



B99 The Critical Angle of Bullet Impacts in Common Materials Seen in Forensic Casework

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The goal of this presentation is to demonstrate the angles of bullet impacts into materials that will penetrate, ricochet, or fragment.

This presentation will impact the forensic science community by informing attendees that the approximate angles to which bullets will penetrate or ricochet a material can be crucial to the reconstruction of a shooting event.

A case was investigated that involved the death of a young woman who was killed from a rifle bullet at long range.¹ There was debate as to whether the bullet that struck the victim was a direct shot or had ricocheted off a river between the shooter and the victim. Data from previous research related to bullet ricochet characteristics served as a basis to perform independent testing.² An AK-style rifle similar to the one used in the incident was fired into water at various angles and the departure angles from ricocheted bullets were documented through witness panels. During this experiment, the impact angle at which the bullet ricocheted off the water was evaluated. The impact angle that yielded penetration into the water was approximately seven degrees and greater. Although consistent with previous literature, the question was raised as to whether this angle would vary across other substrates encountered in forensic casework.

It is known that a bullet will ricochet off the surface of a substrate, such as wood, at one angle and penetrate the surface at steeper angle.³ The angle at which a bullet will penetrate/perforate versus ricochet off a substrate is referred to as the critical angle.⁴ An experiment was devised to measure critical angles from 25 shots using two common law enforcement pistol and rifle calibers with standard bullet types. Substrates utilized for this experiment included wallboard, automotive steel, wood, and two different types of glass.

Critical angle results from this experiment varied from five to nine degrees, depending on the surface composition. Attendees will be presented with the specific critical angle determinations from these tests as well as the detailed interaction of the bullet and surface that was captured with high-speed videography.

Reference(s):

1. Wyant, RT, Allgire J. Over the River and through the Woods: The Gadwa Long Distance Shooting Reconstruction. *Proceedings from the Association of Firearm and Tool Mark Examiners*: 2015, Dallas Texas.
2. Haag, LC. The Application of Doppler Radar to Bullet Ricochets from Water. *AFTE Journal*. Volume 49, Number 1. Winter 2017.
3. Mattijssen, E.J.A.T, Kerkhof W. Bullet Ricochets on Wood. *AFTE Journal*. Volume 48, Number 1. Winter 2016.
4. Haag, LC., Haag, MG. *Shooting Incident Reconstruction*. Academic Press 2001, ISBN-13: 978-0123822413.

Critical Angle, Bullet Impact, Ricochet