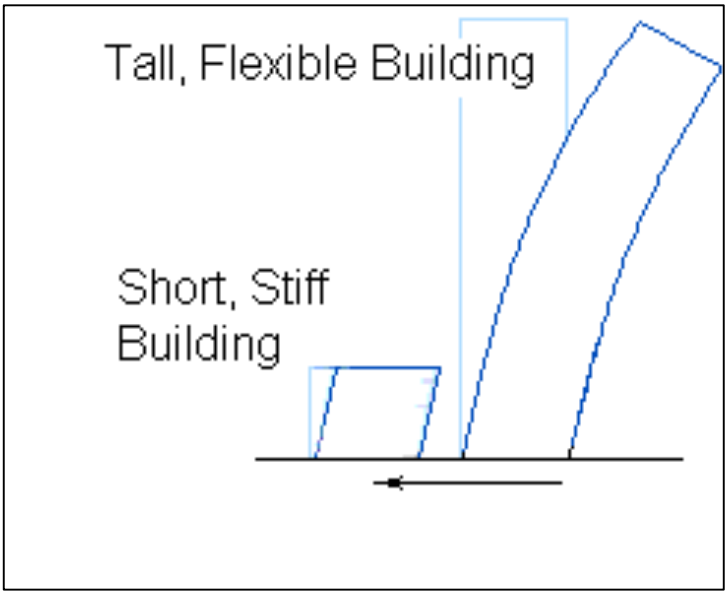
NAME:_____ Date:_____ Teacher: _____

Graphing Natural Frequency And Stiffness

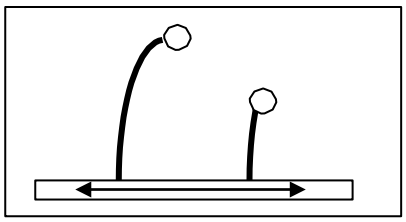
Now that you have measured your building height, let's determine its **natural frequency**.



What is **natural frequency**? Frequency is the number of times a building moves back and forth (one cycle) in one second. Frequency is measured in a unit called a **hertz** (Hz) which is the same as one cycle per second. All buildings have a unique natural frequency that depends on the building height, stiffness and the amount of mass in the building.

We can now test your buildings and find out what their natural frequencies are! Make sure you take notes of each group's building height and natural frequency.

1. Before we start looking at your buildings, let's take a look at some simpler structures: masses on rods.



What is the frequency of the short rod with mass on top? _____
What is the frequency of the middle rod with mass on top? _____
What is the frequency of the tall rod with the mass on top? _____

2. Compare how these rods performed when they were shaken in this demonstration.

3. Do you think your structure will have a frequency closer to the short rod or the tall rod? Explain why you think this is?

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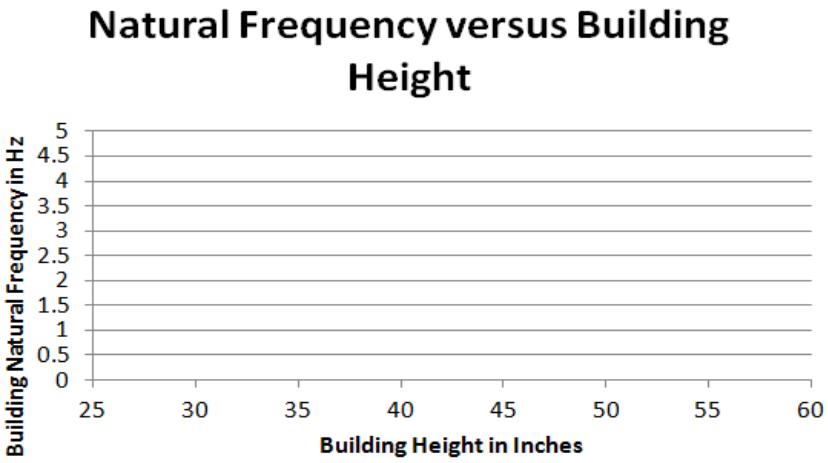
4. Now let's test all of your class' buildings on the shaking table and record their natural frequencies in the following table. Ask your presenter to help you find the natural frequency of your building is. Then fill out a plot of the natural frequencies versus height in your class.

Building	Frequency (Hertz)	Height (inches)
1		
2		
3		
4		
5		
6		



5. According to your graph, how does your building's natural frequency compare to all the other buildings?

_____

_____

6. In general, how does natural frequency affect buildings?

_____

_____

7. If your building was 50 inches tall, would its natural frequency be higher, lower or the same as your building?

Circle one: Higher Lower Same Guess your 50in. tower's frequency:_____

STIFFNESS

Although most tall buildings have lower natural frequencies, not all of them do. Sometimes they have higher frequencies because they are **stiffer** than other buildings. Your tower's **stiffness** is the amount that it can bend without breaking.

8. What are some things that you think make your tower more stiff?

_____

_____

9. If your tower is very stiff (meaning it does not bend very much), do you think your tower will have a higher or lower natural frequency then if your tower was flexible (meaning it bends a lot)?

_____

_____

_____