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Delay in Construction its Causes and Mitigation: A review

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Abstract - *The construction industry is a huge sector all over the world. construction industry play an important role in increasing the gdp of the nation because the number of people involved in the sector is huge which increase the buying and spending of the people .To manage the construction industry is not a easy job and sometime which lead to delay in the construction .delay can be of any type and need special attention toward the work when the work is in progress .as the number of stakeholders is on the higher side then it is necessary to check whether they are performing their duty or not. Due to the delay several activates are disturb and which lead increase the cost of the project .The objective of this paper is to study the causes of delays in construction work and how can we reduce it by proper method.*

Key Words: Delay, Mitigation, Problems

1. INTRODUCTION

The construction industry in world is one of the important sectors that contribute to world economic growth. The industry acts as a catalyst for our economy through the creation of industries such as education, finances, manufacture, service, and many others. The problem of delays in the construction industry is a global issue. A construction project may defined as a successful project when it is completed on time, within the budget, with appropriate quality, follow the specifications and to stakeholders' satisfaction. Other than that, functionality, profitability to contractors and absence of claims have also been used as measures of project success Delay is a situation when a project is not completed within the agreed contract period. The project is skid over its planned schedule and is considered a common problem in construction projects. It is very infrequently to see a construction project is completed on time. Delays can make the disruption of work and loss of productivity get a rise, other than that completion of the project are late, increased time-related costs and third-party claims. Delays are very costly and always result in disputes and claims. Therefore, it is important to keep track of project progress to avoid the possibility of delay occurrence or identify it at the early stages.[1]

In Saudi Arabia, Assaf et. al. (2006) conduced a research about construction project delay different type of project in the state. During the study it was observed that 70% of projects experience time overrun. The survey was conducted with 23 contractors, 19 consultant and 15 owners. Seventy-three cause of delay was recognized and the causes are grouped into nine classes. The outcome of the survey that agreed by all three parties is change order. The overall results are stated that the factor related to labor, contractor, project, owner and consultant are in the highest rank. [2]

Shabbab Al Hammadi, M. Sadique Nawab.studied that the construction project consists of three phases namely: Conception, designing and Construction. Timely completion of projects is an indicator of efficient construction industry. Construction time‖ often serves as a benchmark for assessing the performance of a project and the efficiency of the project organisation.A project is said to be successful on timely completion. The time required to complete construction of projects is often more than specified time in Contract. These overruns or time extensions happens due to many reasons, such as designer changes or errors, economic conditions, resource availability and performance of project parties. Usually, majority of project delay occurs during Construction phase, where unforeseen factors are always involved.[3]

Abd El-Razek et al. (2008) studied delay in building construction project in Egypt, a total number of 32 delay causes were selected grouped according to responsibility (contractor, consultant, owner and common responsibility) and categorized under 9 groups namely (financing, manpower, Changes, Contractual relationships, Environment, Equipment, Rules and regulations, Materials, Scheduling and Control). Each delay cause was measured on a Likert scale using four options: very important; important; somewhat important; and not important. On the basis of survey and overall results, they concluded that the most important causes were: financing by contractor during construction; delays in contractor‘s payment by owner; design changes by owner or his agent during construction; partial payments during construction; and non-utilization of professional construction/contractual management.[3]

Arditi & Pattanakitchamrron (2006) stated that delays in construction can cause a number of changes in a project such as late completion, lost productivity, acceleration, increased costs, and contract termination. The party experiencing damages and the parties responsible for them in order to recover time and cost. However, in general delay situations are complex in nature. A delay in an activity may not result in the same amount of project delay. A delay caused by a party may or may not affect the project completion date and may or may not cause damage to another party. A delay may occur concurrently with other delays and all of them may impact the project completion date.[4]

Kumaraswamy et al. also done a survey on finding the causes of construction delays but in Hong Kong. The survey exposed the differences in perceptions of the relative importance of factors between the three groups, that is clients, contractors and consultants indicative of their experiences, possible prejudices and lack of effective communication.[1]

2. TYPE OF DELAY

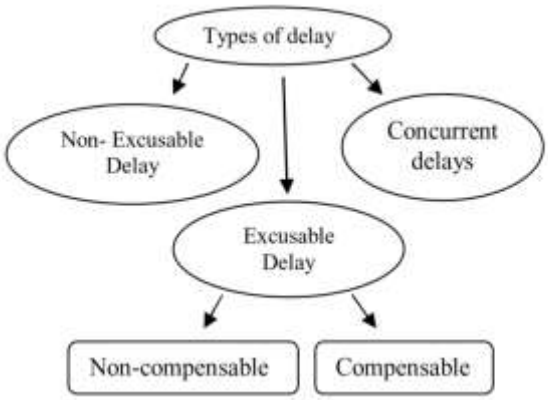

Fig.1 shows the type of delay

Delays generally fall into four categories. Delay is considered a major cause of construction claim.

In the process of determining the effect of a delay on the project, the analyst must determine whether the delay is critical or noncritical. The analyst must also assess if delay are concurrent. All delays that are identified in the analysis will be either excusable or non-excusable. Delay can be further categorized into compensable or non-compensable delays.[4]

- Critical and Non-Critical Delays

Delays that affect the project completion, or in some cases a milestone date, are considered as critical delays, and delays that do not affect the project completion, or a milestone date, are noncritical delays. If these activities are delayed, the project completion date or a milestone dater will be delayed. The determining which activities truly control the project completion date depends on the following: [4]

a. The project itself
b. The contractor's plan and schedule (particularly the critical path)
c. The requirement of the contract for sequence and phasing
d. The physical constraint of the project, i.e. how to build the job from a practical perspective

- Excusable and Non-Excusable Delays

Excusable delays are those not attributable to the contractor's actions or inactions and typically include unforeseen events. It allows the contractor to obtain a time extension to complete the contract without being penalized. However, this type of delay normally does not entitle the contractor to any damages caused by the delay.

The examples of excusable delays to a contractor's action are differing site conditions, design problems, changes to the work, inclement weather, and strikes. This type of clause sometimes called a "force majeure" clause, lists excusable delays. As this list implies when unanticipated outside 'forces delay completion of the contractor's work, the delay is generally considered as excusable.[1]

Non-excusable delays are events that are within the contractor's control or that are foreseeable. These are some examples or non-excusable delays: [5]

a. Late performance of sub-contractors
b. Untimely performance by suppliers
c. Faulty workmanship by the contractor or sub-contractors
d. A project-specific labor strike caused by either the contractor's unwillingness to meet with labor representative or by unfair labor practices

- Compensable Delays and Non-Compensable Delays

A compensable delay is a delay where the contractor is entitled to a time extension and to additional compensation. Relating back to the excusable and non-excusable delays, only excusable delays can be compensable. Non-compensable delays mean that although an excusable delay may have occurred, the contractor is not entitled to any added compensation resulting from the excusable delay. Thus, the question of whether a delay is compensable must

be answered. Additionally, a non-excusable delay warrants neither additional compensation nor a time extension.

Whether or not a delay is compensable depends primarily on the terms of the contract. In the most cases, a contract specifically notes the kinds of delays that are non-compensable, for which the contractor does not receive any additional money but may be allowed a time extension. [5]

- Concurrent Delays

The concept of concurrent delay has become a very common presentation as part of some analysis of construction delays. The concurrency argument is not just from the standpoint of determining the project's critical delays but from the standpoint of assigning responsibility for damages associated with delays to the critical path. Owners will often cite concurrent delays by the contractor as a reason for issuing a time extension without additional compensation. Contractors will often cite concurrent delays by the owner as a reason why liquidated damages should not be assessed for its delays.[4]

3. CLASSIFICATION OF CAUSES OF DELAY

The causes of construction delays could vary from country to country because of the differences in political, economic, social, and environmental conditions, and government regulations. In previous studies, different researchers have examined construction project delays from a different perspective and identified several different causes of delay. From these studies and the interviews that the authors conducted with engineers experienced in project execution, 24 potential causes of delay were identified. The pertinence of these causes was verified through senior engineers, involved in the construction projects implemented by three government-owned, major infrastructure construction organizations; BD, RDA, and NWSDB. The selected causes were classified into three main categories, namely, management-related causes, finance-related causes, and construction-related causes, based on the origin, as follows: [6]

Management Related Causes (MRC)

a. Poor project planning & scheduling
b. Incompetence of key staff
c. Poor decision making by management
d. Poor coordination with sub contractors
e. Delays in material supply
f. Disputes with other parties
g. Internal organisational problems
h. Disputes with other parties
i. Fraudulent practices in the organisation

Finance Related Causes (FRC)

a. Low profit margin
b. Inadequate cash flow management
c. Inefficiency in billing and collecting payments
d. Poor estimation practices
e. Inadequate progress reviews
f. Poor cost controlling system

Construction Related Causes (CRC)

a. Handling of too many projects at a given time
b. Faulty work
c. Poor communication with other parties
d. Insufficient quality control
e. Poor supervision of work
f. Insufficient availability of equipment
g. Unqualified workforce

- Methods of Minimizing Construction Delays

When a construction delay occurs, there is no question that the Owner suffers financially. But the extent to which an Owner can recover its loss of income from the Contractor, and more importantly minimize the risk that such delays will occur, depends largely on how the construction contract was drawn up.[4]

Methods of Minimizing Construction Delays

a. Frequent progress meeting.
b. Use up-to-date technology utilization .
c. Use proper and modern construction equipment.
d. Use appropriate construction methods .
e. Effective strategic planning .
f. Proper material procurement .
g. Accurate initial cost estimates .
h. Clear information and communication channels
i. Frequent coordination between the parties involved.

An analysis is needed to identify the impact of delay on time and cost followed by taking the appropriate action to mitigate delay and minimize the cost required. Mitigation efforts are necessary to minimize losses and this can be achieved by many procedures such as protection of uncompleted work, timely and reasonable reprocurement, and timely changing or cancellation of purchase orders. It is important to predict and identify the problems in the early stages of construction and diagnose the cause to and implement the most appropriate and economical solutions.

This factor increases the probability of delay occurrences in construction projects and makes effective management important to reduce the diversions from the original program.[7]

Table -1: Mitigation plan for different causes of delay.

Sr.	Causes of delay	Group	Mitigation plan
1	Legal disputes b/w various parts	Project	Amicable solution should be provided between parts. Appoint arbitrator to take final decision.
2	neffective delay penalties	Project	Monetary penalties should be effective on consultant/contractor for any delay in project and it should be in signed agreement.
3	Delay in progress payments by owner	Owner	It should be compensated by making advance payment to vendors/contractors
4	Delay to furnish and deliver the site to the contractor by the owner	Owner	Motivate contractor by paying bonus so as to complete work as per rescheduled activities. Labors can be paid extra for extra work done to complete work on schedule.
5	Change orders by owner during construction	Owner	Owner should stick upon their orders. If orders needs to be changed then owner should plan it ahead so as not to impact on schedule
6	Late in revising and approving design documents by owner	Owner	Prior execution of project, owner must have finalized drawings and documents.
7	Delay in approving sample materials	Owner	Prior to execution of project, material sample should be finalized as per its availability and need of project.
8	Poor communication and coordination by owner and other parties	Owner	Weekly review meetings should followed religiously by owner to track project progress.
9	Slowness in decision making process by owner	Owner	Decision process should be simpler and faster
10	Rework due to errors during construction	Contractor	Work should progress as per plan. Engineer/Architect should monitor ongoing work so as to avoid any errors during execution of work. Timely monitoring work will reduce the need of rework
11	Conflicts b/w contractor and other parties (consultant and owner)	Contractor	Owner should conduct weekly/monthly meetings so that alarming issues between contractors and other parties can be addressed
12	Poor site management and supervision by contractor	Contractor	Qualified and experienced staff should be hired for site management and supervision
13	Poor communication and coordination by contractor with other parties	Contractor	Contractor should co-ordinate with subcontractor and other parties on weekly basis. Contractors should publish work schedule on regular basis.
14	Ineffective planning and scheduling of	Contractor	Planning/Scheduling should be practical and achievable.

	project by contractor		Planning and schedule should be reviewed by experienced staff and owner.
15	Improper construction methods	Contractor	Consultant should provide timely guidance on work methodology to accelerate the
16	Delay in performing inspection and testing by consultant	Consultant	Consultant should timely inspect the site
17	Delay in approving major changes in the scope of work by consultant	Consultant	Scope of Work should be finalized by taking meetings so as to avoid any delay in approval process. Work schedule should be planned in accordance to that
18	Inflexibility (rigidity) of consultant	Consultant	Before project execution, owner should ensure that consultant is aware of his responsibilities & expectations set by owner. A signed legal agreement should be in place for the same.
19	Mistakes and discrepancies in design documents	Design	Design documents should be reviewed by consultant.
20	Delays in producing design documents	Design	Design document schedule must be strictly adhered by consultant and design engineer. In case of any delay made by consultant and design engineer, owner should schedule meeting and make the
			project expectations clear to them
21	Insufficient data collection and survey before design	Design	Consultant should provide complete data needed for designing to Design Engineers
22	Misunderstanding of owner's requirements by design engineer	Design	Requirement gathering should be properly done by having repeated meetings and reviews with Owner/Client
23	Changes in material types and specifications during construction	Materials	It's part and parcel of project but can be avoided by taking fast decisions and having backup plan. Backup plan (like vendors list) would avoid any delay in delivery of material.
24	Delay in material delivery	Materials	Delivery schedule should be adhered with proper planning like having material in place before execution and making advance payments for booking material in case of scarcity. Backup plan like material vendors list should be handy.
25	Damage of sorted material while they are needed urgently	Materials	Sufficient material should be in store, considering the material damage
26	Late procurement of materials	Materials	Material should be procured as per the need of project and availability in market. If there is scarcity of material in market then it should be booked in

			advance by making partial payments
27	Shortage of equipment	Equipment	Equipment's should be made available by contractor as per schedule and project status
28	Low level of equipmentoperator's skill	Equipment	Skilled labors should be hired by contractor for usage of equipment's
29	Low productivity and efficiency of equipment	Equipment	Equipment selection should be done as per its productivity and need of project. Skilled labors should be hired for using equipment
30	Shortage of labors	Labor	Equipment's should be used to maximum so as to reduce dependency on labors.
31	Unqualified workforce	Labor	Skilled labors should be hired for work. Trainings should be provided to unskilled labors.
32	Low productivity level of labors	Labor	Contractor should sort out difficulties faced by labors during work and motivate them by providing incentives for good work
33	Personal conflicts among labors	Labor	Contractor should handle conflicts by having proper communication.
34	Delay in obtaining permits from municipality	External	Documents should be complete. Process of approvals should be started early
35	Rain effect on construction	External	Activities should be planned and prioritized by considering
36	Unavailability of utilities in site (such as, water, electricity, telephone, etc.)		Basic utilities on site should be considered during planning and arranged before start of project execution
37	Effect of social and cultural factors	External	While planning consideration of labors social & cultural factors should be done.

4. CONCLUSION

After studing various literature it was observe that there are several type of delay which are discus in the paper and we classify the delay according to the delay type .which help to understand the delay properly and after that we can plan to reduce the delay effect on the construction project .the delay such as non-excuable, excusable, concurrent, non concurrent,compensable and non compensable are studied in detail from which we came to know that if there is any delay in construction project we can classify that delay properly and manage the construction project.

REFERENCES

1. INTAN DIANA BINTI MUSA (2012)THE CAUSES AND EFFECT OF DELAY IN CONSTRUCTION INDUSTRY PROJECT ,
2. N. Hamzaha, M.A. Khoirya, I. Arshada, N. M. Tawilb and A. I. Che Anib (2011) Cause of Construction Delay - Theoretical Framework , The 2nd International Building Control Conference, 490 – 495
3. Ghada Taha1, Mohamed Badawy 2, Omar El-Nawawy3 (2016)A Model for Evaluation of Delays in Construction Projects,
4. KANG SIK WEI (2010) CAUSES, EFFECTS AND METHODS OF MINIMIZING DELAYS IN CONSTRUCTION PROJECTS, UNIVERSITI TEKNOLOGI MALAYSIA,
5. Twana Ahmed,(2015),Delay in Construction Project,researchgate,1-18
6. D. A. R. Dolage and T. Pathmarajah,(2015)Mitigation of Delays Attributable to the Contractors in the Construction Industry of Sri Lanka - Consultants', The Institution of Engineers, Sri lanka,21-30
7. Aamon Monty Mukasera, (2016),An investigation into causes, effects and measures for minimising time overruns in road construction projects in Malawi,university of Bolton.1-120

8. Aleksander Srdić, Assoc. Prof. Jana Šelih,(2015),Delays in Construction Projects: Causes and Mitigation,research paper,3-5
9. SYMON ANTONY KWATSIMA(2016), AN INVESTIGATION INTO THE CAUSES OF DELAY IN LARGE CONSTRUCTION PROJECTS IN KENYA , JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY.
10. Frank D.K. Fugar and Adwoa B. Agyakwah-Baah (2010)Delays in Building Construction Projects in Ghana, Australasian Journal of Construction Economics and Building,103-116
11. Mrs. Rani M. Mate ,Dr. G. A. Hinge ,(2015)Delay Mitigation in the Construction Industry ,international Journal of Engineering Research & Technology,issn 2278-0181

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