Department for Transport

Traffic Advisory Leaflet 1/99
April 1999

Monitoring Local Cycle Use

INTRODUCTION

The purpose of this leaflet is to offer general guidance on monitoring cycle use locally. It is based on research carried out by the Transport Research Laboratory (TRL) for the Department of the Environment, Transport and the Regions (DETR). More detailed information is contained in TRL reports "Research on monitoring cycle use" and "Guidance on monitoring local cycle use".

SUMMARY

Unlike the established methodology for counting motor vehicles, monitoring cycle use is still in its early stages. The main problem has been the lack of reliable automatic traffic counting (ATC) equipment designed specifically to count cyclists. However, due to growth in demand, partly stimulated by TRL's research in this area, the situation is now improving. Other means of carrying out surveys of cycle use levels (eg cycle parking surveys, road-side interviews, etc) are more established, but need to be undertaken regularly if they are to be an effective means of monitoring.

In the future, more highway schemes will be developed that accommodate cycling, both exclusively and as part of wider schemes incorporating other transport modes. An important part of the planning and design process for these schemes is the accurate assessment of cycle flows before and after implementation. The DETR will expect local highway authorities to monitor the cycle use of schemes included within their Local Transport Plans (LTPs).

BACKGROUND

The National Cycling Strategy (NCS), launched in *1996* and supported by the DETR, included a headline national target of doubling cycle use by 2002, and doubling it again by 2012. This was endorsed by the Government's recent White Papers, "A New Deal for Transport: Better for Everyone" and "Travel Choices for Scotland". An integral part of the NCS is the expectation that highway authorities will set their own local cycle use targets. However, in order to set sensible targets, highway authorities must first accurately assess the current level of cycling in their areas. Once this has been done and targets set, cycle use levels should be regularly measured to assess progress.

OVERALL MONITORING PROGRAMME

Given the above requirements, the guidance below may be followed when devising a programme for monitoring cycle use locally. Whenever possible, the monitoring programme should include, complement, or take account of the following:

- **National Data:** ie National Travel Survey, DETR National Traffic Census, National Population Census. Much of the cycling-related information from these studies is summarised in DETR's "Cycle Use in Great Britain" publication.

- **Automatic Traffic Counters (ATCs) :** ATCs can be useful on major cycle routes that are being promoted, and on adjacent routes from which cyclists might divert. One or more control sites should be established, equipped with permanent or long-term ATCs. These sites should be located on routes where no cycle infrastructure changes are anticipated and where relatively high levels of cycle use are known to exist. The ATC data should be compared at least every 6 months with that from manual classified counts, and if need be adjusted. This validation process will assist in adjusting the data for factors such as coincidence (two cyclists crossing the loop at the same time), footway cycling, etc. Ideally, validation checks should be carried out during both peaks and troughs in the traffic flow.

- **Manual Classified Counts (MCCs):** For results to be statistically significant a number of counts are needed. In most cases, the high cost of hiring a sufficient number of enumerators would rule out MCCs as the exclusive method of monitoring cycle use. Therefore, it is advisable that some ATC monitoring is carried out to supplement manual counting. Whatever method is selected, a suitable sampling size is important if the results are to be an accurate reflection of cycling levels. The exact time of year to count will depend on any factors that may affect the characteristics of the cycle flows, eg educational, leisure, employment, etc. Manual counts can also be used to obtain additional information by observation, eg the sex and age of the cyclist.

- **Cordon and Screenline Counts:** When manual cordon or screenline counts are carried out to measure general traffic flows, bicycles should be counted as a separate category. Those involved in the process should be properly briefed, particularly where off-carriageway cycling is concerned. To maximise the accuracy of any count, and reduce the number of enumerators required, cordon and screenline stations should be located where cyclists are "funnelled", eg railway, canal or motorway crossings.

- **Destination Surveys:** Useful information on cycle use trends can be obtained by counting parked cycles at transport interchanges, schools, workplaces, etc. If total monitoring of all such establishments is not possible, then ideally a stratified sample should be obtained, eg a representative number of railway stations.

- **Interview Surveys:** Roadside interview surveys are more expensive, and require careful planning and execution. However, they are one of the few methods of obtaining accurate cycle flow data, with trip origin, destination and purpose infarmation. Care should be exercised when analysing a single day's data as, on its own, this will only give a momentary "snapshot" of cycling trends. This variability can be minimised if sites with high cycle flows are chosen.

AUTOMATIC TRAFFIC COUNTING EQUIPMENT

There are three types of ATC capable of counting cycle flow. The merits and disadvantages of each is discussed briefly below. Increasing the sophistication, such as using vehicle classification, will increase the costs for all three types :

- **Pneumatic Tube Counters:** A tube counter consists of a rubber tube connected to a counter unit. A vehicle depresses the tube, causing a pneumatic pulse to be sent to the counter unit. Whilst the capital cost of this system is relatively low, the equipment often requires frequent inspection and maintenance as a result of damage by vandals and from high traffic volumes. In mixed traffic conditions, a pair of tube counters are usually capable of distinguishing between cycles and other vehicles. A pair of tubes can also provide additional information on vehicle speed and direction. Where longer than average tubes have been deployed (eg. across four lanes of single carriageway), the weight of a bicycle passing over may not generate a big enough pulse to reach the counter. However, this problem can be partly overcome by the use of a second (more sensitive) tube. The equipment at new sites should be calibrated using data from manual classified counts. Thereafter, this exercise should be repeated from time to time to ensure continued accuracy of the data.

- **Piezoelectric Counters:** Piezoelectric counters work through the principle of the strain gauge, in that the pressure exerted by a wheel on an embedded strip is converted into an electrical signal and recorded by a central control unit. Given that the characteristics of the pressure, and hence the signal, generated by different classes of vehicle varies, it is possible to identify any particular type of vehicle in mixed traffic conditions. However, as cycles are lighter than other vehicles, a separate and more sensitive piezoelectric strip is sometimes needed to count them in mixed traffic. The counters are relatively expensive, costing up to £5,000 each. However, whilst they are at least 95% accurate in the short-term, this can reduce significantly due to wear on the strip. This type of sensor is used by DETR to count cycles at their continuous monitoring sites.

- **Inductive Loops:** Inductive loops consist of a coiled wire buried in the road generating a small localised magnetic field. The size and shape (often trapezoidal for cycles) of the loop is designed to register the wave form generated by the passage of a metal object through the magnetic field. The result is recorded by the counter unit. Inductive loop sites are relatively inexpensive, costing about £1,100 each. They require little maintenance, and are up to 95% accurate when installed correctly. Inductive loops are the most common method of counting general traffic over a long period. Unfortunately, the accurate detection of cycle flows is difficult using inductive loops, due to the relatively small amount of metal in a bicycle, and the likelihood of a bicycle and another vehicle crossing the loop simultaneously. These problems have been partly overcome by at least one loop manufacturer, who was also responsible for providing the equipment for the TRL ATC trials.

CHOOSING SUITABLE MONITORING SITES

When selecting sites local authorities might wish to consider the following:

General: Some local authorities have found it helpful to use temporary surface fixed counters, or to undertake short manual counts in order to test the suitability of a site before installing a permanent counter.

Strategic: The sites should contribute to the monitoring programme and not be selected on the basis of convenience alone.

Local: The site layout and traffic characteristics should suit the monitoring equipment chosen.

High Cycle Flows: Sites with high cycle flows should be chosen. This will minimise the variability of the data over a given period of time.

Mixed Traffic Flows: Since most cycling occurs on all-purpose roads, it is important that mixed traffic sites are included in the monitoring programme. However, it should be recognised that the accuracy of ATC data from such sites will be heavily dependent on the site conditions.

Segregated Flows: To complement mixed traffic flow sites, locations where bicycles are segregated from motor vehicles should also be selected. These include cycle tracks, lanes, gaps, etc. The data from these sites will prove more reliable and require less validation.

Counting All Cyclists: As far as possible, sites should be chosen where it is difficult for cyclists to bypass the counter. Where avoidance is known to occur, such as cyclists using a footway, a manual count should be undertaken and an appropriate adjustment made to the ATC data obtained.

Junctions, Bends and Gradients: Some ATCs are not capable of counting cyclists travelling at (say) less than 5mph. Therefore, sites at uphill gradients, bends or junctions should be avoided.

Electrical Interference: Inductive loops should not be positioned close to potential sources of electrical or radio interference. Metal bridges, buried cables, rail lines, etc can adversely affect the data from an inductive loop.

Power Supply: Where electrical interference is not an issue, permanent ATC sites should have access to a mains power supply. Sites running on battery power can be more expensive in the long term. However, some battery changes may be carried out during routine maintenance visits, to minimise running costs.

WHEN TO COUNT

Unless high intermittent peak flows are envisaged (eg at schools, factories, etc), daily flows should be recorded. Hourly flows should also be recorded, since this would be compatible with other traffic data. Periods shorter than this may be useful for junction or signal design purposes. For manual counts it should be borne in mind that, as a general rule of thumb, the results from a series of short peak period counts will be statistically more robust than a 12 hr count on a single day. This is because urban cycle traffic tends to be for commuting and educational purposes, and is therefore more peaked than motor vehicle traffic.

HOW MANY DAYS TO COUNT

Short term counts may be used to estimate long term traffic flows. The quality of this estimate is dependent upon the following:

- The accuracy of the counters.
- The length of the count period - longer the better.
- The size of the flows - bigger the better.
- The day to day variability of the flows.

In order to accurately detect changes in cycle flows, a statistically significant number of counts needs to be carried out. The information in Table 1, derived from national cycle count data, can be used as a first step

towards selecting an appropriate sampling programme. For example, to detect an annual change of 20% in a flow exceeding 250 bicycles/day, with 90% confidence, at least 7 counts must be carried out every year.

Table 1: Number of counts required to accurately detect a given change in cycle flow

CYCLE FLOW	PERCENTAGE CHANGE			
	10	20	30	40
	NUMBER OF COUNTS			
250+	29	7	4	2
100-250	-	13	6	4
10-100	-	29	14	8

TIME OF YEAR TO COUNT

Unlike the case of monitoring motorised traffic flows, there is a relatively small body of cycling flow data on which to produce factors to convert short periods to annual averages, or to compare counts from one period of the year with another. When monitoring cycle flows, and until such data is available, the following points should be kept in mind:

- Count when flows are highest.
- Count during good weather.
- Count during British Summer Time.
- For most sites, count outside school holidays, but for monitoring leisure sites counting during the holidays may be more appropriate.
- Comparison counts should be undertaken at the same times of the year.

MONITORING THE OVERALL LEVEL OF CYCLE USE

There are two ways to monitor overall cycle use trends in a particular area. The first is to set up a system of cordons or screenlines, incorporating MCCs, on a regular basis, at similar times of the year. The data derived from this can be supplemented with that obtained from long-term ATCs. The main disadvantage of this approach is that cyclists may "leak through" the cordon by using minor roads and footpaths. This may lead to underestimates of cycling and uncertainties over observed changes through time. Nevertheless, cordon or screenline counts are probably the most practical way for a local authority to monitor cycling trends from one year to the next.

An alternative to the above is to take a random, or at least stratified random, sample of all roads, and cycle tracks and paths to estimate the absolute level of cycling, and then repeat these counts at suitable intervals. This is the method used, in part, by the DETR to estimate national cycle-kilometres. Given an estimate of the cycle-kilometres on any given road type, and knowing the length of road of that type, then the total cycle-kilometres for the area can be calculated. Repeat surveys could then be used to estimate changes in cycle kilometres. The main drawback with this method is that the uncertainty of year-by-year values could so great as to mask all but the largest changes in cycling levels.

TRL REPORT 396 - RESEARCH ON MONITORING CYCLE USE

The first stage of the research involved sending out a questionnaire to 54 local authorities, primarily in an attempt to discover the extent to which cycling was monitored in their areas - fifty-six percent responded. 41% said that they had introduced cycle use targets, and 45% said that they intended to do so. Regular cycle counts were carried out by 63%.

Authorities were also asked to estimate cycle use levels in their area. On the basis of this information, 6 local authorities, each with varying levels of cycling activity, agreed to assist with on-road trials. Two were selected from the top 25% of authorities (based on number of cycling journeys to work in 1991), 2 from the middle 50% and 2 from the lowest 25%. The authorities were: Somerset County Council (Taunton); Norfolk County Council (Norwich); London Borough of Hackney; Surrey County Council (Guildford); Birmingham City Council; and Hyndburn District Council & Lancashire County Council (Hyndburn).

INDUCTIVE LOOP ATC TRIALS

A total of 18 inductive loop ATC sites were installed and run in these areas. The main purpose of these trials was to estimate the accuracy of the ATCs. This was done by validating the ATC data with manual counts. Table 2 gives a sample of the results.

ATCs installed at off-road sites, such as cycle tracks, generally performed better than those used on all-purpose roads. There was a general tendency for the ATC data to under-count the total number of cycles. The main reason for this was masking of cycles by motor vehicles. There was also some under-counting of cycles on off-road sites. This was caused by some cyclists arriving simultaneously at the ATC by travelling two or more abreast, resulting in only one being counted. Common to some on and offroad sites was the tendency of some cyclists to bypass ATC loops completely, eg by travelling on the footway of an all purpose road, or by using the pedestrian part of a shared use cycle track.

Initially it was found that, in the absence of a mains power supply, battery life on the ACT counters could be limited to as little as two weeks. During the course of, and as a direct result of the trials, the counter manufacturer was able to modify the system to extend battery life.

It should be noted that much was learned by TRL and the local authorities through the trials. Those considering installing ATCs should not be put off by the discrepancy between ATC and MCC figures given in Table 2. ATCs installed in accordance with the manufacturer's current instructions and the recommendations provided in this leaflet should show much greater accuracy than the figures suggest.

ROADSIDE INTERVIEW SURVEYS

Roadside interviews of cyclists were also undertaken in a variety of locations in Birmingham and Hackney, including public roads, canal towpaths and cycle paths on disused railways. Cyclists in Birmingham were given a postal questionnaire to complete. Generally, cyclists were only too willing to stop and be interviewed, except at very busy times. However, this was not the case in London where most of the cyclists concerned were working as couriers. Wet weather also reduced the willingness of cyclists to stop.

In Birmingham, a total of 810 questionnaires were handed out to cyclists on a screenline cutting across roads, on and off-road cycle paths, cycle tracks and a canal towpath. This revealed that 82.5% of cycle trips were for commuter purposes; most cyclists would cycle more if there were less traffic and more facilities on the road; and 95% cycle at least 2-3 times per week.

The results of the Hackney roadside survey were not available when the TRL reports and this leaflet were prepared.

Table 2 - Sample of Validation counts at TRL study sites

AREA	TYPE	COUNT PERIOD (HRS)	COUNTER	ATC	MCC (%)	DIFF
HACKNEY[1]	Road	12	Cycles	375	436	-14.0
HYNDBURN	Cyclepath	12	Cycles	3	54	-35.2
NORWICH	Cycle Lane	6	Cycles	153	189	-19.0
			Vehs[2]	2315	2630	-36.2
GUILDFORD	Road	12	Cycles	58	114	-49.1
			Vehs	8093	8155	-0.8
TAUNTON	Cycle Track	12	Cycles (n)	273	313	-12.8
			Cycles (s)	277	353	-21.5
Notes: 1&2. ATC's did not cover all carriageway so vehicle validations not applicable.						

DETR'S LONG TERM TRAFFIC COUNTING SITES

Cycle counting data from the DETR's Long Term Traffic Counting Sites was examined. About fifty of these sites are capable of distinguishing between cycles and other traffic through the use of piezoelectric strips. The main purpose of this exercise was to estimate the implications of long term variations in cycle flow. To do this, three years of data for five of the sites, from 1994 to 1996, was analysed to identify any relevant factors. The results of this study have been used to provide advice on the sampling regime required to monitor changes for any given site. Figure 1 illustrates the degree to which motor traffic varies from cycle flows during a typical year.

OTHER WORK

The TRL report also includes details of other cycle monitoring work carried out by Greater Manchester Transportation Unit, Surrey County Council, Somerset County Council, Cambridgeshire County Council, Nottinghamshire County Council, University of Sunderland, and Sustrans. Most of this work involved ATC/MCC surveys, cycle parking counts at schools and town centres, roadside interviews and employment surveys.

TECHNICAL ENQUIRIES

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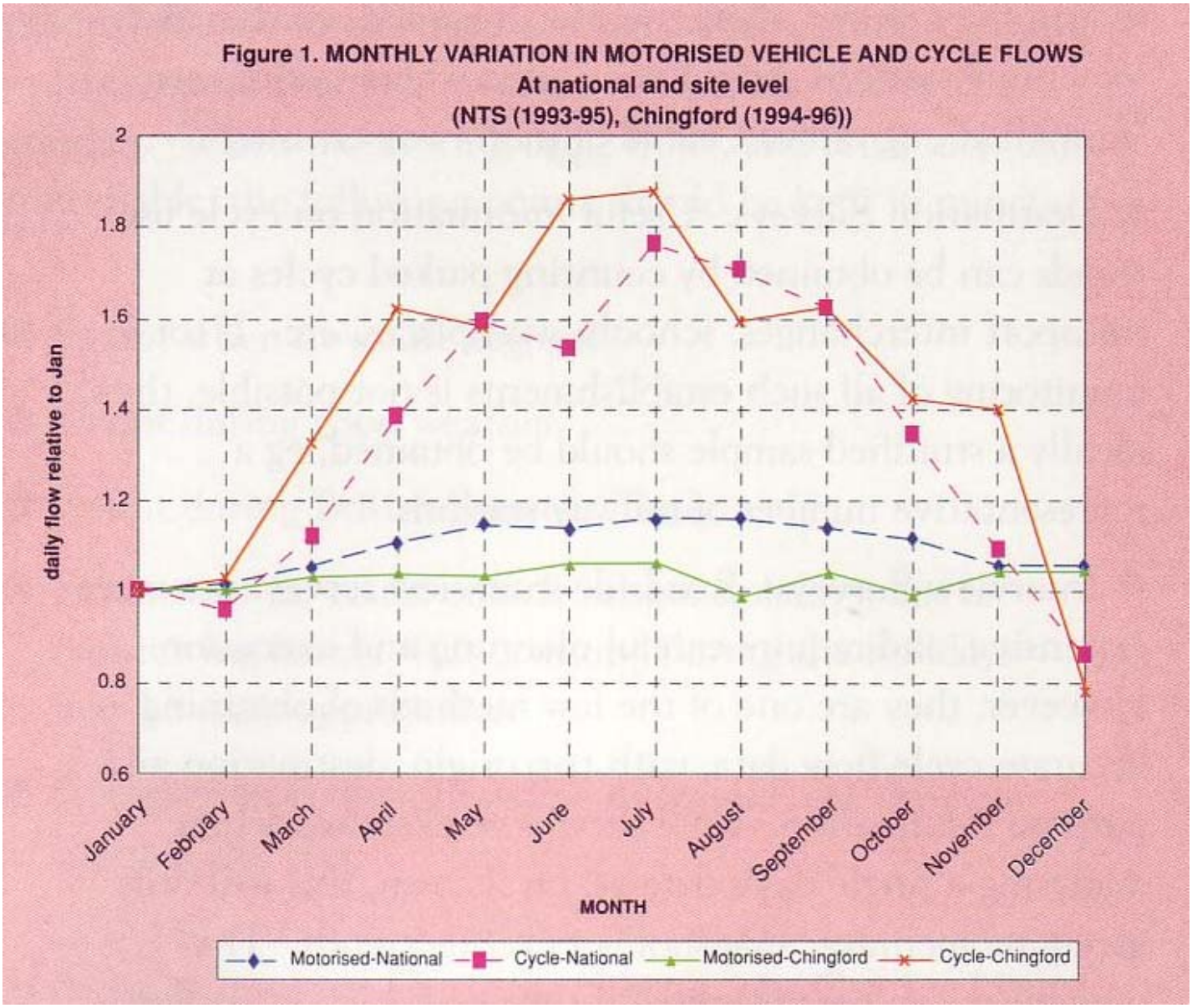
REFERENCES

Cycling in Great Britain, DETR. TSO, 1996

"Research on monitoring cycle use", TRL Report *396.* TRL, 1999.

"Guidance on monitoring local cycle use", TRL Report 395. TRL, 1999.

(Contact number for TRL Reports: 01344 773131)



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