

Grade 7 Science Structures **Structural Failure and Testing**

Name: _____ **KEY** _____ Class: _____ Date: _____

We have all heard of how some buildings fall down and how violent storms destroy some buildings.

Why does this happen? **Forces acting on structure are too great and the building breaks.**

It all has to do with forces (dynamic) and structural strength. Structures are designed to withstand certain loads or forces. But sometimes the structures are not designed correctly or the loads too much. Designers can engineer a structure to be very sturdy but that increases costs so it is always a balance between cost, beauty and safety.

When structures fail, scientists like engineers analyze what happened to learn more from what happened. They then share this information so that the information is used to make structures more safe in the future.

Your task is to look up information on a structural 'disaster'.

Here are a couple of famous examples:

Leaning Tower of Pisa (Pisa, Italy)
Quebec Bridge Collaspe (Quebec City, Canada)
Sampoong Dewpartment Store Collapse (S. Korea)
Lotus Riverside Compound (Shanghai, China)
Three High-Rise Office Buildings (Rio, Brazil)
Hyatt Regency walkway collapse (Kansas City, USA)
Savar Building (Dhaka, Bangladesh)
Ronan Point (London, England)
Royal Plaza Hotel (Nakhin Ratchasima, Thailand)
World Trade Center Twin Towers (New York City, USA)

For your miniresearch, find the following

Title of Disaster: **Answers will vary**

Year of disaster:

What happened?:

What forces caused the failure:

Inevitably, it is a part of the structure that is no longer able to support the rest of the structure - either because of a storm, additional load or the foundation is compromised by not being strong enough. Either through improper design or additional loads.

Sometimes there are controlled demolitions of buildings or other structures. Sometimes they go as planned and sometimes they do not.

Look up some videos of controlled demolitions. Here is a link to a pretty good collection:

<https://youtu.be/Mb4MNe1vk70>

What did you notice about the controlled demolitions?

They are very cool and the center often falls first and the outer parts of the structure collapse inward. The explosives used are put at the structural base so that gravity pulls the building down.

The last part of this worksheet discusses how we use tests to make sure that the strength of materials are sufficient to withstand the load of the building or structure being designed and also the dynamic loads that will influence them. Thinking back to the video we watched on the Burj Khalifa, what were some of the tests done on different parts of the building as it was being designed and built? Try to describe 2 or three of them.

Elevator test of mechanism

Wind tunnel tests for shape of building

Earthquake test on noodle model

Airplane engine for wind test on windows

Do a search on what a 100-year event or a 1000-year event is?

The chance that a storm or event will happen in any given 100-year period. Sometimes seen as a 1-in-a-hundred chance of happening (1%). This is the maximum storm event that would happen in this time. 1000 year would even be higher since it is 1 in a thousand (0.1%).

Why do design engineers have to account for this type of event (rain, snow, earthquake, hurricane, etc)?

Engineers have to account for this since it might happen and the structure must be able to withstand these event forces or it will fail and people will be hurt or killed.

Why are these events happening more and more (think of global climate change)?

Weather events and the environment is heating up and as a result, the storms are becoming more powerful and more frequent. This means that buildings have to be able to withstand ever greater forces from the environment since environmental forces are more powerful.