

Road Fatalities

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Abstract

Traffic fatalities indicate the number of deaths resulting from road incidents. Annually, between 750,000 and 880,000 individuals lose their lives in traffic-related events globally, predominantly in developing and transition countries. Motorized road traffic is a fundamental aspect of contemporary growth and society. While this advancement offers numerous advantages, it also incurs significant human suffering, leading to not only personal tragedies but also considerable societal losses resulting from traffic incidents.

Keywords: Traffic, Roads, Safety, Alcohol, Accidents

1. Introduction

The main objective of traffic engineering is to ensure a secure system for highway usage [1]. This is a significant issue. In the last few years, the annual death toll on U.S. roads has consistently exceeded 40,000.

Although the total yearly deaths on highways have remained relatively unchanged for several decades, accident rates per vehicle-mile have steadily decreased. This trend occurs because drivers in the U.S. are covering more miles annually. With a consistent total of fatalities, the rising annual vehicle-miles traveled leads to a reduced fatality rate.

Improvements in fatality statistics can be attributed to various trends, many of which traffic engineers have played a vital role in promoting. Enhanced measures aimed at eliminating dangerous drivers from the road have resulted in notable safety benefits. Regulations regarding driving under the influence (DUI) and driving while intoxicated (DWI) have become stricter, making it easier to suspend or revoke licenses due to DWI offenses, poor accident history, or violations. Advances in vehicle design have significantly progressed due to several Congressional mandates for specific enhancements. Modern vehicles now include padded dashboards, collapsible steering columns, seat belts equipped with shoulder straps, multiple airbags (with some models featuring as many as eight), and anti-lock braking systems. Highway design

has evolved with the introduction of advanced barrier systems for medians and roadside zones. Traffic control systems have improved communication capabilities, and monitoring systems can alert services to accidents and issues within the traffic framework.

Nevertheless, over 40,000 individuals still die in traffic incidents each year. The ultimate aim of safe travel remains the top priority and is an ongoing pursuit for traffic engineers.

2. Safety

The key components of traffic operations include drivers, vehicles, roadways, and the surrounding environment [2]. Among these, the driver is deemed the most vital element influencing driving behavior, with over 90% of traffic collisions attributable to risky driving habits. Investigating the factors that contribute to hazardous driving is crucial for enhancing traffic safety, making research in this domain a significant area of focus within transportation studies.

Operating a vehicle involves various complexities, and the safe management of a vehicle is affected not just by external factors such as traffic conditions, weather, landscape, and road structures, but also by individual aspects like the driver's experience, mental health, and physical state. Investigating the diverse elements that lead to perilous driving behaviors can offer insights and assist in enhancing the driving habits of individuals in light of the ever-

changing and unpredictable circumstances surrounding drivers. Current research can be leveraged to focus on training those drivers who frequently engage in unsafe driving practices or to aid in their self-evaluation of driving proficiency.

The primary characteristics of drivers analyzed encompass focus and capacity for information processing, visual abilities, reaction times, and speed selection [3]:

2.1. Focusing and Information Processing: While humans can swiftly absorb a vast quantity of information, there is a cap on how much can be processed per second (humans have the ability to consciously recognize 16 units of information in a single second). Thus, roadway designers must take into account the cognitive load, which refers to the information amount available to drivers. Crafting the road environment to align with driver expectations enhances information processing, making the consistency in the design elements crucial. Presenting data sequentially instead of all at once aids in managing the cognitive load and streamlines information processing.

2.2. Vision: A staggering 90% of the data utilized by drivers is visual. Key components of vision include visual acuity, which is the ability to see clearly at a distance; contrast sensitivity, which is the capacity to differentiate light levels between an object and its surroundings; peripheral vision, which allows detection of objects beyond the central field of sight; depth perception, which helps estimate the speed of an approaching vehicle; and visual scanning, which is the ability to monitor the rapidly changing surroundings while inside a moving vehicle and gather necessary information.

2.3. Reaction Time: Perception-reaction time encompasses the duration required to identify an object, interpret the information, choose a response, and initiate an action. This reaction time is influenced by numerous factors, including the driving context, the identified object, and the traits of the driver.

2.4. Speed Selection: The velocity that drivers opt for when unimpeded by other vehicles is shaped by both the road design and the surrounding environment.

The descriptions of transportation and traffic engineering elucidate further goals [1]:

- Speed
- Comfort
- Convenience
- Economy
- Environmental compatibility

Many of these aspirations are clear and obvious to travelers. Most individuals prefer their journeys to be speedy, comfortable, easy, affordable, and environmentally friendly. All these aims are also relative and must be weighed against one another, alongside the foremost goal of safety.

Although a rapid travel experience is highly desirable, it is constrained by the limits of transportation technology, human

factors, and the necessity to ensure safety. Comfort and ease are broad concepts that hold different meanings for various individuals. Comfort pertains to the physical attributes of vehicles and roadways and is shaped by our feelings of safety. Ease is more about the simplicity of executing trips and the capability of transit systems to meet our travel demands at suitable times. Affordability is also a relative term. There is very little in contemporary transportation infrastructures that can be labeled as “inexpensive.” The construction, upkeep, and operation of highways and other transit systems entail significant expenses, usually funded through general and user-based taxes and fees. Nonetheless, every engineer, regardless of their field, is expected to deliver the best possible systems within the available financial resources.

Environmental compatibility is a multifaceted concern that has gained significance over time. All transit systems exert certain adverse effects on the environment. They all generate various forms of air and noise pollution and consume precious land resources. In numerous urban areas today, transportation networks can occupy as much as 25% of the overall land area. “Harmony” is realized when transportation systems are crafted to lessen negative environmental consequences, and when their designs offer visually appealing facilities that blend seamlessly with their surroundings.

The traffic engineer is responsible for all these various aims and objectives, making suitable compromises to enhance both transportation systems and the effective use of public funds for their construction, maintenance, and operation.

3. Traffic Engineer

The traffic engineer maintains a distinctly unique relationship with the broader public [1]. Possibly more than any other engineering discipline, traffic engineers are directly involved in the everyday safety of a large portion of the community. Although it could be argued that every engineer who designs any product carries this responsibility, few are faced with such a high volume of users relying on their work so consistently and completely. As a result, the traffic engineer bears a unique duty to apply the existing knowledge and advanced practices to improve public safety within available resources.

Additionally, the traffic engineer operates in an environment where several key stakeholders lack an understanding of traffic and transportation challenges or how these issues genuinely impact specific projects. This group includes elected and appointed officials who have decision-making authority and other experts with whom traffic engineers collaborate on a collective project effort. Many individuals, due to their regular interaction with the transportation system, tend to have an inflated sense of their comprehension of traffic and transportation matters. The traffic engineer is tasked with effectively handling challenges that arise from naive assumptions, designs, and plans that fail to acknowledge transportation and traffic necessities, as well as overly simplified analyses and minimized impacts.

Similar to other engineering professionals, traffic engineers are obligated to understand and adhere to ethical codes of conduct. The main ethical codes applicable to traffic engineers are those established by the National Society of Professional Engineers and the American Society of Civil Engineers. The latest versions of these codes can be accessed online. On a general note, sound professional ethics dictate that traffic engineers should only operate within their specialized domains; ensure that all work is done thoroughly and completely; maintain complete honesty with the public, clients, and employers; follow all relevant codes and standards; and perform to the best of their capabilities. In the realm of traffic engineering, there is significant pressure to downplay the negative impacts of projects, often enforced by clients eager for project advancement and employers intent on client satisfaction. In all engineering fields, the necessity to minimize costs should not undermine the essential requirements for safety and reliability.

Moreover, traffic engineers hold the obligation to safeguard the community from potential liabilities through sound practices. There are several areas where agencies responsible for traffic and transportation could face liability. These include (but are not limited to):

- Placing control devices that do not meet relevant standards for their design and placement.
- Failure to maintain devices effectively, which could lead to severe issues, such as a traffic signal malfunctioning where no indication is displayed due to bulb or equipment failure.
- Failure to apply the most recent standards and guidelines when making traffic control decisions, creating facility plans or designs, or conducting investigations.
- Implementing traffic regulations (and installing necessary devices) without possessing the proper legal authority.

Traditionally, it has been established that “due care” should be exercised in developing plans, and the decisions made during this process ought to be reasonable and “not arbitrary.” It is widely acknowledged that professionals need to make value judgments, and the phrases “due care” and “not arbitrary” undergo continuous legal scrutiny.

The core ethical challenge for traffic engineers lies in ensuring public safety through proactive initiatives, proper practice, expertise, and established procedures. Equally important, though less emphasized, is the necessity to steer clear of liability issues.

4. Alcohol

Development of reliable technology for assessing alcohol content in the body and linking that to impairment and heightened accident risk formed the foundation for a major change in preventing drink-driving [4]. Norway was the pioneer in implementing legislation that criminalized driving with a blood alcohol concentration (BAC) exceeding a designated limit, initially established at 0.05%, with similar regulations quickly being passed by other Scandinavian nations. These laws were distinctive as they rendered driving at a particular BAC level an offence on its own, commonly referred to as per se laws.

The interest in using per se laws as a tactic to tackle the issue of drink-driving expanded to other regions. In 1967, Great Britain enacted a per se statute (the Road Safety Act) with a legal threshold set at 0.08%. The initial outcomes were considerably positive, showing a significant decline in the number of alcohol-related accidents; however, over time, collision rates seemed to revert to nearly the levels seen before the law was enacted. Regardless, the initial effects of these regulations were remarkable, prompting other nations to adopt similar measures in the years that followed. The implementation of per se laws in various European nations, Canada, the United States, Australia, Japan, and beyond has consistently influenced rates of drink-driving and related injuries and fatalities. A crucial element determining the effectiveness of these laws is how much they affect the perceived probability of being apprehended for inappropriate drinking and driving.

As a result, many regions that initially established higher legal limits (for example, at 0.08% or more) have opted to lower the permissible BAC limits over time. The reasons for lowering these legal thresholds include findings that driving-related skills can become substantially impaired at very low BAC levels, that collision risks are notably increased at 0.05% BAC or possibly even lower, and that implementing and reducing legal limits can lead to declines in alcohol-related accidents, injuries, and fatalities within the community. Generally, the reduction of legal limits has led to decreased rates of collisions, injuries, and deaths across numerous countries.

In various regions, young drivers, inexperienced drivers, and individuals with prior convictions for drink-driving have been recognized as being particularly vulnerable to involvement in collisions and have faced stricter BAC limits or complete bans on driving after consuming any alcohol. These focused BAC regulations seem to be effective in curtailing drink-driving among the targeted demographics, including young and inexperienced drivers and those with a previous drink-driving conviction.

Other initiatives based on deterrence have demonstrated effectiveness in decreasing fatal accidents related to drink-driving. Administrative licence suspensions (ALSs) involve the revocation of a driver's licence by the governing body, usually for a brief duration (ranging from a few days to several months), at the moment a drink-driving charge is filed or when an individual is caught driving with a blood alcohol concentration (BAC) exceeding a set limit. This practice was initially adopted in the United States to establish uniformity in licensing decisions concerning impaired drivers and to enhance the deterrent impact of such measures. Studies evaluating ALS regulations have indicated they can lead to diminished frequencies of self-reported drink-driving incidents and fatalities on the road. Implementing spot-checks, sobriety checkpoints, or ‘blitz’ operations serves as a strategy to uphold a heightened sense of the probability of being stopped by law enforcement. Research supports that spot-check initiatives, which combine public awareness campaigns with highly visible enforcement, can effectively lower accident rates during the operation of these measures. In Australia and

many regions in Europe, random breath testing (RBT) has been initiated, allowing law enforcement to request breath tests from drivers without any prior suspicion of impairment. This approach enables a larger number of drivers to be assessed, likely increasing the driving population's perception of the chances of being caught. Evaluations of RBT indicate it can considerably lower instances of drink-driving and traffic accidents associated with alcohol, especially when paired with visible enforcement practices.

Individuals who engage in impaired driving or face drink-driving charges exhibit significantly higher rates of alcohol-related issues compared to the general populace. Many jurisdictions have rolled out rehabilitative or corrective programmes for those convicted of drink-driving, often incorporating alcohol education and brief interventions, with some requiring extended treatment. These programmes offer significant advantages to participants, including enhanced traffic safety outcomes, lower rates of alcohol and drug consumption, and health improvements such as decreased mortality rates. Other strategies intending to modify drink-driving behaviors, particularly ignition interlock programmes, appear to hold potential for enhancing road safety.

5. Traffic Collisions

Traffic accidents are essentially considered a crime scene [5]. The term collision is used because numerous traffic investigators have noted that the word accident suggests that no laws were broken and that the event occurred by chance. Therefore, traffic investigators now prefer the phrase collision investigation instead of accident investigation. Traffic infractions violate both state and local laws. Hence, collisions should be recorded similarly to a crime scene, particularly if there is a fatality involved. The concept of capturing overall, midrange, and close-up images applies to collision photography just as it does in crime scene photography. However, the main distinction in collision photography lies in the subject of the photographs.

Begin by taking pictures of the vehicle as it approaches the location, noting any obstacles and signage leading up to the area. It is also vital to capture photographs from the perspectives of all drivers involved. Your perspective is generally irrelevant unless you share the same eye level as one of the drivers; viewpoints of witnesses and pedestrians should be documented as well. Ensure you adjust the focal length of the "normal" lens according to your camera's specific image sensor.

Conditions of the scene and the weather may have influenced the collision. Nighttime conditions necessitate additional lighting; consider utilizing a flash for documenting the scene while also taking images using available light to accurately represent the actual lighting circumstances. Dusk and dawn present challenges for both drivers and photographers; again, it is important to document these lighting conditions. Weather typically has some effect on collisions. Not only must the camera be shielded, but the weather conditions should also be recorded. This documentation may include stop motion photography. When it is daylight, fill lighting techniques should be employed to capture the areas of the

scene that are in shadow.

Essential items to document include the complete scene from the perspectives of drivers and witnesses, initial vehicle positions, traffic control mechanisms, road conditions, debris from the collision, skid and gouge marks, tire and footwear impressions, the impact area, any obstructions, damage to non-roadway areas such as ditches and embankments, and impairments to the vehicles involved, including issues like inappropriate tires or sagging springs. If the crime scene investigator has little experience with collisions or has not conducted such investigations recently, it may be worthwhile to seek assistance from a fatality investigator.

The placement of the accident scene is achieved as a distinct, separate or simultaneous act along with similar actions in all areas if there are instances of discontinuity or multiple locations [6]. It can also occur as a sequential action when it is necessary to identify the location of the incident beforehand. The significance of accurately positioning the accident scene becomes particularly clear in scenarios involving fleeing from the scene of an incident, such as cases of "hit and run." This importance is further highlighted when there is an attempt to fabricate the circumstances and identity of those involved, in instances of completely staged traffic incidents, and especially in those cases where a real action was conducted that appeared to be a traffic accident or served as a means to commit another criminal act. Such instances are infrequent, yet they represent some of the most complicated situations.

Securing the accident scene encompasses a series of actions and protocols initiated from the moment of first arrival, followed by the initial exit and intervention, and continuing throughout the entire main activity involved in the crime scene examination. It is crucial to note that the effectiveness of these actions directly influences the depth and quality of the investigative activities at the incident site, particularly on the thoroughness and extent of situational assessments and subsequent evaluations. This is especially significant since the primary goal is to maintain the condition of the event at its final phase.

6. Conclusion

To elevate road safety to a better standard, society must considerably enhance its commitment towards upgrading transport infrastructure and fostering a culture of responsible driving. A substantial portion of this responsibility falls on the Ministry of the Interior, particularly the traffic police, which needs to enhance the traffic discipline of all participants through its initiatives. Among the three critical elements for road safety—participants, vehicles, and roadways—the traffic culture of all individuals, especially drivers, can most rapidly contribute to mitigating the occurrence of tragic outcomes [7].

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