Department for Transport

Traffic Advisory Leaflet 4/96
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Traffic Management and Emissions

Introduction

The Environment Act 1995 requires local authorities to review air quality in their area against targets to be set by the Government. Where air quality standards do not (or are not expected to) meet those targets, authorities will be required to establish local air quality management action plans.

Traffic can be a major contributor to poor local air quality. It can be expected that most action plans will need to include measures to reduce the impact of traffic emissions. Even where action plans are not required, regard needs to be had to the effect that new traffic management schemes might have on vehicle noise and exhaust emissions. To help in this, Driver Information and Traffic Management Division (DITM) of the Department of Transport has commissioned the Transport Research Laboratory (TRL) to undertake research into the effects of different traffic management techniques on the environment, with a particular emphasis on the air quality implications.

The first stage of this project was an examination of existing material on the subject. The full report, "The environmental assessment of traffic management schemes: A literature review"(TRL Project Report 174) can be purchased from TRL. This leaflet is based on the findings on traffic management and exhaust emissions. A separate TA Leaflet is to be issued concerning traffic management and noise.

Neither the scope of the research, nor this leaflet, specifically covers the use of traffic management to influence short "episodes" of atmospheric pollution.

Air pollution

The most obvious air pollution caused by traffic is dust, dirt, smoke and fumes. Besides being immediately unpleasant, there is concern over potential longer term health implications of these pollutants. The level of concern may well be determined more by the immediate perceptions of nuisance than by the actual measured level of pollution. It is important to appreciate that most air pollution is not likely to be detected by people, as the pollutants are colourless and odourless in the atmosphere. Traffic management measures should be able to play a part in reducing both the "headline" air pollution effects of traffic and the underlying levels of local emissions, though the extent to which this can be achieved has still to be determined.

Traffic management schemes

General

Traffic management schemes can affect vehicle emissions by altering the volume, speed and composition of the traffic stream and the driving pattern (steady speed, stop/start, acceleration and deceleration).

There is also the need to recognise that, whilst traffic management schemes may be able to reduce the impact of traffic on air quality in the immediate locality, they may have a relatively small city wide effect.

Measures that reduce the volume of traffic, as in schemes introduced to remove congestion, should lead to lower levels of air pollution, particularly in the immediate area. Free flowing traffic results in much lower emissions, and reduced fuel consumption, than in the conditions where stop/start conditions occur. However, care needs to be exercised. If the traffic is simply diverted elsewhere, problems may occur on these alternative routes if they are not able to cope with the additional traffic. The initial benefits of reduction in vehicle flow can quickly be lost if additional traffic is attracted to the area because of the improvements introduced. This argues for complementary measures which discourage or restrain vehicles, such as reductions in traffic backed by traffic calming.

One of the objectives in the design of traffic management schemes should be to encourage smooth traffic flow without harsh acceleration or deceleration.

Junction Control

Changes in types of junction control can affect vehicle emissions. Reductions in fuel consumption have been obtained by schemes which have replaced traffic signal controlled junctions by mini-roundabouts, together with turning prohibitions at intermediate side roads.

In terms of priority junctions and signalled controlled junctions, emissions appear to be greater on the minor approach to a priority junction that with the similar arm of a signalled junction.

Advanced stop lines for cyclists at signal controlled junctions, as well as improving the safety and convenience of cyclists, may also cause less disruption to other traffic as fewer cyclists will be interspersed within the queues formed. This may encourage more passive driving styles to be adopted by motor vehicle drivers.

Urban traffic control systems (UTC)

UTC systems for traffic signalled networks can reduce congestion. However, many large towns already have some form of UTC system so whilst improvements are possible, there may be limited potential for achieving further large reductions in fuel savings and vehicle emissions by this method. Further research is being carried out on this.

Parking Control

Parking controls on major roads can, by reducing congestion, increase average speeds and hence reduce emissions. However, it will be necessary to ensure that additional traffic is not attracted because of the improvements gained.

The availability of convenient parking is a major factor in influencing the decision to drive to a particular location. Authorities should have regard to the location, price and availability of on and off street parking.

Where it is possible to maintain accessibility to an area by attractive alternative and less polluting transport modes, reducing the number of parking spaces can encourage a shift to such transport. But traffic queuing to enter car parks, or circulating an area looking for parking spaces, may generate additional local emissions. Ensuring there is adequate advance notice of the availability of spaces, and their location, may help to combat this. However, if parking controls lead to a marked decline in accessibility in one area, this may cause trips to be transferred elsewhere, to the potential detriment of that environment.

Little information is yet available on the environmental effects of policies that favour short-term parking at the expense of long-stay. Where congestion is a particular problem at peak periods, discouraging commuter parking may help to ease traffic flow. However, if the

increased turnover associated with short-stay parking means that additional car trips are generated, overall air quality may be affected.

Traffic Restrictions

Area bans, such as pedestrianisation, or urban lorry bans, tend to divert rather than restrain traffic, and the overall city wide effect on emissions is likely to be small unless the restricted area is extensive.

Pedestrianisation can have a positive effect on emissions in the area pedestrianised, but care has to be taken that this is balanced against likely conditions on peripheral roads. More positive effects on the periphery of pedestrianised schemes may be obtained if the pedestrianisation is accompanied by improved public transport. Allowing full access by cyclists into the pedestrianised areas may help to encourage more use of this form of transport.

Proposals for vehicle bans which utilise rising bollards, for instance where residents' permit systems are introduced, should pay careful regard to the equipment being used. Care must be taken that they cannot injure pedestrians or cyclists, and that the bollards have a fail safe system which prevents the bollard rising beneath a vehicle. If traffic signals are required, only three aspect signals would be permitted.

Schemes such as the banning of cars on alternate days based on "odd and even" licence plates, as has been tried in Athens and Turin, may not have so great an impact as might be expected. Such an approach can encourage people who commute in to use their cars because of the reduced congestion. Also, the purchase of another car, with an appropriate licence plate number, may be undertaken in order to gain daily access.

Speed Limits

The effects of speed limits on vehicle emissions depends upon driver behaviour. In urban conditions, some pollutants are likely to increase with vehicle speed, whilst others may decrease. However, emissions can generally be reduced if vehicles are driven in a smooth manner, and drivers observe speed limits. Self enforcement by drivers is, therefore, important. Ensuring that the speed limit properly reflects the character of the road will influence the degree to which drivers adhere to the speed limit. Traffic calming, or other traffic management measures, can assist in changing the character of a road to fit the desired speed limit.

Bus Priority

Priority measures for buses, such as bus lanes, bus gates, priority at signals, and bus UTC, can assist operators to provide more efficient and attractive services. This in turn helps in development of other policies to encourage fewer trips being made by cars.

Priority for buses can achieve a significant decrease in emissions from buses, because of the increase in speed and fewer stop-starts. However, these benefits need to be balanced against the possible congestion effects to other traffic.

Park and Ride

Park and ride schemes have the potential to reduce car use within the inner city area, but the impact on overall travel demand and on vehicle emissions is not entirely known. There are indications that Park and Ride schemes are more successful if they form part of an integrated transport strategy. However, if the drive to and from the site starts with a cold engine, and the engine remains relatively cold for a large part of the car journey there may be little overall environmental benefit.

One study has suggested that additional trips have been generated with some drivers driving further. Some trips, previously made entirely by public transport, may have changed with the first part now being made by car.

If car trips are attracted away from the more congested centres, some form of restraint will be necessary to ensure that any resultant spare capacity does not attract other drivers. The siting of the park and ride facilities will also need to have regard to the likely effects on the environment in the immediate area.

Cycle Schemes

Attractive, safe and convenient cycle facilities have the potential to reduce the use of motorised transport. 45% of journeys under 5 miles are made by car. Many of these journeys could equally be made by cycle. Effective promotion of cycling, and the provision of comprehensive facilities, can encourage greater cycle use. Without such features there is little chance of such changes taking place.

Pedestrians

A number of short trips presently made by car could reasonably be undertaken on foot. To achieve this, pedestrian routes need to be safe, convenient and attractive. Adequate footway width is essential. Traffic calming measures can often be used both to reduce the speeds of motor vehicles and provide additional footway surface.

Appropriate and convenient crossing places are essential in encouraging pedestrian activity. Signal controlled junctions without pedestrian phases can cause considerable concern to pedestrians, as it may not be clear from which direction traffic is approaching. Unless pedestrians can be directed to alternative and convenient crossing facilities elsewhere, the continued installation of signalled junctions without pedestrian phases should not be encouraged.

Traffic calming

Research into the effects of traffic calmed areas on vehicle emissions suggests that some schemes may have resulted in increased emissions for some pollutants. However, the considerable increase in NOx suggested by certain road hump experiments abroad is unlikely to occur. This is because the harsh acceleration and deceleration modelled in these experiments is not typical of the driving habits generally adopted.

To obtain a general reduction in emissions, traffic calmed areas require a road design that encourages smooth driving behaviour. The speed of vehicles at the calming feature should be, as far as possible, similar to the speed between the features. In order to achieve this, relatively close spacing of features may be required. A typical instance is that with a road hump spacing of around 50m to 60m the "speed difference" will be 5 mph. Spacing of features in excess of 100m will encourage high in-between speeds and hence result in a larger "speed difference".

The apparent, though not necessarily real, effects of a traffic calming scheme can influence people's perception of the changes to the environment that have taken place. For example, if frequent queuing occurs in one or both directions at single lane pinch points, (particularly if this is outside a residential property) the local conviction may be that air quality has deteriorated. So the siting of such features needs to be considered carefully, accepting that in urban areas it would be extremely unlikely that features could always be located away from residential properties.

Summary

Table 1, taken from information in TRL Report 174, provides a summary of the existing knowledge of the effects of traffic management schemes in terms of fuel consumption and vehicle emissions. The values are approximate and based on empirical and theoretical studies.

The changes in car modal split and CO2 equivalent emissions are based on the results from the TRL Report 107, "Impact of transport policies in five cities". The study assumed that parking places of all types could be reduced, which may be difficult for both legal and practical reasons.

Table 1 - The effects of Traffic Management Schemes on Fuel Consumption, Emissions and Modal Split

Traffic management measure	Outer city/local	Inner city/central area	Citywide
UTC system for central area	-	Fuel consumption reduced 5% to 15%	Not known
Traffic signal optimisation at isolated traffic signals	Reduced fuel consumption of up to 25%	Not applicable	Not known
Different junction control	Emission changes of between 5% and 20%	-	Very small changes
Public transport priority	Bus emissions reduced by up to 60%	Little impact on model split without car restraint	Uncertain, but probably small changes
Park and ride	May increase car trips	Little impact on car use without restraint	Uncertain
Halving parking places in central area	Increased car model split from 61% to 67%	Reduced car model split from 56% to 29%	Reduction in CO_2 equivalent emissions between 4% to 6%
Central area traffic ban	Increases in traffic outside banned area	Reduction of emissions in proportion to vehicles banned	Probably quite small e.g. 5% reduction
Parking control on major urban roads	Reduction in vehicle emissions of 1 to 16% on routes affected	Reduced congestion may attract more vehicles	Not known
Traffic calming	Probably reduced NOx but may increase HC, CO and fuel consumption	-	Uncertain but probably small
Lower speed limits (depends on enforcement)	Lower exhaust emissions	Lower exhaust emissions	Small changes e.g. up to 2% reduction in NOx

Research

Further research is being undertaken to examine in more detail the effects of various traffic management measures on the environment. Further information will be published as it becomes available. Ultimately it is the intention to produce a good practice guide describing the environmental benefits of different traffic management measures. This would bring together the work being carried out on emissions, traffic noise, traffic vibrations, and other related matters.

Other Considerations

Those responsible for the planning, design and implementation of traffic management schemes need to be conversant with the changing trends in emission limits and air quality standards. Account should be taken of guidelines issued by the Department of the Environment. Traffic management schemes should not be considered in isolation. When planning and designing traffic management schemes due regard should be paid to wider transport and environmental issues. These extend to local air quality action plans, land use change, environmental enhancement objectives, urban design and transport policy, and the need to encourage alternative means of travel which have less environmental impact than the private car.

Enquiries on Air Quality

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References

- TRL Report 174 The environmental assessment of traffic management schemes: A literature review.
- TRL Report 107 Impact of transport policies in five cities.
- TRL Report 130 Future scenarios for inland surface transport.
- TRL Report 186 Traffic Calming - Road hump schemes using 75mm high humps.
- TA Leaflet 2/96, 75mm high humps.
- TRL Report 104 Literature review of short trips.
- TA Leaflet 8/93, Advanced Stop Lines for Cyclists.
- Advanced stop lines for cyclists - a simplified layout. A Wheeler, Traffic Engineering and Control, May 1995.
- TRL Report 15 Cycling in Pedestrian Areas
- LTN 1/95, The Assessment of Pedestrian Crossings, HMSO.
- LTN 2/95, The Design of Pedestrian Crossing, HMSO.

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