

**KANSAS GEOLOGICAL SURVEY
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COMPRESSIONAL WAVE VELOCITY OF POLYVINYL CHLORIDE
(PVC) PIPING

by

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Introduction

An experiment was performed on October 10, 1994 in order to determine the direct wave velocity of polyvinyl chloride (PVC) piping, the type of piping commonly used to case water monitoring wells in Kansas.

Data Collection

A piece of PVC piping two inches in diameter and 20 feet in length was used for the testing of direct wave velocities. The equipment used for the velocity testing was a 4-hz shear-wave geophone as a receiver, a wrench as a source, and a Bison 2400, 24-bit seismograph as a recording device. The seismograph was set at a 0.25 ms sample rate, the smallest increment available on the instrument. A low cut filter of 4 hz, and minimal gains (a seismograph gain setting of "A"), were applied to the data before recording.

The PVC piping was placed parallel to the ground and then elevated approximately four inches with several wooden blocks. This was performed in order to reduce the effect of waves travelling through the ground. The shear-wave geophone was leveled and affixed to one end of the piping with electrical tape. The source was gently tapped against the opposite end of the piping.

Ten traces were recorded with only a single hit to the end of the piping, and another ten were recorded with five hits stacked together.

Results

Of the two data sets, the single hit and the five hit stacks, the stacked data gives the best overall results. Initial difficulties with the adhesion of the geophone to the piping resulted in more variations of the single hit data.

Analysis of the first arrival information shows compressional waves take approximately 0.003 seconds to travel the length of the PVC pipe (figure 1). Dividing the length of the pipe, 20 feet, by the travel time results in a velocity of approximately 6,670 ft/sec. Given the sample rate of 0.00025 seconds, an error of one sample (ie: the first arrival is actually 0.00275 seconds to 0.00325 seconds) results in an overall velocity range of 6,150 ft/sec to 7,270 ft/sec. A more accurate velocity analysis would have been possible if the sample rate of the seismograph were smaller.

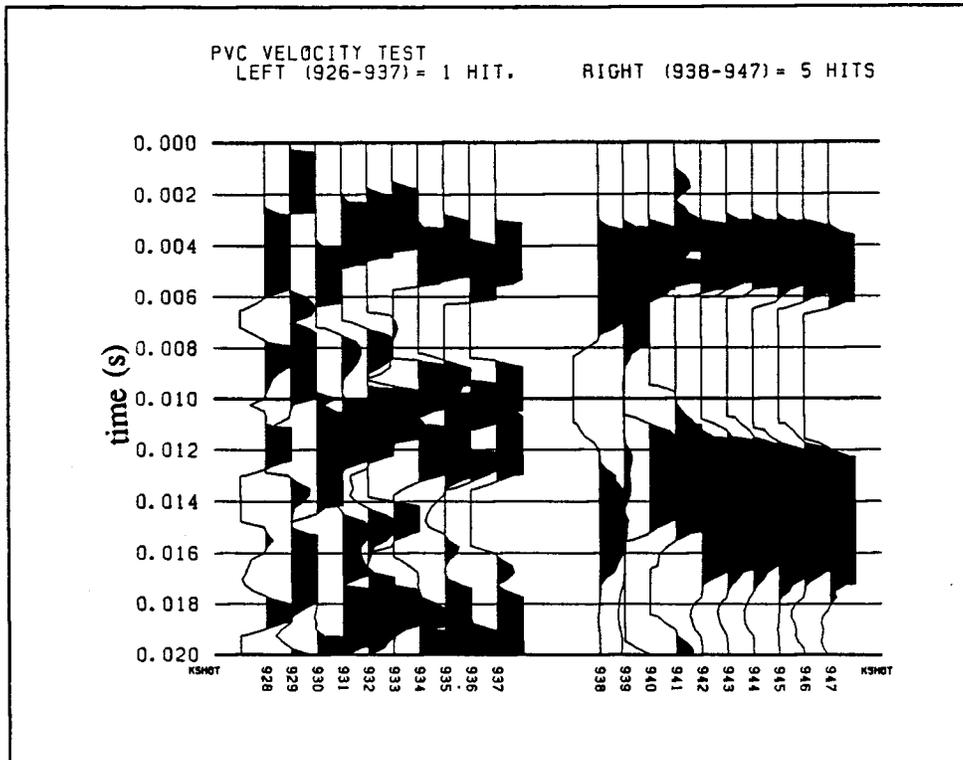


Figure 1: Shown above are the twenty traces recorded during the experiment. As can be seen, the stacked data have much more consistent first arrival times than the single hit data. The average first arrival time of both data sets is approximately 0.003 seconds. As the PVC piping used for the experiment was 20 feet in length, this first arrival travel-time results in a direct wave velocity of approximately 6,670 ft/sec.