



# **TENNESSEE BUREAU OF INVESTIGATION**

## *Forensic Services Division*

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### Violent Crime Response Team Standard Operating Procedures Bullet Path Trajectory

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#### **10.22 Bullet Path and Shot Pattern Documentation**

##### **10.22.1 Purpose**

Projectile paths can be important in determining the approximate physical origins of gunshots, location of additional physical evidence, and other general crime scene reconstruction. This procedure provides general guidelines in the identification, reconstruction, and documentation of bullet flight paths based on impact marks including penetrating, perforating, or non-penetrating points of impact.

##### **10.22.2 Equipment and Reagents**

Sodium rhodizonate & buffer solutions  
Trajectory rods and/or string  
Angle measuring devices (e.g., inclinometer)  
Protractor  
Level  
Plumb bob and line  
Laser device  
Tape measure, ruler, etc.

##### **10.22.3 Procedure**

###### **10.22.3.1 Documentation of Defects, Bullet Paths, and Projectiles**

**10.22.3.1.1** Take photographs of the vehicle or item of evidence in its original condition.

**10.22.3.1.2** Identify and document each defect using a uniform system (e.g., A1, D1, etc.).

**10.22.3.1.3** Any projectile found inside a defect should be labeled with a marker number as it shall be collected if possible.

**10.22.3.1.4** Take photographs of the defects with a scale for reference purposes.

**10.22.3.1.5** Document the location of each defect using an approved measurement method (e.g., triangulation, rectangular coordinate, etc.).



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#### **10.22.3.2 Presumptive Testing**

**10.22.3.2.1** Sodium Rhodizonate (NaRho) is a chemical test that can be used to locate the presence of lead and to recognize possible impact marks or holes as well as direction of fire (see VCRT 10.2 Sodium Rhodizonate for additional information).

**10.22.3.2.2** Using the sodium rhodizonate and buffer solutions, perform a negative/positive control. If the controls work as expected, spray each defect. Document the results of the controls and defects in your notes.

NOTE: A positive result will be indicated by a pink color change. A negative result does not necessarily indicate that the defect was not caused by a projectile due to the nature of projectiles and the possible use of lead-free ammunition.

**10.22.3.2.3** If the background of the defect is dark in color or if the result appears to be negative, the defect may be sprayed and then wiped with filter paper and the filter paper observed for the pink color change.

#### **10.22.3.3 Bullet Path Documentation**

**10.22.3.3.1** At least two points of reference are generally needed to establish a path.

NOTE: Direction of travel can sometimes be determined from the shape and characteristics of an impact mark, as well as from bullet material deposition.

**10.22.3.3.2** Metal or fiberglass trajectory rods are the most common tool to document the bullet path.

NOTE: String may also be used.

**10.22.3.3.3** Choose the appropriate diameter trajectory rod and insert it through at least two defects to establish a path.

NOTE: Trajectory rods may be attached together to adjust the length if needed.

**10.22.3.3.4** Plastic cones, rubber o-rings, tape, etc. may be used with the trajectory rods for stabilization.



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**10.22.3.3.5** Document the bullet path, horizontal & vertical angles, using an inclinometer and protractor. Document these results in your notes.

**10.22.3.3.6** Photographs should be made of the trajectory rods in place. The results of the inclinometer and protractor angles may also be photographed at the VCRT member's discretion.

**10.22.3.3.7** A laser may also be used with the trajectory rods and photographs made using specialized photographic techniques.

**10.22.3.3.8** Language may be used such as:

- Driver side to passenger side or passenger side to driver side
- Outside to inside or inside to outside
- Left to right or right to left
- Upward or downward angle

#### **10.22.3.4 Shot Pattern Documentation**

**10.22.3.4.1** The angle of incidence (impact angle) of a shot pattern can be calculated from measurements of the minor and major axis.

**10.22.3.4.2** Measure the minor and major axis. Record the results in your notes.

#### **10.22.3.5 Collection**

**10.22.3.5.1** Every attempt should be made to recover the bullet(s), projectile(s), fragment(s), shot pellets, wadding, etc. from the termination point.

**10.22.3.5.2** Care should be taken to preserve the evidence associated with projectile impacts as well as to avoid damaging the projectile during collection.

**10.22.3.5.3** Properly package, seal, and label evidence.  
NOTE: It is recommended that projectiles be secured in double packaging as they may have sharp edges that could possibly perforate the packaging.