

이 3개의 경우를 각각 살펴 보자.

[Case 3] $V_1 < V_2$ 인 경우를 생각해 보자. 이 경우 $h > 0$ 인 경우를 생각해 보자.

(1) 임계거리 (Critical Distance) T_d 찾기

[Case 2] AD 경로를 생각해 보자. D 는 임계거리에서 T

$$T_d = \frac{X}{V_1}$$

이다.

(2) 최적거리 (Optimal Distance) T_r 찾기

[Case 2] $ABCD$ 경로를 생각해 보자. D 는 임계거리에서 T

$$T_r = \frac{AB}{V_1} + \frac{BC}{V_2} + \frac{CD}{V_1}$$

$$= \frac{1}{V_1} \left\{ h \sec \theta_c + \left(X - 2h \tan \theta_c \right) \frac{1}{V_2} \right\} + \frac{1}{V_1} \left\{ h \sec \theta_c \right\}$$

$$= \frac{2}{V_1} \left\{ h \sec \theta_c \right\} + \frac{X}{V_2} - \frac{2h \tan \theta_c}{V_2}$$

$$= 2h \left(\frac{1}{V_1 \cos \theta_c} - \frac{\tan \theta_c}{V_2} \right) + \frac{X}{V_2}$$

$$= 2h \left(\frac{1}{V_1 \cos \theta_c} - \frac{1}{V_2} \frac{\sin \theta_c}{\cos \theta_c} \right) + \frac{X}{V_2}$$

$$= 2h \left(\frac{1}{V_1 \cos \theta_c} - \frac{1}{V_2} \frac{\sin \theta_c}{\cos \theta_c} \right) + \frac{X}{V_2}$$

$$\cos\theta_c = \frac{2h}{V_1 \cos\theta_c} \left(1 - \frac{V_1}{V_2} \sin\theta_c \right) + \frac{X}{V_2}$$

由以上各式可得，

$$\frac{V_1}{V_2} = \sin\theta_c$$

将

$$T_r = \frac{2h}{V_1 \cos\theta_c} (1 - \sin^2\theta_c) + \frac{X}{V_2}$$

$$= \frac{2h}{V_1 \cos\theta_c} (\cos^2\theta_c) + \frac{X}{V_2}$$

$$= \frac{2h \cos\theta_c}{V_1} + \frac{X}{V_2}$$

由式(1)可知，当 $\theta_c = 0$ 时， $\cos\theta_c = 1$ ，可得

将

$$\cos\theta_c = \sqrt{1 - \sin^2\theta_c} = \sqrt{1 - \frac{V_1^2}{V_2^2}}$$

将

$$T_r = \frac{2h \sqrt{1 - \frac{V_1^2}{V_2^2}}}{V_1} + \frac{X}{V_2} = \frac{2h \sqrt{V_2^2 - V_1^2}}{V_1 V_2} + \frac{X}{V_2}$$

由式(2)

$$\frac{X_0}{V_1} = \frac{X_0}{V_2} + \frac{2h \sqrt{V_2^2 - V_1^2}}{V_1 V_2}$$

$$\frac{X_0}{V_1} = \frac{X_0}{V_2} + \frac{2h \sqrt{V_2^2 - V_1^2}}{V_1 V_2}$$

$$h = \frac{X_0}{2} \sqrt{\frac{V_2 - V_1}{V_2 + V_1}}$$

由式(3)

由式(3)可知，当 $V_1 = 0$ 时， $h = \frac{X_0}{2} \sqrt{\frac{V_2}{V_2 + 0}} = \frac{X_0}{2} \sqrt{\frac{V_2}{V_2}}$ ，即 $h = \frac{X_0}{2}$ ，此时， h 为常数，与 V_2 无关。

由式(4)可知，当 $V_2 = 0$ 时， $h = \frac{X_0}{2} \sqrt{\frac{0 - V_1}{0 + V_1}} = \frac{X_0}{2} \sqrt{\frac{-V_1}{V_1}}$ ，即 $h = \frac{X_0}{2} \sqrt{-1}$ ，此时， h 为虚数，无物理意义。

速度/m/s	速度/m/s	速度/m/s	速度/m/s
速度	305~610	速度	2750~4270
速度, 速度	468~915	速度	1830~3970

□□(□)	610~1830	□□□	2140~6100
□□	915~2750	□□	4270~5190
□	1430~1680	□□□	4580~5800
□□	1460~1530	□□□	3050~7020
□□	1830~3970	□□	3673

3. Method & Result

[Figure 4] shows the seismic wave arrival times for the 24 channels. The data was collected using a multichannel seismic system (source) with 24 channels. The x-axis represents distance in feet, and the y-axis represents time in seconds. The seismic wave arrival times are plotted for each channel, showing the time delay between the source and the receiver. The arrival times are generally increasing with distance, indicating the presence of a subsurface layer with a lower seismic velocity.

[Figure 5] shows the seismic wave arrival times for the 24 channels, plotted against distance in feet. The arrival times are generally increasing with distance, indicating the presence of a subsurface layer with a lower seismic velocity.

Results of seismic refraction survey.

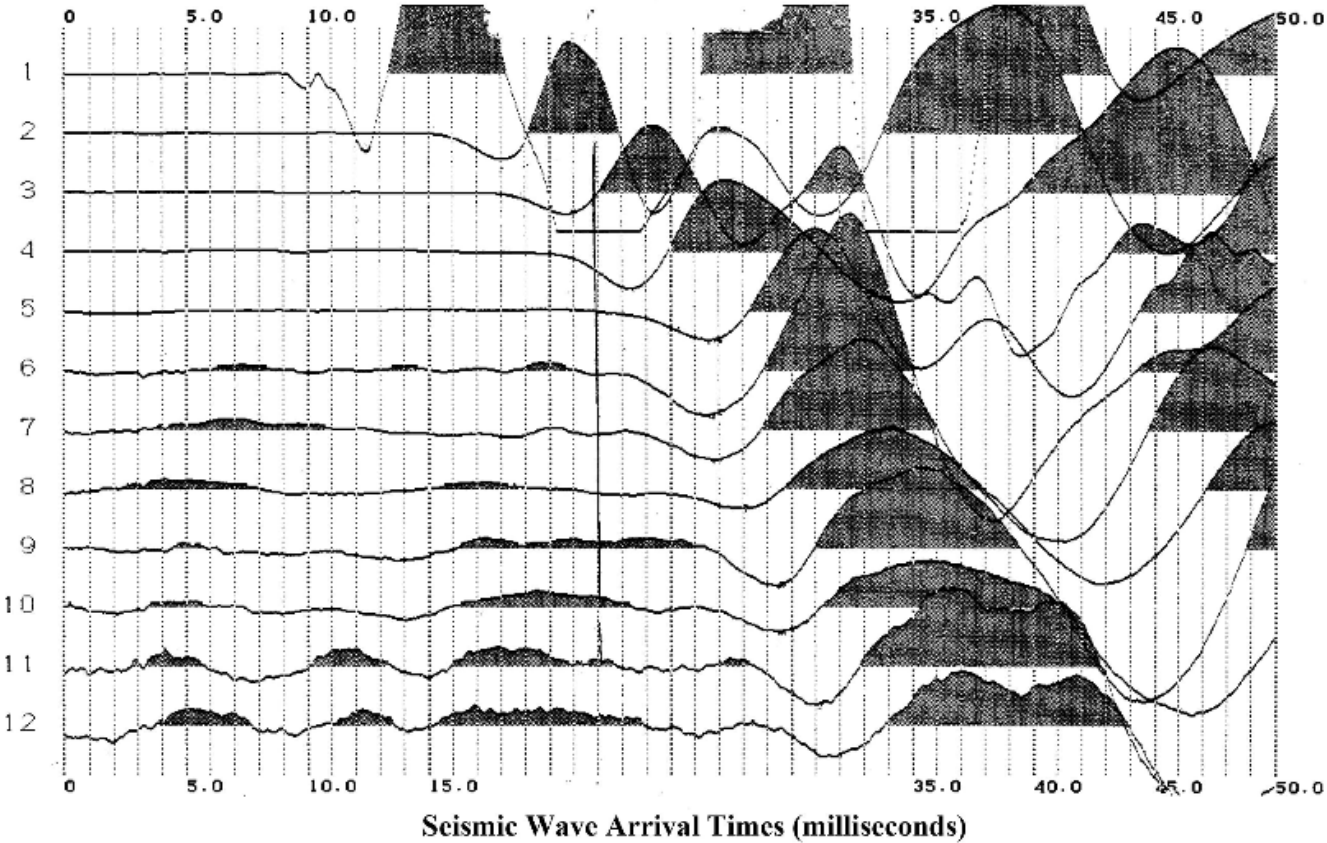
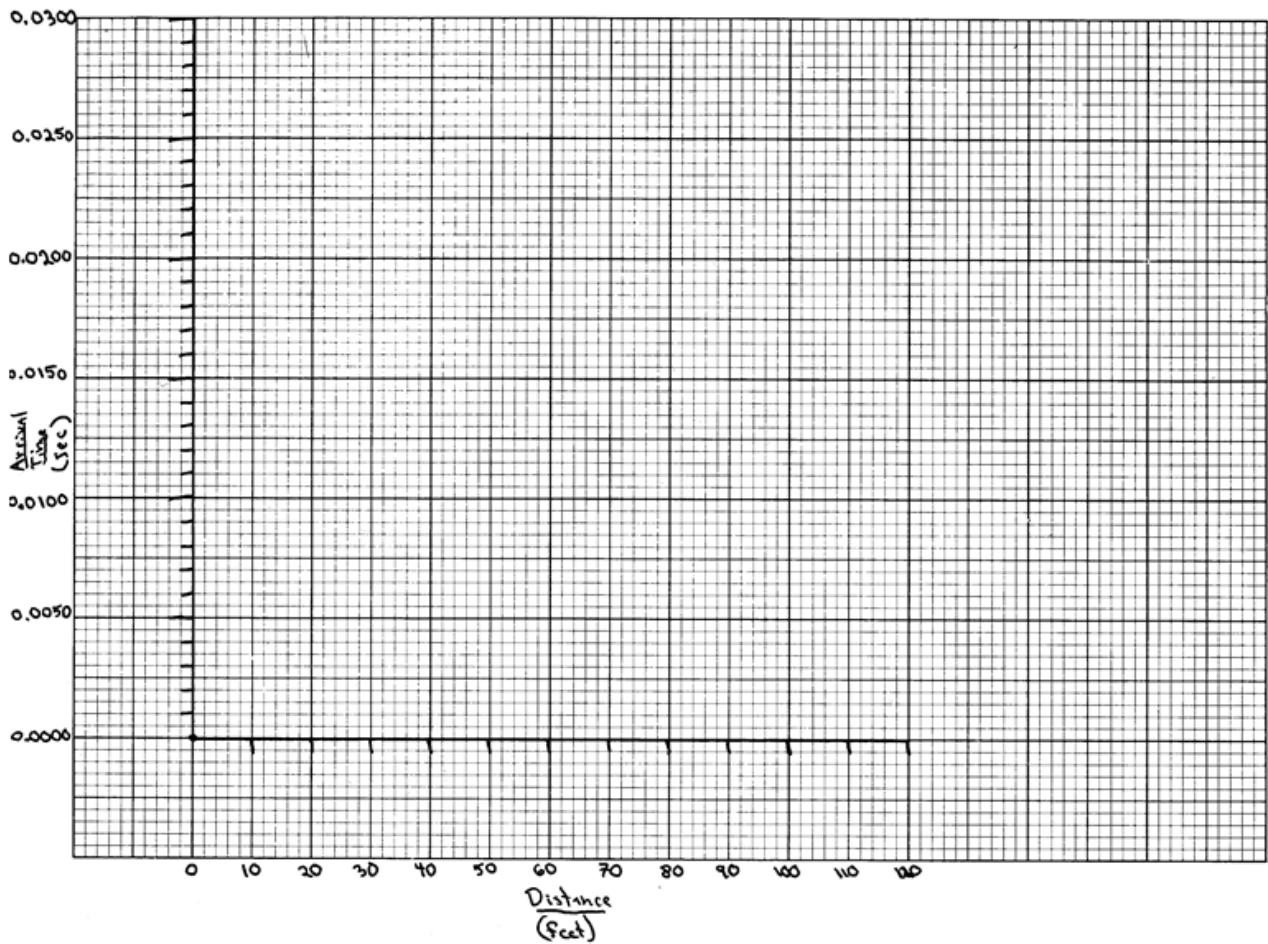


Figure 4 Seismic wave arrival times



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4. Discussion

1. Discuss the results of your experiment.

2. Discuss the sources of error.

3. Discuss the significance of your results.

4. Discuss the limitations of your experiment.

5. Reference

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