International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 02 | Feb 2019 www.irjet.net p-ISSN: 2395-0072
One Day National Conference on Recent Advancement in Civil Engineering (RACE 2K19)
25th February 2019
Organized by
Department of Civil Engineering, T John Institute of Technology, Bangalore-83

CONSTRUCTION APPROACH AND SCHEDULE TECHNICAL FOR TREATMENT PLANT

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***Abstract*:-** Construction of the Waste Treatment Plant will occur over multiple phases for various aspects of the work. Each work phase will require different resource levels, staging requirements, materials, equipment, and overall durations. In addition, each phase will result in varying impacts to the site and its surrounding area in terms of noise and vibration, dust, light and glare, erosion, traffic impacts, and workforce requirements. The following sections provide a discussion of the major phases that are anticipated to occur over the course of the plant construction, and the expected impacts that will result during each phase. Work described herein is related to the construction of the 36 mgd treatment plant required by 2019. Work related to future capacity expansions is not accounted for in this document.

Index Terms:-Treatment plant, construction, scheduling, pri- mavera, EVM,

I. INTRODUCTION

Since the 1960s INDIA has been designing and constructing regional wastewater treatment and collection systems. Begin- ning with the initial treatment plants at Renton and West Point, the organization that is now the Wastewater Treatment Division within the Department of Natural Resources and Parks has expanded treatment capacity, improved the level of treatment, and built collection systems as necessary to respond to the growth of the region over the past 40 years.

There have been major upgrades and expansions to wastewater treatment and conveyance facilities in the 1980s and 1990s. The work performed as part of those expansions and upgrades resulted in high-quality and reliable facilities that have performed to required standards for many years. As these projects were constructed, the work conformed to rigorous schedules and budgetary controls, as well as environmental controls. The work was also performed in a manner that recognized and addressed local community concerns related to construction.

The Brightwater System will be implemented using approaches and methods of construction that have been successfully utilized on similar projects in the past and that are safe, reasonable and reliable approaches in the construction industry today. This TM describes the major elements of work required for the Brightwater Program, provides descriptions of the anticipated processes for performing the work and provides the anticipated schedule for each activity. It describes the anticipated impacts at each major work location, including proposed wastewater treatment facilities, conveyance systems and marine outfall alternatives as described in the Brightwater Draft Environmental Impact Statement (DEIS).

II. LITERATURE REVIEW

This literature review on wastes from water treatment plants discusses previous literature reviews on the subject, sources and types of waste, characteristics of each type of waste, and waste management. The discussion of management of sludge (waste) covers minimizing sludge production, methods of sludge treatment, and ultimate sludge disposal.

During the period 1969 to 1981 the American Water Works Association (AWWA) Research Foundation and the AWWA Sludge Disposal Committee prepared a series of reports with a comprehensive literature review on the nature and solutions of water

treatment plant waste disposal problems. The first report, prepared by the AWWA Research Foundation, was divided into four parts (AWWA Research Foundation, 1969a, 1969b, 1969c, 1970) and was entitled"Disposal of Wastes from Water Treatment Plants." The first part of this report (AWWA, 1969a) covered the status of research and engineering practices for treating various wastes from water treatment plants. The second part (AWWA, 1969b) reviewed plant operations for the disposal of various types of wastes, and the regulatory aspects of disposal. The third part (AWWA, 1969c) described various treatment processes employed and their efficiency and degree of success, and presented cost analyses. The last part (AWWA, 1970) summarized research needs, engineering needs, plant operation needs, and regulatory needs.

In 1972, the AWWA Disposal of Water Treatment Plant Waste Committee published an updated report (AWWA, 1972). It dealt with processing and re-processing in sludge production, i.e., selection and modification of treatment processes, reclamation of lime and alum, recovery of filter backwash water, processing of wastes to recover useful by-products, processing of wastes for disposal, ultimate disposal, and future research needs.

In 1978, the AWWA Sludge Disposal Committee prepared a 2-part article (AWWA Sludge Disposal Committee, 1978a, 1978b) entitled"Water Treatment Plant Sludge an Update of the State of the Art." Part 1 dealt with regulatory requirements, sludge production and characteristics, minimizing of waste production, and European and Japanese practices. Part 2 de- tailed non-mechanical and mechanical methods of dewatering water plant sludges, ultimate solids disposal, and research and development needs. These reports focused mainly on coagulant sludges. In 1981, the AWWA Sludge Disposal Committee provided an overview of the production, processing, and disposal of lime-softening sludges; recent technological advances in handling, treatment, and disposal of softening sludges; and research needs (AWWA, 1981).

III. METHODOLOGY

The construction projects are so vast and complex in nature and therefore for simplification of work, use of softwares came into existence. The project was scheduled and monitored using Primavera P6 software. Primavera is the Project Management software use for Planning, Scheduling and Controlling the Construction Project. The steps involved in treatment plant are Earthwork, Concrete Work, Brickwork, Plastering, Flooring, Plumbing etc.

The WBS for the project is created and several activities are identified. The durations of the activities are estimated on basis of Historical data, interviews with project manager, applying labour productivity factor formulae and application of analysis of rates. The relationships are examined and applied to the activities. The following procedure involved in scheduling and monitoring projects.

A. Objective of Study

The objectives of this study are:

- To identify construction sequence for a treatment plant construction.
- To work out the practical durations required to carry out the activities.
- To identify scheduling technique used by the organization in developing plan and scheduling.
- To develop scheduling using Primavera project planners software.
- To track the project and analyse the reasons for delays, and increase in estimated budget etc.
- To investigate defects in the planning and scheduling procedure of the organization, and suggest suitable improvements in their methods.

B. Use of PMS in construction

The construction industry has a poor image in general. In 1999 alone, in the India, the industries spent more than 1 billion on rework and in 2003, more than 1 5 billion on performance measurement applications .In spite of high expenditure, only 34% of construction projects today meet the iron triangle criteria. During the review we found Primavera and MS Project to be the most frequent PMS used in the construction industry .In the India, over 64 of construction companies indicated Primavera as their specified software, with only just over 20 % requiring the MS Project.

Primary reasons for using a PMS in the US construction industry were (in ascending order) a periodic control of work after the start of construction, development of 'look ahead' schedules, coordination of subcontractors, detailed planning of work prior to construction, schedule impact, claims analysis, tracking of changes, coordination of own trades, estimating and bidding, tracking shop drawings and submits, calculating payment requests for work performed, design development, operation and maintenance of projects, tracking costs and materials planning. This affirms that the construction industry still sees and acknowledges the PM mainly as Critical Path Method (CPM). Nonetheless, it is encouraging that academia anticipates that by the end of this decade, the industry will have implemented the PMS in their day-to-day business. Furthermore, in the area of IS, a resource and an IT management have become the most frequent topics of discussions today.

1) PMS in the SEE construction: The construction industry in the SEE has even lower performance than that of the developed countries. Following the end of the socialist regime, where software development was mostly carried out through the internal IS functions of a large government controlled enterprises the economic and political pressures have been forcing the industry to change its everyday processes listed the purposes for the IS use in the SEE construction industry: 98 % for accounting and bookkeeping, 89,8 % for personnel management, 79,6 % for spreadsheets, 73,5 % for cost prediction, bidding and Bills of Quantities (BoQ), 53,1 % for CAD and only 28,6 % for scheduling. This indicates that the sector is still trying to Cope with traditional management procedures through accounting and that the SEE is still a transitional economy.

In addition, the SEE construction has a specific business culture. Unlike the US, the SEE countries have a strict law regulation that defines project stakeholders. There are three main management perspectives: investors (sponsors, developers), consultants (project managers, designers, architects, supervision) and contractors. Owing to the former socialist regime policy, the project management is still unknown to the construction companies. It was introduced into the Croatian regulations only recently, in 2008, while Slovenia and Bosnia and Herzegovina still have no such terminology in place. Furthermore, construction companies are not allowed to appear in projects of two different functions at the same time, for instance in a project management and building or a project management and design. Hence, the 'Design and Build' types of projects are not allowed by the law in Croatia. Construction projects are under strict government control and their performance has to be reported by the law defined templates. This is mainly the responsibility of the supervision and the contractor. For this reason, the supervision and the contractors are actually the ones who manage projects, while project managers are often put aside and seen as an obstruction to the construction process.

C. Construction, Planning, and Scheduling Tracking

1) Construction Planning: Construction planning is a fundamental and challenging activity in management and execution of construction projects. It includes the selection of technology, the definition of work task, the estimation of required durations and resources of individual task, and identify the interactions between different work tasks. A good construction plan is the base for developing the schedule and the budget for work. Developing the construction plan is a critical task in construction management, even if the plan is not written or else for ly recorded.

During planning a planner begins with a result (a design) and he must synthesize the steps required to yield this result. The necessary aspects of construction planning include the generation of required activities, analysis of the implications of these activities and the choice among various alternatives methods of performing these activities. A planner must imagine the final design and describe it in plans and specifications. In developing a construction plan the importance is given either cost or schedule. Some projects a primarily divided into expense categories with associated cost in these cases planning is cost

oriented. In this category, a distinction is made between cost incurred directly in the performance of the activity and indirectly for the accomplishment of the project.

For other projects where time is a critical or the planner ensures that proper predeceasing among activities is maintained and that efficient scheduling of the available resource prevails. In such cases a critical path scheduling procedure is followed. Finally most of the complex projects require considerations of both cost and schedule over time, so that planning; monitoring and record keeping must be considered in both dimensions. In these cases integration of budget and scheduling information is a major concern.

2) Scheduling: Scheduling is determination the timing of events in the project that is when and which task will be performed? Putting it in simple words it is a reflection of plan. In other words we can say, planning is How, What and Who whereas scheduling is when and why. Scheduling can be also defined as the detailed plan of the project work tasks with respect to time. A schedule is al so a good communication tool between all the stakeholders of the project. Schedule gives an overall sense of expected progress of the project without schedule it is very difficult to explain someone unfamiliar with the project what is going on and what is expected to take place

3) Tracking: Tracking is the process of collecting, enterin‘g and analyzing of actual project performance values, such as work on tasks and actual durations. Tracking is the second major phase of project management. The main thing to focus on project planning is developing and communicating the details of project plan before actual work starts. When work begins, the next phase of project management is tracking progress. Tracking means recording project details such as what work did by whom, when the work was done, and at what costs these details are called as actual. Properly tracking actual work and comparing its against original plan is useful to identify the difference in actual and planned and it enables to adjust incomplete task of the plan.

IV. RESEARCH METHODOLOGY

Research methodology is designed in three stages:

A. Data Collection

This stage consists of literature review, setting of objectives and problem statement and based on that selection of research area has been done. For the research purpose, residential building is taken as a case study. The data collection has been done in three parts:

1) Daily progress reports: The DPR consist of detailed description of the work done, labor and resources required for the work and record of the inventory. All the DPR from the starting day of project till now have been collected. Sample of DPR is given in Appendix A.

2) Work Output of labor: Work output is the amount of work done by one person (Labor) in 1 day. It is used to calculate durations required for activity based on the available manpower on site.

3) Activities with their planned duration: Total activities for construction of the residential project with their planned duration (based on work output and man power available on site) are entered in primavera for further working.

B. Data Analysis

For data analysis each activity of construction of building are found out and noted down, which are used in Primavera software for working. Practical construction sequence is under- stood during field training and is used in linking of activities in primavera along with provision of necessary lag (Float) in predeceasing and succeeding activities. Resources required for each activity have been allocated in primavera along with their cost, which have given a cost of total project, which will be

further referred to actual cost.

C. Resource Planning

In planning resource requirement the following points to be considered:

a) The total resource requirements for a project over its duration.

b) Minimum delay in completion of the project when insufficient resources are available.

c) Most efficient utilization of resources to carry out the project in a fixed time.

Resource planning is the process of making sure resources are available as required to execute the project according to schedule. Two types of resource planning problems exist while preparing schedule. In one, the project faces a scarcity of resources and the activities on network must be arranged in such a way that the requirement of resources does not exceed availability. In case such an arrangement is not feasible, the one which gives the minimum additional requirement of resources is chosen. The resources are allocated among competing activities in the order of importance. In other type of resource planning problem the scarcity condition is relaxed and what is needed is to level up the highly fluctuating demand for resources at different times, primarily to facilitate project supervision and enhance efficiency.

D. Cost Estimation

Cost estimating is the process of calculating the cost of the identified resources needed to complete the project work. One doing estimating must consider the possible fluctuations, conditions and other causes of variances that could affect the total cost the estimation. There is distinct difference between cost estimating and pricing. A cost estimate is the cost of the resource required to complete the project work. Pricing however includes a profit margin. During the actual execution of the construction, detailed analysis of costs are required to be made. The cost estimates prepared during the design stage may not be sufficient or applicable during the execution stage. During the execution stage, the control estimation system serves two useful purposes. It develops the production information for materials, labour and equipment that can be used as inputs for future estimates. It generates information so that one may study to take corrective measures to minimize the cost at any step.

1) Cost Estimate Inputs:

- Using the Work Breakdown Structure
- Relying on the resource Requirements
- Calculating Resource Rates
- Estimating Activity Duration
- Historical Information

2) Estimating Project Costs:

- Analogous Estimating
- Parametric Modeling
- Bottom-up Estimating
- Computerized Tools

3) Outputs From Cost Estimation:

- Cost Estimates
- Supporting details
- Cost management plan

E. Concepts of EVM

Earned value analysis is a method of performance measurement. Earned value is a program management technique that uses work in progress to indicate what will happen to work in future. EVM is system for planning and controlling the project cost performances. EVM establish work packages earned value baseline by integrating project scope, time and cost objectives .This baseline is called as cost control and is used for Performance evaluation of project on a given date. Analysis of variance from the baseline provides the cost related informations for problem identification, trend analysis and corrective actions such as re-planning and revising budget. Earned value analysis serves two main purposes, it analyses cost changes which is resulting in time and cost over-run or under-run so that timely corrective actions are taken such as modification of cash flow, updating financial forecast and project profitability expectations. Analysis of variance from baseline using earned value management systems given variety of variances which are analyzed to provide current status of project, to initiate corrective actions and to forecast future trends.

F. Sschedule Analysis

Earned value is a technique for measuring project performance according to project cost and schedule. The comparison between budgeted and actual performance is performed. There are three earned value parameters as shown below.

Planned Value (PV): It is the cost of the project according to the schedule of the project. It is also called Budgeted Cost of Work Schedule (BCWS).

Earned Value (EV): It is the Budgeted Cost of the Work Performed (BCWP) till date. It is cumulative budgeted cost incurred in activities that have been completed on the due date.

Actual Cost (AC): It is the actual cost that has spent on the project till date. It is also called as actual Cost of Work Performed (ACWP).

The variances are used to check deflection or deviation of project from the path of original schedule. It is also used to analyze the extent and cause for the delays of works or tasks of the project. Following are two variances:

Cost Variances (CV): It is used to check the difference between the proposed planned project and present project on the specific date. It shows the variation of project in form of cost.

Schedule Variance (SV): It is used to examine the deflection of present project in from the planned project. If considerable change appears than the project objectives must be revised.

Schedule Performance Index (SPI): SPI can be used to estimate the projected time to complete the project. It is calculated as follows,

SPI = Earned Value / Planned Value SPI = 1 means Project is on Schedule

SPI lessthan 1 means Project is behind Schedule

SPI greaterthan 1 means Project is ahead of Schedule Cost Performance Index (CPI):

CPI can be used estimate the project cost to complete the project based on performance to date. It is calculated as follows,

CPI = Earned Value / Actual Cost

CPI = 1 means Planned and Actual cost are same CPI lessthan 1 means Project is under Budget CPI greaterthan 1 means Project is over Budget

Estimate at Completion (EAC): The Estimate at Completion is the actual cost to date plus an objective estimate of costs for remaining authorized work. The most common is

EAC = Actual cost + Estimate to Complete

V. CONCLUSIONS

The provision of centralized wastewater collection and treatment for a subdivision with failing onsite sewage systems was evaluated. Collection systems evaluated consisted of con- ventional collection systems, vacuum Collection systems and pressure systems using individual grinder pumps. Treatment systems evaluated included individual package wastewater treatment plants for each subdivision, regional wastewater treatment plants treating wastes from several subdivisions and collecting and transporting the wastewater to existing wastewater treatment plants in the closest municipality. Likewise, an analysis for the proposed developments in the southern portion of the county was also completed. The analysis for the proposed developments was similar to the analysis completed for the existing subdivisions with failing onsite sewage systems.

EVM provides important information for project work pack- age decision making. The efficiency of project is demonstrated by SPI is 0.88 which is less than 1 hence project performed less efficiently and running at about 88% of the planned schedule. The study shows important, implementation and unique features of EVM that benefits project managers and ultimately results in project success.

The key point here is that Earned Value Analysis enables you to spot a potential problem early in the project and do something to correct the situation. Earned Value Management is a remarkable method of project management because it integrates cost, schedule and scope and can be used to forecast future performances and project completion dates. It allows projects to be managed better on time and in budget.

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