TBL # 3: Near-surface, SH-wave surveys in unconsolidated, alluvial sediments
Young & Hoyos, 2001

DUE: Monday, October 17, 2016

Overview

This case history consolidates many of the basic concepts related to refraction seismology within the context of an environmental problem. Your goal is to summarize the case history within the context of the 7-Step process. Both refraction and reflection seismic are discussed, this exercise will focus primarily on the refraction seismic portion of the case history. Please provide insightful but brief answers to the following questions.

Instructions

Answer the following questions within the context of the 7 step framework. Your answers should be brief, and point form can be used where appropriate.

Resources

- GPG: Seismic

Setup

Q1. What motivated the study?

Q2. What background information is available?

Q3. What is the objective of their geophysical study?

Physical Properties

Q4. Which physical properties were diagnostic. Provide typical values to show why.

Geophysical Survey

Q5. Which surveys were selected and what was the basic design?

Data Collection

Q6. Consider the P-wave refraction experiment (the data are shown in Figures 2 in Young & Hoyos 2001)

a. What was the source?

b. Sketch the ray path for the refracted wave and show the motion of the particles along the ray path. Indicate particle motion with an arrow.

Q7. Consider the SH-wave refraction experiment (the data are shown in Figure 4 in Young & Hoyos, 2011)

a. What was the source? How does it differ from the P-wave source?

b. Sketch a ray path for the refracted wave and indicate the particle motion using arrows.

Data Processing & Interpretation

Q8. Consider the P-wave refraction data, shown in Figure 1 below.

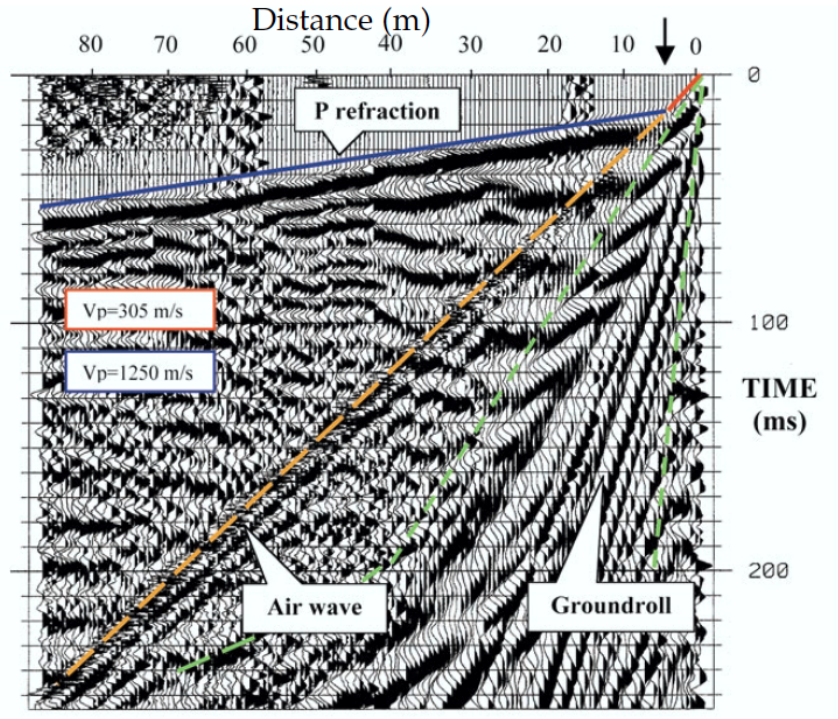

Figure 1: P wave data. (Figure 2 in Young & Hoyos, 2001)

a. What is the P-wave velocity for the direct arrival? Evaluate this from the arrivals on the seismic section and do not use the number provided in the box.

b. What is the estimated thickness of the upper layer? You can use either the intercept method or the cross-over distance. Why is the cross-over distance so close to the shot?

c. To what does this refraction event correspond geologically? Why does it exist?

d. Do you expect to observe this refraction event in the SH refraction data?

Q9. Consider the SH wave refraction data, shown in Figure 2, below.

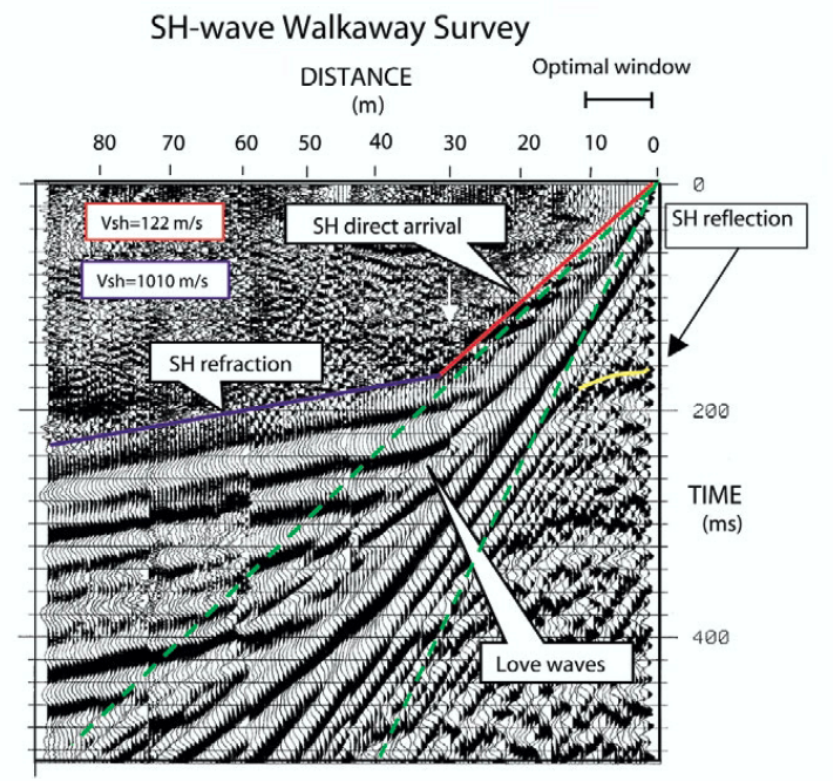

Figure 2: SH-wave data (Figure 4 in Young & Hoyos, 2001).

a. What is the S-wave velocity for the direct arrival? Estimate this from the arrival times on the seismic section. How does it compare with the P-wave velocity?

b. What is the S-wave velocity for the refracted arrival? Estimate this from the arrival times on the seismic section.

c. Estimate the thickness of the top layer using the three methods given below.

- intercept time method
- cross-over distance
- two-way travel time corresponding to the reflection event. This event is marked on the right hand side of the plot.

d. To what does this refraction event correspond geologically?

e. Why is this event difficult to see in the P-wave refraction data?

Synthesis

Q10. Overall, what is the important information that was obtained from each of the refraction surveys?

Q11. Was the seismic refraction effective in finding the gravel lenses at the base of the alluvium? Why or why not?