Maths Modelling Challenge: Years 7 - 12

Student Handout

Scenario: School Run

The start and end of the school day is a well-recognised time of increased congestion on our roads. The majority of school run pick-up and drop-off is by car, leading to an increase in traffic and driver frustration, particularly around school zones, as well as an increase to safety concern, noise pollution and air pollution.

Local Councils are looking at ways to reduce the impact of the school run. A viable alternative is to encourage more students to cycle to school. Cycling has numerous benefits, including reduction of car congestion, noise pollution and air pollution. Cycling also provides daily exercise which has been proven to improve physical health and mental wellbeing.

The local Councils and schools have decided to partner and are planning to start a month-long initiative "Cycle to School" at the beginning of the next school year. Your group has been asked to help the Councils measure the environmental impact of the proposed initiative at your school over the full school year.

There are many ways to approach this problem but a good place to start is to consider the number of students in your school, the average distance they are travelling from and the amount of fuel needed to drive these students to school every day.

Key points the Councils have asked you to address are:

- How much fuel is used to do the school run for your school every year?
- What is the associated carbon footprint of these yearly car journeys?
- How would this figure change if 20% of students who go to school by car decided to participate in the Cycle to School month and then 5% went on to take this up for the whole year?

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Useful Resources

There are many ways to approach this problem and many sources for reference. Below is a list of useful links and hints that provide some background reading and may aid in your approach to the problem. These can all be access without special licenses to journals.

A great link that explains why cycling to school is good for you and the environment.
https://bq.org.au/resources/why-ride-to-school/

Video link of Daniel O'Doherty, *2008 'Action Against Climate Change' Eureka Schools Prize winner*, as he determines his hypothesis then designs and conducts a study about carbon emissions. His simple formula may help you design your approach but there are many more factors that you can consider. (Begins at 13:20)
https://www.abc.net.au/catalyst/giant-cuttlefish---daniel-odoherty---sea-urchins/11011536?jwsource=cl

A great study on the social cost of carbon is given here.
http://www.cobham-erc.eu/wp-content/uploads/2019/04/preprint_Ricke2018_country_level_scc.pdf

You may already know the number of students, catchment area and number of school days in a year but if not you can always ask your teacher. However, the following are some useful links to estimate catchment area and fuel consumption.

Catchment area

https://www.qgso.qld.gov.au/maps/edmap/

Fuel consumption

https://co2.myclimate.org/en/car_calculators/new

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Carbon absorption rate of trees: a process whereby carbon is removed from the atmosphere and stored long-term in trees, roots and soil.

Catchment area: is the area in which a state school's core intake of students must live.

Fuel consumption: is the amount of fuel used per unit distance travelled; for example, litres per 100 kilometres (L/100 km). This can be converted into CO_2 emissions using online calculators.

Greenhouse gas emission: the release of harmful gases into our environment from transport.

*Planetary health:*the health of human civilization and the natural systems, such as the environment, on which it depends.