
ADMISSIBILITY AND EVIDENTIARY WEIGHT OF BALLISTIC FORENSICS

Shreya Kshirsagar, B.A., LL.B (Hons.), Maharashtra National Law University Mumbai

Introduction - Ballistic Forensics as part of Expert Evidence

Evidence is a mode of ascertaining the truth. According to section 60 of Indian Evidence Act, 1872 (hereinafter “IEA”), direct evidence by a witness should refer to a fact what has been seen, heard or perceived by any other organs or by any other means or manner.¹ To draw the conclusion from the set of facts is within the domain of the court. However, there are situations when the court is unable to draw its conclusion on certain subject when are beyond the common knowledge and experience. Since some subject requires special studies, rule has been relaxed and provision have been made under section 45 of IEA, 1872 to admit the opinion of the Expert which is simply conclusion drawn from a set of facts coming to his knowledge and observation. The same has been retained in section 39 of Bharatiya Sakshya

Adhiniyam, 2023 (hereinafter “BSA”) which states:-

“39. (1) When the Court has to form an opinion upon a point of foreign law or of science or art, or any other field, or as to identity of handwriting or finger impressions, the opinions upon that point of persons specially skilled in such foreign law, science or art, or any other field, or in questions as to identity of handwriting or finger impressions are relevant facts and such persons are called experts.”²

The scope of this section is very broad and the word science should be construed wide enough to incorporate at intervals its compass the opinion of a professional in every branch of those subjects³ and should therefore take under its ambit the Forensic Ballistics. The opinion furnished by experts are called expertise. The pertinent questions that need to be considered in respect of an expert evidence are three-fold (a) Whether the subject, upon which the opinion of an expert has been obtained, is such that it is beyond the common experience of men/women ?

¹ The Indian Evidence Act, 1872, § 60, No.1 , Acts of Parliament, 1872 (India).

² The Bharatiya Sakshya Adhiniyam , 2023, § 39 , No. 47 , Acts of Parliament, 2023 (India).

³ State v. S.J. Choudhary, (1996) 2 SCC 428

(b) What are the qualifications necessary to entitle a witness to testify as an expert? (c) Has the witness those necessary qualifications in order to rate him as an expert? The first two questions are matters of law and third is a matter of fact.

Firstly, Ballistic forensics, being a specialized branch of forensic science, involving the analysis of firearms, ammunition, and their residual traces to reconstruct events in criminal investigations is a specialized field of science that is well beyond a common man's knowledge. Secondly, the requirements of Ballistic Expert witness are alike to requirements of any expert witness which requires skill and experience. Thirdly who is an expert, is a question to be decided by the court and in order to enable the court to take a decision upon this point, the expert must mention the facts regarding his (a) academic background; (b) professional training; (c) his experiences; (d) the means at his command for conducting experiments and the necessity of applying those means; and (e) actual application of those means in the concerned case for arriving at a particular decision. An Expert opinion in the specialized field of firearms analysis must not merely reflect the unsubstantiated views of the expert or bald opinion; rather, it should consist of well-founded conclusions derived from the factual evidence presented in the case.⁴ For an expert's opinion to be accepted, they are required to bring before the court all the materials and evidence available that resulted in their conclusion, allowing the court in absence of specialized knowledge to make an independent assessment and judgment based on the data presented.⁵

The scientific foundation of ballistic forensics rests on the principle that each firearm imparts unique microscopic markings on bullets and cartridge cases during discharge. As William McGee James elucidated that striations from barrel rifling, breech face impressions, and firing pin indentations—act as a firearm's "fingerprint".⁶ He explained the application of comparison microscopes in comparing test-firings of bullets with evidence bullets, a method that continues to form the core of ballistic analysis even today, supplemented by contemporary instruments such as the Integrated Ballistic Identification System (IBIS). The Central Forensic Science Laboratories (CFSLS) and State Forensic Science Laboratories (FSLs) in India use similar techniques, examining the rifling details (such as the number of grooves, their width, and the angle) and ballistic residues for correlation of weapons with crime sites with accuracy.

⁴ Chunni Lal v. State of Haryana, 2003 SCC OnLine P&H 1176

⁵ Ajit Rai, Shiv Prasad Mehta v. Bai Bersumate, AIR 1969 Guj 1948 p.54.

⁶ William M. James, Expert Evidence in Ballistics, 8 Chi.-Kent L. Rev. 33 (1930).

Historically, Calvin Goddard, who is also known as the father of forensic ballistics, first used the term in his 1925 paper with the same title.⁷ Forensic science distinguishes four categories of "ballistics"; The forces, pressure, and ignition that act on the bullet while it is still inside the gun are referred to as internal ballistics; The flight of a bullet between the muzzle of a firearm and its impact at the target is referred to as external ballistics; The mechanics of impact on the projectile and the target are described by terminal ballistics; and The study of bullet and cartridge case evidence and its application to connect specimens to specific weapons and to one another is known as forensic ballistics.⁸ Ballistic forensics gained international credibility as more accurate comparison microscopes were developed.⁹ In 1930, the Calcutta Police established a small ballistic laboratory and appointed an Arms Expert to handle firearms examination in India. Other State CIDs also set up small ballistics labs to aid in their criminal investigations as the threat posed by firearms increased.¹⁰ India's forensic facilities have also become more advanced now, with NFSU training ballistic specialists and implementation of automated technologies such as IBIS in key CFSLs, including New Delhi and Chandigarh. This advancement improves the credibility of ballistic evidence, allowing specialists to provide testimony on details such as bullet caliber, firearm type, and firing distance—information vital to crime scene reconstruction.¹¹

The expert opinion in India can be in form of documentary evidence by the manner of written expert report or in form of testimonial evidence by means of summoning and examination of the expert. The section 293 of Code of Criminal Procedure, 1973 provided for the admissibility of reports from certain government experts without the necessity for these experts to be summoned to the court.¹² It identifies specific government scientific experts whose reports are admissible in court. It includes the Director/ Deputy Director/ Assistant Director of a Central Forensic Science Laboratory or a State Forensic Science Laboratory. By allowing court to accept Ballistic report without actually summoning the experts, it reduces the time and resources required for legal proceedings but one of the primary concern associated is the

⁷ Forensics Blog, *Calvin Hooker Goddard – Father of Forensic Ballistics - Forensic's Blog*, (2022), <https://forensicfield.blog/calvin-hooker-goddard-father-of-forensic-ballistics/> (last visited Apr 10, 2025).

⁸ Robert A. Rinker, *Understanding Firearm Ballistics* 78, Mulberry House Publishing 2005.

⁹ B.J. HEARD, *Handbook of firearms and Ballistics: Examining and Interpreting Forensic Evidence* 149 (John Wiley & Sons) (1997).

¹⁰ Tewari RK & Ravikumar KV, *History and Development of Forensic Science in India*, 46 J. Postgrad. Med. 303-308 (2000)

¹¹ Mihir Joshi, *Analytical Study of Forensic Ballistics in the Criminal Investigation in India*, 1 VIDHINAMA 1, 20 (2023)

¹² The Code of Criminal Procedure, 1973, § 293, No.2, Acts of Parliament, 1974 (India).

potential for misuse or misinterpretation of scientific reports and absence of opportunity for the defence to cross-examine the expert witness thought the discretion does always lie with the court to physically summon such expert witness as and when required. Where any such expert is summoned by a Court, and he is unable to attend personally, he may, unless the Court has expressly directed him to appear personally, depute any responsible officer working with him to attend the Court, if such officer is conversant with the facts of the case and can satisfactorily depose in Court on his behalf. According to the Supreme Court, a ballistic report that was filed under seal and submitted by the director, deputy director, or assistant director of a lab would be considered to have complied with requirements of Section 293 of CrPC.¹³

The same provision is retained in the section 329 of Bhartiya Nagarik Suraksha Sanhita, 2023.¹⁴ But the discretion of the court to summon the expert witness making the report as and when required is curtailed to certain extent by the proviso inserted in section 330, which states that “no expert shall be called to appear before the Court unless the report of such expert is disputed by any of the parties to the trial”.¹⁵ Thus it now becomes unclear as to can court summons the expert witness in the court for its aid in understanding the report when the report in itself remains undisputed, though it is very rare scenario to arise in itself.¹⁶

The probative value of ballistics in India, however, is not constant; it shifts with judicial perspective and case to case basis. It serves multiple roles: corroborating witness statements, resolving inconsistencies, or standing alone when direct evidence is absent. Its significance is amplified in a criminal justice system historically reliant on oral testimony, where ballistic evidence offers an objective counterweight. As ballistic forensics continues to shape criminal adjudication, understanding its role under the evidentiary framework is essential to assessing its contribution to justice delivery in India.

Judicial Scrutiny of Ballistic Evidence in Indian Courts

Evidence of testimony by Ballistics Expert has had an increasing value in the past few years but it remains a settled position that ballistics testimony per se cannot uphold a conviction. In *Mahmood v. State of U.P.*, the Supreme Court held it "highly unsafe" to convict on expert

¹³ Ashok Kumar Singh Chandel v. State of U.P., (2022) 20 SCC 114.

¹⁴ The Bhartiya Nagarik Suraksha Sanhita, 2023, § 329, No.46, Acts of Parliament, 2023 (India).

¹⁵ The Bhartiya Nagarik Suraksha Sanhita, 2023, § 330, No.46, Acts of Parliament, 2023 (India).

¹⁶ Ankita Mahesh Menon, *FORENSIC BALLISTICS AND THE BNSS: ENHANCING CRIMINAL INVESTIGATION THROUGH SCIENTIFIC PRECISION*, 7 IJLLR 5528, 5528-5535 (2024).

opinion alone, with little corroboration, a gesture towards a larger judicial reluctance to overrely upon forensic proof.¹⁷ If a direct proof such as ocular proof (eyewitness) conflicts with ballistic results and is considered reliable, the former usually prevails, as in the case of *Malappa Siddappa Alakumar v. State of Karnataka*.¹⁸ Judicial examination is a matter of concern on various issues: the qualifications of the expert, methodology employed, the integrity of the chain of evidence, and the necessity for corroboration by other evidence, e.g., eyewitness testimonies or circumstantial evidence.¹⁹ This chapter will first access the required of ballistic expert evidence in cases involving firearms, then access the manner in which expert ballistic evidence corroborate and contradict the ocular evidence.

A. Obtaining Report or Examination of Ballistic Expert is not an Inflexible Rule

In *Mohinder Singh v. State of Punjab*, the Supreme Court dealt with a case of murder in which the prosecution stated that the accused killed the deceased using a gun. Evidence hinted, nevertheless, that the victim's injuries were most probably inflicted by a rifle, raising suspicion about the identity of the weapon. No ballistic expert was questioned to determine if such injuries pointed towards more than one shooter or to ascertain the type of firearm, even though direct evidence that had not been challenged was readily available. The court held: "Where the prosecution case hinges on a specific firearm but the injuries suggest otherwise, and there is no evidence from a duly qualified expert to resolve such discrepancies, the failure to examine an expert constitutes a serious infirmity in the prosecution case."²⁰ Similarly in *Sukhwant Singh v. State of Punjab*, despite recovery of an empty cartridge from the crime scene and a live cartridge pistol from the appellant, the prosecution failed to produce ballistic report. The court commented that in cases where injuries are caused by firearms, the opinion of the ballistic expert is of a considerable importance where both the firearm and the crime cartridge are recovered during the investigation to connect an accused with the crime. Failure to produce the expert opinion before the trial court in such cases affects the creditworthiness of the prosecution case to a great extent.²¹

The demarcation of when the ballistic evidence is necessary and when not is not very clear. In what cases the examination of ballistic expert is essential for the proof of prosecution case

¹⁷ *Mahmood v. State of U.P.*, (1976) 1 SCC 542

¹⁸ *Mallappa Siddappa Alakanur v. State of Karnataka*, (2009) 14 SCC 748

¹⁹ Suresh Kumar, *Forensics Ballistic in Criminal Justice System*, 4 DJMR 248, 248-258 (2022).

²⁰ *Mohinder Singh v. State of Punjab*, AIR 1953 SC 415

²¹ *Sukhwant Singh v. State of Punjab*, (1995) 3 SCC 367.

depends upon the facts and circumstances of each case.²² The test became somewhat clearer in *Vineet Kumar Chauhan v. State of U.P.*, where clarified that it is not a mandatory rule that ballistic expert testimony must be presented in every case involving the use of firearms. If the direct evidence provided by eyewitnesses is reliable and the injuries recorded in the medical reports align with that evidence, ballistic analysis may not be essential. However, in cases where direct evidence is lacking or there are doubts about whether a particular weapon caused the injuries, a ballistic expert's opinion can help resolve inconsistencies or support the prosecution's version. In the case at hand, the prosecution presented strong ocular evidence, and medical testimonies from the treating doctor (PW 5) and the post-mortem examiner (PW 7) clearly established that the injury, which resulted in the victim's paralysis, was caused by a bullet. The bullet's path—from the jaw to the thoracic spine, damaging the spinal cord—was medically verified. Hence, the absence of a ballistic expert's testimony did not weaken the prosecution's case.²³ In, *Chatar Singh v. State of Haryana* although a pistol and bullets were recovered and sent for ballistic analysis, no expert report was obtained due to delays. Despite this, the High Court convicted the accused based on other strong evidence, and the Supreme Court upheld the conviction. The Court held that the absence of ballistic evidence did not weaken the prosecution's case, especially since the bullets likely lacked identifiable rifling marks due to damage on impact and the probable use of a country-made pistol without standard barrel markings, making expert analysis unlikely to add value.²⁴

In *Gulab v. State of Uttar Pradesh*, appellant, Gulab, accompanied by Idrish, shot the deceased, Hanifa, with a country-made pistol. The prosecution relied on three related eyewitnesses (the deceased's brother and cousins), whose accounts were consistent and credible, corroborated by the post-mortem report showing a gunshot wound with entry and exit points.²⁵ No firearm was recovered, and no ballistic report was produced. The defense argued that this omission was fatal, but the court upheld the conviction under Sections 302 and 34 IPC.²⁶ In *Pritinder Singh v. State of Punjab*, the accused, Pritinder Singh and Manjit Kaur (the deceased's stepmother), allegedly shot the deceased, Ravinder Singh, with a double-barreled gun. The prosecution's case rested on circumstantial evidence, including an extra-judicial confession and the last seen theory. A gun and two empty cartridges were recovered from the crime scene, but no ballistic

²² Gurcharan Singh v. State of Punjab, 1962 SCC OnLine SC 42

²³ Vineet Kumar Chauhan v. State of U.P., (2007) 14 SCC 660

²⁴ Chatar Singh v. State of Haryana, (1976) 2 SCC 263

²⁵ Prachi Bhardwaj, Examination of a Ballistic Expert Is Not an Inflexible Rule in Every Case Involving Use of a Lethal Weapon: SC, SCC Times (Dec. 29, 2021),

²⁶ Gulab v. State of Uttar Pradesh, (2022) 12 SCC 677

expert was examined to link the wad and pellets found in the deceased's body to the recovered cartridges or gun. The credibility of the confession and last seen witnesses was doubted due to inconsistencies and unnatural conduct. The Supreme Court held that in cases reliant on circumstantial evidence, ballistic evidence is of considerable importance when firearms and cartridges are recovered. The failure to examine a ballistic expert was a "glaring defect" in this case, especially given the serious doubts about the credibility of the circumstantial evidence. This omission, combined with the weak evidence chain, led to the accused's acquittal.²⁷

In recent case of *Ram Singh v. State of Uttar Pradesh*, the Supreme Court explained the discretionary but central role of ballistic evidence, acquitting the appellant of a murder under Sections 301/302 IPC on grounds of non-recovery of the gun and lack of ballistic examination in the wake of questionable eyewitness testimony. The inability of the prosecution to connect a recovered cartridge tikli and pellets to the purported country-made pistol forensically, as well as inconsistent testimonies by PW 1, PW 2, and PW 3, weakened the case. The court cited *Sukhwant Singh case* and *Pritinder Singh case*, and held that although ballistic evidence is not obligatory according to *Gurucharan Singh case*, its absence becomes determinative when ocular evidence—sullied by enmity and non-examination of important witnesses—does not cohere.²⁸

B. Corroboration and Contradiction with other evidences

The Ballistic Expert Evidence should produce facts and not opinions that cannot be checked.²⁹ In *Anvaruddin and Others v. Shakoor and Others*, the Supreme Court clarified the critical requirement for ballistic evidence to be positive and conclusive to significantly influence a criminal trial's outcome. The Court rejected the High Court's reliance on the ballistic expert's opinion, which suggested that two gunshot wounds on the deceased likely resulted from a single shot, as it was "nebulous" and "oscillating." The expert's uncertainty—acknowledging the possibility of two shots and relying on assumptions about standard ammunition rather than the countrymade weapons involved—rendered the evidence unreliable. The Court held that such inconclusive ballistic evidence could not override the consistent testimony of eyewitnesses claiming two separate shots, absent glaring infirmities in their accounts.³⁰

²⁷ *Pritinder Singh v. State of Punjab*, (2023) 7 SCC 727

²⁸ *Ram Singh v. State of Uttar Pradesh* (2024) 4 SCC 208

²⁹ Kaushalendra Kumar, *Forensic Ballistics in Criminal Justice*, 1 (Eastern Book Publications 1987).

³⁰ *Anvaruddin and Others v. Shakoor and Others* (1990) 3 SCC 266

Similarly, in *Sidhartha Vashisht alias Manu Sharma v. State (NCT of Delhi)*, the eyewitnesses (PWs 1, 2, 6, 20, 24) consistently identified Manu Sharma as firing two shots, one killing Jessica Lal. The defense's "two-gun theory" relied on ballistic reports (Ext. PW 89-DB, PW 95) suggesting two cartridge cases were from different pistols, but these were deemed vague due to the term "appear," lack of test firing without the weapon, and tampered documents. The Court ruled that such inconclusive ballistic evidence could not outweigh reliable eyewitness testimony, upholding Manu Sharma's conviction.³¹

In *Kalua v. State of Uttar Pradesh*, the Supreme Court maintained Kalua's conviction and death sentence for the killing of Daya Ram with a country-made 12-bore pistol, together with a two-year term for unlawful possession of a firearm. The circumstantial case of the prosecution was predicated on Kalua's motive, a previous threat, a cartridge (Ex. I) discovered close to the victim's cot, and his fabrication of the pistol (Ex. III) from a hidden corn-bin. A firearms expert, Shyam Narain, tested, testing cartridges and testing by microphotographs to establish that Ex. I was fired from Ex. III, on the basis of corresponding chamber impressions. The Court, in spite of the High Court's skepticism regarding eyewitnesses, acted on this uncontroverted ballistic evidence and circumstantial proof to uphold guilt, finding defense allegations regarding planting of evidence to be speculative. Kirk's *Crime Investigation* was cited to affirm that cartridge cases, bearing distinctive markings from breech-blocks, firing pins, and chambers, offer greater evidentiary significance than bullets due to their variety and clarity, enabling positive identification of a specific firearm—a principle the Court applied to link the cartridge (Ex. I) to the pistol (Ex. III). Soderman and O'Connell's *Modern Criminal Investigation* reinforced this by detailing the necessity of photomicrographic examination to confirm breech-block markings, a method mirrored in the expert's microphotographs of test cartridges (Exs. 9, 10) and the evidence cartridge, lending precision to the conclusion that only the appellant's pistol fired the shot.³² The Taylor's *Medical Jurisprudence* further cautioned against dismissing a cartridge's origin unless markings starkly differ, while noting individual firearm characteristics—such as firing pin impressions—typically allow definitive identification, a standard the Court adopted to dismiss speculative defence claims.³³ This case upheld the

³¹ *Sidhartha Vashisht v. State (NCT of Delhi)*, (2010) 6 SCC 1

³² Anoop Modak (eds.), *Firearms Investigation* 178 (Universal Law Publishing, an imprint of LexisNexis, Gurgaon, 2016).

³³ Shankar, Sakshi, *Corroboration Apropos Forensic Evidence: Implications and Precautions* (November 25, 2021). Available at SSRN: <https://ssrn.com/abstract=4025567>

expert's findings, highlighting their importance in establishing the connection of the firearm to the crime.³⁴

In the Supreme Court case *Hari Shanker v. State of U.P.*, ballistic evidence was instrumental in securing Hari Shanker's conviction for the murder of Parshadi Lal under Section 302 IPC, while proving insufficient to implicate Shiam Behari under Section 34 IPC. The ballistic expert, B. Roy (PW 8), confirmed that the spent cartridge (Exhibit P-15) was fired from Shiam Behari's 12-bore gun, and his testimony established that the weapon required a deliberate trigger pull, effectively dismantling the defense's claim of accidental discharge. This evidence corroborated the accounts of eyewitnesses (PWs 1, 3, and 4), who stated Hari Shanker shot from 4-5 paces, and the medical findings of Dr. S.K. Nagauria (PW 2), who noted blackening and cork wads in the wound, suggesting a firing distance of about 3 feet. The upward trajectory of the wound, as reconciled with *Modi's Medical Jurisprudence*, further supported the prosecution's narrative. However, while ballistic evidence conclusively tied Hari Shanker to the act and intent of the shooting, it could not establish Shiam Behari's common intention without additional proof of his active involvement, leading to his acquittal. Thus, ballistic evidence was decisive in proving the weapon's use and Hari Shanker's guilt but limited in extending culpability to others without corroborative intent.³⁵

The ballistic evidence if conflicting with other evidence, then such inconsistency needs to be resolved.³⁶ In the case of *Raza Pasha alias Kamar Miyan v. State of Madhya Pradesh*, ballistic evidence was central to the Supreme Court's decision to uphold the conviction under Section 302 IPC, dismissing the accused's self-defense claim. The ballistic expert's analysis, which determined that the fatal shot was fired from a distance of 10 to 15 yards based on pellet dispersion and the absence of blackening on the deceased's shirt, took precedence over the medical expert's conflicting estimate of a closer range (not more than 10 feet). This scientific evidence was corroborated by eyewitness accounts and physical clues, such as the spot map and bloodstains, placing the deceased in a lane outside the accused's premises at the time of the shooting. The established firing distance undermined the self-defence plea by indicating that the deceased posed no immediate threat, supporting the prosecution's case of intentional

³⁴ Kalua v. State of U.P., 1956 SCC OnLine SC 109

³⁵ Hari Shanker v. State of U.P., (1996) 9 SCC 40

³⁶ Soham K. Luthra, *THE PROBATIVE VALUE OF FORENSIC BALLISTICS UNDER SECTION 45 OF THE INDIAN EVIDENCE ACT, 1872*, 3 IJLR 2022.

killing. Thus, the Court relied heavily on ballistic evidence to resolve discrepancies and affirm the accused's guilt.³⁷

C. Newer challenges

The position today reflects a judiciary is increasingly attuned to forensic capabilities, elevating ballistic evidence as a cornerstone of evidentiary integrity. The newer technological advancements such as the Integrated Ballistics Identification System (IBIS), have revolutionized the field by enabling precise matching of ballistic markings and increasing the accuracy.³⁸ The Delhi High Court in the case of *Sourabh Magoo @ Sunny v. State (GNCT of Delhi)* examined the possibility of creating a ballistic database, storing reports of all firearms for which licenses are issued or endorsed to public, which may be accessed in case of an investigation.^{39,40} The highly sophisticated computerised image analysis system known as IBIS takes striated pictures of bullets and cartridge cases and compares them to a national and growing global image database.⁴⁰ With the introduction of newer technologies including Gunshot Audio Forensics Datasets, 3D Imaging of Firearms Toolmarks, Quantum 3D Microscope and ALIAS Technology, it is predicted that developments in forensic ballistics will keep stretching the limits of the discipline. Through continued research and advances in technology, we can look forward to even more accurate analysis, quicker processing, and better compatibility with other forensic sciences.⁴¹ Yet, despite these advances, the judiciary has not yet squarely addressed whether this increased accuracy should increase the evidentiary value of ballistic evidence in court. This raises the question “ought the reliability of ballistic evidence be reevaluated in light of such technological advancement ” ?

Ballistic Evidentiary Standard in US

The judicial use of firearms comparison evidence in the United States traces its history to the

³⁷ Raza Pasha v. State of M.P., 1984 Supp SCC 354

³⁸ Integrated Ballistics Identification System (IBIS), EBSCO Research Starters, <https://www.ebsco.com/research-starters/science/integrated-ballistics-identification-system-ibis> (last visited Apr 1, 2025).

³⁹ Nupur Thapliyal, *Examine Possibility Of Creating A Ballistic Database: High Court Tells Delhi Police*, (Jan.

⁴⁰, 2022), <https://www.livelaw.in/news-updates/delhi-high-court-create-ballistic-database-arms-act-190265>

⁴⁰ S.S. Baisoya, National Ballistics Imaging Database Management and its Applications in Indian Perspective

The Indian Police Journal (2005) May. 2, 2025, 10.00 AM, <http://www.bprd.nic.in/>

⁴¹ Nyayags, *LATEST INNOVATIONS IN FORENSIC BALLISTICS.*, Nyayags (2023), <https://nyayags.org/latestinnovations-in-forensic-ballistics/> (last visited Apr 10, 2025).

19th century, with an erratic and developing process regarding its admissibility.⁴² The first such endorsement is found in *Commonwealth v. Best*, when Justice Oliver Wendell Holmes of the Massachusetts Supreme Judicial Court upheld the admissibility of firearms evidence, regarding potential mistakes as immaterial.⁴³ However, this early support was not universal. In 1923 Supreme Court in Illinois case rejected such evidence, criticizing the state's reliance on a police officer's unsupported claim that a specific bullet could be conclusively linked to a particular firearm. The court found this assertion to be scientifically unfounded and implausible, given the standardized rifling in firearms of the same model.⁴⁴ By the late 1920s, courts were embracing firearms toolmark identification in large numbers, owed in no small measure to the work of Major Calvin Goddard, a preeminent early expert in ballistic forensics. Judicial acceptance remained widespread, with courts admitting such evidence on a regular basis, from the 1930s forward.⁴⁵

Daubert standard, controls the admission of scientific evidence in federal courts.⁴⁶ Established in *Daubert v. Merrell Dow Pharmaceuticals*,⁴⁷ it is codified in Federal Rule of Evidence 702, obliges judges to see that expert testimony is relevant and reliable. Unlike the previous Frye test, which required merely "general acceptance" in a scientific community, Daubert requires strict criteria: testability, peer review, known error rates, standardized procedures, and general acceptance. A "fundamental problem with toolmark and firearms analysis is the lack of a precisely defined process," according to the NAS's seminal report, *Strengthening Forensic Science in the United States*, published in 2009. The AFTE methodology "does not even consider, let alone address, questions regarding variability, reliability, repeatability, or the number of correlations needed to achieve a given degree of confidence." ⁴⁸ “

The court in *United States v. Glynn* took a more cautious approach.⁴⁹ Though it allowed the government's ballistics testimony, it restricted the expert from making definitive claims about scientific certainty. The judge questioned the underlying scientific assumptions of forensic

⁴² Southern California Law Review Admin, *Judging Firearms Evidence*, Southern California Law Review (2024), <https://southerncalifornialawreview.com/2024/05/14/judging-firearms-evidence/> (last visited Apr 20, 2025).

⁴³ *Commonwealth v. Best*, 62 N.E. 746 (Mass. 1902).

⁴⁴ *People v. Berkman*, 139 N.E. 91, 94–95 (Ill. 1923).

⁴⁵ *Supra* Note 23.

⁴⁶ Cicchini, Michael D., *The Daubert Double Standard*, Michigan State Law Review 705 (2021).

⁴⁷ *Daubert v. Merrell Dow Pharmaceuticals, Inc.* 509 U.S. 579 (1993).

⁴⁸ Brandon Garrett, *Judging Firearms Evidence and the Rule 702 Amendments | Judicature*, (2023), <https://judicature.duke.edu/articles/judging-firearms-evidence-and-the-rule-702-amendments/> (last visited Apr 20, 2025).

⁴⁹ Dack, Jeremy R., *Using Forensic Ballistics In The Courtroom*, 637 Law School Student Scholarship 2014.

ballistics and ruled that the expert could only testify that a match was “more likely than not.”⁵⁰ In *Commonwealth v. Pytou Heang*, they articulated four factors in order to determine the admissibility of forensic ballistic expert testimony. *First*, the evidence and testimony must assist a jury in reaching a verdict by having the benefit of the opinion, as well as the information needed to evaluate the limitations of such an opinion and the weight it deserves. *Second*, in discovery defence counsel must be furnished with documentation necessary to prepare an effective cross-examination or sufficient data to repeat the expert’s identification in an attempt to rebut the government’s expert witness. *Third*, provide the jury necessary background concerning the theory and methodology of forensic ballistics. *Fourth*, if necessary, limit the opinion matching a particular firearm to recovered projectiles or cartridge casings to a “reasonable degree of ballistic certainty”.⁵¹ “

In 2016, the President’s Council of Advisors on Science and Technology Report (PCAST) recommended the judges not admit firearms tool mark identification evidence as it still falls short of the scientific criteria for foundational validity.⁵² Admissibility challenges to firearms identification evidence surged following the PCAST report’s release.⁵³ In *United States v. Tibbs*, the District Court for the District of Columbia took a strong stance by entirely excluding expert testimony on firearms toolmark analysis. The court emphasized that the technique failed to meet the reliability criteria under the *Daubert* standard, citing the subjectivity of comparative analysis, absence of rigorous error rate studies, and the lack of objective standards for declaring a match.⁵⁴ In *United States v. Adams*, the District of Columbia while acknowledging the concerns raised by the scientific community, it allowed the expert testimony with significant limitations. The court prohibited absolute assertions such as matches “to the exclusion of all other firearms” and only permitted probabilistic or qualified conclusions, ensuring that juries

⁵⁰ *United States v. Glynn*, 578 F. Supp. 2d 567 (S.D.N.Y. 2008)

⁵¹ *Com. v. Pytou Heang*, 458 Mass. 827, 846-50, 942 N.E.2d 927, 944-47 (2011)

⁵² Kiersten Houseman, *Presidential Council Issues Report Arguing That Ballistics Testimony Should Not Be Admitted as Evidence*, National Association of Attorneys General (2017), <https://www.naag.org/attorneygeneral-journal/presidential-council-issues-report-arguing-that-ballistics-testimony-should-not-be-admitted-asevidence/> (last visited Apr 14, 2025).

⁵³ Kiersten Houseman, *Presidential Council Issues Report Arguing That Ballistics Testimony Should Not Be Admitted as Evidence*, National Association of Attorneys General (2017), <https://www.naag.org/attorneygeneral-journal/presidential-council-issues-report-arguing-that-ballistics-testimony-should-not-be-admitted-asevidence/> (last visited Apr 14, 2025).

⁵⁴ *United States v. Tibbs*, No. 2016 CF1 19431, 2019 WL 4359486 (D.C. Super. Ct. 2019).

were not misled by overstatements of certainty.⁵⁵ These post-PCAST rulings reflect a shift toward stricter scrutiny, driven by scientific critiques.⁵⁶

For the first time in more than 20 years, Rule 702 of the Federal Rules of Evidence was changed in December 2023. This change was made in response to the Rules Committee's concerns about the calibre of federal decisions pertaining to forensic evidence and its failure to address how forensic experts present their findings in court. The changes explicitly state that: (1) an expert's proponent must demonstrate, by a preponderance standard, that a number of reliability requirements are satisfied; and (2) an expert's opinions must be backed up by a trustworthy application of reliable methods to data.⁵⁷ A common pattern in forensics in general is followed by the arc of judicial review of firearms evidence. Judges limited firearms evidence in a variety of ways in response to more recent scientific criticisms, following early decisions that predated contemporary scientific methodologies. Even though there is still "an overwhelming acceptance" of firearms identification, the long-standing judicial acceptance has weakened recently.⁵⁸

Conclusion

Ballistic evidence occupies a nuanced position in Indian courts, where it is admissible as expert testimony under Section 45 of the Indian Evidence Act, 1872, and Section 39 of the Bharatiya Sakshya Adhiniyam, 2023. Courts view it as a valuable tool for corroborating other evidence, such as eyewitness accounts or medical findings, rather than a standalone basis for conviction. Its role is discretionary—but yet crucial at some junctures. This reflects a balanced approach but the court in Indian remain uncritical about the scientific and empirical basis of ballistic forensics which is highlighted in US in the recent past. U.S. has witnessed a marked shift toward reduced reliance on ballistic evidence, driven by the Daubert standard and the 2016 PCAST report. These developments have exposed flaws in ballistic analysis, leading courts to limit or exclude it in certain cases, where its scientific reliability was deemed insufficient. This growing skepticism highlights a key difference: while Indian courts treat ballistic evidence as

⁵⁵ *People v. Ross*, 129 N.Y.S.3d 629 (N.Y. Sup. Ct. 2020)

⁵⁶ *Supra* Note 36.

⁵⁷ *hlr, Federal Rule of Evidence 702*, Harvard Law Review (2025), <https://harvardlawreview.org/print/vol138/federal-rule-of-evidence-702/> (last visited Apr 22, 2025).

⁵⁸ Southern California Law Review Admin, *Judging Firearms Evidence*, Southern California Law Review (2024), <https://southerncalifornialawreview.com/2024/05/14/judging-firearms-evidence/> (last visited Apr 22, 2025).

a supplementary aid, U.S. courts increasingly demand rigorous validation of its methodology, reflecting a broader reevaluation of its forensic credibility.

There is a need for caution in choosing an approach to ballistic evidence. Ballistic forensics suffers from significant limitations, including subjectivity in toolmark matching, potential human error, and the inability to definitively link a bullet to a specific firearm due to wear, modifications, or inconsistent standards. These shortcomings, widely acknowledged in the U.S., suggest that Indian courts should temper their reliance on such evidence with greater scrutiny. Adopting a more critical stance—perhaps inspired by the Daubert framework—could ensure that ballistic testimony is both relevant and reliable, safeguarding against undue influence on judicial outcomes.

Ultimately, while ballistic evidence remains a useful component of criminal investigations, its imperfections demand a judicious approach. Indian courts should weigh its probative value against its limitations, insisting on corroboration and transparency in expert methodologies, to align with evolving global standards and uphold the integrity of justice.