

Reduction of Time & Cost by Using Value Stream Mapping Tool

Mustafa Udaipur^{*1}, Aditya Malpani², Pratik Navale³, Rohit Shetty⁴, Prof.P.B.Bhosale⁵

^{*1,2,3&4} *Sinhgad Academy of Engineering, Kondhwa, Pune, India*

⁵ *Assistant Professor at Sinhgad Academy of Engineering, Kondhwa, Pune, India.*

Abstract

Lean construction(LC) is excellent in managing the construction process, eliminating waste & optimizing material and energy. LC is also capable to enhance sustainability in construction thus the quality of life for future construction industry. Value stream mapping is a lean management method for analyzing the current state and designing a future state for the series of events that make a product or services from its beginning through to the customer with reduced lean wastes as compared to current map.

Our objective for the project is to study lean construction concept and its various tools, study Value Stream Mapping(VSM) tool, observing and analyzing the data by VSM, drawing the Current State Map and Future State Map and comparing the two tools by calculating time & cost, and graphical representation of Time & Cost. We will employ the following procedure for achieving our objectives: Site Selection & Observation, Data Collection, Data Analysis, Current State Mapping & Future State Mapping.

At present, work is mostly done manually which causes inefficiency and indirectly increases time and cost to a huge extent. Through this project we aim to minimize time and cost using value stream mapping tool of lean construction.

Keyword: *Lean Construction(LC), Value Stream Mapping(VSM), Current State Map(CSM), Future State Map(FSM)*

1. INTRODUCTION

1.1 Introduction of the Project Work

Lean construction is basically implemented construction. Lean construction is a “way to design production system to minimize waste of materials, time and effort to generate the maximum possible amount of value “. Its helps to identify value from the customer’s point of view, define the value stream, eliminate waste, flow of work processes, pull planning and scheduling continuous improvement,. In our project we will be studying the concept of Value Stream Mapping, a tool of lean construction. It is a method for analysing the current state and designing a future state for the series of events that take a product or services from its beginning through to the customer with reduced lean wastes as compared to current map. This tool requires only pen and paper does not require any software.

1.2 Problem Statement

In today’s day and age time and cost are the biggest and the most common problem faced by construction companies all over the world including India. In this project we intend to reduce the time and cost required for the completion of the processes in construction by using VSM.

1.3 Objectives

Our objectives will be completed in the following steps:

- 1) Study Value Stream Mapping tool.

- 2) Draw the Current State Map (Data related to current scenario on site) by using value stream mapping tool
- 3) Draw the Future State Map (Modified data based on CSM) by using value stream mapping tool.
- 4) Comparison between Current State Map and Future State Map.
- 5) Conclusion is based on time and cost.

1.4 Scope of the project

We will take into consideration the various operation like excavation, concreting, plastering, painting, and many more. We will complete our objective by creating a current state map for the processes to transform it into the future state map by applying, correcting and implementing new techniques. Finally we will provide an idealised state map for all the processes taken into consideration to reduce time and cost. This will provide an efficient way to complete all the processes and minimum amount of wastes produced.

1.5 Limitations of Study

The few limitation of VSM are the challenges faced like illiteracy towards lean management principle and unavailability of skilled labour because of which the labourers need to be trained with the symbols and details of the map for achieving goal of lean construction.

1.6 Expected Outcome

The main purpose is to know how VSM is a powerful tool in lean implementation and to tackle the improvement areas from the current state & to propose the future state which helps in reducing the lead time and cost without compromising the quality of construction

2. LITERATURE REVIEW

Lean construction Technique in Indian Construction Industry [1]. Lean construction in Indian Construction is an effective management tool to enhance productivity in construction. Lean principle is adopted by the construction. Major problem of availability of skilled labour to avoid such problem, construction firm required use of latest innovation technology like lean management. Implementing LC in the construction industry benefits by maximizing value and improved stability.

Lean Construction Value Stream Mapping For Residential Construction [2]. In this paper we studied the value stream process used in lean construction, its various properties and uses to improve the construction process.

Applying Value Stream Mapping For Improving Productivity in Construction [3]. In the journal we studied and focused on the symbol and signs used for constructing the value stream map. As VSM method consist of Current State Map(CSM) and Future State Map(FSM). Both of these maps are designed and constructed by converting data and information into symbol and signs which will help the users to read and understand.

Value Steam Mapping as a Tool for Lean Implementation-A Case Study[4]. A current state map is a snapshot of how a process is done. It may be a current state process flowchart, or a current state value stream map(VSM), but the principle is the same. It shows the current methodology of how you produce product or perform services for your customers

Value Stream Mapping as a Lean Construction Tool – A Case Study[5]. Future State Map is used for elimination of wastes and improvement of the of the existing practices. The map shows the standard time with which the activities should be executed to achieve the desired pour cycle and improved cycle time. The work sequence and the information passed will help to efficiently complete the process. The future state map is our plan for the next two to three months.

Working of Automatic Wall Plastering Machine[6]. For saving time , cost of construction & geting good plaster finishing of the wall use of automatic wall plastering machine is recommended. The machine gives high quality plaster and reduces the wastage of mortar upto 60% .

Quality control of RMC[7]. This paper describes how the quality of RMC should be properly maintained. The main goal of this paper is to give the idea to the civil engineer on why RMC is more advantages over onsite concrete. This page gave us the idea how RMC helps in reducing the time & cost and increasing the productivity of a particular project.

3. METHODOLOGY

3.1 Data Collection :-

Data collection is a process includes a detailed evaluation of particular site selected and collecting reliable data. The parameters selected for site selection were:-

A. Collection from site.

- Site should make use of adequate equipment and traditional methods.
- Site should have standard procedure for construction with proper planning.
- Site having provision for data collection and storage.

B. Collection from literature review.

C. Data collection from web search .

3.2 Data Analysis :-

Data analysis is a process of inspecting, cleansing, transforming and modelling data with the goal of discovering useful information, informing conclusions and supporting decision-making.

A. Formulas

%CostReduction

$$= \frac{C.M.COST - A.M.COST}{C.M.COST} * 100$$

B. MS Office.

C. Smart draw.

4. CASE STUDY

We have selected different activities so that their efficiency with respect to time and cost increases. Site we had selected was a perfect choice for our project as it included all the activities that we wanted.

1. Developer – F5 Realtors
2. Site Name – Green County Phase 2
3. Project Cost – Rs. 9,28,37,102
4. Project Duration – 484 days
5. Equipments Used – Hammer, Vibrator, Poklan Machine, Breaker Machine, JCB, Dumper, Tractor, Mixer, Scaffolding lift, Horizontal railing track
6. Tools Used – Thapi, Ghamela, Phavda, Levelling bar, Plumb bob

We applied the Value Steam Mapping (VSM) technique, lean construction tool, to the site mentioned above. VSM helps to identify the wastes in a process and suggests methods for improvement in different situations. It consists of Current State Map (CSM) and Future State Map (FSM). Both of these maps are designed and constructed by converting data and information into symbols and signs which will help the users to read and understand.

Activities considered are-

1. Steel work
2. Concrete
3. Slab casting
4. Brickwork
5. Plastering
6. Painting

5. CALCULATIONS

COST SAVING

SR.NO.	ACTIVITY	CURRENT	ADVANCE	SAVING (RS.)	SAVING %
1	Steel work	152,957.50	122,000.00	30,957.50	20.23928215
2	Concrete	33,191,944.00	32,762,681.50	429,262.50	1.293273151
3	Slab casting	5,045,263.11	3,703,837.30	1,341,425.81	26.5878266
4	Brickwork	6,122,080.00	5,154,876.00	967,204.00	15.79861746
5	Plastering	2,638,576.00	2,506,812.00	131,764.00	4.993754207
6	Painting	2,962,119.00	2,781,648.00	180,471.00	6.09263166
	TOTAL	50,112,939.61	47,031,854.80	3,081,084.81	6.148281921

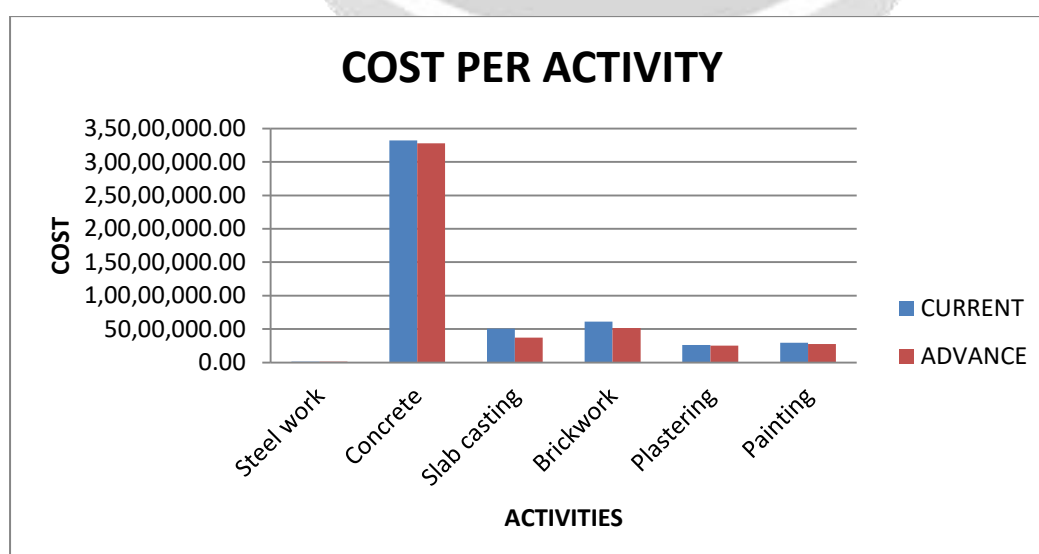
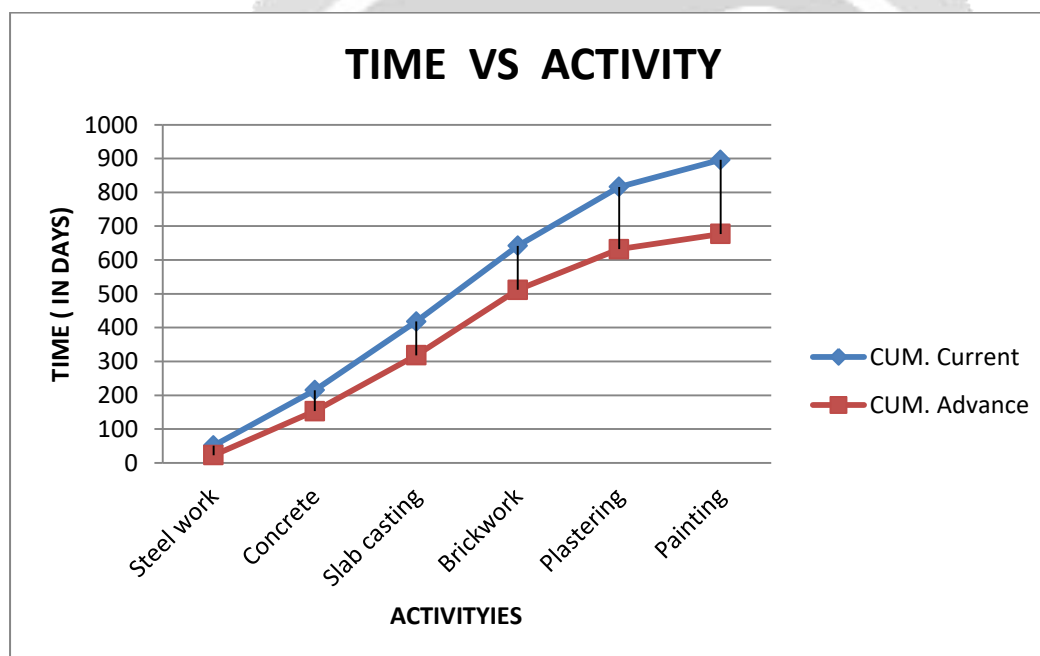
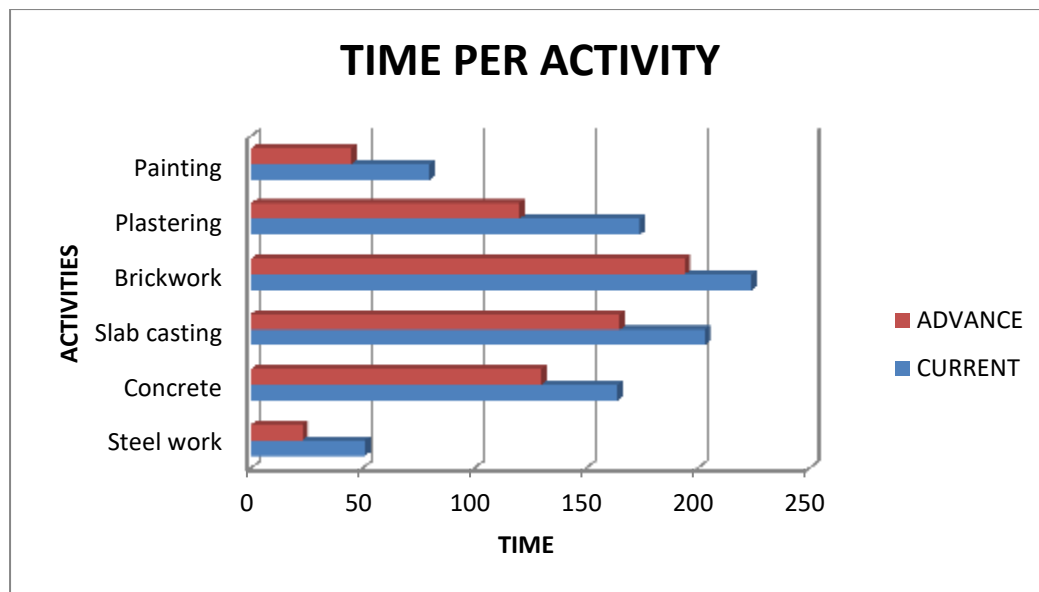
TIME SAVING

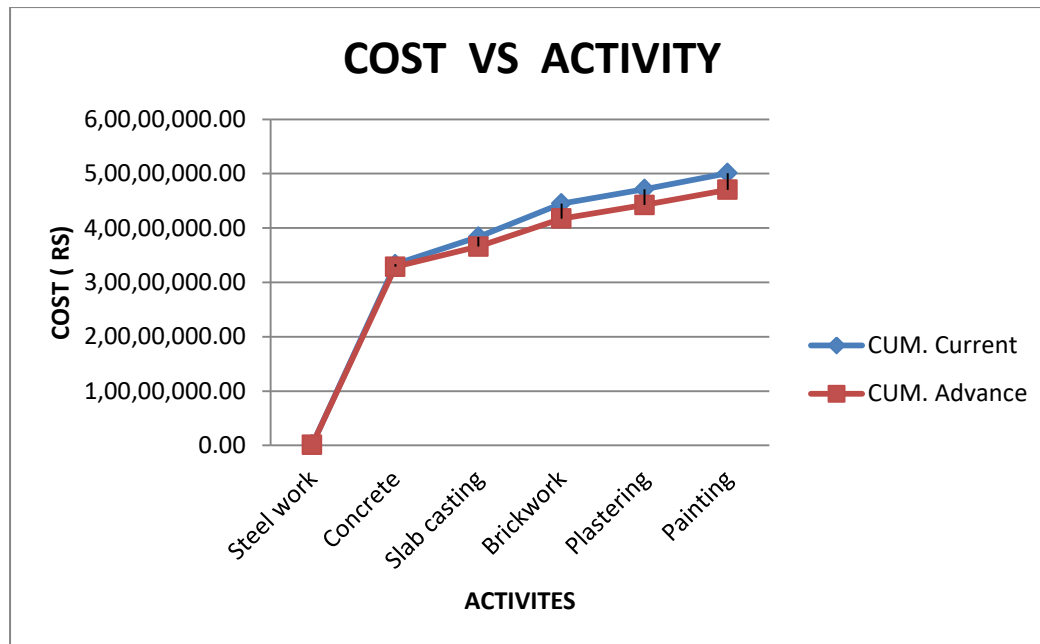
SR.NO.	ACTIVITY	CURRENT	ADVANCE	SAVING (in days)	SAVING %
1	Steel work	51	23	28	54.9019608
2	Concrete	164	130	34	20.7317073
3	Slab casting	203	165	38	18.7192118
4	Brickwork	224	194	30	13.3928571
5	Plastering	174	120	54	31.0344828
6	Painting	80	45	35	43.75
	TOTAL	896	677	219	24.4419643

Here current methods are the method that were used and adopted on the site by developers or we can say traditional methods generally practised on site. The data was collected periodically.

Advance methods are our recommendation and the suggestion to the developers, which are more efficient and new to the engineering world.

After collecting observing and analysing the data, we have comprised the stats and made several charts for comparison and better understanding, such as

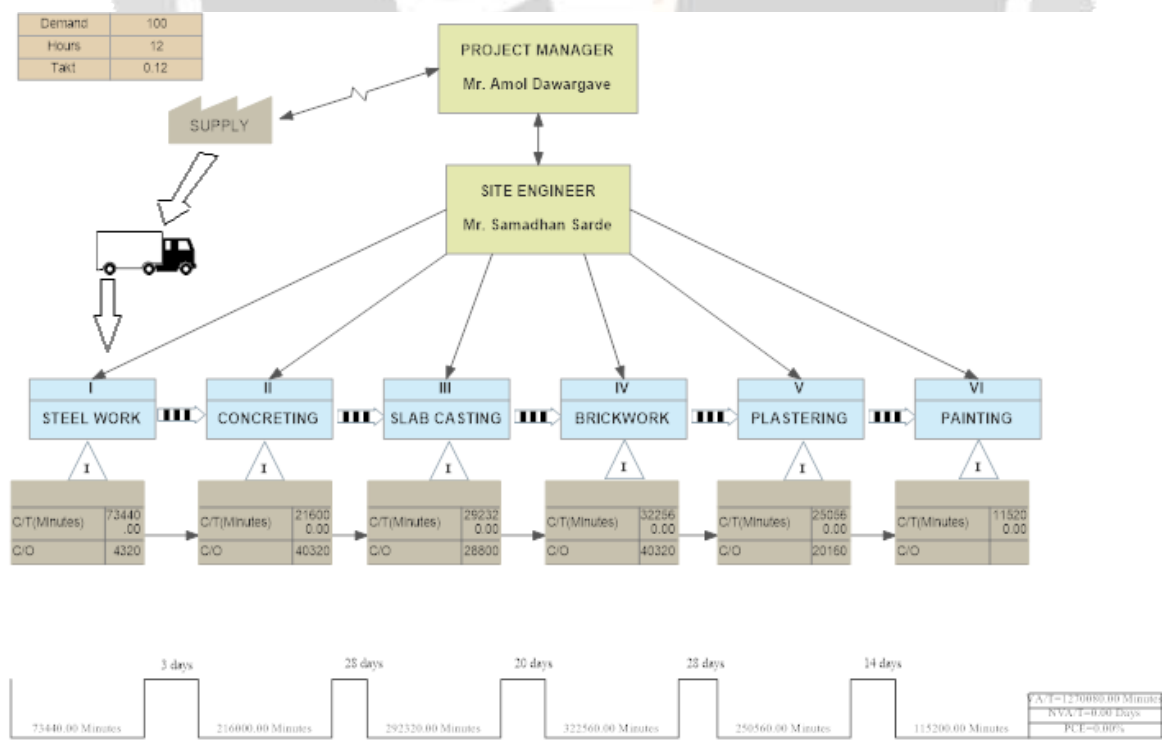




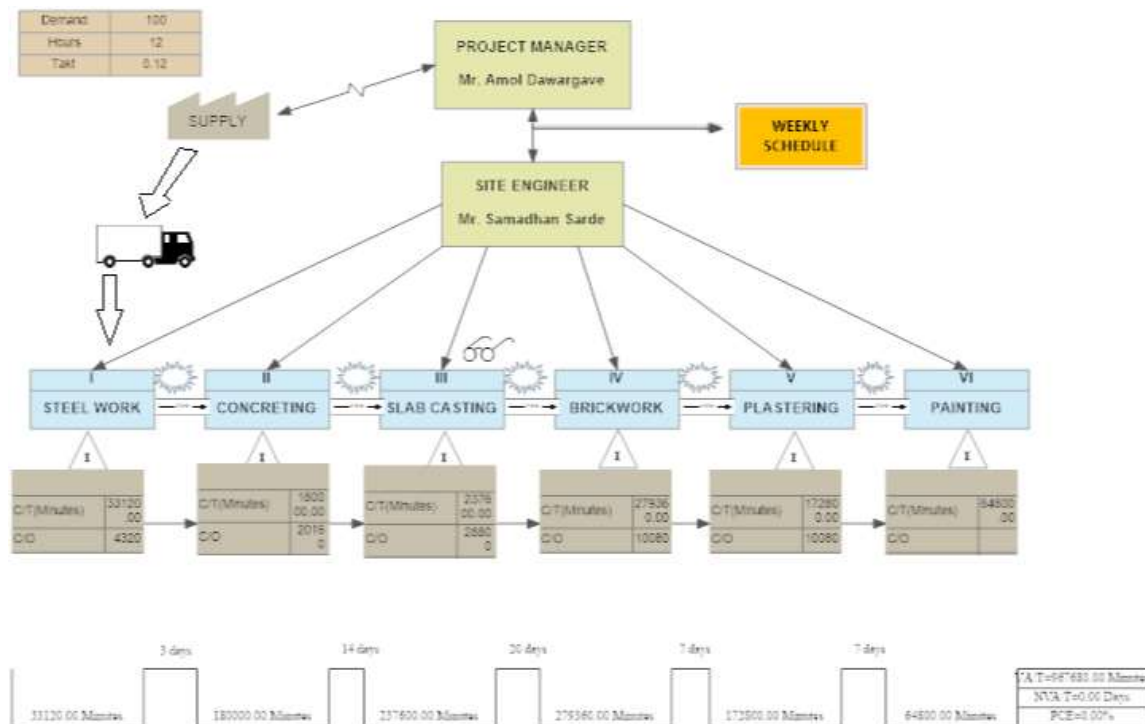
Graph and chart above shows the cost and time comparison between current and advance methods, we can easily compare and acknowledge that by just planning and choosing methods and equipments properly we can save time and cost.

After computation of data CSM & FSM are drawn

Current state map



Future state map



6. Result

	TIME	COST
CURRENT	896 days	4,77,38,238.61
ADVANCE	677 days	4,47,75,724
SAVING	219 days	29,62,515
SAVING (In %)	24.4 %	6.2 %

7. Conclusion & recommendation

In our project, we have considered a few construction activities namely brickwork, plastering, painting, concreting, steelwork and slab casting. We have efficiently managed the activities to reduce the time and cost for the activities which ultimately reduces the time and cost of the project.

In the brickwork process we have used Autoclave Aerated Concrete (AAC) blocks instead of bricks. These AAC blocks save about 10-15% of cement, almost 70% mortar, 10% labour and the construction speed increases 3 times. The blocks do not require waterproofing which helps to save water. AAC blocks can be cut into any shape and size without the loss of any material.

The automatic plastering machine, we recommend, requires only 1 or 2 labours, also it reduces the time taken to complete the activity by one-third. This machine uses less material as compared to manual plastering as the wastage of material is less. The cost of activity also reduces as the labour requirement is less.

We have used a spray gun for painting as it is much faster as compared to a paint brush and roller. The spray gun provides an even coating, smooth finish and no extra coating is required which reduces the time and cost considerably.

In Concreting, we recommend RMC as it reduce the time and also reduce the hustle and bustle on site as it get manufactured in plant and then transported to site for direct use. It also reduce noise pollution produce over site during concrete production.

In steelwork, the binding wire work is generally done by hand which requires a lot of time. We have used a tying machine which has a little high cost but completes the work in almost one-third the time required to do the work manually.

For reducing cost as compared to serviceability, we recommend voided slab. Bubble deck slab which is a type of voided slab, produces 20% faster floors with beams and limited formwork, which minimize the construction costs by 12% and agrees with 32% minimization in concrete use

In the present work, work is mostly done manually which causes inefficiency and indirectly increases time and cost to a huge extent. In this project we aimed to minimize time & cost using value stream mapping tool of lean construction and we achieved 6-7% saving in overall cost of production and saved 20-25% time. By just investing the little concentration over new methods and equipment at the time of planning and designing we can save time and cost.

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