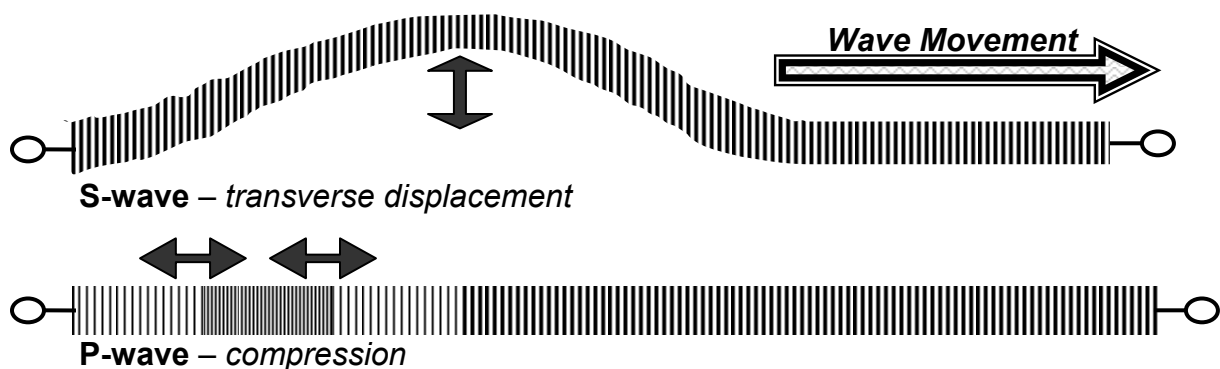

Earthquakes and Seismic Waves

Purpose: To explore movement and properties of P-wave and S-wave forms through various media.

Materials: Slinkys®, coiled spring, meter stick, stopwatches



Procedure: Read the following safety instructions carefully, then complete the following exercises using both the coiled spring and Slinkys®.

SAFETY ALERT!!!

Both the Slinky® and coiled spring can store an enormous amount of energy when stretched. Do **NOT** release either while they are under tension – especially the coiled spring. Someone could lose an eye. If you get tired while holding the coiled spring, switch off with a teammate rather than risk losing your grip.

Do **not** overstretch your Slinky® or it will break. The Slinkys® are metal, so when they burst, they snap back hard. The edges on a broken Slinky® are quite sharp, and there is also the possibility of shrapnel.

There is also a very small chance that the coiled spring could break (it would require some serious effort from the people stretching the spring). Stick to the procedures and you should have no problems.

Also be careful when doing the S-wave experiment with the coiled spring. Be sure that no one is in the line of fire, so to speak, before you start. The coiled spring is heavy enough to hurt someone simply by striking them (especially if you hit them in the head), but the spring can also snag someone's clothing or hair and yank them out of their chair. The coils are very tight and the spring has a remarkably strong grip.

Velocities of Simulated P and S Waves

Purpose: To investigate the velocities of compression and transverse (shear) waves in a metal spring and a Slinky®.

Hypothesis: *The P-wave (compression wave) in the spring and/or coil travels faster than the S-wave (transverse wave).*

Based on this week's lecture do you expect to reject this hypothesis?

Yes No

Materials: coiled spring, Slinky®, stopwatch, meter stick.

Roles: Each group will need two holders, two timekeepers, a distance measurer, and a data recorder (total of 6 people).

Compression Waves: Have the two holders each take an end of the coiled spring and stretch it out (~10 meters total stretch). Use the meter stick to measure the distance between the ends of the coil to the nearest decimeter and record that data below.

Stretched Coiled Spring Length: _____ meters

One of the holders should grasp 5 coils together between the index finger and thumb and press them together (compressing the coils) . This holder can then release the pinched coils, producing a compression wave (P-wave) of expansions and contractions of the coil.

Both timers should use the stopwatches to determine how long the wave takes to travel the distance indicated and record that time. (multiply distance by 2 to get the total 2-way travel distance and by 4 for the 4-way travel distance). Calculate and record the velocity of the wave.

$$\text{Velocity (V)} = \frac{\text{distant traveled (D)}}{\text{time (T)}}$$

Transverse Waves. With the same coil used in step 2, practice creating a transverse wave by abruptly snapping your hand up and down (once only) about 3 or 4 inches. Measure the travel times (2- and 4-way) for the transverse wave. Calculate and record the velocity of the wave.

Repeat the procedure with the Slinky®. Suspend the Slinky® in the air, just like the coiled spring, but don't stretch it further than ~3 meters.

Stretched Slinky® Length: _____ meters

Compression Waves

2-way

| Object | Distance (m) | Time (sec) | Velocity (m/sec) |
|-------------------|--------------|------------|------------------|
| Spring | | | |
| Spring | | | |
| Spring | | | |
| Average Velocity: | | | m/s |
| Slinky® | | | |
| Slinky® | | | |
| Slinky® | | | |
| Average Velocity: | | | m/s |

4-way

| Object | Distance (m) | Time (sec) | Velocity (m/sec) |
|-------------------|--------------|------------|------------------|
| Spring | | | |
| Spring | | | |
| Spring | | | |
| Average Velocity: | | | m/s |
| Slinky® | | | |
| Slinky® | | | |
| Slinky® | | | |
| Average Velocity: | | | m/s |

Transverse Waves

2-way

| Object | Distance (m) | Time (sec) | Velocity (m/sec) |
|-------------------|--------------|------------|------------------|
| Spring | | | |
| Spring | | | |
| Spring | | | |
| Average Velocity: | | | m/s |
| Slinky® | | | |
| Slinky® | | | |
| Slinky® | | | |
| Average Velocity: | | | m/s |

4-way

| Object | Distance (m) | Time (sec) | Velocity (m/sec) |
|-------------------|--------------|------------|------------------|
| Spring | | | |
| Spring | | | |
| Spring | | | |
| Average Velocity: | | | m/s |
| Slinky® | | | |
| Slinky® | | | |
| Slinky® | | | |
| Average Velocity: | | | m/s |

| | Spring | Slinky® |
|-------------------------|--------|---------|
| Average S-wave Velocity | | |
| Average P-wave Velocity | | |

Do your results support this hypothesis?

Hypothesis: The P-wave (compression wave) in the spring and/or coil travels faster than the S-wave (transverse wave).

In a 400-700 type-written essay (due at the beginning of the next lab meeting), discuss your answer to question 1 above. Did all of the groups get the same answer? Include a discussion of possible causes of variation in your data.