Crime Scene Diagramming: Back to Basics

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It is quite common in crime scene reconstruction for some type of analysis, e.g., trajectory, blood spatter, etc., to be based on measurements taken at a crime scene. The foundation for the analysis is based on the assumption that adequate and proper scene measurements were obtained. If the methodology is called into question during a legal proceeding, then the resulting analysis could be challenged as well.

Many times people focus on using a measuring method or tool that is faster. It does not matter how fast you measure and clear a scene if you measure the wrong item, measure incorrectly, or forget to measure at all. This article is going to discuss a review of the various measurement methods used when “hand” measuring a scene.

Proper scene documentation starts with creating a field sketch; one of the most important pieces of the puzzle. A rough sketch should be completed at the scene; hence the name field sketch. A sketch is a rough drawing of the layout of the street or floor plan of the building. The sketch should include roadway widths, etc. or dimensional room data when hand measuring a scene. The sketch should also include items like roadway markings, sign locations, and building positions for outdoor scenes. Interior scene sketches should include door, window, and furniture/appliance locations.

While not necessarily shown on a finished crime scene diagram, the locations of witnesses, parked vehicles, photo locations, and addresses of surrounding buildings can also be included on a sketch. Additionally your reference points, lines, or origin should be clearly identified, as well as a rough indication of north.

The physical evidence locations are also included on the sketch, and often a separate sketch is better as it allows more detail. When done properly a sketch will combine the best features of your scene photos and notes. A proper sketch will help the investigator recall details of the scene in preparing the final crime scene diagram. The field sketch is no different from field notes, and departmental procedures should be followed regarding their disposition.

There are four basic techniques that can be used to measure a scene; rectangular/ coordinate system, baseline/ station line, triangulation/ trilateration, and azimuth/ polar coordinates. Regardless of which measurement method you use, they are all based on having known starting points. These items should be relatively permanent in nature. Ideally you want to use the same reference point for all measurements. Having multiple reference points in a scene, while sometimes necessary, commonly causes errors in measurements. Regardless of which measurement method is used, the measured point can be repositioned in a crime scene, on a roadway, or plotted on a scale diagram later.

Each item of evidence or item of interest requires a minimum of one set of two measurements. A straight tire mark or gouge mark that is less than 1' in length can typically be documented with only one set of measurements to the center of the mark. Marks that are longer than 1' require a minimum of two sets of measurements; one to locate the beginning and one to locate the end. Curved marks require enough sets of measurements to be able to reproduce the mark on paper or in a CAD program.

Vehicle locations should be documented by measuring at least two tires from the same side of the vehicle. If the vehicle is badly damaged then it may be necessary to document the other two tires and/or additional features on the vehicle. For most items of evidence, taking a single set of measurements to the center of the object is sufficient. If the orientation of the item such as a knife, or a gun is important then it will be necessary to take two sets of measurements to be able to accurately reproduce the item in a diagram.

Using rectangular measurements, also known as the Cartesian coordinate system, is likely the most commonly used method. This method can easily be accomplished by one person. However, if done improperly, using this method can introduce error. Using this method establishes a location based on an “x” axis and a “y” axis measurement. For items that have an elevation above or below the ground surface a third measurement along the “z” axis must also be obtained.

Measurements are taken from the two closest walls, curb lines, or other straight lines at an approximately 90 degree angle. One set of two measurements is needed for each location you intend to measure. In the example shown in Figure 1, measurements are shown for the gun which is located 5’4” south of the north wall and 5’3” east of the west wall. Here you would need to ensure the tape measure was perpendicular when taking each measurement from the wall to the gun.

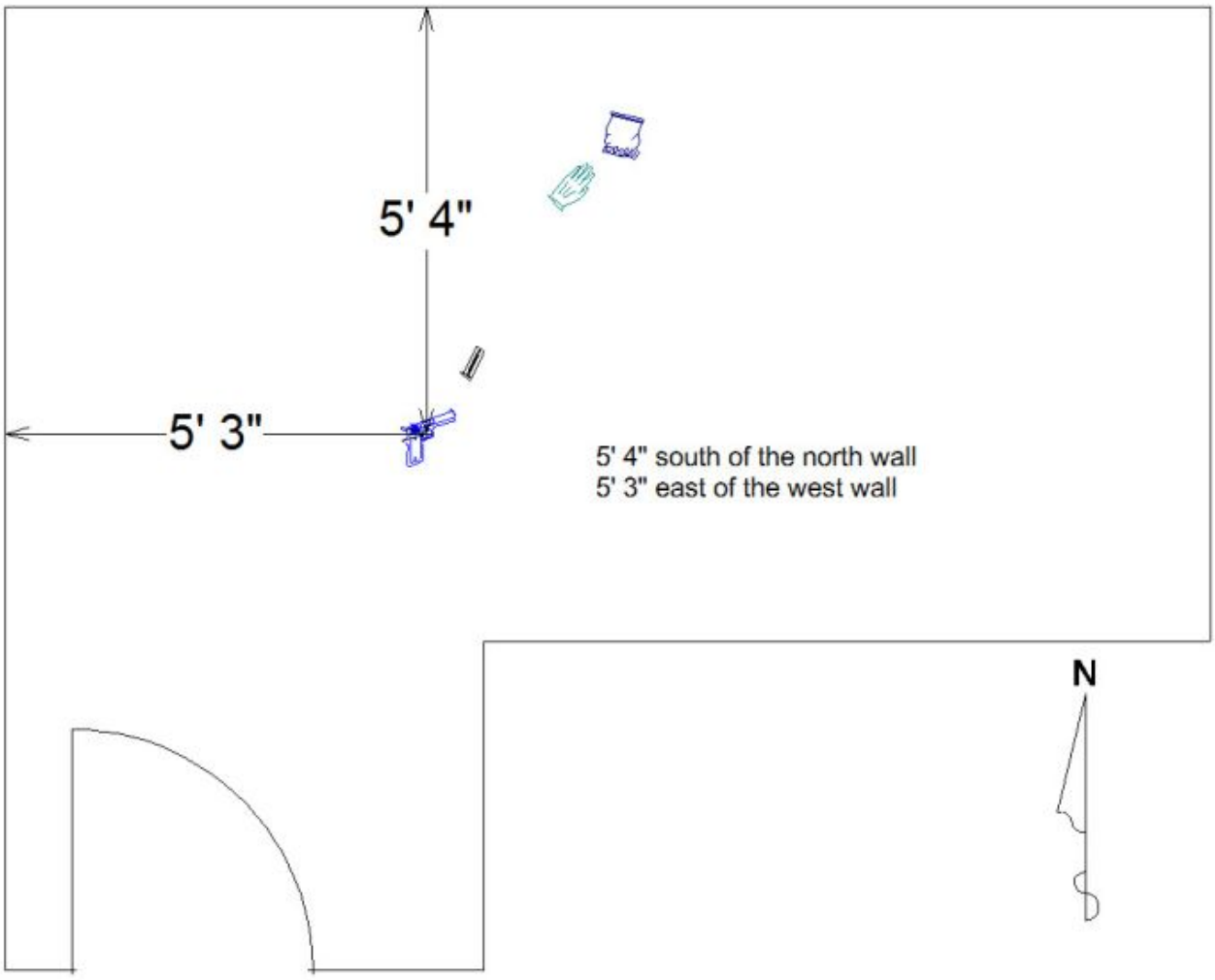

Figure 1: Baseline measurements taken perpendicular from two walls to a gun.

The use of a baseline or station line is very similar to the coordinate system in that you still need a minimum of two measurements for each item of interest. This method can also easily be accomplished by one person. Measurements are obtained by securing a steel tape measure on the floor, ground, or roadway extended through the scene. The zero end of the tape measure is your origin and is commonly referred to as 0+00. The first zero references the end of the tape measure, and the numbers following the plus sign represent the distance along the station line. Should measurements extend beyond a 100’ steel tape measure a second tape measure can be added, and measurements would be indicated as 1+00, etc. Items are measured by locating the position relative to the origin point, and perpendicular from the station line using another measuring tape.

The example shown in Figure 2 shows a station line placed in the same scene, in the “middle” of the evidence. There are two important things to document regarding station lines. The first is the location of the station line in the scene, e.g., is it parallel to a curb or wall, or does it run diagonally through the scene. The second is the direction in which numbers increase. The station line in Figure 2 is located 3’3” south of the north wall, and numbers increase in a positive direction to

the east. Here, the station line is parallel to the north wall, so care should be taken to be sure both ends of the tape measure are the same distance from the wall. The gun is located 5’3” along the station line and 2’1” south of the station line. This language can be shortened in your report and indicated as 0+5’3” by 2’1” south. With this method you only have to worry about one measurement being perpendicular; the measurement from the station line to the item of interest.

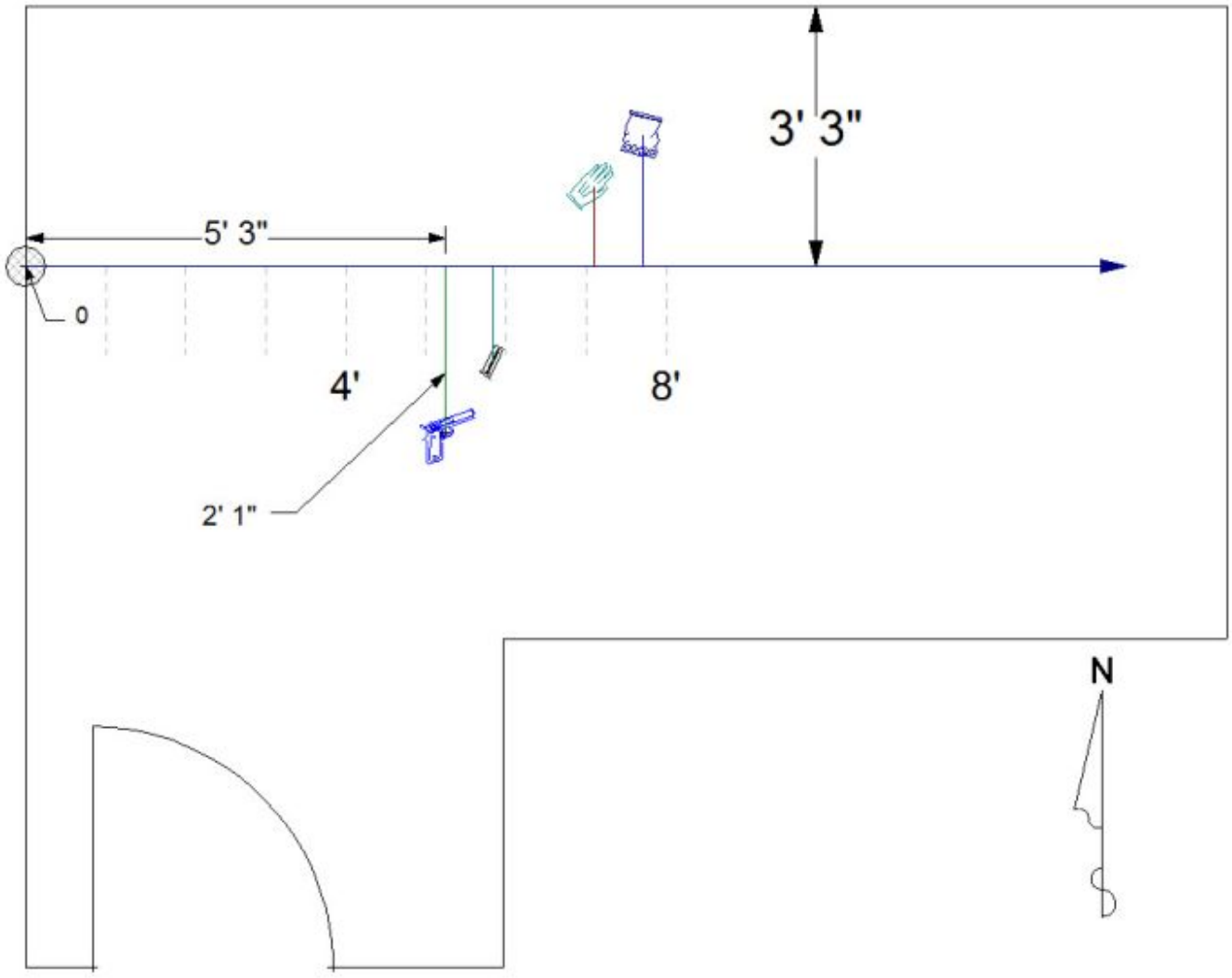

Figure 2: Station line measurements taken perpendicular from the station line to a gun.

Photo 1 shows a tape measure placed along one wall in a hallway. The zero end of the tape measure (origin) is located in the corner of the hallway near the spinning wheel. The second tape measure was placed perpendicular measuring from the station line to the credit cards. The inset of Photo 1 shows the second tape measure is located at 9’0” along the station line and the measurement to the credit cards is 1’0”. This measurement would be reported as 0+9’0” by 1’0” west.

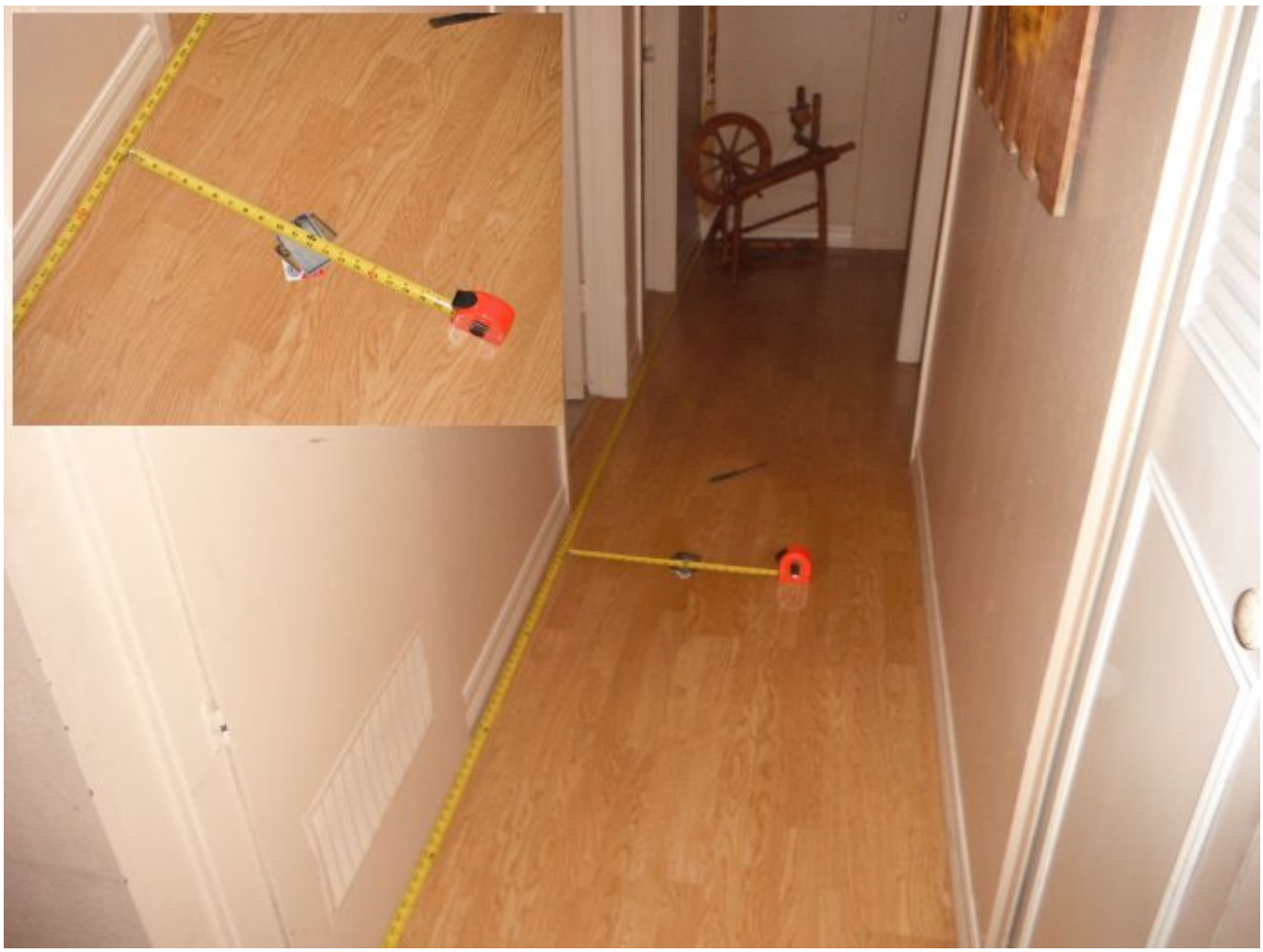

Photo 1: Station line measurements taken perpendicular from the tape measure to credit cards.

A Rolatape was used to measure from the intersection corner 243’2” west to the center of the water main cover shown in Photo 2. This was used as the origin for the station line which was placed on the south curb line. The handle of the screw driver was located 10’9” along the station line and 4’10” north of the station line. This measurement would be reported as 0+10’9” by 4’10” north.

Photo 2: Station line measurements taken perpendicular from the tape measure to a screw driver.

Triangulation is a method that can be used when the scene is irregularly shaped. A proper term for the common methodology used is trilateration, which describes the use of two measured distances as opposed to angles. It may be necessary to use two people to use this method depending on the size of the scene. Two control points are used for this method. They can be fixed objects in a scene such as a corner of a building or a manhole cover. Ideally when using trilateration you should avoid using round objects such as telephone poles or fire hydrants. You want to use as small an object as possible as well as items you can put the tape measure on top of. It is imperative you record the distance between the two control points. You also need to take sufficient measurements to be able to establish the locations of the control points in your scene diagram. In the coordinate system and station line methods you are measuring from a reference line or station line to the item of evidence. When using trilateration you are measuring from the item of evidence to the two control points.

The example shown in Figure 3 shows the two control points were established in the

northwest and southeast corners of the room in the same scene. The distance between the control points is 16’11.5”. A measurement was taken from the gun to control point one (CP1) and determined to be 7’5.5”. A second measurement was taken from the gun to control point two (CP2) and determined to be 10’1”.

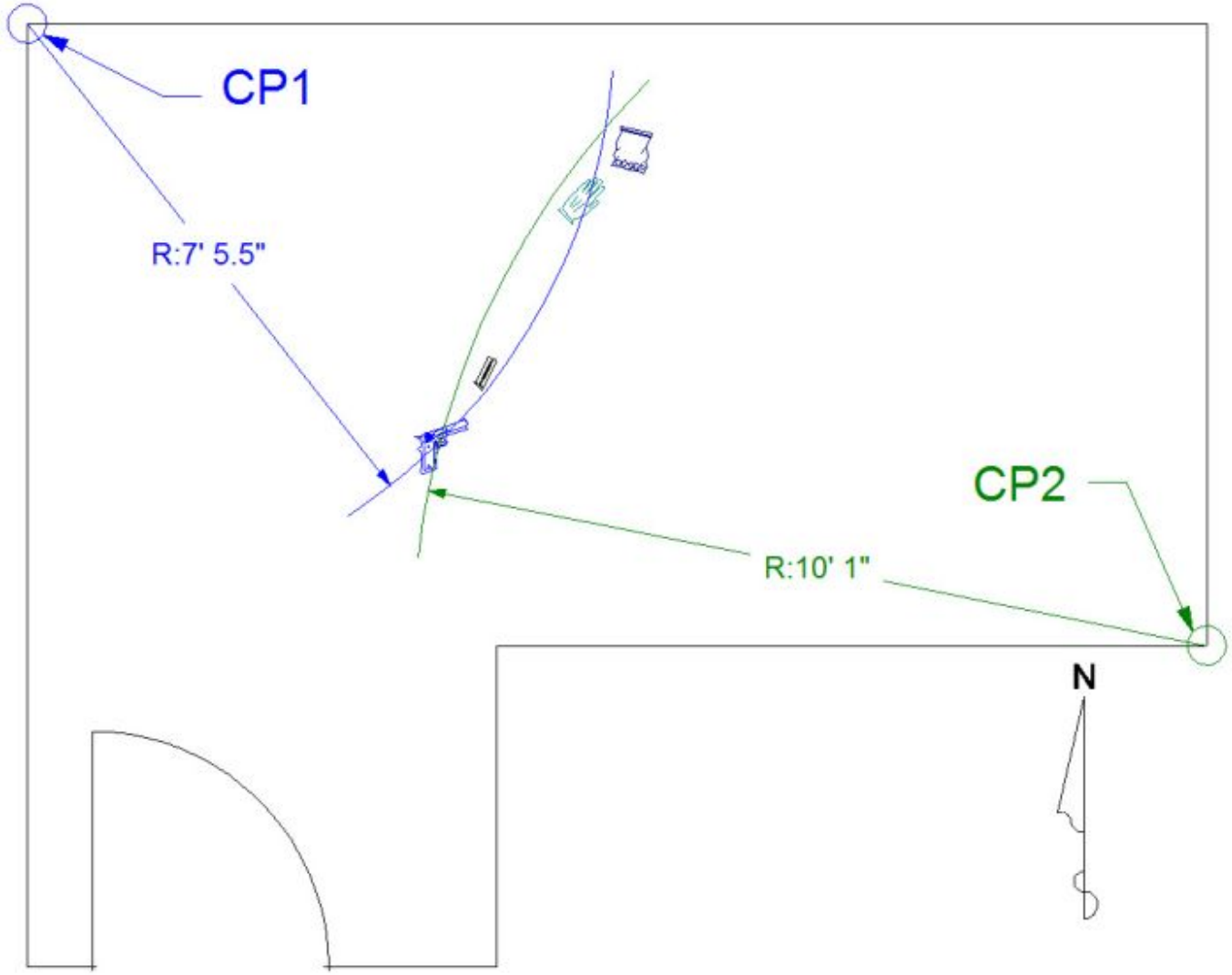

Figure 3: Trilateration measurements taken from two control points to a gun.

It is important when using this method to indicate the direction relative to the control points or walls. At any point along the blue arc the distance to CP1 is 7’5.5”, and at any point along the green arc the distance to CP2 is 10’1”. You can see where the arcs cross near the glove and baggy. The same measurements hold true at both locations, only one of which is correct. Using this method you do not have to worry about your measurements being perpendicular.

Triangulation can easily be accomplished by one person when using a handheld laser measuring device mounted on a monopod. Photo 3 shows an example measuring from the beer bottle to the corner of the room above the pillows. The red laser projecting from the device is outlined with a yellow circle.

Photo 3: Using a laser measuring device and a monopod to measure from the beer bottle to the control point (corner).

The final method known as azimuth uses polar coordinates. This method requires two people; one to hold each end of a tape measure. This type of measuring convention is best suited for large open areas where there might not be any fixed reference points. A known starting point must be established in your scene which might require pounding in a stake. That point is located by using a handheld GPS (global positioning system). A large protractor or some other type of board marked with a circle and degree increments is used. The zero location on the board is oriented toward magnetic north.

The combination of a tripod and handheld laser measuring device can simplify this process. Each point is determined by measuring a distance from the center of the board to the item of interest. The electronically measured distance and the angle are recorded.

Here are some suggestions for proper scene documentation:

- All measurements taken to/from items of evidence should, if possible, be in/on the same plane as the object being measured.
- Do not have too many origins; use only one when possible.
- Usually, you will not be able to, and should not, combine measurement methods; e.g., part station line, part trilateration.
- Make sure you take sufficient measurements to be able to reproduce the item on paper or in a CAD program.
- Make sure you reference the correct curb lines or walls when recording measurements.
- Do not use anything other than a tape measure or laser measuring device if using triangulation/trilateration.
- When using triangulation/trilateration try to pick reference points that are on opposite sides of the roadway or scene.

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