



GO

INSPIRE THE FUTURE

**Building Bridges
CREST Challenge**

NATIONAL CURRICULUM MAPPING – ENGLAND



A British Science Association programme

MATHEMATICS

Curriculum area	Attainment target	How is this met?
Working mathematically - Develop fluency	Move freely between different numerical, algebraic, graphical and diagrammatic representations.	Participants will be required to use several different graphical representations, and written explanations, to describe their plans.
Working mathematically - Develop fluency	Use language and properties precisely to analyse 2-D and 3-D shapes.	This Challenge asks participants to consider a complex 2-D map, and to design 3-D structures and areas within that map. They will also use a combination of graphical, written and spoken communication to articulate their ideas.
Subject content - Number	Use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 and distinguish between exact representations of roots and their decimal approximations.	Area calculations are required in this Challenge, so participants may gain experience of using integer power 2 to solve real-life problems. They will certainly gain experience in using units of area as squared metres (m ²).
Subject content - Number	Use standard units of mass, length, time, money and other measures, including with decimal quantities.	Participants are required to use and exchange quantities between metres, kilometres and m ² as part of this Challenge.
Subject content - Number	Use a calculator and other technologies to calculate results accurately and then interpret them appropriately.	Participants will need to use a calculator to complete some of the operations required in this Challenge, and are required to interpret results appropriately.
Subject content - Geometry and measures	Calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes.	Participants will need to calculate areas of woodland, which are likely to be composite shapes, areas of soakaway, and other areas in order to complete the Challenge.
Subject content - Geometry and measures	Draw and measure line segments and angles in geometric figures, including interpreting scale drawings.	Participants will use, draw and interpret scale drawings as part of this Challenge.

SCIENCE

Curriculum area	Attainment target	How is this met?
Working scientifically – Scientific attitudes	Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience.	Participants will need to study several bridges in order to gain an understanding of the structures, and also conduct research, using observations of the real world alongside research, prior knowledge and experience, to develop a solution to a problem. Participants will also need to frame questions to put to engineers, in order to gain further information to help them to arrive at a sensible solution.
Working scientifically – Analysis and evaluation	Present observations and data using appropriate methods, including tables and graphs.	Participants will need to summarise their findings as a result of their research and their visit to bridges, in such a way that they can use it to inform the development of their solutions. This will require the use of tables, and participants will need to select the most appropriate method to present this information.
Working scientifically – Analysis and evaluation	Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions.	Participants will use their research and observations to draw conclusions about the best solution to the Challenge, and will need to explain this in their work.
Working scientifically – Analysis and evaluation	Present reasoned explanations, including explaining data in relation to predictions and hypotheses.	Participants will need to explain their reasoning as part of the CREST process, both when presenting their project, and when discussing it with assessors.
Working scientifically – Measurement	Understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature.	Participants will be required to use metres, m ² and other units as part of this Challenge.
Biology – Interactions and interdependencies – Relationships in an ecosystem	Know how organisms affect, and are affected by, their environment, including the accumulation of toxic materials.	Participants are required to identify species that are adapted to grow in specific environments, in order to plant trees on the contaminated part of the site.

SCIENCE CONT.

Curriculum area	Attainment target	How is this met?
Physics – Motion and forces – Forces	Recognise forces as pushes or pulls, arising from the interaction between two objects.	Participants will encounter this concept during their bridge visit, and also the concept of balanced forces as the way bridges retain their strength.
Physics – Motion and forces – Forces	Use force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces.	Activity leads may wish to encourage participants to draw force arrows on their diagrams of bridges, in order to aid their understanding of the structures and the ways they work. Participants will encounter balanced and unbalanced forces in two dimensions when studying bridge structures.
Physics – Motion and forces – Forces	Know about forces associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces; with pushing things out of the way; resistance to motion of air and water.	Material strengths, wear and tear on bridges, and concepts of stress, strain and metal fatigue may be introduced as part of the bridge visits.
Physics – Motion and forces – Forces	Know about forces measured in newtons, measurements of stretch or compression as force is changed.	Participants will be encouraged to think about forces as stretch and compression when studying bridge structures.
Physics – Motion and forces – Balanced forces	Know about opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface.	The idea of compressed surfaces supporting bridges and compressed members forming part of their structures can be introduced as part of the bridge tour.

DESIGN AND TECHNOLOGY

Curriculum area	Attainment target	How is this met?
Design	Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools.	Participants must produce 2-D plans, annotated sketches and written proposals as part of this Challenge.
Evaluate	Analyse the work of past and present professionals and others to develop and broaden their understanding.	The visit to bridges requires participants to study completed bridges in order that they gain the necessary understanding to develop an appropriate solution for this Challenge.
Evaluate	Investigate new and emerging technologies.	Participants may wish to look into new structural materials, which offer significant benefits over traditional materials. Examples might include glass-reinforced plastic and, though further from implementation, carbon nanotube ropes.
Evaluate	Test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups.	Participants are given a specification for the Challenge, and must measure their response and their solution against it as part of the Challenge. Although this will not involve interaction with potential users, it is a useful exercise and begins participants' thinking in this area.
Evaluate	Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists.	Participants will work with professional engineers and construction professionals. As a result, they will gain some understanding of the obligations of designers, engineers and technologists when designing and constructing bridges, or running any construction site, particularly in the areas of health, safety and environment.
Evaluate	Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions.	This is an integral part of designing a solution to the Challenge, though participants are not required to understand the role of particular structural elements or the detailed properties of materials in order to achieve a solution. Participants will not have the opportunity to test their solution, but they will gain an appreciation of the issues facing professionals in the field.

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