مجلة جامعة بني وليد للعلوم الإنسانية والتطبيقية
Bani Waleed University Journal of Humanities and Applied Sciences
تصدر عن– جامعة بني وليد – ليبيا
Website:https://jhas-bwu.com/index.php/bwjhas/index

ISSN 3005-3900 الصفحات (01 -16) المجلد الحادي عشر – العدد الأول – 2026

Road Safety Audit of the Third Ring Road (Highway) in Benghazi City, Libya

Abubakr A. B. Mohammed [1]*, Aeshah Alzayani [2], Abdelsalam Abuzreda [3]

[1] Lecturer, at the Higher Institute of Engineering Technologies Benghazi, Libya

[2] Doctoral student at the Higher Institute of Water Sciences and Techniques of Gabes – University of Gabes. Assistant Professor and Director of the Office of Scientific Affairs at the Higher Institute of Engineering Technologies Benghazi, Libya

[3]Associate Professor & Postdoctoral Research fellow Senior Advisor Department of Health Safety and Environmental (HSE), Arabian Gulf Oil Company (AGOCO) and University of Benghazi, and the higher Institute of Engineering Techniques Benghazi, Libya

boker1979@yahoo.com

تدقيق السلامة المرورية في الطريق الدائري الثالث (الطريق السريع) بمدينة بنغازي، ليبيا

أبوبكر المهدي بن صالح*[1] ، عائشة الزياني [2] ، عبد السلام بوزريدة [3]

[1] محاضر بالمعهد العالي للتقنيات الهندسة، بنغازي ، ليبيا

[2] طالب دكتوراه في المعهد العالي لعلوم وتقنيات المياه بقابس – جامعة قابس. أستاذ مساعد ومدير مكتب الشؤون العلمية بالمعهد العالي للتقنيات الهندسة، بنغازي ، ليبيا.

[3] أستاذ مشارك وباحث ما بعد الدكتوراه، ومستشار أول بقسم الصحة والسلامة والبيئة ((HSE) بشركة الخليج العربي للنفط (AGOCO)، وجامعة بنغازي، والمعهد العالي للتقنيات الهندسة، بنغازي ، ليبيا.

Received: 09-11-2025	Accepted: 15-12-2025	Published: 01-01-2026

الملخص:

تعتبر مشكلة الحوادث المرورية من أهم وأكبر المشكلات التي تواجه شعوب العالم، ونظراً لأضرار تلك الحوادث وما تسببه من خسائر بشرية واقتصادية فادحة بمختلف أنواعها، فإنها أصبحت ظاهرة تثير اهتمام المسئولين في كافة انحاء العالم، والتصدي لهذه المشكلة يعد غاية في الأهمية ويعتبر من الأولويات التي تتخذها كافة الدول بهدف الحدّ من هذه الظاهرة، والوصول إلى أعلى مستوى من الأمان على الطرق. ركز البحث على تحليل الحوادث المرورية بمدينة بنغازي، حيث شهدت مدينة بنغازي ارتفاعًا متواصلًا في معدلات الحوادث المرورية، حسب البيانات الإحصائية لعام 2023 أظهرت تسجيل 1524 حادثًا، نتج عنها 178 وفاة، و518 إصابة بليغة، و539 إصابة بسيطة. التحليل الزمني بين عامي 2014 و2023 يظهر تصاعدًا كبيرا في أعداد الحوادث والإصابات في المدينة. ركزت هذه الدراسة أيضا على تدقيق السلامة المرورية في الطريق الدائري الثالث بمدينة بنغازي، والتي تعتبر من الطرق الحيوية بالمدينة. استند البحث

إلى منهجية ميدانية تضمنت رصد المشكلات وملاحظتها من خلال زيارات ميدانية متكررة، وتوثيق ذلك في نماذج القياسية، حيث أظهرت نتائج تدقيق السلامة المرورية في الطريق أن العوامل الهندسية والسلوكية أثرت بشكل كبير على سلامة مستخدمي الطريق بالإضافة إلى نقص العلامات المرورية، وإهمال البنية التحتية الخاصة بالمشاة. اقترحت الدراسة توصيات من شأنها تحسين ظروف السلامة المرورية بالطريق المذكور.

الكلمات الدالة: البنية التحتية، تدقيق السلامة ، الحوادث المرورية ، السلامة المرورية ، علامات المرور.

Abstract

Traffic accidents represent one of the most significant global challenges, causing substantial human and economic losses. This study focuses on analyzing traffic accidents in Benghazi, Libya, which has experienced a steady rise in accident rates. According to 2023 statistical data, Benghazi recorded 1,524 accidents, resulting in 178 fatalities, 518 major injuries, and 539 minor injuries. A temporal analysis from 2014 to 2023 reveals a significant upward trend in accidents and injuries. The study also conducts a detailed road safety audit of the vital Third Ring Road in Benghazi. The methodology involved repeated field visits, visual inspections, and documentation using standard audit forms and photography. The audit results identified critical safety issues stemming from a combination of engineering deficiencies and risky driver behaviors. Key problems include a lack of traffic signs, neglected pedestrian infrastructure (including subways), poor road surface conditions, damaged safety barriers, and inadequate road markings. The study concludes with practical recommendations to improve safety conditions on the Third Ring Road, including infrastructure repairs, enhanced signage, public awareness campaigns, and the adoption of intelligent traffic management systems. These recommendations are proposed as part of a broader strategy to reduce traffic accidents in Benghazi and can serve as a model for other similar roads.

Keywords: Infrastructure, Safety Audit, Traffic Accidents, Traffic Safety, Traffic Signs, Benghazi.

1. Introduction

Road traffic accidents, in all their forms, constitute a global problem with severe economic and social repercussions. WHO estimated 1.19 million road traffic deaths worldwide, with rate of 15 road traffic deaths per 100 000 populations. They significant economic burden on scarcities estimated at 1–3% of GDP [1]. The impacts extend beyond individuals and their families to affect entire societies and national economies, due to disabilities caused, treatment costs for the injured, and the tragic loss of life. Libya has witnessed significant developmental growth in recent decades, leading to population increase, a rise in vehicle ownership, and consequently, a notable expansion in transportation mobility [2]. This has been accompanied by a continuous increase in traffic accidents and fatalities. Studies confirm that traffic accidents in Libya are responsible for approximately 7 deaths daily. In Libya, road accidents contribute to about 11% of total hospital fatalities, making them the third major cause of hospital-reported illnesses and injuries. [3]. Young people aged 20 to 34 represent about 34% of total traffic fatalities. Speeding is the leading cause of fatal accidents, accounting for about 65% of deadly crashes in the country [4]. Each year, road traffic accidents result in a significant loss of human and economic resources for Libya, with the problem escalating at an alarming rate alongside rapid population and vehicle growth [5].

Several previous studies have addressed traffic accidents in Libya. For instance, in 2009, Al-Ghaweel et al. found that from 1,265 accidents, 11.14% resulted in fatalities, 67.35% caused severe injuries, and 21.51% led to minor injuries [6]. In 2024 Yousef, B. A. emphasized that Libya experiences some of the highest rates of traffic-related fatalities and injuries in the region. [7]. In 2019 Mohamed et al. conclude that several factors increase the risk of accident injury severity in Libyan roads; including Weekends, horizontal curves, speed driving, and driver age [8].

Benghazi, as Libya's second-largest city, suffers severely from traffic accidents. This is attributed to deficiencies in road and traffic management, as well as driver-related factors such as speeding and a lack of awareness of traffic rules and laws.

Previous studies indicate that Road Safety Audit (RSA) is observed as a new system for regulatory the road quality and safety and their maintenance services, and it is an effective and organized approach for evaluating existing or

newly constructed roads [9,10]. Conducting a careful audit at all stages of road development from planning to operation helps identify and eliminate errors early, thereby preventing the emergence of accident-related factors on both existing and future roads [10]. Another study highlights that RSA is an essential tool for observing road quality and addressing risks that fall outside conventional standards and codes, noticing that road safety audits can avoid about 27% of road traffic accidents. [11] Furthermore, research highlights that while accident analysis is a reactive technique, RSA represents a practical approach aimed at reducing future number of accidents and severity by finding potential risk factors during various project stages. [12]

The Third Ring Road in Benghazi experiences significant congestion and accidents due to various reasons, including a lack of traffic law awareness, poor road conditions, and excessive speed, leading to increased accidents, injuries, disabilities, and fatalities. This study aims to identify the factors influencing traffic accidents on the Third Ring Road in Benghazi, highlight its importance, and inform decision-makers about the magnitude of this problem to find possible solutions and means to reduce and mitigate traffic accidents.

2. Study Objectives

This study aims to achieve the following specific objectives:

1. To analyze traffic accident data in Benghazi, highlighting its scale and describing the problem to gain a clear vision of the traffic safety level in the city.
2. To conduct a road safety audit of the Third Ring Road, identifying the problems and obstacles leading to increased traffic accidents on this corridor.
3. To propose necessary solutions and improvements to enhance traffic safety on the mentioned road, contributing to broader national road safety efforts.

3. Study Area

Benghazi is the second-largest city in Libya by area, distinguished by its strategic geographical location and a commercial port, the second-largest in the country. This location makes it a transit point between cities. According to available statistics, Benghazi has relatively high traffic accident rates. The city has witnessed an increase in the number of traffic accidents over the past years, mostly resulting from human factors like speeding and non-compliance with traffic rules. This study was conducted within the city, specifically on the Third Ring Road, a vital artery connecting most city areas. The study segment extends from the intersection at the Qaryounis roundabout to the Al-Sirti area roundabout, covering approximately 9 kilometers.

Figure (1) : Study Area Map

4. Materials and Methods

To achieve the study objectives, a work plan was developed as follows:

1. Descriptive-Analytical Method for City-Level Analysis: Analysis of traffic accident trends in Benghazi over ten years (2014-2023) based on severity (fatalities, major injuries, minor injuries). Data was collected from official statistical records of the Benghazi Traffic Department.

2. Field Audit for Road-Level Analysis: A road safety audit was conducted on the specified segment of the Third Ring Road. This involved:

- Repeated Field Visits: Multiple site visits at different times to observe traffic flow and user behavior.
- Data Collection Tools: Standardized road safety audit checklists were used to systematically record observations. These checklists covered elements like road geometry, signage, markings, pedestrian facilities, and roadside hazards.
- Photographic Documentation: Photographs were taken to visually document and illustrate identified safety issues and defects.
- Risk Assessment: Identified hazards were assessed and prioritized based on a risk matrix, as shown in Table (1).

Table (1): Risk Assessment Level and Proposed Treatment Approach

Risk Level	Proposed Treatment Approach
Very High	The safety issue must be corrected (at any cost).
High	The safety issue must be corrected (or risk significantly reduced), even if the cost is high.
Medium	The safety issue should be corrected (or risk significantly reduced) if the correction cost is moderate, but not high.
Low	The safety issue could be corrected (or risk reduced) if the cost is low.

5. Results and Discussion

5.1. Analysis of Traffic Accidents in Benghazi City

Benghazi City witnesses a continuous annual increase in traffic accident rates and the resulting fatalities, major and minor injuries, and material damages, alongside a noticeable increase in population and vehicles. The problem of traffic accidents in Benghazi is no longer hidden from anyone, as its human and material losses constitute a significant national loss. In 2023, official statistics recorded 1,524 accidents, killing 178 people, injuring 518 with major injuries, and 539 with minor injuries. Table (2) shows the historical development of traffic accidents and their losses over the past ten years, indicating a rising trend in these losses. On average, over the past five years, approximately 265 fatalities occurred annually at accident scenes, with no less than 500 major injuries on average, some of whom sustain permanent disabilities. This underscores the severity of the problem in the country and its noticeable negative impacts.

Table (2): Traffic Accidents in Benghazi City during the Period 2014 - 2023

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Accidents	437	575	1097	1279	1569	1626	1539	1573	1454	1524
Fatalities	170	176	150	186	178	266	291	258	269	239
Major Inj.	91	178	337	479	550	502	433	469	498	518
Minor Inj.	111	130	106	143	355	329	349	369	420	539

Interpretation of Results:

- **Absence of Road Markings**: Locations with absent or faded road markings showed a significantly higher odds ratio (OR) for accidents compared to locations with clear markings. This underscores the critical role of clear guidance in organizing traffic flow and preventing lane-drift and side-swipe accidents.
- **Damaged or Absent Safety Barriers**: The presence of damaged or missing barriers was associated with an increased odds of severe accidents (e.g., run-off-road crashes). This highlights their importance in containing and redirecting errant vehicles.

- **Uncovered Drain Openings**: This variable was a strong predictor, significantly increasing the odds of accidents, likely due to sudden swerving or vehicle damage.
- **Poor Condition of Traffic Signs**: The analysis confirmed that poor or absent signage contributes to driver confusion and erroneous maneuvers, increasing accident risk.

This analysis provides a scientific, data-driven link between the observed engineering deficiencies (collected via field audit tools) and the negative safety outcomes (accidents). It strengthens the argument for prioritizing interventions related to road markings, barrier integrity, and drain covers.

5.2. Audit Findings on the Third Ring Road

To conduct an in-depth analysis of the traffic safety situation in the study area, repeated field visits were carried out to observe and record factors negatively impacting traffic safety and to identify improvement priorities that could have a significant impact.

A. Uncovered Stormwater Drain Openings:

Most drain openings along the study route were observed to be uncovered, posing a hazard to vehicles and pedestrians. The absence of covers can negatively affect driver safety and increase the likelihood of accidents as drivers attempt to avoid them. It also causes tire and wheel damage, potentially leading to vehicle breakdowns or loss of control.

Figure (2): Uncovered Stormwater Drain Openings

B. Road Surface Defects:

The presence of defects like potholes and cracks negatively impacts road user safety. They cause sudden reactions from drivers trying to avoid them, potentially leading to loss of control. These defects also damage vehicles and tires and can contribute to water pooling during rain, increasing skidding risks

Figure (3): Road Surface Defects

C. Damaged Road Safety Barriers:

Safety barriers on road sides play a vital role in enhancing safety. If missing or damaged, they lose their ability to redirect vehicles and keep them within the roadway, increasing the probability of vehicles hitting solid objects or overturning.

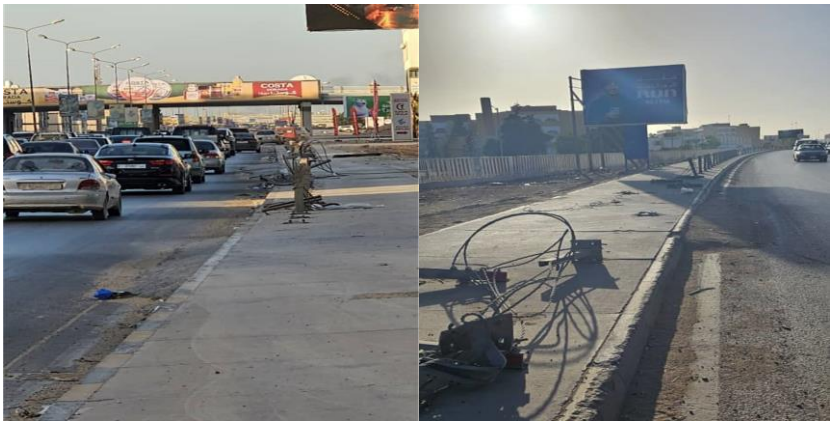


Figure (4): Damaged Safety Barriers

D. Lack of Warning and Guidance Traffic Signs:

Traffic signs are fundamental for ensuring road user safety. A notable lack of essential signs was observed, including speed limit signs, directional signs, warnings for sharp curves, and pedestrian crossing signs. This deficiency directly compromises the safety of drivers and pedestrians.

E. Lack of Road Markings:

The absence of clear and well-maintained road markings, such as lane dividers, direction arrows, and exit gore markings, negatively affects safety. It makes it difficult for drivers to maintain their lane and identify exits, leading to sudden lane changes, disruptions in traffic flow, and increased rear-end collision risk.

Figure (5): Lack of Road Markings

F. Improper Entry and Exit and Speeding:

Wrong-way entries and erratic exits cause confusion and panic among drivers, leading to unconsidered reactions and potential accidents. Additionally, exceeding the legal speed limit was widely observed, a primary cause of accidents in the city and country.

Figure (6): Improper Entry and Exit Maneuvers

G. Neglected Pedestrian Subways:

The pedestrian subways on the Third Ring Road suffer from severe neglect. They lack drainage, nighttime lighting, and regular cleaning. Walls, floors, and ceilings are damaged, with unpleasant odors and trash present. This neglect discourages their use, pushing pedestrians to cross the highway at grade, which is extremely dangerous

Figure (7): Neglected Pedestrian Subways

H. Lack of Guide Signs:

The absence or damage of guide signs makes navigation difficult, leading to wrong turns, confusion, unnecessary maneuvers, and time loss. It also contributes to accidents due to a lack of information about speed limits, lane changes, and upcoming intersections.

5.4. Economic Impact of Accidents

The rising trend of accidents in Benghazi carries a significant economic burden. While a full cost-benefit analysis is beyond this study's scope, the economic impact can be conceptualized through direct and indirect costs.

- **Direct Costs:** Include medical and rehabilitation expenses for the injured, emergency service costs, vehicle repair and replacement costs, and administrative/legal costs.
- **Indirect Costs:** Include loss of productivity due to disability or death, loss of family income, traffic delay costs caused by accidents, and the long-term costs of caring for disabled victims.

Based on the high number of fatalities and injuries reported (e.g., 178 deaths and 1057 injuries in 2023 alone), the cumulative economic loss for Benghazi and Libya is substantial. Investing in the safety improvements recommended in this study, as indicated by prior research (e.g., Tandrayen-Ragoobur, 2025), There is a significant economic cost associated with road accidents and casualties, which negatively impacts real GDP.

6. Recommendations and Proposed Treatments

Based on the comprehensive safety audit, the following recommendations are proposed to address the identified deficiencies. These are summarized in a detailed table format below and expanded into a national awareness plan.

Table(3) : Key of Recommendations from the road Safety Audit

Recommendation Category	Specific Action	Priority	Expected Outcome
Infrastructure	Install covers on all drain openings.	Very High	Prevent vehicle damage and loss of control.
	Repair all potholes and road surface cracks.	Very High	Improve vehicle stability and reduce sudden swerving.
	Repair or replace damaged safety barriers.	High	Contain errant vehicles and reduce severity of run-off-road crashes.
	Rehabilitate pedestrian subways (lighting, drainage, cleaning).	Medium-High	Encourage safe pedestrian crossing, reducing pedestrian-vehicle conflicts.
Signs & Markings	Install missing regulatory, warning, and guide signs.	Very High	Provide essential information to drivers, reducing confusion and errors.
	Re-paint all road markings (lane lines, directional arrows).	Very High	Improve lane discipline and guide drivers through intersections and exits.
Traffic Management	Install static speed radar displays and speed cameras at critical locations.	High	Deter speeding, a major cause of accidents.
	Improve street lighting, especially at intersections and subways.	Medium	Enhance visibility for all road users at night.
Emergency Response	Establish clear protocols for rapid incident response and removal.	Medium	Reduce secondary accidents and congestion caused by incidents.

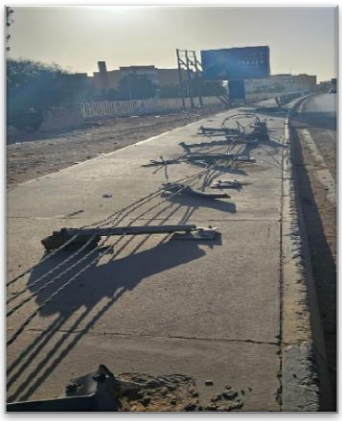
Table(4) : Results and recommendations of road safety audit on the Third Ring Road

location	Safety concerns	Drawing/Picture	Risks	Recommendation
Highway entrance to Target Island	Text clarity: Difficulty in reading. Driver confusion: Overlapping information. Poor visibility: Weather affecting visibility. Outdated information: Outdated data poses risks. Lack of warnings: Insufficient information about hazards. Complex design: Difficulty in understanding. Overlapping signs: Overlapping signs lead to confusion. Neglected maintenance: Damage affecting effectiveness. Pedestrian safety: Lack of clear directions. Emergency response: Lack of necessary information.		**law**	Suitable Location: Signs should be placed in prominent locations such as intersections and entrances, ensuring clear and unobstructed visibility. Design: Use an appropriate size for the location, bright and contrasting colors (e.g., blue background with white text), and simple, easy-to-read fonts such as Arial. Content: Clearly display the area name, provide clear directions (arrows), and indicate the remaining distance. Symbols and Images: Use easily understandable symbols and add images of landmarks if appropriate. Quality and Durability: Use weather-resistant materials and maintain them regularly to preserve clarity. Technology Integration: Include QR codes for additional information. Awareness: Organize campaigns to educate the public about the importance of signage.

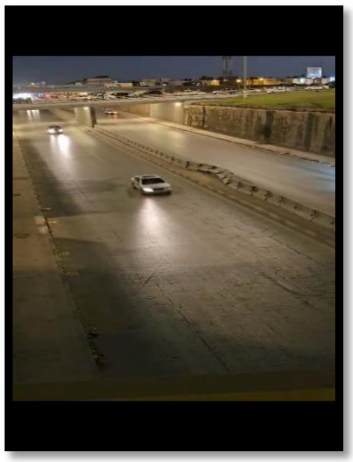
Table(4) : Results and recommendations of road safety audit on the Third Ring Road, Continued

location	Safety concerns	Drawing/Picture	Risks	Recommendation
Arab Medical University Bridge Highway	Material Selection: Use strong, weather-resistant materials. Design: The cover is designed to withstand the weight of vehicles and ensures proper drainage. Safety: Incorporate clear traffic signs and good lighting. Maintenance: Perform regular maintenance to address any damage quickly. Sustainability: Use environmentally friendly materials whenever possible. Cooperation: Collaborate with local authorities to ensure appropriate standards are met.		**HIGH**	Suitable Location: Signs should be placed in prominent locations such as intersections and entrances, ensuring clear and unobstructed visibility. Design: Use an appropriate size for the location, bright and contrasting colors (e.g., blue background with white text), and simple, easy-to-read fonts such as Arial. Content: Clearly display the area name, provide clear directions (arrows), and indicate the remaining distance. Symbols and Images: Use easily understandable symbols and add images of landmarks if appropriate. Quality and Durability: Use weather-resistant materials and maintain them regularly to preserve clarity. Technology Integration: Include QR codes for additional information. Awareness: Organize campaigns to educate the public about the importance of signage.

Table(4) : Results and recommendations of road safety audit on the Third Ring Road, Continued

location	Safety concerns	Drawing/Picture	Risks	Recommendation
Highway barriers Iron side barriers	Impact Resistance: May not withstand strong impacts. Corrosion: Exposure to elements that damage barriers. Improper Design: May not prevent skidding at high speeds. Location: Barriers in non-public areas may be ineffective. Lack of Visibility: May be invisible to drivers, increasing the risk of collisions. Impact on Traffic: May cause minor damage or traffic hazards.		Medium	Design and Durability: Barriers must be designed according to specific engineering standards to withstand the impact of large vehicles. High-quality stainless steel materials should be used, regardless of their durability. Location: Barriers should be installed at intersections where collisions are possible. Slopes: to prevent vehicles from skidding. Areas with high recovery capacity: such as highways and urban areas. General Maintenance: Conduct regular inspections, including checking for any mobile phones or other sounds, supervising and revising instructions to improve visibility, and replacing damaged or ineffective parts. Awareness Campaign: Install informational signs to educate drivers about the importance of barriers and organize workshops or community awareness campaigns to promote road safety. Materials and Coatings: Use weather-resistant materials such as anti-corrosive steel paint to protect against corrosion and a clear coating to ensure visibility at night or in adverse weather conditions. Implementation and Evaluation: Conduct periodic interventions to activate barriers and use data to analyze targets and identify areas needing improvement.

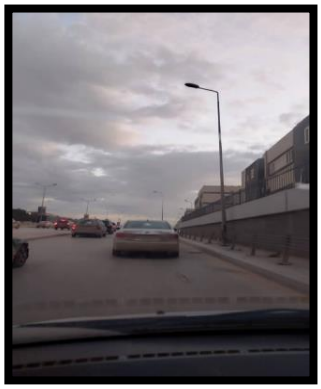
Table(4) : Results and recommendations of road safety audit on the Third Ring Road, Continued

location	Safety concerns	Drawing/Picture	Risks	Recommendation
Highway tunnel median barriers	Limited visibility: Barriers may obstruct drivers' view, increasing the likelihood of an accident and potentially leading to serious injury from a collision. Traffic congestion: Inadequate design can cause bottlenecks, affecting traffic flow. Pedestrian safety: Barriers may impede pedestrian crossing, increasing the risk of being struck by vehicles. Difficulty maneuvering: In emergencies, barriers may prevent traffic from changing speed. Weather effects: Conditions that may affect the effectiveness of barriers increase the risk of accidents		Very high	Appropriate Design: Barriers must be designed according to traffic safety standards, adhering to strict safety standards and ensuring adequate thickness to guarantee sufficient protection. Materials Used: High-quality concrete with proven durability and precision should be used. Location: Barriers should be placed in locations subject to physical force or where forces need to be separated. Comprehensive Regularity: Regular inspections of barriers should be conducted to ensure their integrity and prevent corrosion or damage. Lighting and Marking: Vehicle authorization should be achieved through the addition of lights or warning signs, subject to barrier control. All Additional: These measures can provide rapid intervention in collision situations. Integration with Neural Network: Barriers must be integrated with the lane design and the neural network's internal structure.

Table(4) : Results and recommendations of road safety audit on the Third Ring Road, Continued

location	Safety concerns	Drawing/Picture	Risks	Recommendation
The highway after the mandatory diversion, Gulf Street	Accident risks: Potholes and cracks can cause significant vehicle damage, increasing the likelihood of accidents. Road deterioration: These are defects. Ground instability: Large cracks may indicate underlying problems, such as soil erosion or a lack of overall support. Driver anxiety: Drivers may feel unsafe, affecting their concentration and ability to drive safely. Impact on traffic flow: Potholes can slow down traffic or close roads, causing delay		high	Install regulatory signs at the entrance indicating the "mandatory right or left turning direction" of a size appropriate for the speed environment. 
The highway is an entrance to Al-Khaleej Street in Al-Laithi.	Safety Risks: The absence of signs increases the risk of injury. Community Awareness: The area needs signs to promote awareness of traffic rules. Urban Planning: Objectives should be defined using color-coded measures. Shared Responsibilities: Cooperation between authorities and the community is essential to promote public safety		High	Install regulatory signs at the entrance indicating "mandatory right or left turn" of appropriate size for the speed environment 

Table(4) : Results and recommendations of road safety audit on the Third Ring Road, Continued

location	Safety concerns	Drawing/Picture	Risks	Recommendation
The highway after the mandatory diversion, Gulf Street	Accident risks: Potholes and cracks can cause significant vehicle damage, increasing the likelihood of accidents. Road deterioration: These are defects. Ground instability: Large cracks may indicate underlying problems, such as soil erosion or a lack of overall support. Driver anxiety: Drivers may feel unsafe, affecting their concentration and ability to drive safely. Impact on traffic flow: Potholes can slow down traffic or close roads, causing delay		high	Periodic inspections: Conducting inspections of excavation sites. Rapid repairs: Implementing immediate repairs using high-quality materials. Design improvements: Redesigning roads using more durable materials. Awareness campaigns: Increasing drivers' awareness of the dangers of excavations. Cooperation: Urgent coordination between municipalities and the Ministry of Roads and Bridges.
The highway is an entrance to Al-Khaleej Street in Al-Laithi.	Public Safety: Improved nighttime visibility reduces traffic accidents and increases pedestrian safety. Security: Lighting helps reduce crime and provides a sense of security for residents and passersby. Improved Quality of Life: It contributes to making the area more attractive for commuting and social gatherings. Area Development: Good lighting can encourage investment and development in the surrounding areas.		medium	Increased Accidents: Poor lighting can lead to an increase in traffic accidents, especially at night. Crime: Dark areas encourage crime, such as theft and assault. Pedestrian Safety: Insufficient lighting threatens the safety of pedestrians and cyclists, increasing the risk of collisions. Difficulty Seeing Traffic Signs: Inadequate lighting makes it difficult to see traffic signs and signals, leading to driver confusion. Psychological Impact: Feeling unsafe in dark areas can negatively affect traffic flow and road use

Table(4) : Results and recommendations of road safety audit on the Third Ring Road, Continued

location	Safety concerns	Drawing/Picture	Risks	Recommendation
Rainwater accumulates on the Third Ring Road	Vehicle skidding: Increases the risk of accidents Limited visibility: Affects drivers' visibility Traffic obstruction: May lead to traffic jams Mechanical malfunctions: Cause problems in vehicles Infrastructure deterioration: Affects road quality Pedestrian safety: Poses a risk to pedestrians		High	Traffic warnings: Place warning signs along the road to alert drivers to water accumulation. Identifying hazardous areas: Conduct studies to identify locations most prone to water accumulation and place clear signage in these areas. Improving drainage: Ensuring that drainage systems are in good working order to minimize water accumulation. Reducing speed: Reducing the speed limit in areas prone to water accumulation. Awareness campaigns: Disseminating information to drivers on how to handle wet road conditions. Regular maintenance: Conducting regular road maintenance to ensure there are no obstructions that could lead to water accumulation.

7. Proposed National Traffic Safety Awareness Plan Based on Study Findings

The results from Benghazi and the Third Ring Road are symptomatic of broader national issues. Therefore, a comprehensive national awareness plan is proposed:

1. **Target Audience:** All road users (drivers, pedestrians, children), with specific campaigns for young drivers and commercial vehicle operators.
2. **Key Messages:**
   - Dangers of Speeding and Reckless Driving.
   - Importance of Seat Belt and Helmet Use.
   - Understanding and Respecting Traffic Signs and Markings.
   - Dangers of Distracted Driving (e.g., mobile phone use).
   - Safe Practices for Pedestrians and Cyclists.
3. **Channels:**
   - **Media:** TV and radio commercials, social media campaigns, newspapers.
   - **Education:** Integrate road safety into school curricula.
   - **Community Engagement:** Workshops, seminars, and events in collaboration with traffic police, universities, and NGOs.
   - **Enforcement Support:** Publicize enforcement campaigns (e.g., against speeding) to enhance deterrence.
4. **Monitoring & Evaluation:** Use pre- and post-campaign surveys to measure changes in awareness and attitudes, and monitor relevant accident statistics.

8. Conclusion

This study provided a focused road safety audit of the Third Ring Road in Benghazi. The analysis revealed that traffic safety is compromised by a combination of significant engineering deficiencies and risky driver behaviors. Key infrastructure problems include road surface defects, uncovered drain openings, damaged safety barriers, and

neglected pedestrian subways. A critical lack of traffic signs and road markings further exacerbates the situation by failing to guide and inform drivers adequately. Behaviors such as improper entry/exits and prevalent speeding were directly observed and are scientifically linked to the engineering shortcomings through statistical analysis.

The study concludes that a holistic approach is necessary to significantly improve safety. The proposed recommendations address the immediate physical improvements needed on the Third Ring Road. Furthermore, the proposed national awareness plan, based on the identified behavioral issues, aims to tackle the human factor at a broader level. Implementing these engineering, enforcement, and educational measures can transform the Third Ring Road into a safer corridor and serve as a replicable model for enhancing road safety across Libya.

References

1. World Health Organization. (2023). Global status report on road safety 2023. World Health Organization.
2. Mohammed, A. A., Mahashhash, B. O. (2025). Evaluation and Optimisation of the Traffic Accident Reporting Form: A Case Study from Benghazi, Libya. Libyan Journal of Engineering Science and Technology (LJEST) Vol. 5, No. 1.
3. Mahashhash, B. O., Yusoff, N. I. M., Yazid, M. R. M., Mubaraki, M. A., & Rosyidi, S. A. P. (2023). Factors influencing injury severity in road traffic collisions: a comprehensive analysis from Libya. International journal of transport development and integration, 7(4).Al-Ghamdi, A. B. S. Basic Concepts in Traffic Science. 1st Edition.
4. Alfarsi, W. M., Alsaiti, A. M., & Mohamed, B. M. (2019). Prediction of Road Traffic Accidents in Libya Using Artificial Neural Network and Principal Component Regression. International Science and Technology Journal, 2019, 1-18.
5. Mohammed, Bubaker MB, Abdelghffar F. Almnifi, and Akram M. Alabdali. (2017). Identification of Traffic Fatality Leading Factors in Libya Using Principal Component Regression.
6. Al-Ghaweel, I., Mursi, S. A., Jack, J. P., & Joel, I. (2009). Factors affecting road traffic accidents in Benghazi, Libya. Journal of Family and Community Medicine, 16(1), 7-9.
7. Yousef, B.A. (2024). Road Traffic Accident. Alostath, (27), 791–802. Retrieved from https://uotpa.org.ly/alostath/index.php/alostath/article/view/371
8. Mohamed, B. O., Yusoff, N. I., Mubaraki, M., & Rosyidi, S. A. (2019). Statistical overview of factors influencing traffic accidents severity on El-Brega Coastal Freeway in Libya. The Open Transportation Journal, 13(1).
9. Baklanova, K., Voevodin, E., Cheban, E., Askhabov, A., & Kashura, A. (2021). Road safety audit as a tool for improving safety on the intercity road network. Transportation research procedia, 54, 682-691.
10. Huvarinen Y., Svatkova E., Oleshchenko E., Pushchina S. Road Safety Audit, Transportation Research Procedia, 20 (2017), pp. 236-241
11. Sahu, S., Mishra, S. P., Barik, K. K., & Sahu, D. K. (2022). Implementation of road safety audit to highlight the deformities in the design and environmental safety features: A case study on national highway-326. International Journal of Environment and Climate Change, 12(11), 1123-1140.
12. Altoboli, A. M., & Jalgham, R. (2025). Predicting Road Accidents in Bani Walid, Libya, Using Neural Network Artificial Intelligence. *Bani Waleed University Journal of Humanities and Applied Sciences*, *10*(4), 292-300.
13. Chatterjee, S., Bandyopadhyaya, P. S., & Mitra, S. (2020). Identifying critical safety issues on two-lane national highways in india–a case study from nh 117 and nh 60. Transportation research procedia, 48, 3908-3923.
14. Tandrayen-Ragoobur, V. (2025). The economic burden of road traffic accidents and injuries: A small island perspective. International Journal of Transportation Science and Technology, 17, 109-119.