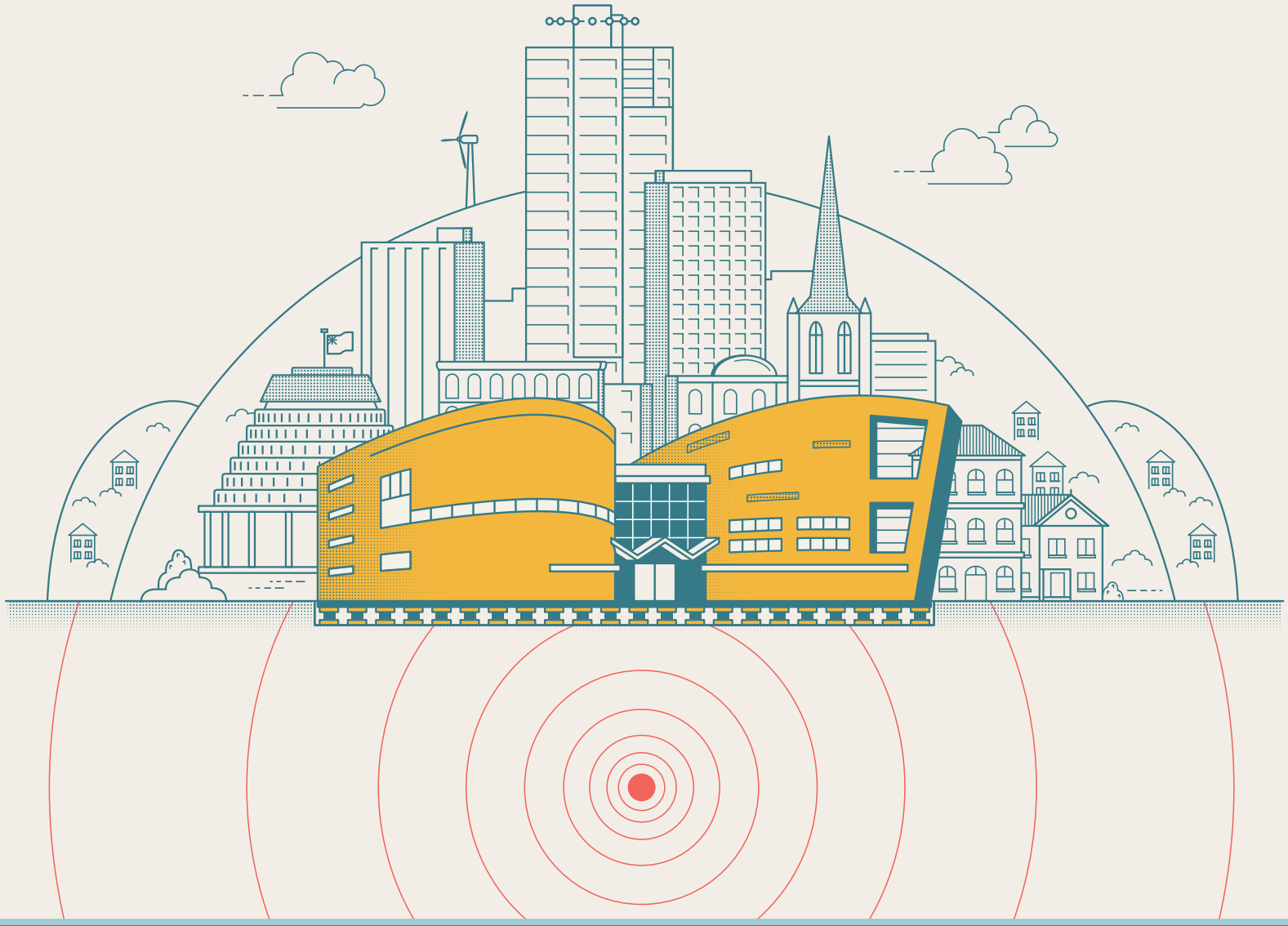
BUILDING AN EARTHQUAKE-READY FUTURE

TEACHER RESOURCE



EQC
EARTHQUAKE COMMISSION
Kōmihana Rūwhenua

TE PAPA
OUR PLACE

CONTENTS

ABOUT THIS RESOURCE

In Building an Earthquake-Ready Future students get the opportunity to make a difference to communities affected by earthquakes and to help build better protections against natural disasters.

Students will follow the Stanford Design Thinking process, working through the different steps to understand the process a designer goes through when creating something to solve a problem. This process can be applied to other projects the students do, and is a great way to navigate Technology in the *New Zealand Curriculum*.

In the Junior Model

Students will investigate the types of damage made to a house by an earthquake. They will look into what causes the damage and what changes could be made to prevent it.

From there, the students will pick three or four problems that they will create solutions for, and which can be easily tested in class together.

They will work together to brainstorm and prototype solutions for one problem, which they will test, reflect on, and iterate to improve, based on reflections and feedback.

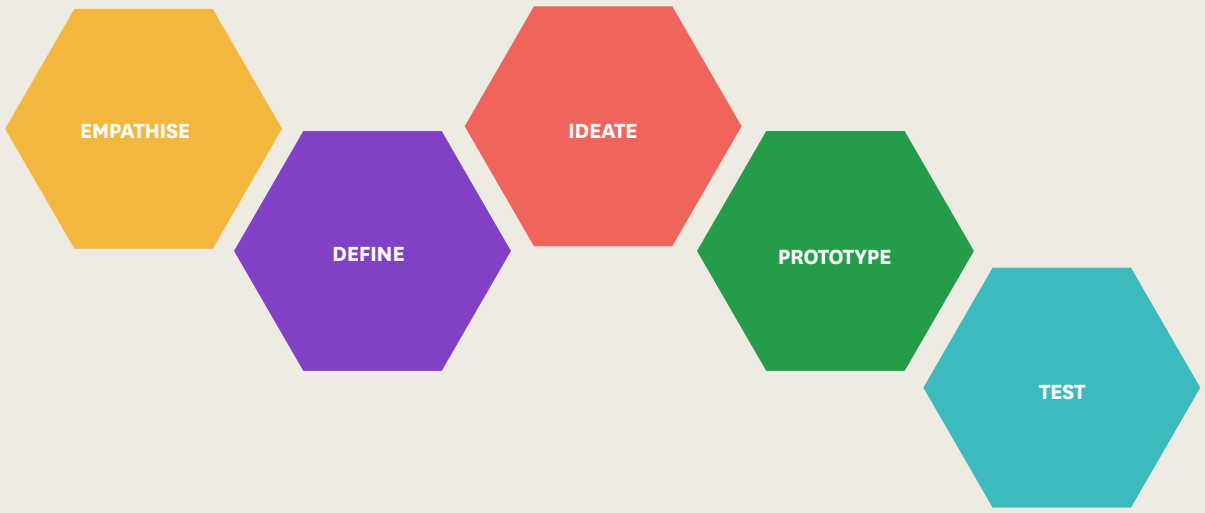
In the Senior Model

Students will begin by investigating the damage that is done by earthquakes, in all its different forms. From there they will identify the main problems, and how they have come to be. After that, students will divide into groups, pick a problem to work on, and ideate some solutions.

They will pick what they feel is the best solution and begin to prototype and test it, recording and documenting their processes along the way. Finally, they will present their problem, solution, test results, and records to the rest of the class, and ideate around what the next steps would be if they were to continue pursuing their plans.

STANFORD DESIGN THINKING

Stanford Design Thinking is a methodology for creative problem solving used by many companies and groups around the world. It comprises five steps for innovators to follow when creating and innovating a product.



The Five-Step Process

Empathise
Interview the end user of the product you want to design. Who is it for? What specifically do they need? What can current products not provide them?

Define
Reflect on your findings and come up with a problem statement that best describes what you need to make.

Ideate
Sketch/create many different products that could be the solution to the problem. Pick the most suitable one.

Prototype
Create a prototype of the best idea.

Test
Test this prototype.

Design Thinking for Kids

Stanford Design School worked with the Children's Creativity Museum in the United States to create a three-day workshop around this methodology for kids. This included an extra step at the end: sharing. Students shared their ideas with their peers and stakeholders and the processes they went through.

More infomation from Ideaco
http://www.ideaco.org/2013/07/standfords-design-process-for-kids-teaching-big-picture-problem-solving/

Bringing Design Thinking to students in schools
https://ed.stanford.edu/news/design-thinking-kids-an-interview-with-stanford-about-bringing-the-process-to students-in-school-not-just-workplaces

Activities to introduce students to the design process
https://dschool.stanford.edu/resources/getting-started-with-design-thinking

New Zealand Curriculum
http://nzcurriculum.tki.org.nz/The-New-Zealand-Curriculum

KEY COMPETENCY LINKS

THINKING

Students will take the information they have researched and use it to inform their thinking. They will come up with innovative ideas based on a brief and keep a record of their thinking to share with the class at the end.

MANAGING SELF

As the students will be following their own design path, it is up to them to make sure that they are on task and everyone is working together in a cohesive way.

RELATING TO OTHERS

Students will need to gather enough information to be able to understand what people struggle with in the aftermath of an earthquake. This understanding will help them to create a better, user-friendly product, and get them to think about the needs of their audience and end users.

PARTICIPATING AND CONTRIBUTING

The students will be working in groups so will need to ensure that everyone's ideas are heard and respected.

LEVELS 3–4 **CURRICULUM LINKS**

ENGLISH
LEVELS 3–4

Speaking, Writing, and Presenting

Students will:

Processes and strategies
Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.

Ideas
Select, form, and communicate ideas on a range of topics.

Structure
Organise texts, using a range of appropriate structures.

SCIENCE
LEVELS 3–4

Nature of Science

Students will:

Understanding about science

Appreciate that science is a way of explaining the world and that science knowledge changes over time.

Identify ways in which scientists work together and provide evidence to support their ideas.

Investigating in science

Build on prior experiences, working together to share and examine their own and others' knowledge.

Ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations.

Participating and contributing

Use their growing science knowledge when considering issues of concern to them.

Explore various aspects of an issue and make decisions about possible actions.

LEVELS 3–4 CURRICULUM LINKS

TECHNOLOGY
LEVEL 3

Technological Practice

Students will:

Planning for practice

Undertake planning to identify the key stages and resources required to develop an outcome. Revisit planning to include reviews of progress and identify implications for subsequent decision making.

Brief development

Describe the nature of an intended outcome, explaining how it addresses the need or opportunity. Describe the key attributes that enable development and evaluation of an outcome.

Outcome development and evaluation

Investigate a context to develop ideas for potential outcomes. Trial and evaluate these against key attributes to select and develop an outcome to address the need or opportunity. Evaluate this outcome against the key attributes and how it addresses the need or opportunity.

Technological Knowledge

Students will:

Technological modelling

Understand that different forms of functional modelling are used to inform decision making in the development of technological possibilities and that prototypes can be used to evaluate the fitness of technological outcomes for further development.

Technological products

Understand the relationship between the materials used and their performance properties in technological products.

Technological systems

Understand that technological systems are represented by symbolic language tools and understand the role played by the 'black box' in technological systems.

LEVELS 3–4 **CURRICULUM LINKS**

TECHNOLOGY
LEVEL 3

Nature of Technology

Students will:

Characteristics of technology
Understand how society and environments impact on and are influenced by technology in historical and contemporary contexts and that technological knowledge is validated by successful function.

Characteristics of technological outcomes
Understand that technological outcomes are recognisable as fit for purpose by the relationship between their physical and functional natures.

TECHNOLOGY
LEVEL 4

Technological Practice

Students will:

Planning for practice
Undertake planning that includes reviewing the effectiveness of past actions and resourcing, exploring implications for future actions and accessing of resources, and consideration of stakeholder feedback, to enable the development of an outcome.

Brief development
Justify the nature of an intended outcome in relation to the need or opportunity. Describe the key attributes identified in stakeholder feedback, which will inform the development of an outcome and its evaluation.

Outcome development and evaluation
Investigate a context to develop ideas for feasible outcomes. Undertake functional modelling that takes account of stakeholder feedback in order to select and develop the outcome that best addresses the key attributes. Incorporating stakeholder feedback, evaluate the outcome's fitness for purpose in terms of how well it addresses the need or opportunity.

LEVELS 3–4
CURRICULUM LINKS

TECHNOLOGY
LEVEL 4

Technological Knowledge

Students will:

Technological modelling

Understand how different forms of functional modelling are used to explore possibilities and to justify decision making and how prototyping can be used to justify refinement of technological outcomes.

Technological products

Understand that materials can be formed, manipulated, and/or transformed to enhance the fitness for purpose of a technological product.

Nature of Technology

Students will:

Characteristics of technology

Understand how technological development expands human possibilities and how technology draws on knowledge from a wide range of disciplines.

Characteristics of technological outcomes

Understand that technological outcomes can be interpreted in terms of how they might be used and by whom and that each has a proper function as well as possible alternative functions.

LEVELS 1–2 CURRICULUM LINKS

ENGLISH LEVEL 1

Speaking, Writing, and Presenting

Students will:

Processes and strategies
Acquire and begin to use sources of information, processes, and strategies to identify, form, and express ideas.

Ideas
Form and express ideas on a range of topics.

ENGLISH LEVEL 2

Speaking, Writing, and Presenting

Students will:

Processes and strategies
Select and use sources of information, processes, and strategies with some confidence to identify, form, and express ideas.

Ideas
Select, form, and express ideas on a range of topics.

Structure
Organise texts using a range of structures.

LEVELS 1–2 **CURRICULUM LINKS**

SCIENCE
LEVELS 1–2

Nature of Science

Students will:

Understanding about science
Appreciate that scientists ask questions about our world that lead to investigations and that open-mindedness is important because there may be more than one explanation.

Investigating in science
Extend their experiences and personal explanations of the natural world through exploration, play, asking questions, and discussing simple models.

Communicating in science
Build their language and develop their understandings of the many ways the natural world can be represented.

Participating and contributing
Explore and act on issues and questions that link their science learning to their daily living.

TECHNOLOGY
LEVEL 1

Technological Practice

Students will:

Planning for practice
Outline a general plan to support the development of an outcome, identifying appropriate steps and resources.

Brief development
Describe the outcome they are developing and identify the attributes it should have, taking account of the need or opportunity and the resources available.

Outcome development and evaluation
Investigate a context to communicate potential outcomes. Evaluate these against attributes; select and develop an outcome in keeping with the identified attributes.

LEVELS 1–2 CURRICULUM LINKS

TECHNOLOGY LEVEL 1

Technological Knowledge

Students will:

Technological modelling
Understand that functional models are used to represent reality and test design concepts and that prototypes are used to test technological outcomes.

Technological products
Understand that technological products are made from materials that have performance properties.

Technological systems
Understand that technological systems have inputs, controlled transformations, and outputs.

Nature of Technology

Students will:

Characteristics of technology
Understand that technology is purposeful intervention through design.

Characteristics of technological outcomes
Understand that technological outcomes are products or systems developed by people and have a physical nature and a functional nature.

TECHNOLOGY LEVEL 2

Technological Practice

Students will:

Planning for practice
Develop a plan that identifies the key stages and the resources required to complete an outcome.

Brief development
Explain the outcome they are developing and describe the attributes it should have, taking account of the need or opportunity and the resources available.

Outcome development and evaluation
Investigate a context to develop ideas for potential outcomes. Evaluate these against the identified attributes; select and develop an outcome. Evaluate the outcome in terms of the need or opportunity.

LEVELS 1–2

CURRICULUM LINKS

TECHNOLOGY

LEVEL 2

Technological Knowledge

Students will:

Technological modelling

Understand that functional models are used to explore, test, and evaluate design concepts for potential outcomes and that prototyping is used to test a technological outcome for fitness of purpose.

Technological products

Understand that there is a relationship between a material used and its performance properties in a technological product.

Nature of Technology

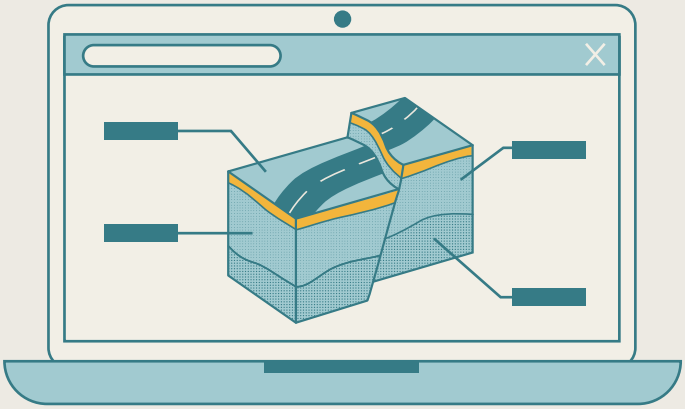
Students will:

Characteristics of technology

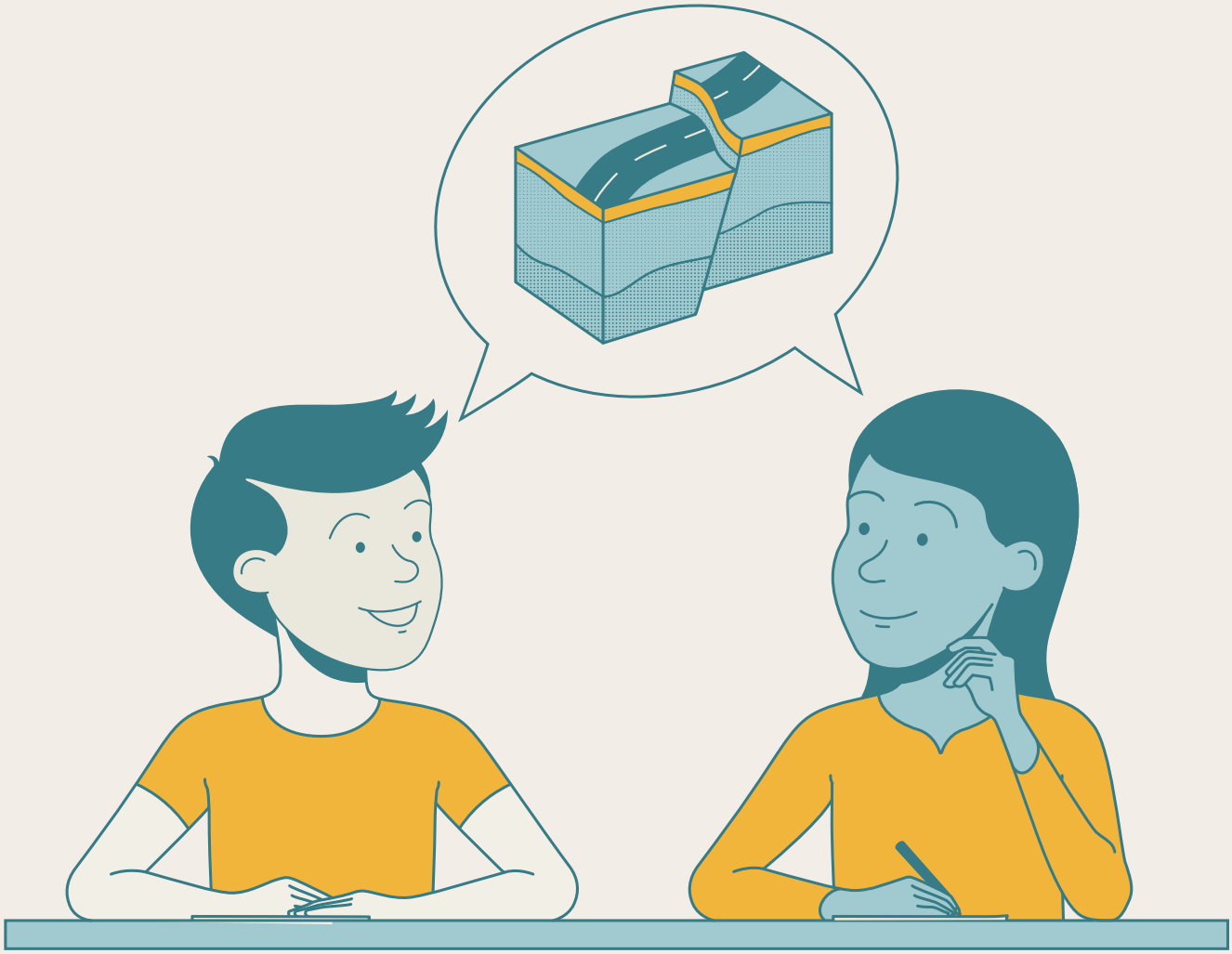
Understand that technology both reflects and changes society and the environment and increases people's capability.

Characteristics of technological outcomes

Understand that technological outcomes are developed through technological practice and have related physical and functional natures.



LEVELS 3–4 LESSON PLANS



LEVELS 3–4 **LESSON PLAN**

1. EMPATHISE

Time to complete:
1–2 sessions

Goal
Students will understand the difference between social and physical issues that result from earthquakes and will empathise with those going through them.

Lesson Introduction

In this lesson, students will be introduced to the damage that is caused by earthquakes. They will identify the different types of damage, both physical and social, by reading and finding the information they need.

Suggested Activities

Class discussion:

1. Introduce the topic and begin a class discussion about earthquakes.

2. Have a scribe to take notes on the board as the discussion flows (this could be a student or a teacher). Start getting students talking about what they know about earthquakes. This can be anything.

3. Ask the students if anyone has any personal stories they want to share, or stories of people they know. This can create student empathy with situations they may not have known their peers have experienced.

4. Have students begin to think about problems that might affect communities after an earthquake. Begin with physical problems (problems that we can see, such as building collapses and road destruction/damage, and so on). THINK, PAIR, SHARE some problems they might have heard of happening, or that they think people might face after an earthquake.

5. Ask them to think about some social problems (things we might not physically see, but that humans might have to deal with). THINK, PAIR, SHARE these ideas, and add them to the brainstorm.

6. Pick one or two videos or readings from the resource list (p 35) that you think will resonate with the students, and show/read them the first one.

7. Get them to discuss what the problem is, if it is social or physical, and how they might feel if it happened to them.

8. In pairs give them two or three minutes to see if they can think of any way that this might either be fixed, or ways that we could do things differently to reduce it in the future.

9. Repeat for second reading/video if required.

LEVELS 3–4 **LESSON PLAN**

1. EMPATHISE

Questions

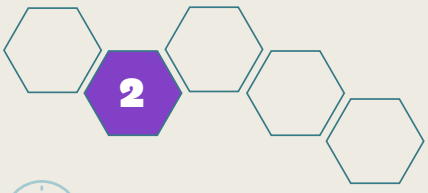
What is an earthquake? Have you had any experience with earthquakes? How did it make you feel? Do you know anyone who has had their house or their possessions damaged in a quake? What did they do? How did they feel? What is a 'physical' problem? What are some examples of physical problems that can happen as a result of an earthquake? What is a 'social' problem? What are some examples of social problems that can happen as a result of an earthquake?

Resources Needed

One or two resources from the resource list (p 35) (or ones chosen yourself)

Something to write notes on (whiteboard, smartboard, large sheet of paper, and so on)

2. DEFINE



Time to complete:
2–3 sessions

Lesson Introduction

Students now need to identify all of the problems and as much information as they can about each problem. This enables them to choose which problem they would like to work on solving, and to have a better understanding of where the problem lies. This is also a good time to introduce to them what the task is going to be, so they can start to think about what task they want to do.

1. Suggested Activities

Class brainstorm:

1. Have students get into pairs and give one resource per pair.

2. Talk about what information might need to be taken from the readings in order to inform the others in the class what it is about (these can be taken from the discussion points).

3. Pairs will work through the reading or video and identify the important parts/answer discussion point questions.

LEVELS 3–4 LESSON PLAN

2. DEFINE

Goal
By the end of the allotted time, students should be familiar with the problem they are solving, examples of where and when this has happened, and possible solutions that might have already been tried/tested.

Suggested Activities

Class brainstorm continued:

4. These can then be shared back to the class and recorded. We suggest either creating a shared document (in Google, or your preferred digital tool) that the students can add the problem they found to, OR using a physical book, or sheet of paper, where students can write this. This will need to be displayed in the classroom somewhere so it can be referred back to.

Optional

Reading rotations
Articles could be part of students' reading rotations and as they go through one they add it to a list.

Own research
Students are put into pairs to conduct their own research into possible solutions (BEWARE: students may come across disturbing/graphic images) OR students may be given the resource list (p 35) to choose from.

2. Choosing a Topic

(Choose which way works best for your class):

1. Students pick a topic that interests them, and then get into groups based on who is interested in creating a solution to which topic.

OR

Students divide into groups and decide on a problem that they would like to find a solution for.

2. Groups then spend the remainder of the lesson (or whatever time you think is sufficient) researching as much as they can about the problem. Use the discussion points to inform their research, which can be recorded in whichever way you see fit (shared digital documents, books, and so on).

LEVELS 3–4 **LESSON PLAN**

2. DEFINE

Questions

What is the reading about? What did the earthquake do? What are they having trouble fixing? What do they need solutions for?

Possible Damages

Building foundations broken/cracked/uneven, buildings not being strengthened, lack of/inability to create criteria for an 'earthquake safe building', liquefaction, cracked exterior concrete, unstable roofs, warped plumbing, loss of water/power/communication lines for undisclosed periods of time, flooding, loss of historic buildings (for example, Christchurch Cathedral), roads blocked, train tracks warped, heightened anxiety in children, mass exodus from cities, housing market plummeting, insurance issues, and so on.

Questions for Further Research

What is the problem? What caused the problem? What are some important details? What are some 'flow on effects' (things that happen because of this issue)? Who is affected by this and how? Where has this happened before? Are there any real life examples? Has anyone tried to fix this problem before? If so, what are some solutions that they have tried? What were some issues with these solutions?

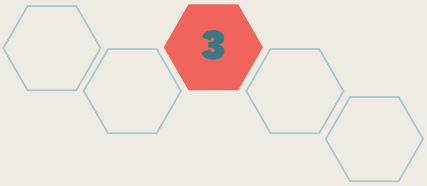
Resources Needed

— Resource list
— Computers to read on
— Google Docs (or preferred digital tool)

OR
— Large sheet of paper
— Pens

LEVELS 3–4 **LESSON PLAN**

3. IDEATE



Time to complete:
2–3 sessions

Lesson Introduction

Here, students start to plan solutions to their problem. They will create detailed plans for a few different solutions to their problem, and decide from there which is going to be best to test, based on the materials and time available.

Suggested Activities

Ideation demonstration:

1. As a class, create a plan for a solution to a problem, so that students understand what is needed when trying to create a solution. For this example, we are going to take the problem of 'metal plumbing', but you can use something from one of the readings you looked at together in Step 1, or something else completely.

2. Revisit the problem: house plumbing can be made from metal/copper, and when house foundations and structures move, so does plumbing. Metal plumbing doesn't move with the house, causing it to bend and break. The cost and time to replace plumbing is huge.

3. Have the students come up with ideas to fix or reduce this problem. Remind them that sometimes reducing the problem is just as good as eliminating it. Have them talk with a partner for one minute, then either come and write up their solutions, or share them with the class while the teacher writes them up. No answer is wrong, accept everything for now, as it is going to be narrowed down according to constraints. Make it fast-paced and energetic so students come up with great ideas. Some of these could include pipes made of rubber, having dedicated outside rooms that are for all water use, and having community water supplies delivered like milk used to be, with more appliances made to be stand-alone/filled, rather than plumbed.

4. Talk about all the ideas and how we are going to be prototyping these solutions (discuss prototyping if students are unsure) and that we are restricted to the time we have, and the materials we have at school or at home. Start to eliminate the solutions that do not fit these constraints.

LEVELS 3–4 LESSON PLAN

3. IDEATE

Goal

By the end of this session students should understand how to ideate their ideas to come up with their final design.

Suggested Activities

Ideation demonstration continued:

5. Have them settle on two or three that they will then write a plan for. We will settle on stand-alone appliances and rubber plumbing.

6. Demonstrate drawing a diagram and labelling the different parts. It is important that people know the function that each part serves and the material it will be made out of. Remind them that these are plans for the prototype, not the actual solution, although these would be good to have when presenting your solution at the end.

7. Decide on the prototype you are going to create. To do this, students will need to think about how they are going to test it and what success looks like. For our stand-alone shower, success means that we have a portable, refillable shower that hangs on the wall and heats itself. Rubber piping means it is able to carry liquids from one place to another and can have things attached to it, such as showerheads, toilets, and so on. For our shared example, we will decide on the plumbing as it is easier to prototype, the materials are easily available (rubber tubing, silicone straws, and so on), and we know how to test it.

8. Lastly, make a list of what is needed to start creating the prototype (what materials they need, how to make it, problems they think may arise). This is important as students will need to keep a log of their progress for when they present their solutions at the end.

Students Ideate

1. Students follow the ideation process, either in books, or in whichever form the teacher would like.

Teachers please note

Feel free to do this step-by-step with your class, rather than in one big chunk, if you think that would be more beneficial to your learners.

LEVELS 3–4 **LESSON PLAN**

3. IDEATE

Questions

What is the problem? How can I solve it? What materials do I need? What are some problems that might arise? Do I have enough time to complete a prototype? Is there anyone or any place I can go to get more information? How might I record that information?

Resources Needed

— Whiteboard
— Pens
— Wherever the teacher would like this information recorded (books, Google Docs, and so on)

4. PROTOTYPE AND TEST

Time to complete:
5 sessions
(Could be more or less depending on the class)

Lesson Introduction

Students take their most viable plan, and prototype and test it. They will need to take notes of everything they do – all the successes and failures so that they can report back on these at the end.

Suggested Activities

Testing:

In these sessions, students will create and test their prototype. This is also a good opportunity to make contact with experts who might be able to provide students with information that will help their solution. (For our example, it may be great to get in contact with a plumber, to see if the prototype is viable at a larger scale.)

LEVELS 3–4 LESSON PLAN

4. PROTOTYPE AND TEST

Suggested Activities

Recording:

Throughout this process, it is important that the students keep a record of problems they have and solutions they find, to report back at the end.

These could be recorded in a book, via photos or a video/vlog – whichever way the teacher would like or the child sees fit.

Give students 10 minutes at the end of each session to record what they did that day, any problems they faced, and what they need to do in the next session, so they know where to start next time.

Questions

What went wrong? What could I change? Why did that fail? Would this work if we transferred it into real life? What are the barriers to using this in real life?'

Resources Needed

Materials will be based on student needs, and an emphasis should be put on them being responsible for making sure they have the right equipment ahead of time.

LEVELS 3–4 **LESSON PLAN**

4. PROTOTYPE AND TEST

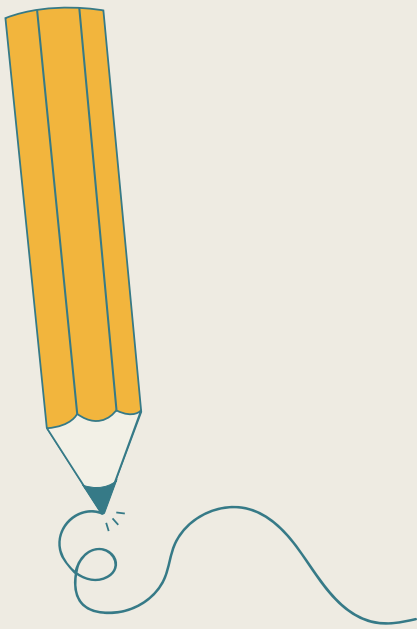
Questions

What is going to be the best way for me to present this? Who is this solution aimed at (target audience)? When might the solution need to begin? Where would this take place? What would be the next steps, to make sure that information gets out to the community?

Materials are dependent on how the students/teacher wants them presented.

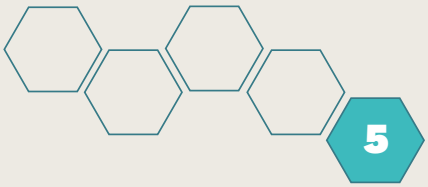
Assessment Criteria

These can be taken from the details that students need to have in their presentation, as outlined in the sharing preparation on the next page. You may also want to include some of the discussion points, and any other criteria you may use in class for presentation assessments.



LEVELS 3–4 **LESSON PLAN**

5. SHARE



Time to complete:
2 sessions

1 session for prep (could be done at the same time as prototyping and testing, depending on students)

1 session for sharing

Lesson Introduction

Groups to share their findings back to the rest of the class. They talk about the problem they chose and how they decided to solve it, acknowledging all the problems they came across in the process.

Suggested Activities

Sharing preparation:

1. Discuss with students that they will be sharing back to the class.

The information they will need to share back includes:

— the details of their problem

— the three solutions they came up with

— the plan for their prototype and the prototype itself

— the prototyping process – what it was made out of, how they made it, who they talked to, problems they came up with (these will come from the record they kept)

— how they tested it and what the results were.

2. Have the students decide the best way they want to share this. It could be a PowerPoint, poster, display, video, speech, website, pamphlet and so on.

OR

If the teacher has a specific way they want things shared back, then use that.

3. Give the students time to prepare their presentations.

Sharing day:

Students share back to the class. Give the other students an opportunity to ask questions at the end. The discussion points could also be a way to widen their thinking on the subject and these could be used as add-on questions at the end of their presentation, or questions that need to be answered within their presentation.

LEVELS 1–2 LESSON PLANS

LEVELS 1–2 **LESSON PLAN**

1. EMPATHISE

Time to complete:
1 session

Goal
Students will identify the types of damage that can be made to a house when there is an earthquake, and how these might affect people.

Lesson Introduction

In this lesson, students will be introduced to the damage that is caused by earthquakes.

Suggested Activities

Class discussion:

1. Introduce the topic and begin a class discussion about earthquakes.

2. Have a scribe (this could be a student, or a teacher could take notes on the board as the discussion flows) and start getting students to talk about what they know about earthquakes. This can be anything.

3. Ask the students if anyone has any personal stories they want to share, or stories of people they know. This can get students to start to empathise with situations they may not have known their peers have experienced.

4. Have students begin to think about things that get damaged in an earthquake. THINK, PAIR, SHARE some problems they might know of (walls and ceilings cracking, cupboards and draws opening and things falling out, special personal items falling off shelves, chimneys and ceilings falling down, pipes leaking, power outage, phone lines down, and so on).

5. Ask them to think about how some people might feel when these things happen to them. THINK, PAIR, SHARE these ideas, and add them to the brainstorm.

Questions

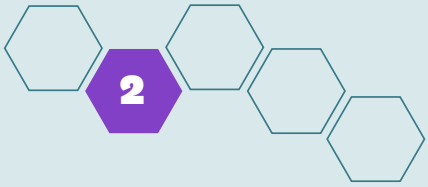
What is an earthquake? Have you had any experience with earthquakes? How did it make you feel? Do you know anyone who has had their house or their possessions damaged in a quake? What did they do? How did they feel?

Resources Needed

— Something to write notes on (whiteboard, smartboard, large sheet of paper, and so on)

LEVELS 1–2 **LESSON PLAN**

2. DEFINE



Time to complete:
1–2 sessions

Goal
By the end of the allotted time, students should be familiar with the problem they are solving, examples of where and when this has happened, and possible solutions that might have already been tried/tested.

Lesson Introduction

Students now need to identify all the problems, and as much information as they can about the problem. This then enables them to choose which problem it is they would like to work on, and to have a better understanding of where the problem lies. This is also probably a good time to introduce to them what the task is going to be, so they can start to think about what task they want to do.

Suggested Activities

1. *Class brainstorm:*

Look back at the list made previously of the types of damage that can be made to houses in earthquakes and see if students would like to add any more damages that they have thought of.

OPTIONAL:

As a class or in pairs, have students look over some of the suggested resources (p 34) to get more ideas about damages.

OR

Have the students talk about it at home the night before and bring some ideas back to school.

2. *Choosing a topic:*

Decide on three or four problems that the students are going to create solutions for that will be easy to test in class. As an example, we are going to use: things falling off shelves, cupboards and draws opening, bookshelves tipping over. If you have some kids who are set on designing break proof walls/ceilings, or have other great ideas they can test, feel free to let them.

Choose which way works best for your class:

Students pick a topic that interests them, and then get into groups based on who is interested in creating a solution to which topic.

LEVELS 1–2 **LESSON PLAN**

2. DEFINE

Goal

By the end of the allotted time, students should be familiar with the problem they are solving, examples of where and when this has happened, and possible solutions that might have already been tried/tested.

Suggested Activities

Choosing a topic continued:

OR

Students divide into groups and decide on a problem that they would like to find a solution for.

Groups then spend the remainder of the lesson (or whatever time you think is sufficient) researching as much as they can about the problem. They use the discussion points to inform their research, which can be recorded in whichever way you see fit (shared digital documents, books, and so on).

Questions for Further Research

What is the problem? What caused the problem? What are some important details? What are some 'flow on effects' (things that happen because of this issue)? Who is affected by this and how? Where has this happened before? Are there any real life examples? Has anyone tried to fix this problem before? If so, what are some solutions that they have tried? What were some issues with these solutions?

Resources Needed

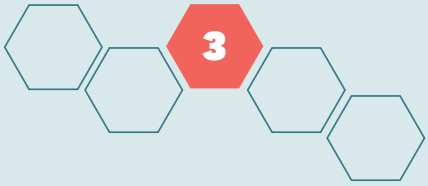
— Resource list (p 34)
— Computers to read on
— Google Docs (or preferred digital tool)

OR

— Large sheet of paper
— Pens

LEVELS 1–2 **LESSON PLAN**

3. IDEATE



Time to complete:
2–3 sessions

Goal
By the end of the allotted time, students should be familiar with the problem they are solving, examples of where and when this has happened, and possible solutions that might have already been tried/tested.

Lesson Introduction

Students will brainstorm possible solutions to their problems, then narrow these down to one final idea, ready to prototype.

Suggested Activities

Ideation demonstration:

1. As a class, have a lightning brainstorm session for each problem.

a. Revisit each problem and talk about how people might feel when this problem happens to them.

b. Have the students close their eyes, and think about if there were no limits. For example, if they had all the time, money, and skills they needed, what would be some ideas they might come up with to fix the problems. Encourage them to think inside and outside the box and at this point, no answer is wrong. Examples for 'things falling off the shelves' could be shelves made of pillows, bowl-shaped shelves, lipped shelves, sticky shelves, and so on.

c. Do this for each problem.

d. By the end, each problem should have a page of solutions.

Introducing the tests:

1. Introduce the students to the tests that their solutions will need to pass. There are two ways this could be done, depending on the resources available and the skill level of the students.

a. The test could be a desk that is wobbled five times by the teacher, and the students create their solution from scratch.

OR

b. Students are given a shelf or a draw/cupboard that they need to modify. This needs to be able to be shaken, or put on a surface that can be shaken to simulate an earthquake.

Lesson continues on the following page

LEVELS 1–2 LESSON PLAN

3. IDEATE

Goal

By the end of this session students should understand how to ideate their ideas to come up with their final design.

Suggested Activities

Choosing their prototype:

1. After seeing the tests, talk with the students about the amount of time they have to create their prototype and what materials they have available (both in the classroom and that they may be able to bring from home). Discuss how this might limit examples, and maybe talk about a few.

2. Have the students get back into their groups and look at the brainstorms that were made for their problems. (If you have more than one team per problem, these may need to be copied, so each group has a copy.)

3. Have the groups start to eliminate ideas that they will not be able to make, based on the limits they have.

4. Have students narrow it down to the three ideas they like best.

Drawing plans:

1. If this is not already familiar, demonstrate to the students how to draw diagrams of their solutions and label them.

2. They will need to write down what each part is for, what it is made of, and anything else they think might be important to remember about the design.

3. Once they have designs for all the solutions, work with each team to pick their best one, which they are going to create. This will be the one that is achievable in the timeframe provided and with the materials that are easily accessible.

Questions

What is the problem? How can I solve it? What materials do I need? What are some problems that might arise? Do I have enough time to complete a prototype? Is there anyone or any place I can go to get more information?

LEVELS 1–2 **LESSON PLAN**

3. IDEATE

Resources Needed

— Whiteboard, pens, wherever the teacher would like this information recorded (books, Google docs, and so on)
— Testing resources
— A list of resources available for students to use to create their solutions

4. PROTOTYPE

Time to complete:
2 sessions

Lesson Introduction

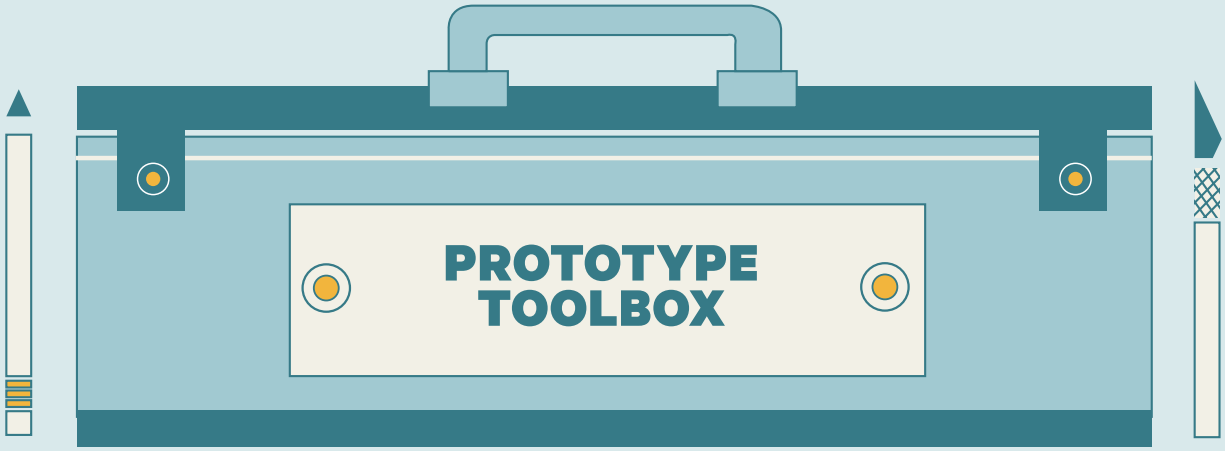
Students build their design.

Suggested Activities

Students will use this session to build the prototype they planned.

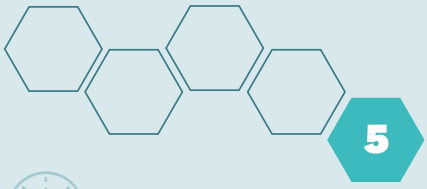
Resources Needed

Materials will be based on student needs and an emphasis should be put on them being responsible for making sure they have the right equipment ahead of time.



LEVELS 1–2 **LESSON PLAN**

5. TEST AND ITERATE



Time to complete:
2 sessions

Goal
By the end of the allotted time, students should be familiar with the problem they are solving, examples of where and when this has happened, and possible solutions that might have already been tried/tested.

Lesson Introduction

Teachers will help students to test their prototype and then iterate their prototype, based on what happened in the test and the feedback they received from their classmates.

Suggested Activities

Test and reflect:

1. Test each group's prototype.

2. Get the students to tell the class about what they have made and what problem they are trying to solve.

3. Complete the test.

4. Get the class to tell the group two things they thought were good about the design and two things they could do to make it better. Try to get the class to think about usability – use discussion questions.

Iteration on previous model:

1. Use this session to have students make changes to their model based on the feedback they received last session.

Questions

What went wrong? What could I change? Why did that fail? Would this work if we transferred it into real life? What are the barriers to using this in real life? Does the solution hinder the usability of the original product in anyway? Does it look nice? Would people buy it? Are there certain people who might not be able to use it/install it? How might it be sold?

Resources Needed

— Tests for prototypes

— Materials for alterations

LEVELS 1–2 **LESSON PLAN**

6. FINAL TEST AND SHARE

Time to complete:
1–2 sessions

Lesson Introduction

Students will do a final test on their changed model and reflect on the learning process.

Suggested Activities

1. Students will tell the class the changes they made to their models and why they made them.

2. The teacher will retest their prototypes and encourage the students to comment on whether they think their first or second prototype was better, and why.

Reflections:

1. Have students reflect on the process in whichever way is appropriate. This could be written, video, voice to text, and so on.

2. Have them answer the following questions:

— What was your problem?

— What did you invent to solve it?

— What happened in the first test?

— What did you change for the second test?

— What would you change/add for a third test?

Resources Needed

Materials are dependent on how the teacher wants to record the reflections.

Assessment Criteria

These can be taken from the details that the students need to have in their reflections and any other criteria you may use in class for presentation assessments.

YEARS 1-4
RESOURCES

Click on the links to discover some of our favourite recommended resources

Years 1–4:

The primary effects of earthquakes: ground shaking, ground rupture, landslides, tsunamis, liquefaction, and fires (web page)
https://topex.ucsd.edu/es10/es10.1997/lectures/lecture20/secs.with.pics/node10.html

Earthquake facts for kids: what an earthquake is, where they come from, and how they are measured (video)
https://www.youtube.com/watch?v=cu_PBjBIFKI

What is an earthquake (web page)
https://www.dkfindout.com/us/earth/earthquakes/effects-an-earthquake/

Hazardous earthquake effects (web page)
http://uwiseismic.com/General.aspx?id=14

What is an earthquake (cartoon video)
https://www.youtube.com/watch?v=dJpIU1rSOFY

All about earthquakes: a page of fun facts and videos (web page and videos)
https://www.theschoolrun.com/homework-help/earthquakes

YEARS 5-8
RESOURCES

Earthquake effects (shaking, landslides, liquefaction, and tsunamis) (web page)
http://eqseis.geosc.psu.edu/~cammon/HTML/Classes/IntroQuakes/Notes/earthquake_effects.html

Earthquakes – causes and effects (picture slideshow with voiceover)
https://www.youtube.com/watch?v=FowixCmKNKs

The impacts of earthquakes (web page facts and pictures)
https://opentextbc.ca/geology/chapter/11-4-the-impacts-of-earthquakes/

Effects of earthquakes on humans and environments (brief essay)
https://www.ukessays.com/essays/sociology/the-disastorous-effects-of-humans-and-environments-sociology-essay.php

Psychosocial effects of the earthquakes: a New Zealand perspective (article)
http://www.stuff.co.nz/the-press/opinion/perspective/6892800/Psychosocial-effects-of-the-earthquakes

Health effects of Canterbury earthquakes (article and video)
https://www.stuff.co.nz/national/health/108978391/health-effects-of-canterbury-earthquakes-like-a-wartime-recovery

Public health impact and medical consequences of earthquakes (academic reading)
https://pdfs.semanticscholar.org/ec9c/b1750ad34f6ee022f3d32de69bf34f015476.pdf

What is an earthquake: facts and information (video)
https://www.youtube.com/watch?v=hlePrsXTGxQ

22 February 2011 Canterbury earthquake for kids (web page)
https://my.christchurchcitylibraries.com/canterbury-earthquake-2011-for-kids/

Canterbury earthquakes and mental health (web page)
https://www.sciencemediacentre.co.nz/2019/04/09/canterbury-earthquakes-and-mental-health-expert-reaction/

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