
Reducing construction and demolition waste through lean production: Observations from Tel-Aviv, Israel

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Introduction

-centralized mixing station.

-supplying cement mortar, plaster, and glue to multiple finishing operations in a high-rise residential construction project.

The research is divided into two stages:

A- Qualitative analysis .

B-Quantitative analysis.



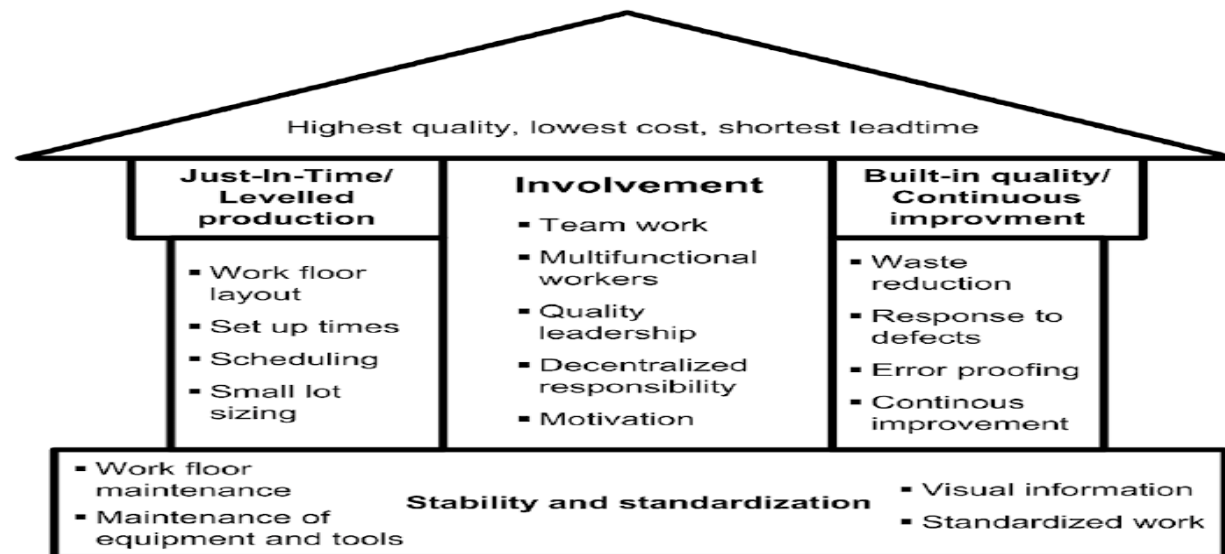
Goals

The aim of this study was to evaluate the reduction in construction wastes due to implementing centralized mixing at a station at the construction site and, at the request of the sub-contractor to maintain Just in time (JIT) delivery of the mixed material to the subcontractor.



Lean Construction

- **Lean Construction** refers to the application and adoption of the underlying concepts and principles of the Toyota Production System (TPS). It is focus on reducing waste, increasing value to the customer, and continuous improvement.
- **5S** (sort, set in order, sustain, standardize and shine): is a systematic method for organizing the work environment



5S

Sort: the first step is to sort everything in the work areas and to identify what is required to perform the work.

Set in order: in this stage all the materials and equipment are set in order using planning and labelling. In this stage the main focus is on site storage areas.

Shine: cleaning the workplace. This includes placing waste bins, and make system for evaluation the individual works, like cleaning the workplace daily after finishing their work.

Standardize: requires the operations in the workplace to be in a standard fashion and according to the specifications and codes.

Sustain: to make sure that the standards are committed from the workers. Weekly checking is performed to guarantee the standards remain.



Types of waste.

- Transportation
- Inventory
- Waiting
- Over-production
- Over-processing
- Defects and rework

7 Wastes of Lean



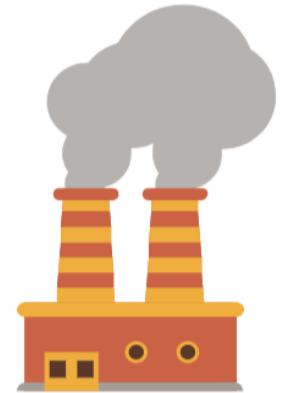
Inventory



Waiting



Defects



Overproduction



Motion



Transportation



Over-processing

Research Methodology and Data Collection

- Case study Research
- Qualitative analysis.
- Quantitative analysis
- Two alternatives for mixing the material
 - A- Mixing in a central location with material deliver to the requested location.
 - B- Mixing through traditional construction methods.
- Site visits with questionnaire interviews



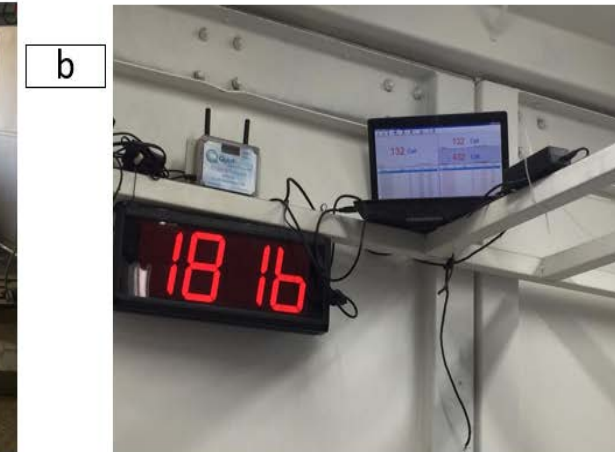
Case study description

The centralized mixing station consists mainly of three mixers (Fig a). Each mixer for a specific material. The station contains a Kanban tool represented by a digital screen (Fig b), which helps the subcontractor in the different work zone to send a signal for the worker in the station to prepare the proper material with the exact quantity (Fig c) and deliver it at the right time using a lift erected beside the station. In the station, there is a place to properly store the materials, contributing to maintaining an organized and clean work environment that is less likely to lead to contamination of the building materials.

In each workplace, there is a bottom erected on the lift. It helps the sub-contractor to push it to send a signal for the worker in the station. The worker in the station receives a signal on the screen explaining the material type required with its quantity and to which workplace it should be delivered. After each mixing operation, the worker cleans the mixer and the workstation (Fig d) to keep it clean and organized.



a



b



c



d

Results and Discussion

- 1- Eliminating the non-value-adding activities: This is satisfied by providing the subcontractors with ready-mixed material and enabling them to devote their time to value-adding-activities.
- 2-Eliminating the non-value-adding activities required for cleaning: workers to clean the construction site, delivering the waste using the crane to a specific location in the site, bringing trucks to deliver these wastes to a landfill and paying for dumping the wastes.
- 3-Keeping the construction site clean and in order: This helps to reduce accidents resulting from slips and trips which in turn improve safety issues in the construction site.
- 4- Improving the mix properties and characteristics: A worker in the mixing station for all sub-contractors will mix according to the ratios specified in the standards and specifications and this will standardize work, which is a lean goal.

Results and Discussion

5- Improving the mix quality: This is satisfied by avoiding mixing two materials with different characteristics, which cause quality problems. For example, plaster cracks result from mixing mortar in the same container where gypsum materials were mixed. Gypsum swells when it absorbs water, so the remaining gypsum particles in the mixing container causes the plaster to be cracked and dislocated.

6- Supporting control and monitoring of materials: The presence of materials in a specific location helps in identifying and recognizing the consumption of each material daily. Also, it helps in keeping the material safe from weather effects and theft.

7- Eliminating material waste: This is satisfied by mixing in the exact quantity required by the sub-contractor. Traditionally, the sub-contractor mixes the material in a random quantity, so at the end of the day, the surplus material will be wasted. However, applying the centralized mixing concept helps in delivering the right quantity to the sub-contractor which means at the end of the day the material waste will be close to zero. In this way, we achieve pull flow, which in turn can reduce the mixing of excess materials.

Conclusion

1- The implementation of centralized mixing and supply of bulk materials as a lean construction concept demonstrates that lean principles play an important role in reducing the different types of wastes and energy due to eliminating certain energy-consuming operations in the construction industry.

2-Non-value-adding activities were reduced by improving individual sub-contractors' operations.

3-It removed the need for workers to clean the construction site and transport those wastes to landfills.

4-Safety issues improved by reducing the probability of slips and trips since the construction site is clean and organized.

5-The quality of the mixing improved the mixing ratios are controlled by the worker in the mixing station, and this maintains the lean standardization concept.

the centralized mixing station can potentially address environmental waste control through reducing the amount of wasted materials and their transportation to a landfill which can be translated to carbon footprint and GHG.

Future Research

This paper shows the first stage of this research, a qualitative assessment of the impact of centralized mixing and supply of bulk materials station. A second stage that quantifies the mixing stage and material waste reduction is ongoing.



Thank you



Questions

