

Y5 - D&T - Bridges

Inspiration Creativity – problem solving	Partnership with parents Place and belonging- local history of bridge building. https://www.clevelandbridge.com/our-work/all/		
Key Questions	Concepts		<i>Also covered in:</i> Y2- Shelters Y3- Desk tidy
Design	<ul style="list-style-type: none"> - What are the different types of bridges? - How can we strengthen and reinforce materials? - What is the brief for my design? - 	<ul style="list-style-type: none"> - Strengthening materials - Design constraints - 	By the end of this unit, the children will be able to: <ul style="list-style-type: none"> - Understand the basic engineering of different types of bridges - Know how to strengthen and reinforce materials - Design a bridge that meets a product brief - Test and refine a product - Evaluate a final product
Make	<ul style="list-style-type: none"> - How can we test a design? - How can I improve my design? 	Skills <ul style="list-style-type: none"> - With guidance, products are designed with some reference to the user experience. - With support, prototypes are made and later developed. - When reminded, a high-quality finish is achieved by applying art skills. - There are some good examples of precision cutting. - When reminded, the qualities of materials are considered when selecting tools. - With support, a range of practical skills are used effectively to make or repair products. - with support, elements of design from notable designers are incorporated into designs. - There are some good examples of designs that improve upon existing products. - When reminded, evaluations are carried out throughout and at the end of the design process. 	
Evaluate	<ul style="list-style-type: none"> - How well did my design work? 		

Knowledge

- Beam bridges are the oldest and simplest of the four types of bridges. Originally people used a long piece of stone or tree trunk to cross small streams. As weight is placed on the beam the compression force shortens the upper part. This tension causes the lower part to lengthen. The beam bends and if the pressure is too great it will break. Many beams are made of steel or concrete to make sure that they are strong enough to hold the weight.
- Arch bridges were invented by the Romans, who realised that a wedge shaped stone could carry heavy loads if built in the shape of an arch. Originally Arch bridges were built using materials such as stones and bricks that can withstand compression. Many modern bridges are built using concrete or steel. Strong support is needed on each side of the arch to stop it from spreading out.
- Truss bridges - triangle structures are added to a simple beam bridge. The triangles, or trusses, make the bridge stronger and so the bridge can span a longer distance. The trusses spread out the forces acting on the bridge along the beam. The open structure of a truss also allows the wind to pass through easily, which stops the bridge from feeling too much force from the wind.
- A suspension bridge is really just a beam that hangs from steel cables. This type of bridge can be used where there is a long distance to be crossed. The steel cables are held in position at the two ends of the bridge by enormous concrete blocks which act like an anchor. This gives a suspension bridge an 'M' shape. The anchor blocks need to be strong and heavy enough to not only hold up the deck of the bridge, but also to hold any vehicles that will pass over the bridge. When vehicles go over the bridge, the weight pulls down on the cables causing tension. The cables then pass the load onto the columns. The columns feel this load as compression. Each cable is made up of smaller cables joined together to make one very strong cable.
- A cable-stay bridge is a type of suspension bridge. A cable-stay bridge supports the road with large steel cables. The cables go directly from the road up to a tower, making an 'A' shape, this shape makes a cable-stay bridge easy to recognise. The cables are fixed to each side of the tower and pull down, helping to balance each other.
- A cantilever is any beam that is fixed to something at only one end and sticks out, like a diving board or a shelf. This end is what supports the beam. A cantilever bridge is made up of two beams, called cantilevers, which are each attached to a pier at one end and joined in the middle by a connecting beam. This connecting beam is supported in the middle by a column.
- Triangles don't twist, bend, or collapse easily, in comparison with rectangles and other shapes. A triangle is the only shape that cannot be pushed or pulled out of shape without changing the length of one of its sides. Changing the shape of materials affects their strength for example tubing or corrugating.

Topic Specific Vocabulary beam bridge, arch bridge, suspension bridge, truss bridge, triangulation, diagonal, stable, strength, framework, material, tube, rigid, section	NC Subject content <ul style="list-style-type: none"> - use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups - generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes - select from and use a wider range of tools and equipment to perform practical tasks accurately - select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities - investigate and analyse a range of existing products - evaluate their ideas and products against their own design criteria and consider the views of others to improve their work - understand how key events and individuals in design and technology have helped shape the world - apply their understanding of how to strengthen, stiffen and reinforce more complex structures
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Subject Specific/Academic Vocabulary
This vocabulary should be explicitly taught in context. Other tier 2 words should also be explored as they are encountered.

Year 3	Year 4	Year 5	Year 6
Appropriate, features, specific, concept, range, sequence, structure	Economic, identified, potential, procedure, process, variables	Affect, analyse, criteria, demonstrate, specify	Technique, component, justify, outcome

We are engineers
Iterative design process leading to final high quality model bridge