MOHAI
MUSEUM OF HISTORY & INDUSTRY

Idea Lab at Home

Seattle is a hilly city!

Front Street at Madison Street with cable cars, ca. 1891. MOHAI, 1983.10.6300.1

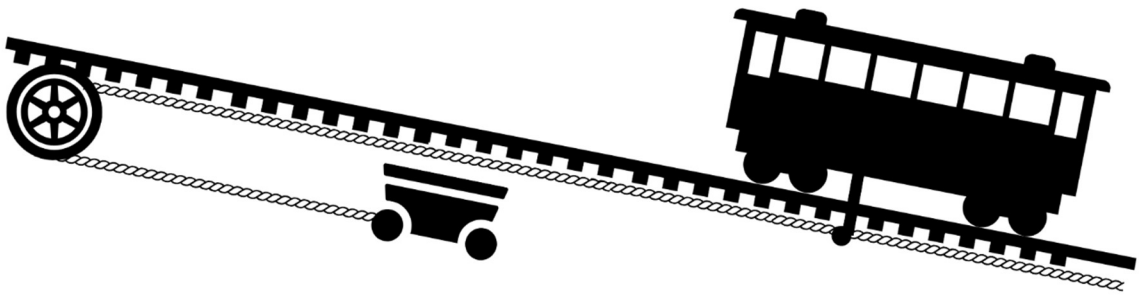
Seattle is covered in hills that were formed by glaciers that once covered the area. Some of these hills are *really steep.* The city's first streetcars were pulled by horses, who could not take passengers up several of the city's steep hills. To travel up, down, and across Seattle's hills, the city introduced its first cable car lines in the 1880s.

A cable car moves by gripping onto a continuously moving cable that runs beneath its tracks. By using a steam powered cable and pulley system underground, cable cars could move up and down steep hills without having to rely on having enough power or traction on the cars themselves. Cable cars worked well on steep slopes but were costly and difficult to maintain, so electric trolleys quickly became the more popular option. However, there were some places where cable cars were still needed, like on Queen Anne Avenue hill.

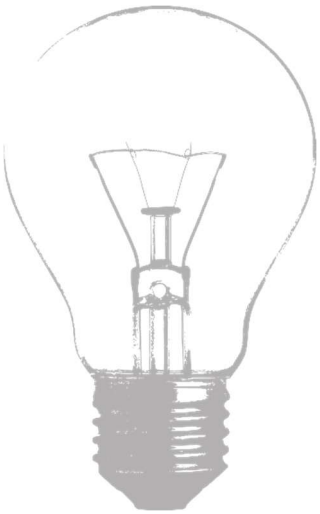
The Queen Anne Counterbalance

Looking up the counterbalance, ca. 1900. MOHAI, 1983.10.8356

The electric streetcar that ran to the top of Queen Anne hill needed a little extra help to get it up the last stretch of its line. As the streetcar approached the base of the hill, a worker would hook it up to an underground cable. This cable was in turn attached by a pulley system to a small iron rail car running on its own tracks in a tunnel underground. The miniature rail car was loaded with concrete to act as a counterweight, helping to pull the trolley uphill and act as a brake as it descended. An attendant at the top and bottom of the hill would attach and release the cars, and adjust the counterweights as needed.



Build a working model of the Queen Anne counterbalance cable car at home!



Build Your Own Queen Anne Counterbalance

Watch the video introduction and demonstration on the MOHAI YouTube Channel (@mohaiprograms)!

What you'll need:

A variety of recyclable materials and found objects. If you don't have the exact materials below, there's probably an equally good substitute you have lying around!

- Large cardboard box
- Toilet paper or paper towel rolls
- Two bobbins/makeshift pulley wheels
- Skewers and toothpicks
- Two toy cars or build your own using small paper cups, popsicle sticks, straws, plastic bottle caps, toothpicks/skewers
- Strong tape and/or glue
- Weights (ex: marbles)
- String

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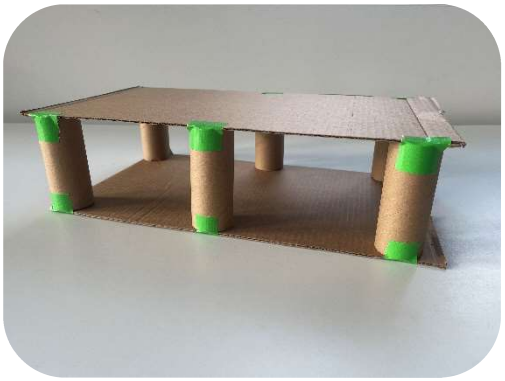
What you'll do:

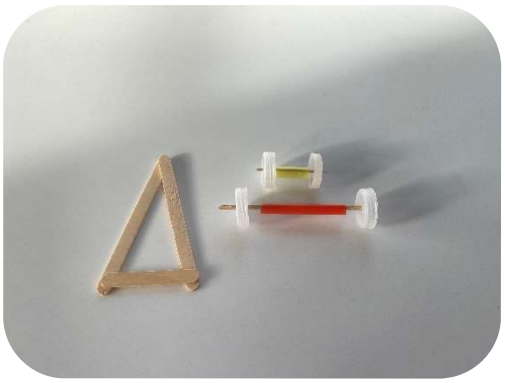


1. Step 1 – Build your tunnel

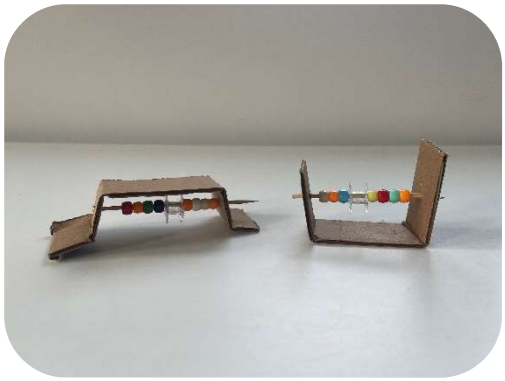
- Cut two large rectangles of cardboard of the same size, preferably without creases, approximately 10x20 inches
- Stack one piece on top of the other, placing toilet paper rolls between them, evenly spaced along the long edges
- Securely attach everything together with tape

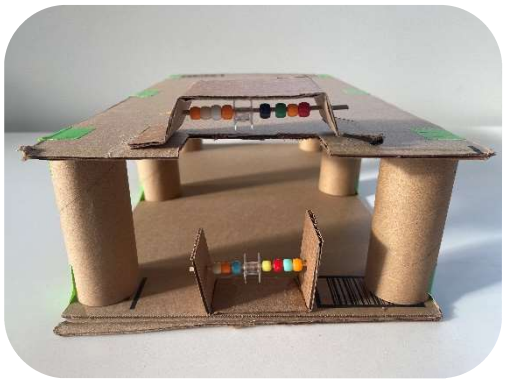
2. Step 2 – Assemble your (2) rail cars

- Version 1: use a toy vehicle that can carry weights (ex: truck) or attach a small container to the top of a toy car
- Version 2: build a wheeled vehicle that can carry small objects using K'nex or similar building toys
- Version 3 (pictured left): build a rail car using upcycled materials. For each…
    - Glue 3 popsicle sticks together to make a triangle frame
    - Glue a small container to the top
    - Make two sets of wheels. For each:
        - Cut a skewer into two pieces slightly wider your frame
        - Cut two pieces of straw that are not as wide as the skewers
        - Poke a hole in the center of two plastic bottle caps
        - With the skewer inside the straw, stick a bottle cap on each end



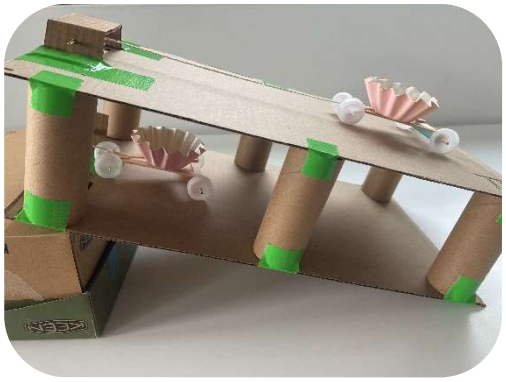
- Glue your wheels to the underside of your frame, one at the front and one at the back of your car.
- Make sure your wheels freely spin!





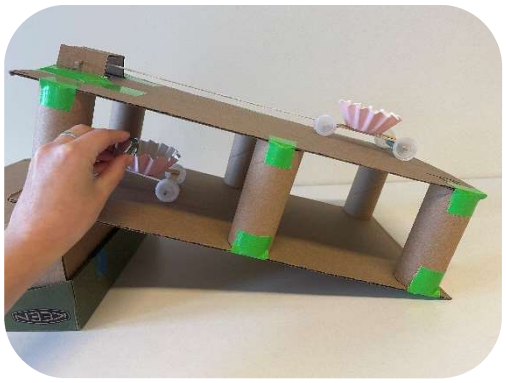
3. Step 3 – Build your pulleys

- A pulley is a free spinning wheel with a groove – spools and bobbins usually have a hole running through their center; you can make a simple pulley by sliding a spool onto a skewer
- To help keep your pulley in place as it spins, add beads to either side to act as spacers
- Cut a long rectangle of cardboard, fold it, and poke each end of the skewer into it to create a bracket for your pulley
- Before attaching the top bracket, mark out the area under the pulley and cut it out from the cardboard so the cable can easily pass down to the lower pulley
- Assemble your guide pulley for the lower level, but this time make a bracket that leaves the space above the pulley open (shaped like a football goal post or staple)
- Attach your guide pulley bracket to the bottom piece of cardboard directly below the street-level pulley



4. Step 4 – Assemble your pulley system

- Assemble your pulley system
- Our pulley at the top is going to help us change the direction of motion, and the pulley at the bottom is acting as a guide, to keep our 'cable' low to the ground
- Tie your string onto the front of your counterbalance car, loop it under the bottom pulley, and over the top pulley
- Before tying the end of the string onto the streetcar, find the length that allows the two cars to be at opposite ends of the ramp from one another (without falling off)



5. Step 5 – Operate your cable car

- Load your streetcar with passengers – add some weights to the top car
- Find the amount of weight needed to add to your counterbalance car in order to bring your streetcar uphill safely
- How can you use the counterbalance to move your streetcar downhill at a steady pace?
- What happens if you add 'passengers'?
- What happens if you change the incline?
- How would you build rails to make sure your trolley stays 'on track'?

Share your counterbalance cable car on social media with us!

@mohaiseattle @seattlehistory