

Factors Affecting Overruns Construction Time and Cost: A Case Study

Surabattuni Murali, Sanjeet Kumar

Abstract: Achievement of any construction venture depends on the timely completion of project within the specified budget. Method of execution, management of workers, equipment, scheduling and cost are some of the factors that affect the project management and these factors are the reason in for the cost and time overruns around the world. This study objective is to identify and prioritized the major causes of time and cost overrun in construction industry using a completed project. Data is collected from Shan-E-Awadh-ground anchoring project, Lucknow, the data is analyzed and compared with the estimated and actual budget schedules to understand the causes of cost and time overruns. Factors are identified from the project using questionnaire with the help of people, who worked for the project through various parties like consultants, contractors, site engineers, etc. The results of the study shows that main factors of the time and cost overruns are poor material management, site conditions, unskilled labours, contractor financial difficulties, machines and equipment difficulties. By obtaining the results and analysis of factors recommendations are suggested as possible remedial solutions for the forthcoming projects. These types of study will help for the new projects which are yet to come in the same season for the proper implementation of construction project.

Keywords: Project, Lucknow, Cost, Time, budget, Management.

I. INTRODUCTION

Construction industry around the world contributes to the socio-economic and infrastructures development growth of any region. In developing countries, vital indicator of the development is construction industries and its opportunities to grow faster. The construction industry is dynamic in nature due to the increasing of uncertainties in technology, budgets and development processes around the world. Time and cost overruns in construction industry or venture these days, become a serious issue around the world and in India during last few decades. Increasing need of infrastructure for the growing population around world, especially in developing countries, the project managers need to deliver assigned projects in time and within the estimated budget. A large number of construction projects in India have been delayed due to various reasons and issues, which has been studied by different researches, but these reasons in India varies from place to place, due to topography of the country [8]. Schedule delays and cost overruns are the most common and serious problem in construction industry, a survey conducted in water drilling projects in Ghana, founds that thirty three out of forty-seven projects are completed in between 1970 to 1999 were delayed and above 38 projects

were facing overruns, according to the owners, contractors and consultants rise of material rates, material Arrangements, funding difficulty from clients was the most important delay factors in Ghana [1]. Survey of literature showing that construction projects in a lot of countries are still facing problem of schedule overruns which needs very serious attention, in Indonesia, 31 high rise buildings causes the time overruns effectively and the most significant factors are to be change of design, poor labour efficiency, inadequate planning, lack of resources, project management consultants believe that contractors are liable for time overrun in construction industry [2].

Successful project management can exist by finishing the project deliverables and objectives within the specified time and designed budget [3]. Basically, factors which are causing time and cost overruns is different from nation to nation and also depend on the economic, political and geological factors, mainly there is no proper method to check the ability level of the workforce before deploying to work and lead to poor output. Time and cost overruns factors are sometime mainly associate with human resources, which highly influence the cost overrun [4]. The successful completion of projects always requirements specialized to do contract work and suit model to real project situation, a method that closely stipulates possibility study on contractor selection and financing [5]. The main achievement of the project should view from the various potential of individuals by a client, contract department, and general public, by which these all common factors of parameters such as time and cost performance [6]. In many countries grant for construction activities is used en route to regulate the economy. As the construction industry continues to grown-up in size, due planning and budgeting problems were occurring an example of northern bypass Kampala which was planned to take two and half years to construct and instead took more than five years and cost also greater than before more than 100%, reduce the alters in the work scopes, as this reduces the maximum impact on cost and time overruns [7].

In developing countries the growth of construction industry will help to anchorage the rise of nations GDP and give the many employment opportunities to the people. The factors of cost and time overruns in highways construction in India are variation in the cost of materials, not having an experienced consultant, lack of quality equipment, equipment availability [8]. Cost overruns having noticeable effects on the construction industry and key stakeholders. These can receive the bad reputation and incapability to

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Surabattuni Murali, Post-Graduate Student, Department of Civil Engineering, Koneru Lakshmaiah Educational Foundation, Deemed to be University, Andhra Pradesh, India.

Sanjeet Kumar, Associate Professor, Department of Civil Engineering, Koneru Lakshmaiah Educational Foundation Deemed to be University, Andhra Pradesh, India.

sheltered project financing or securing is highly effective, changes and raising of materials rates are getting an important factor for these overruns, material rates and labour costing prices should be updated constantly [9].

In India, the construction sector has contributed an estimation of 308 billion to nationwide GDP in 2011-2012 (a share around of 19%). Over 35 millions of people having employment through this sector and 500 construction companies were located in country. There is need to take importance of these time and cost overruns with an immediate effects of measures. The top five factors that causing time and cost overruns in India are changes in material rates, financial instability, currency exchange, political insecurities, and high competitors [10]. Government data suggests that 60% of projects are overwhelmed by time and cost overruns an trends, Mc Kinsey estimates that loss of GDP, US\$200 Billion around 10% in GDP financial year 2017[11].

The present study focus on the examination, identifying and prioritizing of major causes of schedule delays and cost overruns in the construction industry, using data from ground anchoring projects based on a Shan-E-Awadh project in Lucknow; there are many factors that can cause schedule delays and cost overruns in ground anchoring projects. Those are ranges from factors of material management and some of the physical, social, environmental and financial factors which can cause delays and cost overruns. This paper identifies the causes of schedule delay and cost overruns in the Shan-E-Awadh project in Lucknow construction of ground anchoring projects with the objectives of : a) To find the factors and reasons causing schedule delays and cost overruns in construction projects. b) Instructing the recommendations to lessen or minimize cost overruns& schedule delays: hence to reduce similar affects on other construction projects.

II. MATERIALS AND METHODS

The nature of work in soil anchoring projects and the environment which is causing delay and cost overruns, it was mainly depended upon the conditions of the site mainly like soil, air quality, transportation facilities, and weather conditions. Some of the influential factors of time and cost overruns for these kinds of projects are caused by poor technical performance due to improper planning. Work in these projects depends upon the types of equipment, materials; the project may be delayed lack of effective procurement procedures in scheduling.

A. Data collected

SHAN-E-AWADH project located in Lucknow, Uttar Pradesh, India and near to the river of Gomati. So the soil condition is very poor because of sandy conditions, after the laboratory tests of soil, they were confirmed that soil anchoring is necessary for the construction of the project. The table 1. Shows the different data collected relative to the project about the duration and cost of the project.

The Ground anchoring project work in Shan-E-Awadh involving the following activities of drilling of anchor holes. Drilling for anchors was completed by rotary or pneumatic methods, as per installation pattern, sizes and lengths provided in drawings. Drilling was commencing before PCC

level and borehole sides were adequately protected against side collapse by use of PVC or MS casing. The anchor hole was perpendicular to the anchor bearing plate and the deviation of the anchor hole entry angle from its inclination as specified the Contract Documents shall be no greater than + 3 degrees. Table I explain time and cost overruns and details about the case study.

Table I: cost and schedule details

S.No	Name	Details
1	Name of the project	Ground anchoring project- Shan-E-Awadh
2	Name of the client	Nagarjuna Construction Company
3	Name of the contractor	Tech9 Engineering Solutions Pvt. Ltd.
4	Planned start date	12-February-2017
5	Planned finish date	22-April-2017
6	Actual start date	20-February-2017
7	Actual finish date	02-June-2017
8	Delay in days	40 Days
9	Planned cost	6773750 Rupees
10	Actual cost	8100000 Rupees
11	Increased cost	1326250 Rupees

Anchor Reinforcement was done was steel. Tor steel bars of 32mm diameter as per drawings will be cut to a length of the anchor including that required Development length in raft portion. The tor steel bars shall be pretreated to remove rust/oil, scaling, grease, etc. Two coats of epoxy formulation shall be applied on the re-bar. The 2nd coat shall be applied only after allowing the 1st coat to dry for 2-3 hours. Quartz sand to be sprinkled to roughen the surface. Epoxy formulation will be used to Centralizer shall be utilized to position the tor steel bar so a minimum cover of 10mm to reinforcement bar is achieved. The contractor shall determine the number of centralizers required; however, a minimum of one unit shall be placed within 1m of the bottom of the hole and another at the fixed length and free stressing length interface. As an alternative to the 2 coats of epoxy formulation, a minimum grout cover of 40mm can be provided with adequate centralizers. The grout shall entirely fill the annular space between the tor steel bar and the borehole wall in the bond length. Grouting will be done with neat cement grout with non-shrink compound CEBEX 100 or Equivalent compound. Three (3) grout cubes (7.5cm x 7.5cm x 7.5cm) will be cast for each day of grouting. One cube will be tested at 7 days while the remaining cubes will be tested at 28 days. Testing of Anchorages was also done.

At least 2% of the total rock anchors shall be proof tested to 1.1 times the design load. The load will be held at the final test load for at least 15 minutes. The anchors shall be proof tested to 1.1 times the design load in 5 increments. A jack of adequate capacity should be utilized for testing the anchors. The reaction from the jack or reaction anchors should not be within a horizontal distance of the ½ length of test anchor from the test anchor centre. The initial increment



of 10% of the design load will be applied. Elongation should be measured at each of the 5 load increments. The load will be held at the final test load for at least 15 minutes. Anchor can be deemed acceptable upon proof testing if both the below conditions are satisfied, Total elongation is less than 50% theoretical elongation of the anchor fixed length. The development length of the anchor tor steel bar will be fixed with binding wires to the raft main reinforcement bars. The anchor hole shall be made waterproof by suitable methods in conjunction with the waterproofing system for the main foundation. Adequate care shall be taken to ensure that the anchor holes are not the point of ingress for water into the foundation.

B. Methodology

This study is based on the analysis of data collected from the completed project. So, it needs proper monitoring and analysis of the construction project. The data has been collected by tendering department, contractor, account department and interviewing the officials of the construction companies (tech9 engineering solutions & Nagarjuna Construction Company), a study has broadly undertaken as follows:

1. Identify the project for the case study of time and cost overruns.
2. Proper studying of all available plans, schedules, estimates and work procedures details and collected all relevant data about the project.
3. Find out different factors causing schedule delays and cost overruns in construction projects by using the literature review.
4. Carefully prepared a questionnaire of 81 factors from previous investigations and literature reviews
5. Questionary was distributed to 40 members (design department, senior engineers, contractors, marketing dept, assistant engineers, accounts, quality department, quantity dept, a project in charges) who are worked for the project of Shan-E-Awadh soil anchoring projects. Questionary was organized in the form of scaling (1=very low, 2=low, 3= Medium, 4= high, 5=very high).
6. Analyze the data obtained from the survey and finding the important factors which are majorly caused for schedule delay and cost overruns.
7. Listed out all shortcomings and make final conclusions and suggest possible remedial solutions for the upcoming projects.

C. Analysis of Data

The questionnaire consists of 82 factors and survey was conducted to 40 members, who are worked in Shan-E-Awadh project for soil anchoring. Each response in questionnaire survey is analyzed by the method of the relative importance index method, which is described below

The calculation of the factors rating is done by given equation(1).

$$\sum_{i=1}^n (xi \times Yi) \div N$$

Where,

Xi= response of rating

Yi=number of point (values from 1 to 10)

N= number of responses

Table II: main factors of causing time and cost overruns

Factors	1	2	3	4	5	Total points (1 or 2 or 3 4or5)*no of points	Risk rating level $\sum_{i=1}^n (xi \times Yi) \div N$
1.Poor materials management	1	3	4	6	25	(1*1)+(2*3)+ (3*4)+ (4*6)+(5*25)= 168	168/40= 4.225
2. Site conditions	2	1	2	15	18	(1*2)+(2*1)+(3*2)+ (4*15)+(5*18)= 154	160/40=4.00
3. Un skilled labors/ labors strikes	3	2	5	9	19	(1*3)+(2*2)+(3*5)+ (4*9)+(5*19)=153	153/40=3.825
4.Contator financial difficulties	2	6	5	7	18	(1*2)+(2*6)+(3*5)+ (4*7)+(5*18)=147	147/40=3.675
5. Machine and equipment difficulties	3	4	7	9	15	(1*3)+(2*4)+(3*7)+ (4*9)+(5*15)=143	143/40=3.575

III. RESULTS AND DISCUSSION

The questionnaire was analyzed from the work force, who worked for the project of soil anchoring- SHAN-E-AWADH. In order to find the most important factors which influence the time and cost overruns in soil anchoring, factors were ranked based on responses. The analysis shows that, there are many important factors which influence the causes of schedule delay and cost overruns in Shan-E-Awadh project. During the survey, five most important factors which causes were the delay and cost overruns are shown in table II. These factors are poor material management (PMM), site conditions (SC), unskilled labours/labour strikes (USL), contractor financial difficulties (CFD), machines and equipment difficulties (M&ED).

Fig.1 explains about the main factors of cost and time overruns in ground anchoring project and their highest mean values.



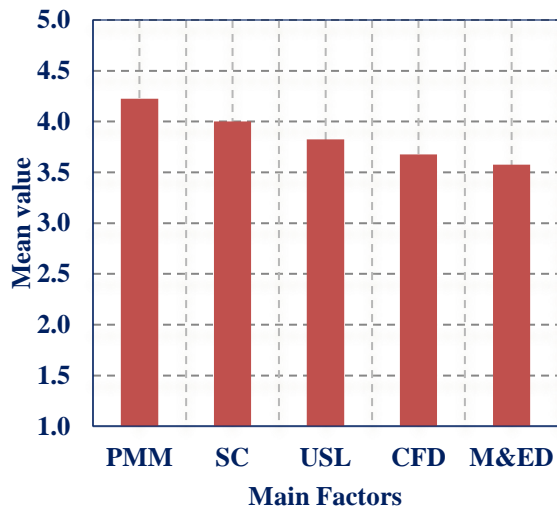


Fig. I: mean values factors influencing time and cost overruns.

By conducting the survey of people, who are worked for the project, it was found that, the project was majorly delayed by the poor material management (PMM) ranked the highest. Its shows that client and contractor has failed to provide the materials in time, like dewatering pipes and machines, cebex, fuel, and material transportation has also delayed and also transportation problems occurred during execution of project. Lack of materials and doesn't have proper planning on the usage of resources leads to delay of scheduling and causing overruns. Every successful execution of the project, material management plays a crucial role and the utilization of equipment and materials in the proper way leads to the success of the project.

The second most important factor by causing time and cost overruns in ground anchoring project is site conditions (SC) for the SHAN-E-AWADH project. Poor site conditions leads to ground anchoring process for stabilization of soil very difficult, Shan-E-Awadh project was very near to river of Gomati, having sandy conditions of soil and also having high water table and poor weather conditions to work. At time of project execution high temperatures were recorded every day, which it leads to reduce the work intensity for labours and causing health issues to labours/employees. Sandy conditions of soil take the main cause of delay by causing of reworks and it leads to cost overruns for the project.

The third significant factor identified was unskilled labours/labour problems (USL), these kinds of ground anchoring and typical projects, required skilled labours. The contractor has failed to provide the trained labours and it leads to work accidents. Some issues of labours strikes happened, the project was delayed and also it leads to cost overruns for the project in the way of compensations and allotting new workers with extra costs due to the urgency of workers.

The fourth factor was identified, Contractor Financial Difficulty (CFD). Because of financial difficulties, material procurement has been delayed and improper planning of funding to the various projects activities caused delay of this project as well as late payments to the employees and labours and paying of low wages to the labours has main reason for the schedule delay and cost runs.

Machines and Equipment Difficulties (M&ED) were ranked fifth in this project; machines were used for drilling machine, hydra, grouting pump, tractors, rollers, dewatering equipment and grout pipes. Lack of proper maintains of the machines causes the regular disturbance to the work and causing heavy problems to the machines, altering of machines also happens and transportation delays occurred. Repairing of machines in time has not happened hence, schedule delays occurred as well as cost also increased for machines repairing and altering and transportation.

Other factors were also reason for the schedule delays and cost overruns such as mainly of change of contractors, rework cost, insufficient early planning, lack of safety awareness, owner factors, labour shortage, unskilled operators for machines and contractors workload were also responsible. At the same time factors like weather conditions, material delivery, mistakes during project, poor inspections, errors in estimate, conflicts, delay in wok approvals, unexpected conditions, slow decision making, shortage of site workers, lack of communication, in effective scheduling, contract modification, project location, change of material specification, equipment availability, quality equipment, in crease of material cost, in accurate material estimate, conflicts between workers, lack of proper monitoring, lack of motivation, government regulations, lack of project staff, design delay, delay in finances, owners in decision, unethical process, lack of safety, lack of quality, language barriers, un skilled operators, lack of maintainers of machines, work suspensions, un realistic contract duration, heavy client interference etc. These factors are used to survey and founded in literature review also [1-11].

IV. CONCLUSIONS

This study investigate the main causes of time and cost overruns in construction projects based on the survey designed, for who are worked in Shan-E Awadh project for ground anchoring and focusing on finding the important factors of project schedule delay and cost overruns. The main conclusions of the survey are material management, site conditions, unskilled labours/labour strikes, contractor financial difficulties, machines and equipment difficulties. In all 81 factors, the above mentioned five factors are the taking the higher precision. Other factors were also some part of influence to schedule delays and cost overruns to the project, but not as much importance of those above five factors. The result shows that many of the problems in ground anchoring projects mainly comes from the execution of the project; project execution requires that control these kinds of factors to overcome these overruns, project management techniques of planning, directing, controlling, monitoring, procedures are needs to implement.

V. RECOMMENDATIONS

The present study analysis suggested some recommendations for the future soil anchoring projects, which reduce the delay and cost overrun as given below:



1. Materials and Machinery management is an important factor, machines which are used in the construction should be regular inspected for any defect. Material needs to be checked upon the delivery to ensure material quality at an early stage, thus replacement of the defect materials and machines should be done.
2. Proper selection of skilled labours can leads quality and productivity of the work. The development of construction time management can be done by providing accomplished manpower and provide employees with high-efficiency levels. Companies should provide knowledge and skill to workers based on their scope of the job in the project.
3. Proper funding and regular payments can help to get quality work from the workers and employees. Funding should be done in an appropriate manner and fast in the process helps to avoid delays.
4. Safety should be the main aspect of any construction industry. Proper safety precautions should be at, site includes driving vehicles within the construction site at the certain speed limit, wearing a safety helmet and safety shoe throughout work, fastened formwork, and avoiding unfastened electrical connections. The evaluation measures involve the availability of safety shoe, gloves, safety helmet, and specifying speed limits in the construction site, providing first aid supplies, provide clear safety program and conducting regular meetings to explain the safety program.

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AUTHORS PROFILE

Surabattuni Murali, Post-Graduate Student, Department of Civil Engineering, Koneru Lakshmaiah Educational Foundation Deemed to be University, Andhra Pradesh, India.

Dr. Sanjeet Kumar, Working as Associate Professor, Department of Civil Engineering, Koneru Lakshmaiah Educational Foundation Deemed to be University, Andhra Pradesh, India.

