



IMPLEMENTATION OF LEAN CONSTRUCTION THEORY: BY USING 5'S METHODOLOGY AS TOOL - CASE STUDY

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ABSTRACT

This study presents a implementation of lean construction theory by using 5'S methodology as tool in construction management. 5'S is a systematic technique used by organizations comes from five Japanese words, Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize), and Shitsuke(sustain). This system helps to organize a workplace for efficiency and decrease wasting and optimize quality and productivity via monitoring an organized environment. It also provides useful visual evidences to obtain more firm result. There is a real need for empirical studies in field of new management systems and their impact on construction management performance. As importance role of continuous improvement in today's organization, and lack of sufficient evidence to show the positive impact of 5'S on organizational performance. The results show that 5'S is an effective tool for improvement of management, inventory control, quality of work, decrease in time as well as cost of construction. In this study the 5'S methodology is applied on actual construction activity of residential building to minimize the wastage of material on construction site and which will be results into lean construction.

INTRODUCTION

5S is an approach originally developed in japan for better housekeeping. Now, it is been utilized for keeping better work place. It includes 5 steps which are to be followed sequence. 5s is a Japanese methodology to organize an improve the efficiency of shared workspace by incorporating regular task such as cleaning, sortening, and rearranging the surroundings and method of operation within the workplace.

5s consists of 5 phases are activities with names starting name the letter 'S' and provides a basic foundation for any organization's lean imitative for continuous improvement.

Following Japanese terms collectively are called 5S.

- 1S – Seiri or Sort
- 2S – Seiton or Set In Order
- 3S – Seiso or Shiny Clean Up
- 4S – Seiketsu or Standardize
- 5S – Shitsukae or Sustain

5S is not about housekeeping. It is not just keeping the workplace organized; it is about instilling the discipline in the work area to keep only what is needed there and having a home for everything.

5S is a workplace organization and continuous improvement system that lays the foundation for the all other lean improvement activities. By starting your lean journey with 5S we will discover the tools and techniques required to be successful in eliminating waste from our process. 5S is not a system or program that can be started and completed. It is continuous improvement process that provides a never ending methodology to continuously improve your operation. It has proven to work in any business, every sector, all industries, in any country and has been instrumental in changing the culture of organization worldwide. Many companies prefers to have "done 5S" many times before.

HISTORY OF 5'S METHODOLOGY

5S was developed in JAPAN. Japanese companies were getting more success using 5S concept, thirty years ago researchers started studying the secret of successes of Japanese manufacturing companies 5S turned out to be the



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most impressive secrets. The factories were so well organized. Two major formworks for understanding and applying 5S to business environments have arisen, one proposed by Osada, the other by Hirano. Hirano provided a structure for improvement programs with a series of identifiable steps, each building on its predecessor. As noted by John Bicheno, Toyota's adoption of the Hirano approach was '4S' with Seiton and Seiso combined.

Additionally, it is quickly obvious when something is missing from its designated location. The benefits of this methodology come from deciding what should be kept, where it should be kept, and how it should be stored. 5S is a cyclical methodology designed for continuous improvement.

Although the process of applying the 5S principles is best illustrated with a circular diagram because it is a continuous process, there is a logical sequence for implementing the 5S methodology.

IMPLEMENTATION OF 'S'

SEIRI (SORT OUT)

Seiri or sort is the first step in 5S, it refers to the sorting of the clutter from the other items within the work area that are actually needed. This stage requires the team to remove all items that clearly do not belong in the working area and only leave those that are required for the processes in question.

- Remove unnecessary items and dispose of them properly.
- Make work easier by eliminating obstacles.
- Reduce chances of being disturbed with unnecessary items.
- Evaluate necessary items with regard to cost or other factors.
- Remove all parts or tools that are not in use.
- Segregate unwanted material from the workplace.
- Need fully skilled supervisor for checking on regular basis.

SEITON (SYSTEMIZE)

Seiton or straighten is the process of taking the required items that are remaining after the removal of clutter and arranging them in an efficient manner through the use of ergonomic principles and ensuring that every item "has a place and that everything is in its place."

- Arrange all necessary items so that, they can be easily selected for use
- Prevent loss and waste of time by arranging work station in such a way that all tooling / equipment is in close proximity
- Make it easy to find and pick up necessary items
- Ensure first-come-first-served basis
- Make workflow smooth and easy
- All above work should be done on regular basis
- Seiton or orderliness is all about efficiency
- This step consists of putting everything in a assigned place so that it can be accessed quickly on construction site.

SEISO (SHINE)

Seiso or sweep is the thorough cleaning of the area, tools, machines and other equipment to ensure that everything is returned to a "nearly new" status. This will ensure that any non-conformity stands out; such as an oil leak from a machine onto a bright, newly painted clean floor.

- Clean your workplace completely
- Use cleaning as inspection
- Prevent machinery and equipment deterioration
- Keep workplace safe and easy to work
- Keep work place clean and pleasing to work in
- When in place anyone not familiar to the environment must be able to detect problems in 5 seconds within 50 feet.
- After work done workplace should be clean.



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- Cleaning must be done by on field workers and managers should have watch on it
- Assign every person or group of person for cleaning
- There should be schedule for cleaning and sweeping which does not caused any
- It can be on daily or weekly basis

SEIKETSU (STANDARDIZE)

Seiketsu or standardize is the process of ensuring that what we have done withing the first three stages of 5S become standardize; that is we ensure that we have common standards and ways of working. Standard work is one of the most important principles of lean manufacturing.

- Standardize the best practices in the work area.
- Maintain high standards and workplace organization at all times.
- Maintain orderliness. Maintain everything in order and according to its standards.
- Everything in its right place.
- Every process has a standard.
- Generate a maintenance system for above phases, make a team for these work, the head of this team should be manager of that construction site
- Define the standards by which person must measure and maintain cleanliness
- Develop procedures, schedules, practices
- Personnel are trained to detect abnormalities and to correct them immediately

SHITSUKE (SUSTAIN)

The final stage is 5S shitsuke or sustain, ensuring that the company continue to continually improve using the previous stages of 5S, maintain housekeeping, and conduct audits and so forth. 5S should become part of the culture of the business and the responsibility of everyone in the organization.

- To keep in proper working order
- Also translate as “do without being told”
- Perform regular audits
- Training and discipline
- Training is goal oriented process. Its resulting feedback is necessary monthly
- The last step of 5S shitsuke means discipline
- Maintain and practices the first 4 s seiri, seiton, sieso, and seiketsu
- Make it a easy way of on field construction management
- The purpose of shisuke is elimination of bad habits and constant practice of good once.

CASE STUDY

The 5S methodology was applied on actual construction site of residential building. The activities were brickwork and plasterwork.

- Residential Building (G+9)
- Total Area = 2543 sq.ft
- Built-up Area = 1463 sq.ft
- Brickwork = 80.1 M³ for G+3
- Plasterwork = 12.9 M³ for G+3

Brickwork Quantity

In the following table the quantity of cement, brick, sand are given for estimated, conventional and 5’S methodology

Table No: 1.1

Material	Estimated	Conventional	5’S
Cement	137	144	139
Brick	40,000	42,000	40,800
Sand	8.6	9.5	9



Cement in bags, brick in numbers, sand in brass

Percentage wastage in Brickwork

Following table shows the percentage wastage of cement, sand, and brick for conventional and 5'S methodology.

Table No: 1.2

Material	Conventional	5'S
Cement	5	1.5
Brick	5	2
Sand	7	1.56

Cost Comparison for Brickwork

Following table shows cost comparison between estimated, conventional and 5'S methodology.

Table No: 1.3

Material	Estimated	Conventional	5'S
Cement	41,100	43,200	41,700
Brick	2,00,000	2,10,000	2,04,000
Sand	44,300	47,500	45,000
Total	2,85,300	3,00,700	2,90,700

1 Bag Birla A-1 Cement= 300 Rs/-, 1 Brick = 5 Rs/-, 1 Brass = 5000 Rs/-

Plasterwork Quantity

In the following table the quantity of cement, and sand are given for estimated, conventional and 5'S methodology.

Table No: 1.4

Material	Estimated	Conventional	5'S
Cement	72	80	75
Sand	5.44	6	5.7

Cement in bags, sand in brass

Percentage Wastage in Plaster work

Following table shows the percentage wastage of cement and sand for conventional and 5'S methodology.

Table No: 1.5

Material	Conventional	5'S
Cement	11	4
Sand	10	4.57

Cost Comparison for Plasterwork

Following table shows cost comparison between estimated, conventional and 5'S methodology.

Table No: 1.6

Material	Estimated	Conventional	5'S
Cement	21,600	24,000	22,500
Sand	27,200	30,000	28,500
Total	48,800	54,000	51,000

1 Bag Birla A-1 Cement= 300 Rs/-, 1 Brass = 5000 Rs/-

Total Cost Difference

For G+3 Building only for Brickwork and Plasterwork

All values from Table 1.3 and Table 1.6



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= $(3,00,700+54,000)-(2,90,700+51,000)$

= $3,54,700-3,41,700$

=13,000 Rs/-

So for G+9 Building

= $13,000*3$

=39,000 Rs/-

RESULTS OF CASE STUDY

1) After applying 5'S methodology on actual construction site activities brickwork and plaster work

For brickwork wastage reduces

Sand: 5% to 1.5%

Brick: 5% to 2%

Cement: 7% to 1.565 %

For plastering work wastage reduces

Sand: 11% to 4%

Cement: 10% to 4.57%

2) Total cost for brickwork and plaster is reduce by Rs. 13,000 for G+3 building

And cost reduction for G+9 building for these two activities may be projected as Rs. 39,000.

CONCLUSION

The lean construction theory is applicable for construction processes. Use lean construction theory in construction management will give an easy way of manages all things such as material, construction equipment, manpower and money which will reduce the cost of construction and improve the quality of work. The 5s methodology is simple and easy to understand to all worker as well as manager.

For successful implementation of 5s methodology need to increase awareness about lean construction and its importance. From the feedback of 5'S methodology it seems that there is need of training of worker as well as some modification in 5'S methodology. Practice of 5'S methodology will give better result.

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