Making Scrap Disposal System More Lean and Mean

Ashish Kumar Saxena, V. Ramani, and Praveen Reddy

Abstract Construction waste generation is inevitable at project sites. Though there have been advancements in the resource monitoring tools which have reduced the wastes considerably, but still, construction industry continues to be the major waste and scrap generator. The large quantity of scrap generated not only affects the environment but also has very severe impact on the project execution. As the building projects have interdependency of large number of activities and are related to have parallel operationality. Considering the logistic issues at a space-constrained project site like the one in this study, timely and efficient scrap disposal is crucial. To ensure this, a well-defined process chart is designed. Since the system involves a lot of approvals, reconciliations, and collaborations, this process chart facilitated rigorous follow-ups and timely identification of the bottleneck. The scrap disposal is reviewed along with the construction program to have seamless coordination and reverse-phased scheduling. With this incorporation, the project site was able to dispose approximately 1500MT of scrap in a planned manner which was in alignment with the construction program.

Keywords Scrap management · Reverse-phased scheduling · Logistic management · Constraint analysis

A. K. Saxena (✉) · V. Ramani · P. Reddy
L&T Construction, Mumbai, India
e-mail: ashishsaxena@lntecc.com

V. Ramani
e-mail: vramani@lntecc.com

P. Reddy
e-mail: praveenreddy@lnntecc.com

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1 Introduction

Construction sector is one of the major generator of waste and scarp. As per the study, approximately 50–60% of the is attributed to material and around 9–10% of the purchased material ends up as scrap [1]. With the limited space in project premises and stringent timelines, disposal of scrap has gradually become one of the most crucial aspect for success of any construction project. The scrap that is continuously getting generated along with the construction activity taking place in the surrounding needs to be taken out of the location for better space and resource management. Most of the times, it starts posing hindrances to the main activities due to poor logistics or space constraints that have arisen due to large volume of scrap that has got accumulated over a period of time. Furthermore, poorly managed logistics can be one of the most obvious and major factor in lost productivity [2]. As material and equipment forms a major share of the project cost, poorly managed materials and equipment consume between 60 and 70% of a project's total budget, and hence, it is one of the vital part of project management to manage these effectively [3, 4].

Construction scrap further poses hindrance to the execution of the surrounding activities as well. These kind of activities are generally considered as non-value-added activities considering their relation to the main activities. While these activities do not directly form the part of the construction program (neither activity nor sub-activity), these activities (should be treated as necessary activities) do affect the actual execution of work. The sub-sections of this paper presents the impact of micro-planning on the overall efficiency of the project.

2 Objective

Scrap disposal system is rarely considered as a part of project execution planning. Major focus is attracted toward scrap during the commissioning stage only. This leads to a lot of resources getting stuck for a longer time with minimum productivity or returns. This paper tries to fulfill the following objectives with a motive to formalize a system for scrap disposal:

1. Implementation of 5S audit system;
2. Strategically planning the scrap disposal considering the salvage value and logistic concerns;
3. Incorporating scrap disposal as a part of the execution of main activities;
4. Optimizing the scrap disposal system through robust planning and monitoring.

3 Research Methodology

Resource management plays a vital role in successful project completion. Even a minimum stay of resource, longer than anticipated may pose drastic cost implication on the project. The project under consideration is a residential project with space constraints due to densely populated locality. Contemplating the commencement of construction activities and their dependency on the site clearance a detailed plan was framed. This included 5S audits, and based on the findings of the audit, scrap was strategically demobilized. This further integrated the auctions, payments, approval systems, and physical lifting of material from site. The robust monitoring and control system enabled the team to surpass the bottlenecks in the whole process. The demobilization plan was prepared and acted upon to the whole process with a birds' view perspective. This guaranteed that the process is optimized as a whole and not in silos. This took care of the transition across the various systems (site level and system approvals) and facilitated efficient demobilization through parallel tracking of progress. This included follow-ups, daily tracker monitoring, and eliminating the bottlenecks.

The study also encompasses the use of reverse-phased scheduling with the additional relationship provided to the scrap disposal without disturbing the completion (and handing over) commitments.

4 Importance of Focus on Scrap Disposal System

With the project timelines getting more stringent and the generation of scrap getting increased due to frequent change of instructions, there developed a demand of giving special focus on the logistics and timely scrap disposal system. This was also intended to facilitate the execution of main activities without any hindrance caused.

Scrap disposal has always been given the lower priority in a construction project. It is considered as the non-value-added activity, but the study has identified it as a non-value-added but necessary (NVAN) activity and mapped it to the schedule of the main activities. A well-defined plan was prepared and followed till the lifting of material.

As a part of the regular practice, 5S audits were conducted (Fig. 1) and poor score highlighted the access-related issues and constraints related to working space. The scrap disposal system was plotted on a process chart with well-defined responsibilities. With rigorous follow-ups and systematic planning, the number of days for scrap disposal was monitored and optimized as per the company norm. Furthermore, the same was linked to the construction schedule.

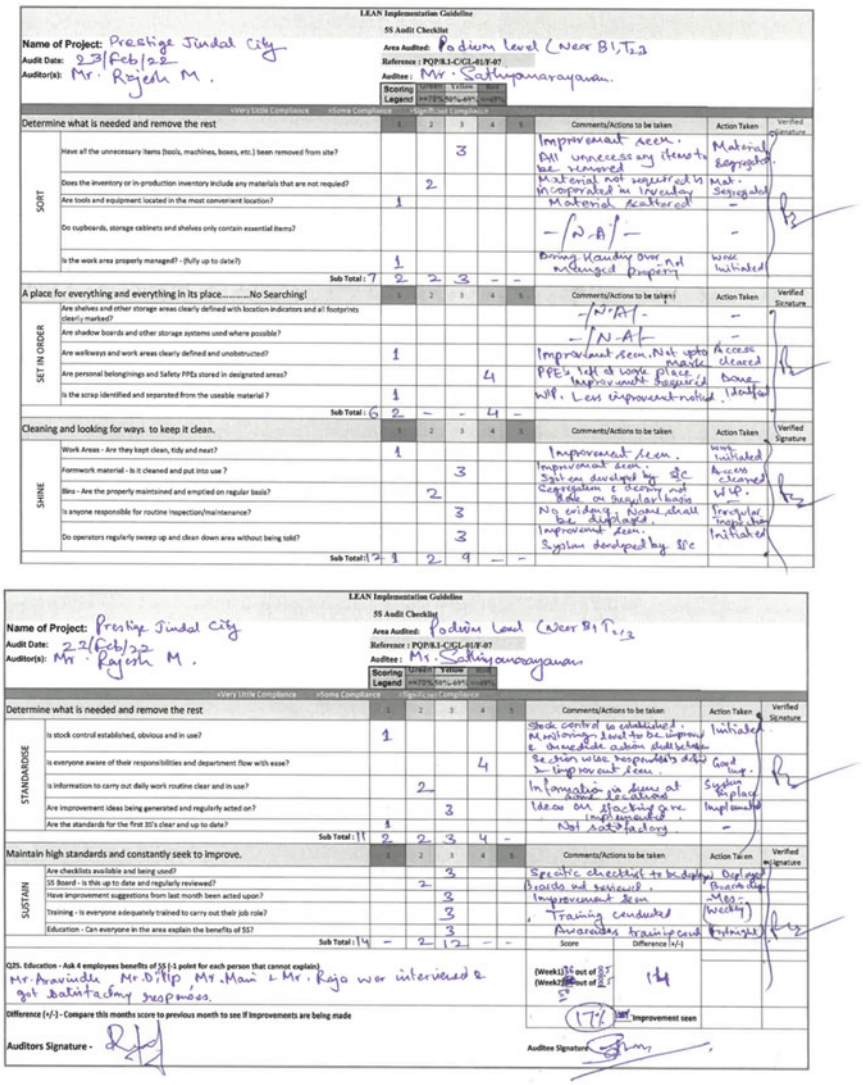

Fig. 1 5S audit report

5 Composition of Scrap

Construction projects typically constitute of variety of materials. These include concrete debris, rebar, formwork material, chutes, drums, etc. The vendors also vary as per the type of material and hence the lead time. Composition of the scrap for the project under consideration shown in Figs. 2 and 3 shows some real pictures which shows the different types of scrap available at project site.

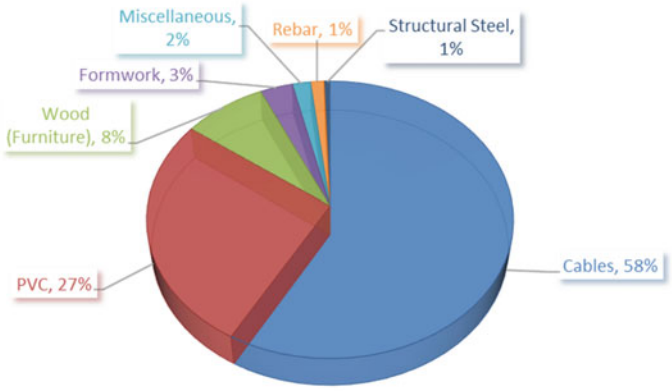

Fig. 2 Composition of scrap (by weight)

Fig. 3 Composition of scrap. *Source* A residential project, Bengaluru

6 Scrap Disposal System

Scrap disposal framework (Fig. 4) is one of the most crucial and yet overlooked process in construction industry. Facilitating a timely disposal of the scrap not only ensures that the logistics at the site are maintained but also the salvage value is realized upfront.

The site first declares the material as scrap with an official intimation to the regional office and issues a manual scrap disposal request (SDR). From the date of SDR, the inspection gets scheduled for 4 days. After the inspection, an e-auction happens, and after the due approval from operations, procurement, and accounts team, an intimation is sent to the vendor for payment. Once the headquarters confirms the payment, a sales order is issued which is shared to the vendor and HQ for delivery challan (DC) linking. This is followed by scrap lifting which may continue for multiple days, post which system DC is generated and invoice is created by the site accountant. After the invoice is approved and reconciled for taxes, it is issued to the vendor which completes the cycle of scrap disposal for the raised request.

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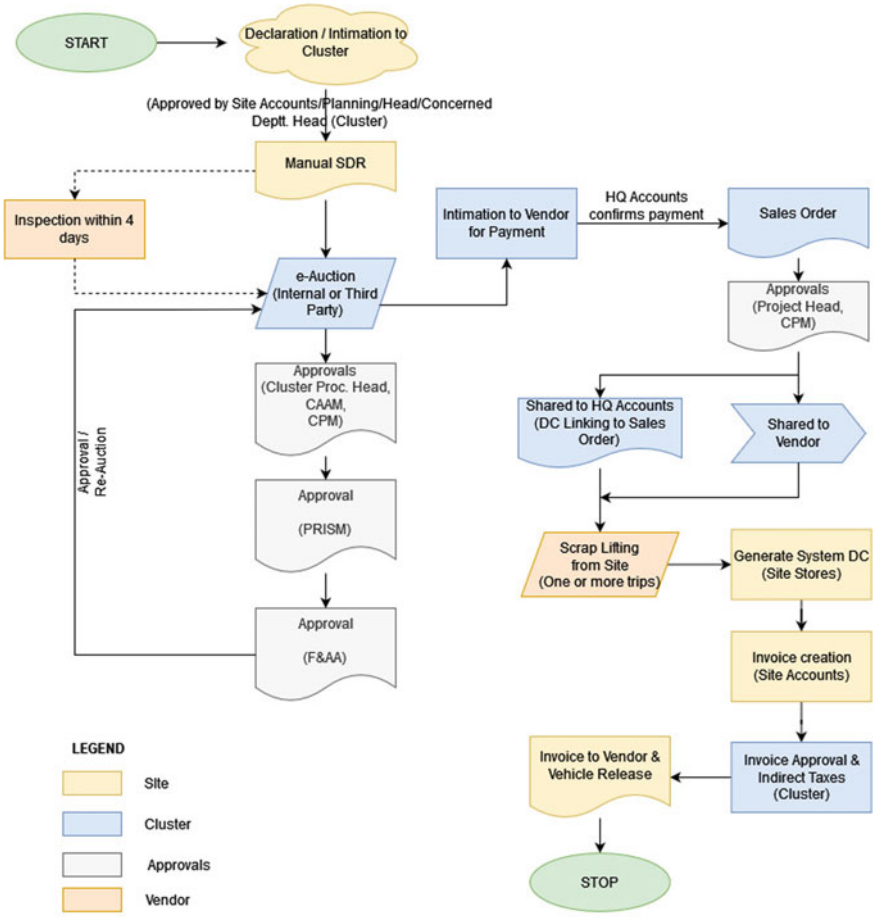

Fig. 4 Scrap disposal system framework

after the due approval from operations, procurement, and accounts team, an intimation is sent to the vendor for payment. Once the headquarters confirm the payment, a sales order is issued which is shared to the vendor and HQ for delivery challan (DC) linking. This is followed by scrap lifting which may continue for multiple days, post which system DC is generated and invoice is created by the site accountant. After the invoice is approved and reconciled for taxes, it is issued to the vendor which completes the cycle of scrap disposal for the raised request.

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Item Description	Quantit	UOM	Received at Cluster	Target for completion	No. of Days from SDR Received	Left over days from Target date	Auction Date	Status								Vendor Name	Current Status
								Cluster Proc.	Cluster CPM	Cluster CAAM	HQ - Proc.	HQ Accounts	Payment Received	DOD Created	Material removed from Site		
wooden H Beam Scrap	40	MT	11-May-22	08-Jun-22	192	164	17-May-22	√	√	√	√	√	X	X	X		8 mt lifted Vehicle will be placed today,
Miscellaneous Scrap	15	MT	14-May-22	11-Jun-22	189	161	27-May-22	X	X	X	X	X	X	X	X		Auction completed
Debris chute scrap	120	Nos	14-May-22	11-Jun-22	189	161	27-May-22	X	X	X	X	X	X	X	X		Auction completed
Structural steel Scrap	15	MT	14-May-22	11-Jun-22	189	161	27-May-22	X	X	X	X	X	X	X	X		Auction completed
TMT Scrap	30	MT	21-May-22	18-Jun-22	182	154	27-May-22	X	X	X	X	X	X	X	X		Auction completed

Fig. 5 Daily scrap disposal tracker

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Based on the process shown in figure, a daily tracker was prepared and used for the follow-ups with the concern. This captured quantity and type of scrap, date of declaration, and the target date for completion, i.e., 28 days from the date of SDR creation. This tracker also projected the status of approvals at different levels which facilitated the approval process.

7 Scrap Disposal Tracking

As the scrap disposal process is a hybrid system of on-site and off-site workings, a detailed process mapping and tracking the lead time or service-level agreement (SLA) is required to be monitored. The daily tracker is shared with the concerns on daily basis. With regular follow-ups and micro-level tracking, the scrap was disposed in a more efficient manner. Figure 5 shows daily tracker followed for the scrap disposal from the regional office based on the process explained in Fig. 4.

8 Incorporating Logistics in Construction Program

Typically, any construction project starts from the activities which are considered in the work order or the payment schedules. With scrap getting generated in huge volumes, it is inevitable to keep prolonging the disposal which will hamper the progress of the surrounding activities.

Many faced delayed start or intermittent halts. Work sampling technique along with the brainstorming sessions was used to identify the main cause of the delay in the main activities' execution. Results persuaded to link the scrap removal to the

relevant activity as a predecessor or as applicable. The scrap disposal was made a part of the construction program with necessary relationship (finish-to-finish or start-to-start). This reverse-phased schedule made the with finish-to-finish relationship. After carrying out brainstorming sessions and relating it to the lean wastes (Table 1), these traditionally considered non-value activities (NVA) were now considered as non-value-added but necessary (NVAN) activities.

The scrap disposal and logistics constraints are incorporated in the construction schedule for more reliable planning. As clear from Fig. 6, scrap disposal activity is added as a predecessor of the main job activities to ensure the dependency and resource planning.

The same thought was replicated while repairing these schedules for the connected activities. Figure 7 shows the inclusion of scrap disposal activity in the external development activities in the reverse-phased construction schedule. This schedule is based on the final date as committed for handing-over. This considers the project final date as the hard-stop deadline.

Table 1 Lean wastes generated due to scrap accumulation near construction activity

Lean waste	Waste identified	Description	Root cause
Traveling	Yes	Taking longer routes for machinery, material and manpower pavement	Heap of scrap material accumulated on/near the work location
Waiting	Yes	Longer lead to shift material to the designated area	
Inventory	Yes	Increase due to delay in material shifting and slow progress	
Movement	Yes	Wasting energy and time	
Over-production	No	–	
Defects	No	–	
Excessive processing	No	–	

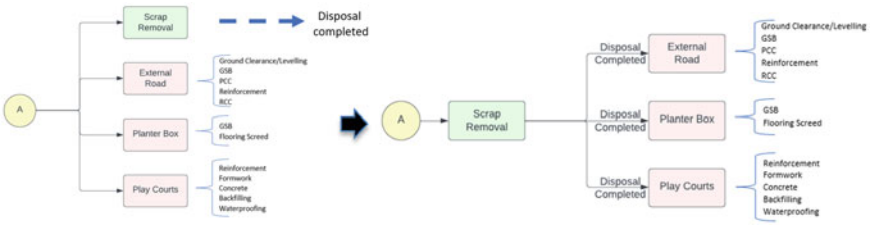

Fig. 6 Incorporating scrap disposal as a part of the construction program

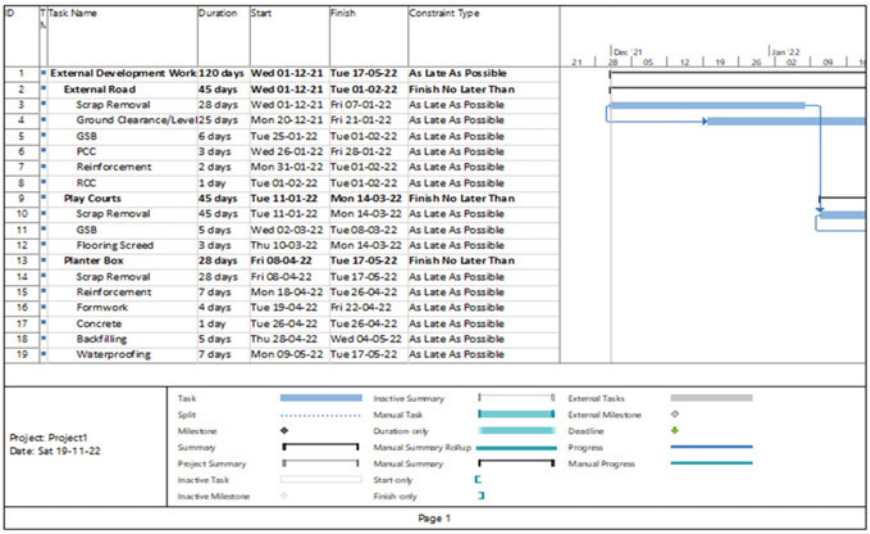

Fig. 7 Reverse-phased schedule for external development works

9 Results

Various lean tools such as root cause analysis, 5S, waste identification, work sampling, reverse-phased scheduling, and big room meetings were implemented and used to optimize the operational time and the flow of work.

With rigorous follow-ups and effective coordination clustering the approval system through parallel approvals and timely feedbacks, there was a visible improvement on the operational scrap disposal time and further project operation. Major benefits can be summarized in the following points:

1. The time taken to dispose the scram nearly became one-third. The month-wise trend is shown in Fig. 8. Though there were other supporting factors contributing to mass demobilization as well such as vendors' willingness and workmen availability, the major impact can be attributed to the robust tracking of approvals and monitoring till the demobilization.
2. With timely scrap disposal, it could be sold at a higher salvage value (than the depreciated vale at a later stage).
3. Reverse-phased scheduling ensured a system of channelized effort and energy. This also facilitated timely completion of work.
4. Clean and scrap-free material ensured the following compliances as well:
   (a) Clean, tidy, and healthy workspace;
   (b) Reduced exposure to potential hazards;
   (c) Encouraged better working conditions;
   (d) Improved productivity and reduced operational cost.

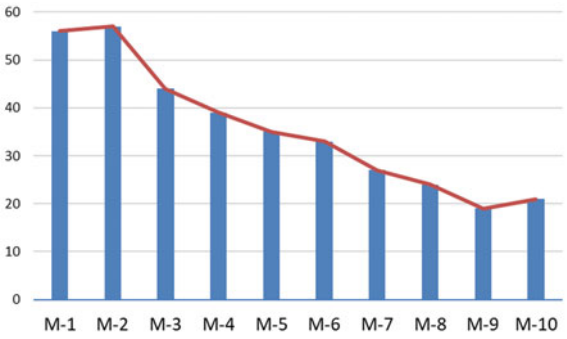

Fig. 8 Monthly trend for number of days required for Scrap Disposal

10 Conclusion

The study captures the robust monitoring of scrap disposal system and incorporating the same in the project schedule as a predecessor activity to the main construction work. The results have aided the overall understanding of the project activities and the importance of NVAN activities in alliance with the value-added activities. The modified approach has been able to reform the thinking of the project team, and the learning is continuing with the similar approach for other operational functions as well. The indirect benefits such as productivity improvement and timely completion organized work location and have provided added cost benefits and have helped in modifying the approach of the individual and team to plan the project as a whole instead of separate activities and work toward total project excellence.

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