Delay Analysis of Highway Construction Using Primavera

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Abstract
Delay being developed industry is an overall marvel, especially in interstate endeavors, and there is no unique case. It is extensively recognized that an errand is productive when it is done on time and cost. Tragically, the colossal number of advancement adventures fails to follow the organized schedule due to various reasons and thus conceded. In any improvement undertaking, arranging and concede assessment transforms into an essential to restrict delays—the utilization of an advancement plan to envision the endeavor fulfillment time. Delay in the zenith of the undertaking can assemble the expense of the endeavor. Errand Management is an essential fundamental capacity in the advancement of the business. Little exercises will be managed capably truly; while immense enterprises aren’t likewise, gigantic errands will be better dealt with by utilizing PCs. Various combinations of programming packs are offered with the assistance of that adventure. The heads will be done basically. In street advancement, inside and out, different resources are required for execution, and besides, the peril is extra during this kind of adventure. Hence, genuine masterminding and booking are required in massive errands to ensure that an improvement adventure is done on time and within the budgetary arrangement. In our errand, an undertaking is made in arranging and defers assessment of vacillated practices stressed in turnpike advancement in Thanjavur area, Tamilnadu, by using primavera programming. The length of the interstate is 47.835 Kms. Four-way arrangement of versatile black-top includes improving channels, minor expansions, huge frameworks, Flyover, VIPs, PUPs, etc. It wanted to 730 days. The improvement unit’s primary goal is to complete the work as an express on time with the proper use of the apparent considerable number of advantages like work, materials, cash, and equipment. To achieve the above goal is to execute the endeavor most financially better, similar to money and time. This examination’s guideline focuses on inspecting the delays being the developed of the expressway and controlling the time and cost of the endeavor.

Keywords
Delay analysis, Highway Construction, Primavera, Time and Cost

I. Introduction
General

Being developed, the word concede suggests something happening soon than masterminded, expected, and decided in an arrangement or past the date that the social events settled upon for the movement of an endeavour. Deferral is the moving down of work interminably improvement inside and out. That can incite time to overpower either past the understanding date or past the date that the get-togethers have settled upon to transport the endeavor. Concedes masterminded into non-excusable deferrals, sensible non-compensable delays, justifiable compensable delays, and concurrent deferments. Deferments in an improvement adventure can be an issue and a particular issue for social affairs, such as clients, specialists, and authoritative laborers. Various disagreeable effects can occur as the results of specific deferments. To lessen this issue from occurring, the heads should be made carefully inside our endeavor coordinated as the eventual outcome of the alternate problems that arise close by the deferrals being developed. There are different methods to be seen by all social events, so annoying things won’t happen. Delays being created endeavors are the very zenith of need.

Objective of the Study
According to the accompanying, the central objective of this endeavor is to inspect the deferments in an advancement adventure by distinct composing study, site activities, and discernments made. Low down composing assignment to describe the various reasons for deferment being developed endeavors. Research on advancing Project site to watch the
activities and to recognize delay factors. Confirmation of Critical Path using Primavera. The assessment similarly incorporates the path toward booking and following an improvement adventure development in programming and related to getting the ball rolling projects in light of deferrals.

II. Literature Review

Murali Sambasivan and Yau wen soon (2007), in a research paper named "Causes and effect of deferment in the Malaysian construction industry," investigated and organized philosophy and tried to explore the impact of unequivocal causes and express effects of undertaking delays. They recognized essential drivers and consequences of deferment of advancement adventures in Malaysia by coordinating a suitably arranged survey audit with clients, guides, and legally binding specialists. Furthermore, they separated the ten most critical concede causes and six special effects of deferrals, and a trial association between them was set up.

Abd El - Razek. et al. (2008), in their investigation named "Explanations behind postponement in Building improvement Projects in Egypt, a survey audit drove and perceived most critical explanations behind deferral being developed endeavor. They contemplated that owners and impermanent laborer’s social occasions differ on the overall centrality of various deferral segments, by and large blaming each other for concedes using essentialness record and spearman rank relationship. Study results prescribed that cooperation is expected to decrease delay.

B. Indhu, P. Ajai (May 2014) for the circumstance study named "Examination of conceding the heads in an improvement adventure - A relevant investigation" recognized most critical factors causing delay and the effect of deferral on the endeavor length. A segment of the components causing delays are atmosphere, no genuine ideal deftly of spending plans and resources, impermanent laborer and client-related and changes in schedule and drawing. The enormous effects of deferral are time and cost influence, diminished work productivity, delay in work, change in labor task, etc.

Kevin J. Shah, Prof. M. R. Apte (2015) for the circumstance study named "Purposes behind Delay in Construction of Bridge Girders," Frequent site visits were done in an advancing range supports improvement adventure and assembled the data from the site for each development of advancement of augmentation uphold and differentiated and its orchestrated length and certifiable term. Perceived the noteworthy purposes behind postponement and the effect of these in the endeavor term. Explanations behind deferral have a direct impact on time overpower and cost attack for the whole errand. Most of the purposes behind deferrals are associated with brief laborers. A segment of the causes is outside the capacity to control all the endeavor social affairs, such as fluctuating site conditions, unforeseen atmosphere, etc. In the overall commitment of deferral, a brief specialist has close about most obligations.

SreeLekshmi A, VishnUnnikrishan (June 2018), in a research paper named "Orchestrating and concede examination of a private complex: A relevant investigation," considered the masterminding, arranging, and following of an advancing multi-storeyed private structure advancement adventure. Schedule orchestrated by the pros was focused explicitly, and the data was gone into Project the chiefs programming Primavera P6 to make the plan and new arranging was done at a smaller than usual level by taking commitments from the legally binding laborer and pondering the authentic effectiveness of works and openness of advantages. Ensuing to encountering genuine reports, the following was improved for different time frames. Time influence examination is performed on the latest revived schedule to get the endeavours new delayed completion date
III. Methodology

IV. About The Study

Case study on, four laning of Cholapuram – Thanjavur section of NH-45C highway construction project length is 47.835 kms. Including 184 nos. structure works in the state of Tamilnadu.

Construction Period : 24 Months  
Project Started : 06/09/2018 
Client : NHAI  
Location : Thanjavur

Project Specification

a) Roads (Flexible Pavement Crust)  
Sub grade 500 mm thick  
Cement Treated Sub base 200 mm thick  
Wet Mix Macadam 150 mm thick  
Dense Bituminous Macadam 50 mm thick  
Bituminous Concrete 40 mm thick

b) Structures  
Reinforced Concrete Structure
c) Concrete
M15 grade – Levelling course / P.C.C. below
Foundations and approach slabs
M20 grade – Carriage waykerb
M30 grade – Approach slabs
M35 grade - Foundations, Piles, Pile caps,
Abutments, Piers, Pier caps, Dirt
Wall and Bracket.
M40 grade – Crash Barriers, Centre
Median and RE wall panels.
M50 grade – PSC Girders.

d) Steel
High Yield Strength Deformed Bars Fe-500D

e) Prestressing
Post Tensioning with High Tensile Steel Wires/Strands

f) Expansion joint
40mm Strip Seal expansion joint system.

g) Bearings
Elastomeric Bearings
POT/PTEF bearings

Project Planning

a. Errand orchestrating is an uncommonly urgent and moving activity to execute work in all advancement adventures. Masterminding incorporates posting activities or tasks in an endeavor, assignment, and posting the need for materials, equipment, and money to accomplish the ambitions. Moreover, cost appraisal is done through masterminding measures. A fair masterminding action helps in arranging and preparing a plan for the work. Rule focus of an endeavor orchestrating is recognizing the various tasks and activities expected to accomplish work and evaluating the proper time for achieving that particular activity considering bury relationship with other back to back activities drew in with that work. To develop a suitable course of action in any endeavor is an incredibly essential task. Cooperative basis, time examination, and booking are associated with adventure organizing. For a masterminding cycle, wellsprings of information will be taken from surveying workplaces, adventure bosses, field creators, chief, and authoritative specialists. Suitable organizing helps in giving useful resources and time to accomplish the activities. A course of action fuses the going with terms:

b. Budget
c. Estimate
d. Time schedule
e. Sequence of completion of each part of work
f. Cash flow budget
g. Manpower planning
h. Equipment and material planning.

Steps involved in Project Planning

A project planning involves following steps:

a. Define the scope of work
b. Preparing list of activities to be performed
c. Preparing network diagram or a logic to establish relationship among different activities
d. Analyzing the network diagram to work out project period, vital and noncritical activities during a project
e. Determine the critical path with the assistance of critical activities Establish standards for the resources (material, men, machinery and money)
About Primavera

Primavera is an attempt adventure portfolio the heads (PPM) programming. It joins adventure the board, booking, resource the chiefs and risk examination, etc., it helps with masterminding, supervise, and control adventures. Accordingly, it is a gadget that energizes you to produce Program containing Activities with Resources (Materials, Manpower, Machinery, and Money) against Time. It moreover helps in separating Critical Path, performs Earned Value examination (when the undertaking is under headway), produces reports, for instance, Resources Histogram, Monthly Budget, and Overall Budget.

Construction Delay

Time is money, and that is particularly evident on an advancement adventure. Right, when improvement adventures don't run on time - the impermanent laborer suffers considering the way that his overhead and costs increase (eating into benefits), and the owner suffers considering the way that he can’t begin his new business on time, which causes lost advantages that he may have been getting. This way, keeping adventures on their basic way designs is enormous. In light of everything, delays on colossal advancement adventures are fundamental because improvement adventures are problematic and incorporate a variety of players. Everyone must participate reliably to avoid delays. Besides, when an endeavor is conceded, the request that is unavoidably presented is who can, in case anybody, for the costs related to the delay. This will rely totally upon the language inside the understanding managing the assignment.

Delay Analysis Results

The following reasons were determined throughout this project work, which may be control accountable for delays,

- Physical possession of the Project site/Land acquisition.
- Issuance of NOC by PWD/WRO, Govt. of Tamil Nadu.
- Shifting of High Voltage Transmission Line.
- Shifting of Water Supply Pipe Line.
- Unforeseen underground utilities shifting/diversion delay.
- Sudden Cyclone “GAJA” & Monsoon rain caused delay in project progress.
- Granting Permission for Extracting Soil from Borrow area.
- Corona Pandemic “COVID-19”

From this project study, the causes of the delay reasons can be listed as below table 1

![Table 1 Reasons for delay in our project](image-url)
Work Completion Details as on Date:
1. Road Works as on Date

| S.No. | Item of Works    | % Complete | % Incomplete |
|-------|-----------------|------------|-------------|
| 1     | Clearing & Grubbing | 82.83      | 17.17       |
| 2     | Embankment       | 18.27      | 81.73       |
| 3     | Sub grade        | 12.37      | 87.63       |
| 4     | Cement Treated Sub base | 10.84      | 89.16       |
| 5     | Wet Mix Macadam  | 8.99       | 91.01       |
| 6     | Dense Bituminous Macadam | 7.06       | 92.94       |
| 7     | Bituminous Concrete | 0.00       | 100.00      |

Table 2 Roadwork Completion Details

2. Structure Works as on Date

| S.No. | Item of Works | % Complete | % Incomplete |
|-------|---------------|------------|-------------|
| 1     | Culverts      | 49.51      | 50.49       |
| 2     | PUPs          | 50.00      | 50.00       |
| 3     | VUPs          | 00.00      | 100.00      |
| 4     | Minor Bridges | 33.93      | 66.07       |
| 5     | Major Bridges | 00.00      | 100.00      |
| 6     | Fly Over      | 00.00      | 100.00      |
| 7     | ROB           | 00.00      | 100.00      |
3. Other Works as on Date

| S.No. | Item of Works                          | % Complete | % Incomplete |
|------|----------------------------------------|------------|--------------|
| 1    | Toll Plaza                             | 00.00      | 100.00       |
| 2    | Road Side Drains                       | 1.57       | 98.43        |
| 3    | Road Signs, Markings, Km Stones         | 00.00      | 100.00       |
| 4    | Crash Barrier                          | 00.00      | 100.00       |
| 5    | Bus Bays & Rest Areas                  | 00.00      | 100.00       |
| 6    | Plantations -Road Side                 | 00.00      | 100.00       |
| 7    | Misc. work                             | 51.00      | 49.00        |

Table 4 Other Work Completion Details

4. Overall Project Status as on Date

| S.No. | Item of Works | % Complete | % Incomplete |
|-------|---------------|------------|--------------|
| 1     | Road          | 9.96       | 90.04        |
| 2     | Structure     | 34.18      | 65.82        |
| 3     | Other         | 0.78       | 99.22        |

Table 5 Overall Work Completion Details
V. Conclusion

The Primavera Software offers simple to utilize decisions while playing out any endeavor. The cost of individual work separately can be known close by length. From our assessment, it might be shut the Construction started in September 2018. The size of the Project as per standard Schedule is 730 days. Following until April 2020 revealed 9.96% completing road works, 34.18% structure work, and 0.78% of various positions, the assignment's overall fulfillment is 20.00%.

Purposes behind deferral in my assignment are recognized by the direct visit and predict the endeavor's fulfillment's unpleasant date. The monumental purposes behind deferrals in our road adventure are Granting Permission for isolating soil from cart locale, Physical responsibility for undertaking site/Land getting, Issuance of NOC by PWD/WRO, Govt. of Tamil Nadu, Shifting of Utilities, Cyclone "GAJA"/Rain and Corona Pandemic COVID-19. The transitory laborer has introduced its revised advancement plan as per the conditions of arrangement and solicitation time growth of 364 days. The altered advancement plan has no association with the primary embraced base Schedule.

Recommendations for Future Study

In this research, we have studied causes of delay in highway construction and claim for time extension have only been considered. It is recommended to further study and analyse the cost of delay in this project.

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OVERALL PROJECT COMPLETION DETAILS

| Category        | Completed Works | Incomplete Works |
|-----------------|-----------------|------------------|
| ROAD WORKS      | 9.96            | 90.04            |
| STRUCTURE WORKS | 34.18           | 65.82            |
| OTHER WORKS     | 0.78            | 99.22            |

R O A D  W O R K S  S T R U C T U R E  W O R K S  O T H E R  W O R K S
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