# COST OF INACTION: A CASE STUDY OF N-55 KOHAT TO KARAK INDUS HIGHWAY ROAD PROJECT


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## CERTIFICATE

This is to certify that this thesis entitled: **"Cost of Inaction: A Case Study of N-55 Kohat to Karak Indus Highway Road Project"** submitted by **Mr. Sherbaz Khan** is accepted in its present form by the School of Economics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in Master of Philosophy in Economics.

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## Declaration

I Mr. Sherbaz Khan hereby state that my M.Phil thesis titled "Cost of Inaction: A case Study of N-55 Kohat to Karak Indus Highway Road Project" is my own work and has not been submitted previously by me for taking any degree from Pakistan Institute of Development Economics or anywhere else in the country/world. At any time if my statement is found to be incorrect even after my Graduation the university has the right to withdraw my M.Phil degree.

Sherbaz Khan

## *Dedication*

*Dedicated to my beloved Parents*

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# ABSTRACT

Human living standards are improving by each passing day and infrastructures, especially, road network, is a basic yardstick for assessing this improvement. Road construction provides the required vital components for the growth of economy of a nation as it increases utmost utilization of economic prospects and also mobilizes services and goods in the desired direction. But it is very difficult to manage all the required activities of constructing a road and that too abiding by the estimated or given cost, time and also to the user's approval. It is all because of delays. When cost of such delays is considered, then the situation becomes more disturbing and freighting. This study examines the financial and social costs of delay in a case study of road construction project, the N-55 Indus Highway from Kohat to Karak. A mixed-methods approach has been adopted in the study by combing quantitative data from project documents and qualitative data from commuter surveys to analyze the private, the accounting, and the social costs associated with the project. It has been found in the study that the private cost accounts for 13.87%, the accounting cost constitutes 25.1%, and the social cost makes 20.13% of the total project cost. Together these findings come to an estimated total cost of inaction of 59.1% of the project budget, thereby imposing significant financial and social burdens on stakeholders as well as impacting project budgets, labor costs, equipment expenses, and commuter inconveniences. Therefore, study has emphasized on ensuring timely action against inaction by sufficient funding through the Public Sector Development Program (PSDP), and improving project planning and execution. Moreover, the study has also highlighted the importance of enhancing data transparency and accessibility, strengthening interdepartmental coordination, and minimizing political interference. By adopting these recommendations, the impact and challenge of project delays can be mitigated in future ventures.



Keywords: Project Delays, Private Cost, Accounting Cost, Social Cost, Road Infrastructure, N-55 Indus Highway, NHA, PSDP

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| | |
|---|---|
| NHA | National Highway Authority |
| NHC | National Highway Council |
| NHEB | National Highway Executive Board |
| TWP | Technical Working Party |
| EOT | Extension of Time |
| PC-1 | Planning Commission -1 |
| T&C | Transport and Communication |

# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

Infrastructure have been discussed globally, so far efficiency of public expenditure in delivering these services has given less attention. Constructing new infrastructure is not the solution, especially when governments have scarce capital. Worldwide, new infrastructure projects often face delays and cost overrun which leads to inefficient use of public resources (Jyoti Bisbey, 2020).

Improvement in human living standards is a continuous process and infrastructure is a basic yardstick for assessing this improvement. Out of the given yardstick of infrastructure communication is the main aspect of human life. Communication has got many forms and road network happens to be one of the most important means of communication in terms of economics. After all, it is a globally recognized fact that if a region is selected for development then it can only be materialized by constructing either a 'canal' or 'road' through it. The countries' capability of providing high quality of life to their people is assessed by Global Competitiveness Index (GCI) and infrastructure constitutes a fundamental factor of this index (Schwab, 2018).

Good quality road communication enables trading of services and goods among different markets, considering the time and security aspects. Road infrastructure affects accessibility to basic facilities of life like education, health, work place and other public aspects (Amoatey & Okanta, 2017; Santoso & Soeng, 2016). Therefore, projects and strategies of road infrastructure play a pivotal role in improving living standards of the people, particularly in emerging countries. Moreover, construction industry is considered as the medium of development in any society, both rural and urban (Alhomidan, 2013). The sector of construction, especially road construction, provides the required vital components for the growth of economy of a nation as it increases utmost utilization of economic prospects and also mobilizes services and goods in the desired direction. But construction of road is not an easy job rather it is a complex process which involves a large number of activities (Ekanem et al. 2020). Mulla and Waghmare (2015) noted that it is very difficult to manage all the required activities of constructing a road which can successfully lead to completion of the given project and that too abiding by the estimated or given cost and also to user's approval.

It is all because of delay, even in today's age of most advanced technologies and innovations. When cost of such delays is considered, then the situation becomes more disturbing and freighting. Therefore, to cater for and also to avoid such situations, more and more competitive exploratory studies are required. Shahid et al. (2015) recognized delays as the main reason of controversies challenging this industry.

Similarly, delay in the construction of roads has become a serious point of dispute among all the concerned parties. The primary factor of success for projects of road construction is their completion within the given time (Aziz & Abdel-hakam, 2016). Even then delays in the projects of road construction are still prevailing as the major issue (Ellis, 2003; Honrao & Desai, 2015). This fact about delays is supported by the findings of Amoatey & Okanta (2017), who observed 70% delays in the given 48 projects of road construction in Ghana. They noted an average duration of delay of upto 17 months in those projects. Elawi, Algahtany, Kashiwagi, & Sullivan (2015) conducted analytical study of 49 projects, comprising mainly of infrastructure projects in Saudi Arabia, and concluded that 39% of those projects were confronting delays. Similarly, Mahamid (2017a) studied 101 projects of road construction in Palestine and found that 48% of the projects are affected by delays. Thus, this most recurrent matter compelled researchers in this field to carry out in-depth studies on the subject of delays. So, for it is a furnished fact that delays in projects of construction, especially highways construction, are prevailing throughout the world which provide basis for numerous adverse effects on the main stakeholders of any project of construction including contractors, clients, users and the public at large.

Pakistan's infrastructure projects play as a backbone of country's development, economic growth and improving public welfare. Public Sector Development Programme (PSDP) is an important tool used by government to achieve its development goals. The federal PSDP is designed to meet the targeted goals of annual, five-year plans and the vast national vision. Through the PSDP, the government focuses on providing essential infrastructure, building national assets, developing human skills, and starting various sectoral programs. Even with the efforts to boost economic growth through public investment, evidence suggests that the impact has been limited in Pakistan. One significant reason is the drastic decline in development expenditure, which has fallen from 7.5 percent of GDP in 1992 to around 1 percent today. This decline, coupled with the addition of new projects to the PSDP each year, has stretched funds thinly across numerous projects, resulting in delays and cost overruns. Data shows that 16 percent of ongoing projects face cost overruns, while 59 percent are delayed. Furthermore,

relying on foreign assistance to fund the PSDP often leads to unfulfilled commitments, adding pressure on domestic resources. In essence, inefficient project management and declining spending have hindered the desired impact of public investment on economic growth in Pakistan (Muhammad Ahmed Zubair, 2023).

### 1.2 Problem Statement

The "Kohat to Karak" project on N-55 represents a critical infrastructure development initiative, yet it has encountered substantial delays and incurred additional cost due to inaction. These unanticipated setbacks not only strain project budgets but also hinder regional economic activity, posing a significant challenge to effective road construction management. Understanding the underlying factors and consequences of these delays and additional cost of the delays are essential for devising strategies to enhance project efficiency and alleviate the economic burdens associated with inaction.

### 1.3 Research problem

The problem at hand is the significant delays and additional cost in the "Kohat to Karak" project on N-55, which is crucial for regional economic activity. These unexpected issues strain project finances and slow down business activity in the region. The challenge lies in comprehending why additional costs are happening and what their consequences are, which is essential for finding better ways to effectively manage road construction projects and reduce the economic problems caused by inaction.

### 1.4 Objectives

The aim is to calculate the additional cost of inaction of this project delay. This would help in providing policymakers and stakeholders with critical insights into the consequences of project delays.

### 1.5 Research Question

What is the total cost of inaction of delay in Kohat to Karak N-55 Indus highway project.

### 1.6 Units of Data Collection

This study employs qualitative and quantitative research methodology and scrutinizes the relevant primary data from NHA officials and secondary sources of data/ information from articles, books, and different websites and government institutions. Experts on the subject, relevant national and international documents, and academics in peer-reviewed publications have been consulted for a variety of pertinent prior assessments and viewpoints. The study area of N-55 (Karak to Kohat) was thoroughly surveyed. User feedback was obtained with the help

of structured questioner. The expert's analysis technique through an in- house session was done to define findings, conclusions and to offer recommendations for policy makers, stakeholders and concerned authorities.

# CHAPTER 2
# LITERATURE REVIEW

## 2.1. Introduction

As title of the chapter indicates, a thorough view of the previous work done on the subject of delay factor in the industry of construction has been given, with the focus on the factor of delay in the projects of construction of roads and highways. It has been tried to restrict discussion to the importance of the construction industry with its major problem areas, highlighting common causes and effects of delays in the projects of construction. Different types of delays in road construction have been identified in this chapter and the specific challenges being faced by road construction sector have been explored in the context of developing countries. Additionally, it also provides an overview of the construction sector in Pakistan. This chapter is the product of critical analysis of different articles, related materials and research publications on different aspects of construction projects.

## 2.2. Literature Review

### 2.2.1. Infrastructure Projects

Transport infrastructure has been a fundamental element of development and organization strategies within the European Union and globally. However, despite significant financial investments, its impact continues to be a subject of debate. Transport infrastructure projects can offer extensive political and managerial advantages, as they present highly visible and tangible forms of public spending that are easy to manage and satisfy citizens. Overall, it can be claimed that politicians and planners have significant incentives to invest in transport infrastructure. In times of limited public resources, rethinking transport infrastructure's role in development policies to highlight human capital and innovation can ensure better returns and greater sustainability (Crescenzi & Rodríguez-Pose, 2012). The possible reasons for the weaker than expected role of planning in infrastructure policies is the limited data availability. Despite substantial efforts to enhance planning methods and institutions, there is no clear connection towards a best practice (Short & Kopp, 2005).

Infrastructure which includes transportation, power, water and telecom systems supports economic activity and drives growth and development. 2.5 trillion dollars is spent on infrastructure per year, yet 3.7 trillion dollars per year will be added by 2035 to achieve the targeted GDP growth. Governments, are allocating more budget to meet the demand for a good reason. The McKinsey Global Institute estimates that infrastructure has a socioeconomic return

rate of approximately, 20 percent. In other words, every $1 invested in infrastructure can increase GDP by 20 cents in the long run. By Implementing best practices can help governments in improving and updating infrastructure decision-making. Utilizing objective criteria for consistent decisions, ensuring checks and balances among entities, and maintaining transparency are crucial for the effectiveness of each step in the framework. This approach can lead to better selection and outcomes for infrastructure projects (Bielenberg, Williams, & Woetzel, 2020).

### 2.2.2. Importance of construction industry

The main yard stick of the development of any nation happens to be the availability of infrastructure in every sphere of life. Provision of infrastructure is the job of construction industry in any country. As overall development is dependent on construction industry, the importance of this industry becomes obvious and accordingly this industry happens to be huge, resilient, and entails incredible capital expenses. Thus, status and quality of the infrastructure proves to be the decisive aspect for the progress of any nation. A thumb rule can easily be established to determine development status of a country by looking at the quality of construction present in that country; if a country is having quality construction, it easily be placed nearer to the desired development level. Those countries where economies are developing, construction industry gets major contribution from road construction. In other words, in such like economies projects of road construction consumes major part of the budget allocated for infrastructure development at national level (Kaliba et al 2009).

At global level, the construction industry is thriving well by each passing day and has a handsome share of about 10% in the GDP of most of the countries. 7% of the total employees are engaged in construction industry and, 40% of the total energy is consumed by this industry. Construction industry is a key for a country's economy and development. The pace and quality of construction activities in any country acts as barometer and measures the level and status of development in that particular country. Construction industry is the basic indicator and contributor in the development of a country everywhere in the world. Statistics of recent years in Pakistan show considerable growth in construction sector. A dependable network of roads and high ways constitutes main part of the construction sector and proves to be major contributor in the country's economic growth. This fact is evident from the share construction sector has in the growth policy as well as gross domestic product (GDP) of a country, mainly in developing countries (Muya et al., 2006).

Generally, the three factors; standard of construction, timeline and completion of the project within allocated budget, determine success of a construction project. Thus, in undertaking projects of construction, management of cost and time become mandatory. Accomplishing projects of construction within the given cost and time save the country from over costing and contributes in the economic development of that country mainly by efficient use of time and project expenses (Aibinu & Jagboro, 2002).

### 2.2.3. Causes of Delay in construction

According to Marzouk and El-Rasas, (2014), construction delay is the time overrun either beyond the contracted date or beyond the date that the parties have agreed upon for the delivery of the project. There are several factors which significantly impacts construction in terms of its standard, expenditures and time duration. From construction management point of view, a project of construction can only be declared as successful if it meets the required standards, timeline and is accomplished within the allocated budget (Falqi, 2004).

The time and cost overrun are a common phenomenon in projects of construction all over the world, but it is more prominent in construction of roads and highways, especially in the third world countries which have not yet taken off in terms of economics. Vidalis, (2002) identified modifications in construction plans, changed circumstances and absence of synchronization of the project activities as the main causative factors of over costing and time overrun in construction projects of roads and highways. Time overrun can be looked at from different angles; Mahamid et al. (2012) has defined Schedule Delay as the difference between the time of actual completion and the projected time of completion, duly approved by the contractor and the client at the time of signing the agreement. According to Stumpf (2000), delay is "an act or event that extends the time required to perform the tasks under a contract. Generally, it takes the form of extra working days or late start of an action". Al-Najjar (2008) has defined schedule delay as "the time increase to complete the project after the planned date which is caused by internal and external factors of the project". Though, delays are caused by a variety of factors yet the interest of client will vanish away if the project expenditures and timeline are not met (Kaliba et al, 2009).

### 2.2.4. Effects of Delay in construction

Economic growth and development banks on the contribution of few main sectors and construction industry is one out of them. However, many projects of construction industry are infected with large-scale delays, resulting in time and cost overruns. In the construction

industry, delay is taken as usual but it adversely affects accomplishment of the project in terms of standard, expenditure, time and safety (Faridi and El-Sayegh 2006). Ahmed et al. (2002) has established that delays are a worldwide phenomenon on construction projects and projects of road construction are very much part of such phenomenon. Delays in projects of construction generally result in overshoot of expenditures which negatively affect the concerned consultants, contractors as well as the clients. The negative effects of delays include strained dealings, issues of cash-flow, suspicion, mediation, lawsuit, and a generalized sense of common fear. The adverse effect of delays on the projects of road infrastructure is more prominent in countries with developing economies.

Negative consequences of delays in construction project encompass overrun of expenditures, disputes in the contract, intercession, and compromise on the required standards. Pourrostam and Ismail (2012) have identified six major causative factors of delays in projects of construction including cost overrun, time overrun, total abandonment, disputes, litigation and arbitration. Moreover, both contractors and users of the projects are negatively affected by these delays. Most of the countries share the same phenomenon of delays in construction projects. However, the phenomenon of delays is most noticeable in developing countries. Many research and analytical studies have established the fact that delays in construction projects negatively affect the consultants, contractors as well as the clients (Marzouk and El-Rasas, 2014).

Delay in the scheduled time of the project may lead to arbitration between concerned parties of the project contract. Under certain circumstances, mediation by a mediator in such cases may also fail and the concerned parties may approach and avail the process of arbitration. In this way the affected projects will be compelled to bear extra money and time spent on engaging professional arbitrators (Sunjka & Jacob, 2013).

The schedule overruns of a project of construction may result in the following outcomes:

**Time overrun:** A project is said to be facing schedule overrun if the given timeline is not met. Schedule overrun means delayed or late completion of the project against the agreed upon time of completion among all the concerned parties of the construction project (Sunjka & Jacob, 2013).

**Cost overrun:** According to Al-Hazim and Salem (2015), cost overrun and delay constitute critical factors in projects of road construction, where cost overrun means expenditures over and above the allocated amount of a particular project.

**Dispute and claims:** Usually time and cost overrun go side by side and end in claims and disputes among various parties involved in the concerned construction project (Sunjka & Jacob, 2013).

### 2.2.5. Types of Delays in Road Construction

Roads have great importance in the life of people and existence of community. Construction of roads is required for connecting different places with one another and to make convenient the goods' flow and people's movement from one place to the other. Construction of roads falls in the category of heavy construction, owned by the public and the source of its financing is therefore public taxes or bonds. High grade machinery is required by such heavy degree of construction. The heavy machinery used in construction of road has replaced the laborious non-automated processes over the passage of time. Moreover, highly specialized builders and engineers are now required in the projects of road construction (Holm et al. 2004).

Chai and Yusof, (2015) and Elawi et al, (2015) have identified numerous studies conducted in the recent past which have tried to differentiate and classify delays related to the projects of road construction on the basis of their context. Keeping in mind such like studies, factors of delay in the projects of road construction can be divided into three major categories; excusable delays with compensation, excusable delays without compensation, and non-excusable delays.

Excusable delays with compensation. This type of delays is caused by unanticipated happenings usually at the hands of clients due to their actions or inactions and which are out of the control of subcontractors or contractors. In this sort of situation, contractors have the right to demand and avail extension in time along with compensation for extra expenditures due laps of time. Example of this type of delay can be a situation where the contractor is not granted access to the location of the project by owner even after issuance of orders to start the work. Such type of delay is not at all caused by some mistake or inaction at the hand of contractor, rather it is caused by unanticipated circumstances (Chai and Yusof, 2015; Elawi et al., 2015).

Excusable delays without compensation. When the responsibility of delay cannot be attributed to both contractor and the client, then it is said to be the mentioned type of delay. Only extension in time is granted in this situation to the contractor for finishing the project without financial compensation as no damages are involved in this type of delay. The causative factors of such delay may be protests, unfavorable weather conditions, delayed availability of required equipment, and delayed availability of required material (Adam et al., 2015).

Non-excusable delays. This type of delay is caused by disregarding the terms and condition of the contract at the contractor's end. Therefore, contractor is held responsible for the losses as per the contract agreement and the same can be claimed by the clients. Such type of delays needs to be highlighted by the clients as project schedules are seldom checked by the clients. These delays are generally caused by anticipated weather conditions, inaction at subcontractors' end, mismanagement of project site at contactor's end, mismanagement of project finances at contactor's end, unavailability of required labour, deviation from schedule of the contract and non-adherence to the specifications chalked out by the owner (VasilyevaLyulina et al, 2015).

In addition to the above-mentioned factors, Shebob et al. (2012) have highlighted some other factors such as administrative regulations, poor planning and allocation of resources, inadequate management at the site, and environmental settings at the site.

After going through the results of Nyasetia et al. (2016), four main classes of factors of delay in projects of road construction can be worked out; Factors related to Contractor, Factors related to Consultant, Factors related to Owner, and Other factors of Miscellaneous nature (including factors of the project, equipment, labour, materials, and some external factors). Hence an extensive series of factors and other issues associated with them have their influence on projects of road construction. These factors generally cause extra expenditures which negatively affect consultants, contractors and the clients. Delay in projects of construction has different meaning for different groups of people associated the projects like it means absence of facilities and financial loss for the owner. From contractor's point of view, it means lack of finances for extra expenditures mainly on materials, equipment and labour acquisition and, of course, cost of time. Therefore, it can be said that different parties are affected differently by different factors (Motaleb, 2014).

### 2.2.6. Road Construction in Developing Countries

The road network is crucial for infrastructure development. Improved quality of highways lead to safer travel experiences, reducing road accidents and fatalities (Solanki, 2022, October). Projects of road construction are solely owned by the governments in developing countries. There are three main factors in these countries which have prominent impact on the expansion and growth projects of road construction including expenditure by the government, economic growth at national level, and the degree of communities' demand (Tang et al., 2003). Okpala and Aniekwu (1988) have concluded that in developing countries the chief concern of

governments is the construction of roads. However, the chief causes and major effects of delays in the projects of road construction remain different for different countries mainly due to the difference in their environments and due to the difference in the application of techniques of construction which ultimately have influence on the processes of construction.

Apart from overruns of cost and time, being the chief effect of delays in projects of road construction, some other effects have been identified by researchers in the field of road construction. According to Kikwasi (2013), effects of delays in the projects of road construction include total abandonment, cancellation of contract, financial loss or low margin of profit, litigation, arbitration, disputes, and compromise on quality. All such effects prove to have adverse consequences on the client as well as the construction firm (Salunkhe and Patil, 2014).

Al-Khalil and Al-Ghafly (1999) determined the connection between different aspects of the projects of road construction like conditions of the project, extent of project work, and timetable of the project. A change in any one of these aspects has impact on the timeline of the project and degree of compensation in case of delay. Thus, awareness regarding different aspects of project delays becomes mandatory including timetable of the project, frequency of delays and their effect on completion and later utilization of the project.

Kaliba et al (2009) also supported the finding about universal nature of delays in projects of construction, especially in the projects of road construction, and also the fact that different parties are affected in different manner. However, they maintained the general outcomes of delays include however, are loss of capacity, time and capital. Al-Kharashi and Skitmore (2009) have ascertained the fact that the causative factors of delays in the projects of road construction are different for different countries.

Shebob et al, (2012) have explored the possibility that certain troublesome events may result in the time overrun of the project of road construction which in turn may slow down the flow of construction work.

A significant increase in demand has been noted for provision of road infrastructure during the ongoing modern era, just because projects of road construction are held responsible for having very important share in various aspects of economy, quality life, education, health and competitiveness at national level (Amare et al, (2017), Al Hosani, et al (2020). It is due to the fact that a country's well-being is highly affected by building, planning, designing, and maintenance of road and highway projects. Therefore, initiating a new project of road construction requires a huge economic struggle (Lee et al, (2018), Lee, et al (2018, 1), the

failure of which, can extremely disturb economies both at the regional and national level (Love et al, 2016).

Projects of road construction are negatively influenced by some undesired phenomena such as corruption, disputes, delays, cost overruns, and others. These phenomena lead to serious outcomes, where the project's successful completion is ultimately compromised (Aziz & Hakam, 2016, Parikh et al, 2019). Different variables, associated with projects of road construction, have different magnitude in terms of their influence on the project and ascertaining of their magnitude stands difficult (Rehak et al, 2018, Useche et al, 2018, Song et al 2018). Therefore, cost assessment and budgeting of the projects of road construction is linked with total uncertainty and complexity (Cavalieri et al, 2019).

When a project is completed, deviation is worked out from its initial cost which can be negative or positive (Love et al, 2013, Catalao et al, 2019). If the deviation is positive, it shows cost overrun, and if the deviation is negative, then it shows cost underrun. In this way cost overrun proves for the project owners as financial risk and matter of great affectation. Project owners are generally used to be public entities who are characterized by spending public money. Whenever and wherever public money is spent it has to processed through extensive claims, , regulations, controls and disputes (Bucciol et al, 2013). Moreover, projects of construction industry are open for cost overruns because of various reasons which can be different for different countries and can be different for different projects (Huo et al, 2018, Bohoruez et al, 2018, Bordat et al, 2004).

Sometimes, cost overruns may lead to interruption in construction activities, and even projects are abandoned in extreme cases, when the unanticipated cost overruns become difficult to be borne by the owner with limited financial capacity. Situations like this results in the suspension of payment of expenses to the contractor. Such alarming situations has prompted the quest for finding solutions to such problems among researchers and concerned professionals, who are now focusing on alleviating the causative factors and characterization of the phenomenon (Cavalieri et al, 2019). But the still exists as evident from the studies on the subject (Love et al, 2016). According to Bordat et al, (2004), 55% of the projects of road construction are facing cost overruns after studying 2668 projects of road construction in the United States of America. 231 road construction projects in Australia show 16.3% cost deviation (Creedy et al, 2018). According to Cantarelli et al, (2012), 62.2% of the projects of road construction were completed with an average of 18.6% cost overrun. Lee, (2008) came out with 50% cost overrun

in 95% of 138 projects of road construction in South Korea. Roxas and Chalermpong (2008) found 5.4% cost overrun in 85 projects of road construction in the Philippines. In Palestine, Mahamid and Bruland (2012) carried out analysis of 169 projects of road construction and concluded that average cost overrun is 14.6%. Seven projects of road construction in Tanzania showed 44% cost overrun at average (Rwakarehe and Mfinanga, 2014).

These figures show that cost overrun is not only found in developing countries, rather this phenomenon is also affecting the developed countries as well. According to Sudasana et al, 2014, improvement in the road infrastructure and its extension need operational area during road maintenance stage. Such an operational zone creates bad impact on the users of the road and surrounding environment of the project in the form of low travelling speed and the reduced road capacity.

The World Economic Forum assesses enhancement in standards of living of 140 countries every year. Its criteria of measurement comprise of 12 factors which are the constituents of GCI. Recent report of GCI highlighted that those geographic regions, which are better connected, are more flourishing than others which are poorly connected (Schwab, 2018). This shows the importance of projects of road infrastructure. Road infrastructures can only be developed, if the projects of road construction are completed within the given time and budget. Adherence to time and budget poses a great management challenge in the construction sector (Amoatey & Okanta, 2017).

Nadir and Ahmed, (2020) are also of the opinion that delay in time of completion and cost overrun from the allocated budget are the most recurring phenomena throughout the world but these are more prominent in developing countries as compared to the developed countries. They have concluded that at average 43% overrun in the cost is found in 71% projects of construction.

### 2.2.7. Construction Sector of Pakistan

Pakistan's overall South Asian ranking for good governance is lower than the region's average, according to the World Bank's Worldwide Governance Indicator. Reason is the existence of institutions like the Federal Board of Revenue (FBR) is very powerful and has the authority to enact laws (known as Statutory Regulatory Orders, or SROs), which grant tax exemptions and other advantages (Haque & Ullah, 2022). Evaluating how well government institutions work is really important, especially in countries that are still developing. This evaluation helps us understand if the plans and programs made by the government are actually working or not. It's

like checking if a recipe is making a tasty dish or not. By looking at the results, we can decide what's going well and what needs to be improved. This helps the government use money and resources better to make things better for everyone. Also, when we know what's working and what's not, people can trust the government more, and the government can learn and do things even better. This is super useful, especially in places where there isn't a lot of extra money to spend, so we can make the most of what we have and make life better for everyone (Khandker, Koolwal, & Samad, 2009)

In developing countries, setbacks in highway construction projects due to financial difficulties hinder the construction industry's potential to contribute to economic development optimally (Edwards et al., 2017). Cost is a crucial factor for project success, and many key elements influencing project expenses are qualitative in nature. These factors include client emphasis on project timelines, the contractor's planning skills, procurement methods, and market conditions, such as the overall construction activity level (Ballal, 2005).

In the context of generation of employment and performance of economy, construction sector of Pakistan is extremely important. Because the construction sector of Pakistan provides bulk of opportunities of employment (Khan, 2008). China Pakistan Economic Corridor (CPEC) has provided a golden opportunity to Pakistan for transforming its economy with US$ 62 Billion available for investment under this program (Memon 2004, Ali et al, 2009). Launching of CPEC program, with courtesy of China, is providing enormous opportunity for thriving of construction sector in Pakistan. However, a downfall can be pointed out in the construction sector of Pakistan. This downfall mainly may be attributed to the familiar and chronic issue known as, “delays in construction projects”. Nadir and Ahmed, (2020) analyzed 65 projects and furnished that only 7 out these projects could be accomplished within the allocated budget. They determined that the projects facing delay were 97% and the projects experiencing cost variation were 90%. They concluded 28.27% cost overrun at average and 2.1 years delay at average. They have highlighted projects of road construction with highest ratio of delay that is 2.3 years as compared to other projects. Such delays result into a number of consequences like cost overruns, claims, and litigation which lead ultimately into abandonment of the projects. Usually the cost overruns make the project non-feasible due to which economic crisis is created ultimately (Memon 2004, Ali et al, 2009).

Like rest of the developing countries, the projects of construction in Pakistan are also infected by time extension and cost overruns. Out of various causative factors of cost and time overruns,

the most commonly occurring factors include force majeure, lack of materials and equipment, escalation, change in specification, change in scope of work, administrative issues, technical issues, social issues, financial issues, scheduling of the project, project planning and project design (Khan et al, 2015).

Any endeavor aimed at mitigating the cost overruns in projects of road construction must take a start with identification of its causative factors. Pai et al, (2018) and Shemi & Asok, (2020), attribute factors of cost overruns to political situation prevailing in the country, delayed activities, change in scope of work, problems of materials and equipment, owners' intervention, poor management and execution at contractor's end, poor programming and planning of activities and problems in design. For a project of construction, time performance matters a lot. All concerning bodies and individuals look for the timely completion of construction projects. However, maximum projects of construction face delay of less than 20% of the given completion time which in turn requires extra funds of 20% over above the allocated budget.

### 2.2.8. Conceptual Framework

The conceptual framework breaks down the Total Cost of Inaction on the N-55 Indus Highway project into three main categories: private, accounting, and social costs. Each category includes specific cost elements that arise due to project delays. The study is based on the data available from the NHA and Planning Commission, as well as the limited data from the PC-1 revision. Due to data limitations, a broader comparative study of other projects could not be conducted.

Under Private Costs, we further differentiate between the costs borne by the National Highway Authority (NHA), consultants, and contractors. For the NHA, private costs primarily consist of salaries paid to staff involved in revising the PC-1 documentation. The consultant's private costs include key personnel salaries for design review during the PC-1 revision phase and construction supervision, as well as non-key personnel salaries for construction oversight. The contractor's private costs cover a range of operational and logistical expenses, including office and accommodation rent at the project site, office furnishing and equipping, office running and maintenance costs, supporting staff expenses, transport maintenance for employees, and costs for machinery and equipment required on-site.

The Accounting Costs are the officially recorded financial expenditures. This includes the allocated budget for the new project phase and the estimated costs tied to the completion timeline, as outlined in project documentation.

Social Costs reflect the broader, indirect impact on commuters due to project delays. These include additional travel time costs for commuters, increased fuel consumption, engine oil usage, and wear and tear on tires. Each of these social costs translates into a tangible burden for the community that relies on this highway, ultimately underscoring the economic significance of addressing and mitigating project delays. Together, these private and social costs underscore the broader implications of project inaction on the N-55 Indus Highway, demonstrating both financial and social repercussions. The conceptual framework is presented below using a flow chart.

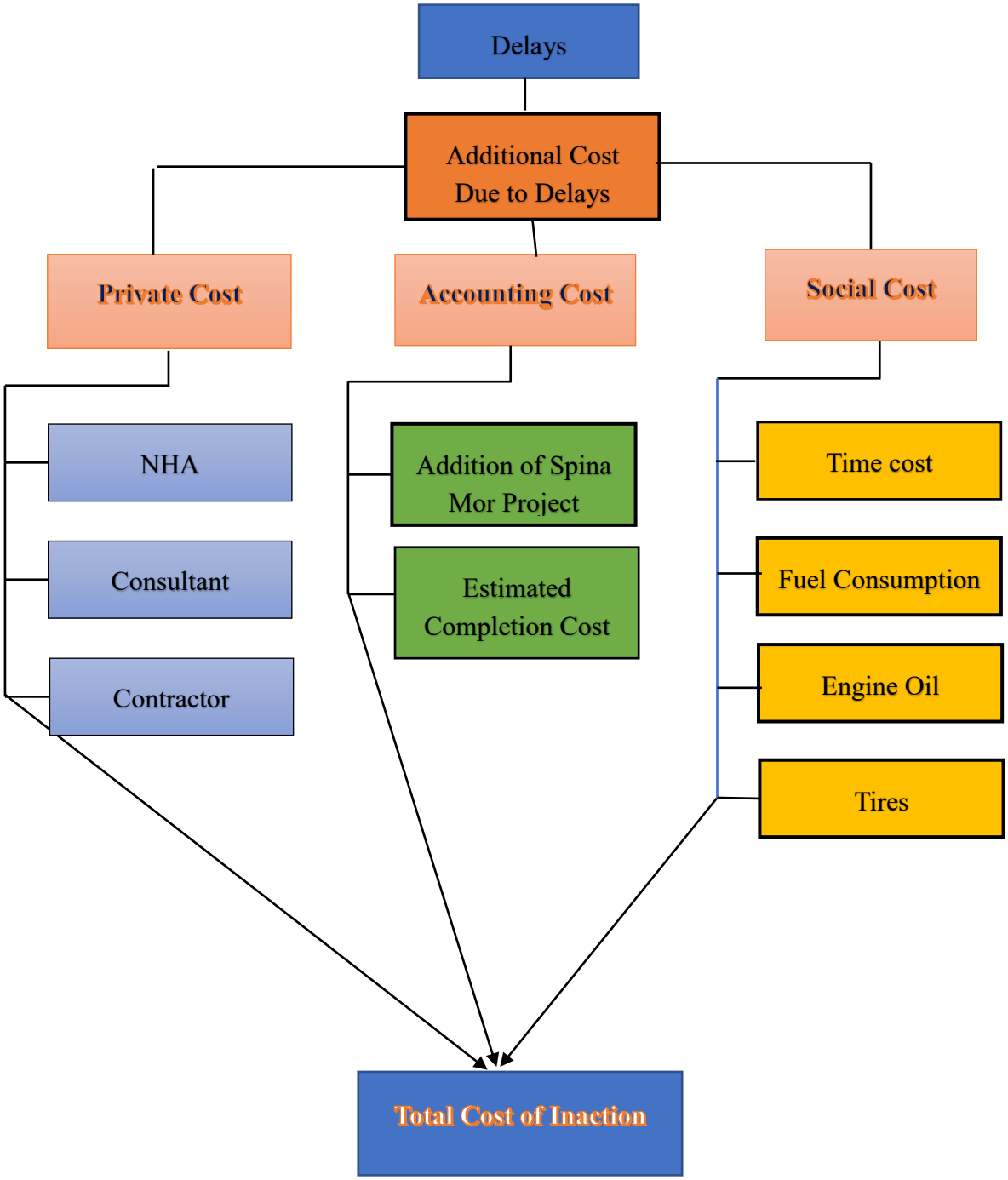



**Figure 2. 1: Conceptual Framework-Data provided by NHA and data from survey**

### 2.3. Research Gap

The current body of literature in construction project delays extensively covers general factors highlighting their impact on project outcomes and economic growth. However, there is a notable research gap in understanding the specific cost of inaction due to delays in road projects within developing countries, particularly in Pakistan.

Although general studies indicate that delays lead to significant financial and operational impacts, there is limited detailed analysis focusing on the total cost of inaction for specific projects, such as the Kohat to Karak N-55 Indus Highway project. This research seeks to address these gaps by conducting comprehensive evaluation of how delays translate into financial losses and broader economic consequences for this critical infrastructure project. Addressing this gap will provide valuable insights into the true economic impact of construction delays and offer a more nuanced understanding of how such delays affect national development initiatives.

### 2.4. Conclusion

The studies provide valuable insights into the causes and effects of delays in construction projects, highlighting factors like cost overruns, time overruns, poor planning, mismanagement, and external political and environmental issues. While delays are a global phenomenon, they are more pronounced in developing countries like Pakistan, where financial limitations, governance challenges, and systemic corruption exacerbate these issues. Though road construction delays have been studied in both developed and developing contexts, a research gap exists in understanding how these general factors specifically impact major road projects in Pakistan, such as the N-55 project. While delays in Pakistan's infrastructure projects are recognized, limited research explores their broader economic impact, particularly in relation to national growth and initiatives like the China-Pakistan Economic Corridor (CPEC). This gap emphasizes the need for further exploration of inactivity costs and their consequences for the country's development.

# CHAPTER 3

# OVERVIEW OF NHA CODE 1999

## 3.1 Introduction

This section provides an overview of the National Highway Authority (NHA) code 1999, detailing its background, organizational structure, powers, and duties. It examines the NHA's planning process and outlines the mandatory stages for project approval, offering a concise understanding of the regulatory and procedural framework governing NHA operations.

## 3.2 Background of NHA

In 1978, the Pakistani government (GoP) made the decision to centralize control over five significant Roads linking together all the provinces, known as "National Highways," by establishing the National Highway Board. This board was responsible for supervising the maintenance and development of these federally controlled roads, working in collaboration with the Provincial Highway Departments. To effectively manage the maintenance, repair, operation, development, and planning of highways and roads of national and strategic importance, the National Highway Authority (NHA) was set up on 26 June 1991 as a result of Act of Parliament. The authority was constituted as a corporate body and headquarters were established in Islamabad. The authority was aimed at to organize, promote, plan, and execute packages and programs for the maintenance, repair, operation, development, and construction of strategic roads, motorways and highways, specially the construction tasks given different authorities, provincial or federal government (NHA).

Since its establishment in 1991, the National Highway Authority had occasionally framed, reviewed and advanced its technical, administrative, and financial procedures. This development spanned from the initial framework of the NHA Act 1991 to the Delegation of Powers in 1992, revised later in 1998, and concluded in the modified NHA Code of 1999. Upon the implementation of the NHA Code 1999, most of the operational issues faced by the authority were addressed effectively. However, the revised code of NHA-1999 became authoritative due to the expanding character of NHA as the guardian of strategic and national assets having value in billions, specifically the network of national highways, which presented challenges in resolving administrative and financial matters. NHA Code-2005 caters for and mitigates such problems and offers more pragmatic policy for operationalizing NHA. It also provides policy guidelines to its employees of all ranks.

The NHA runs 12,131 kilometers of roads of different categories, comprising a total of 39 strategic routes, expressways, motorways, and national highways. This constitutes 4.6% of the entire national road network, which amounts to 263,775 kilometers. Despite this relatively small portion, these routes handle 80% of commercial traffic. Notably, the N-5, considered the lifeline of Pakistan, bears 65% of this nationwide load.

### 3.3 NHA Organogram

Head office of NHA is present in Islamabad and a Chairman heads this head office. Based on their functions, the head office is divided into different branches like Motorways, Highways, Finance, Administration, and Planning wings. A Member heads each of these wings or branches. Being functional heads, all the members have General Managers as their assistants in their concerned wings. The General Managers act as operational heads. The head office is responsible for all NHA activities and operations all over the country.

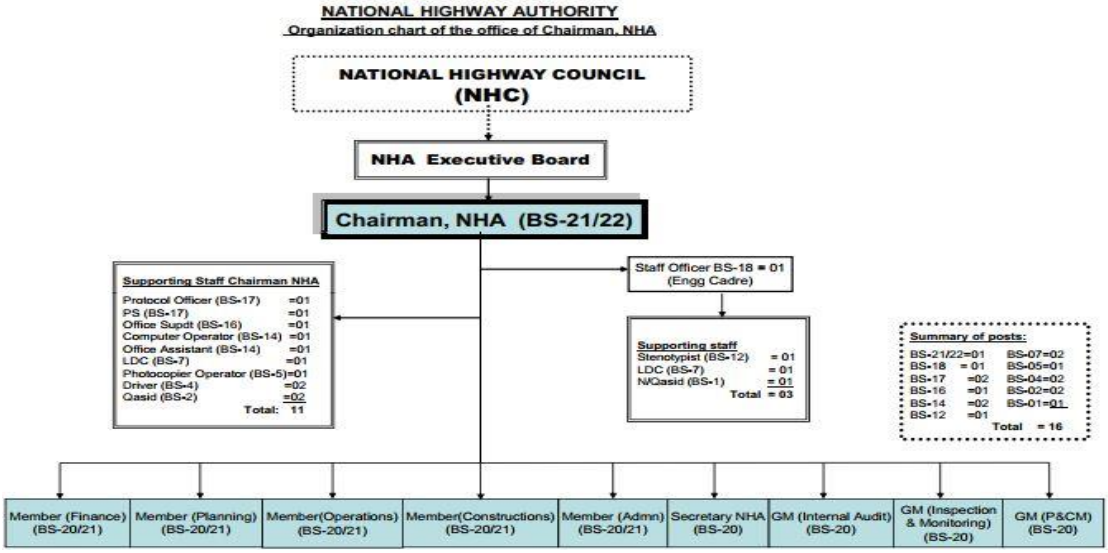



**Figure 3. 1: NHA Organogram**

Six Regional General Managers head their regional offices, out of which one each is located in all the four provincial capitals, one is present in Multan with the name of Punjab (South) and Northern Areas Region office is located at Abbottabad. Each Regional Office has a representative of Member (Finance), known as of Deputy Director (Accounts).

Project General Managers head the offices of major projects or "Self-Accounting Projects". Each project office has a representative of the Member (Finance), known as Director / Deputy Director (Accounts).

### 3.4 Power and Duties

#### 3.4.1 National Highway Council (NHC)

The NHC is headed by Federal Minister for Communication. The responsibilities of NHC include approving the five-year plan recommended by the NHEB, setting up the national policies and guidelines for the authority, reviewing and appraising projects, and approving annual budgets. Composition of NHC is given below

**Table 3. 1: National Highway Council Members**

| | |
|---|---|
| Minister of Communication | President |
| Secretary Finance Division | Member |
| Secretary Planning and Development Division | Member |
| Secretary Communication | Member |
| A Professional in the field of Highway Construction and Management (nominated by President) | Member |
| A Professional in the field of finance and Accounts (nominated by President) | Member |
| Chairman NHA | Member/Secretary |

Source: National Highway Authority Code 1999

#### 3.4.2 National Highway Executive Board (NHEB)

The Executive Board is responsible for considering and approving proposals, schemes, and projects valued between fifty and one hundred million rupees. Proposals over and above the given limit are recommended to CDWP or ECNEC through the Ministry of finance for PSDP funding. Under RMA funding, the Chairman of NHA can approve proposals, schemes, and projects up to one hundred million rupees, while the Executive Board has full authority to approve any such proposals, schemes, and projects. Additionally, the Executive Board reviews progress reports of the Authority and performs other functions as delegated by the Council.

Composition of NHEB is given below:

**Table 3. 2: Members of National Highway Executive Board**

| | |
|---|---|
| Chairman NHA | Chairman |
| IG&MP | Member |
| Additional Secretary Finance | Member |
| Member of Additional Secretary Planning and Development Division | Member |
| Joint Secretary 2, MOC | Member |
| Senior Chief/Chief NTRC | Member |
| President/VP NESPAK | Member |
| Member Finance NHA | Member |
| Member Planning NHA | Member |

Source: National Highway Authority Code 1999

## 3.5 Planning Process

The planning process includes the development of the following types of long-term and short-term plans and budgets:

- Master Plan
- Strategic Plan setting long term objectives of the Authority
- Five Years Plan
- Yearly ADP (in coordination with Finance Wing).
- Annual Revenue and Non-Development Expenditure Budgets

### 3.5.1 Preparation of Master Plan

The Five Years Plan includes projects accepted, with prioritized and approved demands before execution. Projects or services are only accepted when funds are available. Operation/Construction Wings submit new project demands to the Planning Wing with detailed justifications. After review, the Planning Wing submits proposals to the appropriate forum for evaluation, including cost, scope, and return rates. Projects are not split to fit within approval

limits. The Planning Wing, with financial evaluations from the Finance Wing, drafts the Five Years Plan for the National Highway Council's approval. The plan includes detailed project estimates and PC-1 forms, reviewed annually during budget submissions.

### 3.5.2 Preparation of Annual Development Program

The addition of any project in the Yearly Annual Development Program (ADP) is based on the Principle of Acceptance of Necessity, defined as the competent authority's concurrence with the proposed expenditure. The preparation of the ADP is a coordinated effort between the Planning, Operation, Construction, and Finance Wings. Each year, the Planning Wing, in consultation with the other wings, re-evaluates the necessity, viability, and priority of projects in the Five-Year Plan. A Priority List is then issued, including only projects with expected funding. Formal orders are issued for accepted projects. By September 1st, the Planning Wing prepares and submits the Yearly Priority List for approval, then circulates it. The Budget Section consolidates all information to draft the ADP for approval by the NHA Executive Board before submission to the Council.

### 3.5.3 Mandatory Stages for Project Approval

- The projects pass through five distinct stages for final approval,
- A project is considered and Accepted in Principle upon its presence in a Five-Year Plan.
- The presence of a project in the Yearly Priority List signifies the acceptance of its necessity.
- Administrative Approval
- Financial Concurrence
- Technical Sanction

As part of NHA standard procedure, the authority ensures that projects obtain mandatory administrative approval. NHA strictly follow the guideline that the original administrative approval should not exceed by more than 15%. In situations where the execution of the work exceeds the original administrative approval by more than 15%, the authority followed for revised administrative approval. Any additional excess beyond the revised administrative approval necessitates obtaining a fresh revised approval. It becomes the responsibility of the Highways and Motorways Wings to initiate the preparation of a Revised PC-1 as soon as the expenditure exceeds the original approved cost by 15%.

### 3.5.4 Technical Working Party (TWP)

It analyzes PC-1 or project documents before administrative approval and recommends proposed projects for acceptance on priority basis after due evaluation. The TWP plays a key role in ensuring the technical feasibility and viability of projects before they proceed to administrative approval stage. TWP consists of following

**Table 3. 3: Technical Working Party Members**

| | |
|---|---|
| Chairman NHA | Chairman |
| Member Finance NHA | Member |
| Member Planning NHA | Member |
| Member Operations/Construction NHA | Member |
| Chief (T&C) Ministry of Planning | Member |
| Director (R&RT) Ministry of Communication | Member |
| Representative of NTRC | Member |
| GM Design NHA | Member |
| GM Planning NHA | Member/Secretary |

Source: National Highway Authority Code 1999

### 3.5.5 Monetary Limits of Projects Approval

**Table 3. 4: Monetary Limits of Project Approval**

| | Competent Authority | Monetary Limits (Rs in Million) |
|---|---|---|
| National Highways | | |
| PSDP Funding | ECNEC | Full Powers |
| | CDWP | Up to 500 |

| | | |
|---|---|---|
| | NHEB | Up to 100 |
| | Chairman NHA | Up to 50 |
| | Member Construction | Up to 30 |

Source: National Highway Authority Code 1999

### 3.6 Planning Wing

Planning Wing gets the Five Years Plan approved by the National Highway Council. It is also responsible for preparation of detailed project estimates as well as PC-1 where applicable in respect of each project included in the Plan.

### 3.7 Finance Wing

Finance wing is responsible to prepare annual budget of the Authority with the consultation of other wings. It also is responsible to prepare working paper and draft for the approval of the Executive Board.

### 3.8 Operation Wing/ Construction Wing

Operation wing is responsible to submit the demand for new projects or services to the planning wing with detailed explanation of the requirement for review, designing and estimation. Operations/Construction supervise the acquisition of land, obtaining and disposal of moveable or immovable properties or interests within the approved procedures and Policies of NHA.

### 3.9 Administration wing

Administration Wing is responsible for framing procedures for appointments and terms and conditions of services of NHA employees and amendments in the procedures.

### 3.10 Procurement & Contract Section

P&CA section is responsible for procurement of contractors on the basis Public Procurement Rules, 2004 advised by Ministry of Finance. The awarding of contracts is done on the contract's documents standardized by the Pakistan Engineering Council.

### 3.11 Finance Arrangement

The National Highway Authority relied on a various range of financial resources to fund the development, construction, and maintenance of National Highways, as well as the management of associated affairs. These sources included loans from the Federal Government, external loans secured by the Authority, foreign aid, grants, and loans negotiated independently by the Authority. Grants disbursed by the Federal Government, alongside financing from the private

sector, constituted significant portions of the funding. Moreover, revenue generated from toll collection, funds raised through the issuance of bonds or shares, and various other streams such as fees, damages, refunds, and fines were utilized.

Additionally, income derived from the sale of assets, land, vehicles, and investments made with banks and financial institutions were instrumental in financing the Authority's activities. Furthermore, the commercial utilization of the Right of Way (ROW) provided an additional avenue for revenue generation.

At present, the funding for the Annual Development Program of the Authority primarily comes from Cash Development Loans provided annually by the Government of Pakistan, as well as foreign loans and relent loans. Additionally, the Authority secures Suppliers'/Buyers' Credits in accordance with contract agreements signed with various local and foreign firms for project construction. Each loan is subject to specific terms and conditions regarding repayment and interest rates.

# CHAPTER 4
# RESEARCH METHODOLOGY

## 4.1 Introduction

This chapter discusses the research strategy employed in the study, detailing the methods of data collection used to gather comprehensive data. It explains the mixed methods approach utilized to analyze private cost, accounting cost, and social cost. Additionally, it outlines the sample size and sampling technique adopted to ensure robust and representative findings.

## 4.2 Methodology

Mixed Methods Methodology is defined as a type of user research that combines qualitative and quantitative methods into a single study. This methodology combines the advantages of both qualitative and quantitative approaches to offer a more thorough understanding of research issues. According to (Plano Clark, 2017) mixed methods research involves analyzing, collecting, and integrating or mixing both quantitative and qualitative data in a single study or a sustained long-term program of analysis.

The methodology adopted in this research employed a mixed-methods approach to analyze the costs associated with the N-55 Indus Highway construction project, focusing on private, accounting, and social costs. Data was initially collected from government records, project reports, and interviews with stakeholders to obtain preliminary project cost estimates (PC-1), revised project costs, and deviations from the project's timeline. For the cost of PC-1 revision of NHA, the sludge methodology was utilized, focusing on identifying excessive or unreasonable frictions referred to as "sludge" that make it more difficult for people to achieve their goals or act as they intend (Sunstein, 2020), while the private costs for the contractor and consultant were analyzed using a private cost method, which refers to all costs incurred by the relevant individual parties in producing a commodity (Heiko Schmiedel, 2012). Additionally, the overall project budgets were assessed using an accounting cost method, defined as the documented expenses of an activity that are recorded in a business's ledgers and appear in the entity's financial statements (AccountingTools & BOOKS, , 2023). Quantitative analysis addressed private and accounting costs, with secondary data sourced from revised PC-1 document, extensions of time, and contracts with the NHA, contractor, and consultant. These documents provided numerical data on project budgets, contract values, labor costs, equipment costs, and other related expenses, which were thoroughly reviewed and analyzed using simple cost analysis over daily, monthly, yearly intervals, and costs associated with delays.

For assessing social costs, unstructured questionnaires were administered to commuters to gather qualitative data on additional expenses, time delays, and inconveniences.

Social costs are defined as those costs not apparent to the contractual parties but evident to the community near a construction project (Ferguson, 2012). This qualitative data was then quantified using simple cost analysis on a per-day, per-month, and delayed-time basis. Primary data for social costs was collected directly from commuters through surveys and interviews, providing a comprehensive understanding of the project's financial and social impacts by integrating both quantitative and qualitative insights. The study's findings outline the significant cost of inaction on the project, revealing that delays or failure to progress in construction can lead to substantial financial and social costs for all stakeholders involved.

Additionally, analysis of the Public Sector Development Program (PSDP) was conducted. This included estimating the cost of inaction in terms of PSDP allocation, calculating the cost of Inaction of NHA's allocation in the PSDP, the cost of inaction of infrastructure allocation in the PSDP, and the cost of inaction of in GDP from 2010-2024. These analyses highlighted the broader economic consequences of project delays, emphasizing the need for timely and efficient project execution.

### 4.3 Sample Size

The sample size consisted of 40 Hiace/coaches' transporters, commuters / drivers / road users who filled out questionnaires based on increase / decrease time cost, vehicle operating cost, and cost of accidents.

### 4.4 Sampling Technique

The sample technique used for this survey was random sampling. A total of 40 commuters, who were Hiace transporters, were randomly selected to participate in the study. These participants filled out questionnaires at three different locations: Karapa Toll Plaza, Kohat Bypass, and Jail Chowk Karak. The survey questions focused on travel time cost, vehicle operating cost, and the cost of accidents, providing comprehensive data from a diverse set of transporters at key transit points.

### 4.5 Sludge

Social scientists define "sludge" as unnecessary or excessive obstacles that create friction, making it more difficult for individuals to achieve their goals or act according to their preferences (Sunstein, 2020). Sludge in any activity involves complications in documentation procedures that causes unnecessary delays and increases the cost or increase expenditures.

### 4.6 Delays

In this study, "delays" refer to the extended timeline of the project beyond its original completion timeline, which was set for May 2020 in the original PC-1 document. Since the project is still unfinished, delays from 2020 onward were analyzed to capture the extended costs prolonged timeline. Using data provided by the National Highway Authority (NHA), the analysis calculated revised costs to account for additional private cost incurred by key stakeholders including the NHA itself, contractors, and consultants resulting from the delay. This financial breakdown includes the accounting cost which reflects the cumulative expenditure on the overall project from 2020 to the present.

In addition to private and accounting costs, social costs were also considered. Social costs refer to the broader impact on society, specifically the lost benefits that would have been gained by the commuters if the highway had been completed on time. Since the highway remains incomplete, commuters miss out on potential advantages, such as improved travel efficiency, reduced time costs, reduced fuel consumption and enhanced connectivity. By factoring in both financial costs and social costs, this study provides a holistic view of the project's delayed completion, helping to quantify not only the direct expenses borne by stakeholders and society as a result of the delays.

### 4.7 Private Cost

Private cost refers to all the costs incurred by the relevant individual parties in producing a commodity (Schmiedel, Kostova, & Ruttenberg, 2012).

### 4.8 Accounting Cost

Accounting cost refers to the documented expenses of an activity. These costs are recorded in a business's ledgers, thereby appearing in the entity's financial statements (AccountingTools & BOOKS, 2023).

### 4.9 Social Cost

Social costs are those costs that are not apparent to the contractual parties but are obvious to the community near a construction project (FERGUSON, MAy 2012).

### 4.10 Correlation

Correlation is a statistical measure that indicates the extent to which two or more variables fluctuate in relation. The relationship between infrastructure sectors Power Division, Water Division, Railway, and Communication and economic growth rate using data from the State

Bank of Pakistan (SBP) for growth rate and the Public Sector Development Program (PSDP) for infrastructure sector performance.

### 4.11 PSDP

The Public Sector Development Programme (PSDP) is a key component of public sector investment, directing both domestic and foreign resources towards the execution of development plans formulated by federal, provincial, and local agencies. PSDP projects are managed by the sponsoring ministries and carried out by various departments and institutions, with the Planning Commission overseeing, coordinating, monitoring, and evaluating the projects (Wing, n.d.). For the PSDP analysis, the data of NHA budget allocation in PSDP, infrastructure allocation in PSDP which includes power, water, railway and communication sector was taken from the budget document of Finance Division from the year 2010 to 2024.

### 4.12 Gross Domestic Product

GDP data is taken from World Development Indicators (WDI) database for the years 2010 to 2023. This data helped to understand the economic impact in which the PSDP operates. By looking at GDP trends, the study assessed how PSDP projects affect national growth.

### 4.13 Locale

The focus of this thesis is the Kohat to Karak section of the N-55 Indus Highway project in Khyber Pakhtunkhwa, Pakistan. This part of the highway connects the districts of Kohat and Karak, both important for local trade and travel. As part of Pakistan's National Highway network, the N-55 is a key route for people and goods, linking cities and supporting economic activity in the region. Improving this stretch of the highway is essential to make travel faster, safer, and more accessible for the local communities. The challenging terrain, with hills and narrow valleys, requires careful planning and construction. Upgrading this section aims to reduce travel time and support local growth by improving access to markets, schools, and hospitals.

### 4.14 Variables

Salaries of NHA during PC-1 revision.

Consultant Key Personal Salaries in design review of PC-1 revision

Consultant Key Personal Salaries in construction supervision

Consultant Non-Key Personal Salaries in construction supervision

Office and accommodation rent Project Site

Office furnishing and equipping

Office running and maintenance

Office supporting staff

Employees transport maintenance

Machinery and Equipment

Commuter's Time Travel

Fuel Consumption

Engine Oil

Tires

### 4.15 Data Source and Variable Description

The salaries associated with NHA was estimated based on the assumption that out of an 8-hour workday, 4 hours were dedicated to revising the PC-1 document. This effort was calculated over a three-month period taken in PC-1 revision. Salaries for various BPS (Basic Pay Scale) levels were obtained from the Accountant General Pakistan Revenues (AGPR), providing an official salary basis for NHA officials involved in the project.

The variable shows the total salaries paid to six key consultant personnel involved in reviewing and revising the PC-1 project design. The design review process, which took one month, focused on updating the initial project design. Salary figures were sourced from the consultant agreement with the National Highway Authority (NHA), ensuring that contractual rates accurately reflect labor costs.

Consultant Key Personnel Salaries in Construction Supervision represents the total salaries for ten consultants responsible for overseeing the construction phase of the project. These consultants worked continuously throughout the project, with salary data drawn from the consultant agreement with the National Highway Authority (NHA) to ensure accuracy. The salary costs were calculated on monthly, and annual basis, and an additional four-year delay.

Consultant Non-Key Personnel Salaries in Construction Supervision represents the total salaries for 48 non-key personnel involved in supervising the construction phase of the project. Salary figures, sourced from the consultant agreement with the National Highway Authority

(NHA), were calculated on a monthly and annual basis, including adjustments for the additional costs incurred due to project delays. This variable helps capture the extended labor costs associated with non-key personnel throughout the duration of the construction supervision, including the delayed period.

The Office and Accommodation Rent for the Project Site refers to the expenses associated with renting office and accommodation required at the project location, as mentioned in the contractor's agreement with the National Highway Authority (NHA). According to the agreement, these costs are borne by the contractor, with rental rates determined based on local market rates provided by estate dealers in the area. The total cost calculation includes adjustments for the extended project timeline, accounting for expenses incurred due to delays.

The Office Furnishing and Equipping cost includes the contractor's obligation to furnish and equip the project office, assuming a team of 8 officials. Each official's workspace is set up with essential items, including a chair, table, personal computer, printer, and cupboard. Price estimates were obtained from online sources and local markets to ensure accurate cost projections.

The Office Running and Maintenance costs encompass utility bills and various miscellaneous expenses necessary for the day-to-day operation of the project office. According to the agreement, these costs are covered by the contractor and include items reported by office officials to ensure smooth office functionality.

The Office Supporting Staff costs include salaries for a team of 10 personnel, consisting of naib qasids, sweepers, guards, and helpers, as specified in the contractor agreement with the National Highway Authority (NHA). These salaries were calculated for the additional costs incurred during the delayed period, all of which are covered by the contractor.

The Employees Transport Maintenance expense includes monthly maintenance and servicing of vehicles used by project employees, as outlined in the contractor agreement with the National Highway Authority (NHA). Costs are calculated for each month and for the project delayed duration.

The Machinery and Equipment costs encompass 362 pieces of machinery and equipment utilized in the project. Machinery costs were obtained from contractor agreements, with rental rates referenced from the Composite Rate Schedule 2022 (CSR 2022). Rental calculations are

made on an hourly, daily, and monthly basis, with adjustments for additional expenses incurred due to project delays.

The Commuter's Time Travel cost was calculated based on survey data to assess the impact of construction on travel time. Initially, travel time was approximately 2 hours, which increased to 2 hours and 30 minutes during construction. For these calculations, it was assumed that government officials from BPS 1 to BPS 17 travel in a Hiace, with an average BPS level of 9. Salaries for BPS-9 officials were obtained from the AGPR and calculated per hour, factoring in the additional 30-minute delay. Each Hiace accommodates 18 commuters, and with an estimated 1,202 Hiace trips daily, the increased cost was scaled to reflect the extra travel time for all passengers. This additional cost was further multiplied by the delayed duration of the project to account for prolonged impacts on commuters.

The Fuel Consumption examines the increased fuel costs incurred by coaches traveling the N-55 route from Jail Chok to Kohat during the construction period, with data sourced from a field survey. The average petrol price, sourced online from 2020 to 2024, was Rs 239 per liter. Originally, the route covered 67 km, which was extended by 8 km due to construction diversions, totaling 75 km per trip. Each haice, fuel efficiency of 3 km per liter, showed increased fuel usage for the extended route. Costs were calculated for both pre- and during-construction distances to capture the additional expenses per one-way trip. Haices travel an average of 150 km daily, covering a round trip, so daily, monthly, and annual fuel cost differences were assessed to understand the cumulative financial impact of the construction.

These calculations were extended over the entire delay period (2021-2024), considering 1,202 coaches in operation, to reveal the total fuel cost overrun due to increased consumption and distance.

The data was collected through a survey focusing on engine oil consumption patterns for haices operating on the N-55 highway. The average engine oil consumption was found to be 5.5 liters per 3,000 km, with an average engine oil price of Rs. 1,700 per liter from market observations between 2017 and 2024. The average daily running distance of a coach before construction work began at 134 km for a single trip, which increased to 150 km after construction commenced, reflecting a difference of 8 km in daily running. The actual distance covered on the N-55 in the case study area from Jail Chok to Kohat is 67 km, which extended to 75 km during-construction due to diversions.

The data collected through a survey highlights various cost related to tire usage for haices operating on the N-55 highway. The average price of tires from 2020 to 2024 is Rs. 120,000 per set. The actual distance covered in the case study area from Jail Chok to Kohat is 67 km, which increased to 75 km after the start of construction work, resulting in an 8 km difference due to diversions. The average lifespan of the tires is estimated at 30,000 km, with daily running distances recorded at 134 km before construction and 150 km after. To assess the financial impact, the annual cost and the cost over the delayed time for 1,202 haices were calculated based on these distances and the tire lifespan, emphasizing the increased operational costs associated with the construction delays.

**Table 4. 1: Variable Description**

| Variable | Description | Unit |
|---|---|---|
| Salaries of NHA | Estimated salaries for NHA officials based on 4 hours of daily work dedicated to revising the PC-1 document over three months, using official BPS salary data from AGPR. | PKR/ Working hours |
| Salaries of consultants | Consultant per month salaries contractual agreements with NHA. | PKR/ Per month |
| Office and accommodation rent | Total monthly rent expenses for office and accommodation spaces, | PKR/ Per month |
| Office furnishing and equipping | Total expenses for furnishing and equipping office spaces | PKR/ Per month |
| Office running and maintenance | expenses for the operation and maintenance of office, utility bills and miscellaneous costs. | PKR/ Per month |
| Office supporting staff | Monthly salaries of supporting staff in an office. (Naib qasid, cook, helper, sweeper, Guard) | PKR/ Per month |
| Employees transport maintenance | Monthly maintenance costs for employee transportation services, (Fuel, insurance, repair) | PKR/ Per month |
| Machinery and Equipment | Machinery and Equipment costs include 362 pieces sourced from contractor agreements, with rental rates from the Composite Rate Schedule 2022 (CSR 2022), calculated hourly, daily, and monthly, and adjusted for delays. | PKR/ Per hour |
| **Social Cost** | | |

| | | |
|---|---|---|
| Commuter's Time Travel | This variable quantifies that extra time of commuting between the two districts. It reflects the opportunity cost of employee time allocated to specific trip. | PKR/ Per hour |
| Fuel Consumption | This variable measures the total amount of fuel consumed by vehicles or machinery due to divergence of the route, typically expressed in liters. | Ltr / Km |
| Engine Oil | This variable measures the cost of engine oil used for maintenance and operation of vehicles. | Ltr/km |
| Tires | This variable represents the total expenses related to the purchase, maintenance, and replacement of tires for vehicles | Life of Tires/ km |

### 4.16 Conclusion

This study applied a mixed methods approach to comprehensively analyze the costs associated with the N-55 Indus Highway project, focusing on private, accounting, and social costs of NHA, contractor and consultant. Quantitative data from official documents and qualitative data from commuter surveys provided a thorough understanding of the project's financial and social impacts. The robust data collection and random sampling of 40 Hiace transporters ensured diverse and representative understandings. Additionally, the PSDP analysis emphasizes the broader economic consequences, stressing the necessity for timely and efficient project execution to avoid substantial financial and social impacts for all stakeholders involved. Overall, the study underscores the critical need for timely and coordinated project implementation to mitigate these costs. The study was based on the data available from the NHA and Planning Commission, as well as the limited data from the PC-1 revision. Due to data limitations, a broader comparative study of other projects could not be conducted.

# CHAPTER 5
# DISSCUSIONS AND RESULTS

## 5.1 Introduction

This chapter provides a detailed breakdown of project records and reports related to the N-55 Indus Highway construction project, enhanced by insights from interviews with key stakeholders. It offers a comprehensive understanding of the project's progress, challenges, and impacts, including the outcomes of PSDP analysis in terms of costs as a percentage of NHA allocation in PSDP, infrastructure projects allocation in PSDP, and overall PSDP in GDP. The analysis covers the correlation between infrastructure and GDP and various costs associated with the project. It details the private costs incurred by the National Highway Authority (NHA), consultants, and contractors, alongside the accounting costs, presenting a thorough financial overview. Additionally, the chapter explores the social costs borne by commuters, such as time costs and vehicle operating costs, to provide a holistic understanding of the project's impact on all stakeholders.

## 5.2 Project Records

Planning Commission 1 (PC-1) of the project was approved under Public Sector Development Programme 2017-2018 (PSDP 2017-2018) by Executive Committee of National Economic Council (ECNEC) at the estimated cost of 30,130 million rupees. The Authorization of dualization of Indus Highway N-55 (Sarai Gambila to Kohat) section was issued by Planning Commission dated 21-04-2017 whereas, the Administrative Approval was issued by Ministry of Communication (MOC) for the project on 03-05-2017. Thus, Indus Highway N-55 Sarai Gambila to Kohat project is under execution in two packages since 2017.

**Package 1 Sarai Gambila to Karak**

**Package 2 Karak to Kohat**

Out of 30,130 million rupees, 14,268 million rupees were allocated to package 2, the case study in hand. The total length of the project is 128 km in which package 2 is of 68 km. In the initial phase, the National Highway Authority (NHA) invited bids for the construction of the road, opening the biding process on 28-11-2017. Following a rigorous evaluation, NHA selected M/s Anhui Engineering Group (ACEG) and Matracon Joint Venture (JV) construction companies on 09-04-2018. The contract was awarded at the evaluated price of rupees 11,945.666748

million. At the same time NHA initiated the consultancy procurement process, with the technical bid opening on 23-01-2018 and financial bid on 10-05-2018 as these steps are considered crucial for ensuring a comprehensive assessment of consultancy proposals. Subsequently, on 16-01-2019, NHA formally signed the consultancy contract with M/s Zeeruk International in Joint Venture with M/s Kasib Associates. The consultancy contract was awarded at the cost of rupees 99.196893 million. Commencement date for the project execution was set as 26-05-2018. With a stipulated timeframe of 730 days, Matracon embarked on the construction endeavor with diligence and dedication. The completion date was targeted for 25-05-2020, marking a significant milestone for the project's timelines (EOT).

After the project's commencement, the Contractors faced unexpected challenges, prompting them to formally request an extension of time (EOT). Recognizing the contractor's difficulties, the National Highway Authority (NHA) granted an extension from May 2019 to December 2022, accommodating the inclusion of the new Speena Mor project. This adjustment necessitated a revision of the Planning Commission (PC 1) in September 2021 to incorporate design modifications and accommodate the expanded project scope. Despite the extension, delays are still there, causing the project's completion to surpass the revised timeline.

Cost wise summary of original PC-1 is given as under

**Table 5. 1: Cost wise Summary of PC-1**

| Bill Section | Description | Bill of Quantity | Spina Mor Cost | Total Revised Cost |
|---|---|---|---|---|
| 1 | Earth Work | 1,990,876,453 | 2,132,816,845 | 4,123,693,298 |
| 2 | Sub Base and Base | 2,559,706,337 | 758,806,516 | 3,318,572,853 |
| 3 | Surface Course and Pavement | 1,153,203,322 | 218,273,636 | 1,371,476,958 |
| 4 | Structure (Box and Culverts) | 435,108,019 | 494,497,826 | 929,605,845 |
| 5 | Structure (Box Bridges) | 1,570,246,029 | 186,734,323 | 1,756,980,352 |
| 6 | Structure (Soil Investigation for Bridges) | 14,512,875 | 1,566,500 | 16,079,375 |
| 7 | Structure (Retaining Wall, Breast Wall, and Toe Wall | 1,244,089,832 | 1,387,640,492 | 2,631,730,324 |
| 8 | Drainage, erosion and protection Works | 439,452,373 | - | 439,452.373 |
| 9 | Ancillary Works | 678,360,569 | 179,371,960 | 857,732,529 |
| 10 | Ancillary Works (toll Plaza) | 30,000,000 | - | 30,000,000 |

| | | | | |
|---|---|---|---|---|
| 11 | General Items | 99,324,200 | - | 99,324,200 |
| | Total | 10,214,880,009 | 5,359,708,098 | 15,574,648,107 |

Source: Revised PC-1 Document of N-55 Project

### 5.3 Project Reports

The project reports show a series of challenges, leading the Contractors to request for an extension of time, including delays incurred due to various factors. The consultant's recommendation on these incurred delays addressed issues such as the integration of the Spina Mor project, disruptions caused by the COVID-19 pandemic, complications with the forest department, and impediments related to the removal of infrastructure like railway bridges and electricity lines. Inclement weather further intensified the project's timeline. To address these setbacks effectively, the consultant proposed an extension of 18 months, suggesting a revised completion date of May 20, 2023, to adequately execute both new and leftover work while navigating these complexities.

### 5.4 Interviews with Stakeholders

#### 5.4.1 Interview with NHA Head office Officials

Interaction with NHA officials at multiple levels, including the NHA headquarters in Islamabad, provided valuable insights into critical aspects of NHA's operations, especially in the project understudy. At the headquarters, the officials explained NHA procedures, from the NHA Act 1991 to the finalization of the NHA Code 2005. The officials highlighted that the establishment of NHA aimed to plan, promote, organize, and implement programs for the construction, development, operation, repair, and maintenance of National Highways and strategic roads. Moreover, the formulation of the NHA Code 2005 aimed to provide practical guidelines for NHA's functioning, systematically defining roles, duties, and powers. Additionally, the officials clarified NHA's functioning including Power & Duties of the Authority, Planning Process, Tendering Process, Land Acquisition, Right of Way, Major Departments of NHA etc.

Moreover, the officials explained the roles and functions of the National Highway Council (NHC) and the National Highway Executive Board (NHEB). The NHC, previously headed by the Prime Minister of Pakistan, was reconstituted after amendments to the NHA 1991 Act and is now headed by Federal Minister for Communication. The responsibilities of NHC include approving the five-year plan recommended by the NHEB, setting up the national policies and

guidelines for the authority, reviewing and appraising projects, and approving annual budgets. The revised structure of NHC is given below,

**Table 5. 2: National Highway Council Members**

| | |
|---|---|
| Minister of Communication | President |
| Secretary Finance Division | Member |
| Secretary Planning and Development Division | Member |
| Secretary Communication | Member |
| A Professional in the field of Highway Construction and Management (nominated by President) | Member |
| A Professional in the field of finance and Accounts (nominated by President) | Member |
| Chairman NHA | Member/Secretary |

Source: National Highway Authority Code 1999

On the other hand, the NHEB is tasked with considering progress reports of the authority, performing other functions delegated by the NHC, recommending the annual budget for approval, and approving projects funded through tolls and other receipts from highway operations. Composition of NHEB is given below:

**Table 5. 3: National Highway Executive Board Members**

| | |
|---|---|
| Chairman NHA | Chairman |
| IG&MP | Member |
| Additional Secretary Finance | Member |
| Member of Additional Secretary Planning and Development Division | Member |
| Joint Secretary 2, MOC | Member |
| Senior Chief/Chief NTRC | Member |
| President/VP NESPAK | Member |
| Member Finance NHA | Member |
| Member Planning NHA | Member |

Source: National Highway Authority Code 1999

Furthermore, the official elaborated responsibilities of the Technical Working Party (TWP). Before administrative approvals of PC-1 or project documents, as well as proposals for the acceptance of all the proposed projects on priority basis after due evaluation. The TWP plays a key role in ensuring the technical feasibility and viability of projects before they proceed to administrative approval stages.

**Table 5. 4: Technical Working Party**

| | |
|---|---|
| Chairman NHA | Chairman |
| Member Finance NHA | Member |
| Member Planning NHA | Member |
| Member Operations/Construction NHA | Member |
| Chief (T&C) Ministry of Planning | Member |
| Director (R&RT) Ministry of Communication | Member |
| Representative of NTRC | Member |
| GM Design NHA | Member |
| GM Planning NHA | Member/Secretary |

Source: National Highway Authority Code 1999

### 5.4.2 Interview with Project Office Official

During interviews with NHA officials at Kohat and Burhan, the focus was on the N-55 Kohat to Karak project. The officials explained the project's budget allocations and factors contributing to delays. Discussions highlighted several challenges, including poor coordination with other government departments like the forest department for tree cutting and insufficient release of funds by the government. Official at Burhan explained on specific delay factors such as

- Delay addition of the new Spina Mor project
- Delays in payment of mobilization advance
- Delays in relocation of utility lines
- Delays in tree cutting by the KP Forest Department
- Delays in the issuance of construction drawings
- Delays in site possession
- Delay in employer's failure to appoint "The Engineer's Representative
- Inclement weather
- Global Pandemic COVID-19

and price escalation. Furthermore, an official explained that the allocation of funds was often insufficient and not timely, worsening these delays and hindering project progress.

### 5.4.3 Interview with Planning Commission Transport and Communication Official

During an interview with an official from the Transport and Communication (T&C) section of Planning Commission, it was revealed that the National Highway Authority (NHA) rarely submits PC-5 documents, having done so for only four or five projects. The PC-5 document,

essential for evaluating project completion and assessing outcomes against initial objectives, is often overlooked, which hampers thorough post-project analysis and continuous improvement. The official did provide data on five specific projects where the PC-1 documents had been revised. These revisions reflect adjustments in scope, budget, and timelines, highlighting the evolving nature of these projects and the necessity for ongoing modifications throughout their implementation. This information is crucial for understanding the practical challenges and adaptive strategies in managing large-scale infrastructure projects under the NHA's purview.

**Table 5. 5: Revised PC-1 Projects**

| Sr No | Name of Project | Original PC-1 | | Revised PC-1 | |
|---|---|---|---|---|---|
| | | Approval Year | Project Budget in Million Rs | Approval Year | Project Budget in Million Rs |
| 1 | Makran Coastal Road Project (Which was revised to Makran Coastal Highway Project | 2013 | 17,363.327 | 2022 | 21,400 |
| 2 | Construction of Bridge Across River Chenab Linking Shorkot And Garh Maharaja | 2009 | 1779.181 | 2015 | 4,048.264 |
| 3 | Karachi-Multan-Lahore Motorway Project – Construction of Sukkur – Multan Section (387 Km) | 2014 | 276,347.09 | 2016 | 314,977.28 |
| 4 | China-Pak Economic Corridor Islamabad-Raikot Section (Phase-I) Havelian-Thakot | 2014 | 86,880.08 | 2015 | 141,880.82 |
| 5 | Construction of Black Top Road Between Sangan and Aab-e-Gum (length 42.00 km) | 2014 | 1426.80 | 2017 | 2195.9 |

Source: Planning Commission T&C Section

### 5.4.4 Interview with District Police Officer (DPO) and Emergency Officer (EO) of Kohat and Karak

Interviews conducted at the District Police Officer (DPO) offices and Emergency Officer at Rescue 11 22 Kohat and Karak. They explained the concerning frequency of accidents on N-55 Kohat to Karak highway. The officials concluded that poor safety measures, road diversions and delay in project completion are the main factors contributing to these incidents. Data regarding road accidents from 2020 to 2023 brought forth the urgency of addressing safety

concerns and expediting ongoing projects to mitigate risks on this critical roadway. The data (outlined in the table at Annexure) provides quantitative evidence of the persistent challenges faced on this vital transportation route. In the year 2020, there were thirty-five cases of road accidents on N 55 Karak to Kohat highway which caused forty-five deaths and one hundred and eighteen injuries. In the year 2021, the number of road accidents rose to 0ifty-two with seventy five deaths and one hundred and eighty injuries. The figures of road accidents further raised to fifty-four in the year 2022 but a decrease was observed in the number of deaths and injuries as deaths were recorded fifty-eight and number of injuries decreased to one hundred only. For the year 2023 an increase was recorded in road accidents with sixty cases and the number of deaths and injuries remained fifty-four and one hundred and twenty respectively.

**Table 5. 6: Accidents Data from 2020-2023**

| Year | Accidents | Fatalities | Injuries |
|---|---|---|---|
| 2020 | 35 | 45 | 118 |
| 2021 | 52 | 75 | 180 |
| 2022 | 54 | 58 | 100 |
| 2023 | 60 | 54 | 120 |

Source: DPO, Rescue Offices Kohat and Karak

### 5.4.5 Road Users Survey

The objective of the surveys carried out for this study was to examine the influence of social costs on the road users. Unbiased responses were sought through surveys conducted at various locations along the study section, including Kohat Bypass, Kharapa Toll Plaza, and Karak Jail Chowk. Questions, both open and closed-ended, were asked regarding pre and post-construction travel time, fuel consumption, vehicle maintenance, and accident repair costs.

## 5.5 Results and Findings

### 5.5.1 Correlation

The relationship between infrastructure sectors Power Division, Water Division, Railway, and Communication and economic growth rate using data from the State Bank of Pakistan (SBP) for growth rate and the Public Sector Development Program (PSDP) for infrastructure sector performance.

| | Growth Rate | Power | Water | Railway | Communication |
|---|---|---|---|---|---|
| **Growth Rate** | 1 | | | | |
| **Power** | 0.320452424 | 1 | | | |
| **Water** | -0.393796713 | -0.565901 | 1 | | |
| **Railway** | 0.120580885 | 0.5340653 | -0.2541047 | 1 | |
| **Communication** | 0.232819325 | 0.0105513 | -0.6964187 | -0.12496 | 1 |

*Source: Author's own calculation.*

The correlation analysis shows diverse relationships between economic sectors, Power Division, Water Division, Railway, and Communication and the growth rate. The strongest positive correlation 0.32 observed in the power sector underscores its essential role in fostering economic growth. Similarly, the Communication Sector shows a notable positive correlation 0.23, suggesting its substantial impact on growth dynamics. In contrast, the Railway sector displays a moderate positive correlation 0.12, suggesting its intermediate influence on economic growth. On the other hand, the Water Division demonstrates a negitive correlation -0.3, indicating no contribution to the overall growth path. These findings highlight the differential impacts of various sectors on economic growth, with railways and power sectors emerging as significant drivers, while communication plays a moderating role, and the water sector appears inconsequential in comparison.

### 5.5.2 Revised PC-1

PC-I stands for Planning Commission Form -I, which is a project document describing project need, its description, justification, location, duration, cost estimates and the tangible/non-tangible benefits associated with it (Ministry of Planning). The PC-1, or Planning Commission-1, is a key document for Pakistan's National Highway Authority (NHA). It's like a detailed plan for highway projects, showing what needs to be done, how much it'll cost, and why it's important. The NHA's Planning Wing creates this plan, making sure it follows rules and fits with the country's goals. The PC-1 is like a roadmap for decision-makers, helping them understand everything about the project, from engineering details to how it might affect people and the environment. So, it's a vital tool that guides the NHA in building and improving Pakistan's highways (NHA Code).

### 5.5.3 Process of Revised PC-1

During the N-55 Indus Highway project, design changes were done in the original plan because of which the PC-1 was revised. The Project Director started this process. It took three months

for different NHA officials to carefully check and agree on the changes. Finally, the new plan got approved by the NHEB. After all this, the Project Director got the revised plan (details are given in annexure A).

### 5.6 Private Cost

#### 5.6.1 Cost of NHA Officials Salaries in Revising PC-1

In the process of revising PC 1, a total of 28 National Highway Authority (NHA) officials participated, indicating a substantial level of involvement from the organization. The revision process itself spanned a duration of 3 months, underscoring the significant time and effort dedicated to refining the project plan. An interesting aspect appeared regarding the salaries of officials, revealing that the revision work accounted for approximately four out of eight working hours, totaling rupees 89,930. This suggests a considerable allocation of financial resources toward the revision work. Moreover, the process was initiated by the project director on September 7, 2021, and subsequently approved by the National Highway Executive Board (NHEB) on November 4, 2021. It concluded with the final version of the revised PC 1 being received by the project director on December 7, 2021, signifying the completion of the revision process. The results show that a lot of work, time, and money went into revising PC 1 at the National Highway Authority.

#### 5.6.2 Cost of Printing, Electricity and Stationery on Revision of PC-1

The revision of the PC 1 document involved making five photocopies, which cost two thousand, one hundred and twenty-five rupees. Additionally, each individual involved in the revision process was provided with two pens, one pencil, and a highlighter, incurring a cost of two thousand, five hundred and twenty rupees. Moreover, electricity consumption related to photocopying the revised PC 1 document amounted to five hundred rupees. These expenses highlighted the logistical and material resources necessary for the revision process, encompassing document duplication, stationery provisions, and utility usage (Details are given as Annexure A).

#### 5.6.3 Cost of Salaries of Technical Working Party Meeting Participants

The Technical Working Party (TWP) plays a fundamental role in the approval process for project documents and proposals, including PC-I and PC-II forms, and the Acceptance of Necessity. Chaired by the Chairman of the National Highway Authority (NHA), the TWP comprises key members including the Member Finance and Member Operation/Construction of NHA, as well as officials from the Ministry of Planning and Ministry of Communication.

Additionally, representatives from the National Transport Research Center (NTRC) and General Managers from various NHA departments are integral members. During TWP meetings, thorough evaluations are conducted to assess the feasibility and merits of proposed projects. Notably, the cost incurred for TWP meetings amounts to rupees ten thousand, eight hundred and twenty per day, calculated on the basic pay scale salaries of the participating members. This finding shows how much money is used for TWP meetings to make decisions (Details are given as Annexure A).

### 5.6.4 Cost of Stationery and Refreshment of Technical Working Party Meeting

The total cost of stationery for Technical Working Party (TWP) meetings amounted to four thousand, four hundred and thirty-three rupees, covering essential items such as folders for meeting members, copies of meeting agenda documents, blank paper, pens, and pencils. Additionally, the cost of refreshments during TWP-1 tea breaks totaled ten thousand, four hundred and thirty rupees, comprising expenses for mineral water (500ml), tissue boxes, cups of tea, samosas, biscuits, and pakoras. These findings show how money was spent on stationery and refreshments for TWP meetings, emphasizing the importance of catering to participants to ensure productive discussions (Details are given as Annexure A).

### 5.6.5 Cost of Salaries of National Highway Executive Board Meeting Participants

The cost of organizing National Highway Executive Board (NHEB) meetings, totaling rupees eleven thousand, six hundred and sixteen, was calculated on the basic pay scale salaries of the attending members. Chaired by the Chairman of the National Highway Authority (NHA), the NHEB comprised key officials including the Inspector General of National Highways & Motorways Police (NH & MP), Additional Secretary (Finance), Member or Additional Secretary (Planning & Development Division), Joint Secretaries from the Ministry of Communication (MOC), Senior Chief or Chief from the National Transport Research Center (NTRC), and representatives from organizations like NESPAK (Details are given as Annexure A).

### 5.6.6 Cost of Stationery and Refreshment National Highway Executive Board of Meeting

The cost of stationery for NHEB meetings amounted to four thousand, four hundred and thirty-three rupees, covering essentials like folders, copies of working paper documents, blank paper, pens, and pencils. Additionally, the cost of refreshments during NHEB meetings totaled twenty-one thousand, eight hundred and eighty-five rupees, including expenses for mineral water

(500ml), tissue boxes, nestle juice, sandwiches, kababs, cups of tea and green tea, coffee, samosas, biscuits, and pakoras (Details are given as Annexure A).

### 5.6.7 Total Private Cost of NHA in PC-1 Revision

The officials involved in the process of revising PC-1 expended eighty-nine thousand, nine hundred and thirty rupees, while stationery costs amounted to five thousand, one hundred and forty-five rupees. Additionally, the TWP-1 meeting involved expenditures of ten thousand, four hundred and forty rupees for member salaries, four thousand, four hundred and thirty thirty rupees for stationery, and ten thousand, four hundred and forty rupees for tea breaks. Similarly, the NHEB meeting incurred costs of eleven thousand, six hundred and sixteen rupees for member salaries, four thousand, four hundred and thirty-three rupees for stationery, and twenty-one thousand, eight hundred and eighty-five rupees for tea breaks. Altogether, the total cost of the revised PC-1 processes, including all associated meetings, sums up to one lac, fifty-eight thousand, seven hundred and two rupees (Details are given as Annexure A).

**Table 5. 7: Cost of NHA**

| Cost of NHA in PC-1 Revision | Rupees |
|---|---|
| Average Cost of Salaries | 89,930 |
| Cost of Printing, Electricity and Stationery on Revision of PC-1 | 5,145 |
| Cost of Salaries of Technical Working Party Meeting Participants | 10,820 |
| Cost of Stationery and Refreshment of Technical Working Party Meeting | 14,873 |
| Cost of Salaries of National Highway Executive Board Meeting Participants | 11,616 |
| Cost of Stationery and Refreshment National Highway Executive Board of Meeting | 26,315 |
| **Total Cost of PC-1 Revision** | **158,702** |

*Source: Author's own calculation*.

## 5.7 Private Cost of Consultant

### 5.7.1 Cost of Consultant Key Personnel (Design Review) Revised PC-1 Salaries

The private cost incurred for Consultant Key Personnel (Design Review) salaries in the Revised PC-1 amounted to rupees 239,172. This expense was accrued over a period of 31 days, during which six consultant officials were involved in the design review. These key personnel played an important role in conducting design reviews, ensuring the accuracy and effectiveness of the design in revised PC-1. (details are given as Annexure B)

### 5.7.2 Cost of Consultant Salaries in Delayed Time Key Personnel (Construction Supervision)

The accounting cost associated with Consultant Salaries in Delayed Time for Key Personnel (Construction Supervision) amounted to rupees 56,980,000. This significant expenditure encompassed the salaries of 10 key personnel employed by the consultant during the delayed period. These personnel played pivotal roles in overseeing and supervising the construction activities, ensuring adherence to quality standards and project timelines. (details are given as Annexure B).

### 5.7.3 Cost of Consultant Salaries in Delayed Time Non-Key Personnel (Construction Supervision)

The accounting cost associated with Consultant Salaries in Delayed Time for Non-Key Personnel (Construction Supervision) totaled rupees 105.83 million. This expenditure covered the salaries of 48 non-key personnel employed by the consultant during the delayed period. While not occupying key roles, these personnel contributed significantly to the construction supervision process, supporting key personnel and ensuring smooth project operations. Their collective efforts were essential in maintaining workflow efficiency and addressing project requirements (Details are given as Annexure B).

**Table 5. 8: Cost of Consultant**

| Cost of Consultant Over Delayed Time | Million |
|---|---|
| Cost of Consultant Key Personnel's Salaries (Design Review) while Revising PC-1 | 0.239 |
| Cost of Consultant Key Personnel's Salaries (Construction Supervision) during Delayed Time | 56.98 |
| Cost of Consultant Non-Key Personnel Salaries (Construction Supervision) during Delayed Time | 105.83 |

*Source: Author's own calculation*

## 5.8 Private Cost of the Contractor

### 5.8.1 Office and Accommodation Rent

The monthly cost of office rent amounted to eighty thousand rupees and cost of accommodation rent amounted to forty thousand rupees. Thus, the annual office rent comes to nine lac and sixty thousand rupees, and the annual rent of accommodation comes to four lac and eighty thousand rupees. However, during the delayed period of 4 years, the combined cost of running the office and accommodation surged to fifty-seven lac and sixty thousand rupees. This finding highlights

significant financial burden borne by the contractor due to the prolonged delay (Details are given as Annexure C).

### 5.8.2 Office Furnishing and Equipping

The contractor bears the cost of furnishing and equipping the project office, including chair, table, cupboard, PC, photocopier, printer, sofa set, and dispenser. The project office comprises of eight rooms and almost each room is equipped with the mentioned items. Per room cost of chairs comes to rupees forty thousand, table rupees twenty-five thousand, cupboard rupees fifty thousand, PC rupees one hundred thousand, photocopier – rupees five hundred thousand, printer rupees one lac and fifty thousand, sofa set rupees forty-five thousand, and dispenser rupees seventy-five thousand. The combined cost of office furnishing and equipping amounts to thirty-eight lac and eighty thousand rupees (Details are given as Annexure C).

### 5.8.3 Office Running and Maintenance

The office running and maintenance expenses comprise utility bills and miscellaneous costs. On a monthly basis, utility bills amount to eighty thousand rupees, covering electricity, water, and other essential services. Similarly, miscellaneous expenses, such as office supplies and repairs, come to eighty thousand rupees per month. However, due to the ongoing delay and estimated completion of the project by December 2026, the contractor is compelled to spend an extra amount of Seventy-six lacs and eighty thousand rupees under this head (Details are given as Annexure C).

### 5.8.4 Office Supporting Staff

The office has a supporting staff consisting of two Naib Qasids, three cooks/helper, two sweepers, and two guards, each receiving a monthly salary of forty thousand rupees. These staff members are crucial for maintaining the office functioning. The estimated delay of 4.8 years in the project completion will compel the contractor to spend an extra amount of one thousand and ninety-two hundred thousand on the salaries of office supporting staff (Details are given as Annexure C).

### 5.8.5 The Engineer's/Employer's Transport Maintenance

The maintenance of the Engineer's or Employer's transport costs one lac and eight thousand rupees on monthly basis. This expense covers the maintenance and repair of vehicles essential for project operations. For the estimated duration of delay period, the maintenance cost will significantly increase up to fifty-one lacs and eighty-four thousand (Details are given as Annexure C).

### 5.8.6 Cost of Machinery

Three hundred and sixty-two machines and equipment are being utilized in the project. All these machines and equipment are hired at particular hourly rates, covering both rental and fuel expenses. The combined rental cost of all three hundred and sixty-two machines and equipment for the estimated delay of forty months will be one thousand, nine hundred and fifty-six point six million rupees (Details are given as Annexure C).

**Table 5. 9: Cost of Contractor**

| Cost of Contractor Over Delayed Time | Rs in Million |
|---|---|
| Office and Accommodation Rent | 5.76 |
| Office Furnishing and Equipping | 3.88 |
| Office Running and Maintenance | 7.68 |
| Office Supporting Staff | 19.2 |
| The Engineer's/Employer's Transport Maintenance | 5.18 |
| Cost of Machinery | 1,956.6 |

*Source: Author's own calculation.*

## 5.9 Findings from Total Private Cost

The findings reveal considerable inefficiencies and financial impacts in the National Highway Authority's (NHA) handling of the PC-1 revision cost Rs.158,000. The revision process spanned three months and involved thirty officials, reflecting significant time and resource consumption. Consultant costs were notably high, with Rs. 239,172 allocated for design reviews and Rs. 56.98 million and Rs. 105.83 million for key and non-key personnel during delays, respectively, reducing the consultant's profit margins. Additionally, the contractor faced substantial fixed costs including Rs. 5.76 million for office and accommodation rent, Rs. 3.88 million for office furnishing and equipping, Rs. 7.68 million for running and maintenance, Rs. 19.2 million for supporting staff, Rs. 5.18 million for transport maintenance, and an astronomical Rs. 1,956.6 million for machinery. These unavoidable expenses, totaling Rs. 2,990 million, are likely to be passed on to the NHA. As a result, the NHA faces a significant increase in its financial burden, reflecting the broader impacts of delays and inefficiencies in project management.

## 5.10 Accounting Cost of Delay factors

### 5.10.1 Major Delay due to Spina Mor and other Minor Factors.

The allocated amount for the project was Rs. 14,268.3 million which was increased to Rs. 15,574.6 million in Revised PC1 for a delay and left-over work in completion of the project by

31 x months. As for now, the estimated completion date is December 2026 with 40 x months overall delay period which will cost rupees 2,612.6 million.

**Table 5. 10: Accounting Cost of Project**

| Accounting Cost of Project | RS in million |
|---|---|
| Cost of Delay due to Spina Mor | 1,306 |
| Estimated Completion Cost Date December 2026 | 2,612.6 |

*Source: Author's own calculation.*

## 5.11 Finding from Total Accounting Cost

The findings underscore the substantial financial burden on the National Highway Authority (NHA) due to inefficiencies in planning and project management. The total accounting cost amounts to Rs. 3,919 million, while the cost of delays attributed to Spina Mor and other minor factors is Rs. 2,612.6 million. This indicates a significant escalation in expenses, largely resulting from the extended timelines and complex approval processes associated with adding new projects to an existing one. The extensive delays are exacerbated by the need for additional approvals, such as those from the Planning Commission, which further complicate the project lifecycle. These figures highlight the critical need for improved planning and efficiency in the original PC-1 to mitigate excessive financial strain and avoid protracted delays.

## 5.12 Social Cost

This table compares the National Transport Research Centre (NTRC) calculations with the thesis-specific calculations for assessing social costs on the N-55 Indus Highway (Kohat to Karak segment), revealing notable differences due to unique scope and updated variables. While the NTRC provides general VOC estimates across major highways in Pakistan, the thesis targets the specific 67 km segment of the N-55, including an 8 km diversion due to construction. Unlike NTRC's 2019 fuel price of Rs 113 per liter, the thesis uses an average 2020–2024 fuel price of Rs 239, reflecting recent market conditions. Fuel consumption, instead of being based on speed as in NTRC's method, factors in the increased travel distance due to diversions. Engine oil and tire costs are also updated, with the thesis calculating engine oil at Rs 1,700 per liter (versus NTRC's Rs 565) and Rs 120,000 for a set of four tires (versus NTRC's Rs 54,000). Passenger time costs are revised as well, with the thesis assuming an average commuter salary of Rs 33,820 (BPS 9) rather than NTRC's Rs 20,000, based on likely commuter demographics on this segment. Finally, while NTRC does not account for construction delays, the thesis

captures the increased travel time from 2 to 2.5 hours due to construction, offering a localized and realistic assessment of VOC and social costs specific to the N-55 project.

**Table 5. 11: Comparison of NTRC VOC and Thesis Calculations**

| Aspect | NTRC Calculation | Thesis Calculation |
|---|---|---|
| **Distance** | Per/1000km | 67km |
| **Scope** | Major highways of Pakistan | N-55 Kohat to Karak segment |
| **Fuel Price (per liter)** | Rs 113 (July 2019) | Average Rs 239 (2020–2024) |
| **Fuel Consumption Basis** | Based on vehicle speed | Based on added distance from diversion (67 km + 8 km) |
| **Engine Oil Price (per liter)** | Rs 565 (2019) | Average Rs 1,700 (2020–2024) |
| **Tire Cost (4 tires)** | Rs 54,000 (13,500 per tire in 2019) | Average Rs 120,000 (2020–2024) |
| **Passenger Time Calculation** | 24 days/month, 8 hours/day, 10 passengers, Rs 20,000 salary | Assumed BPS 9 with Rs 33,820 salary, 10 passengers |
| **Travel Time Impact** | Not specific to the N-55 construction impact | 2 hours pre-construction; 2.5 hours during construction |

*Source: Author's own calculation.*

### 5.12.1 Time Cost

The study probes into the financial implications of travel time costs incurred by commuters during construction delays. Initially, the daily travel time cost for a commuter with a Bps 9 salary was determined to be Rs 47 per hour. Anticipating a 30-minute increase in travel time due to construction, the additional daily cost was calculated at Rs 23.5. Projecting this increase over a month produced a total of Rs 705, and over a year, Rs 8,460. Over a 4-year delay period, the collective cost overrun for one commuter amounted to Rs 33,840. Generalizing this to a Hiace accommodating 18 commuters, the total cost overrun reached Rs 609,120. As 1202 hiace affected by the delay, the travel time cost overrun rushed to a significant Rs 732.2 million. The study highlights the significant economic impact on commuters due to construction delays, highlighting the urgency of timely project completion to mitigate financial burdens (detail in annexure D).

### 5.12.2 Fuel Consumption

The analysis focuses on the financial implications of fuel consumption costs for hiace during the construction period. With an average fuel price of Rs 239 per liter over the span of 2021 to 2024, the distance covered along the N55 route increased from 67 km to 75 km due to diversions prompted by construction work, resulting in an 8 km difference. Before construction begun, the one-way fuel consumption of a hiace was 22.33 liters, costing Rs. 5337.66. Post-construction, the consumption increased to 25 liters, costing Rs. 5975, resulting in a difference of Rs. 637.34. With a daily running distance of 150 km per hiace, the daily fuel cost overrun amounted to Rs. 1274.68, accumulating to Rs. 38,240.4 monthly and Rs. 4,58,884.8 annually. Over the delay period from 2021 to 2024, the fuel cost overrun for a single hiace totaled Rs. 18,35,539.2, while for 1202 hiace, it surged to a significant Rs. 2,206.3 million (details are given annexure D).

### 5.12.3 Tires Cost

The study examines the financial implications of tire consumption costs for hiace during the construction phase. With an average tire price of Rs. 1,20,000 spanning 2017 to 2024, the N55 route distance increased by 8 km from 67 km to 75 km due to construction diversions. Before construction, hiace covered 134 km daily, increasing to 150 km post-construction. Tire lifespan decreased from 7.4 to 6.6 months after construction commenced, resulting in a daily cost rise from Rs. 536 to Rs. 600. This decoded to a monthly overrun of Rs. 1,920 and an annual overrun of Rs. 23,040 per hiace. Over the delay period (2021-2024), the total tire overrun for 1202 hiace amounted to Rs 110.78 million, underscoring the significant financial strain imposed by increased tire consumption during construction delays (details are given in annexure D).

### 5.12.4 Engine Oil Cost

The analysis investigates into the impact of engine oil consumption costs for hiace in the construction period. With an average consumption of 5.5 litres per 3000 km at a price of Rs. 1700 per litre spanning 2017 to 2024, the cost per km amounted to Rs. 3.1. Prior to construction, hiace covered 134 km daily, increasing to 150 km post-construction. The N55 route distance rose from 67 km to 75 km due to construction diversions, resulting in a daily cost increase from Rs. 417.63 to Rs. 468. This led to a daily cost difference of Rs. 50.37, translating to a monthly overrun of Rs. 1,511.1 and an annual overrun of Rs. 18,133.2 per hiace. Over the delay period from 2021 to 2024, the engine oil overrun for a single coach totaled Rs. 72,532.8, while for 1202 coaches, it reached a significant Rs. 87.18 million (details are given in annexure D).

**Table 5. 12: Social Cost**

| Social Cost Over Delayed Time | Rs In Million |
|---|---|
| Time Cost | 732.2 |
| Fuel Consumption | 2,206.3 |
| Tire | 110.78 |
| Engine Oil | 87.18 |

*Source: Author's own calculation.*

## 5.13 Finding from total Social Cost

The findings of the social cost highlight the significant financial burden caused by construction delays, primarily affecting travel time, fuel consumption, tire wear, and engine oil usage for commuters using Hiace vehicles along the N55 route. Commuters faced increased travel time, leading to higher costs, while the construction diversions caused fuel consumption to rise, further inflating operational costs for each vehicle. The extended delay also accelerated tire wear and increased engine oil consumption due to the longer distances covered daily. These factors, combined over the 4-year delay period, resulted in substantial financial strain on commuters and vehicle operators, with the total cost overrun for 1202 Hiace vehicles reaching a staggering 3,136.4 million rupees. This underscores the need for better planning and efficiency to minimize the economic impact on road users during prolonged construction periods.

## 5.14 Accident Cost

The cost of accidents was assessed by collecting data from road users through questionnaires. According to the responses received, the repair costs varied significantly depending on the type of vehicle involved. For bike accidents, repair expenses ranged from rupees 30,000 to 35,000, while car accidents incurred costs between rupees 300,000 and 350,000 for repairs. Similarly, accidents involving hiace vehicles resulted in repair costs ranging from 800,000 to 1,000,000 units, whereas truck accidents incurred expenses varying from rupees 1,000,000 to 1,500,000. These findings underscored the substantial financial burden borne by individuals and businesses due to road accidents, highlighting the importance of preventive measures and enhanced safety regulations on the roads.

## 5.15 Total Costs in Percentages

The private cost of a project, totaling 2,161.5 million rupees, represents approximately 13.87% of the total project cost, which amounts to 15,574.6 million rupees.

The accounting cost of a project, totaling 3,918.9 million rupees accounts for approximately 25.1% of the total project cost, which amounts to 15,574.6 million rupees.

The social cost of a project, totaling 3,136.4 million rupees, accounts for approximately 20.13% of the total project cost, which amounts to 15,574.6 million rupees.

**Table 5. 13: Costs in %age**

| | **Costs in millions** | **Project cost (millions)** | **% of project cost** |
|---|---|---|---|
| **Private cost** | 2,161.5 | 15,574.6 | 13.87% |
| **Accounting cost** | 3,918.9 | 15,574.6 | 25.1% |
| **Social cost** | 3,136.4 | 15,574.6 | 20.13% |

*Source: Author's own calculation.*

## 5.16 PSDP Analysis

The Public Sector Development Program (PSDP) is a critical component of Pakistan's plan to arouse the economic growth and development through large investments in various infrastructure and public service projects. This comprehensive analysis of PSDP projects focuses on understanding the financial and economic impacts of inaction and delays, particularly in sectors such as the National Highway Authority (NHA) projects, power sector, water sector, railway, and communication divisions. By analyzing these delays and inefficiencies, we aim to uncover their unfavorable effects on Pakistan's GDP and overall economic health. This examination will highlight how the cost of inaction not only escalates project expenses but also hinders economic progress, emphasizing the urgent need for timely and efficient project implementation.

### 5.16.1 Analysis of the Cost of Inaction on NHA Budget Allocation in PSDP

The analysis of the cost of inaction on the National Highway Authority (NHA) budget allocation in the Public Sector Development Programme (PSDP) shows insight into the economic consequences of project delays and inefficiencies. By calculating the cost of inaction as 59.1% of the allocated budget for each fiscal year, the analysis highlights the losses of a huge amount of budget. To mitigate these losses, timely completion of projects is essential to avoid unnecessary expenditure and maximize the benefits of allocated funds.

The table presents an analysis of the cost of inaction, calculated as 59.1% of the National Highway Authority (NHA) budget allocation in the Public Sector Development Programme (PSDP) over various fiscal years.

**Table 5. 14: Cost of Inaction of NHA in PSDP**

| Years | NHA Budget Allocation in PSDP (Rs in millions) | 59.1% cost of inaction (Rs in million) |
|---|---|---|
| **2010-2011** | 44,641 | 26,382 |
| **2011-2012** | 39,900 | 23,580 |
| **2012-2013** | 50,732 | 29,982 |
| **2013-2014** | 63,039 | 37,256 |
| **2014-2015** | 111,563 | 65,933 |
| **2015-2016** | 159,600 | 94,323 |
| **2016-2017** | 188,000 | 111,108 |
| **2017-2018** | 319,720 | 188,954 |
| **2018-2019** | 210,000 | 124,110 |
| **2019-2020** | 155,967 | 92,176 |
| **2020-2021** | 118,675 | 70,136 |
| **2021-2022** | 113,750 | 67,226 |
| **2022-2023** | 118,403 | 69,976 |
| **2023-2024** | 157,500 | 93,082 |

Source: Author's Own Calculations

The chart below illustrates the substantial financial losses due to inaction, calculated as 59.1% of the National Highway Authority (NHA) budget allocation in the Public Sector Development Programme (PSDP) across various fiscal years.

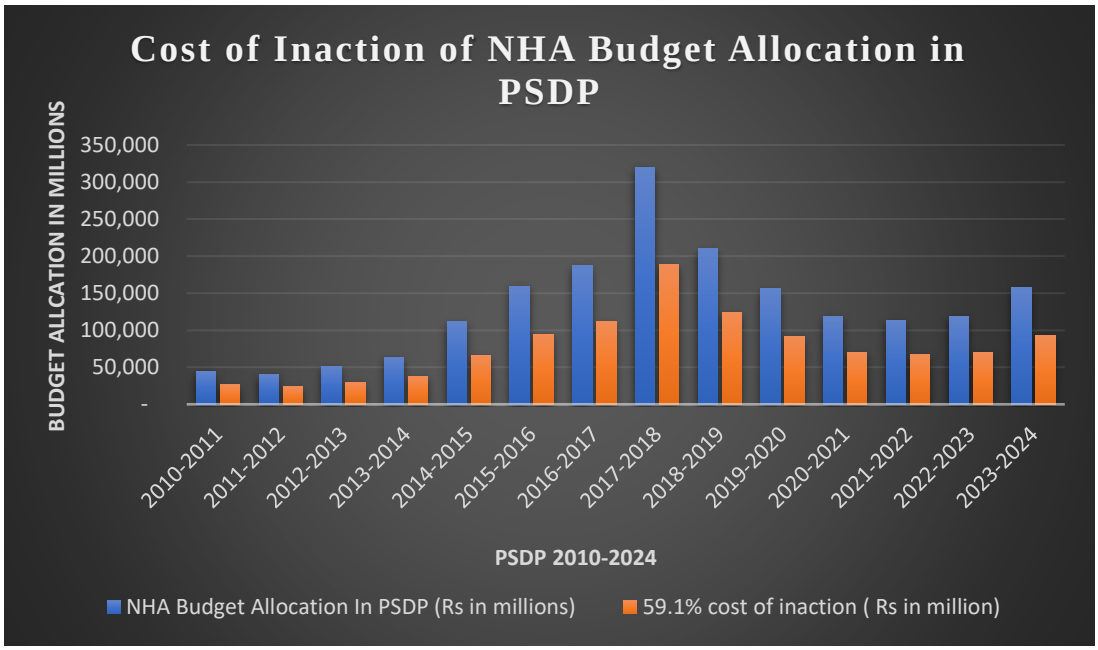



**Figure 5. 1: Cost of Inaction of NHA Budget Allocation in PSDP**

The figure shows the NHA budget allocation from 2010-2024 within PSDP. The blue bars represent the actual budget allocation within the PSDP, reflects the financial resources dedicated to the road infrastructure development over the specified period.

While orange bars represent the estimated cost of inaction, revealing the potential economic losses incurred due to insufficient investment in NHA projects. The gap signifies the opportunity cost associated with the underinvestment in infrastructure projects, serve as a clear reminder of the economic impact of neglecting infrastructure development, such as increased in social cost, decreased productivity and inhibited economic growth. The continuous deficit in funding had made worse delays in project completion, leading to a cycle of projects being carried forward to following PSDP. These delay not only hampers the timely delivery of crucial infrastructure but also escalates project costs due to inflationary pressures and rising prices of construction materials. The consequent increase in project costs further worsens the tension on already limited budget allocations.

### 5.16.2 Analysis of the Cost of Inaction on Infrastructure Budget Allocation in PSDP

The calculation of the effects of inaction on infrastructure budget allocation in the Public Sector Development Programme (PSDP) presents a crucial understanding of the economic impacts resulting from huge investment in infrastructure and very low outcome. The tables given below provide the actual allocation in PSDP of power, water, railway and communication division.

**Table 5. 15: Infrastructure Projects**

| Years | Power Division | Water Division | Railway Division | Communication Division |
|---|---|---|---|---|
| | Rs in Million | | | |
| **2010-2011** | 12,030 | 28,424 | 13,630 | 44,786 |
| **2011-2012** | 32,500 | 36,136 | 15,000 | 40,072 |
| **2012-2013** | 29,650 | 47,192 | 22,877 | 50,874 |
| **2013-2014** | 51,443 | 57,840 | 30,965 | 63,148 |
| **2014-2015** | 63,613 | 43,427 | 39,566 | 111,754 |
| **2015-2016** | 112,288 | 30,120 | 41,000 | 159,965 |
| **2016-2017** | 130,000 | 31,716 | 41,000 | 193,285 |
| **2017-2018** | 60,909 | 36,750 | 42,900 | 333,380 |
| **2018-2019** | 36,125 | 79,000 | 34,411 | 224,481 |
| **2019-2020** | 41,792 | 85,021 | 16,000 | 156,215 |
| **2020-2021** | 39,650 | 81,250 | 24,000 | 118,930 |
| **2021-2022** | 69,485 | 103,473 | 30,026 | 114,201 |
| **2022-2023** | 43,133 | 99,572 | 32,648 | 118,583 |
| **2023-2024** | 54,550 | 107,500 | 33,000 | 157,860 |

Source: PSDP Planning Commission

By applying 59.1 % cost of inaction to the actual allocation of PSDP infrastructure projects highlights the significant losses due to inaction which hampers the project completions. The table below show the cost of inaction in actual allocation of PSDP.

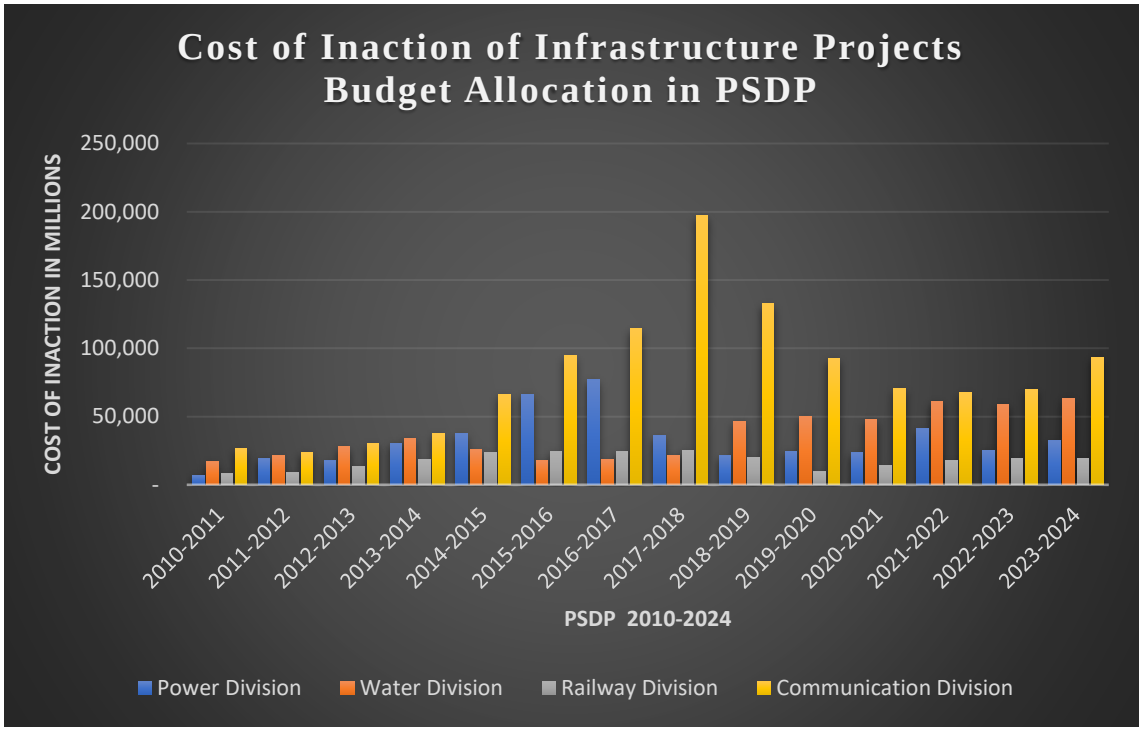



**Figure 5. 2: Cost of Inaction of Infrastructure Projects in PSDP**

The Chart titled " Cost of Inaction of Infrastructure Projects Budget Allocation in PSDP" effectively visualizes the allocation of infrastructure projects within the PSDP. The chart compares the allocation with the cost of inaction across various divisions like power, water, railway, and communication divisions.

The blue bar signifies the cost of inaction in the power sector, demonstrate a significant portion of potential losses. The grey bar indicates the cost of inaction in the railway sector, not as prominent as the power sector, the aforementioned still highlights the importance of addressing issues and investing in railway infrastructure. The orange bar represents the cost of inaction in the water sector, signaling another area requiring attention and investment to avoid negative impacts on water supply, sanitation, and related infrastructure. Remarkably, the yellow bar, representing the communication division, shows an all-time high cost of inaction. This underscores the urgency of addressing challenges within the communication sector to tackle its full potential and avoid significant losses or setbacks.

Comparison of the four divisions, the actual allocation of infrastructure projects within the PSDP, identifies area where priorities may need to be reviewed. For instance, if the

communication division has the highest cost of inaction but receives a lower allocation in the PSDP, it advocates a potential gap that needs to be addressed to improve resource allocation and mitigate cost of inaction. Overall, the chart provides valuable insights into the allocation of infrastructure projects and the potential costs of inaction across key sectors, highlighting areas of concern and opportunities for strategic investment and intervention within the PSDP.

### 5.16.3 Analysis of the Cost of Inaction in GDP

Analysis provides the economic impact of inaction on Pakistan's GDP. Through calculating the cost of inaction as 59.1% of the GDP for each fiscal year, the table highlights the substantial financial losses incurred due to inactions in each sector of country. This analysis underscores the significant economic burden on the country's overall economic performance, emphasizing the critical need for timely and efficient completion of development projects to mitigate these losses and optimize economic growth.

**Table 5. 16: Cost of inaction in GDP**

| Years | GDP of Pakistan in million | 59.1 Cost of Inaction in millions |
|---|---|---|
| **2010-2011** | 16507053 | 9755668 |
| **2011-2012** | 19731030 | 11661039 |
| **2012-2013** | 22344639 | 13205682 |
| **2013-2014** | 25042169 | 14799922 |
| **2014-2015** | 27952815 | 16520114 |
| **2015-2016** | 30425879 | 17981694 |
| **2016-2017** | 32725049 | 19340504 |
| **2017-2018** | 35552819 | 21011716 |
| **2018-2019** | 39189810 | 23161178 |
| **2019-2020** | 43798401 | 25884855 |
| **2020-2021** | 47540409 | 28096382 |
| **2021-2022** | 55836225 | 32999209 |
| **2022-2023** | 66623563 | 39374526 |
| **2023-2024** | 84658000 | 50032878 |

Source: Author’s Own Calculations

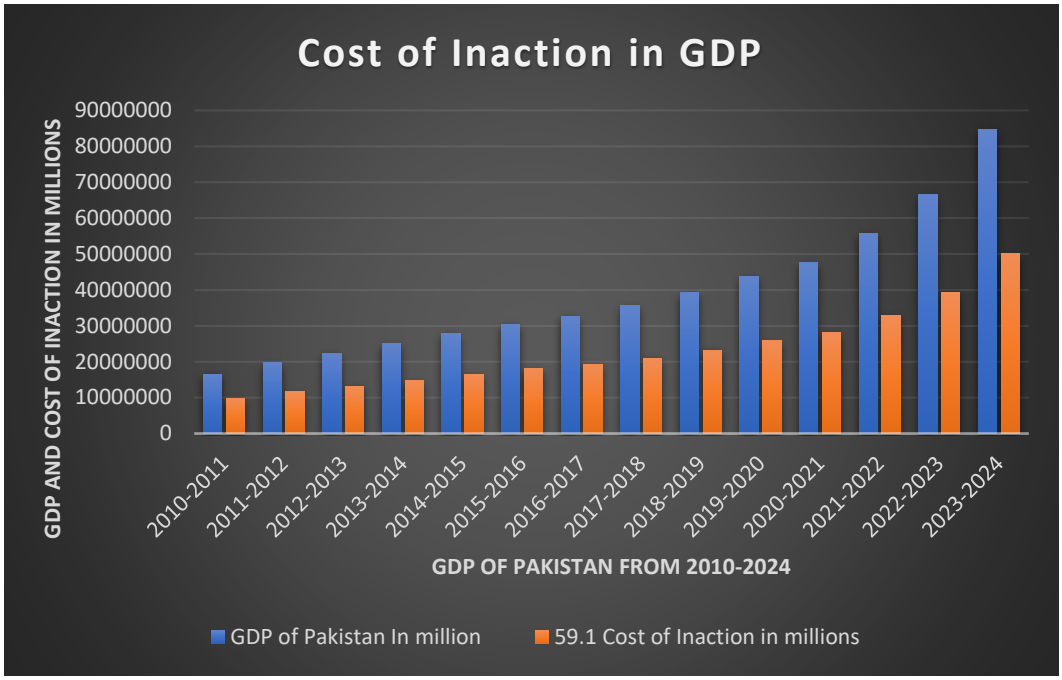



**Figure 5. 3: Cost of Inaction in GDP**

The figure shows "59.1% Cost of Inaction in GDP". The blue one tells us how much money the country made (its GDP) in different fiscal years staring from 2010-2024. The orange one shows the cost of not doing anything useful with some of that money. This means there's a part of the money that could have been used better but wasn't because of inaction or inefficiency. By comparing the two bars, it is easily understandable that how much money was wasted because of inaction. The cost of inaction based on this case study and generalizing it to the GDP from 2010-2024 for each fiscal year, valuable insights emerge regarding the extent of opportunities foregone and is essentially make proactive measures to optimize economic performance. Such analysis not only sheds light on the costs associated with inaction but also underscores the importance of decision-making and policy interventions aimed at maximizing economic productivity and resilience in the face of challenges. Thus, this bar chart serves as an upsetting reminder of the multifaceted impact of inaction on economic prosperity and underscores the urgency of positive measures to mitigate its adverse effects and unlock the full potential of the nation's economic resources.

## 5.17 Conclusion

Concluding the chapter, an in-depth investigation of the N-55 Indus Highway construction project, using project records, reports, and stakeholder interviews. It highlights key phases, approval processes, and budget allocations, revealing numerous challenges such as delays, payment issues, and external disruptions like the COVID-19 pandemic and adverse weather conditions. Insights from NHA officials and other stakeholders underscore coordination and funding issues. The absence of PC-5 documents from NHA hampers project evaluation, while urgent safety concerns due to delays are extracted by District Police and Emergency Officers, supported by accident data. Road user surveys emphasize social costs to commuters, highlighting the need for faster project completion. The financial analysis shows substantial private and accounting costs, with the NHA, consultant, and contractor incurring Rs 158,702, Rs 163.05 million, and Rs 1,998 million respectively, and an overall accounting cost of Rs 3,918 million. The significant social cost, amounting to Rs 3,119 million, includes time delays, vehicle operating costs, and accidents. Incorporating the PSDP analysis, the study reveals broader implications of inaction on infrastructure projects across various sectors. These delays not only escalate costs but also impact Pakistan's GDP and economic stability. The findings underscore the importance of efficient project management to reduce financial and social costs, ensuring successful infrastructure development and economic progress.

# CHAPTER 6
# CONCLUSION AND RECOMMENDATIONS

## 6.1 Conclusion

In conclusion, the analysis of the project, initiated in the 2017 PSDP with a scheduled start date of May 2018, highlights the severe consequences of delays and inefficiencies in its execution. Initially allocated a budget of 14,268 million rupees, the project faced budgetary revisions, ultimately escalating to 15,574 million rupees. A comprehensive assessment of private costs linked to the National Highway Authority (NHA), consultants, and contractors, alongside accounting and social costs like time, vehicle operations, and accident costs, reveals the extensive economic impact of these delays.

The results show that the NHA's handling of the PC-1 revision incurred a significant cost of Rs. 158,000, involving thirty officials over three months, reflecting substantial time and resource consumption. Consultant costs were also notable, with design reviews costing Rs. 239,172, and further expenses of Rs. 56.98 million and Rs. 105.83 million for key and non-key personnel during delays. The contractor, burdened by unavoidable fixed costs such as office rent, maintenance, and machinery, incurred a total of Rs. 2,990 million. These costs are likely to be passed on to the NHA, further increasing its financial liabilities. The total accounting cost reached Rs. 3,918 million, while delays due to factors like Spina Mor added another Rs. 2,612 million, underscoring the critical need for more effective project management.

Additionally, social costs significantly escalated due to construction delays, impacting commuters and vehicle operators along the N55 route. Increased travel time, fuel consumption, tire wear, and engine oil usage for Hiace vehicles resulted in a staggering cost overrun of 3,136.4 million rupees. These delays, affecting thousands of commuters, underscore the wider economic repercussions of inefficient planning and execution.

Overall, the total cost of inaction due to these inefficiencies is estimated at 59.1% of the revised PC-1 cost, illustrating a profound opportunity cost. Resources tied up in this project could have been redirected to vital sectors like health and education. The findings stress the importance of timely and efficient project management, not only to prevent economic losses but also to ensure optimal resource allocation for broader socioeconomic development. This study highlights the urgent need for proactive measures to streamline project execution and better utilize limited resources for the collective benefit of society.

### 6.2 Policy Recommendation

To mitigate the impact of inaction and improve project management efficiency, the following recommendations are proposed,

- Prioritize Action over Inaction:

Identify the delays which are most common in maintain project timelines. Clear milestones and effective monitoring mechanisms assist as precautions against unnecessary project distractions.

- Ensure Sufficient Funding for Ongoing Projects in PSDP:

Sufficient resource allocation for the ongoing projects are important to ensure continuation and timely completion of the projects. Timely disbursement of funds is crucial to prevent project delays resulting from budgetary constraints. Prioritizing funding allocation based on project urgency and importance enhances resource utilization and project efficiency.

- Improve Project Planning:

Project planning minimizes the need for frequent revisions and adjustments, enhancing project efficiency. Collaboration among stakeholders throughout the planning phase ensures alignment of project goals and objectives.

- Improve Data Transparency and Accessibility:

Available platforms for stakeholders to retrieve project data facilitate informed decision-making and effective oversight. NHA should ensure the accuracy of project data to strengthen the reliability in decision-making processes.

- Strengthen Interdepartmental Coordination:

Enhanced teamwork and communication between the NHA and relevant government departments to facilitate smooth project execution and construction. Prior to execution, coordinating with departments in the construction area minimizes conflicts or duplication of efforts. Clear communication channels and coordination procedures streamline the decision-making processes.

- Minimize Political Interference:

NHA should be independent from political interference. As an authority NHA should choose projects based on what's best for everyone, not just for political imposition. To make sure that the experts of roads infrastructure run the NHA, projects get done because they make sense, not just because politicians want them done.

# REFERENCES


Schwab, K. (2018, October). The global competitiveness report 2018. World Economic Forum.

Amoatey, C. T., & Ankrah, A. N. O. (2017). Exploring critical road project delay factors in Ghana. *Journal of Facilities Management*, *15*(2), 110-127.

Santoso, D. S., & Soeng, S. (2016). Analyzing delays of road construction projects in Cambodia: Causes and effects. *Journal of Management in Engineering*, *32*(6), 05016020.

Mejía, G., Sánchez, O., Castañeda, K., & Pellicer, E. (2020). Delay causes in road infrastructure projects in developing countries. *Revista de la Construcción*, *19*(2), 220-234.

Alhomidan, A. (2013). Factors affecting cost overrun in road construction projects in Saudi Arabia. *International Journal of Civil & Environmental Engineering*, *13*(3), 1-4.

Ekanem, S. F., Opawole, A., & Adewuyi, T. O. EFFECTS OF DELAY ON COST PERFORMANCE OF ROAD CONSTRUCTION PROJECT: CASE OF NIGER DELTA DEVELOPMENT COMMISSION PROJECTS IN NIGERIA. *Journal of Contemporary Research in the Built Environment*, 1.

Mulla, S. S., & Waghmare, A. P. (2015). Influencing factors caused for time & cost overruns in construction projects in Pune-India & their remedies. *Int. J. Innovative Sci. Eng. Technol*, *2*(10), 622-633.

Shahid, A., Ahmad, H., Ahmad, N., Shafique, M. N., & Amjad, N. (2015). Analysis of key performance factors affecting residential construction projects in Pakistan. *Arabian Journal of Business and Management Review (Nigerian Chapter)*, *3*(10), 9-14.



Ekanem, S. F., Opawole, A., & Adewuyi, T. O. EFFECTS OF DELAY ON COST PERFORMANCE OF ROAD CONSTRUCTION PROJECT: CASE OF NIGER DELTA DEVELOPMENT COMMISSION PROJECTS IN NIGERIA. *Journal of Contemporary Research in the Built Environment*, 1.



Aziz, R. F., & Abdel-Hakam, A. A. (2016). Exploring delay causes of road construction projects in Egypt. *Alexandria Engineering Journal*, *55*(2), 1515-1539.

Honrao, Y., & Desai, D. (2015). Study of delay in execution of infrastructure projects-highway construction. *International Journal of Scientific and Research Publications*, *5*(6), 1-8.

Amoatey, C. T., & Ankrah, A. N. O. (2017). Exploring critical road project delay factors in Ghana. *Journal of Facilities Management*, *15*(2), 110-127.

Elawi, G. S. A., Algahtany, M., Kashiwagi, D., & Sullivan, K. (2015). Major factors causing construction delays in Mecca. *Journal for the Advancement of Performance Information and Value*, *7*(1), 75-75.

Mahamid, I. (2017). Effect of change orders on rework in highway projects in Palestine. *Journal of financial management of property and construction*, *22*(1), 62-76.

Karimi, S., & Piroozfar, P. (2022). Exploring Causes of Delays in National Road and Highway Projects in Developing Construction Economy. *Journal of Engineering, Project & Production Management*, *12*(2).

(Kaliba, C., Muya, M., & Mumba, K. (2009). Cost escalation and schedule delays in road construction projects in Zambia. *International journal of project management*, *27*(5), 522-531)

Muya, M., Price, A. D. F., & Edum-Fotwe, F. T. (2006). Overview of funding for construction craft skills training in Sub-Saharan Africa: a case study of Zambia. *Construction Management and Economics*, *24*(2), 197-208.

Falqi, I. I., & Kaka, A. (2004). *Delays in Project Complection: A comparative study of construction delay factors in Saudi Arabia and the United Kingdom* (Doctoral dissertation).

Ahmed, S. M., Azhar, S., Castillo, M., & Kappagantula, P. (2002). Construction delays in Florida: An empirical study. *Final report. Department of Community Affairs, Florida, US*.

Khan, A., Choudhary, M. A., Khushnood, S., & Masood, S. A. (2015). Development of econometric models for cost & time over-runs: an empirical study of major road construction projects in Pakistan. *University of Engineering Technology Taxila Technical Journal*, *20*(4), 79.

Khan, A., Choudhary, M. A., Khushnood, S., & Masood, S. A. (2015). Development of econometric models for cost & time over-runs: an empirical study of major road construction projects in Pakistan. *University of Engineering Technology Taxila Technical Journal*, *20*(4), 79.

Mahamid, I., Bruland, A., & Dmaidi, N. (2012). Causes of delay in road construction projects. *Journal of management in engineering*, *28*(3), 300-310.

S. M. Vidalis, "Cost and time overrun in highway construction," 4th transportation specialty conference of the Canadian society for civil engineering, Canada 5/8 June 2002.

Flyvbjerg, B., Skamris Holm, M. K., & Buhl, S. L. (2004). What causes cost overrun in transport infrastructure projects?. *Transport reviews*, *24*(1), 3-18.

Mahamid, I., Bruland, A., & Dmaidi, N. (2012). Causes of delay in road construction projects. *Journal of management in engineering*, *28*(3), 300-310.

Stumpf, G. R. (2000). Schedule delay analysis. *Cost Engineering*, *42*(7), 32.

Enshassi, A., Al-Najjar, J., & Kumaraswamy, M. (2009). Delays and cost overruns in the construction projects in the Gaza Strip. *Journal of Financial Management of property and Construction*, *14*(2), 126-151.

Faridi, A. S., & El-Sayegh, S. M. (2006). Significant factors causing delay in the UAE construction industry. *Construction management and economics*, *24*(11), 1167-1176.

Mejía, G., Sánchez, O., Castañeda, K., & Pellicer, E. (2020). Delay causes in road infrastructure projects in developing countries. *Revista de la Construcción*, *19*(2), 220-234.

Chai, C. S., Yusof, A. M., & Habil, H. (2015). Delay mitigation in the Malaysian housing industry: A structural equation modelling approach. *Journal of Construction in Developing Countries*, *20*(1), 65.

Elawi, G. S. A., Algahtany, M., Kashiwagi, D., & Sullivan, K. (2015). Major factors causing construction delays in Mecca. *Journal for the Advancement of Performance Information and Value*, *7*(1), 75-75.

Chai, C. S., Yusof, A. M., & Habil, H. (2015). Delay mitigation in the Malaysian housing industry: A structural equation modelling approach. *Journal of Construction in Developing Countries*, *20*(1), 65.

Elawi, G. S. A., Algahtany, M., Kashiwagi, D., & Sullivan, K. (2015). Major factors causing construction delays in Mecca. *Journal for the Advancement of Performance Information and Value*, *7*(1), 75-75.

Adam, A., Josephson, P. E., & Lindahl, G. (2015). Implications of cost overruns and time delays on major public construction projects. In *Proceedings of the 19th International Symposium on Advancement of Construction Management and Real Estate* (pp. 747-758). Springer Berlin Heidelberg.

Vasilyeva-Lyulina, A., Onishi, M., & Kobayashi, K. (2015). Delay analysis methods for construction projects: Mathematical modelling. *Int. J. Transp*, *3*(1), 27-36.

Shebob, A., Dawood, N., Shah, R. K., & Xu, Q. (2012). Comparative study of delay factors in Libyan and the UK construction industry. *Engineering, Construction and Architectural Management*, *19*(6), 688-712.

Nyasetia, N. F., Mbabazi, M., Jaya, S., & Ephantus, N. W. (2016). Institutional factors influencing timely completion of road projects in Rwanda: case of government externally financed projects. *European Journal of Business and Social Sciences*, *5*(01), 146-159.

Motaleb, O. H. (2014). *Development of a risk response model to handle delays of construction projects in the United Arab Emirates* (Doctoral dissertation).

Al-Kharashi, A., & Skitmore, M. (2009). Causes of delays in Saudi Arabian public sector construction projects. *Construction Management and Economics*, *27*(1), 3-23.

Tang, S. L., Poon, S. W., Ahmed, S. M., & Wong, F. K. (2003). *Modern construction project management* (Vol. 2). Hong Kong University Press.

Okpala, D. C., & Aniekwu, A. N. (1988). Causes of high costs of construction in Nigeria. *Journal of Construction Engineering and Management*, *114*(2), 233-244.

Chileshe, N., & Kikwasi, G. J. (2013). Perception of barriers to implementing risk assessment and management practices by construction professionals in Tanzania. *Management*, *1137*, 1146.

Salunkhe, A. A., & Patil, R. S. (2014). Effect of construction delays on project time overrun: Indian scenario. *Int. J. Res. Eng. Technol*, *3*(1), 543-547.

Al-Khalil, M. I., & Al-Ghafly, M. A. (1999). Important causes of delay in public utility projects in Saudi Arabia. *Construction Management & Economics*, *17*(5), 647-655.

Kaliba, C., Muya, M., & Mumba, K. (2009). Cost escalation and schedule delays in road construction projects in Zambia. *International journal of project management*, *27*(5), 522-531.

Aibinu, A. A., & Jagboro, G. O. (2002). The effects of construction delays on project delivery in Nigerian construction industry. *International journal of project management*, *20*(8), 593-599.

Kaliba, C., Muya, M., & Mumba, K. (2009). Cost escalation and schedule delays in road construction projects in Zambia. *International journal of project management*, *27*(5), 522-531.

Sunjka, B. P., & Jacob, U. (2013). Significant causes and effects of project delays in the Niger delta region, Nigeria. *Southern African Institute of Industrial Engineering*, 641-14.

Al-Hazim, N., & Salem, Z. A. (2015). Delay and cost overrun in road construction projects in Jordan. *International Journal of Engineering & Technology*, *4*(2), 288.

Sunjka, B. P., & Jacob, U. (2013). Significant causes and effects of project delays in the Niger delta region, Nigeria. *Southern African Institute of Industrial Engineering*, 641-14.

Pourrostam, T., & Ismail, A. (2012). Causes and effects of delay in Iranian construction projects. *International Journal of Engineering and Technology*, *4*(5), 598.

Sunjka, B. P., & Jacob, U. (2013). Significant causes and effects of project delays in the Niger delta region, Nigeria. *Southern African Institute of Industrial Engineering*, 641-14.

Marzouk, M. M., & El-Rasas, T. I. (2014). Analyzing delay causes in Egyptian construction projects. *Journal of advanced research*, *5*(1), 49-55.

Shebob, A., Dawood, N., Shah, R. K., & Xu, Q. (2012). Comparative study of delay factors in Libyan and the UK construction industry. *Engineering, Construction and Architectural Management*, *19*(6), 688-712.

Marzouk, M. M., & El-Rasas, T. I. (2014). Analyzing delay causes in Egyptian construction projects. *Journal of advanced research*, *5*(1), 49-55.

Amare, Y.; Quezon, E.T.; Busier, M. Causes of delays during construction phase of road projects due to the failures of contractor, consultant, and employer in Addis Ababa City Road Authority. Int. J. Sci. Eng. Res.2017, 8, 15–25.

Al Hosani, I.; Dweiri, F.; Ojiako, U. A study of cost overruns in complex multi-stakeholder road projects in the United Arab Emirates. Int. J. Syst. Assur. Eng. Manag. 2020. [CrossRef]

Lee, E.B.; Thomas, D.K.; Alleman, D. Incorporating road user costs into integrated life-cycle cost analyses for infrastructure sustainability: A case study on Sr-91 corridor improvement project (Ca). Sustainability 2018, 10, 179.

Lee, E.B.; Alleman, D. Ensuring efficient incentive and disincentive values for highway construction projects: A systematic approach balancing road user, agency and contractor acceleration costs and savings. Sustainability 2018, 10, 701.

Love, P.E.D.; Ahiaga-dagbui, D.D.; Irani, Z. Cost overruns in transportation infrastructure projects: Sowing the seeds for a probabilistic theory of causation. Transp. Res. Part A 2016, 92, 184–194.

Aziz, R.; Abdel-hakam, A. Exploring delay causes of road construction projects in Egypt. Alex. Eng. J. 2016, 55, 1515–1539.

Parikh, D.; Joshi, G.J.; Patel, D.A. Development of prediction models for claim cause analyses in highway projects. J. Leg. Aff. Disput. Resolut. Eng. Constr. 2019, 11.

Rehak, D.; Senovsky, P.; Slivkova, S. Resilience of critical infrastructure elements and its main factors. Systems 2018, 6, 21.

Useche, S.; Montoro, L.; Alonso, F.; Oviedo-Trespalacios, O. Infrastructural and human factors affecting safety outcomes of cyclists. Sustainability 2018, 10, 299.

Song, Y.; Wright, G.L.; Wu, P.; Thatcher, D.; McHugh, T.; Li, Q.; Li, S.J.; Wang, X. Segment-based spatial analysis for assessing road infrastructure performance using monitoring observations and remote sensing data. Remote Sens. 2018, 10, 1696.

Cavalieri, M.; Cristaudo, R.; Guccio, C. On the magnitude of cost overruns throughout the project life-cycle: An assessment for the Italian transport infrastructure projects. Transp. Policy 2019, 79, 21–36.

Love, P.E.D.; Wang, X.; Sing, C.P.; Tiong, R.L.K. Determining the probability of project cost overruns. J. Constr. Eng. Manag. 2013, 139, 321–330.

Catalão, F.P.; Cruz, C.O.; Sarmento, J.M. The determinants of cost deviations and overruns in transport projects, an endogenous models approach. Transp. Policy 2019, 74, 224–238.

Bucciol, A.; Chillemi, O.; Palazzi, G. Cost overrun and auction format in small size public works. Eur. J. Polit. Econ. 2013, 30, 35–42.

Huo, T.; Ren, H.; Cai, W.; Shen, G.Q.; Liu, B.; Zhu, M.; Wu, H. Measurement and dependence analysis of cost overruns in megatransport infrastructure projects: Case study in Hong Kong. J. Constr. Eng. Manag. 2018, 144.

Bohórquez, J.J.; Oviedo, N.S.; Mejía, G. Cost overruns in transport infrastructure projects: A current review. In Proceedings of the InNGENIO 2018, Medellin, Colombia, 22–24 August 2018; pp. 1–9.

Bordat, C.; McCullouch, B.G.; Labi, S.; Sinha, K. An Analysis of Cost Overruns and Time Delays of INDOT Projects; Joint Transportation Research Program; Indiana Department of Transportation and Purdue University: West Lafayette, Indiana, 2004.

Creedy, G.; Skitmore, M.; Wong, J. Evaluation of risk factors leading to cost overrun in delivery of highway construction projects. J. Constr. Eng. Manag. 2010, 136, 528–537.

Love, P.; Sing, C.; Carey, B.; Kim, J. Estimating construction contingency: Accommodating the potential for cost overruns in road construction projects. J. Infrastruct. Syst. 2014, 21. Appl. Sci. 2020, 10, 5506 22 of 25

Cantarelli, C.; Van Wee, B.; Molin, E.; Flyvbjerg, B. Different cost performance: Different determinants? The case of cost overruns in Dutch transport infrastructure projects. Transp. Policy 2012, 22, 88–95.

Lee, J. Cost overrun and cause in Korean social overhead capital projects: Roads, rails, airports, and ports. J. Urban Plan. Dev. 2008, 134, 59–62.

Roxas, N.; Chalermpong, S. Forecasting inaccuracies in transportation projects in selected South East Asian countries. In Proceedings of the 16th Annual Conference of the Transportation Science Society of the Philippines, Pasay City, Philippines, 19 September 2008; Volume 9, p. 11.

Mahamid, I.; Bruland, A. Cost deviation in road construction projects: The case of Palestine. Australas. J. Constr. Econ. Build. 2012, 12, 58–71.

Rwakarehe, E.E.; Mfinanga, D.A. Effect of inadequate design on cost and time overrun of road construction projects in Tanzania. J. Constr. Eng. Proj. Manag. 2014, 4, 15–28.

Pai, S.; Patnaik, B.; Mittal, A.; Anand, N. Identification of risks causing time and cost overrun in roads and highway projects in India. Int. J. Civ. Eng. Technol. 2018, 9, 683–697.

Shemi, S.; Asok, K. Examination of cost overrun in highway projects using artificial neural networks in Kerala. Int. J. Innov. Sci. Res. Technol. 2020, 5, 1382–1392

Herrera, R. F., Sánchez, O., Castañeda, K., & Porras, H. (2020). Cost overrun causative factors in road infrastructure projects: A frequency and importance analysis. *Applied Sciences*, *10*(16), 5506.

https://tungsten-capital.com/how-much-do-delays-actually-cost-construction-projects/

Nadir, H and Ahmed, A (2020) *Causes and Monitoring of Delays and Cost Overrun in Construction Projects in Pakistan.* International Journal of Engineering Inventions, 9 (8). pp. 20-33. ISSN 2278-7461

Khan, R.A., (2008)"Role of construction sector in economic growth: Empirical evidence from Pakistan economy", Proceedings of the First International Conference on Construction in Developing Countries (ICCIDC), Karachi, Pakistan pp. 279-290.

Memon, Z.A., "Remedial Measures for Delays at Construction Stage", Mehran University Research Journal of Engineering & Technology, Vol. 23, No. 1, pp. 9-20, 2004.

Ali, T.H., Memon, Z.A., and Memon. N.A., "Causes and Remedial Measures for Construction Delays: A Case Study of Pakistan", Mehran University Research Journal of Engineering and Technology, Vol. 28, No. 1, pp. 69-80, January, 2009

Khan, R. A., & Umer, M. (2020). Impact of delays on cost of construction project-a cross sectional study of Pakistani construction industry. *Mehran University Research Journal of Engineering & Technology*, *39*(4), 815-825.

Sudarsana, D. K., Sulistio, H., Wicaksono, A., & Djakfar, L. (2014). The analysis of work zone road user costs due to the delay completion of the road maintenance project. *Advances in Natural and Applied Sciences*, *8*(3), 103-109.

NHA. (n.d.). *Background*. Retrieved from NATIONAL HIGHWAY AUTHORITY: https://mail.nha.gov.pk/sitepages/topic/26

AccountingTools, & BOOKS, A. C. C. (2023). Accounting cost definition.

Ballal, T. E. H. B. (2005). Critical determinants of construction tendering

costs: Quantity surveyors' standpoint. *International Journal of Project Management.*

.

Bielenberg, A., Williams, J., & Woetzel, J. J. M. J. (2020). Four ways governments can get the most out of their infrastructure projects.

Crescenzi, R., & Rodríguez-Pose, A. J. P. i. r. s. (2012). Infrastructure and regional growth in the European Union. *91*(3), 487-513.

Edwards, D. J., Owusu-Manu, D.-G., Baiden, B., Badu, E., Love, P. E. J. J. o. E., Design, & Technology. (2017). Financial distress and highway infrastructure delays. *15*(1), 118-132.

Ferguson, A. (2012). Qualitative evaluation of transportation construction related social costs and their impacts on the local community.

FERGUSON, A. (MAy 2012). QUALITATIVE EVALUATION OF TRANSPORTATION

Haque, N. U., & Ullah, R. R. J. T. P. D. R. (2022). Estimating the Footprint of Government on the Economy. 551-562.

Khandker, S. R., Koolwal, G. B., & Samad, H. A. (2009). *Handbook on impact evaluation: quantitative methods and practices*: World Bank Publications.

NHA (Producer). Background. *NATIONAL HIGHWAY AUTHORITY*. Retrieved from https://mail.nha.gov.pk/sitepages/topic/26

Plano Clark, V. L. J. T. J. o. P. P. (2017). Mixed methods research. *12*(3), 305-306.

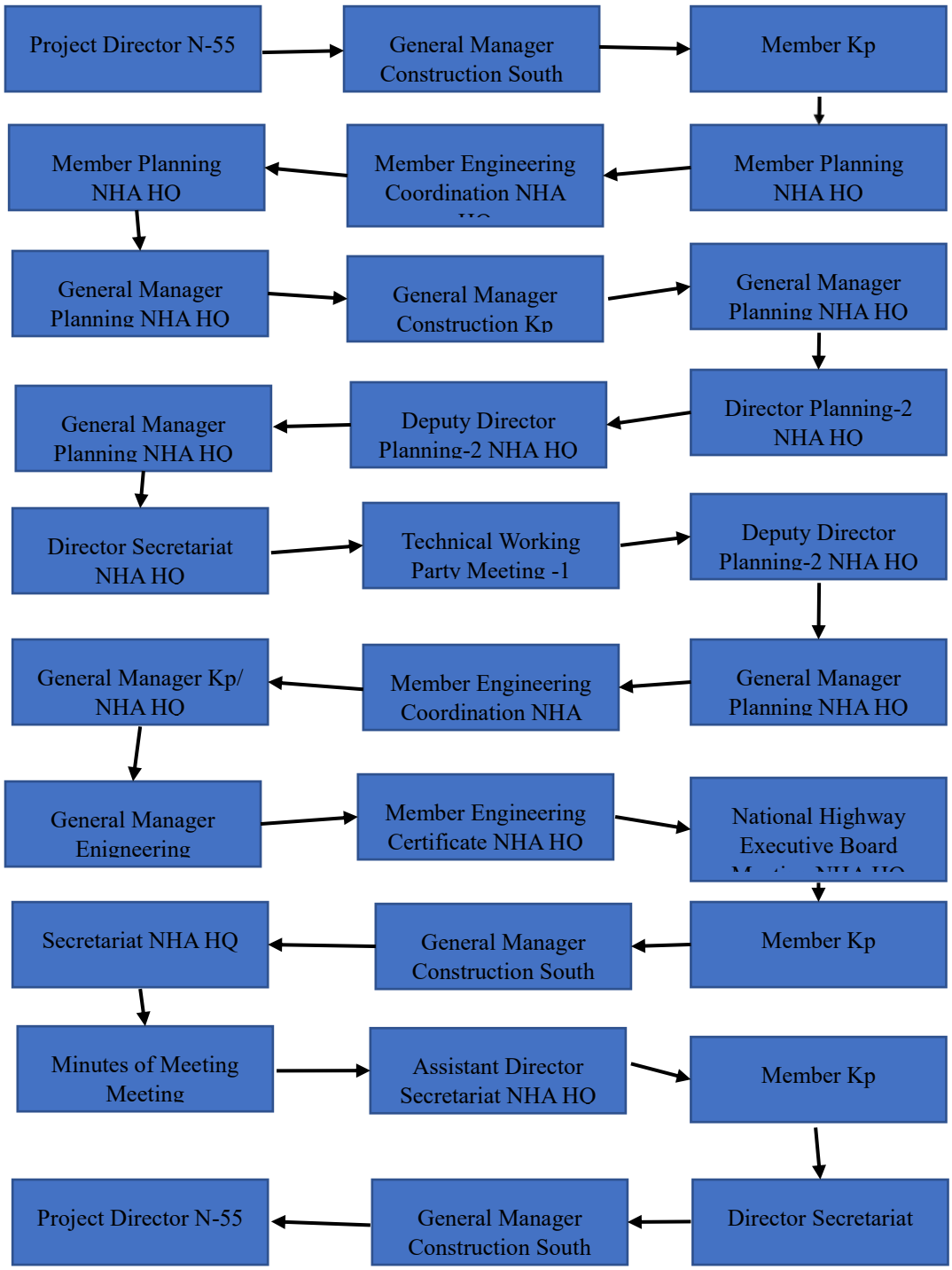
Schmiedel, H., Kostova, G. L., & Ruttenberg, W. J. E. O. p. (2012). The social and private costs of retail payment instruments: a European perspective. (137).

Short, J., & Kopp, A. J. T. p. (2005). Transport infrastructure: Investment and planning. Policy and research aspects. *12*(4), 360-367.

Solanki, P., & Sharma, S. (2022, October). Performance Rating of National Highways Based on Road User Perspective–A Case Study of Kalka–Shimla Highway.

# Annexure A

**Process of Revised PC-1**



**Annexure A**

| Serial No | Designation | Bps Scale | Date of Receiving Pc-1 Document | No of Days | Basic salary in Rupees | Cost of 4/8 working hours in Rupees |
|---|---|---|---|---|---|---|
| 1 | Project Director (N-55) | 19 | 07-09-2021 | 1 | 155790 | 865 |
| 2 | General Manager (Constt N-55) | 20 | 10-09-2021 | 3 | 196130 | 1,089*3= 3,267 |
| 3 | Member (North Zone) | 21 | 10-09-2021 | 0 | 217670 | 1,209 |
| 4 | Member Planning (NHA HQ) | 21 | 14-09-2021 | 4 | 217670 | 1,209*4= 4,836 |
| 5 | Member Engineering Coord (NHA HQ) | 21 | 16-09-2021 | 2 | 217670 | 1209*2=2,418 |
| 6 | Member Planning (NHA HQ) | 21 | 17-09-2021 | 1 | 217670 | 1,209 |
| 7 | General Manager Planning (NHA HQ) | 20 | 24-09-2021 | 7 | 196130 | 1089*7= 7,623 |
| 8 | General Manager (Constt-KP) | 20 | | | 196130 | 1,209 |
| 9 | General Manager Planning (NHA HQ) | 20 | 29-09-2021 | 5 | 196130 | 1,089*5= 5,445 |
| 10 | Deputy Director Planning-2 (NHA HQ) | 18 | 29-09-2021 | 0 | 120780 | 671 |
| 11 | General Manager Planning (NHA HQ) | 20 | 30-09-2021 | 1 | 196130 | 1,089 |
| 12 | Director Secretariat (NHA HQ) | 19 | 1-10-2021 | | 155790 | 865 |
| 13 | TWP-1 Meeting | | 14-10-2021 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 14 | Deputy Director Planning-2 (NHA HQ) | 18 | 26-10-2021 | 26 | 120780 | 865*26= 22,490 |
| 15 | General Manager Planning (NHA HQ) | 20 | 26-10-2021 | 0 | 196130 | 1,089 |
| 16 | Member Engineering Coord (NHA HQ) | 21 | 27-10-2021 | 1 | 217670 | 1,209 |
| 17 | General Manager (Constt NHA HQ/ Constt Peshawar) | 20 | 29-10-2021 | 2 | 196130<br><br>196130 | 1,089*2= 2,178 |
| 18 | General Manager Constt/ Engineering Coord (NHA HQ) | 20 | 01-11-2021 | 3 | 196130<br><br>196130 | 1,089*3= 3,267<br><br>1,089*3= 3,267 |
| 19 | Member Engineering Coord (NHA HQ) | 21 | 03-11-2021 | 2 | 217670 | 1,209*2= 2,418 |
| 20 | National Highway Executive Board Meeting (NHA HQ) | | 04-11-2021 | | | |
| 21 | Member (North Zone | 21 | 8-11-2021 | 5 | 217670 | 1,209*5= 6,045 |
| 22 | General Manager (Constt South) | 20 | 9-11-2021 | 1 | 196130 | 1,089 |
| 23 | Director Secretariat (NHA HQ)<br>Deputy Director Secretariat (NHA HQ) | 19<br><br><br><br>18 | 10-11-2021 | 1 | 155790<br><br><br><br>120780 | 865<br><br><br><br>671 |
| 24 | Minutes of Meeting | | 24-11-2021 | | | |
| 25 | Assistant Secretariat (NHA HQ) | 17 | 25-11-2021 | 15 | 96370 | 535*5= 2,675 |
| 26 | Member (North Zone) | 21 | 25-11-2021 | 0 | 217670 | 1,209 |
| 27 | Member (North Zone) | 21 | 3-12-2021 | 8 | 217670 | 1,209*8= 9,672 |
| 29 | General Manager (Constt South) | 20 | 7-12-2021 | 4 | 196130 | 1,089*4 = 4,356 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 30 | Project Director (N-55) | 19 | 7-12-2021 | 1 | 155790 | 865 |

| | |
|---|---|
| Total Cost of Salaries in Rs | 89,930 |

Cost of Printing, Electricity and Stationery on Revised PC-1

5x Photocopies of Revised Pc-1

2x Pen and 1x Pencil Per head and Highlighter

Electricity Consumption on Photocopy of Revised PC-1

**Cost of Photocopies**

| Number of Pages of Revised PC-1 Document | Copies | Total Pages | Price of 1 Page (Double AA 70gm) in Rs | Cost of 850 pages in Rs |
|---|---|---|---|---|
| 170 | 5 | 170*5= 850 | 2.5 | 850*2.5 = 2,125 |

**Cost of Stationery**

| Number of Officials | 2x Ball Point Pen Per Head | 1x Pencil Per Head | 1x Highlighter Per Head | Price of 1 Ball Point | Price of 1 Pencil | Price of 1 Highlighter | Total Cost of Stationery in Rs |
|---|---|---|---|---|---|---|---|
| 28 | 2*28 = 56 | 1*28 = 28 | 1*28 = 28 | 15 | 10 | 50 | 840+280+ 1400 = 2,520 |

**Cost of Electricity of Printer/ Photocopy Machine**

| Number of Pages | Units Consumed | Price of 1 Unit | Total Cost of Units in Rs |
|---|---|---|---|
| 850 | 10 | 50 | 10*50 = 500 |

**Total Cost of Printing, Electricity and Stationery on Revised PC-1**

| | |
|---|---|
| Total Cost in Rs | 5,145 |

**Technical Working Party-1**

**Cost of Salaries of TWP-1 Participants**

| Serial No | Designation | Basic Pay Scale BPS | Basic Salaries in Rs | Meeting Date | Cost of 4/8 Working Hours in Rs |
|---|---|---|---|---|---|
| 1 | Chairman NHA | 22 | 2,44130 | 14-10-2021 | 1,356 |
| 2 | Member (Finance) NHA | 21 | 2,17670 | | 1,209 |
| 3 | Member (Planning) NHA | 21 | 217670 | | 1,209 |
| 4 | Member (Operation/Construction) NHA | 21 | 2,17670 | | 1,209 |
| 5 | Chief (T&C) Ministry of Planning | 21 | 2,17670 | | 1,209 |
| 6 | Director (R&RT) Ministry of Communication | 19 | 1,55790 | | 865 |
| 7 | Rep NTRC | 19 | 1,55790 | | 865 |
| 8 | General Manager (Design) NHA | 20 | 1,96130 | | 1,809 |
| 9 | General Manager (Planning) NHA | 20 | 1,96130 | | 1,809 |

**Total Cost of TWP-1 Panel**

| | |
|---|---|
| Total Cost in Rs | 10,820 |

Cost of Stationery

1x file per head

1x Copy of meeting agenda document of per head

5x Blank paper per head

2x pen and 1x pencil per head

**Cost of Folder Per Head**

| Number of Officials | Price of 1 File | Total Cost of File in Rupees |
|---|---|---|
| 9 | 425 | 425*9 = 3825 |

**Cost of Meeting Agenda Document Per Head**

| Number of Officials | Document | Price of 1 Page | Cost of Agenda Document in Rs |
|---|---|---|---|
| 9 | 12 | 2.5 | 12*9*2.5 = 270 |

**Cost of Blank Papers Per Head**

| Number of Officials | Blank pages per Head | Total Blank Pages | Price of Black Paper | Cost of Blank Pages in Rs |
|---|---|---|---|---|
| 9 | 5 | 45 | 2.5 | 45*2.5 = 113 |

**Cost of Pen and Pencil Per Head**

| Number of official | 2x Pen Per head | Price of 1 Pen | 1x Pen Per Head | Price of 1 pencil | Cost of Pen and Pencil in Rs |
|---|---|---|---|---|---|
| 9 | 2*9 = 18 | 15 | 1*9 = 9 | 10 | 225 |

**Total Cost of Stationery**

| Total Cost in Rs | 4,433 |
|---|---|

Cost of Tea Break of TWP-1 Meeting

2x Mineral Water 500ml Per Head

1x Tissue box Per head

2x Cup of Tea Per Head

2x Samosa Per Head

250 g Biscuits Per Head

250 g Pakora Per Head

**Cost of Mineral Water Per Head**

| Number of Officials | 2x Mineral Water Per head | Price of 1 Mineral Water 500ml | Cost of Mineral Water in Rs |
|---|---|---|---|
| 9 | 2*9 = 18 | 50 | 18*50 = 900 |

**Cost of tissue Box Per Head**

| Number of Officials | 1x Tissue Per Head | Price Of 1 Tissue Box | Cost of Tissue Box in Rs |
|---|---|---|---|
| 9 | 1*9 = 9 | 230 | 230*9 = 2,070 |

**Cost of Tea Per Head**

| Number of Officials | 2x Cup of Tea Per Head | Price of 1 Cup of Tea | Total Cost of Tea in Rs |
|---|---|---|---|
| 9 | 2*9 = 18 | 80 | 1,440 |

**Cost Samosa Per Head**

| Number of Officials | 2x Samosa Per Head | Price of 1 Samosa | Total Cost of Samosa in Rs |
|---|---|---|---|
| 9 | 2*9 = 18 | Rs 60 | 1,080 |

**Cost of 250 gm Biscuits Per Head**

| Number of Officials | Price of 1 kg Biscuits | 250 g of Biscuits per Head | Cost of Biscuits in Rs |
|---|---|---|---|
| 9 | 1000 | 250 | 9*250 = 2,250 |

**Cost of 250 g Pakora Per Head**

| Number of Officials | Price of 1 kg Pakora | 250 g of Pakora Per Head | Cost of Pakora Rs |
|---|---|---|---|
| 9 | 1200 | 300 | 9*300 = 2,700 |

**Total Cost of Tea Break of TWP-1 Meeting**

| Total Cost | 10,440 |
|---|---|

**National Highway Executive Board (NHEB)**

| Serial No | Designation | |
|---|---|---|
| 1 | Chairman NHA | Chairman |
| 2 | IG NH & MP | Member |
| 3 | Additional Secretary (Finance) | Member |
| 4 | Member or Additional Secretary (plg & dev. Div) | Member |
| 5 | Joint Secretary (2), MOC | Member |
| 6 | Senior Chief/ Chief NTRC | Member |
| 7 | President / VP NESPAK | Member |
| 8 | Member (Finance) NHA | Member |
| 9 | Member (Planning) NHA | Member |

**Cost of Salaries of NHEB**

| Serial No | Designation | Basic Pay Scale (BPS) | Basic salaries | Meeting Date | Cost of 4/8 Working Hours in Rs |
|---|---|---|---|---|---|
| 1 | Chairman NHA | 22 | 2,44130 | 04-11-2021 | 1,356 |
| 2 | IG NH & MP | 22 | 2,44130 | | 1,356 |
| 3 | Additional Secretary (Finance) | 22 | 2,44130 | | 1,356 |
| 4 | Member or Additional Secretary (plg & dev. Div) | 22 | 2,44130 | | 1,356 |
| 5 | Joint Secretary (2), MOC | 22 | 2,44130 | | 1,356 |
| 6 | Senior Chief/ Chief NTRC | 21 | 217670 | | 1,209 |
| 7 | President / VP NESPAK | 21 | 217670 | | 1,209 |
| 8 | Member (Finance) NHA | 21 | 217670 | | 1,209 |
| 9 | Member (Planning) NHA | 21 | 217670 | | 1,209 |

**Total Cost of NHEB Salaries**

| | |
|---|---|
| Total Cost in Rs | 11,616 |

Cost of Stationery

1x file per head

1x Copy of Working Paper document of Per head

5x Blank paper per head

2x pen and 1x pencil per head

**Cost of Folder Per Head**

| Number of Officials | Price of 1 File | Total Cost of File in Rs |
|---|---|---|
| 9 | 425 | 425*9 = 3825 |

**Cost of Working Paper Document Per Head**

| Number of Officials | Document | Price of 1 Page | Cost of Agenda Document in Rs |
|---|---|---|---|
| 9 | 12 | 2.5 | 12*9*2.5 = 270 |

**Cost of Blank Papers Per Head**

| Number of Officials | Blank pages per Head | Total Blank Pages | Price of Black Paper | Cost of Blank Pages |
|---|---|---|---|---|
| 9 | 5 | 45 | 2.5 | 45*2.5 = 113 |

**Cost of Pen and Pencil Per Head**

| Number of official | 2x Pen Per head | Price of 1 Pen | 1x Pen Per Head | Price of 1 pencil | Cost of Pen and Pencil |
|---|---|---|---|---|---|
| 9 | 2*9 = 18 | 15 | 1*9 = 9 | Rs 10 | 225 |

**Total Cost of Stationary**

| Total Cost | 4, 433 |
|---|---|

Cost of Tea Break of NHEB Meeting

2x Mineral Water 500ml Per Head

1x Tissue box Per head

Nestle Juice Per Head

4 Small Sandwich

2x Kabab Per Head

2x Cup of Tea Per Head

2x Cup Green Tea Per Head

2x Coffee Per Head

2x Samosa Per Head

250 g Biscuits Per Head

250 g Pakora Per Head

**Cost of Mineral Water Per Head**

| Number of Officials | 2x Mineral Water Per head | Price of 1 Mineral Water 500ml | Cost of Mineral Water |
|---|---|---|---|
| 9 | 2*9 = 18 | 50 | 18*50 = 900 |

**Cost of Tissue Box Per Head**

| Number of Officials | 1x Tissue Per Head | Price Of 1 Tissue Box | Cost of Tissue Box |
|---|---|---|---|
| 9 | 1*9 = 9 | 230 | 230*9 = 2,070 |

**Cost of Tea Per Head**

| Number of Officials | 2x Cup of Tea Per Head | Price of 1 Cup of Tea | Total Cost of Tea |
|---|---|---|---|
| 9 | 2*9 = 18 | 80 | 1,440 |

**Cost of Green Tea Per Head**

| Number of Officials | 2x Cup of Tea Per Head | Price of 1 Cup of Tea | Total Cost of Tea |
|---|---|---|---|
| 9 | 2*9 = 18 | 80 | 1,440 |

**Cost of Cup of Coffee Per Head**

| Number of Officials | 2x Cup of Tea Per Head | Price of 1 Cup of Tea | Total Cost of Tea |
|---|---|---|---|
| 9 | 2*9 = 18 | 250 | 4,500 |

**Cost Samosa Per Head**

| Number of Officials | 2x Samosa Per Head | Price of 1 Samosa | Total Cost of Samosa |
|---|---|---|---|
| 9 | 2*9 = 18 | 60 | 1,080 |

**Cost of 250 gm Biscuits Per Head**

| Number of Officials | Price of 1 kg Biscuits | 250 g of Biscuits per Head | Cost of Biscuits |
|---|---|---|---|
| 9 | Rs 1000 | 250 | 9*250 = 2,250 |

**Cost of 250 g Pakora Per Head**

| Number of Officials | Price of 1 kg Pakora | 250 g of Pakora Per Head | Cost of Pakora |
|---|---|---|---|
| 9 | Rs 1200 | Rs 300 | 9*300 = 2,700 |

**Cost of 4 Chicken Sandwich**

| Number of Officials | Price of 4 Piece Chicken Sandwich | Cost of Sandwich |
|---|---|---|
| 9 | Rs.1,295 | 9* 1,295 = 3,885 |

**Cost of 2x Kabab**

| Number of Officials | Price of 2x Kabab Per head | Cost of kababs |
|---|---|---|
| 9 | 2*60 = 120 | 120*9 = 1,080 |

**Nestle Juice Per Head**

| Number of Officials | Price 1 Nestle | Cost of kababs |
|---|---|---|
| 9 | Rs 60 | 60*9 = Rs 540 |

**Total Cost of NHEB Tea Break**

| Total Cost | 21,885 |
|---|---|

**Total Cost of Revised PC-1 in Rs**

| Cost of Officials in Revised PC-1 Process | 89,930 |
|---|---|
| Cost of Stationery in Revised PC-1 Process | 5,145 |
| Cost of TWP-1 Member Salaries | 10,820 |
| Cost Stationery In TWP-1 Meeting | 4,433 |
| Cost Tea Break In TWP-1 Meeting | 10,440 |
| Cost of NHEB Member Salaries | 11,616 |
| Cost Stationery in NHEB Meeting | 4,433 |
| Cost Tea Break in NHEB Meeting | 21,885 |
| TOTAL COST OF REVISED PC-1 | 158,702 |

# Annexure B

**Private Cost of Consultant Key Personnel (Design Review) Revised PC-1 Salaries**

| Sr. No | Position | Staff-Days | Monthly Salary in Rupees | 1 Day Salary in Rupees | Total Amount in Rupees |
|---|---|---|---|---|---|
| 1 | Highway Design Engineer/Team Leader | 8 | 3,50,000 | 11,667 | 11,667*8= 93,336 |
| 2 | Sr. Structure Engineer | 4 | 2,18,750 | 7,292 | 7,292*4= 29,168 |
| 3 | Geotechnical Engineer | 3 | 2,18,750 | 7,292 | 7,292*3= 29,168 |
| 4 | Geometric Design Engineer | 3 | 2,62,500 | 8,750 | 8,750*3= 26,250 |
| 5 | Road Safety Engineer | 3 | 2,62,500 | 8,750 | 8,750*3= 26,250 |
| 6 | Drainage Engineer | 4 | 2,62,500 | 8,750 | 8,750*4= 35,000 |
| | Total Salary Cost of Design Review | 31 | | | 239,172 |

**Private Cost of Consultant Salaries in Delayed Time Key Personnel (Construction Supervision)**

| Sr. No | Position | Original Staff-Months | Staff-Months in Delayed Time | Staff Salaries per Month | Total Amount of Salaries in Delayed Time Rupees |
|---|---|---|---|---|---|
| 1 | Resident Engineer/Team Leader | 28 | 48 | 245,000 | 245,000*48= 11,760,000 |
| 2 | ARE Structure-I | 22 | 44 | 122,500 | 122,500*44= 5,390,000 |
| 3 | ARE Structure-II | 22 | 44 | 122,500 | 122,500*44= 5,390,000 |
| 4 | ARE Bridges-I | 22 | 44 | 122,500 | 122,500*44= 5,390,000 |
| 5 | ARE Bridges-II | 22 | 44 | 122,500 | 122,500*44= 5,390,000 |
| 6 | ARE Highways-I | 24 | 48 | 122,500 | 122,500*44= 5,390,000 |
| 7 | ARE Highways-II | 24 | 48 | 122,500 | 122,500*44= 5,390,000 |
| 8 | ARE Highways-III | 24 | 48 | 122,500 | 122,500*44= 5,390,000 |
| 9 | Material Engineer | 24 | 48 | 122,500 | 122,500*44= |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 5,390,000 |
| 10 | Contract Engineer | 5 | 10 | 210,000 | 210,000*10= 2,100,000 |
| | Total | | | | 56,980,000 |

**Private Cost of Consultant Salaries in Delayed Time Non-Key Personnel (Construction Supervision)**

| Sr. No | Position | Original Staff-Months | Staff-Months in Delayed Time of 4 Years | Staff Salaries per Month in Rupees | Total Amount of Salaries in Delayed Time Rupees |
|---|---|---|---|---|---|
| 1 | Quantity Surveyor | 27 | 54 | 96,250 | 96,250*54= 5,197,500 |
| 2 | Assistant Quantity Surveyor-I | 20 | 40 | 56,000 | 56,000*40= 2,240,000 |
| 3 | Assistant Quantity Surveyor-II | 20 | 40 | 56,000 | 56,000*40= 2,240,000 |
| 4 | Assistant Quantity Surveyor-III | 20 | 40 | 56,000 | 56,000*40= 2,240,000 |
| 5 | Chief Surveyor | 12 | 24 | 96,250 | 96,250*24= 2,310,000 |
| 6 | Site Inspector Highway-I | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 7 | Site Inspector Highway-II | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 8 | Site Inspector Highway-III | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 9 | Site Inspector Highway-IV | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 10 | Site Inspector Highway-V | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 11 | Site Inspector Highway-VI | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 12 | Site Inspector Structure-I | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 13 | Site Inspector Structure-II | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 14 | Site Inspector Bridges-I | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 15 | Site Inspector Bridges-II | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 16 | Material Inspector-I | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |

| | | | | | |
|---|---|---|---|---|---|
| 17 | Material Inspector-II | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 18 | Material Inspector-III | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 19 | Material Inspector-IV | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 20 | Material Inspector-V | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 21 | Material Inspector-VI | 24 | 48 | 56,000 | 56,000*48= 2,688,000 |
| 22 | Surveyor-I | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 23 | Surveyor-II | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 24 | Surveyor-III | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 25 | Lab Technician-I | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 26 | Lab Technician-II | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 27 | Lab Technician-III | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 28 | Lab Technician-IV | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 29 | Lab Technician-V | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 30 | Lab Technician-VI | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 31 | Lab Technician-VII | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 32 | Lab Technician-VIII | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 33 | Lab Technician-IX | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 34 | Lab Technician-X | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 35 | Lab Technician-XI | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 36 | Lab Technician-XII | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 37 | CAD Operator | 24 | 48 | 42,000 | 42,000*48= 2,016,000 |
| 38 | Accountant | 27 | 54 | 56,000 | 56,000*54= 3,024,000 |

| | | | | | |
|---|---|---|---|---|---|
| 39 | Computer Operator-I | 27 | 54 | 35,000 | 35,000*54= 1,890,000 |
| 40 | Computer Operator-II | 24 | 48 | 35,000 | 35,000*48= 1,680,000 |
| 41 | Computer Operator-III | 24 | 48 | 35,000 | 35,000*48= 1,680,000 |
| 42 | Office Assistant-I | 24 | 48 | 28,000 | 28,000*48= 1,344,000 |
| 43 | Office Assistant-II | 24 | 48 | 28,000 | 28,000*48= 1,344,000 |
| 44 | Office Assistant-III | 24 | 48 | 28,000 | 28,000*48= 1,344,000 |
| 45 | Office Boy-I | 24 | 48 | 21,000 | 21,000*48= 1,008,000 |
| 46 | Office Boy-II | 24 | 48 | 21,000 | 21,000*48= 1,008,000 |
| 47 | Office Boy-III | 24 | 48 | 21,000 | 21,000*48= 1,008,000 |
| 48 | Office Boy-IV | 24 | 48 | 21,000 | 21,000*48= 1,008,000 |
| | Total | | | | 105,829,000 |

# Annexure C

**Private Cost of the Contractor**

1. Establishment / Running of the Engineer Office and Accommodation
2. Supporting Staff
3. The Engineer's Transport
4. Machinery

**Establishment / Running of the Engineer Office and Accommodation**

| | Office | Accommodation | Total in Rs |
|---|---|---|---|
| Cost PM | 80,000 | 40000 | 1,20,000 |
| Annual Cost | 9,60,000 | 4,80,000 | 14,40,000 |
| Cost of Delay (4 x Years) | 38,40,000 | 19,20,000 | 57,60,000 |

**Office Furnishing and Equipment**

| | Chair | Table | Cupboard | PC | Photo machine | Printer | Sofa Set | Dispenser | Total in Rupees |
|---|---|---|---|---|---|---|---|---|---|
| 1 x Room | 40,000 | 25,000 | 50,000 | 100,000 | 500,000 | 150,000 | 45,000 | 75,000 | 985,0000 |
| 8 x Rooms | 40,000 *8= 320,000 | 25,000 *8= 200,000 | 50,000 *8= 400,000 | 100,000*8= 800,000 | - | 150,000*8= 1,200,000 | 45,000 *8= 360,000 | 75,000 *8= 600,000 | 3,880,000 |

**Office Running and Maintenance**

| | Utility Bills | Misc | Total |
|---|---|---|---|
| Per Month | 80,000 | 80,000 | 160,000 |
| Per Delaying Period | 3,840,000 | 3,840,000 | 7,680,000 |

**Office Supporting Staff**

| Supporting Staff | Monthly Salary | Salary for the Delayed Time Period of 4 years in rupees |
|---|---|---|
| 2 x Naib Qasid | 2 x 40,000 (80,000) | 2 x 1,920,000 (3,840,000) |
| 3 x Cook / Helpers | 3 x 40000 (120,000) | 3 x 1920000 (5,760,000) |
| 2 x Sweepers | 2 x 40000 | 2 x 1920000 |

| | | |
|---|---|---|
| | (80,000) | (3,840,000) |
| 3 x Guards | 3 x 40,000<br>(120,000) | 3 x 1,920,000<br>(5,760,000) |
| Total | 400,000 | 19,200,000 |

**The Engineer's/Employer's Transport Maintenance**

| Maintenance Cost Per Month | Maintenance Cost in Delayed Time of 4 years in rupees |
|---|---|
| 108,000 | 5184000 |

**Cost of Machinery**

| S.NO | Equipment's | Quantity | Cost Per Hour | Quantity * Cost of per hour | Cost one hour per month | Cost one hour for the estimated completion time (40 month) |
|---|---|---|---|---|---|---|
| 1 | Bulldozer | 6 | 8,000 | 6*8,000=48,000 | 1,440,000 | 57,600,000 |
| 2 | Front End Loader | 11 | 7,900 | 11*7,900=86,900 | 2,607,000 | 104,280,000 |
| 3 | Motor Grader | 23 | 6,900 | 23*6,900=158,700 | 4,761,000 | 190,440,000 |
| 4 | Combination Roller 18 Ton | 10 | 6,200 | 10*6,200=62,000 | 1,860,000 | 74,400,000 |
| 5 | Combination Roller 10-12 Ton | 15 | 5,400 | 15*5,400=81,000 | 2,430,000 | 97,200,000 |
| 6 | Water Bowser Tank (12000 Liter) | 16 | 1,800 | 16*1,800=28,800 | 864,000 | 34,560,000 |
| 7 | Tractor Water Tank | 2 | 1,850 | 2*1,850=3,700 | 111,000 | 4,440,000 |
| 8 | Dumper 12-Wheeler | 38 | 4,800 | 38*4,800=182,400 | 5,472,000 | 218,880,000 |
| 9 | Dumper 10-Wheeler | 90 | 4,500 | 90*4,500=405,000 | 12,150,000 | 486,000,000 |
| 10 | Flat Body Truck 8 T | 2 | 3,600 | 2*3,600=7,200 | 216,000 | 8,640,000 |
| 11 | Excavator with or without Jack Hammer | 49 | 5,700 | 49*5,700=279,300 | 8,379,000 | 335,160,000 |
| 12 | Concrete Batching Plant 50 CUM/H | 3 | 10,800 | 3*10,800=32,400 | 972,000 | 38,880,000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | Asphalt Plant (2Ton) | 1 | 5,800 | 1*5,800=5,800 | 174,000 | 6,960,000 |
| 14 | Trailer Low Bed 30 Ton | 2 | 5,950 | 2*5,950=11,900 | 357,000 | 14,280,000 |
| 15 | L.T.V/Pickup | 35 | 1,300 | 35*1,300=45,500 | 1,365,000 | 54,600,000 |
| 16 | Crane 85 Ton | 1 | 24,700 | 1*24,700=24,700 | 741,000 | 29,640,000 |
| 17 | Crane 20 Ton | 1 | 6,200 | 1*6,200=6,200 | 186,000 | 7,440,000 |
| 18 | Pump 4 Delivery (Diesel) | 1 | 5,300 | 1*5,300=5,300 | 159,000 | 6,360,000 |
| 19 | Tractor Trolley | 7 | 1,800 | 7*1,800=12,600 | 378,000 | 15,120,000 |
| 20 | Welding Plant | 10 | 1,200 | 10*1,200=12,000 | 360,000 | 14,400,000 |
| 21 | Generator (Diesel) 75-150 KVA | 4 | 5,000 | 4*5,000=20,000 | 600,000 | 24,000,000 |
| 22 | Generator (Diesel) 220 KVA | 2 | 7,300 | 2*7,300=14,600 | 438,000 | 17,520,000 |
| 23 | Concrete Transit Mixer 6 Cu.M | 13 | 5,450 | 13*5,450=70,850 | 2,125,500 | 85,020,000 |
| 24 | Concrete Pump | 2 | 4,600 | 2*4,600=9,200 | 276,000 | 11,040,000 |
| 25 | Plate Compactor | 6 | 600 | 6*600=3,600 | 108,000 | 4,320,000 |
| 26 | Dewatering pump | 5 | 60 | 5*60=300 | 9,000 | 360,000 |
| 27 | Sheep Foot Roller | 7 | 1,800 | 7*1,800=12,600 | 378,000 | 15,120,000 |
| Total 1,956,660,000 | | | | | | |

# Annexure D

**Social Cost**

| Social Cost | Travel Time Cost | | Vehicle Maintenance Cost | |
|---|---|---|---|---|
| Respondent | 20 | 10 | 5 | 25 |
| Response | 30 minutes increase | 40 minutes increase | 0-19 % | 20-39 % |

**Time Cost of Commuters**

| Respondent | Total Commuters | Working Hours | Increase in Working Hours |
|---|---|---|---|
| 1 | 18 | 8 | 30 mins |

Total Working Hours = 8 Hours = 480 minutes

Average Bps of commuters below bps 17 to bps 1 = 153/17 = 9

Monthly Bps 9 salary = Rs 33,820

Daily Travel Time Cost of Bps 9 Commuter in salary = 33,820/30 = Rs 1,127.3

Daily Travel Time Cost of 8 working hours before starting construction= 1,127.3/24 = Rs 47/hr

Increase in travel time working hours = 30 minutes

Increase in Cost of 30 minutes extra Travel Time after starting construction = 47/2 = Rs 23.5 of 30 minutes.

Monthly Increase = 23.5*30 = Rs 705

Annual Increase = 705*12 = 8,460

Increase in Delay Time of 4 Years = 8,460*4 = 33,840

Cost overrun of travel Time of 1 Commuter in delay time of 4 Years = Rs 33,840

1 Hiace = 18 Commuters

Cost overrun of Travel Time of 18 Commuters = 33,840*18 = 609,120

Travel time cost overrun of 1202 x coaches for the period of delay (2021 – 2024): 609,120*1,202 = Rs 732,162,240

| Bps | Salaries Per Month in Rs | 8 Working Hours Salary Per day in Rs | 30 min working hours In Rs | Monthly Increase | Annual Increase | Increase in Delay time | Commuters in 1 Hiace | Time Cost overrun of 1,202 Hiace |
|---|---|---|---|---|---|---|---|---|
| Bps 9 | 33,820 | 1,127.3 | 23.5 | 23.5*30 = 705 | 705*12 = 8,460 | 8,460 *4 = 33,840 | 18 | 33,840*1,202 = 732,162,240 |

Cost overrun in fuel consumption / Vehicle

Average Fuel Price (2021 - 2024): Rs 239

Actual N 55 Distance covered in the case study (Jail Chok to Kohat): 67 km

N 55 Distance covered in the case study (Jail Chok to Kohat) after start of construction work (adding the extra distance covered due to diversions): 75 km

Difference in distance covered before and after start of construction work: 8 km

Average Fuel Consumption of a coach: 3 km / litre

One-way Fuel Consumption of a coach before start of construction work: 22.33 litres

One-way Fuel Consumption of a coach after start of construction work: 25 litres

Cost of One way Fuel Consumption of a coach before start of construction work: Rs. 5337.66

Cost of One way Fuel Consumption of a coach after start of construction work: Rs. 5975

Difference in cost of one way fuel consumption before and after start of construction work: Rs. 637.34

Average daily running of a coach on N 55 in case study area: 150 km (A single trip)

Daily difference of cost of fuel consumption of a coach / daily fuel cost overrun of a coach: Rs. 1274.68

Monthly difference of cost of fuel consumption of a coach/ daily fuel cost overrun of a coach: Rs. 38,240.4

Annual difference of cost of fuel consumption of a coach/ daily fuel cost overrun of a coach: Rs. 4,58,884.8

Cost of fuel consumption of a coach for the period of delay (2021 – 2024) / fuel cost overrun of a coach for the period of delay (2021 – 2024): Rs. 18,35,539.2

Cost of fuel consumption of 1202 x coaches for the period of delay (2021 – 2024) / fuel cost overrun of 1202 x coaches for the period of delay (2021 – 2024): Rs. 2,20,63,18,118

| Hiace | Average petrol price in Rs | Actual distance | Increase in Distance | Average Fuel Consumption of Hiace | One-way Consumption before Construction | One-way Consumption after start of Consumption | One-way Consumption before Construction | One-way Consumption after start of Consumption |
|---|---|---|---|---|---|---|---|---|
| 1 | 239 | 67 | 67+8 = 75 | 3Ltr/km | 22.33 | 25ltr | 239*22.33= 5,336,.87 | 239*25= 5,975 |

| Difference in cost of one-way fuel consumption before and after start of construction work | Average daily running of a coach on N 55 in case study area | Daily difference of cost of fuel consumption of a coach |
|---|---|---|
| 5,975-5,336.66=637.34 | 75+75=150 | 637.34+637.34=1,274.68 |

| Monthly difference of cost of fuel consumption of a coach | Annual difference of cost of fuel consumption of a coach | Cost of fuel consumption of a coach for the period of delay |
|---|---|---|
| 637.34*30 = 38,240.4 | 38,240.4*12 = 4,58,884.8 | 38,240.4*4 = 18,35,539.2 |
| Cost of fuel consumption of 1202 x coaches for the period of delay (2021 – 2024) | | |
| 18,35,539.2*1202 = 2,20,63,18,118 | | |

**Cost of Tire**

Cost overrun due extra wear / tear of tires

Average tyres Price (2017 - 2024): Rs 1,20,000

Actual N 55 Distance covered in the case study (Jail Chok to Kohat): 67 km

N 55 Distance covered in the case study (Jail Chok to Kohat) after start of construction work (adding the extra distance covered due to diversions): 75 km

Difference in distance covered before and after start of construction work: 8 km

Average life / running of tyres: 30,000 km

Daily running before start of construction work: 134 km

Daily running after start of construction work: 150 km

Completion of tyres life before start of construction work: 223.88 days (7.4 months)

Completion of tyres life after start of construction work: 200 days (6.6 months)

Difference in completion of tyres life before and after start of construction work: 24 days (0.8 months)

Per day cost of tyres before start of construction work: Rs. 536

Per day cost of tyres after start of construction work: Rs. 600

Difference in daily cost of tyres before and after start of construction work: Rs. 64

Monthly difference of cost of tyres of a coach/ monthly tyres cost overrun of a coach: Rs. 1,920

Annual difference of cost of tyres consumption of a coach/ annual tyres cost overrun of a coach: Rs. 23,040

Cost of tyres of a coach for the period of delay (2021 – 2024) / tyres cost overrun of a coach for the period of delay (2021 – 2024): Rs. 92,160

Cost of tyres of 1202 x coaches for the period of delay (2021 – 2024) / tyres cost overrun of 1202 x coaches for the period of delay (2021 – 2024): Rs. 11,07,76,320

| Hiace | Average tires Price (2017 - 2024) | Actual distance | Increase in Distance | Completion of tyres life before start of construction work | Completion of tyres life after start of construction work | Difference in completion of tyres life before and after start of construction work | Per day cost of tyres before start of construction work | Per day cost of tyres after start of construction work |
|---|---|---|---|---|---|---|---|---|
| 1 | 120,000 | 67 | 67+8 = 75 | 223.88 days | 200 days | 24 days | 120,000/223.88 = 536 | 120,000/200 = 600 |

| Difference in daily cost of tyres before and after start of construction work | Average daily running of a coach on N 55 in case study area |
|---|---|
| 64 | 150 |

| Monthly difference of cost of tyres of a coach/ monthly tyres cost overrun of a coach | Annual difference of cost of tyres consumption of a coach/ annual tyres cost overrun of a coach | Cost of tyres of a coach for the period of delay (2021 – 2024) |
|---|---|---|
| 64*30 = 1,920 | 1920*12 = 23,040 | 23040*4 = 92,160 |

| Cost of tyres of 1202 x coaches for the period of delay (2021 – 2024) |
|---|
| 92,160* 1202 = 11,07,76,320 |

**Cost of Engine Oil**

Average engine oil Consumption of a coach: 5.5 litres / 3000 km

Average Engine Oil Price (2017 - 2024): Rs 1700 / litre

Average Cost of engine oil Consumption of a coach: Rs. 9,350 / 3000 km

Average Cost of engine oil Consumption of a coach for one km: Rs. 3.1

Average daily running of a coach on N 55 in case study area before start of construction work: 134 km (A single trip)

Average daily running of a coach on N 55 in case study area after start of construction work: 150 km (A single trip)

Difference in daily running before and after start of construction work: 8 km

Actual N 55 Distance covered in the case study (Jail Chok to Kohat): 67 km

N 55 Distance covered in the case study (Jail Chok to Kohat) after start of construction work (adding the extra distance covered due to diversions): 75 km

Running of 3000 km is at the cost of Rs. 9,350

Daily Cost of engine oil (134 km) before start of construction work: Rs. 417.63

Daily Cost of engine oil (150 km) after start of construction work: Rs. 468

Difference in daily cost of engine oil before and after start of construction work: Rs. 50.37

Monthly difference of cost of engine oil before and after start of construction work of a coach/ monthly engine oil cost overrun of a coach: Rs. 1,511.1

Annual difference of cost of engine oil before and after start of construction work of a coach/ annual engine oil cost overrun of a coach: Rs. 18,133.2

Cost of engine oil consumption of a coach for the period of delay (2021 – 2024) / engine cost overrun of a coach for the period of delay (2021 – 2024): Rs. 72,532.8

Cost of engine oil consumption of 1202 x coaches for the period of delay (2021 – 2024) / engine oil cost overrun of 1202 x coaches for the period of delay (2021 – 2024): Rs. 8,71,84,425.6

| Hiace | Average engine oil Consumption of a coach: | Average Engine Oil Price (2017 - 2024) | Average Cost of engine oil Consumption of a coach | Average Cost of engine oil Consumption of a coach for one km | Average daily running of a before start of construction work | Average daily running of a coach after start of construction work | Daily Cost of engine oil (134 km) before start of construction work | Daily Cost of engine oil (150 km) after start of construction work |
|---|---|---|---|---|---|---|---|---|
| 1 | 5.5 litres / 3000 km | Rs 1700 / litre | Rs. 9,350 / 3000 km | 9,350/3000 = 3.1 | 134 km (A single trip) | 150 km (A single trip) | 3.1*134 = 417.63 | 3.1*150 = 468 |

| Difference in daily cost of engine oil before and after start of construction work | Average daily running of a coach after start of construction work |
|---|---|
| 468-417.63 = 50.37 | 150 |

| Monthly difference of cost of engine oil before and after start of construction work of a coach/ monthly engine oil cost overrun of a coach | Annual difference of cost of engine oil before and after start of construction work of a coach/ annual engine oil cost overrun of a coach | Cost of engine oil consumption of a coach for the period of delay (2021 – 2024) |
|---|---|---|
| 50.37*30 = 1,511.1 | 1,511.1*12 = 18,133.2 | 18,133.2*4 = 72,532.8 |

| Cost of engine oil consumption of 1202 x coaches for the period of delay (2021 – 2024) |
|---|
| 72,532.8*1202 = 8,71,84,425.6 |

| **Cost of Accidents** | | | | |
|---|---|---|---|---|
| Vehicles | Bikes | Cars | Hiace | Truck |
| Number of Vehicles | 46 | 45 | 13 | 27 |
| Cost of Accident Repairing 1 Vehicle in Rupees | 20000 to 25000 | 300,000 to 350,000 | 800,000 to 1,000,000 | 1,000,000 to 1,500,000 |
| Cost of All Vehicles | 25000*46 = 1,150,000 | 350,000*45 = 15,570,000 | 1,000,000*13 = 13,000,000 | 1,500,000*27 = 40,500,000 |
| Total Accidents Repairing cost in Rupees | 70,220,000 | | | |

## Annexure E

Cost of Inaction: A Case Study Of N-55

Kohat to Karak Indus Highway Road Project

Social Cost Survey

Respondent's Name: _____

Respondent's Title: _____

Respondent's Experience: _____

Respondent's Address: _____

Question 1: Before construction began, how many minutes did you travel from Karak to Kohat?

_____

Question 2: If your travel time to work has increased because of construction, how many extra minutes do you spend in the vehicle?

_____

Question 3: How is your work productivity affected when you travel through this under construction road?

_____

Question 3: Did this road construction increase maintenance cost of your vehicle?

_____

Question 4: If yes, by what percentage maintenance cost increases?

_____ Less than 10 % 15 % 20 20 % to 40 % More than 40 %

Question 5: Did this road construction increase/decrease fuel cost of your vehicle?

_____

Question 6: If increases, by what percentage fuel cost increases?

_____ Less than 10 % 15 % 20 20 % to 40 % More than 40 %

Question 7: How much it costs to repair accidented car plying on this road, specially accidented due to road construction?