

Integrating Traditional Construction Project Management with Lean Construction Management Concepts

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Abstract- The construction industry has traditionally been one of the second largest industries in India but productivity has been lower than other industry. Construction industry has lots of wastage like time, material and resources. Reason behind this problem is improper traditional management strategy. So it is necessary to explore this problem in construction industry. Lean construction Management is an excellent in managing the construction process. Main aim of Lean Construction Management is eliminating wastage of material, time and resources. Generally eliminating wastage are Overproduction, Substitution, Waiting time, Transportation, Processing, Inventories, Movement at construction site. A field study is conducted to evaluate the effectiveness of some lean construction techniques including last planner, increased visualization, daily huddle meetings, first run studies, the 5S process and fail safe for quality. The data collection methods include direct observations, interviews, questionnaires and documentary analysis at construction site.

Index Terms- construction wastage, traditional construction management, lean construction management, field study, questionnaires survey.

INTRODUCTION

Construction is a key sector of the national economy for countries all around the world, as traditionally it took up a big portion in nation's total employment and its significant contribution to a nation's revenue as a whole. However, until today, construction industries are still facing numbers of contingent problems that wear bounded to be resolved since the past time. The chronic problem of construction are well knows such as Low productivity, poor safety, inferior working condition and insufficient quality and the phenomenon of the poor performance and conditions in construction had long been witnesses and recorded by academics and practitioners throughout the world.

Now a day, increasing foreign competition, the scarcity of skilled labor and the need to improve construction quality are the key challenges faced by the construction industry. Responding to those challenges impose an urgent demand to rise productivity, quality and to incorporate new technologies to the industry. A lack of responsiveness can holdback growth and to development of the needed infrastructure for the construction industry and other key activities in the country.

With the lean construction paradigm, construction industry had started to be reviewed and evaluated in the possibilities of implementing these new lean perspective of production concept in the construction processes to optimize the overall construction performance on construction stage as well as design stage. Performance improvement opportunities in construction can then be addressed by adopting waste identification/ reduction strategies in the flow processes in parallel with the introduction of new management tools and with proper trainings and education programs. Unfortunately, these new lean construction concept especially those on wastes and values most of the times are not well understood by construction processes while non-value adding activities such as inspection, delays, transportation of materials and others are not recognized as waste. As the result of that, the productivity of construction industry cannot be fully optimized due to the narrow interpretation on the concept of waste current adopted. In this case, substantial education programs need to be arranged for all related parties involved in order to implement the new process improvement strategies successfully throughout the construction process cycle.

NEED OF STUDY

It is presumably that construction industries in India are facing the same generic (process-related) problems/ wastes on construction activities which was also faced by their counterparts regardless those in development countries or developing countries. However, the main problem is the lack of clear indication on quantitative parameters to assess the extent of those problem/ wastes to have been impacted on the overall performance and productivity of local construction industries. To date, there have not been many well-documented quantitative studies and records on to process related problems/wastes which arisen on construction site. As a result of that, the introduction of the concepts and framework of new lean construction ideology are seen as an opportunity to address the existing problems in local construction industry and utilizing concepts and framework of new lean construction ideology can then go further to formulate the extent of impacts of those problems/wastes on a more structured and quantitative basis.

Prior to assess the severity of the process-related problems/ wastage which existed in the construction processes for the local construction industries, the differentiate of traditional and new production/ construction concept will have to be drawn prior to further investigation and evaluation on any project performances. New measurement parameters such as waste, value, cycle time or variability that was not covered under traditional concept are to be introduced into this study as accordance to the lean construction ideologies and the subjects in this case; the local construction personnel will be subsequently examined with those new parameter to review the level of understanding and practicability in local construction industry compare to the requirement and the concepts set forth by lean construction philosophy.

OBJECTIVES

1. To study different type of buildings and their management system.
2. To establish their conventional management system problems.
3. To study lean construction management system concepts.
4. To give suitable lean construction management concepts for different types of buildings and improve in time.

5. To propose lean concept.

SCOPE OF STUDY

Future scope of study will be to check feasibility of lean construction project technique which is use in building to identify wastage of construction projects.

LITERATURE

What is lean construction management? Mr. Howell and Mr. Ballard light on this concepts. They said that it is a new way to manage construction. Born in manufacturing, the goals demand a new way to coordinate action, one that is applicable to industries far removed from manufacturing. Implementation requires action be shaped by a deeper understanding of the goals and techniques. This paper explains the implications of the goals and key production principles, and how when taken together they result in a different way to manage construction. Implementing lean in construction then becomes a matter of developing and acting on this new knowledge. Advice on implementation is offered.

Lean thinking is a new way to manage construction. Many people object on first exposure because lean thinking appears to be the application of a manufacturing technique to construction. The goals of lean thinking redefine performance against three dimensions of perfection: (1) a uniquely custom product, (2) delivered instantly, with (3) nothing in stores. This is an ideal that maximizes value and minimizes waste. The principles of lean thinking and production: (1) Stopping the Line, (2) Pulling Product Forward, (3) One-Piece Flow, (4) Synchronize and Align, and (5) Transparency, are techniques which support the goal.

Lean Construction has existed in its own right for more than ten years. At the same time the five lean principles as outlined by Womack and Jones have gained a firm foothold in the manufacturing industries, and the term lean has thus become a household term in manufacturing. This paper tries to establish the basic ideas of Lean Construction Management. The paper sets out by pointing to the fact that the lean concept in general is a western interpretation of the Japanese production philosophy. It then extracts some fundamental principles from the works of Shigeo Shingo as one part of the basis for

Lean Construction. It proceeds by establishing a new understanding of construction as a special kind of production, which in its nature is very different from that found in manufacturing, which was the basis for the work of Womack et al, and by that it identifies and analyses the concepts behind Lean Construction. Construction is obviously a production, and Koskela (2000) establishes a theory for production and demonstrates its use in construction. A general definition of the nature of construction from a production point of view may thus be:

“Construction is a complex production of a one-of-a-kind product undertaken mainly at the delivery point by cooperation within a multi-skilled ad-hoc team.”

The above definition of construction indicates at least four characteristics. Construction is production and it produces a one-of-a-kind product, it is also complex and undertaken through cooperation.

- Construction as Production: Koskela (2000) introduces three basic conceptualizations of production: transformation, flow and value generation. Bertelsen and Koskela (2003) consider these three aspects from a management point of view as outlined in the following.
- Managing Transformation: Managing transformation is the kind of project management most project managers are familiar with. It takes place by managing contracts, establishing quality and safety requirements and procedures, and it frequently leads to what seems to be an increase in productivity but in truth is sub-optimization only.
- Managing Flow: Managing flow in the construction industry introduces several new management activities. One should be to establish a closer cooperation along the supply chain – Supply Chain Management has this been coined in the manufacturing industry. This kind of cooperation should not only comprise cooperation between main contractor and trade contractors, but should comprise the manufacturers and suppliers of construction materials as well. Another activity should be setting up the logistics for materials and information.
- Managing Value Generation: The concept of value is probably the most difficult to approach

in the new way of managing construction projects. Green (1996) proposes an understanding of the value generation during the early design phases as a learning process between the client and the design professionals. Both parties learn and through this a joint understanding of client’s value parameters and their realization in the design is reached.

The movement of Lean Construction away from the manufacturing interpretation of the lean concept has led to several new management approaches. While the transformation-flow-value theory broadens the understanding of project management, the perception of construction as a complex phenomenon opens up for the introduction of completely new approaches to project management. The ordered approach which gave rise to what can be called management-as-planning and management-as organizing should be reinterpreted and supplemented in future project management. Management as co-operation and as learning comes into focus.

DATA COLLECTION

Lean construction management include many objectives. Main object of lean construction is focus on material, time and resources. After study on literature review next step is data collection.

A quantitative research approach was adopted for the thesis requiring development and dissemination of questionnaire survey. Sampling for specific cadre of respondents is conducted by using sampling technique which involves the assembling sample managerial personnel with known experience and expertise in managing construction projects.

The survey is conducted though structured questionnaire containing both open ended and closed ended questions. The respondents were approach though their companies and firms namely like Shivalik and Shilp group, shlok developers as client and Hi-Tech project Pvt Ltd. As contracture. These companies were approached amongst other in the filed due to their immense experience, type of projects they handle, location of the site which have been included in the study and permission to visit their respective site to conduct survey.

Purpose of the survey-
Survey was conducted to

- Determine and document the general planning and management system of projects.
- Identify wastage in terms of Time, Material and resources.

The result will then integrate into research process as the key area to focus while managing construction projects, so as to come up with a model based on Lean construction management concept.

STRUCTURE OF QUESTIONNAIRE

There are 2 part of questionnaire prepared:

1. Questionnaire send to client firm to their respondent and
2. Questionnaire send to client firm to their respondent

Both questionnaire divided in following group:

Clint group	Contractor group
Drawing	Drawing
Material(Reinforcement, Concrete)	Material(formwork)
Time	Manpower
	Resources
	Physical checking

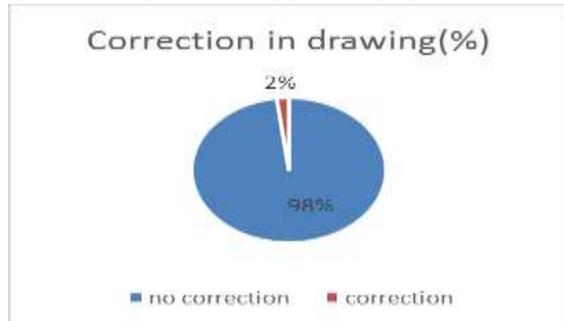
Table 1-Type of questionnaire

In both site material (cement and steel) are under the client firm. So the affected parameter of material purchasing related include in client firm questionnaire.

RCC, masonry and plastering work under to Contractor Company. So resources, material (formwork), manpower related questionnaire attached in contractor firm.

Drawing correction

Sometime there are correction in drawing because of some miscellaneous problems. Drawing correction also affect work progress. In this project 2% correction required during project progress.



There are required correction for discrepancy in structure and architectural drawing. If correction in minor level, it was possible to discussion with structure consultancy. Sometime correction was not possible to saw site actual condition. This is effect on the progress of project generally 1-2 days.

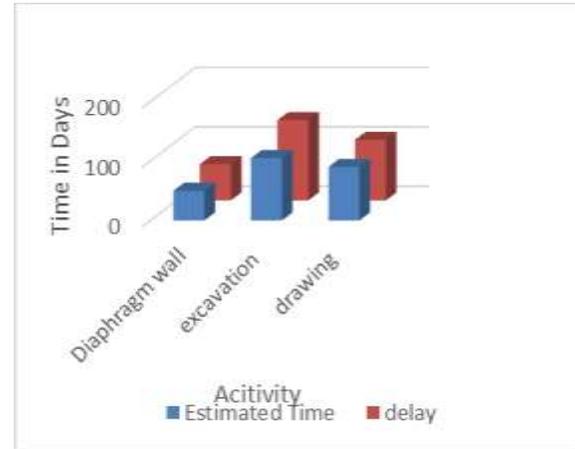


Figure 1-Activity Delay

Total time delay data of project

RCC work is main part of project.so delays in RCC work majorly effect on construction process. Planning and management department always try to minimise delay in RCC work but there are many factor affected to work progress. Mainly delay due to fault material, rework, manpower and equipment planning and management.

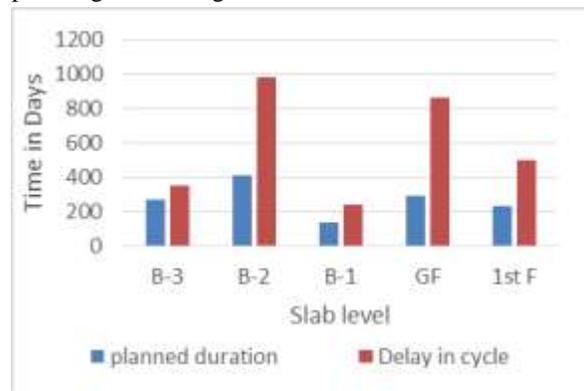


Figure 2- Total Delay of project

MATERIAL

Project progress depends on the material. Proper management of material is good sign indicate for project progress. Generally reinforcement, concrete and formwork are main material requirement for project progress. If planning and management team

are not their work properly, wastage of material, delay in work progress, accident and Rework problem generated.



Figure 3- Total Steel wastage

Rework

In slab

Total 10 sqm area required rework due to steel arrangement in 2nd basement roof slab level.

- 7 sqm area required rework due to laping of steel bars
- This was two major rework affect work progress of project on site and take total 9 days delay.

Beam

At ground floor roof slab level there are 5 beam change due to design changing

- 230 x 785 dia beam was total 4
- 450 x 600 dia beam was total 1

There was also wastage of steel due to rework.

Rework in Concrete

Following 2 major rework affected work progress of project

Sr. No	Elements	No of element	Dimension (mm)	Wastage (cubm)	Delay due to rework
1	ST Column	3	230x2150x2500	3.70	5 days
2	Ramp Column	6	900x900x1000	4.86	8 days

Table 4.5 Element of Rework

Data Analysis for define delay time

There are many objects to affect construction industry. Construction delivery delay is major

problems in every site. Generally, Time, resources and material are main cases behind delay work. They all are co-related to each other. There is not one factor affect to whole project but many objects affect partially or fully.

Delay analysis in Monthly planning

Generally, planning engineer prepaid monthly planning schedule for construction progress. They used overall progress report to make monthly planning schedule. So monthly planning depends on the overall site planning report. Generally daily planning schedule follow on the site. Daily planning schedule prepared using weekly and monthly planning. Site engineer follow daily planning schedule to achieve work progress on site. I have present overall site planning schedule using MS Project.

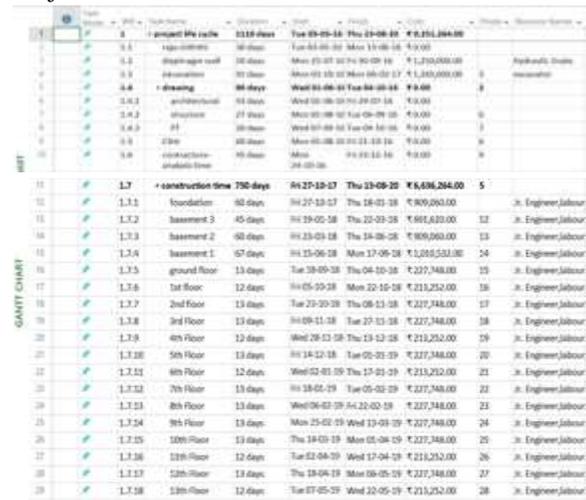


Table 2- construction planning schedule

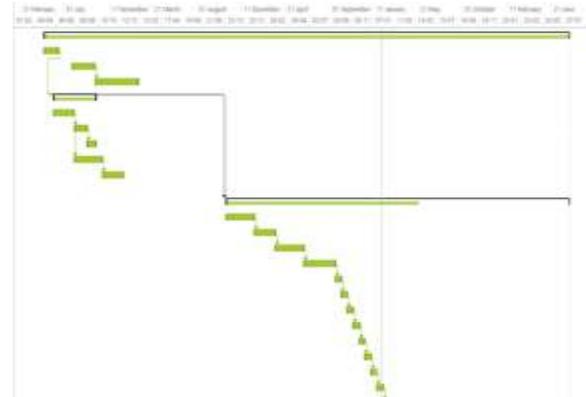


Figure 4- construction planning Gantt chat

Construction site has some delay but this time delay does not include in their planning schedule. Some major delay analysis show in following table.

ID	Task Name	Duration	Start	Finish	Cost	Resource
1	project life cycle	1095 days	Tue 03-05-18	Mon 13-07-20	₹ 10,446,568.00	
1.1	rcpa (initial)	90 days	Tue 03-05-18	Mon 05-08-18	₹ 0.00	
1.2	discharge wall	01 days	Tue 10-08-18	Tue 08-11-18	₹ 1,525,000.00	Hydraulic Grate
1.3	excavation	108 days	Wed 09-11-18	Tue 08-04-17	₹ 1,575,000.00	excavator
1.4	drawing	107 days	Sat 07-05-18	Mon 03-10-18	₹ 0.00	2
1.4.1	architectural	60 days	Sat 07-05-18	Thu 28-07-18	₹ 0.00	
1.4.2	structure	33 days	Fri 29-07-18	Thu 15-09-18	₹ 0.00	
1.4.3	fit	20 days	Fri 16-09-18	Thu 13-10-18	₹ 0.00	3
1.5	Clm	00 days	Fri 29-07-18	Thu 20-10-18	₹ 0.00	
1.6	contractor analysis trial	45 days	Fri 23-10-18	Thu 22-12-18	₹ 0.00	3
1.7	construction time of MCC	384 days	Mon 20-12-17	Thu 25-09-18	₹ 7,344,568.00	3
1.7.1	Foundation	50 days	Mon 20-12-17	Thu 04-02-18	₹ 764,300.00	concrete [1] cumber [1] Engineer
1.7.2	basement 1	30 days	Wed 01-02-18	Thu 22-04-18	₹ 1,096,200.00	12
1.7.3	basement 2	30 days	Wed 01-02-18	Thu 22-04-18	₹ 1,026,420.00	13
1.7.4	basement 3	40 days	Fri 04-03-18	Thu 28-03-18	₹ 628,240.00	14
1.7.5	ground floor	25 days	Fri 04-03-18	Thu 22-03-18	₹ 481,500.00	15
1.7.6	1st floor	20 days	Fri 04-03-18	Thu 22-03-18	₹ 529,230.00	16
1.7.7	2nd floor	20 days	Fri 04-03-18	Thu 22-03-18	₹ 529,230.00	17
1.7.8	3rd floor	24 days	Fri 04-03-18	Wed 30-03-18	₹ 242,244.00	18
1.7.9	4th floor	25 days	Thu 26-03-18	Wed 20-02-18	₹ 228,740.00	19
1.7.10	5th floor	23 days	Thu 26-03-18	Fri 08-04-18	₹ 212,252.00	20
1.7.11	6th floor	23 days	Mon 11-04-18	Wed 27-04-18	₹ 221,748.00	21
1.7.12	7th floor	23 days	Thu 28-04-18	Mon 22-05-18	₹ 221,748.00	22
1.7.13	8th floor	23 days	Tue 29-04-18	Thu 25-05-18	₹ 221,748.00	23
1.7.14	9th floor	23 days	Wed 03-05-18	Tue 21-05-18	₹ 221,748.00	24
1.7.15	10th floor	23 days	Wed 22-05-18	Fri 18-06-18	₹ 221,748.00	25
1.7.16	11th floor	23 days	Mon 13-06-18	Tue 25-06-18	₹ 221,748.00	26
1.7.17	12th floor	23 days	Wed 28-06-18	Fri 13-07-18	₹ 221,748.00	27
1.7.18	13th floor	23 days	Mon 15-07-18	Tue 30-07-18	₹ 221,748.00	28

Table 3- Actual Construction planning

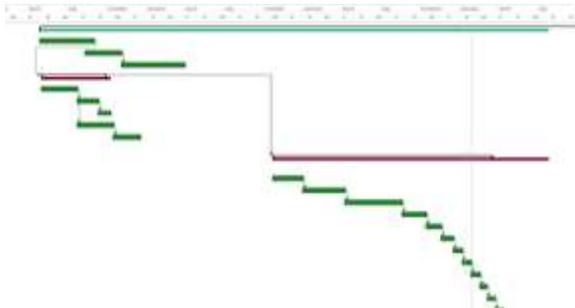


Figure 5- Actual planning Gantt chart

In this study, we define main cases of delay in construction industry. Lean concepts are used to improve traditional construction management. After study of literature, Last planner system is more suitable for improve management system. In this concepts, main aim is improve planning system. In planning system include site manpower to define progress of project. Last planner system basically improve planning system of project. Generally, planning engineer not include site engineer or supervisor for monthly planning system. So, planning was not work properly. Some problem on site not define by planning engineer. So they do not know define properly.

CONCLUSION

This paper was able to establish the fact that the employed or existing project management models and strategies have not been able to deliver projects on time and as a result have created wastes in the construction industry through a comprehensive literature survey. The paper also discussed LC, its principles and wastes in the industry. The authors demonstrated that LC presents a new and robust

approach to dealing with the waste in the construction industry. This was illustrated with some highlights of the importance of LC application (Why LC). Finally, the paper established that, the application of lean tools and techniques by project teams and industry's practitioners will minimize or eliminate waste, enhance performance and lead to a great cost savings for the industry as well as the society. It is expected that the fundamental knowledge provided by this paper will contribute to the knowledge and practice from delay control or waste elimination and also serve as a benchmark for continuous improvements of performance in construction industry.

REFERENCES

- [1] "Modern construction- lean project Delivery and Integrated Practices" by Lincoln H. Forbes and Syed M. Ahmed- Book
- [2] "Implementing lean construction : understanding and action" by Greg Howell and Glenn Ballard
- [3] "The foundations of lean construction" by Lauri Koskela, Greg Howell, Glenn Ballard and Iris Tommelein
- [4] "Construction beyond lean: a new understanding of construction management" by Sven Bertelsen and Lauri Koskela
- [5] "Applying lean thinking in construction and performance improvement" by Remon Fayek Aziz, Sherif Mohamed Hafez
- [6] "Site Implementation and Assessment of Lean Construction Technique" by O. Salem, J. Solomon, A. Genaidy, and M. Luegring
- [7] "Evaluation of lean improvements in residential construction using computer simulation" by Alberto Esquenazi and Rafael Sacks
- [8] "Construction: From Theory to Implementation" by O. Salem, masce, j. Solomon, a. Genaidy and i. Minkarah,masce
- [9] "Lean Management Model for Construction of High-Rise Apartment Buildings by" R. Sacks and M. Goldin, Journal of construction engineering and management
- [10] "Lean Construction: Towards enhancing sustainable construction in Malaysia by" Mohd Arif Marhani, Aini Jaapar, Nor Azmi Ahmad Bari

- [11] “Implementation of lean construction techniques for minimizing the risks effect on project construction time by” Usama Hamed Issa
- [12] “Lean construction: an effective approach for project management” by Richard hannis ansah, shahryar sorooshian and shariman bin Mustafa
- [13] “An ABC Approach to Modeling the Emergence of ‘New Tasks’ in Weekly Construction Planning” by Carel Rouhana and Farook Hamzeh (lean construction journal)
- [14] “Just in time in construction : description and implementation insights” by flora bamana, nadia lehoux, caroline cloutier
- [15] “Lean matrix system – proposal for a performance measurement system for construction projects” by Juliuna Quindere carneiro, vitor arrudce machado,luis felipe candido and jose depaula barros neto
- [16] “A comparison of project alliancing and lean construction” by brendan K. Young, ali hosseini and ola laedre
- [17] “Bottom up strategy for lean construction on site implementation” by Nero lenolti zanoti, flavio leal maranhao, vitor levy casyexaly
- [18] “Improving construction processes using lean management methodologies – cost case study” by piotr nowotarski, jerzy paslawskia, jakub matyja
- [19] “Lean method to improve end user satisfaction in higher education building” by makram bou hatoum, reina el mustapha, christelle nassar, hayyan zaheraldeen and farook hamzeh
- [20] “‘Site layout planning waste’ Typology and its handling through AR-BIM concept : A lean approach” by Abhishek Raj Singh1 and Venkata Santosh Kumar
- [21] “Towards creative lean (clean) construction: from lean production to lean consumption” by vishal singh