Current Mapping on the UBS Surabaya Office Building Construction Project

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Abstract. *In the world of construction, waste is one of the factors that must be minimized or eliminated, because it can cause cost losses and time delays in the implementation of a construction project. Lean production concept approach using Value Stream Mapping (VSM) tools is a method that can be used to minimize waste that can be seen through value added activities, non value added but necessary. The scope of work that has a significant impact on the UBS Surabaya office building construction project consists of iron work, concrete work, and formwork work on the superstructure, during the period from March to May 2021. In the scope of work identified Value Added amounting to 73 activities (61.34%), and Non-Value Added but Necessary totaling 26 activities (21.85%). There are several types of waste that occur during the implementation process,.*

Keywords: *Value Stream Mapping, Value Added, Non Value Added but Necessary*

1. Introduction

The development of the construction industry has resulted in a significant increase in competition between companies, requiring each company to improve the performance of construction. This is necessary to support business continuity in the midst of intense competition in the existing industry. The problem in implementing construction projects is that there is often an inefficiency in the work being done and results in a waste of resources which is often called waste [1].

In the world of construction, waste problems must be minimized because identified waste does not add value to a project. Waste can cause cost losses and time delays in the implementation of a construction project. One method that can be used to maximize value is by applying the concept of lean construction.

Lean construction can be used to minimize activities that do not add value to the final product with the aim of maximizing work to be effective and efficient [2]. The VSM (Value Stream Mapping) method is contained in lean construction by mapping work that is Value Added (VA) or can provide added value, activities that are Non Value Added but Necessary (NVAN) or can have a positive impact on activities but do not provide added value of a project, and activities that do not provide added value or are Non Value Added (NVA).

Value Stream Mapping is a visual mapping process of information and material circulation that aims to prepare better methods and performance [3] The Value Stream Mapping method has the advantage of describing modeling in the form of integrated mapping between processes or activities and the waste that occurs during implementation of a project using a simple and flexible framework.

Modeling in the form of a simple framework is called mapping current and future maps. The current map is a diagram that shows material flows accompanied by actual information [4]. This current map will be the final result of research on the UBS Surabaya project.

2. Materials and Methods

2.1 Waste in Construction

Waste has the meaning of waste. Waste can result in project productivity and increase in final and initial construction costs because waste can occur both before the project construction begins and the project is in progress. Waste construction itself arises because it originates from the unique nature of construction. Unique in the sense that it is not repeated, is temporary, has high uncertainty, and high variability. The waste in construction that often appears is repetition work [5]

2.2 Value Stream mapping (VSM)

Value stream mapping visualizes the entire construction implementation process, both the flow of information and orders [6]. The goal is to find out activities that add added value to the job. VSM stages are [4]:

1. Determination of work activities.
2. Perform a work breakdown or work breakdown structure.
3. Identify VA, NVA, and NVAN jobs.
4. Describe the flow in the form of a Current map.

2.3 Methods

The research is centered on building construction projects in the form of offices with a building area of ± 1750 m² and consisting of seven floors. The initial stages of doing a pareto analysis. Pareto analysis, namely the impact of 80% can be caused by causes that are only 20%, so the pareto analysis is used to identify jobs that have the opportunity to cause waste in the project.

The second stage is to carry out a work breakdown structure (WBS) which can be done based on the 'S' or BoQ curve data. WBS results can be used as an initial reference from field observations.

The third stage is conducting field observations to identify the implementation of the work between the plan and the actual in the field. At this stage, similarity of planned and actual work items will be obtained or vice versa which is suspected to also cause unnecessary work waste.

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The fourth stage is a classification of work items into three categories, namely VA (Value Added), NVA (Non Value Added), and NVAN (Non Value Added Necessary). The final stage is to describe it into CSM (Current State Mapping).

3. Discussion

In Figure 1, it can be seen that the scope of work that has a significant impact on the UBS Surabaya office building construction project is the work of rebar, concrete and formwork, on the superstructure, which consists of rebar, concrete and formwork.

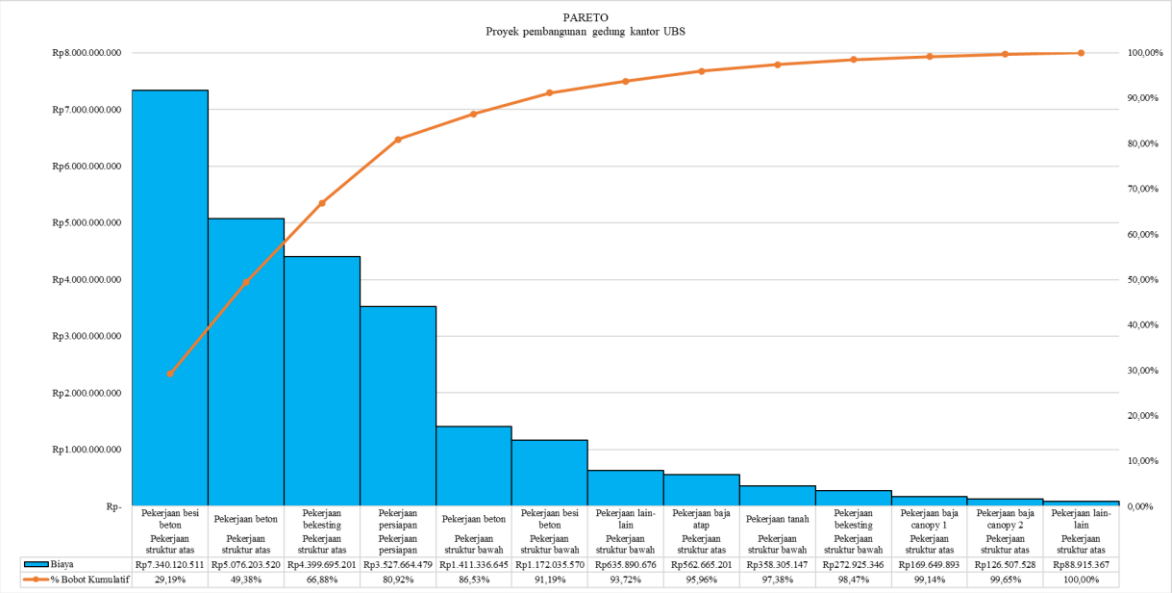

Figure 1. Pareto Graph.

Based on the observation results, it was found that there were 73 Value Added activities (61.34%), 20 Non Value Added activities (16.81%), and 26 Non Value Added but Necessary activities (21.85%). There are several types of waste that occur during the implementation process, including activity waste such as unnecessary activities, activities of moving materials or equipment, and repetition of work.

The results of the VSM depiction can be seen in Figure 2, with the colored manufacturing process symbols representing jobs identified as VA, yellow colors representing jobs identified as NVAN, and green color representing jobs identified as NVA which the researcher then conveyed a recapitalization which can be seen in Table 1.

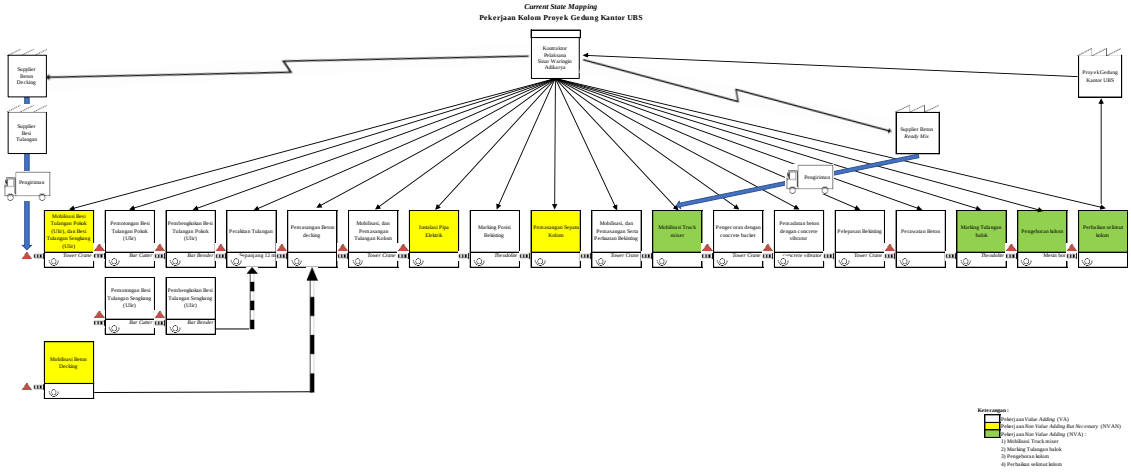

Figure 2. Column Work Value Stream Mapping

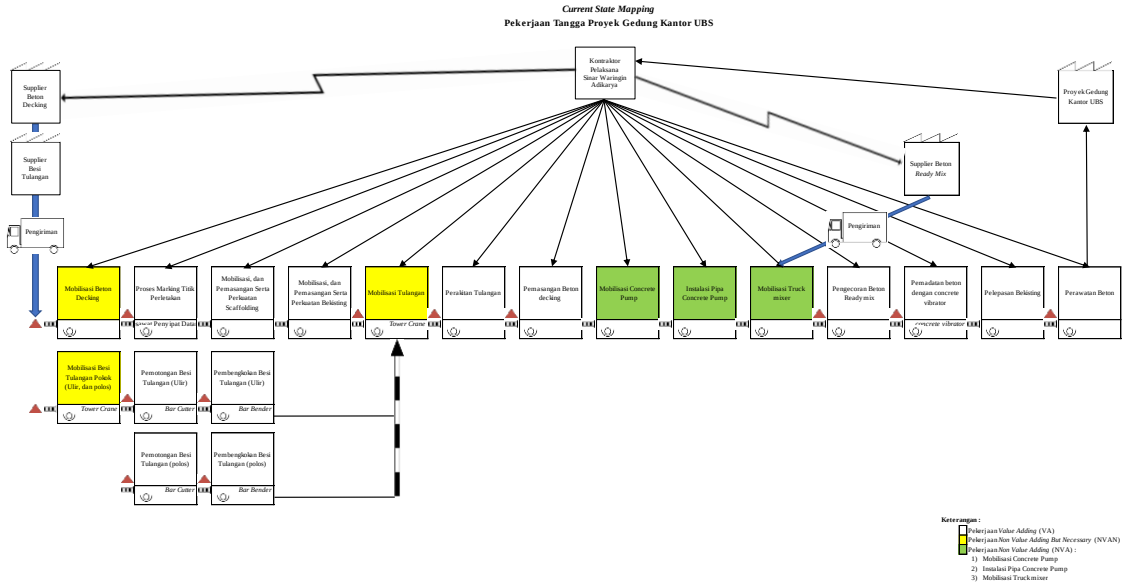

Figure 3. Value Stream Mapping of Ladder Work

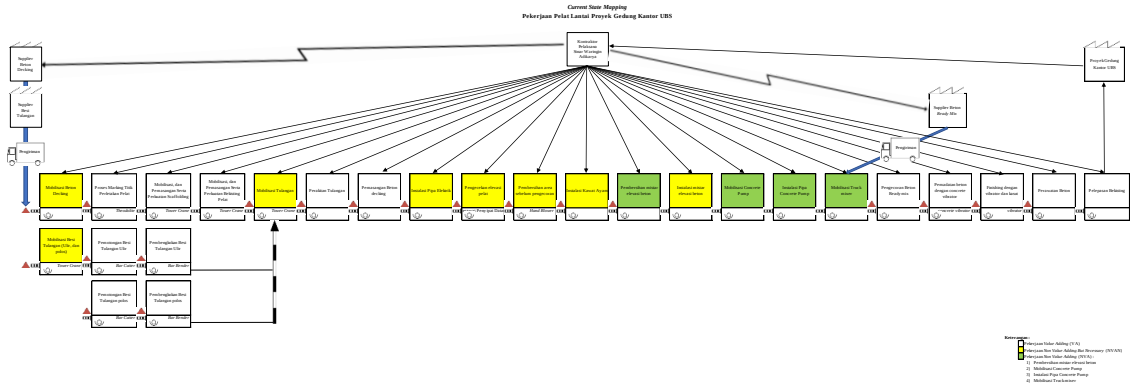

Figure 4. Value Stream Mapping of Floor Slab Work

Table 1. VA activity on columns, stairs and floor slabs

Column	Ladder	Floor Slab
Cutting of Main Reinforcement (Threaded)	Placement Point Marking Process	Plate Laying Point Marking Process
Bending of Main Reinforcing Iron (Threaded)	Mobilization, and Installation and Strengthening of Scaffolding	Mobilization, and Installation and Strengthening of Scaffolding
Cutting of stirrup reinforcement (threaded)	Mobilization, and Installation and Strengthening of Formwork	Mobilization, and Installation and Strengthening of Plate Formwork
Bending of Steel Bars (Threaded)	Cutting of Reinforcing Steel (Threaded)	Threaded Reinforcing Steel Cutting
Reinforcement Assembly	Bending of Reinforcing Steel (Threaded)	Bending of Deformed Reinforcing Steel
Installation of concrete decking	Cutting Rebar (plain)	Plain steel cutting
Mobilization and Installation of Column Reinforcement	Bending of Rebar (plain)	Bending of plain steel bars
Formwork Position Marking	Reinforcement Assembly	Reinforcement Assembly
Mobilization, and Installation and Strengthening of Formwork	Installation of concrete decking	Installation of concrete decking
Casting with a concrete bucket	Readymix Concrete Casting	Readymix Concrete Casting
Compaction of concrete with a concrete vibrator	Compaction of concrete with a concrete vibrator	Compaction of concrete with a concrete vibrator
Release of Formwork	Release of Formwork	Finishing with vibrators and shoes
Concrete Treatment	Concrete Treatment	Concrete Treatment
		Release of Formwork

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Source: Researcher, (2023)

Table 2. NVAN activities on column, beam, and slab work

Column	Beam	Floor Plate
		Mobilization of Decking Concrete
Mobilization of Decking Concrete	Mobilization of Decking Concrete	Mobilization of Reinforcing Iron (Threaded, and plain)
Mobilization of Staple Reinforcement (Screw) and Stirrup Reinforcement (Screw)	Mobilization of Staple Reinforcement (Screw) and Stirrup Reinforcement (Screw)	Reinforcement Mobilization
Electrical Pipe Installation	Mobilization of Beam Reinforcement	Electrical Pipe Installation
Installation of Column Shoes	Electrical Pipe Installation	Plate elevation check
	Beam elevation check	Area cleaning before casting
	Area cleaning before casting	Chicken Wire Installation
	Chicken Wire Installation	Installing concrete elevations
	Installing concrete elevations	

Source: Researcher, (2023)

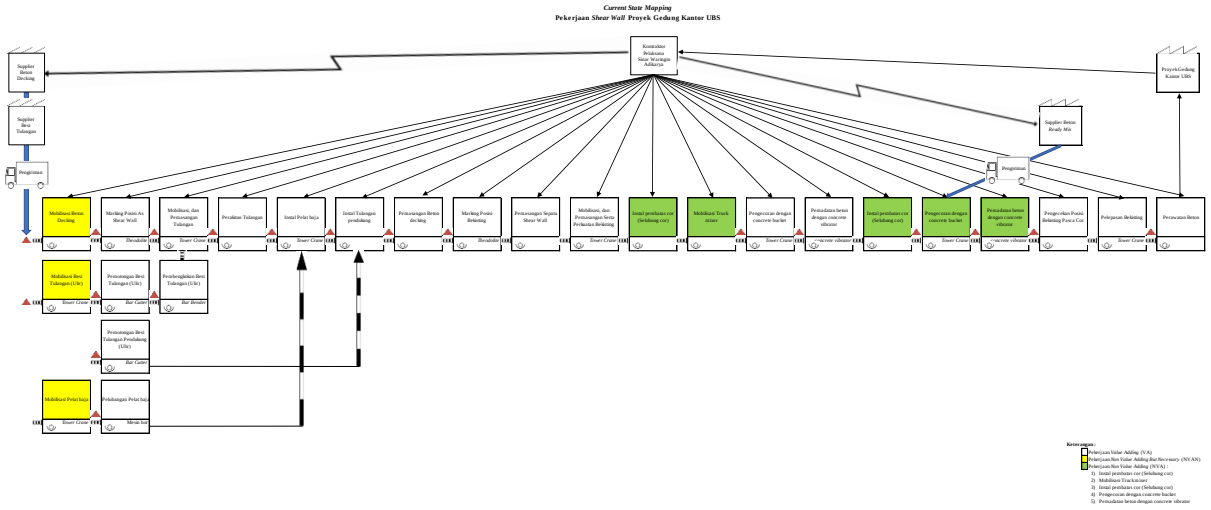

Figure 5. Value Stream Mapping for Shear Wall Work

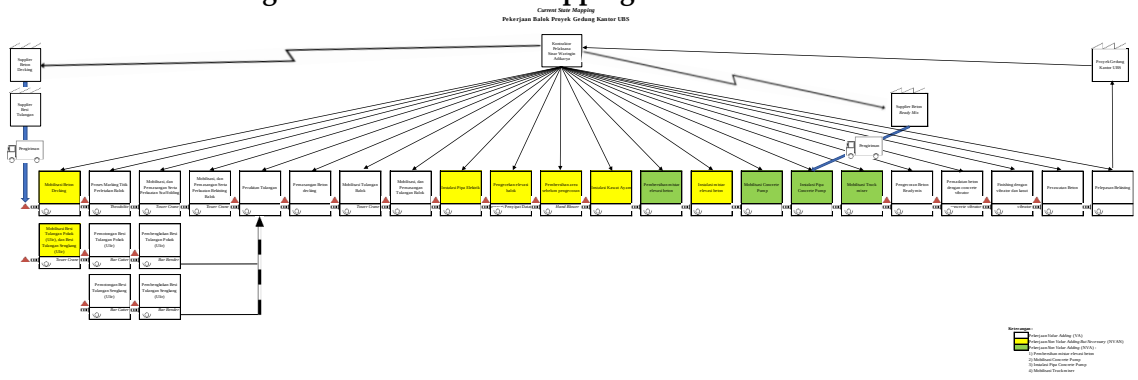

Figure 6. Value Stream Mapping for Beam Work

Table 3. VA activity on shear wall and beam work

Shear Wall	Beam
Cutting of Reinforcing Steel (Threaded)	Marking Process of Beam Laying Points
Cutting of Supporting Reinforcement (Threaded)	Mobilization, and Installation and Strengthening of Scaffolding
Bending of Reinforcing Steel (Threaded)	Mobilization, and Installation and Strengthening of Beam Formwork
Steel plate punching	Cutting of Main Reinforcement (Threaded)
Marking Position As Shear Wall	Bending of Main Reinforcing Iron (Threaded)
Mobilization and Installation of Reinforcement	Cutting of stirrup reinforcement (threaded)
Reinforcement Assembly	Bending of Steel Bars (Threaded)
Install Steel plate	Reinforcement Assembly

Install support reinforcement	Installation of concrete decking
Installation of concrete decking	Mobilization, and Installation of Beam Reinforcement
Formwork Position Marking	Readymix Concrete Casting
Installation of Shear Wall Shoes	Compaction of concrete with a concrete vibrator
Mobilization, and Installation and Strengthening of Formwork	Finishing with vibrators and shoes
Casting with a concrete bucket	Concrete Treatment
Compaction of concrete with a concrete vibrator	Release of Formwork
Post Cast Formwork Position Checking	
Release of Formwork	
Concrete Treatment	

Table 4. NVAN activity on shear wall and ladder work

Shear Wall	Ladder
Mobilization of Decking Concrete	Mobilization of Decking Concrete
Mobilization of Reinforcing Iron (Screw)	Mobilization of Main Reinforcing Steel (Threaded, and plain)
Armor Plate Mobilization	Reinforcement Mobilization

Table 5. Percentage of VA, NVAN, and NVA in all jobs

%	Column Work	Beam Work	Floor Plate Work	Shearwall work	Ladder Work
VA	61.90%	55.56%	53.85%	69.23%	68.42%
NVAN	19.05%	29.63%	30.77%	11.54%	15.79%
NVA	19.05%	14.81%	15.38%	19.23%	15.79%

6. Conclusion

The type of activity waste that occurs during the implementation process in the form of Non-value Added (NVA) is the activity of moving materials or equipment and repeating work. These activities consisted of installing chicken wire, concrete elevation ruler, and installation of column shoes due to the previous casting not reaching the beam elevation. Activities of moving materials or equipment such as procuring concrete decking, mobilizing steel plates, deformed and plain reinforcing bars. Repetition of work such as cleaning the area before casting, checking the elevation of beams and plates.

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