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**Analysis of Road Traffic Crash Cost Using the Human Capital Approach in Kailali
District**

by

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A THESIS

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DEGREE OF MASTER OF SCIENCE IN TRANSPORTATION ENGINEERING**

DEPARTMENT OF CIVIL ENGINEERING

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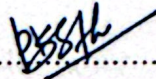
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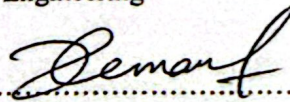
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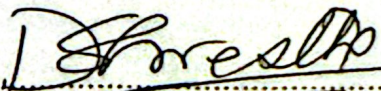
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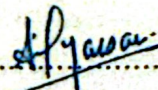
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ABSTRACT

Road traffic crashes impose significant economic and social burdens, particularly in developing countries like Nepal, where resources for road safety improvements are limited. For the FY2022–23 and FY2023–24, this study uses the Human Capital Approach to analyze the road traffic crash cost on respective crash data for 95% confidence interval in Kailali District. The study divides crash-related cost into six main categories: lost productivity, quality of life losses, medical expenses, property damage cost, damage-only crash and administrative cost. For the entire data analysis purpose Kailali District Traffic Police crash data were considered. During analysis the average age of fatality was found to be 38 years and 37 years for FY 2022-23 and FY 2023-24 respectively. Data were obtained from secondary source: Police, Hospitals, Insurance companies, Auto Repair workshop centers and Respective Vehicle Samiti. Questionnaire survey was done while collecting data from auto workshop related to damage crash only. The method adopted for data collection was non-probability purposive convenient sampling. The study also include calculation of lost output of care taker of victim while hospitalized and for follow up days, calculation of detention cost of commercial vehicle and calculation of medical cost as emergency cost, medicine cost and total cost excluding emergency cost and medicine cost with accuracy as data are obtained from database maintained by hospital. From 2022–2023 to 2023–2024, the total economic cost of crash increased by 38.93% from NPR 542.19 million to NPR 753.26 million, demonstrating a significant increase in the financial burden of traffic crash. The largest contribution to costs is still lost output, which accounted for 60.84% in 2022–2023 and 58.15% in 2023–2024. As the quality of life lost cost was calculated using net output method it results as the second highest contributor making up 27.98% in FY2022–23 and 27.53% in FY2023–24. Significant increases were seen in medical expenses and property damage, which went from 3.81% to 4.62% and 5.43% to 6.87%, respectively. Similarly administrative cost and damage only crash contribute 1.41% and 0.53% respectively for FY2022–23 and 1.98% and 0.84% respectively for FY2023–2024. With respect to severity level fatality contribute most to total cost from 80.52% in FY 2022-2023 to 79.05% in FY 2023-2024 then followed by serious injury which was 12.16% in FY2022-2023 and 13.75% in 2023-24. And minor injury contribute only 6.84% to 6.42%.The result emphasize the necessity for efficient road safety measures in Kailali District.

Keywords: Crash Cost; developing country; Fatalities; Human Capital Approach; Road traffic crashes.

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LIST OF ABBREVIATON

| | |
|------|----------------------------------------|
| ADB | Asian Development Bank |
| CBS | Central Bureau of Statistics |
| FY | Fiscal Year |
| RTI | Road Traffic Injury |
| HCA | Human Capital Approach |
| NRs | Nepalese Rupees |
| RTC | Road Traffic Crash |
| PGS | Pain, Grief and Suffering |
| TRL | Transport Research Laboratory |
| WHO | World Health Organization |
| DOTM | Department of Transport and Management |
| WTP | Willingness to pay |
| VOSL | Value of Statistical Life |

CHAPTER 1: INTRODUCTION

1.1 Background of Study

In Nepal's Kailali District, traffic crashes are a major problem that cause large financial losses as well as negative social effects. In addition to immediate medical costs and vehicle damage, these crashes often result in long-term productivity losses and administrative expenses. Calculating these expenses is crucial to comprehending the actual effects of traffic accidents and creating efficient traffic safety regulations.

Global status report on Road Safety states that road crashes cost many countries between 2% - 5% of their GDP including Nepal. (WHO 2023).

Despite owning just 60% of the world's motor vehicles, low- and middle-income countries suffer the most from traffic crashes, accounting for 92% of all road traffic fatalities worldwide. Economic hardship is made worse by this discrepancy, especially for low-income families who are ill-equipped to handle unforeseen medical and burial expenses (World Bank, 2024).

The Human Capital Approach (HCA), which takes into account both direct costs (such as medical bills, property damage, and administrative fees) and indirect costs (such as lost productivity, pain, and suffering), is frequently used to estimate the costs of traffic accidents. According to studies, crashes in underdeveloped countries may go unreported, which could result in an underestimating of their actual economic impact (Mofadal and Kanitpong, 2016).

The working-age population (18–59 years old) is disproportionately affected by fatal traffic crashes, which has long-term financial consequences for both households and entire countries. Families may become exhausted and their dependent ratios may rise as a result of losing their principal provider, thereby taxing social welfare systems (World Bank, 2024).

Putting money into road safety initiatives can pay off handsomely. Research shows that every \$1 invested in road safety enhancements yields \$5 to \$20 in increased economic productivity, fewer injuries, and saved lives (Alrukaibi et al., 2015).

When creating evidence-based policies to lower the number of fatalities and injuries, the cost estimation of traffic crashes is essential. Implementing preventive measures, like better road designs, more strong law enforcement, and public awareness programs, has been more successful in nations that have methodically evaluated the economic cost of traffic crashes (ND LEA Inc. et al., 2008).

The results of this study will assist stakeholders and policymakers in prioritizing road safety improvements, allocating resources effectively, and putting data-driven ideas into practice to lessen the financial burdens associated with crashes. This study intends to promote more robust road safety regulations in Kailali District by drawing attention to the monetary costs associated with crash.

Crash costing determines the overall cost incurred as a result of any road traffic crashes. It gives a picture of the direct costs incurred (medical, property damage) and even some indirect costs (loss of time, pain). Determining the level and variety of these expenditures deserves close attention by government bodies and decision makers in order to make sound strategic decisions on road safety measures and resource distribution.

The Human Capital Approach is frequently used in crash costing studies to estimate the economic loss caused due to the occurrence of road crashes. This methodology measures the loss of economic productivity including injuries or death, health expenses, and other similar costs. Though the relevance is international, the use of the Human Capital Approach in Nepal is scanty especially at the local municipality level. This study therefore seeks to fill this void by applying the Human Capital Approach to analyze the costs of road traffic crashes in Kailali District. It will assist in appreciating the costs associated with road crashes by extending its scope and thus assist in planning affordable road safety measures in the region.

1.2 Statement of the Problem

Road traffic crashes have been alarmingly increasing these years in Nepal, especially in expanding city like Dhangadhi Sub Metropolitan City, Godawari Municipality and Tikapur Municipality within Kailali district. The population growth rate of the Kailali District has increased significantly over recent years. According to the 2021 census, the population was 911,155 reflecting a growth from 775,709 in 2011 that marks an increase of approximately 17.5% over the decade which corresponds to an annual growth rate to about 1.75%, higher than the national average of 1.51% during the same period (CBS, 2021). The numbers of population and vehicle ownership is increasing in this region, the road network development and traffic organization go slower. There seems to have been an increase in crashes, as per District Traffic Police, Kailali number of crash increased by 66% from 115 in FY2022-23 to 191 in FY2023-24, number of fatality increased by 20% from 55 in FY2022-23 to 67 in FY2022-24, number of injuries increased by 48.73% from 197 in FY2022-23 to 293 in FY2022-24 and economically, a lot of loss due to lack of improvement in road crashes. Each crash is known to happen with its respective economic burden, but all available evidence shows that there is extremely scanty collection and analysis of the resources expended as a result of these crashes.

As per DOTM, Dhangadhi, Kailali the number of two wheelers increased by 9.09% from 5619 in FY2022-23 to 6130 in FY2023-24 and the number of three and four wheelers increased by 33% from 1311 in FY2022-23 to 1752 in FY2023-24 which show the more vehicular movement.

Previous studied were concentrated to Kathmandu Valley only (Samikshya Rizal, 2023) Analysis of Road Traffic Crash Cost in Kathmandu Valley. In *2nd International Conference on Integrated Transport for Sustainable Mobility*). This is why district like Kailali not yet done localized crash cost assessments that would be useful for informing targeted road safety policies and appropriate resource allocations. Without understanding the magnitude of an economic burden road crashes place on individuals, families, and the community the current road safety interventions and planning cannot be effectively done.

So, estimating the cost of crashes using the Human Capital Approach, the present study tries to fill this void in Kailali District.

1.3 Research Objectives

The research primarily seeks to estimate the total economic burden incurred by road traffic crashes in the Kailali District, applying the Human Capital Approach. The specific objectives are listed below:

- To determine the cost component of road traffic crashes in Kailali District.
- To perform a comparative analysis of the cost components based on severity level.

1.4 Scope of study

- The crash data for the FY2022-2023 and FY2023-2024 recorded by District Traffic Police, Kailali was taken for calculating the total RTC cost for the study area.
- The data that was taken from traffic police, selected hospitals, insurance firms and workshops were considered as reliable and valid.

1.5 Limitation of study

- For all analysis purpose only District Traffic Police, Kailali data was considered.
- Due to the lack of detailed data on road geometric parameters-such as lane width, curvature, and intersection design-which are critical for understanding the relationship between road design and crash occurrences. This data gap hinders the ability to accurately assess how specific road features contribute to crashes and their associated economic impacts.
- Data collection regarding hospital and workshop was limited to Dhangadhi sub Metropolitan City and Godawari Municipality as these are commercial and administrative center of Kailali district.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview of Crash Costing Method

Generally, road traffic crashes tend to be visualized as individual human losses or statistics of different groups. Unlike aviation and rail crashes, large-scale economic and social impact of road crashes are rarely appreciated because the deaths and casualties due to road crashes usually occur only in ones and twos. Road crash costing refers to an attempt at quantifying estimates of yearly total losses encountered by a country due to road crashes. Various methods used for crash costing include:

A. The gross output" (or human capital) approach

The sociocultural significance of road traffic crashes has been identified in many communities in which the fatalities resulting from a road traffic crash carry substantial emotional burden being sustained by their communities. Based on this concept now it's logical to consider social losses that were acquired directly due to the crash. In this perspective, only some of the identification methods can address the persistence of the pain within the framework of this approach. In the first approach, such losses could define ordinary economic terms. In the second approach, responsible economic losses acquisition mean that there were losses which the society expected to gain such revenue and income streams. Writing these approaches in chronological order creates some confusion about the meaning of several words in this context that belong to the same linguistic family. This also suggests in a general sense that pain from the loss suffered causes some distress that constrains society's activities by illustrating pain that pain caused disruption.

B. The "net output" approach

This is essentially the same as (A) with the important exception that the present value of the victim's lifetime expenditure is deducted from the gross output. It has also here to be possible in

principle to imagine how an estimate can be derived of what a person "consumes" in terms of food, fuel etc. over his or her lifetime. When this method was applied in the UK to valuing road crash, before being replaced in the early 1970's by the gross output method, the latter sum, "the total of consumers' expenditure and public authorities' current expenditure on goods and services" was divided by the total population. A crude estimate of "consumption per head" was thus derived. In this method the gap between an individual's gross output and his future consumption is regarded as one possible measure of the rest of society's economic interest in his continued survival.

C. The "life-insurance" approach

In this approach the value of a road crash or the value of crash prevention is taken to be directly related to the amounts for which typical individuals are willing (or even able) to insure their own lives (or limbs). It may be considered, however, that the amount of insurance cover provided might be some estimate on the part of the insured person of the value of his life to his dependants; it says nothing at all about the value of life to the insured person himself. Thus, a well-off bachelor with no dependents might have little or no life cover, while a much poorer person with several children might have his or her life insured for a much greater sum. The well-off bachelor might well, however, place a very high value indeed upon his own continued survival. Another problem with this approach is that the level of life insurance cover may be well below what it 'ought to be if the intention is to provide sufficient income on which his or her dependents are to survive. Further, to base any analysis on the insured population alone is almost certainly to choose a biased sample. This approach has limited value in developing countries, where relatively few people carry life insurance.

D. The "court award" approach

In the UK, the compensation awarded by courts to the dependents of individuals who are killed or injured in road accidents-whether caused by negligence or crime-can be viewed as an indication of how society values such losses, or the potential cost society places on preventing these incidents. However, the amount of compensation varies due to several complex factors, including the level of negligence on the defendant's part, whether the victim shares any responsibility, whether the

employer of the injured person continues to pay wages, and whether the victim is entitled to industrial injury benefits. These awards generally address only private losses and exclude public costs, such as healthcare expenses covered by the state. Additionally, the compensation awarded is subject to taxes. Given these multiple considerations, it is evident that using court awards as a way to measure the value of life or bodily injury in road crashes is an imprecise and imperfect method.

E. The "implicit public sector valuation" approach

This method tries to understand the costs and values that are implicitly placed on preventing crashes, whether through safety laws or public decisions about investing in safety programs. Unfortunately, when looking at values in Britain, there's a wide variation in how much life is valued-not just between different sectors, but even within the same sector (Mooney, 1977). For example, after a high-rise building partially collapsed in London, building regulations were updated. Estimates (Sinclair et al., 1972) suggested that the changes may have saved a few lives, but at a very high cost-putting the implied value of a life at over £20 million. On the other hand, around the same time, it was suggested (Heys et al., 1968) that a method to prevent stillbirths could be used regularly, costing only £50 per life saved. Since this method wasn't widely used in the UK at the time, this might suggest that £50 could be the maximum value placed on a life. These examples show a huge range-anywhere from less than £50 to over £20 million per life saved-and point to a possible misallocation of resources when it comes to life-saving efforts. This also highlights how imprecise it is to try to put a value on human life in these ways.

F. The "value of risk change" or "willingness to pay" method

This approach is based on the idea that when the public sector makes decisions about how to use limited resources, those decisions should reflect what people truly want and need, especially the ones who will be directly impacted (Jones-Lee, 1976; 1989). In this context, the value of improving road safety-like reducing the risk of crashes-is measured by how much people are willing to pay for it. It's similar to how much compensation someone would expect for taking on more risk. In simple terms, the value of a safety improvement is the total amount that people would be willing

to pay to reduce even a small risk to themselves or their loved ones. For example, the value of preventing a fatal crash is the combined amount that everyone affected would pay to reduce even a small chance of harm to themselves or those they care about. However, figuring out these values isn't as simple as it sounds.

To estimate these values, several studies have looked at situations where people actually make trade-offs between money and risk. One common approach is through surveys where individuals are asked how much money they would be willing to give up to reduce their own or others' risk of injury or death.

2.2 Human Capital Approach (HCA) in Crash Costing

The Human Capital Approach (HCA) is one of the most common ways to estimate the costs of road traffic crashes. Essentially, it calculates the financial losses caused by death, injury, or disability from traffic accidents. In this approach, the value of a person's life is determined by looking at the income they would have earned if they hadn't been involved in the crash. The HCA also considers both the direct and indirect costs of accidents, making it a widely used method in road safety economics.

In a study by Chin, Hague, and Jean (2006), the authors updated previous cost estimates of road traffic crashes that were originally studied by the Asian Development Bank (ADB). The ADB's report showed that, in 2001, road traffic accidents in the region cost S\$699.36 million, which was about 0.5% of the annual GDP. The updated study used more accurate methods to calculate the costs of human loss, lost productivity, and property damage. By 2003, the annual cost had grown to US\$610.3 million, or around 0.34% of the GDP. Additionally, the cost of a fatal accident was revised to a more conservative estimate of US\$878,000, compared to the previous estimate of S\$1.4 million. This research clearly shows that it's important to regularly update the costs of traffic crashes, as these numbers change over time depending on the number of accidents.

In a study conducted by Pichai Taneerananon in 2007, the costs associated with traffic crashes in Thailand were examined. The research focused on five provinces, each representing a different region of the country-Khon Kaen (northeast), Lampang (north), Nakhonsawan (central), Songkhla (south), and Bangkok (the capital). The study used the Human Capital Method (HCM) to analyze

data from 2004, a year in which 13,766 people lost their lives in traffic incidents. The costs were divided into three key areas: the human costs, which include lost productivity, medical expenses, long-term care, quality of life, and emergency services; the property damage costs, covering vehicle and non-vehicle damages; and the general traffic accident costs, which account for insurance, police and judicial services, emergency rescue operations, and travel delays. Additionally, the study calculated costs based on the severity of the accidents. Overall, the estimated total cost of road traffic accidents in Thailand for 2004 was 153,755 million baht, or approximately US\$ 3.46 billion.

In a 2015 study, Mohammad Reza Ahadi and Hesamoddin Razi-Ardakani looked into the financial impact of road traffic crashes in Iran using the Human Capital (HC) Method. Their research found that in 2009, these crashes cost the country about 114,455 billion Iranian Rials-or roughly US\$11.46 billion-which made up around 1.41% of Iran's total GNP that year. Most of this cost came from lost productivity and damage to property, while human costs, medical expenses, and administrative fees also made up a significant portion. The study also broke down the costs by the severity of the crashes-whether they resulted in death, serious injury, minor injury, or just property damage-giving a clearer picture of where the biggest impacts were felt.

In a 2016 study, researchers Adam I. A. Mofadal and Kunawee Kanitpong examined the financial burden of road traffic crashes in Sudan over the years 2010 and 2011. They applied a modified version of the widely accepted cost estimation framework, tailoring it to better capture both present and future aspects of crash-related costs within the Sudanese context. Their approach incorporated detailed crash data categorized by the severity of injuries, types of vehicles involved, and important economic factors like medical expenses, insurance details, and national discount rates.

The findings revealed that road traffic crashes cost Sudan an estimated US\$391 million in 2010-around 0.57% of the country's GDP. By 2011, this figure had increased to US\$413 million, representing about 0.62% of GDP. Although these numbers fall below 1% of the national GDP, the researchers argued that their method met the accepted standards of the Human Capital approach and produced credible, reliable estimates.

They also provided cost estimates based on the severity of each crash. For example, the cost of a single fatality was approximately US\$38,932 in 2010 and rose slightly to US\$39,508 in 2011. Disabilities were valued at US\$43,113 and US\$45,165, while serious injuries were estimated at

US\$6,963 in 2010 and US\$7,596 the following year. The cost for slight injuries ranged from US\$2,570 to US\$3,198, and damages involving only vehicles were valued at US\$2,268 in 2010 and US\$2,579 in 2011.

In a 2023 study, Sumayya Naznin P. H. and Sivanagu Gidugu analyzed the economic impact of road traffic crashes (RTCs) in Ernakulam, a city in southern India. The research used the Human Capital (HC) method, which is particularly effective for assessing crash costs in developing countries. To estimate the financial loss, the study drew from a variety of sources, including detailed police accident reports, survey responses, private hospital records, and repair bills from vehicle garages, with attention to the types of collisions involved.

The findings showed that the largest share of the total cost came from lost productivity, followed by medical expenses, vehicle repairs, and human-related losses. Administrative costs made up the smallest portion, contributing only 0.73% to the total. Overall, the estimated cost of road traffic accidents in Ernakulam between 2018 and 2021 ranged from approximately INR 66.96 crore to INR 103.05 crore. This accounted for 0.44% to 0.7% of the city's GDP-representing a significant and irreversible economic loss for the region.

(Samikshya Rizal, 2023) This paper study estimate the total road crash cost of Kathmandu Valley, which comprises of three district shares 7.8 % to 9.2% of fatalities and 52.5% to 60.5% of crashes of Nepal; based on the crash database for the fiscal year 2007 to 2020 for a 95% confidence interval. This study seeks to review the crash data contribution of Kathmandu Valley and calculate the road crash costing. The detailed road crash database was collected from Traffic police. The primary data regarding vehicle damage cost and medical cost was obtained from purposive convenient sampling, whereas insurance data was collected from sampled companies. Human Capital Approach was used for calculation of crash costing. The average age of fatalities was found to be 34 years, which is an economically active age group. The total cost of road crashes in Kathmandu Valley for the fiscal year 2020 was calculated a NRs. 1827.67 million. Among various components of crash cost, the total cost of lost output share 46.28 %, Vehicle damage cost shares 36.27 %, Medical cost shares 2.16 %, Administrative cost shares 6.01 % and Quality of life shares 9.25 % respectively. These high contributions of road crash costing justify the investment in road safety intervention within the Kathmandu Valley.

2.3 Causes of Road Crash

Several factors contribute to road crashes, as outlined by Hour (2007).

Human factors (Road users)

According to national road crash statistics (TPD, 2019), over 95% of crashes are caused by road users who break traffic laws. Examples include speeding, reckless driving, driving under the influence, using mobile phones while driving, and crossing roads outside of designated pedestrian crossings.

Road design and defect

Another significant factor contributing to road crashes is poor road design. When roads are not properly constructed, it increases the risk of crashes. This includes issues such as poorly positioned road signs, improperly placed barriers or guardrails, and incorrectly located speed bumps. Additionally, a lack of clear road markings and poorly maintained road surfaces can also make accidents more likely.

Vehicle defects

Vehicle defects are another major cause of road crashes. These issues can range from brake failures to tire blowouts. Faulty vehicle components, such as airbags that fail to deploy properly, can also result in more severe injuries during a crash and may even be fatal.

Weather and Climate

Bad weather is another significant factor contributing to road traffic accidents. Conditions like heavy rain, snow, or fog can reduce visibility and decrease friction on the road surface. This makes it more difficult for vehicles to maintain control, leading to skidding or slipping when braking, which increases the risk of collisions with other vehicles or objects.

According to the road traffic data recorded by the District Traffic Police, the cause of road crashes are mainly categorized into eight categories as speeding, distracted driving(negligence), driving under the influence of alcohol or drugs, cattle's on the road, technical fault (tire blow out), damage road, overloading and unlicensed driving. As per the crash report maintained by the Traffic Police

some of the major causes of crash for the fiscal year 2022-2023 and 2023-2024 in Kailali District is as shown in Table 2.3. reveals that, out of a total of 306 road crashes, the highest number were caused by speeding, followed by cattle on the road, distracted driving, and driving under the influence of alcohol or drugs.

Table 2. 3 Cause of road crash in Kailali District as per District Traffic Police

| CAUSE OF CRASH | NUMBER OF CRASH | |
|-------------------------------------------------|-----------------|---------|
| | 2022-23 | 2023-24 |
| Speeding | 75 | 143 |
| Distracted driving (negligence by driver) | 13 | 14 |
| Driving under the influence of alcohol or drugs | 8 | 11 |
| Cattles on the road | 13 | 15 |
| Technical Fault (Tire blow out) | - | 1 |
| Damage road | 4 | 2 |
| Overloading | 2 | 2 |
| Unlicensed driving | - | 3 |
| Total number of crashes | 115 | 191 |

Source: District Traffic Police, Kailali

CHAPTER 3: METHODOLOGY

3.1 Research Design

The research was conducted as shown in Figure 3.1. The research begins with literature review of past study on crash cost component followed by selection of study area.

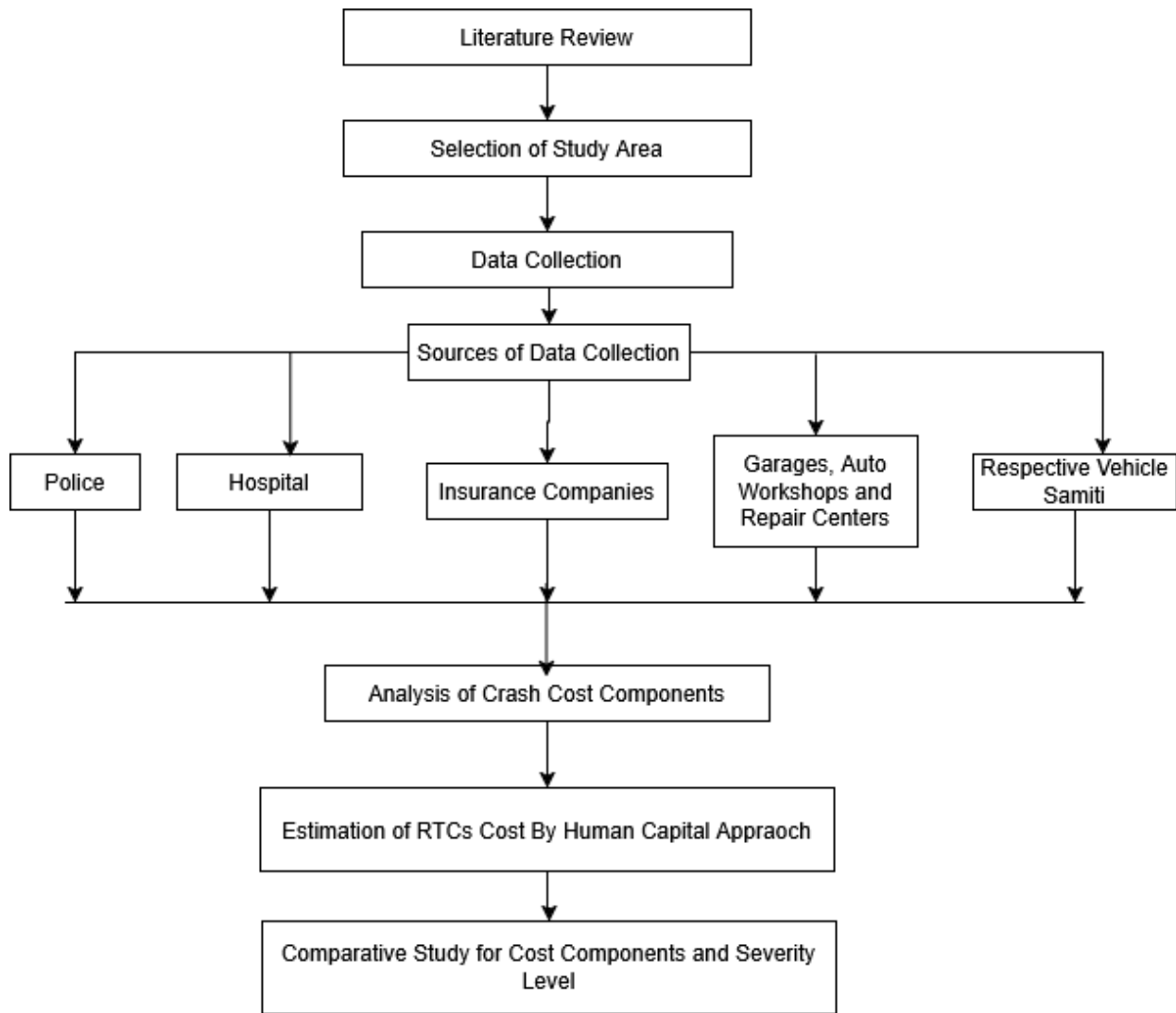


Figure 3.1: Flow Chart for Research Methodology

The crash data of FY2022-2023 to 2023-2024 were collected from the District Traffic Police, Kailali. The number of crashes and their severity level were necessary data for the calculation of total crash cost. Collected crash data were sorted as per number of crashes, severity of the crash, type of vehicle involved, and age of victims. The data collection includes the data from secondary source: Police, Hospitals, Insurance company, Auto Workshop and Respective vehicle samiti. Questionnaire survey was done while collecting data from vehicle samiti and Auto workshop for damage only crash. The fatal age of person involved in fatal crash was calculated from police data and wage rate from Kailali district rate to calculate loss output, for medical cost data were obtained from the record maintained by hospital. Vehicle damage cost data are obtained from three non-life insurance companies. There are twenty non-life insurance companies as per Nepal Insurance Authority. The purposive convenient sampling technique was adopted. The claim amount for vehicle damage of different types of vehicles was collected for the year FY 2022/2023 and FY2023/2024 from three insurance companies. And the number of damage only crash was obtained by questionnaire with Traffic police. The quality of life cost was calculated using Net output method and administrative cost was calculated as percentage basis suggested by Sillock and TRL.

The Gross Output (Human Capital) method was employed to estimate the costs of road traffic crashes. This approach is commonly used in both developed and developing countries. According to Mofadal and Kanitpong (2016), it has proven to be an effective tool for analyzing crash costs.

3.2 Selection of Study Area

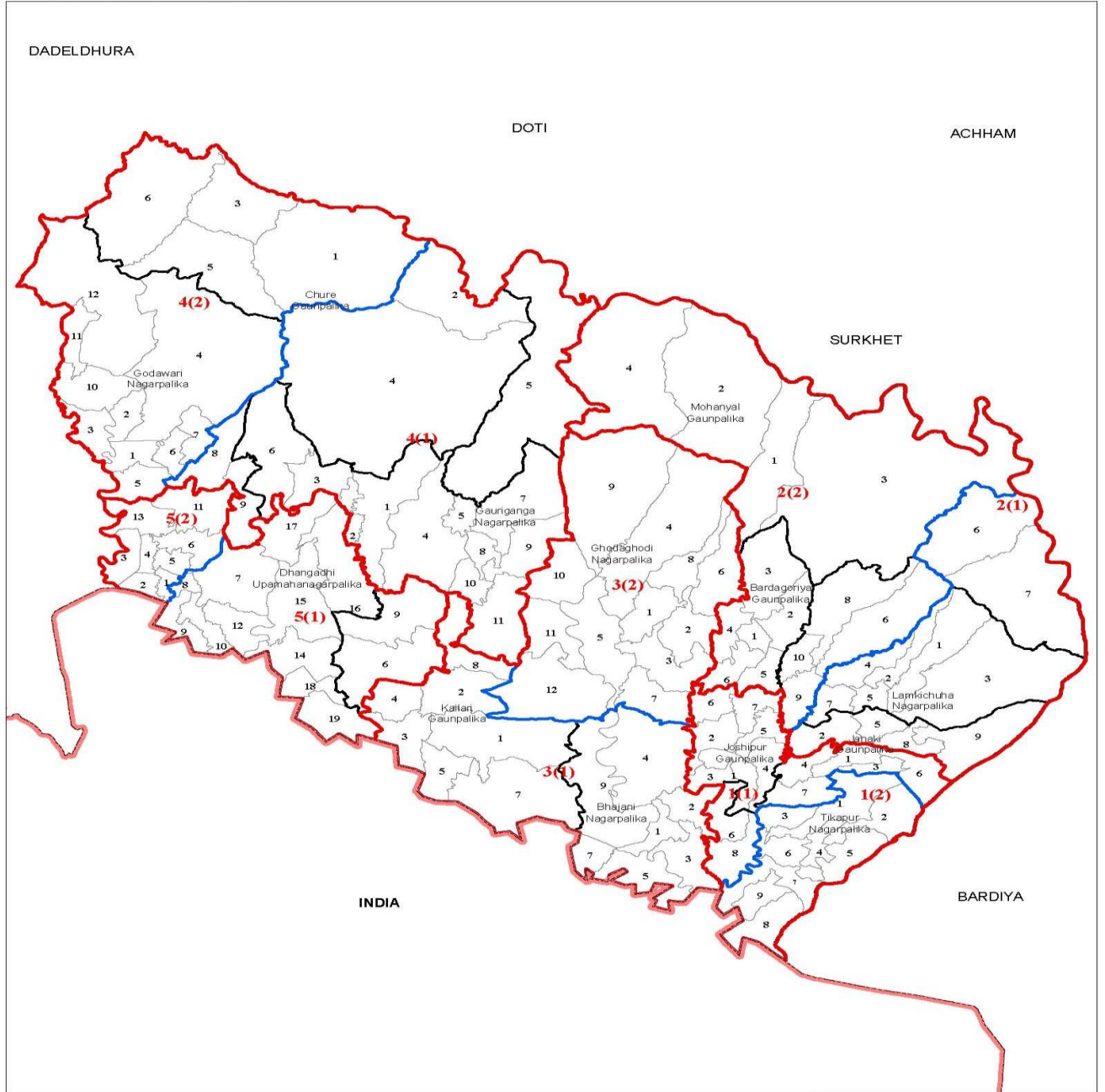
The increased population, vehicles, and the expanding road construction programs are some of the factors for increasing accidents/crashes (Alrukaibi, et al., 2015). At present, road traffic injuries rank as the seventh leading cause of death across all age groups. Road traffic death is seen to be high among low- and middle-income countries concerning the size of their population and the number of motor vehicles in circulation. (WHO, 2018). The situation described above is also observed in Kailali District, located in the Terai plain of Sudur Pashchim Province, one of the 77 districts of Nepal. The district's commercial and administrative centers are Dhangadhi and

Godawari, which serve as its district headquarters. Kailali covers an area of 3,235 square kilometers (1,249 sq mi) and has a population of 911,155 according to the 2021 census, compared to 775,709 in the 2011 census and 616,697 in the 2001 census. The population density is 279.6/km² as per 2021 census. The fast-emerging towns and infrastructures within this district provide a suitable model for the study of road traffic crashes. More people have come to town, and with that, the buildings have changed, adding more vehicles on the road and increasing traffic crashes. This situation is good in terms of taking a look at the cost of traffic crashes in a growing city. The problem of road traffic crashes is rising in city area within Kailali District. The city has seen an increase in more deaths, injuries, and damages from traffic. Increased road traffic crashes have made people shift the need for thorough studies into their economic effects. Road traffic crashes in Kailali range from minor ones to fatal ones. It is these various levels of severity that enable us to look at a number of types of human capital costs: loss of life, disability, medical expenses, and loss of productivity.

There is very limited research work precisely aimed at the economic impact of road traffic crashes in Nepal by applying the human capital (HCA). The majority of studies conducted in Nepal have focused on the issue of road safety or crash prevention without going deeper into the cost dimension using a human-capital framework. The study will, therefore, fill the literature gap and thus be very instrumental in offering relevant insight to policymakers, more so for cities undergoing rapid urbanization. The results can have national relevance in guiding traffic safety policies and resource allocation in other cities that are rapidly urbanizing in Nepal.

KAILALI

No. of House of Representative Constituency: 5
 No. of Provincial Constituency : 10



Legend

- International Boundary
- Province Boundary
- District Boundary
- House of Representative Boundary
- Provincial Constituency Boundary
- Palika Boundary
- Ward Boundary
- Sanskritik Area
- National Park/Wildlife Reserve/Hunting Area/Watershed Area

Spatial Data Source : Survey Department
 Population Data Source : Population Census 2011, CBS
 Government of Nepal

Note:
 1 in 1(1) indicates House of Representative Constituency Number and (1) indicates Province Constituency Number within the House of Representative Constituency Number and likewise.

Prepared By: Electoral Constituency Delineation Commission (ECDC), 2074

Figure 3.2: Study Area Map

3.3 Data Collection and Sources

Secondary data is crucial for triangulating the information obtained from sources and enhancing the reliability of analysis. This data will enable us to evaluate the wider effects of road traffic crashes on public health, the economy, and infrastructure.

3.3.1 Police Records

Objective: Collect official reports and statistics on traffic crash in Kailali District, including crash frequency, severity, causes, types of vehicle involvement, age of victim, gender, crash location, response time and details on fatalities or injuries.

Data Collected

- Crash reports (including date, location, cause, number of vehicles involved, casualties).
- Severity of crash (fatalities, injuries).
- Driver and vehicle details (age of drivers, type of vehicle, whether alcohol or drugs were involved, etc.).

Method: Obtain access to District Traffic police records through formal requests.

3.3.2. Hospitals

Objective: Gather data on the medical treatment costs incurred due to traffic crash. This includes hospitalization records, medical procedures, and rehabilitation costs.

Data Collected:

- Number of crash-related admissions.
- Treatment details (emergency care, surgeries, physical therapy).
- Length of hospitalization and recovery period.
- Direct medical costs (e.g., surgeries, medications).

Method: Contact local hospitals (one government four private) to access records of traffic crash victims.

3.3.3 Insurance Companies:

Objective: Collect data on the financial compensation paid out by insurance companies due to traffic crash. This data can provide insight into the broader economic impact of crashes.

Data Collected:

- Number of claims filed for traffic crash in Kailali District
- Types of claims (vehicle damages) and category of vehicle as commercial, Private and Motorcycle.
- Average payout per claim.

Method: Formal request for data to respective insurance companies head office, ensuring the confidentiality of individual claims and compliance with data protection regulation.

3.3.4. Garages, Auto Workshop and Repair Centre:

Objective: To know the financial costs associated with vehicle damage from road traffic crash, which contribute to the overall economic burden of crashes.

Data Collected:

- Types of vehicle damage (minor, severe).
- Repair costs.
- Time taken for repairs and associated costs.

Method: Approach local garages and towing companies to obtain data on average costs for vehicle repairs related to road traffic crash.

3.3.5. Respective Vehicle Samiti

Objective: To know the vehicle detention cost.

Data to Collect:

- Time period for which the vehicle was out of work.
- Average revenue that particular vehicle generate per day.

Method: Approach local respective vehicle samiti.

Consideration for crash data collection:

According to a road crash costing study in 2017, the average number of days for home recovery for major and minor injuries was 20 days and 3 days, respectively. This same duration was used for the current study. The number of hospitals considered was determined through purposive convenience sampling. Hospitals were selected based on the casualties reported in the crash data from the District Traffic Police of Kailali for the fiscal years 2022-2023 and 2023-2024, which identified thirteen hospitals. However, for the study, five hospitals were selected. The road crash data from Kailali District Traffic Police indicated that casualties were typically referred to the nearest available hospital, whether government or private. Therefore, one government hospital, Seti Provincial Hospital, and four private hospitals-Nisarga Hospital, Maya Metro Hospital Pvt. Ltd, Navajeevan Hospital Pvt. Ltd, and Padma Hospital-were included in the study.

For the vehicle repair cost data, 6 auto workshop and repair centers was taken for the study. The auto workshop is chosen in such a way that it would cover mostly used vehicle companies of all types of vehicles like Tata, Bajaj, Hero, Honda, Mahindra, Yamaha, and Suzuki. As per data of traffic police maximum number of vehicles involved was a motorcycle and then followed by car/jeep/van and then bus and truck. So, the number of repair workshops of the motorcycle was taken more as compared with of rest of the vehicle.

3.4 Analysis of Crash Cost Component

A table that outlines the typical cost components of road crash costs.

Table 3.4: Typical Crash Cost Components

| Cost Component | | |
|------------------------|-----------------------|------------------------------------------------------------------------|
| Human Cost | Loss of Productivity | Fatality loss of output |
| | | Major Injury loss of output (off-work-cost) |
| | | Minor Injury loss of output (off-work-cost) |
| | | Care taker loss of output (off-work-cost) |
| | Quality of Life Costs | Net Output Method |
| | Medical cost | Major and Minor Injury Emergency cost (EC) per fatal crash |
| | | Major and Minor Injury Medicine cost (MC) per fatal crash |
| | | Major and Minor Injury total cost excluding EC and MC per fatal crash |
| | | Major and Minor Injury Emergency cost (EC) per Injury crash |
| | | Major and Minor Injury Medicine cost (EC) per Injury crash |
| | | Major and Minor Injury total cost excluding EC and MC per Injury crash |
| | Property Damage Cost | Vehicle repair cost |
| | | Vehicle Detention period cost |
| Damage only crash cost | | |
| Administrative Cost | | |

3.5 Estimation of RTCs by Human Capital Approach

The Human Capital Approach include estimation of loss of productivity, quality of life costs, medical expenses, property damage costs, costs associated with damage- only crashes and administrative costs as explained in following section:

3.5.1 Loss of Productivity:

The economic loss resulting from a person's inability to work due to injury or fatality caused by a crash. It includes lost wages as explained below:-

- a. Fatality loss of output= [No. fatalities] * [foregoing income per year] using equation mentioned in chapter 4.

*Numbers of fatal crash is obtained from Traffic police data which was 55 and 66 for fiscal year 2022-203 and 2023-2024 respectively and also fatal age was found to be 38 and 37year for F/Y2022-23 and 2023-24 respectively. The lost year was obtained by subtracting the fatal age from average age of retirement of government services i.e. 58 years and found to be 20 years and 21 years respectively. The wage rate per day is obtained from Kailali district rate of respective F/Y which was NRs.1016 and NRs.1065 respectively and value of r is taken as 3 percent. The average numbers of Length of stay in hospital and follow up days for home recovery for major and minor injury is obtained from 2017 RTI costing study in Nepal which was 7 and 20 for major injury and 3 days for minor injury. Also this data is validated by calculating the difference between the date of admission of patient and date of their discharge and interviewing with doctors for follow up days which is found to be same as above.

- b. Major Injury loss of output= [No. of serious injuries] * [No. of days in hospital +No. of follow up days] * [average wage per day]
 - c. Minor Injury loss of output= [No. of serious injuries] * [No. of days in hospital +No. of follow up days] * [average wage per day]
 - d. Lost output of care taker= [No. of injuries by severity] * [No. of day to take care] *[average wage per day]
- *No. of carer to injury =1:1

3.5.2 Quality of Life Costs

The economic valuation of the loss of well-being and life satisfaction due to a fatal crash. It represents the non-economic burden on the victim's family and society, including emotional distress, grief, and the irreversible loss of life.

It is calculated using the Net Output Method. Quality of life costs is equal to difference in amount he/ she can earn if alive and amount he/she consumes during life time. Amount that would be earned was equal to lost productivity of fatalities and amount consumed was obtained from the study survey of Nepal living life standard from 1995 to 2023 conducted by National Statistical data found to be NRs.156330 per year which was average of 20% richest and 20 % poor annual nominal consumption per capita.

3.5.3 Medical Costs

The expenses incurred for the treatment of crash victims, including emergency care, hospitalization, rehabilitation, medication, and follow-up treatments. The medical cost is calculated for injury crash only and the cost is categorized as emergency cost, medicine cost and total cost excluding EC and MC and calculated as mentioned below:

- a. Major and Minor Injury Emergency cost (EC) per fatal crash = Total Emergency cost from database maintained by hospital divided by numbers of major and minor injury for fatal crash
- b. Major and Minor Injury Medicine cost (MC) per fatal crash = Total Medicine cost from database maintained by hospital divided by numbers of major and minor injury for fatal crash
- c. Major and Minor Injury total cost excluding EC and MC per fatal crash = Total cost exclusive of EC and MC from database maintained by hospital divided by numbers of major and minor injury for fatal crash.
- d. Major and Minor Injury Emergency cost (EC) per Injury crash = Total Emergency cost from database maintained by hospital divided by numbers of major and minor injury for injury crash
- e. Major and Minor Injury Medicine cost (MC) per Injury crash = Total Medical cost from software maintained by hospital divided by numbers of major and minor injury for injury crash

- f. Major and Minor Injury total cost excluding EC and MC per Injury crash = Total Emergency cost from database maintained by hospital divided by numbers of major and minor injury for injury crash.

3.5.4 Property Damage Costs

The financial loss due to damage to vehicles. This includes repair or replacement costs for vehicles, and revenue lost due to vehicle being out of work. It was calculated as explained below:

- a. Vehicle Damage cost = [No. of total vehicles damaged] * [average vehicle damage costs]

-The total number of vehicle damage with this category commercial, private and motorcycle was obtained from Traffic police. The average vehicle damage cost is obtained from Insurance companies and Auto workshop and Repair centers. For each category of vehicle respective costs for vehicle damage, injury, fatal, and property damage cost was determined. The mean value of the cost of the claim from three insurance companies was calculated.

In the case of repair cost data, auto workshop were consulted. Based on the checklist for key informant interviews, information regarding the number of road traffic crash cases that come for repair annually, the severity of the damage, portion of damage, labor charge, the average repair cost was collected. From the obtained data tentative mean value of the cost of repair for different category of vehicle provided by different workshop were calculated.

Then the overall mean value of data of insurance companies and data of workshop and repair centers were calculated.

-The net vehicle damage cost was obtained after subtracting the salvage value of vehicle, adding duty and Vat on spare parts and amount of spare parts is taken as two- third of repair cost and adding surveyor cost. As per IRD duty on spare parts is 25 percent and Vat was 13 percent. Finally, total vehicle damage cost per fatal crash and injury crash was determined by multiplying with the sum of weighted value of the cost of all the vehicles with the number of vehicles involved as per fatal and injury- related crashes.

- b. Vehicle Detention cost = Total numbers of vehicle repaired * Average vehicles repaired period * average revenue generated per day. All data regarding this is obtained from the respective vehicle samiti by Questionnaire survey.

3.5.5 Damage only crash cost

The cost associated with crashes that result in property damage but do not involve injuries or fatalities. The above crash cost component contribute to the total cost resulting from causality crashes. However, there are also a significant number of road-crashes which do not involve any casualties but vehicle damage only road traffic crash. The total numbers of the damage only crash was obtained as the average of 40 percent of total crash for that particular year by inquiry with Traffic police and repair center which was 123 and 174 for respective FY. Then the weighted average unit cost for the vehicles involved in damage- only road traffic crashes was determined with the percentage of involvement of vehicle in a road traffic crash was calculated. Finally, the total cost of damage-only road traffic crashes was calculated by multiplying the number of vehicles involved in such crashes by the weighted average unit cost of the vehicles.

3.5.6 Administrative Cost

Administrative costs encompass expenses related to the police, court, and insurance. These costs were calculated as a percentage of the total resource cost, following the method suggested by Silcock and the Transport Research Laboratory. The total resource cost was determined by adding up the costs for lost productivity, medical expenses, and property damage. For fatal crashes, administrative costs were estimated at 0.2% of the total resource cost. As outlined by Silcock and the Transport Research Laboratory (2003), for major injuries, administrative costs were set at 4% of the total resource cost, while for minor injuries, the cost was 14%, and for damage-only crashes, it was 10%.

The total costs, including lost output, quality of life, medical expenses, property damage, and administrative costs, were calculated for both fatal and injury crashes. In the final step, the total cost of casualties from road traffic crashes was determined by adding the costs of fatal crashes and injury crashes. Therefore, the overall cost of road traffic crashes in Kailali District was calculated by combining the casualty costs with the costs from damage-only crashes.

Total Cost of Road Crash=Total Causality Cost+ Total Damage Only Cost

CHAPTER 4: RESULT AND DISCUSSION

4.1 Characteristics of Road Crash

A total of 162 vehicles were involved in road traffic crashes, of which 3 were Truck/Tanker, 1 was Tipper, 2 were Dozer/Loader/Excavator, 11 were Bus, 5 were micro, 11 were Car/Jeep, 17 were Tractor, 3 were Auto, 9 E-Ricksaw, 98 motorcycle and 1 other. Fig. 4.1 shows the composition of different vehicle involvement in traffic crashes for the fiscal year 2022-23. It also indicated that Motorcycle (60%), Bus (7%), Truck (2%), Micro (3%), Car/Jeep (7%), Tractor (10%), E-Ricksaw (6%) Auto (2%), Tipper (1%) and others (1%) were frequently involved in Road Traffic Crash in Kailali District for the year 2022-23.

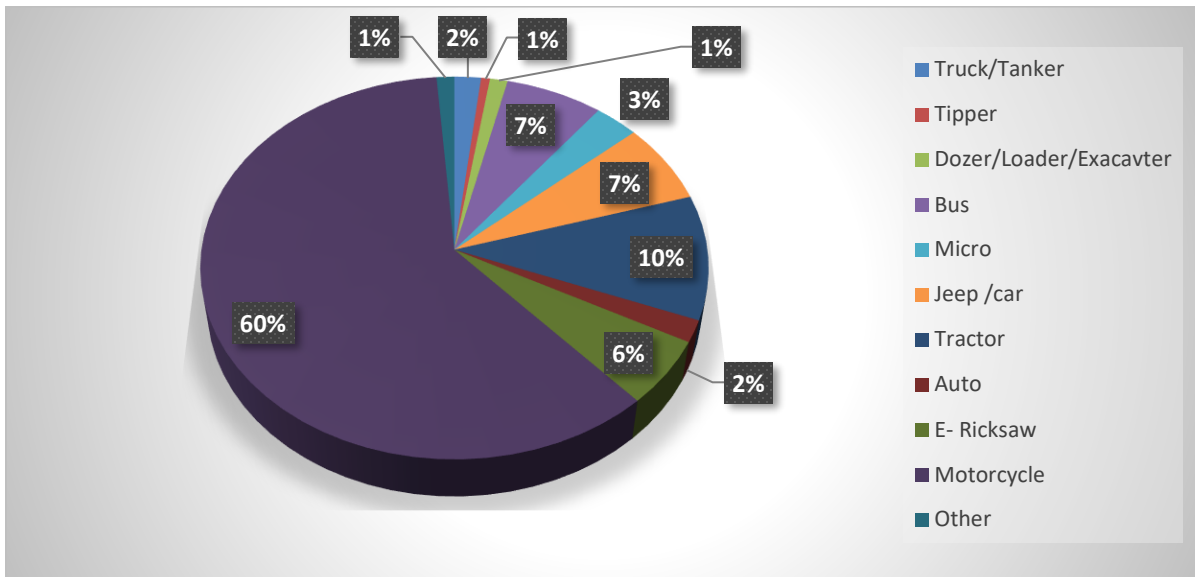


Figure 4.1 Vehicles involvement distribution in a road crash of Kailali District for FY2022-23

A total of 257 vehicles were involved in road traffic crashes, of which 13 were Truck/Tanker, 4 were Tipper, 2 were Dozer/Loader/Excavator, 14 were Bus, 4 were micro, 17 were Car/Jeep, 17 were Tractor, 11 were Auto, 20 E-Ricksaw, 154 motorcycle and 1 other. Fig. 4.2 shows the composition of different vehicle involvement in traffic crashes for the fiscal year

2023-24. It also indicated that Motorcycle (60%), Bus (5%), Truck (5%), Micro (2%), Car/Jeep (7%), Tractor (7%), E-Rickshaw (8%), Auto (4%) and others (less than 1%) were frequently involved in Road Traffic Crash in Kailali District for the year 2022/23.

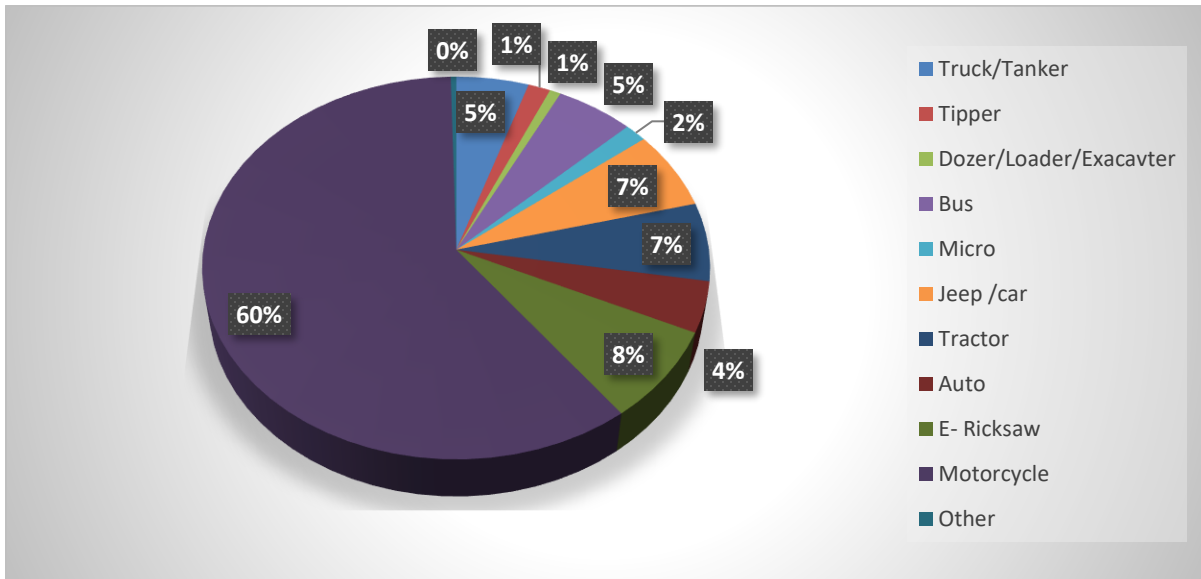


Figure 4.2 Vehicles involvement distribution in a road crash of Kailali District for FY2023-24

The involvement of male in crash is more than female with age between 15-29 and 30-44. As the involvement of two wheeler (motorcycle) is more the number of involvement of male is more.

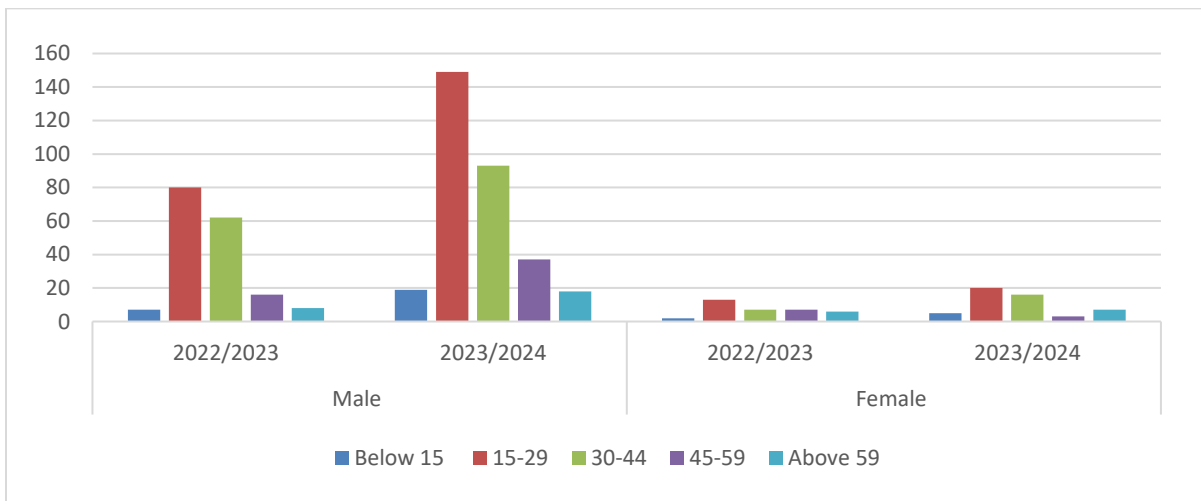


Figure 4.3 Age Groups and Gender Involvement in Road Crashes in Kailali District.

The chart below illustrates that the number of major injury crashes is rising, with fatalities increasing by 20% from FY 2022-2023 to FY 2023-2024. Major injuries also rose by 70% during the same period, while minor injuries increased by 26%.

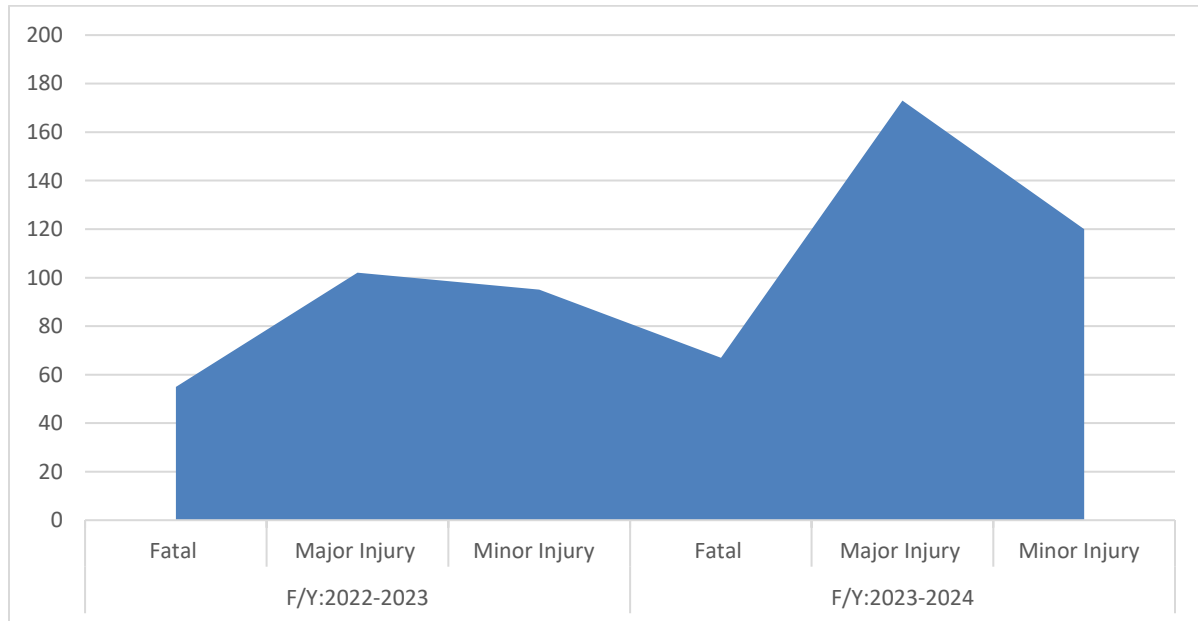


Figure 4.4 Severity Level in road crash of Kailali District for FY2022-23 and FY 2023-24.

4.2 Calculation of the Cost of Road Crash

4.2.1 Lost output

The lost output per fatal casualty was calculated by summing the lost output for all future years, using the following equation (1) (Silcock and Transport Research Laboratory, 2003).

$$\text{Loss of productivity /lost output} = \sum_0^n w/(1+r)^n \dots \dots \dots \text{Eq. (1)}$$

Here, w = average yearly wage rate of Kailali District

r = discount rate

n = average number of years of lost output per fatal causality

The discount rate is taken as 3% per year as previous RTI costing study in 2017.

Table 4.1 Wage rate for an unskilled worker

| F/Y:2022/23 | | | |
|--------------------|--------------------------|-------------------------------------------------|------------------|
| District | Manpower Category | Manpower Type | Wage Rate |
| Kailali | unskilled | Labor | 675 |
| | unskilled | Guard | 675 |
| | unskilled | Camp worker | 675 |
| | unskilled | Chain man | 675 |
| | unskilled | Electrical line worker | 675 |
| | unskilled | Helper | 675 |
| | unskilled | Plumbing helper | 675 |
| | unskilled | Road supervisor | 675 |
| | unskilled | Road Length worker | 675 |
| | unskilled | Irrigation worker | 675 |
| | unskilled | Irrigation Gate Operator | 675 |
| | unskilled | Waste and Drain cleaner | 890 |
| | | The average rate for an unskilled worker | |
| F/Y:2023/24 | | | |
| Kailali | unskilled | Labor | 680 |
| | unskilled | Guard | 680 |
| | unskilled | Camp worker | 680 |
| | unskilled | Chain man | 680 |
| | unskilled | Electrical line worker | 730 |
| | unskilled | Helper | 680 |
| | unskilled | Plumbing helper | 680 |
| | unskilled | Road supervisor | 680 |
| | unskilled | Road Length worker | 680 |
| | unskilled | Irrigation worker | 680 |
| | unskilled | Irrigation Gate Operator | 680 |
| | unskilled | Waste and Drain cleaner | 895 |
| | | The average rate for an unskilled worker | |

Table 4.2 Wage rate for semi-skilled worker

| F/Y:2022/23 | | | |
|--------------------|--------------------------|----------------------|------------------|
| District | Manpower Category | Manpower Type | Wage Rate |
| Kailali | semi-skilled | Mason | 950 |
| | semi-skilled | Meter Reader | 0 |

| F/Y:2022/23 | | | |
|--------------------|--------------------------|-------------------------------------------------|------------------|
| District | Manpower Category | Manpower Type | Wage Rate |
| | semi-skilled | Plumber | 950 |
| | semi-skilled | Senior Supervisor | 700 |
| | | The average rate for semi-skilled worker | 650 |
| F/Y:2023/24 | | | |
| | semi-skilled | Mason | 955 |
| Kailali | semi-skilled | Meter Reader | 730 |
| | semi-skilled | Plumber | 955 |
| | semi-skilled | Senior Supervisor | 705 |
| | | The average rate for semi-skilled worker | 836.25 |

Table 4.3 Wage rate for skilled worker

| F/Y:2022/23 | | | |
|--------------------|--------------------------------------------|--------------------------------------------|--------------------------|
| District | Manpower Category | Manpower Type | Wage Rate |
| Kailali | skilled | Senior Supervisor | 700.00 |
| | skilled | Driver | 1115.08 |
| | skilled | Amin / Assistant computer Operator | 1062.00 |
| | skilled | Computer operator | 1265.46 |
| | skilled | Sub Engineer | 1335.77 |
| | skilled | Lab Technician | 1143.38 |
| | skilled | Heavy Equipment operator | 1447.23 |
| | skilled | Light Equipment operator | 1282.27 |
| | | The average rate for skilled worker | 1039.02 |
| F/Y:2023/24 | | | |
| Kailali | skilled | Senior Supervisor | 705 |
| | skilled | Driver | 1115.08 |
| | skilled | Amin / Assistant computer Operator | 1062.00 |
| | skilled | Computer operator | 1265.46 |
| | skilled | Sub Engineer | 1335.77 |
| | skilled | Lab Technician | 1143.38 |
| | skilled | Heavy Equipment operator | 1447.23 |
| | Kailali | skilled | Light Equipment operator |
| | The average rate for skilled worker | 1039.58 | |

Table 4.4 Wage rate for highly skilled worker and average wage rate of RTC

| District | Manpower Category | Manpower Type | Wage Rate |
|-----------------------------------------------|--------------------------|--------------------------------|------------------|
| Kailali (2022/23) | highly skilled | Engineer -Gazetted third class | 1680.71 |
| Kailali (2023/24) | highly skilled | Engineer -Gazetted third class | 1680.71 |
| The average rate for highly skilled worker | | | 1680.71 |
| Overall average for the fiscal year 2022-2023 | | | 1015.56 |
| Overall average for the fiscal year 2023-2024 | | | 1064.56 |
| The average wage rate of RTC for FY2022-23 | | | 1016 |
| The average wage rate of RTC for FY2023-24 | | | 1065 |

Source: Kailali District Rate

For F/Y 2022-23 the average wage rate per day for unskilled of kailali was calculated as NRs.692.92 as per the district wage rate. Similarly, for semi-skilled, skilled, and highly skilled average wage rate per day was NRs.650, NRs.1039.02 and NRs.1680.71 respectively.

For F/Y 2023-24 the average wage rate per day for unskilled of kailali was calculated as NRs.702.08 as per the district wage rate. Similarly, for semi-skilled, skilled, and highly skilled average wage rate per day was estimated as NRs.836.25, NRs.1039.58 and NRs.1680.71 respectively.

Then the average wage rate of casualties was taken as the average daily wage rate in Kailali District which was found to be NRs.1016 per day and NRs.370,680 per year for FY2022-23. Similarly for FY 2023-24 it was found to be NRs.1065 per day and NRs.388563 per year.

As per traffic data of Kailali District for the fiscal year 2022/23, 55 fatalities were reported in 55 numbers of fatal crashes and for FY 2022023-24, 67 fatalities were reported in 66 numbers of fatal crashes. The average age of RTC fatality was determined by analyzing age of 55 and 67 fatalities. The average age of RTC fatality was found to be 38 for FY 2022-23 and 37 for FY 2023-24. The retirement age is taken as 58 as per the Nepal government (Nepal Law

Commission, 1993), So number of years lost due to road traffic fatalities was determined by calculating the difference between the average age of the RTC casualty and the retirement age.

Table 4.5 Numbers of year lost of victims

| Fiscal Year | Average age of death | Retirement age | Years lost |
|-------------|----------------------|----------------|------------|
| 2022-23 | 38 | 58 | 20 |
| 2023-24 | 37 | 58 | 21 |

The yearly wage rate of causality (w) = NRs.370680 and NRs.388563 for respective FY

Table 4.6 Average cost of lost output per fatality

| FY | Yearly wage Rate of Casuality | discount rate (r=3%) | n=0 | n=1 | n=2 | n=3 | | n=20 | n=21 | Total |
|---------|-------------------------------|----------------------|---------|---------|---------|---------|-------|---------|---------|-----------|
| 2022-23 | 370,680 | 0.03 | 370,680 | 359,884 | 349,402 | 339,225 | | 205,237 | - | 5,885,464 |
| 2023-24 | 388,563 | 0.03 | 388,563 | 377,245 | 366,258 | 355,590 | | 215,138 | 208,872 | 6,378,264 |

As a result, the average cost of lost output for the fatality was calculated as NRs.5,885,464 and NRs.6,378,264 respectively for FY 2022-23 and FY 2023-24 by considering the wage rate to be constant throughout the number of years of lost output without considering the inflation rate.

Similarly, the average length of hospital stay for treatment was determined as 7 days as per survey data of hospitals, and home recovery days were taken as 20 days as per 2017 RTI costing studies in Nepal. Therefore, the average output loss per major injury was calculated by multiplying the sum of the average length of stay in hospital for treatment and home recovery days i.e., 27 days by the average wage rate per day of Kailali district which was found to be NRs.27,432 and NRs.28,755 for FY 2022-23 and FY 2023-24 respectively. Similarly, the average lost output per minor injury was calculated as NRs.3,048 and NRs. 3,195 for FY 2022-23 and FY 2023-24 respectively which is shown in Table 4.7.

Table 4.7 Average lost output per RTC casualty

| Lost output | Time | Cost per unit | Cost |
|-------------|----------|--------------------------------------|----------------|
| Fatality | | | |
| FY 2022/23 | 20 years | NRs. 3,70,680 discounted @ 3%/yr. | NRs. 5,885,464 |
| FY 2023/24 | 21 years | NRs. 3,88,563 discounted @ 3%/yr. | NRs. 6,378,264 |
| Major | | | |
| FY 2022/23 | 27 days | NRs. 1016/day x 27 | NRs.27,432 |
| FY 2023/24 | 27 days | NRs. 1065/day x 27 | NRs.28,755 |
| Minor | | | |
| FY 2022/23 | 3 days | NRs. 1016/day x 3 | NRs.3,048 |
| FY 2023/24 | 3 days | NRs. 1065/day x 3 | NRs.3,195 |

Source: Corresponding hospitals, District wage rate

According to the traffic data for FY 2022-23, there were a total of 55 fatal crashes and 55 fatalities. The total number of injury crashes was reported to be 60. Among the fatal crashes, 23 resulted in major injuries and 48 in minor injuries. For injury crashes, there were 79 major injuries and 48 minor injuries reported.

In FY 2023-24, there were 66 fatal crashes and 67 fatalities. The total number of injury crashes reported was 125. Among the fatal crashes, 31 resulted in major injuries and 34 in minor injuries. For injury crashes, 142 major injuries and 86 minor injuries were reported.

Therefore, the fatality rate per fatal crash was calculated by dividing the total number of fatalities by the total number of fatal crashes. Similarly, for major and minor injury cases, the values were calculated by dividing the number of major injuries by the total number of fatal crashes, and the number of minor injuries by the total number of fatal crashes, respectively. For injury crashes, the number of major casualties was determined by dividing the number of major injuries by the total number of injury crashes, while the number of minor casualties was calculated by dividing the number of minor injuries by the total number of injury crashes. The results are summarized in Table 4.8.

Table 4.8 Number of casualties as per fatal and injury crash

| Fatal crash | | | | Injury Crash | | | |
|--------------------|------|--------------|------|--------------------|------|--------------|------|
| Nos. of casualties | | | | Nos. of casualties | | | |
| FY: 2022-23 | | FY: 2023-24 | | FY :2022-23 | | FY: 2023-24 | |
| Fatality | 1 | Fatality | 1.02 | Major Injury | 1.32 | Major Injury | 1.14 |
| Major Injury | 0.42 | Major Injury | 0.47 | Minor Injury | 0.78 | Minor Injury | 0.69 |
| Minor Injury | 0.87 | Minor Injury | 0.52 | | | | |

Source: District Traffic Police, Kailali

As per Table 4.8 for FY 2022-23 every fatal crash, 1 fatality occur 0.42 major injuries and 0.87 minor injuries and for FY 2023-24 every fatal crash, 1.02 fatalities occur 0.47 major injuries and 0.52 minor injuries. Similarly, for FY 2022-23 on every injury crash 1.32 major injury and 0.78 minor injury occur and for FY 2023-24 on every injury crash 1.14 major injury and 0.69 minor injury occur.

For FY 2022-23, the cost of lost output per fatality, major injury, and minor injury per fatal crash was calculated as NRs. 5,885,464, NRs. 11,472, and NRs. 2,660, respectively. The cost of lost output for major and minor injuries per injury crash was calculated as NRs. 36,119 and NRs. 2,388, respectively. Similarly, the total cost of lost output per fatal crash and injury crash was calculated as NRs. 5,913,728 and NRs. 77,013. The overall cost of lost output for fatal crashes and injury crashes was calculated to be NRs. 325,255,027 and NRs. 4,620,768, respectively.

For FY 2023-24, the cost of lost output per fatality, major injury, and minor injury in fatal crashes was NRs. 6,474,905, NRs. 13,506, and NRs. 1,646, respectively. For injury crashes, the cost of lost output for major and minor injuries was NRs. 32,666 and NRs. 2,198. The total cost of lost output per fatal and injury crash was NRs. 6,505,209 and NRs. 69,728. The total cost of lost output for fatal and injury crashes was NRs. 429,343,787 and NRs. 8,715,960. Therefore, the overall total cost of lost output for both types of crashes was NRs. 329,875,795 and NRs. 438,059,747, respectively. These figures are presented in Table 4.9 below.

Table 4.9 Total cost of lost output of RTC

| Casualty | Fatal Crash | | | | | |
|-------------------------------------------------------------|--------------------------|---------|-------------------------|---------|-------------|-----------|
| | Cost per casualty (NRs.) | | No of casualty involved | | Cost (NRs.) | |
| | 2022/23 | 2023/24 | 2022/23 | 2023/24 | 2022/23 | 2023/24 |
| F/Y | 2022/23 | 2023/24 | 2022/23 | 2023/24 | 2022/23 | 2023/24 |
| Fatality | 5885464 | 6378264 | 1 | 1.02 | 5885464 | 6474905 |
| Major | 27432 | 28755 | 0.42 | 0.47 | 11472 | 13506 |
| Minor | 3048 | 3195 | 0.87 | 0.52 | 2660 | 1646 |
| Care taker lost cost | | | | | | |
| Major | 27432 | 28755 | 0.42 | 0.47 | 11472 | 13506 |
| Minor | 3048 | 3195 | 0.87 | 0.52 | 2660 | 1646 |
| Cost of lost output per fatal crash | | | | | 5913728 | 6505209 |
| Total cost of lost output for fatal crashes | | | 55 | 66 | 325255027 | 429343787 |
| Casualty | Injury Crash | | | | | |
| | Cost per casualty (NRs.) | | No of casualty involved | | Cost (NRs.) | |
| | 2022/23 | 2023/24 | 2022/23 | 2023/24 | 2022/23 | 2023/24 |
| Fatality | - | - | - | - | - | - |
| Major | 27432 | 28755 | 1.32 | 1.14 | 36119 | 32666 |
| Minor | 3048 | 3195 | 0.78 | 0.69 | 2388 | 2198 |
| Care taker lost cost | | | | | | |
| Major | 27432 | 28755 | 1.32 | 1.14 | 36119 | 32666 |
| Minor | 3048 | 3195 | 0.78 | 0.69 | 2388 | 2198 |
| Cost of lost output per injury crash | | | | | 77013 | 69728 |
| Total cost of lost output for injury related crashes | | | 60 | 125 | 4620768 | 8715960 |
| Total cost of lost output due to road traffic crashes (RTC) | | | | | 329875795 | 438059747 |

4.2.2 Quality of Life Cost

It was calculated using the Net Output Method. Quality of life cost is equal to difference in amount he/ she would earn if alive and amount he/she consumes during life time. Amount that would be earned is equal to lost productivity of fatalities and amount consumed was obtained from the study survey of Nepal living life standard from 1995 to 2023 conducted by National Statistical data found to be NRs.156330 per year which was average of 20% richest and 20 % poor annual nominal consumption per capita. Therefore, the cost of quality of life was found as NRs.151,7321,047 and NRs.207,366,302 respectively for FY 2022-23 and FY2023-24.

4.2.3 Medical Cost

For calculating the medical cost first of all the individual details of major injury and minor injury was screened from Traffic Police data and on the basis of hospital referred, respective hospital namely Seti Provincial Hospital (government) and four private hospital : Nisarga, Navajeevan, Maya-metro and Padma Hospital were visited. Firstly administrative department of each hospital was visited and emergency register of the patient were obtained. The RTC cases were filtered out and the date of crash, age and gender with date of admission of patient was verified. The matched detail of patient, along with IPD number were noted and made available to IT section. Using that IPD number, the details about patient, regarding date of admission, date of discharge, Emergency cost, Medicine cost and total cost excluding the emergency and medical cost were obtained. Data was obtained from all selected hospital. Data was collected for out patients only.

For FY2022-2023 EC, MC and total cost excluding EC and MC was NRs.3,791, NRs.10,935 and NRs.59,461 respectively for major injury per fatal crash and NRs.2009, NRs.3,339 and NRs.17,978 respectively for minor injury per fatal crash. The total medical cost with respect to EC, MC and total cost excluding EC and MC was NRs.5800, NRs.14,274 and NRs.77,439 respectively per fatal crash and for total fatal crash the total cost was NRs.318,997, NRs.785,067 and NRs.4,259,156 respectively for EC, MC and total cost excluding EC and MC.

Similarly for Injury crash for FY 2022-2023 EC, MC and total cost excluding EC and MC was NRs.11,937, NRs.34,431 and NRs.187,216 respectively for major injury per injury crash and NRs.1803, NRs.2,997 and NRs.16,137 respectively for minor injury per injury crash. The total medical cost with respect to. EC, MC and total cost excluding EC and MC was NRs.13,740, NRs.37,427 and NRs.203,353 respectively per injury crash and for total injury crash the total cost was NRs.824,393, NRs. 2,245,639 and NRs.12,201,160 respectively for EC, MC and total cost excluding EC and MC.

For FY2023-2024 EC, MC and total cost excluding EC and MC were NRs.4,427, NRs.12,539 and NRs.68,326 respectively for major injury per fatal crash and NRs.1,262, NRs.1,987 and NRs.11,253 respectively for minor injury per fatal crash. The medical cost with respect to. EC, MC and total cost excluding EC and MC was NRs.5,689, NRs.14,527 and NRs.79,579 respectively per fatal crash and for total fatal crash the total cost was NRs.375,502, NRs. 958,751 and NRs.5,252,205 respectively for EC, MC and total cost excluding EC and MC.

Similarly for Injury crash for FY 2023-2024 EC, MC and total cost excluding EC and MC was NRs.10,708, NRs.30,327 and NRs.165,251 respectively for major injury per injury and NRs.1,685, NRs.2,654 and NRs.15,029 respectively for minor injury per injury crash. The medical cost with respect to. EC, MC and total cost excluding EC and MC was NRs.12,394, NRs.32,981 and NRs.180,280 respectively per injury crash and for total injury crash the total cost was NRs.NRs.1,549,189, NRs.4,122,662 and NRs.22,535,007 respectively for EC, MC and total cost excluding EC and MC.

Table 4.10 Average medical cost

| Casualty | out patient for F/Y: 2022-2023 | | | out patient cost for F/Y: 2023-2024 | | | Average Medical cost | | | | | |
|----------|--------------------------------|--------------------|--------------------------------|-------------------------------------|--------------------|--------------------------------|----------------------|--------------------|--------------------------------|---------------------|--------------------|--------------------------------|
| | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | 22-23 | | | 23-24 | | |
| | | | | | | | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC |
| Fatality | - | - | - | - | - | - | - | - | - | - | - | - |
| Major | 353575 | 915,248 | 4,976,628 | 650402 | 1,334,826 | 9,018,983 | 9,066 | 26,150 | 142,189 | 9,426 | 26,697 | 145,467 |
| Minor | 32223 | 45904 | 123600 | 110240 | 131,159 | 742,713 | 2,302 | 3,825 | 20,600 | 2,450 | 3,858 | 21,845 |

Source: Hospital Data

Therefore, the total medical cost with respect to EC, MC and total cost excluding EC & MC was NRs.1,143,391, NRs.3,030,706 and NRs.16,460,316 for FY2022-2023 and NRs.1,924,691, NRs.5,081,413 and NRs.27,787,212 respectively for FY 2023-2024. Overall medical cost for FY 2022-2023 and FY2023-2024 was NRs.20,634,412 and NRs.34,793,317 respectively.

Table 4.11 Total medical cost of RTC

| Casualty | Fatal Crash | | | | | | | No of casualty involved | | Cost (NRs.) | | | | | | |
|--------------------------------------|--------------------------|--------------------|--------------------------------|---------------------|--------------------|--------------------------------|---------------------|-------------------------|--------------------------------|---------------------|--------------------|--------------------------------|--------------------------------|---------------------|--------------------|--------------------------------|
| | Cost per casualty (NRs.) | | | | | | 22-23 | | | 23-24 | | 22-23 | | | 23-24 | |
| | 22-23 | | | 23-24 | | | | | Emergency Cost (EC) | | | Medicine Cost (MC) | Total cost excluding EC and MC | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC |
| | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | | | | |
| Fatality | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Major | 9066 | 26150 | 142189 | 9426 | 26697 | 145467 | 0.42 | 0.47 | 3791 | 10935 | 59461 | 4427 | 12539 | 68326 | | |
| Minor | 2302 | 3825 | 20600 | 2450 | 3858 | 21845 | 0.87 | 0.52 | 2009 | 3339 | 17978 | 1262 | 1987 | 11253 | | |
| Medical cost per Fatal crash | | | | | | | | | 5800 | 14274 | 77439 | 5689 | 14527 | 79579 | | |
| Total medical cost of fatal crashes | | | | | | | 55 | 66 | 318997 | 785067 | 4259156 | 375502 | 958751 | 5252205 | | |
| Casualty | Injury Crash | | | | | | | No of casualty involved | | Cost (NRs.) | | | | | | |
| | Cost per casualty (NRs.) | | | | | | 22-23 | | | 23-24 | | 22-23 | | | 23-24 | |
| | 22-23 | | | 23-24 | | | | | Emergency Cost (EC) | | | Medicine Cost (MC) | Total cost excluding EC and MC | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC |
| | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | Emergency Cost (EC) | Medicine Cost (MC) | Total cost excluding EC and MC | | | | |
| Fatality | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | |
| Major | 9066 | 26150 | 142189 | 9426 | 26697 | 145467 | 1.32 | 1.14 | 11937 | 34431 | 187216 | 10708 | 30327 | 165251 | | |
| Minor | 2302 | 3825 | 20600 | 2450 | 3858 | 21845 | 0.78 | 0.69 | 1803 | 2997 | 16137 | 1685 | 2654 | 15029 | | |
| Medical cost per Injury crash | | | | | | | | | 13740 | 37427 | 203353 | 12394 | 32981 | 180280 | | |
| Total medical cost of Injury crashes | | | | | | | 60 | 125 | 824393 | 2245639 | 12201160 | 1549189 | 4122662 | 22535007 | | |
| Total | | | | | | | | | 1143391 | 3030706 | 16460316 | 1924691 | 5081413 | 27787212 | | |
| Total medical cost of RTC | | | | | | | | | | | 22-23 | 23-24 | | | | |
| | | | | | | | | | | | 20634412 | 34793317 | | | | |

Source: Corresponding Hospital and District Traffic Police, Kailali

4.2.4 Property Damage Cost

A. Vehicle Damage Cost

The vehicle damage cost was analyzed based on data obtained from insurance records and workshop data. From the insurance records, the amount paid for damage due to crash was obtained for each category of vehicles and same was also obtained from Workshop. The overall mean value was calculated. Thus, the overall mean value cost of Commercial vehicles, Private cars, and Motorcycles for FY2022-23 was NRs.195,970, NRs. 216,500 and NRs. 71,261 respectively and similarly the overall mean value cost of Commercial vehicles, Private cars, and Motorcycles for FY2023-24 was NRs.229,632, NRs.181,392 and NRs.155,830 respectively which is shown in Table 4.14. Then the net vehicle damage cost was calculated adding a survey fee to calculated overall mean value with deduction of salvage value and duties and a value-added tax of the spare parts. In this study, the cost of spare parts was assumed as

2/3 of the cost of repair with including 25% Duty and 13% VAT as per 2007 RTC cost study. The salvage value was taken as 10% as per inquiry with insurance companies and also surveyor fee was obtained by consulting with insurance companies. Therefore, Net Vehicle damage cost for FY2022-23 for commercial vehicles, private cars and motorcycles was calculated as NRs. 138,727, NRs. 150,003 and NRs. 55,082 respectively and NRs. 1,60,495, NRs. 127,300 and NRs.109,770 respectively for FY2023-24 as shown in Table 4.15. The percentage of commercial vehicles, private cars and motorcycle involved in road traffic crashes was found to be 31%, 7% and 60% respectively and other category vehicle involvement was 1% for FY 2022-23 and 33%, 7% and 60% respectively and other category vehicle involvement was 0.4% for FY 2023-24 as per insurance data. The weighted value of Net vehicle damage cost for commercial vehicles, private cars, and motorcycles was obtained by the product of the percentage of the vehicles in a road traffic crash and calculated Net vehicle damage Cost. The average cost of vehicle repair per damaged vehicle was determined by summing the weighted value of the Net vehicle damage cost which was calculated as NRs. 114,604 for FY 2022-23 and NRs. 132,522 for FY 2023-24.

Table 4.12 Claim data for vehicle damage

| Claim for vehicle damage | Commercial | | | | Private Car | | | | Motorcycle | | | |
|----------------------------------|---------------------|------------|--------------------|-----------|---------------------|-----------|--------------------|-----------|---------------------|-----------|-----------|-----------|
| | Total Amount (NRs.) | | Number of vehicles | | Total Amount (NRs.) | | Number of vehicles | | Total Amount (NRs.) | | No | |
| | FY2022-23 | FY2023-24 | FY2022-23 | FY2023-24 | FY2022-23 | FY2023-24 | FY2022-23 | FY2023-24 | FY2022-23 | FY2023-24 | FY2022-23 | FY2023-24 |
| Sagarmatha Insurance | 7,269,626 | 13,893,387 | 54 | 51 | 3,867,191 | 3,802,591 | 23 | 23 | 2,195,425 | 5,471,720 | 13 | 15 |
| NLG Insurance | 1,408,322 | 559,150 | 7 | 2 | 987,641 | 1,852,000 | 5 | 5 | 160,960 | 445,000 | 6 | 4 |
| IGI PRUDENTIAL INSURANCE LIMITED | 1,661,500 | 4,611,000 | 10 | 21 | 1193000 | 712,000 | 6 | 10 | 155000 | 90,000 | 4 | 1 |

Source: Corresponding Insurance Companies

Table 4.12 shows the claim amount from corresponding non-life insurance companies with the total number of claims for each category of vehicles.

Table 4.13 Average vehicle damage cost

| Average Vehicle Damage cost | Commercial | | | | Private Car | | | | Motorcycle | | | |
|----------------------------------|-----------------------|-----------|--------------------|-----------|-----------------------|-----------|--------------------|-----------|-----------------------|-----------|--------------------|-----------|
| | Average Amount (NRs.) | | Number of vehicles | | Average Amount (NRs.) | | Number of vehicles | | Average Amount (NRs.) | | Number of vehicles | |
| | FY2022-23 | FY2023-24 | FY2022-23 | FY2023-24 | FY2022-23 | FY2023-24 | FY2022-23 | FY2023-24 | FY2022-23 | FY2023-24 | FY2022-23 | FY2023-24 |
| Sagarmatha Insurance | 134,623 | 272,419 | 54 | 51 | 168,139 | 165,330 | 23 | 23 | 168,879 | 364,781 | 13 | 15 |
| NLG Insurance | 201,189 | 279,575 | 7 | 2 | 197,528 | 370,400 | 5 | 5 | 26,827 | 111,250 | 6 | 4 |
| IGI PRUDENTIAL INSURANCE LIMITED | 166,150 | 219,571 | 10 | 21 | 198,833 | 71,200 | 6 | 10 | 38,750 | 90,000 | 4 | 1 |

Source: Corresponding Insurance Companies

The average vehicle damage cost for each category of vehicle was determined by dividing the total cost of the claim amount for each category of vehicle with the total number of claims which is shown in Table 4.13 above.

Table 4.14 Average damage cost of the vehicles

| Source | Average Cost (NRs.) | | | | | |
|----------------------------------|---------------------|---------|-------------|---------|------------|---------|
| | Commercial | | Private Car | | Motorcycle | |
| | 22/23 | 23/24 | 22/23 | 23/24 | 22/23 | 23/24 |
| Sagarmatha Insurance | 134,623 | 272,419 | 168,139 | 165,330 | 168,879 | 364,781 |
| NLG Insurance | 201,189 | 279,575 | 197,528 | 370,400 | 26,827 | 111,250 |
| IGI PRUDENTIAL INSURANCE LIMITED | 166,150 | 219,571 | 198,833 | 71,200 | 38,750 | 90,000 |
| Auto Repair Workshop | 281,917 | 146,961 | 301,498 | 118,636 | 50,587 | 57,289 |
| Overall average | 195,970 | 229,632 | 216,500 | 181,392 | 71,261 | 155,830 |

Source: Corresponding Insurance Companies, Auto-workshop and repair center

Table 4.15 Net vehicle damage cost

| Vehicle Type | FY | Repair Cost (NRs.) | Duty (25%) and Vat (13%) on spare parts (NRs.) | Estimated Salvage Value (NRs.) | Survey Fee (NRs.) | Net Vehicle Damage (NRs.) |
|--------------------|-------|--------------------|------------------------------------------------|--------------------------------|-------------------|---------------------------|
| Commercial | 22-23 | 195,970 | 49,646 | 19,597 | 12,000 | 138,727 |
| | 23-24 | 229,632 | 58,173 | 22,963 | 12,000 | 160,495 |
| Private Car | 22-23 | 216,500 | 54,847 | 21,650 | 10,000 | 150,003 |
| | 23-24 | 181,392 | 45,953 | 18,139 | 10,000 | 127,300 |
| Motorcycle | 22-23 | 71,261 | 18,053 | 7,126 | 9000 | 55,082 |
| | 23-24 | 155,830 | 39,477 | 15,583 | 9000 | 109,770 |

According to the traffic records from the District Traffic Police, Kailali, for the years 2022/23 and 2023/24, the total number of fatal crashes was 55 and 66, respectively, with a total of 162 and 257 vehicles involved. The number of vehicles involved per fatal crash was calculated as 1.13 for FY 2022/23 and 1.09 for FY 2023/24, as shown in Table 4.16. Similarly, the number of vehicles involved in injury crashes was 1.67 for FY 2022/23 and 1.48 for FY 2023/24. Finally, the total vehicle damage cost per fatal and injury crash was determined by multiplying the average vehicle repair cost by the number of vehicles involved in each type of crash.

Table 4.16 Percentage of vehicle involvement

| Vehicle Involvement in RTC | Kailali District | | Number of vehicles involvement | | Fatal crash | | Injury crash | |
|----------------------------|------------------|-------|--------------------------------|-------|-------------|-----------|--------------|------------|
| | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 |
| | | | | | 55 | 66 | 60 | 125 |
| Fatal crash | 38% | 28% | 62 | 72 | 1.13 | 1.09 | | |
| Injury crash | 62% | 72% | 100 | 185 | | | 1.67 | 1.48 |
| Total | 100% | 100% | 162 | 257 | 1.13 | 1.09 | 1.67 | 1.48 |

Source: District Traffic Police, Kailali

Table 4.17 Total vehicle damage cost

| Vehicle damage cost | Fatal Crash | | | | | | Injury Crash | | | | | | |
|---------------------------------------------|----------------------------|---------|-----------------------------|-------|-------------|-----------|----------------------------------------------|---------|-----------------------------|-------|-------------|------------|------------|
| | Average Repair cost (NRs.) | | Number of vehicles involved | | Cost (NRs.) | | Average Repair cost | | Number of vehicles involved | | Cost (NRs.) | | |
| | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 | |
| | 114,604 | 132,522 | 1.13 | 1.09 | 129,190 | 144,569 | 114,604 | 132,522 | 1.67 | 1.48 | 191007 | 196,132 | |
| Total number of fatal crashes | | | 55 | 66 | | | Total number of injury crashes | | 60 | 125 | | | |
| Total vehicle damage cost for fatal crashes | | | | | 7,105,445 | 9,541,566 | Total vehicle damage cost for injury crashes | | | | | 11460395 | 24,516,525 |
| Total vehicle damage cost of RTC | | | | | | | | | | | 18,565,840 | 34,058,091 | |

The vehicle damage cost per fatal crash was calculated as NRs.129,190 and NRs.191,007 per injury crash for FY2022-23 and for FY2023-24 vehicle damage cost per fatal crash was calculated as NRs.144,569 and NRs.196,132 per injury crash. Similarly, the total vehicle damage cost for fatal crashes was calculated as NRs.7,105,445 and NRs.9,541,566 for respective fiscal year. Also total vehicle damage cost for injury crashes was calculated as NRs.11,460,395 and NRs.24,516,525 for respective year. The total vehicle damage cost of RTC was calculated as NRs. 18,565,840 and NRs. 68,116,182 for particular FY respectively which is shown in Table 4.17 above.

B. Vehicle Detention Cost

To calculate the vehicle detention cost, the first step is to determine the number of commercial vehicles involved i.e. Truck, Bus, Haice, Tipper, Tractor, Dozer/excavator, Auto, E-Rickshaw and their damage extent was sorted out from the sawari durghatana pratibedan maintained by Traffic Police. The time period required to repair those vehicle and per day net revenue generated was collected from respective vehicle samiti through questionnaire. For each category of vehicle the detention cost was calculated by multiplying net revenue generated and detention time period. The total detention cost for all vehicles was calculated to be NRs. 9,604,500 and NRs. 13,897,500 for the respective periods. The average detention cost per vehicle was obtained by dividing the total detention cost by the total number of vehicles, which was found to be NRs. 188,324 and NRs. 163,500 for the respective periods.

The average vehicle detention cost per fatal crash was NRs.84,930 and NRs.46,165 respectively and per injury crash was NRs.103,393 and NRs.117,335 for FY2022-23 and FY2023-24. The total vehicle detention cost for fatal was NRs.4,671,162 and NRs.3,046,871 for FY2022-23 and FY2023-24 and for injury crash was NRs.6,203,599 and NRs.14,666,912

respectively. Therefore, total cost of vehicle detention was calculated as NRs.10,874,761 and NRs.17,713,782 for FY2022-23 and FY2023-24 respectively which is shown in table 4.18.

Table 4.18 Total Vehicle Detention Cost

| Vehicle Involvement in RTC | Kailali District | | Number of vehicles involvement | | Fatal crash | | Injury crash | |
|-----------------------------------------------|------------------|-------|--------------------------------|-------|-------------|-------------|--------------|-------------|
| | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 |
| Commercial | 31% | 33% | 51 | 85 | 0.45 | 0.28 | 0.55 | 0.72 |
| Average vehicle detention amount | | | | | 188324 | 163500 | 188324 | 163500 |
| Vehicle Detention Cost per fatal crash | | | | | 84930 | 46165 | | |
| Vehicle Detention Cost per injury crash | | | | | | | 103393 | 117335 |
| Nos of causality | | | | | 55 | 66 | 60 | 125 |
| Total Vehicle Detention Cost for fatal crash | | | | | 4671162 | 3046871 | | |
| Total Vehicle Detention Cost for injury crash | | | | | | | 6203599 | 14666912 |
| Total Vehicle detention cost | | | | | | | 10874761 | 17713782 |

Total Property Damage Cost= Total Vehicle Damage Cost +Total vehicle Detention Cost

4.2.5 Damage only Crash Cost

The numbers of the respective vehicles were sorted out from Traffic police report and then the total numbers of the vehicle involved in damage only crash was obtained by inquiry with traffic police which was 40 percent of total crash for that particular year and also inquiry with auto workshop and was found to be 123 and 174 respectively. The weighted average cost for each type of vehicle was determined by multiplying the cost by the percentage of involvement for

each vehicle type in a road traffic crash. The overall average vehicle repair cost was then calculated by summing the weighted values for all vehicle types. Therefore, the average repair cost for damage only crash was calculated as NRs. 20,361 and NRs. 34,000 respectively.

Table 4.19 Repair cost of vehicles

| Types of Vehicles | Cost of Repair Amount (NRs.) | |
|-------------------|------------------------------|---------|
| | 2022-23 | 2023-24 |
| Motorcycle | 3,667 | 5,000 |
| Car/jeep | 3,500 | 5,500 |
| Bus | 45,000 | 70,000 |
| Tractor | 9,000 | 20,000 |
| Tipper | 55,000 | 92,500 |
| Auto | 6,000 | 11,000 |
| Average | 20361 | 34000 |

Source: Auto-workshop and repair center

The number of vehicle involvement per damage only crash was obtained as 1.67 and 1.49 for respective FY which was determined by dividing the value of the difference between the total number of vehicles involved and number of vehicles involved in fatal crashes with the value of the difference between total road crashes and fatal road crashes. As a result, the cost per damage only crash of vehicles was NRs. 33,935 and NRs.50,726 respectively for FY2022-23 and FY2023-24. Similarly, the total number of damage only crashes was found to be 85 and 125 for the FY 2022/2023 and FY2023/2024 and the total damage only crash cost of the vehicle was calculated as NRs.2,884,491 and NRs.6,340,726 for respective fiscal year as shown in table 4.20.

Table 4.20 Total Damage only crash cost of RTC

| Area | Number of vehicles involved | | Unit Cost (NRs.) | | Cost of the damage-only crash (NRs.) | |
|-----------------------------------------|-----------------------------|-----------|------------------|-----------|--------------------------------------|-----------|
| | 2022-2023 | 2023-2024 | 2022-2023 | 2023-2024 | 2022-2023 | 2022-2023 |
| Kailali District | 1.67 | 1.49 | 20,361 | 34000 | 33935 | 50726 |
| Total number of damages only crash | | | | | 85 | 125 |
| Total damage only crash cost of vehicle | | | | | 2884491 | 6340726 |

4.2.6 Administrative Cost

Firstly, the total resource cost which is summation of lost output, medical cost and property Damage was calculated and the administrative cost was taken as 0.2 percent for fatal, 4 percent for major injury, 14 percent for minor injury of total resource cost and 10 percent of damage only crash cost. The administrative cost per fatal crash was NRs.15,844 and NRs.18,664 for respective fiscal year and administrative cost per injury crash was NRs.112,668 and NRs.109,593 for respective year. The administrative cost for damage only crash per crash was NRs.3,394 and NRs.5,073 for respective year. The total administrative cost for fatal crash was NRs.871,433 and NRs.1,231,828 for respective fiscal year and for injury crash it was NRs.6,760,076 and NRs.13,699,125 respectively for respective fiscal year. Therefore, the total administrative cost was NRs.7,632,509 and NRs.14,930,953 respectively for respective year as shown in table 4.21.

Table 4.21 Total Administrative cost of RTC

| Cost Components | Fatal Crash (NRs.) | | Injury Crash (NRs.) | |
|--------------------------------------------|--------------------|------------------|---------------------|-------------------|
| | 22-23 | 23-24 | 22-23 | 23-24 |
| Lost Output | 5,913,728 | 6,505,209 | 77,013 | 69,728 |
| Medical Cost | 97,513 | 99,795 | 254,520 | 225,655 |
| Property damage cost | 214,120 | 190,734 | 294,400 | 313,467 |
| Total resource cost | 6,225,361 | 6,795,738 | 625,933 | 608,850 |
| Damage only cost per crash | 33,935 | 50,726 | | |
| Administrative cost for damage only crash | 3,394 | 5,073 | | |
| Fatal administrative cost | 12,451 | 13,591 | | |
| Major administrative cost | | | 25,037 | 24,354 |
| Minor administrative cost | | | 87,631 | 85,239 |
| Administrative cost per fatal crash | 15,844 | 18,664 | | |
| Nos of crash | 55 | 66 | 60 | 125 |
| Administrative cost for total fatal crash | 871,433 | 1,231,828 | | |
| Administrative cost per injury crash | | | 112,668 | 109,593 |
| Administrative cost for total injury crash | | | 6,760,076 | 13,699,125 |
| Total Administrative cost | | | 7,631,509 | 14,930,953 |

4.2.7 Total Casualty Crash Cost

The average cost per fatal crash in Kailali District for F/Y2022-23 and F/Y2023-24 was NRs. 8,999,770 and NRs.9,909,421 respectively. The average cost per Injury crash in Kailali District for FY2022-23 and FY2023-24 was NRs.738,601 and NRs.718,443 respectively which is summarized in Table 4.22 below.

Table 4.22 Average cost of a casualty crash

| Cost Components | Fatal Crash (NRs.) | | Injury Crash (NRs.) | |
|---------------------------------|--------------------|-----------|---------------------|-----------|
| | 2022-2023 | 2023-2024 | 2022-2023 | 2023-2024 |
| Lost Output | 5,913,728 | 6,505,209 | 77,013 | 69,728 |
| Quality of life | 2,758,564 | 3,095,019 | - | - |
| Medical Cost | 97,513 | 99,795 | 254,520 | 225,655 |
| Property damage cost | 214,120 | 190,734 | 294,400 | 313,467 |
| Administrative cost | 15,844 | 18,664 | 112,668 | 109,593 |
| Average cost per casualty crash | 8,999,770 | 9,909,421 | 738,601 | 718,443 |

The total cost of casualty crashes in road traffic crashes of Kailali District was calculated as NRs. 539,303,364 and NRs.746,922,192 for FY2022-23 and FY2023-24 respectively and total damage only crash cost of the vehicle was NRs. 2,884,491 and NRs.6,340,726 for FY2022-23 and FY2023-24 respectively. Therefore, the total cost of road traffic crashes of Kailali District was calculated as NRs.542,187,855 and NRs.753,262,918 for respective fiscal year (i.e. 542.18 million and 753.26 million) which is shown in Table 4.23 below.

Table 4.23 Total cost of road crash

| Type of crash | Total Cost (NRs.) | |
|-------------------|-------------------|-------------|
| | 2022-23 | 2023-24 |
| Causality crash | 539,303,364 | 746,922,192 |
| Damage Only Crash | 2884491 | 6340726 |
| Total | 542,187,855 | 753,262,918 |

4.2.8 Total Cost of Road Traffic Crash Casualties

The total cost of lost output in road traffic casualty crashes for FY 2022-2023 was calculated as NRs. 329,875,795, while the total quality of life cost for these crashes amounted to NRs. 151,721,047. Similarly, the total costs for medical expenses, property damage, damage-only crashes, and administrative costs in road traffic casualty crashes were calculated as NRs. 20,634,412, NRs. 29,440,601, NRs. 2,884,491, and NRs. 7,631,509, respectively.

The total cost of lost output in road traffic casualty crashes for FY 2023-2024 was calculated as NRs. 438,059,747, while the total quality of life cost for these crashes amounted to NRs. 207,366,302. Similarly, the total costs for medical expenses, property damage, damage-only crashes, and administrative costs in road traffic casualty crashes were calculated as NRs. 34,793,316, NRs. 51,771,874, NRs. 6,340,726, and NRs. 14,930,953, respectively. Therefore, the total cost of casualty crashes in Kailali District for the years 2022-2023 and 2023-2024 was NRs. 542,187,855 and NRs. 753,262,918, as shown in Table 4.24.

Table 4.24 Total cost of RTC casualties

| Cost Component | Total Cost (NRs.) | | Percentage | |
|------------------------|-------------------|-------------|-------------|-------------|
| | FY: 2022-23 | FY: 2023-24 | FY: 2022-23 | FY: 2023-24 |
| Lost Output | 329,875,795 | 438,059,747 | 60.84% | 58.15% |
| Quality of life | 151,721,047 | 207,366,302 | 27.98% | 27.53% |
| Medical Cost | 20,634,412 | 34,793,316 | 3.81% | 4.62% |
| Property damage cost | 29,440,601 | 51,771,874 | 5.43% | 6.87% |
| Damage only crash cost | 2,884,491 | 6,340,726 | 0.53% | 0.84% |
| Administrative cost | 7,631,509 | 14,930,953 | 1.41% | 1.98% |
| Total | 542,187,855 | 753,262,918 | 100% | 100% |

The average cost of the road traffic crash with respective to severity level was calculated as sum of all crash cost component with respective severity level with numbers of causality involved as mentioned below and found to be NRs.8,870,600, NRs.722,389, NRs.436,387 and

NRs. 33,935 for FY 2022-23. And also NRs.9,774,250, NRs.658,506, NRs. 443,750 and NRs. 50,726 for FY: 20223-24 as shown in table 4.26.

The percentage coverage of fatal, major injury, minor injury, and property damage only (PDO) costs relative to the total cost was found to be 85.84%, 10.04%, 3.60%, and 0.50%, respectively, for FY 2022-23. For FY 2023-24, the percentages were 82.37%, 11.94%, 4.87%, and 0.80%, respectively, as shown in Table 4.26.

Table 4.25 Average Cost with respect to Severity Level

| Severity Level | Lost Productivity Cost (NRs.) | | Quality of Life Cost (NRs.) | | Medical Cost (NRs.) | | Property Damage Cost (NRs.) | | Administrative Cost (NRs.) | | Total Average Cost (NRs.) | |
|----------------------|-------------------------------|---------|-----------------------------|---------|---------------------|--------|-----------------------------|--------|----------------------------|-------|---------------------------|---------|
| | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 |
| Fatal (K) | 5885464 | 6474905 | 2758564 | 3095019 | - | - | 214120 | 190734 | 12451 | 13591 | 8870600 | 9774250 |
| Major Injury(A or B) | 95181 | 13506 | - | - | 307771 | 307179 | 294400 | 313467 | 25037 | 24354 | 722389 | 658506 |
| Minor Injury (C) | 10095 | 1646 | - | - | 44262 | 43397 | 294400 | 313467 | 87631 | 85239 | 436387 | 443750 |
| PDO (O) | | | | | | | | | | | 33935 | 50726 |

Table 4.26 Percentage contribution of Severity Level to Total cost of RTC

| Severity Level | Nos of Crash | | Avg. Cost Per Case (NRs.) | | Total Cost (NRs.) | | % Contribution to Total Cost | |
|----------------------|--------------|-------|---------------------------|---------|-------------------|------------------|------------------------------|--------|
| | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 | 22-23 | 23-24 |
| Fatal (K) | 55 | 66 | 8870600 | 9774250 | 487882991 | 645100474 | 85.84% | 82.37% |
| Major Injury(A or B) | 79 | 142 | 722389 | 658506 | 57068758 | 93507900 | 10.04% | 11.94% |
| Minor Injury (C) | 47 | 86 | 436387 | 443750 | 20510208 | 38162478 | 3.60% | 4.87% |
| PDO (O) | 85 | 125 | 33935 | 50726 | 2884491 | 6340726 | 0.50% | 0.80% |
| | | | Total | | 568346448 | 783111578 | | |



Figure 4.5: Severity Level contribution to Total cost for FY 2022-2023 and FY 2023-2024

The bar chart compares the percentage contribution of different crash severity types (Fatal, Serious Injury, Minor Injury, and Property Damage Only) to the total crash cost for the years 2022-2023 and 2023-2024. Fatal crashes (K) contribute the highest percentage to the total cost in both years, with an increase of 32.22% in 2023-2024 compared to 2022-2023. Serious Injury (A), Minor Injury (B), and Property Damage Only (PDO) crashes contribute relatively smaller percentages to the total cost. However, there was a slight increase in the cost contribution from Serious Injury (A), Minor Injury (B), and PDO (C) crashes in 2023-2024.

Overall, fatal crashes continue to be the dominant cost factor, with their contribution increasing in the most recent period.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Road traffic crash costing provides the basis for the allocation of sufficient financial resources to decision maker and to those concerned with road safety. The Human Capital Approach was used to calculate the total cost of road traffic crashes. Based on availability of data the cost components were taken into consideration and those component were lost productivity, quality of life losses, medical expenses, property damage (vehicle damage and vehicle detention cost), damage-only crash cost and administrative cost. The secondary source data from traffic police, hospitals, insurance company, auto workshop and repair center and respective vehicle samiti were collected and analyzed.

The traffic crash costs in Kailali District increased by 38.93%, from NPR 542.19 million in FY 2022–2023 to NPR 753.26 million in FY 2023–2024, highlighting a significant amount of resources wasted annually due to road traffic crashes. The highest cost component of the road crash cost was lost productivity. The lost output was found to be 60.84% during FY 2022–2023 and 58.15% during FY 2023–2024, that reflects the high productivity loss due to fatalities as productive year loss of fatal was 20 years and 21 years for respective FY. Since fatal crash cost was found to be the highest among other types of crash, it is important to consider measures that can reduce the number of fatal crashes.

The quality of life cost is the second-largest contributor, accounting for 27.98% in FY 2022–2023 and 27.53% in FY 2023–2024. This cost reflects the long-term social, psychological, and physical impacts of traffic crashes on victims and their families, highlighting the need for comprehensive rehabilitation and support systems.

In FY 2023–2024, the percentage of medical expenses increased from 3.81% in FY 2022–2023 to 4.62%. This rise implies that increasingly severe injuries requiring continuous care are placing a greater burden on the healthcare system.

The cost of property damage significantly increased, rising from 5.43% in FY 2022–2023 to 6.87% in FY 2023–2024. This upward trend reflects greater crash severity and increased damage to both vehicles and infrastructure, highlighting the need for stricter enforcement of car safety regulations and improved road infrastructure.

These results emphasize the urgent need for comprehensive road safety initiatives aimed at reducing both the frequency and severity of traffic crashes, ultimately alleviating their financial burden.

5.2 Recommendation and future study

The results and findings from the total road traffic crash cost study in Kailali District, conducted using the Human Capital (HC) crash costing method, lead to the following key recommendations:

- Instead of using average hospital rate, the accuracy of the crash costing can further be enhanced by taking into account of the government and private hospitals rate separately.
- It is advised to create a separate department in the hospitals for keeping record of traffic crash cost because hospitals lack an adequate system for recording data on traffic casualties.
- Some crash cost components-such as losses from non-vehicle damages, long-term disability costs, and travel delay costs for road users-were not included in this study due to a lack of available data. These components are recommended to be incorporated in future crash cost studies in Kailali District.
- It is recommended to create data driven policies, create crash data system and evaluate crash costs on a regular basis.

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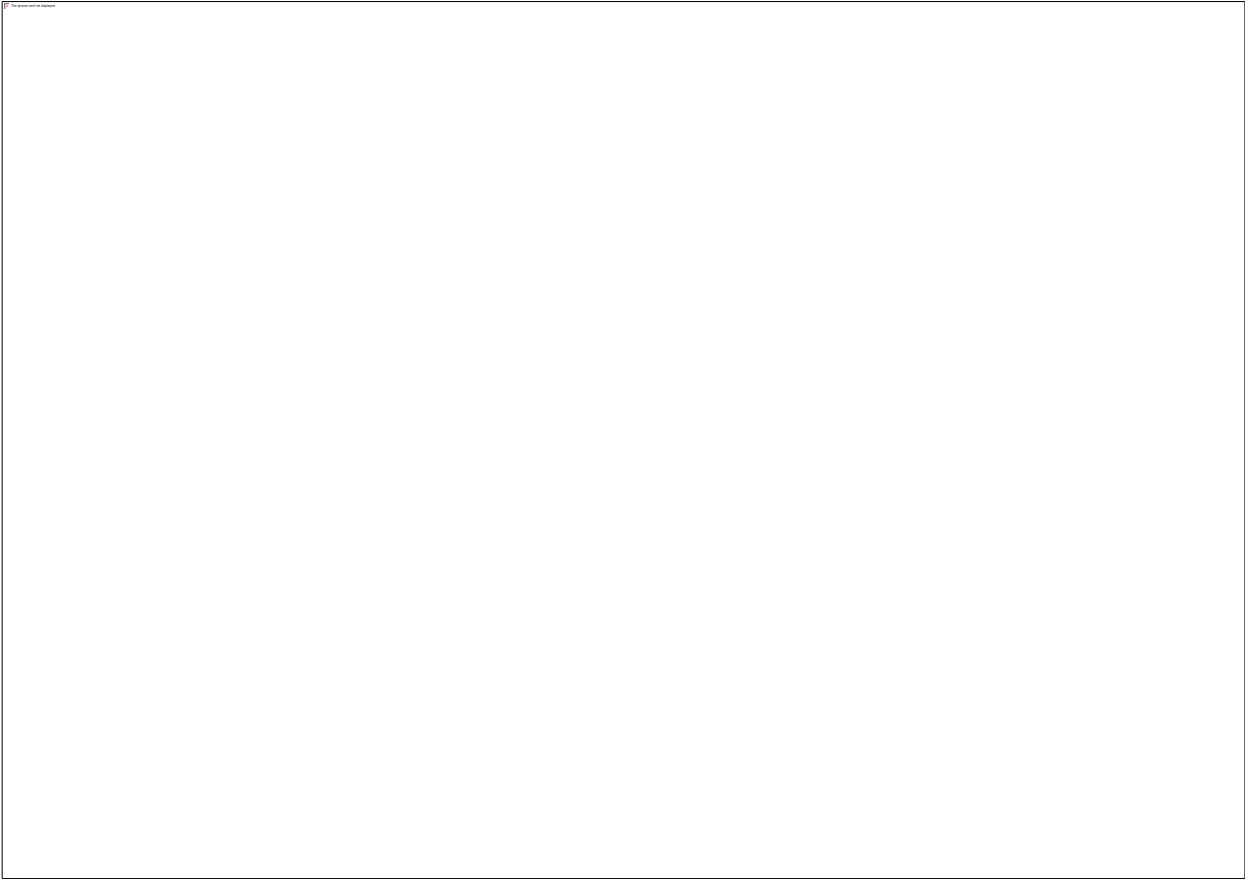
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ANNEX

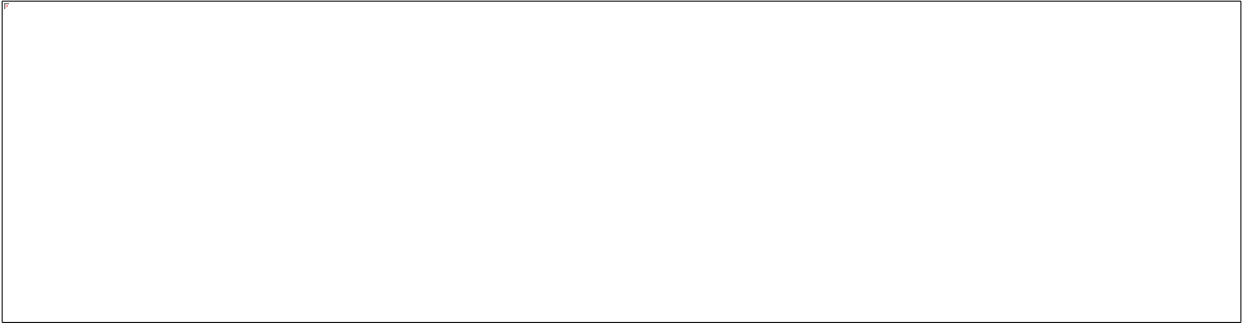
Annex 1: Age of Fatalities involvement in Road Traffic Crash of Kailali District for Fiscal year 2022/2023

| S.N. | Fatality age (Year) | Gender | S.N. | Fatality age (Year) | Gender | S.N. | Fatality age (Year) | Gender |
|----------------------------------------------|---------------------|--------|------|---------------------|--------|------|---------------------|-----------|
| 1 | 29 | M | 21 | 15 | F | 41 | 46 | F |
| 2 | 50 | M | 22 | 20 | M | 42 | 45 | M |
| 3 | 55 | M | 23 | 35 | M | 43 | 50 | M |
| 4 | 35 | M | 24 | 33 | M | 44 | 38 | M |
| 5 | 28 | M | 25 | 27 | M | 45 | 19 | M |
| 6 | 30 | M | 26 | 4 | MC | 46 | 70 | M |
| 7 | 40 | M | 27 | 22 | M | 47 | 45 | M |
| 8 | 16 | M | 28 | 73 | M | 48 | 42 | M |
| 9 | 70 | F | 29 | 40 | M | 49 | 27 | M |
| 10 | 44 | M | 30 | 45 | F | 50 | 50 | F |
| 11 | 32 | M | 31 | 71 | M | 51 | 26 | F |
| 12 | 28 | M | 32 | 46 | M | 52 | 55 | M |
| 13 | 37 | M | 33 | 28 | M | 53 | 27 | M |
| 14 | 33 | M | 34 | 63 | M | 54 | 27 | M |
| 15 | 22 | M | 35 | 65 | F | 55 | 21 | M |
| 16 | 55 | M | 36 | 80 | M | | | |
| 17 | 21 | M | 37 | 1 | MC | | | |
| 18 | 70 | M | 38 | 40 | M | | | |
| 19 | 40 | M | 39 | 28 | M | | | |
| 20 | 32 | M | 40 | 15 | F | | | |
| Total number of RTC Fatalities | | | | | | | | 55 |
| Average age of RTC Fatalities | | | | | | | | 38 |
| M = Male; F = Female; MC = Male child | | | | | | | | |

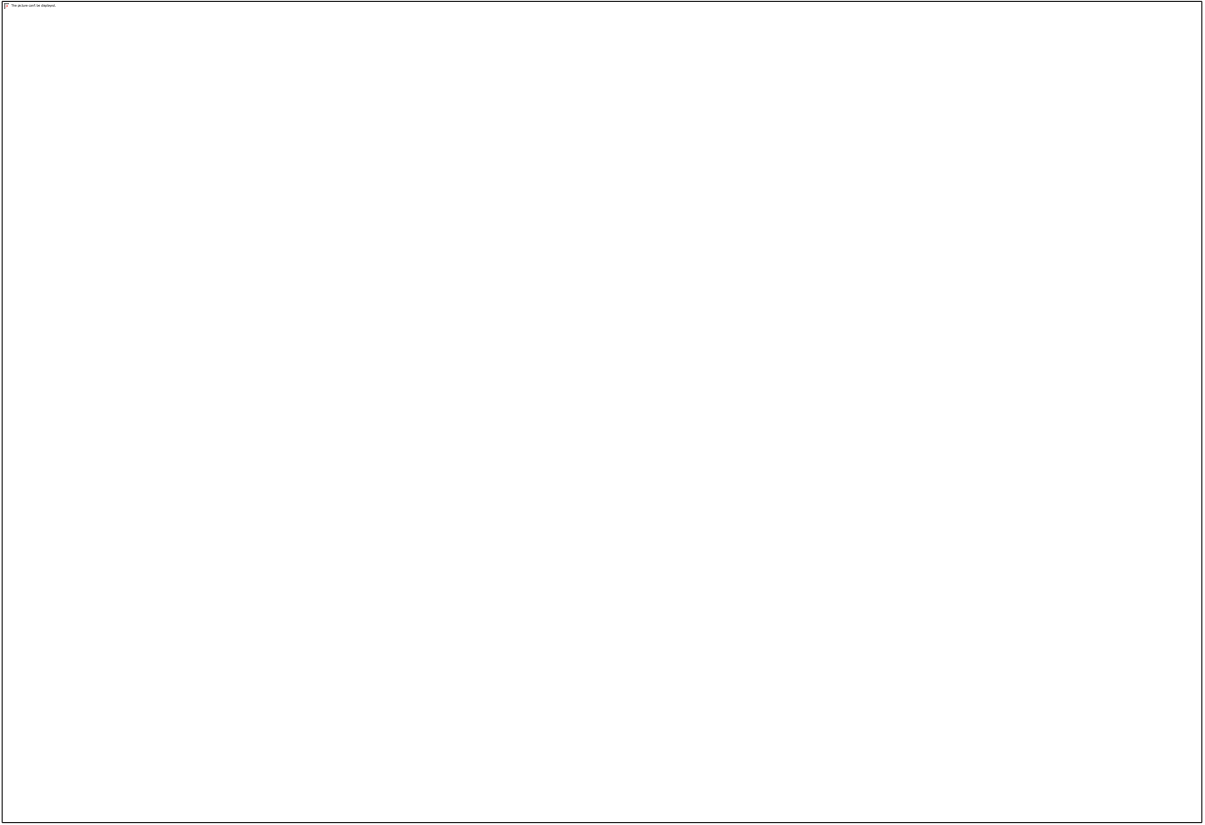
Annex 2: Age of Fatalities involvement in Road Traffic Crash of Kailali District for Fiscal year
2022/2023



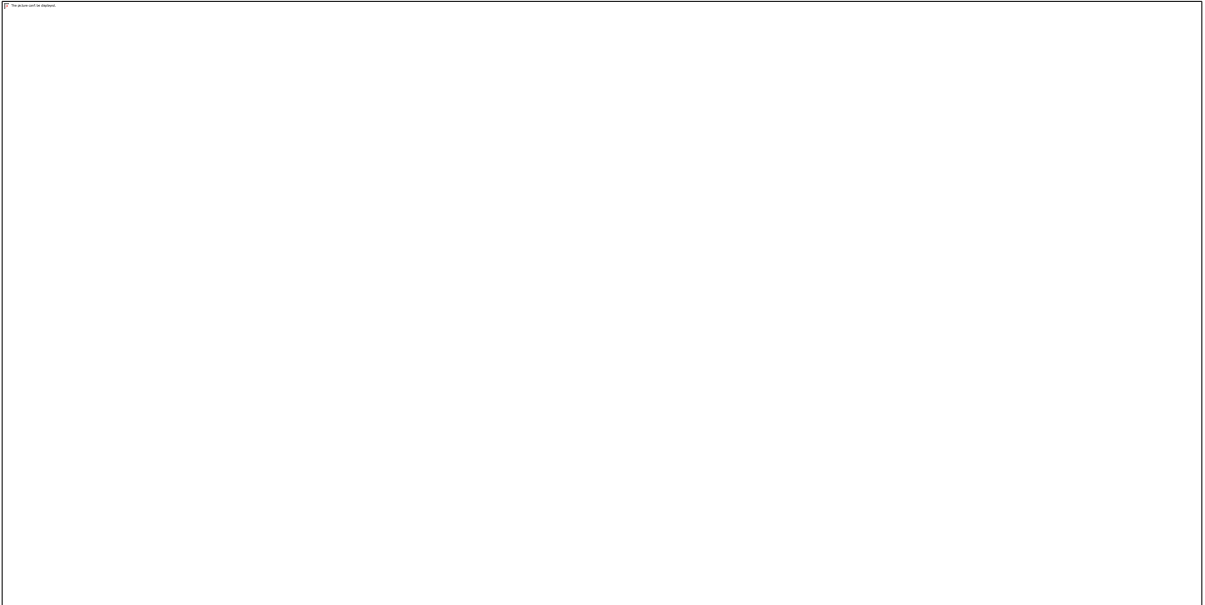
Annex 3: Sample of Insurance claim data



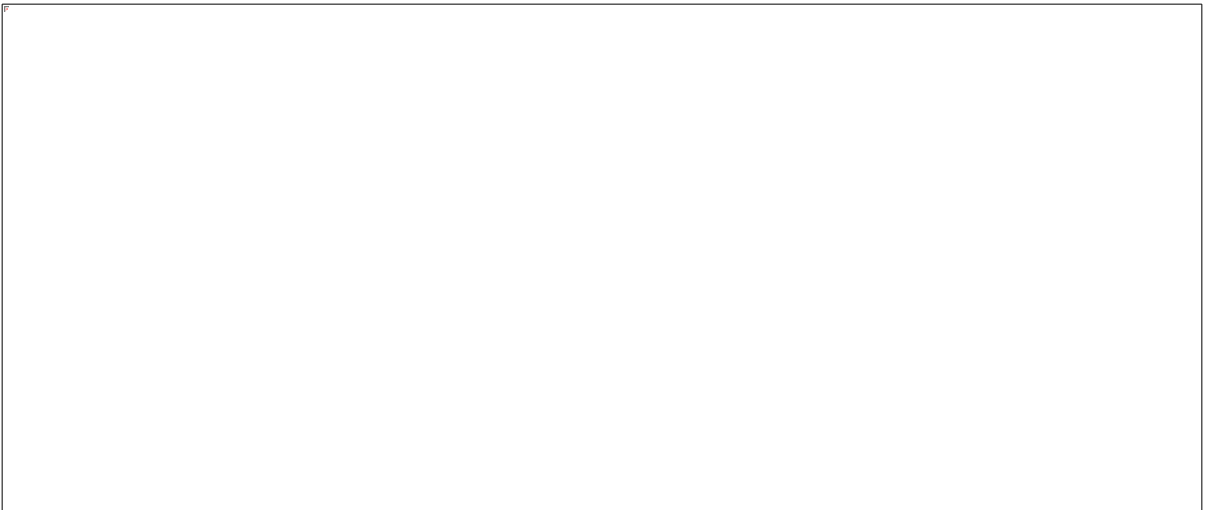
Annex 4: Sample of District Traffic Police Data



Annex 5: Summary of crash for FY 2079/080



Annex 6: Summary of crash for FY 2080/081



Annex 7: Numbers of crash, fatality, major and minor injury for fatal and injury crash

| |
|--|
| |
|--|

Annex 8: List of Respective Vehicle samiti

| |
|----------------------------------------------------------------------------------|
| 1. सुन्दर सुदुर पश्चिम यातायात प्रा.लि. (Sundar Sudur Paschim Yatayat Pvt. Ltd.) |
| 2. कैलाली ट्याम्पु यातायात प्रा.लि. (Kailali Yatayat Pvt. Ltd.) |
| 3. सेती महाकाली ट्रक यातायात व्यवसायी सङ्घ |
| 4. रिभरसाइड यातायात प्राली |
| 5. खप्तड यातायात प्राली |
| 6. मालिका यातायात प्राली |
| 7. शिवपुरी यातायात प्राली |
| 8. खप्तड मालिका यातायात प्राली |
| 9. गोदावरी यातायात प्राली |
| 10. बिधुतिय रिक्सा सङ्घ |

Annex 9: List of Auto workshop and Repair Centers

| S.N. | Name of the Auto-workshop and repair center |
|------|---------------------------------------------|
| 1. | Prapti moto cor. Pvt. Ltd |
| 2. | Sweta trading concern |
| 3. | Thakur Auto care center Pvt. Ltd |
| 4. | Vishesh Automobiles Pvt. Ltd |
| 5. | Sipradi Trading LTd |
| 6. | MAW Rides Pvt. LTd |

Annex 10: Questionnaire Sample for Auto workshop and Repair center

Section 1: General Information

a. Name of Workshop: _____

b. Location: _____

Section 2: Vehicle Repair Data

c. Total number of vehicles received for repair for FY 2022/23 and FY 2023/24: _____

d. Total number of crashed vehicles received for FY 2022/23 and FY 2023/24: _____

Section 3: Vehicle Category Breakdown

e. Number of vehicles by category:

Commercial Vehicles: _____

Private Vehicles: _____

Motorcycles: _____

f. Number of crashed vehicles by category:

Commercial Vehicles: _____

Private Vehicles: _____

Motorcycles: _____

Section 4: Cost Analysis

g. Average repair cost per category:

Commercial Vehicles: NPR _____

Private Vehicles: NPR _____

Motorcycles: NPR _____

h. Average labor cost per category:

Commercial Vehicles: NPR _____

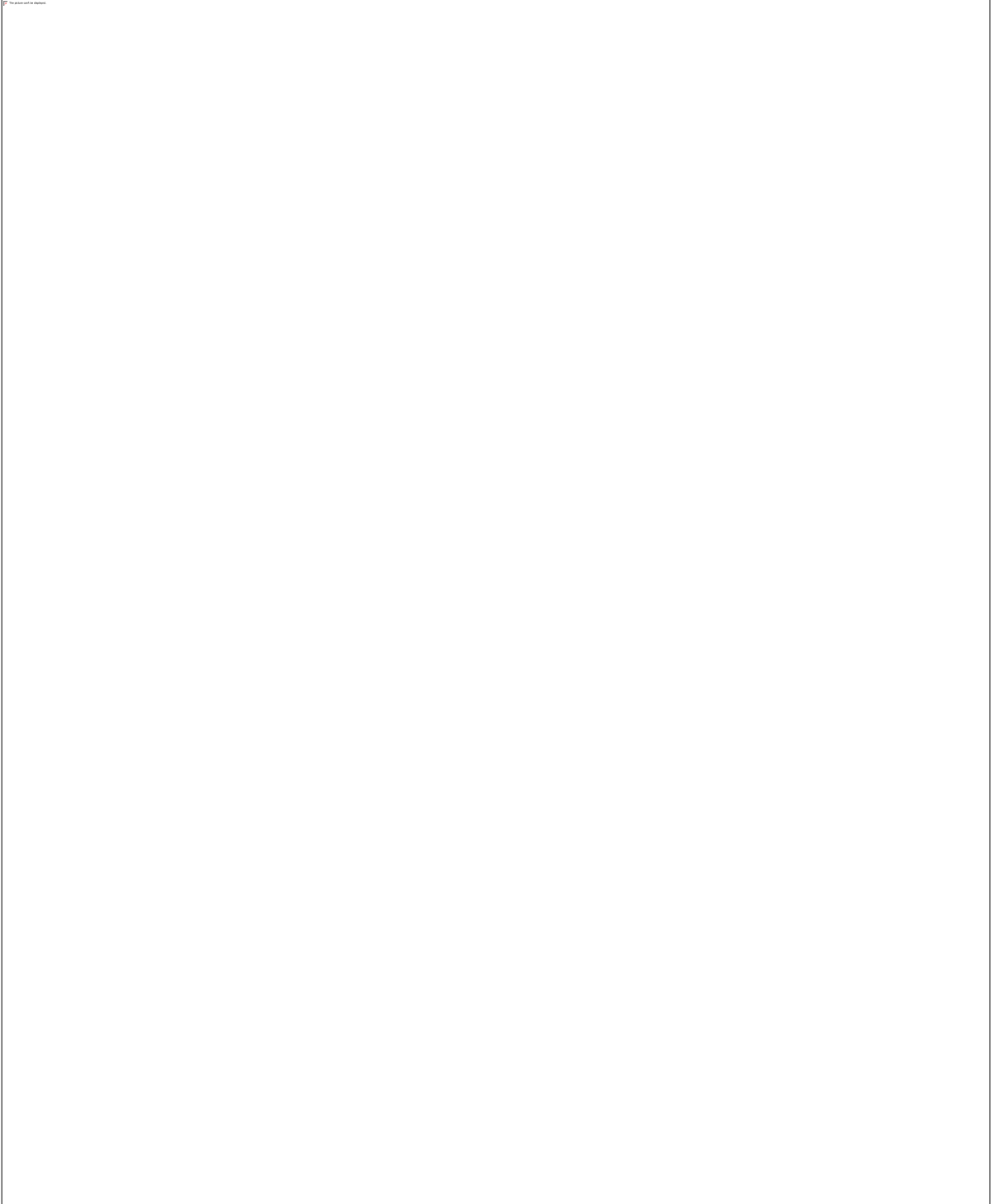
Private Vehicles: NPR _____

Motorcycles: NPR _____

i. Total repair cost for all vehicles FY 2022/23 and FY 2023/24: NPR _____

j. Total labor cost for all repairs FY 2022/23 and FY 2023/24: NPR _____

Annex 11: आ. व. ०७९/०८० र ०८०/०८१ मा सामान्य दुर्घटना भई मर्मत गर्न आएका सवारीको Minimum Repair Cost



Annex 12: Data for nominal per capita consumption

