GSI

Report of
Non-Destructive Crosshole Sonic Logging

TEST SHAFT
BRIDGE REPLACEMENT
ON 9TH STREET over I-235
POLK COUNTY, IOWA

GSI PROJECT NO. 066053
March 21, 2006

Prepared By:

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Prepared For:

Mr. Michael Kemery

Longfellow Drilling

1209 County Highway J23

Clearfield, Iowa

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GSI

March 21, 2005

Mr. Michael Kemery
Longfellow Drilling
1209 County Highway J23
Clearfield, Iowa 50840

RE: CROSSHOLE SONIC LOGGING TESTS
NONDESTRUCTIVE TESTING OF TEST SHAFT
BRIDGE REPLACEMENT ON 9TH STREET *over* I-235
POLK COUNTY, IOWA
GSI PROJECT NO. 066053

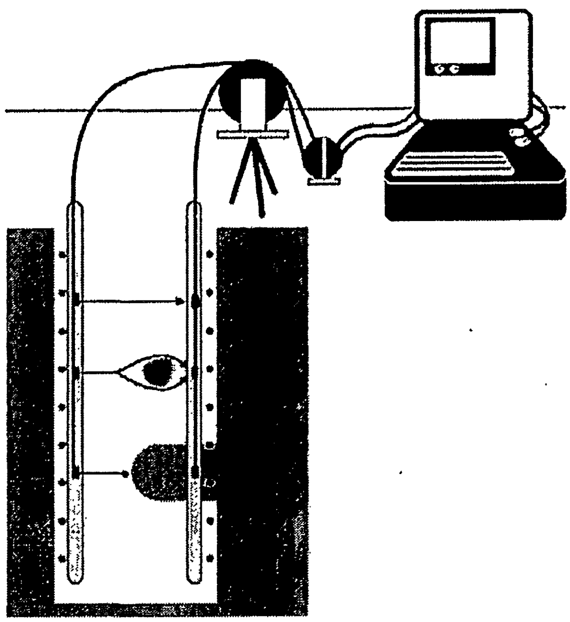
Dear Mr. Kemery:

Geotechnical Services, Inc. (GSI) is providing this report of nondestructive test results for the test shaft at the above referenced bridge. We are providing these services in accordance with the Special Provisions for this project.

Crosshole Sonic Logging tests were performed on March 17, 2006 on the test shaft located at the southeast corner of Day Street and 9th Street on the north side of I-235 in Polk County, Iowa. The test shaft was constructed on March 14, 2006 using the direct rotary and pumped concrete placement method. Four (4) sonic testing access tubes were attached to the inside of the shaft reinforcing steel cage and extended above the shaft concrete. The demonstration shaft included an Osterberg Cell which was located near the bottom of the shaft and the CSL access tubes passed through the Osterberg Cell. The shaft diameter is 760 millimeters. The estimated overall shaft length from the project plans is 19.4 meters and our scanned lengths varied between 18.1 and 18.3 meters. The access tubes consist of Schedule 40 steel pipe with an inside diameter of 51 millimeters and the tubes were filled with water prior to placement of shaft concrete.

Crosshole Sonic Logging (CSL) is a nondestructive test for determining the integrity of concrete in drilled shaft foundations and concrete slurry walls. The test requires that an ultrasonic pulse pass through the concrete between a source and receiver probe, both of which are pulled from the bottom to the top in water filled access tubes in the concrete. These access tubes are cast in the concrete at the time of concrete placement and filled with water to provide a good "connection" between the pulse and the concrete. The position of the probes with respect to the top of the shaft is recorded during the test with a calibrated measurement wheel for the probe cables.

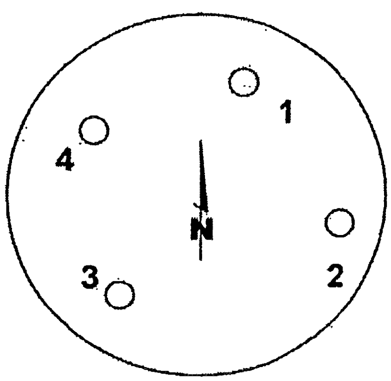
During the test, a high voltage ultrasonic pulse is generated for every 3 to 6 centimeters of probe travel as the cables are pulled. The receiver response and the depth are recorded for each interval and processed with a personal computer based logging system. Please refer to the Crosshole Sonic schematic below for the test setup.



The analysis of the concrete quality is based on the relationship between wave (pulse) travel times between the source and the receiver, and the receiver response energy. Wave velocities can be calculated from the wave travel times and the distance between tubes. Assuming that the access tubes are bonded to the concrete, longer wave travel times and corresponding slower velocities indicate poor quality concrete. If the signal is completely lost, a significant defect or void exists between the corresponding tubes tested.

CROSSHOLE SONIC LOGGING METHOD

The CSL tests for this project were conducted by the author using an Olson Instruments, Inc. CSL-1 system. This system utilizes 10 volt, 35 kilohertz transducers with a diameter of 32 millimeters. The steel access tubes were extended to the bottom of the reinforcing steel cage. The CSL method cannot locate enlargements in the shaft because of the test geometry; however, the test is effective in locating neck-downs and voids because the signal paths are interrupted.



A sketch of the access tube configuration with respect to direction is shown at the left. CSL tests are conducted around the perimeter of the shaft, i.e., tubes 1 to 2, tubes 2 to 3, tubes 3 to 4, and tubes 4 to 1 initially. Crosshole tests are then conducted between tubes 1 to 3, and tubes 2 to 4. In crosshole testing, the source probe and receiver probe is interchangeable between pairs of access tubes.

Plots of six (6) Crosshole Sonic Logs performed for this drilled shaft are enclosed in Appendix A.

The sonic logs for the test shaft exhibit strong signal strength and relatively consistent wave arrival times. No increases in arrival times in excess of 10 percent were observed. Therefore, it is our opinion that the sonic logs indicate sound quality concrete.

GSI

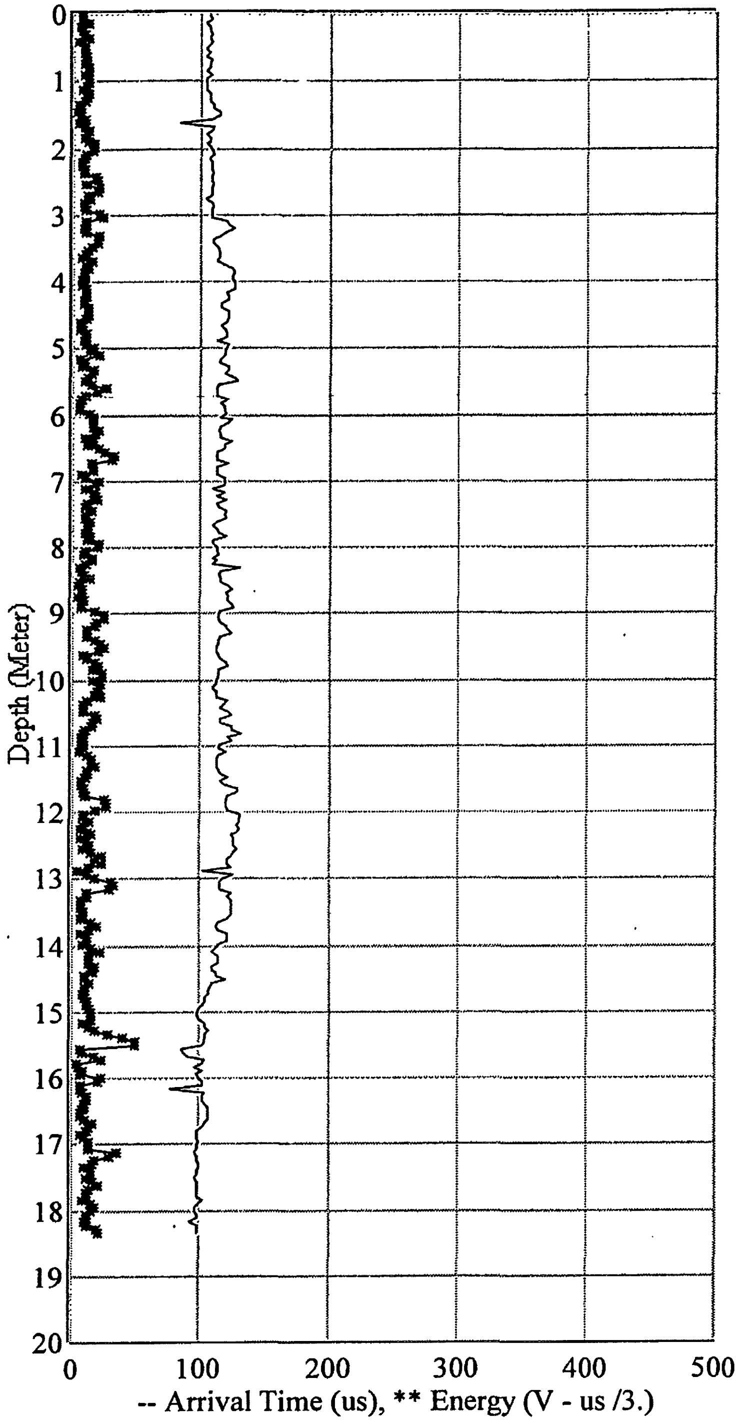
Our services were performed in accordance with generally accepted nondestructive testing practices. If we can provide additional service, please contact us at 515-270-6542.

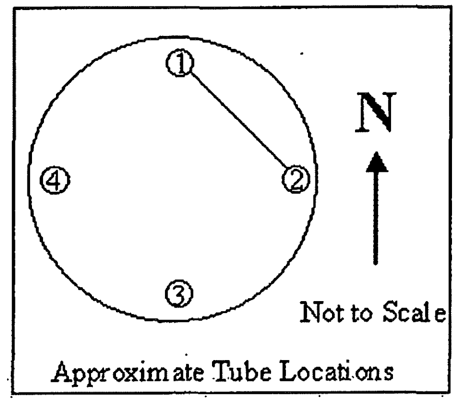
Respectfully,
Geotechnical Services, Inc.

Shihai Zhang
Staff Engineer

Michael T. Lustig, P.E.
Principal Engineer

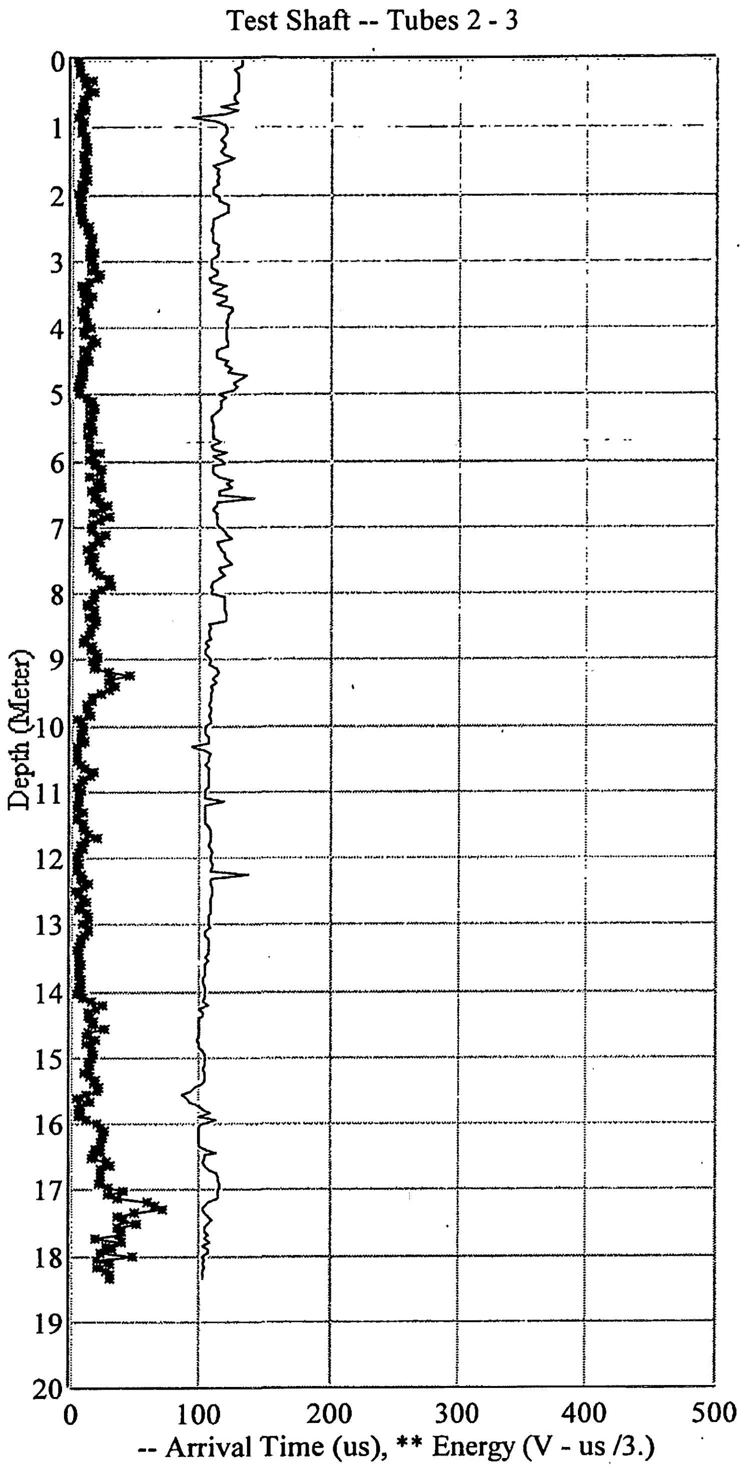
Test Shaft -- Tubes 1 - 2

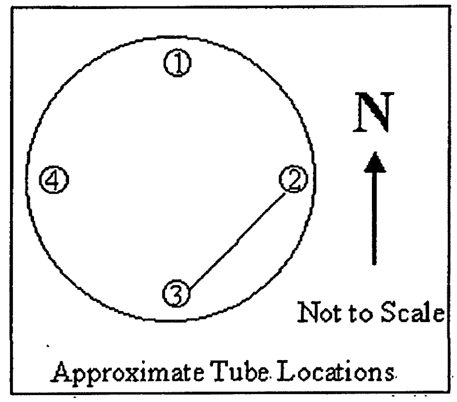




Tube Spacing :	34.29	cm
Signal Gain :	1	
Threshold :	1.50	
At Depth of	2.05	meter
Velocity	3100	m/s
First Arrival Time	108	us
Signal Energy	126.03	V-us

Fig. 1

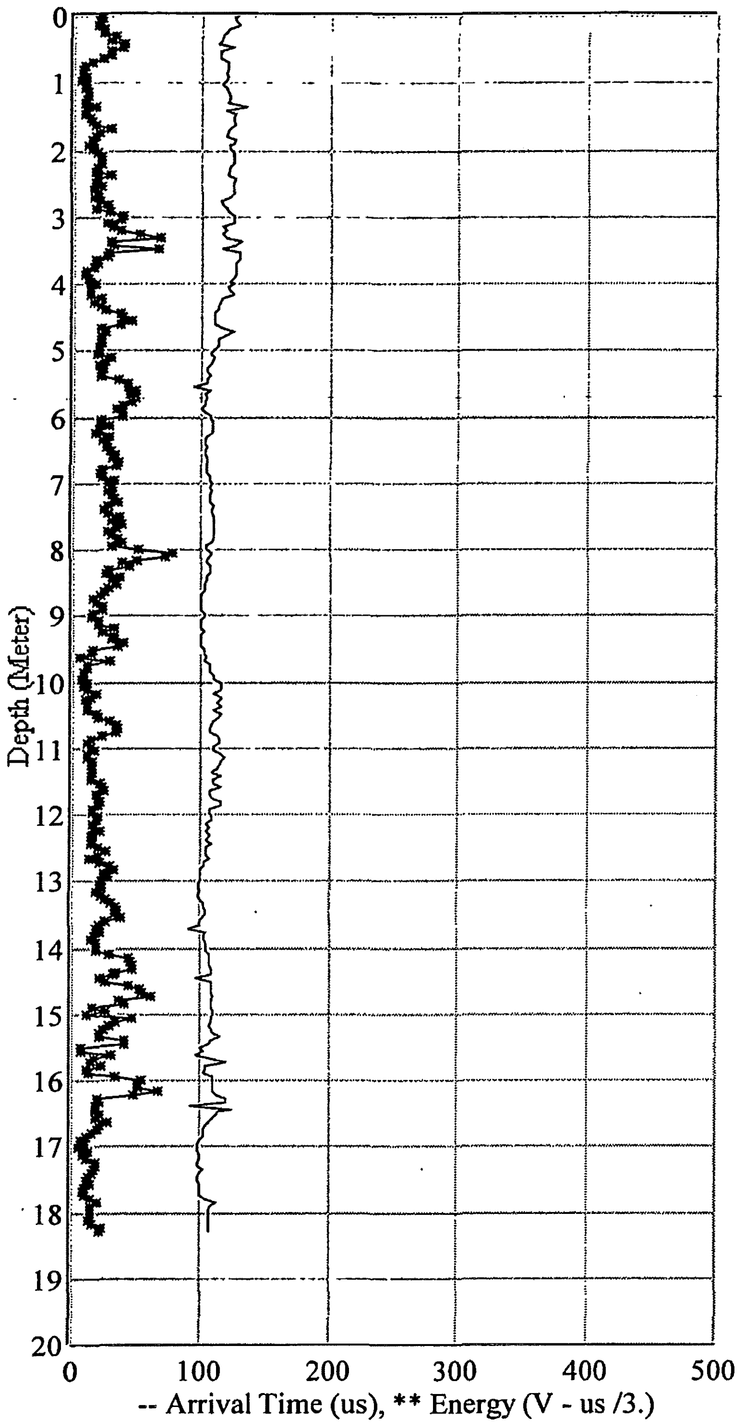


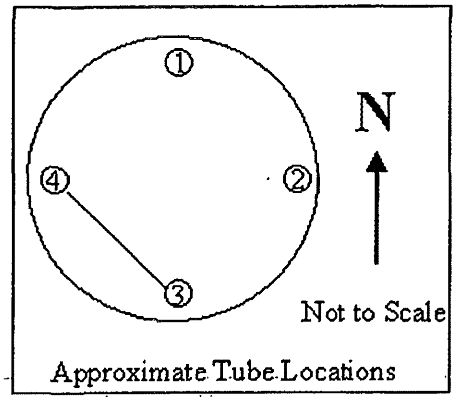


Tube Spacing :	39.37	cm
Signal Gain :	1	
Threshold :	1.50	
At Depth of	2.05	meter
Velocity	3400	m/s
First Arrival Time	114	us
Signal Energy	59.69	V-us

Fig. 2

Test Shaft -- Tubes 3 - 4

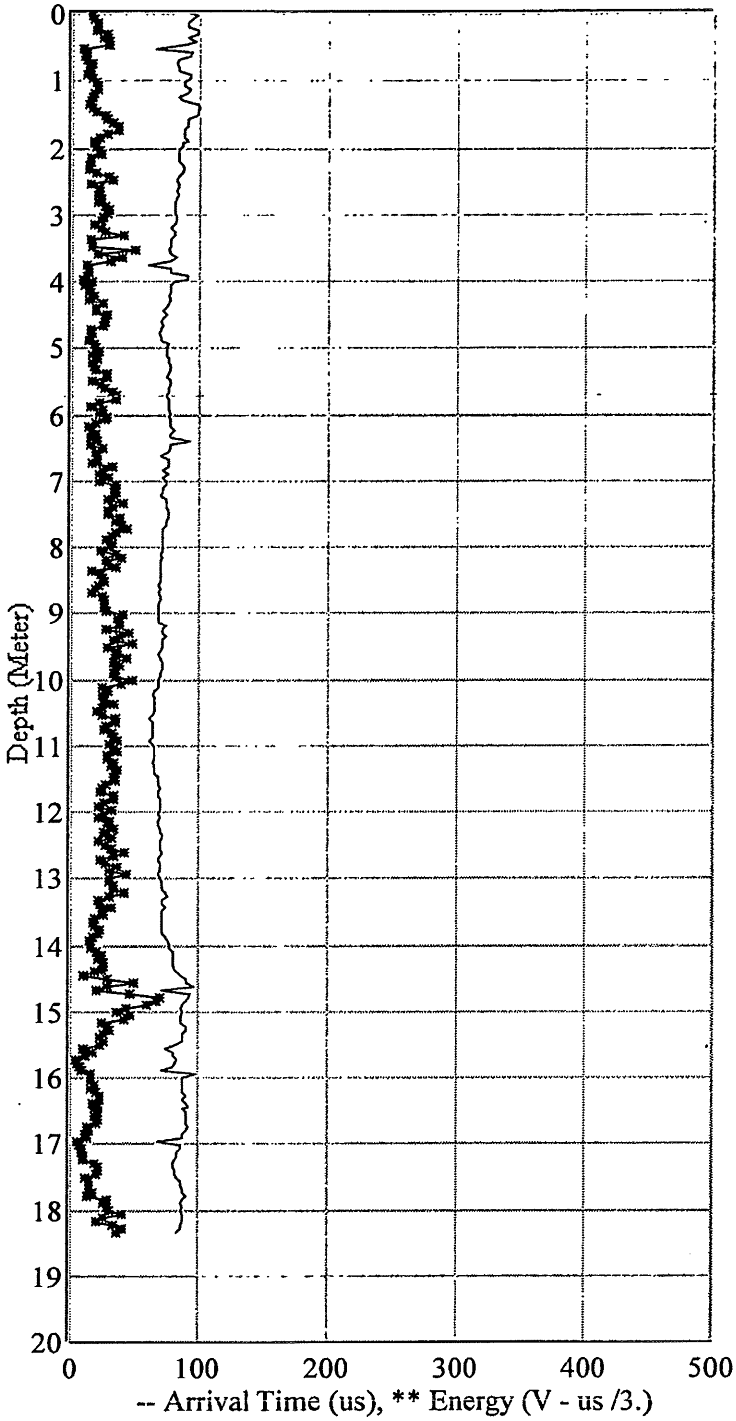


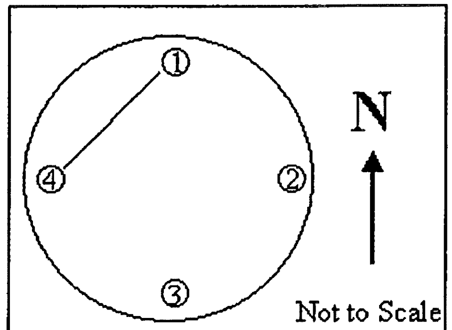


Tube Spacing :	41.91	cm
Signal Gain :	1	
Threshold :	1.50	
At Depth of	2.05	meter
Velocity	3300	m/s
First Arrival Time	124	us
Signal Energy	166.31	V-us

Fig. 3

Test Shaft -- Tubes 4 - 1

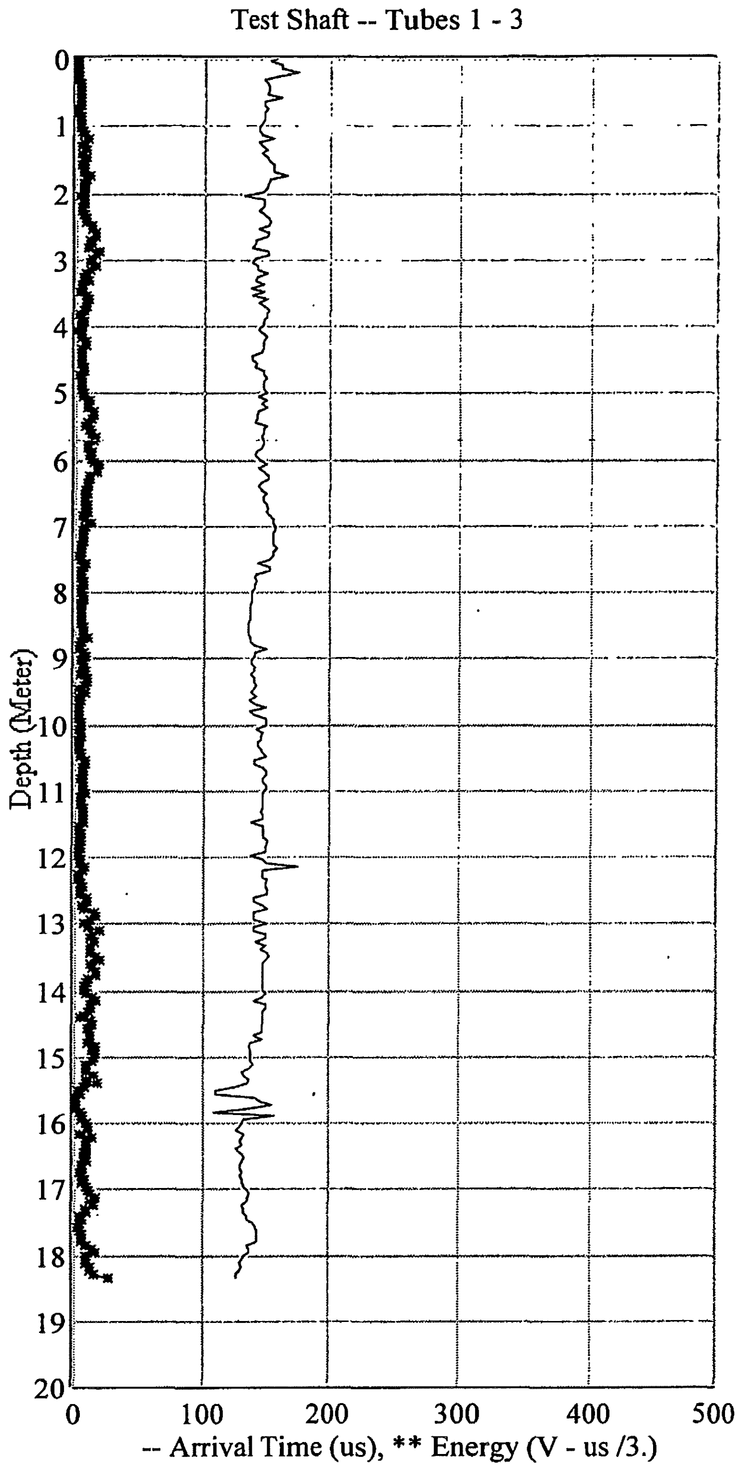


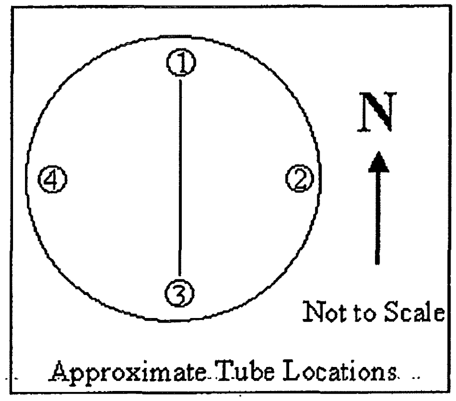


Approximate Tube Locations

Tube Spacing :	27.94	cm
Signal Gain :	1	
Threshold :	1.50	
At Depth of	2.05	meter
Velocity	3300	m/s
First Arrival Time	84	us
Signal Energy	201.89	V-us

Fig. 4

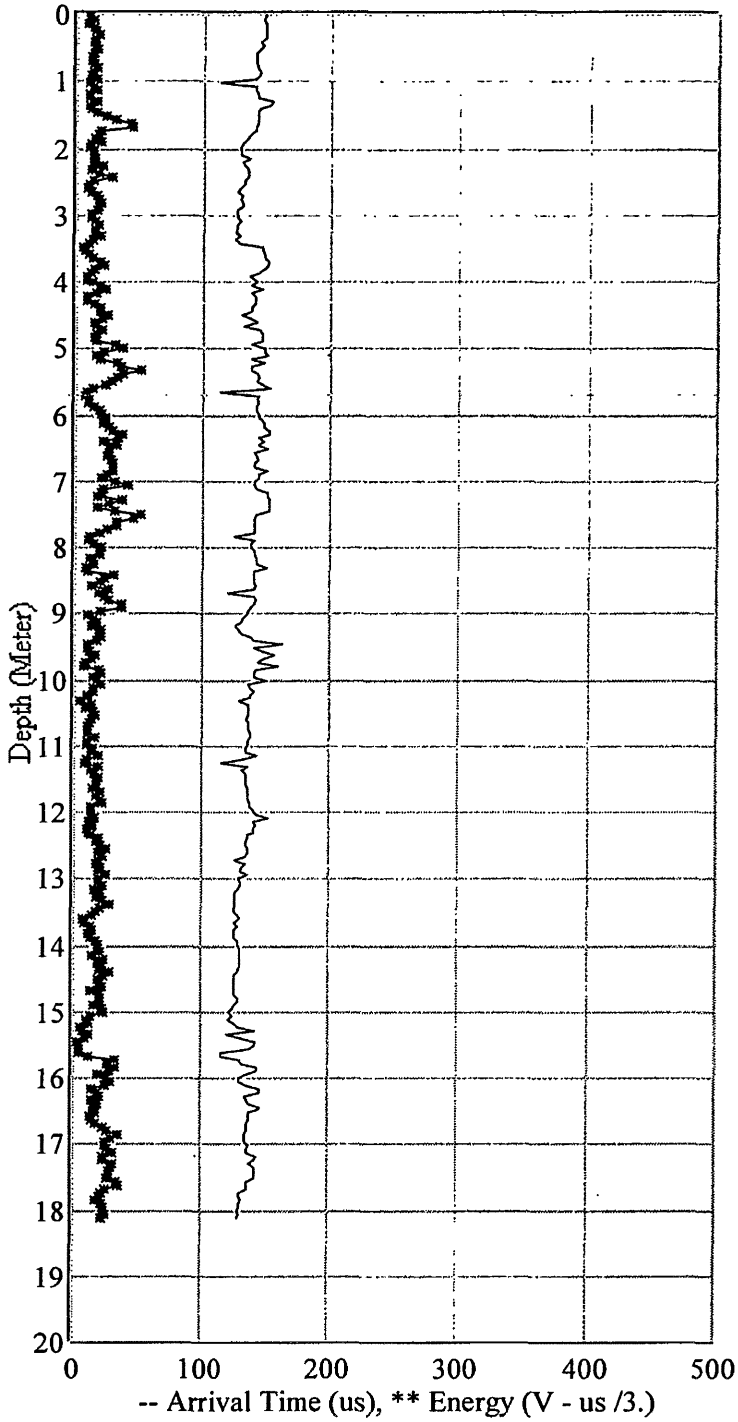


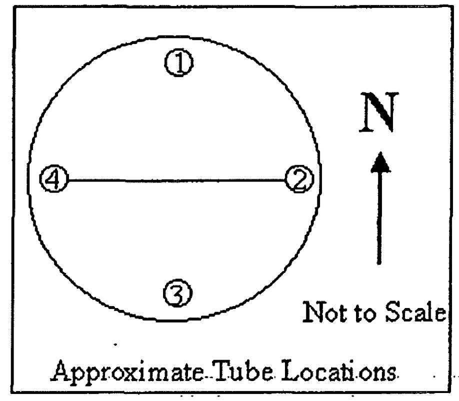


Tube Spacing :	48.26	cm
Signal Gain :	1	
Threshold :	1.50	
At Depth of	2.05	meter
Velocity	3700	m/s
First Arrival Time	130	us
Signal Energy	28.68	V-us

Fig. 5

Test Shaft -- Tubes 2 - 4





Tube Spacing :	52.07	cm
Signal Gain :	1	
Threshold :	1.50	
At Depth of	2.05	meter
Velocity	4000	m/s
First Arrival Time	128	us
Signal Energy	113.11	V-us

Fig. 6