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STEAM: E is for Engineering

Marshmallow Structures: Bridges

Bridges

Have you ever driven over a bridge? Chances are you have because they are everywhere. I bet you never really thought about how they are made, or how they hold up so much weight!

A bridge is a structure normally used to allow people to cross a gap, over a body of water, or to go over another road below. Some are even just for walking, like swing bridges. However, bridges have to be extremely strong to support all the weight they must carry. It also has to stand against wind, snow, earthquakes and extreme heat. So let's find out how do they do all of this.

There are different ways that bridges have been built over the years, and some work better than others. Some of the different types are: **cable bridges, truss bridges, beam bridges,** and **arch bridges.**

You can watch this quick video below that gives on overview on the difference between these bridges. Kids Guide to Building Bridges

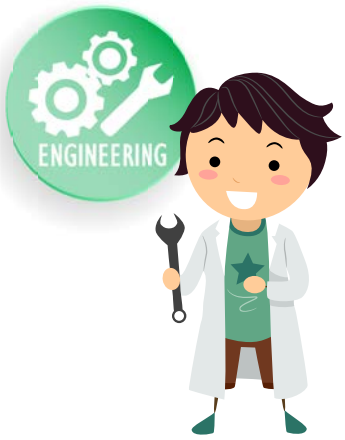
Did you know:

- The world's oldest bridge is in China and is called the Zhaozhou Bridge. It was built in 605 A.D and is still standing today!
- One of the world's busiest bridges is the Brooklyn Bridge in America. It has over 145,000 vehicles crossing it every day!
- One of the most well-known bridges, the Golden Gate Bridge, built in 1937 in San Francisco, has over 129,000km of wire in its two main cables alone!

Great, now that you are a bridge expert, let's build our own bridges!

Materials

- Tape
- Uncooked spaghetti or wooden skewers.
- Toy cars or other items to test your bridge's structure



Experiment

Step One:

Set up a space where you can build your bridge. Between two tables/chairs works well, and place these about 30cm apart. Plan what type of bridge you will be constructing. Will it be a truss, beam, arch, or another type of bridge?

Step Two:

Using your skewers/spaghetti and marshmallows, construct your bridge. The aim is for your bridge to be self-supported between the space you have created, and for it to carry the most weight.

Step Three:

Once your bridge has been constructed, now it's time to test it. You can do this in two ways. The first, you can place your toy cars, or other objects across the top of the structure evenly and make sure that your bridge doesn't bend or collapse. The second way of testing your structure is to hook a paper clip in the center with a small bucket or container. The idea is to fill the container slowly (rice or pasta works well), and see if the bridge bends with the weight as it is added.

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Wind Energy: Windmills

Wind Energy

I'm sure you all know what it's like to step outside on a windy day and feel how strong that wind can be! But did you ever think about how wind is made? We can generate our own **wind energy**: suck in a deep breath and blow it out like you are blowing out the candles on a cake. There, you just created wind.

Just like us, the earth has its own wind that is created when the earth heats up by the sun. Now, like all hot air, this rises but it rises at a difference pace over land than it does over our oceans. This difference in rising rates causes the air to move and that is how we have wind.

Did you know that wind can be used create energy? Windmills have been used for centuries to pump water or even to grind up grain. Now we use wind energy to help generate our electricity. Wind turbines are what we use today. You may have seen them before; they look like huge windmills with long blades that turn. So how do these massive constructions make electricity?

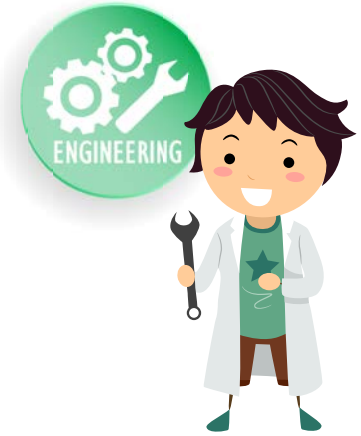
Well, each turbine has a generator inside it. The wind turns the blades around and this connects to generator which changes the motion into electricity. This electricity is then sent to a power grid which then goes out into our homes. All of that from a bit of wind! And what's even better is that we will never run out of wind and nor does wind energy cause any pollution!

To see how this works in action, check out this video that explains how wind turbines work The Science of Wind Energy.

Great, let's create our own windmill and see how the blades turn in the wind !

Materials

- A square piece of coloured card/paper
- Paper straws
- Paper pin fasteners
- A hole-punch
- Scissors



Experiment

Step One:

Get your square card and fold it in half to make a triangle. Unfold this and repeat with the other corners. You should have a fold line that runs to each corner. Now fold back your paper in half and make a cut 2/3 down from the top point of the triangle. Unfold and repeat the same on the other side until all four corners have a cut. Open your paper once more.

Step Two:

On the right side of each flap, use your hole-punch to make a hole. Use your scissors or a skewer to puncher a small hole in the center of the paper.

Use your skewer or scissors to also puncture a small hole near the top of your straw.

Step Three:

Pull all four corners with the hole punch towards the center and put your paper pin through these, including the straw last to hold them in place. You have should now have a windmill that spins!

For another fun and different design, check out this project and template Paper Roll Windmill.

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Air Resistance: Parachutes

Air Resistance and Terminal Velocity

We all know that **gravity** pulls something down to the ground. If we throw a ball, it won't simply stay up in the air, it will always come straight back down. However, if we were to throw a stone and a feather which one do you think would hit the ground first? If you picked the stone, you would be correct. However, if you think that the stone would hit the ground first because it is heavier, think again. It is because the feather catches more air as it falls and therefore slows down. This is because it has more **air resistance**.

A great way to learn about **air resistance** is by looking at parachutes. They use air resistance to their advantage with their lightweight nylon material that doesn't allow air to travel through it.

Check out this quick video that explains how air resistance works Air Resistance Explained

Great, so if that's air resistance, what is **terminal velocity**?

Terminal velocity is the fastest speed something can get to when falling. **Velocity** itself simply means how fast something changes in speed and direction. So if something is falling, when can it no longer fall any faster? Well, it happens when **force**, which is caused by **gravity** pulling the object down, is the same as the very opposite force, which is air resistance or **friction**.

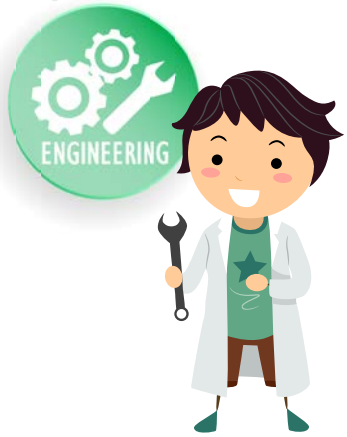
So how can we look at terminal velocity with parachutes?

A skydiver that has jumped from a plane will free-fall at around 200km/h. this is the terminal velocity. It takes around 15 seconds to reach this speed. However, if the skydiver makes themselves smaller by tucking in their arms and legs, the terminal velocity will increase to around 320km/h because there is less space the skydiver is taking up, so there is less air resistance. Once the skydiver releases its parachute, the chute takes up more space and creates enough air resistance to slow down to a safer speed and this decreases the terminal velocity.

Now that we understand Air Resistance and Terminal Velocity, let's make our own parachutes to see this in action!

Materials

- A disposable cup
- Plastic rubbish bag or a piece of nylon material
- String/twine
- Hole-punch
- Scissors
- Tape measure



Experiment

Step One:

Use your hole-punch to create four evenly-spaced holes in the top of your disposable cup. Get your plastic bag or nylon material and cut a square around 35cm length and width. Hole-punch each corner of your chute.

Step Two:

With your string or twine, cut four 35cm pieces of string and tie one piece of string to each hole in the chute and then to the disposable cup. Make sure that these are even so that the parachute with open properly.

Step Three:

Yay, your parachute is completed. All that's left to do is to find a high place that you can drop it from and watch as the chute creates air resistance that will make it float.