

KEEPING SAFE AROUND TRUCKS Curriculum resources

4.0. EXTENDING IDEAS

4.1. Future of trucking

[Extending ideas]

[Links to New Zealand Curriculum Learning Areas: Mathematics and Statistics, Social Sciences, Science]

We can find out what vehicles moving heavy loads were like in the past (refer to the Timeline of Transportation Technology https://en.wikipedia.org/wiki/Timeline_of_transportation_technology).

But no one knows for certain what moving heavy loads will be like in the future.

All the same, many different people across the world are imagining what it might be like. They are thinking about what is best for the future of transport and trucking. They are experimenting with different options, inventing, designing, testing and exploring how they can make what seems impossible possible.

Investigate the future of trucking using the video resources below.

Videos and Other Resources

Past trucks

Search online for photographs and videos showing early transport using trucks, when they took the form of vehicles powered by donkeys, oxen, horses, water buffalo or steam. Carefully check that all online images and video found are suitable for students.

For example, search Getty Images <http://www.gettyimages.co.nz/> for early archival images of trucks or the Internet Archive <https://archive.org/index.php> for early videos about keeping safe around trucks when sharing the road.

Australian Trucking Past & Present – Documentary: <https://youtu.be/Oj3zpkFLHlw>

Singing Wheels – 1940's Trucks and Transport Educational Documentary – Ella73TV: <https://youtu.be/OOdHc9RrAKM>

The Engine that Powers the World – Diesel Engine Documentary: <https://youtu.be/wCA5pInfPpM>

Future trucks

8 Future Trucks & Buses You Must See: <https://youtu.be/Yhj4-pwi0sg>

Mercedes Self Driving Truck Driving Itself Mercedes Future Truck 2025 Commercial CARJAM

TV 4K 2015: <https://youtu.be/XZxZC0lgOlc>

Future Audi Truck Concept: <https://youtu.be/1KH8qafcsiM>

MB Actros 1851 MP4 Interior (by Geo93): <https://youtu.be/TIBRmRogQe8>

Der Neue MB Actros - The new MB Actros: <https://youtu.be/npl1FsFfvLM>

1. Future driverless trucks and truck platoons (truck trains)

Self-driving automated vehicles and truck platoons are already delivering goods in different places in the world. Different commentators are exploring what this will mean.

The Driverless Truck Is Coming: <https://techcrunch.com/2016/04/25/the-driverless-truck-is-coming-and-its-going-to-automate-millions-of-jobs/>

Self-driving Trucks: <https://www.theguardian.com/technology/2016/jun/17/self-driving-trucks-impact-on-drivers-jobs-us>

Future Timeline: <http://www.futuretimeline.net/blog/2016/04/10.htm#.WHGcbVxi9QI>

Driverless Trucks – The Long-haul Truck of the Future: <https://www.mercedes-benz.com/en/mercedes-benz/innovation/the-long-haul-truck-of-the-future/>

Road Trains: The World's Longest Truck – Road Train in Australia:
<https://www.youtube.com/watch?v=0a6JxqoE16Q>

Safety and Efficiency: Truck Platooning: <http://peloton-tech.com/>

Drivers choose when to platoon and always retain primary control of their own truck. They work together to save fuel and manage the changing environment.

Elon Musk Wants to Replace Truck Drivers with ‘Fleet Managers’:

<https://www.inverse.com/article/23297-elon-musk-tesla-trucks-fleet-drivers>

Tesla’s Elon Musk talks about driverless trucks with a fleet manager in the cab.

Uber for Trucking: <http://www.frg-law.com/truck-accident-blog/trucking/uber-impact-entering-trucking-industry/>

Uber Freight and Amazon Prepare to Fight over Future-trucking:

<https://www.inverse.com/article/25771-uber-freight-amazon-prepare-fight-future-trucking>

Companies like Uber (Uber Freight) and Amazon are experimenting with apps to connect people directly with automated trucks, cutting out broker fees.

2. Future surfaces used by trucks

Smart highway: https://en.wikipedia.org/wiki/Smart_highway

Smart highways are road surfaces, incorporating photovoltaic cells to generate solar power to fuel autonomous vehicles.

Amazon Has a Patent for Floating Blimp Warehouses:

<https://www.inverse.com/article/25761-amazon-aerial-fulfillment-centers-blimp-drone-warehouses>

Amazon's patent is designed to replace trucks with aerial drones operating from permanently floating aerial warehouses.

Cargo Sous Terrain: https://en.wikipedia.org/wiki/Cargo_Sous_Terrain

Cargo Sous Terrain Becomes Operational in Switzerland:

<http://www.futuretimeline.net/21stcentury/2030.htm#cargo-sous-terrain>

This planned system of underground tunnels is designed as a "complete, automated, flexible and durable underground cargo system which allows the transport of pallets and crates for packages, individual items, break bulk cargo and bulk goods, as well as their intermediate storage".

Norway to Create World's First Floating Underwater Tunnel:

<https://www.rt.com/business/353690-norway-underwater-floating-tunnels/>

Norway's Public Roads Administration plans to solve transport problems by building a submerged tunnel system, floating about 30 metres underwater in the fjords.

3. Future fuel sources used to power trucks

Nikola One Unveiling Introduction: <https://youtu.be/N1OQY5vIZYM> (short version)

Nikola Motor Company Unveiling – Official Video: <https://youtu.be/wLidTCqAAAtY> (long version)

American hybrid truck design company, Nikola Motors, has unveiled a class 8 truck powered by a hydrogen fuel cell that will have an operational range of up to 1,900km when launched by 2020. Hydrogen-powered trucks with zero carbon emissions would address some of the concerns about climate change and carbon emissions from diesel-burning trucks.

Wright Speed Range-Extended Electric Power Trains: <http://www.wrightspeed.com/>

4. Future social implications of changes in the transport industry

Other researchers focus on the social implications of growing cities – the job losses for the many people who work in the transport industry and depend on driving pizza, people or products for a living – and the new jobs created.

How Will Cities Adjust to the Population Boom?:

<https://www.theatlantic.com/video/index/512744/how-will-growing-cities-adjust-to-the-population-boom/>

Tasks

1. **List** the ways people moved heavy loads before the invention of the diesel engine truck.

2. **Describe** ways in which technology has made sharing the roads with large, heavy trucks safer today.
3. **Explain how and why** an identified new technology would make child pedestrians and cyclists safer when they share the road with large, heavy trucks.
4. **Analyse** the technologies used in an autonomous self-drive truck and explain how each technology contributes to safer journeys for pedestrians and cyclists.
5. **Create a model (2-D or 3-D)** representation of a “future truck”, a future “transport system” or a “future city”, in which you identify the features that will help keep pedestrians and cyclists safe.

NZC Learning Areas Overview

Refer to the resource for Achievement objectives and Learning intentions (L1 to 4)

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
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4.2. Extending ideas on truck safety and energy use

Fact – Explanation – Future Thinking cards

NOTE: The total resource of Fact – Explanation – Future Thinking cards contains 15 cards on truck safety and 3 cards on energy use.

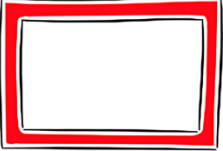


Ask students to work in groups to:




- Complete explanations and wonderings for five Fact – Explanation – Future Thinking cards.
- Create a class resource of explanations and wonderings by collating the different group responses.

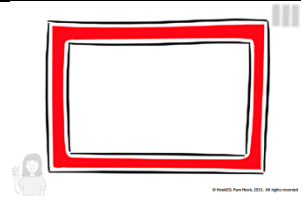
- Select and publish (in a multimodal output suited to the audience) the best explanation and wondering for each card.
- Create a community event or a community resource in which students share these facts, explanations and wonderings with others.

Note: For a teacher resource of exemplar explanations and wonderings, refer to the appendix.

Trucks are larger and heavier than other vehicles using the road.

TRUCK SAFETY FACT 1.	
	<p>FACT: Large trucks do more damage in a collision than smaller and lighter vehicles travelling at similar speeds on the roads.</p>
	<p>EXPLANATION:</p>
	<p>FUTURE THINKING:</p>

TRUCK SAFETY FACT 2.	
	<p>FACT: Large trucks take more time and distance to stop than smaller vehicles. Trucks cannot stop suddenly.</p>
	<p>EXPLANATION:</p>
	<p>FUTURE THINKING:</p>

TRUCK SAFETY FACT 3.

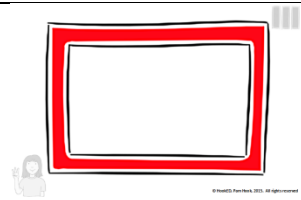
FACT: Large trucks take more time to accelerate and more time to slow down than smaller vehicles.



EXPLANATION:

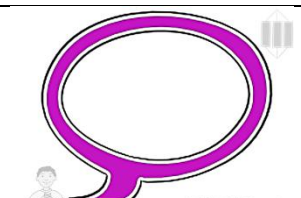


FUTURE THINKING:

TRUCK SAFETY FACT 4.

FACT: Large trucks have bigger blind spots than smaller vehicles. A blind spot is an area around the vehicle that the driver cannot see. Truck blind spots are found:

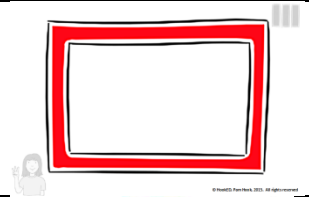
- **immediately in front of the truck** – the driver cannot see pedestrians crossing in front of the truck
- **beside the truck driver's door**
- **on the passenger side** – this is bigger than the driver's side blind spot, stretching the length of the truck and extending out the width of three lanes
- **directly behind the truck** – the cab has no rear vision mirror because the trailer behind a truck is so high, a rear vision mirror would only show the truck driver their own trailer.



EXPLANATION:



FUTURE THINKING:

TRUCK SAFETY FACT 5.

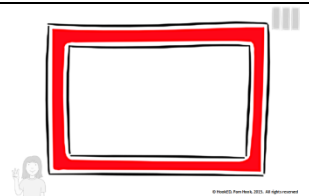
FACT: Large trucks need more room to turn than smaller vehicles.



EXPLANATION:



FUTURE THINKING:

TRUCK SAFETY FACT 6.

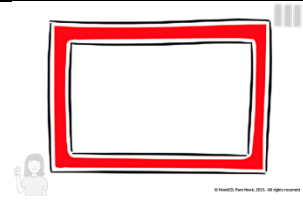
FACT: Large trucks take longer to pass than smaller vehicles.



EXPLANATION:



FUTURE THINKING:

TRUCK SAFETY FACT 7.

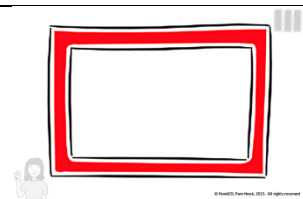
FACT: Large trucks throw out more water during wet weather than smaller vehicles.



EXPLANATION:



FUTURE THINKING:

TRUCK SAFETY FACT 8.

FACT: Large trucks create more air turbulence than smaller vehicles, which can affect oncoming vehicles.

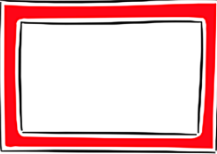




EXPLANATION:






FUTURE THINKING:

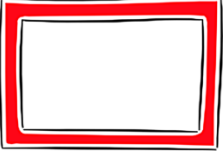


TRUCK SAFETY FACT 9.

	<p>FACT: Large trucks have a high centre of gravity (a point around which an object is balanced in all directions). A high centre of gravity makes trucks more susceptible to rollovers when cornering or in high wind gusts.</p>
	<p>EXPLANATION:</p>
	<p>FUTURE THINKING:</p>

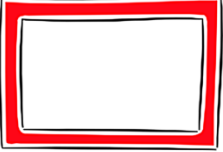


TRUCK SAFETY FACT 10.

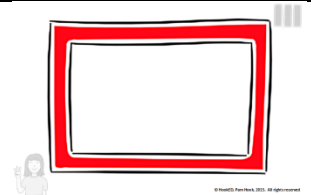
	<p>FACT: Long distance truck drivers' work conditions can make them vulnerable to driver fatigue.</p>
	<p>EXPLANATION:</p>
	<p>FUTURE THINKING:</p>

TRUCK SAFETY FACT 11.

	<p>FACT: When they are stopped on an upgrade, large trucks can roll backward for a length of between 4m and 5m before the forward gears engage.</p>
	<p>EXPLANATION:</p>
	<p>FUTURE THINKING:</p>

TRUCK SAFETY FACT 12.

	<p>FACT: Large trucks can gain speed when travelling on a downgrade, especially if they are fully loaded.</p>
	<p>EXPLANATION:</p>
	<p>FUTURE THINKING:</p>

TRUCK SAFETY FACT 13.

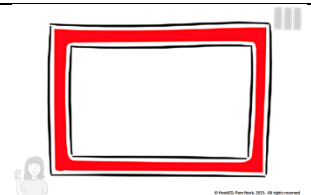
FACT: Large trucks with separate trailer units can jack-knife when braking.



EXPLANATION:



FUTURE THINKING:

TRUCK SAFETY FACT 14.

FACT: Large trucks can damage pavements, bridges and road surfaces and a greater rate than other modes of transport.

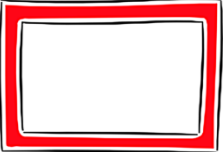




EXPLANATION:









FUTURE THINKING:

TRUCK SAFETY FACT 15.

	<p>FACT: Large trucks need lots of space.</p>
	<p>EXPLANATION:</p>
	<p>FUTURE THINKING:</p>

TRUCK ENERGY USE FACT 1.

	<p>FACT: Large trucks consume energy resources and, in doing so, contribute to greenhouse gas emissions (climate change).</p>
	<p>EXPLANATION:</p>
	<p>FUTURE THINKING:</p>

ENERGY USE FACT 2.	
	FACT: Large trucks create more air resistance than smaller vehicles, which can increase fuel use.
	EXPLANATION:
	FUTURE THINKING:

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4.3. Trucking – a future scenario

Ask students to work in groups or individually to:

- Analyse the future scenario below.
 - Read the text several times to pull out the major ideas.

- Highlight possible challenges and opportunities in the text.
- Explain why these might present a challenge or an opportunity for the mega-city.
- Make a generalisation about the most important trucking challenge or opportunity facing the people living in the mega-city.
- Generate possible solutions to the trucking challenges and opportunities.
- Select a promising outcome for transport of freight in the city and elaborate on it using drawings, plans, annotations, photographs or short video etc.
- Use a mock-up of a crowd funding approach to promote your future thinking to a group of citizens.

Future Freight Scenario

Everyone wanted to live in the mega-city – to lease an affordable high-rise apartment close to the jobs, the restaurants, bars and cafés, the hospitals, the fitness centres, the art galleries and entertainment complexes. Whatever you wanted, it was closer in the mega-city – you could walk or bike to most places or get there with better public transport. If you did need to grab a self-drive car, then commuting times were short and fares were cheap. The mega-city was buzzy: it offered more options and more lifestyle choices – except when it wasn't and it didn't.

Take tonight, for example. It was 2am, and the mega-city was choked. The streets were jammed with truck platoons (truck trains) and big rig haulers – and no one was getting anywhere fast. The autonomous truck platoons with their human back-up drivers drove mostly at night. Taking advantage of times when the mega-city traffic flows were slower helped reduce congestion and made more efficient use of the road network. This self-monitoring scheduling saw most truck platoons moving at off-peak hours and parked up during daylight hours. In this way they caused minimum disruption to the mega-city's non-commercial traffic – the cyclists, motorbikes and self-drive cars moving people around the city. Any initial concerns about the noise levels as the trucks moved through the streets, loading and unloading through the night, were quickly overcome when city residents saw the difference it made to traffic congestion during the day.

Trimble was stuck in a gridlock of container truck platoons trying to get goods into a port area just north of the city. Many of the platoon drivers had given up, switched over to shared control and left their trucks idling while they joined other drivers gathering on the pavements. The harsh white glare of LED street lighting made the night seem like day. Meeting other truck drivers like this was a treat and they enjoyed passing the time with gossip and VR games like trucker's cube. Most of them wore face masks and carried inhalers as protection from the acrid air and the dense clouds of diesel fumes that hung over the port area. A mega-city trucker needed not only a graduate degree in data aggregation and an independent spirit, but also great dollops of patience and a healthy respiratory system.

This most recent bottleneck was caused by an extreme weather event that had damaged half the container cranes working on the north area docks. The long delays, inefficient use of driver time and fuel wasted as the large rigs sat idling in traffic were painful for all concerned. Trimble and her fellow truck drivers expected the gridlock to last all of the night and stretch well into daytime tomorrow. Mega-city dwellers would not be pleased to see

the trucks when they rose in the morning. Luckily Trimble's cab was well equipped with a sleeping pod, feeding station and bathroom ready for when she got tired or hungry or just needed a shower. It was funny, she thought, just how tired and hungry not going anywhere could make you.

Living in one of the fastest-growing mega-cities in the southern hemisphere, people expected the traffic jams and air pollution. Towering one-bedroom studio apartment blocks crowded out every space; they might have rooftop gardens, and recreation and dog exercise areas but they were a poor substitute for the city parks of the past. All of these people needed and wanted goods and services – so they all relied on transport of one kind or another. The trouble was, thought Trimble, that the transport they needed and wanted was choking the city.

Gazing out across the artificially lit streets, she wondered when the waste disposal trucks would be back in the schedule. After the violent demonstrations last year, the importers and exporters of perishable goods and medical supplies had been granted priority access to city roads around the ports. A bit like the triage system in the emergency room at a hospital, port access was granted in response to an algorithm determining the most urgent freight need. Trucks wanting to get into the port simply had to wait to be notified that their turn had arrived. It seemed a fair solution at the time but the priority goods freight just seemed to grow and grow, crowding out all the rest.

Trimble reckoned that if the smell from the teetering piles of waste rubbish bags slowly taking over the pavements was anything to go by, someone needed to rejig the algorithm before the non-collection of public waste became a public health issue. She could see that the rubbish had already attracted the interest of the mega-city rats – or were they feral cats? The rats were so large and fearless it was hard to tell the difference nowadays. Still, she supposed, the smell would make the importers of air freshener happy. Many people would choose to work from home tomorrow, air conditioning on and windows tightly closed – leaving more space on the pavements and roads for the rubbish bags and gridlocked trucks.

In many ways, it made sense to work, study and shop from home even if you weren't trying to avoid the garbage smells, air pollution and crowded pavements. Most products could be ordered online and, if you paid a little extra, you could get same-day delivery. If you didn't like the product for any reason – its colour, size or taste – it was easy to notify a courier and get a replacement delivered. You really did not need to leave your home to shop.

The trouble was that it was hard to convince even green-oriented consumers to go back to the labour-intensive practice of shopping in the real. Nor were many people keen to delay the same-day timeframes they expected for online delivery, which would have made better use of truck capacity.

Visiting a physical store took more time – the stores did not offer such a wide choice of products, and the local shops could not match the online prices of goods manufactured in other countries with cheaper labour and bigger markets. It was much like the coffee-drinking fad in 2015 when coffee drinkers knew about the clean water costs of processing

coffee beans but insisted on queuing up for their trim lattes: no one denied online shopping and express delivery harmed the environment but, from the consumer's point of view, when you visited a physical store you ended up paying much more for much less.

Increasing personal choice – with everything from bespoke hamburgers to individualised clothing – had seemed like a wonderful idea at first. However, over time it became apparent that meeting the purchasing needs and the priority timeframes of individual city dwellers only increased the demand for transport of smaller packages, creating more traffic congestion and air pollution and further reducing space for traffic on the roads.

Complicating the issue, mega-city apartments were furnished with smart appliances using the “Internet of Things” connectivity. Microprocessors in electronic tags detected when different household goods were running out (or wearing out) and interacted with other devices that alerted supermarkets, mega-stores and courier companies of the need to buy milk, restock the pantry, and purchase a printer cartridge or a new pair of shoes. Each mega-city apartment dweller had their own personal shopper – they didn't need to check the cupboards or the courier company freight delivery schedule before going online. They did not even need to go online – their appliances did it for them, monitoring every step of the purchase process.

While she waited for the truck platoon to inch forward, Trimble streamed content from a mega-city citizens' debate from the day before. The latest extreme weather event had been clearly linked to global warming. The Mega-city Citizens for Change group were demanding a “green supply chain” to meet concerns about the transport sector's almost 20% share of global carbon emissions. Trimble agreed with many of their arguments but without government intervention it was hard to see the transport sector voluntarily making greater use of alternative energy sources and fuel-saving strategies when they would face some significant extra costs in converting all the existing truck platoons to alternative fuel sources like hydrogen fuel cells.

The increasing scarcity of fossil fuels and the ability of a small number of sellers to control the world markets for fuel made it difficult for transport companies to decide how to react. Trimble knew only too well that profit margins were tight and even though consumers in the city experienced the air and noise pollution first hand, they still had to buy food, pay the rent, and cover medical expenses. She knew the choices she made when things got tight at home. City dwellers might indicate they would pay more for cleaner air in an online survey but what they said in the survey and what they did in reality were not necessarily the same thing.

Still Trimble was worried about the mega-city, the air pollution and the congestion. What would happen when the truck traffic in the mega-city was always choked regardless of the time of day? The transport sector may well use a disproportionately large amount of fuel compared with other sectors but it also provided the fuel the other sectors needed. The challenges were complex.

Trimble knew that many of her fellow drivers hoped a new technology would rescue them like it had in the past.

Trucks had always been much larger and heavier than other vehicles using the road. In the past, trucking had been a hazardous and often lonely lifestyle. It had created many health and safety issues for truck drivers and for others sharing the roads. Over more recent years new technologies had helped truck drivers and drivers of non-commercial vehicles to monitor safe driving distances, keep in their lanes, brake safely, monitor blind spots for bikes and other vehicles, minimise rolling movements when cornering and importantly detect driver fatigue before it became a safety issue. New technologies had rescued them and changed the industry for the better.

Some truck drivers favoured a transport future where Amazon's aerial drones and floating warehouses distributed freight; others liked Switzerland's Cargo Sous Terrain system of underground depots and tunnels, or Norway's floating underwater tunnels. Trimble wondered if the solution would instead be found in changing people's expectations about transport. She couldn't settle on which future for trucking she preferred – she only knew that, regardless of the present congestion, she was glad to be driving trucks in the present rather than the past.

Trimble still remembered the "Truck Safety Facts" test she had studied for when trying to get a place in the truck drivers' driving academy all those years ago. You had to choose 10 facts and then explain each one before resolving the safety issue in some way. The full test involved practical and theoretical challenges – it tested the physical fitness and the critical and creative thinking necessary to successfully work with the big rigs and truck platoons. Only the very smartest and most imaginative candidates made it through.

Remembering the safety issues people faced in the past made Trimble feel much more relaxed about the current gridlock. Her truck platoon had enjoyed a "Vision Zero – no more traffic deaths" rating for the past five years and that was the way she liked to drive.

Can you complete the same test as X did?

TRUCK SAFETY FACTS TEST

- **Select** a fact.
- **Explain** how and/or why this is a safety issue.
- **Reflect** on how this issue might be resolved now or in the future.

Fact 1: Large trucks do more damage in a collision than smaller vehicles.

Fact 2: Large trucks take more time to stop than smaller vehicles.

Fact 3: Large trucks take more time to accelerate or slow down than smaller vehicles.

Fact 4: Large trucks have bigger blind spots than smaller vehicles.

Fact 5: Large trucks need more room to turn than smaller vehicles.

Fact 6: Large trucks take longer to pass than smaller vehicles.

Fact 7: Large trucks throw out more water during wet weather than smaller vehicles.

Fact 8: Large trucks create more air turbulence than smaller vehicles.

Fact 9: Large trucks have a high centre of gravity.

Fact 10: Large truck driving makes drivers vulnerable to fatigue.

Fact 11: Large trucks can roll backwards when starting on an upgrade.

Fact 12: Large trucks gain speed when travelling on a downgrade.

Fact 13: Large trucks with trailers can jack-knife when braking.

Fact 14: Large trucks damage pavements, bridges and road surfaces.

Fact 15: Large trucks need lots of space.

TRUCK ENERGY USE FACTS TEST

Fact 1: Large trucks consume energy resources and contribute to air pollution.

Fact 2: Large trucks create more air resistance than smaller vehicles.

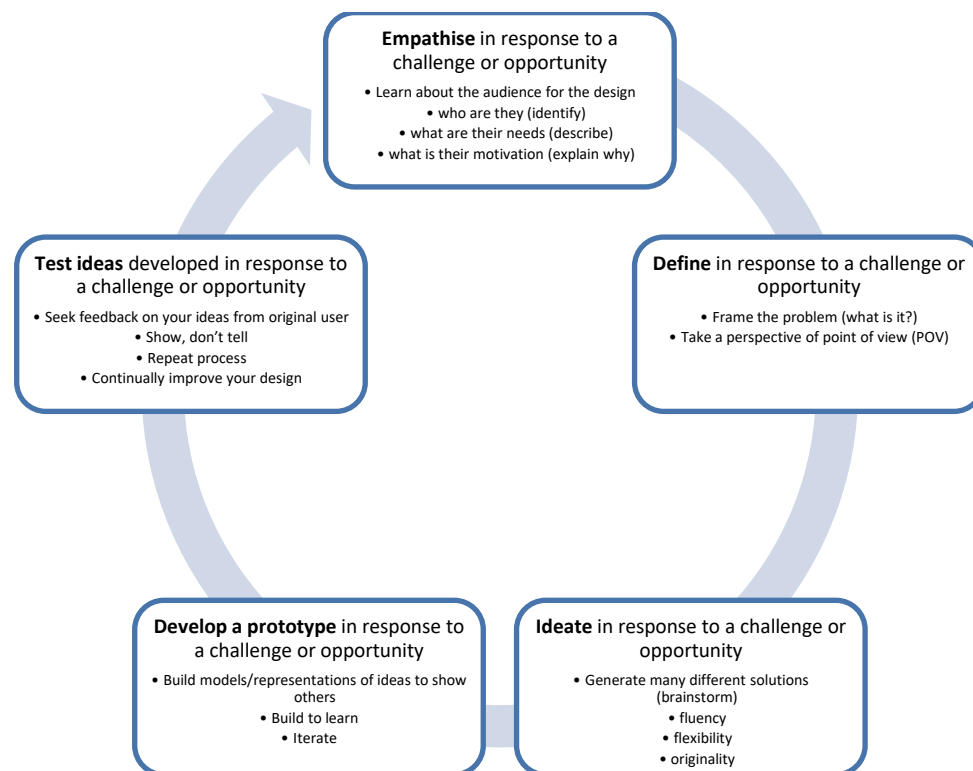
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4.4. Apply design thinking in response to a trucking safety issue in your local community

Working in groups of three to five students, use design thinking to explore a local trucking safety issue.



First **empathise**. Identify and investigate the people affected by the trucking issue so you can learn more about the audience for the design response:

- Who are they? (Identify who is affected by the trucking issue.)
- What are their needs? (Describe their needs.)
- What is their motivation? (Explain why they need a solution.)

Next **define** in response to a challenge or opportunity in the trucking issue.

- Frame the problem. (What is it?)
- Take a POV (point of view).

Then **ideate** in response to the defined trucking issue.

- Generate many different solutions (brainstorm), looking for:
 - fluency
 - flexibility
 - originality.

Next **develop one or more prototypes** in response to the trucking issue.

- Build models/representations of ideas to show others.

- Build to learn.
- Iterate.

Finally **test ideas** developed in response to the trucking issue.

- Seek feedback on your ideas from the original people affected.
- Show, don't tell.
- Repeat process.
- Continually improve your design.

Create a storyboard for a two- to three-minute video pitch of your design solution. You will need to explain the truck safety issue, why it is important, and how and why your solution will help resolve the issue.

Select the design solution most likely to succeed.

Think about what can be done to successfully introduce or implement your solution by involving individuals, your class, school community, clubs and youth organisations, government or community churches.

Work with those affected to present your design ideas to those most likely to help them progress.

NZC Learning Areas Overview

Refer to the resource for **Achievement objectives and Learning intentions (L1 to 4)**

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	

Reflection on Extending Ideas Sessions

What do you know you don't know about keeping safe around trucks?

What have you learnt that is new to you about keeping safe around trucks?

What do you wonder about keeping safe around trucks?