How High is HI?

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Computing HI (height of instrument above datum) is one of those troublesome tasks that must be performed in the field, and the importance of doing so has often been underestimated.

When a dealer or manufacturer's representative demonstrates a total station, they will invariably set up the total station, walk over to the instrument with the plumbing pole and reflector, and adjust the prism to the same height as the optical centre of the instrument. Then, to demonstrate the elevation reading capabilities of the instrument, they will say, "Let's assume the elevation is 100'." This in fact does demonstrate that the instrument will read the Z coordinate directly in the field, but for production work, it is necessary to be much more precise. We also want to record measurements to the vertical control in our electronic field notes.

If we are concerned with the vertical position of the points that we are collecting in the field, there are three things that should be considered:

1. The bench mark elevation and description.
2. A check bench mark that can easily be seen from the instrument location.
3. The standard rod height (which will be uniform for all measurements unless changed for a specific observation).

With this information in hand, we will first calculate a relative vertical position, which will be programmed into the instrument itself. Then we will calculate the actual height of the instrument above datum (HI), be it assumed, local, sea level, etc.

After recording the bench mark elevation and description and the standard rod height in the field book (handwritten), the first direct observation to the bench mark is made. Switch the instrument to the difference-in-height mode and note the measurement in your field book, remembering that the instrument does not take the rod height into account when it gives the difference in height. It assumes that the reflector is the bench mark. If the height of the rod never varied, that would be well and good, but it does.

In order to compensate for the rod height variance, the relative vertical position of the instrument must be computed. The surveyor must be careful at this time to note whether the sign of the measurement is positive or negative. Let us assume that the reading that was taken (Figure 1) was + 0.75' as read on the display of the instrument, which means the reflector is 0.75' above the instrument. For the purpose of this example, the bench mark is 976.42'. Then we subtract 0.75' from 976.42', which gives the relative vertical position of 975.67'. This relative vertical position is then input to the instrument, and the display for the vertical coordinate should read 976.42'. If it does not, you should check your arithmetic. This is one of the great advantages of using a total station; you have the ability to check your work immediately.

In another example (Figure 2), the difference in height is -0.75', which means the reflector is 0.75' below the instrument. We now simply add the bench mark elevation of 976.42' and the difference in height of 0.75', and the relative vertical position is 977.17'. As in the previous example, this relative vertical position is input to the instrument, and the display for the Z coordinate should read 976.42'. Once the correct relative vertical position is established, we are ready to compute the actual HI. The instrument HI must be known and input as a note in the data collector, so point reduction software or office staff can efficiently reduce the field notes. To compute the HI for the example in Figure 1, add the standard rod length (5.00') to the relative vertical position (975.67'). The resulting HI is 980.67'. To compute the HI for the example in Figure 2, the standard rod length (5.00') is added to the relative vertical position (977.17'). The resulting HI in this case is 982.17'. These computations should be noted in the handwritten field book, and the HI should be noted and coded in the electronic field notes.

An observation to the backsight bench mark, in both the direct and indirect position, should not be made and recorded in the data collector. The instrumentperson should observe the display to determine if the direct and indirect observations are within tolerance. This gives the total station user an opportunity to correct any misadjustment of the instrument before large amounts of data are recorded.

A shot to another bench mark should also be made, viewed, and recorded to assure the operator that the rodperson has indeed come off the correct bench mark. They can now proceed with the work, confident that they are properly oriented.

Our standard operating procedure requires that the bench mark be observed in both the direct and indirect position and that a confirming bench be checked before work proceeds.

We further require our technicians to check a vertical control point to verify that the instrument is still properly oriented, before they disassemble a set-up.

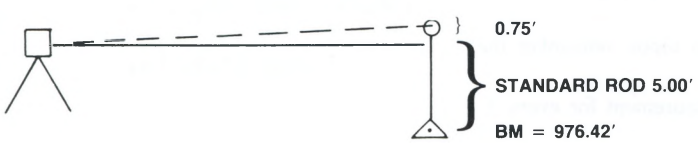

FIGURE 1

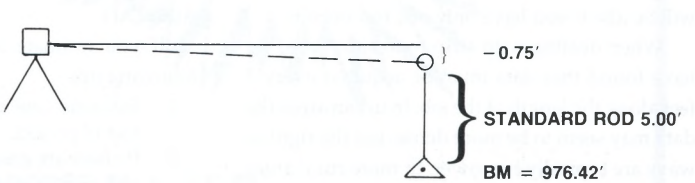

FIGURE 2