



The Effect of Bridge Design on Weight Bearing Capacity

STEM4inclusive schools
WP2 – Toolbox

Școala Gimnazială Nr. 7, Galați

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Structure of the activity

A Introduction

about the topic

Determine how different bridge designs affect the weight-bearing capacity of the bridge.

B Training phase

about the training

Design and construct a stable and visually appealing bridge

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A: About the topic

Different bridge designs

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Definition!



A **bridge** is a structure built to span a physical obstacle (such as a body of water, valley, road, or railway) without blocking the path underneath. It is constructed for the purpose of providing **passage over the obstacle**, which is usually something that is otherwise difficult or impossible to cross.

There are many different designs of bridges, each serving a particular purpose and applicable to different situations. **Designs of bridges** vary depending on factors such as the **function** of the bridge, the nature of the **terrain** where the bridge is constructed and anchored, the **material used** to make it, and the **funds** available to build it.

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<https://deepai.org/>

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Types of Bridges

Definition!



Beam Bridge: A simple structure with a horizontal beam supported at each end.



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Truss Bridge: Uses a framework of triangles to distribute weight.

Pratt Truss



Warren Truss



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Arch Bridge: Has a curved structure that transfers weight to the supports at each end.



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Suspension Bridge: Uses cables suspended between towers to hold up the bridge deck.



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Did you know?



Historically, some of the longest-lasting limited-distance bridges are built around arches. Here are a few examples of arch bridges that have withstood the test of time:

1. The **Pons Fabricius** has connected Tiber Island to the heart of Rome since 62 B.C. It is the oldest bridge in the city. Overall, the structure is 200 feet long and 18 feet wide. It includes two broad arches, supported by a central pillar. It's built of ancient volcanic rock with brick and marble facing.



https://en.wikipedia.org/wiki/Pons_Fabricius#/media/File:Ponte_Quattro_Capi.jpg



Did you know?



2. The ancient Romans constructed some of the most durable bridges ever. They built the **Caravan Bridge**, the world's oldest reliably dated bridge. It's a stone arch span over the Meles River in Izmir, Turkey. According to Guinness World Records, it dates from 850 B.C., making it almost 3,000 years old.



<https://time.graphics/es/event/2704321>

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Did you
know?



3. The **Arkadiko Bridge** is a Mycenaean bridge located on the Peloponnese in Greece. It dates back to the Greek Bronze Age and is one of the oldest arch bridges still in use. The structure is 72 feet long, 18 feet wide, and 13 feet high. The bridge was originally designed for chariot use.



https://en.wikipedia.org/wiki/Arkadiko_Bridge

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Did you
know?



4. The **Anji Bridge**, built in 695 AD, is the oldest bridge in China. It's known as the "safe crossing bridge" because it was carefully designed to be structurally sound.



https://en.wikipedia.org/wiki/Anji_Bridge

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Langkawi Sky Pedestrian Bridge – Malaysia

Did you know?



- 125 meters long, and 1.8 meters wide.
- Designed as a curved walkway to maximize the viewing experience.
- Formed of steel and concrete panels set on top of an inverted triangular truss.
- Suspended by 8 cables from an 81.5m high single pylon, and hangs at about 100m above ground.
- Designed to carry a maximum capacity of 250 people.

https://en.wikipedia.org/wiki/Anji_Bridge



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Did you know?



Tretten collapsed bridge



The bridge was 148 metres long with a main span of 70 metres and a width of 10 metres.

Causes of failure:

- A short construction period, span lengths and reuse of existing foundation;
- The choice of material and a strong focus on aesthetics, contributed to the structure not being robust.

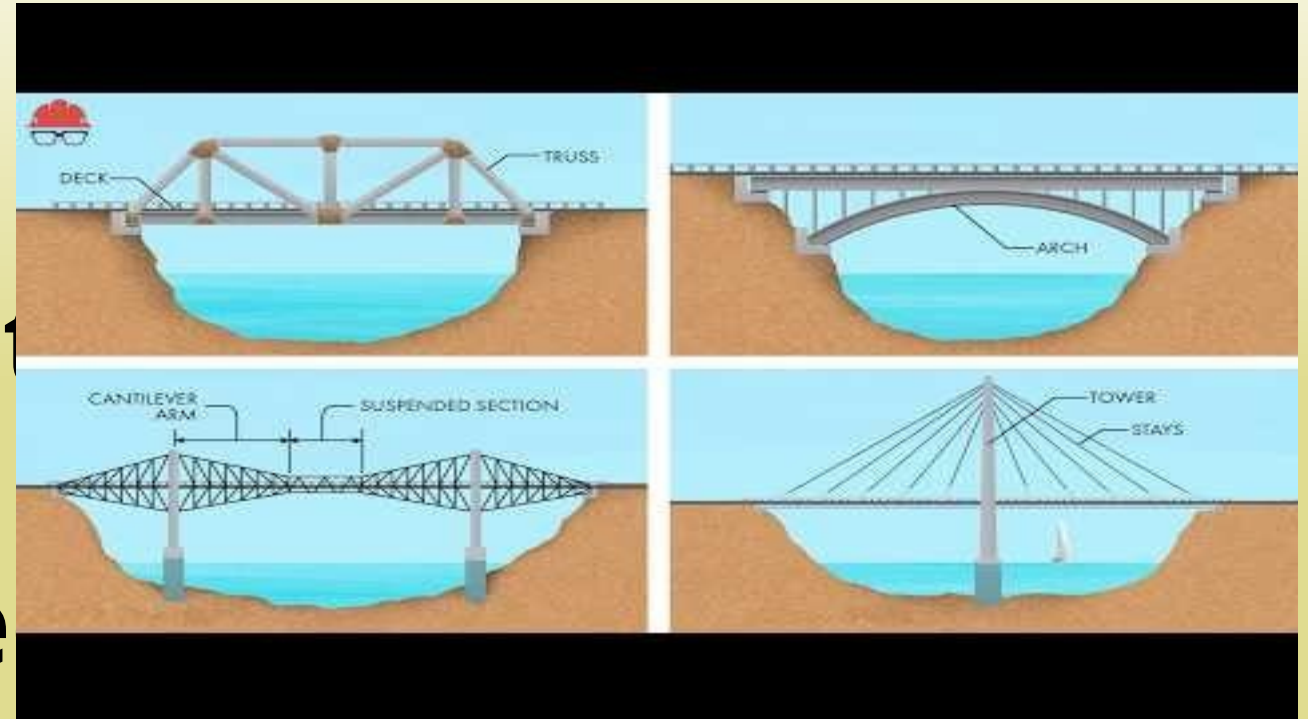
https://en.wikipedia.org/wiki/Tretten_Bridge



Let's have a look at this
youtube video!



The different models Bridges vide



Youtube channel name: **Practical Engineering**
Name of video: **Every Kind of Bridge Explained in 15 Minutes**
Link: https://www.youtube.com/watch?v=DX_zkaK5Pal
Accessed: 9.12.2024

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Needed materials:

- **Popsicle sticks or balsa wood** (for building the bridges)
- **Glue** (wood glue or hot glue)
- **Weights** (small weights or sandbags)
- **Scale** (to measure the weights)
- **Ruler or measuring tape**
- **Notebook** (for recording data)

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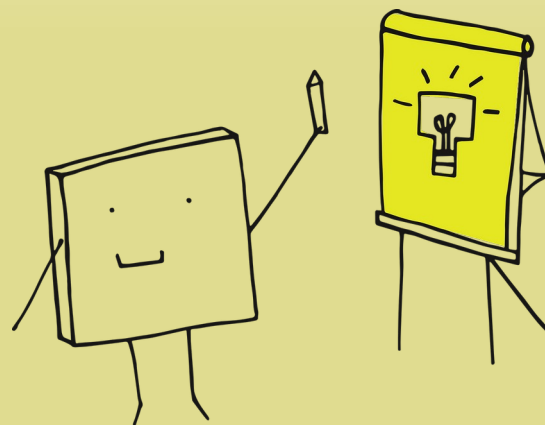


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B: Training phase

Construct your bridge



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Task 1:



- You're a team of engineers working to design a bridge using glue and 200 popsicle sticks or less. Work in **group of three** to complete the task and include also the learners who are not able to draw on their own by integrating their comments and ideas.
- You have **30 minutes** to design a bridge who can must be able to hold around 10 kg of weight. Structure must span a minimum of 35 cm in length. If there are learners with special needs in your group, you will receive an additional **10 minutes** to ensure that their contributions and ideas are fully integrated.
- Ensure that you collaborate effectively with your partners. Support learners who may have visual or physical impairments, ensuring everyone has the opportunity to contribute.



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Task 2:

- Let's have a look at the following video:



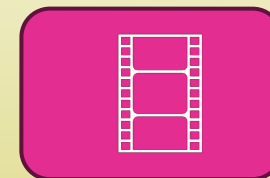
Youtube channel name: **Physics Burns (Raymond Burns)**

Name of video: **Easy Popsicle Stick Bridge**

Link: https://www.youtube.com/watch?v=s3HZievz_3Y

Accessed: 9.12.2024

Describe what you saw in a video. Please work together with other person or record an audio about your ideas with your mobile phone.



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Task 3:



- **Construct** the designed bridge using popsicle sticks or balsa wood. Ensure each bridge has around 35 cm span length for a fair comparison.
- **Glue** the pieces together and allow them to dry completely.
- **Set up** a testing area where you can place the bridges between two supports.
- **Gradually add weights** to the center of each bridge until it fails (collapses or breaks).
- **Record the maximum weight** each bridge can hold before failing.
- **Measure and record** the weight each bridge held before collapsing.
- **Compare** the weight-bearing capacities of the different bridge designs.
- **Analyze** the data to determine which design was the strongest and why.



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H5P- Tasks 1: What it is a bridge?

A **bridge** is a structure built to span a physical obstacle (such as a body of water, valley, road, or railway) without blocking the path underneath.

☐ True

☐ False

☒ Submit

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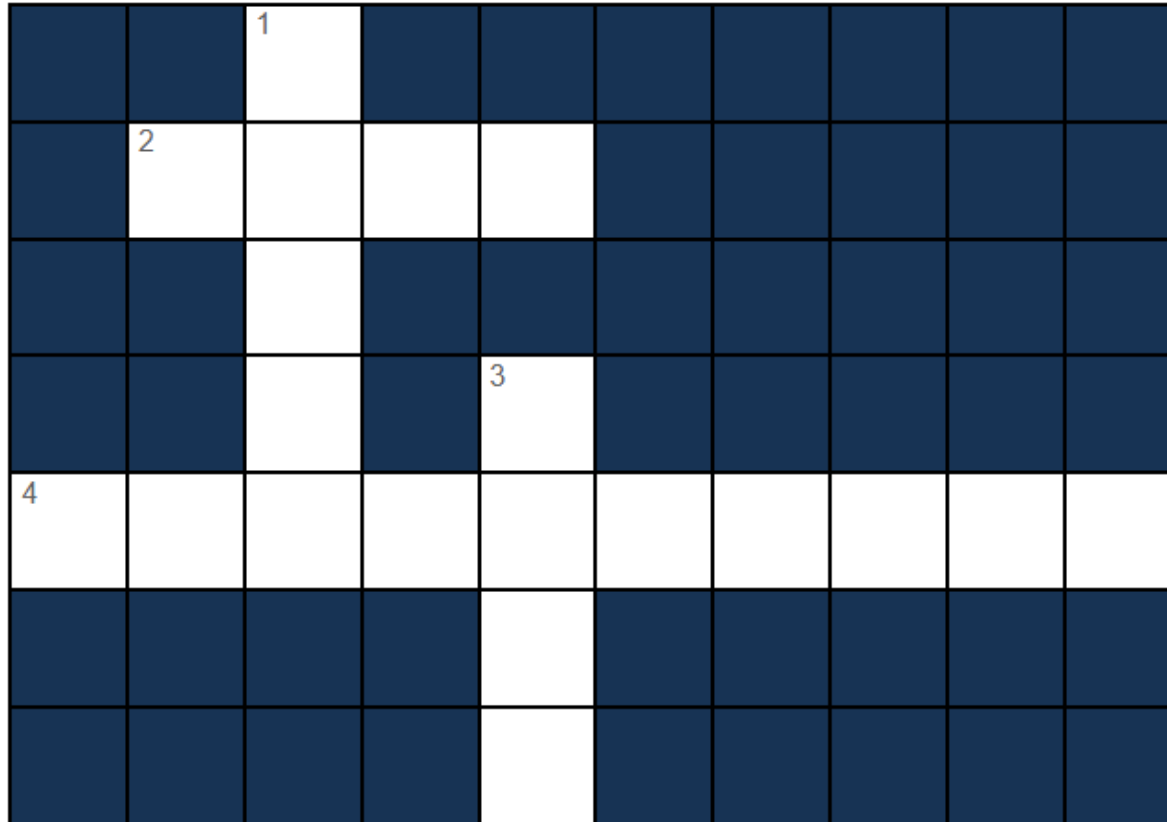


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H5P- Tasks 2: What are the different types of bridges?



Find the bridge's type.



Across

2 Has a curved structure that transfers weight to the supports at each end. (4)

4 Uses cables suspended between towers to hold up the bridge deck. (10)

Down

1 Uses a framework of triangles to distribute weight. (5)

3 A simple structure with a horizontal beam supported at each end. (4)





H5P- Tasks 3: On what a bridge design depends?

Designs of bridges vary depending on factors such as:

- ☐ the **aesthetic** factor, the **reused** materials.
- ☐ the **function** of the bridge, the **nature of the terrain**.

✓ Submit

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Congratulations!

You mastered the activity about designing and constructing a bridge.

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