FEASIBILITY STUDY OF JUST IN TIME INVENTORY MANAGEMENT ON CONSTRUCTION PROJECT

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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.

I. 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 depends 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

Second Step:
I) Vendor Selection Process.

Third Step:
I) Material Procurement Plan Preparation
II) Equipment Productivity Calculation.

Case study
Introduction about company:
Place: Aland (Gulbarga)
Type of work: Road Construction
Type of Road: Black Top Road (Flexible Pavement)
Length of Road: 63KM

JIT Implementation steps:
One of the major objectives in implementing JIT System is to achieve a common goal of the whole company.

First step:
I) Material Quantity Calculation.
II) ABC analysis.
III) Selection of Material.

Cost of Project: 37Cr
Name of Company: Patil and Company
State-Maharashtra, Dist-Solapur,
Country-India
Name of Incharge: Vijay Patil
Mo No: 9036450000.

3 JIT Implementation process:

Step 1:
3.1) Material Quantity Calculation
Total monthly target= 3.5 km
GSB required for 1 km = 660 cum. (lxbxh)
For 3.5 km GSB 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 BM Required=297X3.5=1039.5 cum

Fig no 2: Shows road cross section
Sample material calculation for BM:
1000X5.5X0.054 (LXBXH) = 297 Cum

3.2) ABC Analysis:
ABC Analysis was performed in order to select
major materials for JIT application. Chart and
Graph below Highlights the A, B and C items.
Table 1: Shows ABC Analysis

<table>
<thead>
<tr>
<th>% COST</th>
<th>100</th>
<th>90</th>
<th>84.5</th>
<th>70</th>
<th>66.2</th>
<th>45.5</th>
<th>23.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B (MURUM)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (SDBC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For JIT application BM, GSB and WMM Material
Selected.

Step 2:

3.4) Vendor Selection Process:
One of the important parameter which may have
High influence an success of JIT is Vendor
Selection. Five criteria’s were selected for vendor
evaluation they are cost, quality, providing
document in time, service and cooperation. Based
on the material following vendors were Primarily
Shortlisted.

i) Murum
   a) Hindustan Company b) Trimurti Company C) Moraya Company.

ii) GSB and WMM
   a) Paranjape Company

iii) BM and SDBC
   a) Rudra Company

Analytical Hierarchy Process was used for vendor
selection and following vendors are selected.

i) Murum- Hindustan Company

ii) GSB and WMM- Paranjape Company

iii) BM and SDBC- Rudra Company
Fig No 4: Shows AHP Process:

Step 3:
3.5) Monthly material procurement plan
JIT, calls for material procurement when required, so based on equipment productivity and fleet management from available equipment, procurement plan is developed.
Fleet required for laying GSB layer includes: 1) Loader 2) Hauling Unit 3) Grader and Paver’s.
Sample production is stated below and base on the same procurement plan is tabulated in below.

Table no 2: Shows Material Procurement Plan

3.6) Equipment productivity calculation
I. Hindustan front end loader Production
Loader Output = \( \frac{3600 \times Q \times F \times F \times V \times C}{T} \)
\( = \frac{3600 \times 3.1 \times 0.95 \times 0.85 \times 1}{86} \)
= 104.78 m³/hr

II. Tipper Production
No. of bucket loads = \( \frac{\text{Tipper volume}}{\text{bucket volume} \times \text{Fill factor}} \)
= \( \frac{13.44}{3.1 \times 0.95} \)
= 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

Output = \( \frac{\text{Tipper volume} \times 60}{\text{Tipper cycle time}} \) = \( \frac{13.44 \times 60}{59} \) = 13.40 \( x \) e = 13.40 x 0.76 = \textbf{10.38} \text{m}^3/\text{hr.}

III. Grader

\[ \text{Distance} = \text{Speed} \times \text{efficiency} \]

\[ = 6 \times 0.385 \text{ (mile)} \]

\[ = 2.3 \times 0.84 \]

\[ = 1 \text{ hour} = 34 \text{ cum} \]

IV. Paver:

\[ \text{Quantity} \times 60 \]

\[ = 13.44 \times 60 \]

\[ = 22.4 \]

\[ = 36 \text{ cum} \]

3.7 JIT Implementation Plan:

For better Control and ease in operation and for the benefit of vendor procurement plan was prepared on daily basis. Sample of GSB Stated In table:

\textbf{Table no 3: JIT Implementation Plan}

4. Feasibility Analysis

4.1 JIT Method Cost:

Table no 4: shows cost of equipment and material in JIT method

4.2 Conventional Method Cost:

Table no 5: Shows cost of equipment and material in Conventional Method
In order to check the feasibility of the proposed application of JIT procurement plan, economic analysis was carried out for comparison, two stretchers were selected.
1) Where JIT was not applied and other (3.5Km) Where JIT was applied.

Following table gives detailed economic analysis.

**JIT Procurement Plan has reduced cost required to complete 3.5 km road construction work by Rs-7,24,500.**

### 5. CONCLUSIONS:

1) Above analysis shows that application of JIT procurement plan has reduced cost required for completing 3.5 km road work by Rupees 7,24,500.

<table>
<thead>
<tr>
<th>Type of item</th>
<th>quantity</th>
<th>Type of equipment</th>
<th>Cost of Material (per cum)</th>
<th>Total cost of equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSB</td>
<td>2310</td>
<td>GRADE R</td>
<td>24,01,938</td>
<td>1,89,000</td>
</tr>
<tr>
<td>WMM</td>
<td>3426.5</td>
<td>GRADE R</td>
<td>38,29,113.75</td>
<td>2,31,000</td>
</tr>
<tr>
<td>BM</td>
<td>1039.5</td>
<td>PAVER</td>
<td>56,12,988.15</td>
<td>73500</td>
</tr>
<tr>
<td>All 3 material</td>
<td></td>
<td>HYWA</td>
<td>Total cost = 1,18,44,03 9.5</td>
<td>14,13,50 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total cost of equipment</td>
<td></td>
</tr>
</tbody>
</table>

Also time required is reduced by 21 days
2) Overall saving in contribution through application of JIT comes to be 5%.
3) Due proper procurement plan; equipment utilization is also improved

### 6. ACKNOWLEDGMENTS:

The authors would like to thank faculty of collage, company executive engineer and company president for their cooperation in this research project

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