

Implementing Standardized Work at ThyssenKrupp in Brazil

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This article presents the results obtained as the result of the implementation of Standardized Work at two working stations at a ThyssenKrupp – Campo Limpo (Sao Paulo, Brazil) crankshaft plant. These results includes work-in-process (WIP) reduction by 40%, operator movement reduction by 1,500 meters/day, productivity improvement by 9%, improved operator satisfaction, and better safety conditions

ThyssenKrupp is one of the biggest global technology groups working in the following areas: steel, automotive products, elevators, and services. It has investments in Europe, Asia, North America, Central, and South America. One of them is situated in Campo Limpo Paulista – São Paulo, Brazil (TKMCL), where forgings and machining plants produce crankshafts, piston rods, wheel cubes, among other items, for the domestic and global automotive industry.

In the early 1990's, the plant had succeeded in a significant transformation effort to create flow in its machining operations, moving from a functional layout to a flow layout for each product family. More recently, in the last 3-4 years, some new tools like value stream mapping (VSM) and the implementation of pull systems, along with set-up reduction and maintenance improvements were implemented, among other efforts, to make the company more productive.

A New Stage of Lean Implementation at TKMCL

The overvaluation of the Brazilian currency (Real) of about 25% from 2003 to 2006 compared to the U.S. dollar and an increasing entry of new companies from lower labor cost countries into this market increased pressure on TKMCL, particularly in its export business. The company felt the need to continue its lean

transformation efforts in order to sustain its performance in a more difficult environment.

To achieve a new stage in its lean transformation, the company decided to implement some new lean tools like continuous flow based on the operator balance charts, a pull system, inbound logistics, and standardized work (SW) to improve operations.

This article shows specifically the SW implementation strategy and the initial results obtained in a pilot area.

What is Standardized Work?

Standardized work is a basic lean tool focused on the operator's movement and work. It is applied in a production environment with repetitive processes and it is used primarily to eliminate waste. It establishes precise procedures and sequence for the work of every operator in a production process, based on three elements:

1. **Takt time**, which is the rate at which products must be made in a process to meet customer demand
2. **The work sequence** in which an operator performs the tasks within takt time
3. **The standard in-process inventory**, including units in machines required to keep the process operating smoothly

Standardized work allows the practice of just-in-time production and jidoka (autonomation) and assures basic stability in the processes to guarantee that eventual improvements are sustained over time.

It must be highlighted that standardized work does not mean work standards.

ThyssenKrupp already had basic work standards like the documents that describe the processes specifications and measurements (lengths, diameters, tolerances, among other things). But there was no standardized work.

Standardized Work Implementation

The tool was taught in a two-day workshop run by [Lean Institute Brasil](http://www.lean.org.br) specialists who had the knowledge, examples, and practical exercises on the plant floor. In order to deploy the knowledge easily later on, the participants were selected from the pilot crankshaft line but also from other production areas such as forgings, piston rods etc.

The first step was to collect data about the operational times at the actual work place or gembu (Japanese for “shop floor”). Available times from the engineering department were not considered. Besides, support from the leaders and operators involved in the area was important to produce the operator balance chart (OBC) for each operator.

Figure 1 shows that before the SW implementation, the operators’ cycle times were much higher than the takt time, meaning that operators could not comply with customer demand during a normal shift. This fact always led to the need for overtime. After the standardized work implementation, the operators could perform their tasks in less time than the takt time, complying with customer demand in plenty of time.

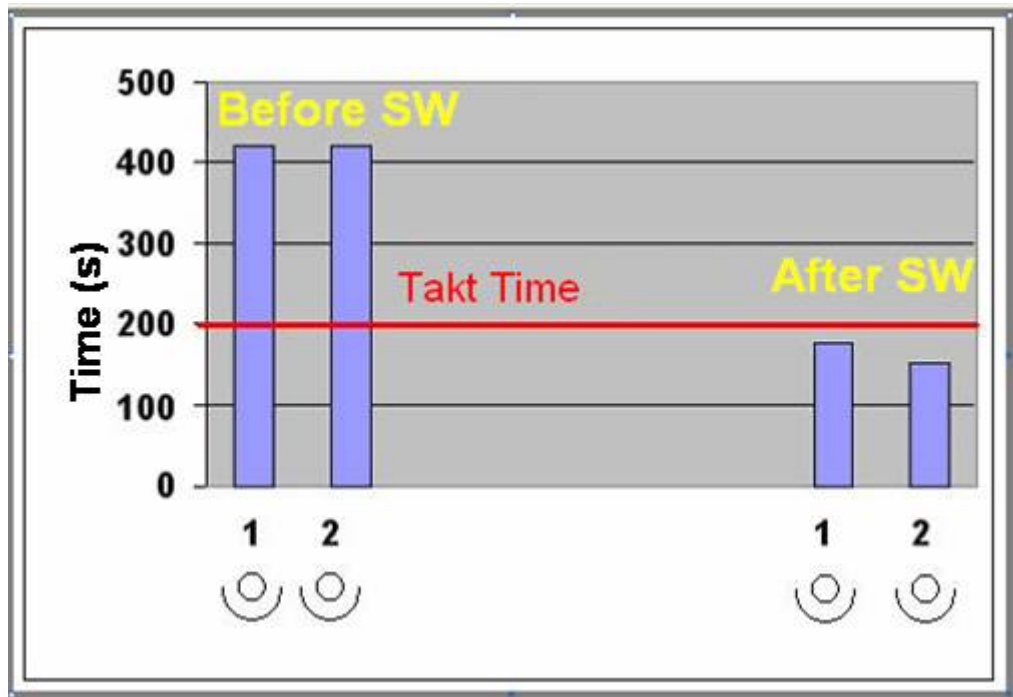


Figure 1 - Operator Balance Chart (OBC); before and after SW

Furthermore, the data collected about the automated machine processing times was measured as other additional tasks (for example, walking) was used to create the standardized work combination table (SWCT), as it is shown in figure 2.

Using as a base the OBC shown in figure 1 (before the improvement), it was possible to develop the SWCT, shown in figure 2, in which the overload of work (surpassing the takt time) for both operators was evident,...

WORKERS

After the standardized work was implemented, the following improvements were achieved:

1. The operator loading was distributed according to the takt time limit, which meant operators could comply with customers demand without overtime.
2. Some of the operator work elements were transferred to a previous [work station](#) (thread control) that had available time, thus occupying the operator work time in a better way.
3. Some manual operations now are done while the machine runs automatically (deburring and stamping).
4. After the tasks of the two operators had been separated, walking was not necessary anymore, so this waste was fully eliminated.
5. After reducing the operator work load and working according to takt time, the waste of waiting caused by running short of parts in the previous operation was eliminated.

Consequently, the operator work content changed as demonstrated in figure 3.

Standardized Work Combination Table (After SW)				KR №: 4586	PROCESS: Washing Machine / Defects Elimination	FROM: Standardized Work Team	DATE: 02/05/06	<div></div> TAKT TIME (s): 194	<div></div> WALK															
						TO: UV 58	AREA: UV 58	<div></div> HAND	<div></div> AUTO															
Sequence	Work Elements	Time (s)			WORK TIME (seconds)																			
		Hand	Auto	Walk		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	
MAN 1	1 deburring and stamping	25	20	0	<div></div>	<div></div>	<div></div>																	
	2 line - sandpapering machine	25	45	0	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>															
	3 sandpapering machine - washing machine	40	0	0		<div></div>	<div></div>	<div></div>	<div></div>															
	4 washing machine + air	25	0	0				<div></div>	<div></div>	<div></div>														
	5 thread and flange control	30	0	0						<div></div>	<div></div>	<div></div>												
	6 defects elimination line	25	0	0							<div></div>	<div></div>	<div></div>											
MAN 2	1 defects elimination - control	145	0	0	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	
	2 return part to line	5	0	5							<div></div>	<div></div>												
TOTAL		320	Waiting	5		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	

Figure 3 - Standardized Work Combination Table – SWCT (after SW)

After the acceptance of the new SWCT (figure 3) by the team and the operators, the operation was standardized by the standardized work chart (SWC), as it is shown in figure 4a (before SW) and figure 4b (after SW).

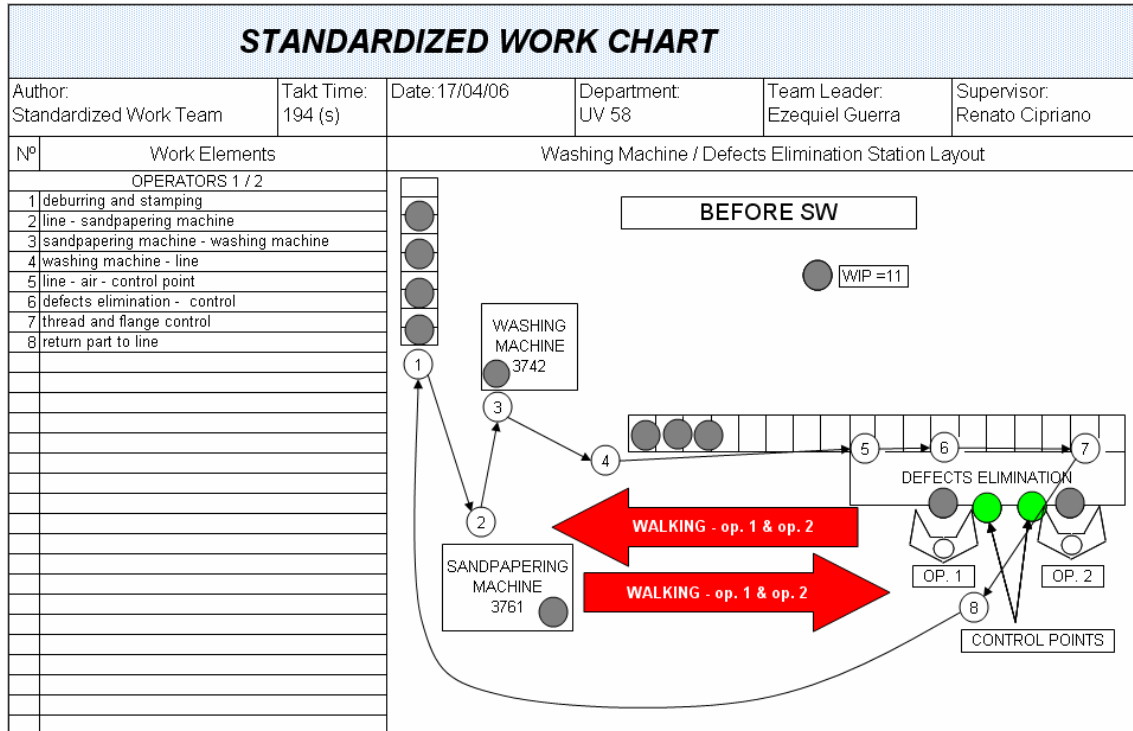


Figure 4a – Standardized Work Chart (SWC), before SW

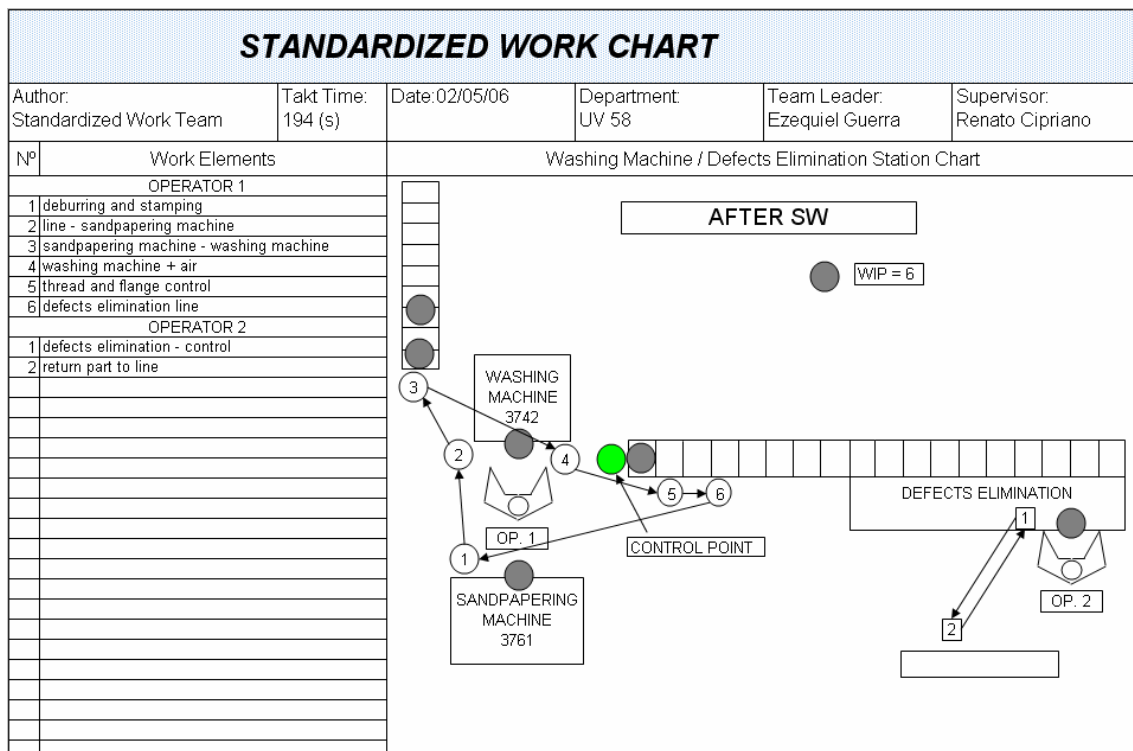


Figure 4b - Standardized Work Chart (SWC), after SW

Benefits of Standardized Work

Without any financial investment, the company achieved the following results by the SW implementation:

1. WIP (Work in Process) reduction by 40%
2. Operator movement reduced (1,500 meters/day) and work content transferred to a previous work station
3. Productivity improved 9% by distributing the operator work elements in relation to takt time, avoiding operator overload, and eliminating overtime (2 hours/day)
4. Improved operator satisfaction. “Why didn’t they think about this before?” said an operator after seeing the resulting improvements from the SW implementation, understanding that this new tool improved the operation process and made his life easier
5. Improved safety conditions. Before the SW implementation, there were two different floor levels for the execution of the operations. The operators had to walk up and down many times each day to complete their work sequence. After the operation was separated, the walking and stepping up and down was eliminated. This avoids work accidents and the strain on the operators.

Lessons Learned

The SW implementation was a powerful tool to support kaizen. Now the company is able to make improvements that are not only efficient but can be sustained continuously and receive full support and cooperation from the workers. The teamwork capabilities involved in this project found new opportunities to improve the performance and then increase profits.

Other elements of lean thinking such as level pull and continuous flow based on the takt time, among other things, became stronger than before and problems now are easier to find in this pilot area. So, by using SW and the correct ways to solve problems, it is possible to assure processes stability.

Involving the operators and leaders was essential for the success of the SW implementation. Not only due to their level of understanding and actual knowledge but also because it implies that suggestions programs gained more

importance and the operator finally can participate in the definition and improvement of his/her own work.

And the operators training became easier because all the tasks now have a clear content and work sequence, from the first step to the last one.

Deploying SW to Other Areas of TKMCL

The learning and benefits obtained from the SW implementation in this pilot project of the crankshaft production area are being deployed to other crankshaft production lines as well as other departments like piston rods, forgings, etc. SW has been helping ThyssenKrupp Metalúrgica Campo Limpo to take a leap in their lean journey.

Bibliography

The workbook *Creating Continuous Flow* (Portuguese) by Rick Harris and Michael Rother (Lean Institute Brasil, 2002) teaches how to make the Operator Balance Chart. And the *Lean Lexicon* (Portuguese, Lean Institute Brasil, 2007, 2nd edition) provides further information on the main lean terms.

About the Authors

Gilberto Kosaka is the Executive Director of Lean Institute Brasil. He worked for nine years at Toyota do Brasil where he was a director. Marino Kishida is a lean specialist from Lean Institute Brasil. He worked as the production manager at Toyota do Brasil's Indaiatuba plant where the Corolla is made. Ezequiel Guerra is a machining master and Adriano Silva is a junior engineer at TKMCL.

Participants in the standardized work workshop were João Luiz Marassi, Luis Fernando Ruffino, Alessandro Pessoto, Elcio Ferracini and Renato Cipriano from TKMCL. Gilberto Kosaka is the TKMCL project manager and Walter Medeiros is the TK machining industrial director.

Standardized Work Combination Table (Before SW)				KR N° : 4586	PROCESS: Washing Machine / Defects Elimination	FROM: Standardized Work Team	DATE: 17/04/06	<div></div> TAKT TIME (s): 194	<div></div> WALK															
				TO: UV 58		AREA: UV 58		<div></div> HAND	<div></div> AUTO															
Sequence	Work Elements	Time (s)			WORK TIME (Seconds)																			
		Hand	Auto	Walk	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450		
1	deburring and stamping	40	0	0																				
2	line - sandpapering machine	25	20	0																				
3	sandpapering machine - washing machine	25	45	0																				
4	washing machine - line	25	0	16																				
5	line - air - control point	30	0	0																				
6	defects elimination - control	145	0	0																				
7	thread and flange control	60	0	0																				
8	return part to line	5	0	5																				
TOTAL		355			25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450		
			Waiting	21																				

Standardized Work Combination Table (After SW)				KR N°: 4586	PROCESS: Washing Machine / Defects Elimination		FROM: Standardized Work Team	DATE: 02/05/06	<div></div> TAKT TIME (s): 194	<div></div> WALK												
Work Elements		Time (s)		WORK TIME (seconds)																		
		Hand	Auto Walk	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	
1	deburring and stamping	25	20	0																		
2	line - sandpapering machine	25	45	0																		
M A N 3	sandpapering machine - washing machine	40	0	0																		
4	washing machine + air	25	0	0																		
5	thread and flange control	30	0	0																		
6	defects elimination line	25	0	0																		
M A N 1	defects elimination - control	145	0	0																		
2	return part to line	5	0	5																		
TOTAL		320	Waiting	5	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450

STANDARDIZED WORK CHART

Author: Standardized Work Team		Task Time: 194 (s)		Date: 17/04/06		Department UV 58		Team Leader: Ezequiel Guerra		Supervisor: Renato Cipriano	
Work Elements OPERATORS 1 / 2				Washing Machine / Defects Elimination Station Layout							
1 deburring and stamping 2 line - sandpapering machine 3 sandpapering machine - washing machine 4 washing machine - line 5 line - air - control point 6 defects elimination - control 7 thread and flange control 8 return part to line											

STANDARDIZED WORK CHART

Author: Standardized Work Team		Takt Time: 194 (s)		Date: 02/05/06		Department: UV 58		Team Leader: Ezequiel Guerra		Supervisor: Renato Cipriano	
Nº Work Elements				Washing Machine / Defects Elimination Station Chart							
OPERATOR 1 1 deburring and stamping 2 line - sandpapering machine 3 sandpapering machine - washing machine 4 washing machine + air 5 thread and flange control 6 defects elimination line OPERATOR 2 1 defects elimination - control 2 return part to line											