Optimum Utilization of Steel Reinforcement and Its Management

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Abstract – Optimum utilization of steel in construction industry optimize by means of standardization of BBS Techniques and managing steel yard to reduce construction steel wastage. BBS techniques can be improve by utilizing standard software like Autodesk Rivet, VICO, Naviswork. Steel yard management technique should be improve with improving lay down yard management and using advance Autodesk software for BIM models for effective implementation of successful construction project.

Keywords – Steel Yard, Reinforcement, Steel Yard Management

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1. INTRODUCTION

Steel as “A type of item” in construction, it means it requires accurate records and tight control is requires while dealing with steel in construction industry. As per ABC analysis A type of item need appropriate order plan means “just-in time” to avoid excess capacity. Performance of construction project depends on investment involved in project by means of direct and indirect, optimum utilization of man, material and machineries and profit gained out of project in socio-economic aspect.

This study mainly focuses on optimum utilization of steel and steel yard management in construction industry. Optimum utilization of steel (reinforcement) is possible with the concept of “Work from whole to part and not from part to whole.” By means of calculating the overall quantity of steel requires in project should be calculated in well advance before starting of project with advance BBS modeling, sequencing of order quantity of steel and cutting and bending of steel in steel yard to reduce or to say nullify wastage of steel in construction project. It is advisable to use CPM and PERT network for sequencing of cutting of steel to nullify wastage in project.

Steel Yard is a lay down yard where sequencing of cutting bending and threading of steel is done with proper tag system. Location of steel yard in project is also a very curtail analytical part by which indirect cost of transportation can be reduce to optimum extent. Position of cutting , bending, and threading machine in steel yard along with steel inward and outward yard with stacking arrangement like “first come first out “with diameter wise is impactful for proper functioning of steel yard.

2. REVIEW OF LITERATURE

Optimum utilization of steel and steel yard management is a technique of management to reduce wastage of steel in construction. This technique encourages quality construction, good quality product and wastage control in steel management in construction project. There are wide scopes of exercises in utilization of advance automated machineries for cutting, bending and threading of steel to reduce labor use in construction. For administrative control and economic aspect like cash-flow management this technique is useful. Organizations everywhere throughout the world are leading towards automation practices to reduce labor involvement in construction.

Darren Olsen, JD, and J. Mark Taylor.(2017): Study focus comparative study of traditional quantity takeoff with the use of 2-D drawings and Building Information modeling (BIM).In recent years construction sectors are shifting towards Building information modeling. Autodesk modeling and cost control software facilitate optimum utilization of material productivity and wastage control.

Izatul Laili Jabar, Faridah Ismail, and Arniatul Aiza Musafa (2016): There are several issues in managing Industrialized Building System (IBS) like delay, quantity overrun cost. This research analyses issues related in pre-construction, construction and

post construction phase of IBS project. Severity of issues is critical in construction phase.

Lingguang Song, Tanvir Mohammed, David Stayshich, Neil Eldin (2015): In construction industry, scaffolding material such as scaffolding, props, side plate, ledger pipe, clamp, u-head, forehead, spindle, etc. The cost effective building material tracking and locating solution obtained with use of GPS technology for lay down yard which connected with computer system should get validated with geological survey benchmark.

Ionna N. Papadaki, Athanasios P Chassiakos (2016): Layout planning is key point of for successful project undertaking. The solution of study is defined in Quadratic Assignment Problem (QAP).

S. E. SAPUAY (2016): Construction industry generates major waste like unusable material for which contractor is responsible. In most of the cases it is observed that in spite of reuse and recycle of material, material is hauled away from site. Dumping of waste contaminate environment. Thus this paper enforces to implement proper waste management at construction site.

3. STEEL YARD REALISATION

Project success realization indicator relates to lineout of preliminary practices like stacking of material, machineries lay down yard setup and automation of processes. Site investigation shows a realistic approach towards good practices of steel yard should require following for timely assessment of project.

A. Optimum utilization of steel and Quantity takeoff:

Utilization of steel in project is regulated with standard practices incorporated with BBS techniques. Conventional BBS was calculated with 2-D drawings collected from architect, in recent practices of construction industry shifting towards Building information Modeling (BIM). With this model communication errors are reduced between architect and contractor. It becomes easier to separate superseded drawings and GFC drawings. Related hindrances of site execution are possible to communicate in administrative forum [1].

BIM allows contractor to extracts information related to quantity takeoff. Advance Autodesk software is available, which facilitate easier calculation and cost control model for analysis.

Fig-1.BIM for Steel Yard Operation

Data collected from Autodesk software is analyzed properly with utilization of CPM or PERT network to reduce wastage of steel in steel yard operation compared with full length reinforcement rod length of 12 m. As per requirement of site operation sequencing of steel is done, related information is given for steel yard operation.

Bar Mark	Description of Elements	ø of Bars	N°of Elmts	N°of Bars	Total N°	Cutting length	Code	A	B	C	D	E	F	Shape	Weight (Kg)
1	S1														
	Short span @ 200	T8	2	6	12 N°	2480	310	1075	80	1285	60	60		60 1075 80 1285 60	11.755
		T8	2	5	10 N°	1660	310	295	80	1245	60	60		60 295 80 1245 60	6.557
	Distribution @ 220	T8	2	7	14 N°	2340	100	2340						2340	12.940
	Short span @ 200	T8	2	4	8 N°	1640	310	1095	80	425	60	60		60 1095 80 425 60	5.182
		T8	2	5	10 N°	2470	310	1110	80	1240	60	60		60 1110 80 1240 60	9.757
	Distribution @ 220	T8	2	7	14 N°	2030	100	2030						2030	11.226
	Short span @ 200	T8	2	6	12 N°	2590	310	1165	80	1300	60	60		60 1165 80 1300 60	12.277
		T8	2	5	10 N°	1750	310	305	80	1320	60	60		60 305 80 1320 60	6.913

Fig-2. BBS Format for Quantity Takeoff

B. Steel Yard Operation:

Steel yard operation is a standard practice of operation of steel management to fulfill site requirement for successful completion of construction project.

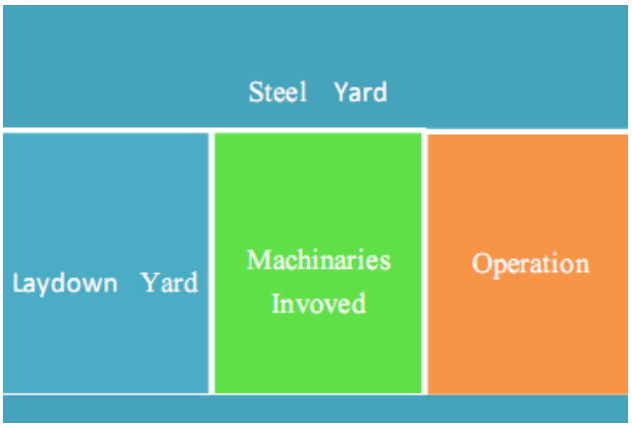


Fig-3.Steel Yard Operation

Recent years contractual terms are restricting contractor for timely handover of project. Standardization of practices is essential for smooth functioning of project. Steel is A-type of item in construction industry, requires should be managed.

B. Lay down Yard:

Steel yard, lay down yard lineout is a crucial network of controlling project in pre-construction phase of project.

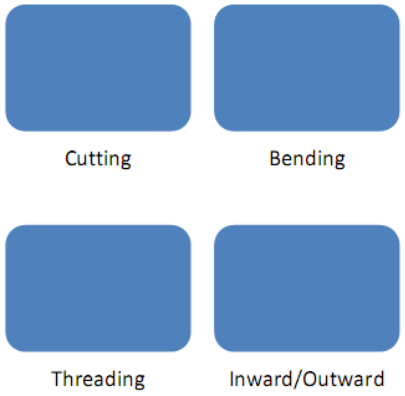


Fig-4.Lineout of Steel Yard

Location of steel yard in project should be managed in efficient way to reduce logistic interruption. Efficient layout planning is key point of successful project regulation, possible to be managed with Quadratic Assignment Problem (QAP).At the same time below mentioned parameters contribute in cost minimization [4].

- Per day frequencies of trip made between pairs of facility
- Distance between predetermined location(meters)
- Transportation cost between location (unit/meter)
- Construction cost facility at alternate location (cost units)

Optimization of objective is done to minimize total cost indicated in relationship

$$Min\ TC = (x+a)^n = \sum_{i,x,j=1}^{n} d_{xi} f_{xi} u_{ij} d_{ij} + \sum_{i,x=1}^{n} d_{xi} c_{xi}$$

Subject to

i = 1, 2, 3,……., n

- TC = Total cost
- n = Number of facility in location
- d_{xi}= permulative matrix variable
- f_{xi} = Trip frequency between facility i and j
- u_{ij} = Transportation cost between location i and j
- d_{ij} = Distance between location i and j
- c_{xi} = construction cost if facility x is placed in location i

C. Steel Yard Operations

a. Stacking of rebar:

Rebar stacking is very important in Steel Yard Management. After awarding contract next to procurement stage, rebar stacking is required to be done carefully.

- Direct contact of rebar to soil is avoided to reduce rusting.
- A platform required to be preparing above ground.
- Rebar should be stock dia. wise to avoid mess-up
- First enter first go system should follow.
- There should be proper drive way should be maintained in stocks of different dia of rebar.
- Tag system should be maintained for inward and outward stock of rebar.
- Exact number of bar get shifted towards cutting and bending yard, according to bar bending schedule of particular area.

D. Reinforcement Couplers

Different mechanical splicing system based on type of reinforcement coupler used

- Threaded Coupler

Threaded coupler is sub-divided into three types according to type of threading as

1) Parallel threaded coupler

2) Tapered threaded coupler

3) Upset Parallel threaded coupler

⋙ Coupler with crimped sleeve

⋙ Coupler with injected sleeve

1) Molten metal injection

2) Grout or Epoxy resin

⋙ Butt splices

⋙ Other patented type

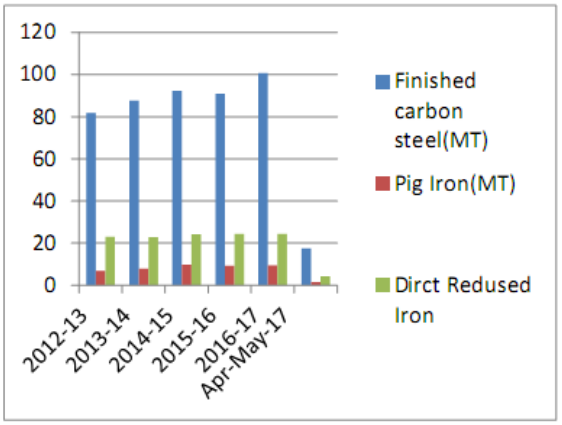
Trend of Steel Production in India

Steel yard management is an involve process in construction industry. Quantum of work is rising day by day development process. Development of industry in every sectors like residential, commercial, IT sector, Institutional, Railway, Road, Bridges, Water resource, Docks and Harbor, Airport etc. As per need of civilization construction sector is raising hands for development as per need of urbanization.

(Table-1) Componant of Construction Investment in Other Sector

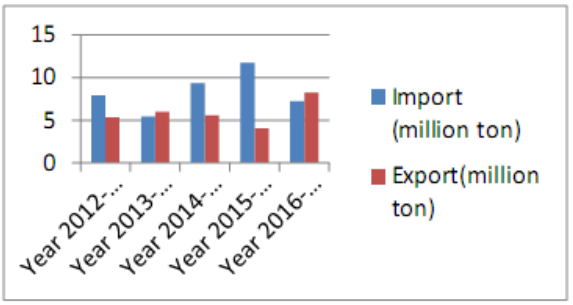
Sr.No.	Sector	% of Cost going in Civil Construction
1	Power	37
2	Space & Specific Research	20
3	Education & Culture	37
4	Health	40
5	Railway	50
6	Roads	60
7	Transport	60
8	Civil Aviation	30

Construction is largest sector after agriculture in India. In case steel production trend, it is easy to understand depth of steel yard industry in India. Steel Yard management is TQM process. Source: Joint Plant Committee. Rise of construction sector in India, leads demands of steel. Accordingly production rate of steel is increases. Now India is third largest production country all over the globe. Government releases National Steel Policy-2017, which are encourages industrialist for production road map. Steel industry was de-licensed in1991 and de-controlled in 1992.India is second largest producer of sponge iron.



Trend of Steel Production in India (chart 1)

From year 2003-2015, India is largest producer of sponge steel and second largest producer in 2016 after iron. Regulation of price was done on16.01.1992.Since 1992 regulation of prices determined on market trend. In ministry of steel functions an Inter-Minstrels Group (IMG). Secretary of ministry of steel monitor IMG. Currently 18% GST applied on steel without export duty.



Import-Export of finished steel (alloy / stainless + non alloy)-(chart-2)

4. KEY FACTORS TO ADOPT STEEL YARD MANAGEMENT

a. Cost Effective

Steel Yard utilization is cost effective process. With use of ready to use bended rebar reduce wastage. Labor cost is minimized as manual bending is not required.

b. Zero wastage

As cutting and bending is done with build center, with advancement wastage reduced to zero.

c. Optimum utilization of labor

As cutting and bending of rebar is done with build centre, optimum labor uses for majorly fixing work only.

d. Time Management

Fine quality of cutting and bending rebar are getting from build centre with precise time management.

e. Easier procurement of rebar

As total quantity of rebar is finalized in project initiation stage, hence bulk quantity of order is placed towards manufacturer. Hence there is saving in project cost.

f. Freedom in design

As machine can bend any shape of rebar with precise accuracy, so designer have free hand for design structure.

g. Lower working capital

Ready build is designed as per project demands, reduces labor cost in project.

h. Strengthening of brand

As timely delivery of rebar with precise accuracy is done project, develops brand of organization.

CONCLUSION

1. Centralized steel yard management technique affects over strength management of construction project. Steel consuming 30-35% segment and directly related to strength, likely to be organized in large extent.

2. Standardize practice requires to be motivated, which will improve level of organization in global scenario.

3. Optimum utilization of resources facilitates achievement of project economy. Controlling project activity is necessary to reduce 20-30% cost of rework.

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