MOL.20020509.0131

Attachment II

Included on CD Enclosure 1

** Click on the accession # to view additional record information.*

Accession #	Type	Title *(1 to 1 of 1)*
MOL.20020509.0131	DATA	COMPACT DISK, SUPPLEMENT TO SCIENTIFIC NOTEBOOK SN-M&O-SCI-024-V2, BOREHOLE SUSPENSION SEISMIC COMPONENT OF GEOTECHNICAL INVESTIGATION FOR A POTENTIAL WASTE HANDLING BUILDING, ATTACHMENT II: FINAL PRODUCT CD-ROM (C)

ATTACHMENT III

TECHNICAL NOTE

EXPERIMENTAL VERIFICATION OF P-S SUSPENSION LOGGER SOURCE ACTUATION DELAY

Borehole Suspension Seismic Component of Geotechnical Investigation for a Potential Waste Handling Building

SN M&O- SCI-024- V1 &V2

3/14/02
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TECHNICAL NOTE

EXPERIMENTAL VERIFICATION OF

P-S SUSPENSION LOGGER SOURCE ACTUATION DELAY

January 26, 1999

Objective

There is a finite delay time in the source actuation of the P-S Suspension Logger. This delay time is stated by the manufacturer (OYO Japan) to be 3 milliseconds for the four-conductor P-S suspension logging system, and 4 milliseconds for the seven-conductor system. This delay time is used in the source-to-receiver analysis (S-R1), which in turn provides quality assurance of receiver-to-receiver results (reference Procedure For Oyo P-S Suspension Seismic Velocity Logging Method). This NOTE describes an independent verification of this delay using a simple experiment. The objective of this experiment was to verify that the delay in the four-conductor P-S suspension logging system is 3 milliseconds, plus or minus 2%.

Test Equipment Used

There was no special test equipment required other than the four-conductor P-S suspension logging system. The procedure outlined below was designed to utilize the recorder itself to measure the delay.

Procedure

The procedure outlined below was designed to utilize the recorder itself to measure the delay.

1. Assemble the complete four-conductor P-S suspension logging system using the hydrophone receiver section as prescribed by the manufacturer in the same way as prior to logging a borehole. The reason for using the hydrophone instead of the geophone receiver section is that experiments showed that the geophone string is much more susceptible to the EM pulse in the source coil during actuation.

2. Bend the receiver section around until R1 (lowest in the borehole, nearest to source) is directly adjacent to the source. Keep all parts of the tool from touching each other, especially the "hard sections". Hold R1 about ½ inch away the source (not touching) and above the floor so that only sound is transmitted through air, and not vibration (otherwise this data logger has too much gain).

3. Initialize data logger and record a data record of not more than 0.01 second using a ≤10 microsecond sample period.

4. Use P-S Log to view the record and measure the delay.

Results

Figure 1 shows an example record of the data recorded using the above procedure.

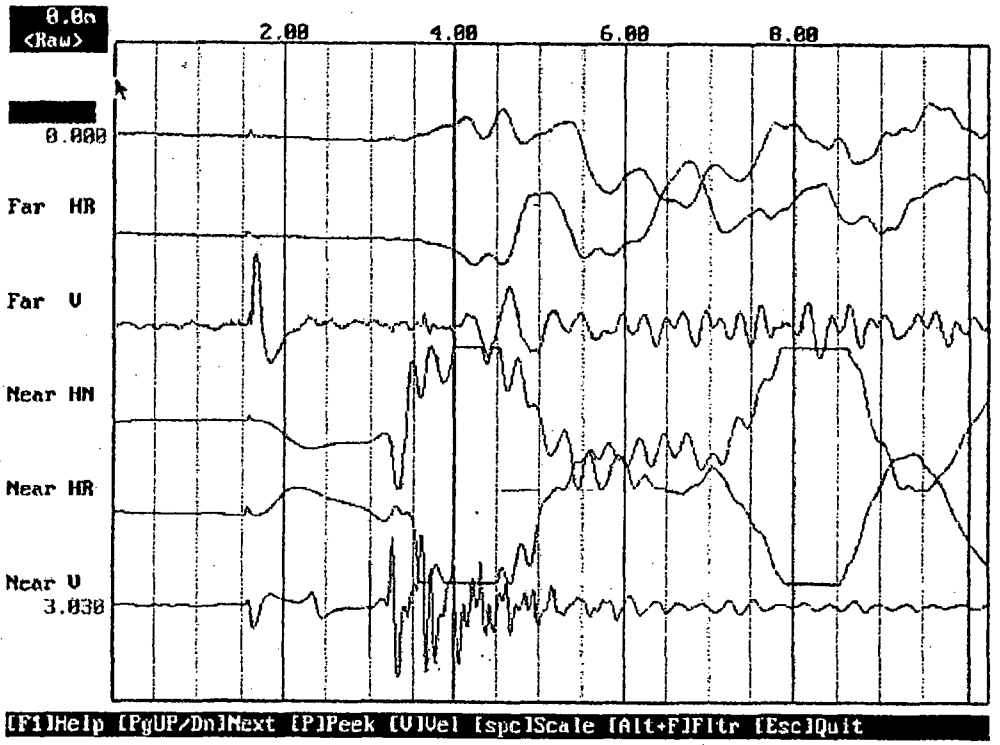

Figure 1 Raw Data

Figure 2 is the subset of this record from 1 to 4 milliseconds. Following is an explanation of the artifacts shown in the figure:

1. This pulse corresponds to switching relay that connects each sensor signal to the recorder. Clearly it occurs at exactly the same time for each sensor. In this case, R2 is one meter away so this pulse has nothing to do with the source actuation.

2. This pulse is visible only on the vertical channel, and is believed to be the response of the vertical coil to the EM pulse of the source coil actuation. The reason the vertical coil responds more than the horizontal is that the vertical coil is oriented 90 degrees from the horizontal coil so its orientation relative to the source is different.

3. This is believed to be the on-set of the acoustical pressure wave emanating from the source. The cursor line is set at 3.03 milliseconds.

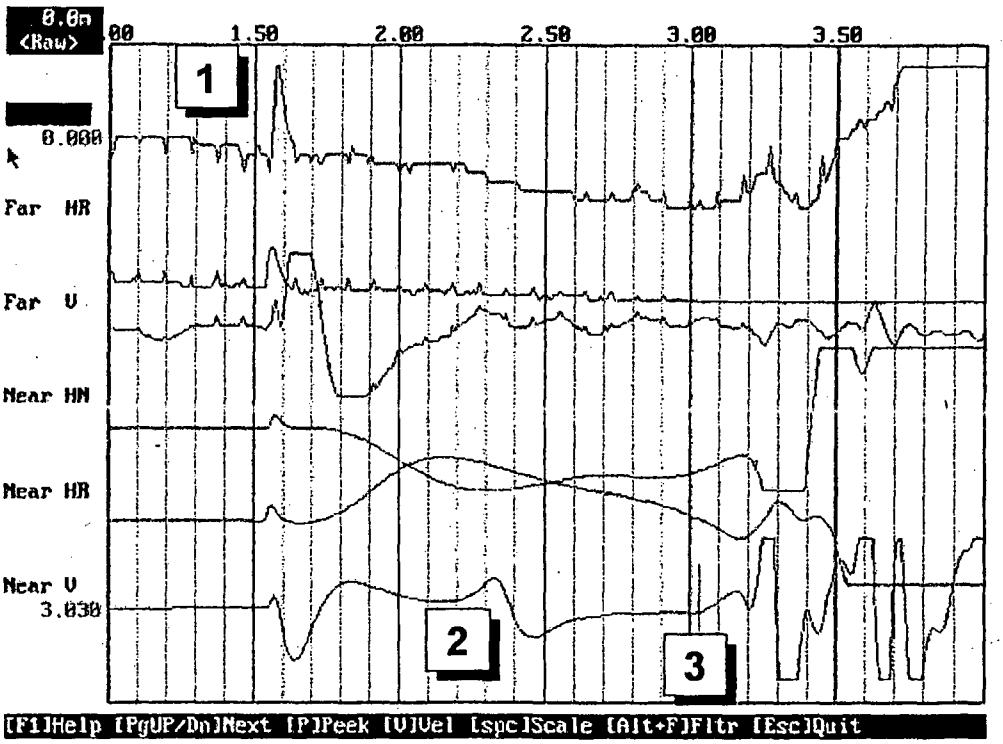

Figure 2 Expanded Section of Figure 1

This measurement was repeated three times yielding arrival times of 3.03, 3.06 and 3.065 (the first measurement has a resolution of .01ms, and the last two, .005ms).

Discussion

There is a travel time of sound through ½ inch of air equal to approximately .04 milliseconds. The travel time through the case of either the source or receiver is considered negligible.

The average measured source delay time for these three measurements obtained by subtracting the .04 milliseconds of travel time in air is 3.01 milliseconds.

Conclusion

The manufacturer's source delay value for the four-conductor P-S suspension logging system of 3 milliseconds seems to be correct based on simple tests.