**Which skyscraper structures ,between rectangular, triangular, circular, and oval cross sectional skyscrapers, withstands the highest wind velocity?**

**Background Knowledge:**

* Definition of skyscraper: A very tall building with many stories.
* All skyscrapers have a different structure.
* Skyscrapers that are the most durable will withstand the most wind.
* Most of today’s skyscrapers are rectangular, triangular, circular, and oval cross sectional, and each one has different characteristics that make it better and worse than another.
* Since skyscrapers are so tall, they need to be able to withstand winds and multiple disasters.
* Most skyscrapers hold tons kilograms of people and equipment.

**Hypothesis**: If triangular, circular, rectangular and oval cross sectional skyscrapers are confronted with common velocity winds, then the circular design will take the longest time to topple over because it is the sturdiest.

**Independent Variable:** Triangular, circular, rectangular and oval cross sectional skyscrapers are confronted with common velocity winds.

**Dependent Variable:** The Circular design will take the longest time to topple over since it is the sturdiest.

**Controls**:

* Same wind velocity between skyscrapers – 200 miles per hour
* Same area where skyscrapers are being tested – NASA Wind Tunnel
* All skyscrapers are the same height- 2500 feet - Scale 1:25 – 100 feet
* All skyscrapers are same width – 175 feet – Scale 1:25 – 7 feet
* Same base material – steel
* Same amount of windows – 2250 – scale 1:25 – 90 windows
* No people or equipment are inside structure.
* All buildings are attached to base in the same way.

**Materials:**

* Scale models of Rectangular, Triangular, Circular, and oval cross sectional skyscrapers that fit the given controls.
* Wind Tunnel with Capability of generating winds up to 200 miles per hour.
* Base to align scale model skyscrapers into wind tunnel.
* People to test and record data.

**Procedure:**

1. Get scale models of skyscrapers and align them into the bases.
2. Put base with scale models of skyscrapers into a wind tunnel that can generate winds up to 200 miles per hour.
3. Turn on wind tunnel.
4. Measure qualitative and quantitative data at 0, 10, 20, 30, 40, 50, 60, and 70 hours after initial turn on of wind tunnel.
5. Write time when specific structure topples on chart and table, and also write qualitative data on qualitative chart.

**Prediction:** The circular design will last the longest because of the design. When air comes directly toward the building, the wind will spread to the sides of the building making it hard for a direct wind to hit a certain spot of the building without spreading. This will in return make the building less venerable to winds. With the triangular and rectangular structures if a wind is coming toward a face, there is nowhere for the wind to go except toward the walls, making the building more venerable to the winds. With the Oval cross sectional structure, even though it is similar to the circular structure, it will still be harder for wind to slide to the small width side from the large width side than the circular structure. Therefore the circular structure will retain the most wind in the experiment.

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| --- | --- |
| **Type of Structure** | **Hours required for structure to topple over** |
| **Rectangular** | **X Hours** |
| **Triangular** | **Y Hours** |
| **Circular** | **Z Hours** |
| **Oval Cross Sectional** | **W Hours** |

**Data Tables and Transformations:**

**Type of Structure of Skyscraper versus Duration of Time of Resistance**

**Type of Structure of Skyscraper versus Duration of Time of Resistance Qualitative Data**

|  |  |
| --- | --- |
| **Type of Structure** | **Qualitative Observations** |
| **Rectangular** |  |
| **Triangular** |  |
| **Circular** |  |
| **Oval Cross Sectional** |  |

**Type of Structure of Skyscraper versus Duration of Time of Resistance**

Oval Cross Sectional

|  |
| --- |
| Rectangular - X hours |
| Triangular - Y hours |
| Circular - Z hours |
| Oval Cross Sectional - W hours |

**Conclusion:** If triangular, circular, rectangular and oval cross sectional skyscrapers are confronted with common velocity winds, then the circular design will take the longest time to topple over because it is the most sturdy. Restate hypothesis and state if hypothesis was supported or not.

**Evidence:** State all quantitative or qualitative data that supported or unsupported hypothesis.

**Three Sources of Error:**

1. Since Scale Models were used, results might have been distorted.
2. The Wind tunnel was only checked for quantitative and qualitative data only 8 times.
3. During a wind storm or other natural disaster, the wind velocity isn’t going to stay constant at 200 mph and there are also going to be things flying around such as trees.
4. Base absorbed some of winds and vibrations produced by wind tunnel.

**Improvements’:**

1. Use real buildings to test instead of scale models.
2. Check the wind tunnel for quantitative and qualitative data twenty times instead of eight. Also use a computer that is always keeping track of qualitative and quantitative data 24/7.
3. Change the velocity of the wind from time to time in the wind tunnel, and put some small objects inside wind tunnel to act as objects flying in real life.
4. Don’t use base in wind tunnel. Attach models straight to wind tunnel.

**New Related Problems:**

* Will using real buildings change the results of this experiment?
* What is a different type of building structure that will resist the winds for a longer time that wasn’t tested?