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To Study and Mitigate Delays in Mega Construction Projects in Khyber Pakhtunkhwa (KPK) Through Fast Tracking Technique: A Case Study of Bus Rapid Transit (BRT) Peshawar

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Abstract

The issue of delays in mega constructions has been an unending challenge, especially in developing countries such as Pakistan, which leads to time overruns, cost escalation, and compromised quality. This study examines the key causes of delays through a detailed case study of the Bus Rapid Transit (BRT) Peshawar project, aiming to examine, analyze, and propose practical solutions for delay mitigation in mega construction projects. Data was collected through an organized questionnaire and interviews with key stakeholders involved in the project. The qualitative and quantitative mixed approach in addition to Relative Importance Index (RII) approach was applied. This study reveals that the most remarkable causes of delay are scope changes with a Relative Importance Index (RII) value of 0.767, design-related issues with an RII of 0.733, and limited availability of resources with an RII of 0.673, planning deficiencies with an (RII) of 0.635, and external factors with a Relative Importance Index (RII) of 0.624. Based on the findings, this study recommends the adoption of modern construction technologies such as precast construction, drone-based surveying, and Ground Penetrating Radar (GPR) to help reduce delays in future infrastructure projects.

INTRODUCTION

The construction industry plays a vital role in the economic development of a country by contributing to infrastructure growth, employment generation, and investment attraction. However, despite its importance, the sector consistently struggles with one critical issue across the globe, which is project delays. These delays not only affect project timelines and costs but often result in contractual disputes, resource wastage, and stakeholder dissatisfaction. According to [1] delays are considered "an unavoidable

problem in practically all construction projects" and can severely impact the project's success by increasing costs and risking contract termination. Globally, the causes of construction delays are well-documented, which are poor planning, resource shortages, weak coordination among stakeholders, legal and financial obstacles, design changes, and environmental factors. [2] Stressed that "unreasonable project scope, lack of early planning, and poor risk management systems" are primary delay factors, which can either be compensable or non-excusable.

In countries like Pakistan, pushing large infrastructure projects forward is rarely straightforward. Layers of red tape, inconsistent funding streams, political interference, and gaps in technical expertise all make the process far more complicated than it should be. Major undertakings like the China-Pakistan Economic Corridor (CPEC) or provincial mass transit systems frequently run into delays that stretch timelines, blow up budgets, and leave the public feeling frustrated and disillusioned.

These challenges are even more intense in mega projects. Their complexity demands tight coordination across several government bodies, while external pressures, political shifts, social expectations, and media scrutiny, can slow things down even further. In the end, it's not just about laying concrete or laying tracks; it's about navigating a landscape where progress depends as much on managing systems and people as it does on engineering.

An example of case study is the Multan Metro Bus Project, where researchers find out that out of various contributing factors, material-related issues and external constraints such as funding delays and political intervention were most remarkably concerned with project delays [3].

Similarly, poor planning, inadequate stakeholder engagement, and weak decision-making frameworks were found to be remarkable issues across several governments funded infrastructure projects.

The Bus Rapid Transit (BRT) project was introduced in Khyber Pakhtunkhwa (KPK) with hopes, as a solution for traffic congestion and to offer a safer, more efficient way for people to move around the city. But even with the promise and heavy investment, delays are observed in this project. Over time, it has become a focusing point for media attention and public frustration, which the

issues in large-scale projects planning, management, and delivery.

It is an urgent need of the time to identify and address delay factors in mega construction projects like Bus Rapid Transit (BRT) Peshawar, this study proposes the mitigation of these delays through fast tracking where sequential project activities are performed in parallel to save time, recognized as an effective project management strategy, particularly in delay-prone environments. However, as [1]cautions, such acceleration strategies must be implemented with great care to avoid compromising project quality or increasing risks.

To Explore and investigate this, we created and distributed the organized questionnaire among stakeholders, which included the Peshawar Development Authority (PDA), TransPeshawar, the general public, Mott MacDonald Pakistan (MMP), and various contractors involved in the project. The responses collected were then analyzed using qualitative and quantitative methods to obtain a clearer picture of the delay factors and assess how fast tracking can mitigate them. This technique requires careful coordination and oversight to avoid the introduction of new risks or compromising the quality of work, as stated in [1] . This report presents an investigation of the challenges that are commonly lead to delays in major infrastructure projects, and having a focus on understanding their root causes and exploring practical strategies to address them. in order to get a detailed view, data was collected from key stakeholders through questionnaire responses, including the Peshawar Development Authority (PDA), TransPeshawar, Mott MacDonald Pakistan (MMP), various contractors, and members of the general public. This research explores the causes of delays in the Bus Rapid Transit (BRT) Peshawar project and explore how fast-tracking techniques can be systematically applied to mitigate such delays and improve project outcomes.

PROBLEM STATEMENT

Mega construction Projects worldwide tend to experience numerous delays, which resulting impact on the cost, duration, and quality of the Projects. This problem is even prevalent in the developing nations such as Pakistan where infrastructure construction projects are of extreme importance to the growth of the nation and provision of services to the people. Delays in such project

leads cost overrun, schedule interruptions, and extended resource allocation. In recent years various infrastructure development projects in Pakistan have experienced such setback, indicating a broader systemic issue in project planning and execution. A study conducted on the Multan Bus Rapid Transit (BRT) system identified key reasons for project delays including insufficient technical expertise delayed decision making, lack of proper feasibility studies and poor inter agency coordination [3] .All these issues not only apply to Multan project alone but also represent a national trend that concerns and requires urgent action and prevention measures. Despite the implementation of similar BRT systems in major cities like Lahore and Islamabad, BRT Peshawar has not been investigated or even discussed in nearly the extent the systems in Lahore or Islamabad, despite basically having the same objectives. The project that has been critical to the Khyber Pakhtunkhwa (KPK) has however encountered a number of problems during its lifecycle that have led to project overruns in terms of time and cost. No literature studies have been conducted to evaluate the delays in BRT Peshawar and that is why it is necessary to execute the research.

LITERATURE REVIEW

This section presents detail literature review related to delays in mega construction projects. The review is divide into five sections. The first section provides an overview of delays in construction projects, including their definitions and classifications. The second section explores common causes of delays in mega infrastructure developments. In the third section, the impacts of delays on project outcomes are analyzed. The fourth section examines various global strategies and frameworks employed to mitigate delays. Finally, the last section connects these findings with the current case study on BRT Peshawar, highlighting how fast-tracking is applicable in similar contexts.

Construction delays are defined as the time overrun either beyond the completion date specified in a contract or beyond the date that the parties agreed upon for delivery of a project. Delays can be classified into several types:

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that the parties agreed upon for delivery of a project.

Transit (BRT) Peshawar which is a project that has not been examined in. It combines a qualitative, quantitative as well as relative Importance Index (RII) analysis to rank causes of delays accurately. In addition, it proposes the novel mitigation measure of fast-tracking relying on the actual data of stakeholders. This is a case based and technically inclined model that promotes the applicability of solutions to similar mega projects in Khyber Pakhtunkhwa (KP).

METHODOLOGY

The methodology section provides the framework for comprehending the planning, execution, and analysis of the study. With an organized overview of the methods and approaches used to look into the reasons behind delays in large-scale building projects, it focuses on Peshawar's Bus Rapid Transit (BRT) system in particular. The research concept, data gathering techniques, and procedures for obtaining significant insights are described in this section, which also demonstrates how various information sources were combined to comprehend the issue and offer answers.

According to the complexity and scale of infrastructure projects in developing regions, especially in Khyber Pakhtunkhwa, an integrated methodological framework is essential to show the multifaceted nature of project delays. The study adopts a case study based approach, focusing on Bus Rapid Transit (BRT) Peshawar as a representative example of the challenges faced in public sector construction. The methodology is shaped to explore both technical and managerial dimensions of delay, as well as the potential of Fast-Tracking techniques to mitigate these issues.

The research combines both qualitative and quantitative methods. Better comprehension and cross-verification of the results are made possible by this mixed-method approach. Data was collected from a wide range of stakeholders, including clients, consultants, contractors, engineers, and members of the public, whose view point helped build a comprehensive picture of the project's lifecycle and its challenges.

The questionnaire was prepared following the project lifecycle: Initiation, Planning, Execution, Monitoring & Control, and Closure. The questionnaire was distributed both physically among engineers, contractors,

and members of the public and online, to reach a broader and more diverse group of respondents.

A single questionnaire format was used instead off creating separate versions for each category. The decision was made to ensure comparability of responses and streamline data analysis. The general public, might not be familiar with technical construction terminology, a confidence level scale was included with each question. It can help to express their level of confidence in their responses, we were able to evaluate the data's dependability and adjust the responses accordingly.

The methodology flow chart is shown in Figure 3-1.

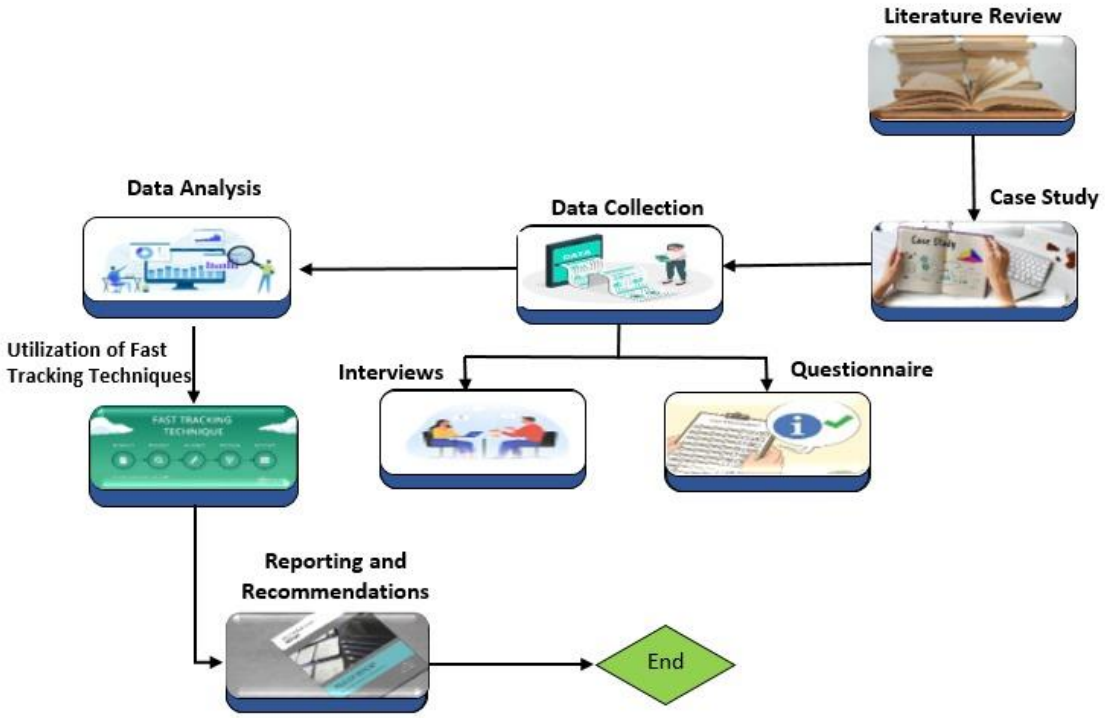

Figure 1 Methodology

RESEARCH DESIGN

This research uses the Bus Rapid Transit (BRT) Peshawar as a case study because of its capacity, its crucial nature to the organization and because of the massive amount of public attention that it attracted during its development. One of the biggest urban transportation projects in Khyber Pakhtunkhwa (KP), the project was to map out the change, by providing a modern, efficient,

and accessible form of public transport to Peshawar.

The projected time of the project implementation was 6 months though the project took longer and took them 2.1 years to complete the project. Such a big delay called into question the efficiency of the planning process and the coordination of stakeholders and the application of the fast-tracking methods. The difference between the planned and the actually completed periods is attributed to the fact that Bus Rapid Transit (BRT) Peshawar is a good example to use in trying to find out the underlying causes of delays and how successfully fast tracking strategies can be applied in the future.

The Bus Rapid Transit (BRT) Peshawar involve multiple Stakeholder's like, Contractors, Consultants, and politically sensitive dynamics makes it an effective case for this research. Due to public interest it created a challenging environment, where both technical and managerial delays unfolded throughout the project's development. This case shows how fast tracking can be used effectively, and to generate understanding that apply not only to the BRT Peshawar project, but also to other large scale infrastructure projects across Pakistan.

Questionnaire Structure

The questionnaire is prepared based on project life cycle:

Initiation Phase

This initial phase involves feasibility studies, Preparation of PC- I and PC- II, stakeholder identification, and project authorization. Questions here explored whether the project was clearly defined from the start and if initial planning documents were in place.

Planning Phase

This phase includes scheduling, budgeting, resource allocation, and risk management. Respondents were asked whether planning was realistic and whether coordination among stakeholders was effective during this phase.

Execution Phase

This section focuses on the actual implementation of the project. It included questions about contractor performance, availability of materials and labor, and whether work was carried out according to the plan.

Monitoring & Control Phase

It shows how well the project was tracked during execution. Questions were asked on progress reporting (submission of PC- III), issue resolution, and whether corrective actions were taken when delays were identified.

Closure Phase

The final phase shows how the project was wrapped up. It included questions about final deliverables, stakeholder satisfaction, submission of PC- IV, and whether lessons learned were documented for future projects.

Mixed-Methods Approach

We used a mixed-method approach, integrating both qualitative and quantitative techniques to provide a well-rounded understanding of delay factors in Bus Rapid Transit (BRT) Peshawar. This approach was selected to ensure that the research shows not only the underlying causes of delays such as design changes, coordination gaps, and resource shortages, but also the extent to which these issues impacted the project timeline in measurable terms.

For the collection of qualitative data, we use questionnaire and stakeholder feedback which offered insights into the experiences, perceptions, and decision making processes that contributed to delays. However, the quantitative data provided the number of delay incidents and the duration of time overruns, helping to see the project's performance more clearly and fairly.

Data Collection Strategy

For the collection of data, we have used two approaches: a detailed questionnaire which is distributed among different stakeholders and interviews were conducted from the industry experts.

Questionnaire Based Data Collection

A single questionnaire was developed to show both quantitative and qualitative information from stakeholders affiliated with the Bus Rapid Transit (BRT) Peshawar project. Questions were closed ended in (yes/no) format, which allowed for straightforward analysis of delay related factors. Participants were asked about the duration of delays, using units such as days, weeks, or months, depending on their experience.

Towards the end of the section an open ended feedback was added to address the additional issues related to the project.

The questionnaire is distributed through both online and physical channels. The online version was facilitated via platforms like Zoho Forms, while printed copies were circulated directly at project sites and organizational offices. This hybrid approach helps to reach broad range of participants, thereby improving response diversity and quality.

Interview Based Data Collection

We have carried out 20 intensive interviews of the chosen stakeholders. The selection of interviewees was done according to the valid domain of their experience and participation in the project Bus Rapid Transit (BRT) Peshawar. Client Organization people, contractors, consultants and engineers were involved in interviews.

Our presentation has used a semi structured pattern where we have had a planned series of questions to be asked as well as have been flexible enough to allow inquiry and explained discussions and elaborations. This methodology gave valuable background information like project delay, resources issues as well as fast tracking strategies.

Policy or preference limited recording though recording was not necessary as the questionnaire could be used and a depth of note could be taken per each session so as to aid the analysis and triangulate findings with the questionnaire data because each interview lasted about 30 min.

Population and Sampling

This section shows the selection criteria of population and their sampling. It details the target population, sampling method, respondent composition, and techniques applied to ensure data credibility and relevance.

Target Population

The population involve in this study include the stakeholders of Bus Rapid Transit (BRT) Peshawar project. This include Project Managers, Engineers, Consultants, Contractors, and Clients all of them had significant experience with the planning and execution of the project. The specific organizations represented in the sample included the Peshawar Development Authority (PDA) as the client, Maqbool Kalson and various subcontractors as contractors, and Mott MacDonald Pakistan (MMP) as the consulting firm. Additionally, Professors from University of Engineering and Technology (UET) Peshawar and members of the general public were included to capture external perspectives, grouped under the "Public" category.

Sampling Technique

To guarantee the inclusion of individuals who had direct involvement in the Bus Rapid Transit (BRT) Peshawar project, a purposeful sample technique was used. People connected to the initiative were given the survey, enabling a wide but pertinent variety of answers. General background information, including

years of experience and organizational role, was gathered at the start of the questionnaire to facilitate meaningful analysis. This background knowledge served to ground the answers and emphasize viewpoints influenced by actual project participation.

Sample Size and Composition

Twenty in-depth interviews with chosen stakeholders were conducted to supplement the 50 questionnaire responses that were gathered. The results of the survey were validated and given qualitative depth by these interviews. Additional interviews were carried out with stakeholders chosen for their technical competence and organizational significance, and in a number of situations, those who answered the questionnaire also took part in follow-up interviews. Since most responders had technical expertise, the data was guaranteed to represent knowledgeable viewpoints on project management techniques and delay factors.

Below Figure below illustrates the percentage based distribution of stakeholder groups who responded to the questionnaire. 35% population is consultants, 28% Client, 19% Contractors, 11% Public and 7 % Professors.

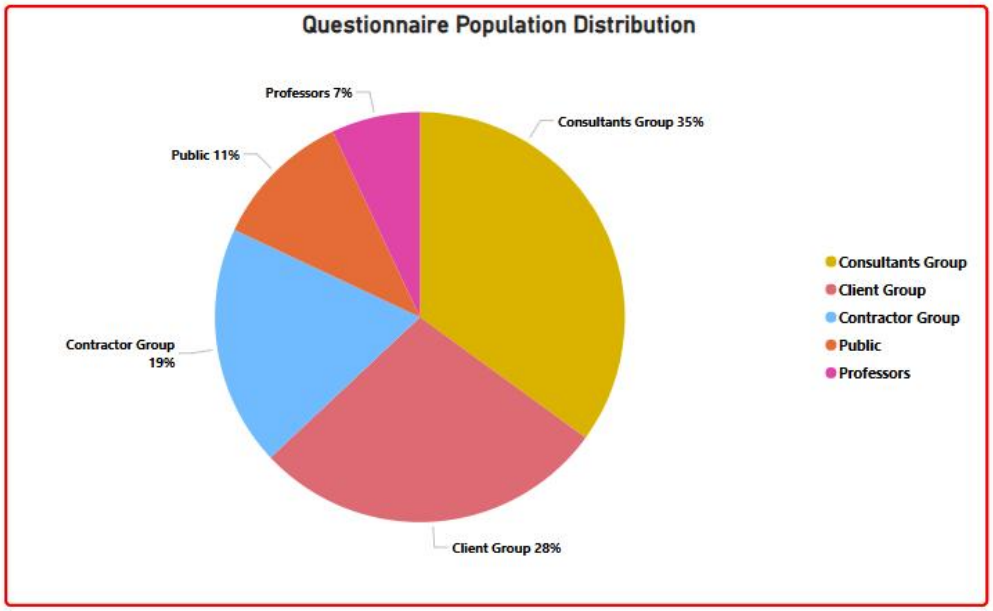

Figure 2 Respondents Profile

Confidence Level Scale

A confidence level scale is added to ensure the reliability. The respondents were asked to use

the following four-tier scale to indicate how certain they were:

- 0–25%
- 25–50%
- 50–75%
- 75–100%

There were four choices for the confidence level, so respondents could choose the one that best reflected their level of assurance for each response. Because of this feature, the study team was able to evaluate each response's credibility and give it the proper weight while doing analysis. While lower-confidence responses were examined more carefully to preserve the integrity of the results, inputs with higher confidence levels were given priority.

Data Analysis Techniques

Qualitative Analysis

Closed-ended responses that gathered stakeholder perspectives of delay drivers throughout several stages of the project life cycle, including planning, design, procurement, execution, and external impacts, provided the study's qualitative insights.

Responses were filtered using the "Yes" selection to identify the occurrence of delays under each thematic category. The frequency of affirmative responses within each category was divided by the total number of respondents to determine the proportional weight of primary delay causes.

For secondary causes, each individual section was assigned a specific percentage based on the number of "Yes" responses attributed to that item within its respective category. This allowed the analysis to reflect not just binary occurrences, but also the relative contribution of each sub-factor to overall delays.

The entire qualitative analysis was carried out using Microsoft Excel, which facilitated data organization, thematic grouping, and percentage calculation. This structured, phase-based approach helped highlight stakeholder experience and perception in a consistent, data-supported manner.

Quantitative analysis

The quantitative analysis in this study was based on delay durations reported by respondents across various project phases. Participants were asked to use pre-established time ranges (days, weeks, or months) to indicate the amount of delay that occurred under each category. To determine the overall delay impact linked to each theme category such as design, execution, coordination, funding, and external factors these delay durations were then added together.

Because each reported delay was carefully connected to its corresponding stage of the project life cycle, the research team was able to examine disruption in a methodical and situation-specific way. A better understanding of how different obstacles affected overall progress was provided by the study analysis of the frequency and severity of delay durations across categories. This analytical method provided valuable insight into the project's performance and guided future mitigation actions by highlighting the regions where delays were focused.

Relative Importance Index (RII)

The Relative Importance Index (RII) was used to classify the factors of delay according to their level of importance. The technique is common in construction research when aiming to prioritize variables depending on the opinion of the stakeholders. Every delay-related element was measured by its importance using a weight based on its level of severity and RII was calculated by the following formula (3.1):

Relative importance index (RII) = $\frac{\mathbf{w}}{\mathbf{A}*\mathbf{N}}$ [35]

Where:

w = Weighted sum of responses for a particular factor (i.e., the product of the number of responses and the corresponding weight for each rating)

A = Highest possible rating (in this study, A = 4)

N = Total number of respondents

Further examination of reliability of the data was carried by creation of a rating scheme that would give the percentage of the confidence level to every response category. Such a structure established the successive coherence of analysis, matching certainty of stakeholders with the stated durations of delays.

Table 1 Rating Criteria (Project Specific)

Rating	**Response Category**	**Confidence Level** (%)
4	Strongly Agree	75-100
3	Agree	50-75
2	Disagree	25-50
1	Strongly Disagree	0-25

Fast-Tracking Approach

The proposals given in this section were developed by going very deep through the

delay factors clearly documented in the Bus Rapid Transit (BRT) Peshawar project and Put together with alternatives to mitigation strategies reported in the literature worldwide and locally. Reasons of delay were classified into major categories. On their basis, there were then suggested practical measures applicability to the local setting considering the contemporary trends in project management, cutting edge construction technology, and learning gathered through other comparable transport projects. This strategy guaranteed that the proposals will be based on real life problems and aimed at enhancing the future project delivery.

Validation and Reliability

The research instrument (questionnaire) was also subjected to an immense examination by several specialists before its finalization, to make sure that it was healthy. These were the academic supervisor, senior faculty with more than 20 years of experience and University of Engineering and Technology (UET) Peshawar alumni who gave an insight based on field experience. Their comments were quite precise to work on the format of the questions, words, and thematic orientation.

The findings conclude the previous qualitative and quantitative analyses by determining the most influential variables from the stakeholders' viewpoint to enable specific delay mitigation in future infrastructure projects

worksheet window which we have used for RII Analysis

Using the above approach in Microsoft Excel the following results are obtained for the major causes of delay in BRT Peshawar.

Scope Changes were the most remarkable cause of delay, with a Relative Importance Index (RII) of 0.767. Which is due to scope changes and scope that were inadequately defined and created disruption in procurement procedures and schedules.

Design Delays being the second major cause of delay in BRT Peshawar, had an RII of 0.733, resulting from late issuance of construction drawings, layout redesigns, and delays in approval of design documents leading to on-site interruptions.

Execution Issues, with an RII of 0.674, which is due to inadequate contractor and consultant coordination, delayed site mobilization, ineffective use of equipment, and inadequate Coordination with the client.

Resource Constraints had an RII of 0.673 and were caused due to late procurement, material shortage, and inadequate skilled labor, and they impacted work continuity.

Pre-construction and Planning Issues had an RII of 0.635. These were concerned with delays in PC-II approval, ambiguous technical specifications, underutilization of project management tools, and insufficient risk management.

External Factors has RII of 0.624, including delays from third-party services, inflation, ADB funding issues, political/security disruptions, and unforeseen site conditions.

Table 2 Ranking (Primary Causes) RII

Rank	Primary Cause	RII
1	Scope Changes	0.767
2	Design Delay	0.733
3	Execution Challenges	0.674
4	Resource Constraints	0.673
5	Pre-Construction and Planning Challenges	0.635
6	External Factors	0.624

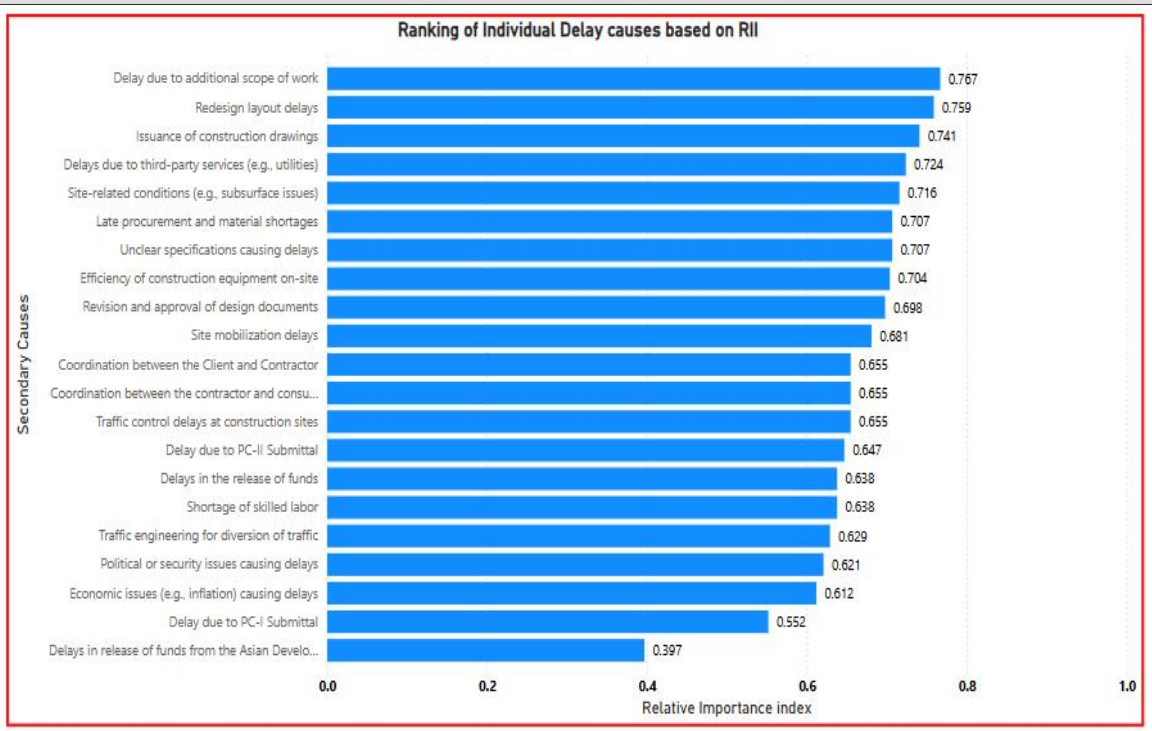

Figure 3 Ranking of Individual causes based on RII

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The main focus of this research is to understand the main reasons of the delays in the BRT Peshawar project. By using a mix of surveys, interviews, and data analysis, the study identified six major causes of delay, which are changes in project scope, design issues, resource shortages, execution problems, external challenges, and early planning weaknesses with sub-causes. Scope changes ranked number 1 and late design approvals ranked number 2 in the delaying project timeline base on Qualitative, quantitative and RII analysis. These delays caused confusion, rework, and inefficiencies that pushed the project far beyond its intended deadline. After finding the root causes, the study offered practical solutions using the Fast Tracking technique. This method involves overlapping project phases, starting certain tasks earlier, and improving coordination between teams. The recommended strategies include early vendor engagement, parallel approvals, better use of planning tools, modular procurement, and the use of modern technologies like drones, Ground Penetrating Radar, and slip form shuttering. These findings give a practical indication for

improving the planning and delivery of large construction projects in Pakistan. If public and private stakeholders adopt these methods, future projects can be completed more efficiently, with fewer delays, better coordination, and stronger public confidence.

Recommendations

Based on the analysis of delay causes and the practical Fast Tracking strategies discussed, the following recommendations are the recommendation to improve planning and execution in future infrastructure projects. Each recommendation aligns with a specific category of delay seen in the Bus Rapid Transit (BRT) Peshawar case.

Design Delays

Fast-tracking success depends on strong collaboration from the early stages. Key roles must be defined to improve cooperation, and contractors should be involved during design for better scheduling and constructability alignment. Assigning a full-time design coordinator to work closely with contractors can help resolve issues faster. Innovative structures like Project Construction Management (PCM) promote responsibility sharing, avoid conflicts, and ensure clear communication.

To handle overlapping design and construction phases effectively, a reliable drawing review system should be set up at the start. It must include defined communication channels to manage frequent design changes. Early decisions that affect future flexibility should be identified and evaluated during the design phase to avoid rework and better coordinate between work packages.

Execution Challenges

Integrated Execution Team:

In large projects like BRT Peshawar, small issues that arose on-site needed formal approvals through letters or emails, have made some share of delays in the BRT Peshawar Project. By forming a joint team of contractor and consultant staff on-site, daily short meetings, or "technical huddles," could be to quickly solve minor issues on the spot. This would save valuable time (reduced delay), reduce paperwork, and keep the work moving without unnecessary delay. It also strengthens teamwork and helps everyone stay aligned with the day-to-day site needs.

Design and Construction Overlap:

Otherwise, in order to await the completion of all the design drawings and their approval, the project team can start working on some components which are already

approved (and easier) like storm water drains, curb walls or access roads. This will keep the place busy and avoid total stagnation of work when more elaborate (such as stations or flyovers) designs are being proposed. It will enable the project to run concurrently in different portions, thus saving a lot of time. This is one of the most important fast-tracking measures, particularly sought after in projects where time is limited in abundance.

Parallel Vendor Engagement:

In BRT Peshawar, the time lapse between the site mobilization and actual onset of the work was evident, and was primarily caused by the vendors' were not lining up on time. It would be more prudent to involve main vendors such as the equipment suppliers, scaffolding contractor, or workmen contractor throughout the mobilization phase itself. This is to ascertain that when the site is prepared, the vendors are getting ready to start. It prevents wasting time and ensures that the project momentum is kept high, particularly where the project has little time.

Work Front Planning Before Mobilization:

The project team ought to determine several independent work zones ways before the commencement of actual mobilization e.g. earthwork in one location, utility relocation in another and demolition on yet another. This will enable the various teams to work simultaneously without hampering one another. The delays were rampant in BRT Peshawar since teams had to wait until one of the zones was complete to commence another. Advance planning of parallel lines of work would accelerate the works and would make the best of the manpower and equipment.

Prepare Access and Haul Routes Early:

The delays are likely to occur in the rapidly implemented projects with the criterion of BRT Peshawar through the transfer of heavy machinery, which is not accessible on site. By establishing haul roads, discharge areas, and the access routes at the initial movement period, the equipment and materials may be transported and put in place with no delays. The minor move guarantees uncomplicated logistics, less downtime and it keeps the site activity flowing continuously, which is of importance in hectic urban corridors. Parallel Client Review:

Implement staggered approvals for different zones so that work can continue without waiting for each zone to finish completely.

Scope Changes

Managing Scope Extensions:

The new addition to the project must be approached as a mini-project and performed by running parallel without disturbing the workflow. They need to be moved to areas which have specially dedicated teams and resources that will deal with them effectively. This will guarantee that the main project remains within its schedule as it meets the changing needs.

Delayed or Undefined Timeframes:

In order to identify the gaps caused by delays regarding schedules, set up Look-Ahead Planning to plan future activities. Any additional scope should be incorporated into short-term schedule that has clear dates of targets. Generate executing teams that are dedicated to guaranteeing accountability and simplified delivery. This method improves transparency, concentration and promptness.

Resource Constraints

Forecast-Driven Procurement:

To solve the problem of late delivery of the materials, initiate procurement was made on anticipated demand and later lead time once the materials have been utilized as against the completed drawing or approval. This is a rather pro-active measure that enables the running of the teams to be more convenient, idle time on-site is reduced, the project flow is better as it is possible to organize the necessary materials that are particularly needed in advance. It also reduces the probability of incidents in prices and supply chain and hence assembling planning and engineering and procurement departments as early as possible is important in achieving successful implementation.

Parallel Procurement Streams:

Dividing procurement into zone-specific packages can reduce central coordination delays and allow parallel progress across project sections. If implemented effectively, this approach can significantly reduce procurement-related delays and accelerate project delivery.

Buffer Stock in Decentralized Yards:

Having excess materials around places where construction is underway is a way of minimizing movement time of resources and making resources available on time. This decentralized model reduces waiting time and allows going on with the smooth workflow. It helps to minimize dependencies on central storage hence increasing on-site flexibility or responsiveness. This strategy implemented can help in smooth implementation and reduced

time of delivery of formerly large scale infrastructure projects.

Material Look-Ahead Plans:

Procurement must be aligned with a 3-6 weeks ahead planning scheme with references to the future requirements of construction. This proactive way of planning will facilitate the availability of materials in good time, reduce incidences of shortage of supplies at the last minute and enhance team coordination. With the foresight of the future demands, the project will be in a position to continue running smoothly and stay out of the purchase barrier-related delay. Such an approach allows to conduct its implementation effortlessly, as well as maintain the project on schedule.

Labor Forecasting:

Project manpower needs zone-wise in advance and arrange standby teams to ensure continuous workflow. This proactive approach prevents staffing gaps during peak or unexpected periods. If implemented effectively, it can reduce labor-related delays and contribute to faster, more reliable project delivery.

External Factors

Sub-Surface and Utilities:

Implementing Ground Penetrating Radar (GPR) technology can help accurately detect underground utilities before excavation begins. This proactive approach minimizes unexpected site conditions, reduces rework, and prevents delays caused by utility conflicts.

The use of 1,491 cast-in-place piles significantly contributed to time overruns. By switching to precast piles, construction time can be greatly reduced, as precast elements allow for faster installation and improved quality control, leading to more efficient project delivery.

Use of Drone survey:

Traditional surveying methods used in the BRT project were time-consuming and limited in coverage. By integrating drone-based surveying during the initial stages, large areas can be mapped quickly and with higher accuracy.

Use of Slip Shuttering:

In time-sensitive projects like BRT, conventional formwork methods can slow down the pace of vertical construction such as piers and columns. Slip form shuttering offers a faster alternative by enabling continuous casting without the need to stop and reset formwork.

Economic Volatility:

To control the effect of the variable market conditions that introduce inflation projections and carry periodic baseline checks on major material costs like cement, fuel and steel towards the initial stages of planning. It makes it easier to estimate costs and budget, and it is also possible to adjust acquisition strategy in time. Leading indicators in the economy enable financial risks to be minimized and also enable effective decision-making during the project lifecycle..

Traffic Management:

During the mobilization phase, traffic control plans should be finalized along with close coordination with the locals to avoid future work stoppages and argue the smooth operations of sites. Early involvement enables the parties to meet regulating requirements, reduce impacts to the general population as well as guarantee that the sites and materials delivery is not interrupted during the course of the project.

Political Pressure:

Consultants should advocate for realistic timelines based on technical justification and present milestone-based alternatives to satisfy political goals without compromising execution quality.

Pre-Construction and Planning Delays

Unclear Specifications:

In most of the fast-track projects, the delays experienced by the project awaiting the full set of final drawings is not necessary. Instead, it would be a more fruitful idea to issue partial IFC (Issued for Construction) earlier-on-the scope items which are already well understood, such as drainage or pavement layers. In the meantime, the rest of the details that are not clear can be ironed out during the weekly coordination meetings between the consultant and the contractor. This enables the construction works to start as opposed to waiting until design is completely done and assists in keeping the project on site.

Weak Planning Tools:

The planning tools in BRT Peshawar were weak or not so connected to track actual progress and react swiftly to delays. Real-time control and coordination can be enhanced by using combined applications such as Primavera, excel based dashboards, or mobile reporting applications. Such aids can assist in matching the site with the schedule and in early identification of delays as well as facilitating better decision-making. Even the simplest digital systems can take a project based on fast track to great heights.

Risk Management:

Risks that are not foreseen in fast-track projects might halt the project, especially when they arise suddenly. It is also beneficial to use the planning stage to create a detailed risk register as well as mitigation strategies that are easy to implement, thereby ensuring the team is ready. As an example, the risks, such as late utility shifts or material shortages, may be identified early in order to form backup plans. This is a proactive way which overshadows surprises in the execution phase and ensures that the project is more tractable.

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