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Reduce Production Time by Modifying Existing Manufacturing Process Planning In 50t Ell Crane

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ABSTRACT

Every company wants to achieve more and more profit and it wants to complete the project before time so that can produce more goods. Time and cost are two basic and important parameters which can decide the position of the company in the market. There are two companies. The big company is very good at all it's working but it delays the product very often, but the small company do its duty regularly and delivers the good product in less cost before time. Soon that day is not far enough that this small company will step on towards a big company. Thus these two basic values make a large difference. In our paper we have reduced the time and simultaneously increase the profit subsequently minimize the cost. We have planned for allocation of the men and go to various shop floor arrangements for fast production. We have prepared CPM (Critical path method) and directly go to the critical path to make the reduced time. It can be generated modified layout of the plant. It can be made sequencing of the operations and using parallel operations. It reduced time as well as cost of the ELL Crane. In some cases, we changed the plate to get improved economy and as per the time of concerned.

Keywords : Critical Path Method(CPM); Electrical Level Luffing (ELL); Crane; Longitudinal Travel Mechanism (LTM)

I. INTRODUCTION

What is a Level Luffing Crane?

A level-luffing crane is a crane mechanism where the hook remains at the same level while luffing; moving the jib up and down, so as to move the hook inwards and outwards relative to the base.

Usually the description is only applied to those with a luffing jib that have some additional mechanism applied to keep the hook level when luffing. Level-luffing is most important when careful movement of a load near ground level is required, such as in construction or shipbuilding. This partially explains the popularity of fixed horizontal jibs in these fields. In short, Level luffing simply means the load being carried remains level as the jib is (luffed) lowered or raised.

Features of the ELL

1) This is a type of crane used in dockyards and wharves.
2) This saves a lot of time and work when ships are being unloaded.
3) It has high weight lifting capacity around 150T.
4) It can move and rotate.

Applications of the ELL

1) Used at Port sectors
2) For Loading and Unloading Heavy Containers.
3) Used at Construction site
4) For Lifting Heavy weight as readymade RCC structure, etc.
5) Used at Big Industries
6) For loading material in big quantity quickly and efficiently for Example - Loading coal in trains

Parts of level luffing crane

1) L.T. Mechanism
2) Portal leg
3) Portal beam
4) Vertical mast

5) Machinery frame
6) A frame
7) Rocker arm & Ballast assembly
8) Jib & tie
9) Rope
10) Hooks

II. METHODS AND MATERIAL

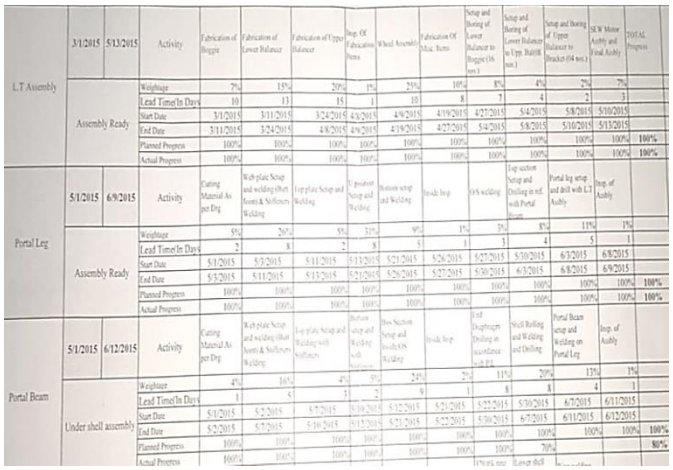
1. Problem

As the level luffing crane is new for industry so its production takes time to manufacture and thus manufacturer has to invest more time as well as cost. So maximum manufacturing time is constrain.

Time reduction

Before going to the work, first look at the existing data of proposed planning time of the ELL crane, we have the following sheet provided by the manufacturer. Our target is to set below the fabricating time of ELL crane using various methodology and time saving techniques.

Existing Planning Sheet -



2. Methodology and Problem Solving

L.T. Mechanism

The L. T. Mechanism is the base part of the whole structure. It travels on the rail on a levelled surface and drives the level luffing crane.

L. T. Mechanism consists of following parts

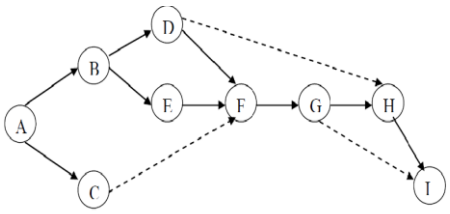
a) Bogies
b) Lower balancer
c) Intermediate balancer
d) Upper balancer
e) Wheel assembly

To reduce the time taken by the manufacturing of the L.T. Mechanism

Firstly, paper acknowledge with the existing time taken by the fabrication unit and then we should go to the critical path of the system.

CPM of L.T. Mechanism

Activity	Description	Predecessor activities	Successor Activities	Start time	End time
A	Start	-	B,C	-	-
B	Fabrication of the bogie	A	D,E	0	16
C	wheel assembly	A	F	0	10
D	Fabrication of the lower balancer	B	F,G	17	29
E	Fabrication of the upper balancer	B	F,H	17	33
F	Inspection	C,D,E	G	31	31
G	Set up of bogie to lower balancer	F	H	32	35
H	Set up bogie to upper balancer	G,E	I	36	37
I	SEW motor assembly and final	H	-	38	40



Summary Sheet for machining operation:

The fabrication time required to fabricate the bogie is as follows in which ergonomics factor is also considered.

CNC Cut - 25 minutes
Fabrication set up and welding -180 minutes
Drilling - 60 minutes
Grinding - 90 minutes
Quality check - 30 minutes

As per this all, increase the number of welders so it is required to improve the method also to get the better

result as we wanted from it. So that re-arranging the task associated to the workers

Bogies are fabricated within just 2 days 2 hours

+ 25×16 minutes = 3 days

By using this operation sequence we can complete the manufacturing of bogies within 3 days which was previously made 16 days to complete the same task.

3. Portal leg:

Marking and cutting:

For the workers, if work completed part design for cutting the part they stat confusing in the data as well as they repeatedly look for the design to understand and with all of this they get frighten of getting errors. These all will reduce the efficiency of the workers. So, we have to give them a schematic layout which they can easily understand. Nested design or say nesting is used instead. In nesting all the similar parts are grouped on the same plate and then dimensions of one part is given and workers cut accordingly as required.

This will lead to

a) Time saving in marking and cutting
b) Reduce in scrap
c) Cost can be reduced
d) Profit will increase

Pressing:

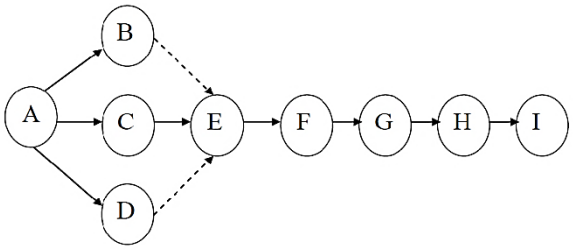
Instead of manual pressing by hammer, it can be used the hydraulic jack. Advantages of using hydraulic jack are the time reduction and quality improvement.

With the advancement of this type of techniques, reduces 12 days of manufacturing time.

Portal Beam:

CPM of the portal beam

Activity	Description	Predecessor Activities	Successor Activities
A	Cutting the material	-	B,C,D
B	Web plate set up, welding, stiffener welding	A	E
C	Top plate setup & stiffener welding	A	E
D	Bottom setup and welding with stiffener	A	E
E	Bar section set up and welding with stiffener	B,C,F	F
F	Inside inspection	E	G
G	End diaphragm drilling in accordance with P.L.	F	H
H	Shell rolling and welding and drilling	G	I
I	Portal beam setup and welding on portal leg	H	-



Arrangement of different operations

Marking and cutting:

a) For the workers to complete the part design for cutting the part they start confusing in the data as well as they repeatedly look for the design to understand and with all of this they get frighten of getting errors. These all will reduce the efficiency of the workers. Thus, the schematic layout which can be easily understand.
b) Nested design or say nesting is used instead. In nesting all the similar parts are grouped on the same plate and then dimensions of one part is given and workers cut accordingly as required.

c) Instead of manual pressing by hammer can use the hydraulic jack.
d) Instead of using positioning welding process can use c-position.

In this, reduced the manufacturing time by 4 days compared to existing manufacturing process.

Vertical Mast

Total days to complete the fabrication of the vertical mast are 65days.

Existing situation Plate:

1) 12000×1000×22 (5 no's)
2) 12000×1500×22(6 no's)
3) 12000×1800×22(2 no's)
Material cost: 16, 41,341
No. of joints required: 12

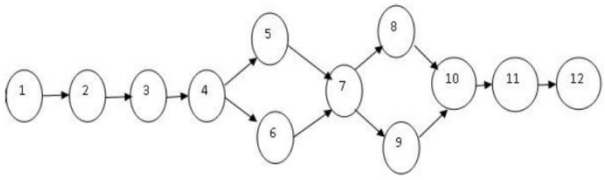
Instead of using the three different types of plates, proposed to use only one sized plate that is 12000×2500×22

- Total length of the vertical mast =14450 mm above the portal beam + 2971 mm below the portal beam =17411 mm
- Circumference = πD = π (3520) =11058.4061 mm
- Total numbers of plates required = 17411 ÷ 2500 = 6.96 = 7 plates. So, numbers of joints required are 6.
- Total suck seam welding = perimeter × 6 = 66350.4366 mm
- If the speed of the welding is 2500 mm/hour then the time required to complete the welding is, = 66350.4366 ÷ 2500 = 26.54 hours= 3.3175 working days = 3 days 2 hours 32 min

In paper, describe two numbers of teams. Using two teams the time consumed in the production is reduced to half. So, now time required for V-edge preparation and long seam welding is halved. In drilling with portal beam shell, there are 348 drills are required. In this if we are working with two teams, the time required to drill will be reduced. Then it can be drilled in just 6 days.

CPM of Vertical Mast

Activity	Description	Predecessor activity	Successor activities	Start time	End time
A(1-2)	Cutting of plates	-	B	0	2
B(2-3)	V-edge preparation	A	C	2	4.5
C(3-4)	Rolling	B	D,E	4.5	10.5
D(4-5)	Long seam welding	C	F,G	10.5	12.5
E(5-6)	Suck seam welding	C	F,G	10.5	13.9
G(7-8)	Drilling	D,E	H	13.9	19.9
G(7-9)	120 thick ring welding	D,E	H	13.9	19.9
H(9-10)	Lower shell welding	F,G	I	19.9	23.9
I(10-11)	Ring welding and machining	H	J	23.9	38.9
J(11-12)	Inspection	I	-	38.9	39.9



III. RESULTS AND DISCUSSION

Result of vertical Mast

Previous time for manufacturing = 65 days

New scheduled time for the manufacturing = 39.9 days = 40 days

Total time saving = 25 days

Assembly of A frame

Here, in the assembly of A-frame it takes 29 days to assemble the whole structure as the structure is too heavy. In added to the complexity of the structure, the assembly unit has to assemble it at certain height of about 30-35 meter above the ground surface. Sixteen bores are to be produced at that height of 30-35 meters that consumes more time and effort as well.

Result of A frame

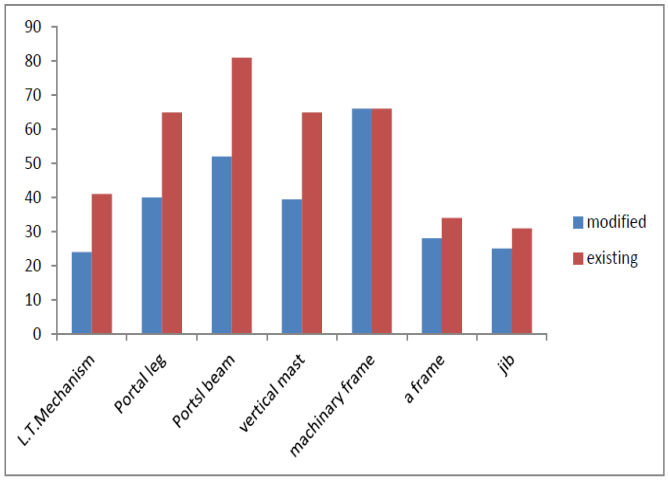
In A-frame assembly, two mating parts are assembled via pin joint. So, in boring of that pin joint takes considerable time which is reduced by 6 days via modifying the process.

Jib

The function of the jib is to connect machinery frame to the fly jib. The main jib is connected to the machinery frame via pin joint assembly. At some distance from that point it is connected to the luff drive and rocker arm tie. The other end is connected to the fly jib.

In Jib assembly, two mating parts are assembled via pin joint. So, in boring of that pin joint takes considerable time which is reduced by 6 days via modifying the process.

Representation of the time reduction by chart



IV. CONCLUSION

Above result summaries that total Saving Days are 66. In this problem solution we have used various time saving methodologies, several new thoughts were generated and also faced many kinds of difficulties on manufacturing site, which were solved instantaneously. We have reduced time as well as cost that makes the product valuable in the market and company can earn more profit and handle more project as well.

V. SCOPE AND FUTURE

The use laminated hook instead of crane hook and that laminated hook may be made of the waste material of the sheets which have not been used or as scrap. This will lead to cost reduction as well and profit will increase. Moreover waste scrap handling will be done and inventory will be reduced. Instead of using the L.T.mechanism, should try with chain wheels. It reduce more time and cost for the more benefit, the company can earn. We will also keep in mind customer's satisfaction with good quality of the product as well.

VI. ACKNOWLEDGMENT

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