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FEASIBILITY STUDY OF JUST IN TIME INVENTORY MANAGEMENT ON CONSTRUCTION PROJECT

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Abstract – Abstract*:* Just in time philosophy has lot of Potentional for managing movement of construction material from manufacturing yard to construction site. The traditional approach to material delivery has been used in construction industry for many years. It is imbedded in the corporate structure as the way to procure materials. Major Construction Industries have been trying to adopt new business initiatives in order to stay alive in the new competitive market place. Companies must strive to create high quality, and Low cost products that can get to the customers in the shortest time possible. Just-in-time production system is one of these initiatives that focus on cost reduction by eliminating non-value added activities. This Paper Deals with Implementing Just in Time Inventory Control Approach on Highway Construction. JIT has Tremendous Effect on Material Delivery Operation. During Implementation of JIT Organization is required, to put desired efforts on all levels of the work.

Keywords: just in time, Cost Reduction, Non value added activity.

1. Introduction

Increasing Global competition has forced the Indian construction Industries to look for some new techniques to meet the challenges in Construction Industry. During last two or three decades construction environment all over the world has experienced more changes, particularly, the construction environment has become one of the most important elements in creating the value added contents for the products and service [1], [2]. The traditional approach to material delivery has been used in construction industry for many years [3]. The approach created lot of problem to construction industry. Fast development in communication, better quality material and fast material transportation systems has become global in nature. Construction industry also demands more product variety that means reduced lot size and high flexibility in construction work. Manpower cost has also risen [4], [5]. All these factors tend to increase the material and project cost. But the industry has to maintain the cost at a reasonable level. To overcome material delivery problem just in time method is used for large projects [6[, [7]. Just in Time method application on delivery of concrete is done in Japan. Ready mix concrete is prototypical example of batch process where a customer process releases an order to batch for the supplying process and receives product as a result. This batch process does not allow any inventory of product to be maintained because the product is perishable [8]. Precast concrete supplier examine if contractors are ready to adopt the JIT philosophy for receiving and installing precast concrete components on-site. Lessons are drawn from the empirical findings to determine how contractors can prepare for JIT management of precast concrete components [9].

JIT principle was introduced by Toyota Company in Japan. JIT is a system that produces the required item at the time and in the quantities needed. By using JIT principle we can maintain quality of the entire project and increase efficiency of the workers. JIT principle says that inventories are not more important and should be considered as waste [10], [11].

Conceptually, JIT is an approach that combines difficult objectives of low cost, less space requirement for material stock, high quality and delivery dependability [12].

JIT Implementation depend on supplier .The character of every supplier is strongly related to the success or failure of any materials-management system. Thus, selection of vendors is the critical initial step, because selection of vendors affects the construction itself. Therefore, good vendor selection is important for an effective materials-management system, which leads the successful completion of a project [13].

2. CONCEPT OF JUST IN TIME

Just in Time (JIT) production is a manufacturing philosophy which increases speed of production. JIT Concept is, "Company produces only what is needed, when it is needed and in the quantity that is needed". The company produces only what the customer requests, to actual orders, not to forecast. JIT can also be defined as producing the necessary units, with the required quality, in the necessary quantities, at the last safe moment. It means that company can manage with their own resources and allocate them very easily.

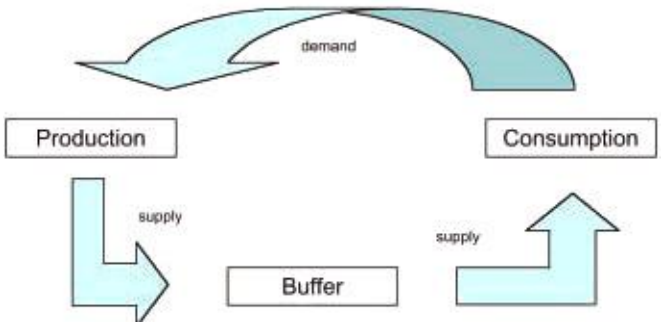

Fig no1: Shows JIT Concept

Various Steps in Implementation of JIT:

Source identification: Just in Time means produce right quantity of material at right time. Not before or after the work. Large company has their own source but small construction industry is facing problems in material management.

Vendor analysis: vendor is a organization who supplies material to company. Vendor may be single or more it's depending upon company.

Scheduling: scheduling gives clear idea about daily work. Submit advance schedule to vendor. Make storage facility and safety stock for material. Plan includes date, time, place, quantity, place and no. of equipment

.

3. Case study

3.1) Introduction about company:

Place: Aland (Gulbarga)

Type of work: Road Construction

Type of Road: Black Top Road (Flexible Pavement)

Length of Road: 63KM

Cost of Project: 37Cr

.Name of Company: Patil and Company

State-Maharashtera, Dist-Solapur,

Country-India

Name of Incharge: Vijay Patil

Mo No: 9036450000.

3.2) JIT Implementation Process:

One of the major objectives in implementing a JIT System is to achieve a common goal of the whole company. First step is identification of material delivery problem in company and provide solution to company. Second step is Material Quantity Calculation. ABC, HML, VED, SDE Analysis is done. Analysis helps to select material for JIT Application. Third Step is preparation of JIT plan. Equipment productivity calculated. Find out number of days required to complete work. Plan includes date, place of material delivery, time and no. of equipment required. Fourth step is vendor selection. Analytical Hierarchical Process is used for vendor selection. Then material procurement plan prepared. JIT Plan Submit to plant and vendor. Maintain proper communication between site engineer, vendor and plant supervisor.

ABC Analysis:

A class items required tight inventory control, A class tem have high consumption value. Special care must be taken because consumption value is high and Wastage Creates more economical loss to the company. B class items In between A and C moderately care must be taken. B Class items have low consumption value than A Class items but higher consumption value than C Class items. Grouping of ABC items largely used in material management. By using this method we can select items for just in time application.

Table No 1: Shows ABC Analysis

Item	Cost	Annual consumption	Total cost	% Cum	Category
GSB	1039.80	32445	3,37,36,311	23.66	A
BM	5399.70	5775	3,11,83,267.5	45.54	A
WMM I&II LAYER	1117.50	26460	2,95,69,050	66.28	A
MURUM	362	71820	2,59,98,840	84.52	B
SDBC	7639.60	2887.5	2,20,59,345	100.00	C
		TOTAL COST	14,25,46,813.5		

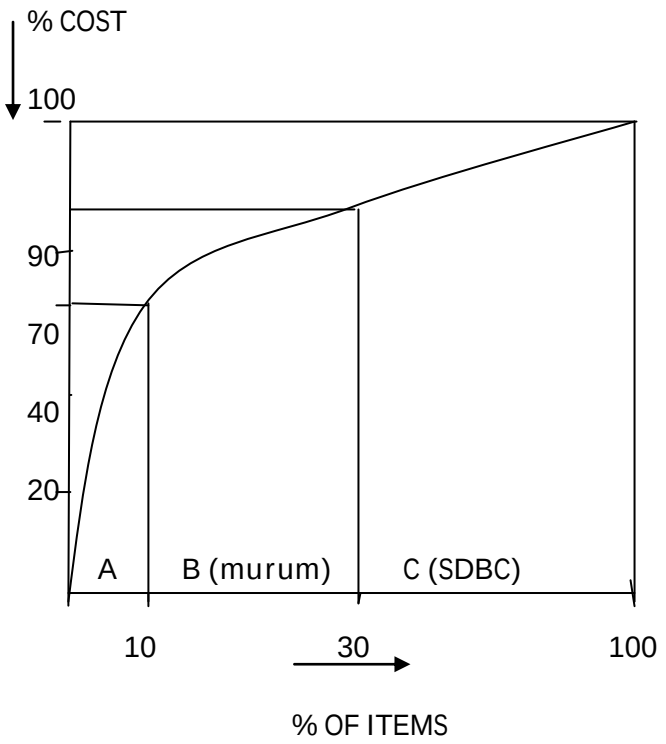

Fig No 2: Shows ABC Analysis Graph

3.3) Equipment productivity calculation

I. Hindustan front end loader Production

$$\text{Loader Output} = \frac{3600\ X\ Q\ X\ F\ X\ E\ X\ V.C.}{T}$$

$$= \frac{3600\ X\ 3.1\ X\ 0.95\ X\ 0.85\ X\ 1}{86} = 104.78 m^3/hr$$

II. Tipper Production

$$\text{No. of bucket loads} = \frac{Tipper\ volume}{bucket\ volume\ X\ Fill\ factor}$$

$$= \frac{13.44}{3.1\ X\ 0.95} = 4.56 \approx 5 \text{ buckets}$$

Loading time=Loader cycle time X No of Buckets= 86X5=430sec=7.16min

Cycle time = Loading Time = 7.16 min

+ Haul Time = 31 min

+Dump Time = 2 min

+Return Time = 18.84 min

Cycle Time = 59 min

$$\text{Output} = \frac{Tipper\ volume\ X\ 60}{Tipper\ cycle\ time} = \frac{13.44\ X\ 60}{59} = 13.40 \text{ x e} =$$

13.40 x 0.76 = 10.38m³/hr.

III. Grader = $\frac{\text{no of passes x distance}}{\text{Speed x efficiency}}$

= $\frac{6X\ 0.385\ (mile)}{2.3x\ 0.84}$)

= 1 hour= 34 cum

IV. Paver: = $\frac{\text{Quantity x 60}}{\text{TIME}}$

= $\frac{13.44X60}{22.4}$

= 36 cum.

Table No: 2 Shows Equipment Productivity Calculation

EQUIPMENT	EFFICIENCY	EQUPMENT PRODUCTIVTY	Capacity of Tipper
Volvo-930(Grader)	84.33%	34	
Paver	84.33%	36	
Hywa-1	63.85%	8.44	13.44
Hywa-2	60.24%	8.04	13.44
Hywa-3	84.33%	11.25	13.44
Hywa-5	63.85%	8.46	13.44
Hywa-6	87.95%	11.65	13.44
Hywa-7	87.95%	11.65	13.44
Hywa-8	87.95%	11.65	13.44
Hywa-9	60.24%	8.04	13.44
Hywa-10	51.80%	6.83	13.44

3.4) Monthly Consumption of each item

Total monthly target= 3.5 km

GSB required for 1 km = 660 cum. (lxbxh)

For 3.5 km G.S.B required = 3.5x660=2310 cum.

WMM required for 1 km=979 cum.

For3.5kmWMM Required=979X3.5=3426.5

BM required for 1 km=297 cum.

For 3.5 km WMM Required=297X3.5=1039.5 cum

4) Economical analysis Between Conventional Method and JIT Method

4.1) JIT Method Cost

Table No: 3 Shows Material Consumption cost

item	Quantity (cum)	Cost per (cum)	Total cost
GSB	2310	1039.80	24,01,938
WMM	3426.5	1117.50	38,29,113.75
BM	1039.5	5399.70	56,12,988.15
		Total cost=	1,18,44,039.5

Table No: 4 Equipment cost

Type of item	Type of equipment	Cost per hour/day	Total cost
GSB	GRADER	1500	1,05,000
WMM	GRADER	1500	1,26,000
BM	PAVER	1500	42,000
ALL 3 MATERIAL	HYWA	4000(PER DAY)	4,16,000
		TOTAL COST=	6,89,000

1) Conventional Method Cost

Table No: 5 Shows Material Consumption cost

item	Quantity (cum)	Cost per (cum)	Total cost
GSB	2310	1039.80	24,01,938
WMM	3426.5	1117.50	38,29,113.75
BM	1039.5	5399.70	56,12,988.15
		Total cost=	1,18,44,039.5

Table No: 6 Shows Equipment cost

Type of item	Type of equipment	Cost per hour/day	Total cost
GSB	GRADER	1500	1,89,000
WMM	GRADER	1500	2,31,000
BM	PAVER	1500	73500
ALL 3 MATERIAL	HYWA	4000(PER DAY)	920000
		TOTAL COST=	14,13,500

JIT Method Total Cost for 3.5 km required =

1, 18, 44,039.5+6, 89,000 = 1, 25, 33039.5 Conventional Method Cost saving by using just in time method=

1, 18, 44,039.5+14, 13,500 =1, 32, 57,539.5

Total Cost Saving BY using JIIT method is

1.32,57,539.5-1,25,33,039.5=724500

To complete 3.5 km target per month:

Conventional method requires 47 days and for just in time it requires 26 days.

5) Monthly material procurement plan

Table No: 7 Shows Material Procurement Plan (3.5Km)

Name Of Item	Quantity of Item (CUM)	Month	Vendor name	Equipment required
GSB	231	June	Paranjape company	HYWA-6 13.44(CAPACITY ALL)
GSB	231	June	Paranjape company	HYWA-6
GSB	231	June	Paranjape company	HYWA-6
GSB	231	June	Paranjape company	HYWA-6
GSB	231	June	Paranjape company	HYWA-6
WMM	285.54	June	Paranjape company	HYWA-6
WMM	285.54	June	Paranjape company	HYWA-6
WMM	285.54	June	Paranjape company	HYWA-6
WMM	285.54	June	Paranjape company	HYWA-6

Developing procurement plans – when to buy, from where and how much Monitoring flow of materials, delivery and consumptions.

Vendor evaluation is the ranking of supplier's performance in terms of quality of material, cost of material, cooperation of vendor to company, document submission within time. Selection of vendor s critical procedure but selection process essentials to large company where investment is more this analysis past performance of vendor is recorded. Rating depends upon vendor performance. Cost, service, cooperation, quality are some things in which vendor maintain his level usually, the most important measure of a supplier's service is his record of past performance. From literature review Selection criterion for Vendor is done. Five criteria are selected such as cost, quality, providing document in time, service and cooperation. For Murum Hindustan Company, Trimurti Company, Moraya Company are the Vendors. For GSB and WMM- Paranjape Company is vendor and for BM and SDBC- RUDRA COMPANY is Vendor.

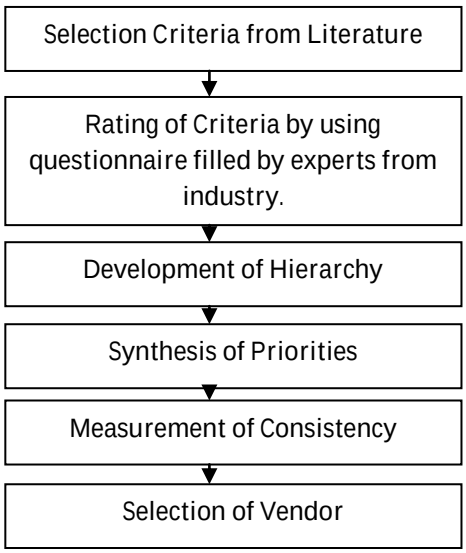

Fig No 3 Shows AHP Process:

Description of item	Date	Time of delivery of material	Quantity (cum.)	Place (chainage)	Equipment Required
GSB	1.6.2015	9:00 TO 1:00 2.00 TO 5:30	124.2 108.2	2+400 To 5+900	Hywa=4 Grader=1 Hywa=4 Grader=1
GSB	2.6.2015	9:00 TO 1:00 2.00 TO 5:30	124.2 108.2	2+400 To 5+900	Hywa=4 Grader=1 Hywa=4 Grader=1
GSB	3.6.2015	9:00 TO 1:00 2.00 TO 5:30	124.2 108.2	2+400 To 5+900	Hywa=4 Grader=1 Hywa=4 Grader=1
GSB	4.6.2015	9:00 TO 1:00 2.00 TO 5:30	124.2 108.2	2+400 To 5+900	Hywa=4 Grader=1 Hywa=4 Grader=1

Table No: 8 Shows JIT Implementation Plan (3.5Km)

Study of causes of delay in material delivery on site:

Problem: Improper Communication between site engineer, plant supervisor and vendor We observed improper communication between plant supervisor and engineer during Construction Work. This is a first reason about late material delivery. We suggest to engineer and vendor, prepare plan and according to that communicate each other. Second Problem is poor fleet management. There is no proper special staff for fleet management. Managers not maintain record of inspection and maintains of fleet. Manager not careful about fuel purchasing system. We suggest to company for preparation of plan for fleet replacement. Company must have proper fuel purchasing system. Third problem is poor planning of material delivery. We suggest to company for vendor selection. Prepare monthly procurement plan. We submit JIT plan to company. JIT Plan helps to company to reduce cost of construction

6. CONCLUSIONS:

1) JIT Method used to complete 3.5 Km. as per plan The Completion of 3.5 Km Road Construction work .JIT Method Required 26 days. Conventional Method takes 47Days to Complete Same Target.

2) JIT Method Saves 5% Cost of Construction.

3) No of Tipper used During JIT Application 104. No Of Tipper Used during Conventional Method 230.JIT Method Helps to Reduce equipment Required.

4) During JIT Application Material Production was 100% as per target. But Conventional affects material production. As Per Conventional Method Material Production was only 50% as per Target.

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