

**COST AND TIME OVERRUNS IN HIGHWAY PROJECTS IN  
PAKISTAN**

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By:

Rafiq Muhammad Choudhry<sup>1</sup>; Abdur Rehman Nasir<sup>2</sup>; and Hamza Farooq Gabriel<sup>3</sup>

### Abstract

Timely completion within allocated cost reflects good project management. Construction industry of Pakistan having a contribution of 2.4 percent of the total GDP suffers due to lack of investment in infrastructure sector including roads, rail and poor management resulting in projects experiencing delays and cost overruns. Highways are a vital trade route in transport sector as it carries 80 per cent of the country's commercial traffic, clearly indicating that it constitutes major component of the construction industry. The objective of this study is to investigate key factors causing cost and time overruns in highway projects of Pakistan. Identified factors of cost and time overruns in highway projects were investigated through questionnaire survey of 25 contractors, 21 consultants and 10 clients. A total of 28 cost overrun and 30 delay factors were ranked using relative importance index (RII). Analysis of the results show that scope changes and additional work, inappropriate government policies and priorities, improper planning, price escalations on major construction materials and land acquisition and resettlement were major factors responsible for cost overruns. Delay in progress payments to contractors, conditions under force majeure, financial difficulties faced by clients and land acquisition and resettlement were established as most important causes for delays. This study shows considerable agreement among contractors, consultants and clients regarding ranking of factors using rank agreement factor. The identified factors are required to be carefully managed to avoid risks and calls for improved risk and project management practices by clients, contractors and consultants. This work can assist professionals in taking proactive measures for reducing cost overruns and delays in road construction projects.

**Keywords:** Construction sites; Highway projects; Delays; Cost overruns; Time overruns; Pakistan.

### Introduction

A project is considered successful if it is completed on time, within budget and to the specified quality standards (Frimpong et al. 2003). Project Management as defined by Oberlender (1993) is the art and science of coordinating people, equipment, materials, money, and schedule to complete a specified project on time and within approved cost which clearly indicates that balancing the competing demands of cost within scheduled time is very essential to a project. Cost and time overruns are major problems faced by both developed and underdeveloped world, however their dynamics are quite different in both (Angelo and Reina 2002). In case of developing countries, where wealth measure is greatly dependant on performance in infrastructure especially on road construction projects; exceeding of project costs or schedules from planned targets would ultimately lead to compromised client satisfaction and the resulting effects become detrimental (Kaliba et al. 2009). According to (Ahmed et al. 2003), delays on

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construction projects are a universal phenomenon and road construction projects are no exception. They are usually accompanied by cost overruns which have a debilitating effect on clients, contractors, and consultants owing to growth in adversarial relationships, mistrust, litigation, arbitration, cash-flow problems, and a general feeling of trepidation towards each other.

In Pakistan, transport is the fourth largest sector which contributes about 10% to the Gross Domestic Product (GDP) and over 17% to the Gross Capital Formation. The sector is recipient of 20-25% of the annual federal Public Sector Development Program (PSDP). It is estimated that 2.3 million people (6% of the total employed labor force of Pakistan) earn their livelihoods from this sector (Javied and Hyder 2009). The government is trying to improve the quality of road network and ultimately improving the quality and standard of life of the masses. Road density of Pakistan, an indicator of prosperity and development level is currently 0.32 km/km<sup>2</sup>, which is much less even from regional standard. The government is endeavoring hard to double the road density to 0.64 km/km<sup>2</sup>. Starting with only around 50,000 km in 1947, current road network is now more than 260,000 km. This includes national highway network of around 12,000 km, which despite being merely 4% of the overall road network takes 80% of commercial traffic (ESP 2010-11). With deteriorating performance of the Pakistan Railways, the road sector has progressively increased its share in the market. The reliance on roads has increased enormously, where the road sector now carries over 96% of inland freight and 92% of passenger traffic as compared to that of total 8% in 1947 (ESP 2010-11).

In an attempt to overcome the deficiencies of infrastructure sector highlighted in World Bank Document (Durrani 2007), which showed transport sector inefficiencies costing the economy between 4-5 percent of GDP each year, a high level activity was carried out in road construction sector of Pakistan vide billion dollars in loans from financial institutions including World Bank, Asian Development Bank (BMI's Report 2008). Numerous projects of highways have been planned and executed to increase the contribution of road sector to the GDP of country. Unfortunately, objectives of timely completion within costs are not achieved in highway projects of Pakistan as same delayed badly with exceeded costs. Tribune (2010) a leading newspaper of the country, published a news article regarding approval of a \$130 million loan by World Bank on the request of government to cover cost overruns and for completion of works on road projects, facing delays. Several factors are responsible for these delays and cost overruns and few might be totally different from building projects.

A wide range of studies have been made worldwide in order to evaluate factors that cause cost overruns and delays in construction projects. Similarly in Pakistan, a number of studies were carried out to identify factors causing delays and cost overruns in construction projects, mostly focused on building projects or construction projects of all types, indicating a clear need to identify these factors specifically in highways sector as probably, none of the study has been documented till date. In order to carry out a study in road sector, following objectives are considered:

1. To obtain information through interviews from highly experienced professionals of road construction sector to get an insight of the challenges faced by the road construction sector;
2. To conduct a questionnaire survey in order to obtain the response for analyzing the data statistically for evaluating important causes of cost overruns and delays in highway projects.

## Literature Review

### Cost Overruns

Cost overrun is simply defined as ‘when the final cost of project exceeds original estimates’ (Avots 1983). It is an excess of actual cost over budgeted one. Cost overrun is sometimes called “cost escalation”, “cost increase”, or “budget overrun” (Zhu and Lin 2007). United States General Accounting office in 1997, found that 77% of highway projects in the USA experienced cost escalation. The study for cost and time overrun factors in highway projects of Zambia found bad or inclement weather, resulting from heavy rains and floods on the top list of factors causing cost overruns in road projects (Kaliba et al. 2009). Other major factors identified by the study were scope changes and additional work, land acquisition and resettlement, schedule delays, labor disputes and strikes, law and order situations, technical challenges, price adjustment, shortening of contract period due to government pressures and priorities. A study undertaken to evaluate factors causing cost overruns in Ghanaian Road Construction Sector shows that delays in monthly payments to contractors, variations, inflation, schedule slippage and lack of project knowledge are the five most important factors agreed by project participants i.e. clients, contractors and consultants (Nicholas and Paul 2010). Inconsistent cash flow was the most significant factor causing delays in construction projects of Pakistan (Nadir 2010).

Changes in design and scope, inadequate site investigation, inadequate quality of contract documents, relocation of services and utilities, shortening of contract period due to government pressures and priorities, land acquisition and resettlement, environmental issues were the most dominant factors identified, resulting in cost escalations in highway project (Creedy et al. 2010). Scope changes and additional work, changes in design, inappropriate government policies were the leading factors contributing to cost overruns in international development projects (Ahsan and Gunawan 2010). Morris (1990) studied the factors influencing cost overruns in public sector projects and found that escalation in costs is attributable partly to the fact that the original estimates were prepared at the then current prices, and partly to delays which enhance the effect of inflation and to direct escalation in costs arising out of change in scope and errors. Based on certain assumptions with regard to the pace of expenditure on projects, Morris (1990) has roughly computed that for the 133 projects, which were studied, only 25 to 30% of the cost increase is attributed to inflation. The remaining 70 to 75% has to be explained in terms of delays, inefficiencies, scope changes, changes in statutory levies, variations in exchange rates and to the combined effect of these factors with inflation.

Study of Datta (2002) depicts that delays between the planning stage and actual implementation of especially large infrastructure projects is a ubiquitous problem resulting in cost and time overruns. Other studies (Mansfield et al. 1994; Schexnayder et al. 2003) identified that cost overruns occur due to a result of problems such as delay in land acquisition, unexpected problems in supply of raw materials, illegal encroachment on land even during project implementation, or due to internal problems in government organizations.

### Time Overruns

Time overrun refers to a condition where a construction project does not meet completion within the planned period (Daniel and Mohan 1997). It is defined as the extension of time beyond planned completion dates traceable to the contractors (Kaming et al. 1997). Also known as ‘delay’/ it cause the project completion date to be delayed (Al- Gahtani and Mohan 2007). Ahmed et al. (2003) grouped the delays in the following four broad categories depending on how they operate contractually: 1) Non-excusable delays; 2) Non-compensable excusable delays; 3) Compensable excusable delays; and 4) Concurrent delays. Ahmed et al. (2003) found that the most common type of delay is excusable-compensable at 48%, followed by non-excusable delays with 44% and 8% for excusable non-compensable delays. In most of the

cases, it is found that when the contractor has the responsibility, the type of delay respectively is non-excusable; when the responsibility is the owner's or the consultant's it is an excusable compensable delay; and when the government is responsible, the delay is considered an excusable compensable.

The study conducted by Kaliba et al. (2009) for cost and time overrun factors in highway projects of Zambia came up with the factors like delay in progress payments by the owner, slow financial process, difficulties in financing project by contractor, contract modification, delay in material procurement, design changes, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications and labor disputes and strikes as the major causes of delays in road projects. The responsibility of each delay factor was mentioned in terms of major stakeholders i.e. construction contractor, consultant and the client.

Delay in material procurement, land acquisition and resettlement, environmental issues, natural catastrophes, slow financial process, riots and commotion, and scope changes were the leading factors contributing to time overruns in international development projects (Ahsan and Gunawan 2010). Daniel and Mohan (1997) came up with a conclusion that poor site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, clients-initiated variations and necessary variations of work are five significant causes of delays in construction projects. Contractor's improper planning, poor site management, inadequate experience, and inadequate client's finance and payments for completed work and problems with subcontractors were the delay factors evaluated in Malaysian construction industry (Sambasivan and Soon 2007).

Important causes of delays identified (Mansfield et al. 1994) were financing and payment for completed works, poor contract management, changes in site condition and shortages in materials. Odeyinka and Yusuf (1997) classified the causes of delay via project participants and extraneous factors. Client-related delays identified include variation orders, slow decision-making and cash flow problems while contractor-related delays include financial difficulties, material management problems, planning and scheduling problems, inadequate site inspection, equipment management problems and shortage of manpower. Extraneous causes of delay identified were inclement weather, natural catastrophes, labor disputes and strikes (Aibinu and Jagboro 2002). Literature review indicates that several studies were conducted worldwide in order to evaluate factors that cause cost overruns and delays in construction projects. In Pakistan, nonetheless, not many studies were carried out to identify factors causing delays and cost overruns focused on construction projects of all types, indicating a clear need to identify the factors specifically in highways sector.

### **Research Methodology**

In order to identify the major causes of delays and cost overruns in highway projects detailed literature review, structured interviews and questionnaire survey was carried out. Structured interviews were targeted at respondents from construction contractors, consulting firms and agencies responsible for implementing and executing projects. The interview questions were structured based on the information gathered through literature review. The main intention was to identify challenges that major stakeholders face in implementing highway projects. Obtaining possible factors of delays and cost escalations in highway projects was the major intention. A total of ten (10) respondents, selected from a cross-section of organizations in road construction sector, were interviewed. Two experienced professionals from client, four each from contractors and consultants of road construction sector were interviewed that provided preliminary insights into the challenges faced by road construction sector in which the government is more or less the sole client. Following information from the interviewees were acquired: 1) Overview of the

projects handled by the interviewees in last five years; 2) Cost Overruns; 3) Delays; 4) Key factors that contribute to projects failing to meet desired objectives; and 5) Frequency of projects failing to meet objectives.

Information of projects, on which the interviewees had been involved in the past five years, were captured. Questions relating to the number of projects undertaken, contract values, the extent to which the projects had satisfied the objectives of budget, schedule and performance requirements were asked. The interviewees indicated that they had been involved with not less than 3 projects in their work experience. Further, the value of contracts managed by the interviewees ranged from Rs. 1,000 Million to Rs. 8,000 Million. The contract values indicate that significant magnitude of resources has been injected by the government which requires effective and efficient utilization of resources.

### **Cost Overruns**

Interviews indicate that cost overruns on projects were a common occurrence. Five of the interviewees indicated that 'many' projects they had been involved in, suffered cost overruns. Four stated that 'quite a few' projects had budget overruns, while only 1 believed that the number of projects that had experienced budget overruns was 'negligible'. With the above responses, it was quite clear that the subject warrants further exploration. Interviewees indicated that scope change in a project or additional work is main reason for cost overruns. The issue of land acquisition and relocation of services was raised as to cause overruns in the total project cost allocated by the government through PC-1. Inaccurate cost estimation results in changing the original project cost while differing ground conditions lead to re-rating of items caused due to inadequate field survey.

### **Delays**

Results of the interviews showed that a significant number of projects were not completed within schedule. Six of the interviewees indicated that 'many' projects they were involved in suffered from delays. Three responded that 'quite a few' projects had schedule overruns, while only one stated that the number of projects with schedule overruns was 'negligible'.

The literature showed that completing projects within time is one of the biggest challenges being faced in various parts of the world. It was revealed that if risks are not managed well, schedule overruns are likely to occur. From the interviews, it was clear that schedule overrun risks were significantly high on road projects in Pakistan. Main reasons for delays in highway projects highlighted by the interviewees were delayed payments to the contractors on the certified work done, restriction to work due to land acquisition issues, delay in permits from other organizations, design errors and abnormal changes in the original scope of work.

### **Factors Contributing for Failure of the Desired Objectives**

Key factors responsible for failure of highway projects in achieving objectives of cost, time and quality were necessary to be identified through interviews. From the experience of respondents, it was asked to pick out from a given list, factors considered by them as most significant in contributing to projects failing to meet desired objectives. Contractor's incapability to do the job was rated by majority of the interviewees as the most significant factor contributing to failure of a highway project. Other factors include delay in progress payment by client, delay in decision making by client, inaccurate cost and time estimation and inappropriate government policies and priorities. These results are similar with most of the factors identified through the literature review.

Interviewees were asked to rate the frequency of projects failing to meet project objectives. Four interviewees marked the prevalence as 'high', 5 rated 'medium', while one rated the frequency as 'low'. It was highlighted by the interviews that government is solely the only client in highway

projects and the major factors that affect the project objectives are related to client. The findings from the interviews were vital input into the questionnaire design.

### Questionnaire Survey

A questionnaire was developed in order to assess the perceptions of owners, consultants, and contractors for delays and cost escalation in highway projects. Factors were examined and identified through literature review and by conducting structured interviews that sought advice from experienced construction practitioners. A total of 28 factors were evaluated for survey that can cause cost escalations in highway projects. For time overruns, a total of 30 factors were evaluated.

The questionnaire was targeted at major project participants only related to road construction sector and consisted of two parts related to the factors of time and cost overruns in highway construction projects. First part was aimed at organizational and personal profile while second part was targeted at factors influencing cost escalation and schedule overruns. In second part, respondents were asked to rate the causes of cost escalation and schedule overruns. The rating of factors given by the respondents for cost and time overruns were used to rank the factors so as to obtain the construction industry's perspective of the main causes of cost escalation and delays.

There were three types of organizations targeted for response i.e. Contractor, Consultants and Clients. The highest response rate observed was 45% (25 responses) from contractors, 37% (21 responses) from consultants and 18% (10 responses) from clients were obtained. The response rate for contractors, consultants and owners was 70.8% with 56 respondents out of a total of 79. The experience of respondents in survey was documented. It was found that 11% of the respondents were having an experience of 5 years or less, 13% of the respondents were having an experience of 6 to 10 years, 11% of the respondents were having an experience of 11 to 15 years, 29 % of the respondents were having an experience of 16 to 20 years while 38% of the respondents were having an experience of 20 years or more. Overall, majority of the survey respondents were having an experience of more than 15 years.

Designation of respondents from three groups (clients, contractor, consultant) in terms of four categories; Senior officers and executives, Project manager and team leader, Site engineers, and / or Office engineers were documented. It was found that 40% of the respondents belonging to clients were office engineers, 10% were project managers and 50% were senior officers. In contractor group, 4% were office engineers, 12% were site engineers, 56% were project managers and 28% were senior officers. In the group of consultants, 23.8% were office engineers, 19% were site engineers, 19% were project managers and 38.1% were senior officers. It is evident from the percentages that the project managers and the senior officers have greater representation indicating their experience in the profession.

### Data Analysis and Results

The data was analyzed and ranked using the 'relative importance index' as used by Kometa et al. (1994). This method was adopted for the analysis of the data collected from the current questionnaire survey. The five-point scale was transformed to relative importance indices for each factor to determine the ranks of the different causes. The relative importance index (RII) was evaluated using the expression (Kometa et al. 1994):

$$(RII) = \sum w / (A \times N), (0 \leq \text{index} \leq 1) \quad \text{Eq. (1)}$$

where  $w$  = weighting given to each factor by the respondents and ranges from 1 to 5 where '1' is 'not significant' and '5' is 'extremely significant',  $A$  = highest weight (5 in this case), and  $N$  = total number of respondents (in this case 56) .



In order to determine the magnitude of agreement between different groups of respondents (clients, contractor, consultant), a rank agreement factor was used for any two groups. The factor represents the extent of agreement in the ranks of the items as used by Okpala and Aniekwu (1988) as shown in the Equation (4), known as Ranking Agreement Factor (RA). For any two groups, assuming the ranking of the  $i^{\text{th}}$  item in group 1 is  $R_{i1}$ , and in group 2 be  $R_{i2}$ . Then the absolute difference  $D_i$  between rankings of the  $i^{\text{th}}$  item by the groups would be

$$D_i = |R_{i1} - R_{i2}| \quad \text{Eq. (2)}$$

Where  $i = 1, 2, 3, \dots, N$  (when there are  $N$  number of items)

$D_{\text{max}}$  is defined as the maximum absolute difference between the rankings of all  $N$  items by the two groups, which assumes the two groups are in complete disagreement (they ranked the items in opposite orders).

$$D_{\text{max}} = |R_{i1} - R_{j2}| \quad \text{Eq. (3)}$$

Where  $j = N - i + 1$  (For example, for five items  $N = 5$ , when  $i = 1$ ,  $j = 5 - 1 + 1 = 5$ ; for  $i = 3$ ,  $j = 5 - 3 + 1 = 3$ )

The rank agreement factor (RA) is:

$$RA = \frac{\sum_{i=1}^N |R_{i1} - R_{i2}|}{N} \quad \text{Eq. (4)}$$

While a maximum rank agreement (RA max) is:

$$RA_{\text{max}} = \frac{(\sum_{i=1}^N |R_{i1} - R_{j2}|)}{N} \quad \text{Eq. (5)}$$

The percentage disagreement (PD) and percentage agreement (PA) are defined as:

$$PD (\%) = (RA / RA_{\text{max}}) \times 100 \quad \text{Eq. (6)}$$

$$PA (\%) = 100 - PD \quad \text{Eq. (7)}$$

The rank agreement factor can be greater than one, with a higher factor implying greater disagreement. A lower value of RA implies a closer agreement between the two groups while a Rank Agreement Factor of zero implies perfect agreement.

### Causes of Cost Overruns in Highway Projects

Table 1 shows the ranks and relative importance indices for the top ten most important cause of cost overruns according to each group as well as the overall response from all three groups. The top ten most important causes of cost overruns in highway projects of Pakistan as perceived by the respondents included additional work, inappropriate government policies and priorities, improper planning, price escalation on major construction materials and price adjustment, land acquisition and resettlement, inconsistent cash flows, delay in decision by employer, design errors and changes, inaccurate estimation, relocation of services and utilities. Relative importance index (RII) and rank for contractors, consultants, clients as well as the overall RII and ranking is shown in Table 1.

*Additional work* is the most important cause of cost escalations in highway projects of Pakistan. It was ranked, according to overall respondents, at the first position with RII = 0.832. Contractors and consultants with RII = 0.872 and RII = 0.819 respectively ranked the factor as first, while the clients ranked it as fourth factor with RII = 0.760 which showed considerable agreement among the parties for this factor (see Table 1). Decision by client to include additional scope in the existing contract, changes the contract cost drastically for which the

client is responsible and the same give space to re-rating of items in accordance with the contract conditions.

*Inappropriate government policies and priorities* (RII = 0.786) was ranked as second important factor in the list with an individual RII = 0.824 by contractor, RII = 0.760 by consultant and RII = 0.700 by client (see Table 1). As the sole client in highway construction is government itself, this factor is the cause of difficulty with the employer for arranging funds in order to maintain the progress of works at the committed contract amount and the delay caused by client ultimately leads to cost overruns.

*Improper planning* was the third most important factor and was ranked according to overall respondents at the third position with RII = 0.786. Contractor, consultant and client agreed that this factor is one of the main causes for cost overruns in highway projects. It was ranked by contractor in the fifth position with RII = 0.792, fourth by consultant with RII = 0.781 and sixth by client with RII = 0.740 (see Table 1). The poor planning by the parties leads to project cost escalations since they lack in giving proper attention to the project in the concept, design and execution phases. The improper planning by clients in the initial phases leads to cost overruns as long time period is elapsed during estimation and tendering. This reason accounts for higher rates by the bidders which ultimately lead to award of contract to lowest bidder.

*Price escalation on major construction materials and / or Price Adjustment* (RII= 0.775) was ranked as the fourth most important cause for cost overrun as shown in Table 1. There is agreement between parties that this factor is one of the important factors, included in the top ten list of each party. It was ranked by client as first with RII = 0.800, third by consultant RII = 0.781, and eighth by contractor RII = 0.760. All the parties were of the view that this factor is responsible for escalating the contract price with a high percentage due to inflation. The compensation for said increase in the price of construction materials is paid to the contractors through price adjustment formula included in the contract conditions. Nonetheless, no amount is allocated in the bill of quantities (BOQ) for such price increase. Consequently, the said amount is paid to the contractor in addition to the original contract amount thus becoming a major factor for the client in highway projects.

Table 1: Important Causes of Cost Overruns

Factors	Contractor		Consultant		Client		Overall Response	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Additional work	0.872	1	0.819	1	0.760	4	0.832	1
Inappropriate government policies and priorities	0.824	3	0.762	6	0.700	8	0.786	2
Improper planning	0.792	5	0.781	4	0.740	6	0.786	3
Price escalation of construction materials and / or price adjustment	0.760	8	0.781	3	0.800	1	0.775	4
Land acquisition and resettlement	0.728	12	0.781	2	0.800	2	0.764	5
Inconsistent cash flows	0.848	2	0.676	16	0.680	11	0.754	6
Delay in decision by client	0.808	4	0.705	8	0.580	19	0.739	7
Design errors and changes	0.784	6	0.705	9	0.700	9	0.736	8
Inaccurate estimation	0.776	7	0.686	14	0.720	7	0.732	9
Relocation of services and utilities	0.720	13	0.705	10	0.760	3	0.729	10

*Land acquisition and resettlement* was ranked at fifth position with RII = 0.764. There was perfect agreement between consultant and client that the factor is part of the most important causes for cost escalation. The factor was ranked by consultant and client in 2nd position with RII = 0.781 and 0.800, while the contractor ranked the same factor at 12th position with RII = 0.728 (see Table 1). The said factor caused severe cost demand if necessitated during acquiring of the project right-of-way which gets escalated due to the slow regulatory framework.

*Inconsistent cash flows* was ranked in sixth position with RII = 0.754. The factor was considered as very important by contractors (RII = 0.848) who being most affected due to inconsistent cash flows. The consultant and client ranked the same as sixteenth and eleventh position with RII = 0.676 and RII = 0.680 respectively. This factor is responsible for cost overruns on the project and the same leads to suspension of work by contractor, which results in claims for idle charges of equipment and manpower.

*Delay in decision by employer* was ranked as seventh most important factor from the responses of all three parties having RII = 0.739. It was ranked by contractor in fourth order with RII = 0.808 while consultants and clients rated at eighth and nineteenth position with RII = 0.705 and RII = 0.580 (see Table 1.). This factor is responsible for cost overruns and sometimes causes the work suspended by the contractor which makes ground for financial claims.

*Design errors and changes* were rated at eighth position from responses of all three parties having RII = 0.736. It was ranked by contractors in sixth order with RII = 0.784 while consultants and client rated the same at ninth with RII = 0.705 and RII = 0.700 (see Table 1). This factor leads to cost overruns as changes in design necessitate or design errors lead to changes in quantities of the BOQ.

*Inaccurate estimation* was ranked at ninth as an important cost overrun factor with RII = 0.732 and it was ranked as seventh factor by both contractors and clients with RII = 0.776 and RII = 0.720. The consultant ranked this factor at thirteenth position with RII = 0.686. This factor causes cost overruns due to change in quantities during the execution phase.

*Relocation of services and utilities* was ranked in the tenth position with RII = 0.729. The client consider it the most important factor, ranked it at third with RII = 0.760. The contractor rated the same factor at thirteenth with RII = 0.720, while the consultant rated at tenth with RII = 0.705. The clients were of the view that concerned departments demand highly escalated rates for relocation of utilities and services which cause cost overruns in the amount allocated by the client.

### **Causes of Delays in Highway Projects**

Ranks and relative importance indices for the top ten most important causes of time overruns and delays in accordance with each group as well as the overall response from all three groups are shown in Table 2. The top ten most important causes of delays in highway projects as perceived by all the respondents included delay in progress payments, extreme weather and law and order (force majeure), contractor's incapability to do the job, financial difficulties faced by client, land acquisition and resettlement, ineffective planning and scheduling, scope changes and additional work, delay in handing over site to contractor, delay in obtaining permits and delay in decision by client. All ten factors are described and discussed.

*Delay in progress payments* is the most important cause of delays in highway projects. Overall, it was ranked at the first position with RII = 0.861. Contractor ranked this factor at first position with RII = 0.928 while consultant and client ranked the factor at fourth with RII = 0.790 and RII = 0.800 respectively. This factor is usually debated in the construction industry because many projects get affected due to delayed payments from the clients. Respondents revealed that due to delayed progress payments, the pace of works gets slow on-site which ultimately leads to

stoppage or suspension of work when contractor's funding to the project is subjected to timely provision of funds by the client. The conditions of contract enables the contractor for action of slow pace of works, suspension of work for nonpayment and in the last stage even to termination of the contract. This factor comes under excusable-compensable delay category.

*Extreme weather, law and order (Force majeure)* was ranked as the second important factor with RII = 0.804 in the overall category. This factor was ranked at the 2<sup>nd</sup> position with RII= 0.832 by contractors, RII = 0.790 by consultant and RII = 0.760 by client. Occurrence of heavy rains and floods like that of 2010 in Pakistan, severely affected the project durations. Law and order situation is also affecting the construction pace especially in the provinces of Baluchistan and some part of Khyber Pakhtunkhwa where work remains suspended till the normalization of security in some areas. Sometimes the project staff gets harassed by the militants forcing them to leave the project site. This results in unavailability of manpower which ultimately leads toward project delays. This factor is counted among excusable-compensable delay category.

*Contractor's incapability to do the job* was the third most important factor with RII = 0.786 in the overall. Contractor, consultant and client agreed that this factor is one of the main cause for cost overruns in highway projects. It was ranked sixth by contractor with RII = 0.784, second by consultant with RII = 0.790 and ninth by client with RII= 0.760. The contractors compete very hard in order to get or win the contract but sometime fail in delivering the project in accordance with the contract. Contractor sometimes do not have the capability in effectively handling the project. This factor comes under non-excusable delay category.

*Financial difficulties faced by client* (RII= 0.786) was ranked as fourth most important cause for time overrun (see Table 2). This factor was ranked by contractor at fourth (RII = 0.816), third by consultant (RII = 0.790) and sixteenth by client (RII = 0.700). This factor got importance in current financial situation when funds to concerned ministries and departments were not released on timely basis by the government which ultimately lead to notification of the client to contractor for unavailability of funds resulting in project delays. This factor comes under excusable-compensable delay category.

*Land acquisition and resettlement* was ranked in fifth position with RII = 0.764. The factor was ranked ninth by contractor (RII = 0.760), seventh by consultant (RII = 0.733) and third by client in (RII = 0.820). Respondents consider this factor with prevail in coming years since future projects of highway either target construction of new carriageways for which land from concerned departments will be acquired or widening of existing carriageways which ultimately warrants the requirement of land to extend the right of way. It was highlighted that delays occur in acquiring additional land only because of the slow regulatory framework. The land acquiring process in the first stage requires census of all the affected persons (APs) and then pricing of land in accordance with the market price of district and the locality. After comprehensive working, required amount needs to be transferred to the revenue department which is responsible for transferring payments to actual APs. In majority of the cases the APs reject to take the price and starts legal proceedings. After stay been issued, they bound the executing agencies not to commence construction of certain stretches. This whole procedure severely delays a highway project since a mechanism of the current law governing land acquisition for public purposes i.e. Land Acquisition Act of 1894 is followed. This delay factor is counted among excusable-non compensable category of delays.

*Ineffective planning and scheduling* factor was ranked in sixth position with RII = 0.764. This factor was considered as very important by all the parties with contractors rating the same as eighth (RII = 0.768), consultant rating as fifth (RII = 0.725) and client rating as fifth (RII = 0.780). Less importance by the client on a specific project at the time of start leads to failure of project. Less mobilization of resources by the contractors instead of being in accordance with the

resources mentioned in the contract documents for technical assurance, and inadequate allocation of finance for a project at initial stage results in delays. The implementation program or schedule submitted by the contractors are mostly unrealistic and are made only to win the contract at the time of bidding. This factor is included in non-excusable delay category.

*Scope changes and / or additional work* is ranked as seventh most important factor from the responses of all three parties having RII = 0.746. It was ranked by contractor in seventeenth position with RII = 0.712, while the consultant and client rated as sixth and first factor with RII = 0.743 and RII = 0.840 respectively. This factor is responsible for delays since a considerable amount of time is required for completion of additional scope of work along with original scope in similar time marked in the contract document. This factor is included among excusable-compensable delay factors.

Table 2: Important Causes of Delays

Factors	Contractor		Consultant		Client		Overall Response	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Delay in progress payments	0.928	1	0.790	4	0.800	4	0.861	1
Extreme weather, law and order (Force majeure)	0.832	2	0.790	1	0.760	8	0.804	2
Contractor's incapability to do the job	0.784	6	0.790	2	0.760	9	0.786	3
Financial difficulties faced by clients	0.816	4	0.790	3	0.700	16	0.786	4
Land acquisition and resettlement	0.760	9	0.733	7	0.820	3	0.764	5
Ineffective planning and scheduling	0.768	8	0.752	5	0.780	5	0.764	6
Scope changes and additional work	0.712	17	0.743	6	0.840	1	0.746	7
Delay in handing over site to the contractor	0.736	14	0.705	8	0.840	2	0.743	8
Delay in obtaining permits	0.816	3	0.657	14	0.660	17	0.739	9
Delay in decision by client	0.752	12	0.705	9	0.760	11	0.739	10

*Delay in handing over site to the contractor* was ranked as eighth in the delay factor list with RII = 0.743. The factor was ranked as fourteenth factor by the contractor with RII = 0.736, eighth by consultant with RII = 0.705 and second by client with RII = 0.840. The factor usually leads toward delays when a contract is awarded without full assurance of availability of complete project stretch to be executed. This factor comes under excusable-non compensable delay category.

*Delay in obtaining permits* was ranked as ninth in the important delay factor list with RII = 0.739. The contractor considered this factor as most important factor, ranking as third with RII = 0.816. The factor was ranked as fourteenth and seventeenth by consultant and client with RII = 0.657 and RII = 0.660 respectively. Permits and / or NOCs are required for relocation of electric poles, telephone cable, and stoppage of river water from concerned departments. This factor comes under excusable-non compensable delay category.

*Delay in decision by client* was ranked in the tenth position with RII = 0.739. The consultant ranked this factor at ninth with RII = 0.705. The contractor rated as twelfth with RII = 0.752, while the client rated as eleventh with RII = 0.760. The consultants rated this factor higher as compared with contractors and clients. This factor in most of the cases results in suspension of the work. Common examples quoted by the contractors under factor were delay in decision by client on the inclusion of non BOQ items during the execution phase, rerating of existing BOQ items due to exceeded quantities and approval of any design change proposed mutually by contractor and consultant. This factor comes under excusable-non compensable delay category.

### Rank Agreement Factor and Percentage Agreement

Table 3 and Table 4 shows values of rank agreement factor (RAF) and percentage agreement (PA) for the client-contractor, client-consultant and consultant-contractor groups for the cost and time overrun factors ranked. The agreement between client and consultant was the highest in the cost overrun factors with an agreement percentage of 69.4% while the agreement between client and contractor was considerable with an agreement of 65.3%. The agreement between contractor and consultant is the lowest among all and was above the half way with an agreement percentage of 57.1%. This shows the agreement in general among major groups in the category of cost overruns (see Table 3).

Table 3: Rank Agreement Factor and Percentage Agreement on Cost Overrun

Group	RAF	PA (%)
Client – Contractor	4.9	65.3 %
Client – Consultant	4.3	69.4 %
Consultant - Contractor	6.0	57.1 %

Table 4 shows that for time overrun factors identified, there was a considerable agreement among major stakeholders. Client and consultant had large agreement with a percentage agreement of 75.6%, Consultant and contractor had medium agreement with 64.9% while the agreement between client and contractor was also good with percentage agreement of 59.6%. The overall agreement among stakeholders show that the parties agree to a considerable extent for time overrun factors of highway projects.

Table 4: Rank Agreement Factor and Percentage Agreement on Delay Factors

Group	RAF	PA (%)
Client - Contractor	6.1	59.6 %
Client – Consultant	3.7	75.6 %
Consultant - Contractor	5.3	64.9 %

## Conclusion

The study was carried out to identify major factors causing cost and time overruns in highway projects separately. Among the 28 factors of cost overruns, the *additional work* is considered as the most important cause of cost overruns in highway projects. Other major factors which contribute to increase in the project cost include inappropriate government policies and priorities, improper planning, price escalation on major construction materials and / or price adjustment, land acquisition and resettlement, inconsistent cash flows, delay in decision by employer, design errors and changes, inaccurate estimation relocation of services and utilities. Among the 30 factors of time overruns, the *delay in progress payment* is considered as the most important cause of delays in highway projects. Other major factor of delays include extreme weather and law & order (force majeure), contractor's incapability to do the job, financial difficulties faced by client, land acquisition and resettlement, ineffective planning and scheduling, scope changes and additional work, delay in handing over site to contractor, delay in obtaining permits and delay in decision by client.

The clients, consultants and contractors agree on the overall ranking of cost and time overrun factors. Respondents agree that cost and time overruns are very much the 'twin evils' for road construction sector as huge cost and time variation had been recorded on many projects. Most of the identified factors come under the responsibility of client. A considerable attention is required to build a policy so as to ensure reduction in impacts of identified factors for infrastructure development in the country. The findings of this study and the methodology may be useful for research in other construction sectors and culture. The study can assist professionals in taking proactive measures for reducing cost overruns and delays in road construction projects.

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