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Analysis the Financial Impact on Infrastructure Project Due to Wastages of Construction Materials

Mr. Uday Kumar J Phatak[1]*, Dr. I. N. Yadav[2]

[1] PG Scholar, Shridhar University

[2] Professor, Shridhar University

Abstract - The study covered only the construction stage of infrastructure projects with the assumption that lean design has already been considered at the design stage. Construction stage refers particularly to the construction of sub-structures, super-structures and architectural elements such as finishes. Surveys carried out at these phases enabled on- site observations to be conducted simultaneously. The activities considered for study were concreting and excavation. The research focused on the flow of activities. Surveys in the forms of questionnaires and personal interviews were conducted with the proponents who were undertaking referenced projects. Proponents mentioned refer precisely to the site managerial staffs concerned such as project managers, quantity surveyors and senior site engineers. The study focused on construction sites of Mumbai Metro line 3 due to site accessibility and availability of contacts. These sites were made up of construction of underground metro stations

Keyword - Wastages, construction Materials, Financial Impact ,Mumbai metro

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INTRODUCTION

The 60 to 70% expenditure of the any construction project spend on construction materials. And it is found that huge quantity of wastage of material take place on site during the construction phase. Wastages of material has major problem in building construction industry which must be recognize very efficiently. Effective control on wastages of material saves money, so that organizations profit margin will increase. The majority of this wastage of material can be avoided by competent & firm control over supervision of site, flow of construction material & strict labour supervision. This study identifies sources for wastages of construction material and critical factor causing wastages of material for those sources & also states the necessary suggestion for reduction in wastages of construction material. Most importantly, Construction waste management reduces dependence on natural resources such as trees, oil, and minerals plus creates less pollution by reducing manufacturing and transportation related emissions. Reduction of the energy and water required to produce building materials from virgin materials contributes to reduced greenhouse gasses related to the manufacturing and transportation of those materials. Thus, the environmental impact of the project can be reduced. Segregation of Construction waste at source increases the efficiency of waste materials for reuse and recycle and increases salvage value of the same.

ABOUT CASE STUDY

One of these crucial projects is the construction of Mumbai Metro Line 3 (MML-3), which would greatly enhance the city's public transportation system. The MML-3 project, a 33.5-kilometer-long corridor connecting Colaba and Bandra to the SEEPZ, aims to alleviate traffic congestion in the Greater Mumbai area. The Mumbai Metro Line-3 (MML-3) project is being led by the Mumbai Metro Rail Corporation Limited (MMRC). It was formed as a joint venture (JV) by the Government of India (GOI) and the Government of Maharashtra (GOM), with each contributing 50%. For the analysis of causes and its financial impact concreting activity selected

Causes of Wastage of Time & Material

1. After the analyzing the work methodology and onsite visits, we found some causes of wastage of time, cost & material. These are as follows,

2. **Wrong grade of concrete received on site :** While receiving the concrete on the site, sometimes it is observed that wrong grade of concrete is supplied from the plant.This happened due to miscommunication between procurement dept. and plant in charge. Sometimes confusion can be generated if various grade concrete is supplied on same

site.

3. **Segregation of aggregate in the concrete :** While transportation of concrete from plant to the site, sometimes road condition is not good. Sometimes Transit mixers passes through lots of potholes, speed breakers and inclined road. This causes segregation of aggregate. If concrete is not properly mixed before pouring, then it affects the quality & strength of concrete.

4. **Reduction in quantity of concrete due to bleeding of concrete :** Sometimes due to excess water-cement ratio, bleeding of concrete takes place.In this condition, concrete slurry gets separated from the concrete and it flows like water. This slurry gets wasted and it tends to reduce quantity of concrete.

5. To prevent sand and aggregate from separating from the cement paste, the water-to-cement ratio should not be too high. Further, when concrete cures, any water that was not absorbed during the hydration process might evaporate, leaving behind small gaps that weaken the material. When there's an overabundance of water, the material shrinks even more as the surplus evaporates, leading to fissures both on the inside and the outside. Once again, this will lessen the concrete's ultimate strength.

6. **Lack of modern Tools &Equipment :** Due to lack of modern tools and equipment like Boom placer, time required to complete the concrete pouring, is more.Also the requirement of manpower is more. The errors in work are also more when it is done by manual process. Proper use of appropriate equipment contributes to Economy, safety, speed, Quality and timely completion of work.

7. **Chocking of concrete pump while pouring of Concrete :** This is one of the main reason of wastage of concrete on site.When the concrete pump gets choked, the concrete in the pipe line starts its hydration. This leads to the setting of concrete. Due to the loss of flowability, that concrete is not suitable for pouring and ultimately gets wasted.

8. **Waste of time due to delay in transportation of concrete from plant to site :** As the distance of RMC plant is more than 25 km, the time reqd. to reach the transit mixer on the site is more.Sometimes, due to traffic congestion, transit mixer gets delayed. This increases overall concrete pouring time. This affects economy of activity with respect to labour charges.

9. **No active Supervision by Engineers while pouring of concrete:** This is the common cause of errors from labours. It has been observed that lots of times, engineers depend on supervisors for the concrete pouring work.This leads to some technical errors while pouring of concrete. i.e. less thickness of slab, pouring of concrete from more than 1 m height, pouring of concrete directly into beam etc. This affects overall strength of structure.

10. **Bad quality of Formwork :** Formwork and the way it is used and handled, affects the quality of the concrete and the concrete finish.If formwork is not of good quality, it gets bulged while pouring of concrete. This results in wastage of concrete. This leads to ordering extra concrete which ultimately affects economy.

11. **Wrong alignment of Formwork :** Due to the wrong alignment of formwork, the concrete slurry leaks from it.This results in honeycombing in the rcc member. Honeycombing affects the strength of structure.

12. **Continuous electricity supply throughout the work time :** Sometimes it is observed that there is interruption in electricity supply while pouring of concrete.Due to this interruption, it needs to stop the pouring work as non-availability of vibrating concrete compactor. For that compacting purpose, either they need to wait for electricity or they need diesel compactor. This ultimately results in delay in operation.

13. **Non-availability of skilled meson and labours for pouring & levelling of Concrete:** Sometimes, this becomes the main reason for delay in concrete pouring.Unskilled labours take more time to work in co-ordination. This situation tends to more errors while pouring. It requires very sharp and active supervision to control the overall activity due to unexperienced and unskilled manpower.

14. **No adequate staff available on site :** Staff available on site is not in sufficient quantity. Many supervisors are doing multi-tasking. So they are unable to concentrate on particular work.

15. **No any training of manpower before the operation :** There is no any training is provided to the mesons and labours regarding the correct methodology of the operation.This leads to errors in doing operation. They are unaware about the risk involved in it. This also increases the risk of accidents while pour of concrete.

Remedies to Overcome from Wastage

To overcome from the wastage, following remedies are suggested.

1. **Confirmation of Order:** While placing the order of concrete to the supplier, procurement department checks the correct grade of concrete order should be placed.Before one day of delivery, they again confirm the same. Proper communication with site engineer, procurement dept. and supplier is very important to reduce wastage of concrete.

2. **Reducing the travel time of Concrete:** While transportation of concrete, it is very important to reduce the distance of site and concrete plant.For this, ordering concrete from nearer plant is going to help. Care should be taken while handling, placing, transporting, compacting and also at finishing stages.

3. **Reduction in bleeding of Concrete:** following ways are applied to reduce the bleeding of concrete on site(a)Reduction in water content. Use lower slump mix (b) Use finer cements (c) Increase amount of fines in the sand (d) Use supplementary cementitious materials (e) Use air entraining admixtures.

4. Keeping the Water-Cement Ratio in Concrete Consistently High Keeping the water-cement ratio constant minimizes the small holes that weaken the concrete's overall strength. It aids in keeping cement paste and aggregates together. It helps to reduce shrinkage in concrete. This again helps to increase the final strength of concrete.

5. **Use of modern Tools &Equipment :** Due to use of modern tools and equipment like Boom placer, time required to complete the concrete pouring, is reduced by at least 10%.Also the requirement of manpower is less. The errors in work are also reduced due to automation. Proper use of appropriate equipment contributed in Economy, safety, speed, Quality and timely completion of work.

Fig 1.1: Use of Modern Equipment- Boom placer

1. **Chocking of concrete pump while pouring of Concrete :** Active supervision by the pump operator will reduce the chocking of pump.All the pipe joints should be inspected by operator after every 2 hours of concreting. To reduce loss of flowability of concrete, retarders are should be used.

2. **Reduction in delay of transportation of concrete from plant to site :** To reduce the time reqd. to reach the transit mixer on the site, ordering the concrete from nearby supplier is the best way.It is also viable to do the concrete pouring in the night to avoid the traffic conjunction.This affects economy of activity with respect to labour charges.

3. **Active Supervision by Engineers while pouring of concrete :** Active supervision by Engineers is the key factor to reduce the wastage of concrete.This leads to avoid some technical errors while pouring of concrete. i.e. less thickness of slab, pouring of concrete from more than 1 m height, pouring of concrete directly into beam etc. This increases overall strength of structure.

Fig 1.2: Active supervision by Engineers

1. The quality of the concrete and the concrete finish is enhanced by using and handling high-grade formwork. High-quality formwork prevents concrete from bulging when it is poured. As a consequence, less cement is wasted.

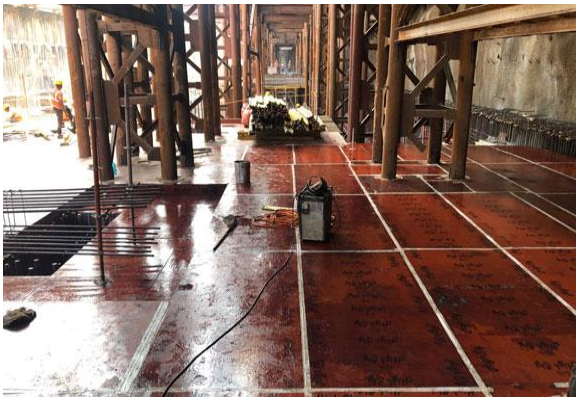

Fig 1.3: Good Quality of Formwork

2. **Correct alignment of Formwork :** Due to the correct alignment of formwork, the concrete slurry could not leak from it.This helps in avoiding honeycombing in the rcc member. Honeycombing affects the strength of structure.

Fig. 1.4: Correct Alignment of Formwork

3. **Availability of skilled meson and labours for pouring & levelling of Concrete:** Skilled labours take less time to work in co-ordination. This situation tends to minimize errors while concrete pouring.Due to experienced and skilled manpower, it takes less time to complete the activity. As the labours are skilled, it reduces the workload from supervisors and engineers.

Fig. 1.5: Proper Levelling and Finishing by Skilled Meson

4. **Adequate & motivated staff available on site :** Staff available on site must be sufficient in quantity. So that no one should do multi-tasking. So that they are able to concentrate on particular work and complete the work in minimum time.

Fig. 1.6: Adequate Manpower available on site

5. **Training of manpower before the operation :** Training should be provided to the mesons and labours regarding the correct methodogy of the operation.This leads to fewer errors in doing operation. They should aware of the risk involved in it. This also decreases the risk of accidents while pouring of concrete.

RESULTS OBTAINED

1. After application of suggested remedies, wastage of concrete is reduced by 44%. This helped to increase the economy of the project as concreting is one of the main activities which consumes budget.

2. Due to the use of equipment and modern tools, required manpower to complete the activity is also decreased. This also reduced the expenses on labour wage and welfare. It also helped to reduce the time duration of the activity.

3. Due to use of skilled meson, labours and modern equipment, time to complete the concrete pouring activity is reduced. This also decreased the errors while pouring of concrete.

4. Reduction in errors while pouring of concrete due to skilled labour and active supervision.This helps to complete the work with fast pace. It also increases the strength of the concrete.

5. Due to trainingof staff, rate of accidents while pouring of concrete. It helps to achieve the safety standards as per the norms described by the government. It also reduces the errors while doing the work.

6. Due to skilled meson, good finishing of concrete is achieved. It also helps to achieve the proper thickness of concrete, reduce honeycombing and increase strength. It also helps to reduce shrinkage and small cracks on surface.

7. During overall observation period, it is observed that, wastage of time is reduced by 2 working days for the same work quantity. This is achieved due to application of all suggested remedies. This allows site team to plan and execute some extra work.

8. All the suggested remedies are applied during the work. This resulted in reduction in wastage of time& material. It also increased the economy of the project.

Following chart shows the decrease in the wastage compared to the ordered concrete quantity.

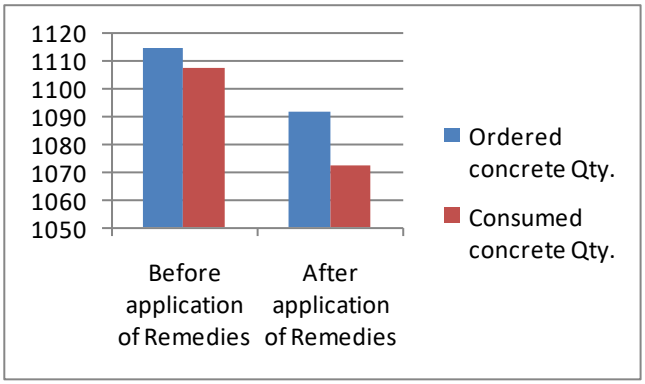

Chart 1.1: Comparison of Ordered and Consumed Concrete Qty.

CONCLUSION

- After the analyzing the wastage of time and cost in excavation activity of the case study, The Mumbai Metro line 3, and remedies are suggested. After application of all the remedies successfully, output is increased by 18 %. Net profit is also increased by 15%. The time duration to complete the activity is also reduced by 7 days compared to previous work schedule.
- After the analyzing the wastage of time and cost in concreting activity of the case study, it is observed that some changes can be made to reduce wastage of time and material. After application of the suggested changes in the procedure, it is resulted in decrease in wastage of concrete is by 40%. The work is completed 2 days before the schedule without any compromising in quality.
- According to the research conducted, there is a need for a change in the way resources are managed in order to increase productivity and efficiency on building sites. This is because poor handling of construction materials affects the overall performance of construction projects in terms of cost, time and quality. From the study it is understood that this area require further research to find some feasible solutions to control the total project cost.

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Corresponding Author

Mr. Uday Kumar J Phatak*

PG Scholar, Shridhar University