green area.

5) Support for feet out of ideal position. There isn't enough space for legs.

Figure 6: Ergonomics problems for the operator

6) "C+K" dimension higher: this kind of operations causes damages for his shoulders.

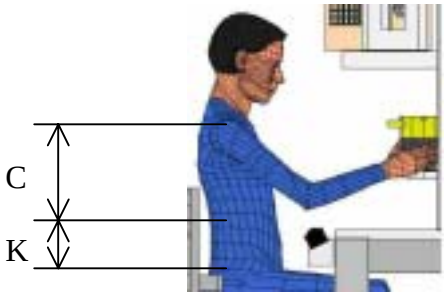

Figure 7: Side vision of workstation

7) It's difficult to position the machine frame in the device.

Figure 8: Device for machine frame

8) It's difficult to get one steel plate: they are mixed in a box

9) It's difficult to get a bearing from the flume: they are out of reach

10) It's difficult to position the steel plate in the device

After the identification of the critical points, the MTM team suggested some solutions:

1) Improve mobile parts and eliminate aluminum bar. Change it for a non-reflexive material.

2) Bring the device closer to operator.

3) a) Bring bearing flume closer to operator.
b) Improvements on bearing flume.

4) Smaller steel parts box.

5) Support for feet easier adjustable, according to each operator.

6) a) Reduce device height.
b) Possibly take off bar above the stand.
c) Let operator work sited, increasing stand height and space for legs.

7) Install guide pins in the device for an easier position.

8) Use foam for easier steel plates get.

9) Install support to get bearings.

10) Change the device and then leave the positions process and start an easier move process.

4. Improvement on three fases

The improvements applications were taken on three levels. In every study level, new solutions for the operation were proposed and the station, naturally, changed. After each level, a new time calculation with MTM was done. The MTM application is a continuous improvement to get a satisfactory index.

4.1. First Study

In the first level, MTM team have done the decisions below:

- Bring the device closer to operator;
- The steel plates were putted in the operator green area;
- A adjustable support for feet were installed;
- The aluminum bar was eliminated.

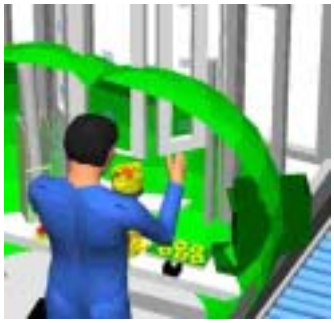

Figure 9: Proximity favored best reach of steel plates – they are inside green area.

Figure 10: Elimination of the stand bar, increasing space for legs.

After this changes, the time reduced to 12,86 seconds. It weas necessary another study level to reduce the time. The MTM team started another study level adopting others suggestions.

4.2. Second Study

In this level, these initiatives were applied:

- Reduction of "C+K" dimension;
- Installation of guide pins;
- Change the steel plate box for a foam receptacle;
- Instillation of a better bearing flume

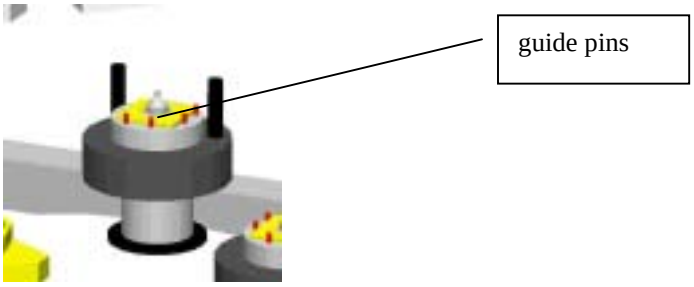

Figure 11: Improvements on device

The second level obtained a little decrease: 12,61 seconds. These changes weren't deep enough to attend the client. Another study lever were done.

4.3. Third Study

In this last level, MTM team got some new ideas to reduce the production time. They changed the structure of the workstation. They started a new study level again, aiming the client necessity:

- Change of the door protection to a fixed protection. Then it was not necessary to open the door making the operation agile.
- All products and components were placed in the green area;
- The area vision became wider.

Figure 12: Improvements on protection system

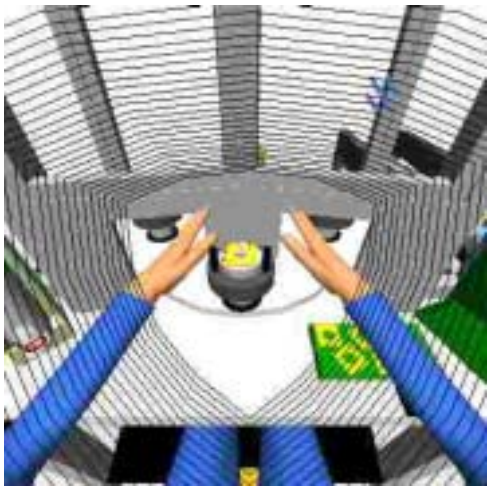

Figure 13: Operator view of workstation

At the end of this study level, the final time was 8,5 seconds.

5. Results

The results are indicated on table 1 and graphic 1 and it is possible to see the time reduction caused by MTM team. The final result is very satisfactory. After the three studies levels, the conclusion is MTM is a very important method for an accurate time calculation and allows gains on ergonomics and indicates wastes that should be eliminate.

Table 1: Results from MTM application in the workstation

	Time (s)	Reduction tax
Initial situation	18.3	-
First Study	12.9	30%
Second Study	12.6	31%
Thrird Study	8.5	54%

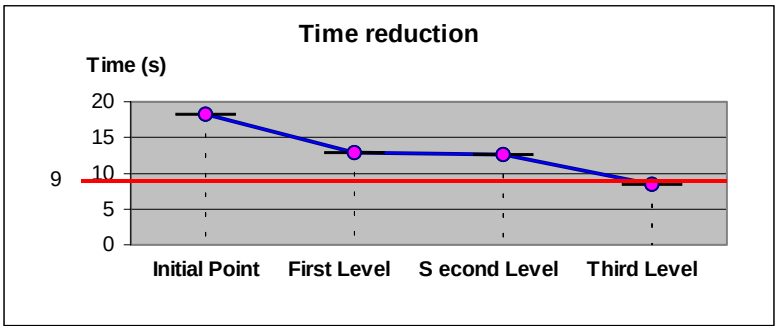

Figure 14: Time reduction

The MTM application requires patience and hard work. To reach an ideal time, it is necessary the use of intelligence, creativity and experience to change the workstation.

There is an important benefit to point. After a consult on Labor Justice Department in Campinas, is known that since 1997 this company haven't got a lawsuit from operators or from the union caused by ergonomics problems. A compensation for a serious injury is usually expensive and the damage for operator always is irreparable.

Then, the conclusion is that MTM is an engineering technique worried about human resources, using all their capacity for work bur simultaneously caring about their health. This is not accidental. The basis of study of the method in MTM is the Gilbreth research of fatigue of operator (Gilbreth, 1911). Although Taylor and Gilbreth are old studies in industrial engineering, we can get from them great solutions.

5. Conclusions

The time stipulated by the client was hit and many ergonomic improvements were offered to the worker. Further of the attempting the client it was possible to maintain the physical health of the worker. The results of these works make clear the great usage of MTM as precise method of time operation calculation.

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