BikeReady Lesson 6

Demonstrate skills for emergency stopping

PLANNING FOR LESSON 6

Skills focus

Emergency stopping

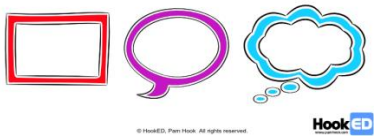
- Observe how each brake works
- Pumping brakes can correct a skid (release and reapply)
- Stopping distances increase in the wet.

Reflection on skills training session

Share new learning with classroom teacher

Identify experiences students enjoyed when taking part in cycle skills training about emergency stopping. Record your findings on a SOLO Strip.

Draw pictures (take photographs or video) in response to the following prompts.



- What did you enjoy when you were taking part in the cycle skills lesson? [SOLO Multistructural – rectangle]
- Why do you think it was like that? [SOLO Relational – speech bubble]
- What does it make you wonder about cyclists and/or cycling? [SOLO Extended abstract]

Add to the class list of all the enjoyable experiences students encountered during cycle skills training.

Identify any **new terms and vocabulary** introduced in the skills training session. Highlight new terms and vocabulary.

E.g. brakes, stopping distance, distance, metres, skid, pumping brakes, forces, friction.

Add the terms and their meanings to the class/group glossary. Identify unfamiliar terms and use them in a Frayer Vocabulary Chart.

Opportunities for community engagement

Make connections with people and organisations in the local community with experience in ***better braking.***

Make connections with people and organisations in your local community who might volunteer to visit or host students wanting to find out more about braking.

For example, contact people who have to slow down or stop suddenly for their work or who rely on braking in their jobs.

This might include brake design engineers, brake pad replacement technicians, car testing station workers, crash testing centre employees, friction surface engineers, non- skid surface manufacturers, rest home workers, ice skating rink workers, drift racers, police officers or crash investigators.

Alignment to NZC learning areas

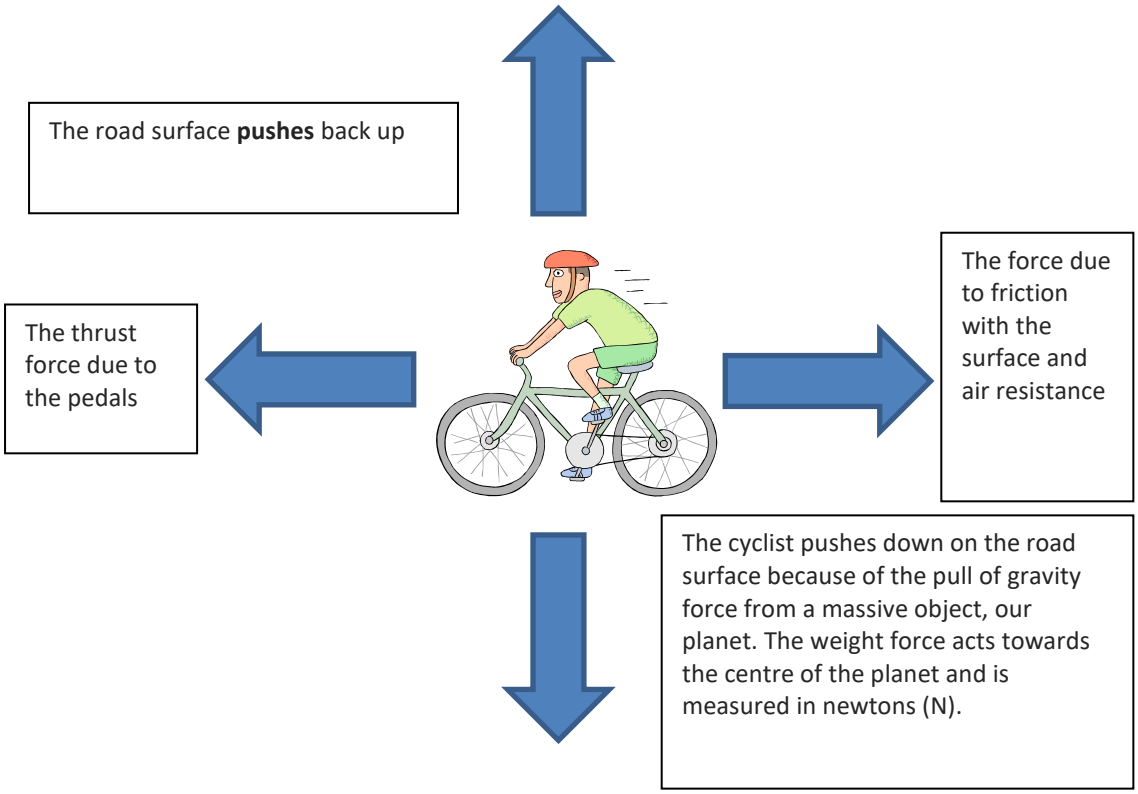
Refer to NZC Learning Areas Overview. Refer to the resource for Achievement Objectives and Learning Intentions (L1 to 4).

English	***Listening, Reading and Viewing***		***Speaking, Writing and Presenting***		
The Arts – Drama	**Understanding the Arts in contexts**	**Developing Practical Knowledge**	**Developing Ideas**	**Communicating and Interpreting**	
Health and Physical Education	**Personal Health and Physical Development A – A3 Safety Management**		**Healthy Communities and Environments S – D2 Community Resources**		
Mathematics and Statistics	***Geometry and Measurement***				
	Measurement	**Shape**	**Position and orientation**		
Science	***Nature of Science***				**Physical World**
	Understanding about science	**Investigating science**	**Communicating in science**	**Participating and contributing**	**Physical inquiry and physics concepts**
Social Sciences	**Identity, Culture and Organisation**	**Place and Environment**	**Continuity and Change**	**The Economic World**	
Technology	**Technological Practice**	**Technological Knowledge**	**Nature of Technology**		

CLASSROOM ACTIVITIES

Acquire surface and deep understanding needed to support the cycle skills sessions.

Forces acting on a cyclist



When a cyclist is **at rest** or moving at **constant speed** (neither speeding up nor slowing down) and is not changing shape or direction, the **forces on the cyclist are equal and balanced**.

This is sometimes referred to as 'moving with an unchanging motion.'

Unbalanced forces change an object's speed, direction and shape.

If you see an object speeding up or slowing down, changing direction or changing shape, then an unbalanced force must be acting.

Ask students to go on a slow pedagogy walk around the school grounds looking for places where unbalanced forces are acting. Look for objects:

- speeding up or slowing down
- changing direction
- changing shape.

6.1. How brakes work

[Bringing in ideas]

[Links to NZC Learning Areas: Science]

Define friction

What is friction?

All bicycle brakes work in the same way. They have mechanisms to increase the amount of friction force acting and use this unbalanced friction force to slow or stop the bicycle.

Ask students to work in pairs to create an annotated diagram to represent one of the definition statements below.

- Friction is a force that occurs when two surfaces move over one another.
- Friction is a force that tries to prevent two surfaces sliding past each other.
- Friction is a force that can either oppose motion (a cyclist slowing down) OR cause motion (a car accelerating).
- Friction is a force that results in the conversion of kinetic energy (energy that moving objects have) into heat (and sometimes sound) energy.

Friction can occur between:

- two solids, such as dragging a box across a floor, or between the moving parts of a machine
- solid and liquid, such as a person or fish swimming through water
- solid and air, such as a parachutist falling
- liquid and air, such as water falling over a waterfall.

The only situation where a moving object does not encounter friction is when a spacecraft is moving through outer space, which has no air.

When is a friction force useful?

Friction can be useful. We wouldn't be able to walk without the friction between our shoes or feet and the ground, and we wouldn't be able to drive a car or ride a bike without brakes.

Often, however, friction is a nuisance and we seek to reduce it; e.g. friction between the moving parts of a machine causes it to wear out and makes the machine less efficient.

When a bicycle is speeding up, the forward forces are greater than the friction forces opposing the motion.

When a bicycle is travelling at a constant speed, these friction forces must be balancing the forces pushing the bicycle forward.

Similarly, when we try to push a heavy object and it doesn't move, the friction force must be exactly equal and opposite to our pushing force.

Ask students to:

Study a range of different bike braking systems.

Take photographs of different braking systems and work out how and where the friction forces will be applied to slow down and/or stop the cycle.

Annotate the photographs to show where the two solid surfaces will come in contact.

6.2 Investigating friction forces with a lift-the-flap book

[Relating ideas]

[Links to NZC Learning Areas: English Creating Meaning; Science]

To investigate friction forces; e.g. explore the path and motion of a marble rolling down a slope across surfaces made of different materials or a bike rolling down a ramp and across different surfaces.

Ask students to:

Read the section "Intersections with traffic lights" in *The New Zealand code for cycling*

Intersections with traffic lights

Read at least one of the following articles about forces used when braking.

Science of cycling (Exploratorium)

Cycling aerodynamics (Science Learning Hub)

Bicycle brake

Ask students to work in pairs to make a draft version of a lift-the-flap picture book.

Call it 'Where is the friction force?' and use it to give a message about braking.

Use text and images (line drawings, collage or mixed media) to communicate the message that cyclists use the roads in many different ways but they all use friction to slow down and stop.

For example, use images to represent five very different cyclists and place each one under a flap alongside a description ending 'Who am I?' Lifting the flap reveals the person on the page is a cyclist using friction to slow and stop a bike.

Before you start planning your book, look at several examples of lift-the-flap books to see how they work.

For example:

Where is Maisy?: A lift-the-flap book by Lucy Cousins

Where's My Baby? by H. A. Rey

Dear Zoo: A lift-the-flap book by Rod Campbell

Grandma, Where Are You? by Harriet Ziefert

Where's Spot by Eric Hill

Little Red Riding Hood by Nick Sharratt and Stephen Tucker

Identify the conventions that these writers and illustrators use, such as having an easy-to-follow concept or big idea, using repetitive phrases, and structuring the book with a counting pattern or questions and answers.

You may get extra ideas by researching the history of lift-the-flap and pop-up books:

Paper engineering: fold, pull, pop & turn (Smithsonian Libraries, YouTube)

Look online for instructions on how to make a lift-the-flap book.

How to make a lift-the-flap book (YouTube)

Flap happy shapes (YouTube)

Lift-the-flap fact book (YouTube)

When making your lift-the-flap book, think about some of the 'big ideas' and 'big experiences' that you want it to communicate.

Ask yourself how you can use flaps and a few well-chosen words to help convey that message.

6.3. Stopping distances increase in the wet

[Extending ideas]

[Links to NZC Learning Areas: English Creating Meaning; Technology; Social Sciences]

How long does it take an unbalanced friction force to stop a bicycle?

Use your science learning from the previous activity to arrange a series of images in sequence to tell the story of the forces used to change the speed of a bike when slowing down.

Where is the unbalanced force acting?

Use terms like pull force, push force, change speed, slow down, speed up, stationary and friction force.

Your images should show the forces acting on a bike at the following points in the journey.

Stationary	Speeding up	Constant speed	Slowing down	Stationary

Many cyclists think that if the vehicle in front brakes suddenly, the person following will be able to react and brake so that both vehicles will stop the same distance apart.

However, the total stopping distance is made up of 4 factors, as described in the table below.

Delays can be built into any of these components, which can markedly increase the stopping distance and result in a collision.

Ask students to work in pairs to come up with situations that could increase the length of time that each of these components contributes to stopping time.

How could wet weather influence each of these factors?

The four components in the total stopping distance of a bicycle

How long it takes **the cyclist to notice or see the hazard**. If a cyclist is distracted, they may not immediately notice the hazard.	How long it takes for **the cyclist to react** to the hazard and apply the brakes.	How long it takes for **the cycle to react** to the cyclist's actions, which depends on the working order of the braking system.	**How effective the cycle's braking system is**, which depends on tyre pressures, type of brakes, road surface, slope of road, cycle weight, tyre tread, suspension etc.
Describe a situation that could increase this time.	*Describe a situation that could increase this time.*	*Describe a situation that could increase this time.*	*Describe a situation that could increase this time.*

Stopping distances in bicycles

The requirements for stopping distance apply to all vehicles using the roads.

When cyclists follow other vehicles, they must leave enough clear space to stop if the vehicle in front stops suddenly or a vehicle pulls out in front of them.

The two-second rule

Under normal conditions, the two-second rule is an easy way to make sure you have allowed enough following distance between your cycle and the vehicle in front, no matter what speed you're travelling at.

To check if you are travelling 2 seconds behind the vehicle in front:

- watch the vehicle in front of you pass a road marking or other feature on or off the road
- as it passes the marking, start counting 'one thousand and one, one thousand and two'
- if you pass the marking before you finish saying those eight words, you are following too closely – slow down, pick another marking and repeat the words to make sure you have increased your following distance.

The Exploratorium has an online calculator that lets you calculate the stopping distance for cyclists.

Note: it bases its calculations on the speeds you supply in miles per hour, so you'll need to convert speeds from kilometres per hour to miles per hour before you enter this information. The calculator then gives stopping distances in metres as well as feet.

Braking and steering (with calculator – Exploratorium)

Mark out some of these distances in the school playground or field using chalk, orange cones and metre rulers to mark out the approximate stopping distances for cyclists travelling at different speeds.

Extension: Stopping distances in cars

Drive provides a useful unit on the importance of stopping distance and how to get it right:

Following distances (Drive)

Ask students to:

Watch this video about the importance of speed and stopping distances.

The faster you drive the greater the danger (Tasman District Council)

Use a stopping distance calculator to calculate stopping distances on different road surfaces and when travelling at different speeds.

Stopping distance calculator

In the school playground, use chalk and metre rulers to mark out the approximate stopping distances for vehicles travelling above, at and below the speed limit of a local road near you.

The stopping distance required is often too great to prevent a collision.

If the road is slippery or wet, if the driver is travelling fast, or is slow to react because of age, being tired, being under the influence of drugs or alcohol or medication, or because of distractions (e.g. texting, changing a music track, using a cell phone, interacting with passengers), then the car will take even longer to stop.

A driver can only avoid a collision if they see the cyclist or pedestrian far enough ahead.

Stopping distance demonstration (Tasman District Council)

Following distance (New Zealand road code)

Stopping distance (RAC UK)

Stopping distance (One Special Science Teacher)

WRAP UP

Session reflection

What do you know you don't know about emergency stopping when cycling?

What have you learnt that is new to you about emergency stopping when cycling?

What do you wonder about emergency stopping when cycling?

Use the student responses to make decisions about follow-up sessions.

Key competency self-assessment rubric

Thinking	Managing self	Participating and contributing	Relating to others	Using language symbols and text
Develop a critical eye (situational awareness) for unsafe environments and unsafe actions when out on your bike.	Act appropriately when on and around bikes. Act in ways that create and maintain 'bike fun and safe environments'.	Display an awareness of local issues around riding bikes. Be actively involved in community issues around having fun and keeping safe when riding bikes Contribute to physical environments and local events to make them 'bike fun and safe'.	Interact with others to create 'fun and safe' biking environments at school and in the local community.	Interpret messages in communications about 'bike fun and safe environments'. Use language symbols and text to communicate messages about 'bike fun and safe environments'.

For more about key competency self-assessment rubrics, see Appendix B.