

NATIVE ENGINEERS



BUILDING WITH S.T.E.A.M.



NATIONAL
COWBOY
& WESTERN HERITAGE
MUSEUM



NATIVE KNOWLEDGE

Native people were artists and weavers. They planted crops and hunted wildlife. They also built large communities across North America with their smart engineering ideas! Native people didn't need machines or blueprints to build a home. They used their knowledge of the land!



Construction Material

Native American engineers understood that different materials have different strengths. Wood is good for houses because it's easy to cut. It also bends a little without breaking. Native engineers knew that the earth could be used for climate control. It kept homes both warm and cool.

Compressive Strength

This is an engineer's way of saying how much a material can be squished before it breaks. Materials like wood posts and clay walls have high compressive strength. That's why they were used by Native engineers often.

Constructability

This means how easily a home can be built. Engineers want to use materials that are in good supply. Native American builders used nearby, natural resources. They built homes that worked with, not against, the natural environment.

Smart Engineering

Native Americans used many smart engineering ideas that we still use today. They built strong homes that fit the land and the climate where they lived. Their engineering ideas can show us how to build safe homes that will last a long time.

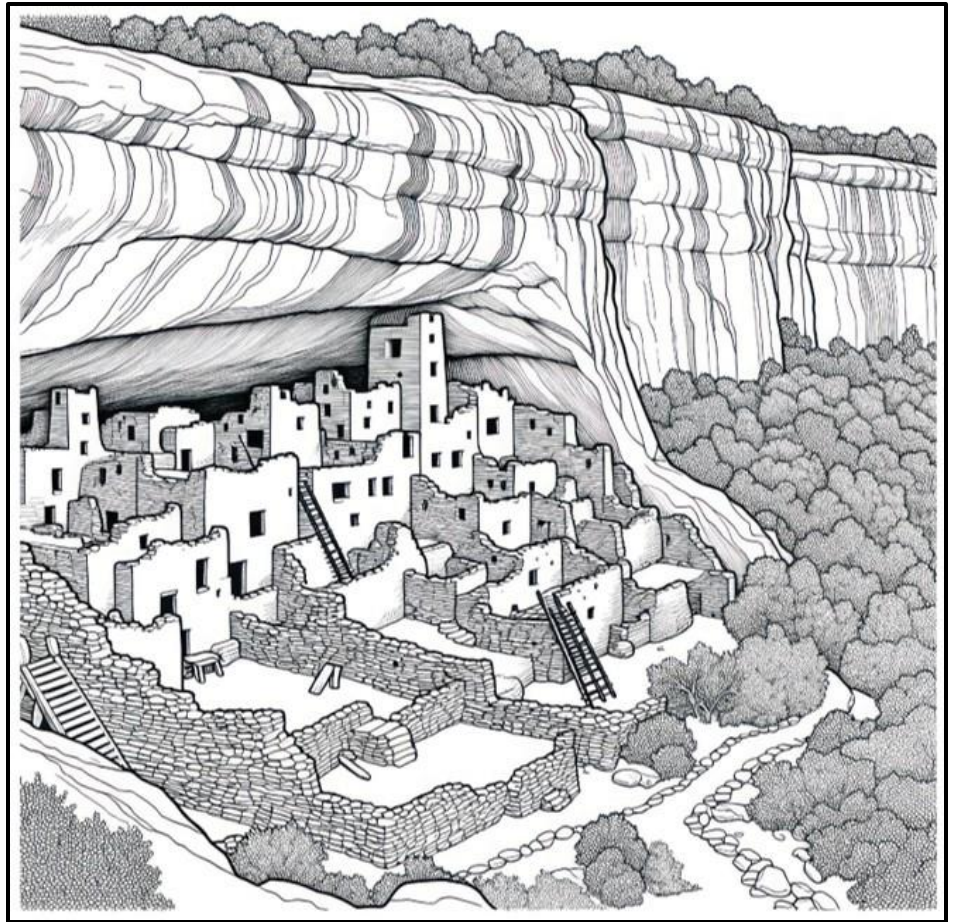
ANCESTRAL PUEBLO PEOPLE

Who were they?

The Ancestral Pueblo people were Native American groups who lived a long time ago in the Southwest United States. They are called "ancestral" because they are the great-great-grandparents of the modern Pueblo people. The Hopi and Zuni people are their modern-day relatives.

How were ancestral Pueblo people great engineers?

These expert builders used smart engineering ideas. They built their homes and huge communities into the sides of tall cliffs. Location was important. They chose a spot under an overhang of rock. Like a giant umbrella, it kept them safe from rain, snow and hot sun.



Durable Construction

The early Pueblo people built homes to last. Stone from the cliffs made strong walls. Mud, water and dried grass made mortar. It worked like glue to hold the stones together. Wood from nearby trees supported the ceilings. The thick stone walls were like a natural blanket. They kept homes cool in the summer and warm in the winter. All of this was done without metal tools!

Stairstep Design

The ancestral Pueblo also built their homes stacked on top of each other. This saved space. Often villages were four or five stories high! The stepped shape placed the roof of one room below the front porch of the home above it. Engineers use this same today to build skyscrapers.

Specific Purposes:

Safety- To keep safe from enemies, the rooms on the ground floor usually did not have any doors or windows. People used removable wooden ladders to climb up to an opening in the roof. If there was danger, they could simply pull up the ladders.

Community Needs- Rooms connected but each had a purpose. Some were for sleeping, other stored food. Some called "kivas" were meeting places. Kivas were round and underground. Important religious ceremonies were held there.

WATCH AND LEARN

Take a guided tour with a national park ranger! Explore Mesa Verde cliff dwellings!



NATIVE ENGINEERS

HOPÍ PEOPLE

Who were they?

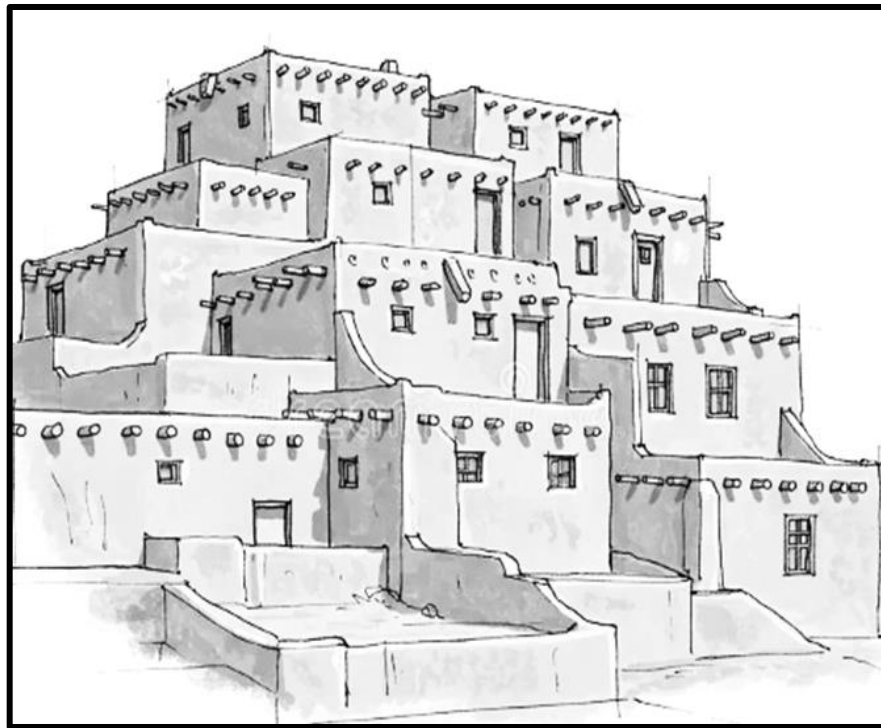
The Hopi are one of the oldest groups of people in North America, living in the same area of the Southwest for thousands of years. Their name means "peaceful people."

How are the Hopi skilled Engineers?

The Hopi adapted their ancestors' engineering skills to build homes and farms in dry places. They worked with their environment instead of against it. Like their ancestors, Hopi still build with materials like adobe, but in new and different ways.

Adobe

Adobe is a special material that Pueblo people, like the Hopi, created. Adobe is a mix of mud, clay, sand and grass. It is shaped into bricks. Homes are built from adobe bricks. During the day, the thick walls soak up the heat. At night, it is cold in the desert, but adobe bricks store the day's heat and homes are kept warm.



Dry Farming

This smart engineering idea helped the Hopi grow food in deserts. They planted seeds deeper so roots could find underground water when there was little rain. They also planted gardens in dry riverbeds. When it rained, the seeds would catch the runoff.

Three Sisters

The Hopi, like many Native people, knew how to plant different crops together. One "engineering" way was called the Three Sisters (corn, beans, squash). Beans helped the soil stay healthy. Corn was tall, helping to support and shade the squash vines.

WATCH AND LEARN

Take a walk through a modern Hopi cornfield and learn how Hopi engineers use dry farming today!





CADDO

Who were they?

The Caddo people lived on the southern plains. Their villages stretched for miles along rivers, like the Red River. The Caddo were farmers, hunters, builders, artists and traders.

How were the Caddo people great engineers?

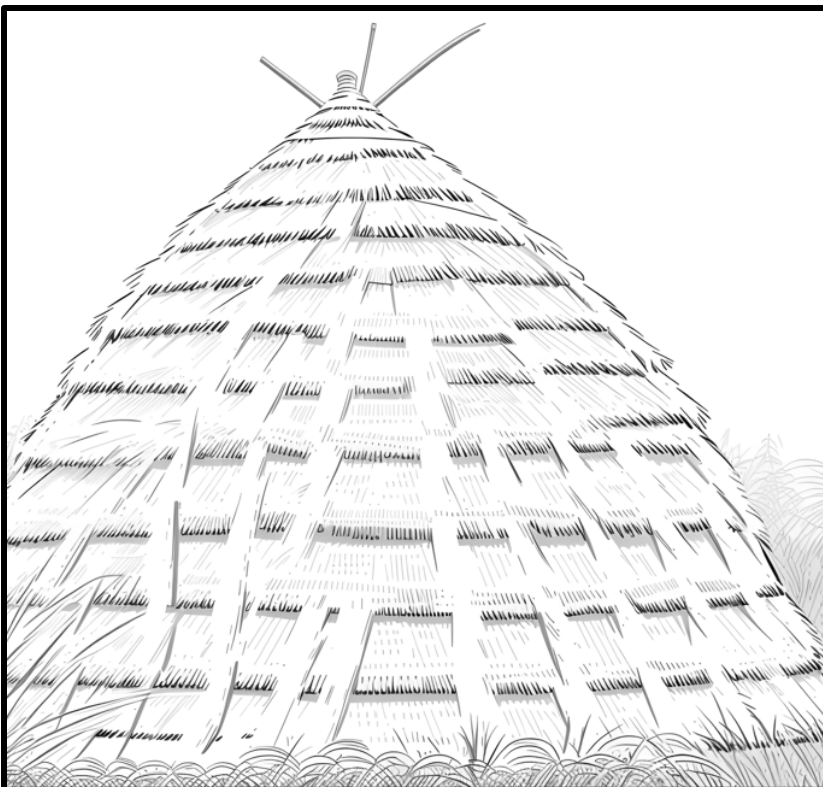
The Caddo people were smart engineers who built beehive-shaped homes made from nearby resources.

Load Path

A "load path" is the route that weight of a roof travels to the ground. Engineers have to plan carefully for the weight of a roof. The Caddo drove wooden poles from small trees into the ground in a circle. Then, they bent the tops of the poles toward the center. This spreads out the weight of the roof. The strong winds of the plains can't easily blow it over.

Arched Roofs

A dome shape is one of the strongest shapes in nature! It's like an eggshell. The curved top makes it easy for ice and snow to slide off the roof. This keeps a heavy pile of snow from building up on top and making the roof fall in.



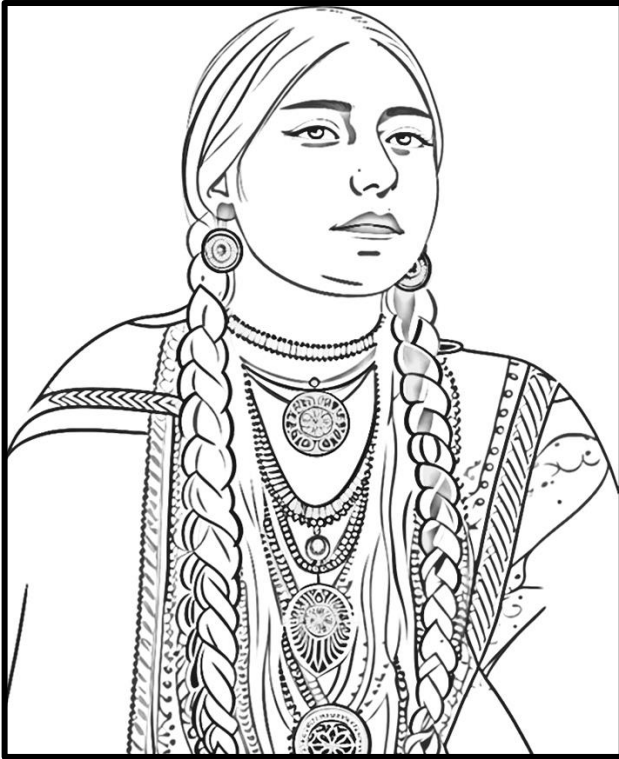
Waterproofing

Keeping a Caddo home dry was done by gathering prairie grass and tying it into thick bundles called thatch. Then, the bundles were tied onto the wooden frame in layers. These overlapped layers were like shingles on a roof. The rain runs right off the top layer and keeps the inside dry.

WATCH AND LEARN

Did you know that the Caddo and Wichita people are related? They speak a similar language and built similar homes. Take a tour of a Wichita grass lodge.





KIOWA: PEOPLE OF THE PLAINS

Who were they?

The Plains people were groups of Native Americans who lived on the Great Plains. These Tribes (like the Kiowa, Lakota and Comanche) had a special way of life. The most important animal to the Plains Tribes was the bison. It was like a supermarket on four legs! The bison gave them food to eat, skin for tipis, clothes and tools. The Tribes were nomadic sometimes, which means they moved their villages to follow the bison herds.

How were Plains people great engineers?

Plains peoples' homes had to be quick and easy to move. The tipi was a "star" of Native engineering!

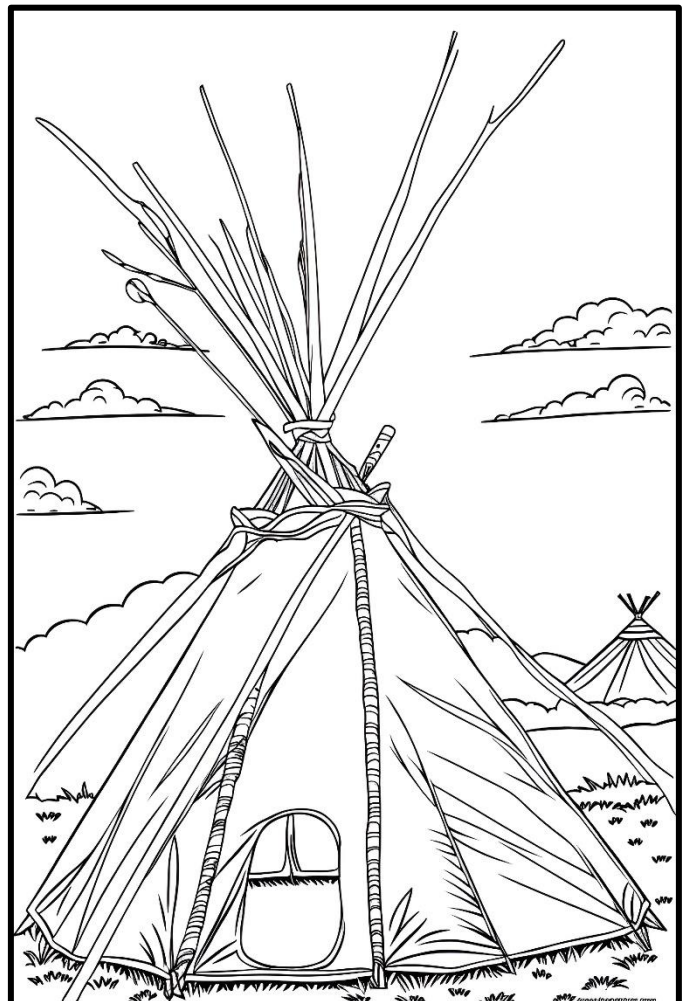
Function means that a home is built for a specific reason. A tipi could be taken down and packed up in a very short time. Tipis are made from long wooden poles, joined together at the top to make a frame. This looked like a pyramid in the shape of a circle. A cover was made from bison hides and placed over the frame. This cone shape makes the tipi very strong. The strong winds on the Great Plains slide around the smooth, round sides.

Climate Control

Tipis are also made with "skirts." These help control the climate. In summer, the skirts are raised off the ground so air can flow through (ventilation). In cold weather, the skirt lies on the ground. It blocks cold drafts from getting inside. Smoke from the center fire escapes through the top. Hot air rises and goes out the smoke hole. This engineering idea keeps air inside the tipi fresh, even without windows!

WATCH AND LEARN

Learn how a tipi is raised and the importance of its symbols.





PAWNEE

Who were they?

The Pawnee are Native American people whose homeland is the Great Plains. They were both hunters of bison and farmers.

How were the Pawnee people great engineers?

The Pawnee needed two types of homes. One that could be moved during hunting was called a tipi. When the Pawnee stayed in one place to farm, they lived in huge earth lodges. These lodges could house many families.

Framework Strength

Pawnee builders set four big posts deep into the ground in the center of a circle. Then, they put strong logs (beams) across the tops of the posts. This created a strong skeleton like the metal frame that holds up a skyscraper. This framework kept the heavy roof from falling in.

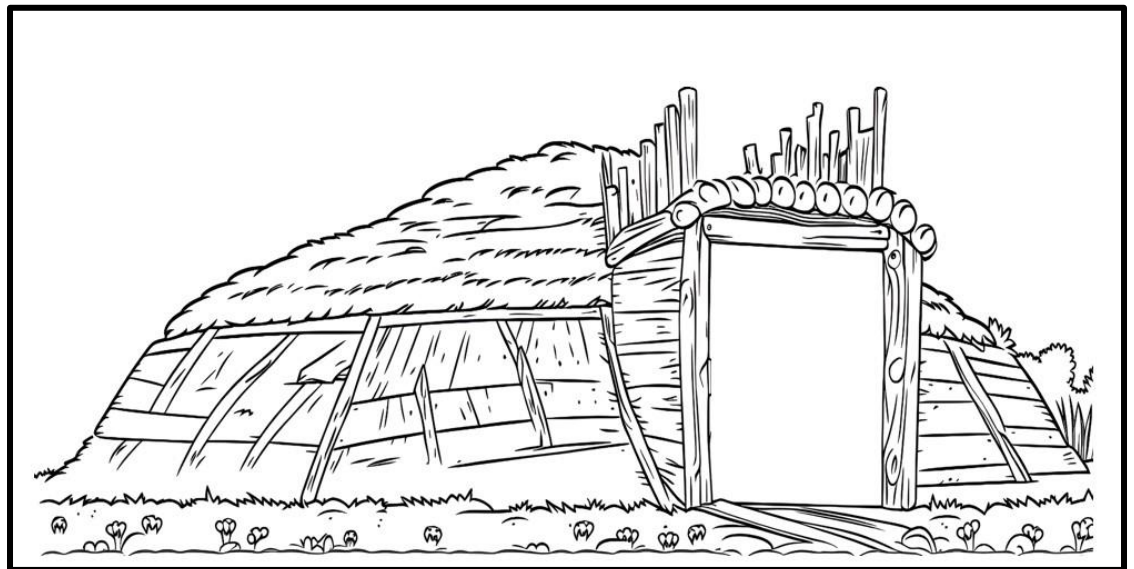
Wind Resistance

The winds blow strong on the plains. Round buildings are stronger against the wind than square buildings. The round shape moves the wind around them, instead of pushing against flat walls. This means it is much harder for the wind to damage a home or knock it down.

Saving Energy

Energy is about heating, cooling and lighting that is needed for a home.

The Pawnee put a thick layer of earth or sod (grass and soil) over the walls and roof. This layer worked like a giant thermos bottle. It sealed in the heat from the



central fire and kept the cold out. The entrance was often a long, covered passage that faced the East (the rising sun). It brought in the early sunlight and kept the wind and snow from blowing into the main room. The Pawnee also dug into the earth to make the floor sit into the ground. The ground stays almost the same temperature all year, no matter how hot or cold it is outside.

WATCH AND LEARN

Join a Pawnee celebration of the building of an earth lodge!



NATIVE ENGINEERS



CHICKASAW



Who were they?

The Chickasaw are one of the Five Nations whose homelands were in the southeast part of the United States. The Chickasaw now live Oklahoma.

How were the Chickasaw people great engineers?

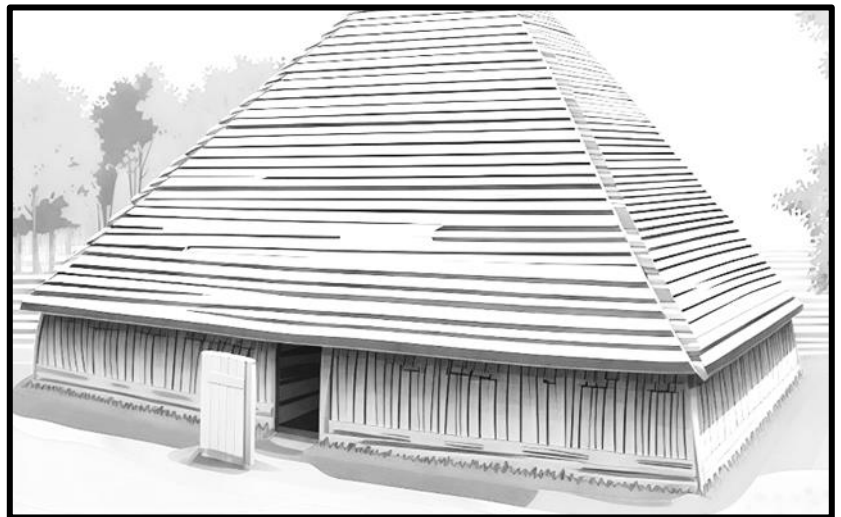
The Chickasaw built villages on bluffs or high hills to be safe from attack and spring floods. The many kinds of buildings in these villages show how they used great engineering ideas.

Function

Chickasaw engineers built different structures for many reasons. Families had winter houses and summer houses. They also built corn cribs (food storage buildings) and council houses (town meeting places). Around many villages were high fences, called palisades. These were made of large log wooden posts set into the ground. They protected the village like a fort.

Gravity Drainage

Winter houses were built to keep people dry and warm. Large tree trunks made a frame and supported the roof. The roof was covered with shingles made of tree bark or grass. Roofs were built with a slope (pitch). This angle makes rainwater and ice flow downward with the pull of gravity. Another engineering trick is overlapping shingles. When rain hits a shingle, it flows down to the next shingle. Water never finds a gap to leak into the home.



Insulation

This engineering idea uses smooth layers of insulation outside the home's frame. Insulation is anything that keeps the cold from getting in or the inside heat from escaping. The Chickasaw covered their outside walls with several coats of "daub" (a heavy paste made of clay, wet grass and crushed shells). This kept the cold wind and rain from blowing into the home.

WATCH AND LEARN

Take a tour of a traditional village and see the skills of Chickasaw engineers.

