



“To Analyze The Causes Of Time And Cost Overrun In Pune Metro Project”

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Abstract- to determine the key causes of construction project delays in India Following data gathering via a questionnaire survey with a wide range of construction professionals based in Metro Projects, the key causes of delays from this research study were analyzed. The findings of this study used an importance index to determine the major causes of delays, and the main conclusions drawn from the data could aid the construction industry in better assessing not only the major causes of delays on construction projects, but also how to minimize them through proper planning. However, greater understanding of health, hygiene, and safety risks may present opportunity for safer working practices. The importance of safety leadership is sometimes disregarded in guidelines, despite its importance in ensuring the safe implementation of working procedures. Apart from addressing the rising demand, Delay issues can be avoided in the current context by appropriate decision-making throughout the construction process, although more research is required. This could include research into decision communication, the content of construction site manager training programmes, the value of apprenticeship schemes to provide a more skilled workforce, the possibilities of greater use of pre-cast materials, and so on. This study identified the causes of construction project delays in India during the pandemic.

Because metro projects are such an important element of the city, they must be completed as soon as possible for public benefit. Almost all of India's metro projects are experiencing delays. Delay is widely regarded as the most common, complicated, and dangerous problem in building projects. Overruns in time describe the majority of building projects in developing countries. Deadlines and unpredictability plague all initiatives, regardless of their size or complexity. Every construction project experiences delays, and the extent of these delays varies greatly from project to project. This study conducts a thorough evaluation of prior studies on time and cost overrun drivers.

Keywords- Delay, Metro, Cost, Time, budget, Management, Risk Management, Planning, Quality, Schedule

I. INTRODUCTION

The construction industry is repeatedly criticized for being inefficient and slow to innovate.

The term advanced construction technology covers a wide range of modern techniques and practices that encompass the latest developments in materials technology, design procedures quantity surveying, facilities management services, cost-effective, structural analysis and design and management studies.

Incorporating advanced construction technology into practice can increase levels of quality, efficiency, safety, sustainability and value of money.

Improved job-site efficiency through more effective interfacing of people, Process, Materials, Equipment, and information

1. Greater use of prefabrication, preassembly, modularization, and off site fabrication techniques and process
2. Widespread deployment and use of interoperable technology application
3. Innovative, widespread use of demonstration installations
4. Effective performance measurement to drive efficiency and support innovation
5. It is project delivery strategy to start construction before the design is complete.
6. The purpose is to shorten the time to completion
7. The final cost of the project is uncertain when construction begins because design is not complete.
8. Fast-Track is more difficult to manage than the traditional design bid build process. It requires detailed knowledge of the process, effective planning, integrity and close coordination among the organizations executing the work.

The Impact of pandemic situation on the construction industry; the global impact of pandemic; the impact of global impact, and the prospects of economy; the study covers the impact on global and regional economies. The construction industry and its economic prospects are also discussed in the global pandemic.

The major causes of delays based on an importance and relative index, and the main conclusions from output of the data could help the construction sector to better assess not only the major causes of delays on construction projects but also how to minimize them by proper planning.

The most common factor of delay are natural disaster in construction industry like flood and earthquake and some others like financial and payment problems, improper planning, poor site management, insufficient experience, shortage of materials and equipment etc. We cover the delay factors and causes of delay and some suggestion for reducing these delays in metro construction projects.

The importance of applying proper management in dealing with delays in construction for a growing economy; the main objective of this paper is to identify the management tools that are practiced in the local construction industry in mitigating delay. It also aims to identify the main factors that lead to project delays and to suggest recommendations on how to overcome or mitigate effects of the problem.

The purpose of this study was to explore the causes of delay risk through a field survey study. Data were collected from construction professionals working in owner, consultant and contractor organizations. All together questionnaire instruments were used and analyzed by employing statistical tools (SPSS computer program).

Construction projects delay presents the relationship between new technology and time overrun in those projects. One of the main causes of delay in many projects is that they use an old generation of construction technologies; however, the role of technology adoption in delay is ignored.

Lack of efficient construction planning plays the second key role in adverse time performance. While the effect of lack of commitment on contractor's inefficiency is highly significant, neither of these two factors has any direct impact on time delay in projects.

II. LITERATURE REVIEW

Yash Kumar Mittal, Virendra Kumar Paul (2018) identified the critical factors for delay in metro rail project in India. They identified 10 most critical delay-factors; . The identified factors included: Delay in land acquisition and site handover to contractor, Shifting of utilities and contingency works, Scope change, Delay in payments, Effects of unforeseen subsurface and changing ground condition, (Shortage of construction materials in the market, Delays in design approvals and decision making, Shortage of labour, Lack of data collection and survey before design, and Delay in obtaining permits from local body. Project management interventions based on the identified critical factors of delay can improve the delivery of upcoming metro rail projects in terms of schedule compliance. The Application of suitable course correction measures targeting the critical factors can result in mitigation of delays.

Time and cost overrun are also commonly observed in case of metro rail projects in India. Delhi metro project, commissioned in 2002, was the first modern metro project in India. The first phase of the project performed well in terms of schedule and cost compliance. The other commissioned projects in the last decade include Namma Metro, Rapid Metro, Mumbai Metro, Jaipur Metro, Chennai Metro, Kochi Metro and Hyderabad Metro. Almost these entire metro rail projects have faced delayed ended up with substantial schedule overruns. With reference to such scale and frequency of delays in metro rail projects, it becomes significant to investigate the projects for identifying the factors responsible for the delay

Vishwas H S, Dr G D Gidwani (2017) has identified risk and gave control measure in metro railway line construction project at Hyderabad. Construction industry has large no. of injuries compared to other industries thus to reduce accidents the identification of risks is very important. The steps for risk identification and risk assessment are hazard identification ,risk assessment, risk control, implementation of risk control ,Monitor & review .The methodology used to find hazards in construction site by using Job Safety Analysis. It aims to improve method of production. The technique used for this is SREDIM i.e. Select, record, examine, develop, install and measure. Various risks were identified and control measures were given. The risk were further broken into7sub categories design risk, external risk, environmental risk, organisational risk, project management risk, right of way risk, and construction risk. Further risk score were calculated. Few risk with high impact and high probability are required further analysis. Conclusion: Job Safety Analysis is elaborated effectively also the risk matrix is shown to represent different types of risk which is further categories into sub-category. This will help company to manage risk effectively and greater productivity, improve success rate and better decision making.

Sai Krishnan, Gangadhar Mahesh and Parthasarathy M (2016) conducted literature survey in order to identify the existing literature pertaining to risk identification and analysis of risks that come up during procurement of specialised items in a metro rail project. The study carried out has the following objectives are identifying the risks involved in procurement of specialised items for metro rail project, Qualitative Analysis of the risks involved which include finding the owners of the risks, Quantitative Analysis of the risks involved which include finding probability, severity and impact of all the risks involved Preparing priority list of risks based on overall impact on the project value. Risks are identified based on study of Contract documents, brainstorming with procurement team and interview with experts. Detailed analysis of risks identified will help in deciding effective response strategies before their occurrence. The analysis carried out as part of the study can be utilized for all the projects of same nature. This becomes even more significant as there is an increase in number of Metro Rail projects in recent times. The risk management framework developed here will be helpful for procurement of project specific items for all future Metro Rail Project. Study is carried out with respect to procurement of 5 specialized items in Hyderabad Metro Rail Project (HMRP). Packages considered are selected based on their uniqueness with respect to other construction projects. Packages were considered from each of the main sections in a construction project.

Manvinder Singh and Debasis Sarkar (2017), has identified risk by 2 techniques Expected Value Method (EVM) and (FMEA) in order to mitigate risk of elevated corridor of metro rail project. The data is collected from 66 experts is analysed using EVM. Failure Mode and Effects Analysis (FMEA) is a risk management and planning technique that can be used to identify and prioritize potential errors/failures within a project/system/process and come up with possible solutions to avoid these errors. RPN (Risk Priority Number) is computed as a product of S, O and Severity, occurrence and detection. Case study considered is Ahmedabad elevated metro of the stretch 4.6 km from Gyaspur to Sheyas station. Total 550 piles and 136 piers to be constructed and around 1320 segments major risks are identified. Conclusion: It is concluded that, Feasibility and DPR, Land hand over, Tender and award of contract, construction programme planning, launching girder and obligatory span activities are found very risky in both of the methods and are having very high to high risk severity and RPN value. Hence risk mitigation measures by authorities should be taken accordingly.

Uma Maheswaria et al. (2016), presented study is to capture the dependencies among activities and NCRs using a structured approach that can be utilized to estimate the total project duration, which is inclusive of the delays due to non-conformances. To achieve this objective, a case study-based MDM (Multiple Domain Matrix) solution methodology has been proposed and the same has been demonstrated with the case study of a metro project.

This NCR-activity mapping using MDM is effective in planning repetitive projects. There is delay in project when NCR is issued. Rework due to NCR has negative impact in quantitative and qualitative terms on projects i.e. delay in project or cost overrun. They explore the application of framework in order to identify the dependencies among the activities and the NCRs that can be subsequently used for assessment of the delay due to NCRs in linear projects. This is based on the premise that complete and correct identification of the origin and propagation of NCRs shall result in accurate assessment of the delays. A case-based solution methodology using MDM has been proposed for monitoring the activities and the open NCRs. Case study data on open NCRs was collected from a metro construction project over a period of six months.

It has been attempted to use MDM to capture and analyze the dependencies among activities and NCRs due to quality deviations only. The proposed concept for delay assessment has been verified with two other metro projects. Initial results of this experiment were quite convincing. It was found that total planned duration ignoring delays due to NCRs was 161 days and total planned duration considering delays due to NCRs was 180 days. Non-conformance in quality is a major concern in the construction projects as it can delay the project and eventually can escalate the project cost. It has been attempted to adopt a MDM-based methodology to capture the dependencies among the activities and NCRs.

N Banachandra, M.M Saravannan(2014) identified the major risk sources and quantified the risk in terms of likelihood, impact and severity in complex infrastructure project for the construction of underground corridors for metro railways. Based on various factors from literature review, preliminary questionnaires' was framed and distributed to engineers working in metro projects. The data further would be analyzed by SPSS (Statistical Package for Social Science) and Risk Priority number. Objectives are to identify risks involved during the construction project of a company. To identify the major risk factor in construction project through questionnaire survey. To prepare a model which will serve as guideline and explain how various risks can be entered and managed using management software. To create an efficient risk management system in the construction project

Mahdi Khosari and Kalle Kahkonen (2015), studied internal and external issues in underground project and impact on project management is discussed. They aim to explore the complexities in underground construction of metro projects. The results in this paper are based on qualitative and quantitative data from real world projects and experts of underground construction. The challenges faced during construction are divided into external and internal complexities. The internal complexities change in construction phase like if there are any mistakes must be changed, if there change in design occurs during execution of project, second is Experience, if there is repetition of previous task there are better results third is financial management must be done to avoid issues during construction fourth is the integration. Some of external complexities are caused by situations and conditions of project like the traffic problems restriction by public, political a issue which delay the project and affects the cost.

Debasis Sarkar (2012), aims to develop a tool through decision tree analysis (DTA) to enable decision making about the most feasible option that the project authorities should adopt so that the project is executed most effectively and economically within the stipulated time and cost frame. Responders' person associated with metro rail projects the risk likelihood and association weightages has been collected through questionnaires' survey. The risk classification was done for metro project almost 21, major activities were identified further they divided into 14 sub risk sources decision point and the chances points reflects the decision situation of alternate sources and chance of occurrence. Based on their points expect cost and expect time was calculated. It is observed that the EC overrun of the project due to risks is about 25% and the ET overrun is about 50.39%. The EC overrun and time overrun values are so high that if the project authorities do not adopt proper risk mitigation measures the probability of successful completion of the project with stipulated time and cost frame would reduce drastically.

Gang Chen, Kefan Xie, Qian (2012) have analyzed various emergency events in metro engineering construction project. They divided paper into the emergency events in metro engineering construction project into three types: conventional emergency event, semi-conventional event, and unconventional event. They found three types of emergency event in metro construction project, dynamic, complexity and differences where these three leads to more complication in assessment grading and classification of metro construction. Further in terms of impact scope and extent of emergencies into extraordinary accidents, serious accidents, major accident and comparatively large accidents, moreover depending on chance of occurrence three types of emergencies they are conventional unconventional and semi conventional. There are different kinds of emergencies in each stage of metro construction projects, which depend on construction environment and emergency development. Therefore, metro construction emergency has characteristics of dynamicity, complexity, and divergence, which means that it cannot ignore the development process and law of emergency, and its impact as well. Thus, dynamic scale

methods should be adopted in level to-level management of metro construction project. In additional, scientific control strategies should be adopted to interdict situation deterioration according to the emergency development law, which is of necessity in security management of metro construction project.

Aim

- ✓ To decrease the time required for completing construction activity by proper decision-making throughout the construction process.
- ✓ To find the factor of delays in construction of emergency services and to overcome cost with advance construction technology.

Objectives

1. To evaluate the metro project delay factors based on the interview, questionnaire & Case Study through various programs. This includes identifying different parameters for delay & cost overruns in view of respondents & comparing them. Evaluate the impact of advance technology to improve construction activities that relate to time.
2. To study the delay impact on project, its mitigation measures and recommendations to further metro projects.
3. To study cost-benefit analysis process through pune Metro project.

Problem Statement

“To study economic feasibility for metro construction; the study addresses the factors that determine location, the attributes that enhance rail use through satisfaction and financial analysis, presents the social impacts and their requirements for the achievement of the social objectives, and discusses the benefits social, economic, environmental that are accrued from the existence of metro Construction.”

III. RESEARCH METHODOLOGY

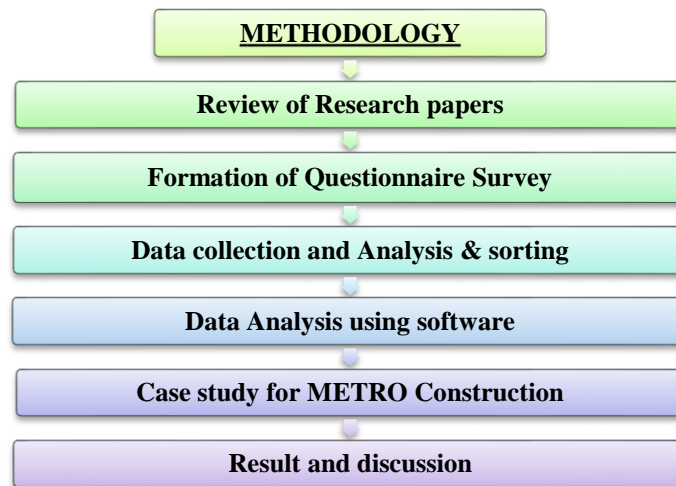


Figure1.1: Flow of Methodology

IV. DATA COLLECTION

By reading guideline I observed that because of delays in releasing of payment from the government agencies and sanctioning of material from the government engineers caused delay in construction activity.

By operating advance technology at construction project reduce delay in transporting of material and increase efficiency of work that ultimately reflect of time and cost.

From literature found that because of frequent change of project managers, Appointment of staffs in the site who are not experienced and also Non sequential progress of works and that Work was not followed as per procedure instead it was followed as per availability of resources caused delays in construction project.

Miss out of few materials while quoting tender by the tendering department. Delay in planning of resources from tendering department. Requirement of materials for future use, not noticed by the site engineer; no stock yard available for storing materials leads to material wastage

Unavailability of adequately trained health workers and lack of experience in managing an unprecedented emergency; the pandemic and the confinement measures created a psychosocial burden for the population and, especially, the wellbeing of the health workforce.

The construction industry is the vehicle through which physical development is achieved, and this is truly the locomotive of the national economy. The more resources, engineering know-how, labor, materials, equipment, capital, and market exchange provided from within the national economy, the higher the extent of self-reliance. The increasing complexity of infrastructure projects and the environment, within which they are constructed, place greater demands on construction managers to deliver projects on time, within the planned budget and with high quality.

Therefore, improving construction efficiency by means of cost-effectiveness and timeliness would certainly contribute to cost savings for the country as a whole. Efforts directed to cost and time effectiveness were associated with managing time and cost.

It also aims to identify the main factors that lead to project delays and to suggest recommendations on how to overcome or mitigate effects of the problem. Data is gathered from responses from questionnaire survey and interviews with those involved in construction project.

The surveys and research findings indicate that delay incidents occur mainly during the construction phase of a project and one or more parties usually contribute to delay. This paper highlights the importance of having more experienced and capable construction managers as well as skilled labourers to enable the industry to develop at a faster rate either nationally or internationally.

A questionnaire and personal interviews have formed the basis of this research. Factor analysis and regression modelling were used to examine the significance of the delay factors. From the factor analysis, most critical factors of construction delay were identified as

- Lack of commitment;
- Inefficient site management;
- Poor site coordination;
- Improper planning;
- lack of clarity in project scope;
- lack of communication; and
- Sub-standard contract.

V. DATA ANALYSIS

Questionnaire Survey

- Among the many available methods in collecting data two methods were adopted; these are literature review and questionnaires.
- The first step involves general information collection, including both first-hand and second-hand data, in order to identify major themes from the literature.
- In the second step, with the literature review and unstructured reviews, important factors of safety were identified. With these factors, a questionnaire was formed and Survey was conducted through Google form or any other.
- The Google form questionnaires will distribute through various electronic media platform to a variety of respondent working around the construction projects.

Pilot Survey and Questionnaire Revision

- To improve the questionnaire section, a pilot study was accompanied. This section contained identification of different causes, collection, and conclusions of data
- Questionnaires were sent to labourers, contractors, government employee, project managers, valuers and project engineers at metro project.
- To get more suitable and consistence meaning some factors should be rearranged.
- Some factors should be changed to give clearer importance and understanding. Better and accurate questionnaire related to the topic was achieved from the pilot study.
- The perfections related to the organization of the questionnaire and the response time.

SPSS SOFTWARE

Analysis of the questionnaires survey was done using IBM SPSS Software. SPSS Statistics is a software package used for statistical analysis.

The software name originally stood for Statistical Package for the Social Sciences (SPSS).

SPSS data View: The Questionary Survey responses were reported in excel file.

SR.No	Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
1	1.Abhishhek	1	1	1	3	1	2	1	1	2	1	2	1
2	2.Abhilash	1	1	1	1	1	1	1	1	1	2	1	2
3	3.Akhay A	2	1	1	2	1	1	3	2	1	1	3	1
4	4.Ani jng	1	1	1	1	1	1	1	3	1	1	2	1
5	5.Aru ad	1	1	1	1	2	1	1	1	1	1	2	2
6	6.Bhagash	1	1	1	1	1	2	1	1	1	1	3	2
7	7.Dipti Bb	1	1	1	1	1	1	1	1	1	3	3	1
8	8.Ganesh S	1	1	1	3	1	1	1	2	2	1	2	1
9	9.Jyoti Sh	2	1	2	1	2	1	1	1	1	1	2	3
10	10.Khushbu	1	1	1	1	1	1	1	1	2	2	2	1
11	11.Kiran Pa	1	1	1	3	1	2	1	1	1	1	3	1
12	12.Kunal Sh	1	1	1	1	1	2	1	1	1	1	2	1
13	13.Laksh G	1	1	1	1	1	1	3	1	1	1	1	1
14	14.Mansh S	3	2	1	3	1	1	1	1	3	1	2	1
15	15.Mansha	1	1	1	2	1	1	1	1	2	1	2	1
16	16.Nehant	1	1	1	1	1	3	1	1	2	1	2	1
17	17.On.Pawar	1	1	1	1	1	1	1	1	1	1	1	2
18	18.Priyash	1	1	1	1	1	1	1	3	1	1	2	1
19	19.Pritash	1	1	1	2	1	1	1	1	1	1	2	1
20	20.Puushkar	1	1	1	1	1	1	1	1	1	1	2	1
21	21.Puushkar	1	1	1	1	1	3	1	1	3	1	2	1
22	22.Radhika	1	1	1	1	3	2	1	1	2	1	1	1
23	23.Rahul Pa	3	1	1	2	2	1	1	1	1	1	1	2

SPSS Variable View:

An SPSS data file always has a second sheet called variable view. It shows the metadata associated with the data. Metadata is information about the meaning of variables and data values.

In Variable View, different columns are displayed. Each line corresponds to a variable. A variable is simply a quantity of something, which varies and can be measured, such as.

Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Is	
1	SR.No	Numeric	8	0	SR.No	None	None	8	Right	Scale
2	Name	String	8	0	NAME	None	None	22	Left	Display
3	Q1	Numeric	8	0	Do you believe that poor management system contributed to the jumbo covid center's late compl...	(1, YES)	None	8	Right	Display
4	Q2	Numeric	8	0	Is it true that heavy rain causes building activity to slow down?	(1, YES)	None	8	Right	Display
5	Q3	Numeric	8	0	Do you believe that using advanced construction techniques to build a jumbo covid center is the...	(1, YES)	None	8	Right	Display
6	Q4	Numeric	8	0	Do you believe that this project's delays are due to government funding and payment issues?	(1, YES)	None	8	Right	Display
7	Q5	Numeric	8	0	Do you think that project will be delayed as a result of the late release of the site, drawings, and...	(1, YES)	None	8	Right	Display
8	Q6	Numeric	8	0	Is the project team heavily reliant on one another for assistance, intelligence, or enforcement to c...	(1, YES)	None	8	Right	Display
9	Q7	Numeric	8	0	Do you believe the errors in layout caused by incorrect data in drawings lead to further work ben...	(1, YES)	None	8	Right	Display
10	Q8	Numeric	8	0	Do you believe the project team members and staff lack expertise in the construction of an emer...	(1, YES)	None	8	Right	Display
11	Q9	Numeric	8	0	Can you tell there is a lot of uncertainty on the project for the project team members?	(1, YES)	None	8	Right	Display
12	Q10	Numeric	8	0	Do you believe that advanced building techniques were used, any of the above factors will be ell...	(1, YES)	None	8	Right	Display
13	Q11	Numeric	8	0	Do you believe that India's health infrastructure is sufficient to solve the Covid 19 problem?	(1, YES)	None	8	Right	Display
14	Q12	Numeric	8	0	Do you think that quality of the work would suffer as a result of the fast-track construction?	(1, YES)	None	8	Right	Display
15	Q13	Numeric	8	0	Do you think the best choice for constructing a jumbo covid center is to use advanced building te...	(1, YES)	None	8	Right	Display
16	Q14	Numeric	8	0	Do you believe that the lack of construction management is required to complete the project on t...	(1, YES)	None	8	Right	Display
17	Q15	Numeric	8	0	Do you believe that a jumbo covid center should be built at the start of the covid to save the lives...	(1, YES)	None	8	Right	Display

SPSS Data analysis

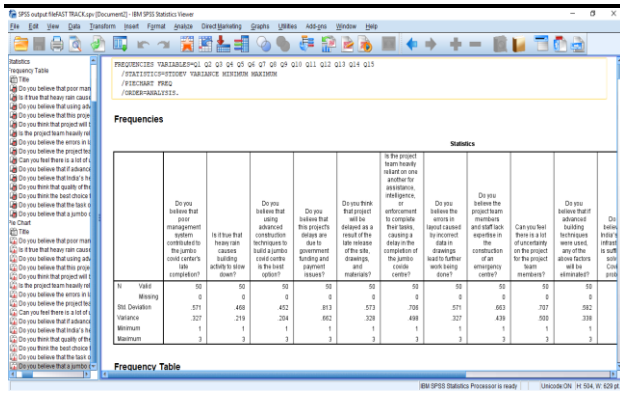
- SPSS can open all sorts of data and display them -and their metadata- in two sheets in its Data Editor window
- In our data contain a variable holding respondents' on emergency services in pandemic Situations related question

SR.No	Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
1	1.Abhishhek	1	1	1	3	1	2	1	1	2	1	2	1
2	2.Abhilash	1	1	1	1	1	1	1	1	2	1	2	2
3	3.Akhay A	2	1	1	2	1	1	3	2	1	1	3	1
4	4.Ani jng	1	1	1	1	1	1	1	3	1	1	2	1
5	5.Aru ad	1	1	1	1	2	1	1	1	1	1	2	2
6	6.Bhagash	1	1	1	1	1	2	1	1	1	1	3	2
7	7.Dipti Bb	1	1	1	1	1	1	1	1	1	3	3	1
8	8.Ganesh S	1	1	1	3	1	1	1	2	2	1	2	1
9	9.Jyoti Sh	2	1	2	1	2	1	1	1	1	1	2	2
10	10.Khushbu	1	1	1	1	1	1	1	1	2	2	2	1
11	11.Kiran Pa	1	1	1	3	1	2	1	1	1	1	3	1
12	12.Kunal Sh	1	1	1	1	1	2	1	1	1	1	2	1
13	13.Laksh G	1	1	1	1	1	1	3	1	1	1	1	1
14	14.Mansh S	3	2	1	3	1	1	1	1	3	1	2	1
15	15.Mansha	1	1	1	2	1	1	1	1	2	1	2	1
16	16.Nehant	1	1	1	1	1	3	1	1	2	1	2	1
17	17.On.Pawar	1	1	1	1	1	1	1	1	1	1	1	2
18	18.Priyash	1	1	1	1	1	1	1	3	1	1	2	1
19	19.Pritash	1	1	1	2	1	1	1	1	1	1	2	1
20	20.Puushkar	1	1	1	1	1	1	1	1	1	1	2	1
21	21.Puushkar	1	1	1	1	1	3	1	1	3	1	2	1
22	22.Radhika	1	1	1	1	3	2	1	1	2	1	1	1
23	23.Rahul Pa	3	1	1	2	2	1	1	1	1	1	1	2

SPSS Output Window

SPSS output viewer window. It holds a table with all statistics on all variables we chose. The Output Viewer window has a different layout and structure than the Data Editor window.

- Creating output in SPSS does not change our data in any way; unlike Excel, SPSS uses different windows for data and research outcomes based on those data.



RII Manual Method

- The sample for this study is relatively small. As a result, the analysis had combined all groups of respondents (clients, consultants, contractors and regulatory boards) in order to obtain significant results.
- Data was analysed by calculating frequencies and Relative Importance Index (RII). The data analysis was carried out using SPSS.
- SPSS was used to generate the frequency (fi) of the response category index for the cause and effect factors. The relative importance index (RII) for each factor was calculated using the frequency data for each response categories generated from SPSS
- Data analysis was done calculating Relative Important Index (RII) by following formula.

$$RII = \Sigma W / A * N$$

Where, W = weight given to each factor by respondents (1-3)

$$\Sigma W = 3 \times W_3 + 2 \times W_2 + 1 \times W_1$$

A = highest weight (i.e. 3)

N = total number of respondents (i.e. 100)

EXPECTED OUTCOMES

- Construction delays are common at sites, but they can be minimized if proper construction methods, such as advanced construction techniques and a fast track system, are employed.
- The fast track construction method is not only cost-effective, but it also contributes to better environmental management.
- The cost savings from eliminating site rework is projected to be 3-4 percent of the overall project cost. As a result, by applying advanced building techniques on the job site, the construction industry can save money.
- Benefits to Public for comfortable, economic and secure travel, connecting unconnected areas, decongestion of roads along with Social, Economic and many environment and benefits. This study has involved various civil engineering concepts which are used in practical fields.
- The development such metro projects would boost the infrastructure and help the economy to develop.

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