

# Planning And Scheduling With Optimization Of Cost And Time Of Six Lane Bridge With Cast In Situ And Precast Elements At Kolathur, Chennai

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**Abstract:** Construction industries play a vital role in the economy of all developing countries including India. In any construction “Time and cost” are the two main concerns which decide the effectiveness of the project. Further, optimization of time and cost is also very vital. This has increased the importance of adopting time and Cost optimization in all construction projects. Optimization is a systematic effort made to ensure a reasonable profit margins and to obtain the best results under given circumstances or situations.

The optimization of “Time and cost” in any construction project can be obtained by proper planning and scheduling of each part or activity involved and by using multiple construction techniques.

Here It is proposed to try to optimize the “Time and cost” involved in a highway bridge construction at Kolathur junction, Chennai. For the optimization of “Time and cost” involved in the project, two different construction techniques called “ Cast in situ method” & “Pre cast technology”, are analyzed and optimum planning and scheduling is prepared.

**Keywords:** Construction Industry, Time&Cost, Cast in situ Elements, Precast Elements, Cost Optimization)

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## I. Introduction

There are many challenges faced by the construction industries which include, design and Constructability issues, land acquisition issues, adverse political changes, shortage of talent, time and cost related issues, material and labour cost escalations, structural changes. Time and cost are two main factors in planning of construction projects and hence there is an increase in importance of time and Cost optimization. It is important to estimate the time and cost of each activity through which the total duration and total cost of the project are determined for the planning task. Optimization is a systematic effort made to improve profit margins and obtain the best results under given circumstances or situations. The main objective of cost optimization of a project is to gain the maximum profit within the design period and with satisfactory quality of work.

### 1.1 Objective of the project

To prepare a detailed planning and work schedule with optimization of cost and time including cost estimate for the construction of Six Lane Bridge with “cast in situ” and “precast elements” at Kolathur, Chennai .

### 1.2 Scope of the project

The exercise of optimizing the cost and time through value planning and scheduling for both cast in situ and Precast Construction method can be extended to other similar projects in our country.

### 1.3 Project Goals

A project is successful when the needs of the stakeholders have been met. A stakeholder is anybody directly or indirectly impacted by the project.

As a first step it is important to identify the stakeholders in your project. It is not always easy to identify the stakeholders of a project, particularly those impacted indirectly. Examples of stakeholders are:

- ❖ The project sponsor
- ❖ The customer who receives the deliverables
- ❖ The users of the project outputs
- ❖ The project manager and project team

### 1.4 Project Methodology

An efficient project control methodology systems generates information that can improve the productivity of men and materials economize the employment of resources;

The methodology adopted involves the following steps.

- ❖ Collection of all relevant and required data of Six Lane Bridge work at Kolathur at Chennai from Highways Department and Contractor.
- ❖ Carrying out Preliminary Analysis and Detailed Analysis of the project proposal.
- ❖ Preparing a detailed planning and work schedule with optimization of cost and time using PRIMAVERA and preparing the cost estimate for both cast in situ and precast elements.
- ❖ Comparing the Cost and Project time for Cast in Situ and Precast Elements and proposing the best for adoption.

## **II. Literature Review**

### **2.1 Introduction**

In this chapter a review of literature of the techniques used in planning and scheduling of Construction projects are presented.

### **2.2 Definitions & Findings**

A. Christ.Hendrickson (1990) - Use of Advanced Scheduling Techniques

In this study he explained Construction project scheduling is a topic that has received extensive research over a number of decades. With the availability of more powerful computers and software, the use of advanced scheduling techniques is becoming easier and of greater relevance to practice

**K.K.Chitkara (1998) - Explains the methodology used in Planning and Scheduling of Construction Projects.**

In this study he explained the methodology used in Planning and Scheduling of Construction Projects.

**Shanmugapriya S., Dr. Subramanian K.,( 2013) - “Investigation of Significant Factors Influencing Time And Cost”**

In this study they explained, Time and cost overruns is a severe problems faced by large construction industries in India. They was found that five most significant factors causing time and cost overruns in Indian construction are material, market rate, contract modification, high level of quality requirement, project location, depends on the freshers to bear the whole responsibility for time overruns and high transportation cost, change in materials specification, escalation of material price, frequent breakdown of construction machineries and rework for cost overrun.

**Mr.CI Anyanwu (2013) – Project Cost control in the Nigerian Construction Industry**

In this study they explained, the resources well managed or mismanaged today that makes for tomorrow prosperity or depression. The economic depression we are now facing is more out of mismanagement of resources than lack of resources.

**Mr.Seyed Ali Mousavi Dehmourdi (2014) – Optimization of Construction Cost Applying Advanced Techniques**

In this study he explained, Construction industry can do a better job by using advanced construction techniques. Systematic data collection, analysis, reviews to monitor progress will reduce the possible errors in any project thereby avoiding all possible expenditure. He considered least cost method / North West corner Method can be the best result oriented of transportation problem to optimize the transportation cost.

**Prof.Dipak.P.Patil , Prof. Pankaj P.Bhangale & Swapnil S.Kulkarni (2014) – “ Study of Cost Control on Construction Project**

In this study they explained, they are observed that the major factors that contributes to poor inventory control are -

- a) Improper management of time, cost and manpower.
- b) Ignorance of contractor towards material management in construction project.

**Ms.Anuja Rajguru, & Mr.Parag Mahatme (2015) - Effective Techniques in Cost optimization of construction project**

In this study they analyzed different techniques for optimization and found the construction cost and duration at each stage is important to minimize

## **III. Research**

### **3.1 Cost Optimization Techniques**

It is necessary to decide which optimization is required and amount of detail that will be in used into the construction stage. Many cost optimization methods have been implemented in the past by different companies and have not survived. The cost itself is a major difficulty in operating a detailed cost optimization system. It is an expensive operation for a large contract to carry out a detailed cost optimization system. There are three types of cost optimization system; they are by comparison with a cost standard, by subdivision by detail and by integration with other functions. In comparison with a cost standard method, the standard set up by

estimator is compared at the time of tender. For example, it may be combined with a labor utilization scheme, in which the optimization is kept on the optimal utilization of the labor employed.

**3.2 Time optimization Techniques:**

A general mathematical formulation is presented for the scheduling of construction projects and is applied to the problem of highway construction scheduling. The new construction scheduling model provides the capabilities of both the critical path method ( CPM) and linear scheduling method ( LSM) approaches. Repetitive and non-repetitive tasks, multiple group strategies, work continuity constraints and the effects of varying job conditions on the performance of a team can be modeled. An optimization formulation is presented for the construction project scheduling problem, with the goal of minimizing the direct construction cost. For any given construction duration, the model yields the optimum construction schedule for minimum construction cost automatically.

The project is scheduled for both the techniques cast in situ and precast, which is tabulated in Table 2 & 3. The details cost estimate is worked out by using MS Excel and shown in Table.4.

S.No	Task Name	Start Date	Finish Date	Duration in Days
	<b>OVERALL DURATION</b>	<b>27.03.2016</b>	<b>03.07.2017</b>	<b>464</b>
1	Foundation Works	27.03.2016	21.07.2016	117
2	Sub Structure Works	02.04.2016	26.07.2016	116
3	Super Structure Works	09.05.2016	28.06.2017	416
4	RE Wall	15.06.2016	31.03.2017	290
5	Road Works	02.12.2016	19.06.2017	200
6	Painting Works	02.03.2017	04.06.2017	95
7	Handing Over	24.06.2017	03.07.2017	10

S.No	Task Name	Start Date	Finish Date	Duration in Days
	<b>OVERALL DURATION</b>	<b>07.04.2016</b>	<b>11.01.2017</b>	<b>280</b>
1	Foundation Works	14.04.2016	03.08.2016	112
2	Sub Structure Works	11.05.2016	24.08.2016	106
3	Super Structure Works	07.04.2016	01.10.2016	178
4	RE Wall	12.05.2016	23.10.2016	165
5	Road Works	26.06.2016	22.11.2016	200
6	Painting Works	24.09.2016	27.12.2016	95
7	Handing Over	23.12.2016	11.01.2017	21

S.No	Task Name	Cast in situ Elements	Precast Elements
		Amount In Lakhs	
1	Earth Work Excavation	12.53	12.53
2	Piling Works	701.40	701.40
3	Structure Works ( PCC / RCC)	979.49	929.27
4	Reinforcement Steel	1587.60	1587.60
5	HTS Strands	96.10	209.25
6	Bearing	57.39	57.39
7	Strip Seal Expansion Joint	34.65	34.65
8	G.I.Drainage Spout	6.50	6.50
9	Mastic With BC	142.00	142.00
10	Road Works	602.40	602.40
11	RE Wall	604.44	604.44
12	Painting Works	203.11	203.11
13	Erection of Girders		118.96
	<b>TOTAL</b>	<b>5027.61</b>	<b>5209.50</b>

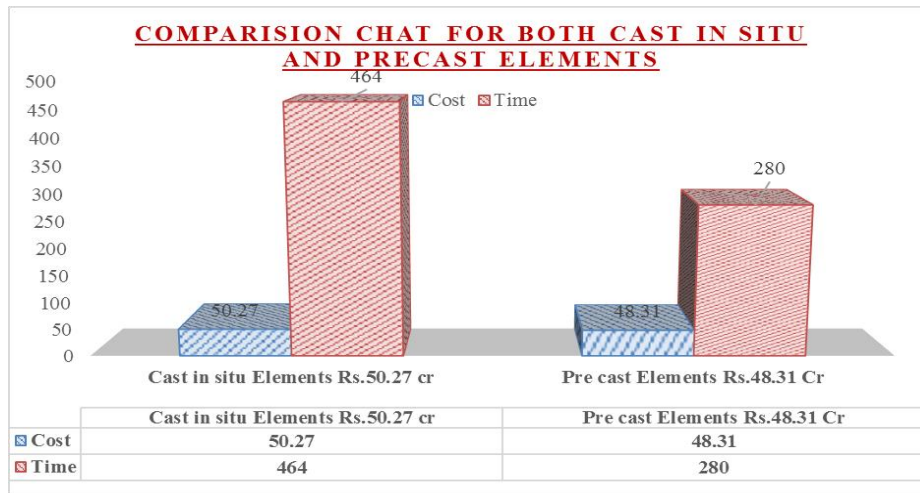
The Cost benefit over the time is considered as advantage in precast construction method, because all other recurring costs like right of way maintenance, resurfacing at an fixed intervals etc are same in both the cases. The cost benefit over time optimization is

- ❖ Interest over the capital cost at 14.5% Per Annum  
 $Rs.50.27 \text{ Crores} \times 14.5\% / 365 \text{ days} \times 184 \text{ Days} = Rs.3.67 \text{ Crores}$
- ❖ As per traffic survey 11721 PCU / HR So the interest on time Savings value by the road users  
 $11721 \times 24 \text{ Hrs} \times 184 \text{ days} \times Rs.50 / \text{Vehicle} \times 14.5\% / 365 \text{ days} = Rs.0.11 \text{ Crores}$   
**Total Cost benefit due to time savings = Rs.3.78 Crores**

Estimated cost of construction Using Precast Element = Rs.52.09 Crores  
 Cost benefit due to time Savings = (-) Rs. 3.78 Crores

**Net Cost by Using Precast construction technique = Rs.48.31 Crores**

ITEMS	CAST IN SITU ELEMENTS	PRECAST ELEMENTS	ADVANTAGE
<b>Time</b>	464 Days	280 Days	Early completion of 184 days
<b>Cost</b>	Rs.50.27 Crores	Rs.48.31 Crores	Rs.1.96 Crores Savings over using Cast in situ elements



#### IV. Conclusion

- ❖ From the results obtained, it is observed that when the Pre Cast Elements is used in the construction of Bridges, the total project cost and the duration of the project is lesser than the Construction of Bridges by Cast in Situ.
- ❖ The Pre Cast Girders can be Casted simultaneously along with substructure construction and hence the structure duration could be reduced **by 184 days (35 to 40 percent)** over the Construction of Bridges by cast in Situ.
- ❖ The Precast construction can achieve not only faster rate of construction and can also bring down the estimated cost by **1.96 Crores (3 to 5 percent)** over the Construction of Bridges by Cast in Situ method with lesser labour inputs and minimum disturbance to the existing traffic.

#### References

##### Journal papers

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