ROAD TO ZERO

POST-VISIT ACTIVITY: CALM DOWN! SPEED AND TRAFFIC TREATMENTS INVESTIGATION

Traffic calming treatments are installations such as speed reduction humps or portable rumble strips designed to slow, deter or redirect traffic. Traffic calming devices aim to encourage safer, more responsible driving in changing and risky conditions. Using streets local to the school, students explore the effect of a traffic calming treatment on vehicle speed. Students then analyse the data and consider the effectiveness of the treatment.

VCE Vocational Major curriculum alignment

This activity supports:

Numeracy	**Unit 3** Outcome 1 – could be considered under either Personal or Civic Numeracy Outcome 2 – all stages of the problem-solving cycle can be covered Outcome 3 – a range of tools and technologies are covered Areas of Study – main focus is on Relationships, and also supports Quantity and Measures

Learning intention

To understand the effects of traffic calming treatments on vehicle speed.

Success criteria

- Collect accurate data about vehicle speeds in two different road environments
- Calculate the average speed of the vehicles in two different road environments
- Analyse the results to decide if traffic treatments slow the speed of vehicles.

Resources

Student information sheet	**Calculating vehicle speeds**
Student worksheet	**1. Calm Down! Collecting vehicle speed data** **2. Calm Down! Speed and traffic treatments analysis & reflection** **3. Calm Down! Speed and traffic treatments analysis: your report**
Other	**Metre wheel or long measuring tape** **Stopwatches**

Activity duration

Approximately 3-4 lessons

Learning activity description

This activity models the approach as outlined in the VCE Vocational Major Numeracy Study Design.

Outcome1

This activity about road safety could be considered to be either Personal or Civic Numeracy:

- Personal numeracy relates to the mathematical requirements for personal organisational matters involving numbers, data, money, time and travel. Personal numeracy relates to understanding, using and interpreting numerical and mathematical information presented and embedded in different formats and media, to undertake personally relevant activities in a range of routine, non-routine, unfamiliar and some specialised situations.
- Civic numeracy relates to participating in civic life through knowing how to stay informed, and understanding government, political and social data, information and processes. Civic numeracy includes understanding, interpreting and evaluating statistical and quantitative information presented by governments and in news and media reports, and other data-related sources to meet the demands and challenges of life at local, state, national and global levels. It can incorporate the understanding, use and interpretation of quantitative and statistical information.

Outcome 2

All four stages of the problem-solving cycle can be covered by this activity. It needs to be remembered that the students need to be supported to work through the problem-solving cycle that is part of Outcome 2. This covers the following four stages and activities:

- Identifying the maths to be used
- Acting on and using maths to solve the problem – doing the mathematics
- Evaluating and reflecting on the results
- Communicating and reporting the outcomes.

Outcome 3

This activity requires students to use a number of tools and applications chosen from their mathematical toolkit to undertake the different activities and related calculations. These tools or applications could include:

- A tape measure, trundle wheel or a measurement app on a smartphone
- A stopwatch or timer on a smartphone
- A calculator or a spreadsheet.
- Software for creating a report or presentation on the findings.

Areas of Study covered

The main focus of the activity is on Relationships, but it also supports.

Relationships Key knowledge covered include	Quantity and measures Key knowledge covered include
• a range of rates of change m/s and kmh • relevant and straightforward proportions • common, relevant and real-life algebraic formulas, relationships and algebraic expressions and thinking • representation and visualisation of change such as algebraic expressions and formulas, conversion charts or graphs • standard conventions used in the development, use and writing of a range of algebraic expressions.	• a range of measures of distance, including the use and application of common and routine measurement formulas • a range of metric units of measurement and conversion between units • a range of units of time • a range of measurement estimation strategies • a range of measurement tools • understanding of accuracy and tolerances in measurements.

Note: not all aspects of the above Areas of Study are covered through this activity, and other aspects would need to be covered through supplementary tasks and activities.

Pre-class preparation

Location scout!

For this investigation, you or the students need to locate two roads (or two sections of the same road) that have the same speed limit, but differ in design:

- a straight stretch, 100m long with no traffic calming treatments
- a straight stretch, 100m long with a traffic calming treatment approximately midway, e.g. raised safety platform, road hump, kerb outstand, chicane, slow point.

Selection criteria

We are looking for roads:

- close to your school
- with clear sight lines for student observation of the road (minimal roadside vegetation and parking zones) 50km/h speed zones or lower.

Safety note

Your students will be collecting data by observing vehicles travelling on active roads. Please plan a safe route to the chosen location and choose a safe spot for students to observe the vehicles.

Activity 1

Background to the problem and identifying the maths to be used

Start the activity with a class discussion about the purpose of the activity and what they need to do.

1. Remind students that safer roads, safer speeds, safer people and safer vehicles all contribute to achieving the goal of a future where there are zero lives lost and zero serious injuries on the roads.
   Safe roads – Roads must be designed to both prevent crashes and, in the event of a crash, reduce the severity and minimise the chance of injury.
   Safe speeds – The appropriate speed for the conditions, including the state of the road, amount of traffic, number and type of other road users as well as weather. Speed limits indicate the safe speed for that road in normal weather conditions, but if the weather or light is poor, then drivers should reduce their speed to be safer.
   Safe people – Road safety is a shared responsibility. Everyone can play an important role in helping reduce road trauma and death shouldn't be seen as an inevitable consequence of making a mistake on our roads.
   Safe vehicles – Vehicle safety has gradually improved over time. Vehicles are getting better at helping to avoid a crash and better protecting drivers and passengers in crashes. If everybody upgraded their vehicle to the safest in its class, road trauma would drop by a third.
2. Inform students that they are going to conduct an investigation about how roads can be designed using treatments that encourage drivers to maintain lower speeds and be aware of other road users. These treatments are known as traffic calming treatments. Discuss treatments that students are aware of and create a list, especially of any such features that are in the area near to the school.
3. Ask the students to break into small groups of students (3 or 4 students per group) to discuss or brainstorm how they might be able to collect some information or data to decide if one such calming treatment that they could review (e.g. raised safety platform, road hump, kerb outstand, chicane, slow point) has any impact on how fast cars travel down the road. You might need to provide some prompts of they cannot see how to do this – or what information they might need to collect. Highlight issues that they need to consider, which might include:
   - How could they find out if a calming treatment works or not?
   - What would they need to compare? Why might they need two different sites/roads to study?
   - What information would they need to collect in order to decide?
   - What do they think their hypothesis might be?
   - How much difference do they think the calming treatment might make?
4. Following their small group discussions have a whole group discussion to share their ideas and firm up on a more structured and agreed approach for each group to then implement in order to see if they can decide if the calming treatments do in fact slow down the traffic. Highlight mathematical content that they will need to understand, which might include:

- How do you calculate speed (of a car)
- The advantage of calculating an average over a distance such as 100 metres and why? Do they remember how to work out averages?
- What units of speed are commonly used – and can they use the common speed of cars (km/h or kph sometimes) easily in their measurements?
- What conversions might they need to undertake?
- What equipment, tools or apps might be required?
- What level of accuracy in their calculations would they expect or need?

5. Work through the key maths required for the task based on Student information sheet 1: Calculating vehicle speeds, and make sure the students understand how to use and apply the maths.

Activity 2

Using maths to solve the problem and collect the data (Stage 2 of the problem-solving cycle)

Acting on and doing the mathematics

Each group of students then work together to undertake their activity.

Hand out **Student Worksheet 1: Calm down! Collecting vehicle speed data** for them to check and agree on, and adapt if necessary, and for them to decide on the two locations required for their investigation.

The maths students will need to use in this activity are:

- the use of the speed formula
- conversions between metres per second (m/s) and kilometres per hour (km/h). There is information in the box on the next page about how to do this conversion.
- working out the average speeds.

What to do

Students should work in groups of three (or four).

- Use a metre wheel or long measuring tape to measure 100m of the straight length of road with no traffic calming treatments. Students could even use measurement app on their smartphone and check the accuracy of the app with the measuring tape. Which one do they think is more accurate?
- Position a student (A) at the start of the 100m course, and another student (B) at the end. A third student (C) is responsible for timing.
- When a vehicle passes A, they raise their arm, signalling to C to start the stopwatch. When the car passes B, they signal to C to stop timing. Student C records the time on the student investigation sheet.
- This should be done 10 times.
- Repeat the steps described above with the second stretch of straight road, with the traffic calming treatment at the midway point.

Activity 3

Individual or small group evaluation and reflection on the results (Stage 3 of the problem-solving cycle)

The students should then answer the questions on Student Worksheet 2: Calm down! Speed and traffic treatments analysis & reflection about the differences in time and speed and comment on the effectiveness of the traffic calming treatment as a means of encouraging slower speeds and driver concentration.

Activity 4

Presentations, class discussion and conclusions (Stage 4 of the problem-solving cycle)

Students should develop their own reports or presentations, using the information on Student Worksheet 3: Calm down! Speed and traffic treatments analysis: Your Report.

Each small group should compare their findings and discuss reasons for any differences in their findings. Then hold a whole class discussion about the investigation, pulling together the overall results and the key reflections from the students, including their reflections on the methodology used and if they were surprised, or not, by the results.

Finally, ask the students to suggest other local roads which could benefit from traffic calming treatments.

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STUDENT INFORMATION SHEET 1: CALCULATING VEHICLE SPEEDS

How to work out the speed of a vehicle

To work out the speed of a vehicle, students need to use the formula:

$$Speed = \frac{(distance)}{time}$$

$$s = \frac{u}{time}$$

To do this you need to know the distance the vehicle travelled and divide this by the time it took to travel that distance.

For example, if a car travels 100 metres and takes 10 seconds to travel that distance, the speed it travelled at would be 10 metres per second.

We would write this as:

$$s = \frac{d}{t} = \frac{100}{10} = 100 \div 10 = 10$$

Speed is 10 metres per second or abbreviated this is 10 m/s.

The vehicle travelled at 10 metres per second.

Practice

1. Convert the following into speed in m/s:

a) a car takes 8 seconds to travel 100 metres

b) a bike takes 22.5 seconds to travel 100 metres

c) a car takes 12.75 seconds to travel 500 metres

d) a person takes 30 seconds to run 200 metres.

Converting from m/s to km/h

However, we usually measure the speeds of cars into kilometres per hour (km/h. So, we need to convert metres per second (m/s to kilometres per hour (km/h.

What you need to know:

There are 60 seconds in 1 minute. There are 60 minutes in 1 hour.

There are 3,600 seconds in 1 hour (60 x 60 = 3,600). There are 1,000 metres in 1 kilometre.

For every metre you travel in a second, you will travel 3,600 times as many metres in an hour – because there are 3,600 seconds in an hour.

So, 1 m/s = 3,600 m/h (and 2 m/s = 7,200 m/h; 3 m/s = 10,800 m/h, and so on

But there are 1,000 metres in a kilometre, so we need to change the metres to kilometres. To do this, we divide by 1,000.

1 m/s = 3,600 m/h = 3,600 ÷ 1,000 km/h

1 m/s = 3.6 km/h

A simple way of doing this conversion

Multiply the metres per second by 3.6 (called the conversion factor.

So, if a vehicle was travelling at 15 m/s you can multiply this number by 3.6. 15 x 3.6 = 54

The vehicle travelled at 54 km/h

Practice

1. Convert the following speeds from m/s to km/h:

a) 8 m/s **b)** 22.5 m/s **c)** 17.5 m/s

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STUDENT WORKSHEET 1: CALM DOWN! COLLECTING VEHICLE SPEED DATA

Research question: What effect can road design have on car speeds?

Background information

In local streets and near schools, there are many different types of road users, including vulnerable road users such as pedestrians and cyclists. One very effective way to make roads safer in these areas is to reduce the speed limit to 40km or less. But, what happens if someone is speeding, or not paying attention? Have you considered that a road can be designed to force drivers to keep their speed down, and/or pay attention at dangerous spots, such as near schools or at pedestrian crossings?

Your task

You will collect data to explore if road treatments that calm (slow) traffic on roads can make people drive more safely.

Note: You could enter your data into a spreadsheet to do the calculations and use formulae to generate the results for you.

Your predictions

What do you think you will find out in your investigation?	
Do you think the average speeds for each street will be above and below the speed limit? By how much?	
What do you think the average speeds might be for each street? How much difference between the one with the calming treatment and the one without?	

Your data

Data table 1 – Straight road (no traffic calming treatments)

Length of road: 100m

Location: _____

Speed limit (when data collected): _____

Trial number	Time vehicle takes to travel 100 metres in seconds	Speed of vehicle in metres per second (m/s) (speed = distance (100 metres) ÷ the time the vehicle took)	Speed of vehicle in kilometres per hour (km/h) (multiply the speed in m/s by 3.6)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
		Average (mean) speed:	

Your data

Data table 2 – Straight road with traffic calming treatment

Length of road: 100m

Location: _____

The traffic calming treatment we are investigating is: _____

Speed limit (when data collected): _____

Describe and draw the traffic calming treatment.

Trial number	Time vehicle takes to travel 100 metres in seconds	Speed of vehicle in metres per second (m/s) (speed = distance (100 metres) ÷ the time the vehicle took)	Speed of vehicle in kilometres per hour (km/h) (multiply the speed in m/s by 3.6)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
		Average (mean) speed:	

Name:

STUDENT WORKSHEET 2: CALM DOWN! SPEED AND TRAFFIC TREATMENTS ANALYSIS & REFLECTION

Analysing the data

What did you find out? How effective was the traffic calming treatment at reducing vehicle speeds?

Prompt: What does a car do before, during and after interacting with the traffic calming treatment?

On the road with no treatment, what was the average time the vehicles observed took to travel 100 metres?	
On the road with traffic calming treatment, what was the average time the vehicles observed took to travel 100 metres?	
On average, how much longer did a vehicle take to travel 100 metres on the road with traffic calming treatment?	
On the road with no traffic calming treatment, what was the average speed, in kilometres per hour, of the vehicles observed?	
On the road with traffic calming treatment, what was the average speed, in kilometres per hour, of the vehicles observed?	
On average, how much faster or slower (in kilometres per hour) did a vehicle go to travel 100 metres on the road with traffic calming treatment?	

Further analysis

Why do you think there was a difference in speed?	
On the road with no traffic calming treatment, what was the highest speed in kilometres per hour (km/h)?	
On the road with no traffic calming treatment, what was the lowest speed in kilometres per hour (km/h)?	
On the road with traffic calming treatment, what was the highest speed in kilometres per hour (km/h)?	
On the road with traffic calming treatment, what was the lowest speed in kilometres per hour (km/h)?	
On the road with no traffic calming treatment, how many cars exceeded the speed limit? List the amount they were over the speed limit.	
On the road with no traffic calming treatment, how many cars exceeded the speed limit? List the amount they were over the speed limit.	
Was the traffic calming treatment effective in encouraging the driver to slow down? Why?	
Was this a good use of a traffic calming treatment? Why?	
Do you think a different traffic calming treatment would have been more effective? Why?	

Further reflections

How confident are you that your data and results are acceptable and accurate enough? Explain why or why not you feel this is the case.	
Did you change your mind as you were proceeding, or did you make any mistakes? How and why did you change things? What did you learn from these changes or mistakes?	
If you were able to do the investigation again, what would you do the same and what would you do differently? Why?	

Name:

STUDENT WORKSHEET 3: CALM DOWN! SPEED AND TRAFFIC TREATMENTS ANALYSIS: YOUR REPORT

Your report

You now need to write up and present as summary of the key findings of your investigation into the calming treatment and its usage and impact.

You could choose to write up a brief report, a poster, or create a presentation that explains what you found out and your results.

You should include:

- The purpose of the investigation
- The methodology you used
- A summary highlighting what sorts of mathematics and what calculations you needed to undertake in order to do your investigation
- A summary of your key findings
- A justification of your results based on the mathematical outcomes of your research, reflecting on your research and the outcomes– do you think they are justified and valid? If you did the investigation again, how might you improve on it?