

# Investigation of the Accuracy and Geometry of Velocity Head Rods

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**Abstract** There are many occasions in which it may be necessary to determine velocities in remote reaches of streams. Establishing aquatic habitat, restoring a river reach, or determining sediment transport are just a few of the reasons that the stream velocity may be necessary. In years past, common ways of determining the stream velocity have been current meters, the floating chip, and the velocity head rod. The ideal instrument for this purpose would be lightweight, durable, accurate, and simple to use.

The velocity head rod, developed in 1944, is all of the above. A velocity head rod is a staff with a cross sectional shape that allows water to pass smoothly over one face and be impeded by the opposite face. The general cross sectional shape of the rod is to have a square or blunt face on one side of the rod and a tapered edge or "knife's edge" opposite the blunt face. Positioning a rod with the "knife's edge" facing upstream, the operator can read the flow depth of the stream as flow is directed smoothly around the instrument. With the blunt face positioned upstream, water is forced to run up the blunt face a distance equal to the velocity head in the stream, allowing the operator to read the velocity head. Using the Bernoulli's equation, the continuity velocity may then be calculated.

In years past the velocity head rod has been used to determine both the velocity and discharge of mountain streams. Studies have been conducted to determine the accuracy of the rod; however, there have been no studies of the rod geometry and insertion depth of the rod. Tests at the Colorado State University Engineering Research Center were conducted to explore alternate geometries such as a circular geometry, a wing shaped geometry, and the classic velocity head rod geometry. A stabilizing notch was also introduced to examine the effects of containing the velocity head reading in an attempt to improve the accuracy and ease of use of the instrument.

Preliminary results suggest that, when calibrated properly, a full insertion depth is more accurate than insertion depths of one-third or two-thirds depths. It is also apparent that the classical geometry and circular geometry are the most accurate rods. The presentation will highlight the construction, testing, and preliminary results of the test program.