Learning about

AIR QUALITY

VIRTUAL CITY GUIDE

A Guide to the Virtual City Spotfire Tool

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Virtual City Tool

The Virtual City is designed to allow pupils to see how changing the numbers of vehicles on the road and fuel type can affect air quality.

A map of a virtual city containing typical road environments is displayed. A school is located next to each of these roads. The air quality (good/moderate/poor) is indicated by a coloured dot at each school, whilst relative changes are illustrated on the bar chart.

❚ Virtual city map
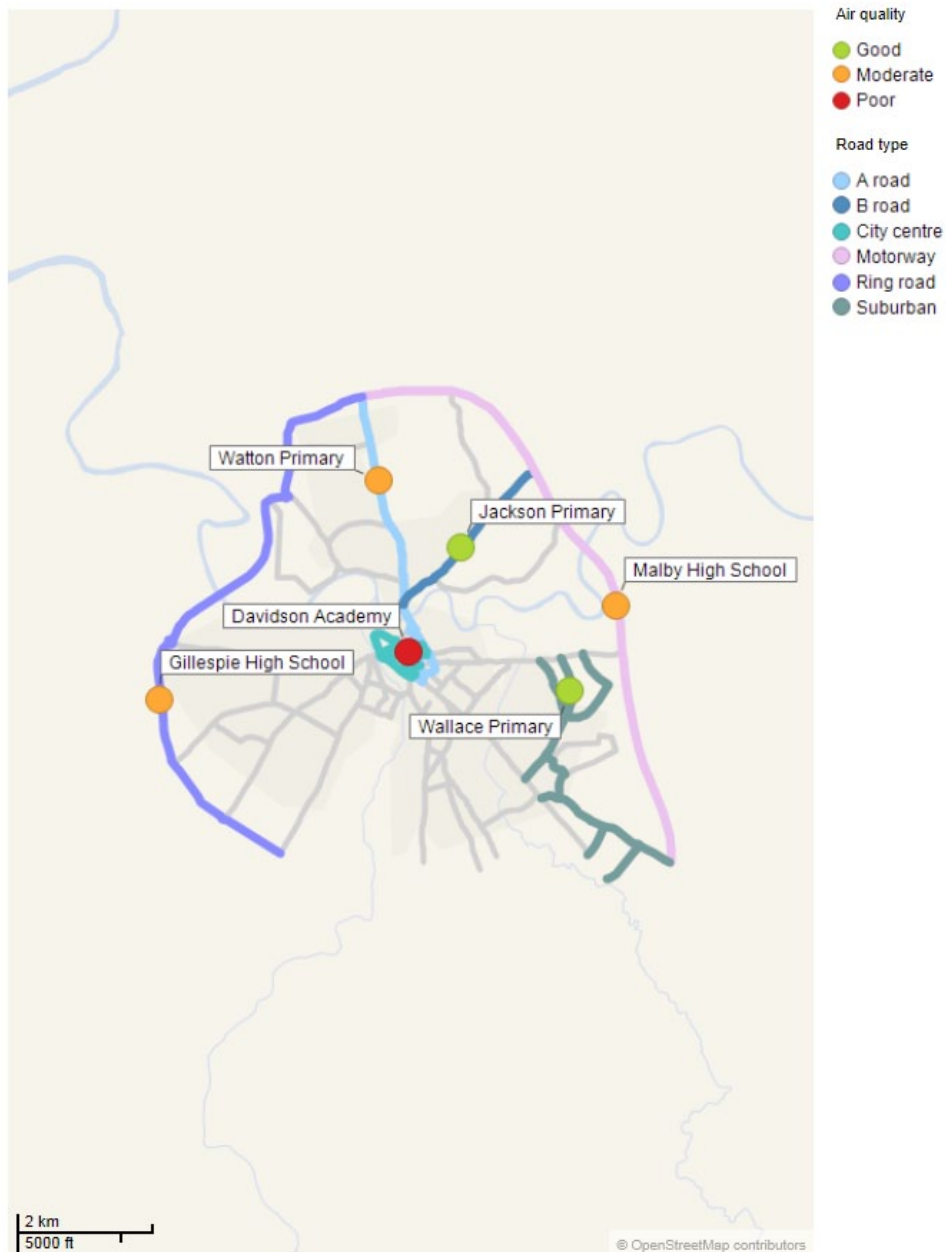
From the data selector the pupils can select a school and initially the typical numbers of vehicles passing that school per day will appear in the boxes below.

Data selector
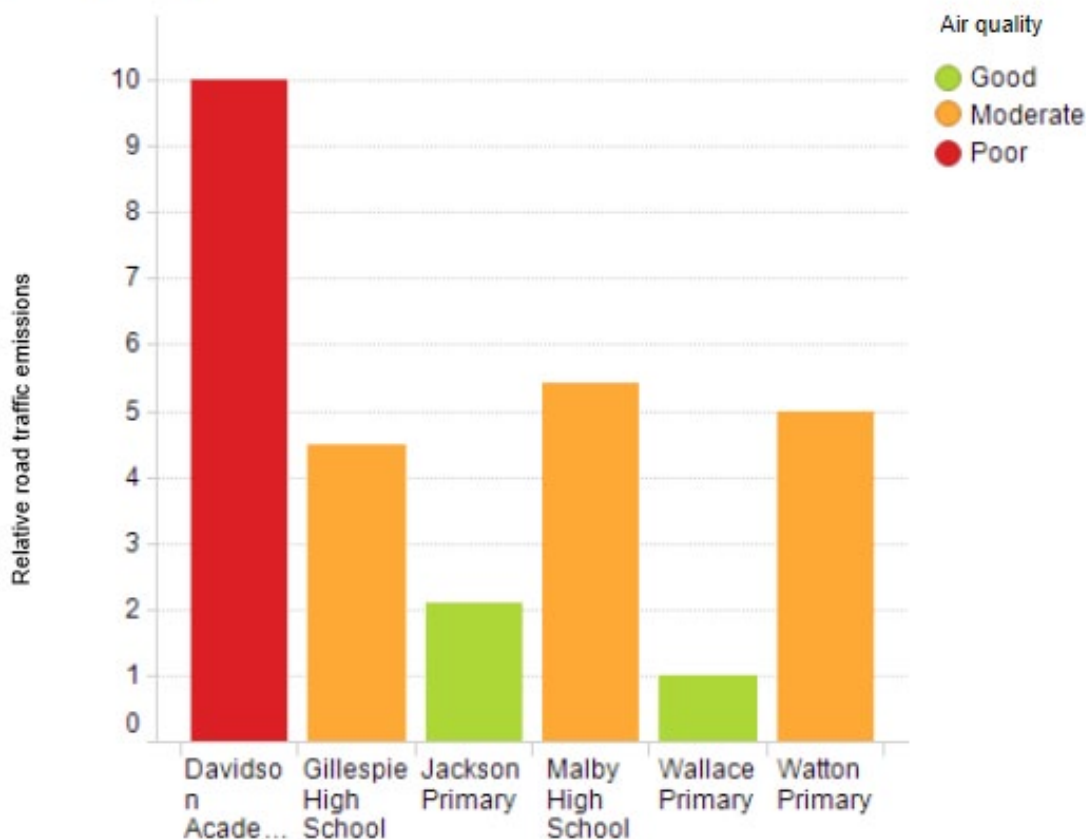
School:
Davidson Academy ▾

Enter number of vehicles per day in each box and press return.

Bus	Car	Lorry	Motorbike	Van	Walk	Cycle
870	12000	90	150	1900	96000	9000

Car fuel type:
Petrol/Diesel 50:50 ▾

Reset

The bar chart shows the relative air quality at the schools due to the passing traffic.

Using the data selector the pupils can change the numbers of vehicles and the bar-chart and coloured dot on the map will update to show the impact this has on air quality. The pupils can also change the fuel type.

Some general notes regarding school locations:

Malby High School – located next to the motorway. This road has the highest volume of traffic that is mainly cars and lorries. The road is wide and open and the vehicles are fast flowing. This results in less emissions per vehicle per mile travelled and greater dispersion of the pollutants.

Wallace Primary School – located in the middle of a suburban housing area with small narrow roads. These roads have some of the lowest volume of traffic which is dominated by cars that drive at low speed; therefore the overall emissions will be the lowest.

Jackson Primary School – located next to a B road that takes traffic in and out of the suburbs towards the main roads for the city centre. Traffic on this road will be light to moderate depending on the time of day. The main mix will be cars and buses that will be travelling at relatively low speeds. Emissions from this traffic will be relatively low given the overall volume of traffic and the fact that the flow is kept constant (i.e. no start/stops within the journey).

Walton Primary School – located next to the A road which is the main road from the outskirts of the city to the city centre. Traffic will be a mix, given that it is a main road for cars, buses and Lorries in to town. Traffic movement will be slightly faster than the B road but there is a greater volume of traffic and more start/stop due to traffic lights along the road, this results in greater emissions along the road. Peak times can potentially result in stationary traffic, thus generating greater emissions, whilst buildings of varying height are along the full length of the road and so dispersion of the pollutant can be less.

Gillespie High School – located close to the ring road which acts as a bypass for traffic wanting to get across the city without going in to the city centre and for taking traffic from one end of the city to another. Traffic volume is slightly less than the motorway but more mixed and relatively fast flowing outwith peak periods. The level of emissions will be mixed depending on time of day, but they will achieve good dispersion with open roads and less built-up areas.

Davidson Academy – located in the city centre which is the most congested area of the city, with all roads leading to the centre. Volume of traffic isn't the highest, but there are a high proportion of Lorries, vans and buses which emit more pollution per mile than any other vehicle, with cars dominated by diesel taxis. Traffic movement is slow with a lot of start/stop due to traffic lights and pedestrian crossings. Although there are oneway streets to try and maintain the flow of traffic the roads have high buildings on either side and so dispersion of the pollutants from the roadside is very low, resulting in pollutants building up at the street level.

Class/individual Exercises

Where would your school fit in to the virtual city?
Look at the schools and their locations around the city (see general notes on school location above). What location is best suited to your school within the virtual city and what does the traffic look like.

Write down any observations you may have on your school and its location.

Considering vehicle emissions – what vehicle pollutes the most?
To see what vehicle type contributes the most to traffic emissions, select Watton Primary and increase the numbers of each vehicle type by 1000 (remember to change each back again before moving to the next vehicle type).

Write down in order from highest emissions to lowest emission.

> **Answer** – The order from the most polluting vehicle to the least is Bus > Lorry > Van > Car > Motorbike. Some may then mention walking and cycling, both don't contribute to emissions.

Moving traffic around – does this work?
Look at what happens if you take traffic off one road and just add it to another. Select Watton Primary and remove 10,000 cars and 1000 Lorries, then select Jackson Primary and add 10,000 cars and 1000 Lorries.

What happens to the emissions around each of the schools and explain your observations.

> **Answer** – Removing the vehicles from Watton Primary results in changing the emissions from moderate to good, whilst adding the same number of vehicles to Jackson Primary increases the emissions from good to moderate. You don't get any net benefits from just moving traffic around as you need to reduce it in a way that improves emissions.

Looking to the future – what fuel type is best?
The fuel we use in our cars has changed over the years, with the removal of lead and sulphur to the actual type of fuel. Over the years we have moved from petrol towards diesel cars, this is because diesel has less of an impact on climate change.

You can see what this shift in fuel type does for air quality. Change the 'car fuel type' from the current Petrol/Diesel 50:50 mix to Petrol/Diesel 90:10 mix. Looking in to the future electric and other forms of fuel are now being used. Change the 'car fuel type' to a Petrol/Hybrid 50:50 mix.

What changes can you see across all the schools and therefore what fuel type should we aim to use and why?

Answer - Changing the fuel type from Petrol/Diesel mix to one that is predominantly Petrol improves air quality however the future Petrol/Hybrid mix offers the greatest air quality improvements. In the future we should aim to use hybrid electric cars as this would provide the greatest improvements to both air quality and reduced contribution to climate change.

Developing a Low Emissions Zone – what do we need to change?

One way to improve air quality in the city centre is to restrict the traffic. To develop a Low Emissions Zone and bring Davidson Academy down to moderate what would you need to do?:

1. You want to increase the level of cycling and walking

2. You want to restrict cars going in to the city centre area, such as taxis only or ultraclean cars and reduce the number of buses, or cleaner buses

When changing the numbers of vehicles can you see what type would have the most impact on emissions? What does increasing walking and cycling do to emissions?

Answer – You need remove a far greater number of cars than buses, this is because buses are more polluting that cars, whilst cleaning the cars by bringing in hybrid taxies will help considerably. Both walking and cycling does not add to the emissions, so promote active travel along with reducing traffic and restricting traffic type would achieve the best results.

Developing your own plan – what changes would you make?

Pick a school and develop your own transport scenario around that school, test it and see what changes you need to make to improve the emissions around that school.

When developing your plan note what changes you make and think about alternative forms of transport so that people can still travel around the city.