



Curriculum resource, updated 2023

## Section 4: Extending ideas

### 4.1. Future of trucking

*Learning areas: Mathematics and Statistics, Social Sciences, Science*

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

We can find out what vehicles moving heavy loads were like in the past.

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 resources below.

#### Past trucks

[Timeline of transportation technology \(Wikipedia\)](#)

[Trucks in NZ \(A DigitalNZ story\)](#)

[Road and rail to the early 20<sup>th</sup> century \(Te Ara\)](#)

[Truck \(Encyclopedia Britannica\)](#)

[The Engine that Powers the World – Diesel Engine Documentary](#)

### **Future trucks**

[12 Future Trucks & Buses You Must See](#)

[Mercedes Self Driving Truck Driving Itself](#)

[Future Audi Truck Concept](#)

### **Future driverless trucks and truck platoons (truck trains)**

[TuSimple completes its first driverless autonomous truck run on public roads](#)

[Self-driving truck \(Wikipedia\)](#)

[The Long Road to Driverless Trucks \(NY Times\)](#)

[The road to driverless truck technology \(Shell Australia\)](#)

[Partially Automated Truck Platooning Demonstration \(YouTube, US Federal Highway Administration\)](#)

[Semi-autonomous truck platooning — how does it work? \(YouTube, Scania\)](#)

[Logistics Disruptors: Replicating Uber's success in the trucking industry](#)

### **Future surfaces used by trucks**

[Electrified Roads Power Your EV While You Drive, Making Charging Pit-Stops a Thing of the Past \(Popular Mechanics\)](#)

[Amazon files patent for flying warehouse \(BBC\)](#)

[Switzerland moves ahead with underground autonomous cargo delivery](#)

[Cargo sous terrain animated video](#)

[Norway's plans for a floating tunnel](#)

### **Future fuel sources used to power trucks**

[Fonterra welcomes Milk-E, New Zealand's first electric milk tanker](#)

[NZ's first hydrogen trucks hit the road \(Newsroom\)](#)

[Foodstuffs and EECA partner up to build NZ's first 100% electric refrigerated logistics truck \(YouTube\)](#)

### **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? \(The Atlantic\)](#)

[New generation trucks threaten millions of jobs \(NZ Herald\)](#)

## 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.

## 4.2. Extending ideas on truck safety and energy use

Learning areas: Health and PE, Science

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Mathematics and Statistics	Geometry and Measurement				
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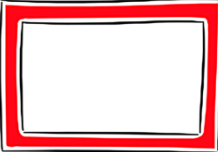


### Fact – Explanation – Future Thinking cards




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

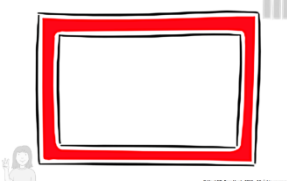


Ask students to work in groups to:

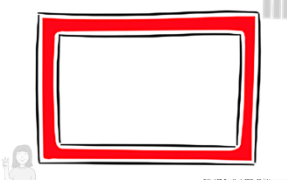


- Complete explanations and wonderings for 5 Fact – Explanation – Future Thinking cards.
- Create a class resource of explanations and wonderings by collating the different group responses.
- Select and publish (in a multimodal output suited to the audience) the best explanation and wondering for each card.
- Create a community event or a community resource in which students share these facts, explanations and wonderings with others.

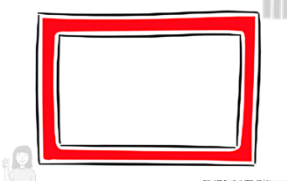


Note: For a teacher resource of exemplar explanations and wonderings, refer to the appendix.

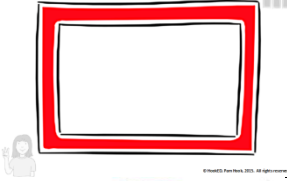


TRUCK SAFETY FACT 1	
	<b>FACT:</b> Large trucks do more damage in a collision than smaller and lighter vehicles travelling at similar speeds on the roads.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

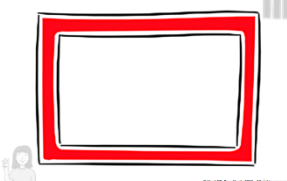


TRUCK SAFETY FACT 2	
	<b>FACT:</b> Large trucks take more time and distance to stop than smaller vehicles. Trucks cannot stop suddenly.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

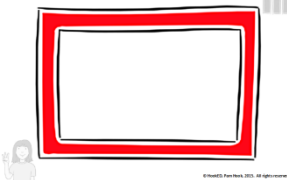


TRUCK SAFETY FACT 3	
	<b>FACT:</b> Large trucks take more time to accelerate and more time to slow down than smaller vehicles.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

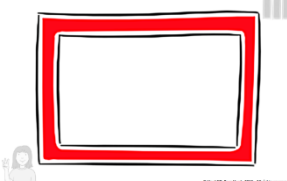


TRUCK SAFETY FACT 4	
	<b>FACT:</b> Large trucks have bigger blind spots than smaller vehicles. A blind spot is an area around the vehicle that the driver cannot see. Truck blind spots are found: <ul style="list-style-type: none"> <li>• <b>immediately in front of the truck</b> – the driver cannot see pedestrians crossing in front of the truck</li> <li>• <b>beside the truck driver's door</b></li> <li>• <b>on the passenger side</b> – this is bigger than the driver's side blind spot, stretching the length of the truck and extending out the width of three lanes</li> <li>• <b>directly behind the truck</b> – 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.</li> </ul>
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

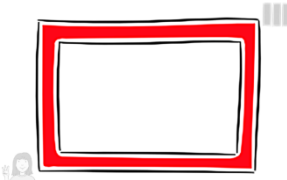
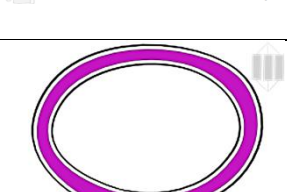

TRUCK SAFETY FACT 5	
	<b>FACT:</b> Large trucks need more room to turn than smaller vehicles.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

TRUCK SAFETY FACT 6	
	<b>FACT:</b> Large trucks take longer to pass than smaller vehicles.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

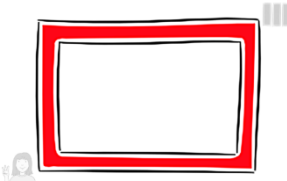


TRUCK SAFETY FACT 7	
	<b>FACT:</b> Large trucks throw out more water during wet weather than smaller vehicles.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

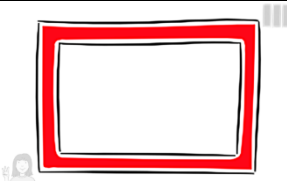


TRUCK SAFETY FACT 8	
	<b>FACT:</b> Large trucks create more air turbulence than smaller vehicles, which can affect oncoming vehicles.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

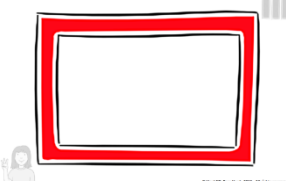


TRUCK SAFETY FACT 9	
	<b>FACT:</b> Large trucks have a high centre of gravity (a point around which an object is balanced in all directions). A high centre of gravity makes trucks more susceptible to rollovers when cornering or in high wind gusts.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

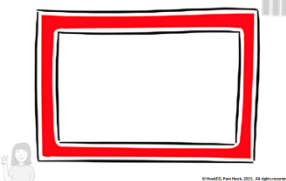


TRUCK SAFETY FACT 10	
	<b>FACT:</b> Long distance truck drivers' work conditions can make them vulnerable to driver fatigue.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

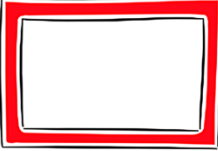




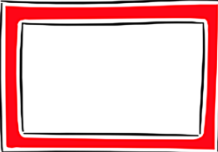


TRUCK SAFETY FACT 11	
	<b>FACT:</b> When they are stopped on an upgrade, large trucks can roll backward for a length of between 4m and 5m before the forward gears engage.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

TRUCK SAFETY FACT 12	
	<b>FACT:</b> Large trucks can gain speed when travelling on a downgrade, especially if they are fully loaded.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

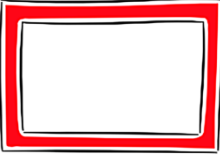


TRUCK SAFETY FACT 13	
	<b>FACT:</b> Large trucks with separate trailer units can jack-knife when braking.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

TRUCK SAFETY FACT 14.	
	<b>FACT:</b> Large trucks can damage pavements, bridges and road surfaces at a greater rate than other modes of transport.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

TRUCK SAFETY FACT 15.	
	<b>FACT:</b> Large trucks need lots of space.
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

TRUCK ENERGY USE FACT 1.	
	<b>FACT:</b> Large trucks consume energy resources and, in doing so, contribute to greenhouse gas emissions (climate change).
	<b>EXPLANATION:</b>
	<b>FUTURE THINKING:</b>

## ENERGY USE FACT 2.

 <small>© Newell's Press Inc. 2015. All rights reserved.</small>	<b>FACT:</b> Large trucks create more air resistance than smaller vehicles, which can increase fuel use.
 <small>© Newell's Press Inc. 2015. All rights reserved.</small>	<b>EXPLANATION:</b>
 <small>© Newell's Press Inc. 2015. All rights reserved.</small>	<b>FUTURE THINKING:</b>

### 4.3. Trucking – a future scenario

Learning areas: Health and PE, Social Sciences

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				
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Ask students to work in groups or individually to:

Analyse the future scenario on the following pages.

- 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.

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 live in a high-rise apartment close to jobs, the restaurants and bars, hospitals, entertainment. Everything was closer in the mega-city. You could walk or bike to most places or use 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 and offered more choices – except when it wasn't and it didn't.

Take tonight. 2am. The mega-city was choked. Streets were jammed with truck platoons and big rigs, no one getting anywhere fast. The auto-truck platoons with human back-up drivers were nocturnal, active at night. They took advantage of times when the mega-city traffic flows were lighter. This self-monitoring schedule saw most truck platoons moving at off-peak hours and parked up during daylight. This minimised disruption to the mega-city's non-commercial traffic –cyclists, motorbikes self-drive cars. Any initial concerns about noise at night were quickly overcome when city residents saw the difference to traffic congestion during the day.

Trimble was stuck in a gridlock of container truck platoons trying to get goods to the port. Many platoon drivers had given up for the moment, 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. Most wore face masks and carried inhalers as protection from the acrid air and dense clouds of diesel fumes.

A mega-city trucker needed not only a graduate degree in data science and an independent spirit, but also great dollops of patience and sturdy lungs.

Tonight's bottleneck was caused by extreme weather that had damaged half the container cranes working on the docks. Driver time wasted, fuel burned – not good. Trimble expected the gridlock to stretch well into daytime tomorrow. Mega-city dwellers would not be pleased to see the trucks when they rose in the morning. Luckily, her cab was well-equipped with a sleeping pod, feed station and bathroom.

It was funny, she thought, just how tired and hungry not going anywhere could make you.

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. Now, 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.

She gazed up at the tall apartment towers that some people hardly left – zipping from home to the internal gym and back again. 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. You really did not need to leave your home to shop.

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.

Increasing personal choice – with everything from bespoke hamburgers to individualised clothing – had seemed like a wonderful idea at first. But 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.

Complicating the issue, mega-city apartments were furnished with smart appliances. The fridge and the pantry alerted supermarkets, mega-stores and courier companies of the need to buy milk or bread or a new pair of shoes. Each mega-city apartment dweller didn't need to check the cupboards or 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 citizens' debate the day before. The latest extreme weather event had been clearly linked to global warming. The Mega Citizens for Change group were demanding a "green supply chain" to meet concerns about the transport sector's almost 20 percent 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 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.

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?

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 car drivers 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 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.

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. 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 Trimble did?

### **Truck safety facts test**

- **Select** a fact.
- **Explain** how 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.

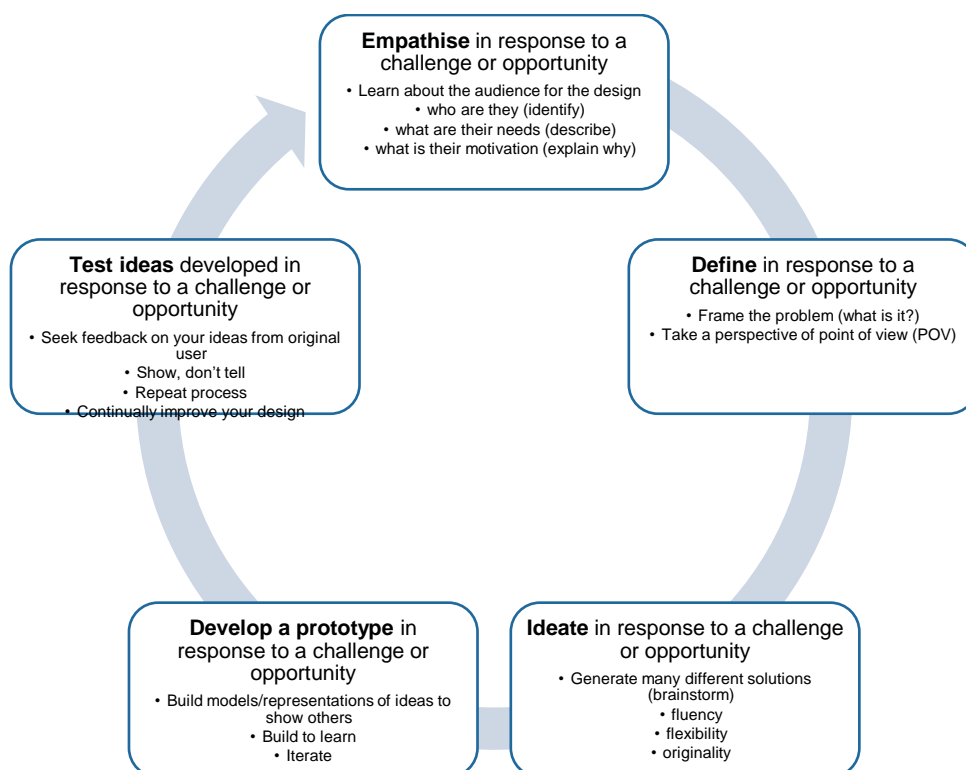


## 4.4. Apply design thinking in response to a trucking safety issue in your local community

Learning areas: Health and PE, Science, Social Sciences

Health and Physical Education	Personal Health and Physical Development A – A3 Safety management		Healthy Communities and Environments S – D2 Community resources	
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Working in groups of 3-5 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 2-3 minute video pitch of your design solution. You will need to explain the truck safety issue, why it's 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.

### 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?