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## **VALUE STREAM MAPPING IN OPTIMIZING TERRESTRIAL PIPELINES ASSEMBLY**

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### **ABSTRACT**

To meet the demand for the supply of oil and its derivatives, companies in this sector in Brazil, especially Petrobras, invest in the assembly of terrestrial pipelines to transport these products. The costs to perform such tasks are high and involve large amounts of labour and equipment resources. Among the various activities in the assembly of pipelines, the welding process is particularly noteworthy. This work has as general objective the application of the Value Stream Mapping (VSM) tool in the evaluation of the welding processes of terrestrial pipelines assembly used for supply oil and its derivatives. As specific objectives and following the concept of (VSM), the Current State and the Future State of the Value Stream of the welding process were elaborated. After the critical evaluation of the Future State, a work plan was proposed for possible improvements by Petrobras senior management. The focus of the changes was to reduce the costs and deadlines for the process development.

**Keywords:** terrestrial pipelines, welding, value stream mapping.

### **INTRODUCTION**

The construction and assembly of terrestrial pipelines, when compared to the automobile industry, resembles an inverted assembly line, since in the assembly of pipelines the labor and equipment involved in the activities do not remain in workstations, waiting for the product to move towards them, on the contrary, they are people and equipment that move through the work, divided by specialized teams, to perform the tasks, as shown in Figure 1 (Freire, 2009).



Fig. 1 - (a) Tubes prepared with machined bevels (source <http://www.chilexpo.com/> consultation on 05/06/2017); (b) top welding of the tubes forming a column (Source: Petrobras collection, 2010)

Therefore, the authors understood that the use of the Value Stream Mapping (VSM) tool (Shook, 2003) is adequate to introduce welding process improvements to the ground tubes in the field. This work has as general objective the application of the Value Stream Mapping Tool (VSM) in the evaluation of the welding processes of terrestrial pipelines assembly used

to supply oil and its derivatives. As specific objectives and following the concept of (VSM), the Current State and the Future State of the Value Stream of the welding process were elaborated. After the critical evaluation of the Future State, a work plan was proposed for introductions improvements to be evaluated by Petrobras senior management. The focus of the changes was to reduce costs and deadlines for the process development.

## RESULTS AND CONCLUSIONS

The result found through the State of Future Map, from the current one, made it possible to reduce production lead time from 172 minutes to 142 minutes. This means a 17.4% reduction in lead time, maintenance of value added time in 86 minutes, for the GMAW combination with FCAW in both teams, would generate a 50% to 60% increase in the total lead time used for activities that add value and a significant increase in OEE with the change in the SMAW welding methodology. So OEE of 0.67 will increased to 0.79 if GMAW could be combined with FCAW. This result is reflected in the higher quality of welded joints, avoiding rework of these joints. In view of the aforementioned considerations, the following Plan of Action was drawn up (Table 1).

Table 1 - Action Plan to be proposed to Petrobras Senior Management

Improvement Point	Immediate Actions	Future Actions
Reduction of the pipe stock displacement time to the welding site	1. Anticipation of the start and end of the workload of the tube loading team. 2. Request from the supplier to implement the VSM in the tube concreting activity reducing the execution time of this service.	1. Study of the locations for pipe supply to equalize the average distance between the welding tubes sites. 2. Consider, when defining the pipeline, the best accesses between possible pipe suppliers and the places where the work will be performed.
Welding method change (SMAW for GMAW / FCAW)	1. Change of welding equipment 2. Training of operators, if necessary.	Before the beginning of the works, study the best combination of welding methods to be implemented in the pipeline construction, aiming at reducing lead time.
Study of new welding methods	1. Identification of studies about welding methods potentially more productive than those currently used in the work. 2. If a new method is identified, perform tests to review the welding procedure.	Before the beginning of the works, study the best combination of welding methods to be implemented in the pipeline construction, aiming at reducing lead time.

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