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Role of Forensic Science in Road Traffic Accident Investigation under Motor Vehicles Act, 1988: A Critical Legal Analysis

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ABSTRACT

This research paper examines the evolving role of forensic science in the investigation of road traffic accidents within the legal framework of the Motor Vehicles Act, 1988. With the increasing incidence of road accidents in India, the need for accurate, objective, and scientific methods of investigation has become imperative. Traditionally, accident cases relied heavily on eyewitness testimony and police reports, which are often inconsistent and unreliable. In this context, forensic science has emerged as a crucial tool in reconstructing accident scenarios, determining causation, and establishing liability. The study adopts a doctrinal and analytical approach to examine the integration of forensic techniques such as accident reconstruction, forensic medical analysis, and technological tools including CCTV footage and event data recorders. It further evaluates the evidentiary value of expert opinions under the Bharatiya Sakshya Adhiniyam, 2023, highlighting the growing judicial reliance on scientific evidence in Motor Accident Claims Tribunal proceedings. The paper also critically analyses the impact of the Motor Vehicles (Amendment) Act, 2019, particularly the shift towards a streamlined compensation mechanism under Section 164, and its implications for the role of forensic evidence in determining negligence. Despite its significance, the study identifies key challenges such as inadequate forensic infrastructure, lack of trained personnel, procedural delays, and inconsistent investigative practices that hinder effective implementation. The research concludes by proposing reforms aimed at strengthening forensic capabilities, improving investigative standards, and enhancing legal frameworks to ensure a more scientific, efficient, and just system of accident adjudication in India.

I. INTRODUCTION

Road Traffic Accidents (RTAs) have emerged as one of the most pressing public health and legal concerns in India.¹ With rapid urbanisation, exponential growth in the vehicular

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¹ MINISTRY OF ROAD TRANSPORT & HIGHWAYS, ROAD ACCIDENTS IN INDIA 2024, at 12 (2025).

population, and increasing mobility, the incidence of road accidents has risen significantly over the past decades. India today accounts for a substantial proportion of global road accident fatalities, making it a matter of grave national concern.²

The legislative framework governing road safety, liability, and compensation is primarily contained in the Motor Vehicles Act, 1988,³ which was substantially amended in 2019⁴ to enhance penalties, improve the enforcement mechanism, and introduce provisions for victim compensation. Despite these reforms, the effective implementation of the law continues to face several challenges, particularly in the accurate determination of fault and causation.

RTAs in India are caused by a multitude of factors, including negligent driving, over-speeding, drunken driving, poor road infrastructure, lack of adherence to traffic regulations, and inadequate vehicle maintenance. However, beyond identifying these causes at a superficial level, the legal system requires precise and reliable evidence to establish liability, both for criminal prosecution and for the adjudication of claims before the Motor Accident Claims Tribunals (MACTs).

Traditionally, accident investigations in India have relied heavily on eye-witness testimonies and police reports. However, such evidence is often unreliable due to inconsistencies, bias, or a lack of technical expertise.⁵ This creates a significant evidentiary gap, which directly affects the administration of justice. In this context, the integration of scientific methods through forensic science becomes not only relevant but indispensable.

A. Importance of Forensic Science in Road Traffic Accident Investigation

Forensic science, as an interdisciplinary field, applies scientific principles and techniques to aid in the investigation and adjudication of legal matters.⁶ In the context of RTAs, forensic science plays a crucial role in reconstructing the sequence of events leading to an accident, determining the cause and manner of injuries or death, and establishing the degree of negligence involved.

One of the key contributions of forensic science lies in accident reconstruction, which involves the scientific analysis of physical evidence such as skid marks, vehicle damage, debris distribution, and road conditions. Through such analysis, experts can estimate speed, point of impact, direction of movement, and other critical factors that help in determining fault.⁷

² WORLD HEALTH ORG., GLOBAL STATUS REPORT ON ROAD SAFETY 2023, at 45 (2023).

³ The Motor Vehicles Act, 1988, No. 59, Acts of Parliament, 1988 (India).

⁴ The Motor Vehicles (Amendment) Act, 2019, No. 32, Acts of Parliament, 2019 (India).

⁵ RATANLAL & DHIRAJLAL, THE LAW OF EVIDENCE 230 (27th ed. 2019).

⁶ B.R. SHARMA, FORENSIC SCIENCE IN CRIMINAL INVESTIGATION AND TRIALS 14 (6th ed. 2019).

⁷ *Id.*

Additionally, forensic medicine contributes significantly through the preparation of Medico-Legal Cases (MLCs) and post-mortem reports (PMRs).⁸ These documents provide objective insights into the nature of injuries, the cause of death, and the nexus between the injuries and the accident. Similarly, forensic toxicology is vital in cases involving suspected intoxication, enabling the detection of alcohol or drugs in the system of the drivers involved.⁹

The importance of forensic science is further underscored in judicial proceedings. The courts increasingly rely on expert opinions to supplement, and in some cases override, unreliable oral evidence. The admissibility of such expert evidence is governed by the Bharatiya Sakshya Adhiniyam, 2023 (earlier the Indian Evidence Act, 1872), particularly the provisions relating to expert testimony.¹⁰¹¹

Despite its significance, the appreciation of forensic science in RTA investigations in India remains inconsistent. Factors such as a shortage of trained personnel, inadequate infrastructure, delayed forensic reporting, and limited awareness among investigating officers hinder its effective utilisation. Consequently, there exists a gap between the potential and the actual use of forensic science in achieving justice in accident cases.¹²

B. Research Framework

The present research is structured as a critical legal analysis of the role of forensic science in road traffic accident investigations under the Motor Vehicles Act. It adopts a multidisciplinary approach, integrating legal principles with forensic and medical sciences to provide a comprehensive understanding of the subject.

The study is guided by the objective of examining how forensic evidence contributes to the determination of liability and compensation in RTA cases, particularly within the framework of MACT proceedings. It seeks to evaluate the evidentiary value of forensic reports, the extent of judicial reliance on expert testimony, and the challenges faced in practical implementation.

The research employs a doctrinal methodology, involving the analysis of statutory provisions, judicial precedents, and scholarly literature. In addition, an analytical approach is adopted to critically assess the effectiveness of forensic applications in real-world scenarios. Wherever

⁸ MODI, A TEXTBOOK OF MEDICAL JURISPRUDENCE AND TOXICOLOGY 410 (26th ed. 2020).

⁹ *Id.*

¹⁰ The Bharatiya Sakshya Adhiniyam, 2023, No. 47, Acts of Parliament, 2023, § 39 (India).

¹¹ The Indian Evidence Act, 1872, No. 1, Acts of Parliament, 1872, § 45 (India).

¹² G.K. Goswami, *Forensic Science in India: An Analysis of Legislative Framework and Judicial Attitude*, 54 J. INDIAN L. INST. 415 (2012).

relevant, a comparative perspective is also introduced to highlight best practices from other jurisdictions.

II. LEGAL FRAMEWORKS UNDER THE MOTOR VEHICLES ACT

The legal framework governing road traffic accidents in India is primarily embodied in the Motor Vehicles Act, 1988.¹³ This legislation establishes the foundation for regulating motor vehicles, ensuring road safety, determining liability, and providing compensation to the victims of accidents. Over time, the Act has evolved from a rigid fault-based system into a more welfare-oriented framework that seeks to balance the interests of victims, vehicle owners, and insurers. The amendments introduced in recent years have further strengthened the mechanisms for compensation and enforcement, reflecting the growing need to address the alarming rise in road traffic accidents.

The effectiveness of this legal framework depends not only on statutory provisions but also on the ability of the adjudicatory bodies to accurately determine the facts and circumstances of each case. In this regard, the integration of scientific and forensic methods becomes essential, particularly in establishing causation and liability in complex accident scenarios.

A. Principles of Liability under the Motor Vehicles Act

Liability under the Motor Vehicles Act is determined through a combination of fault-based and no-fault principles, which together aim to ensure both fairness and efficiency in adjudication.

The traditional basis of liability is rooted in the concept of negligence.¹⁴ Under this principle, a claimant is required to establish that the accident occurred due to the wrongful act or omission of the driver. This involves proving that the driver owed a duty of care, that such duty was breached, and that the breach directly resulted in injury or damage. Acts such as rash driving, over-speeding, violation of traffic rules, or driving under the influence are commonly relied upon to establish negligence.¹⁵¹⁶ In such cases, the burden of proof lies on the claimant, and the outcome often depends on the quality and reliability of the evidence presented before the tribunal. Forensic analysis plays an increasingly important role in this context, as it provides objective and scientific insights that help establish causation and responsibility.

After the Motor Vehicles (Amendment) Act, 2019, the earlier framework of no-fault liability under Chapter X underwent a structural change. The traditional provisions such as Section 140

¹³ The Motor Vehicles Act, 1988, *supra* note 3.

¹⁴ M.N. SHUKLA, THE LAW OF TORTS 112 (24th ed. 2019).

¹⁵ Syed Akbar v. State of Karnataka, (1980) 1 S.C.C. 30 (India).

¹⁶ Ravi Kapur v. State of Rajasthan, (2012) 9 S.C.C. 284 (India).

(interim compensation on a no-fault basis) and Section 163A (the structured formula) have effectively been overshadowed and, in substance, replaced by a more streamlined mechanism, particularly through the introduction of Section 164.¹⁷ Section 164 now provides for fixed compensation in cases of death or grievous injury arising out of motor vehicle accidents, without requiring proof of fault. This provision replaces the earlier fragmented approach and ensures immediate relief to victims or their families. The compensation amounts are statutorily fixed, which reduces litigation over quantum at the initial stage. It would therefore be inaccurate to say that no-fault liability has been completely abolished; instead, it has been consolidated into a uniform statutory compensation scheme.¹⁸

In addition to these principles, courts have also applied doctrines such as composite negligence in cases involving multiple vehicles¹⁹. In such situations, liability is apportioned among the parties based on their respective contribution to the accident. Determining the extent of such contribution often requires careful examination of physical and medical evidence, where forensic science becomes highly relevant.²⁰ The application of these varied principles demonstrates the flexibility of the legal framework in addressing diverse factual scenarios.

B. Role of the Motor Accident Claims Tribunal (MACT)

The adjudication of claims arising out of road traffic accidents is entrusted to specialised tribunals known as Motor Accident Claims Tribunals (MACTs).²¹ These tribunals are constituted under the Motor Vehicles Act with the objective of providing a speedy and effective remedy to victims, their families, and their legal representatives.

The jurisdiction of the tribunal extends to all claims for compensation arising from motor vehicle accidents. Unlike ordinary civil courts, the tribunal is not bound by strict procedural rules and is empowered to adopt a summary procedure that facilitates quicker resolution of disputes.²² This flexibility is particularly important in accident cases, where timely compensation is crucial for the financial stability of victims and their dependants.

The tribunal is vested with the authority to determine the liability of the driver, owner, and insurer, and to award compensation that it considers just and reasonable. In exercising this

¹⁷ The Motor Vehicles Act, 1988, § 164 (India).

¹⁸ P.M. Singh, *No-Fault Liability and Welfare Directives under the Motor Vehicles Act: Post-2019 Regime*, 45 COCHIN U. L. REV. 134 (2021).

¹⁹ Reshma Kumari v. Madan Mohan, (2013) 9 S.C.C. 65 (India).

²⁰ N. Ragesh, *Evaluating Composite Negligence through Crash Simulations*, 17 INT'L J. TRAFFIC SAFETY STUD. 63 (2020).

²¹ The Motor Vehicles Act, 1988, § 165 (India).

²² LAW COMM'N OF INDIA, 119TH REPORT ON ACCIDENT CLAIMS TRIBUNALS: ALTERNATIVE FORUM FOR SPEEDY ADJUDICATION 22 (1987).

function, the tribunal takes into account a wide range of evidence, including police reports, medical records, witness testimonies, and expert opinions. Although the strict provisions of the Bharatiya Sakshya Adhiniyam, 2023 (earlier the Indian Evidence Act, 1872) are not rigidly applied, the underlying principles of relevance and reliability continue to guide the decision-making process.²³

The role of the tribunal is not merely adjudicatory but also remedial in nature. It seeks to balance the rights of the claimant with the defences available to the respondent, particularly insurance companies. The increasing reliance on forensic and medical evidence has enhanced the accuracy and fairness of tribunal decisions, especially in cases where direct evidence is limited or contested.

C. Compensation Mechanism under the Motor Vehicles Act

The compensation mechanism under the Motor Vehicles Act is designed to ensure that victims of road traffic accidents receive adequate and timely financial relief. The concept of compensation is grounded in the principle of *restitutio in integrum*, which aims to restore the injured party, as far as possible, to the position they would have been in had the accident not occurred.²⁴

Compensation under the Act is broadly categorised into pecuniary and non-pecuniary damages. Pecuniary damages include quantifiable financial losses such as medical expenses, loss of income, and loss of future earning capacity, whereas non-pecuniary damages account for intangible losses such as pain and suffering, loss of consortium, and loss of enjoyment of life. In cases involving death, the tribunal assesses the financial dependency of the family members and calculates the quantum of compensation accordingly.

One of the commonly adopted methods for determining the quantum of compensation is the multiplier method, which involves assessing the annual income of the deceased or the injured person, deducting personal expenses, and applying a multiplier based on age, as authoritatively laid down in *Sarla Verma v. Delhi Transport Corporation*²⁵ and further refined in *National Insurance Co. Ltd. v. Pranay Sethi*²⁶. This method has been standardised through judicial interpretation to promote consistency and fairness in awards. In addition, structured compensation schemes under the statutory provisions aim to simplify the process and reduce delays.

²³ S.B. Upadhyay, *Evidentiary Challenges Before Motor Accident Claims Tribunals*, (2018) 3 S.C.C. (J.) 21.

²⁴ Shukla, *supra* note 14, at 6.

²⁵ *Sarla Verma v. Delhi Transp. Corp.*, (2009) 6 S.C.C. 121 (India).

²⁶ *National Insurance Co. v. Pranay Sethi*, (2017) 16 S.C.C. 680 (India).

Insurance plays a pivotal role in the compensation framework. The Act mandates compulsory third-party insurance, thereby ensuring that victims are compensated even when the vehicle owner is unable to pay. However, disputes often arise regarding the extent of the liability of the insurer, particularly in cases of breach of policy conditions or questions of coverage.²⁷ In such disputes, forensic evidence can provide critical insights into the circumstances of the accident and assist in resolving the issues of liability.

The determination of compensation ultimately rests on the principle of what is just and reasonable in the given circumstances. This requires a careful evaluation of medical evidence, including the nature and extent of injuries, the degree of disability, and the long-term impact on the victim's life. Forensic medical analysis plays an essential role in this assessment, ensuring that compensation is based on objective and reliable data.

III. FORENSIC SCIENCE IN ACCIDENT INVESTIGATION

The investigation of RTAs has evolved significantly with the advancement of forensic science. Traditional methods of relying solely on eye-witness accounts and police reports have increasingly proven inadequate in addressing the complexities involved in modern accident scenarios. In this context, forensic science provides a scientific and objective framework for analysing the circumstances surrounding an accident, thereby enabling accurate determination of causation, liability, and responsibility. Within the legal framework of the Motor Vehicles Act, 1988, forensic science plays a vital role in strengthening the evidentiary basis of claims before adjudicatory bodies.

Forensic investigation in road traffic accidents is inherently multidisciplinary, involving principles of physics, engineering, medicine, and digital analysis. It assists not only in reconstructing the sequence of events but also in corroborating or contradicting other forms of evidence. As accident cases often involve conflicting narratives, the objective nature of forensic findings enhances the credibility of the investigative process and contributes to more reliable judicial outcomes.

A. Accident Reconstruction

Accident reconstruction constitutes one of the most crucial applications of forensic science in road traffic investigations. It involves the scientific analysis of physical evidence to recreate the sequence of events leading to an accident. This process is based on established principles of mechanics and kinematics, enabling investigators to determine factors such as the speed of

²⁷ Amit Anand, *The Evolving Matrix of Third-Party Insurance and Victim Compensation in India*, 62 J. INDIAN L. INST. 189 (2020).

vehicles, the point of impact, the direction of movement, and the behaviour of the drivers involved.²⁸

The reconstruction process typically begins with a detailed examination of the accident scene. Investigators collect data relating to road conditions, weather, visibility, the position of vehicles, and the distribution of debris. The skid marks and tyre impressions are carefully analysed to estimate braking patterns and speed, and measurements of distances and angles are used to create scaled diagrams, which help in visualising the collision dynamics.²⁹

In addition to scene analysis, the examination of the vehicle forms a crucial component of reconstruction. The nature and extent of damage to vehicles provide valuable insights into the force and direction of impact. Deformation patterns, paint transfer, and mechanical failures are analysed to determine how the collision occurred. These findings are often supplemented with mathematical modelling and simulation techniques to produce a coherent reconstruction of the accident.³⁰

Accident reconstruction is particularly significant in cases where direct evidence is unavailable or unreliable. It enables the investigator to move beyond subjective accounts and arrive at conclusions based on scientific reasoning. In legal proceedings and claim cases, such reconstruction reports carry substantial evidentiary value, especially when supported by expert testimony.

B. Role of Forensic Experts

Forensic experts play a central role in the investigation and adjudication of road traffic accidents. Their expertise bridges the gap between scientific analysis and legal interpretation, enabling courts and tribunals to understand complex technical issues.

Experts in accident reconstruction, forensic medicine, and forensic engineering contribute at various stages of investigation. For instance, a forensic medical expert examines the injuries sustained by the victims and determines the cause and manner of death. This analysis helps to establish the nexus between the injuries and the accident, which is crucial in determining liability and compensation. Similarly, forensic engineers analyse vehicle dynamics and mechanical aspects to identify factors such as brake failure, steering defects, or structural weaknesses.³¹

²⁸ LYNN FRICKE, TRAFFIC ACCIDENT RECONSTRUCTION 88 (2010).

²⁹ W.G.S.S. FIELD, FORENSIC ENGINEERING AND ACCIDENT RECONSTRUCTION 204 (2002).

³⁰ T. Sivasubramanian, *Scientific Reconstruction of Road Accidents: Indian Perspective*, 8 INDIAN J. FORENSIC MED. & TOXICOLOGY 45 (2014).

³¹ *Id.* at 11.

The opinions of forensic experts are recognised as relevant evidence under the Bharatiya Sakshya Adhiniyam, 2023 (earlier the Indian Evidence Act, 1872). The courts rely on such expert opinions to supplement factual evidence, particularly in cases involving technical complexities.³²³³ However, the weight accorded to expert testimony depends on the credibility, methodology, and consistency of the findings.

Despite their importance, the effective utilisation of forensic experts in India faces several challenges. There is often a shortage of trained professionals, and delays in obtaining expert reports can hinder the timely disposal of cases. Additionally, the lack of standardised protocols for accident investigation sometimes leads to inconsistencies in expert findings. Addressing these issues is essential to maximise the potential of forensic expertise in the legal system.

C. Use of Technology in Accident Investigation

Technological advancements have significantly enhanced the capabilities of forensic science in accident investigation. The integration of digital tools and modern equipment has improved the accuracy, efficiency, and reliability of forensic analysis.

One of the most important technological tools in contemporary investigations is the use of CCTV footage. Surveillance cameras installed on roads, highways, and nearby establishments often capture the occurrence of accidents, and such footage provides real-time visual evidence of the incident, enabling investigators to observe the sequence of events, identify the vehicles involved, and assess the behaviour of the drivers. CCTV evidence is particularly valuable in cases involving hit-and-run incidents, where identifying the offending vehicle may otherwise be difficult.³⁴ In addition to fixed surveillance systems, the increasing use of dash cams has further strengthened accident investigation, as these devices record continuous footage from within vehicles, offering direct and often decisive evidence regarding the manner in which the accident occurred.³⁵

Vehicle damage analysis has also benefited from technological advancements. High-resolution imaging, computer modelling, and crash simulation software enable a detailed examination of impact dynamics. By analysing deformation patterns and energy transfer, investigators can reconstruct the collision with a high degree of accuracy³⁶³⁷. In some cases, data from vehicle

³² State of H.P. v. Jai Lal, (1999) 7 S.C.C. 280 (India).

³³ Ramesh Chandra Agrawal v. Regency Hosp. Ltd., (2009) 9 S.C.C. 709 (India).

³⁴ K.A. Shinde, *Application of Forensic Science in Hit and Run Cases*, 14 J. INDIAN ACAD. FORENSIC MED. 112 (2012).

³⁵ Tomaso Bruno v. State of U.P., (2015) 7 S.C.C. 178 (India).

³⁶ Shafhi Mohammad v. State of H.P., (2018) 2 S.C.C. 801 (India).

³⁷ Arjun Panditrao Khotkar v. Kailash Kushanrao Gorantyal, (2020) 7 S.C.C. 1 (India).

event data recorders, commonly known as the “black box,” can provide additional information about speed, braking, and driver inputs immediately before the collision. The significance of such devices may be understood by drawing a parallel with the aviation industry, where flight data recorders, commonly referred to as black boxes, have played a crucial role in accident investigation, as seen in incidents such as the Ahmedabad flight crash,³⁸³⁹ where the recovery and analysis of flight data and cockpit voice recordings assisted investigators in reconstructing the sequence of events leading to the crash and identifying contributing factors.⁴⁰ This comparative perspective highlights the potential of similar data-driven technologies in enhancing the accuracy and reliability of road accident investigations.

The use of such technologies enhances the objectivity of accident investigations and reduces reliance on subjective evidence. However, challenges remain in terms of accessibility, cost, and the technical expertise required for effective implementation. Ensuring the widespread adoption of these technologies is crucial for improving the quality of forensic investigation in road traffic accidents.

IV. MEDICAL AND FORENSIC EVIDENCE

Medical and forensic evidence occupies a central position in the adjudication of road traffic accident claims. While accident reconstruction and physical evidence help in determining how an accident occurred, medical and forensic documentation establishes the nature, extent, and consequences of the injuries sustained. This evidence forms the backbone of both criminal proceedings and compensation claims under the Motor Vehicles Act, 1988, as it directly influences findings on causation, negligence, and the quantum of compensation.

In the context of road traffic accidents, medical evidence is primarily documented through medico-legal reports, post-mortem examinations in fatal cases, and assessments of injury and disability. These records are prepared by qualified medical practitioners and often serve as crucial documentary evidence before the courts and the Motor Accident Claims Tribunals. Their evidentiary relevance is further supported by the provisions relating to expert opinion under the Bharatiya Sakshya Adhiniyam, 2023 (earlier the Indian Evidence Act, 1872), which recognise the importance of specialised knowledge in assisting judicial determination.

³⁸ *Hundreds Dead as Air India Plane Crashes into Medical School Accommodation*, BMJ (June 16, 2025), <https://www.bmj.com/content/389/bmj.r1245>.

³⁹ *Air India Plane Crash AII 71: Ahmedabad to London*, BBC NEWS (June 12, 2025).

⁴⁰ David Rivers, *Black Box Data Admissibility and Vehicle Event Data Recorders in Accident Reconstruction*, 29 FORENSIC SCI. INT’L 210 (2018).

A. Medico-Legal Reports (MLCs)

A Medico-Legal Case arises when a medical practitioner examines a patient whose injuries appear to have been caused under circumstances that may involve legal implications, such as road traffic accidents. The Medico-Legal Report is a contemporaneous document prepared by the attending doctor, recording the condition of the injured person at the time of examination.

The MLC typically contains details such as the identity of the patient, the time and date of examination, the history of the incident as narrated by the patient or accompanying persons, and a detailed description of the injuries observed.⁴¹ The nature, size, location, and type of injuries are carefully documented, along with the opinion of the medical officer regarding whether the injuries are simple or grievous.⁴² This classification assumes legal significance, particularly in determining the severity of the offence in criminal proceedings and the extent of compensation in civil claims.

The evidentiary value of an MLC lies in its immediacy and objectivity. Since it is prepared at the earliest point of medical contact, it provides a reliable account of the injuries before any external influence or alteration.⁴³ The courts often rely on MLCs to corroborate or contradict oral testimony, especially where there are discrepancies in the version of events presented by the parties.

However, the accuracy and reliability of MLCs depend on the diligence and expertise of the medical practitioner. Incomplete documentation, ambiguity in injury description, or failure to note relevant details can weaken the evidentiary value of the report. Therefore, proper training and standardisation in medico-legal documentation are essential for ensuring the effectiveness of this form of evidence.

B. Post-Mortem Reports

In cases where road traffic accidents result in death, post-mortem examination becomes a crucial component of forensic investigation. The post-mortem report, prepared by a forensic medical expert, provides a detailed analysis of the cause and manner of death, as well as the nature of injuries sustained by the deceased.

The primary objective of a post-mortem examination is to determine whether the death was caused by injuries resulting from the accident and to establish a causal link between the accident

⁴¹ R.K. Gorea, *Medico-legal Documentation of Road Traffic Accident Victims*, 22 J. CLINICAL FORENSIC MED. 89 (2015).

⁴² The Bharatiya Nyaya Sanhita, 2023, No. 45, Acts of Parliament, 2023, §§ 116-117 (India); The Indian Penal Code, 1860, No. 45, Acts of Parliament, 1860, § 320 (India).

⁴³ Modi, *supra* note 8, at 3.

and the fatal outcome.⁴⁴ The report includes findings on external and internal injuries, the condition of vital organs, and any other relevant observations. It also specifies the probable cause of death, which is a critical factor in both criminal liability and compensation claims.⁴⁵

Post-mortem reports are particularly significant in resolving disputes regarding the cause of death. For instance, questions may arise as to whether the death was immediate or delayed, whether it resulted directly from the accident or due to subsequent complications, or whether pre-existing medical conditions contributed to the outcome. The forensic expert's opinion helps clarify these issues and provides a scientific basis for judicial determination.

In addition to determining the cause of death, post-mortem examinations may also reveal evidence of intoxication, prior injuries, or other factors that could influence the assessment of liability. As with MLCs, the evidentiary value of post-mortem reports is recognised under the Bharatiya Sakshya Adhiniyam, 2023 (earlier the Indian Evidence Act, 1872), and courts frequently rely on such reports in adjudicating accident cases.

C. Injury and Disability Assessment

The assessment of injuries and the resulting disability is a critical aspect of determining compensation in road traffic accident cases. While immediate medical reports document the injuries sustained, a comprehensive evaluation of the long-term impact of those injuries is necessary for awarding just compensation.

Injury assessment involves determining the severity and nature of the harm suffered by the victim. This includes identifying fractures, internal injuries, neurological damage, and other forms of physical or psychological trauma. The classification of injuries as simple or grievous has legal implications, particularly in criminal proceedings, and also influences the quantum of compensation awarded.

Disability assessment goes a step further by evaluating the extent to which the injuries have affected the victim's functional capacity. This includes both temporary and permanent disabilities, as well as partial or total impairment. Medical boards or qualified specialists assess the percentage of disability based on established guidelines, taking into account factors such as loss of limb function, reduced mobility, and impact on daily activities.⁴⁶

The distinction between medical disability and functional disability is particularly important in legal proceedings. While medical disability refers to the physical impairment as assessed by

⁴⁴ *State of Haryana v. Bhagirath*, (1999) 5 S.C.C. 96 (India).

⁴⁵ *Id.*

⁴⁶ JUSTICE KANNAN & J.A. KHAN, *MODERN LAW OF MOTOR VEHICLES AND COMPENSATION* 302 (5th ed. 2018).

doctors, functional disability considers the effect of such impairment on the victim's ability to earn a livelihood. The courts and tribunals often rely on this distinction to determine appropriate compensation, especially in cases involving loss of earning capacity⁴⁷⁴⁸.

Forensic medical evidence plays a vital role in ensuring that such assessments are objective and scientifically grounded. Accurate disability certification helps to prevent both under-compensation and exaggerated claims, thereby promoting fairness in adjudication.

V. EVIDENTIARY VALUE AND JUDICIAL TRENDS

The determination of liability in road traffic accident cases depends not merely on the occurrence of an accident but on the quality and reliability of the evidence presented before the adjudicatory forum. In this context, forensic and medical evidence has assumed increasing importance in both criminal proceedings and claims under the Motor Vehicles Act, 1988. The courts and tribunals are often required to resolve conflicting narratives, assess technical issues, and arrive at findings on causation and negligence. Scientific evidence provides an objective foundation for such determinations and reduces reliance on uncertain or biased oral testimony.

The evidentiary value of forensic science lies in its ability to present verifiable and methodically sound conclusions. However, the weight accorded to such evidence depends on its admissibility, the credibility of expert witnesses, and the consistency of judicial interpretation.

A. Admissibility of Expert Evidence

The admissibility of expert evidence in India is now governed by the Bharatiya Sakshya Adhiniyam, 2023, which has replaced the earlier Indian Evidence Act, 1872. Under Section 39 of the Bharatiya Sakshya Adhiniyam, 2023, the opinions of persons especially skilled in fields such as science, medicine, and engineering are recognised as relevant facts.⁴⁹ In the context of road traffic accidents, this includes forensic experts, medical practitioners, and accident reconstruction specialists, whose technical expertise assists courts and tribunals in understanding complex factual issues and arriving at informed conclusions.⁵⁰

Expert evidence is not treated as conclusive proof but as an advisory opinion that assists the court in understanding technical matters beyond ordinary knowledge. The court retains the discretion to accept or reject such opinions based on their reliability, coherence, and consistency

⁴⁷ R.K. Malik v. Kiran Pal, (2009) 14 S.C.C. 1 (India).

⁴⁸ Manpreet Singh v. State of Punjab, (2016) 1 S.C.C. 10 (India).

⁴⁹ The Bharatiya Sakshya Adhiniyam, 2023, *supra* note 10, § 39.

⁵⁰ Anuradha Parasar, *Role of Expert Witness under Modern Indian Evidence Regimes*, 11 J. FORENSIC JURIS. 77 (2024).

with other evidence on record. The probative value of expert testimony depends on factors such as the qualifications of the expert, the methodology adopted, and the factual basis of the opinion.

In proceedings before the Motor Accident Claims Tribunals, the strict rules of evidence are relaxed to ensure speedy justice. Nevertheless, the principles of relevance and reliability continue to apply. Forensic reports, medical certificates, post-mortem findings, and technical analyses are routinely admitted as evidence, provided they are properly authenticated. The increasing reliance on such material reflects a shift towards scientific adjudication.

At the same time, the courts have cautioned against blind reliance on expert opinion. Where the opinion is speculative, lacks supporting data, or is inconsistent with established facts, it may be disregarded. Thus, while expert evidence enhances the quality of adjudication, it must be subjected to judicial scrutiny to ensure fairness and accuracy.

B. Key Judicial Precedents

Judicial interpretation has played a crucial role in shaping the evidentiary value of forensic and medical evidence in accident cases. Courts in India have consistently emphasised that expert evidence must be evaluated in conjunction with other material on record rather than in isolation.

In *State of Haryana v. Bhagirath*⁵¹, the Supreme Court observed that medical evidence serves as an important corroborative tool but cannot override credible eyewitness testimony unless it completely rules out the possibility of the occurrence as described. This principle highlights the complementary nature of medical and oral evidence. Similarly, in *R.K. Malik v. Kiran Pal*⁵², the Court underscored the importance of reliable evidence in determining just compensation and emphasised that tribunals must adopt a pragmatic approach in evaluating claims arising out of motor accidents. The judgment reflects the need to balance technical evidence with considerations of justice and equity.

In *Kusum Lata v. Satbir*⁵³, the Supreme Court clarified that proceedings before a MACT are summary in nature and that strict rules of evidence are not applicable. The Court held that the standard of proof is based on the preponderance of probabilities rather than proof beyond reasonable doubt. This principle enhances the relevance of forensic evidence, as it can tilt the balance in favour of one version of events.

⁵¹ *State of Haryana v. Bhagirath*, *supra* note 44, at 16.

⁵² *R.K. Malik v. Kiran Pal*, *supra* note 47, at 18.

⁵³ *Kusum Lata v. Satbir*, (2011) 3 S.C.C. 646 (India).

Another significant decision is *N.K.V. Bros. (P) Ltd. v. M. Karumai Ammal*⁵⁴, where the Court emphasised that tribunals should not adopt a hyper-technical approach and must ensure that victims are not denied compensation due to minor inconsistencies. This approach supports the use of scientific evidence to arrive at a fair conclusion.

These precedents collectively demonstrate that, while expert evidence is not decisive on its own, it plays a vital role in strengthening the evidentiary framework and guiding judicial reasoning.

C. Role of Forensic and Medical Evidence in Determining Negligence

The determination of negligence is central to liability in road traffic accident cases. Forensic and medical evidence plays a crucial role in establishing the elements of negligence, particularly causation and breach of duty.

Forensic analysis helps to reconstruct the circumstances of the accident and provides insights into factors such as speed, point of impact, and driver behaviour. This information is essential in assessing whether the driver acted with reasonable care or deviated from accepted standards. For instance, the presence of skid marks may indicate sudden braking, while the pattern of vehicle damage may reveal the direction and force of impact. Such findings assist the tribunal in determining whether the accident was caused by rash or negligent driving.

Medical evidence, on the other hand, establishes the nexus between the accident and the injuries sustained. The nature and location of injuries can corroborate or contradict the version of events presented by the parties. In fatal cases, post-mortem reports determine the cause of death and help establish whether the death resulted directly from the accident. This is particularly important in cases where there is a dispute regarding causation or where intervening factors are alleged.

Forensic toxicology also plays a significant role in determining negligence in cases involving suspected intoxication. The detection of alcohol or drugs in the driver's system can establish a breach of legal duty and significantly influence the outcome of the case.⁵⁵

In situations involving multiple vehicles or contributory negligence, forensic evidence assists in apportioning liability among the parties. By providing an objective basis for analysis, it reduces the scope for arbitrary decision-making and enhances the fairness of the adjudicatory process.

⁵⁴ *N.K.V. Bros. (P) Ltd. v. M. Karumai Ammal*, (1980) 3 S.C.C. 457 (India).

⁵⁵ Modi, *supra* note 8, at 3.

VI. CHALLENGES AND LIMITATIONS

Despite the growing recognition of forensic science as a crucial component in road traffic accident investigation, its practical implementation in India continues to face significant challenges. While the legal framework under the Motor Vehicles Act, 1988 envisages a fair and efficient mechanism for adjudication, the effectiveness of this framework is often undermined by systemic deficiencies in investigation and evidence collection. The gap between the theoretical potential of forensic science and its actual utilisation reveals structural and procedural limitations that affect the quality of justice delivered in accident cases.

This section critically examines the major challenges that impede the effective use of forensic science, focusing on infrastructural inadequacies, deficiencies in investigative standards, and the delays and procedural gaps that weaken the evidentiary framework.

A. Lack of Infrastructure

One of the most pressing challenges in the application of forensic science to accident investigation is the inadequacy of infrastructure. Forensic laboratories in India are limited in number and often concentrated in urban centres, resulting in unequal access across different regions. This disparity creates significant hurdles, particularly in rural and semi-urban areas, where timely forensic analysis is often unavailable.

Existing laboratories are frequently overburdened with a high volume of cases, leading to backlogs and delays in processing evidence.⁵⁶ In many instances, laboratories lack the specialised facilities required for advanced accident reconstruction, vehicle analysis, and toxicological examination. The absence of modern equipment and technology further restricts the scope and accuracy of forensic investigations.

Another aspect of infrastructural deficiency is the shortage of trained forensic professionals. The demand for experts in fields such as forensic engineering, accident reconstruction, and forensic toxicology far exceeds the available supply. This shortage not only delays the preparation of expert reports but also affects the quality and reliability of the analysis conducted.

The lack of standardised protocols and coordination among different forensic institutions adds to the problem.⁵⁷ Variations in methods of evidence collection and analysis can lead to inconsistencies in findings, thereby reducing the evidentiary value of forensic reports. These

⁵⁶ NATIONAL CRIME RECORDS BUREAU, ACCIDENTAL DEATHS & SUICIDES IN INDIA 2024, at 84 (2025).

⁵⁷ LAW COMM'N OF INDIA, 234TH REPORT ON LEGAL REFORMS IN CIVIL AND CRIMINAL JUSTICE SYSTEMS 45 (2009).

infrastructural limitations significantly hinder the effective integration of forensic science into the legal process.

B. Poor Investigation Standards

The quality of accident investigation in India is often compromised by inadequate training and a lack of awareness among investigating authorities.⁵⁸ Police officers, who are typically the first responders at the scene of an accident, play a crucial role in collecting and preserving evidence. However, in many cases, they lack the necessary expertise to handle forensic evidence properly. Improper handling of the accident scene can result in contamination or loss of critical evidence. Failure to secure the site, inaccurate documentation, and inadequate recording of observations are common issues that weaken the evidentiary foundation of the case. Important elements such as skid marks, debris distribution, and vehicle positions may not be properly documented, making it difficult for forensic experts to reconstruct the accident accurately.

In addition, there is often an over-reliance on eye-witness testimony and preliminary police reports, which may be subjective or inconsistent. The absence of a scientific approach in the initial stages of investigation undermines the reliability of subsequent forensic analysis. In many instances, forensic experts are involved only at a later stage, when the quality of available evidence has already been compromised.

The lack of coordination between investigating officers and forensic experts further exacerbates the problem. Without effective communication and collaboration, the potential benefits of forensic science cannot be fully realised. These deficiencies in investigation standards highlight the need for a more structured and scientific approach to accident investigation.

C. Delay and Procedural Gaps

Delays in forensic analysis and procedural inefficiencies constitute another major challenge in the effective utilisation of forensic science. The time taken to process the evidence and prepare expert reports often extends over several months, if not years. Such delays have a direct impact on the adjudication of claims before the courts and the Motor Accident Claims Tribunals.

Prolonged delays can lead to the deterioration of evidence and the fading of witness memory, thereby affecting the overall quality of the case. In compensation claims, delays in obtaining forensic reports may postpone the award of relief to victims, defeating the very objective of providing timely justice.

⁵⁸ Goswami, *supra* note 12, at 4.

Furthermore, issues related to the admissibility and interpretation of forensic evidence can create additional hurdles. While expert evidence is recognised under the Bharatiya Sakshya Adhiniyam, 2023 (earlier the Indian Evidence Act, 1872), the absence of detailed guidelines on evaluation and weightage can lead to varying judicial approaches. This inconsistency affects the predictability and reliability of outcomes in accident cases.

Administrative inefficiencies, including the lack of coordination among police, forensic laboratories, medical institutions, and adjudicatory bodies, further contribute to delays. The absence of an integrated system for data sharing and case management results in duplication of efforts and unnecessary procedural bottlenecks.

VII. SUGGESTIONS AND REFORMS

The increasing reliance on forensic and medical evidence in road traffic accident cases has highlighted both its potential and its limitations within the Indian legal system. While forensic science offers an objective and scientific basis for determining causation and liability, its effective utilisation remains constrained by infrastructural, procedural, and institutional shortcomings. In the context of the Motor Vehicles Act, 1988, these limitations directly affect the quality of adjudication and the timely delivery of justice to victims.

A comprehensive reform-oriented approach is therefore essential to bridge the gap between the theoretical importance of forensic science and its practical application. This section proposes key suggestions focusing on strengthening forensic infrastructure, improving the training of police and investigators, and introducing necessary legal reforms to enhance the overall effectiveness of accident investigation and adjudication.

A. Strengthening Forensic Infrastructure

One of the primary challenges in the effective use of forensic science in road traffic accident investigations is the inadequacy of infrastructure. Forensic laboratories in India are often overburdened, under-resourced, and unevenly distributed across regions. This results in delays in analysis and reporting, which in turn hampers the timely resolution of claims before the courts and the Motor Accident Claims Tribunals.

To address this issue, there is a pressing need to establish well-equipped forensic laboratories at the regional and district levels. These laboratories should be capable of handling specialised tasks such as accident reconstruction, vehicle analysis, and toxicological examination. Investment in modern equipment, digital tools, and simulation software is essential to enhance the accuracy and efficiency of forensic analysis.

In addition to physical infrastructure, there is a need to increase the number of trained forensic professionals. Recruitment and capacity-building initiatives should focus on developing expertise in niche areas such as forensic engineering and traffic accident reconstruction. Collaboration with academic institutions and research centres can further contribute to the development of specialised knowledge and innovation in forensic techniques.

Standardisation of forensic procedures is another critical aspect of infrastructural reform. The adoption of uniform protocols for evidence collection, preservation, and analysis will ensure consistency and reliability across different jurisdictions, and such standardisation will also enhance the credibility of forensic evidence in judicial proceedings.

B. Training of Police Personnel and Investigators

The role of police officers and investigating authorities is crucial in the initial stages of accident investigation. The quality of evidence collected at the scene of the accident significantly influences the outcome of forensic analysis and subsequent legal proceedings. However, in many cases, investigating officers lack the necessary training and expertise to handle forensic evidence effectively.

There is a need for comprehensive training programmes that equip police personnel with basic knowledge of forensic science and its application in accident investigation.⁵⁹ Such training should include techniques for securing the accident scene, collecting and preserving physical evidence, documenting observations accurately, and coordinating with forensic experts.

Specialised training modules on accident reconstruction, the interpretation of skid marks, and the identification of vehicle damage patterns can enhance the investigative capabilities of police officers. The use of technology, such as digital photography, video recording, and mapping tools, should also be incorporated into training programmes to improve documentation and analysis.

Periodic refresher courses and workshops should be conducted to keep investigators updated with advancements in forensic science. Collaboration between the police departments and forensic institutions can facilitate knowledge-sharing and promote a more integrated approach to investigation.

Improving the coordination between investigating officers and forensic experts is equally important. Clear communication channels and defined roles can ensure that forensic inputs are effectively utilised at every stage of the investigation process.

⁵⁹ Shinde, *supra* note 34, at 13.

C. Legal Reforms

While the existing legal framework provides for the admissibility of expert evidence under the Bharatiya Sakshya Adhiniyam, 2023 (earlier the Indian Evidence Act, 1872), there is a need for more specific provisions addressing the role of forensic science in accident investigation. The law should explicitly recognise and encourage the use of scientific methods in determining liability and causation.

One important reform would be the introduction of statutory guidelines for accident investigation. Such guidelines can mandate the use of forensic techniques in serious accident cases and prescribe standard procedures for evidence collection and analysis.⁶⁰ This will ensure uniformity and reduce the scope for arbitrary or inadequate investigation.

Another area requiring reform is the timely submission of forensic reports. Delays in obtaining expert opinions often prolong the adjudication process. Establishing statutory timelines for the completion of forensic analysis and the submission of reports can significantly improve efficiency.

The legal framework should also address the qualification and accreditation of forensic experts. Ensuring that expert witnesses meet prescribed standards of competence and integrity will enhance the reliability of their testimony and strengthen judicial confidence in forensic science.

In addition, there is a need to promote the use of technology in legal proceedings. The admissibility of digital evidence, such as CCTV footage and electronic data from vehicles, should be supported by clear legal provisions and procedural safeguards. This will facilitate the effective use of modern investigative tools in accident cases.

Finally, awareness among judicial officers regarding forensic science must be enhanced. Training programmes and judicial workshops can help judges and tribunal members better understand technical evidence, enabling them to evaluate expert opinion more effectively.

VIII. CONCLUSION

The study reveals that forensic science plays a vital role in enhancing the quality of road traffic accident investigations. Through techniques such as accident reconstruction, forensic medical analysis, and technological tools, it provides an objective basis for determining causation and liability. This is particularly significant in cases where traditional forms of evidence, such as eye-witness testimony, are unreliable or insufficient.

⁶⁰ The Bharatiya Nagarik Suraksha Sanhita, 2023, No. 46, Acts of Parliament, 2023, § 176 (India); The Code of Criminal Procedure, 1973, No. 2, Acts of Parliament, 1974, § 157 (India).

The analysis of the legal framework demonstrates that the Motor Vehicles Act has evolved to incorporate both fault-based and welfare-oriented principles. The introduction of streamlined compensation mechanisms reflects a legislative intent to provide timely relief to victims while maintaining the relevance of negligence-based liability for final adjudication. In this framework, forensic evidence assumes critical importance in establishing the elements of negligence and influencing the outcome of claims.

The study also highlights the growing reliance of the courts and the Motor Accident Claims Tribunals on expert evidence. Judicial precedents indicate a pragmatic approach, where forensic and medical evidence is used to supplement other forms of proof and to resolve technical complexities. At the same time, the courts exercise caution in evaluating expert opinions, ensuring that such evidence is reliable and consistent with the overall factual matrix.

Despite these advancements, the research identifies significant challenges in the effective utilisation of forensic science. These include inadequate infrastructure, a shortage of trained experts, delays in forensic analysis, a lack of standardised procedures, and limited awareness among investigating authorities and judicial officers. These shortcomings hinder the full realisation of the potential of forensic science in accident investigation.

A. Critical Evaluation

A critical examination of the existing system reveals a gap between the theoretical importance of forensic science and its practical application. While the legal framework recognises the relevance of expert evidence under the Bharatiya Sakshya Adhiniyam, 2023 (earlier the Indian Evidence Act, 1872), the absence of detailed statutory guidelines on forensic investigation leads to inconsistencies in practice.

The reliance on scientific evidence is often undermined by procedural deficiencies at the initial stages of investigation. Improper collection and preservation of evidence can compromise the accuracy of forensic analysis, thereby affecting the outcome of legal proceedings. Furthermore, delays in obtaining forensic reports not only prolong litigation but also diminish the evidentiary value of such reports.

Another critical issue is the uneven integration of technology in accident investigation. While tools such as CCTV footage and digital analysis have the potential to significantly enhance accuracy, their use remains limited and inconsistent across different regions. This disparity reflects broader systemic challenges in terms of resources and institutional capacity.

The study also underscores the need for a balanced approach in the use of forensic evidence. While scientific methods provide objectivity, they must be carefully evaluated in conjunction

with other evidence to avoid over-reliance on technical opinions. Judicial discretion and critical analysis remain essential in ensuring that justice is not compromised.

B. Way Forward

The future of road traffic accident investigation in India lies in the effective integration of forensic science with legal processes. Strengthening forensic infrastructure, enhancing training for police and investigators, and introducing targeted legal reforms are essential steps in this direction. Standardisation of procedures and timely reporting will further improve the reliability and efficiency of forensic analysis.

There is also a need to promote interdisciplinary collaboration between legal professionals, forensic experts, and medical practitioners; such collaboration can lead to a more holistic approach to accident investigation, ensuring that all relevant aspects are adequately addressed.

Judicial awareness and capacity-building are equally important. Training programmes for judges and tribunal members can enhance their understanding of forensic principles, enabling them to evaluate expert evidence more effectively. This will contribute to more informed and reasoned decision-making.

The adoption of advanced technologies and digital tools should be encouraged to modernise the investigative process, and ensuring the accessibility and affordability of such technologies will be crucial in achieving uniformity across jurisdictions.

C. Conclusion

Forensic science has emerged as an indispensable component of road traffic accident investigation and adjudication in India.⁶¹ Its ability to provide objective, scientific, and reliable evidence significantly enhances the accuracy of findings and the fairness of outcomes under the Motor Vehicles Act, 1988. However, the full potential of forensic science can only be realised through systematic reforms that address existing challenges and strengthen institutional capacities.

The integration of forensic science into the legal framework represents a progressive step towards a more scientific and evidence-based system of justice. By bridging the gap between law and science, it ensures that determinations of liability and compensation are grounded in factual accuracy rather than conjecture. As India continues to grapple with the growing problem of road traffic accidents, the role of forensic science will remain central to achieving justice, accountability, and effective legal redress.

⁶¹ Sharma, *supra* note 6, at 3.