Tests of sand-bags to couple geophones to the earth's surface

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ABSTRACT

Sandbags were used as a means of coupling geophones to the ground as part of the Priddis shoot in July of 2012. The main object was to see if better shear wave data could be obtained. Twenty older geophones were deployed at ten metre intervals along a short portion of the main test line, and their response was recorded for all the source tests that were done. A source line of dynamite charges was used to match the two data sets, but very little shear wave data could be found. The investigation was continued by comparing ground-roll data, where the sand-bag data seemed to be more consistent than the comparable spike-phone data

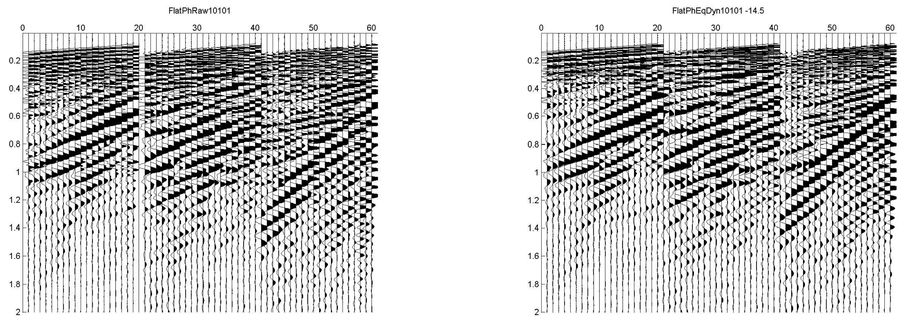

FIG 1: The sandbag records (left) and the spike records (right) from shot 10-101. The panels are vertical, in-line and cross-line. There appears to be more detail on the sandbag cross-line panel.

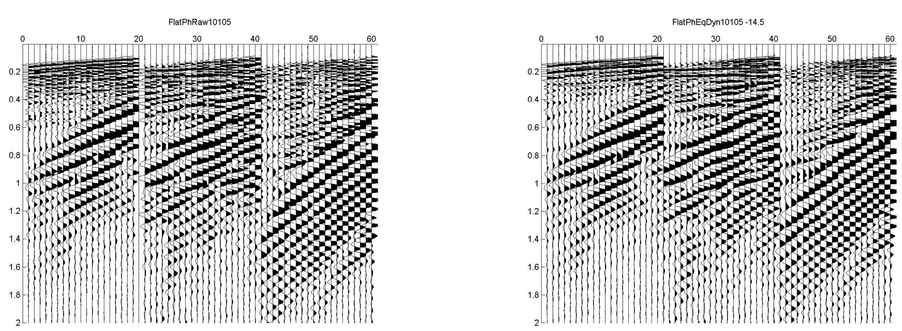

FIG 2: The records from shot 10-105. The spike phone in-line panel has picked up some energy from the cross-line panel .

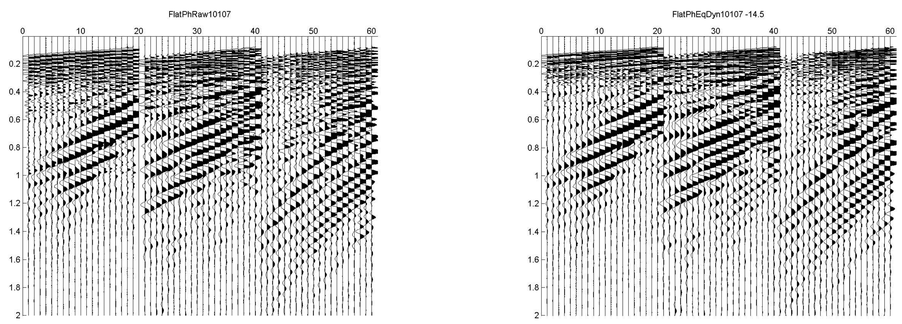

FIG 3: The records from shot 10-107. Here also, the spike phone in-line panel has picked up some energy from the cross-line panel .

GROUND-ROLL ANALYSIS

Since no shear wave events could be found, it was decided to investigate ground-roll on the uncorrelated vibroseis records, and look for the combination of vertical and horizontal motion characteristics of ground-roll. Finding this type of motion would indicate that the horizontal in-line recording was working as expected, and therefore could also record shear waves if they were present. The operator chosen to detect ground roll (GR) is given by

$$GR = U_z \frac{\partial U_x}{\partial t} - U_x \frac{\partial U_z}{\partial t}$$

where U_z is the vertical component, and U_x is the in-line shear component. The display should show black for one rotational direction, and white for the other. Linear displacements (pressure or shear events) should show grey.

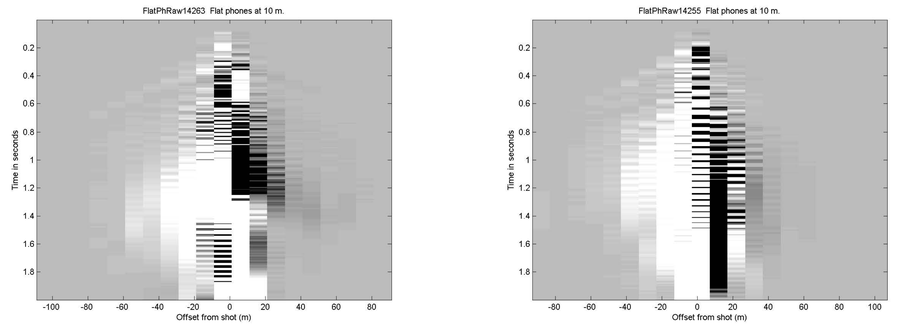

FIG 4: The ground-roll measure of sandbag phones at shotpoints 263 and 255, in the middle of the spread. The display shows considerable opposed rotation energy on each side of the spread, consistent with ground-roll.

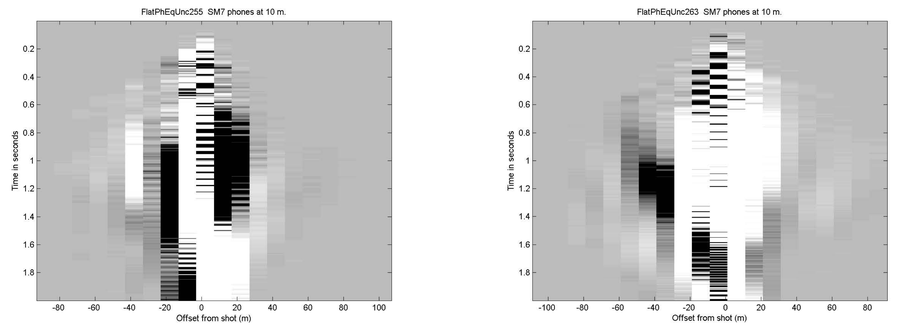

FIG 5: The ground-roll measure of the spike phones at equivalent positions within the sandbag spread. The rotation displays seem almost random.

CONCLUSIONS

The singlefold comparisons show that the sandbag data has frequency content comparable to that recorded on the spiked phones, and seems to separate the in-line and transverse shear energy more effectively.

The sandbag phones detect ground-roll motion more effectively, and therefore are likely recording shear energy with more accurate amplitude and phase.