**Instructions to Build & Use a Shear to Cut TDR Probe Rods.** S.R. Evett, USDA-ARS, Bushland, TX.

A shear to cut type 316L stainless steel rod, as illustrated in Fig. 1, may be built from tool steel, steel angle, and steel sheet. Drawing 1 gives dimensions and instructions for cutting the three tool steel pieces for a 1/8 inch shear from 2 inch square bar stock. After hardening, the three tool steel pieces are bolted to pieces of 2 inch steel angle that have been similarly drilled and milled (Fig. 2). Both pieces of steel angle are drilled with a 5/8 inch hole to accommodate the 5/8 inch bolt that holds the pieces together and provides a pivot point for the center tool steel piece. The hole is in the same position as shown in Drawing 1. The left piece of steel angle has a 3/16 inch hole drilled in the same position as the 1/8 inch hole drilled in the tool steel pieces (Fig. 3). The right piece of steel angle has a 1/4 inch slot cut into it in the same position as the slot in the right tool steel piece (Drawing 1 and Fig. 4). Both pieces of steel angle have a 5/8 inch hole drilled as desired to allow bolting the shear to a plate of ½ inch sheet steel.

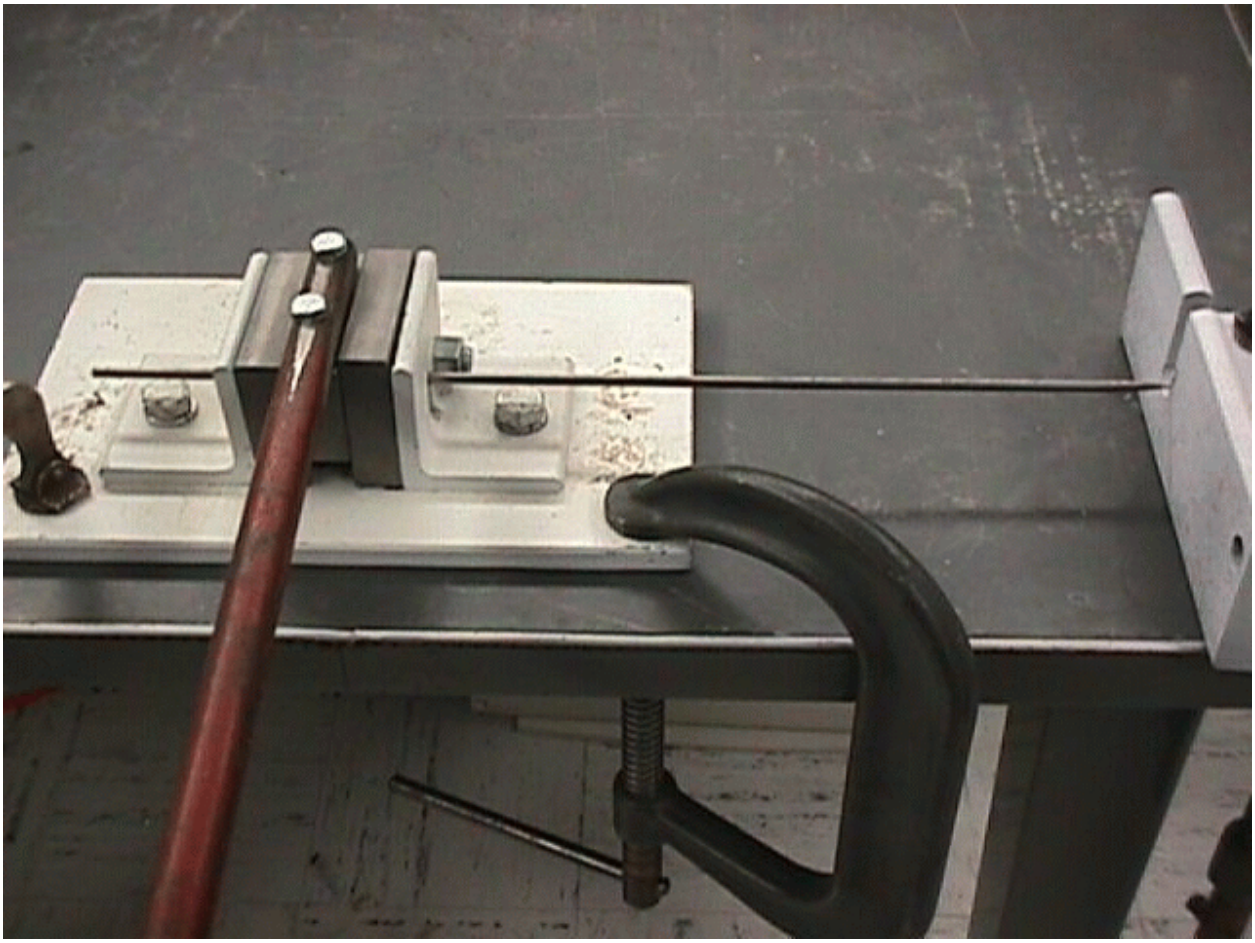


**Figure 1**. Rod shear being used to cut 3/16" rod. The stop at right is positioned using a master rod cut to the exact length desired. The master is inserted into the shear while the handle is in the down position so that the rod butts against the cutting face. Then the stop is positioned at the end of the master rod and clamped in place. A rod is cut by pushing it through the shear from the left hand side until it reaches the stop positioned on the right side. The handle is depressed to shear the rod. The cut rod is extracted by bending it slightly so that it passes through the vertical slot in the stop. Instructions given here are for building a shear for 1/8 inch rod.

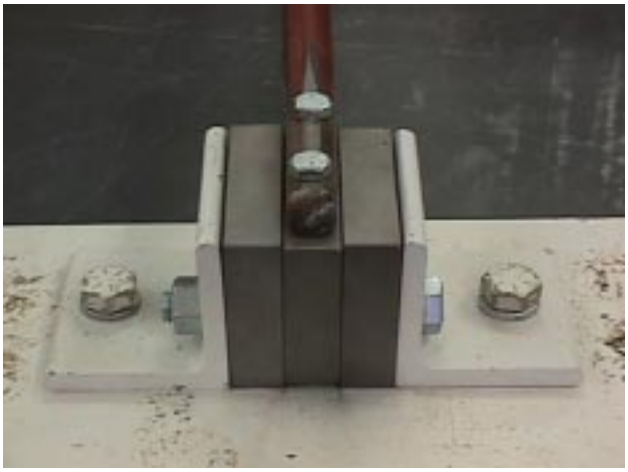


**Figure 2**. The three tool steel pieces are clamped between two pieces of 2 inch steel angle using the 5/8 inch pivot bolt. This view is from the back of the shear. The handle is bolted to the top of the middle tool steel piece.

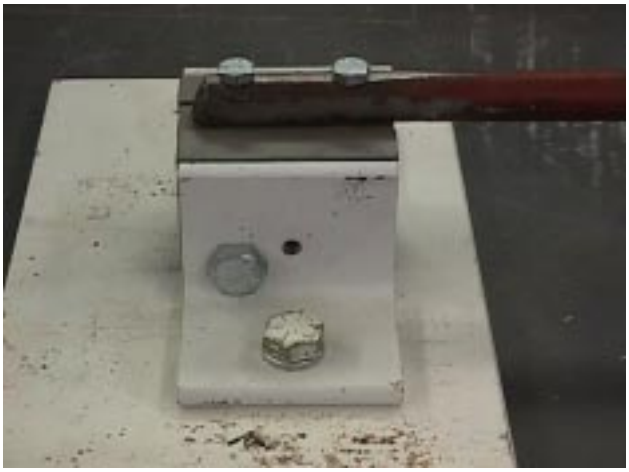


**Figure 3**. The left side of the shear showing the piece of steel angle that was drilled, 1) for the pivot bolt, 2) to allow the rod to be inserted into the shear (center hole visible in photo), and 3) to allow the shear to be bolted to a steel plate.

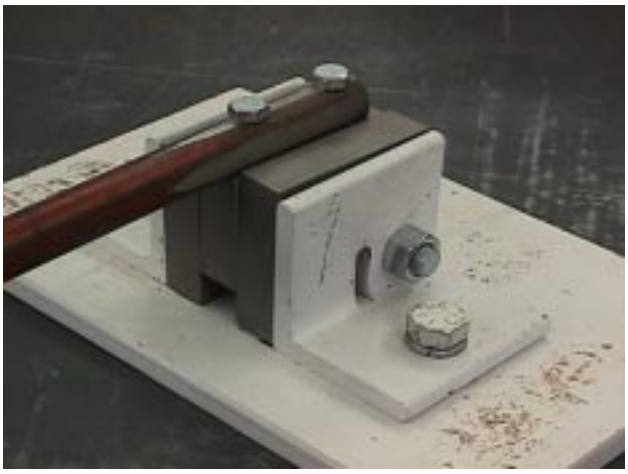


**Figure 4**. The right piece of steel angle is drilled for the pivot bolt and for a bolt holding the shear to the steel plate. It is also milled with a 1/4 inch slot to allow the rod to pass through, and to move downward as it is cut. The middle tool steel piece is seen to be truncated. With the handle in this position, the 1/8 inch holes in the tool steel pieces are aligned and the rod to be cut may be passed through the shear from the left.

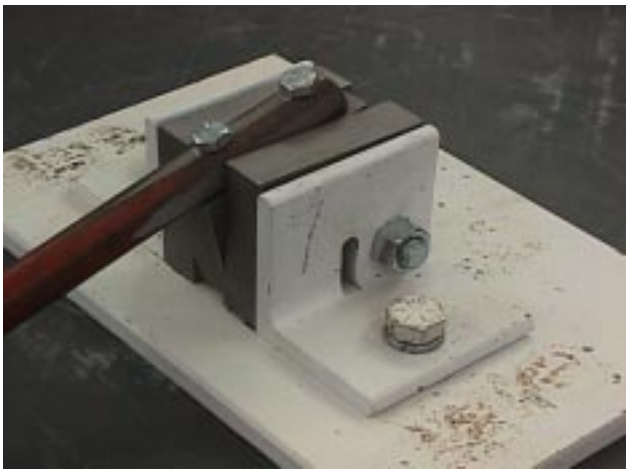
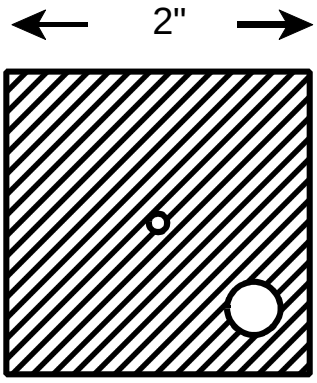
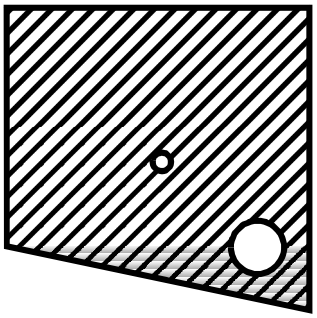


**Figure 5**. The truncated center tool steel piece allows the handle to be depressed. In this position, the holes in the tool steel pieces are not aligned. If a rod were in the shear it would be cut.

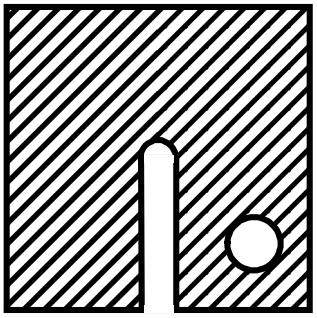
The stop shown at the right side of Fig. 1 is made from a piece of 3-inch steel angle. The handle may be made from a length of 3/4 inch diameter steel rod or cut from ½ inch steel plate.




Left piece.
Center hole is 1/8" diameter.
Hole in corner is 5/8" diameter to accept 5/8" hardened steel bolt.



Center piece.
Center hole is 1/8" diameter.
Hole in corner is 5/8" diameter.
Bottom is truncated to allow downward rotation. Top is drilled and tapped for 5/16" NF bolts at ½" from each end.



Right piece.
Mill 1/4" wide slot to center.
Hole in corner is 5/8" diameter.

Cut pieces from 2" square tool steel bar.
Pieces are 3/4" thick.
Hole in corner is 5/8" diameter to accept 5/8" hardened steel bolt.
Drawing is not to scale.
S.R. Evett, USDA-ARS, Bushland, TX, 20 Mar. 2000.

**Drawing 1.**

**Using the Shear**

The base plate of the shear is clamped (or bolted if holes are drilled in the plate) to a work bench (Fig. 6). The handle is then depressed so that the holes through the left and center tool-steel pieces are not aligned. A master rod, with the exact length desired for the cut rods, is inserted into the shear from the right side until if butts against the face of the left tool-steel piece (The plane between the left and center tool-steel pieces is where cutting occurs). Next, the stop is positioned at the free end of the master rod, with the slot in the stop just to one side of the end of the rod (Fig. 7).

**Figure 6**. Clamping the shear to the work bench. Two more clamps are needed on the other two corners of the base plate.

**Figure 7**. Positioning the stop against the end of the master rod so that the slot in the stop is next to the rod end.

After the stop is clamped in place (Fig. 8) the master rod is removed by bending it slightly so that it can be pulled free of the shear by pulling it through the slot in the stop. To cut a rod, insert the pointed end of the rod through the shear from the left side until the point butts up against the stop on the rod side(Fig. 9). Depress the handle until the rod is cut, and pull the waste piece from the left side of the shear (Fig. 10). Then bend the cut rod slightly and pull it through the slot in the stop (Fig. 11).

**Figure 8**. Clamp the stop in place.

**Figure 9**. Run pointed rod through the shear.

**Figure 10**. The rod is cut by depressing the handle. The waste piece is removed by pulling it from the left side of the shear. It has been removed in this photo.

**Figure 11**. Remove the cut rod by bending it slightly, then pulling it through the slot in the stop.

Note that if the probes are to be inserted into the soil rather than buried, the rods should be pointed to ease insertion and reduce soil crushing and disturbance near the rods. The rods should be pointed and the points flatted before the rods are cut to length. Flatting the points is desired to reduce safety concerns posed by extremely sharp points, and to prevent length changes due to rapid wear of sharp points.