If the designer projects to the backstop a line that is perpendicular to the end of the firing line, he must provide a backstop with sufficient runoff to the right and left to contain rounds with a 5-degree wobble, which is predicted as normal dispersion.

The designer would provide ground baffles to catch rounds that ricochet. The purpose of ground baffles is to intercept rounds skipping and rising. Theory states that a ricocheting round leaves the point of impact at the same angle under which it impacted. In reality, that's not true because there are a lot of surface irregularities. The designer, however, must follow the theory. The designer places ground baffles to intercept the ascending ricocheting rounds before they get over the backstop.

In front of the firing line, the designer places overhead baffles to contain shots that otherwise would travel over the berm.

Site Selection

One of the most important criteria to control range construction cost is to select a proper site. There must be sufficient distance behind the backstop so that sound does not affect the neighbors. You don't want neighbors to complain. Also, if a round or ricochet gets out, it should fall within the range's non-accessible fenced property.

If you build in a populated area, your range must be totally baffled so that the range owner can demonstrate to a judge that a round cannot escape. Ranges are very expensive to construct.

The Tenoroc Shooting Range, near Orlando, Florida, was constructed using these guidelines and moderately priced. Tenoroc will contain a round in a prescribed area should it escape through the baffles.

Baffles

Let's look at an example of baffling requirements. A shooter at a 5-foot-6-inch eye level is in a covered pistol line; you should design a baffle so that his line of sight goes below the first baffle. The shooter's line of sight would intercept the backstop 5 feet from the top. All shots that are fired within this height are going to impact the berm.

If you were to take an angle up to 35 degrees from the muzzle, some type of structural material must be provided on the roof to make sure that a bullet does not go through unimpeded. It must be intercepted so that it will not travel maximum distance. The recommendation for Tenoroc Shooting Range was a construction of sheet steel sandwiched between wood.

In a pistol range cross section of a typical baffled range design, if a shooter makes a shot from the 5-foot-6-inch eye level that is just caught by the bottom of the first baffle, then it also is caught by the top of the second baffle, which gives you an 85-percent reduction in energy for that bullet.

The next design consideration would be shooting from the bench. If the shot clears below the bottom of the second baffle, it is intercepted by the top of the berm. All shots are contained. Obviously, a range should not allow prone shooting if all shots cannot be contained. You must be able to control the shooting that is done within your range. If you want to allow prone shoot-

when firing from the firing line. This type of design allows for prone shooting to occur. This design is more expensive than what was done at Tenoroc Shooting Range.

Typical ground baffles are sandwiched composite construction. You may choose to put additional earth material behind it in order to stop the shot.

The National Rifle Association recommends 45- or 90-degree exit angle baffles for urban areas. Basically, it is steel construction with prestressed hollow-core concrete slabs at a 25-degree angle.

NRA recommends that, if property owners have built or could build dwellings within a half mile downrange of your property, you could possibly get by with a 45-degree angle design and should baffle the range completely, from the firing line to the target line. If neighbors are within one-quarter mile, then the recommendation is to use a 90-degree design. This design is such that if someone pointed a firearm up and fired vertically, the bullet would not leave the range.

Gateway Rifle and Pistol Club

I'm very proud of the design for the Gateway Rifle and Pistol Club, a 2,700-family member club where I'm president. It was designed by competitive shooters. It is made available to the public in Jacksonville, Florida, because we needed to provide a place for community members to shoot.

Gateway has 16 ranges that are operated by competitive shooters. At least two competitions are conducted every weekend, and Gateway is open every day of the year. We also let day guests from the general public use our range.

The pistol complex has 15-, 25- and 50-yard lines. The smallbore rifle complex is 100 yards long. Gateway has a 200-meter high-power rifle range. The range has a silhouette range at the center; action pistol has seven ranges to the east. There is a 100-yard rifle practice range in the northwest corner and an air gun range in half of Building 1.

The 15-yard pistol and 100-yard rifle ranges alone provide income for 25 percent of Gateway's budget annually. That is income from paying guests who are coming in off the street.

Gateway's ranges face northwest toward airport property, which surrounds us to the north, east and west. We have entered into a lease arrangement for airport property off the easterly property line. We shoot shotgun, and the shotfall is off of our property to the east on leased airport property.

Range managers must cultivate the range's neighbors; Gateway members and the board of directors are very active in community relations. We support local politicians; we support 4-H; we help with YMCA. This type of activism has made us a valuable part of the city fabric. The city considers Gateway an asset, as opposed to a sore spot or liability.

Conclusion

Range site selection has got to be done with respect to the safety concerns that I just covered. The site selected is going to dictate how much money you're going to spend developing the range.