

Summary	Duration
<p>Recently, the Harbour Bridge has become too congested so a second bridge between the north and south side of Sydney needs to be created. The City of Sydney has hired Crown Street Public School to design the new bridge. They need a bridge that can carry a lot of weight (because of the amount of trains and cars that will cross the bridge) and something that can become the new icon of Sydney.</p>	<p>9 weeks Detail: 1-2 sessions per week</p>
Unit overview	Language
<p>The Build a Bridge unit provides opportunities for students to work as a group and explore the design process to solve a real life problem. Students will identify the problem in their own words, brainstorm solutions to solve this problem and plan their design ideas. They will then be able to create their design and compare with other groups before redesigning their prototype. Students will learn to justify their design features and explain their reasoning.</p>	<p><i>accuracy, analysis, anecdotal record, argument, brainstorming, challenge, collaboration, communication, computational thinking, creative thinking, criteria, critical thinking, divergent thinking, drawing conclusions, evidence, higher order thinking skills, inference, model, prior knowledge, product, prototype, qualitative, self-directed, STEM</i></p>
Outcomes	Assessment overview
<p>Science and Technology K-6</p> <ul style="list-style-type: none"> › ST2 1WS S questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations › ST2 2DP T selects and uses materials, tools and equipment to develop solutions for a need or opportunity › ST2 7MW T investigates the suitability of natural and processed materials for a range of purposes › ST2 9PW ST describes how contact and non-contact forces affect an object's motion <p>Mathematics K-10</p> <ul style="list-style-type: none"> › MA2 12MG measures, records, compares and estimates the masses of objects using kilograms and grams › MA2 18SP selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs › MA2 1WM uses appropriate terminology to describe, and symbols to represent, mathematical ideas 	<ul style="list-style-type: none"> › Science journal entries › Annotated drawings › Class discussion contribution › Scientific questioning › Final Prototype

Content	Teaching & learning experiences:
<p>Working Scientifically</p> <p>Questioning and predicting</p> <ul style="list-style-type: none"> ▪ identify and pose questions in familiar contexts that can be investigated scientifically ▪ make predictions based on prior knowledge (AC SIS053, AC SIS064) <p>Planning and conducting investigations</p> <ul style="list-style-type: none"> ▪ plan scientific investigations with guidance ▪ conduct scientific investigations to find answers to questions ▪ use appropriate materials and equipment safely (AC SIS054, AC SIS065) ▪ consider and apply the elements of fair tests ▪ collect and record accurate, honest observations using labelled observational drawings, basic formal measurements and digital technologies as appropriate (AC SIS055, AC SIS066) ▪ reflect on investigations, including whether testing was fair or not (AC SIS058, AC SIS069) ▪ participate individually and collaboratively with clear roles and goals <p>Design and Production</p> <p>Researching and planning</p> <ul style="list-style-type: none"> ▪ consider sustainable use of resources and time constraints in planning design solutions ▪ develop, record and communicate design ideas and decisions using appropriate technical terms ▪ produce labelled and annotated drawings including digital graphic representations (ACTDEP015) ▪ plan a sequence of production steps when producing designed solutions individually and collaboratively (ACTDEP018) <p>Producing and implementing</p> <ul style="list-style-type: none"> ▪ select appropriate tools for a specific purpose ▪ select and effectively manipulate appropriate materials for a specific purpose ▪ use safe work practices ▪ consider sustainability and constraints when choosing resources and managing time in production of designed solutions (ACTDEP016) <p>Materials are used for a specific purpose</p> <p>Focus question: How do you decide upon which material to use for a particular purpose?</p> <ul style="list-style-type: none"> ▪ identify the roles of people working in science and technology occupations (ACTDEK010) 🧑🏫🔧🌟 	<p>Learning experience 1: Giving Feedback</p> <ul style="list-style-type: none"> • Class watches a YouTube video on the history/design of the Sydney Harbour Bridge. • https://www.youtube.com/watch?v=Jy5cZ-IO0Eg • Teacher shows a photograph of the Sydney Harbour Bridge and then shows their drawing of the Sydney Harbour Bridge. • As a class the teacher will go through the TeacherStarter Critique sentence starters and how to critique another students piece of work. • Using the Sydney Harbour Bridge photograph students create their own drawings of the Sydney Harbour Bridge. • In small groups using post-it notes, students critique another students work. • Opportunity to create a word wall with new terminology. <p>Learning experience 2: The design brief</p> <ul style="list-style-type: none"> • Students state the problem in their own words and are shown the different types of materials available. • Teacher models how to sketch and label a side and rear view design. • Students then brainstorm possible design solutions by themselves. They will create a side and rear view of their chosen design. • The students come together in their small groups to discuss each design. Encourage students to discuss the strengths and weaknesses of each design. The group will collectively decide on a design and sketch and label their plan view of their chosen design. <p>Learning experience 3: Construct</p> <ul style="list-style-type: none"> • Jointly create some expectations with group work (Y-chart). Questions to ask: How do we politely agree or disagree? How do we take turns? What happens if we make a mistake? • Students use materials and/or information to create their design/object physically.

Stage 2 - Mass 1

Students:

Measure, order and compare objects using familiar metric units of mass (ACMMG061)

- recognise the need for a formal unit to measure mass
- use the kilogram as a unit to measure mass, using a pan balance
 - ▶ associate kilogram measures with familiar objects, eg a standard pack of flour has a mass of 1 kg, a litre of milk has a mass of approximately 1 kg (Reasoning)
 - ▶ recognise that objects with a mass of one kilogram can be a variety of shapes and sizes (Reasoning)
- record masses using the abbreviation for kilograms (kg) 

Stage 2 - Mass 2

Students:

Use scaled instruments to measure and compare masses (ACMMG084)

- recognise that there are 1000 grams in one kilogram, ie 1000 grams = 1 kilogram
- use the gram as a unit to measure mass, using a scaled instrument
 - ▶ associate gram measures with familiar objects, eg a standard egg has a mass of about 60 grams (Reasoning)
- record masses using the abbreviation for grams (g) 
- record masses using kilograms and grams, eg 1 kg 200 g

Stage 2 - Data 1

Students:

Identify questions or issues for categorical variables; identify data sources and plan methods of data collection and recording (ACMSP068)

- recognise that data can be collected either by the user or by others

Collect data, organise it into categories, and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies (ACMSP069)

- collect data and create a list or table to organise the data, eg collect data on the number of each colour of lollies in a packet  
 - ▶ use computer software to create a table to organise collected data, ega spreadsheet (Communicating) 
- construct vertical and horizontal column graphs and picture graphs that represent data using one-to-one correspondence
 - ▶ use grid paper to assist in constructing graphs that represent data using one-to-one correspondence (Communicating)

Interpret and compare data displays (ACMSP070)

- describe and interpret information presented in simple tables, column

Learning experience 4: Test and re-design

- Discuss what is a fair test? As a class go through the fair test lab: <http://www.scootle.edu.au/ec/viewing/L540/L540/index.html>
- Students will test their design using the task checklist (does it meet the design criteria?)
- Ask the students:
 - What problem or issue have you noticed?
 - Why did it happen?
 - How can you fix the problem?
- Students will then use the data to redesign and improve their original design.
- Students will retest with updated designs and record new data.
- Teacher emphasises that even the most expert designers learn through doing revisions to original plans and going through the design process a number of times.
- Encourage students to take photos of each of their designs. Have students verbalise what they changed and why they made those changes.

Learning experience 5: Reflect

- As a class record the data and analyse the overall success of each of the designs.
 - Opportunity to create a graph on the classes results.
- Collectively form a recommendation for a whole class design which incorporates the most successful features.

Learning experience 6: Act

- Students need to do a final side and back design of their prototype.
- Create an advertisement for the class prototype outlining the process, design specifications and justifications (encourage students to use correct terminology – may require student research.)

graphs and picture graphs 📊

make conclusions about data presented in different data displays, eg 'Football is the most popular sport for students in Year 3 at our school' (Communicating, Reasoning) 📊

Extension Activities

- There are four main types of bridges: beam, arch, suspension and cantilever. Look at some images of each type of bridge. Draw a labeled example of each. Record the features, the building materials used and a famous example for each bridge type.
- Use Google Sketchup to create a 3D view of their prototype (opportunity to create a 3D printing design.)
- Display the data collected from the testing in a number of different ways e.g. using the computer (Excel)

Evaluation & reflection