

# Analysis of the trend in the accident-prone areas on the existing Ring Road of the Kathmandu Valley

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## LIST OF ACRONYMS AND ABBREVIATIONS

- AADT: Annual Average Daily Traffic
- GIS: Geographic Information System
- KMC: Kathmandu Metropolitan City
- RR: Ring Road
- MVA: Motor Vehicle Accident
- NTA: Nepal Telecommunications Authority
- RHD: Road and Highway Department
- RTIR: Road Traffic Incident Response
- TMC: Traffic Management Center

## ACKNOWLEDGEMENTS

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## EXECUTIVE SUMMARY

The Kathmandu Valley Ring Road has been subjected to a comprehensive analysis focusing on accident-prone areas. Nepal's vulnerability to multiple hazards, including road accidents, has prompted a detailed examination of this critical

transportation infrastructure. The analysis sought to identify and understand the trends in accidents along the Ring Road. Factors such as traffic flow, road conditions, environmental elements, and human behavior were considered in this study. Data collected and analyzed spanned a significant timeframe to capture year wise variations and long-term patterns 2075-2080 B.S. Findings revealed Top ten areas exhibiting higher accident frequencies, attributed to various factors. These accident-prone zones were predominantly characterized by congestion, poor road maintenance, visibility issues, and inadequate signage. Additionally, instances of human error, such as reckless driving and non-compliance with traffic regulations, were significant contributors to accidents.

The analysis highlighted the need for targeted interventions in these identified areas. Recommendations include infrastructure improvements, enhanced road safety measures, strategic traffic management, and public awareness campaigns. Collaboration between relevant authorities, local communities, and transportation experts is crucial to implementing these measures effectively. By focusing on mitigating risks in these accident-prone zones, the goal is to significantly reduce the occurrence and severity of accidents along the Kathmandu Valley Ring Road. This proactive approach aligns with broader initiatives aimed at enhancing road safety and ensuring the well-being of commuters and local residents.

## CHAPTER 1: INTRODUCTION

The Ring Road of Kathmandu Valley, a crucial arterial network, serves as the primary gateway for commuters travelling in and out of the capital city of Nepal. This road system plays a pivotal role in connecting various parts of the valley and provides access to major highways leading to other parts of the country. Over the years, the escalating traffic volume and changing road dynamics have raised concerns about road safety and accident rates on the Ring Road.

## 1.1 Background

The Ring Road of Kathmandu Valley was initially constructed to alleviate congestion within the city and streamline traffic movement. However, urbanization, population growth, and economic development have led to a substantial increase in vehicular traffic on this vital road network. The Ring Road has witnessed a surge in the number of vehicles, including motorcycles, cars, buses, and trucks, resulting in complex traffic conditions. The alarming rise in traffic accidents on the Ring Road has become a major concern for both commuters and authorities. These accidents often lead to fatalities, injuries, and property damage, impacting the lives of residents and travelers passing through the valley. Factors such as speeding, reckless driving, inadequate road infrastructure, and poor traffic management have been identified as key contributors to the high accident rate. Understanding the relationship between traffic flow and traffic accidents on this critical road can provide valuable insights for mitigating safety risks, optimizing traffic management, and enhancing overall transportation infrastructure in the Kathmandu Valley. Road safety is one of the most serious public health and development challenges in the world (National Council for Educational Research and Training [NCERT], 2019). Approximately, 1.35 million people die and 20-50 million get injured each year as a result of road traffic crashes (RTCs) (WHO, 2018c). Roads can be made safe if road traffic injuries and deaths are controlled. Road traffic crashes and injuries involve massive costs to often overburdened healthcare systems, occupy scarce hospital beds, consume resources and result in significant losses of productivity and prosperity with deep social and economic consequences (WHO, 2020a). Of all the systems that people have to deal with daily, road transport is the most complex and the most dangerous one (Mittal, 2018). It is the eighth leading cause of death for all ages (WHO, 2018c). It is also the second leading cause of death in the economically active population group of 15-44 years of age. More than 75 percent of RTC casualties occur in the above-mentioned age group (Teferi & Samson, 2019)

## 1.2 Objectives

Primary Objectives:

- Trend analyzing in the accident-prone hotspots in ring road of Kathmandu Valley.

Secondary Objectives:

- Determining the factor behind the injury and dead.
- Mitigating and managing the aspect of road accidents.

## 1.3 scope of work

Analysis of trends in accident area is carried out in order to determine the cause or causes of an accident (that can result in single or multiple outcomes) so as to prevent further accidents of a similar kind. This analysis of trend is carried towards answering following questions:

- What are the trends in factors affecting road traffic accidents in the ring road of Kathmandu valley?
- Which is the most influencing factor affecting road traffic accident in the ring road of Kathmandu valley?

The study focuses on the existing Ring Road within the Kathmandu Valley. Key areas of interest include intersections, sharp curves, and high-density zones. Our analysis will inform targeted safety measures to reduce accidents and enhance overall road quality.

## 1.4 Study Area

Our analysis covers the following aspects:

Accident Data Collection: Gathering data on accidents from relevant authorities.

Geospatial Analysis: Using GIS to map accident locations and indicate hotspots.

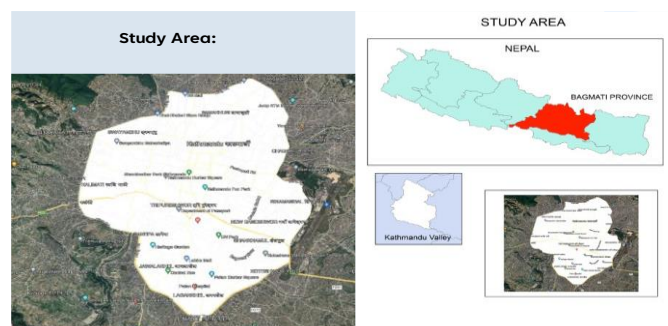
Traffic Flow Assessment: Evaluating traffic volume, speed, and congestion.

Level of Service (LOS): Assessing Road capacity and performance.

Stakeholder Consultations: Engaging with local communities, traffic police, and experts.

Top ten location of Ring Road of Kathmandu valley which are the area of focus:

1. Koteshwor
2. Gwarko
3. Satdobato
4. Chakrapath
5. Swayambhu
6. Kalanki
7. Machhapokhari
8. Chabahil
9. Gaushala
10. Airport



This area faces heavy traffic congestion, especially during peak hours. Road maintenance is a concern, with some sections displaying potholes and uneven surfaces, contributing to accidents.

## CHAPTER 2: LITERATURE REVIEW

There is tremendous rise in RTAs due to increase in vehicular volume on roads, incredible speeding of the vehicles, poor driving skills, drunk driving, bad roads, poor traffic control, and lack of public awareness, rampant indiscipline, incompetent authorities and lack of implementation of existing law to tackle the menace of disrespect to law and rules (Sharma, 2016). The maximum number of accidents occur due to the lack of traffic knowledge, negligence of drivers, and the vulnerable condition of roads (Dhakal, 2018). Road traffic accidents results from a combination of factors related to the components of the system comprising roads, the environment, vehicle and road users, and the way they interact (Shantajit, Kumar, & Zahiruddin, 2018). Road traffic accident (RTA) is defined as a situation. caused by the collision of one or more motorized vehicles, such as cars and motorcycles. The consequences of RTAs can be injuries, property damages, death, and congestion, disruption, and delays to public transport. Alam, & Alharthi (2019) investigated the impacts of sandstorms, temperature, and rainfall on road traffic accidents.

Srinivasa, Kumar and Srinivasan (2013) found that more (60.7 percent) accidents, and bright light favored for 78.1 percent of accidents and this could be because of the bad condition of roads due to rains and density of traffic in day light respectively. Shrestha (2013) explored causes of RTAs and deaths due to that, the reports show negligence, over speed, drinking and driving, poor condition of the vehicles, overtaking as major causes. Drinking and driving is also found to have significant space in RTAs and deaths. Though less significant in comparison to the aforesaid causes, poor condition of the vehicles and overtaking are also found to have caused many RTAs and deaths. Dhakal (2018) stated that the negligence of the driver to the weather condition and the condition

of road. Despite the dense presence of government and its bodies, the study showed that maximum number of road traffic accidents occur in Kathmandu valley. Youngsters riding bikes and driving cars involved in accident are found maximum in number.

## CHAPTER 3: PROJECT METHODOLOGY

Our methodology involves a systematic approach to understanding and mitigating accidents on the existing Ring Road. The project is divided into several phases:

### Phase 1: Preparatory Phase

Stakeholder Engagement: Engaging with traffic police, Road Department and community representatives to understand their perspectives and concerns.

### Phase 2: Planning and Coordination

Clearly define the boundaries of our study, including the specific hotspot of the Ring Road to be analyzed. **Data Collection Plan** Developing a comprehensive plan for collecting accident data, traffic data, road geometry data, and other relevant information about accident in Kathmandu ring road.

### Phase 3: Data Collection

- **Accident Data:** Gathering historical accident data from Kathmandu traffic head office.
- **Traffic Flow Data:** The information on traffic data, speed, zebra cross and Lighting data from traffic head office.
- **Road Geometry and Infrastructure:** The Ring Road data from the Road department Surveying the existing road layout, and other information collected with the help of google earth and OSM.

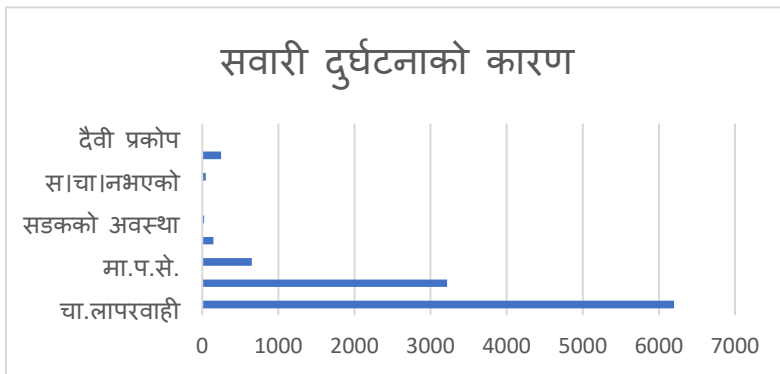
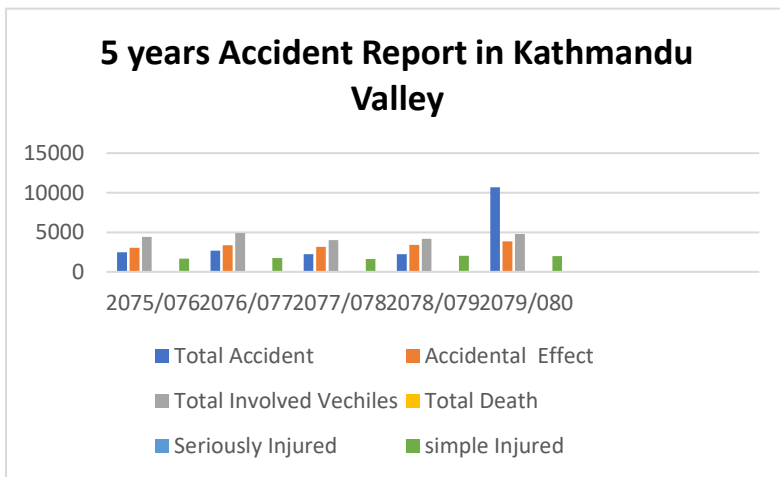
### Phase 4: Data Compilation, Cleaning, and GIS Analysis

- **Data Integration:** Compiling and organizing the collected data into a coherent dataset.

- **Statistical Analysis:** analysis of traffic data with the help of Microsoft excel and other google tools.
- **Geospatial Analysis:** Utilizing Geographic Information System (GIS) tools to map accident locations, indicating hotspots, and assess road conditions.
- **Accident Density Mapping:** Creating visual representations of accident density along the located hotspot in Ring Road Kathmandu.

### Phase 5: Statistical Analysis

we delve into the statistical aspects of our study. Our focus is on understanding accident trends, identifying patterns, and quantifying risk factors. The following analyses were conducted:



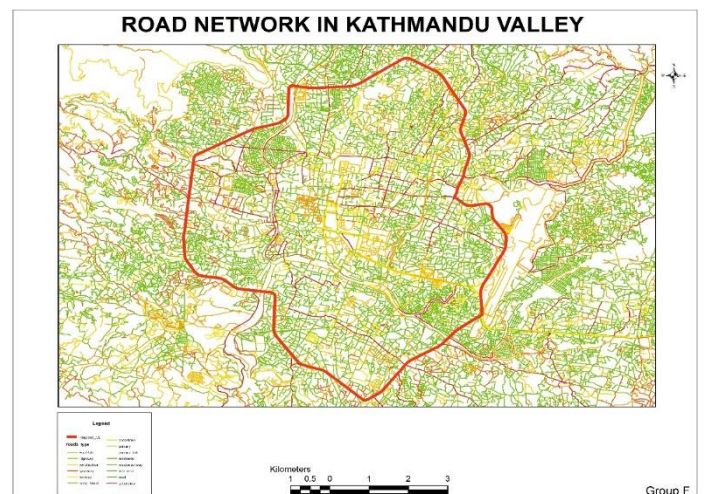
accidental effects, total involved vehicles, total deaths, seriously injured, and simple injured. The graph shows that the number of involved vehicles increased sharply in 2078/079, while the number of deaths and injuries fluctuated over the years.

### Main Cause of accident

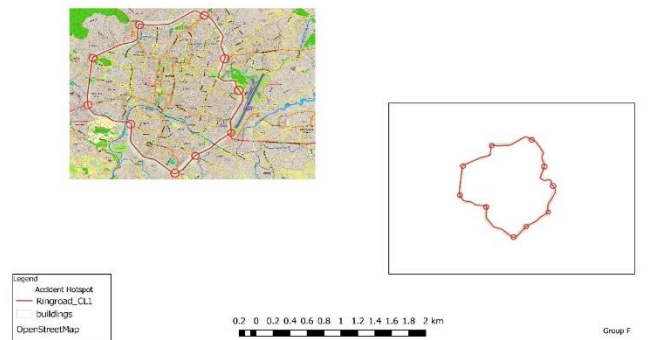
1. speed
2. C. Negligence
3. M.P.S.
4. mechanical disturbance
5. State of the road
6. vandalism
7. S. Cha. Not
8. overtaking
9. divine disaster

### Phase 6: Geospatial Analysis:

Utilizing Geographic Information System (GIS) tools to map accident locations, indicated hotspots, and assess road conditions.

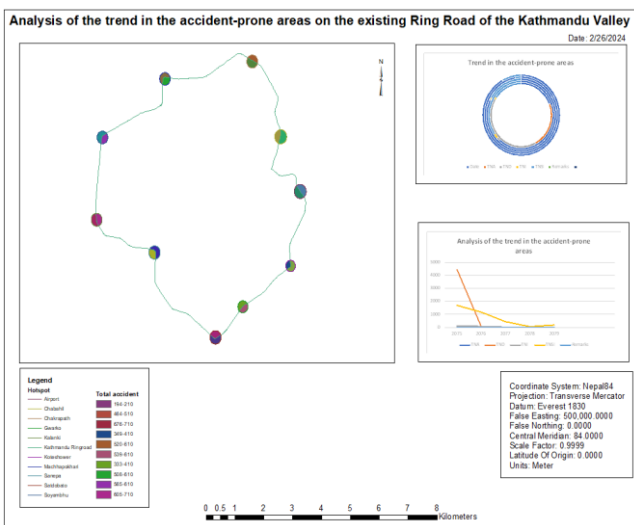


Accidental hotspot in Kathmandu Ringroad



## Phase 7: Output

The statistical analyses provided valuable insights and detected factors affecting road accidents in accident-prone areas along the existing Ring Road. And geospatial analysis provided a topological map of accidental hotspots and analyzed the trend of accidents in ring road Kathmandu using last 5 years traffic data. Our findings will inform targeted safety measures, enhance emergency response, and contribute to overall road safety in the Kathmandu Valley.



## CHAPTER 4: RESULTS

To analyze accident-prone areas on the existing Ring Road of the Kathmandu Valley, we developed an integrated geodatabase. This geodatabase combines accident data, road network information, and spatial data to create a comprehensive dataset for our analysis. Key components of the geodatabase include:

- **Accident Records:** Detailed information on each reported accident, including location, date, time, and condition.
- **Road Network:** Geospatial representation of the existing Ring Road, including Hotspot, near building, and condition.
- **Traffic Flow Data:** Traffic data, speed limits, and zebra cross data and traffic light.

## Analysis:

Using the integrated geodatabase, we conducted a risk analysis to identify accident-prone areas. Our approach involved the following steps:

**Multivariate Logistic Regression:** By considering various factors (e.g., road geometry, traffic flow, time of accident), we modeled the likelihood of accidents occurring in specific hotspot of ring road locations.

## Mitigating and managing road accidents:

It is a critical challenge that requires a multifaceted approach. Here are some strategies from our study and analysis give you 6 points of mitigating and managing road accidents, that can contribute to improving road safety:

### 1. Infrastructure Improvements:

- **Road Design:** Enhance road design by considering factors of road safety such as visibility, signage, lane markings, and safe intersections.
- **Pedestrian Crossings (footpath management):** Install pedestrian crossings (zebra cross) at appropriate locations to ensure safe passage for pedestrians.
- **Speed Bumps:** Implement speed bumps or humps (Warning plate) in residential areas and near schools to reduce speeding.

### 2. Education and Awareness:

- **Driver Education:** Educate drivers about safe driving practices, traffic rules, and the importance of speed limits.
- **Pedestrian Education:** Raise awareness among pedestrians about safe crossing practices and the use of designated crossings.

- **School Programs:** Introduce road safety education in schools to instill good habits from an early age.

### 3. Enforcement by government:

- **Traffic Police:** Strengthen traffic law enforcement to penalize reckless driving, speeding, and other violations.
- **Random Checks:** Conduct random checks for alcohol and drug impairment to deter intoxicated driving.

- **Seat Belt and Helmet Laws:** Strictly enforce seat belt and helmet laws to protect occupants and motorcyclists. Etc.
- 4. **Technology Solutions:**
  - **Speed Cameras:** Deploy speed cameras to monitor and deter speeding on highways and busy roads. Some of area in ring road got installed speed camera.
  - **Automated Traffic Signals:** Implement smart traffic signals that adjust timing based on traffic flow.
  - **Vehicle Safety Features:** Encourage the adoption of vehicles with safety features like airbags, anti-lock brakes, and stability control.
- 5. **Emergency Response:**
  - **Ambulance Services:** Improve emergency medical services to provide timely assistance to accident victims.
  - **Helpline Numbers:** Promote helpline numbers for reporting accidents and seeking immediate help.
- 6. **Community Engagement:**
  - **Community Watch:** Involve local communities in monitoring road safety and reporting hazards.
  - **Youth Engagement:** Engage youth in road safety campaigns and encourage responsible behavior.

## CHAPTER 5: CONCLUSION

Our study revealed several key findings:

1. **Hotspots:** We identified accident hotspots near intersections, sharp curves, and high-density zones along the Ring Road.
2. **Contributing Factors:** We identified Poor Road design, inadequate signage, and heavy traffic flow were main significant contributors to accidents. And other major factors are below:

### Some of reason beyond accident are:

#### दुर्घटनाको कारण

- तिव्रगती (Speed)
  - चा.लापरवाही (Careless of driver)
  - मा.प.से. (Drunk and Drive)
  - यान्त्रीक गडवडी (Mechanical problem)
  - सडकको अवस्था (Road condition)
  - तोडफोड (Vandalism)
  - स।चा।नभएको (Ass. Driver unavailable)
  - ओभरटेक (Overtake)
  - दैवी प्रकोप (Divine Disaster)
3. **Recommendations:** Based on our analysis, we recommend targeted safety measures, including road improvements, traffic management with smart way, and public awareness campaigns will be add in smart traffic management.

In conclusion, understanding accident trends and accidental factors are crucial for enhancing road safety. By implementing our recommendations, we can reduce accidents and create a safer environment for commuters in the Kathmandu Valley.

## REFERENCES

- a) Arispe, M. C. A. (2020). Integrating Spatial Data Analysis for Road Traffic Incident Response System. *International Journal of Advanced Trends in Computer Science and Engineering*
- b) *Traffic data management office and road department*
- c) (Smart traffic management) Article in International Journal of Computer Applications · August 2013
- d) [Manandhar, R. B. \(2022\). Factors Affecting Road Traffic Accidents in the Kathmandu valley Raju Bhai Manandhar. International Research Journal of MMC \(IRJMMC\), 3\(3\), 82-90.](#)
- e) Google earth and OSM data