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Causes of Road Traffic Accidents at Junctions in Pristina

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Summary

As the tenth leading cause of death worldwide, road traffic fatalities account for 1.24 million deaths and 20 to 50 million non-fatal injuries annually - over 90% prevalent in low and middle-income countries with 40% of the world's registered cars. Urban trends estimate hazardous growth of traffic fatality rates in future decades accounting for substantial losses in economic development (accounting for 3% of GDP) and vulnerable road users (pedestrians and cyclists).

Fatal accidents in Kosovo represent 15-20% higher than EU countries presenting evidently declining traffic conditions in its capital city Pristina. Confronted by rapid urbanization, Pristina is the administrative, political economic and cultural hub of Kosovo comprising of increased flows of people and transport commuting from one activity to another. 57% of road traffic accidents occur on urban roads with main causes indicated by unsafe accessibility, inadequate distance, incorrect adjustment of speed to facilitate road conditions, irregular changing of lanes, unsafe driving (Road Safety Strategy and Action Plan for Kosovo, 2015). Extensively far from EU benchmarks, figures show a significant increase of road traffic accidents (RTAs) from 2004 to 2014, confirming that the number of fatalities is considerably high throughout the last 11 years (Road Safety Strategy and Action Plan for Kosovo, 2015).

Road safety has been researched from various disciplines and perspectives and RTAs have been stated to be very difficult to predict due to the randomness of their occurrence. The main research objective was to explain causes contributing to RTAs in order to determine the most significant cause contributing to RTAs at junctions in Pristina. To achieve this objective, three mutually distinctive concepts (human error, built environment and traffic management) influencing RTA causation were examined. To study a deeper context of the research topic, the research strategy used was a multiple case study with mixed methods in order to comprehensively explain causes of RTAs upon real life situations in Pristina. Survey was used to collect driver's perspectives while driving in Pristina complemented by in depth interviews with individuals who were of interest to the case study (e.g. near by residents, RTA victims and experts in the field). Accordingly, both quantitative and qualitative primary data was collected. Quantitative data was analysed using descriptive statistics and binary logistic regression in SPSS whereas qualitative data was analysed manually. Secondary data was also collected for the selection of the case study as well as archives from the Kosovo Police, which further explained and supported research findings.

Based on survey results, the analysis revealed that drivers perceived the built environment and traffic management as significant causes of RTAs at junctions in Pristina. Interviews further concluded that traffic management and human error were significant causes although the built environment ranked comparably near lacking only 1 point. Moreover, secondary data confirmed human error as the cause of 92% of RTAs as reported by the Kosovo Police. Furthermore, to answer the research questions, the research results were analysed through individual and combined effects (human error, built environment and traffic management) based on academic literature. Research findings similarly indicated a combined effect of all three concepts interchangeably producing error resulting in RTAs. Particularly, the TCI model (Fuller, 2005) clarified the role of human error within the task of driving whereas the system perspective model (Reason, 1990) ideally explained the circumstances in which the combined effect of causes increase the probability of RTAs at junctions in Pristina thus answering the research questions.

Keywords

Road Traffic Accidents, Causation, Traffic Safety, Pristina, Kosovo

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Abbreviations

IHS	Institute for Housing and Urban Development
RTA	Road Traffic Accidents
RTAJ	Road Traffic Accidents at Junctions

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Chapter 1: Introduction

1.1 Background

The world's car population has already passed 1 billion and is expected to reach 2.5 billion by 2050 (Voelcker, 2017). As the tenth leading cause of death worldwide, road traffic fatalities account for 1.24 million deaths and 20 to 50 million non-fatal injuries annually - over 90% prevalent in low and middle-income countries with 40% of the world's registered cars. Urban trends estimate hazardous growth of traffic fatality rates in future decades accounting for substantial losses in economic development (accounting for 3% of GDP) and vulnerable road users (pedestrians and cyclists). Above 50% of traffic fatalities occur in cities and similarly severe injuries occur in urban areas, specifically pedestrian to car accidents. (WHO 2009, 2013, 2017; Dimitriou and Gakenheimer 2012; European Commission 2013 in Welle et al, 2015; Road Safety Strategy and Action Plan for Kosovo, 2015). To add, city dwellers globally are expected to increase from 50% in 2007 to 70% in 2030 (UNICEF 2012 in Welle et al, 2015). Consequently, particularly in developing countries, road traffic accidents in urban areas signify leading world issues destructively impacting economic, social and environmental characteristics of our cities.

Kosovo, a developing country, is located in the central Balkan Peninsula bordered by Albania, Republic of Macedonia, Montenegro and Serbia. The collapse of Yugoslavia triggered socio-economic challenges particularly in transport policy, planning, infrastructure and land use followed by fragile transport systems and unbalanced development. Poverty (29.7%) and unemployment (32.9%; 57.7% for youth ages 15 – 25 years) rates are distressingly high and the unstable economy is dependent on foreign aid and transfers from the Diaspora (UNDEP, n.d.). Damaged or poorly maintained infrastructure negatively impacts opportunities for much needed investments and adjustments to facilitate effective sustainable mobility crucial for recent rapid phases of urban development in Kosovo. Strengthening the economy by improving liveability remains a challenge. Transport policy is primarily focused on road network development, disregarding sustainable transport modes and socio-economic matters creating an imbalanced transport sector. Adequate planning and development in terms of modern infrastructure inline with EU standards still remains a critical challenge to address. High car ownership has considerably increased in Kosovo representing negative externalities such as road traffic accidents causing fatalities and injuries, congestion, pollution and health problems. The average age of cars is 18 years old - 10 years older than the European Union standards. For every new car imported in 2014, 16 used cars were imported (GAP, 2015).

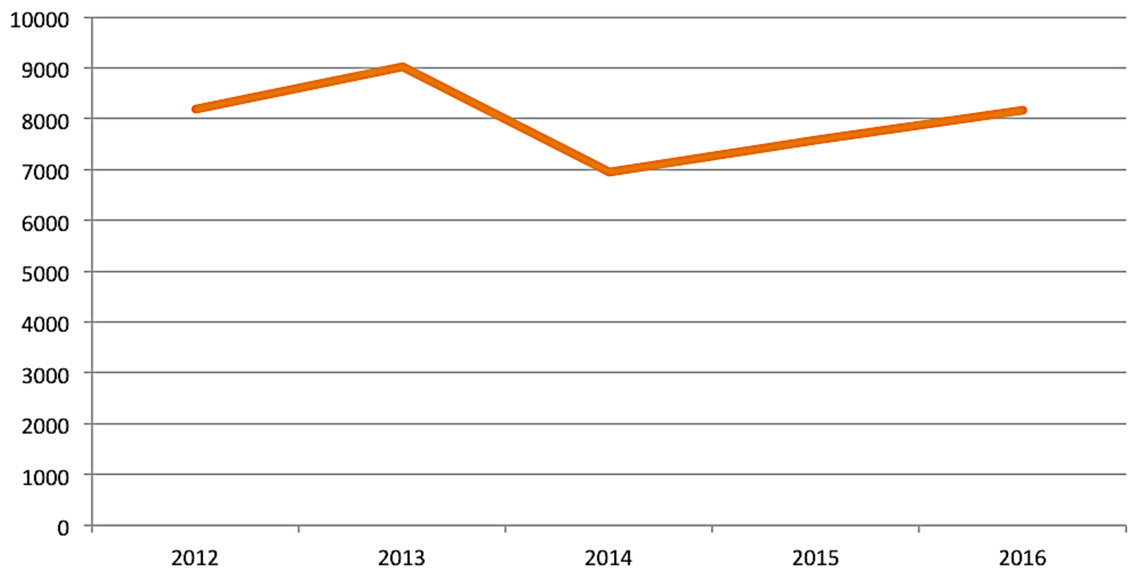
With rising rates of road traffic accidents occurring in the capital city, Pristina, it has been asserted that high numbers arise due to human error (National Endowment for Democracy, 2012). With an area of 572 km², Pristina is the largest and most dense city in Kosovo. Confronted by rapid urbanization, Pristina is the administrative, political economic and cultural hub of Kosovo. With high numbers of the population working or studying in Pristina, increased flows of people and transport (noticeably higher on weekends) commute from one activity to another. Given its compact design, Pristina is a walkable city and travel time is reasonable making most neighbourhoods easily reachable by foot. The Mother Theresa Square is the largest inner city pedestrian zone encouraging walking. However, Pristina still rests as a car-dominated city challenged by daily urban chaos. Current transport modes include the private car, private taxi, informal taxi, public transportation (bus) and walking. Congestion, especially in peak hours, is customary in inner city areas. Main roads, frequented by pedestrians, are narrow (limiting public space), lack accurate maintenance and street design creating disordered urban traffic, which increases risks and hazards. Promotion and implementation of alternate modes of transport are not available or limited although recent public transportation initiatives show new prospects. Parking spaces are also limited encouraging illegal parking and road encroachments on most frequented roads, curbs and sidewalks.

1.2 Problem Statement

Fatal accidents in Kosovo represent 15-20% higher than EU countries, which attain more cars per inhabitants. According to police audit reports, measures were taken (road safety campaigns, police activities and road improvements) however the total number of road traffic accidents increased by 8% over recent years (Audit Report Traffic Police Operations and Road Traffic Safety, 2015).

Declining traffic conditions persist in Pristina. According to the emergency centre at the University Clinical Centre of Kosovo in Pristina, the total number of injured persons in road traffic accidents (RTAs) who have sought medical assistance from January 2009 to December 2012 was 173,563. Previous research showed that possible determinants of road traffic accidents (RTAs) are alcohol consumption, negligence of pedestrians and high speeds (Lenjani et al., 2013). To add, the Kosovo Police verified that the number of RTAs has increased from 2012 to 2016.

Figure 1 - Number of RTAs in Pristina 2012 to 2016



(Source: Kosovo Police, 2017)

It has been observed that the current situation potentially foresees several other causes contributing to the rising rates of RTAs including substantial disadvantages of high volumes of reasonably old cars, poor maintenance of infrastructure, weak law enforcement and widespread tolerance of driving in escalated speeds. Extensively far from EU benchmarks, figures show a significant increase of RTAs from 2004 to 2014, confirming that the number of fatalities remained considerably high throughout the last 11 years (Road Safety Strategy and Action Plan for Kosovo, 2015).

Between January 1 2014 to 31 October 2015, about 5,346 112 emergency calls (approximately 53%) were made to report RTAs in Pristina (UNDP; Open Data Kosovo, 2017). Negligence of pedestrians, particularly children and young people, remains a critical concern and represent 31% of all fatalities and 13% of all injuries ranking them the most vulnerable road users (Lenjani et al., 2013). National road safety plans stated that 57% of RTAs occur on urban/town roads with main causes indicated by unsafe accessibility, inadequate distance, incorrect adjustment of speed to facilitate road conditions, irregular changing of lanes, unsafe driving (Road Safety Strategy and Action Plan for Kosovo, 2015).

1.3 Research Objective

The main objective of this research was to explain relevant causes contributing to road traffic accidents (RTAs) in order to determine the most significant cause instigating RTAs at junctions in Pristina.

1.4 Provisional Research Questions

In accordance with the study objective, the following research questions were formulated:

Which causes significantly contribute to RTAs in Pristina?

1. How does human error contribute to RTAs?
2. How do land use patterns influence RTAs?
3. How does traffic management influence RTAs?

See section 3.1 for revised research questions.

1.5 Significance of the study

Prevailing academic literature to date provided broad knowledge of accident causation, road safety and RTAs in general. The findings of this study demonstrated the most significant causes influencing RTAs at junctions in Pristina. It provided useful knowledge for policy makers in Pristina and the region in order to design, develop and implement adequate traffic measures and policies to effectively increase road safety by reducing RTAs. The output of the research will also positively contribute to the limited academic literature in the field of road traffic safety in Pristina. Most importantly, our communities benefited considering that road safety is a leading world issue today, especially in developing countries like Kosovo.

1.6 Scope and limitations

This research was limited to a specific case study. The study exclusively focused on RTAs in the municipality of Pristina in Kosovo. Only junctions located in the municipality of Pristina taken into account. The analysis was based on junctions selected from the 112 Emergency Calls in Pristina application, which comprised of RTAs from January 1st 2014 to October 31st 2015. Moreover, this study focused on accident causation through significant causes identified through the research academic literature in order to explain RTA at junctions in Pristina.

Chapter 2: Literature Review / Theory

2.1 Introduction

Due to the unsystematic nature of the existence of accidents in general, road safety is a complex topic in transport research. Through human and economic costs, accidents inflict severe problems to humanity and therefore, understanding the causes of risk leading to RTAs is crucial. Great effort has been made in extensive research over the years providing fundamental studies, theories and concepts regarding the area of study. Considerable research has been conducted in recent decades regarding road safety (e.g. why RTAs occur) and causes that affect road safety (e.g. what causes RTAs). Although substantial research has been conducted thus far, additional knowledge is critical to further examine the occurrence of RTAs to effectively provide effective measures appropriate to improve overall road safety.

The aim of this research was to identify which causes significantly contribute to RTAs at junctions in Pristina. This chapter reviewed literature on key theories and concepts relevant to the study of RTAs. The review led to a comprehensive understanding of fundamental contributing causes manifesting in road transportation, which as a result lead to RTAs. An overview of relevant concepts was discussed beginning from accident causation and human behaviour to various contributing causes of RTAs.

2.2 Key Theories and Concepts

Road safety has been researched from various disciplines and perspectives. RTAs have been stated to be very difficult to predict due to the randomness of their occurrence (Elvik, 2004 in C. Wang et al, 2013). On the contrary, other claims that RTAs are deterministic events rather than a random chance (Davis, 2004 in C. Wang et al, 2013). To better understand how to reduce RTAs or accident severity, it is imperative to firstly understand why accidents occur and what factors affect their occurrence.

2.2.1 Accident Causation Theories

Several researchers have attempted to explain accident causation in various manners. Consequently, several theories have been formulated over time to discover and explain common patterns in RTAs.

The following theories have gained attention in academic literature:

- "The *pure chance theory* states that everyone in the population has an equal chance of sustaining an accident. It suggests that no discernible pattern emerges in the events that lead up to an accident. It is usually treated as an act of God, leaving one to accept the fact that prevention is non-existent
- The *biased liability theory* considers that once a person sustains an accident, the probability that the same person will incur another accident in the future has either decreased or increased when compared to the rest of the population at risk. If the probability has increased, the theory is known as the "contagious hypothesis". If the probability has decreased, it is commonly called the "burned fingers hypothesis
- The *accident proneness or the unequal initial liability theory* has been the most widely discussed theory in the history of accident research. It states that there exists a certain subgroup within the general population that are more liable to incur accidents. This theory refers to some innate personality characteristics that cause accident-prone individuals to have more accidents than non-accident prone people

- The *Theory of Unconscious Motivation* originates from the psychoanalytic theory. It states that the subconscious processes that include guilt, aggression, anxiety, ambition, and conflict cause accidents. This theory focuses only on the individual and the interaction of his perception of the environment with his underlying personality constructs
- The *Adjustment-Stress And Goals-Freedom-Alertness Theories* are two complementary theories developed by Kerr (1950, 1957). The adjustment-stress theory states that individuals who fail to reach some sort of adjustment with their working environment will tend to have more accidents than others. This adjustment is affected by physical and psychological stresses. The goals-freedom-alertness theory postulates that individuals have accidents due to a lack of alertness brought about by the fact that these people had no freedom in choosing the goals set for the working situation" (Smillie and Ayoub, 1976)
- *Heinrich's domino theory* (1932) correlates accident causation to "a sequence of events in which one event triggers the next (like the falling of dominos). Events in the sequence may relate to characteristics of the environment (e.g., unsafe conditions), as well as characteristics of people (e.g., unsafe behaviour)" (p.130, Clarke, 2015).

Recent studies such as Elvik (2006), analysed accident causation by connecting it to risk factors stating that numerous risk factors can be explained through statistical regularities denoted as laws of accident causation. The relationship is conveyed through the following laws:

- "The universal law of learning, which states that the ability to detect and control traffic hazards increases uniformly as the amount of travel increases. This law implies that accident rate per unit of exposure will decline as the amount of exposure increases.
- The law of rare events, which states that the more rarely a certain risk factor is encountered the larger is its effect on accident rate. This law implies that a risk factor encountered on, for example 5% of all trips, will be associated with a greater increase in accident rate than an otherwise identical risk factor encountered on 50% of all trips.
- The law of complexity, which states that the more units of information per unit of time a road user must attend to, the higher becomes the probability that an error will make. This law implies that accident rate will increase the more elements of information the traffic environment contains.
- The law of cognitive capacity, which states that the more cognitive capacity approaches its limits, the higher the accident rate. This law implies that impairments affecting mental functions will have a greater effect on accident rate than impairments affecting physical functioning only" (Elvik, 2006).

2.2.2 Behavioral Theories

Human behaviour is a complex notion, which is difficult to clarify. Various researchers have attempted to explain and predict human behaviour in diverse situations through theories in order to explain numerous aspects such as why individuals behave in a certain way and how behaviour is adapted to certain situations.

Drivers are prone to respond to deviations in traffic systems. Drivers usually search for opportunities to fulfil their motives while driving in traffic. "Generally speaking, drivers look for opportunities to satisfy their motives in traffic, which basically means looking for sufficient gaps and for means to maintain their desired speed" (p.104 Summala, 1996).

The theory of planned behaviour (TPB) explains human behaviour stating that behaviours are motivated by behavioural intentions, which are shaped from concepts of attitude (individuals judgment of how positive or negative a specific behaviour is), subjective norms (individuals perception of others (e.g. friends) approval or disapproval of a specific behaviour) and perceived behavioural control (individuals perception of their capability of performing a specific behaviour) (Castanier, 2013). "Studies have also specifically demonstrated its predictive utility for understanding the decision making processes that lead people to violate traffic rules (e.g., Forward, 2009; Iversen, 2004; Turner & McClure, 2004; Zhou, Wu, Rau, & Zhang, 2009)" (p.149, Castanier, 2013).

Behavioural adaptation, explained through the concept as risk compensation, is a central theme in driver behaviour research. Risk and risk-management are imperative controlling components in determining driver behaviour (Ranney, 1994 in Fuller 2000). It has been noted that driving is a complex daily task where the task of driving involves certain degrees of risk, uncertainty and difficulty. Risk compensation theory states that individuals are prone to take more risk with increased security. "The concepts of risk compensation and risk homeostasis are often used to describe or to explain drivers' tendencies to react to traffic system changes whether in roads, vehicles, weather conditions or in their own skills" (p.103, Summala, 1996). Wilde (1982) studied risk compensation based on a psychological perspective defined as risk homeostasis theory, which illustrates human behavioural adaptation to road safety in complex environments. Wilde, states that risk is an integral aspect in all humans where each individual consists of a certain level of risk they are willing to take. If, in a given situation, the risk exceeds ones set risk level, precautions will be taken to reduce the risk whereas if the risk is lower, one will challenge to increase the risk to the set risk level. Therefore humans adapt behaviour due to the constant external fluctuations in the environment intended to increase or decrease safety by adapting to such changes in order to maintain safety (e.g. reducing speed or increasing attention) (Hedlund, 2000).

2.3 Overview of Contributing Causes

Great effort has been focused on analysing RTAs by investigating and identifying diverse contributing factors and thus a vast array of research has been conducted on RTAs from a wide range of dimensions and methods. Various causes, some containing more risk than others, are associated with drivers and other road users (driver/passenger condition and behaviour), traffic conditions (traffic flow and speed), road characteristics (road geometry and infrastructure), cars (design: airbags, electronic stability control, anti-lock braking systems etc.), and the environment (lighting and weather conditions etc.) (O'Donnell and Connor, 1996; Washington et al., 1999, Shankar et al., 1995; Golob and Recker, 2003 in Wang et la, 2013).

Peltzer and Renner (2003) collected data on perceptions of causes of road accident and found that the top three perceived causes were "insufficient knowledge of traffic rules; dangerous parking; drug or alcohol consumption, and the three least important were: bad luck; absence of pavements; sanctions being too lenient" (p.155-156, Vanlaar, 2006).

Garder (2004) further explained how traffic speeds analysed in physics confirm that higher speeds reduce reaction time at any given time resulting in unpredictable circumstances leading to increased intensity of collision in the event of an accident. Driving at 40 miles per hour, drivers need more than 280 Ft. to stop on wet surfaces; at 30 miles per hour, emergency stopping drops to around 130 Ft.; whereas 20 miles per hour, 60 Ft. is needed. Lower speeds have been confirmed to be safer by also increasing safety primarily for vulnerable road users such as pedestrians. "Struck by a vehicle traveling forty miles per hour, a pedestrian has an

85 per cent chance of being killed. The fatality rate drops to 45 per cent at thirty miles per hour and to 5 per cent at twenty miles per hour or less" (p. 349, UK Department for Transport 1997; Zegeer et al. 2002a in Ewing, 2009). Consequently, the probability of pedestrian accidents decreases with reduced speeds in low speed zones (narrow streets) and increases with increased speeds in high-speed zones (wide streets) (Garder 2004 in Ewing, 2009).

On the other hand, Ewing (2009) demonstrates the relationship of how the built environment affects accident rates and severity through factors of traffic volume and speed across development patterns which impact safety through traffic volumes that are produced and speeds that are encouraged. Street designs impact safety through permitted speeds and the traffic volumes they produce. Therefore, traffic volumes are main factors of accident rates whereas traffic speeds are main factors of accident severity. He follows by stating that traffic conditions in dense urban areas develop safer parameters compared to low density areas such as the suburbs since less kilometres driven per capita as well as low speed regulations primarily generate less fatal accidents. To add, dense urban areas are designed with narrow streets combined with traffic calming measures such as street furniture along the proximity of the streets which ultimately provides clear communication for safe and applicable speeds leading to improved road safety compared to conservative road designs (wider streets facilitating drivers not pedestrians) (Ewing, 2009).

Çelik and Oktay (2014) classified risk factors in seven groups: driver (age, gender, education level), vehicle (type), temporal (time of day), environmental (season, weather conditions, lighting, road surface), geometry (road type and road characteristics), and traffic control (traffic lights, signs, pedestrian crossings etc.) (Celik and Oktay, 2014).

Therefore, considering the complexity of accidents triggered by humans, a universal set of contributing cause has yet to be established. However, based on knowledge obtained from the literature review, it has been understood that the following are key causes contributing to RTAs: human error, the built environment and traffic management and thus the rest of the review with follow accordingly.

2.3.1 Human Error

Road safety can be perceived as the result of safe interaction of road users in traffic within the environment. Therefore, traffic safety evaluation must consider physiological and psychological abilities of drivers. Several studies found that human error is the leading cause of 75% of all roadway crashes (Niezgoda et la, 2012; Salmon et la, 2005; Treat et la, 1977; Rumar, 1985 in Allahyari et la, 2008).

Considering that humans are highly disposed to error, various factors in cognitive processing, perception, attitude and memory lead to increased risk and unforeseen behaviours of road users which result in road traffic accidents (Ewing, 2009).

Currently, no universal accepted definition of human error exists. However, "Senders and Moray (1991) proposed that error is something that has been done which was either not intended by the actor or not desired by a set of rules or an external observer or that led the task or system outside of its acceptable limits. Reason (1990) defined human error as, a generic term to encompass all those occasions in which a planned sequence of mental or physical activities fails to achieve its intended outcome, and when these failures cannot be attributed to the intervention of some chance agency" (p. 15, Senders and Moray, 1991; Reason, 1990 in Salmon et la, 2005). Niezgoda et la. (2012) defined error as "an event where planned sequence of mental or physical activity fail to achieve intended outcome and violations are rather deliberate deviations from those practices deemed necessary to maintain safe operation of the potential hazardous system. Errors and violations are complex behaviours that are mediated by different psychological mechanisms. e.g. errors are more due to cognitive failures and violations are strongly dependent on social context" (p.504, Niezgoda et la, 2012). Consequently, human error can be commonly defined as "any mental or physical activity, or failure to perform activity, that leads to either an undesired or unacceptable outcome" (p.15, Salmon et la, 2005)

Errors are a consequence of human cognitive functioning with distinct variations between humans ultimately leading to various forms and rates of errors in a given setting. For example, some humans may be more disposed to memory lapses and inattention and therefore it can be noted that cognitive failure rates can be utilized to measure capacities of humans effecting performance in a task such as driving (Allahyari et la, 2008). Error classification is utilized to identify and categorize various types of human errors. The most widely recognized notion proposed by Reason (1990, 1997) classifies errors by slips and lapses, mistakes and violations. Slips, the most common human error, are errors of execution of the intended action. Lapses are errors, which involve a failure of memory (forgetting subsequent actions in task sequence). Mistakes occur through intentional wrong or inappropriate decisions followed by correct execution of the required action. Violations are understood by behaviours that diverge recognized rules and principles and can be deliberate or unintentional (Salmon et la, 2005; Allahyari et la, 2008).

Reason (1990) suggested theoretical perceptions regarding human error defined by a systems perspective model focusing on human error and accident causality in intricate systems. The person approach and the systems perspective approach are the most significant system approaches to error available in literature (Salmon et la, 2005). The person approach focuses on identification and classification of errors made by actors and pursues to identify psychological factors (e.g. distraction or negligence) involved in the occasion of error. The person approach states that errors occur due to irregular "mental processes such as forgetfulness, inattention, poor motivation, carelessness, negligence, and recklessness" (p. 14, Reason, 2000 in Salmon et la, 2005) and therefore research analyses the rates of errors made within intricate systems in order to develop adequate prevention measures for future errors existence. Application of the person approach indicates that human error is the cause of most accidents within systems that are presumed to be safe. Here, human unpredictability is noted as the main risk within the system and therefore the system must be protected, through training and/or restraints, from human unreliability (Dekker, 2000 in Salmon et la, 2005) Research has established that the majority of human error research is generally categorized as person-based. On the other hand, the systems perspective approach focuses on errors made by systems failure rather than an individual actor's failure and considers collective roles of covert conditions (inadequate equipment, poor designs, inadequate supervision, manufacturing defects, maintenance failures, inadequate training, clumsy automation, inappropriate or ill-defined procedures) and human errors in causality of accidents. Here, rather than human error being the main cause of accidents, the covert conditions existing in the system are noted as the main risk at fault since such conditions and errors merged in such a way allow the accident to occur. Additionally, the systems approach states that human error is an indicator of complications within the system and that human error is associated with the tools utilized, tasks executed and operational environment (Dekker, 2000 in Salmon et la, 2005). Within the transportation sector, most research conducted has been done through the person-based perception on human error by identifying the type and rate of errors made by drivers. To add, the Driver Behaviour Questionnaire (DBQ) (see Reason, et al, 1990) aimed to identify various types of driver error behaviour, is utilized in a large share of research to date. The systems perspective approach on human error has gained limited use; however, it has been acknowledged that the application is beneficial within the transportation sector (Salmon et la, 2005).

Fuller (1999) defines "driving as a control task in a dynamic environment in which the driver has the primary dual tasks of satisfying mobility (e.g. travel) needs and avoiding collision" (p. 48, Fuller 2000) and further explains the concept of driving difficulty through the task–capability interface (TCI) model. In the TCI model, task difficulty arises out of the dynamic interface between the demands of the driving task and the capability of the driver" (p. 463, Fuller, 2005).

Task demand evolves from complex settings of combined components such as the environment (visibility, weather conditions, road geometry, road markings and signs, road surfaces etc.), behaviour of surrounding road users, car performance (information display, control features and amount lighting provided in dark circumstances), "speed, road position and trajectory and driver communication" (Fuller, 2000). Whereas the capability of the driver is dependent on biological limitations (age, gender, information processing, flexibility, reaction time and coordination etc.) complemented by individual education (knowledge and skills gained from experience and formal training) and human factors (attitude, motivation, effort, fatigue, drowsiness, time-of-day, drugs, distraction, emotion and stress). The above stated confirms that the driver's capability is restricted and thus capability denotes the ability of a given driver to convey their level of competence at any given time. Risky behaviour (explained later in the review) further increases the task difficulty (Fuller, 2000).

Therefore, when capability surpasses demand, the task is easy. When capability matches demand the driver nears capability limits and the task is very difficult. While when demand surpasses capability, the task is excessively difficult leading to task failure, which increases chances of control loss possibly resulting in accidents. Consequently, task difficulty is defined by the difference in task demand and capability available to deal with demands by also maintaining safe outcomes. At stationary level of capability, actions, which increase task demand, will consequently increase hazardous differences, increase task difficulty and theoretically challenge safety. For example, "the use of a mobile phone can be an additional task, which pushes demand beyond driver capability increasing the chances of accident by 500%" (Violanti and Marshall, 1996 in Fuller, 2005) (Fuller, 2000, 2005).

Since humans are constrained by biological limitations and accordingly depend on mental functions such as perception, attention and memory. Research on human error has been conducted from different perspectives with the majority focusing on the cognitive perspective. "Cognitive failures are defined as failures in perception, memory, and motor functioning, in which the action does not match the intention therefore including numerous types of execution lapses: lapses in attention (i.e., failure in perception), memory (i.e., failures related to information retrieval), and motor function (i.e., the performance of unintended actions, or action slips). While cognitive failures occur frequently and many do not produce any serious consequences, some—under specific circumstances—will result in accidents. This is true when comparing driving errors and accidents rates. Whereas accidents are relatively rare, drivers routinely commit many errors" (p. 150, Broadbent et la, 1982; Wallace and Chen, 2005 in Allahyari et la, 2008). Several studies on relationships between cognitive capacities and accidents, found that cognitive failures substantially contribute to task performance and safety present in most accidents (Allahyari et la, 2008).

Cognitive failures, illustrated by memory and distraction, relate "to the ability to distribute attention across multiple tasks, particularly under stress. People with a higher tendency toward cognitive failures (i.e., those who are error-prone) are more likely to have accidents. They are also more vulnerable to the symptoms of stress, such as depression, anxiety, difficulty sleeping, and general ill health" (p. 131,Wallace and Vodanovich, 2003; Clarke, 2015). Additionally, it has been "found that ineffective processing of information, lack of attention, and poor judgment are the most common precursors of accidents" (p.131, Brown, 1990 in Clarke, 2015).

Driver condition and behaviour also contribute to the driving task and many authors have argued that human and behavioural factors influence RTAs (Lawton, Parker, Manstead, & Stradling, 1997; Sabey & Taylor, 1980 in Ram , 2016). Assum (1997) claimed, "behavioural factors constitute the lion's share in road accident involvement" (p. 60, Mohamed , 2017). Human behaviour is a complex subject difficult to simplify and can be approached at various levels from physiological processes to social institutions. "Social and personality psychologists have tended to focus on an intermediate level, the fully functioning individual whose processing of available information mediates the effects of biological and environmental factors on behaviour through concepts of social attitudes and personality traits" (p. 179, Ajzen, 1991). Variables such as "demographic variables such as age, gender, and experience, cognitive variables such as distractibility and disregard for negative consequences, and motivational or affective variables such as driver vengeance and aggression" (p. 1223, Lawton et al., 1997; Wiesenthal and Singhal, 2006; Wilson and Daly, 1985; Strayer and Johnston, 2001; Taubman-Ben-Ari et al., 2004; Hennessy and Wiesenthal, 2004, 2005; Lonero, 2000; Neighbors et al., 2002 in Wickens et la, 2008) have been linked to driver behaviour.

It has been confirmed that driver personality is a significant and relevant variable (Elander et al., 1993; Yang et al., 2013; Lucidi et al., 2014 in Azade , 2016). Personality traits influence humans to behave in various manners, which may increase the probability of RTAs. "Beirness (1993) showed that personality variables such as hostility/anger, impulsiveness and thrill-seeking explained more than 35% of the variance in risky driving and about 20% of the variance in accidents" (p.18, Azade , 2016). Jornet-Gibert (2013) states that individual difference in personality traits (distinctive patterns of cognitions, emotions and behaviours) can foresee risky driving, which can lead to RTAs. (Jornet-Gibert, 2013).

"Ivers et al. (2009) found that risky driving behaviour was associated with a 50% increase in accident involvement" (p. 60, Mohamed , 2017). Younger drivers (<30 years), particularly young men, are acknowledged to commit risky behaviour while driving (although stated to decrease with age). However, its had been found that most accidents result from inexperience rather than risky behaviour (McKnight and McKnight, 2003 in Clarke, 2015). Risk-taking is generally correlated with reckless behaviour such as violating safety rules (speeding and/or drunk driving). "Risk-taking may occur when hazards have been correctly assessed, but no action is taken to mitigate the risk. For example, the driver correctly identifies that thick fog represents a significant hazard, but fails to reduce speed and increase distance to the next vehicle accordingly" (p. 132, Clarke, 2015).

2.3.2 Built Environment

The built environment is the physical environment that is constructed by human activity. By one definition, the built environment consists of the following elements: land use patterns, the distribution across space of activities and the buildings that house them; the transportation system, the physical infrastructure of roads, sidewalk, bike paths, etc., as well as the service this system provides; and urban design, the arrangement and appearance of the physical elements in a community" (p.2, Handy et la, 2002 in Saelens and Handy, 2008). Furthermore, land use and street design are essential elements of the built environment and therefore will be clarified accordingly.

Common solutions to traffic issues such as RTAs and congestion is to build more roads to facilitate vehicles. Yet, researchers have argued that such actions would only encourage increased car dependency leading to more roads and increased traffic fatalities.

It has been found that concepts of urban design are critical in improving road safety by reducing the need to travel by also promoting safer speed limits. Referring to new urbanism planning, travel demand is theoretically a 'derived' demand, which indicates that trips occur in the act of pursuing daily activities (e.g. traveling to work or school). Daily activities are accompanied by various characteristics (e.g. land uses, densities, design), which therefore affect the number of trips made as well as chosen modes of travel. Other characteristics such as comparative prices and service quality of rival travel modes also affect travel demand within the built environment (Cervero and Kockelman, 1997). Urban designers focused on new urbanism practices and transit-oriented development and planning have been acknowledged on concepts regarding travel demand within the built environment. Particularly it has been stated that objectives of reducing motorized trips, increasing shares of non-motorized trips, reducing travel distances by also encouraging modal occupancy levels (e.g. public transportation, car-pooling) are applied practices to effectively minimize negative effects of car dependent cities (Banister and Lichfield, 1995; Dittmar, 1995 in Cervero and Kockelman, 1997).

"Sustainable urban development is defined as the urban-built environment that involves compact, mixed land uses, access to high-quality mass transport, and streets that reduce traffic speeds and limit vehicle presence in key areas. This provides opportunities for walking and bicycling rather than driving to school, the park, the store, work, the doctor, family and friends, and other daily activities. As the New Climate Economy explains, these places are connected, compact, and coordinated" (p. 12, Welle et al, 2015). "Promoting sustainable urban development can have a strong and positive relationship with traffic safety. This comes from two key safety issues: exposure and risk. Sustainable urban development practices can (a) *reduce exposure* by preventing the need for vehicle travel, thus preventing a crash before a trip would even begin; and (b) *diminish risk* by encouraging safer vehicle speeds and prioritizing pedestrian and bicyclist safety" (p. 12, Welle et al, 2015). "Data confirms there are fewer fatalities in places with fewer vehicle miles travelled (VMT) and those promoting mass transport, walking and cycling, thus reducing overall exposure" (p.15, Duduta, Adriazola, and Hidalgo 2012 in Welle et al, 2015).

Decades to date show a large portion of research conducted on the relationships concerning the built environment and travel through various concepts. "The built environment is thought to influence travel demand along three principal dimensions - density, diversity, and design (3D's)" (p.199, Cervero and Kockelman, 1997). Cervero (1997) examines how the built environment influences travel demand and the relationship between the 3D's within the built environment suggesting that the combination of higher densities, mixed land uses and pedestrian friendly designs lower car travel rates and vehicle miles travelled (VMT) by simultaneously encouraging non-motorized travel resulting in shifts of modal choices and improved road safety (Cervero and Kockelman, 1997).

A study conducted of the relationship of the 3D's on overall trip rates and modal choices confirmed that density, land-use diversity, and pedestrian-oriented designs generally reduce trip rates and encourage non-motorized travel in statistically significant ways. Essentially, compact designed areas reduce car trips and VMT per capita (particularly on personal business trips) and encourage non-motorized travel by providing proximity between daily activities and therefore disregarding the need for the car. Less parking, improved public transportation, extended mixed land uses and more low-income households further contribute to the reduction of car dependency. Dense areas containing building mixes (ground-floor shops in residential or commercial buildings) and four-way intersections (through controlled street crossings and accessible areas) further encourage additional non-motorized travel by also generating substantially less personal VMT. Areas consisted of rectangular or square blocks can on average generate nine more personal trips per household compared to areas with no quadrilateral blocks and residential areas designed with accessibility to commercial activities likewise result to considerable less VMT per household (Cervero and Kockelman, 1997). Other studies have also found that convenience stores in residential areas encourage non-motorized trips, which ultimately replace motorized travel outside of residential areas (Handy, 1993; Cervero and Radisch, 1996 in Cervero and Kockelman, 1997).

Similar to (Cervero, 1997), Ewing (2009) studied the relationship concerning the built environment and travel through the concept of the 4Ds (density: persons/jobs/housing units per unit area; diversity: mix land use; design: street network features, sidewalk coverage, street furniture, pedestrian crossing; destination accessibility: ease of access in traveling to/from daily activities such as jobs, home, leisure) that is believed to closely contribute to travel behaviour. The concept of the 4Ds is found to be relevant on human behaviour in terms of distance people travel and choice of mode (Ewing, 2009). “Trip lengths are generally shorter at locations that are more accessible, have higher densities, or feature mixed uses. This holds true for both the home end (i.e., residential neighbourhoods) and non-home end (i.e., activity centres) of trips. Walk and transit modes claim a larger share to all trips at higher densities and in mixed-use areas, meaning that the number of vehicle trips (VT) drops as well” (p.350 Ewing, 2009). Additionally, due to the fact that traffic circulation is increased with the combination of local and regional traffic flows, areas with increased population densities, complemented by increased employment hubs and roads experience more road traffic accidents (Ewing, 2009).

Past research has pointed out that the infrastructure factor is the cause of over 30% of road crashes (Treat et al., 1979). In fact, studies have shown that collisions tend to concentrate on certain road segments, indicating that the characteristics of that road segment may play a major role in some accidents. As stated above, the built environment also consists of streets, which are crucial to road safety and design elements, which further improve safety. “Cities with the best road safety records in the world incorporate sound design of their streets for all road users to reduce exposure and risk” (p.20, Welle et al, 2015). Safer urban design can help reduce vehicle speeds and provide a safer and user-friendlier street network for pedestrians. For example, narrow widths consisting of fewer lanes (Huang, Stewart, and Zegeer 2002; Knaap and Giese 2001 in Ewing, 2009) complemented by traffic calming measures (Dumbaugh, 2005 in Ewing, 2009) increases road safety and reduces RTAs by effectively reducing speeds and managing traffic flows. Chao Wang et la (2013) explored the effects of several elements associated with road characteristics such as road geometry (road curvature, number of lanes) and infrastructure (road upgrading, signalization) and found that improved road infrastructure decreases accidents (see Noland and Oh, 2004; Haynes et al., 2007, 2008; Kononov et al.. 2008). (Chao Wang et la, 2013).

2.3.3 Traffic Management

Traffic management is defined by the "planning, coordinating, controlling and organizing of traffic to achieve efficiency and effectiveness of the existing road capacity" (p. 202, Peden et la, 2004). RTAs arise when traffic moves consequently it is essential to examine traffic conditions in order to understand how various conditions contribute to RTAs. Researchers have studied various traffic conditions by examining traffic patterns in RTAs.

Ewing (2009) stated that traffic volumes and speeds (e.g. speed variations in traffic volumes) are main risk factors related to overall traffic conflicts. In terms of traffic volume, increased car travel is followed by increased risk of road traffic accidents. More specifically, Litman and Fitzroy (2005) analysed the correlation concerning per capita traffic fatalities and vehicle miles travelled (VMT) for urban and rural areas where findings confirmed that as VMT increases, traffic fatalities simultaneously increase (urban areas: 1% increase in VMT = 1% increase in traffic fatalities whereas rural areas: 1% increase in VMT = 1.5% increase in traffic fatalities) (Litman and Fitzroy 2005 in Ewing, 2009).

Theofilatos (2014) categorizes traffic as followed: traffic flows (number of vehicles passing a cross-section of a road in a unit time), occupancy (occupancy as proportion of time during which the loop detector is occupied), density (the number of vehicles present per length of road at a given moment) and speed (classified either as the space mean speed or the time mean speed) (Theofilatos, 2014). Traffic flow are claimed to consist of a non-linear relationship with RTA rates, yet other studies state linear relationships. Chang (2005) analysed traffic flows and concluded that accident rates increase while traffic per lane increases. Anastasopoulos and Mannering (2009) argued that in most road segments, accident rates increase as annual average daily traffic (AADT) increases. Traffic congestion, categorized as traffic flows with low speeds, longer trips and queuing, results in complex situations depending on road users skills since freedom of choice of movement is limited in such circumstances. Congestion results in drivers following leading drivers obscuring speed and lane position. "It is found that nearly half of vehicle crashes were due to drivers following their leaders too closely. In such cases, drivers are not able to decelerate fast enough when their leaders decelerate at unexpectedly high rates" (p.1202, Bham and Benekohal, 2004; Wang, 2002 in Wang et al., 2011). Similarly, Shefer and Rietveld (1997) suggested that accident rates increases in congestion due to the increased proximity of vehicles. Conversely, accident severity decreases due to the fact that lower speeds exist in congestion and therefore in this case RTAs are not severe. To add, Noland and Quddus (2005) analysed safety and congestion and proposed that minor or no effect is found in the relationship of congestion and RTAs in urban areas (Theofilatos , 2014). Lower speeds, particularly speeds below 30 kilometres per hours, significantly reduce the risk of fatalities (Rosen and Sander, 2009). Whereas, increased speeds have been found to contribute to RTAs and increases severity (Nilsson, 2004; Elvik et al., 2004 in Theofilatos , 2014). Taylor et al. (2002) claimed that accident rates promptly increase alongside the mean speed stating that a "10% increase in the mean speed may result in a 30% increase in fatal and severe accidents" (Theofilatos , 2014). Whereas, (Garber and Gadirau, 1988) concluded that speed does not influence RTAs and Taylor et al. (2000) stated that RTAs decrease as the mean speed increases (Theofilatos , 2014). Regarding weather, precipitation has been noted to lead to increased RTA rates with inconsistent consequences on accident severity. Other weather conditions such as visibility and wind have not yet gained adequate understanding towards RTAs.

Furthermore, in order for cities to manage and possibility improve social behaviour and reduce RTAs, road safety regulations are implemented. The government develops traffic regulations to provide road safety to all road users and thus the degree of enforcement is correlated with the degree of regulation acceptance, which may or may not lead to RTAs. Through various behaviours and attitudes, humans tend to violate traffic regulations challenging safety by increasing chances of accident occurrence. A large number of road accidents occur due to poor enforcement of traffic laws (Zegeer & Bushell, 2012 in Ram, 2016). A great amount of RTAs are contributed by violations such as overtaking (66 per cent of RTAs), speeding (50 per cent of RTAs), drink driving etc. Drunk driving and surpassing the speed limits are central factors of RTAs. Driving after drinking and violating speed limits are the main causes of road accidents (Hassen, Godesso, Abebe, and Girma, 2011; Afukaar, 2003; Brookland, Begg, Langley, & Ameratunga, 2010; Vanlaar & Yannis, 2006 in Ram, 2016).

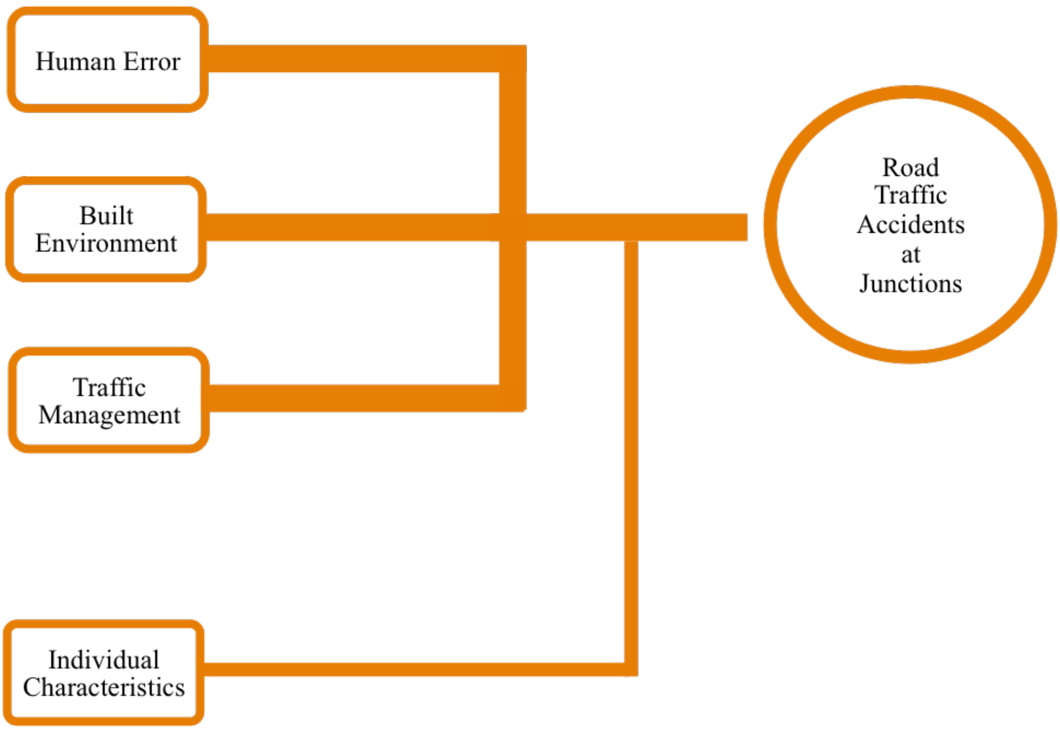
2.4 Conceptual framework

Fundamental theories and concepts on accident causation and human behaviour have been reviewed and analysed. Academic literature to date has been comprehensively assessed identifying significant causes contributing to RTAs. The conceptual framework (

Figure 2 - Conceptual Framework) presents a mapping of the study's analysis. The literature review concluded that there are several factors, which are potential causes of RTAs. Considering traffic and development conditions in Pristina, causes were distinctively grouped into variables based on the logic that driving itself is a task done by humans in the built environment that is regulated by traffic management. The logic expresses that all three causes (humans, built environment, traffic management) actively play a combined effect in influencing RTAs and therefore the study, too, follows this indication and consequently focuses on analysing the combined effect of the variables rather than the effect of the variables in isolated conditions. Accordingly, the causes were grouped into mutually exclusive groups, hereby stated as independent variables: human error, built environment and traffic management.

Besides the above stated independent variables, the literature review also provided information regarding characteristics of humans (drivers) as significant variable influencing human conditions and therefore the occurrence of RTAs (Elander et al., 1993; Yang et al., 2013; Lucidi et al., 2014 in Azade , 2016). Although not identified as independent variables, such characteristics (e.g. age, gender, driving experience) may in fact control or influence the effect of the independent variables on the dependent variable. Thus, individual driver characteristics hereby stated, as control variables were also included in the study.

Figure 2 - Conceptual Framework



Chapter 3: Research Design and Methods

3.1 Revised Research Questions

The provisional research questions (see section 1.4) were marginally adjusted based on the literature review in order to construct more relevant questions for the study. The following revised research questions were included in the study:

Which cause significantly contributes to RTAs at junctions in Pristina?

1. To what extent does human error contribute to RTAs?
2. To what extent does the built environment contribute to RTAs?
3. To what extent does traffic management contribute to RTAs?

3.2 Operationalization

The literature review explained different perspectives of concepts and causes contributing to road traffic accidents (RTAs). Several researchers used diverse data methods and instruments to identify and analyse the many causes contributing to RTAs. The study aimed to explain the most significant causes contributing to RTAs at junctions and therefore the unit of analysis was a road junction. In accordance with the literature review, the causes were grouped into the following three mutually distinctive concepts: human error, built environment and traffic management, which ultimately explained significant causes contributing to RTAs at junctions in Pristina.

The operationalization table below describes and summarizes how relevant concepts and definitions were translated into variables, indicators and values which were measured and collected through various different methods in data collection. See chapter 2 for more detailed descriptions of concepts. Various possible valid and reliable methods of collecting and measuring data of the selected concepts were available. The following operationalization approach was taken for the selection of indicators. All indicators are reported in the table. Representative indicators are further explained.

3.2.1 Introduction of variables and indicators

The study included one dependent variable and three independent variables. A set of control variables were also considered and included accordingly. The following sections below define the variables alongside corresponding indicators that were identified to measure the variables in the study.

3.2.2 Dependent variable: Road Traffic Accidents

The study measured road traffic accidents by rates of RTAs at junctions in Pristina. RTAs at junctions were defined by collisions, involving motorized and non-motorized vehicles (including pedestrians), occurring in proximity or directly on junctions in Pristina. Moreover, if an RTA occurred in closer proximity to a bypass road rather than the junction itself, the RTA was not taken into account. Therefore only RTAs that occurred in close proximity or directly on the junctions were included in the study.

3.2.3 Independent variable 1: Human Error

Referring to the literature review, human error is critical when measuring RTAs and thus it was adopted as a concept. This particular study focused on human error as defined by Salmon et la (2005) consisting two variables and numerous indicators.

As driving is a complex task, drivers are required to constantly observe and process information (e.g. street signalling, speed, directions, traffic rules surrounding vehicles or road users) in order to reach their destination therefore increasing demands on attention and memory. Drivers also behave in various ways under diverse circumstances and take on secondary tasks, which affect the initial task of driving. Therefore, cognitive failure and driver condition (e.g. stress and distraction) and behaviour (e.g. speeding, alcohol consumption) were identified as key variables when understanding accident prevention and causation. Particularly, information processing results in the degree to which drivers recall information, recognize problems and respond to unforeseen circumstances.

Human error can be measured through diverse indicators and methods. The literature review presented several methods adopted by researchers measuring human error in relation to RTAs. Possible approaches were measuring human error through different system approaches (identifying how humans make errors in systems), benchmarking with set guidelines (see Driver Behaviour Questionnaire in Reason, et al, 1990) or intricate models (see task–capability interface). Since human actions (cognitive failure) are mostly unpredictable and the fact that humans engage in risky behaviour (driver condition) in diverse circumstances, the above stated possible approaches were not entirely reliable or valid when measuring the extent to which human error contributes to RTAs.

Besides the above stated approaches, a possible valid and reliable method was to analyse the junctions through the perception of drivers (junctions users). Particularly, how drivers perceived the influence of other junction users, aspects of the built environment or how traffic was managed while driving on the selected junctions in Pristina. Drivers used the selected junctions regularly or on a daily basis and therefore attained valid knowledge of existing issues in human error during the task of driving. Therefore, human error was measured through the perception of junction users (drivers) in order to understand contributing causes to RTAs. Refer to 2.3.1 for further information regarding the concept on human error.

3.2.4 Independent variable 2: Built Environment

This research aimed to study the built environment in line with Handy et la (2002) definition through the perspective of the drivers experience while driving. The literature review presented key variables in the built environment; however, this study focused on land use and street design. Within the built environment, land use and street design can be defined and measured in many ways.

Several approaches were available to measure the built environment. The literature review validated that the built environment included potential causes in land use and street design. Numerous researchers have adopted diverse approaches (GIS mapping, collecting footprints or density) to find errors in the built environment, which contribute to RTAs. A possible approach was to benchmark any given junction with an ideal design aimed to reduce RTAs. This method was not reliable because firstly a universal and applicable "ideal" junction design does not yet exist. Secondly, many researchers have opted to benchmark junctions through various design guidelines for safe streets (see Welle et al, 2015) but seeing as this is was not a design-oriented thesis, this approach was not applicable. Another possible method was to observe elements of the physical junctions in person to see first hand what factors were causing risks in the built environment (e.g. observe street design, or specific characteristics of the junction and how drivers react under various circumstances). Due to time constraints, this approach consisted of limitations and was also not applicable. Alternatively, it was also possible to personally drive on the selected junction and physically analyse the built environment while driving on the junctions. However, since I do not own a car nor a drivers license this also created limitations in the approach.

Similar to the human error concept, the built environment was measured through the perception of drivers. For instance, if the majority of junction users believed that the street width of the junction was causing risks while driving we concluded that the street design was poorly designed. Thus, the built environment was measured through the perception of junction users in order to understand contributing causes. Particularly, the method was used to understand how variations of the built environment (land use and street design) impacted junction users while driving on the junctions.

For instance, land use was measured by the indicators compactness and mixed land use. Here, compactness referred to the density of buildings and infrastructure while mixed land use to the diversity of buildings and infrastructure present in the surrounding area of the junctions. Compactness and mixed land use may determine the level and type of transportation and infrastructure affecting or obstructing available urban space, which may ultimately affect driving on any given junction. Compactness has been found to entail connected urban form, which reduces and shortens travel trips whereas sprawl has been directly related to the increase of RTAs. Additionally, elements of the street design (e.g. public lighting, road geometry and signalling) also play a critical role in the driving task and can therefore can decrease speeds and deliver adequate infrastructure to improve safety. Consequently, data was collected through a survey through the perspective of drivers experience while driving in the built environment (e.g. What parts of the built environment disturb driving?). Refer to 2.3.2 for further information regarding the concept on the built environment.

3.2.5 Independent variable 3: Traffic Management

Traffic management was found to be a critical concept in road traffic safety. The study focused on Peden et la (2004) definition to effectively analyse traffic management on selected junctions. The literature review confirmed that traffic conditions and enforcement of regulations significantly affect, control and shift road management and human behaviour.

Possible approaches to measure traffic conditions in relation to RTAs were through traffic flow, density, speed, vehicle miles travelled (VMT). Moreover, since improving road safety depends on reducing vehicle speeds. speed is a critical indicator when measuring traffic management. Lowered speeds, particularly speeds below 30 kilometres per hour, were found to significantly reduce the risk of RTAs. Fines and penalties also improve safety by planning to shift and manage human behaviour.

Similarly to possible methods discussed in the built environment concept, traffic management could have also been measured through benchmarking with ideal designs for management, physically observing traffic management in person on the junction or driving on the junction themselves. As previously stated, such approaches comprised limitations and therefore perceptions of junction users were applied to analyse and better understand how junction users perceived traffic management (how they rated the significance of variables) on the junctions. Refer to 2.3.3 for further information regarding the concept on traffic management.

3.2.6 Control variables: Individual, vehicle and trip characteristics

As stated in chapter 2, control variables were found as significant variables when analysing RTAs (Elander et al., 1993; Yang et al., 2013; Lucidi et al., 2014 in Azade , 2016). Although interpreted differently, control variables were included in the model similar to independent variables. Control variables were associated to the dependent variable and were accordingly used to reduce their impact within the model. The study adopted the definition from Becker

(2005) that indicated that control variables are factors utilized to avoid other explanations that differ from the relationship between the dependent and independent variables and therefore such variables were applied in the main analysis for statistical control. To examine driver's perceptions of RTAs in Pristina, control variables with the possibility of impacting driver's perceptions were selected.

The study included three types of control variables: individual, vehicle and trip characteristics, which assisted in comparing the previously selected independent variables. For example, to ensure account was taken for all variability of the dependent variables (RTAs), other variables (age, gender, education level, income level etc.) were also taken into account in the model. Although the study did not focus on such variables, they were included in order to control for variability of the dependent variable.

3.3 Operationalization table

Table 1 - Operationalization Table

<table>
<tr><th>Concepts</th><th>Definitions</th><th>Variables</th><th>Indicators</th></tr>
<tr><td>Road Traffic Accidents</td><td>"A road traffic injury is a fatal or non-fatal injury incurred as a result of a collision on a public road involving at least one moving vehicle" (WHO, 2017).</td><td>Rate of RTAs</td><td>Total number of RTAs
(per year: 2014 to 2015)</td></tr>
<tr><td rowspan="14">Control Variables</td><td rowspan="14">Control variables are factors utilized to avoid other explanations that differ from the relationship between the dependent and independent variables. (Becker, 2005)</td><td rowspan="10">Individual Characteristics</td><td>Age</td></tr>
<tr><td>Gender</td></tr>
<tr><td>Education level</td></tr>
<tr><td>Employment</td></tr>
<tr><td>Income Level</td></tr>
<tr><td>Drivers License</td></tr>
<tr><td>Driving experience</td></tr>
<tr><td>Car ownership</td></tr>
<tr><td>Number of RTAs with injuries</td></tr>
<tr><td>Number of RTAs without injuries</td></tr>
<tr><td rowspan="2">Vehicle Characteristics</td><td>Car insurance</td></tr>
<tr><td>Technical Service</td></tr>
<tr><td rowspan="2">Trip Characteristics</td><td>Purpose of Trip</td></tr>
<tr><td>Alternative mode of transport</td></tr>
<tr><td rowspan="2">Human Error</td><td rowspan="2">"Any mental or physical activity, or failure to perform</td><td rowspan="2">Cognitive Failure</td><td>Perceived Influence of Disregard of Traffic Signalling</td></tr>
<tr><td>Perceived Influence of Disregard of</td></tr>
</table>

	activity, that leads to either an undesired or unacceptable outcome" (p.15, Salmon et la, 2005)		priority of passage
			Perceived Influence of U-turn
			Perceived Influence of Changing traffic lanes
		Human Condition and Behaviour	Perceived Influence of Unsafe driving
			Perceived Influence of Unsafe access to the road
			Perceived Influence of Disregard of adequate distance
			Perceived Influence of Poor speed adaption
			Perceived Influence of Alcohol consumption
			Perceived Influence of Driver experience (Years with valid license)
			Disregard of Traffic Regulations
			Perceived Influence of illegal parking
			Perceived Influence of distraction
			Number of traffic violations
			Type of traffic violation
Built Environment	"The built environment consists of land use patterns, the distribution across space of activities and the buildings that house them; the transportation system, the physical infrastructure of roads, sidewalk, bike paths, etc., as well as the service this system provides; and urban design, the arrangement and appearance of the physical elements in a community" (p.2, Handy et la, 2002 in Saelens and Handy, 2008). Specifically, the built environment from the perspective of the driver.	Land Use Note: Perception of land use responsible for RTAs	Perceived Influence of Compactness Note: Refer to 2.3.2
			Perceived Influence of Mixed Land Use Note: Refer to 2.3.2
		Street Design Note: Perception of street design responsible for RTAs	Perceived Influence of Lighting
			Perceived Influence of Level of Road Infrastructure
			Perceived Influence of Road signalling
			Perceived Influence of Street Width
			Perceived Influence of Number of lanes
			Perceived Influence of Street Activity
Traffic Management	-"Planning, coordinating, controlling and	Traffic Conditions Note: Perception of	Perceived Influence of Level of Congestion
			Perceived Influence of traffic police

	organizing traffic to achieve efficiency and effectiveness of the existing road capacity" (p. 202, Peden et la, 2004). Specifically, traffic management from the perspective of the driver.	traffic conditions responsible for RTAs	Perceived Influence of Recommended Speed Limits
			Perceived Influence of Traffic signs
			Perceived Level of Safety
		Enforcement of Regulations Note: Perception of enforcement of regulation responsible for RTAs	Perceived Influence of Penalties and fines

3.4 Research Strategy

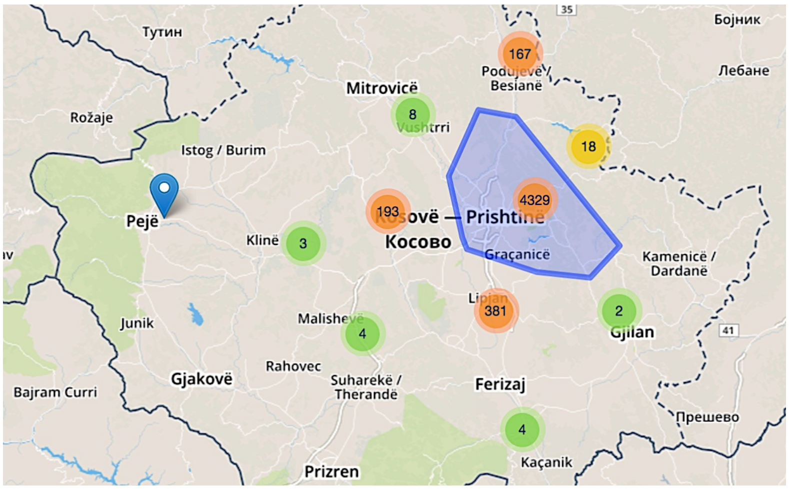
RTAs in the case of Pristina were reflected upon real life situations and therefore the research strategy was to study a deeper context of the research topic rather than observe accident causation of the city as a whole. In depth understanding of contributing causes of RTAs was the objective of the study. The topic of RTAs is complex and therefore a single source of information did not sufficiently explain causes of RTAs. Firstly, primary data (drivers perceptions and interviews with key informants) provided one portion of information whereas secondary data (112 emergency calls and police archives) provided another portion. Since it was essential to collect all necessary information as well as the fact that a single source, which mutually provided all the above stated information, was not available, a mixed methods strategy was effectively adopted in order to comprehensively explain causes of RTAs at junction in Pristina. Comparably stated by Van Thiel (2014), a case study may entail anything and everything a researcher is captivated to observe or assess (i.e. a project, policy, organization, neighbourhood, city or even a country) by explaining, exploring or describing real life circumstances in order to search for appropriate solutions. Case studies are also commonly applied in Public Administration research.

In order to collect data on RTAs in Pristina (dependent variable) as well as select the case study, secondary data was utilized through the application developed by the 112 Emergency Calls project implemented by UNDP and Open Data Kosovo. The application consisted of 24,000 anonymous emergency calls covering diverse incidents (E.g. disturbing the peace, fire, property damage, traffic accident etc.) in Pristina from January 1st 2014 to October 31st 2015 which illustrated emergency calls forwarded to the following categories: the police, medical services, fire brigade and others. The database provided a spatial database that could be viewed at fixed scales illustrating the above stated data across Kosovo. In line with the study, the following categories were selected:

Clustered Map
Municipality: Pristina
Category: Traffic Accident
Forwarded to: Police
Date Range: 01/01/2014 to 01/11/2015
Time Range: 00:00 to 23:59

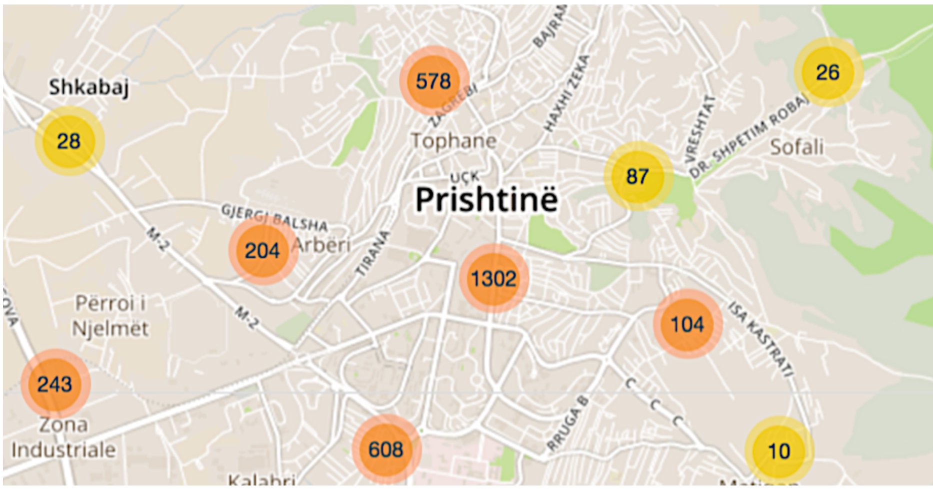
The database included fixed scales that enabled viewing concentrations of RTAs and therefore RTAs at junctions were identified with visual interpretation of the spatial database. Through visual interpretation, accident hotspot analysis was conducted utilizing the spatial data in the application. RTAs were analysed in the spatial database consisting of numerous hotspots (points of concentrated RTAs) that represented RTAs across Kosovo. The application itself allowed analysing the data by clicking onto individual hotspots, which enabled zooming in and out of various scales of the initial hotspot. Each scale then illustrated hotspots spread in clustered or distributed RTAs. Pristina was firstly observed on a scale 1, which presented RTAs across Kosovo illustrating a broad visualization of the situation in the country. To further analyse the area of study, visual interpretation was further expressed by viewing RTAs on different scales.

Figure 3 - RTAs in Pristina (Scale:1, Number of hot spots: 1; Number of RTAs: 4329)



(Source: UNDP; Open Data Kosovo, 2017)

Figure 4 - RTAs in Pristina (Scale:3, Hotspot 1302; Highest rate of RTAs: 1302) (Scale: 3; Hotspot: 1302;



(Source: UNDP; Open Data Kosovo, 2017)

Through visual interpretation, the 112 emergency calls data indicated that RTAs were commonly concentrated at junctions and therefore the study focused on analysing RTAs at junctions and therefore the unit of analysis was a junction. A benchmark to compare junctions does not exist.

Figure 4 displays a zoomed in scale of RTAs in Pristina, which was visually analysed. To effectively compare junctions under analysis, the criterion of junction selection was to identify two junctions with similarities in characteristics (e.g. similar types of roads, land use patterns and conditions) inversely with different rates of RTAs (e.g. high and low risk junctions). The methodology used to select junctions was to repeat the process of systematically selecting hotspots with concentrations of RTAs until identifying two junctions based on the selected criteria (high and low risk). This was conducted by zooming into the application in the following scales: 1 = country level, 2= city level, 3 = zone level, 4 = local level, 5 = junction level A, 6 = junction level B. Consequently, to sufficiently generalize, the process concluded in selecting two junctions and thus a multiple case study strategy was the most suitable approach. After analysing the database, two junctions were selected which are hereby mentioned as junction A and B. Table 2 presents the junction selection results based on the previously stated criteria. Junction A (Idriz Seferi) consisted of 166 RTAs whereas junction B (Bill Clinton) 66 RTAs. Consequently, with the highest rate of RTAs, junction A was considered as a high-risk junction whereas junction B as a low risk junction.

Table 2 - Junction selection

		Total number of RTAs
Junction A	Idriz Seferi	166
Junction B	M2/Bill Clintion	66

The case study entailed a small number of units (two junctions in Pristina) and a large number of contributing variables as stated in the operationalization table. In order to answer the research questions, the study applied mixed data collection methods to effectively gain diverse perspectives of the area of study. The study firstly operationalized with a survey gaining primary data on perceptions of drivers while driving on selected junctions in Pristina. Interviews of key individuals and informants were used to further support the survey findings. Secondary data from the Kosovo Police and 112 Emergency calls data were combined as triangulation by providing further information. Finally, all findings were combined in order to explain the research question and finally complete the case study.

See annex 1 for the complete description of junction selection.

3.5 Validity and Reliability

Reliability of the research involved accuracy and consistency in variable measurement. Accuracy was achieved by effectively developing data collection instruments by focusing on clear conceptualization and communication through accurate levels of measurement. Moreover, the questionnaire was translated into the Albanian language and was also pilot tested to avoid bias and most importantly ensure that content was relevant to the local context as well as to improve questionnaire design elements. Furthermore, collected data was checked through reliability tests through SPSS, which provided relatively accurate results. Consistency on the other hand was achieved by creating an adequate sample size in order to improve levels of consistency of the studies results.

Validity of the research involved internal and external validity. In this case, internal validity was achieved by effectively operationalizing variables into qualified and measurable data intended to analyse driver's perceptions of RTAs through SPSS. The study achieved external validity with an adequate sample size and selection to increase representativeness. Moreover, although the survey strategy offered larger ranges enabling generalization (and hence, external validity) depth inversely may be limited. In return, triangulation was effectively utilized to increase internal validity by checking and comparing data from three effective sources in the area of study.

In addition to the above stated, theories, concepts and methodologies included in the study were formulated from previous studies regarding RTA causation (as stated in the literature review) to further improve reliability and external validity of the research.

3.6 Data Collection Methods

The study adapted mixed methods including quantitative and qualitative data by focusing on collecting RTA primary data from a survey (questionnaire) and interviews by also applying triangulation with secondary data. Therefore the study included various insights from numerous sources, which ultimately enhanced the research by increasing validity.

3.6.1 Primary Data

The Kosovo police offered statistical data of RTAs as collected by the local traffic police. To effectively obtain valid data from junction users in the area of study, surveys and interviews served as more reliable and valid approach. Additionally, witnesses and key informants (residents, shop keepers and RTA victims) also give valuable information (e.g. do drivers usually speed on this junction?) regarding junctions. Therefore, a questionnaire was conducted to collect perceptions of junction users (drivers) on selected junctions.

Since the study demanded collection of a large body of data from numerous respondents, a survey was an applicable data collection method. Limited in the case study strategy, the survey achieves breadth by also enabling generalization to the population. A survey is a highly efficient method in research, which allows collection of people's opinions, or attitudes in a given topic. The research topic consisted of a population of junction users in a city; therefore a questionnaire was designed in order to achieve coverage, insight and overall data collection of an adequate portion of the population resulting in increased reliability. Since limited data was available on the current situation in Pristina, a survey was ideal in generating primary data. Furthermore, due to time constraints a survey enabled quick collection of data from a large body of respondents, which generated data in practical formats ready to use for further statistical analysis.

In order to strategically gain an adequate number of respondents a questionnaire was conducted. To ensure validity and reliability, the questionnaire was limited only to people who drive in Pristina. The questionnaire began with a short description of the study. To avoid duplication of the responses, the first part of the questionnaire presented an image (aggregated from Google maps) in order to select the junction, which the respondent most frequently used. If the respondent used neither of the junctions frequently, they were asked to choose the junction for whom they are most knowledgeable about. Pristina is a relatively compact city meaning that most junction users drive on most of the available junctions in the city (some more frequent than others). Various questions were formulated in relation to the selected independent variables based on driving in Pristina. Moreover, for the purpose of clear communications with respondents, adjustments were made to simplify theoretical terminology in the questionnaire content. See annex 2 for the complete table of terminology. The questionnaire was sent through mass e-mail by RIT Kosovo and further circulated throughout the city through social media (Facebook). Snowball sampling also served the same purpose in order to increase the probability of increasing responses.

Furthermore, to overcome challenges and limitations of the survey, triangulation was applied to achieve more reliability and validity. Triangulation validates data and research by confirming the same data and thus research is strengthened since the data effectively achieves increased reliability and validity.

To gain a broader perspective on road safety and RTAs, qualitative data was collected through in depth semi structured interviews. The following key actors have been identified in traffic safety: government of the Republic of Kosovo, municipality of Pristina, Kosovo Police, traffic engineers and experts. Interviews were conducted by purpose selection in order to select adequate experts and/or officials from key actors. Open-ended questions were used to gain further insight on the area of study.

Visual observations will be used in order to gain visible insights of the selected junctions by observing the physical aspects of the built environment through cross verifying data collected by the survey (drivers experience).

3.6.2 Secondary Data

Secondary data collection is an adequate method to explain, test, evaluate, diagnose, explore/describe or design a given phenomenon. It is efficient, cost effective and allows tracing of fluctuations throughout time. In this case, secondary data was utilized as an additional source of information used as data validation in order to complement the primary data.

Based on the Law on Police, 04 / L-076 approved in 2012, the Kosovo Police is defined as a public service that functions within the Ministry of internal affairs which is responsible for implementing national security polices including road traffic measures. Therefore the Kosovo police are key actors in traffic safety management. In the case of Pristina, the police record RTAs and other traffic violations and conflicts contributing to RTAs. When a RTA occurs, the police are commonly the first to formally record the accident or violation in road traffic thus ensuring validity. Therefore the study involved analysing Police archives.

3.7 Data Analysis Methods

3.7.1 Descriptive analysis

3.7.1.1 Primary data

Quantitative primary data collected by the survey was transferred to quantifiable forms in order and was analysed through Microsoft Excel and SPSS (The statistical package for social sciences) software – a tool for statistical analysis. Descriptive statistics were also used to identify characteristics of the questionnaire respondents. The research topic required measuring the impact of effect of causes (independent variables) contributing to RTAs (dependent variable). Therefore the study aimed to predict the value of the dependent variable based on the values of the independent variables. Moreover, independent variables as set in the conceptual framework in chapter 2 were tested with the Cronbachs alpha reliability test. In order to differentiate perceptions of drivers, the independent T-test was conducted. Factor analysis (principle component analysis) was also conducted to verify the measurements of the independent variables intended for further use in inferential analysis. Through factor analysis, the independent variables were verified and marginally modified complemented by another reliability analysis to test for reliability of the new and verified measurements. A Pearson product moment correlation coefficient was also conducted to test for significant correlations between the control and the independent variables.

Qualitative primary data collected through semi-structured interviews were analysed and categorized manually by reviewing and selecting relevant content which was further used in the analysis to strengthen and explain key findings derived from quantitative primary data. Additionally, charts, graphs, and tables were also used to clarify the analysis and present data accordingly.

3.7.1.2 Secondary data

Data acquired from secondary data from the Kosovo police archives was utilized to better understand the area of study. The statistical data obtained was assessed and interpreted.

Similar to the qualitative data, the police archives were manually analysed to present key trends of RTAs over the years.

3.7.2 Inferential analysis

3.7.2.1 Primary data

Primary data from the survey was further analysed with a binary logistic regression as a method of inferential statistics in order to explore the relationship between the dependent and independent variables.

3.8 Sampling size and selection

3.8.1 Primary data

This study used two different sampling techniques to collect quantitative and qualitative primary data.

Quantitative primary data was collected through the questionnaire. Since the questionnaire intended to gain perceptions of drivers, a sampling method, which avoids bias and represents the target population, is essential. Therefore the aim of the survey is to generalize research results from the total research population and therefore, probability sampling was conducted.

Therefore respondents for the questionnaire were selected through probability sampling aimed at the working population in Pristina. According to the labour force data on municipalities collected from the Kosovo Agency of Statistics, the working population of Pristina consists of 108,632 citizens (Kosovo Agency of Statistics, 2013). Therefore, a representative sample size for the survey was 383 respondents (considering confidence level of 95% and margin of error of 5%). The questionnaire was posted on social media (personal profiles and selected groups on Facebook) and mass mailed to all students, alumni and staff of RIT Kosovo. To increase response rates, the snowball technique was utilized in order to encourage participants to share the survey among friends, family and colleagues around Pristina.

On the other hand, to gain sufficient coverage respondents for the interviews were selected by non-probability purposive sampling based on people who were of close interest to the case study and area of study. Consequently the interview sample consisted of people that drive on the junctions, live or work near the junctions, are responsible for the operation of the junction or people who have generally taken a interest in the area.

Table 3 shows the number of respondents obtained in the questionnaire and interviews for primary data collection.

3.8.2 Secondary data

Secondary data was collected to increase sources of information of RTAs in Pristina. As stated in the research strategy, secondary data from the 112 Emergency Calls project data facilitated the selection of junction used in the study. To add, the database was further analysed for interesting trends regarding RTAs in Pristina.

Secondary data from the Kosovo police were also collected. Specifically, statistical archives on RTAs in urban Pristina from 2012 to 2016.

Table 3 - Data Collection Sampling

	Data collection method	Junction A	Junction B	Total	Sampling method
Primary Data	Questionnaires with drivers	191-192	191-192	383	Probability sampling
	Interviews with individuals exposed to junctions	3	3	6	Non-probability purposive sampling
	Interviews with individuals responsible for the design/management of junctions	-	-	3	Non-probability purposive sampling
	Interviews with key informants in area of study	-	-	3	Non-probability purposive sampling
Secondary Data	Visual Interpretation	1	1	2	Non-probability purposive sampling
	Kosovo Police Archives	-	-	-	Non-probability purposive sampling

Chapter 4: Research Findings

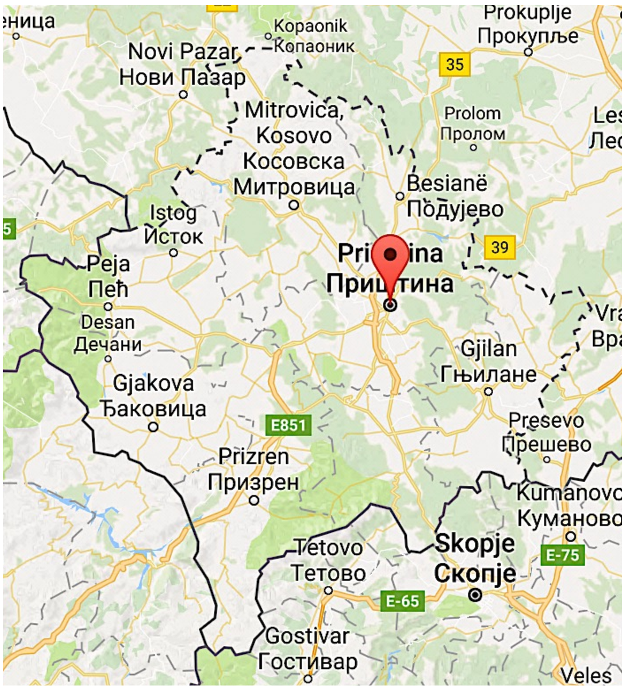
This chapter presents key research findings and descriptive analysis of data collected in fieldwork. As stated in chapter 3 data collection included primary data (questionnaire and interviews) and secondary data.

4.1 Background of research area

Kosovo is centrally located in the Balkans and consists of the following transportation networks: railway, air and road. The road network is categorized as followed: main roads, regional roads and local roads. Main and regional roads are under the administration of the Ministry of infrastructure whereas local roads under the administration of municipalities. According to the Law on Roads and Regulation no. 2004/24, the municipalities have the full responsibility for management of local roads within their territories.

Pristina is the capital and largest city of the Republic of Kosovo with a population of 198,897. It is located in north-eastern Kosovo and is 250 kilometres northeast of Tirana, 90 kilometres 90 kilometres north of Skopje, 520 kilometres south of Belgrade and 300 kilometres east of Podgorica. Holding a central location in the Balkans as well as the country, Pristina is considered as the administrative, political economic and cultural hub of Kosovo.

Figure 5 - Location of Pristina, Kosovo



(Source: Google Maps)

Motorized vehicles significantly dominate urban traffic in Pristina. Compared to other cities in Kosovo, Pristina is commonly recognized for urban and innovative initiatives in regards to public services and management. Recent developments in transportation resulted in the investment of the revitalization of the public transportation network by adding 51 new buses that run through urban and suburban areas of Pristina. Nevertheless, increased numbers of cars still persist. For every new car imported in 2014, 16 used cars were imported (GAP, 2015). Large volumes of different vehicles overload urban roads causing chaos in road traffic in Pristina. With drastically high numbers of vehicles circulating the city, considerable high numbers of RTAs are also present.

The gain excess knowledge of the contributing cause of RTAs, the case study examined two junctions consisting of similar characteristics but with varying rates of RTAs in Pristina. Junctions A and B are both located at key entry/exit points of Pristina.

Figure 6 - Satellite view of junction A and B in Pristina

(Source: Google Satellite Images)

Junction A

Junction A is located in the southern area of the city and was constructed sometime before the war. The junction consists of a roundabout with mixed volumes of national and regional traffic. According to the municipality of Pristina, records on infrastructure projects prior to the war are incomplete or missing. Nearby land features are categorized in proximity as follows: the University Clinical hospital, the American hospital, the medical high school and commercial and residential areas.

Figure 7 - Satellite view of junction A

(Source: Google Satellite Images)

Junction B

Junction B is located in the south-western area of the city. The junction consists of an elevated roundabout with mixed volumes of national and regional traffic. According to the ministry of infrastructure, the roundabout was released for use in 2011 and has not been reconstructed so far because of its complexity and due to the high level of service it offers for the conditions existing traffic. Maintenance is routinely conducted throughout the summer/winter season, intervening ad-hoc depending on the needs that arise in the field in order provide security for all road users.

Nearby land features are categorized in proximity as follows: the international bus station, ministry for Kosovo military forces and industrial zone.

Figure 8 - Satellite view of junction B

(Source: Google Satellite Images)

4.2 Description of samples

To analyse and explain the research area, samples were selected based on people who were of close interest to the case study and area of study. Consequently the questionnaire sample consisted of drivers in Pristina whereas the interview sample of people live or work near the junctions (hereby categorized as "neighbourhood"), responsible for the operation of the junction (hereby categorized as "junction design or management"), people who have generally taken a interest in the area (hereby categorized as "key informants") and lastly other people who have voluntarily expressed their thoughts (hereby categorized as "other"). Accordingly, general characteristics of questionnaire respondents are firstly described followed by key findings from primary and secondary data.

4.2.1 General characteristics of questionnaire respondents

The questionnaire was conducted targeting the working population of Pristina, including a pilot questionnaire with 15 respondents to fine-tune the questionnaire content. In line with the research strategy and methodology set in chapter 3, all survey respondents were drivers in Pristina. Correspondingly, the sample was collected from junction A and B resulting in a combined and separate database. The questionnaire resulted in a total sample size of 454 respondents in Pristina. Descriptive statistics and analysis was conducted in order to answer the research questions.

Respondent's characteristics were expressed through control variables. The study included three types of control variables: individual, vehicle and trip characteristics, which will assist in comparing the previously selected independent variables. For example, to ensure account is taken for all variability of the dependent variables (RTAs), other variables (age, gender, education level, income level etc.) are also taken into account in the model. Although the study does not focus on such variables, they are included in order to control for variability of the dependent variable.

To minimize bias in a representative sample, the questionnaire sample was collected with random sampling, which involves randomly choosing respondents from a target population. Based on the categorization in the junction selection, respondent characteristics were collected. The combined database consists of 454 respondents in Pristina. The separate database consists sample A (253 respondents) and B (201 respondents). The following section describes the combined data frequencies of the questionnaire respondent's samples. Detailed respondent frequencies (combined and separate samples) can be found in annex 5.

As stated in chapter 3, two junctions were selected for the case study based on set criteria that resulted in: junction A (high risk) and junction B (low risk). Junction A consisted of 166 RTAs compared to junction B, 66 RTAs. In the questionnaire respondents were asked about their frequency of the use of two junctions. If neither of the junctions were frequently used, the junction for whom the driver is most knowledgeable about was selected. Based on their use of junctions, respondents were categorized into two groups: junction A and B. Table 4 shows that 55.7% (253) respondents selected junction A, while 44.3% (201) respondents selected junction B resulting in a representativeness sample.

Table 4 - Distribution of respondent's junction selection

Junction	Total		
	N	%	% valid
A	253	55.7	55.7
B	201	44.3	44.3
Total	454	100.0	100.0

The distribution of age groups shows that over half of the combined sample was between ages 20 to 29. As Kosovo holds a young population (over 70% of the populations is below 35 years old) it was expected that the sample too would be representative in terms of age. On the other hand, respondent's distribution of gender shows relatively different figures. Gender of respondents in the combined sample presented 69.4% (315 respondents) males, 30.2% (137 respondents) females and 1% (2 respondents) other respondents – resulting in 39.2% more males compared to females represented in the combined sample. In Kosovo it is generally common for more males to drive compared to females. Due to this social normal, it was similarly expected that males would be more drawn to the questionnaire topic as well as respond to the questionnaire itself seeing as drivers were the sole target of the questionnaire sample. Additionally, the questionnaire was conducted with random probability sampling where questions were designed gender neutral. Therefore due to the above stated, in this case, gender does not generate bias in the questionnaire responses.

Regarding education, the distribution of the sample is in line with the samples ages seeing as the majority of the sample has completed undergraduate or postgraduate studies (42.8% and 46.5%) when compared to primary and secondary education (0.7% and 6.4%). 81.1% of the combined sample is employed full or part time (72.7% and 8.4) where over 50% stated that their income is over €550.00 per month.

The driving status of respondents varied in the combined sample as followed: 95.1% (427 respondents) attain a valid drivers license, 2.9% (13 respondents) never had a drivers license, 1.8% (8 respondents) preferred not to reply, and .2% (1 respondent) have suspended drivers license. Moreover, 79% (359 respondents) consisted of 1 to 20 years of driving experience. More specifically, driving experience varied as followed: 28.4% (129 respondents) attained 10 to 20 years of experience, 25.8% (117 respondents) 1 to 5 years and 24.9% (113 respondent) 5 to 10 years whereas 11.7 % (53 respondents) attain more than 20 years of experience.

Vehicle status of respondents showed that 81.3% (369 respondents) of the combined sample owned a private car whereas 18.7% (85 respondents) did not. From the 81.3% (369 respondents) who owned a car, 97.8% (363 respondents) also owned car insurance and 96.2% (357 respondents) likewise serviced their car in the last year. Furthermore, 59.1% (267 respondents) of the combined sample used their private car for commuting to work whereas 33% (149 respondents) for social/recreational purposes. Only 4.9% (22 respondents) used their car for school and this may be due to the fact that the majority of the sample size has already completed their studies. Lastly, 3.1% (14 respondents) used their car for other purposes not mentioned in the questionnaire. When asked about alternate modes of transport compared to the private car, the combined data showed that 38.3% (174 respondents) stated to commute by walking. Due to compact design, one can commute easily throughout the city and therefore the sample too is representative of this fact. To add, 25.6% (116 respondents) stated that public transportation is their alternate mode whereas, 18.7% (85 respondents) stated taxi. However, 17.4% (79 respondents) stated that they always commute by car.

RTA history of respondents showed that 85.9% (390 respondents) of the combined sample has never been involved in an RTA on junctions A and B whereas 14.1% (64) respondents have. Moreover, 78% (354 respondents) of the combined sample was not involved in an RTA without injuries in the last year. 15.2 % (69 respondents) were involved in one, 4% (18 respondents) in two and 1.8% (8 respondents) in more than three RTA without injuries in the last year. Furthermore, 92.7% (421 respondents) of the combined sample was not involved in an RTA with injuries in the last year. 4.2 % (19 respondents) were involved in one, 1.1% (5 respondents) in two and .9% (4 respondents) in more than three RTA with injuries in the last year.

Traffic violation history of respondents showed that 89.2% (405 respondents) of the combined sample has never been penalized for a traffic violation on junctions A and B whereas 10.8% (49 respondents) has. Moreover, 59% (271 respondents) of the combined sample were not penalized for a traffic violation in the last year. 19.4 % (88 respondents) were penalized for one, 11.5 (52 respondents) for two and 5.9% (27 respondents) for more than three traffic violation in the last year. Furthermore, from the 36.8% (167 respondents) of the combined sample that were penalized for traffic violations in the last year, the distribution of the most frequent traffic violations were as followed: 57.3% (110 respondents) were penalized for speeding, 17.7% (34 respondents) were penalized for illegal parking and 7.8% (15 respondents) for seatbelt use. 5.7% (11 respondents) were penalized for disregards of traffic signs, 6.3% (12 respondents) for other reasons and 3.1% (6 respondents) did not wish to disclose this information. Separate data showed that drivers were penalized for speeding 8.4% more on Junction B compared to Junction A.

Finally, regarding the level of safety, respondents were asked to agree or disagree with the following statement "*I feel safe while driving on junction x*". Combined data shows that

39.5% (179 respondents) disagree and 23.8% (108 respondents) strongly disagree whereas 23.0% (104 respondents) feel neutral with the statement. The separate sample shows similar results.

Table 5 - Distribution of questionnaire respondents

ITEM	N	%
Age (years)		
<20	35	7.8
20 to 29	237	52.5
30 to 39	120	26.6
40 to 49	41	9.1
50 to 59	16	3.5
> 60	2	.4
Gender		
Male	315	69.4
Female	137	30.2
Other	2	.4
Education		
Primary School	3	.7
Secondary School	28	6.4
Undergraduate	188	42.8
Postgraduate	204	46.5
Prefer not to reply	16	3.6
Employment		
Full-time	330	72.7
Part-time	38	8.4
Volunteer	9	2.0
Unemployed	61	13.4
Prefer not to reply	16	3.5
Income		
> 300.00	45	12.6
300.00 to 450.00	46	12.9
> 550.00	195	54.6
Prefer not to reply	71	19.9
Drivers license		
Never had a drivers license	13	2.9
Suspended drivers license	1	.2
Valid drivers license	427	95.1
Prefer not to reply	8	1.8
Driving Experience (years)		
> 6 months	12	2.6

6 months to 1 year	27	5.9
1 year to 5 years	117	25.8
5 years to 10 years	113	24.9
10 to 20 years	129	28.4
More than 20 years	53	11.7
Prefer not to reply	3	.7
Car Ownership		
No	85	18.7
Yes	369	81.3
Car Insurance		
No	8	2.2
Yes	363	97.8
Car Service		
Yes	357	96.2
I don't know	14	3.8
Car use		
Work	267	59.1
School	22	4.9
Social/recreational	149	33.0
Other	14	3.1
Alternate Mode		
Public transportation	116	25.6
Taxi	85	18.7
Walking	174	38.3
I always commute by car	79	17.4
RTA on junction		
No	390	85.9
Yes	64	14.1
RTA without injuries		
None	354	78.0
One	69	15.2
Two	18	4.0
More than three	8	1.8
I prefer not to reply	5	1.1
RTA with injuries		
None	421	92.7
One	19	4.2
Two	5	1.1
More than three	4	.9
I prefer not to reply	5	1.1
Traffic violation on junction		

No	405	89.2
Yes	49	10.8
Traffic violation		
None	271	59.7
One	88	19.4
Two	52	11.5
More than three	27	5.9
I don't know	12	2.6
I prefer not to reply	4	.9
Frequent traffic violation		
Disregard of traffic signs	11	5.7
Speeding	110	57.3
Drinking and driving	4	2.1
Illegal parking	34	17.7
Seat belt	15	7.8
I prefer not to reply	6	3.1
Other	12	6.3
Level of safety		
Strongly Disagree	108	23.8
Disagree	179	39.5
Neutral	104	23.0
Agree	48	10.6
Strongly Agree	14	3.1

4.3 Key Research Findings

As stated in chapter 3, the study applied mixed methods by collecting data from three sources of data to effectively complete the case study. Primary data was collected through a questionnaire and interviews whereas secondary data was collected through archives from the Kosovo Police. Each source of data was vital in explaining significant causes of RTAs at junctions in Pristina.

4.3.1 Primary Data

Primary data collection resulted in two sets of data: 1) questionnaire and 2) interviews.

4.3.1.1 Questionnaire

Firstly, the questionnaire provided primary data on driver's perceptions on causes of RTAs while driving in Pristina. See section 4.2.1 for further information of the general characteristics of the questionnaire sample. The following section presents data collected on the variable level.

4.3.1.1.1 Human Error

In the questionnaire, perceptions of human error were tested using two five points Likert-scale questions to indicate their level of agreement on causes of RTAs. These statements were used to identify which and to what extent human driving habits contribute to RTAs.

Frequencies of respondent responses are presented below. As seen in the charts below, one question was directed to the personal driving habits whereas the other 10 questions to driving habits of other drivers. When asked, “Do you take on secondary tasks while driving?” over 50% of respondents answered “Disagree” or Strongly Disagree”. When asked about driving habits of other drivers, a higher “Agree” or “Strongly Agree” response rate to all other statements regarding driving habits was evident.

Chart 1 - Survey question 9 - responses for questions regarding "human error"

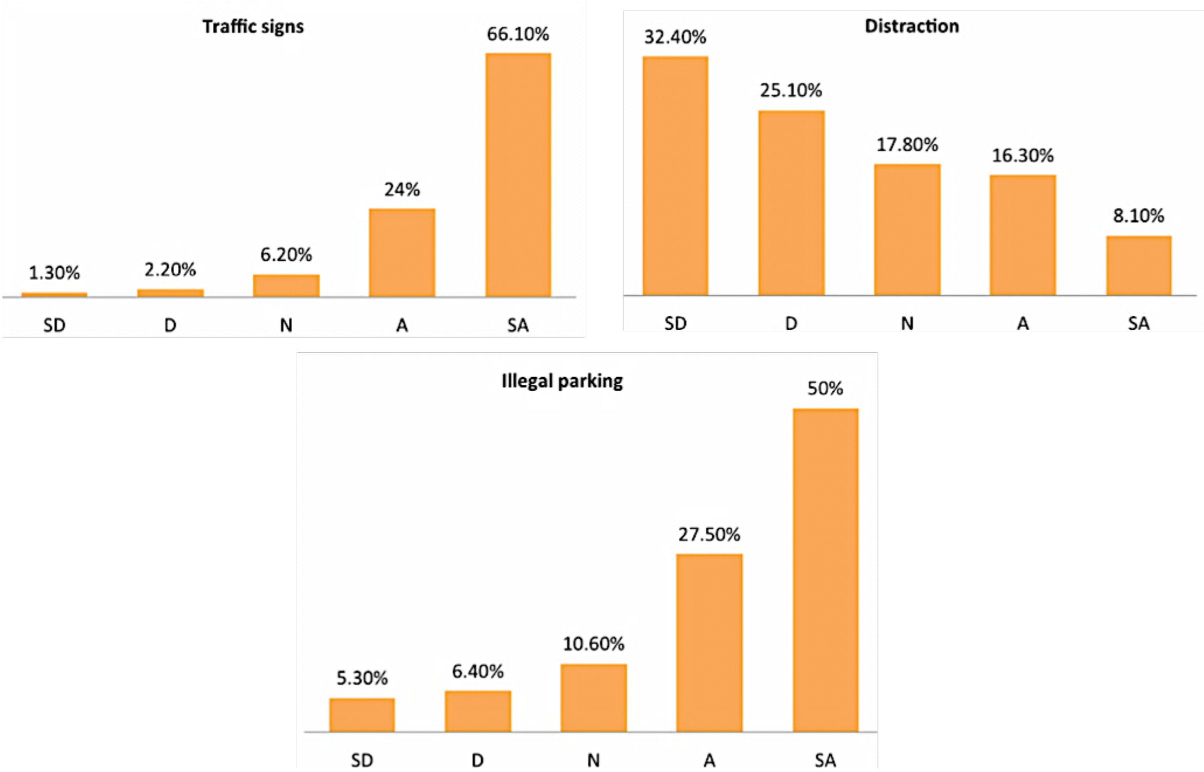
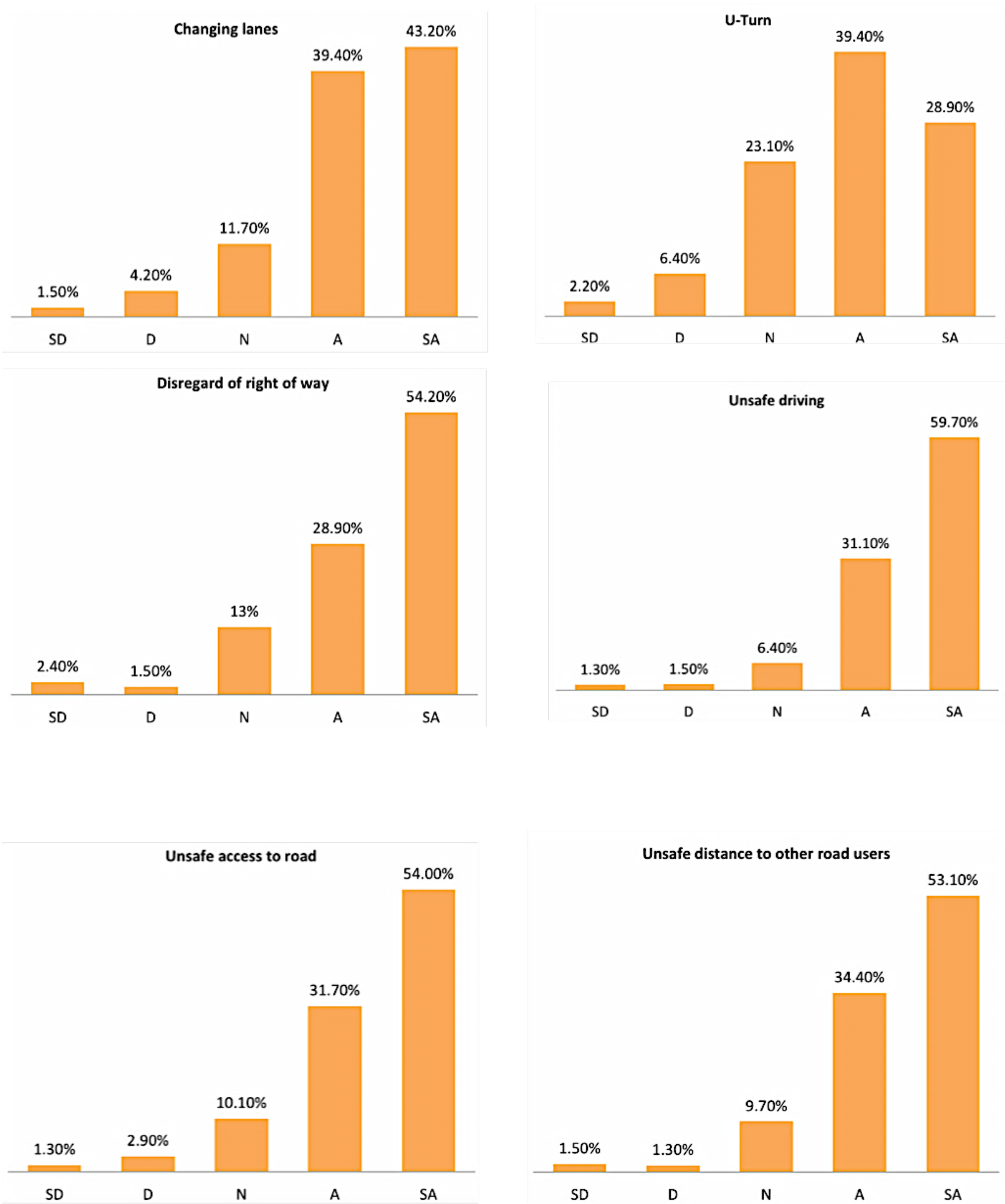
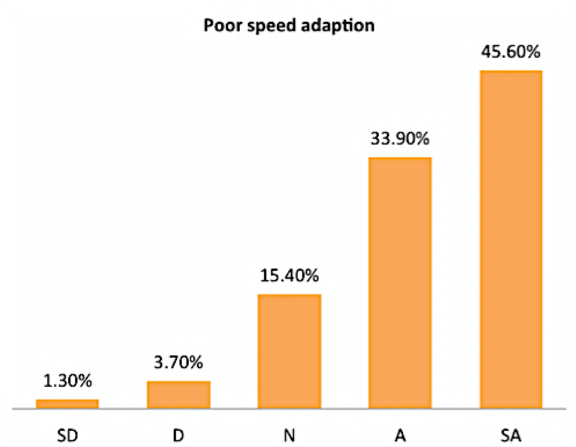
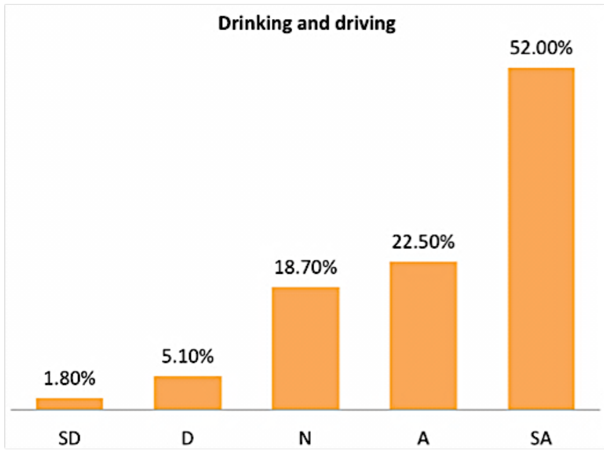
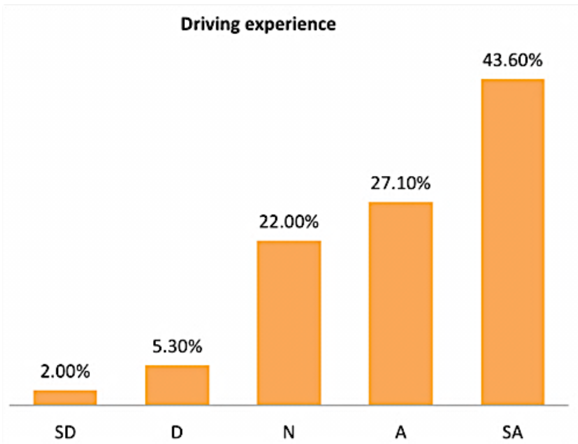


Chart 2 - Survey question 13 - responses for question regarding "human error"









As previously confirmed, the questionnaire provided one portion of data within the case study. Various methods were available and applicable when testing for reliability and validity in quantitative data. The following sections describe and present steps taken to ensure validity and reliability.

To further analyse the data of the above stated questions and ultimately answer the research questions in the study, the data derived from the questionnaire was adequately grouped in order to be utilized in further statistical testing. However, a reliability test, Cronbach's alpha, was initially performed to describe and assess the internal consistency and provide an overall reliability coefficient for each set of variables used in the study. The Cronbach's alpha ranges from 0 to 1, where 0 means no consistency at all and 1 means perfect consistency. A score of 0.60 and above is acceptable for further analysis. Moreover, with a score of 0.69 and above, it is stated that the group contains sufficient degree of reliability to combine the group into a new indicator intended for further analysis.

The Cronbach's alpha was performed on 12 ordinal human error indicators as previously listed in the above response frequencies. Cronbach's Alpha was .786, which indicated that the indicators were measured in a consistent way and thus was reliable. To statistically test, compare and explain differences in perceptions in junction A and B, independent samples t-tests were performed. Independent samples t-tests are used in situations in which there are two experimental conditions (e.g. Junction A and B) where different participants (e.g. sample A and B) have been used in each condition. In this case, the independent t-test were used to investigate if the means of perceptions of sample group A and B differ based on their driving experience on junctions A and B. To perform the statistical test, two hypotheses are formed:

- Null hypothesis: no significant difference is evident between the means (junction A drivers and junction B drivers consist of equal perceptions)
- Alternative hypothesis: significant difference is evident between the means (junction A drivers and junction B drivers consist of unequal perceptions)

The null hypothesis is rejected if the value of $p \leq 0.05$ and is accepted when $p > 0.05$.

The t-test results Table 6 indicated a significant difference regarding perceptions towards "illegal parking" between junction A (M=4.33, SD=0.997) and junction B (M=3.94, SD=1.239). The p value is 0.000, therefore there was a significant difference between the means ($p > 0,05$) and thus we rejected the null hypothesis and accepted the alternative. The difference in perceptions of both groups was 9%, which means that both junctions similarly perceived "illegal parking" as an important cause in human error.

Table 6 - Statistical test for variable "human error"

Junction	**α**	**"Illegal parking"**			**t**	**p**
		N	**M**	**SD**		
A	.786	253	3.94	1.239	3.695	.000
B		200	4.33	0.997		

For all other indicators. the Levene's test was non-significant ($p > .05$), and thus it was assumed that the variances were roughly equal. The t-tests showed no significance and therefore the means were not significantly different ($p > 0.05$) and therefore we accepted the null hypothesis. Here, it was assumed that variances in the means were equal and that the drivers did not perceive these indicators as significant causes in human error.

The complete independent samples t-test can be found in annex 8.

4.3.1.1.2 Built Environment

In the questionnaire, perceptions of the built environment were tested using two five points Likert-scale questions to indicate their level of agreement on causes on RTAs. These statements were used to identify which and to what extent the built environment contributes to RTAs. Frequencies of respondent responses are presented below.

As seen in

Chart 3, driver's perceived street design as a larger contributor compared to land use. Chart 4 further presented responses for the measurement of "land use". Here, it was identified that drivers had mixed responses although still presenting higher "Agree" or "Strongly Agree" responses for "compactness 2" and "compactness 3" compared to "compactness 1".

Chart 5 further presents responses for the measurement of “street design”. Here, it was noticed that drivers perceive street design as a larger contributor compared to land use with the majority of high concentrations of responses answered “Agree” or “Strongly Agree”.

Chart 3 - Survey question 5 - responses for questions regarding "built environment"

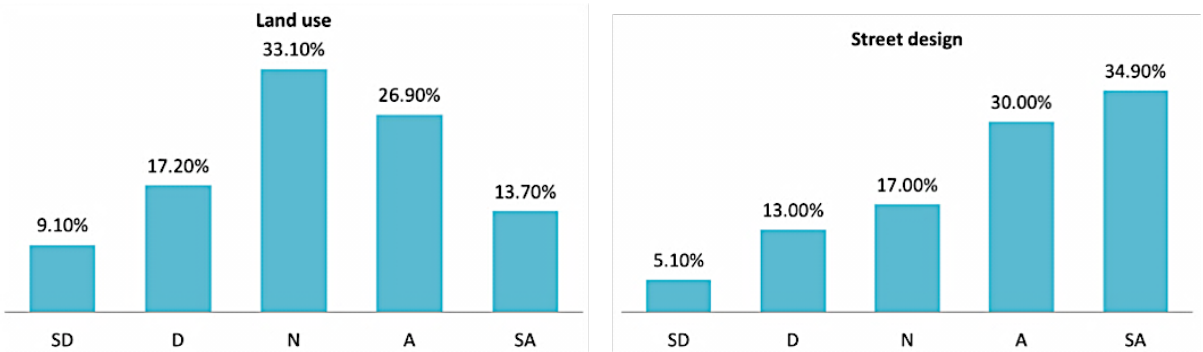


Chart 4 – Survey question 6 - responses for questions regarding "land use"

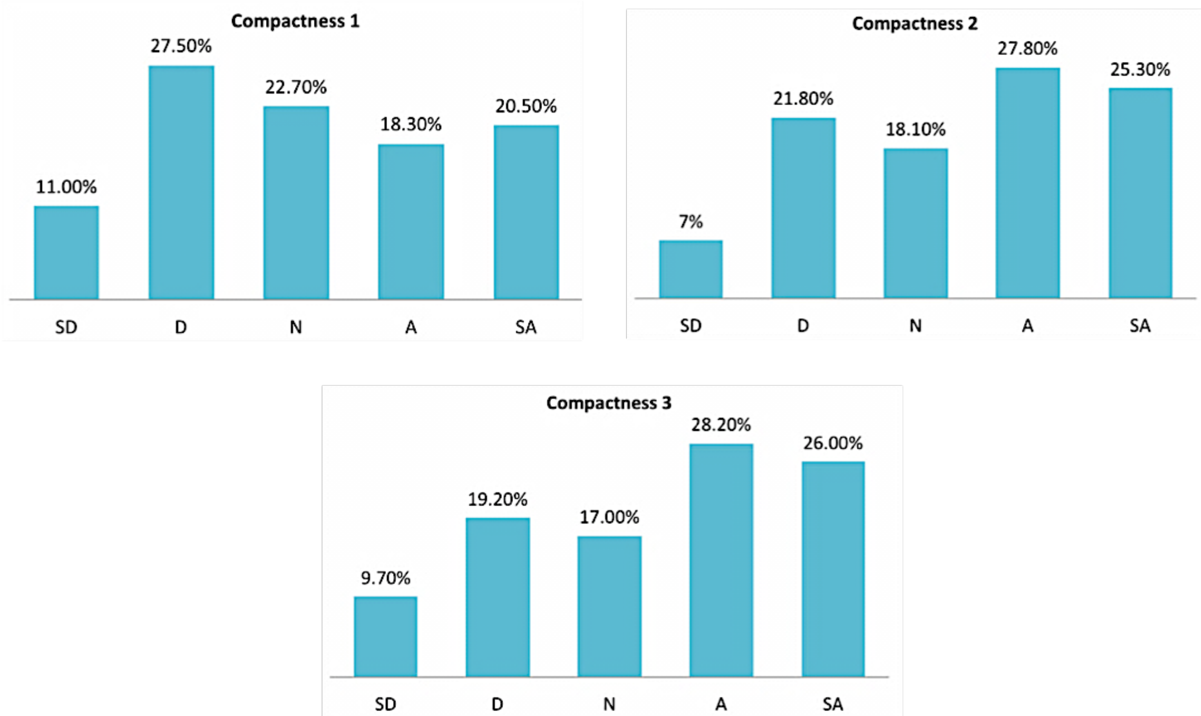
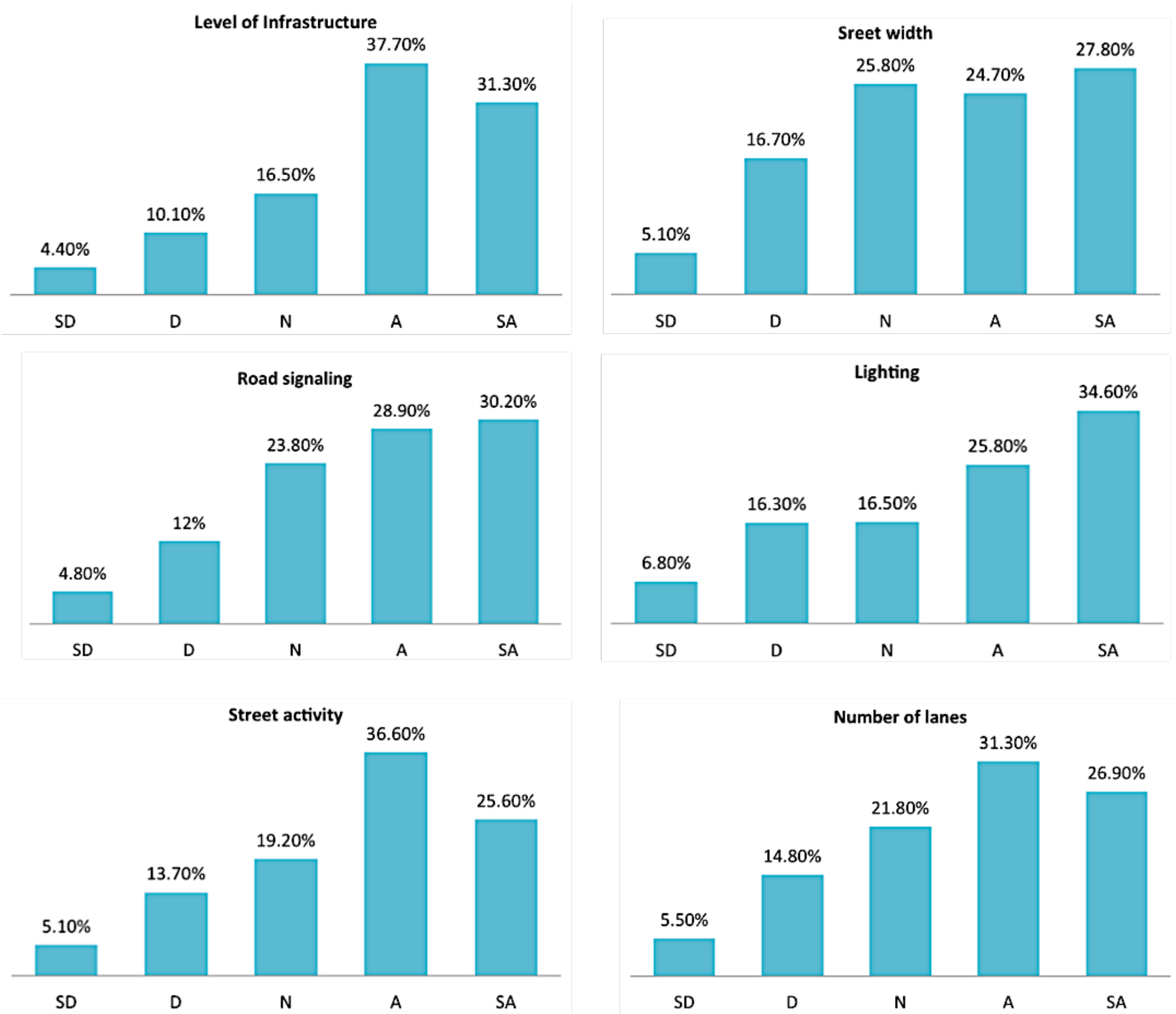


Chart 5 – Survey question 8 - responses for questions regarding "street design"



As previously stated, a reliability test was performed followed by an independent sample t-test, as presented in Table 7. Cronbach's alpha was performed on 11 ordinal built environment indicators as previously listed in the above response frequencies. Cronbach’s Alpha was .879, which indicated that the indicators were measured in a consistent way and thus was reliable.

The t-test results (Table 7, Table 8 and Table 9) indicated a significant difference regarding perceptions towards “compactness 3” (Junction A: M=3.64, SD=1.312 and junction B: M=3.24, SD=1.295), “lighting” (Junction A: M=3.48, SD=1.300 and junction B: M=3.78, SD=1.265) and “street activity” (Junction A: M=3.76, SD=1.101 and junction B: M=3.54, SD=1.180) between both junctions A and B. The p value was 0,000, therefore there was a significant difference between the means ($p > 0,05$) and thus the null hypothesis was rejected and the alternative was accepted.

Table 7 - Statistical test for variable "built environment"

Junction	**α**	**Perceived influence of compactness 3**			**t**	**p**
		N	**M**	**SD**		
A	.879	253	3.24	1.295	3.215	.001
B		201	3.64	1.312		

The difference in perceptions of both groups was 10.9%, which means that both junctions similarly perceived “compactness 3” as an important cause in the built environment. The complete independent samples t-test can be found in annex 8.

Table 8 - Statistical test for variable "built environment"

Junction	α	Perceived influence of lighting			t	p
		N	M	SD		
A	.879	253	3.78	1.265	-2.480	.014
B		201	3.48	1.300		

The difference in perceptions of both groups was 7.9%, which means that both junctions similarly perceived “lighting” as an important cause in the built environment. The complete independent samples t-test can be found in annex 8.

Table 9 - Statistical test for variable "built environment"

Junction	α	Perceived influence of Street activity			t	p
		N	M	SD		
A	.879	253	3.54	1.180	2.029	0.43
B		201	3.76	1.101		

The difference in perceptions of both groups was 5,8%, which means that both junctions similarly perceive “street activity” as an important cause in the built environment. The complete independent samples t-test can be found in annex 8.

For all other indicators. the Levene’s test was non-significant ($p > .05$), and thus it was assumed that the variances were roughly equal. The t-tests showed no significance and therefore the means were not significantly different ($p > 0.05$) and therefore we accepted the null hypothesis. Here, it was assumed that variances in the means were equal and that the drivers did not perceive these indicators as significant causes in the built environment.

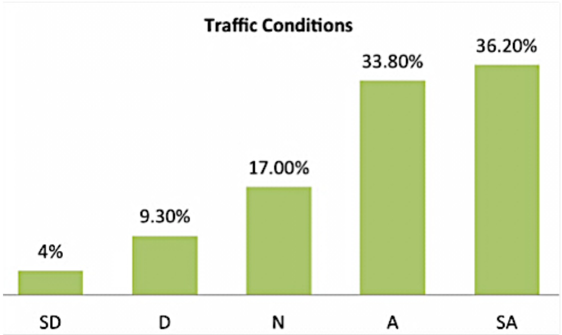
4.3.1.1.3 Traffic Management

In the questionnaire, perceptions of traffic management were tested using two five points Likert-scale questions to indicate their level of agreement on causes on RTAs. These statements were used to identify which and to what extent traffic management contributes to RTAs. Frequencies of respondent responses are presented below.

As seen in Chart 6, within traffic management, drivers perceived traffic conditions and enforcement of regulations with high concentrations of responses answered “Agree” or “Strongly agree”. Chart 7 further presents responses for the measurement of “traffic conditions”. Here, we can see that drivers perceived traffic congestion as the largest cause compared to the rest of the indicators. Similarly, “level of safety” presented 63% of all responses concentrated at high “Agree” or “Strongly Agree”. However, “recommended speed limits”, “traffic signs” and “traffic police” similarly presented high “Agree” or “Strongly Agree” responses.

Chart 8 further presents responses for the measurement of “enforcement of regulations”. Here, varying responses of perceptions of drivers were identified. Although approximately 50% of responses indicated that police are regularly active on the junctions, almost 44% perceived that drivers do not get often penalized for traffic violations.

Chart 6 - Survey question 5 - responses for question regarding "traffic management"



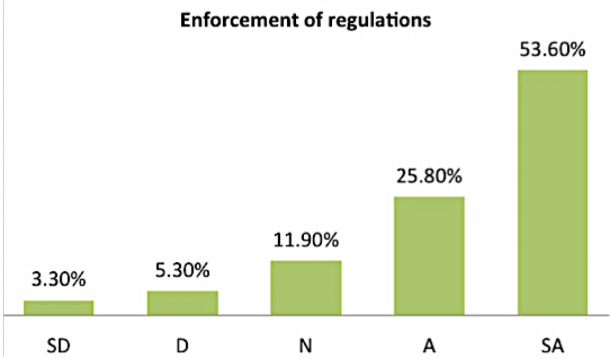
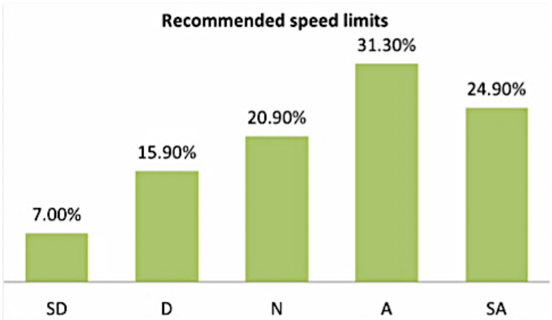
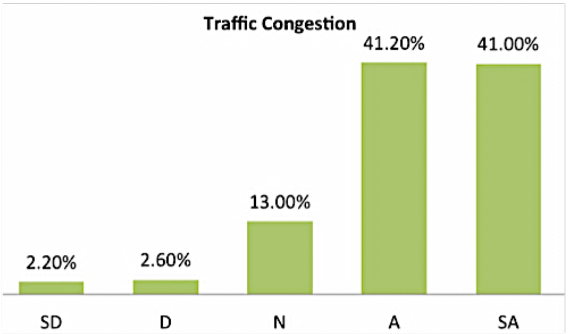
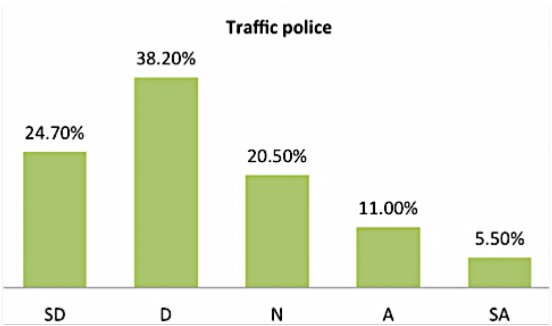


Chart 7 – Survey question 10 - responses for questions regarding "traffic conditions"







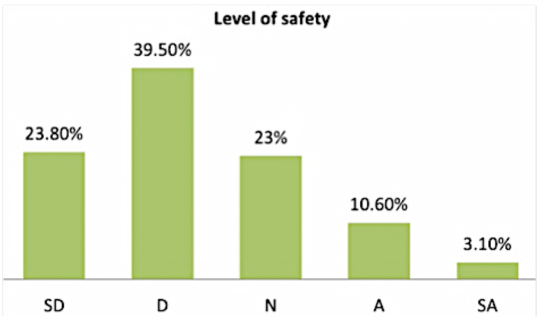
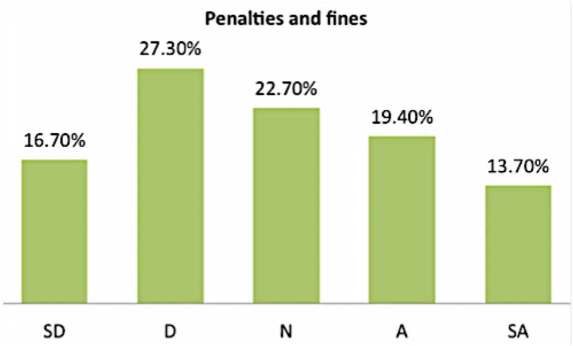
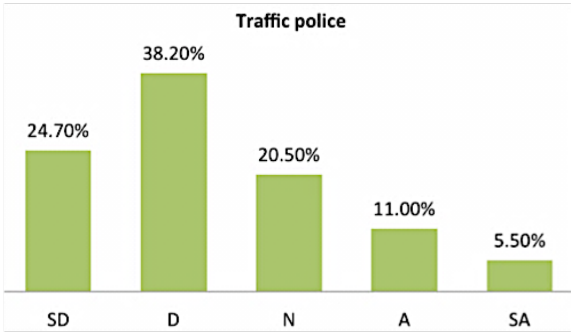


Chart 8 - Survey question 9 - responses for questions regarding "enforcement of regulations"





Cronbach's alpha was performed on 9 ordinal traffic management indicators as previously listed in the above response frequencies. Cronbach's Alpha was .609, which indicated that the indicators were measured in a consistent way and thus is reliable.

The t-test results (Table 10 and Table 11) indicated a significant difference regarding perceptions towards "enforcement of regulations" (Junction A: M=4.33, SD=0.67 and junction B: M=4.12, SD=0.71), "traffic congestion" (Junction A: M=4.27., SD=0.054 and junction B: M=4.07, SD=0.62) between both junctions. The p value was 0,000, therefore there was a significant difference between the means (p > 0,05) and thus the null hypothesis was rejected and the alternative was accepted.

Table 10 - Statistical test for variable "traffic management"

Junction	α	Enforcement of regulations			t	p
		N	M	SD		
A	.609	253	4.12	1.131	2.159	.031
B		200	4.33	.952		

The difference in perceptions of both groups was 5%, which means that both junctions similarly perceived "enforcement of regulations" as an important cause in traffic management. The complete independent samples t-test can be found in annex 10.

Table 11 - Statistical test for variable "traffic management"

Junction	α	Perceived influence of level of traffic Congestion			t	p
		N	M	SD		
A	.609	253	4.07	.993	2.379	.018
B		201	4.27	.768		

The difference in perceptions of both groups was 4.68%, which means that both junctions similarly perceived "traffic congestion" as an important cause in traffic management. The complete independent samples t-test can be found in annex 10.

For all other indicators. the Levene's test was non-significant ($p > .05$), and thus it was assumed that the variances were roughly equal. The t-tests showed no significance and therefore the means were not significantly different ($p > 0.05$) and therefore we accepted the null hypothesis. Here, it was assumed that variances in the means were equal and that the drivers did not perceive these indicators as significant causes in traffic management.

KEY FINDINGS FROM QUESTIONNAIRE

On the variable level, interview respondents stated the following as important causes of RTAs:

1. Human error: Illegal parking
2. Built environment: Compactness, lighting and street activity
3. Traffic management: Enforcement of regulations and traffic congestion

4.3.1.2 Interviews

In depth interviews provided a second portion of primary data of causes of RTAs in Pristina. The interviews were utilized to support key findings derived from the questionnaire as well as to draw additional insights. See annex 6 for further information of the general characteristics of the questionnaire sample.

In order to collect additional primary data on causes of RTAs, the approach for interviews was to gain sufficient coverage of people who are of interest to the case study (selected junctions) and the area of study. Moreover, when analysing causes of RTAs at junctions, potential causes can be attributed to an array of people that observe the area of study with mutually distinctive perspectives and therefore provide different opinions of various aspects of the area of study. Although diverse profiles of people exist in providing important insights a small number of people provide in depth information and therefore this study focused on identifying people which are of close interest to the area of study in order to effectively collect varied opinions and perspectives resulting in valid and concrete data on causes of RTAs. Consequently the study focused on interviewing people that drive on the junctions, live or work near the junctions (neighbourhood), responsible for the operation of the junction (junction design or management), people who have generally taken a interest in the area (key informants) and lastly other people who have voluntarily expressed their thoughts (other). By doing so, the study included adequate coverage of data collected.

As stated in chapter 3, semi-structured interviews were conducted with open-ended questions, which allowed respondents to openly express their opinions. Due to time and cost constraints, in total 15 in depth interviews were conducted. Table 12 presents the distribution of interview respondents. See annex 6 for further details regarding interview respondent characteristics.

Table 12 - Distribution of interview respondents

Respondent Group	Description	Quantity
Neighbourhood	Resident	2
	Shopkeeper	2
Junction design and management	Municipality of Pristina	2

	Ministry of Infrastructure	1
	Kosovo Police	1
Key informants	Traffic Safety Expert	1
	Public Safety Awareness Officer	1
	Director of Medical Emergency Centre	1
	RTA Victims	2
Other	Comments/feedback from social media and survey publication	2

Interview respondents were generally open to discussing the topic of RTAs in Pristina and commonly responded in similar manners providing and confirming vital information (also identified through the questionnaire). Although respondent profiles vary, as stated in Table 12, all respondents similarly provided information on distinct irregularities, which cause RTAs at junctions in Pristina and therefore consisted of good coverage of the situation in Pristina. The following section below presents data collected from interviews, which are presented on the variable level. Data extracted from the interviews further supports and validates key findings that resulted from the questionnaire. Additional relevant findings are also mentioned accordingly.

4.3.1.2.1 Human Error

Significant in the questionnaire results; illegal parking was also cited in the interviews. Due to the obvious increase of cars circulating Pristina, parking spaces and lots are exceedingly absent creating challenges in public parking. To add, existing parking spaces do not meet the demand of current rates of cars in the city. In return, drivers have been noted to stop at bus stops or wherever convenient for anywhere from 5 to 30 minutes creating disruptions on roads as well as occupying pedestrian sidewalks. According to the Kosovo police, stopping at irregular spots and/or irregular parking are common traffic violations in Pristina.

According to the municipality of Pristina, anti-parking measures have been implemented to deal with illegal parking with aims of improving safety by also alleviating sidewalks for pedestrians.

Figure 9 - Anti parking infrastructure

(Source: Municipality of Pristina, 2017)

A number of other human error factors were also mentioned throughout the interviews. A large portion of the population has opted to commute by private vehicles, which drastically increased the flows of road users the city. This is apparent with residents of Pristina and vising residents from other municipalities adding on to the already massive flow of vehicles circulating the city. Shortcomings in areas of the built environment and traffic management (discussed in further sections) have simultaneously added on to undesirable human behaviour, which significantly impacts the level of road safety in Pristina. As an initial cause, the majority of interviewees have stated that within human error, disregard of traffic regulations is an on going issue increasing chances of RTAs. More explicitly, speeding, drunk driving, reckless driving, illegal parking, incompetent overtaking, disregard of pedestrian crossings and taking on secondary tasks such as cell phone use, smoking and or eating have been identified to directly endanger road safety and increase RTAs in Pristina. However, drivers were cited to not be the only road users at fault seeing as pedestrians have also been noted to irregularly cross roads at various road segments or cross roads at red lights but have also been noted to wait for green lights and respect traffic regulations.

According to the Kosovo Police, the most common traffic violations in Pristina are disregard of traffic lights, speeding, distance between vehicles, priority of passage, stopping at irregular spots and irregular parking, etc. Within the region of Pristina (including in total 7 municipalities) from January to August 2017, 40851 traffic fines were issued, which means that 5106 fines were issued per month. For the year 2016, 45387 were issued, 3782 per month.

Additionally, an interesting insight gained from the interviews was how the lack of knowledge of the surrounding areas impacts road safety and the task of driving. It was stated that drivers that are unfamiliar with the built environment maintain high speeds, which increases the occurrence of RTAs. This was stated to be more apparent in urban areas consisting of fewer lanes compared to the periphery areas with extended lanes. The above stated may be more evident during night time driving since a number of other contributing factors such as visibility is also present. During night-time driving, drivers have been stated to increase speeds since there are fewer cars by also taking advantage of the excess space and further accelerate speeds.

Junction A and B interview responses similarly mentioned the on-going issue of speeding on the junctions stating that drivers commonly speed when entering junctions A and B in Pristina. Since the drivers are initially driving at higher speeds on national roads (e.g.

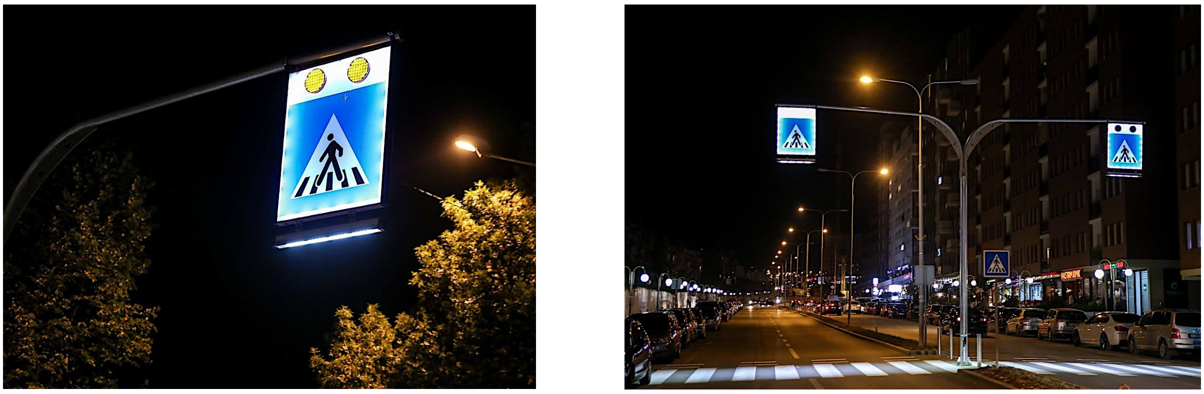
highways) they tend to not effectively adapt to the speed limits. Both junctions A and B respondents also mentioned the issue of illegal parking stating that drivers irregularly park near commercial or residential areas from anywhere between 5 to 30 minutes.

4.3.1.2.2 Built Environment

In regards to the level of compactness (found to be significant in the questionnaire results), interview respondents similarly mentioned the challenge of high motorization in Pristina. In terms of the built environment, narrow roads, number of lanes and mixed land use factors were especially mentioned to play a role in RTA's. Particularly, due to mixed urban development, high concentrations of institutional, commercial, residential and cultural areas are condensed in the city centre resulting in high circulation of road users.

Lighting (visibility) while driving was primarily mentioned in cases of night-time driving in Pristina as stated in the previous section of human error. It was also mentioned that B lacks visibility during night-time driving which increases difficulty in the task of driving as well as overall risk. According to the municipality of Pristina, street lighting (**Figure 1**) was added to various pedestrian crossings in the city to increase visibility and improve safety for vulnerable road users such as pedestrians.

Figure 10 - Street lighting added to pedestrian crossings



(Source: Municipality of Pristina, 2017)

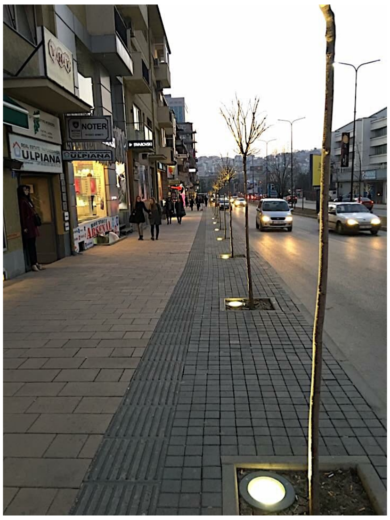
Comparable to the influence of compactness, interview respondents discussed street activity in relation to the density of mixed land use at the city centre which ultimately leads to high circulation of roads users concentrated at condensed areas in Pristina.

Other factors within the built environment were also mentioned in the interviews. The interviewees generally stated that existing infrastructure does not effectively facilitate the large flow of cars. The quality of road infrastructure, which is mostly old or damaged, does not meet the needs of current flows of traffic and the number of road users commuting throughout. Within the built environment, risk prone areas have been stated to be located at entry or exit points of the city since all national roads pass through Pristina drastically increasing traffic flows. Consequently, increase traffic flows in Pristina and surrounding regions similarly adds on to the issue of the level of satisfactory infrastructure to meet current transport demands. Compared to local roads, regional and national roads have been stated to be safer due to the fact that they have been recently built or reconstructed over the years to improve the level and quality of infrastructure and safety. The department of urbanism and planning in the municipality of Pristina has stated that due to budget constraints the development of road infrastructure throughout the years was not able to keep up with the urban expansion of the city leading to the construction of new roads with minimal criteria. Similarly, according to the department of public services in the municipality of Pristina, challenges arise in implementing road safety measures due to the need of large investments in road infrastructure – especially for the construction of ring roads to reduce inner city congestion. Lacking support from the national level, crucial infrastructure projects are ultimately limited and subsequently difficult to implement.

Vulnerable road users such as pedestrians and cyclists are especially impacted by poor or missing infrastructure (e.g. bike lanes) thus challenging free and secure movement for all road users. With large numbers of cars overriding roads, minimal available space is left for other road users. Physical characteristics such as narrow streets, number of lanes, street lighting, cameras, unclear horizontal and vertical signalling have also been stated as current issues impacting RTAs.

Complementing the addition of streetlights to increase visibility, the municipality of Pristina has also implemented reforms to improve street design. Existing infrastructure was adapted to accommodate people with special needs at pedestrian crossings as well as other road segments. As seen in Figure 11 guided sidewalks for people who are visually impaired were implemented. Existing infrastructure was also adapted to facilitate individuals with special needs (e.g. with wheel chairs) as seen in Figure 12.

Figure 11 - Guided sidewalks for visually impaired people



(Source: Municipality of Pristina, 2017)

Figure 12 - Easy accessible street curbs

(Source: Municipality of Pristina, 2017)

According to the ministry of infrastructure, junction B is equipped with horizontal and vertical signalling as well as with light signalling to provide safety and visibility to vehicle drivers who move on this road segment during night conditions. Since there have been a number of RTAs at this junction, the ministry of infrastructure anticipates to improve horizontal and vertical signalling with durable materials to increase reflection and visibility as well as additional vibrating strips at junction entry points to increase awareness for drivers to lower speeds.

4.3.1.2.3 Traffic Management

Significant in the questionnaire results; enforcement of regulations was also apparent throughout the interviews. Interview responses primarily focused on the fact that the level of law enforcement is absent and that existing laws and regulations are not sufficiently implemented.

The Kosovo police are primarily responsible for managing traffic accompanied by cooperation with the local and central levels of government. According to the Kosovo Police, obstacles in implementing safety measures do not exist on their part. However, they have stated that road safety also varies on other institutions and the competencies to provide and maintain a satisfactory level of road safety in Pristina. On the other hand, according to the municipality of Pristina, violations from road users are not the only existing problem causing RTAs – the effectiveness of responsible institutions such as traffic police is also a key factor in reducing RTAs. The municipality has also stated that traffic monitoring and management does not meet satisfactory levels since the number of traffic police does not meet the demands of Pristina in relation to its perimeters.

Moreover, interviews respondents have stated that appropriate cooperation of all key actors in the area of road safety is present to some extent although still compromising the level of enforcement. Precisely, increased responsibility and accountability is missing among key actors resulting in further improvement needed in terms of enforcement (e.g. road users be tolerably penalized for violations).

According to the Kosovo police, traffic police patrol and monitor traffic flows. Specifically, intersections are monitored as well as streets with large flows of vehicles and pedestrians in order to assist with easing traffic circulation. Fines are also given to road traffic users who violate traffic regulations and in the case of RTAs they are also dealt with. In regards to the level of enforcement from the Kosovo Police interview responses revealed negative perceptions primarily indicating that traffic police do not effectively enforce traffic regulations while patrolling streets of Pristina. It was stated that road users are not properly penalized for traffic violations (e.g. pedestrians are not penalized as frequently as drivers although they commonly violate traffic regulations) as well as that appropriate fines are not given (drivers are mostly penalized for speeding although other violations occur).

Additionally, another key finding from the interviews was the level of enforcement practiced by other key actors; particularly the judicial system. Due to lack of capacities (number of judges), traffic violations are not given priority resulting in increased numbers of unprocessed cases. Therefore comparably road traffic safety laws are not strictly enforced resulting in poor implementation of traffic safety measures.

Another interesting find from the interviews regarding the level of enforcement of driving schools that train new candidate as well as relevant institutions that issue drivers license. Corruption and weak criteria in driving schools was primarily cited which allows new drivers with improper or lack of training to easily enter the roads of Pristina. To add, also mentioned in the human error section, knowledge of traffic laws are also absent. Explicitly, it was mentioned that drivers lack knowledge when driving on roundabouts increasing risk for all road users on the junction.

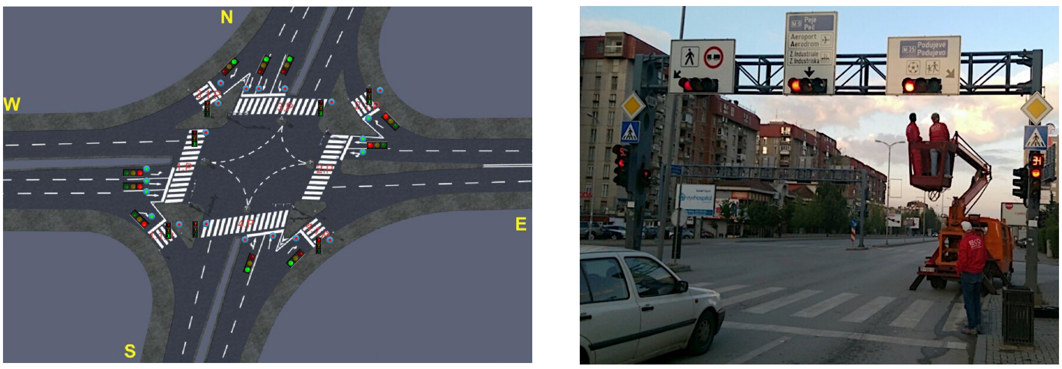
Holding the largest population of residents and cars, interviews have unceasingly validated that the massive use of personal vehicles for daily commuting adds on to excessive levels of congestion throughout Pristina as comparably mentioned in the human error and built environment sections. Likewise, as stated in the built environment section, existing infrastructure in proportion to high motorization demand and mixed land use instantaneously does not satisfy current demands of traffic and therefore causing increased congestion throughout the city.

Moreover, lacking adequate public transportation systems consisting of ideal coverage of Pristina and surrounding regions (from Pristina to urban-peripheral zones) also further impacts high levels of congestion since citizens do not comprise of other transport options besides opting to private cars. Additionally, traffic is also increased due to the mix of local and national road traffic circulating Pristina (e.g. Ferizaj-Mitrovica-Fushe Kosove). Therefore with the large volumes of cars, drastic increases of mixed traffic manifest therefore overloading capacities of roads causing difficult road conditions for all road users.

Since both junction A and B are located in proximity to key entrance/exit roads in Pristina, interviews also stated that high volumes of traffic in such areas increase chances of RTAs since drivers are already driving at higher speeds on national roads. In comparison, inner city local roads have said to show lower risk due to lower speeds.

Interviews respondents also discussed their perceptions of the level of safety in Pristina, which is directly related to traffic management. Generally, respondents stated that the level of safety is worrying and that relevant institutions as well as citizens should do much more in order to improve the current situation. Vulnerable road users such as pedestrians or children were primarily quoted. To improve road safety the municipality has focused on increasing safety for pedestrians. As stated in the built environment sections, street lighting was added to increase visibility. The municipality of Pristina has also added additional pedestrian's crossings, which are frequented by pedestrians. Specifically, pedestrian crossings were added to 18 areas throughout the city. To regulate traffic and control speeding, the municipality has also added traffic lights (Figure 13) and speed radars (Figure 15) at various locations. Furthermore, traffic-calming measures such as speed bumps were added to school zones and pedestrian crossings (Figure 14) to reduce speeds. However, although improving road safety, the above stated traffic calming additions haven also been noted to create further complications by increasing congestion. This in return has made drivers unsatisfied with current traffic management additions to designated areas in Pristina.

Figure 13 - Traffic Lights



(Source: Municipality of Pristina, 2017)

Figure 14 - Traffic Calming measures

(Source: Municipality of Pristina, 2017)

(Source: Municipality of Pristina, 2017)

Figure 15 - Speed Radars

(Source: Municipality of Pristina, 2017)

Junction A and B interview responses similarly mentioned lack of police patrol at junctions. It was observed that traffic police patrols roads but do not take necessary measures such as penalize for traffic violations. Traffic police were also mentioned to be more active during the summer seasons since due to the Diaspora visiting, traffic flows increase even more increases RTA occurrence.

KEY FINDINGS FROM INTERVIEWS

On the variable level, interview respondents stated the following as important causes of RTAs:

<u>Supporting questionnaire findings:</u>

1. Human error: Illegal parking

2. Built environment: Compactness, lighting and street activity

3. Traffic management: Enforcement of regulations and traffic congestion

<u>Additional relevant findings:</u>

1. Human error:

- Disregard of traffic violations (by all road users)
- Lack of knowledge of built environment (especially during night-time driving)

2. Built environment:

- Level of infrastructure does not meet current motorization demands
- Risk prone areas are located at entry and/or exit points of Pristina
- Due to budget constraints and rapid urbanization, road infrastructure developed with minimal design criteria.
- Currently investment challenges arise in implementing larger infrastructural projects.

3. Traffic management:

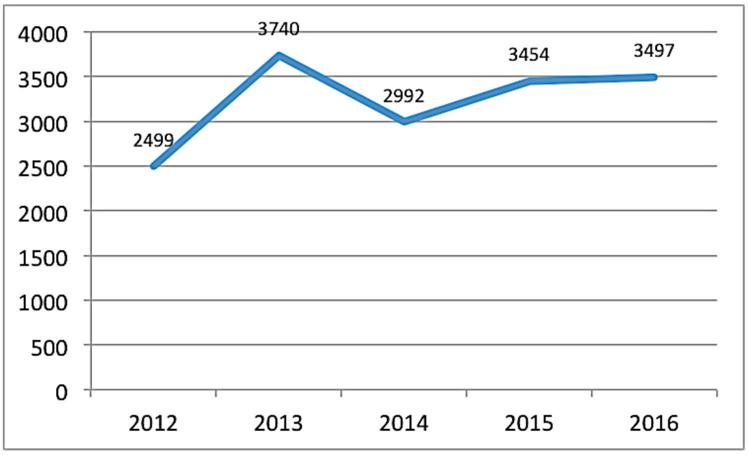
- Traffic police unit does not meet the demands of Pristina in relation to its perimeters.
- Traffic police do not entirely or constantly enforce traffic regulations
- Increased responsibility and accountability is missing among key actors in the area
- Lack of judicial staff leads to unprocessed traffic cases.
- Drivers lack knowledge when driving on roundabouts increasing risk for all road users on the junction.

4.3.2 Secondary Data

As stated in chapter 3, secondary data provided a third set of data within the case study. Secondary data was collected to increase sources of information of RTAs in Pristina as well as to increase data validation complementing primary data. Secondary data was also collected from the Kosovo Police archives. According to the statistics collected from the Kosovo Police, RTAs have increased over the years.

Chart 9 demonstrates that RTAs have increased gradually from 2012 to 2016. Particularly, RTAs have increased by 14.4% from 2014 to 2016.

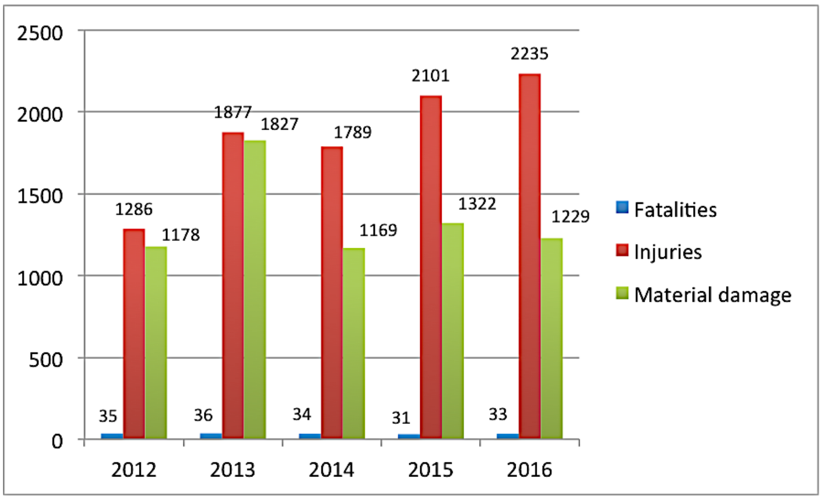
Chart 9 - Rate of RTAs 2012 to 2016



(Source: Kosovo Police, 2017)

Chart 10 shows RTAs by type in Pristina from 2012 to 2016. From 2012 to 2016, RTAs with fatalities show steady rates with an average of 33.8 RTAs per year. From 2012 to 2016, on average 867.2 RTAs with injuries and 1345 RTAs with material damage were reported per year. To add, RTAs with injuries show gradual increase from 2012 to 2016 holding considerable higher rates compared to RTAs with fatality or material damage. RTAs with material damage show a gradual rise from 2012 to 2013, stable rates from 2013 to 2014 followed by a progression of rates from 2014 to 2016.

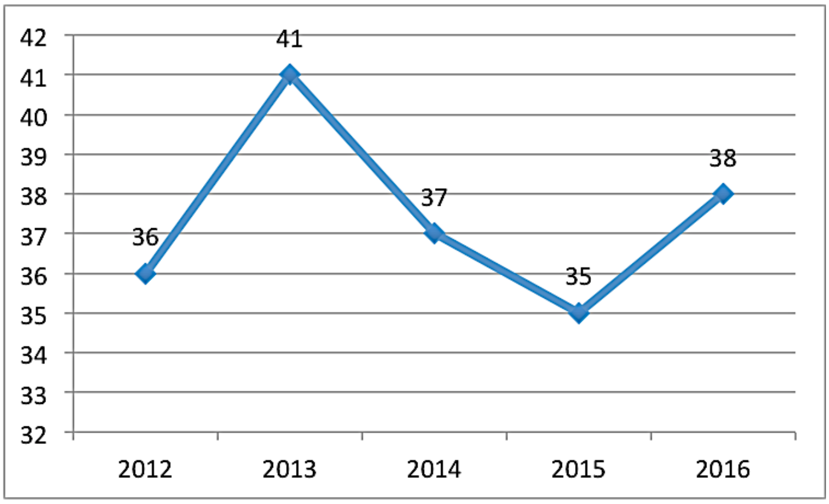
Chart 10 - RTAs by type 2012 to 2016



(Source: Kosovo Police, 2017)

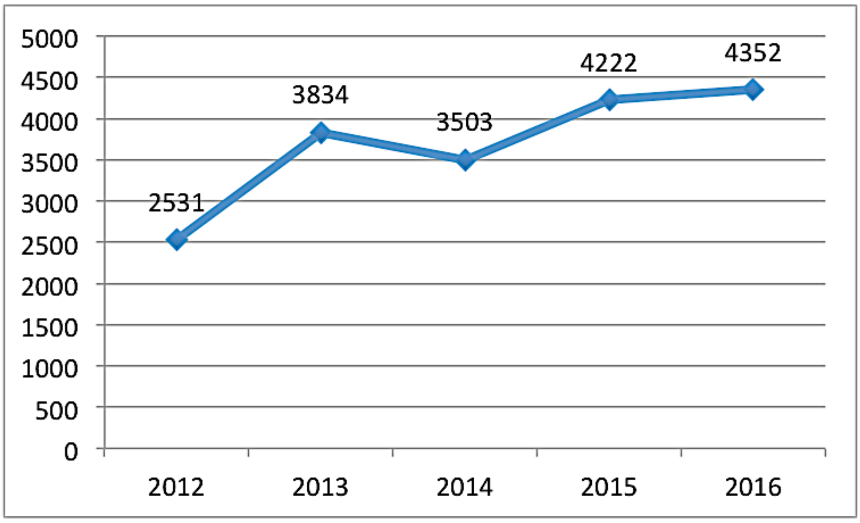
Chart 11 presents data on the total number of dead persons from 2012 to 2016. In 2012 the number of dead persons increased sharply reaching a peak of a total of 41 dead persons in 2013. From 2013 to 2015 the number of dead persons decreased dramatically followed by another sharp increase in 2016. On the other hand, Chart 12 demonstrates the total number of injured persons from 2012 to 2016. From 2012 to 2013, the total number of injured persons increased sharply gradually increasing to a peak of 4352 injured persons in 2016. Throughout the years, data shows that RTAs with injuries are significantly more occurring compared to RTAs with fatalities.

Chart 11 - Total number of dead persons 2012 to 2016



(Source: Kosovo Police, 2017)

Chart 12 - Total number of injured persons 2012 to 2016



(Source: Kosovo Police, 2017)

As mentioned in chapter 3, the Kosovo police reports RTAs based on the following contributing factors driving under the influence of alcohol, not adapting speed to road conditions, not respecting the distance, changing traffic lanes, U-turn, unsafe access to road, unsafe driving, disregard of priority of passage, disregard of traffic signs and other. Chart 13 presents RTAs recorded from 2012 to 2016 based on contributing factors formulated by the Kosovo police.

Chart 13 - Contributing factors 2012 to 2016

	2012	2013	2014	2015	2016
Driving under the influence of alcohol	13	9	17	17	22
Not adapting speed to road conditions	463	669	621	695	674
Not Respecting the Distance	550	929	693	956	928
Changing Traffic Lanes	279	544	268	362	385
U-turn	184	288	244	221	221
Unsafe Access to Road	160	213	201	219	260
Unsafe Driving	456	625	510	521	543
Disregard of Priority of Passage	63	66	88	85	76
Disregard of Traffic Signs	65	110	100	155	147
Other	266	287	250	223	241
Total	2499	3740	2992	3454	3497

(Source: Kosovo Police, 2017)

KEY FINDINGS FROM KOSOVO POLICE ARCHIVES

1. Human error:

- RTAs have increased by 14.4% from 2014 to 2016.
- From 2012 to 2016, on average 33.8 RTAs with fatalities, 867.2 RTAs with injuries and 1345 RTAs with material damage per year.
- RTAs with injuries consist of considerable higher rates compared to RTAs with fatality or material damage.

4.4 Conclusion: Principal component analysis

The previous sections presented key findings collected from fieldwork. The chapter concludes by presenting further descriptive analysis that was conducted in order to further analyse data that was used for inferential analysis in the following chapter. Therefore, exploratory factor analysis was applied in the study to primarily extract overlapping or redundant data.

Exploratory factor analysis is a tool for interdependence analysis, which means that all the variables that are considered in the analysis attain equal status. Therefore only independent variables are used. Although there are numerous types of factor analysis, this study applied principal component analysis. The purpose of principal component analysis is to reduce data to ultimately simplify the data analysis by identifying interrelationships between variables. By doing so, an improved model is designed. Moreover, it extracts overlapping or redundant information from concepts and questions in the questionnaire resulting in a reduced but significant database to further continue with inferential analysis. In this case, principal component analysis was used to set up descriptive analysis of the variables by identifying how perceptions of drivers were interrelated in order to analyse possible causes of RTAs. Based on the literature in chapter 2, numerous causes were identified which were then grouped and presented in the conceptual framework. In total, 25 variables were identified which were also tested for reliability in previous sections in this chapter. In the questionnaire, variables were scored on a five point Likert-scale (strongly disagree to strongly agree) with values ranging from 1 to 5 where 1 is strongly disagree and 5 is strongly agree.

All 25 variables were included in the factor analysis. The factors analysis firstly presented the KMI and Barllet's test as seen in Table 13. Firstly the Kaiser-Meyer-Olkin measured the sample adequacy that is considered as a good result if greater than .5. In this case, the Kaiser-Meyer-Olkin measurement of sample adequacy was .850, which means the sample is sufficient for further analysis. The significance level derived from the Barlett's tests of sphericity was .000, which means that there was at least one statistical significant correlation between two variables in the database.

Table 13 - KMO and Bartlett's test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.850
Bartlett's Test of Sphericity	Approx. Chi-Square	5442.506
	df	496
	Sig.	.000

Next, the total variance explained table (complete table is found in annex 12) was reviewed and analysed. Firstly, the last value in the cumulative % column within the rotation sum of squared loadings column was checked. The value here was 7, which means that the analysis assumed that the 3 original variables could be reduced to 7 underlying factors, which were therefore extracted in the analysis.

The 7 factors explained 60.446 % of the variance in the data; in other words, it predicted 60.446 % of the information in all of the 3 original variables. In general, data of social science areas should be able to extract a minimum of 60% of the variance, although under certain conditions, variances of < 55% are also acceptable.

Afterwards, the rotation component matrix (complete matrix is found in annex 12) was reviewed and analysed to identify which different factors were extracted. The rotation component matrix consisted of estimated correlations between each of the variables, which were grouped into distinctive cohorts. Table 14 shows the 7 factors (columns 1 to 7) that were extracted in the analysis.

Table 14 - Rotated component matrix

1	2	3	4	5	6	7
Perceived influence of unsafe driving	Perceived influence of number of lanes	Perceived influence of compactness 1	Perceived influence of road signalling	Perceived influence of traffic police	Traffic conditions	Changing lanes
Perceived	Perceived	Perceived	Perceived	Perceived	Enforcement	Not

influence of unsafe distance	influence of street width	influence of compactness 2	influence of traffic signs	influence of penalties and fines	of regulations	respecting traffic signs
Perceived influence of unsafe access t road	Perceived influence level of road infrastructure	Land use	Perceived influence of traffic police	Perceived influence of level of safety	Street Design	
Perceived influence of disregard of right of way	Perceived influence of lighting	Perceived influence of compactness 3	Perceived influence of traffic Recommended speed limits	Perceived influence of distraction		
Perceived influence of poor speed adaption	Perceived influence of road signalling					
Perceived influence of drinking an driving						

Due to the fact that unforeseen aspects (e.g. questionnaire design or consistency of peoples responses) may arise, implicit errors may exist in the database and therefore this was taken into consideration when analysing the rotated component matrix and formulating redefined variables. Consequently the rotated component matrix was utilized as a guideline of which variables to adequately combined for further inferential analysis.

Based on initial variables (as stated in the conceptual framework in chapter 2), the initial and redefined groups of variables did not show large differences. When compared, the main differences were primarily in the manner in which they were grouped; specifically the number of combined variables per group. As stated in the conceptual framework in chapter 2, initial variables were grouped in three distinctive groups whereas the redefined variables were further grouped in 7 distinctive groups as seen in Table 15 below.

Table 15 - Differences from initial and modified variable groups

Initial variable groups	Modified variable groups
Human Error	Human Error 1

	Human Error 2
Built Environment	Street Design
	Land use
Traffic Management	Traffic Management 1
	Traffic Management 2
	Traffic Conditions

Consequently, Table 16 presents the redefined variable groups formulated based on the rotation component matrix, which were used for further inferential analysis. The last row presented the redefined variable label in line with the literature review in order to logically justify the redefined variables extracted from the rotation component matrix.

Table 16 - Redefined variable groups

1	2	3	4	5	6	7
Perceived influence of unsafe driving	Perceived influence of number of lanes	Perceived influence of compactness 1	Perceived influence of road signalling	Perceived influence of traffic police	Traffic conditions	Changing lanes
Perceived influence of unsafe distance	Perceived influence of street width	Perceived influence of compactness 2	Perceived influence of traffic signs	Perceived influence of penalties and fines	Enforcement of regulations	Not respecting traffic signs
Perceived influence of unsafe access t road	Perceived influence level of road infrastructure	Land use	Perceived influence of traffic police	Perceived influence of level of safety	Street Design	
Perceived influence of disregard of right of way	Perceived influence of lighting	Perceived influence of compactness 3	Perceived influence of traffic Recommended speed limits	Perceived influence of distraction		
Perceived influence of poor speed adaption	Perceived influence of road signalling					
Perceived						

influence of drinking an driving						
HE 1	**Street design**	**Land use**	**Traffic Conditions**	**TM 1**	**TM 2**	**HE 2**

To test the reliability of the redefined variables, Cronbach's alpha was performed (see Table 17 below). Only variable "H2 2" did not meet required values and therefore this variable was excluded from further analysis. The remaining 6 variables were computing into new variables in SPSS in order to be used for inferential analysis.

Table 17 - Reliability of redefined variables

1	2	3	4	5	6	7
HE 1	**Street design**	**Land use**	**Traffic Conditions**	**TM 1**	**TM 2**	**HE 2**
α = .820	α = .853	α = .775	α = .745	α = .644	α = .662	α =. 410

Accordingly, the principal component analysis extracted the independent variables (based on drivers perceptions), which were valid and therefore adequate to continue including in further inferential analysis. As stated in the literature review in chapter 2, individual characteristics have been linked to driver personality resulting in a significant and relevant variables, which influence human behaviour. As stated in chapter 3, control variables, also referred to independent variables, were also included in the analysis. In order to distinguish if control variables were significant for further analysis, a bivariate test was performed to test for correlations between the control variables and the previously selected 6 independent variables. A Pearson product-moment correlation coefficient was computed to evaluate the relationship between the control variables (individual, vehicle and trip characteristics) and 6 independent variables (drivers perceptions on causes of RTAs). Overall, the tests presented strong and positive correlations between control variables and independent variables. Further concluding from the Pearson product-moment correlation coefficient, it can be understood that individual characteristics (control variables) influence driver's perceptions. Thus in this case, although control variable do not directly cause RTAs, they play an important role within driver's perceptions and therefore were included in the model for further analysis. See annex 12 for the complete table.

Consequently, as previously stated the principle component analysis and Pearson product-moment correlation coefficient resulted in further analysing data to effectively gain a valid and reliable database. The above stated provided the study with a revised theory and equation for further analysis inferential analysis in order to answer the research questions.

Chapter 5: Conclusions

5.1 Binary Logistic Analysis

To answer the research questions, a binary logistic regression was applied for inferential analysis. The previous sections have reduced the data by adequately grouping the variables based on positive correlations. By doing so the model was fitted correctly including only significant variables in the logistic analysis. Consequently, initial variables were redefined and tested for reliability and lastly computed into new variables to be included in the logistic regression. Control variables were also tested for further positive correlations. Moreover, in order to explain which causes of RTAs influence RTAs at junctions, a regression analysis, specifically binary logistic analysis was used and therefore the analysis assessed the correlation of causes of RTAs based on driver's perceptions in Pristina.

A binary logistic regression (Logit model) is used to predict a dichotomous dependent variable from a set of predictor independent variables. The logistic regression assumed that P (Y=1) is the probability of the event occurring (high or low risk RTA) and therefore the dependent variable is dichotomous and is coded as 1 = high risk and 0 = low risk. The independent values are of any measurement – in this case they were categorical. The binary logistic regression is used to describe the relationship between the categorical predictor independent variables and the dependent variable. Therefore in the logistic regression, the predicted dependent variable is a function of the probability that the independent variables will be in one of the categories (e.g. high or low risk). Table 18 presents all variables used in the binary logistic regression. Since the study examined causes of RTAs at the junction, the independent variables and control variables were therefore used to predict how they influence the dependent variable. The model was also performed without control variables but results were weak compared to their inclusion in the model.

Table 18 - Binary logistic regression variables

Variables	**Description (value)**
Dependent variable	
High or low risk junctions	Nominal
Independent variables	
Human error	Ordinal
Street design	Ordinal
Land use	Ordinal
Traffic Conditions	Ordinal
Traffic Management 1	Ordinal
Traffic Management 2	Ordinal
Control Variables	
Age	Scale
Gender	Nominal
Education	Ordinal
Employment	Nominal
Income	Ordinal

Driving experience	Ordinal
Car insurance	Nominal
Car service	Nominal
Car use	Nominal
Alternate mode of transport	Nominal
Drivers license	Nominal

The "Omnibus Tests of Model Coefficients" output presented the overall test of the model. It was used to check that the new model (including explanatory variables) was an improvement compared to the null model. The test included a Chi-square test for homogeneity of the model, which determined if the prediction model placement satisfaction was a statistically significant relationship with the dependent variable – in other words if the prediction model fits significantly better to the data compared to the null model with no predictors. The Chi-square test produced a p value of .014 resulting in a significant placement model. Thus since $p < .014$ the null hypothesis was rejected and the alternative was accepted.

Table 19 - Omnibus Test of Model Coefficients

Omnibus Tests of Model Coefficients				
		Chi-square	df	Sig.
Step 1	Step	78.149	53	.014
	Block	78.149	53	.014
	Model	78.149	53	.014

The Hosmer and Lemeshow Test was a goodness of fit test, which presented that p=. 602 (>.5), suggesting that the model was a good fit to the data.

Table 20 - Hosher and Lemeshow Test

Hosmer and Lemeshow Test			
Step	Chi-square	df	Sig.
1	6.404	8	.602

The classification table summarized the level of accuracy of the model outcome. The results presented that the model correctly classified the outcome of 71.2% of the cases.

Table 21 - Classification Table

Classification Table a		
Observed	Predicted	
	DV	Percentage Correct

			Low risk	High risk	
Step 1	DV	Low risk	70	51	57.9
		High risk	32	135	80.8
Overall Percentage					71.2
a. The cut value is .500					

The coefficients and odds ratios were explained in table 22 below. The table included the regression coefficient (B), the Wald statistic (to test statistical significance) and all odds ratio (Exp (B)) for significant variables included in the model. As shown in table 22, only variables built environment and traffic management significantly influenced the likelihood of RTAs on junctions. Other variables in the model were not found to be significant (p>.05).

Table 22 - Logistic regression analysis for variables predicting RTAs

Variables	**Indicators**	**Value**	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% C.I. for EXP (B)**	
									Lower	**Upper**
Built Environment	Land use (1)	Strongly disagree			10.003	4	0.04			
	Land use (2)	Disagree	-0.971	0.954	1.036	1	0.309	0.379	0.058	2.456
	Land use (3)	Neutral	0.487	0.686	0.505	1	0.477	1.628	0.424	6.248
	Land use (4)	Agree	-0.586	0.533	1.21	1	0.271	0.557	0.196	1.581
	Land use (5)	Strongly agree	-1.034	0.509	4.121	1	0.042	0.356	0.131	0.965
Traffic Management	Traffic management (1)	Strongly disagree			8.769	4	0.067			
	Traffic management (2)	Disagree	3.434	1.581	4.716	1	0.03	30.994	1.397	687.461
	Traffic management (3)	Neutral	0.502	0.784	0.41	1	0.522	1.652	0.356	7.676
	Traffic management (4)	Agree	0.84	0.512	2.688	1	0.101	2.316	0.849	6.32
	Traffic management (5)	Strongly agree	1.142	0.473	5.845	1	0.016	3.134	1.241	7.914

To perform the statistical test, two hypotheses were formed:

- Null hypothesis: no significant difference is evident between the effects of the predictor independent variables and the dependent variable
- Alternative hypothesis: significant difference is evident between the effects of the predictor independent variables and the dependent variable

The null hypothesis is rejected if the value of $p \leq 0.05$ and is accepted when $p > 0.05$.

As stated above, a logistic regression analysis to investigate the main cause of RTAs based on driver's perceptions was conducted. The predictor variables, (independent and control variables as listed in Table 18 were tested. The binary logistic regression indicated a significant difference ($p<0.05$) regarding perceptions towards the built environment and traffic management and therefore the null hypothesis was rejected.

Within the built environment, categories land use 1 ($0.04<p$) and land uses 5 ($0.042<p$) were found to be significant in the model. However, from the Table 22 it is seen that category land use 1 contains a missing Exp (B) cell, which is used to compare the relative odds of the occurrence of the outcome of the dependent variable (high or low risk). When testing for correlations and effects, it is challenging to present probabilities without corresponding odds ratio and therefore, category land use 1 was eliminated from the results since the capacity of the equation is not strong enough to explain the effect of the strongly disagree category within the model. Moreover, according to the model, perceptions of the built environment (category land use 5) stated that the odds ratio is $0.356<1$ which means that the contributing cause is correlated with the lower odds ratio – low risk junctions. Therefore based on driver's perceptions, causes of the built environment are 0.356 times likely to result at a low risk junction. In other words, based on driver's perceptions, drivers strongly agree that the built environment causes low risk RTAs.

Within traffic management, categories traffic management 2 ($0.03<p$) and traffic management 5 ($0.016<p$) were found to be significant in the model. Driver's perceptions of traffic management presented stronger correlations compared to the built environment. Perceptions of traffic management (category traffic management 2) stated that the odds ratio is $30.994 > 1$ which means that the contributing cause is correlated with the high odds ratio – high-risk junctions. Therefore based on driver's perceptions, causes of traffic management are 30.994 times likely to result at a high-risk junction. In other words, based on driver's perceptions, drivers disagree that traffic management causes high risk RTAs. On the other hand, drivers perceptions of traffic management (category traffic management 5) stated that the odds ratio is $3.134 > 1$ which means that the contributing cause similarly is correlated with the high odds ratio – high-risk junctions. Therefore based on driver's perceptions, causes of traffic management are 3.134 times likely to result at a high-risk junction. In other words, based on driver's perceptions, drivers strongly agree that traffic management causes high risk RTAs. From the above stated analysis of the odds ratio, it is clear that drivers have critical views of traffic management as a cause of high risk RTAs at junctions.

5.2 Summary of Research Results with Mixed Methods

5.2.1 Data source 1: Driver's perceptions on RTAs

According to driver perceptions collected through the questionnaire, the built environment and traffic management were found to be the strongest predictors of high and low risk RTAs at junctions in Pristina. From the binary regression analysis, we can see that drivers have clear opinions about the built environment and traffic management and therefore they are more critical of their perceptions. As stated above, based on driver's perceptions, drivers strongly agree (0.042<p) that the built environment causes low risk RTAs. On the other hand, a quota of drivers disagree (0.03<p) that traffic management causes high risk RTAs whereas others strongly agree (0.016<p) that traffic management causes high risk RTAs.

The perceptions of drivers were based on driving on junctions in Pristina. It can be understood that during the task of driving drivers view the built environment they are driving in accompanied by traffic management that regulates driving. Since the questionnaire asked questions based on causes of RTAs while driving, driver's perceptions focused on how the built environment and traffic management influence driving conditions and driver behaviours. Based on driver's perceptions, errors in the built environment and traffic management effect the occurrence of high and low risk RTAs. Although many other factors influence the occurrence of RTAs, drivers specifically perceived the built environment and traffic management as the main predictors contributing to RTAs at junctions in Pristina.

5.2.2 Data source 2: Interviews on RTAs

Interviews on the other hand were used to support survey results and identify other key findings. As stated in chapter 4, interview respondents were individuals who were of close interest to the case study or the area of study. Moreover as further discussed in chapter 4, interview respondents comparably supported preliminary results gained from the questionnaire and also reinforced the final regression results based on drivers perceptions, which are stated above. In order to include additional information to support answering the main research question, besides the statements mentioned in chapter 4 regarding the area of study, interview respondents were also asked a distinctive question asking about their opinions on the main cause of RTAs at junctions. Frequencies of responses were manually categorized in order to conclude on their opinions. The frequencies established that based on the independent variables as stated in the conceptual framework, traffic management and human error were viewed as the strongest predictors influencing RTAs at junctions in Pristina. Moreover, as seen in Table 23, the built environment variable only falls short by one point, meaning that interview respondents also perceived the built environment as a key predictor of RTAs at junctions. The complete annex of relevant quotes used in this process is found in annex 15.

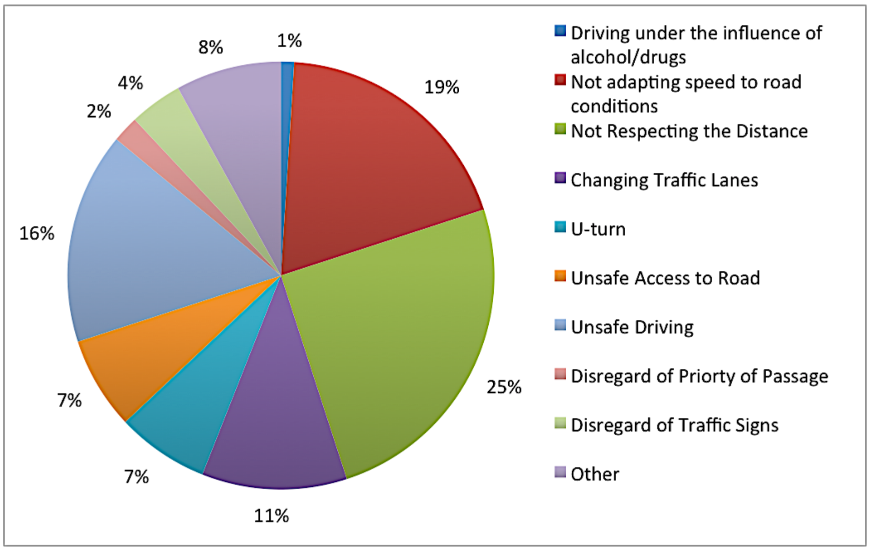
Table 23 - Frequency of interview responses of main cause of RTAs

Variables	Frequencies (Total)
Human Error	9
Built Environment	8
Traffic Management	9

5.2.3 Data source 3: Police archives on RTAs

Since the Kosovo Police is responsible for implementing national security and polices including road traffic measures, statistical reports on RTAs in Pristina from 2012 to 2016 were collected and analysed. With the responsibility of enforcing traffic regulations, the Kosovo police predominantly focused on observing human behaviours while driving. This is also evident from their archives since they collect data on contributing factors based on traffic violations.

Chart 14 - Human error as main cause of RTAs 2012 to 2016



(Source: Kosovo Police, 2017)

Derived from validated data from the Kosovo Police archives,

Chart 14 states that 92% (16,182) of RTAs from 2012 to 2016 resulted from human error. Among all contributing factors as reported by the Kosovo police, 25% (4,056 RTAs) occurred due to "not respecting the distance", 19% (3,122 RTAs) occurred from "not adapting speed to road conditions", 16% (2,655 RTAs) due to "unsafe driving" and 11% (1,838 RTAs) from "changing traffic lanes" whereas 8% (1,267 RTAs) from other factors other than human error. Although many other factors influence the occurrence of RTAs, the Kosovo police reported that human error was the main predictor influencing RTAs in Pristina.

As stated above, main causes of RTAs at junctions were concluded from each source of data collected in the study. Table 24 presents the results that will be used in further discussion in order to answer the research questions.

Table 24 - Analysis results of main cause of RTAs

Data Source	**Main Cause of RTAs**
Survey	Built Environment / Traffic management
Interviews	Traffic Management / Human Error
Secondary data	Human Error

5.3 Discussion with Literature Review

In order to answer the research questions, the following section discusses the research findings in relation to the area of study (as presented in the literature review) to finally explain how selected causes individually and combined influence RTAs at junctions in Pristina.

RTAs occur from moving traffic in the built environment, where traffic management regulates driving by humans. It is clear that all concepts, as stated in the conceptual framework and later marginally modified through principle component analysis, play important roles in RTA causation based on quantitative and qualitative analysis conducted in the study. As seen in Table 24, the research results from all three sources of data concluded in a combined effect all three concepts as discussed in the literature review in chapter 2. To better discuss the results gained from the case study under analysis it was firstly imperative to understand how all three concepts individually cause RTAs at junctions and further complemented by reasoning of how three concepts are interrelated among one another consequently combined causing RTAs at junctions.

5.3.1 Individual effect of causes of RTAs

Firstly, within the built environment, the literature review primarily discussed concepts of sustainable urban development and how the application of compact and mixed land use design and planning reduced motorized trips and speeds by effectively reducing exposure of RTAs (Banister and Lichfield, 1995; Dittmar, 1995 in Cervero and Kockelman, 1997; Ewing, 2009; Welle et al, 2015). In the case of Pristina, although the city itself is compact consisting of mixed land use, the vast amount of cars circulating the city is not in line with the built environment therefore causing chaotic traffic situations which finally obstruct road safety. Therefore, instead of reducing the presence of cars and exposure to RTAs, the built environment is constantly overcome by large flows of cars, eradicating the whole concept of sustainable compact design and planning. Ewing (2009) also stated that the combination of local and regional traffic flows accompanied by increased populations densities and employment hubs experience more RTAs. Likewise, both junctions A and B are located at entry/exit points of Pristina which consist of mixed traffic of local and national roads. The case study junction sample too validated this statement since in Pristina; junctions A and B consist of the highest rates of RTAs. Regarding street design within the built environment, the research findings were inline with research from Treat et al., 1979, which stated that infrastructure, causes over 30% of RTAs. As stated throughout chapter 4, the levels of infrastructure does not sufficiently, and with required levels of safety, meet the demands of all road users circulating the city. Post conflict Pristina in 1999 resulted in drastic urbanization which was not effectively managed throughout the years and which negatively resulted in constructing limited criteria infrastructure dominated by motorized transport. Inevitability within the built environment, street design is crucial in improving road safety. The literature review also stated that improved road infrastructure decreases accidents (see Noland and Oh, 2004; Haynes et al., 2007, 2008; Kononov et al. 2008). Compared to junction A, junction B was constructed much recently (2011) and was also designed with improved horizontal and vertical signalling to provide increased safety and visibility to road users. In return an also in line with the literature review, junction B presented improved safety and reduced exposure to risk resulting in a low risk junction consisting of 66 RTAs compared to junction A with 166 RTAs. Consequently in the case of Pristina, improved infrastructure in the built environment resulted in less RTAs compared to junctions with old and damaged infrastructure.

Secondly, since traffic management organizes driving within the built environment, it is clear that correlations between the two causes exist. Specifically, the built environment is related to traffic management since it impacts road safety through permitted speeds and traffic volumes it produces. Considering traffic management, the literature reviews stated that traffic management is applied to plan, coordinate, control and organize traffic to achieve efficiency and effectiveness of the existing road capacity" (p. 202, Peden et la, 2004). The literature review also stated that traffic management includes the enforcement of traffic regulations by responsible institutions to control human behaviour. Zegeer & Bushell (2012) stated that a large number of road accidents occur due to poor enforcement of traffic laws (Zegeer & Bushell, 2012 in Ram, 2016). The research study results similarly emphasized the poor level of enforcement regarding traffic regulations by relevant and responsible actors in the area leading to an increase of RTA occurrence. Traffic regulations are implemented in order for cities to manage human behaviour by improving road safety and therefore the degree of enforcement is significantly correlated with the degree of regulation accepted by the society. In Pristina, speeding as a main traffic violation was continuously cited which is also associated to Garder (2004) which stated that higher speeds reduce reaction time at any given time resulting in unpredictable circumstances leading to increased intensity of collision in the event of an accident. Seeing as the enforcement of regulations is low from responsible institutional actors (particularly from the Kosovo Police and Judicial Court), citizens of Pristina furthermore do not accept the rule of law and therefore consistently exceed speeds and other traffic offences. Regarding traffic conditions, Chang (2005) and Shefer and Rietveld (1997) analysed traffic flows and concluded that accident rates increase while traffic per lane increases whereas Ewing (2009) stated that traffic volumes and speeds (e.g. speed variations in traffic volumes) are main risk factors related to overall traffic conflicts. Pristina, similarly illustrated issues of high traffic volumes, which were stated to contribute to RTAs. Although the case study presented traffic flows with lower speeds, it is still considered to impact road safety and ultimately increase rates of RTAs. As stated by Wang et al. (2011), while traffic congestion is categorized as traffic flows with low speeds, longer trips and queuing, leads to complex situations depending on road users skills since freedom of choice of movement is limited. Ultimately, congestion results in drivers following leading drivers obscuring speed and lane positions which means that while driving in close proximity to leading drivers reaction times are significantly reduced. Such scenarios result in RTAs with injuries compared to fatalities since the RTAs occur at lower speeds. This is also evident in Pristina where RTAs with injuries are most apparent. (See Chart 12 for RTA injury rates in Pristina). Ewing (2009), Chao Wang et la (2013) and Welle et al, (2015) all similarly explored how improved infrastructure complemented by traffic calming measures reduce RTAs. In the case of Pristina, the municipality of Pristina and the ministry of Infrastructure (see chapter 4) has recently implemented traffic calming measures (reduce speeds and improve security for pedestrians) to improve road safety. Although such measures were taken, it is too soon to conclude on their effectiveness.

Furthermore, as stated at the beginning of this section, RTAs occur from moving traffic in the built environment, where traffic management regulates driving by humans. The concept of human error is doubtfully very complex to research as well as to explain. As discussed in the literature review, humans are highly disposed to errors and are also prone to respond to deviations in traffic systems, which lead to disrespecting traffic violations. According to the Kosovo Police, human error is the main cause of RTAs in Pristina. The literature review stated numerous theories and explanations of cognitive errors as well as driver behaviours, which lead to RTAs. In the case of Pristina, drivers were considered to contribute to the level of RTAs from errors made subconsciously or intentionally in regards to the degree of respecting traffic regulations while driving. Due to cognitive failures (e.g. memory and distraction), drivers make unforeseen errors that contribute to task performance challenging safety by increasing chances of accident occurrence. Reason (1990, 1997) explained the most common human error as “slips” which were errors of execution of the intended action. In line with theories discussed by Fuller (2000, 2005) driving involves a complex setting of components and therefore the driver’s capability is restricted. Thus, due to the above stated, drivers nevertheless may unintentionally violate traffic regulations. Moreover, in line with

Summala (1996), Castanier (2013), drivers behave based on intentions to fulfil their motives while driving in traffic. In the case of Pristina, this is evident when drivers intentionally violate traffic regulations. For instance, drivers illegally park, exceed speed limits or other traffic violations knowing that they are illegal. As stated by Fuller (2000) and Hedlund (2000) drivers also behave in accordance with the environment they are driving in. Drivers adapt their behaviours based on risk compensation meaning that their behaviours are determined by the amount of risk they are willing to take while driving. Although one may state that drivers act accordingly for reasons of running late to their destination, this again is significantly correlated with the level of enforcement accepted by responsible institutional actors as well as citizens themselves as stated in previously mentioned traffic management section.

5.3.2 Combined effect of causes of RTAs

The previous section discussed how all three concepts (human error, built environment and traffic management) individually contribute to RTAs at junctions in Pristina. To effectively explain how all three concepts interchangeably cause RTAs; Reason's (1990) systems perspective model was distinctly suitable. As stated in the literature review, the systems perspective approach is the most significant system approaches to error available in literature (Salmon et la, 2005). Although considerable research to date in road transport was conducted through the person approach perspective, the case of Pristina is more appropriately explained through the systems approach perspective. As stated in the literature review, the persons approach perspective is apparent when humans, due to psychological factors (e.g. distraction or negligence) and cognitive processes (e.g. forgetfulness or recklessness) cause errors within systems that are assumed to be safe, which lead to RTAs. On the other hand, the systems approach perspective entails errors made by systems failure (e.g. inadequate equipment, poor designs, inadequate supervision, manufacturing defects, maintenance failures, inadequate training). Compared to the persons approach perspective where human error is the main cause, here the systems failures exist in such a way that create space for further errors to occur in the system. The study analysis and results indicated that in Pristina, the system approach perspective is distinctly clear in many ways. As previously stated, undesirable aspects of the built environment and traffic management are on going issues in Pristina, which contribute, to RTAs. Firstly, the built environment consists of mixed and compact development resulting in high concentrations of road users. To add, inadequate levels of infrastructure (e.g. horizontal/vertical signalling) create difficulty while commuting. Secondly, traffic management demonstrated low levels of enforcement of key institutional actors, which created further chaos in traffic by not effectively managing traffic in the city. Traffic police do not actively patrol streets nor effectively penalize road users for traffic violations. Lack of judicial capacity also resulted in longstanding and neglected traffic violation cases. Additionally, traffic itself is also not efficiently managed creating challenging congestion. Therefore, the built environment and traffic management, initially create poor conditions for drivers. Comparably, with the addition of human error, in relation to the literature review, Fuller (2005) describes driving through the task–capability interface (TCI) model stating that driver's capability is restricted in complex settings. For instance, when drivers commute in difficult settings (such as components of the built environment and traffic management in Pristina), their competences are limited resulting in room for error to occur. This is also apparent from secondary data from the Kosovo Police archives, which reports human error as the main cause of 92% of RTAs in Pristina. Consequently, in relation to the systems perspective approach, it can be concluded that the built environment and traffic management create incompetent settings in which allow humans to make further errors which as a result contribute to RTAs at junctions in Pristina.

In relation to the literature review and case study, the above sections explained how causes individually, combined and therefore interchangeably contribute to RTAs. Although it has been understood that all three causes contribute to RTAs on different levels, to answer the main research question (Which cause is most significant in contributing RTAs?) the final results from the mixed methods will be discussed through Reason's (1990) systems perspective model approach. Through inferential analysis, quantitative data revealed that the built environment was found to be a significant cause in relation to low-risk junctions whereas qualitative data stated that although most junctions consists of low quality infrastructure, junctions with improved infrastructure still show high rates of RTAs. On the other hand, through inferential analysis, quantitative data revealed that traffic management displayed critical significance in relations to high-risk junctions whereas qualitative data presented problematic issues regarding the level of enforcement by key institutional actors. Additionally as confirmed by the Kosovo Police, among all contributing factors, from 2012 to 2016, 25% (4,056) of RTAs occurred due to "not respecting the distance", 19% (3,122 RTAs) occurred from "not adapting speed to road conditions", 16% (2,655 RTAs) due to "unsafe driving" and 11% (1,838 RTAs) from "changing traffic lanes" whereas 8% (1,267 RTAs) from other factors other than human error. Although one may conclude that the above stated is correlated primarily with the human error variable, traffic management on the other hand is increasingly important in explaining which cause is most significant within Reason's (1990) system based model approach. In this case, the level of enforcement is evidently significant in the number and degree of traffic violations occurring in Pristina. To add, as previously stated, the degree of enforcement of regulations is also significantly correlated with the degree of regulation accepted by the society. Therefore, in this case although human error is evidently seen as a significant cause in relation to RTAs, traffic management shows more evidence of creating the highest degree of error within the system resulting in increased space for further error to occur (e.g. traffic violations by humans) which ultimately lead to RTAs. Therefore in the case of Pristina, adopting Reason's (1990) system based approach, traffic management significantly causes excessed error complemented by other errors in the built environment which therefore lead to further errors created by humans which ultimately result in RTAs at junctions. **Therefore the answer the to main research question is that traffic management was the main cause significantly contributing to RTAs at junctions in Pristina.** To support this statement, interviews have also considerably mentioned the lack of enforcement and traffic management measures to significantly cause RTAs. Specifically, if responsible institutions do not actively do their part in effectively managing road transport and safety through traffic regulations, awareness and education then the acceptance from citizens will also evidently be low leading to on-going traffic violations that ultimately results in more exposure of RTA risk. Also, considering the fact that, the Kosovo Police manages traffic as well as that traffic violations are substantial issues in Pristina, the poor level of enforcement from the Kosovo Police further allows citizens to disobey traffic violations. To answer the research sub questions, the study concluded that within Reason's (1990) system based approach, the built environment and human error are significant causes, which occur interchangeably from initial strong errors constituted from traffic management and therefore through combined effect results in RTAs at junctions in Pristina.

5.4 Conclusion

Road safety has been researched from various disciplines and perspectives and RTAs have been stated to be very difficult to predict due to the randomness of their occurrence. The objective of the research was to explain causes contributing to RTAs at junctions in Pristina in order to determine the most significant cause. Little or not research was conducted in Pristina regarding causes of RTAs at junctions and therefore the outcome of this research is anticipated to add value to existing literature. The findings may also be useful in developing policies on road safety and RTA prevention by relevant institutions.

The case study included two junctions, which selected based on secondary data collected from 2014 to 2015. In order to answer the research questions, a number of potential causes were examined. The study used mixed methods, which resulted in collecting primary and secondary quantitative and qualitative data from three sources: survey, interview, Kosovo police archives in order to complete the case study.

The quantitative data was analysed with descriptive and inferential statistics in Excel and SPSS. A binary logistic regression was applied to describe the relationship between the categorical predictor independent variables (causes of RTAs) and the dichotomous dependent variable (high or low risk RTAs). The qualitative data was analysed manually based on relevant content, which was further used to strengthen the quantitative analysis findings. The final logistic regression model followed by a discussion with the academic literature presented in chapter 2 answered the research questions. Explicitly, the literature review provided numerous theories to effectively explain the situation in Pristina. Traffic management was identified as the most significant cause of RTAs at junction in Pristina answering the main research question. Moreover, the TCI model (Fuller, 2005) clarified the role of human error within the task of driving whereas the system perspective model (Reason, 1990) ideally explained the circumstances in which the combined influence (combined effect) of possible causes increase the probability of RTAs at junctions in Pristina thus answering the research sub questions. The findings were further validated with qualitative data from interviews and quantitative data from police archives.

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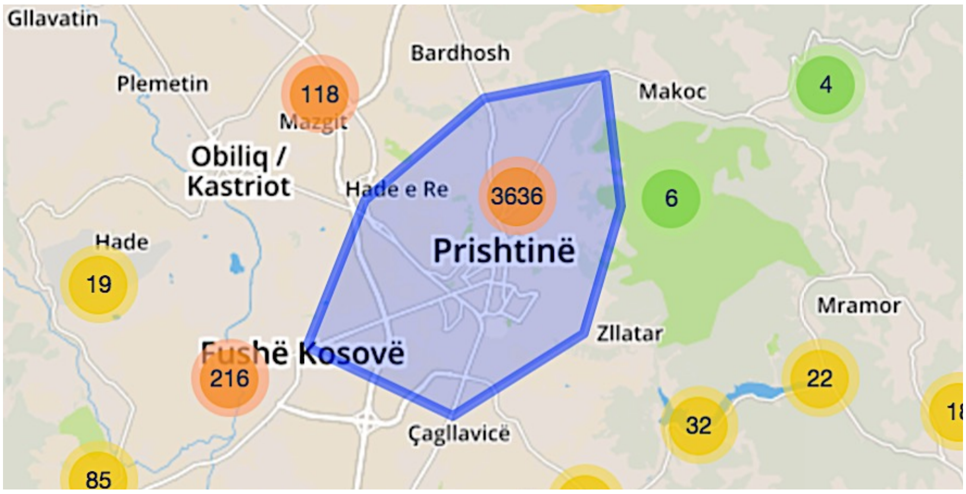
Annex 1: Junction selection

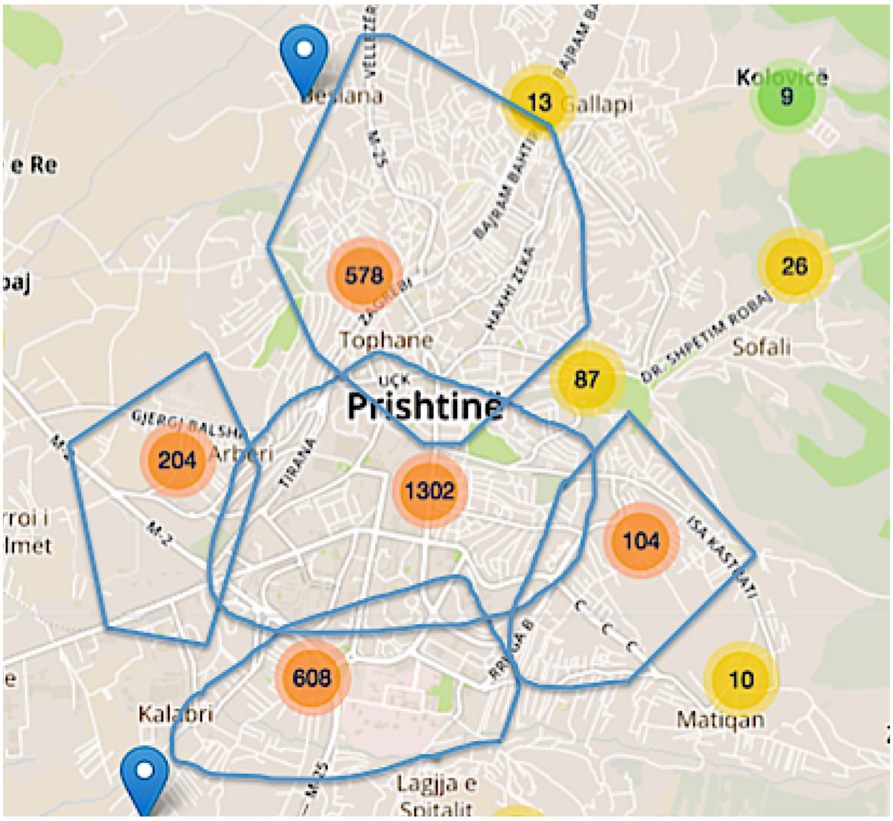
Preliminary selection of junctions

Figure 1 - Scale: 2; Number of hotspots: 1; Number of RTAs per hotspot: 3636.



(Source: UNDP; Open Data Kosovo, 2017)

Figure 2 - Number of hotspots: 5 Number of RTAs per hotspot: 1302, 608, 578, 204, 104.



(Source: UNDP; Open Data Kosovo, 2017)

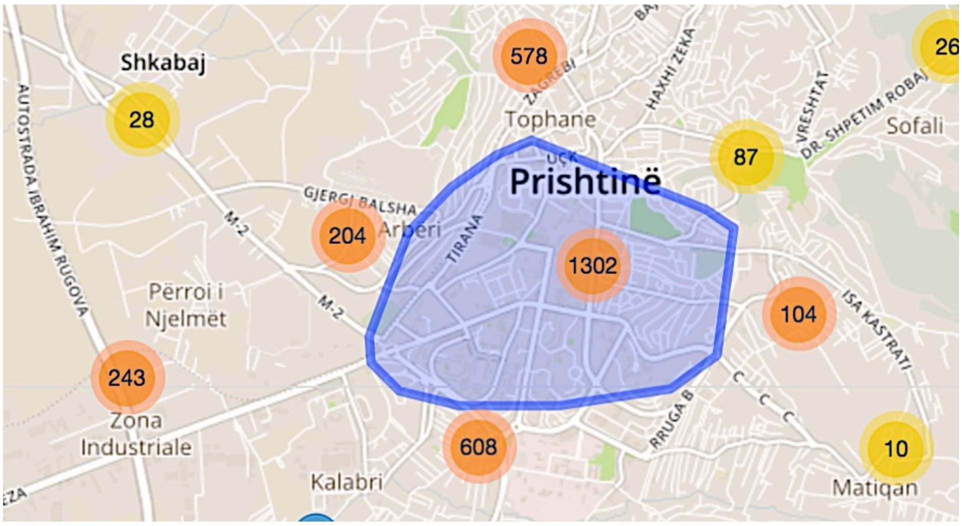
Step 1: By visually analysing the map on scale 3, it was clearly seen that the north/south corridor was more prone to RTAs compared to the east/west corridor. To increase probability of identifying significant causes, the top two most concentrated zones (central and south zones) were selected for analysis.

Step 2: Since the unit of analysis was a junction, selected zones were further analysed individually at scales 3 to 6 in order to identify junctions per zone. Correspondingly, two junctions with similar characteristics per zone were selected based on proximity to junctions. The proximity to junctions was determined by the presence of internal roads or other interfering elements. If a RTA was closer in proximity to an internal road rather than the junction, it was not taken under consideration in the total number of RTAs concentrated at the junction.

a) Central Zone

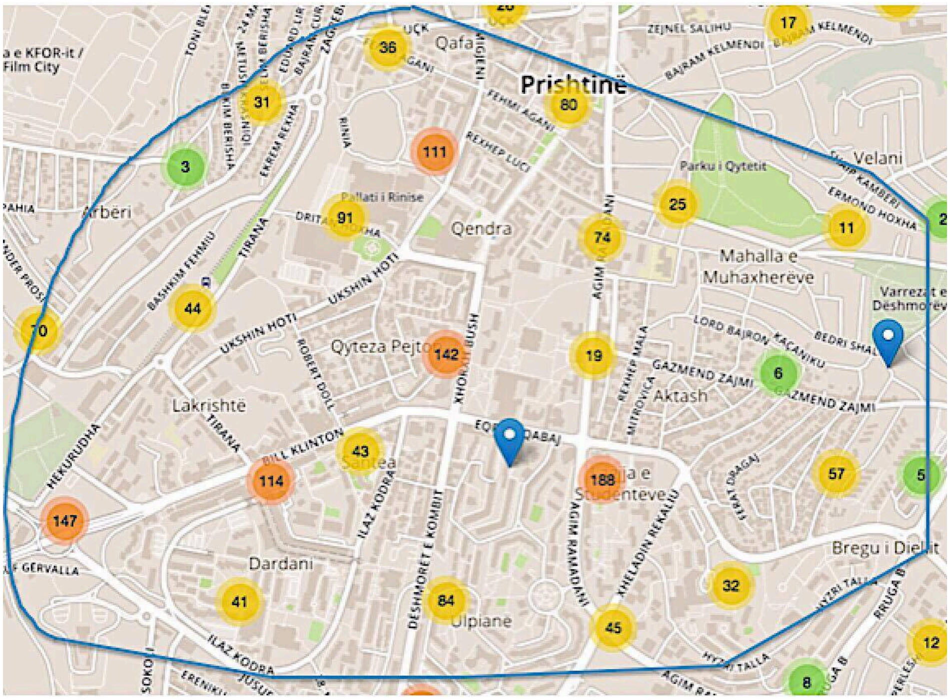
The methodology indicated that intersection M2-Bill Clinton Boulevard was the most prone junction in the central zone resulting in 66 RTAs. Detailed process is described below.

Figure 3 - Scale: 3; Hotspot: 1302; RTAs: 1302.



(Source: UNDP; Open Data Kosovo, 2017)

Figure 4 - Scale: 4; hotspot: 1302; RTAs per junction: 188 and 147.



(Source: UNDP; Open Data Kosovo, 2017)

On scale 4, the most concentrated hotspots were 188 and 147. When zoomed into scale 5, it was clear that hotspot 147 illustrated more concentrated RTAs whereas hotpot 188 more distributed ones (see images below). Therefore, hotspot 147 was selected.

Figure 5 - Hotspot 188, Scale: 5; hotspot: 188; RTAs per junction: 69.

(Source: UNDP; Open Data Kosovo, 2017)

Figure 6 - Hotspot 188, Scale: 6; hotspot: 188; RTAs per junction: 27.

(Source: UNDP; Open Data Kosovo, 2017)

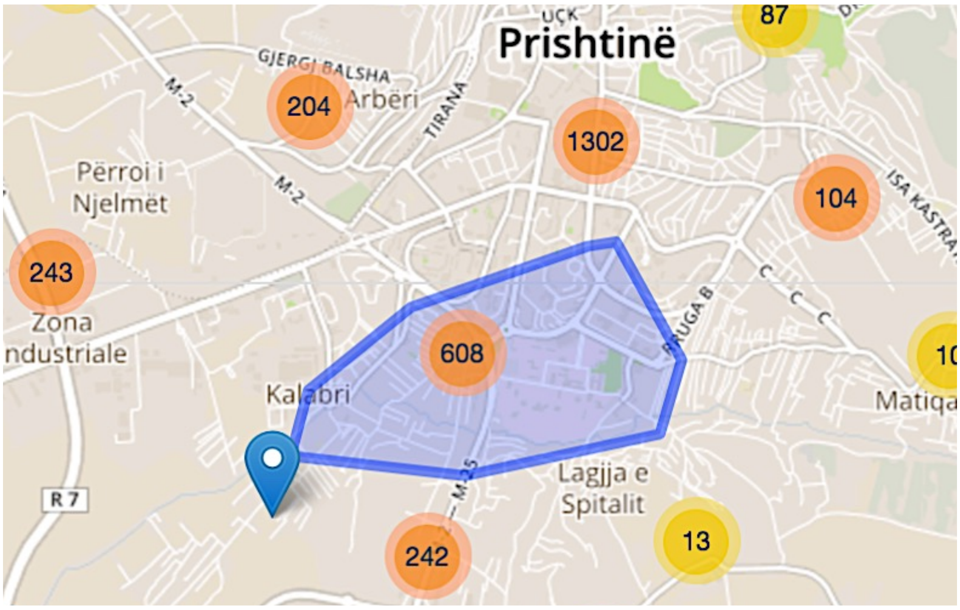
Figure 7 - Hotspot 147, Scale: 5; hotspot: 147; RTAs per junction: 66.

(Source: UNDP; Open Data Kosovo, 2017)

b) South Zone

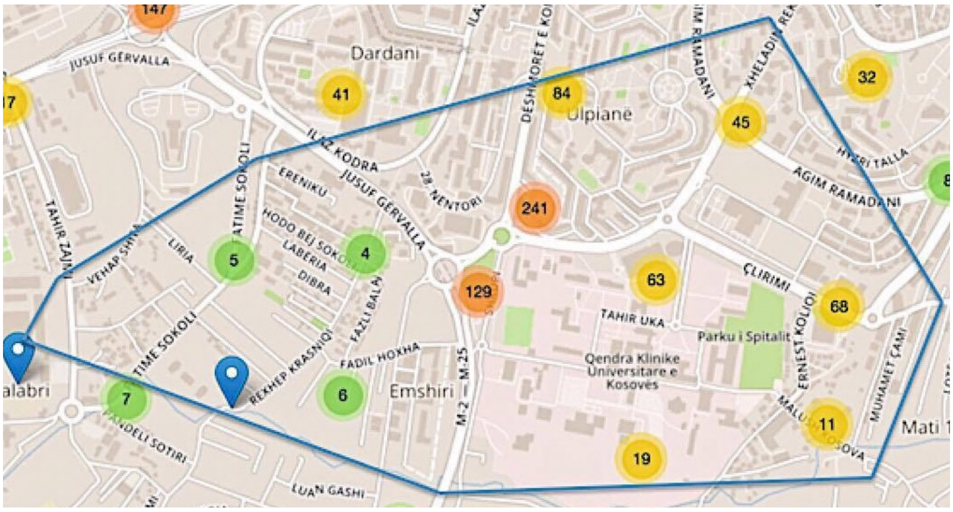
The methodology indicated that Square Idriz Sheferi presentd similar characteristics to M2/Bill Clinton representing in total 166 RTAs. Detailed process is described below.

Figure 8 - Scale: 3; Hotspot: 608; RTAs per junction: 608.



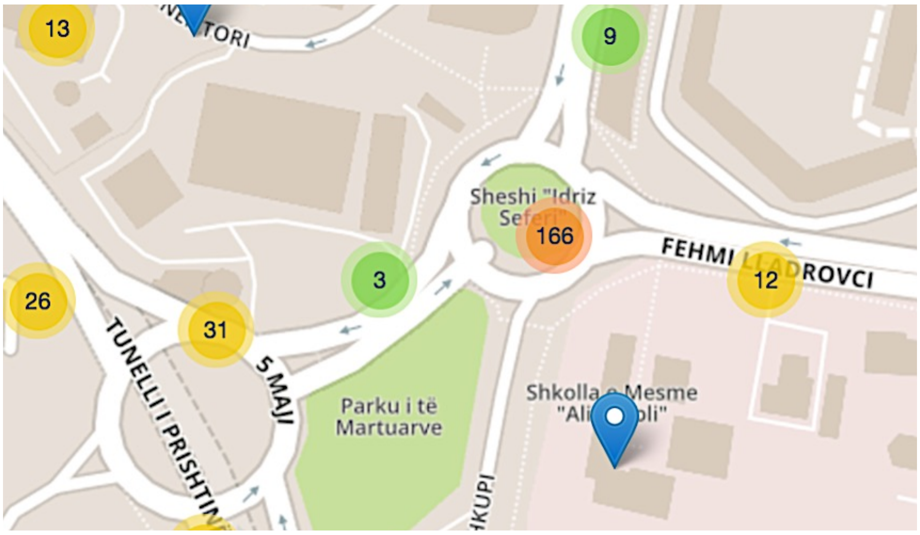
(Source: UNDP; Open Data Kosovo, 2017)

Figure 9 - Scale: 4; hotspot: 608; highest rate of RTAs per junction: 241.



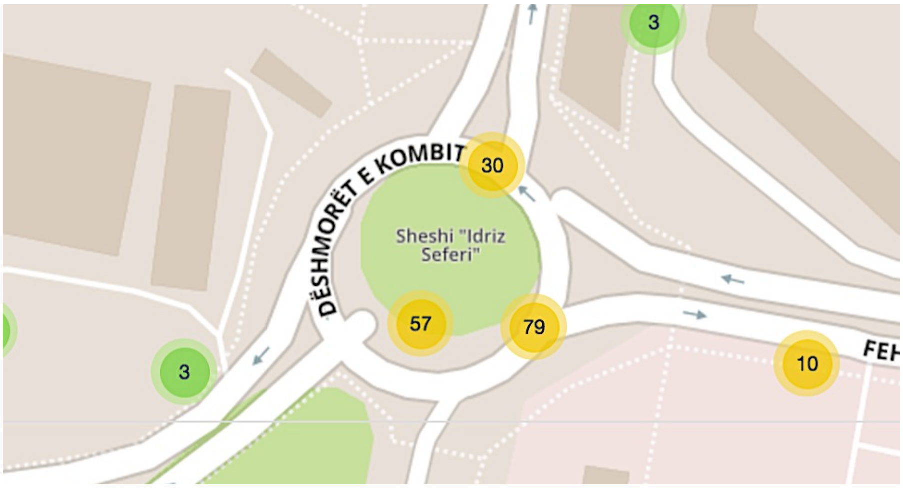
(Source: UNDP; Open Data Kosovo, 2017)

Figure 10 - Scale: 5; hotspot: 608; RTAs per junction: 166.



(Source: UNDP; Open Data Kosovo, 2017)

Figure 11 - Scale: 6; hotspot 166; RTAs per junction: 166.



(Source: UNDP; Open Data Kosovo, 2017)

Annex 2: Questionnaire terminology

<table>
<tr><th colspan="3">THEORY</th><th rowspan="2">QUESTIONNAIRE</th></tr>
<tr><th>CONCEPT</th><th>VARIABLES</th><th>INDICATORS</th></tr>
<tr><td rowspan="2">Human Error</td><td rowspan="2">Human condition and behaviour</td><td>Perceived influence of illegal parking</td><td>“Drivers usually park on street curbs on the junction.” (q. 9-h)</td></tr>
<tr><td>Perceived influence of distraction</td><td>“I often take on secondary tasks.” (q. 9-f)</td></tr>
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</table>

Annex 3: Survey questionnaire

Language: English

If you want to see less road traffic accidents in Pristina, you are most welcome to complete this 5-minute survey. The findings of this study will be sent to relevant institutions to implement appropriate changes to reduce road traffic accident rates and improve road safety in Pristina.

This research is conducted in part of my MSc. thesis in Urban Management and Development at the Erasmus University Rotterdam. In depth understanding of contributing causes of road traffic accidents is the objective of the study. The survey attempts to gain knowledge of driver's experience and perceptions while driving on selected junctions in Pristina.

This survey is completely anonymous. Data collected is confidential and will only be used for scientific purposes.

Note: The study is limited to people who drive in the municipality of Pristina.
Please answer questions only if you drive in Pristina and based only on your experiences in Pristina or where specified only on the selected junctions in Pristina.

Thank you for contributing to positive change in Pristina!

START

---

1. Do you drive in Pristina?
a) Yes
b) No

If answered no: This survey is only intended for people who drive in Pristina. Thank you for your interest. If you have any further questions or comments, please contact 463396ga@student.eur.nl

2. Out of the two junctions, which junction do you use more? (If you do not use it frequently, select a junction for which you are most knowledgeable about).

a) Junction A

b) Junction B

Please answer the rest of the questions based on this junction selection.

3. Have you ever been involved in a road traffic accident on the junction? (This questionnaire is anonymous.)

a) Yes
b) No

4. Have you ever been penalized for a traffic violation on the junction? (This questionnaire is anonymous.)

a) Yes
b) No

5. What do you think is the main cause of road traffic accidents on the junction?
Please agree or disagree with each statement listed below.

a) Land use (how land is used by different activities; e.g. residential or commercial and how it effects traffic on roads.) [1-5]
b) Road Infrastructure (e.g. traffic signs, street width, number of lanes, street lighting) [1-5]
c) Traffic conditions (road conditions such as traffic congestion, speed limits, level of safety). [1-5]
d) Enforcement of regulations (level of accepted enforcement by people, traffic police and relevant institutions). [1-5]

6. Do you think that the surrounding development at the junction causes traffic accidents? Please agree or disagree with each statement listed below.

a) The buildings are close to each other
b) The roads are too narrow
c) Pedestrian zones interfere with the junction

7. Which nearby land features do you think disturb traffic at the junction?
(These features increase traffic flows, which may cause traffic accidents.

a) Bus station
b) Highway

c) Hospital
d) School
e) Residential buildings
f) Commercial buildings
g) Industrial Zone

8. Which parts of the road infrastructure are responsible for traffic accidents on the junction? Please agree or disagree with each statement listed below.

a) Street lighting (visibility) [1 – 5]

b) Level of road infrastructure [1 – 5]

c) Traffic signs [1 – 5]

d) Width of the street [1 – 5]

e) Number of lanes [1 – 5]

f) Activities on/near the junction [1 – 5]

You're halfway there. Only a few more questions to go!

9. Please agree or disagree with each statement listed below.

a) Traffic signs are unclear, missing or incomplete on junction x. [1 – 5]
b) Drivers do not respect traffic signs on the junction x. [1 – 5]
c)Drivers often get penalized for traffic violations on the junction. [1 – 5]

d) Traffic police are regularly active on the junction. [1 – 5]

e) I feel safe while driving on the junction. [1 – 5]

f) I often take on other tasks while driving. [1 – 5]

(E.g. using a mobile phone, smoking, controlling radio, eating, attending to passengers etc.)

g) I always wear a seat belt while driving. [1 – 5]

h) Drivers usually park on street curbs on junction x. [1 – 5]

10. Which road conditions are responsible for road traffic accidents on the junction? Please agree or disagree with each statement listed below.

a) Level of Congestion [1 – 5]
b) Recommended Speed limits [1 – 5]
c) Traffic police [1 – 5]
d) Traffic signs [1 – 5]

11. In the last year, how many traffic violations were you penalized for?
(This questionnaire is anonymous.)
Please select one option.

a) None
b) One
c) Two
d) More than three
e) I don't know
f) I prefer not to reply.

12. In the last year, what is the most frequent traffic violation you were penalized for? (This questionnaire is anonymous.)
Please select one option.

a) Disregard of traffic signs and/or regulations
b) Speeding
c) Drinking and driving
d) Illegal parking
e) Seatbelt use
f) Other ___________.
g) I prefer not to reply.

13. Which driving habits are responsible for traffic accidents?
Please agree or disagree with each statement listed below.

a) Changing lanes [1 – 5]
b) U-turn [1 – 5]
c) Speeding [1 – 5]
d) Disregard of traffic signs [1 – 5]
e) Disregard of right of way [1 – 5]
f) Unsafe driving [1 – 5]
g) Unsafe access to road [1 – 5]
h) Unsafe distance to other road users [1 – 5]
i) Poor speed adaption [1 – 5]
j) Drinking and driving [1 – 5]
k) Lack of driving experience [1 – 5]

14. In the last year, how many traffic accidents, without injuries, have you been involved in? (This questionnaire is anonymous.)
Please select one option.

a) None
b) Two
c) One
d) More than Three
e) I prefer not to reply.

15. In the last year, how many traffic accidents, with injuries, have you been involved in? (This questionnaire is anonymous).
Please select one option.

a) None
b) Two
c) One
d) More than Three
e) I prefer not to reply.

16. What the maximum speed limit for driving in residential areas is?

a) 30 hm/hr
b) 40 km/hr

c) 50 km/hr
d) 60 km/hr
e) I don't know

17. What is the legal alcohol limit?
Please select one option.

a) 0.00%
b) 0.05%
c) 0.06%
d) 0.08%
e) I don't know.

Almost done! A few last questions.

18. What is your age? _________

19. What is your gender?
a) Male
b) Female
c) Other

20. What is your highest level of education?
a) Primary School
b) Secondary School
c) Vocational School
d) Undergraduate
e) Postgraduate
f) I prefer not to reply.

21. Are you currently employed?
a) Yes, full-time
b) Yes, part-time
c) Yes, volunteer
d) No
e) I prefer not to reply.

22. What is the level of your monthly net income (in euros)?
a) Less than 300.00
b) 300.00 - 450.00
c) 450.00 – 550.00
d) More than 550.00
e) I prefer not to reply.

23. How many years of driving experience do you hold?
a) Less than 6 months
b) 6 months to 1 year
c) 1 year to 5 years
d) 5 years to 10 years
e) 10 to 20 years
f) More than 20 years
g) I prefer not to reply.

24. Do you own a car or other motor vehicle (e.g. motorcycle)?
a) Yes

b) No

25. Do you have car insurance?
a) No
b) Yes
c) I don't know

26. Have you professionally serviced your car in the past year?
a) No
b) Yes
c) I don't know

27. For what purposes do you use the car?
a) Work
b) School
c) Social/Recreational
d) Other

28. When you don't drive, which mode of transport do you mainly use?
a) Public transportation (bus)
b) Taxi
c) Walking
d) I always commute by car

29. What type of drivers licence do you hold?
a) Never had a drivers license
b) Suspended drivers license
c) Valid drivers license
d) I don't know
e) I prefer not to say.

Thank you!

Don't forget to click 'Submit' to complete this survey.

If you are interested in a follow-up interview or have any further questions or comments, please contact: gonxhe.amula@student.eur.nl

SUBMIT

Annex 4: Interview Questions

Exposed To Junctions

RESIDENTS/SHOPKEEPERS

- Name/surname:
- Age:
- Gender:
- What is your highest level of education?
- Are you employed?
    - What is your current position?
- Do you hold a valid drivers license?

RTA in PR

- Describe road safety in Pristina.
- Do you feel safe driving/commuting in Pristina?
- Do you think RTAs are an important issue in Pristina?
- What do you think causes RTAs in Pristina? What is the main cause?
  (e.g. cars, human error (cognitive failure/driver condition and behaviour), built environment (land use/street design), traffic management (traffic conditions/enforcement of regulations).
- Other than the above stated, what do you think causes RTAs on this junction?
- Do you think RTAs can be prevented?

Junction A/B

- How often do you use this junction?
- Do drivers often speed on this junction?
- What time of day is the junction most frequently used?
- Do drivers usually follow traffic regulations on this junction?
- Is it legal to park on the street curb?
    - Do drivers usually park on the street curb?
    - If yes, on average for how long?
- Have you ever witnessed a RTA on this junction?
    - Can you please describe briefly what happened?
- Do RTAs occur frequently on this junction?
- Do traffic police regularly patrol this junction?
- How often have you witnessed drivers get fined for a traffic violation on this junction?

RTA VICTIMS

- Name/surname:
- Age:
- Gender:
- What is your highest level of education?
- Are you employed?
    - What is your current position?
- Do you hold a valid drivers license?

RTA in PR

- Describe road safety in Pristina.

- Do you feel safe driving/commuting in Pristina?
- Do you think RTAs are an important issue in Pristina?
- What do you think causes RTAs in Pristina? What is the main cause?
  (e.g. cars, human error (cognitive failure/driver condition and behavior), built environment (land use/street design), traffic management (traffic conditions/enforcement of regulations).
  - Other than the above stated, what do you think causes RTAs on this junction?
- Do you think RTAs can be prevented?

RTA Info

- Please answer the following questions to the best of your knowledge based on the RTA you were involved in.
- When did the RTA occur? [Month; day of week; time of day; day/night]
- Where did it occur? (Location)
- Please explain how it happened.
  - How many vehicles were involved in accident? [What type of vehicle?]
  - Were you the driver or passenger? – where were you seated in the car?
  - Did the driver attain a valid drivers license?
  - Did all passengers have a seat belt on?
  - Did the driver or other passengers consume alcohol before driving that day?
  - At what speed were you driving at?
  - At what speed was the other car (s) driving at?
  - Who's fault was it?
  - Causality [fatal/nonfatal]
  - If non-fatal, what were the outcomes of injuries [Fully recovered, Permanently disabled, Temporarily disabled]
- Did injuries affect your socio-economic life?
- Did injuries cause you to lose your job?
- What was the condition of the road? [dry, wet, foggy, no info]
- Other road conditions [e.g. pedestrian, threat on road, other vehicle in way, overtaking, animals, weather hazards or other (specify)]
- How long did it take for police or emergency services to reach you?
- How did the police or emergency services deal with the situation? (Were they prepared/helpful?)
- Did you receive and assistance for legal or medial matters post accident?
- To your knowledge, answer the following questions based on the RTA location.
  - Do drivers often speed?
  - Do drivers usually follow traffic regulations?
  - Do traffic police regularly patrol junction?
  - How often have you witnessed drivers get penalized for a traffic violation on junction?

Responsible For The Design Or Management

KOSOVO POLICE

- Name:
- Position:
- Work experience?

Road Safety In Pristina

- Describe road safety in Pristina?
- Do you feel safe while commuting in Pristina?
- What do you think causes RTAa in Pristina?
- What is the main cause?
- Do you think that RTAs can be prevented?
- What role does the K. Police play in improving road traffic safety?
- What are the current road safety challenges in Pristina?
- What are your recommendations / opinions on how to improve road safety in Pristina?

Traffic Police

- Please describe a daily routine of a traffic officer in Pristina.
- What are your daily tasks and responsibilities?
- How many officers patrol daily?
- How are you usually informed about RTAs once they have occurred?
- Do issues occur in attaining direct information regarding RTAs once they have occurred?
- What can improve the expertise of Kosovo police in the effective management of road traffic situation in Pristina?
- Adequate equipment?

RTAs in Pristina

- Is the police, municipality or government currently trying to improve the situation?
  - If yes, what measures are bring taken to reduce RTAs in Pristina?
- How would you compare the rate of RTAs in Pristina to other municipalities in Kosovo? Or other countries in the region?

Traffic Regulations

- According to your experience do people follow traffic regulations in Pristina?
- Do issues evolve in implementing traffic safety measures in Pristina?
- Do you think that existing traffic regulations reduce RTAs?
- On average, have many traffic violations are reported in 1 month? 12 months?
- What is the most common traffic violation?
- The new law on traffic regulations came into effect at the end of September 2016. In general, does the number of traffic offenses increase in the last 10 months?
- Do you think that increasing fines and systems with negative points make the difference in how people ride in Pristina?
- Should heavy penalties be imposed on people who violate traffic regulations such as speeding up?

MINISTRY OF INFRASTRUCTURE:

- When was the junction constructed? Has it been reconstructed so far?
- How does the maintenance work?
- What technical criteria or priorities are considered in order to prevent traffic accidents?
- Do you think the set criteria in the existing roads reduce the number of traffic accidents?

DEPARTMENT OF PUBLIC SERVICES, MUNICIPALITY OF PRISTINA:

- What are current road safety challenges in Pristina?
- When was the junction constructed? Has it been reconstructed so far?
- How does the maintenance work?
- What technical criteria or priorities are considered in order to prevent traffic accidents?
- Do you think the set criteria in the existing roads reduce the number of traffic accidents?
- Do issues occur in the implementation of traffic safety measures in Pristina?
- - If yes, which specific issues? How can they be better implemented?

DEPARTMENT OF URBANISM, MUNICIPALITY OF PRISTINA:

- What are current road safety challenges in Pristina?
- What factors do you think is cause RTAs in Pristina? What is the main cause?
- What criteria are considered when designing the roads?
- What technical criteria or priorities are considered in order to prevent traffic accidents?
- What criteria are considered when designing the roads?
- Do you think the criteria of existing roads reduce the number of traffic accidents?

Key Informants

TRAFFIC SAFETY EXPERT / NATIONAL PUBLIC SAFETY AWARENESS OFFICER

- Name/surname:
- Age:
- Gender:
- What is your highest level of education?
- What is your current position? / Area of expertise?
- How many years experience do you hold?

RTA in PR

- Describe road safety in Pristina.
- What role does your company/institution play in promoting road safety?
- What are current road safety challenges in Pristina?
- Do you think that people in Pristina follow traffic regulations?
- What do you think causes RTAs in Pristina?
- What is the main cause?
  (e.g. cars, human error (cognitive failure/driver condition and behaviour), built environment (land use/street design), traffic management (traffic conditions/enforcement of regulations).
- How does the built environment and traffic management influence RTAs? Please explain.
- Is the police, municipality or government currently trying to improve the situation?
    - If yes, what measures (e.g. policies) are bring taken to reduce RTAs in Pristina?
- What is the level of enforcement regarding traffic regulations? (Do you think people often get fined?)
- Do issues occur in implementing traffic safety measures in Pristina?
    - If yes, what specific issues? How can they be implemented better?
- Do you think that existing traffic regulations reduce RTAs?
- How would you compare the rate of RTAs in Pristina to other municipalities in Kosovo? Or other countries in the region?

DIRECTOR OF EMERGENCY CENTRE, UNIVERSITY CLINICAL CENTRE OF KOSOVO IN PRISTINA

- Name/surname:
- Age:
- Gender:
- What is your highest level of education?
- What is your current position? / Area of expertise?
- How many years experience do you hold?

Road Safety in PR

- Describe road safety in Pristina.
- What are current road safety challenges in Pristina?
- What role does your company/institution play in promoting road safety?
- What are current road safety challenges in Pristina?
- Do you think that people in Pristina follow traffic regulations?
- What do you think causes RTAs in Pristina?
- What is the main cause?
  (e.g. cars, human error (cognitive failure/driver condition and behaviour), built environment (land use/street design), traffic management (traffic conditions/enforcement of regulations).
- Do you think that RTAs can be prevented?

RTAs in PR

- How are you usually informed about RTAs?
- Do issues occur in reporting RTAs once they have occurred?
  - If yes, what specifically?
- Do you attain adequate equipment?
- What are the most common injuries related to RTAs?
- Is the police, municipality or government currently trying to improve the situation?
  - If yes, what measures (e.g. policies) are bring taken to reduce RTAs in Pristina?
- How would you compare the rate of RTAs in Pristina to other municipalities in Kosovo? Or other countries in the region?

Annex 5: Distribution of Survey Respondents

Distribution of respondent ages

Age (years)	Junction A			Junction B			Total		
	N	%	% valid	N	%	% valid	N	%	% valid
< 20	21	8.3	8.3	14	7.0	7.0	35	7.7	7.8
20 to 29	124	49.0	49.0	113	56.2	56.8	237	52.2	52.5
30 to 39	74	29.2	29.2	46	22.9	23.1	120	26.4	26.6
40 to 49	22	8.7	8.7	19	9.5	9.5	41	9.0	9.1
50 to 59	10	4.0	4.0	6	3.0	3.0	16	3.5	3.5
> 60	1	.4	.4	1	99.0	.5	2	.4	.4
Total	252	99.6	100.0	199	1.0	100.0	451	99.3	100.0
Missing values	1	.4		2	100.0		3	.7	
Total valid	253	100.0		201			454	100.0	

Distribution of respondent gender

Gender	Junction A			Junction B			Total		
	N	%	% valid	N	%	% valid	N	%	% valid
Male	185	73.1	73.1	130	64.7	64.7	315	69.4	69.4
Female	67	26.5	26.5	70	34.8	34.8	137	30.2	30.2
Other	1	.4	.4	1	.5	.5	2	.4	.4
Total	253	100.0	100.0	201	100.0	100.0	454	100.0	100.0

Distribution of respondent education

Education	Junction A			Junction B			Total		
	N	%	% valid	N	%	% valid	N	%	% valid
Primary School	2	.8	.8	1	.5	.5	3	.7	.7
Secondary School	15	5.9	6.1	13	6.5	6.7	28	6.2	6.4
Undergraduate	105	41.5	42.9	83	41.3	42.8	188	41.4	42.8
Postgraduate	115	45.5	46.9	89	44.3	45.9	204	44.9	46.5
Prefer not to reply	8	3.2	3.3	8	4.0	4.1	16	3.5	3.6

Total	245	96.8	100.0	194	96.5	100.0	439	96.7	100.0
Missing values	8	3.2		7	3.5		15	3.3	
Total valid	253	100.0		201	100.0		454	100.0	

Distribution of respondent employment status

Employment	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
Full-time	185	73.1	73.1	145	72.1	72.1	330	72.7	72.7
Part-time	24	9.5	9.5	14	7.0	7.0	38	8.4	8.4
Volunteer	4	1.6	1.6	5	2.5	2.5	9	2.0	2.0
Unemployed	33	13.0	13.0	28	13.9	13.9	61	13.4	13.4
Prefer not to reply	7	2.8	2.8	9	4.5	4.5	16	3.5	3.5
Total valid	253	100.0	100.0	201	100.0	100.0	454	100.0	100.0

Distribution of respondent income

Income (Euros)	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
> 300.00	26	10.3	12.5	19	9.5	12.8	45	9.9	12.6
300.00 to 450.00	27	10.7	13.0	19	9.5	12.8	46	10.1	12.9
> 550.00	105	41.5	50.5	90	44.8	60.4	195	43.0	54.6
Prefer not to reply	50	19.8	24.0	21	10.4	14.1	71	15.6	19.9
Total	208	82.2	100.0	149	74.1	100.0	357	78.6	100.0
Missing values	45	17.8		52	25.9		97	21.4	
Total valid	253	100.0		201	100.0		454	100.0	

Distribution of respondent drivers license status

Drivers license	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
Never had a drivers licence	7	2.8	2.8	6	3.0	3.0	13	2.9	2.9
Suspended drivers licence	1	.4	.4	-	-	-	1	.2	.2

Valid drivers licence	238	94.1	94.4	189	94.0	95.9	427	94.1	95.1
Prefer not to reply	6	2.4	2.4	2	1.0	1.0	8	1.8	1.8
Total	252	99.6	100.0	197	98.0	100.00	449	98.9	100.0
Missing values	1	.4		4	2.0		5	1.1	
Total valid	253	100.0		201	100.00		454	100.0	

Distribution of respondent driving experience

Driving experience (years)	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
> 6 months	4	1.6	1.6	8	4.0	4.0	12	2.6	2.6
6 months to 1 year	14	5.5	5.5	13	6.5	6.5	27	5.9	5.9
1 year to 5 years	61	24.1	24.1	56	27.9	27.9	117	25.8	25.8
5 years to 10 years	58	22.9	22.9	55	27.4	27.4	113	24.9	24.9
10 to 20 years	85	33.6	33.6	44	21.9	21.9	129	28.4	28.4
More than 20 years	29	11.5	11.5	24	11.9	11.9	53	11.7	11.7
Prefer not to reply	2	.8	.8	1	.5	.5	3	.7	.7
Total valid	253	100.0	100.0	201	100.0		454	100.0	100.0

Distribution of respondent car ownership

Car ownership	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
No	48	19.0	19.0	37	18.4	18.4	85	18.7	18.7
Yes	205	81.0	81.0	164	81.6	81.6	369	81.3	81.3
Total valid	253	100.0	100.0	201	100.0	100.0	454	100.0	100.0

Distribution of respondent car insurance

Car insurance	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
No	3	1.2	1.5	5	2.5	3.0	8	1.8	2.2
Yes	202	79.8	98.5	161	80.1	97.0	363	80.0	97.8

Total	205	81.0	100.0	166	82.6	100.0	371	81.7	100.0
Missing values	48	19.0		35	17.4		83	18.3	
Total valid	253	100.0		201	100.0		454	100.0	

Distribution of respondent technical service

Car service	Junction A			Junction B			Total		
	N	%	% valid	N	%	% valid	N	%	% valid
Yes	201	79.8	98.0	156	77.5	94.0	357	78.6	96.2
I don't know	4	1.6	2.0	10	5.0	6.0	14	3.1	3.8
Total	205	81.0	100.0	166	82.6	100.0	371	81.7	100.0
Missing values	48	19.0		35	17.4		83	18.3	
Total valid	253	100.0		201	100.0		454	100.0	

Distribution of respondent car use

Car use	Junction A			Junction B			Total		
	N	%	% valid	N	%	% valid	N	%	% valid
Work	155	61.3	61.8	112	55.7	55.7	267	58.8	59.1
School	13	5.1	5.2	9	4.5	4.5	22	4.8	4.9
Social/recreational	77	30.4	30.7	72	35.8	35.8	149	32.8	33.0
Other	6	2.4	2.4	8	4.0	4.0	14	3.1	3.1
Total	251	99.2	100.0	201	100.0	100.0	452	99.6	100.0
Missing values	2	.8					2	.4	
Total valid	253	100.0					454	100.0	

Distribution of respondent alternate mode of transport

Alternate mode	Junction A			Junction B			Total		
	N	%	% valid	N	%	% valid	N	%	% valid
Public transportation	72	28.5	28.5	44	21.9	21.9	116	25.6	25.6
Taxi	38	15.0	15.0	47	23.4	23.4	85	18.7	18.7
Walking	92	36.4	36.4	82	40.8	40.8	174	38.3	38.3

I always commute by car	51	20.4	20.2	28	13.9	13.9	79	17.4	17.4
Total valid	253	100.0	100.0	201	100.0	100.0	454	100.0	100.0

Distribution of respondent RTA on junction

RTA on junction	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
No	222	87.7	87.7	168	83.6	83.6	390	85.9	85.9
Yes	31	12.3	12.3	33	16.4	16.4	64	14.1	14.1
Total valid	253	100.0	100.0	201	100.0	100.0	454	100.0	100.0

Distribution of respondent RTA without injuries in last year

RTA without injuries	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
None	200	79.1	79.1	154	76.6	76.6	354	78.0	78.0
One	32	12.6	12.6	37	18.4	18.4	69	15.2	15.2
Two	11	4.3	4.3	7	3.5	3.5	18	4.0	4.0
More than three	5	2.0	2.0	3	1.5	1.5	8	1.8	1.8
I prefer not to reply	5	2.0	2.0	-	-	-	5	1.1	1.1
Total valid	253	100.0	100.00	201	100.00	100.00	454	100.0	100.0

Distribution of respondent RTA with injuries in last year

RTA with injuries	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
None	233	92.1	92.1	188	93.5	93.5	421	92.7	92.7
One	10	4.0	4.0	9	4.5	4.5	19	4.2	4.2
Two	3	1.2	1.2	2	1.0	1.0	5	1.1	1.1
More than three	2	.8	.8	2	1.0	1.0	4	.9	.9
I prefer not to reply	5	2.0	2.0	-	-	-	5	1.1	1.1

Total valid	253	100.0	100.00	201	100.00	100.00	454	100.0	100.0

Distribution of respondent traffic violation on junction

Traffic violation on junction	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
No	228	90.1	90.1	177	88.1	88.1	405	89.2	89.2
Yes	25	9.9	9.9	24	11.9	11.9	49	10.8	10.8
Total valid	253	100.0	100.0	201	100.0	100.0	454	100.0	100.0

Distribution of respondent traffic violations in last year

Traffic violation	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
None	145	57.3	57.3	126	62.7	62.7	271	59.7	59.7
One	54	21.3	21.3	34	16.9	16.9	88	19.4	19.4
Two	28	11.1	11.1	24	11.9	11.9	52	11.5	11.5
More than three	16	6.3	6.3	11	5.5	5.5	27	5.9	5.9
I don’t know	7	2.8	2.8	5	2.5	2.5	12	2.6	2.6
I prefer not to reply	3	1.2	1.2	1	.5	.5	4	.9	.9
Total valid	253	100.0	100.0	201	100.0	100.0	454	100.0	100.0

Distribution of respondent frequent traffic violation in last year

Frequent Traffic violation	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
Disregard of traffic signs	6	2.4	5.2	5	2.5	6.5	11	2.4	5.7
Speeding	62	24.5	53.9	48	23.9	62.3	110	24.2	57.3
Drinking and driving	3	1.2	2.6	1	.5	1.3	4	.9	2.1
Illegal parking	20	7.9	17.4	14	7.0	18.2	34	7.5	17.7
Seat belt	11	4.3	9.6	4	2.0	5.2	15	3.3	7.8

I prefer not to reply	4	1.6	3.5	2	1.0	2.6	6	1.3	3.1
Other	9	3.6	7.8	3	1.5	3.9	12	2.6	6.3
Total	115	45.5	100.00	77	38.3	100.00	192	42.3	100.0
Missing values	138	54.5		124	61.7		262	57.7	
Total valid	253	100.0		201	100.00		454	100.00	

Distribution of respondent perceived level of safety

Level of safety	**Junction A**			**Junction B**			**Total**		
	N	**%**	**% valid**	**N**	**%**	**% valid**	**N**	**%**	**% valid**
Strongly Disagree	56	22.1	22.1	52	25.9	26.0	108	23.8	23.8
Disagree	104	41.1	41.1	75	37.3	37.5	179	39.4	39.5
Neutral	55	21.7	21.7	49	24.4	24.5	104	22.9	23.0
Agree	30	11.9	11.9	18	9.0	9.0	48	10.6	10.6
Strongly Agree	8	3.2	3.2	6	3.0	3.0	14	3.1	3.1
Total	253	100.0	100.0	200	99.5	100.0	453	98.8	100.0
Missing values	-	-	-	1	.5		1	.2	
Total valid	253	100.0	100.0	201	100.0		454	100.0	

Annex 6: Distribution of interview Respondents

Interviews with individuals exposed to junctions

Code	Gender	Nationality	Description	Junction	Key characteristics
A	M	Kosovar	Resident	A	- Uses junction daily
B	F	Kosovar	Shopkeeper	A	- Uses junction daily
C	F	Kosovar	Resident	B	- Uses junction daily - Close proximity to junction
D	M	Kosovar	Shopkeeper	B	- Uses junction daily - Close proximity to junction
E	M	Kosovar	RTA victim	-	- Non-fatal - Victim paralyzed for the last 10 years
F	F	Kosovar	RTA victim	-	- Fatal (driver) - Occurred near junction B

Interviews with individuals responsible for the design/management of junction

Code	Gender	Nationality	Position	Key characteristics
G	M	Kosovar	Head of Investigation Unit at Kosovo Police	Responsible for implementing national security (traffic regulations)
H	M	Kosovar	Ministry of Infrastructure	Administers junction B
I	M	Kosovar	Department of Public Services, Municipality of Pristina	Administers junction A
J	M	Kosovar	Department of Urbanism, Municipality of Pristina	Administers junction A

Interviews with key informants of area of study

Code	Gender	Nationality	Area of expertise	Years of professional experience
K	M	Kosovar	Traffic Safety Expert	17
L	F	Kosovar	Public Safety Awareness	10
M	M	Kosovar	Medical emergency services	30

Interviews through social media

Code	Gender
N	M

Interviews through questionnaire

Code	Gender
O	F

Annex 7: Interview Quotes

HUMAN ERROR
“The greatest risk during driving in Pristina is during night time hours when the flow of vehicles decreases while the possibility of increased speeds occurs from irresponsible drivers. This also depends on the road layout – if the road is straight with more than one lane, drivers tend to use the additional lane to overcome the speed limit.”[G]
“The most common traffic violations in Pristina are: disregard of traffic lights, speeding, distance between vehicles, priority of passage, stop at irregular spots and irregular parking, etc.” [G]
“When in the streets of Pristina one can see pedestrians not crossing roads at designated pedestrian crossings as well as those who are already walking when it’s a red light; but, you can also see numerous road users waiting for green lights or respectively following horizontal and vertical road traffic signs.” [G]
“Large load of cars in Pristina, mainly from residents and other road users that visit the city on a daily or weekly basis for work increase challenges in public parking spaces. Also, existing parking spaces do not facilitate the number of cars.” [I]
“Non-compliance with the road traffic regulations by road traffic participants leads to the occurrence of road accidents. These rules are violated by vehicle drivers but also by pedestrians.”[L]
“(Drunk driving, reckless driving, fast driving, incompetent overtaking)”. “Pedestrians that walk on the street, driver tend to bypass parked vehicles”. “Park their vehicles wherever they can; blocked sidewalks” [L]
“1. Speeding (not respecting traffic laws), 2. Use of cell phones, 3. Eating, 4. Handing radio or other music in car, 5. Use of stimulants such as alcohol and/or pharmaceutical/synthetic drugs.” [M]
“Lack of knowledge of the area (residents of other cities or tourists visiting). Drivers that are not familiar with the area (e.g. do not know if there will be a roundabout ahead or not) tend to speed without being aware of what exactly is ahead of them which may lead them straight to a RTA. Usually this occurs in the inner city roads whereas in the periphery it is currently being improved with the extension of lanes.” [M]
“Drivers that are not familiar with the area (e.g. do not know if there will be a roundabout ahead or not) tend to speed without being aware of what exactly is ahead of them which may lead them straight to a RTA. Usually this occurs in the inner city roads whereas in the periphery it is currently being improved with the extension of lanes.” [M]
HUMAN ERROR - JUNCTIONS
“Drivers tend to already be speeding once entering the junction and therefore do not adapt the speed the necessary speeds in the roundabout.”[A]
“(Speeding) especially drivers entering the junction from Mitrovica and head towards Veternik. Drivers tend to already be speeding once entering the junction and therefore do not adapt the speed the necessary speeds in the roundabout.”[A]
“People follow traffic regulations.”[A] – “A lot of people do not; especially younger generations”[B]
“People park on the street curbs.”[A] - Yes, they park wherever they can.”[B]
“Drivers do not follow the traffic rules.”[B]

“Drivers usually park to go to a nearby store or wait to pick people up.” [C] “Mostly drivers coming from Veternik or the highway since they are already driving pretty fast. At night I think people speed more since there are less cars.”[C] “When drivers see there is no police around they do not follow traffic regulations. Mostly, people do not follow speed limits.”[C] “People park on street curbs” [D] “I think drivers speed more entering the city (from Veternik) or at night.” [D] “I think that when they notice police around the area, drivers tend to follow more rules. At night, when there are less people around, they don’t really care.” [D] “In my experience, unless there is police regulating the traffic at that moment, they will rarely follow regulations.” [F] “Yes, drivers often speed on the junction.” [F]
BUILT ENVIRONMENT
“Visibility is poor during night time driving, making it difficult to see while driving on junction B – this occurs for people that are not familiar with this specific junction; they do not know it is coming ahead of them and therefore to not know they should lower their speed.” [A] “The road infrastructure does not have enough capacity for the number of vehicles that circulate today in Pristina, as well as many accompanying elements such as lack of cameras, road signalling and street lighting etc.” [G] “Pristina faces issues in the implementation of road safety measures because of the fact that large investments in infrastructure and especially for the construction of ring roads are needed. Since budgetary possibilities are very limited in this regard and also without the support of the central level it is impossible to implement much needed capital projects. ” [I] “All central and international institutions, public and private universities, the public hospital, student centre and businesses are all concentrated in the city centre” [I] “Given the budgetary possibilities, road infrastructure could not precede with the rapid rise of population in Pristina and the expansion of the city occurred with the addition of new roads with minimal criteria” [J] “- High level of motorization and lack of road infrastructure for a large number of vehicles. - Lack of adequate infrastructure for free and secure movement for pedestrians and cyclists” [K] “Lack of adequate road criteria, narrow roads and visibility in general and also specifically in areas of road connections” [K] “A big number of vehicles, which, when entering Pristina (as majority of them are from the outskirts of Pristina and from other cities)” [L] “In my opinion road safety is lacking in Pristina due to the quality or lack of infrastructure. Highways are safer because they are constructed on better quality whereas regional roads are not similar and should be improved by the national level.” [M] “Institutions must implement and use correct signage on the junction” [N]
BUILT ENVIRONMENT - JUNCTIONS
“The visibility is poor during night time driving, making it difficult to see while driving on the junction – this occurs for people that are not familiar with this specific junction; they do not know it is coming ahead of them and therefore to not know they should lower their speed.”[A] “Although the road is equipped with horizontal and vertical signalization as well as public lighting at every roundabout branch, the number of recent RTAs is noticeable, so this year we are

planning to mark the horizontal signal lines with a material that is more expensive which guarantees greater durability and improved reflection properties during reduced visibility conditions. We also plan to place vibration-vibrating strips at each entry of the roundabout branches, similarly to how acoustic tapes are usually be placed in front of schools, nurseries, pedestrian crossings, intersections and dangerous turns where high speeds of movement usually occur. With this, we wish to grab the attention of drivers with sounds and vibrations to warn them that they should reduce speeds according to the limitations provided by traffic regulations or road signage.” [H]
TRAFFIC MANAGEMENT
“In Pristina this phenomenon is associated with the rule of round junctions (roundabouts). The general rule is that drivers from within the roundabout have the right to pass (right of way), and the rule is misunderstood in such a way that drivers think they have the right to pass even before others already in the roundabout (in other lanes) just because they are existing the junction. This phenomenon is a serious cause because they feel confident of they’re actions even though they are wrong.” [A] “I also think a lot of people easily can get their driver license since the system is corrupt. This allows people to become drivers without the proper knowledge needed to enter streets. This is a big problem in Pristina.” [C] “The police also do not effectively do their part in managing traffic – more people should be penalized so they do not do the same mistakes again.” [C] “There is a lot of corruption in getting a drivers license too. Some people do not even enter intro the examination and still get granted a license by paying a “fee”. .” [D] “Traffic police only patrol streets but do not take necessary measures (such as penalizing drivers for violations)” [E] “ The Kosovo police needs greater capacity to enforce laws in a consistent and uncorrupted way” [F] “Court and legal system needs greater capacity to follow up with the penalties or punishments due to violations of traffic rules.” [F] “A better system in issuing driving licenses – including the testing and the corruption in passing the test.” [F] “The greatest risk during driving in Pristina is during night time hours when the flow of vehicles decreases while the possibility of increased speeds occurs from irresponsible drivers. This also depends on the road layout – if the road is straight with more than one lane, drivers tend to use the additional lane to overcome the speed limit.”[G] “Only harsh penalty methods reduce speeding.” [G] “The implementation of traffic regulations to a large extent by all authorized institutions impacts RTAs by reducing the number of road accidents and at the same time raising discipline in compliance with the rules” [G] “Road accidents can not be stopped altogether, but reducing their number can occur if we have engagement of all relevant institutions that would directly contribute to the prevention of accidents, no one can do it alone.” [G] “There are no issues in implementing safety measures to improve road safety. But it also depends on other responsible institutions based on their abilities, such as the municipality for security cameras and signalling on road infrastructure.” [G] “Since the majority of institutional, financial and commercial areas are concentrated in the city centre as well as increased use of private cars from residents of Pristina and neighbouring regions, challenges in congestion persist within the inner city.” [I]

“Inadequate organization of public transport for passengers traveling from Pristina to urban-peripheral zones such as F. Kosove, Obiliq, Graqanice, dhe Lipjan is also a current challenge.” [I]

Additionally, inadequate organization of public transport for passengers traveling from Pristina to urban-peripheral zones such as F. Kosove, Obiliq, Graqanice, dhe Lipjan is also a current challenge.” [I]

Pedestrian crossings have been added to 18 points in the city which are most frequented by pedestrians; roads: Bill Clintin, Fehmi Lladroci, Agim Ramadani, rruga “B”, Enver Maloku, Vellezerit Fazliu, Tirana, deshmoret e Kombit, Muharrem Fejza. Speed radars were added to the following roads: Shpetim Robaj, rruga e Zagrebit, Enver Maloku, Tahir Zajmi, Isa Kastrati, Nazim Gafurri (2 per road/direction) [I]

“Road safety is not only impacted from road users that disregard traffic regulations. The proficiency of authorized institutions and traffic police in reducing traffic violations is also a very important aspect within the area of traffic management” [I]

“The operation of many domestic institutions and foreign organizations in Prishtina, this results in high congestion in Pristina. With increased traffic and lack of capacity on existing roads, increased waits and delays occur, traffic jams/queues of vehicles are frequent.” [J]

“From the problems created and the increased risk for traffic participants, Pristina has taken some safety measures in traffic with the application of physical obstacles in the road in order to reduce the speed of movement. But their realization is creating other obstacles such as the creation of traffic congestion and as a result car drivers are not happy with this.” [J]

“Traffic monitoring and management is not at the level it should be by the traffic police since in relation to the size of the city, the number of traffic police operating the city is small. In general, road capacities are lacking in relation to traffic demands.” [J]

“The local Police, together with the Municipality of Pristina cooperate well. However, this cooperation should be intensified in regular meetings and concrete plans in order to improve the situation.” [K]

“Large load of vehicle presence and consequently traffic participants” [K]

“Massive use of personal vehicles for daily commuting (for work and other traveling) and lack of adequate public transport.” [K]

“Enforcement of laws and regulations- problems with illegal parking, speeding, occupation of sidewalks etc.” [K]

“Traffic safety measures would be better implemented if the road traffic safety laws were strictly enforced.” [K]

“I think Law Enforcement is not being implemented as adequately as it should. Fines in most cases are charged to the citizens for violations of “speeding”. But other violations are also important; such as illegal parking and stopping at bus stops or other wrong places. While, pedestrians are not penalized (or penalized less) when they uncontrollably cross the road. ” [K]

“(traffic safety) Measures would be better implemented if the road traffic safety laws were strictly enforced. ” [K]

“Law Enforcement is not being implemented as adequately as it should. Fines in most cases are charged to the people for violations of “speeding”. But other violations are also important; such as illegal parking and stopping at bus stops or other wrong places. While, pedestrians are not penalized (or penalized less) when they uncontrollably cross the road. [K]

“Rigorous enforcement and increased punitive measures should be taken based on the severity of traffic violations in order to increase awareness and minimize future violations”. [K]

“It should be conveyed that a lot has been done in Kosovo but the number of accidents clearly indicates that there is still a lot more to be done as improving road safety is a shared responsibility

and requires clear lines of institutional responsibility and accountability. It is a multi-sectorial and a multi-dimensional issue. It calls for traffic laws to be enforced, and when violations to these laws take place, offenders to be penalized. Government institutions must co-operate with the private sector, academia and civil society, in forming effective coalitions to help design and implement Kosovo-wide safety programmes." [L] "Courts should prioritize traffic offences and employ more judges if that is the case. Also, to improve the collection of points failed since it is not giving satisfactory results." [L] "People are penalized for traffic violations but due to the lack of judges (have been told so from various sources) traffic cases are not given priority by judicial courts leading to the and increase in the number of cases and also impacting the system of collection of points which fails to give satisfactory results. ". [L] "Also a big Kosovo wide problem we perceive is the fact that road traffic offences are not given priority by courts (due to the lack of judges?!), hence more should be done in this direction because the number of cases has increased and the system of collection of points failed to give satisfactory results. I have been told that traffic cases are not dealt with and then cases get very old." [L] "Great numbers of cars on the road of Pristina" [L] "The large amount of cars makes the capacity of roads very difficult. It is impossible to drive normally under current conditions. This is also because of increase of congestion in Pristina and the region, which does not meet the current infrastructure." [M] "The majority of RTAs occur in the entrance/exit of Pristina where the speed is usually high whereas more minor RTAs occur in the inner city since drivers usually cannot drive at such high speeds due to the high frequency of cars circulating in the city." [M] "The Kosovo Police and Emergency services hold an annual meeting every December to discuss ways to spread awareness in order to educate drivers. The Kosovo Police has assisted in various activities in schools and around the city. The Emergency services also takes various initiatives to ensure that people follow traffic rules." [M] "The police are wrong in their approach, by blaming speeding for everything that happens. Surely, inappropriate speed at residential areas and dangerous overtaking manoeuvres contribute to the high number of accidents. However, countries such as Germany have liberal laws regarding speeding and yet far better in fatality rates. " [O]
TRAFFIC MANAGEMENT - JUNCTIONS
"Traffic police do not patrol the main point of junction."[A] "Traffic police do not patrol the junction as much as needed." [F]

Annex 8: Independent T-Test For Human Error

Group Statistics

	DV data	N	Mean	Std. Deviation	Std. Error Mean
Not_respect_traffic_signs	1	200	4.55	.794	.056
	0	253	4.49	.834	.052
Other_tasks_driving	1	200	2.49	1.307	.092
	0	253	2.38	1.311	.082
Street_curb_parking	1	200	4.33	.997	.071
	0	253	3.94	1.239	.078
Driving_habits_Changing_lanes	1	201	4.23	.859	.061
	0	253	4.15	.943	.059
UTurn	1	201	3.87	.983	.069
	0	253	3.86	.976	.061
Disregard_right_of_way	1	201	4.38	.823	.058
	0	253	4.25	.999	.063
Unsafe_driving	1	201	4.53	.762	.054
	0	253	4.41	.815	.051
Unsafe_access_road	1	201	4.38	.887	.063
	0	253	4.31	.860	.054
Unsafe_distance	1	201	4.38	.858	.061
	0	253	4.35	.810	.051
Poor_speed_adaption	1	201	4.22	.890	.063
	0	253	4.16	.944	.059
Drinking_driving	1	201	4.23	.980	.069
	0	253	4.13	1.049	.066
Lack_experience	1	201	4.08	1.031	.073
	0	253	4.03	1.017	.064

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Not_respect_traffic_signs	Equal variances assumed	.445	.505	.775	451	.439	.060	.077	-.092	.212
	Equal variances not assumed			.779	435.695	.436	.060	.077	-.091	.211
Other_tasks_driving	Equal variances assumed	.257	.612	.924	451	.356	.115	.124	-.129	.358
	Equal variances not assumed			.925	427.790	.356	.115	.124	-.129	.358

Street_curb_parking	Equal variances assumed	6.573	.011	3.603	451	.000	.388	.108	.176	.600
	Equal variances not assumed			3.695	450.851	.000	.388	.105	.182	.595
Driving_habits_Changing_lanes	Equal variances assumed	.159	.691	.918	452	.359	.079	.086	-.090	.247
	Equal variances not assumed			.928	443.685	.354	.079	.085	-.088	.245
UTurn	Equal variances assumed	.026	.871	.043	452	.965	.004	.093	-.178	.186
	Equal variances not assumed			.043	427.715	.965	.004	.093	-.178	.186
Disregard_right_of_way	Equal variances assumed	2.676	.103	1.534	452	.126	.134	.087	-.038	.306
	Equal variances not assumed			1.568	451.376	.118	.134	.086	-.034	.302

Unsafe_driving	Equal variances assumed	.648	.421	1.555	452	.121	.116	.075	-.031	.263
	Equal variances not assumed			1.567	440.136	.118	.116	.074	-.030	.262
Unsafe_access_road	Equal variances assumed	1.152	.284	.799	452	.424	.066	.082	-.096	.228
	Equal variances not assumed			.797	423.059	.426	.066	.083	-.097	.228
Unsafe_distance	Equal variances assumed	.752	.386	.385	452	.700	.030	.079	-.124	.185
	Equal variances not assumed			.383	417.422	.702	.030	.079	-.125	.186
Poor_speed_adaption	Equal variances assumed	1.425	.233	.654	452	.514	.057	.087	-.114	.228
	Equal variances not assumed			.658	438.928	.511	.057	.086	-.113	.227

Drinking_driving	Equal variances assumed	1.004	.317	1.033	452	.302	.099	.096	-.090	.289
	Equal variances not assumed			1.041	440.347	.299	.099	.096	-.088	.287
Lack_experience	Equal variances assumed	.240	.624	.537	452	.592	.052	.097	-.138	.242
	Equal variances not assumed			.536	426.469	.592	.052	.097	-.138	.242

Annex 9: Independent T-Test For Built Environment

Group Statistics

	DV data	N	Mean	Std. Deviation	Std. Error Mean
Main_cause_of_RTAs_on_junction_LandUse	1	200	3.18	1.093	.077
	0	253	3.20	1.192	.075
Road_Infrastructure	1	200	3.77	1.134	.080
	0	253	3.77	1.256	.079
Surrounding_development_Buildings_too_close	1	201	3.03	1.311	.092
	0	253	3.15	1.307	.082
Roads_too_narrow	1	201	3.38	1.263	.089
	0	253	3.46	1.277	.080
Pedestrianzones_interfere	1	201	3.64	1.312	.093
	0	253	3.24	1.295	.081
Street_Lighting	1	201	3.48	1.300	.092
	0	253	3.78	1.265	.080
Level_of_Road_Infrastructure	1	201	3.83	1.070	.075
	0	253	3.80	1.155	.073
TrafficSigns	1	201	3.67	1.214	.086
	0	253	3.68	1.133	.071
Street_width	1	201	3.58	1.189	.084
	0	253	3.49	1.214	.076
Number_of_Lanes	1	201	3.69	1.156	.082
	0	253	3.51	1.207	.076
Activities_junction	1	201	3.76	1.101	.078
	0	253	3.54	1.180	.074

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Main_cause_of_RTAs_on_junction_LandUse	Equal variances assumed	.991	.320	-.162	451	.871	-.018	.109	-.231	.196
	Equal variances not assumed			-.164	441.227	.870	-.018	.108	-.229	.194
Road_Infrastructure	Equal variances assumed	1.493	.222	-.016	451	.987	-.002	.114	-.226	.222
	Equal variances not assumed			-.016	443.013	.987	-.002	.113	-.223	.219

Surrounding_development_Buildings_too_close	Equal variances assumed	.197	.657	-.973	452	.331	-.120	.124	-.363	.123
	Equal variances not assumed			-.973	428.444	.331	-.120	.124	-.363	.123
Roads_too_narrow	Equal variances assumed	.041	.840	-.702	452	.483	-.084	.120	-.320	.152
	Equal variances not assumed			-.703	431.030	.482	-.084	.120	-.320	.151
Pedestrianzones_interfere	Equal variances assumed	.030	.863	3.215	452	.001	.396	.123	.154	.638
	Equal variances not assumed			3.210	426.456	.001	.396	.123	.153	.638
Street_Lighting	Equal variances assumed	1.649	.200	-2.480	452	.014	-.300	.121	-.538	-.062

	Equal variances not assumed			-2.472	423.652	.014	-.300	.121	-.539	-.061
Level_of_Road_Infrastructure	Equal variances assumed	1.766	.185	.222	452	.824	.023	.106	-.184	.231
	Equal variances not assumed			.224	441.453	.823	.023	.105	-.182	.229
TrafficSigns	Equal variances assumed	1.558	.213	-.083	452	.934	-.009	.110	-.226	.208
	Equal variances not assumed			-.083	414.902	.934	-.009	.111	-.228	.210
Street_width	Equal variances assumed	.531	.466	.774	452	.439	.088	.114	-.135	.311
	Equal variances not assumed			.776	432.756	.438	.088	.113	-.135	.311

Number_of_Lanes	Equal variances assumed	.755	.385	1.543	452	.124	.173	.112	-.047	.393
	Equal variances not assumed			1.551	436.584	.122	.173	.111	-.046	.392
Activities_junction	Equal variances assumed	3.495	.062	2.029	452	.043	.220	.108	.007	.432
	Equal variances not assumed			2.045	440.422	.041	.220	.107	.009	.431

Annex 10: Independent T-Test For Traffic Management

Group Statistics

	DV data	N	Mean	Std. Deviation	Std. Error Mean
Traffic_Conditionss	1	200	3.96	1.031	.073
	0	253	3.84	1.168	.073
Enforcement_of_Regulations	1	200	4.33	.952	.067
	0	253	4.12	1.131	.071
Often_penalized	1	200	2.83	1.305	.092
	0	253	2.89	1.284	.081
Active_police	1	200	2.45	1.150	.081
	0	253	2.26	1.108	.070
Feel_safe	1	200	2.26	1.037	.073
	0	253	2.33	1.046	.066
Traffic_Congestion	1	201	4.27	.768	.054
	0	253	4.07	.993	.062
Rec_Speed_Limits	1	201	3.52	1.237	.087
	0	253	3.51	1.210	.076
Traffic_Police	1	201	3.54	1.245	.088
	0	253	3.34	1.186	.075
Traffic_Signs	1	201	3.51	1.141	.080
	0	253	3.57	1.158	.073

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Traffic_Conditionss	Equal variances assumed	1.722	.190	1.125	451	.261	.118	.105	-.088	.324
	Equal variances not assumed			1.141	445.454	.254	.118	.103	-.085	.321
Enforcement_of_Regulations	Equal variances assumed	5.059	.025	2.117	451	.035	.211	.100	.015	.408
	Equal variances not assumed			2.159	449.232	.031	.211	.098	.019	.404
Often_penalized	Equal variances assumed	.017	.897	-.493	451	.622	-.060	.122	-.301	.180

	Equal variances not assumed			-.492	424.083	.623	-.060	.123	-.301	.181
Active_police	Equal variances assumed	.968	.326	1.690	451	.092	.180	.107	-.029	.390
	Equal variances not assumed			1.682	419.609	.093	.180	.107	-.030	.391
Feel_safe	Equal variances assumed	.059	.808	-.741	451	.459	-.073	.099	-.267	.121
	Equal variances not assumed			-.742	428.815	.459	-.073	.098	-.267	.121
Traffic_Congestion	Equal variances assumed	2.290	.131	2.379	452	.018	.202	.085	.035	.370
	Equal variances not assumed			2.449	451.680	.015	.202	.083	.040	.365
Rec_Speed_Limits	Equal variances assumed	.307	.580	.099	452	.921	.011	.116	-.216	.238

	Equal variances not assumed			.099	424.839	.921	.011	.116	-.216	.239
Traffic_Police	Equal variances assumed	1.051	.306	1.758	452	.079	.201	.115	-.024	.426
	Equal variances not assumed			1.748	419.353	.081	.201	.115	-.025	.428
Traffic_Signs	Equal variances assumed	.001	.980	-.485	452	.628	-.053	.109	-.266	.161
	Equal variances not assumed			-.486	431.900	.627	-.053	.109	-.266	.161

Annex 11: Secondary Data From The Kosovo Police

	2012	2013	2014	2015	2016
ACCIDENTS WITH FATALITY	35	36	34	31	33
ACCIDENTS WITH INJURY	1286	1877	1789	2101	2235
ACCIDENTS WITH MATERIAL DAMAGE	1178	1827	1169	1322	1229
TOTAL	2499	3740	2992	3454	3497
TOTAL NUMBER OF DEAD PERSONS	36	41	37	35	38
TOTAL NUMBER OF INJURED PERSONS	2531	3834	3503	4222	4352
VIOLATIONS BY TYPE	49715	53089	42870	40300	45387
CONTRIBUTING FACTORS					
Driving under the influence of alcohol/drugs	13	9	17	17	22
Not adapting speed to road conditions	463	669	621	695	674
Not Respecting the Distance	550	929	693	956	928
Changing Traffic Lanes	279	544	268	362	385
U-turn	184	288	244	221	221
Unsafe Access to Road	160	213	201	219	260
Unsafe Driving	456	625	510	521	543
Disregard of Priorty of Passage	63	66	88	85	76
Disregard of Traffic Signs	65	110	100	155	147
Other	266	287	250	223	241
TOTAL	2499	3740	2992	3454	3497

Annex 12: Factor analysis; principal component analysis

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.850
Bartlett's Test of Sphericity	Approx. Chi-Square	5442.506
	df	496
	Sig.	.000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.172	22.413	22.413	7.172	22.413	22.413	3.795	11.858	11.858
2	3.597	11.241	33.654	3.597	11.241	33.654	3.616	11.301	23.159
3	2.170	6.781	40.436	2.170	6.781	40.436	2.573	8.039	31.199
4	1.518	4.745	45.180	1.518	4.745	45.180	2.205	6.891	38.090
5	1.371	4.285	49.466	1.371	4.285	49.466	2.172	6.787	44.876
6	1.314	4.106	53.572	1.314	4.106	53.572	1.930	6.032	50.908
7	1.150	3.593	57.165	1.150	3.593	57.165	1.607	5.022	55.931
8	1.050	3.281	60.446	1.050	3.281	60.446	1.445	4.516	60.446
9	.951	2.971	63.417						
10	.852	2.663	66.081						
11	.840	2.626	68.707						
12	.788	2.464	71.170						
13	.766	2.394	73.564						
14	.714	2.230	75.794						
15	.686	2.143	77.937						
16	.655	2.048	79.985						
17	.632	1.974	81.959						
18	.597	1.865	83.824						

19	.565	1.766	85.591						
20	.548	1.711	87.302						
21	.486	1.518	88.820						
22	.458	1.430	90.250						
23	.446	1.395	91.645						
24	.401	1.252	92.897						
25	.369	1.155	94.051						
26	.323	1.010	95.061						
27	.306	.956	96.017						
28	.297	.927	96.944						
29	.276	.864	97.807						
30	.252	.788	98.596						
31	.232	.726	99.321						
32	.217	.679	100.000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

	Component							
	1	2	3	4	5	6	7	8
13_Unsafe_driving	.848							
13_Unsafe_distance	.835							
13_Unsafe_access_road	.802							
13_Disregard_right_of_way	.668							
13_Poor_speed_adaption	.603							
13_Drinking_driving	.522							
13_Lack_experience								
8_Number_of_Lanes		.813						
8_Street_width		.805						
8_Level_of_Road_Infrastructure		.724						
8_Street_Lighting		.601						
8_TrafficSigns		.591		.507				
8_Activities_junction								
6_Buildings_too_close			.750					
6_Roads_too_narrow			.657					
5_LandUse			.640					
6_Pedestrianzones_interfere			.633					
10_Traffic_Signs				.801				
10_Traffic_Police				.764				
10_Rec_Speed_Limits				.567				
9_Active_police					.779			
9_Often_penalized					.724			
9_Feel_safe					.633			

9_Other_tasks_driving					.549			
5_Traffic_Conditionss						.767		
5_Enforcement_of_Regulations						.720		
5_Road_Infrastructure						.605		
13_UTurn							.820	
13_Changing_lanes							.793	
9_Not_respect_traffic_signs								
9_Street_curb_parking								
10_Traffic_Congestion								

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 8 iterations.

Annex 13: Pearson Correlation

Table is too large. Please find in separate attached file.

Annex 14: Binary Logistic Analysis

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	288	63.4
	Missing Cases	166	36.6
	Total	454	100.0
Unselected Cases		0	.0
Total		454	100.0

a. If weight is in effect, see classification table for the total number of cases.

Block 1: Method = Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	78.149	53	.014
	Block	78.149	53	.014
	Model	78.149	53	.014

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	313.725[a]	.238	.320

a. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	6.404	8	.602

Classification Table[a]

		Predicted		
		DV		
	Observed	low risk	high risk	Percentage Correct

Step 1	DV	low risk	70	51	57.9
		high risk	32	135	80.8
	Overall Percentage				71.2

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	HE_F			3.067	4	.547	
	HE_F(1)	18.959	19142.641	.000	1	.999	171253602.504
	HE_F(2)	-20.074	40192.970	.000	1	1.000	.000
	HE_F(3)	1.488	.852	3.052	1	.081	4.430
	HE_F(4)	.053	.322	.027	1	.870	1.054
	STREET_DESIGN_F			7.476	4	.113	
	STREET_DESIGN_F(1)	-1.152	1.458	.624	1	.430	.316
	STREET_DESIGN_F(2)	-.791	.780	1.027	1	.311	.454
	STREET_DESIGN_F(3)	-1.139	.585	3.795	1	.051	.320
	STREET_DESIGN_F(4)	-.047	.472	.010	1	.921	.954
	LAND_USE_F			10.003	4	.040	
	LAND_USE_F(1)	-.971	.954	1.036	1	.309	.379
	LAND_USE_F(2)	.487	.686	.505	1	.477	1.628
	LAND_USE_F(3)	-.586	.533	1.210	1	.271	.557
	LAND_USE_F(4)	-1.034	.509	4.121	1	.042	.356

TRAFFIC_C_F			8.769	4	.067	
TRAFFIC_C_F(1)	3.434	1.581	4.716	1	.030	30.994
TRAFFIC_C_F(2)	.502	.784	.410	1	.522	1.652
TRAFFIC_C_F(3)	.840	.512	2.688	1	.101	2.316
TRAFFIC_C_F(4)	1.142	.473	5.845	1	.016	3.134
TM_1_F			3.373	4	.497	
TM_1_F(1)	1.818	1.369	1.764	1	.184	6.161
TM_1_F(2)	1.153	1.321	.761	1	.383	3.168
TM_1_F(3)	1.365	1.324	1.064	1	.302	3.917
TM_1_F(4)	.971	1.376	.498	1	.480	2.641
TM_2_F			4.395	4	.355	
TM_2_F(1)	2.638	1.415	3.476	1	.062	13.980
TM_2_F(2)	.173	.823	.044	1	.833	1.189
TM_2_F(3)	.398	.523	.579	1	.447	1.489
TM_2_F(4)	-.031	.355	.008	1	.929	.969
@18_Age	.038	.031	1.528	1	.216	1.039
@19_Gender			2.379	2	.304	
@19_Gender(1)	-.846	2.016	.176	1	.675	.429
@19_Gender(2)	-1.400	2.042	.470	1	.493	.247
@20_Education			2.954	4	.566	
@20_Education(1)	.098	1.576	.004	1	.950	1.103
@20_Education(2)	.034	.991	.001	1	.972	1.035
@20_Education(3)	.726	.818	.786	1	.375	2.066
@20_Education(4)	.898	.799	1.263	1	.261	2.455

@21_Employment			2.352	4	.671	
@21_Employment(1)	-.212	.840	.064	1	.801	.809
@21_Employment(2)	.543	1.016	.285	1	.593	1.721
@21_Employment(3)	.331	1.454	.052	1	.820	1.393
@21_Employment(4)	-.523	.926	.320	1	.572	.592
@22_Income			2.705	3	.439	
@22_Income(1)	.174	.707	.060	1	.806	1.190
@22_Income(2)	-.393	.570	.476	1	.490	.675
@22_Income(3)	-.545	.423	1.659	1	.198	.580
@23_Driving_experience			6.031	5	.303	
@23_Driving_experience(1)	-.789	1.645	.230	1	.631	.454
@23_Driving_experience(2)	-.163	1.339	.015	1	.903	.850
@23_Driving_experience(3)	.353	.840	.177	1	.674	1.424
@23_Driving_experience(4)	.630	.756	.695	1	.404	1.879
@23_Driving_experience(5)	.995	.596	2.789	1	.095	2.705
@25_Car_insurance(1)	.351	1.160	.092	1	.762	1.421
@26_Car_service(1)	2.285	1.088	4.410	1	.036	9.824
@27_Car_use			8.168	3	.043	
@27_Car_use(1)	2.016	.876	5.298	1	.021	7.511
@27_Car_use(2)	4.589	1.732	7.018	1	.008	98.366
@27_Car_use(3)	2.057	.921	4.988	1	.026	7.824
@28_Alternative_transport_mode			3.762	3	.288	
@28_Alternative_transport_mode(1)	-.212	.490	.188	1	.665	.809
@28_Alternative_transport_mode(2)	-.870	.508	2.936	1	.087	.419
@28_Alternative_transport_mode(3)	-.591	.430	1.887	1	.170	.554
@29_Drivers_license			.172	2	.918	

@29_Drivers_license(1)	21.309	21243.078	.000	1	.999	1796955086.436
@29_Drivers_license(2)	-.594	1.433	.172	1	.678	.552
Constant	-5.574	3.565	2.445	1	.118	.004

a. Variable(s) entered on step 1: HE_F, STREET_DESIGN_F, LAND_USE_F, TRAFFIC_C_F, TM_1_F, TM_2_F, @18_Age, @19_Gender, @20_Education, @21_Employment, @22_Income, @23_Driving_experience, @25_Car_insurance, @26_Car_service, @27_Car_use, @28_Alternative_transport_mode, @29_Drivers_license.

Annex 15: Interview quotes for main research question

MAIN CAUSES OF RTAS AT JUNCTIONS
HUMAN ERROR
“Based on statistical data, the human factor is the main cause.” [K]
“All together: human error (drunk driving, reckless driving, fast driving, incompetent overtaking)”. “Pedestrians that walk on the street, driver tend to bypass parked vehicles” “Park their vehicles wherever they can; blocked sidewalks” [L]
“Non-compliance with the road traffic regulations by road traffic participants leads to the occurrence of road accidents. These rules are violated by vehicle drivers but also by pedestrians. The main cause of accidents is human error – especially disregard of traffic regulations. The main reasons are: speeding, disregard of traffic lights, overcoming other vehicles, distance between vehicles, disregard of pedestrian crossing by both drivers and pedestrians etc.” [G]
“I think that we as humans are the initial cause. 1. Speeding (not respecting traffic laws), 2. Use of cell phones, 3. Eating, 4. Handing radio or other music in car, 5. Use of stimulants such as alcohol and/or pharmaceutical/synthetic drugs.” [M]
“Lack of knowledge of the area (residents of other cities or tourists visiting). Drivers that are not familiar with the area (e.g. do not know if there will be a roundabout ahead or not) tend to speed without being aware of what exactly is ahead of them which may lead them straight to a RTA. Usually this occurs in the inner city roads whereas in the periphery it is currently being improved with the extension of lanes.” [M]
“I think people cause accidents because they are careless. I see from a lot of my friends, that a lot of them use their phones, or eat or smoke while they are driving. A lot of people also rush when going places and this too can increase the chances of accidents.” [C]
“I think mostly people cause accidents. People, who drive, people who walk, people who make traffic rules and especially the ones that manage them. People are very careless and they should be more aware of what they are doing to our society when speeding, ignoring laws etc.” [B]
“I think there are too many cars and too many non-knowledgeable drivers in Pristina. People often speed or even drive while drunk or on drugs.” [D]
“The main issues are speeding.” [E]
“Yes, people often speed and there are continuous RTAs.” [E]
“Disregard of traffic regulations; speeding”. “human factor as traffic participant also plays an important role in causing accidents. The consumption of alcohol and other narcotic elements as well as economic and social situation are additional key factors and level of participants traffic safety.” [J]
BUILT ENVIRONMENT
“Road infrastructure, lack of parking lots (irregular parking)” [L]
“Narrow street for big number of vehicles” [L]
“The huge increase of traffic flows is not in line with the existing infrastructure in the city. [G]

"It should again be mentioned that the quality of road infrastructure" [M]
"The infrastructure and traffic management is also weak which adds on to the negative situation. The infrastructure does not meet the needs of all the cars in Pristina and the police also do not penalize the way they should." [D]
"Poor road infrastructure, not enough road signalling." [E]
"In my opinion, there are two factors that are responsible for the amount of fatalities: poor road infrastructure and old or cars with without technical control." [O]
"Great numbers of cars on the road of Pristina, lack of proper parking lots, lack of static and mobile radars in the city is some of the problems that I can name and that are directly contributing to the poor level of road safety which contributes to the big number of accidents. " [L]
"The road infrastructure does not have enough capacity for the number of vehicles that circulate today in Pristina, as well as many accompanying elements such as lack of cameras, signalling, lighting, alternate modes of transportation, etc."[G]
"Infrastructure is also a big issue since it is mostly old or damaged and does not help with the large amount of cars in the city." [C]
"Lack of adequate road criteria, narrow roads and visibility in general and also specifically in areas of road connections" [J]
TRAFFIC MANAGEMENT
"Traffic management plays a very important role in road safety and rate of RTAs." [K]
"Short training period for young drivers." [L]
"Non-implementation of Law on Road Traffic Safety." [L]
"High traffic flows when entering Pristina (as majority of them are from the outskirts of Pristina and from other cities)" [L]
"Big number of vehicles" [L]
"The huge increase of traffic flows is not in line with the existing infrastructure in the city. [G]
"The majority of RTAs occur in the entrance/exit of Pristina where the speed is usually high whereas more minor RTAs occur in the inner city since drivers usually cannot drive at such high speeds due to the high frequency of cars circulating in the city." [M]
"In my opinion the main cause is traffic management, then as a consequence, human error." [A]
"The infrastructure and traffic management is also weak which adds on to the negative situation. The infrastructure does not meet the needs of all the cars in Pristina and the police also do not penalize the way they should." [D]
"Traffic congestion and small fines from police for traffic violations." [E]
"Main reasons according to me are: a) Police needs greater capacity to enforce laws in a consistent and uncorrupted way. b) Court and legal system needs greater capacity to follow up with the penalties or punishments due to violations of traffic rules.

c) A better system in issuing driving licenses – including the testing and the corruption in passing the test.” [F]

“Lack of proper monitoring by the traffic police and small penalties” [J]

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