

X-TREME FACTS: ENGINEERING

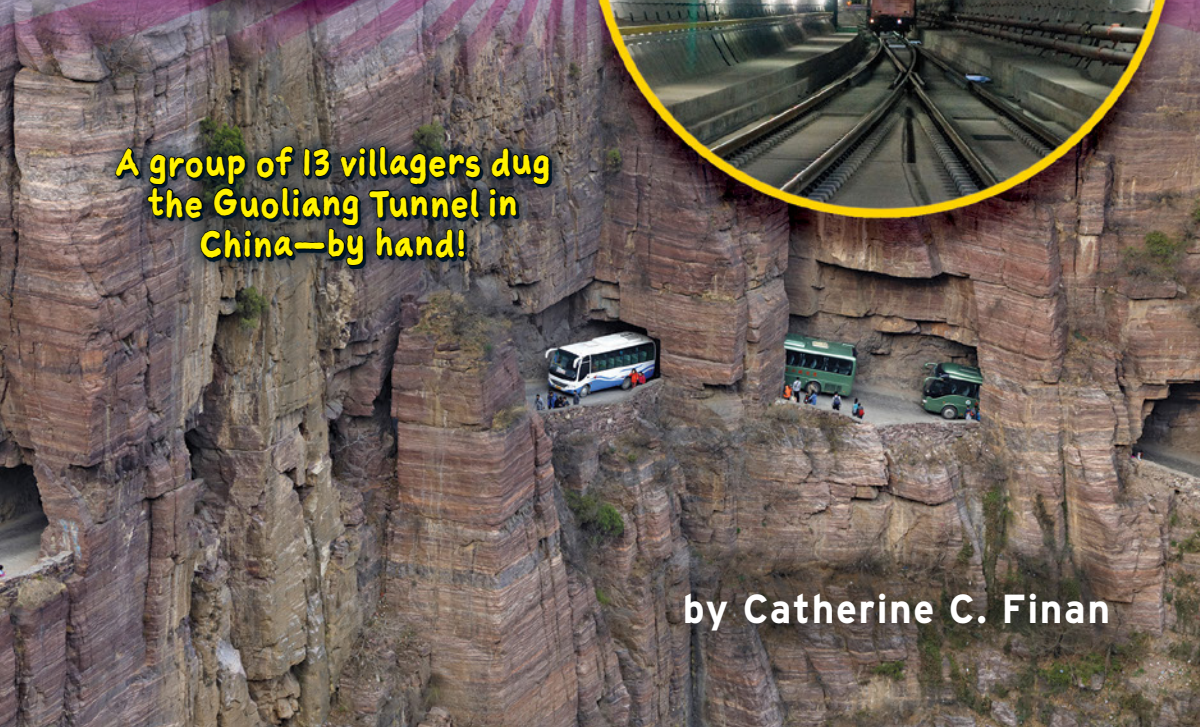
TUNNELS



A tunnel in Malaysia can be filled with water to avoid flooding in the city.



The Gotthard Base Tunnel in Switzerland is the world's deepest tunnel.



A group of 13 villagers dug the Guoliang Tunnel in China—by hand!

by Catherine C. Finan

Contents

Can You Dig It?	4
Ancient Tunnel Vision	6
Do as the Romans Do	8
Down in the Catacombs	10
Under the River	12
Super Subways	14
A Huge Improvement	16
I'll Take the Chunnel!	18
Running the Rails	20
On the Road	22
Mine over Matter	24
Terrific Tunnels	26
Mountain Tunnel	28
Glossary	30
Read More	31
Learn More Online	31
Index	32
About the Author	32

Can You Dig It?

Some of the greatest things ever built by humans are actually deep underground beneath our feet. What could they be? Tunnels! These tube-shaped passageways have allowed people to travel in ways that would otherwise be impossible. Holes made through stone or soil may seem simple at first glance. But tunnels are fantastic feats of **engineering**! Let's dig a little deeper . . .



The Holland Tunnel between New York and New Jersey was popular from the start. Almost 52,000 cars drove through the tunnel on its opening day in 1972.



OHHH, THAT'S WHERE THE WATER COMES FROM!

The next time you turn on a faucet, think about where the water comes from. **Underground tunnels** help carry water to people's homes.



In 1971, a railway **strike** stopped circus animals from reaching New York City by train. **So, instead, 19 elephants walked through the Lincoln Tunnel to get to their show!**

THE SHOW
MUST GO ON!

Japan's Seikan railway tunnel is one of the world's deepest underwater tunnels. At 460 feet (140 m), it's deeper than the height of Egypt's Great Pyramid.



In the engineering world, **building a tunnel is called driving.**

Constructing tunnels often includes **blasting hard rock** with **explosives** and digging dirt with huge machines.

SO, IF YOU'LL
JUST LOOK AT
THE BUILDING
PLANS ...

DON'T YOU MEAN
THE *DRIVING*
PLANS?

Ancient Tunnel Vision

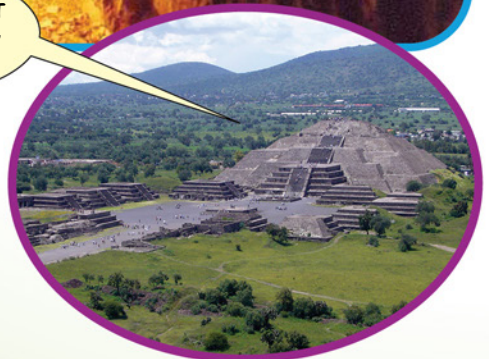
Although building tunnels can be tricky, people have been doing it for thousands of years. The ancient Egyptians built some of the earliest tunnels about 4,700 years ago. These tunnel systems connected rooms beneath pyramids. **Archaeologists** believe the Mesopotamians made the first underwater tunnel beneath the Euphrates River a few centuries later. And those weren't the only groups to build tunnels long ago. Tunnels have dug their way through history!

Ancient Egyptians used saws made of copper and drills made from hollow reeds to carve tunnels into rock cliffs. That's some hard work . . . literally!

PHEW, I THINK
I JUST EARNED
MY LUNCH
BREAK!

I SUPPOSE I KEPT
MY SECRET LONG
ENOUGH . . .

Archaeologists found a secret tunnel beneath the Pyramid of the Moon in Teotihuacan, Mexico. It was built more than 2,000 years ago.



The Mesopotamian tunnel below the Euphrates River **is believed to have been 3,000 ft (914 m) long.**



To make the Euphrates tunnel, workers probably **diverted** the river, dug a **trench** across the riverbed, built a brick tunnel, and then let the river flow over it.

Hezekiah's Tunnel was built 2,700 years ago to bring water into Jerusalem, Israel. Today, you can walk through it—but you might get a little wet!

WOW, THIS IS SO OLD...

AND SO DAMP!



Do as the Romans Do

Of all the people who built tunnels long ago, the ancient Romans made some that really stood out. Between about 300 BCE and 200 CE, they built huge stone structures called aqueducts to get water to people across the Roman Empire. The aqueducts were connected to a network of underground tunnels. And those were just some of the amazing tunnels in ancient Rome!

Rome's aqueducts were designed to use **gravity** and the **slope** of the land to move water downhill from lakes to cities.

About four-fifths of Rome's aqueduct system was made up of tunnels. That's a lot of tunnels!

RUN UP THAT HILL
AND FETCH SOME
WATER.

THERE'S NO NEED!
THE AQUEDUCTS
WILL BRING
WATER TO US!

Water from the aqueducts was used for farming, drinking, and bathing—all things that we wouldn't want to live without!



Rome's Colosseum had tunnels below it. In ancient times, wild animals were lifted up from the tunnels onto a stage where they battled to the death.

WAIT, SO NOW WE'RE FIGHTING?!

YEAH—YIKES! AND I THOUGHT THAT DARK TUNNEL WAS GOING TO BE THE WORST PART!

Tunnels were also used to move pee and poop away from some ancient Roman cities.

The ancient Romans built the Pausilippo Tunnel in 36 BCE. The 4,800-ft (1.5-km) tunnel was dug through solid rock by hand.

WHAT A STINKY JOB!

THIS ISN'T THE TUNNEL THEY USE TO MOVE POOP AND PEE, IS IT?

NO, THANK GOODNESS! IT'S THE ONE THEY DUG BY HAND.

Mountain Tunnel

Craft Project

Engineers have designed incredible tunnels that allow people to travel through many different places, including mountains. Now, it's your turn to design your own mountain tunnel. Use your imagination—and some craft supplies—to travel through a massive mountain. Where will your tunnel take you?



The East River Mountain Tunnel takes travelers between two different states—Virginia and West Virginia.



Gotthard Base Tunnel is as long as 21 Golden Gate Bridges!

What You Will Need

- Cardstock
- A pencil
- Scissors
- Tape
- A piece of cardboard cut to 13 x 8 inches (33 x 20 cm)
- Construction paper
- Glue
- Toy cars

