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Bridges

Bridges are structures that let people and vehicles cross over rivers, valleys, canyons, and other obstacles. Bridges have been built for thousands of years to connect routes and people. Bridges need to be designed well and built strongly to be safe and useful.

History of Bridges

For a long time, bridges were made using simple materials like wood, rope and stone. Ancient Roman bridges called aqueducts carried water across valleys using tall stone arches. Medieval bridges in Europe used wood planks resting on stone pillars to cross rivers. Rope bridges made of plant fibers provided a way to get across canyons and gorges in the Andes mountains in South America.



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New designs like arch bridges and suspension bridges used metal cables. The Brooklyn Bridge opened in 1883 with steel suspension cables and tall Gothic towers. It was the longest suspension bridge in the world at the time. Moveable bridges that could pivot or slide open were also built to allow ships to pass.

In the 1900s, steel beam bridges spanned longer distances than ever. Advanced designs like cantilever, suspension and cable-stayed bridges used stronger steel cables. Now bridges could extend over a mile long between supports.

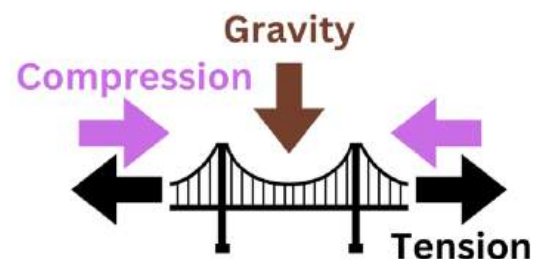
Forces on Bridges

For a bridge to be safe, it must stand up to huge forces pushing and pulling on it. Gravity is always pushing down. Moving traffic adds force through vibration and weight. Wind pushes sideways and is stronger on long bridges. Earthquakes shake the ground as well as the bridge.

The four main forces the bridge structure must handle are:

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The foundation at the bottom of the bridge must resist these forces trying to tip it over or move it. Cables, beams, trusses, and arches redirect the forces across the different bridge parts. Careful design keeps the bridge stable so it can handle all the pushes and pulls.

Building Bridges

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Construction starts with building the foundation piers in the water and on land. Huge concrete footings anchor the piers against forces. Then tall temporary towers called falsework are put up to support the bridge deck as it's assembled. The falsework towers come down when the bridge can stand on its own.

For concrete bridges, the deck and towers use poured concrete to shape their forms. The concrete hardens into the final shape. Getting the right shape and structure takes complex planning.



Famous Bridges

Many famous bridges are icons of engineering. The Brooklyn Bridge with its stone Gothic towers was the longest suspension bridge when it opened in 1883.



Brooklyn Bridge

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Future Bridges

New materials and technology will change bridge design in the



Golden Gate Bridge

future. Lighter composite materials reinforced with carbon fiber will enable longer bridges. Sensors can monitor forces and stresses to improve safety. Automated construction and solar power will be more common.



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Conclusion



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Future bridges will push possibilities further with eco-friendly, automated designs. But bridges will always reflect the human desire to overcome obstacles and bring people together.

Reflection Questions:

1. What are
2. What materials were used to build early bridges?
3. What is the
4. Why did
5. What was a notable feature of the Brooklyn Bridge when it opened in 1883?
6. What are the four main forces that affect the structure of a bridge?
7. What role
8. What factors are
9. What future technologies and materials might change bridge design?

Extension Questions and Answers:

1. What is the significance of the truss design in bridge construction, and what are some of the engineering principles that make it effective?
2. How
3. What are some

Reflection Questions: KEY

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Extension Questions and Answers:

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