Column -to-beam moment capacity ratio of framed building

Submitted by

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In Partial fulfilment of the Requirement for the degree

of

MASTER OF ENGINEERING

In

STRUCTURAL ENGINEERING

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Hasmukh Goswami College of Engineering

Vahelal, Ahmedabad

CERTIFICATE

This is to certify that research work embodied in this report titled **"Column -to-beam moment capacity ratio of framed building"** was carried out by **Gamit Kinjalben Lallubhai with Enrollment No. 22020608010040** at **Hasmukh Goswami College of Engineering** for partial fulfillment of Master of Engineering degree in **structural Engineering** to be awarded by Monark Univeristy. This research has been carried out under my guidance and supervision and is to my satisfaction.

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Place:

Signature of Guide

Prof. JAYDIP D. JADIA

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Prof. JAYDIP D. JADIA

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COMPLIANCE CERTIFICATE

This is to certify that research work embodied in this dissertation titled **"Column -to-beam moment capacity ratio of framed building"** was carried out by **Gamit Kinjalben Lallubhai with Enrollment No. 22020608010040** at **Hasmukh Goswami College of Engineering** for partial fulfilment of Master of Engineering degree in **structural Engineering** to be awarded by Monark Univeristy. She has complied to the comments given by the Dissertation phase-1 to my satisfaction.

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PAPER PUBLICATION CERTIFICATE (if any)

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Date:

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Prof. JAYDIP D. JADIA

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DISSERTATION PHASE 1 REPORT

APPROVAL CERTIFICATE

This is to certify that research work embodied in this dissertation titled **"Column -to-beam moment capacity ratio of framed building"** was carried out by **Gamit Kinjalben Lallubhai with. 22020608010040** at **Hasmukh Goswami College of Engineering** is approved for award of the degree of Master of Engineering degree in Structural Engineering by Monark Univeristy.

☐ Approved

☐ Approved with Suggestions

☐ Rejected

Date:

Place:

Examiner - 1 Sign and Name **Examiner - 2 Sign and Name**

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DECLARATION OF ORIGINALITY

We hereby certify that we are the sole author of this Dissertation Phase 1 Report and that neither any part of this Dissertation Phase 1 Report nor the whole of the Dissertation Phase 1 Report has been submitted for a degree to any other University or Institution.

We certify that, to the best of our knowledge, the current Dissertation Phase 1 Report does not infringe upon anyone's copyright nor violet any proprietary rights and that any ideas, techniques, quotations, or any other material from the work of other people incorporated in our Dissertation Phase 1 Report published or otherwise, are fully acknowledged in accordance with the standard referencing practices. Furthermore, to the extent that we have included copyrighted material (if any) that surpasses the boundary of fair dealing within the meaning of the Indian Copyright (Amendment) Act 2012, we certify that we have obtained a written permission from the Copyright owner to include such materials in the current Dissertation Phase 1 Report and have included copies of such copyright clearance to our appendix.

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Date:

Signature of Students

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Signature of Guide

Prof. JAYDIP D. JADIA

Civil Engineering Department,

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Dedicated To My loving parents

Acknowledgement

I would like to take this opportunity to thanks several individuals for their help and contributions to the successfully completion of this study. First, I would like to thank God, who makes all things possible.

I would also like to thanks **Prof. Jaydip Jadia**, HOD Civil Engineering Department, HGCE Ahmedabad for directing a path towards our study.

I would also like to thank **My Family** for their everlasting love and financial support throughout my numerous academic years. I would also like to say thanks **to My Classmates, All Teaching Staff Members and Non-Teaching Staff Members** who have directly or indirectly provided their unerring support throughout the course of this Dissertation Work.

Gamit Kinjakben L.

Enrollment No: 22020608010040

M.E. Civil (Structure Engineering)

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ABSTRACT

In India, construction projects are facing major problems due to delays. These problems are harming economic success and development. The purpose of this study is to identify the most significant factors that cause delays in construction projects through a survey. A survey was carried out on the various stack holders of construction industries such as architects, engineers, owners, contractors, supervisors, and labours. Out of 30 reasons, 5 major factors are identified using the Relative Important Index (RII) method. **Keywords: Delay factors, Effects of delays, Project management, Construction time.**

CHAPTER 1

INTRODUCTION

1.1 General:

The construction industry is India's second-largest industry, after agriculture. One of the most common problems in construction projects is delay Construction delays are measured in terms of project success in terms of time, cost, quality, and safety. The timely completion of a construction project may help in the project's success. The construction project contributes a major role to national economies all around the world. Many countries' GDP and employment rates are controlled by the construction project. Delays canarise for many reasons. Rework, poor organization, quality issues, equipment failure, designchanges, natural disasters, and other variables could all play an important role.

When a project is delayed, the delivery time is either extended or the project's work is aggressively increased to meet the deadline. Project delays in the construction industry have an impact not just on the construction industry, but also on a country's general economy. Unexpected project delays are difficult to manage and have a detrimental influence on project operations and outcomes. An unanticipated delay will extend the project's overall duration and raise project costs. It has time-related cost consequences, which means that it will use more resources and take longer to complete the project. During completion of the projects is a measure of efficiency, the building process is subject to several variables and unpredictable events that arise from many sources.

The construction industry in India faces various obstacles, but one of the most significant is labour productivity. Every project has some building challenges, such as material, money, tools, and the expense of construction by a local contractor. With the current state of construction labour productivity on the decline, it is crucial to identify the elements that influence it and then select the most important ones from the available options. This study suggested factors, that will help construction projects by reducing contract disputes. Delays have a strong link to carry out work failure. Construction projects are implemented up of many compared to controls such as labour, cost, material, schedule, and other resources, making it difficult to identify which reasons contributed to a project's delay.

Several causes create delays in construction projects. Parties to the project have many issues. A delay can be caused by multiple parties (client, contractor, consultant), or by none of them. In construction, a delay can be described as a timeout beyond the agreed-upon date for project stakeholder delivery through the contract termination date. It refers to the production and rentable area attributable to the owner as a result of a delay or loss of income owing to a plant function that no longer exists. Furthermore, delays might lead to disputes, arbitration, total abandonment, and protracted litigation between the parties. Construction is a large, dynamic business that requires a large amount of capital. The work usually has low rates of return by the level of risk involved. Construction project delays are a common occurrence. There has most likely been significant research to reduce the impact of project delays and delayed discovery. Construction project delays are a worldwide occurrence, with time and expense overruns being more typical in undeveloped and developed countries.

The construction industry is currently complex due to the vast number of parties involved, such as clients, contractors, consultants, stakeholders, shareholders, regulators, and others. Any construction project's failure is primarily due to issues and poor performance. As a result, this research is critical in identifying and analyzing the major elements influencing the performance of building projects. This study is needed to evaluate the level of understanding and applying these delayed concepts in planning, design, and field operation.

1.1 Problem Statement

- Indian construction industry plays a major role in National development but Delay, overall cost and dissatisfaction are main problems which face the construction industry.

- Delay is a significant issue in the construction business, and it has been highlighted as one of the primary reasons of schedule delays and cost overruns.
- Fail to achieve the project's deadlines, estimated costs, designer changes or errors, user changes, weather, late delivery, and stated quality results in different of unanticipated negative effects.
- In the construction industry, when projects are delayed, the entire cost of the project rises.

1.2 Objectives of study

- To determine the factors that influence the success of construction projects in South Gujarat.
- To identify the effect of delay on construction projects.
- To rank the factor using the RII (relative importance index) method.

1.3 Scope of study

- To identify the reason behind the delay in a construction project.
- To identify the effect of delay on construction projects.
- To rank the causes of delay in construction projects.

1.4 Need of Study

- The construction industry is currently complex due to a large number of parties involved, such as clients, contractors, consultants, stakeholders, shareholders, regulators, and others. Any construction project's failure is mainly due to problems and poor performance. As a result, this research is critical in identifying and analyzing the major elements influencing the performance of building projects.

1.5 Thesis structure

- Chapter I: Introduction

- Chapter II: Literature review
- Chapter III: Research Methodology
- Chapter IV: Data collection
- Chapter V: Data analysis
- Chapter VI: Results & Discussion
- Chapter VII: Conclusion

Chapter-I Introduction:

- It represents the background, problem statement, objectives of the study, scope of the study and need of study.

Chapter-II Literature Review:

- It includes general information about construction project delay factors in a construction project. It covers research done in other countries regarding a study of factors affecting construction project delay.
- It covers the research methodology. The methodological approach consists of the overall research strategy and the research design.

Chapter- III Research Methodology

- It covers the research methodology. The methodological approach consists of the overall research strategy and the research design.

Chapter- IV Data Collection

- It covers the data collection process. and respondent details of various stakeholders.

Chapter- V Data analysis:

- It contains the analysis of the data and the discussion part. It contains the findings on factors that cause construction project delays.

Chapter- VI Results & Discussion

- This chapter includes the top findings by data analysis and shows major factors affecting the construction project delay.

Chapter- VII Conclusion

- This chapter covers the conclusion of the research work and recommendations to reduce the cost of a construction project.

CHAPTER 2

2.1 LITERATURE PAPER-15

PAPER-15	Analyzing Causes of Delay in Construction Projects
JOURNAL	International Journal for Innovative Research in Science & Technology
AUTHOR	Kartik Kalkani, Shakil Malek
LOCATION	India
KEYWORDS	Construction, Management, Delays, India, Project
FINDING	• The causes of time overrun in the Indian construction industry were investigated in this research. • This survey was created using 73 time overrun criteria that were divided into 9 major groupings. • Clearances on time, drawing revisions, and clearances from consultant/client/PMC, incompetence of labour, unrealistic planning, failure to use monitoring and controlling tools and technologies, lack of leadership qualities in managers, procurement planning, and procurement process are all major causes of delays.

2.2 LITERATURE PAPER-16

PAPER-16	Effect of organizational culture on delay in construction
JOURNAL	International Journal of Project Management
AUTHOR	David Arditi, Shruti Nayak, Atilla Damci
LOCATION	Turkey
KEYWORDS	Organizational culture; Delay; Scheduling
FINDING	• The purpose of this paper is to investigate the relationship between organizational culture and delay in the construction industry. • The survey also found that the percentage of project delays is lower in the United States than in India.

2.3 LITERATURE PAPER-17

PAPER-17	Evaluation of Factors Affecting Construction Project Performance Management
JOURNAL	International Journal of Science and Engineering Research
AUTHOR	K.Prakash, N.Nandhini
LOCATION	India
KEYWORDS	Construction Industry, Performance management, factors affecting project performance, suggestions, statistical analysis
FINDING	• The criteria will be ranked in this study using the Statistical Package of Social Sciences (SPSS) software. • The survey includes 39 factors in this study. • SPSS ranks Accident rate, Cost of overtime, Waste of material, Management and labour do not work together. Low-quality materials and equipment are used. Unexpected mishap The project's complexity, Error-prone rework Laborer's age, Management failure.

2.4 LITERATURE PAPER-18

PAPER-18	A methodology to identify the delays and rank its Causative factors in Indian construction industry
JOURNAL	International Research Journal of Engineering and Technology
AUTHOR	Anup Wilfred, Muhamad Sharafudeen
LOCATION	India
KEYWORDS	Causes of delay, Indian Construction Industry, ranking of delay causes, Relative Importance Index, Importance Index, Case Study
FINDING	• The key reasons for construction delays in India are revealed in this study. • Relative Importance Index, Frequency Index, Severity Index, and Importance Index methods are used in this research. • This study also included a case study in Karnataka.

2.5 LITERATURE PAPER-19

PAPER-19	Causes of delays in construction projects- a case study
JOURNAL	International Journal of Current Research
AUTHOR	Prakash Rao, Joseph Camron Culas
LOCATION	India
KEYWORDS	Delays, Apartment Project, Contractor, Client, Consultant.
FINDING	• The goal of this research was to figure out what causes construction delays and how to avoid them. A literature review and a questionnaire survey were used to conduct this research. • Delay revision and approval of design papers, delays in subcontractor work, and poor communication and coordination of modification orders by the owner during construction were the top three factors that contributed to delays. Contractor-related delays were ranked first, followed by client-related delays.

2.6 LITERATURE PAPER-20

PAPER-20	Delay Analysis in Construction Project
JOURNAL	International Journal of Emerging Technology and Advanced Engineering
AUTHOR	Aditi Dinakar
LOCATION	India
KEYWORDS	Delays in a construction project, causes for delays, the impact of delays on a Construction project
FINDING	• This article investigated the construction of a new district jail in Andhra Pradesh's Kurnool district. • The data is analyzed using MS Project. • After reviewing the statistics, it is evident that the contractor's contribution to the construction project's delay is greater than that of the client and consultant. External causes play the smallest role in construction project delays.

2.7 LITERATURE PAPER-21

PAPER-21	Analysis of Causes of Delay and Time Performance in Construction Projects
JOURNAL	Journal of Construction Engineering and Management
AUTHOR	Pablo Gonzalez, Vicente Gonzalez, Keith Molenaar.
LOCATION	New Zealand
KEYWORDS	Activity delays, Project planning, Reasons for noncompliance, Relationship, Time performance
FINDING	• The primary goal of this research is to investigate the linkages between delay causes and their effects on project timeliness by quantifying the impact of noncompliance reasons on construction delays as measured by the delay index. • The reason for noncompliance (RNC) is a scheduling failure indicator, while the delay index (DI) is a time-performance indicator that describes the effects of delays on important and non-critical tasks.

2.8 LITERATURE PAPER-22

PAPER-22	Critical Causes of Delay in Residential Construction Projects: Case Study of Central Gujarat Region of India
JOURNAL	International Journal of Engineering Trends and Technology
AUTHOR	Megha Desai, Rajiv Bhatt
LOCATION	India
KEYWORDS	Causes of delay, Construction industry, India, Relative importance index, Importance index
FINDING	• This study looks into the reasons for delays in residential construction projects. • The data is analyzed using the Relative Importance Index and the Importance Index approach. • This study found 59 reasons for delays.

2.9 LITERATURE PAPER-23

PAPER-23	Critical Factors Affecting Labour Productivity In Construction Projects: Case Study Of South Gujarat Region Of India
JOURNAL	International Journal of Engineering and Advanced Technology
AUTHOR	Mistry Soham, Bhatt Rajiv
LOCATION	India
KEYWORDS	labour productivity, Construction contractor, India, Relative importance index, Analytic Hierarchy Process, rank.
FINDING	• The primary goal of this research is to identify essential elements that influence labour productivity. • Analytic hierarchy process (AHP) and Relative Importance Index (RII) approaches were used to assess a total of 51 feedbacks. • Delays in payments, labour skill, technical specification clarity, material shortages, and labour motivation are the five most important criteria, in order, according to the RII technique.

2.10 LITERATURE PAPER-24

PAPER-24	Causes of delay in project construction In developing countries
JOURNAL	Indian Journal of commerce & management studies
AUTHOR	Shubham VYAS
LOCATION	India
KEYWORDS	Project construction, delay in construction, delay elements, the impact of delay and technique for avoiding delay
FINDING	• A survey was undertaken on various projects, including the development of a power plant, a factory, and a multi-story structure. • One way for identifying the root cause is to utilize a systematic and scientific approach.

2.11 LITERATURE PAPER-25

PAPER-25	Evaluation of critical factors influencing resource allocation in Indian construction projects
JOURNAL	Applied Mechanics and Materials
AUTHOR	M.P.Venkatesh, S.M.Renuka, Balasubramanian Malathi, C.Umarani
LOCATION	India
KEYWORDS	Resource allocation, construction projects, India
FINDING	• The goal of this article is to identify the essential factors that influence resource allocation in private and public building projects in India. • The findings reveal that the eleven most critical factors include materials selection and changes in types and specifications during construction, improper equipment maintenance, construction material shortages, financing between the owner and contractor, force majeure labour shortages, poor material procurement, labour skill, equipment availability, and material quality.

2.12 LITERATURE PAPER-26

PAPER-26	Analyzing factors affecting delays in Indian construction projects
JOURNAL	Journal of Construction Engineering and Project Management
AUTHOR	Hemanta Doloi , Anil Sawhney , K.C. Iyer , Sameer Rentala
LOCATION	India
KEYWORDS	Time delay, Indian construction industry, Factor analysis, Regression modelling
FINDING	• This study first identified the important elements affecting building delays in India, and then established the relationship between the critical features to develop prediction models for measuring the effects of these factors on delays. • The relevance of the delay factors (1) lack of commitment (2) inefficient site management (3) inadequate site coordination was investigated using factor analysis and regression modelling.

2.13 LITERATURE PAPER-27

PAPER-27	Delays in construction projects: The case of Jordan
JOURNAL	Journal of Construction Engineering and Project Management
AUTHOR	G. Sweis , R. Sweis , A. Abu Hammad , A. Shboul
LOCATION	Jordan
KEYWORDS	Construction delays, Residential construction projects, Jordanian construction industry
FINDING	• The study's goals are to identify the key reasons for construction delays in Jordan's residential sector, as well as to analyse the relative relevance of these issues from the perspectives of residential project consultants, contractors, and owners, using ANOVA analysis. • The internal setting Financial constraints are the most commonreason for delay within the contractor's internal environment.

2.14 LITERATURE PAPER-28

PAPER-28	Causes of delay in large construction projects
JOURNAL	Journal of Construction Engineering and Project Management
AUTHOR	Sadi A. Assaf, Sadiq Al-Hejji
LOCATION	Saudi Arabia
KEYWORDS	Construction projects, Delay causes
FINDING	• A survey on the timely completion of several types of construction projects in Saudi Arabia was done to discover the causes of delays and their importance to each of the project participants, the owner, consultant, and contractor. Data was gathered through a survey and analysed by using frequency, severity and importance indices. • According to surveys, 70 percent of projects are above budget, and 45 of the 76 projects assessed are behind schedule.

2.15 LITERATURE PAPER-29

PAPER-29	The effects of construction delays on project delivery in Nigerian construction industry
JOURNAL	Journal of Construction Engineering and Project Management
AUTHOR	A.A. Aibinu, G.O. Jagboro
LOCATION	Nigeria
KEYWORDS	Managing projects; Cost; Time; Claims
FINDING	• The effects of construction delays are identified, evaluated using a questionnaire, and assessed using an empirical method in this paper. • The delay of 61 construction projects was investigated in this paper. • In the Nigerian construction business, cost overrun and time overrun were the two most common consequences of delays.

2.16 LITERATURE PAPER-30

PAPER-30	Construction delay computation method
JOURNAL	Journal of construction engineering and management
AUTHOR	Jonathan Jing sheng Shi, Cheung, and David Arditi
FINDING	• This document explains how to calculate activity delays and evaluate their impact on project delays. • The approach consists of a set of equations that may be simply written into a computer programme to provide quick access to project delays and activity contributions. • They give an objective benchmark for establishing who is to blame for delays. To improve and automate the construction delay analysis process, the approach can be implemented into any delay analysis system.

2.17 RESEARCH GAP

After reviewing the literature related to construction project delay, we have identified many research Gap of the study.

- There are separate investigation related to individual project type but in this research we have not limited for typical one type of project but it covers the overall factors which effects on project delay irrespective of project type.
- Majority offline questionnaire survey approached used, So to check appropriateness of data and for more accurate investigation personal interview and form filling approach has used.
- In this research, analysis of the respondent is done with two methods RII method and IMPI which has not adopted in the literature referred related to this area.
- This study also not conducted on Indian Construction industry, so keeping this thought in mind whole investigation of this research has been done.

2.18 LIST OF LITERATURE

TABLE1: LITERATURE

Sr.No.	Title	Author	Year
1	Study of construction delays in Amravati city and Study of construction practices in the city	Mr Aishwarya Avinashe, Prof. S.Sabihuddin	2021
2	Improving the efficacy of the delay notification process of construction projects in Sri Lanka	B. A. K. S. Perera, M. K. C. S. Wijewickrama, P. J. A. Goonawardana & Chandana Jayalath	2019
3	Analysis of causes of delay in Indian construction projects and mitigation measures	Prasad K.V., Vasugi V., Venkatesan R., Nikhil Bhat	2019
4	Causes of delay in Saudi public construction Projects	Jawad A. Alsuliman	2019
5	Delay Factors in Building Construction Projects in Rwanda	Umuhoza, Esperance, Sung-Hoon	2019
6	Causes of Delays in Construction Projects	Raut S. P., Gohatre V. S., Nistane H.P.	2018

7	Delays in Construction Projects: Causes, Effects and Impacts of RERA	Akshaykumar P. Udasi, Milind M. Darade	2018
8	Study and Assessment of Causes and Effects of Delay in Large Public Construction Projects in Jordan	Ghanim A. Bekr	2018
9	Delays and its Analysis: Indian Residential Construction Projects	Rakesh L. Metha and Suraj V. Gaikwad	2017
10	Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient: Empirical Study	Tsegay Gebrehiwet, Hanbin Luo	2017
11	An exploration of causes for delay and cost overruns in construction projects: case study of Australia, Malaysia & Ghana	Raj Kapur Shah	2016
12	Causes and Effects of Delays in Indian Construction Projects	Dinesh Kumar R	2016
13	Delays in Construction Projects and their Preventions	Deshmukh Sushma Shridhar	2016
14	Causes of Delay in the Construction Industry in Pune region of India	Ms. Leena Mali, Mr. A. A. Warudkar	2016
15	Analyzing Causes of Delay in Construction Projects	Kartik Kalkani, Shakil Malek	2016
16	Effect of organizational culture on delay in construction	David Arditi, Shruti Nayak, Atilla Damci	2016
17	Evaluation of Factors Affecting Construction Project Performance Management	K.Prakash, N.Nandhini	2015
18	A methodology to identify the delays and rank its Causative factors in Indian construction industry	Anup Wilfred, Muhamad Sharafudeen	2015
19	Causes of delays in construction projects- a case study	Prakash Rao, Joseph Camron Culas	2014
20	Delay Analysis in Construction Project	Aditi Dinakar	2014

21	Analysis of Causes of Delay and Time Performance in Construction Projects	Pablo Gonzalez, Vicente Gonzalez, Keith Molenaar.	2013
22	Critical Causes of Delay in Residential Construction Projects: Case Study of Central Gujarat Region of India	Megha Desai, Rajiv Bhatt	2013
23	Critical Factors Affecting Labour Productivity In Construction Projects: Case Study Of South Gujarat Region Of India	Mistry Soham, Bhatt Rajiv	2013
24	Causes of delay in project construction In developing countries	Shubham VYAS	2013
25	Evaluation of Critical Factors Influencing Resource Allocation in Indian Construction Projects	M.P.Venkatesh, S.M.Renuka, Balasubramanian Malathi, C.Umarani	2012
26	Analyzing factors affecting delays in Indian construction projects	Hemanta Doloi , Anil Sawhney , K.C. Iyer , Sameer Rentala	2011
27	Delays in construction projects: The case of Jordan	G. Sweis , R. Sweis , A. Abu Hammad , A. Shboul	2007
28	Causes of delay in large construction projects	Sadi A. Assaf, Sadiq Al-Hejji	2005
29	The effects of construction delays on project delivery in Nigerian construction industry	A.A. Aibinu, G.O. Jagboro	2002
30	Construction delay computation method	Jonathan Jingsheng Shi, Cheung and David Arditi	2001

2.18 LITERATURE PAPER-1

PAPER-1	Study of construction delays in Amravati city and Study of construction practices in the city
JOURNAL	Open Access International Journal of Science & Engineering
AUTHOR	Mr. Aishwarya Avinashe, Prof. S.Sabihuddin
LOCATION	India
KEYWORDS	Planning, Project Delays
FINDING	• The outcomes of a survey on the relative importance of entrepreneurs and consultants, which was calculated using the Relative Importance Index (RII) • As per the findings of this study, adopting current engineering building and design practice approaches saves time by around 15% and costs by approximately 5% to 10%.

2.19 LITERATURE PAPER-2

PAPER-2	Improving the efficacy of delay notification process of construction projects in Sri Lanka
JOURNAL	International Journal of Construction Management
AUTHOR	B. A. K. S. Perera, M. K. C. S. Wijewickrama, P. J. A. Goonawardana & Chandana Jayalath
LOCATION	Sri Lanka
KEYWORDS	Contractual provisions, delay notification process, delay notices, FIDIC, mixed approach
FINDING	• Improve the success rate of delay claims submitted bycontractors working on Sri Lankan building projects in this study. • The study's data was gathered from a total of 248 projects, using a combination of qualitative and quantitative methods. • It is also critical for contractors to be aware of contractual provisions to overcome the weaknesses in the delay notice process.

2.20 LITERATURE PAPER-3

PAPER-3	Analysis of causes of delay in Indian construction projects and mitigation measures
JOURNAL	Journal of Financial Management of Property and Construction
AUTHOR	Prasad K.V., Vasugi V., Venkatesan R., Nikhil Bhat
LOCATION	India
KEYWORDS	Infrastructure projects, India, Construction time, Construction project management, Construction in developing countries, Delays in project delivery
FINDING	• The focus of this research is to look into the causes of delays in India by project sector (transport, power, buildings, and water), as well as to compare delay causes in design-build (DB) and design bid build (DBB) projects. • The Importance Index was used to rate the delay caused by mitigation measures. • The top delay causes were claims settlement delays, contractor financial troubles, owner delays in paying for extra work/variations, late payments from contractors to subcontractors or suppliers, and owner variant orders/changes of scope during construction.

2.21 LITERATURE PAPER-4

PAPER-4	Causes of delay in Saudi public construction Projects
JOURNAL	Alexandria Engineering Journal
AUTHOR	Jawad A. Alsuliman
LOCATION	Saudi Arabia
KEYWORDS	Delay factors, Public projects, Construction delay
FINDING	• This study looks into the reasons for construction project delays in Saudi Arabia. • Using the developed simplified formula, a case study was conducted to show the percentage of time delay compared to the master schedule. • The goal of the study is to give individuals working on public construction projects effective alternatives for avoiding delays.

2.22 LITERATURE PAPER-5

PAPER-5	Delay Factors in Building Construction Projects in Rwanda
JOURNAL	Journal of the Korea Institute of Building Construction
AUTHOR	Umuhoza, Esperance, Sung-Hoon
LOCATION	Korea
KEYWORDS	delay factors, rwanda, risk assessment, risk management
FINDING	• The primary goal of this research is to identify significant elements that cause construction delays in Rwanda. • A literature review and a questionnaire survey were used to conduct this research. • The top sources of delay identified in this study include cash flow constraints, delays in approving design documents, and physical plan confidentiality.

2.23 LITERATURE PAPER-6

PAPER-6	Causes of Delays in Construction Projects
JOURNAL	International Journal of Engineering Science and Computing
AUTHOR	Raut S. P., Gohatre V. S., Nistane H.P.
LOCATION	India
KEYWORDS	causes of delays, effects of delays, construction project
FINDING	• The impact of delays in construction projects is investigated in this research. • The goal of this article is to look into solutions to reduce the causes of construction delays. Missing funding, revisions in the drawings, a lack of good communication, and poor project management are all examples of project delays.

2.24 LITERATURE PAPER-7

PAPER-7	Delays in Construction Projects: Causes, Effects and Impacts of RERA
JOURNAL	International Journal for Research Trends and Innovation
AUTHOR	Akshaykumar P. Udasi, Milind M. Darade
LOCATION	India
KEYWORDS	causes of delays, effects of delays, construction industry, Real Estate (Regulation and Development) Act,2016 (RERA)
FINDING	• This article divides 101 reasons for delays into nine types. • The use of an escrow account will help to avoid delays in progress payments and material and equipment deliveries. • Both the consumer and the builder benefit from RERA.

2.25 LITERATURE PAPER-8

PAPER-8	Study and Assessment of Causes and Effects of Delay in Large Public Construction Projects in Jordan
JOURNAL	International Journal of Applied Engineering Research
AUTHOR	Ghanim A. Bekr
LOCATION	Jordan
KEYWORDS	Delay causes, importance index, project's performance, public construction projects, Jordan.
FINDING	• The purpose of this study is to determine the most significant delays in Jordan's large-scale public projects. • Importance Index, Frequency Index, and Severity Index methods are used to analyse the data. • According to this study, almost 95% of projects have delays, with more than half of those experiencing delays of 10% to 30%.

2.26 LITERATURE PAPER-9

PAPER-9	Delays and its Analysis: Indian Residential Construction Projects
JOURNAL	Journal of Construction Engineering and Project Management
AUTHOR	Rakesh L. Metha and Suraj V. Gaikwad
LOCATION	India
KEYWORDS	Residential Projects, Construction Delays, Importance Index, Correlation Analysis, Principal Component Analysis
FINDING	• This research examines delays in residential construction. • The fact that the construction industry in India grew at an annual pace of 8.1 percent in 2014-15 indicates the commercial significance of such delays. • Financial, labour, and planning concerns were identified as key contributors to construction delays in this article.

2.27 LITERATURE PAPER-10

PAPER-10	Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient: Empirical Study
JOURNAL	Procedia Engineering
AUTHOR	Tsegay Gebrehiwet, Hanbin Luo
LOCATION	Ethiopia
KEYWORDS	Causes and Effects of delay; Construction Project; Ethiopia
FINDING	• This article explores the common causes of construction delays at various phases and their impact on Ethiopian construction projects. • The relative important index (RII) and the correlation coefficient were used in this study's methodology.

2.28 LITERATURE PAPER-11

PAPER-11	An exploration of causes for delay and cost overruns in Construction projects: case study of australia, malaysia & Ghana
JOURNAL	Journal of Advanced College of Engineering and Management
AUTHOR	Raj Kapur Shah
LOCATION	Australia, Malaysia and Ghana
KEYWORDS	Cost and time overruns, delay factors, construction industry, projects delay, and developing countries
FINDING	• By studying case studies in three different nations throughout the world, this research intended to find the most influential reasons generating project delays and cost overruns and offer viable solutions. • Identify the top 3 factors by the RII method.

2.29 LITERATURE PAPER-12

PAPER-12	Causes and Effects of Delays in Indian Construction Projects
JOURNAL	International Research Journal of Engineering and Technology
AUTHOR	Dinesh Kumar R
LOCATION	India
KEYWORDS	Construction Management, Causes of Delays, Effects of Delays, Construction Industry, India.
FINDING	• The purpose of this study is to identify the most important elements that cause delays in Indian building projects. • In this research, 103 reasons for delays are divided into eight categories. • The lack of dedication and cooperation among project participants is the root of all of these problems.

2.30 LITERATURE PAPER-13

PAPER-13	Delays in Construction Project and their Preventions
JOURNAL	International Journal for Research in Emerging Science and Technology
AUTHOR	Deshmukh Sushma Shridhar
LOCATION	India
KEYWORDS	causes of delays, effects of delays, construction projects, project management
FINDING	• Delays in payment to contractors, information delays, poor project management, compensation concerns, design changes, whether impacts and labour strikes are all discussed in this study. • Cost overruns, time overruns, disagreements, and poor societal impact are all consequences of delays.

2.31 LITERATURE PAPER-14

PAPER-14	Causes of Delay in the Construction Industry in Pune region of India
JOURNAL	International Journal of Application or Innovation in Engineering & Management
AUTHOR	Ms. Leena Mali, Mr. A. A. Warudkar
LOCATION	India
KEYWORDS	Construction Delay, Factors, Building projects, Ranking, Pune region
FINDING	• The delays in the construction project in Pune were investigated in this research. • For data analysis, the Relative Importance Index approach is used. • The majorityof delays are due to a labour scarcity, a lack of high-tech mechanical equipment, and site mobilization.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 GENERAL

- The method used in this study to obtain the research goal is described in this chapter. In general, there are many steps to this research.
- The first phase of the study focuses on the introduction of construction project delays.
- Literature reviews are included in the second step.
- The third phase is interviewing construction project stakeholders to determine the reasons for delays in projects.
- The collection of data is the fourth phase of research. A questionnaire will be used to collect data. Which include construction project delay.
- The fifth phase includes the distribution of the questionnaire and the gathering of responses.
- The data collected from questionnaire surveys are analysed in the sixth phase.

3.1.1 Phase-1 Literature Review

This section covers a review of literature on the subject, as well as identifying and analysing design-construction interface problems in construction projects, as well as their impact on project cost, time, and quality, from literature published in various national, international, and other journals; national, international, as well as other conferences; published reports; master and PhD thesis; journals; various standards published by different authorities; and more about interface management. As a result, this section gives a thorough background in terms of improving knowledge of the topic by analyzing it in scope and contents, as well as placing the entire study in a relevant theoretical point of view.

3.1.2 Phase-2 Pilot Study

A pilot study provides a trial run for the questionnaire, which involves testing wording questions, identifying ambiguous questions, and testing the technique was used to collect the data. The researcher distributed the questionnaire to a sample of construction stakeholder's experts such as contractors, consultants & site engineers. They have a strong practical, and experienced in construction fields. Their sufficient experiences are a suitable indication for the pilot study.

Table 3.1 List of Experts for a pilot study

NO	Name	Occupation	Experience
1	Mr. Artikbhai Patel	Contractor	7 Years
2	Mr. Chetanbhai Patel	Client	-
3	Mr. Dharmeshbhai Patel	Lab Assistant	7 Years
4	Mr. Darshilbhai Shah	Engineer	3 Years
5	Mr. Jaydeepbhai Patel	Engineer	8 Years
6	Mr. Sandipbhai Makwana	Architect	15 Years

3.1.3 Phase-3 Questionnaire design

From the literature review and pilot study various factors-related to construction project delay are found which are listed below,

Table 3.2 List of construction project delay factors

Sr.No.	Delay factors
1	Shortage in labour
2	Shortage of materials
3	Shortage of equipment
4	Delay in materials delivery
5	Failure of equipment
6	Lack of communication with consultant/owner
7	Problem with neighbours
8	Accidents during construction
9	Difficulties in obtaining work permits
10	Poor planning and scheduling of the project by the contractor
11	Delay in the approval of contractor submissions by the engineer
12	Mistakes in soil investigation
13	Poor monitoring and control
14	Using obsolete technology
15	Delays in site preparation
16	Severe weather conditions on the job site
17	The slowness of the owner's decision-making process
18	Delays in contractor's payment by the owner
19	Suspension of work by the owner
20	Rework due to errors during construction
21	High labour wages
22	Labour strikes at site
23	Labour health problems when working in a hazardous condition
24	Labour safety problems
25	Weather effect on construction activities
26	An improper technical study by a contractor during bidding
27	Lack of experience/incompetence of contractor's key staff
28	Changes in government regulations and laws
29	Change in design
30	Slow decision making by developer
31	Delay in testing results
32	Delay by owner in approval of the design from government authority
33	Rework due to errors during construction
34	Government tendering system requirement of selecting the lowest bidder
35	Inappropriate construction methods

3.1.4 Phase-4 Questionnaire survey

A questionnaire will be used to collect data. contractor, engineers, architects and owner responses were gathered based on their previous experiences. A survey questionnaire was prepared for finding the most significant causes of construction project delay.

3.1.5 Phase-5 Data analysis

3.1.5.1 Methods of data analysis

- **Relative Importance Index**

The purpose of the questionnaire survey was to understand the causes of project delays in constriction. Experts in the construction industry were questioned. Respondents are given a Likert scale ranging from 1 to 5, and they are asked to score each one of the interface problems in the table based on their professional experience.

The data from the surveys were entered into a datasheet, which was then analyzed using a formula.

$$\mathbf{RII} = \sum \mathbf{W} / (\mathbf{A} \ \mathbf{X} \ \boldsymbol{N})$$

Where w denotes the weighting given by each respondent on a scale of one to five, with one denoting the least and five denoting the most. N is the total number of people in the sample, and A is the highest weight.

- **Mean Score Method**

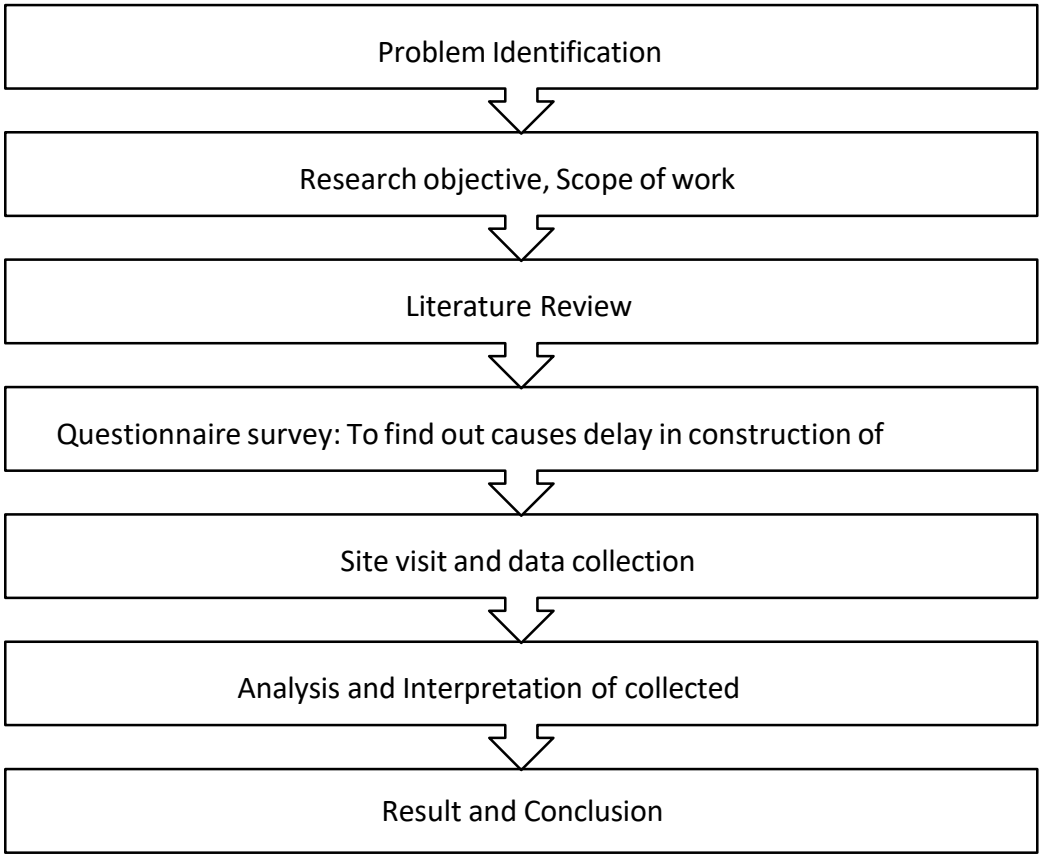
The most significant causes of construction project delays are determined using the mean score method. The following formula is used to compute the mean score.

$$Mean = \Sigma W / N$$

Where, ΣW= Total sum of responses given to each problem,

N= Total numbers of responses received

3.2 Flow of Research



Chat3.1 Flow of

Research

CHAPTER

4

DATA COLLECTION

4.1 GENERAL

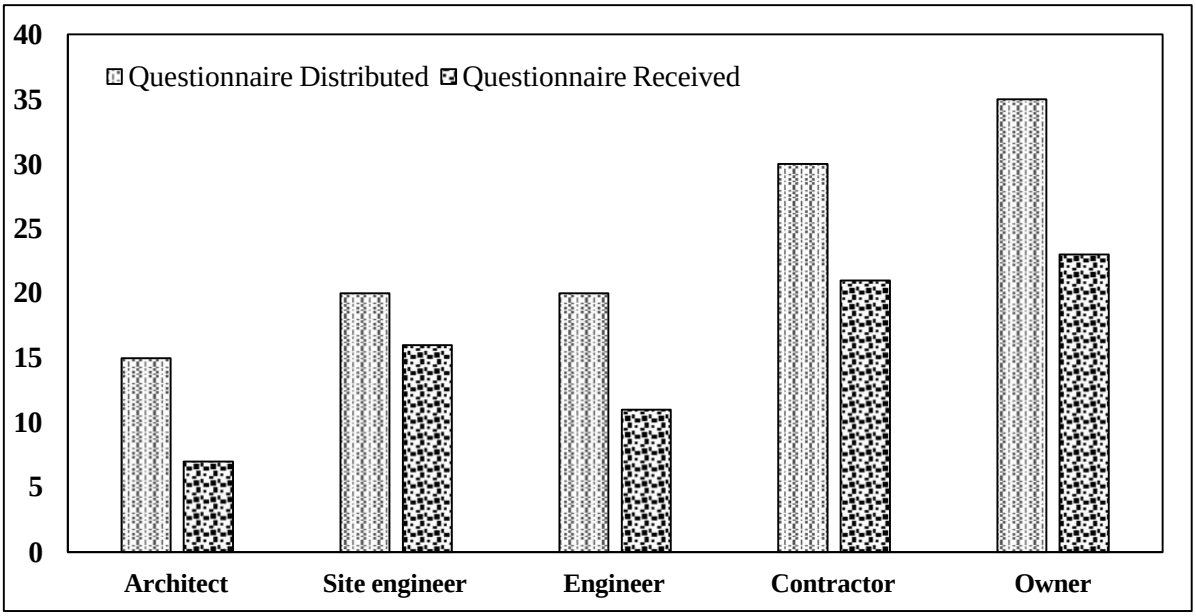
This chapter is about gathering feedback from stakeholders of the project, contractors, engineers, consultants, architects and owners. This chapter contains information on the many contractors, engineers, consultants, architects and owners who were contacted during the field survey. It also includes information on the responses received for data analysis.

4.2 DATA DISTRIBUTION AND COLLECTION

To begin, a list of contractors, engineers, consultants and architects was prepared from a local survey, and questionnaires were personally handed to various contractors, engineers, consultants, architects and owners. At the end of the questionnaire, the researcher's phone number, e-mail address, and mailing address were provided for contacting him or her with any questions or for returning the response. The questionnaire was distributed to various stakeholders, informing them of the research's goal. The participant was given a questionnaire after showing initial desire. A total of 120 questionnaires were distributed to engineers, consultants, architects and owners. From this study, 78 responses were received. As a result, this study's response rate is 65 percent.

Table 4.1 Percentage of a questionnaire distributed and responses received

Sr.No.	Respondent	Questionnaire Distributed	Questionnaire Received	Percentage
1	Architect	15	7	46.67
2	Site engineer	20	16	80
3	Engineer	20	11	55
4	Contractor	30	21	70
5	Owner	35	23	65.71
	Total	120	78	65



Graph 4.1 Respondent Details

Table 4.2 List of Architects

Sr.No.	Name of Architect	Experience (Years)	City
1	Mr. Sandipbhai Makwana	15	Bardoli
2	Mr. Roshanbhai Patel	11	Bardoli
3	Mrs. Jensyben Bhathawala	5	Bardoli
4	Mr Abhishekbhai Savaliya	4	Bardoli
5	Ms. Bhoomiben Bhesania	1	Bardoli
6	Ms. Karunaben Patel	2	Bardoli
7	Mrs. Jinalben Chauhan	7	Bardoli

Table 4.3 List of Engineer

Sr.No.	Name Of Engineer	Experience (Years)	City
1	Mr. PD Patel	9	Bardoli
2	Mr. MB Chaudhari	10	Vyara
3	Mr. Mitulbhai Vaghela	9	Bardoli
4	Mr. Niravbhai Chaudhari	8	Vyara
5	Mr. IA Vasava	10	Vyara
6	Mr. Mobinbhai Ansari	7	Songadh
7	Mr. Prakashbhai Chaudhari	6	Surat
8	Mr. Bharatbhai Tank	5	Bardoli
9	Mr. Amitbhai Chauhan	5	Surat
10	Mr. Swapnilbhai Asaravala	8	Bardoli
11	Mr. Viralbhai Chaudhari	4	Vyara

Table 4.4 List of site engineer

Sr.No.	Name of Site Engineer	Experience (Years)	City
1	Mr. Rahulbhai Chaudhari	7	Mandvi
2	Mr. Priteshbhai Gamit	2	Bardoli
3	Mr. Miteshbhai Chaudhari	1	Vyara
4	Mr. Rutvikbhai Patel	3	Mahuva
5	Mr. Vishalbhai Chaudhari	1	Vyara
6	Mr. Saurabhbhai Gamit	2	Vyara
7	Mr. Amanbhai Shah	2	Surat
8	Mr. Dhruvbhai	1	Surat
9	Mr. Vivekbhai Jariwala	2	Surat
10	Mr. Mohil Jariwala	2	Surat
11	Mr. Abhishekbhai Rathod	4	Surat
12	Mr. Priyankaben Chaudhari	2	Surat
13	Mr. Nikhilbhai Chaudhari	3	Vyara
14	Mr. Nehalbhai Parmar	7	Dolvan
15	Mr. Narsingbhai Patel	9	Vyara
16	Ms. Tanviben Kokni	1	Vyara

Table 4.5 List of contractor

Sr.No.	Name of Contractor	Experience (years)	City
1	Mr. Artikbhai Patel	8	Surat
2	Mr. Kalpeshbhai Patel	7	Surat
3	Mr. Jaydeepbhai Patel	5	Surat
4	Mr. Ravibhai Shiddhapura	10	Surat
5	Mr. Nitinbhai Bhesania	21	Bardoli
6	Mr. Vinodbhai	20	Vyara
7	Mr. Sureshbhai Bagada	5	Vyara
8	Mr. Kanubhai Gamit	4	Vyara
9	Mr. Akashbhai Chaudhari	2	Vyara
10	Mr. Girishbhai Chaudhari	7	Vyara
11	Mr. Vishalbhai Chaudhari	2	Dolavn
12	Mr. Jitendrabhai Parmar	10	Bardoli
13	Mr. Jaydevsinh Jadeja	15	Surat
14	Mr. Vishveshbhai Chaudhari	1	Madhi
15	Mr. Champakbhai Chaudhari	14	Dolvan
16	Mr. Anilbhai Gavit	5	Dolvan
17	Mr. Alapbhai Parekh	3	Bardoli
18	Mr. Mehulbhai	5	Navasri
19	Mr. Savanbhai Mistry	10	Bardoli
20	Mr. Vinodbhai Vasava	2	Vyara
21	Mr. Dipeshbhai Patel	3	Navsari

Table 4.6 List of Owners

Sr.No.	Name of Owner	City
1	Dr. Pranaybhai Patel	Dolvan
2	Mr. Manishbhai	Bardoli
3	Mr. Manojbhai	Bardoli
4	Mr. Jigneshbhai Patel	Bardoli
5	Mr. Gajendrabhai Tandel	Navsari
6	Mr. Mehulbhai Patel	Bardoli
7	Mr. Kaushikbhai Chaudhari	Vyara
8	Mr. Kalpeshbhai Chaudhari	Madhi
9	Mr. Pravinbhai Chaudhari	Vyara
10	Mr. Chetanbhai Patel	Navsari
11	Mr. Pranalbhai Tailor	Ena
12	Mr. Nehaben Agrawal	Maroli
13	Mr. Prafulbhai Gadhvi	Songadh
14	Mr. Alkeshbhai Patel	Navsari
15	Mr. Karanbhai Shah	Bardoli
16	Mr. Jayeshbhai Desai	Songadh
17	Mr. Rinkalbhai Kokni	Dolvan
18	Mr. Jainish Gamit	Vyara
19	Mr. Divyeshbhai Gamit	Songadh
20	Mr. Trupalbhai Chaudhari	Vyara
21	Mr. Mehulbhai Chaudhari	Dolvan
22	Mr. Mihirbhai Patel	Bardoli
23	Mr. Vijaybhai Chaudhari	Bajipura

CHAPTER

5

DATA ANALYSIS

5.1 Methods of Data Analysis

5.1.1 Relative Importance Index

The purpose of the questionnaire survey was to understand the causes of project delays in constriction. Experts in the construction industry were questioned. Respondents are given a Likert scale ranging from 1 to 5, and they are asked to score each one of the interface problems in the table based on their professional experience.

The data from the surveys were entered into a datasheet, which was then analyzed using a formula.

$$\mathbf{RII} = \sum \mathbf{W} / (\mathbf{A} \mathbf{X} \boldsymbol{N})$$

Where w denotes the weighting given by each respondent on a scale of one to five, with one denoting the least and five denoting the most. N is the total number of people in the sample, and A is the highest weight.

5.1.2 Mean Score Method

The most significant causes of construction project delays are determined using the mean

score method. The following formula is used to compute the mean score.

$$Mean = \Sigma W/N$$

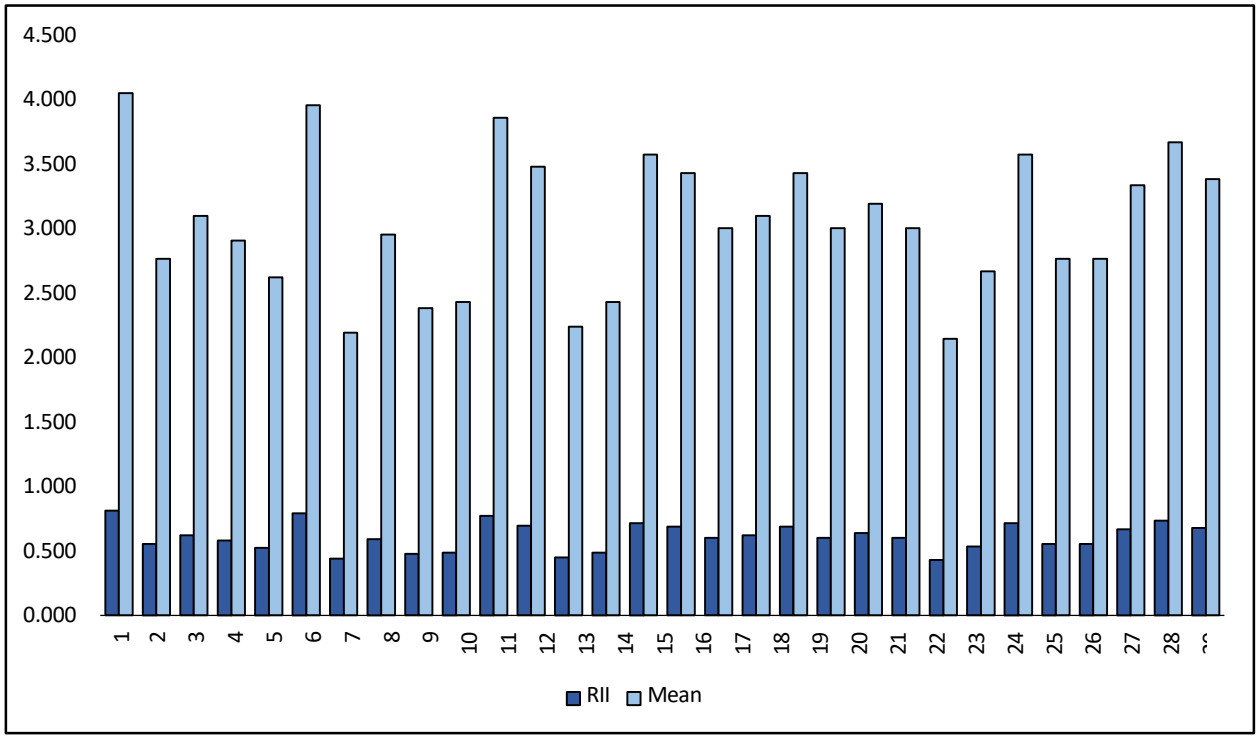
Where, ΣW= Total sum of responses given to each problem,

N= Total numbers of responses received

Table 5.1 RII and Mean score of Construction project delay according to a contractor

Sr.No.	Delay factors	RII	Mean
1	Shortage in labour	0.810	4.048
2	Shortage of materials	0.552	2.762
3	Shortage of equipments	0.619	3.095
4	Delay in materials delivery	0.581	2.905
5	Failure of equipments	0.524	2.619
6	Lack of communication with consultant / owner	0.790	3.952
7	Problem with neighbours	0.438	2.190
8	Poor planning and scheduling of the project by the contractor	0.590	2.952
9	Delay in the approval of contractor submissions by the engineer	0.476	2.381
10	Mistakes in soil investigation	0.486	2.429
11	Poor monitoring and control	0.771	3.857
12	Using obsolete technology	0.695	3.476
13	Delays in site preparation	0.448	2.238
14	Severe weather conditions on the job site	0.486	2.429
15	The slowness of the owner decision-making process	0.714	3.571
16	Delays in contractor's payment by owner	0.686	3.429
17	Suspension of work by owner	0.600	3.000
18	Rework due to errors during construction	0.619	3.095
19	High labour wages	0.686	3.429
20	Labour health problems when working in a hazardous condition	0.600	3.000
21	Labour safety problems	0.638	3.190
22	Weather effect on construction activities	0.600	3.000
23	An improper technical study by contractor during bidding	0.429	2.143
24	Lack of experience/incompetence of contractor's key staff	0.533	2.667
25	Change in design	0.714	3.571
26	Slow decision making by developer	0.552	2.762
27	Delay in testing results	0.552	2.762

28	Delay by owner in approval of the design from government authority	0.667	3.333
29	Rework due to errors during construction	0.733	3.667
30	Inappropriate construction methods	0.676	3.381

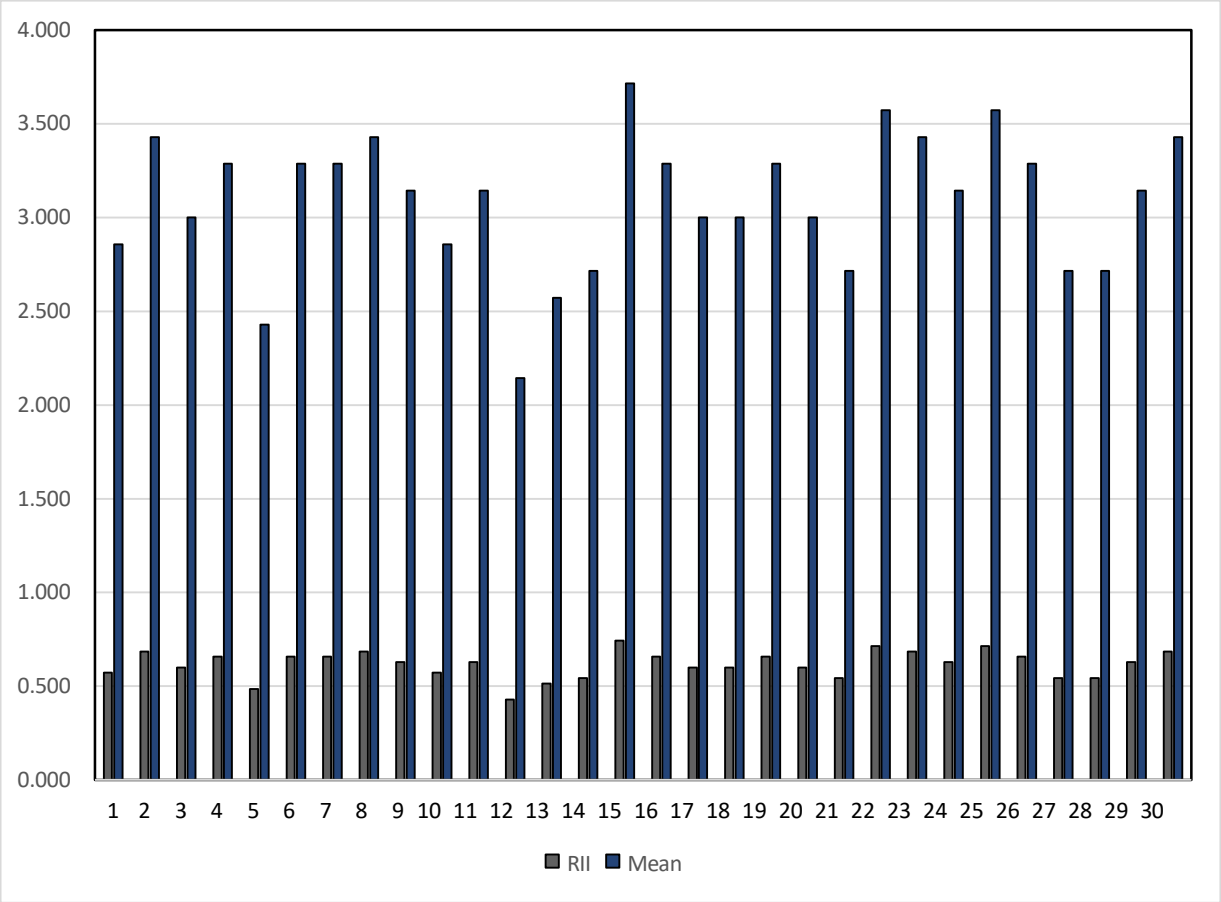


Graph 5.1 RII and Mean score of Construction project delay according to a contractor

Table 5.2 RII and Mean score of Construction project delay according to Architect

Sr.No.	Delay factors	RII	Mean
1	Shortage in labour	0.571	2.857
2	Shortage of materials	0.686	3.429
3	Shortage of equipments	0.600	3.000
4	Delay in materials delivery	0.657	3.286
5	Failure of equipments	0.486	2.429
6	Lack of communication with consultant / owner	0.657	3.286
7	Problem with neighbours	0.657	3.286
8	Poor planning and scheduling of the project by the contractor	0.686	3.429
9	Delay in the approval of contractor submissions by the engineer	0.629	3.143
10	Mistakes in soil investigation	0.571	2.857

11	Poor monitoring and control	0.629	3.143
12	Using obsolete technology	0.429	2.143
13	Delays in site preparation	0.514	2.571
14	Severe weather conditions on the job site	0.543	2.714
15	Slowness of the owner decision making process	0.743	3.714
16	Delays in contractor's payment by owner	0.657	3.286
17	Suspension of work by owner	0.600	3.000
18	Rework due to errors during construction	0.600	3.000
19	High labour wages	0.657	3.286
20	Labour health problem when working in hazardous condition	0.600	3.000
21	Labour safety problems	0.543	2.714
22	Weather effect on construction activities	0.714	3.571
23	Improper technical study by contractor during bidding	0.686	3.429
24	Lack of experience/incompetence of contractor's key staff	0.629	3.143
25	Change in design	0.714	3.571
26	Slow decision making by developer	0.657	3.286
27	Delay in testing results	0.543	2.714
28	Delay by owner in approval of design from government authority	0.543	2.714
29	Rework due to errors during construction	0.629	3.143
30	Inappropriate construction methods	0.686	3.429

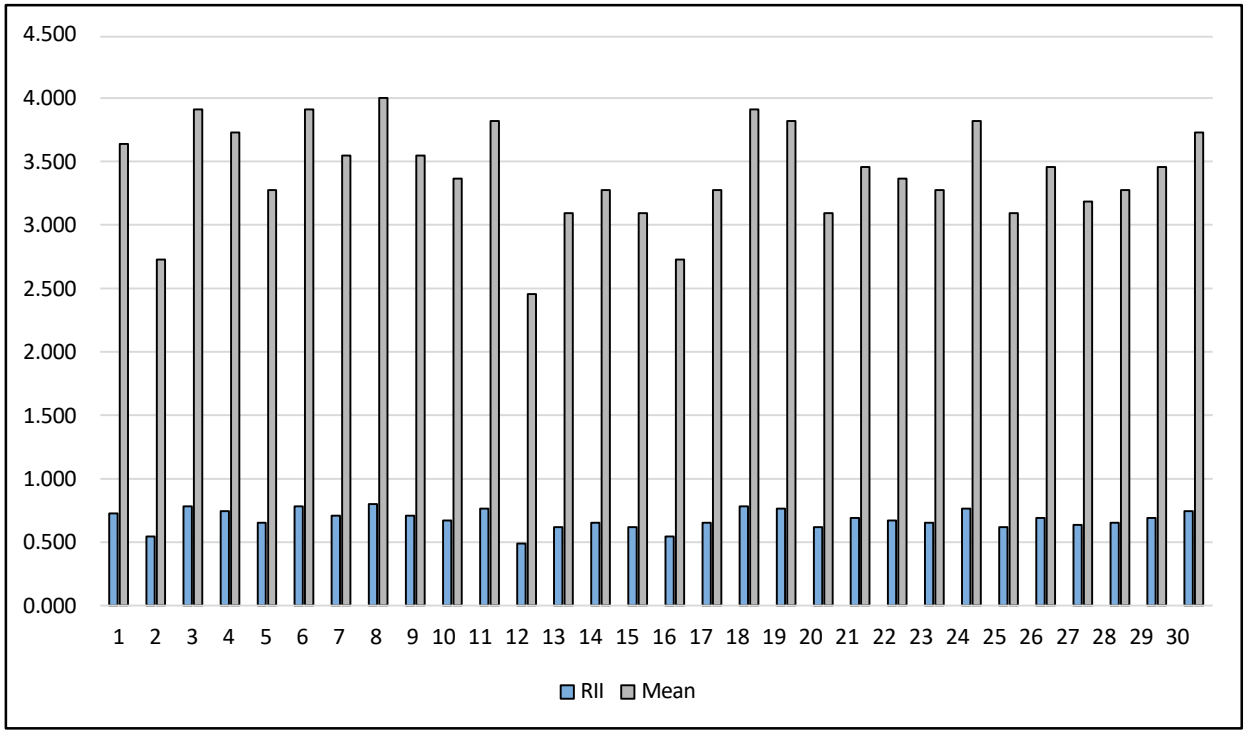


Graph 5.2 RII and Mean score of Construction project delay according to Architect

Table 5.3 RII and Mean score of Construction project delay according to Engineer

Sr.No.	Delay factors	RII	Mean
1	Shortage in labour	0.727	3.636
2	Shortage of materials	0.545	2.727
3	Shortage of equipments	0.782	3.909
4	Delay in materials delivery	0.745	3.727
5	Failure of equipments	0.655	3.273
6	Lack of communication with consultant / owner	0.782	3.909
7	Problem with neighbors	0.709	3.545
8	Poor planning and scheduling of the project by the contractor	0.800	4.000
9	Delay in the approval of contractor submissions by the engineer	0.709	3.545
10	Mistakes in soil investigation	0.673	3.364
11	Poor monitoring and control	0.764	3.818

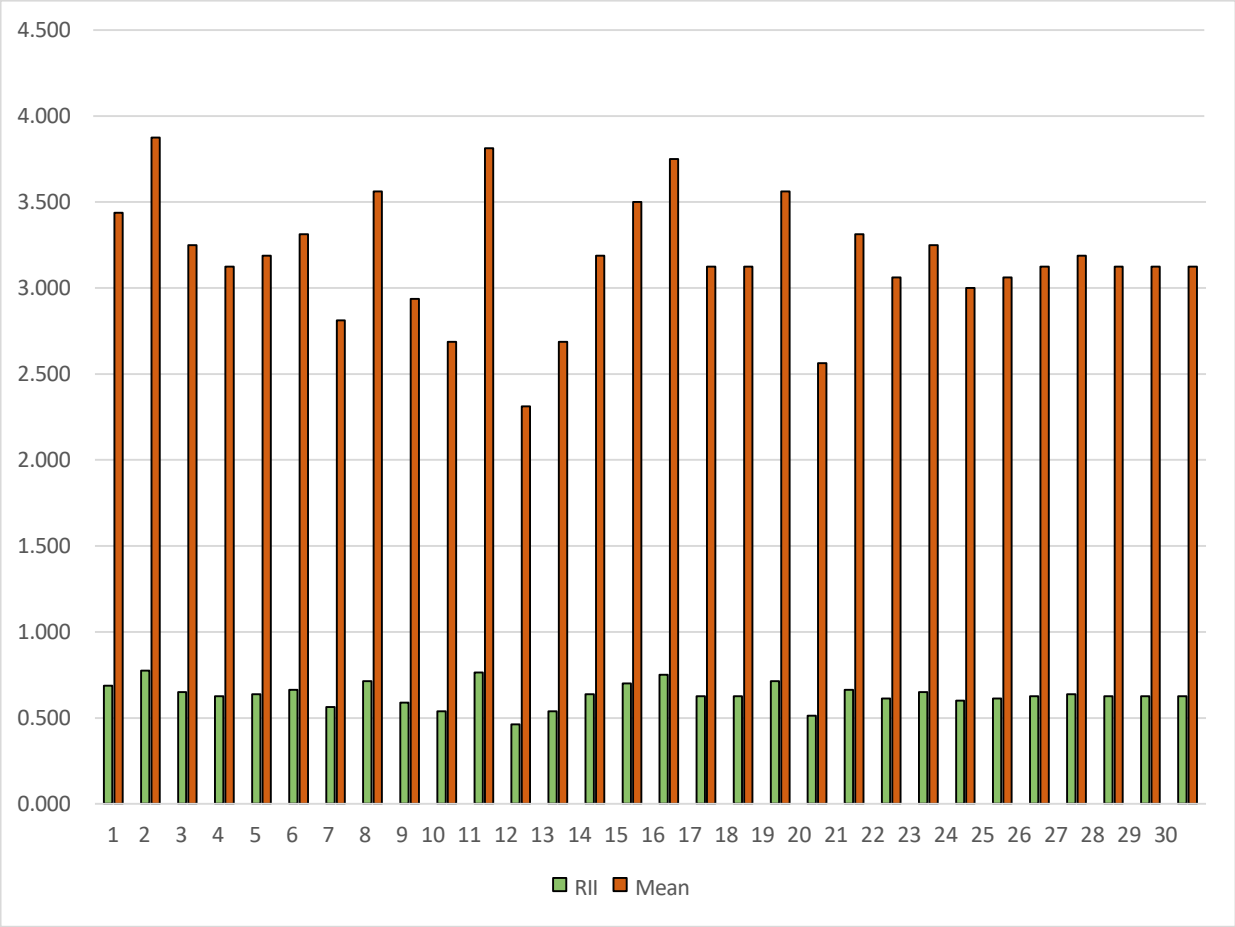
12	Using obsolete technology	0.491	2.455
13	Delays in site preparation	0.618	3.091
14	Severe weather conditions on the job site	0.655	3.273
15	Slowness of the owner decision making process	0.618	3.091
16	Delays in contractor's payment by owner	0.545	2.727
17	Suspension of work by owner	0.655	3.273
18	Rework due to errors during construction	0.782	3.909
19	High labour wages	0.764	3.818
20	Labour health problem when working in hazardous condition	0.618	3.091
21	Labour safety problems	0.691	3.455
22	Weather effect on construction activities	0.673	3.364
23	Improper technical study by contractor during bidding	0.655	3.273
24	Lack of experience/incompetence of contractor's key staff	0.764	3.818
25	Change in design	0.618	3.091
26	Slow decision making by developer	0.691	3.455
27	Delay in testing results	0.636	3.182
28	Delay by owner in approval of design from government authority	0.655	3.273
29	Rework due to errors during construction	0.691	3.455
30	Inappropriate construction methods	0.745	3.727



Graph 5.3 RII and Mean score of Construction project delay according to Engineer

Table 5.4 RII and Mean score of Construction project delay according to Site Engineer

Sr.No.	Delay factors	RII	Mean
1	Shortage in labour	0.688	3.438
2	Shortage of materials	0.775	3.875
3	Shortage of equipments	0.650	3.250
4	Delay in materials delivery	0.625	3.125
5	Failure of equipments	0.638	3.188
6	Lack of communication with consultant / owner	0.663	3.313
7	Problem with neighbours	0.563	2.813
8	Poor planning and scheduling of the project by the contractor	0.713	3.563
9	Delay in the approval of contractor submissions by the engineer	0.588	2.938
10	Mistakes in soil investigation	0.538	2.688
11	Poor monitoring and control	0.763	3.813
12	Using obsolete technology	0.463	2.313
13	Delays in site preparation	0.538	2.688
14	Severe weather conditions on the job site	0.638	3.188
15	Slowness of the owner decision making process	0.700	3.500
16	Delays in contractor’s payment by owner	0.750	3.750
17	Suspension of work by owner	0.625	3.125
18	Rework due to errors during construction	0.625	3.125
19	High labour wages	0.713	3.563
20	Labour health problem when working in hazardous condition	0.513	2.563
21	Labour safety problems	0.663	3.313
22	Weather effect on construction activities	0.613	3.063
23	Improper technical study by contractor during bidding	0.650	3.250
24	Lack of experience/incompetence of contractor’s key staff	0.600	3.000
25	Change in design	0.613	3.063
26	Slow decision making by developer	0.625	3.125
27	Delay in testing results	0.638	3.188
28	Delay by owner in approval of design from government authority	0.625	3.125
29	Rework due to errors during construction	0.625	3.125
30	Inappropriate construction methods	0.625	3.125

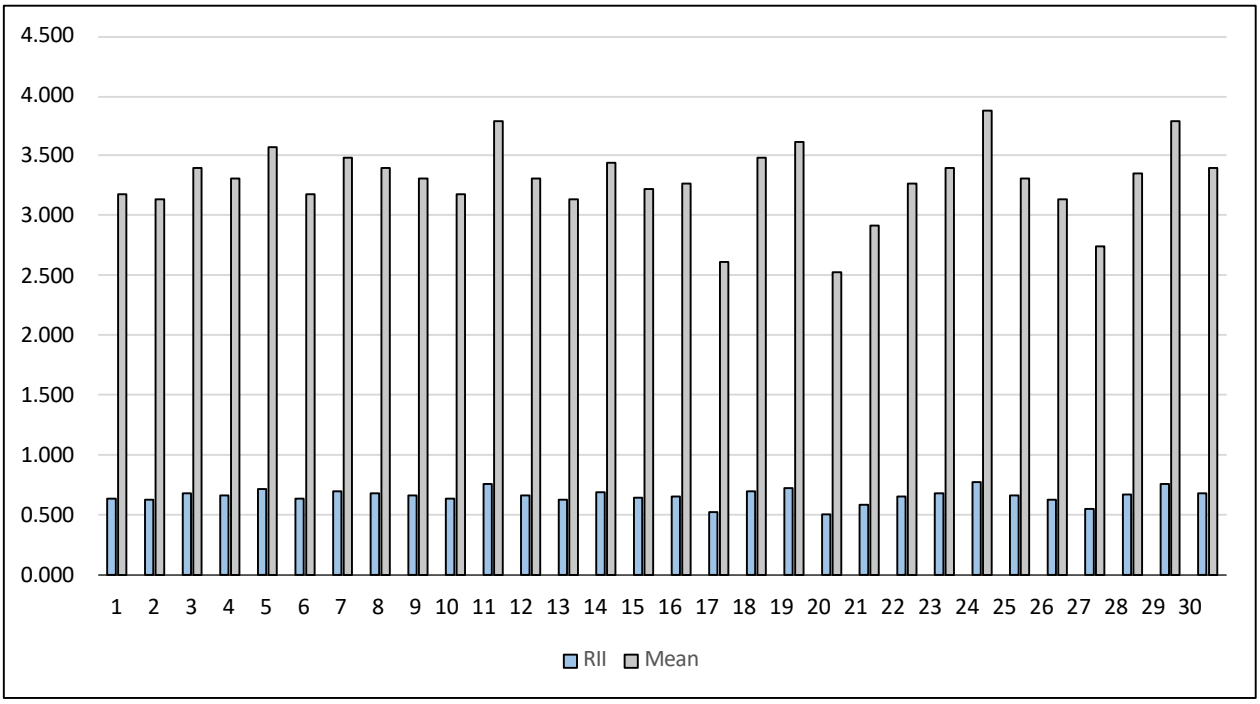


Graph 5.4 RII and Mean score of Construction project delay according to Site Engineer

Table 5.5 RII and Mean score of Construction project delay according to Owners

Sr.No.	Delay factors	RII	Mean
1	Shortage in labour	0.635	3.174
2	Shortage of materials	0.626	3.130
3	Shortage of equipment	0.678	3.391
4	Delay in materials delivery	0.661	3.304
5	Failure of equipment	0.713	3.565
6	Lack of communication with consultant / owner	0.635	3.174
7	Problem with neighbors	0.696	3.478
8	Poor planning and scheduling of the project by the contractor	0.678	3.391
9	Delay in the approval of contractor submissions by the engineer	0.661	3.304
10	Mistakes in soil investigation	0.635	3.174
11	Poor monitoring and control	0.757	3.783
12	Using obsolete technology	0.661	3.304

13	Delays in site preparation	0.626	3.130
14	Severe weather conditions on the job site	0.687	3.435
15	Slowness of the owner decision making process	0.643	3.217
16	Delays in contractor's payment by owner	0.652	3.261
17	Suspension of work by owner	0.522	2.609
18	Rework due to errors during construction	0.696	3.478
19	High labour wages	0.722	3.609
20	Labour health problem when working in hazardous condition	0.504	2.522
21	Labour safety problems	0.583	2.913
22	Weather effect on construction activities	0.652	3.261
23	Improper technical study by contractor during bidding	0.678	3.391
24	Lack of experience/incompetence of contractor's key staff	0.774	3.870
25	Change in design	0.661	3.304
26	Slow decision making by developer	0.626	3.130
27	Delay in testing results	0.548	2.739
28	Delay by owner in approval of design from government authority	0.670	3.348
29	Rework due to errors during construction	0.757	3.783
30	Inappropriate construction methods	0.678	3.391



Graph 5.5 RII and Mean score of Construction project delay according to Owners

CHAPTER

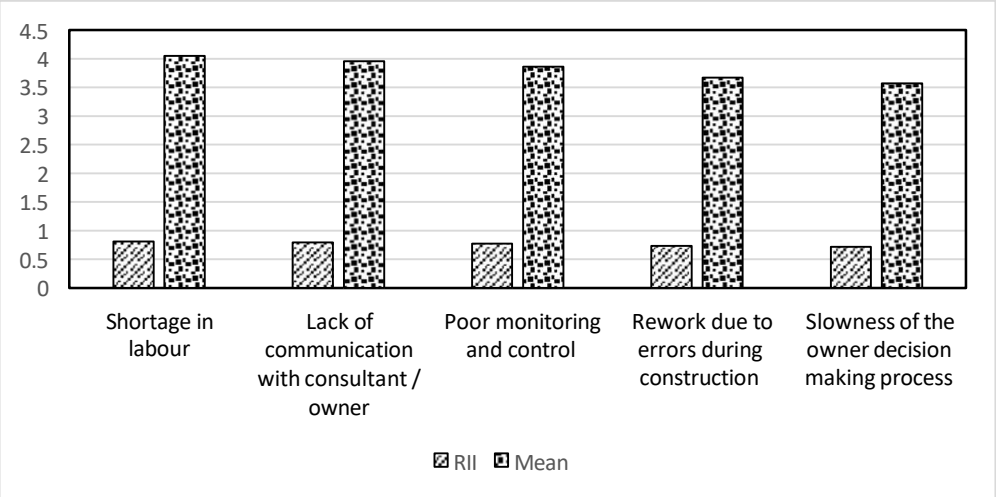
6

RESULTS & DISCUSSION

6.1 Most Significant causes of construction project delay

Table 6.1 Most significant causes of construction project delay according to contractor

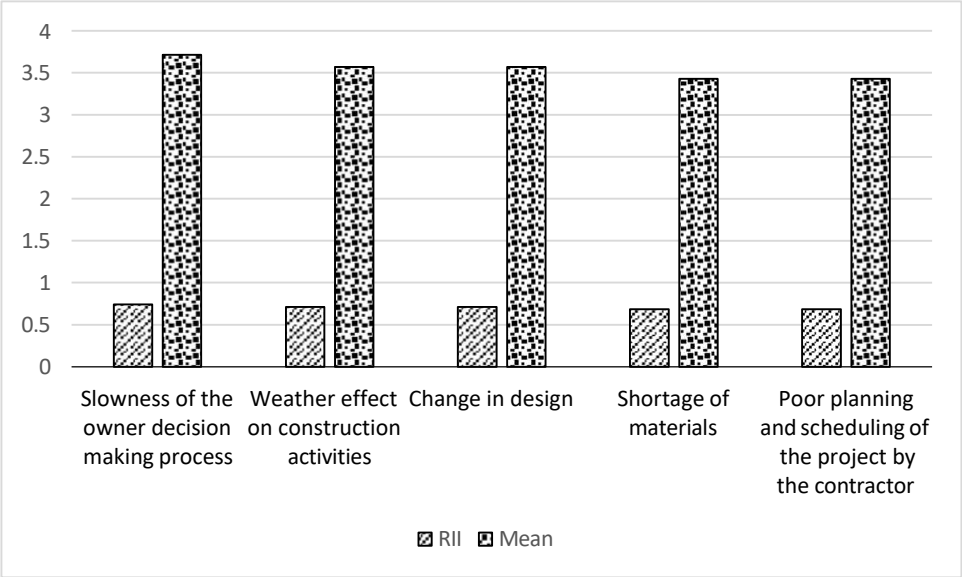
Rank	Delay factors	RII	Mean
1	Shortage in labour	0.810	4.048
2	Lack of communication with consultant / owner	0.790	3.952
3	Poor monitoring and control	0.771	3.857
4	Rework due to errors during construction	0.733	3.667
5	Slowness of the owner decision making process	0.714	3.571



Graph 6.1 Top five construction project delay according to Contractor

Table 6.2 Most significant causes of construction project delay according to Architect

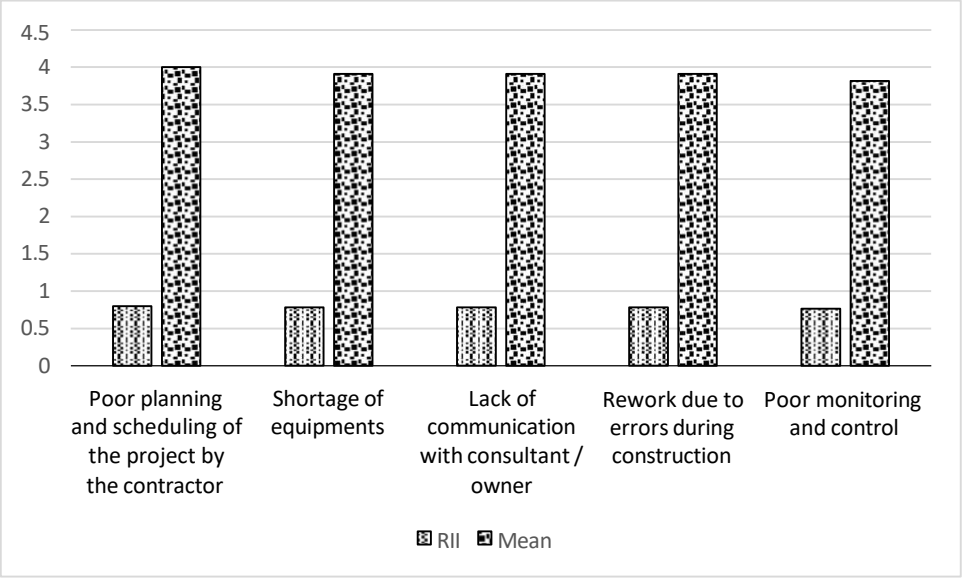
Rank	Delay factors	RII	Mean
1	Slowness of the owner decision making process	0.743	3.714
2	Weather effect on construction activities	0.714	3.571
3	Change in design	0.714	3.571
4	Shortage of materials	0.686	3.429
5	Poor planning and scheduling of the project by the contractor	0.686	3.429



Graph 6.2 Top five construction project delay according to Architect

Table 6.3 Most significant causes of construction project delay according to Engineer

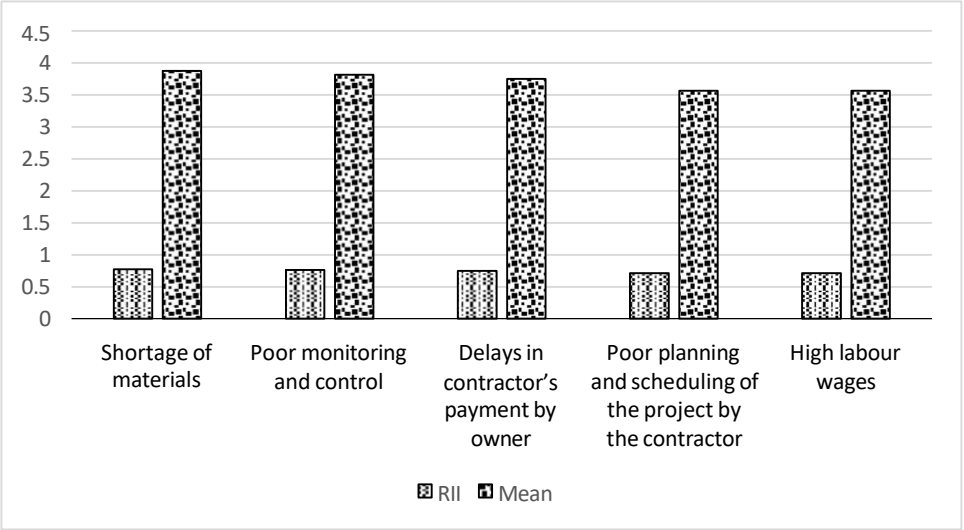
Rank	Delay factors	RII	Mean
1	Poor planning and scheduling of the project by the contractor	0.800	4.000
2	Shortage of equipment's	0.782	3.909
3	Lack of communication with consultant / owner	0.782	3.909
4	Rework due to errors during construction	0.782	3.909
5	Poor monitoring and control	0.764	3.818



Graph 6.3 Top five construction project delay according to Engineer

Table 6.4 Most significant causes of construction project delay according to Site Engineer

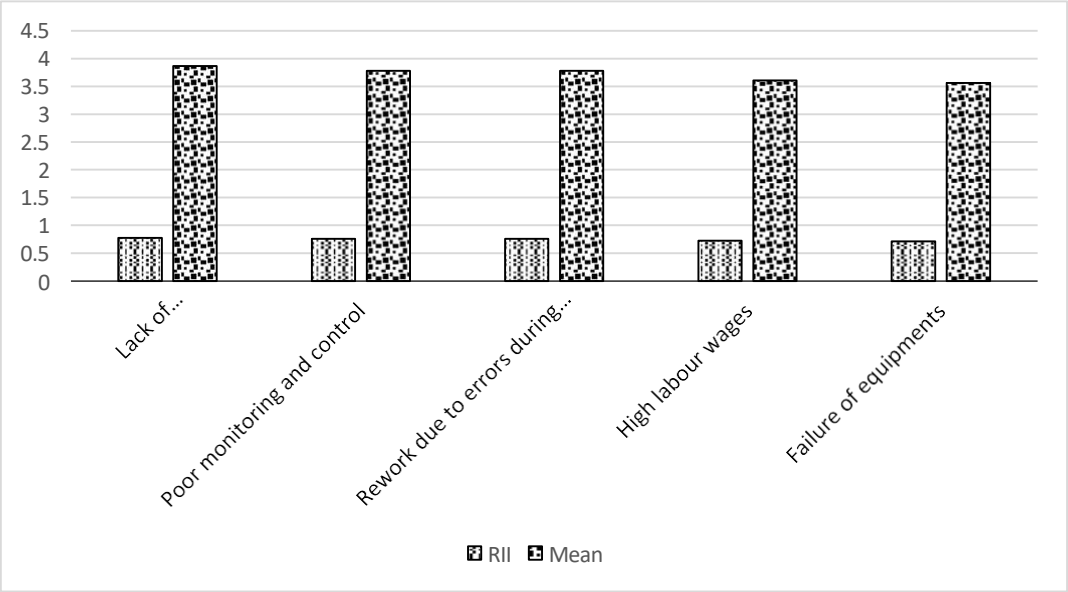
Rank	Delay factors	RII	Mean
1	Shortage of materials	0.775	3.875
2	Poor monitoring and control	0.763	3.813
3	Delays in contractor's payment by owner	0.750	3.750
4	Poor planning and scheduling of the project by the contractor	0.713	3.563
5	High labour wages	0.713	3.563



Graph 6.4 Top five construction project delay according to Site Engineer

Table 6.5 Most significant causes of construction project delay according to owner

Rank	Delay factors	RII	Mean
1	Lack of experience/incompetence of contractor's key staff	0.774	3.870
2	Poor monitoring and control	0.757	3.783
3	Rework due to errors during construction	0.757	3.783
4	High labour wages	0.722	3.609
5	Failure of equipment	0.713	3.565



Graph 6.5 Top five construction project delay according to Owner

CHAPTER

7

CONCLUSION

Based on the data collected through preventative measures and suggestions, guided by strict criteria, based on the opinions provided by respondents involved in the construction industry, as well as prior studies conducted by previous researchers. factors affecting the completion time of the project and their effects on construction projects at high risk that affect their performance. Our study's ranking system revealed five key causes for project delays.

The following are the top five causes according to contractor, in order of importance, from most serious to least serious. Shortage in labour, Lack of communication with consultant / owner, Poor monitoring and control, Rework due to errors during construction and Slowness of the owner decision making process.Top five causes according to Architect Slowness of the owner decision making process, Weather effect on construction activities, Change in design, Shortage of materials and Poor planning and scheduling of the project by the contractor.

This causes are according to Engineer are Poor planning and scheduling of the project by the contractor, Shortage of equipments, Lack of communication with consultant / owner, Rework due to errors during construction and Poor monitoring and control. And also causes are according to site engineer are Shortage of materials, Poor monitoring and control, Delays in contractor’s payment by owner, Poor planning and scheduling of the project by the contractor and High labour wages.This causes are according to owners Lack of experience/incompetence of contractor’s key staff, Poor monitoring and control, Rework due to errors during construction,

High labour wages and Failure of equipment. Effects of these delays are cost overruns, time overruns, and loss in profit. Furthermore, the findings of this study will reach in identifying key issues and reducing project delays even more.

REFERENCE

[1] A. Avinashe, “STUDY OF CONTRUCTION DELAYS IN AMRAVATI CITY AND STUDY OF CONSTRUCTION PRACTICES IN THE CITY,” || *ISO*, vol. 6, 2021, doi: 10.51397/OAIJSE07.2021.0018.

[2] B. A. K. S. Perera, M. K. C. S. Wijewickrama, P. J. A. Goonawardana, and C. Jayalath, “Improving the efficacy of delay notification process of construction projects in Sri Lanka,” *Int. J. Constr. Manag.*, vol. 21, no. 7, pp. 755–768, 2021, doi: 10.1080/15623599.2019.1581593.

[3] P. K.V, V. Vasugi, V. R, and N. Bhat, “Analysis of causes of delay in Indian construction projects and mitigation measures,” *J. Financ. Manag. Prop. Constr.*, vol. 24, no. 1, pp. 58–78, Mar. 2019, doi: 10.1108/JFMPC-04-2018-0020.

[4] J. A. Alsuliman, “Causes of delay in Saudi public construction projects,” *Alexandria Eng. J.*, vol. 58, no. 2, pp. 801–808, Jun. 2019, doi: 10.1016/j.aej.2019.07.002.

[5]) Umuhoza, An, and Sung-Hoon, “Delay Factors in Building Construction Projects in Rwanda,” *J. Korea Inst. Build. Constr*, vol. 19, no. 5, pp. 467–475, 2019, doi: 10.5345/JKIBC.2019.19.5.467.

[6] R. S. P, G. V S, and A. Professor, “Causes of Delays in Construction Projects,” 2018. [Online]. Available: http://ijesc.org/.

[7] A. P. Udasi and M. M. Darade, “Delays in Construction Projects: Causes, Effects and Impacts of RERA,” 2018. [Online]. Available: www.ijrti.org.

[8] G. A. Bekr, “Study and Assessment of Causes and Effects of Delay in Large Public Construction Projects in Jordan,” 2018. [Online]. Available: http://www.ripublication.com.

[9] R. L. Metha and S. V Gaikwad, “Delays and its Analysis: Indian Residential Construction Projects,” doi: 10.6106/JCEPM.2017.7.4.020.

[10] T. Gebrehiwet and H. Luo, “Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient: Empirical Study,” *Procedia Eng.*, vol. 196, no. June, pp. 366–374, 2017, doi: 10.1016/j.proeng.2017.07.212.

[11] R. K. Shah, “An Exploration of Causes for Delay and Cost Overruns in Construction Projects: Case Study of Australia,” 2016.

[12] D. Kumar, “Causes and Effects of Delays in Indian Construction Projects,” 2016. [Online]. Available: www.irjet.net.

[13] D. S. Shridhar, “Delays in Construction Project and their preventions,” no. December, pp. 4–7, 2003.

[14] BALDWIN, MANTHEI JM, ROTHBART H, and HARRIS RB, “Causes of delay in the construction industry,” *ASCE J Constr Div*, vol. 97, no. CO2, pp. 177–187, 1971, doi: 10.1061/jcceaz.0000305.

[15] K. Kalkani and M. SHAKIL, “Analyzing Causes of Delay in Construction Projects,” *Int. J. Innov. Res. Sci. Technol.*, vol. 2, no. 12, pp. 257–262, 2016, [Online]. Available: www.ijirst.org.

[16] D. Arditi, S. Nayak, and A. Damci, “Effect of organizational culture on delay in construction,” *Int. J. Proj. Manag.*, vol. 35, no. 2, pp. 136–147, 2017, doi: 10.1016/j.ijproman.2016.10.018.

[17] K. Prakash and N. Nandhini, “Evaluation of Factors Affecting Construction Project Performance Management,” *Int. J. Sci. Eng. Res.*, vol. 3, no. 4, pp. 1–5, 2015.

[18] I. Journal, “IRJET-A METHODOLOGY TO IDENTIFY THE DELAYS AND RANK ITS CAUSATIVE FACTORS IN INDIAN CONSTRUCTION INDUSTRY.”

[19] P. Rao, “CAUSES OF DELAYS IN CONSTRUCTION PROJECTS,” 2014. [Online]. Available: http://www.journalcra.com.

[20] W. : Www and A. Dinakar, “International Journal of Emerging Technology and Advanced Engineering Delay Analysis in Construction Project,” 2008. [Online]. Available: www.ijetae.com.

[21] P. González, V. González, K. Molenaar, and F. Orozco, “Analysis of Causes of Delay and Time Performance in Construction Projects,” *J. Constr. Eng. Manag.*, vol. 140, no. 1, p. 04013027, Jan. 2014, doi: 10.1061/(asce)co.1943-7862.0000721.

[22] M. Desai and R. Bhatt, “Critical Causes of Delay in Residential Construction Projects: Case Study of Central Gujarat Region of India,” *Int. J. Eng. Trends Technol.*, 2013, [Online]. Available: http://www.ijettjournal.org.

[23] S. Mistry and R. Bhatt, “Critical FactorsAffecting Labour Productivity InConstruction Projects: Case Study Of South Gujarat Region Of India,” *Int. J. Eng. Adv. Technol.*, no. 2, p. 583, 2013.

[24] S. Vyas, “Causes of Delay in Project Construction in Developing Countries,” *Indian J. Commer. Manag. Stud.*, vol. IV, no. 2, pp. 24–29, 2013.

[25] M. P. Venkatesh, S. M. Renuka, and C. Umarani, “Causes of delay in Indian construction industry,” in *Applied Mechanics and Materials*, 2012, vol. 174–177, pp. 2768–2773, doi: 10.4028/www.scientific.net/AMM.174-177.2768.

[26] H. Doloi, A. Sawhney, K. C. Iyer, and S. Rentala, “Analysing factors affecting delays in Indian construction projects,” *Int. J. Proj. Manag.*, vol. 30, no. 4, pp. 479–489, May 2012, doi: 10.1016/j.ijproman.2011.10.004.

[27] G. Sweis, R. Sweis, A. Abu Hammad, and A. Shboul, “Delays in construction projects: The case of Jordan,” *Int. J. Proj. Manag.*, vol. 26, no. 6, pp. 665–674, Aug. 2008, doi:

10.1016/j.ijproman.2007.09.009.

[28] S. A. Assaf and S. Al-Hejji, “Causes of delay in large construction projects,” *Int. J. Proj. Manag.*, vol. 24, no. 4, pp. 349–357, May 2006, doi: 10.1016/j.ijproman.2005.11.010.

[29] A. A. Aibinu and G. O. Jagboro, “The effects of construction delays on project delivery in Nigerian construction industry,” *Int. J. Proj. Manag.*, vol. 20, no. 8, pp. 593–599, 2002,doi: 10.1016/S0263-7863(02)00028-5.

[30] B. Jonathan Jingsheng Shi, S. O. Cheung, and D. Arditi, “CONSTRUCTION DELAY COMPUTATION METHOD.”