

Energy and Transport

This document is for ...

- teachers
- school managers,
- other professionals involved with travel to and from school.

It...

- summarises the impact of school travel on the environment and the safety and well-being of pupils,
- outlines what steps can be taken to reduce the adverse impacts,
- suggests how this may be done in ways that involve pupils in educationally and socially useful activities.

Sources of printed and web-based materials giving more detailed information, advice, suggestions and support are included in each section.

There are four sections:-

- Section 1** Some basic facts about school travel
- Section 2** Information for teachers on curriculum relevance and resources
- Section 3** Pupil activities for primary and secondary levels
- Section 4** Information for school managers on developing a school travel plan

Section 1:

The Basic Facts

- Roughly 30% of UK pupils are driven to school by car.
- During the term-time morning rush hour, about one car in five is ferrying children to school.
- Each year, the average pupil travels about 1,000 miles (1 600km) by car to/from school.
- The UK school run uses about 78 million litres of fuel per year. That's over 1000 road tankers full.



- Each litre of petrol is responsible for releasing 2.4kg of carbon dioxide into the air. For diesel the value is 2.7kg per litre.
- In 6000 miles (10 000km) a car will produce roughly its own weight in carbon dioxide.
- Exhaust from all the cars in the UK while on the school run releases about 200,000 tonnes of carbon dioxide into the air, contributing to climate change.

Carbon dioxide production

Mode of travel	Typical CO ₂ emissions (g / km)
walking	3
cycling	3
small car (1 litre)	150
medium car (2 litre)	190
large car (4 litre)	350
mini-bus	300
urban bus	1200

- The exhaust from vehicles on short school runs will also contain oxides of nitrogen and sulphur together with organic compounds and minute particles of soot. All four are potential health hazards.
- In congested traffic, pollution levels inside cars can be up to 3 times higher than outside.
- Reducing traffic ...
 - improves air and environmental quality,
 - reduces accidents,
 - reduces road congestion so improves both the fuel efficiency and the emissions of remaining vehicles.
- Walking or cycling to school has environmental, educational, social and health benefits.

Section 2:

Teachers' Notes

A. Curriculum relevance

School-related travel can be used as a context for work in ...

- English communication skills when ...
 - making phone calls and writing letters to obtain information
 - presenting results of travel surveys and recommendations to a variety of audiences
- Mathematics
 - counting, sampling, calculating
 - presenting data from travel surveys
 - spatial awareness through walking
- Science
 - forces, energy, movement
 - energy efficiency
 - fossil fuels as a limited resource
 - combustion, pollution, climate change
- Technology
 - challenges of powered urban transport
 - alternative power units (LPG, gas, battery, hydrogen, solar)
- ICT
 - processing survey data
 - mapping software
 - using internet and other information resources
- Geography
 - characteristics of places
 - desirable improvements
 - maps and travel routes
 - the rise of the commuter and distance travelled, dormitory towns
 - increasing zoning of home areas by ability to afford travel

- History
 - the growth of conurbations and commuting
- Citizenship }
PSE / PSHE } personal responsibility, individual and
ESD } communal action

B. Information and inspiration for teachers

- The Sustainable School Travel database is part of the National Grid for Learning's Learning Resources Index. It gives details of initiatives, educational resources, publications, etc.
www.databases.dtlr.gov.uk/schools/search1.asp
- School Travel Resource Pack - Information, leaflets, OHP masters, notes, etc
Available free from DTLR Publications, PO Box 236, Wetherby LS23 7NB Tel: 0870 1226 236
- Safe Routes to Schools Scheme - Teachers' Resource Pack (for primary or secondary schools in England or Wales, single pack for Scotland), newsletter, factsheets (several languages), videos and downloads available. Details from Sustrans
www.saferoutestoschool.org.uk
- A Better Way to Get to School - Materials use travel to school as a context for work supporting the National Literacy Strategy in England
www.ex.ac.uk/cee/better
- National Travel Survey - Government statistics on personal travel that can be used by pupils and students in project work and for comparisons with survey data for their own school. Factsheet 2 covers journeys to/from school.
www.transtat.detr.gov.uk/personal/index.htm

Section 3:

Pupil Activities

A. Travel survey *Primary and secondary pupils*

This activity provides a real world context for work in Maths, English, Geography, Design Technology, Information and Communications Technology (ICT), Personal, Social and Health Education (PSHE) and Education for Sustainable Development (ESD). It can be adapted for any age of pupil.

Typical school travel questionnaires cover such as items as ...

- Mode of transport - foot, bike, car, bus, train
- Distance -
- Equipment carried - books, sports kit, musical instruments
- Factors influencing choice of mode - distance, time, safety, lack of suitable bus, etc
- Improvements required to encourage less polluting travel - safety, security, supervision, storage for outdoor clothes, public transport services
- Effects of school traffic - congestion, parking, noise, fumes, safety

The data can be collated on a computer and used to answer such questions as ...

- What proportion of pupils use each form of transport?
- What distances do they travel? (average, maximum, minimum, daily aggregate)
- Which journeys use fuel?
- What are the reasons for using powered transport rather than walking or cycling?
- What improvements to travel arrangements are most often requested and why?

The data could also be used to test the validity of hypotheses, such as ...

- Pupils are only driven to school only on wet days or when they have a lot to carry.
- Most pupils travel to school by bus.
- Parents that drop off their daughters/sons would be passing the school on their way to work anyway.
- Most pupils would walk or cycle to school if there were fewer cars and buses.

The average pupil in the school travels about 1000 miles (1600km) per year by car on the way to/from school.

Developing plans for improvements may require Design Technology skills. English will be required to present them effectively to school managers and other audiences. Art, Music and Drama could be utilised to present them in innovative ways.

A. Travel survey *continued*

However, most questionnaires do not cover fuel use or carbon dioxide emissions. In order to quantify the amount of CO₂ released by school travel, it would be useful to ask those that travel by powered transport ...

- Car, taxi, mini-bus, bus or train?
- Number of passengers?
- Is the school run a special trip with the driver returning home, or is the driver on the way to/from somewhere else?
- Time for which the engine is kept running in cold weather to heat the car while waiting outside school at end of day?
- Journey times by vehicle and for same distance on foot or by bike.

This data can be used to calculate ...

- the total distance travelled by a class per day by car, taxi, bus, train.
- the number of shared journeys (other pupils or adults going to/from work).
- the vehicle miles saved if pupils walked or cycled from homes less than 1, 2, 3 and 4km from school.

This information can be used by secondary pupils in Activity B.

B. Emission calculations *Secondary pupils*

This activity estimates the amounts of carbon dioxide released by different modes of transport. It can be used at secondary level in Maths, Science, ICT, PSHE and ESD. English and Design will be required to present the results to various audiences. Art, Music and Drama could be utilised to present them in innovative ways.

Use the following calculations as patterns for estimating CO₂ produced.



Walking

Walking transforms energy at a rate of about 50 watts.
Assume the walk lasts 10 minutes, covering about 1km.

$$\begin{aligned}\text{Energy involved} &= \text{watts} \times \text{seconds} \\ &= 50 \times 60 \times 10 \\ &= 30\,000 \text{ Joules}\end{aligned}$$

During exercise, for every 2 880kJ of energy transformed, approximately 264g of carbon dioxide are produced (from respiration of 1 mole of glucose.)

The mass of CO₂ released during the 1 km walk

$$\begin{aligned}&= 264 \times \frac{30\,000}{2\,880\,000} \\ &= 2.75 \text{ g} \\ &= 3 \text{ grams}\end{aligned}$$



Cycling

Cycling transforms energy at a rate of about 100 watts.
Assume the ride lasts 5 minutes, covering perhaps 1km.

$$\begin{aligned}\text{Energy involved} &= \text{watts} \times \text{seconds} \\ &= 100 \times 60 \times 5 \\ &= 30\,000 \text{ Joules}\end{aligned}$$

The mass of CO₂ released during the 1km ride \approx 3 grams
Walking or cycling faster will increase the rate of energy transformation, but decrease the time, so does the amount of CO₂ released change significantly?



Motoring

Consider driving 1 km in a car with a fuel consumption of 9.7 litres per 100 km (\approx 30 mpg). This is equivalent to 0.097 litres per km.

For each litre of petrol, 2 400g of CO₂ are produced. (Diesel: 2 700g)

$$\begin{aligned}\text{So for every km travelled, the CO}_2 \text{ produced} &= 0.097 \times 2\,400 \\ &\approx 230 \text{ grams}\end{aligned}$$

B. Emission calculations *continued*

The fuel consumption and CO₂ emission data for new cars is published by the Vehicle Certification Agency. Their database is at www.vcacarfueldata.org.uk/fcb.htm

Note that:-

- Vehicles that are started from cold consume more fuel and produce more CO₂ per km for a short journey, such as a school run, than vehicles on a long journey where the engine is at optimum operating temperature for most of the time.
- Vehicles caught in morning or evening rush hours, when optimum speeds cannot be maintained and idling is frequent, will consume much more fuel and release far more CO₂ than when on the standardised VCA test.
- Increasing the number of passengers in a vehicle increases petrol consumption and hence the amount of CO₂ produced, but this is shared between all the passengers. Luggage has the same effects.
- Fuel consumption and CO₂ production are affected by the style of driving. Gentle acceleration and slowing down improves fuel economy and reduces emissions.
- Energy, and hence fuel, is used during the exploration, extraction, purification and distribution of the fuels used for passenger transport. Fuel is also used when vehicles travel empty. Both should be included when calculating emissions per vehicle-kilometre, but they have been excluded from the above calculations. Data is available from the Motor Industry Research Association www.mira.co.uk/app/vcs/trialvcs.asp

By using calculations based on their own school's travel survey data, pupils can put a lower value on how much fuel is used per day getting pupils to/from school and the current amount of CO₂ being emitted.

This gives some idea of the potential for making savings from ...

- walking/cycling rather than being driven,
- car-sharing,
- using smaller cars,
- using a bus rather than a car.

Section 3:

Developing a School Travel Plan

A. Who should be involved

All members of the school community should have the opportunity to contribute to the formulation of the School Travel Plan, since it is they who have to carry it out and will benefit from it. As well as the school council, environment or energy committee, and those pupils that have carried out the school travel survey, consultation should include ...

- all other parents and pupils,
- headteacher and governors,
- teachers and support staff,
- cleaners and caretakers,
- catering staff.

Other organisation and individuals can be invited to assist.

They include

- school crossing patrols
- local authority sustainability / LA21 / environment officer
- local authority safety officer
- police
- road safety organisations
- operators of school buses and taxis
- drivers of delivery vehicles
- neighbours of the school
- the wider community

B. The School Travel Plan should cover ...

Aspect	Objectives	Action Plan could include
Safety	equable treatment for <ul style="list-style-type: none"> • pedestrians • cyclists • bus users • car users • train users • delivery drivers • the disabled 	<ul style="list-style-type: none"> • identifying safe routes to/from school • improvements to road and walking routes • segregation of vehicles, cyclists and pedestrians within school and near to school gates • safe parking / pupil pick-up areas • pedestrian, cycle, passenger and driver training • pedestrian, cycling, passenger and driver Codes of Behaviour
Facilities	to encourage healthier / less polluting means of travel	<ul style="list-style-type: none"> • walking bus • trolleys for transporting schoolbags, PE kit, sport gear, musical instruments etc by those using the walking bus • secure storage for bicycles • showers and changing rooms • storing/drying of walkers' and cyclists' outdoor clothing, helmets etc
Procedures	to encourage healthier / less polluting means of travel	organisation and supervision of ... <ul style="list-style-type: none"> • road crossings • rota of adults to accompany cyclists • car-sharing • return home after out-of-hours activities
School travel	to minimise CO ₂ emissions, perhaps as part of the school's energy policy	<ul style="list-style-type: none"> • local trips • school visits • away sports fixtures
Costs & benefits	for each group within the school community	<ul style="list-style-type: none"> • identification of benefits for each group • dissemination of this information
Partners	outside help	<ul style="list-style-type: none"> • what help is to be requested • how it will benefit the school and the environment • how giving it will benefit the donor • how it will be publicly recognised
Set targets	realistic but challenging	<ul style="list-style-type: none"> • timetable for implementation of each stage • implications for administration, training, funding
Monitor & report	track and record progress	<ul style="list-style-type: none"> • identify problems and seek advice • publicise and celebrate success • thank partners for their contribution
Review & revise	modify policy and action plan	input to review from whole school community and its partners
Longer term	To further reduce CO ₂ emissions	See section 4c

C. Be innovative!

- ★ Schools could also consider **planting trees** to absorb carbon dioxide so as to offset at least some of their vehicle emissions. They can be grown ...
 - within the school grounds, perhaps as part of landscape improvements or environmental action. For advice contact Learning through Landscapes www.ltl.org.uk
 - at other sites by companies such as Future Forests www.futureforests.com
- ★ Schools with their **own vehicles** could investigate the use of clean fuel vehicles (CFVs) that produce either less local pollution and CO₂ than petrol or less local pollution than diesel (with similar CO₂).
www.powershift.org.uk
 - LPG Liquefied petroleum gas (Autogas)
 - CNG Compressed natural gas
 - LNG Liquefied natural gas

Not all garages can supply these alternative fuels, so ask the local authority, NHS trust or near-by fleet operator if their facilities can be used. Alternatively, consult websites such as ...

LPG Association www.lpga.co.uk/refueling_stations2.htm
Dual Fuel Systems www.dualfuelsystems.co.uk
BP www.bp.com/cleanerfuels.uk
Calor Gas www.calorgas.co.uk

- ★ Schools with a high **technology profile** or a strong **environmental ethos** might consider:-
 - an electric vehicle for on-site or local use
 - a hybrid fuel/battery electric vehicle

The educational opportunities presented by the CFVs themselves should not be overlooked. Technical information can be obtained from the Alternative Fuels Data Centre in the USA.

www.afdc.nrel.gov

Technologies being developed, but not yet ready for general adoption include ...

- E10 (blended ethanol/petrol fuel)
- bio-diesel (made from waste materials such as cooking oil)
- vehicles powered by fuel cells

- ★ Schools might consider **pre-driving courses** to encourage secondary pupils and tertiary students (and their parents) to think before they drive and to adopt an energy-efficient style when they do drive. For example, gentle acceleration and braking can reduce fuel consumption and emissions by up to 25%.

D. Key government publications on school travel plans for school managers

- School Travel – A document covering educational, transport and health aspects, together with downloadable materials for educational and promotional use, including slides (MS PowerPoint format) as a basis for presentations involving children and adults.
www.local-transport.dtlr.gov.uk/schooltravel
- A Safer Journey to School - a guide to school travel plans for parents, teachers and governors
Available free from DfES Publications,
PO Box 5050, Annesley, Nottingham NG15 0DJ
Tel: 0845 602 2260
- Schools Travel Strategies and Plans - A best practice guide for local authorities (Publ: DETR, 1999)
Available free from DTLR Publications,
PO Box 236, Wetherby LS23 7NB
Tel: 0870 1226 236

E. Initiatives to support school transport plans

Initiative	Outline and contacts
School Travel Plans: Site Specific Advice	Up to five days of advisor's time to help schools develop and implement a school travel plan as part of the Government's Energy Efficiency Best Practice programme. www.energy-efficiency.gov.uk/transport Environment and Energy Helpline: Tel: 0800 585 794
Green2School	Travel management software sponsored by the DfES to help schools develop walking bus, cycle club and car share schemes within the Safer Routes to School initiative. Demonstration disc available from Intrinsic Technology Ltd E-mail: green2school@intrinsic.co.uk
YoungTransNet	Information, computer-based travel survey and analysis, games www.youngtransnet.org.uk/main/home.htm
Walking Bus	Advice on setting up a walking bus, a list of authorities and schools that already have them and a page for kids www.walkingbus.org
Walk to school days	www.pedestrians.org.uk www.walktoschool.org.uk
Green transport weeks and car free days	These are action campaigns co-ordinated at local, national and European levels. Contact your local council for details.
Don't Choke Britain	Travel campaign managed by Going for Green www.dcb.org.uk
TransportAction	TransportAction PowerShift is a grant scheme from the Energy Saving Trust that helps with the purchase of new clean fuel vehicles or the conversion of vehicles up to one year old, e.g. school mini-bus. www.powershift.org.uk www.transportaction.org.uk
Eco-Schools Award	School travel is one of the themes of this Europe-wide scheme that recognises schools that take action on environmental issues. www.eco-schools.org.uk
Greener Fleet Certification Scheme	Motorvate is a government-backed scheme to recognise improvements in vehicle fleet management. Because of the registration costs, schools might prefer to join as part of their local authority's application. The Motorvate website includes ideas, downloads and a discussion forum for small operators for whom membership is inappropriate. www.greenerfleet.org.uk

F. Other resources and organisations

School Travel Strategies and Plans. Information and advice. Possible sources of funding for measures are given in Chapter 9.
- www.local-transport.dtlr.gov.uk/schooltravel/

Case studies and project summaries are available from .. The National TravelWise Association - www.travelwise.org.uk/schools.htm

Road safety issues are covered by organisations such as ... The Royal Society for the Prevention of Accidents - www.rospa.org.uk/roadsafe.htm
BRAKE - www.brake.org.uk

Vehicle pollution is the concern of ... TransportAction Clean-up - www.cleanup.org.uk

The National Society for Clean Air and Environmental Protection
- www.mistral.co.uk/nsca

Air pollution data is available from the UK National Air Quality Information Archive
- www.aeat.co.uk/netcen/airqual/welcome.html

Car-sharing (ride-sharing) for school staff may be arranged through such companies as ... Lift Share - www.liftshare.com
Smart Moves - www.smartmoves.co.uk
National CarShare - www.nationalcarshare.co.uk

Reducing car use

Cutting Your Car Use by Anna Semlyen
ISBN 1-870098-87-0; Publ: Green Books, Foxhole, Dartington, Totnes,
Devon YQ9 6EB Tel: 01803 863 260 - www.cuttingyourcaruse.co.uk
Carbusters provides an e-magazine and downloadable resources for anti-car activists
(some in several languages) - www.carbusters.ecn.cz

Cycling issues are addressed by the National Cycling Strategy
- www.nationalcyclingstrategy.org.uk

Transport issues in general are dealt with by Transport 2000
This campaigning organisation has a number of videos and publications
such as A Safer Journey to School and The Healthy Transport Toolkit.
- www.transport2000.org.uk/

Transform Scotland - www.transformscotland.org.uk

Disclaimer: The addresses and/or websites of organisations are given in good faith. No responsibility is accepted for their accuracy or continuing existence.

New sites: Recommendations of other relevant materials, initiatives and websites should be sent to info@create.org.uk