

INTERNATIONAL JOURNAL OF LAW
MANAGEMENT & HUMANITIES
[ISSN 2581-5369]

Volume 9 | Issue 3
2026

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Role of the Ballistics Division in Firearm-Related Cases

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ABSTRACT

This paper examines the critical role of the ballistic division in forensic laboratories in the investigation of firearm-related crimes. It defines forensic ballistics as the scientific analysis of evidence such as bullets, cartridge cases, and gunpowder residues left behind when a firearm is discharged. These elements, often described as “ballistic footprints,” enable experts to identify the weapon used and establish links between the firearm, the victim, and the crime scene. The study highlights how traditional methods of visual comparison have evolved with technological advancements, leading to greater accuracy and reliability in forensic analysis. It also emphasizes the prevalence of unlicensed firearms in serious crimes and homicides, underscoring the importance of ballistic evidence in criminal investigations. Further, the paper explains how ballistic experts determine key aspects such as the type of weapon, firing distance, and trajectory of the bullet. The uniqueness of markings on bullets and cartridge cases enhances the evidentiary value and admissibility of such findings in courts of law. Overall, the research analyses the scientific foundations of ballistics, rooted in the study of projectile motion, and underscores its indispensable role in crime scene reconstruction and the administration of justice.

I. INTRODUCTION

The role of ballistic division in forensic labs come into picture when there is ballistic evidence recovered from the crime scene. Forensic ballistic can be defined as the examination of any evidence retrieved from a firearm which has been used in the commission of a crime. When a gun is used, the bullet is fired and it leaves traces and marks on the bullet along with the cartridges case and gun powder.¹ These are nothing but ballistic footprints left behind in the scene of crime. The forensic ballistic expert performs his expertise to identify the bullet and the weapon from which the bullet was fired or compare the marks left behind and their similarity to the weapon recovered.² The comparisons have been done by these experts through naked eye for centuries but with the advancements in science and development in infrastructure, different

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¹ Firearms and Toolmarks. <https://www.nist.gov/firearms-and-toolmarks> (last visited 28 November 2025)

² Ibid

mechanisms are coming up which provide more accurate details along with the expert opinion.³

It has been majorly observed that the most common weapon used for homicide and serious crimes is through unlicensed firearms.⁴ The link between firearm, the victim and the crime scene is established through ballistic forensics. The experts of this division through such ballistic evidence determine the type of firearm used in the crime scene, the shooting trajectory, and the distance from which it was shot.⁵ What makes the ballistic evidence increase its admissibility in the court of law is its uniqueness, that is no missile or bullet discharged from the same or different firearm will bear the same trace or residual mark.⁶

The term “ballistics” was derived from the Latin word “ballista” meaning to anybody which is in motion.⁷ Therefore it can be induced that this branch of forensic science deals with the study of motion of projectile.⁸ In the terms of physics, projectile refers to the path in which the body in motion travels especially in air.⁹ Therefore it involves the study of firearms effecting the reconstruction of the crime scene. The researcher of this paper aims to analyse the importance of ballistic evidence in firearm related case and the role of ballistic division forensic labs in examination of the same.

Literature Review

In the paper of “Admissibility and Appreciation of Expert Evidence with Special Reference to Ballistics”¹⁰, the author tries to lay emphasis on the admissibility of expert evidence with context to ballistic forensic evidence. The author also critically emphasize on the point that with each passing day the dependence on forensic expert specifically ballistic expert is increasing. The author concludes that in the present era, with increased organized crimes, and terrorism along with transboundary criminals, the reliance of witnesses become insufficient. Therefore, the author implies that there is a need to make expert evidence more admissible and reliance needs to be placed on the expertise which will help in further administration of justice.

³ Ibid

⁴ Tania Inowlocki, “Mapping Murder, The Geography of Indian Firearm Fatalities” India Armed Violence Assessment, small arms survey. <https://www.files.ethz.ch/isn/143581/IAVA-IB2-mapping-murder.pdf> (last visited 28 November 2025)

⁵ Vemasani Monish, “Forensic Ballistics”, IJIRT, Volume 11 Issue 5, October 2024

⁶ MC Sarkar, et al, “Sarkar’s Law of Evidence”, (Wadhwa and Company Law Publishers: Nagpur, 1999) 877.

⁷ Bhagwan Gawali, “Admissibility and Appreciation of Expert Evidence with Special Reference to Ballistics.”, International Journal of Research in Computer Application and Management, Vol. 2(10), 2012.

⁸ Ibid

⁹ Ibid

¹⁰ Bhagwan Gawali, “Admissibility and Appreciation of Expert Evidence with Special Reference to Ballistics.”, International Journal of Research in Computer Application and Management, Vol. 2(10), 2012.

In the paper of, “Forensic Challenges in the Examination of Country-Made Firearms: A Forensic Approach”¹¹ the author highlights a very big challenge that is occurring in the ballistic forensic examination. The author mentions that there is an increase in amount of country made firearms in India which as reported by NCRB, amounts to 97% of the firearm offences with illegal firearm.¹² This is making the detection difficult as there is no record of those firearms and making forensic investigation complicated. The recommendations made by the author of this paper refers to alternative forensic methodology, enhanced documentation and upgraded and specialised database for nonstandard firearms.¹³

In the paper of, “Forensic Ballistics”¹⁴ the author simply analyses the role of forensic Ballistics and the types of Ballistic weapon that is examined in the labs. This paper is more of an academic in nature and informative regarding the methodologies used in forensics along with the fundamentals of forensic science with regards to Ballistics. The paper doesn't identify any loophole in the existing scenario and simply highlights the importance of ballistic forensics.

In the paper of, “Forensic examination of ballistic weapons and its relevance in Indian criminal justice system.”¹⁵, the author highlights how there is an increase in crimes in India with specific reference to an increase in firearms used in commission of such crimes. The paper also discusses that how ballistic division in forensic labs plays an important role in retracting evidences related to firearms in ballistic material. The main aim of the author in the paper has been to discuss the problems and challenges arising within the examination ballistic weapon in forensic investigations.

Research Methodology

The research is basically founded on fundamentals of a doctrinal examination. Referring and investigating the current information, for example, laws and insights requires a doctrinal research and examination. The researcher believes that the current issue is significantly relied upon present laws and how they have an effect on one another. To play out a viable exploration on such subject, it is best recommended to undertake doctrinal research and analyse different important laws in question.

¹¹ Sourav Shil, Ajitesh Pal, “Forensic Challenges in the Examination of Country-Made Firearms: A Forensic Approach” InSight Bulletin, Volume-2, Issue-7 / July - 2025

¹² Ibid

¹³ Ibid

¹⁴ Vemasani Monish, “Forensic Ballistics” IJIRT | Volume 11 Issue 5, October 2024

¹⁵ Suresh Kumar, “Forensic examination of ballistic weapons and its relevance in Indian criminal justice system.” Shodganga. <http://hdl.handle.net/10603/410565> (last visited on 28 November, 2025)

The researcher also believes in adhering to the critical and analytical concepts in focus and will try to develop a more concrete analysis of the topic in question and the related aspects associated with it. Hence the best form of research for this kind of a study is Doctrinal Research.

II. ANALYSIS

The ballistic experts play an important role in the administration of justice. They work with the investigating officers when there is a crime committed involving any fire arm. He analyses the evidences discovered in the crime scene and concludes his findings and appear before to court as an expert witness.¹⁶ Their role in the administration of justice becomes a very important “complementary role” in the society.¹⁷ Their expertise make the analysis effective and helps in contributing to the degrees of principle of probability. The ballistic expert mainly tests various aspects like testing the fire range.¹⁸ The ballistic expert along with the chemical analyst may develop certain analysis through examination and come to a conclusion of how the firearm was used for the commission of a particular offence and the nature of the ammunition used. There are also instances where the firearm is left on the scene of the crime. Such is collected from the scene of crime and sent to the expert. The expert helps in extracting the type of the firearm along with the model, the calibre size and the trademark. The bore walls in the arm is also checked for the powder odour for estimating the time of firing.¹⁹

The expert establishes the projectile of the firearm by examining all the object in the line of fire for example the dents and damages in the wall ceiling or roof.²⁰ When a bullet is recovered, the ballistic expert examines the size, shape, form and design to identify the firearm and the traces left on the bore walls. These are a few ways in which the expert helps reconstruct the scene of crime where a ballistic weapon is used. Therefore to precisely conclude the role of ballistic division is to find out whether the object used is a firearm or a country made similar model weapon.²¹ Also they examine whether the weapon retrieved is the one from which the offence was committed or a different weapon was used.²² Along with these, they also give answer to what kind of firearm was used in the commission of the crime.²³

Therefore broadly classified, forensic ballistic has two roles. Firstly the scientific function in

¹⁶ Bharatiya Sakshya Adhiniyam, 2023, section 39, Acts of Parliament, 2023.

¹⁷ Bhagwan Gawali, “Admissibility and Appreciation of Expert Evidence with Special Reference to Ballistics.”, *International Journal of Research in Computer Application and Management*, Vol. 2(10), 2012.

¹⁸ Ibid

¹⁹ Id

²⁰ Bhagwan Gawali, “Admissibility and Appreciation of Expert Evidence with Special Reference to Ballistics.”, *International Journal of Research in Computer Application and Management*, Vol. 2(10), 2012.

²¹ Ibid

²² Ibid

²³ Ibid.

which they collect, gather, testing and evaluate and give their report along with forming an opinion.²⁴ And secondly the forensic function where the expert testifies as an expert witness and form a logical conclusion in the court of law for better administration of justice.²⁵

Some basic techniques and methodologies followed by the forensic expert are like, Firearm and Ammunition Analysis, where the experts analyses the weapon and how they mechanically operates. Here the main analysis is the type of bullet and their cartridges quality, then, ballistic imaging, where the 3D imaging is used to connect bullets to certain weapons used or retrieved from the scene of crime, then Gunshot Residue Analysis(GSR), where the residues left on the shooters hand is examined. and shooting reconstruction, which includes analysis of the firing trajectory, possible positioning of the victim and the accused and impacting angles.²⁶

Further forensic ballistics can be divided into three parts. Firstly internal ballistics that studies the movement of the bullet inside the firearm.²⁷ The pressure created while firing the bullet and the tear on the cartridges determines the quality of the weapon. Secondly the external ballistics that reconstructs the projectile of the line of firing and the bullet.²⁸ And thirdly, terminal ballistics that analyse the impact of the trajectory of the bullet and the victim coming into contact, for example missed shots or dissemination of the bullet.²⁹

III. JUDICIAL STANDING

As the Indian evidence laws, specifically provides for expert testimonies of experts skilled in science along with other things,³⁰ the science skill is something the ballistic expert is a trained and experienced personal. Therefore in firearm related cases, ballistic experts are trained experts in the field of science. In the case of Sukhwant Singh v. State of Punjab³¹, where the Supreme court held that when there is a failure to produce expert testimony from the prosecution side, it affects the case severely, however the testimony of a ballistic expert is necessary but will depend from case to case, especially when there is a firearm used in the commission of the crime. In other cases like, Jaidev and Hari Singh v. State of Punjab³² and Mohinder Singh v. State,³³ the court reinstated that where there is an evident instance that a firearm has been used, the parties

²⁴ Richard, Saferstein, "Forensic science Handbook", Prentice Hall Regents: New Jersey, 1982.

²⁵ Ibid

²⁶ Vemasani Monish, "Forensic Ballistics" IJIRT | Volume 11 Issue 5, October 2024

²⁷ Sourav Shil, Ajitesh Pal, "Forensic Challenges in the Examination of Country-Made Firearms: A Forensic Approach" InSight Bulletin, Volume-2, Issue-7 . July - 2025

²⁸ Ibid

²⁹ Ibid.

³⁰ Bharatiya Sakshya Adhiniyam, 2023, section 39, Acts of Parliament, 2023.

³¹ Sukhwant Singh v. State of Punjab, 1996 Cri LJ 1713.

³² Jaidev and Hari Singh v. State of Punjab, 1963 Cri LJ 495.

³³ Mohinder Singh v. State, AIR 1953 SC 415.

must bring in expert testimony to connect the weapon and the injury inflicted. The facts of this case was that the weapon found in the scene of crime did not match with the bullet found in the body of the victim. Ballistic expert played an important role in the case of Ghurey Lal v.State of U.P³⁴, there were two bullets fired. Here the ballistic evidence combined with the medical evidence proved to be very beneficial for the case. The prosecution claimed that the two bullets fired resulting into one death and one injury were from two different weapons but the report suggested that both were fired from the same gun.

In the case of Mahesh Chand v. UT of Chandigarh,³⁵ the issue revolved around three country made riffles and bullets recovered from the body of the victim were tested by the ballistic expert. The expert opined that all the three bullets were fired from those firearms and the court held the accused guilty based on the ballistic evidence.

There also have been instances of the court giving preference to ballistic experts' report than on the medical expert's. In the case of Charan Singh v. State of Punjab³⁶ there were conflicting few points about the range of fire and the court appreciated the logistic conclusion of the ballistic expert to be more accurate.

IV. CHALLENGES FACED

There are a few difficulties faced by forensic ballistic division. In cases of firearms produced domestically without licence and shotguns sometimes lack a distinctive pattern.³⁷ Therefore preciseness comes into question. When it's a country manufactured firearms, it makes comparisons less accurate and trustworthy. There are sometimes cases of misfire and blow up during examination in the lab, in case of non-licenced guns.³⁸ Also there is a severe lack in documentation of these riffles. The manufactured and licenced ones are regularly updated and documented. However for the locally or illegally produced ones are not easily traceable through these data bases.³⁹

V. CONCLUSION AND SUGGESTIONS

Therefore, the researcher of this paper concludes that ballistic division is a crucial wing in forensic evidence analysis. It helps in identifying the firearms used and establishing a link

³⁴ Ghurey Lal v.State of U.P, MANU/SC/3223/2008

³⁵ Mahesh Chand v. UT of Chandigarh, AIR 1995 SC 1951

³⁶ Charan Singh v. State of Punjab, 1974 Cri LJ 1253.

³⁷ Sourav Shil, Ajitesh Pal, "Forensic Challenges in the Examination of Country-Made Firearms: A Forensic Approach" InSight Bulletin, Volume-2, Issue-7 / July - 2025

³⁸ Ibid

³⁹ Ibid

between the victim whose death or injury occurred due to use of any firearm.

The court has positively relied on ballistic expert evidence for establishing the chain of circumstances. However, there are a few ethical concerns that the expert needs to follow. The expert shall be unbiased and accurately give testimony with reference to the facts for proper administration of justice. Further there are problems associated with country made guns that account for majority crimes where firearms are used. In order to control such a limitation, the regulations need to be made more watertight and constant inspections in the potential areas where such illegal manufactures takes place, shall be done.
