BILSTON CHURCH OF ENGLAND PRIMARY

MEDIUM TERM PLANNING

Subject	Topic/Key Question	Year Group	Term	Time Allocation
Design and Technology	Bridges	5	Spring 2	hours
End of upper key stage 2 objectives	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, pattern pieces and computer-aided design. Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work. Apply their understanding of how to strengthen, stiffen and reinforce more complex structures			
Stable structures				
End of unit objectives	I know what beams and pillars are and how they are used in bridge construction. • I can predict which beams will be strongest from their cross-section. • I can test the strength of different beam shapes using paper and card. • I can explain what a truss is and how trusses make bridges stronger. • I can identify the three types of trusses commonly used in bridge design. • I can build a truss bridge spanning a width of 40cm using paper straws. • I can use a fair test to evaluate the strength of my truss bridge. • I can explain how arches work to make bridges stronger.			

	• I can test the arch heights to see which can bear the most load. • I can make an arch frame. • I can explain how suspension bridges use tension forces to work. • I can design, make and evaluate a prototype suspension bridge using a scale of 1:100 according to specific design criteria.	
Vocabulary	Design	Range of ideas, collect information, Different sources, Produce, Detailed, Step by step plan, Explain, Specific audience, Product, Design, Users view, Suggest, Alternative plan, Positives, Drawbacks
	Make	Tools, Equipment, Competently, Make, Prototype, Final piece, Persevere, Stages of making, Process, Accurate, Measurement, Precise, Strong, fit for purpose, Refine, Improve
	Evaluate	Suggest, Alteration plans, Positive features, Drawbacks, Evaluate, Appearance, Function, Original contents, Checking, best it can be, fit for purpose, Strong, Explain, Refine, Test
	Structures	Choose, Make, Attractive, Strong, Prototype, Joining techniques, Rolling, Folding, Concertinaing, Reinforce

Lesson Sequence	Time Allocation	Key Question/WALT	Teaching Activities	Resources
Technical knowledge Lesson 1	2 hours	To investigate how pillars and beams are used in construction.	The first slide shows a tree fallen across a stream. Explain that the first bridges were probably either found or made in this way. Early bridges were not much different – beams, like the fallen tree, were used to span gaps. More complex beam bridges have decks and sides (called parapets). These make bridges stronger and easier to cross. Pillars are used to make bridges which span bigger gaps. Show the slide with the image of an old clapper bridge' supported by stone pillars. What modern materials might be used to make beams and pillars? Children are to think, pair, share their ideas. The following slide explains the benefits of using concrete and steel in bridge construction. Beams are formed into different shapes for different purposes. Show the slide with cross-sections of beams. Which do you think will be strongest? Children are to discuss their ideas. Provide the children with the images from the slide show. Can they evaluate the bridge giving positive and negative points regarding construction and the materials used. Modern materials allow for the construction of bridges over deep water. The pillars of these bridges stand on piers with deep foundations. The slide shows the Millennium Footbridge in London as an example of this. Explain that today we will be investigating and exploring the effectiveness of different pillar or beam designs. Using the resources 1A,B, C children will explore the different kinds of beams that they can construct with the given cross section.	PlanBee Lesson 1 Slides printed images Card
Technical knowledge Lesson 2	2 hour	To investigate different structures.	Ask the children to think about a structure. Where would you find this structure? What is it used for? What materials are used and why?	Twinkle Power Point Structures Newspaper

			Divide the class into groups and provide each group with one of the starting activities: build a table, bridge, tallest tower. Children to evaluate each others structure and think about how they could improve their structure. Continue by looking at the different structures on the power point. Now change the task for each of the groups to try again with the knowledge of how to improve the strength of the structures.	Sticky tape
Technical knowledge Lesson 3	2 hours	To explore ways in which trusses can be used to strengthen bridges.	Show the slides with some examples of truss bridges. Explain that engineers can build stronger bridges using truss sections made from a number of beams connected in different ways. The decks of these bridges usually run on top of or through the trusses. Why do trusses make bridges stronger? The following slides explain how weight is distributed as objects travel across a bridge, and how trusses help to distribute the compression forces exerted by the moving weight. •Show the slides with examples of different truss designs. You may wish to display this slide for reference during the main activity. Explain that today we will be exploring ways in which trusses can be constructed and used to strengthen bridges. Firstly children will use the Bridges app on the ipads to explore how to create the Bridge. NOTE: Prior to undertaking the main activity, you may wish to demonstrate some ways in which the materials you have selected can be used to make truss sections; the slides and Truss Pattern cards have some examples of truss designs. Using the materials and prompts from 2A, B, C children will complete the different kinds of Truss Patterns and evaluate.	Plan Bee lesson 2 Slides Worksheets 2A/2B/2C Truss Patterns Art straws and sticky tape; sets of weights; toy cars; K'NEX, Meccano or similar construction kits Ipads Bridges app

Technical knowledge Lesson 4	1 hours	To explore ways in which arches are used to strengthen bridges.	Show the slides with examples of stone arch bridges. Until developments in technology and engineering meant that engineers could construct large beams using iron and later, steel, the best way to construct long, strong and long-lasting bridges was with arches made of stone. Why do you think that other materials such as wood might not be so good for spanning large distances, or for building bridges crossing water? Children to think, pair, share their ideas. The following slides explain why. • Stone is weak under tension but strong under compression. This means that it is not a suitable material for long beams. The slides explain how and why these forces act on beams in bridges. You may wish to give pieces of cleaning sponge for children to explore these ideas, as suggested in the slide. • Arches help to spread the load by changing the direction of the compression forces caused by the weight of the bridge itself and the weight of the objects crossing it. Show the diagrams explaining how arches redirect the compression forces to the strong abutments on either side of an arch bridge. • Explain that today we will be exploring the effectiveness of arches of different shapes and sizes in spreading the load on bridges. Firstly try using the wooden bricks to create an arch, now explore testing the arches using the resource sheets 3A,B,C.	Plan Bee lesson 3 Slides Worksheets 3A/3B/3C Card, paper, sets of weights, rulers, plasticine.
Technical knowledge Lesson 5	2 hour	To identify types of bridges.	Ask the children to name different types of Bridges. Why are these Bridges called this. Using the powerpoint explore the different kind of Bridges. Children will then use the information to create a information booklet on the types of bridges. To support the children use images from the PP printed out so that children can use them in their booklets.	Twinkle Power point Types of Bridges
Designing and making	2 hour	To understand how suspension bridges are	Recap information from previous lesson on types of bridges.	Plan Bee lesson 4 Slides

Lesson 6		able to span long distances.	Show the slides with images of suspension bridges. Explain that suspension bridges are different to many other bridge designs because they spread out the weight of the bridge and the traffic crossing it in a different way. With other bridge designs, compression forces distribute the weight more evenly across the bridge, or to the abutments on either side of the bridge rather than the bridge's weak centre point. Suspension bridges use tension forces, pulling rather than pushing. The following slides explain how this works. Modern engineering means that huge suspension bridges can be built. Thick, heavy, twisted steel cables transfer the weight of the bridge to the vertical columns. Their weight means they have to hang in long loops between the columns. The cables are anchored at either side of the bridge deep into hard rock or into tonnes and tonnes of poured concrete. Because the columns of suspension bridges can withstand huge compression forces, they can be built with long decks and big gaps between them. Another advantage is that the deck can be hung high above the gap it is spanning, unlike other bridge designs. Explain that today we will be designing and making suspension bridge models. Using the 4A,B,C in groups children will create a suspension bridge. Firstly planning their bridge with annotated drawings. Bridges will be evaluated and tested in the next lesson.	Worksheets 4A/4B/4C String, scissors, art straws, card, paper, sticky tape.
Evaluate Lesson 6	2 hours	To analyse and evaluate products according to design criteria.	Note: This lesson follows on from the learning activity undertaken by children in lesson five. Show the slide with the design brief from the previous lesson. How can we test to see if a prototype bridge design is any good? The following slide explains that prototypes can be analysed by answering questions based on design criteria. How will you test your prototype bridge? Children are to discuss their ideas with reference to their design criteria. After a few minutes, gather children's responses. If the main	Twinkle 'Building Bridges' Plan Bee Lesson 6

			activity was undertaken during the last lesson, a series of tests that are the same for all bridge prototypes should be agreed upon. If the 'Fancy something different...?' activity was undertaken, different tests may be required for each bridge prototype. Explain that today we will be analysing and evaluating our prototype bridge designs, taking account of the views of others. Using the evaluation criteria in the resources 6A,B,C	