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COUNTING METHODS AND SAMPLING STRATEGIES DETERMINING PEDESTRIAN NUMBERS

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CONTENTS

1. Introduction

1.1 Study Objectives

1.1.1 Any new road, road improvement or traffic management scheme could affect pedestrian journeys in its locality or elsewhere. Some journeys may be affected directly, with severance caused where the new road or road improvement cuts across a pedestrian route, others may be affected indirectly with a new road causing changes in traffic levels elsewhere. To enable effects on pedestrians to be given proper weight when decisions are taken, techniques are required that forecast the effects of the scheme on the number and quality of pedestrian journeys. This is particularly true in urban areas, since effects on pedestrians may be one of the main benefits or disbenefits of measures to relieve urban traffic.

1.1.2 As a first stage of research in this area, TRRL placed a contract with The Institute for Transport Studies at the University of Leeds. The terms of reference were:

i) to review literature for currently available techniques and possible approaches and for any useful and general background information on:

   a) estimating numbers of pedestrian journeys
   b) assessing changes in pedestrian amenity;

ii) to make recommendations as to the best (if any) currently available techniques for (a) and (b) above, taking into account the availability of any data required as inputs to the techniques;

iii) if the literature review reveals that further work is necessary in these areas, either in the development or testing of existing methods, or in the development of new methods, to make detailed proposals to carry out the necessary research.

As well as the literature review (May et al 1985) that study produced recommendations for further research (May, 1985). In 1986 TRRL commissioned the Institute for Transport Studies to conduct a research project based on those recommendations, whose detailed elements were designed to:

1) develop sampling procedures/expansion factors for pedestrian counts;
2) identify proportions of pedestrians by type;
3) test predictive models of pedestrian numbers;
4) develop dose-response relationships for overall nuisance and individual environmental effects;
5) explore evidence among residents of trip suppression and diversion in response to environmental conditions.

1.2 Study Reports

This report deals only with items (1) and (2) above. Other reports based on this study provide an update to the original literature review (Turvey, 1987); a description of the survey

design (Hopkinson et al, 1987a); and the results of work on items (3), (4) and (5) above (May et al, 1987; Hopkinson et al, 1987b; Hopkinson et al, 1987c).

1.3 Study Method

The study method involved the selection of 15 centres, in five categories of three each. Of each set of three, one was to be set aside for validation purposes. The centres are listed in Table 1 and sketch plans of each location are included in Appendix 1. The procedures for site selection are described in Hopkinson et al, 1987a.

The study programme involved the following fieldwork:

(1) manual classified counts of pedestrians;
(2) video data collection for pedestrian numbers and traffic flows;
(3) on-street pedestrian interviews;
(4) household interviews;
(5) noise and pollution monitoring;
(6) observation of site characteristics.

Of these items (1)-(3) and (6) were collected at all centres; items (4) and (5) were collected at two and three sites respectively as indicated in Table 1. This report makes use only of data from sources (1), (2) and (6).

Table 1

Study Locations for On-Street Interviews and Pedestrian Counts

Type	Centre 1	Centre 2	Validation Centre
Large urban active	Manchester*	Aberdeen	Bristol
Large urban depressed	Lewisham*	Sheffield	Coventry
Small urban historic	Lanark**	Winchester	Guildford
Small urban other	Chesterfield	Kilmarnock	Epsom
District Centre	Hebden Bridge*	Twickenham	Hazel Grove**

* Pollution Studies
** Household Interviews

1.4 Report Outline

In developing the detailed methods for recording data and determining sampling procedures, use was made of previous literature and earlier work by the Institute in Manchester (Hopkinson, 1987). These are described in Chapters 2 and 3 respectively. Chapter 4 describes the methodology adopted in this study. Chapters 5 to 7 presents the results of the main analyses, and Chapter 8 draws conclusions from the study.

2. Previous Count Methods

2.1 Types of Count

The earlier literature review (May et al, 1985) identified three types of count of pedestrians which might be of interest:

flow along pavements in a given time period;
flow crossing roads for a given length of road and a given time period;
concentration of pedestrians in a given area of pavement at a specific instant.

These are referred to in the remainder of this report as pavement flows, crossing flows, and pavement concentration.

2.2 Count Methods

The Manual of Environmental Appraisal (DTp, 1983) sets out three basic methods for the direct counting of pedestrian numbers:

(1) film based counts;
(2) the moving observer method;
(3) manual spot counts.

The Manual advocates that selection of the method should be dependent on the size of the survey and the equipment available rather than on any inherent superiority of one particular method.

(1) Film Based Counts

Film methods may involve video tape or time lapse photography, and offer a permanent record of events at low running costs. They can be used, given a suitable vantage point, to provide all three types of count. Also, both quantitative analysis of pedestrian numbers and qualitative assessment of pedestrian behaviour is possible.

Disbenefits are the high capital and analysis costs, the inability to classify pedestrians, and difficulties in achieving a good camera vantage point.

(2) Moving Observer Method

The observer traverses a unit distance (usually 100m) in one direction counting every person he/she passes in both directions and deducting the number of persons overtaking. The count is then repeated in the opposite direction and the pavement concentration is given by the mean of the two values divided by the area of pavement.

This method depends critically on the assumption that flows of pedestrians in all directions, including those crossing the pavement, are constant over the period of study. However, this equilibrium situation is unlikely to exist in most urban centres, and serious errors can arise where it does not. In a study carried out in 1985 in Knaresborough the moving observer method

was found to be a poor method for the representation of pavement concentration (Hopkinson and May, 1986).

(3) Manual Spot Counts

Manual counts of pedestrians can be made from a specified fixed location. Movements across a screen line are recorded on tally counters. For pavement flow the screenline would be an imaginary line drawn across the pavement perpendicular to the carriageway; for crossing flows the length of screenline needs to be defined.

Limited data can be recorded by any one member of the survey team and hence the more data required, the larger the survey team resulting in high labour costs. Analysis costs are low however, and pedestrian classification is possible using this method. Recent developments in portable event recorders may reduce the cost of data collection, by increasing the volume of data able to be recorded by one person, and increase the reliability, as well as providing a more permanent record (Polus, 1978; Ghahri-Saremi, 1987).

Further details of the application of the methods outlined are given in May et al,(1985).

2.3 Duration of Count

10 minutes appears to be the length of manual count which is most commonly used (City of Coventry, 1973). The basis for this is not statistical. Such a count period allows for a 10 minute period directional count at a site with a 5 minute break followed by a count of the other crossing direction or pavement flow or at another site, within a half hour time period. This duration of count period is also claimed to minimise observer boredom and hence keep errors to a minimum. Haynes (1977) looking just at peak periods indicates that extending from a 10 minute count to a 15 minute count period would reduce errors by 10%.

For film based methods a two hour film has generally been considered adequate for studies involving some assessment of behaviour. The cost of film methods depends both on the duration of film to be analysed and the amount of data to be extracted. Again, resource limitations will restrict both film and analysis time.

2.4 Classification of Flow

Little information is available regarding appropriate levels of disaggregation for pedestrian data. It is generally agreed however that there is a need to treat the elderly and the young as separate components of flow. The normal approach in the literature has been to classify the young as those under twelve and the elderly as those over 65 years of age. The separation of these age groups is not well defined and is often left to subjective assessments by observers on street or from film.

3. Pilot Surveys: Manchester

3.1 Background

In the absence of guidance regarding suitable count periods and the resource commitment that may be required in order to attain a given level of accuracy, further analysis was conducted of pedestrian data collected as part of a research studentship in Manchester in 1986 (Hopkinson, 1987).

The data available was collected on video tape from a first floor vantage point in Cross Street, Manchester on 14/5/86 and 15/5/86 (both weekdays).

3.2 Characteristics of Temporal Distribution of Flow

Figure 1 is compiled by taking consecutive 5 minute flow counts for one pavement on 14/5/86 from the video and plotting these values against time. Figure 2 indicates the smoothed results for both pavements. The maximum 5 minute flow occurs at just after 1300 and registers just over 240 persons/five minute period. Minimum flows in the off peak are as low as 40 persons/five minutes. Both these figures are representative of the main shopping pavement in Cross Street. The opposite pavement has few retail or commercial outlets along the segment being filmed. However, whilst its flows are typically 35% below those of the main shopping pavement, the same characteristics of temporal distribution apply.

3.3. Identification of Analysis Periods

From Figure 2 the effects of both the morning and evening 'peaks' can be observed along with a more pronounced midday 'peak'. Therefore in the period 0830 to 1720 two 'off peak' periods are also observed, one in the morning and one in the afternoon. It appears realistic to divide the day into 5 periods each of which displays particular characteristics.

The following periods seem appropriate:

(1)	0815 - 0920 (start of film)	Period P1	(AM Peak)
(2)	0920 - 1150	Period P2	(AM Off Peak)
(3)	1150 - 1440	Period P3	(Midday Peak)
(4)	1440 - 1650	Period P4	(PM Off Peak)
(5)	1650 - 1720 (end of film)	Period P5	(PM Peak)

3.4 Identification of Sample Count Duration

Within each of the analysis periods identified in Section 3.3 it is possible to conduct a 'sample count' which is representative of the analysis period as a whole and to which an expansion factor could be applied to give an estimate of total pedestrian flow for that analysis period. Accuracy will be determined both by the duration and timing of the sample count.

FIGURE 1 PEDESTRIAN FLOWS FOR MANCHESTER PILOT SURVEY, (14/05/86).

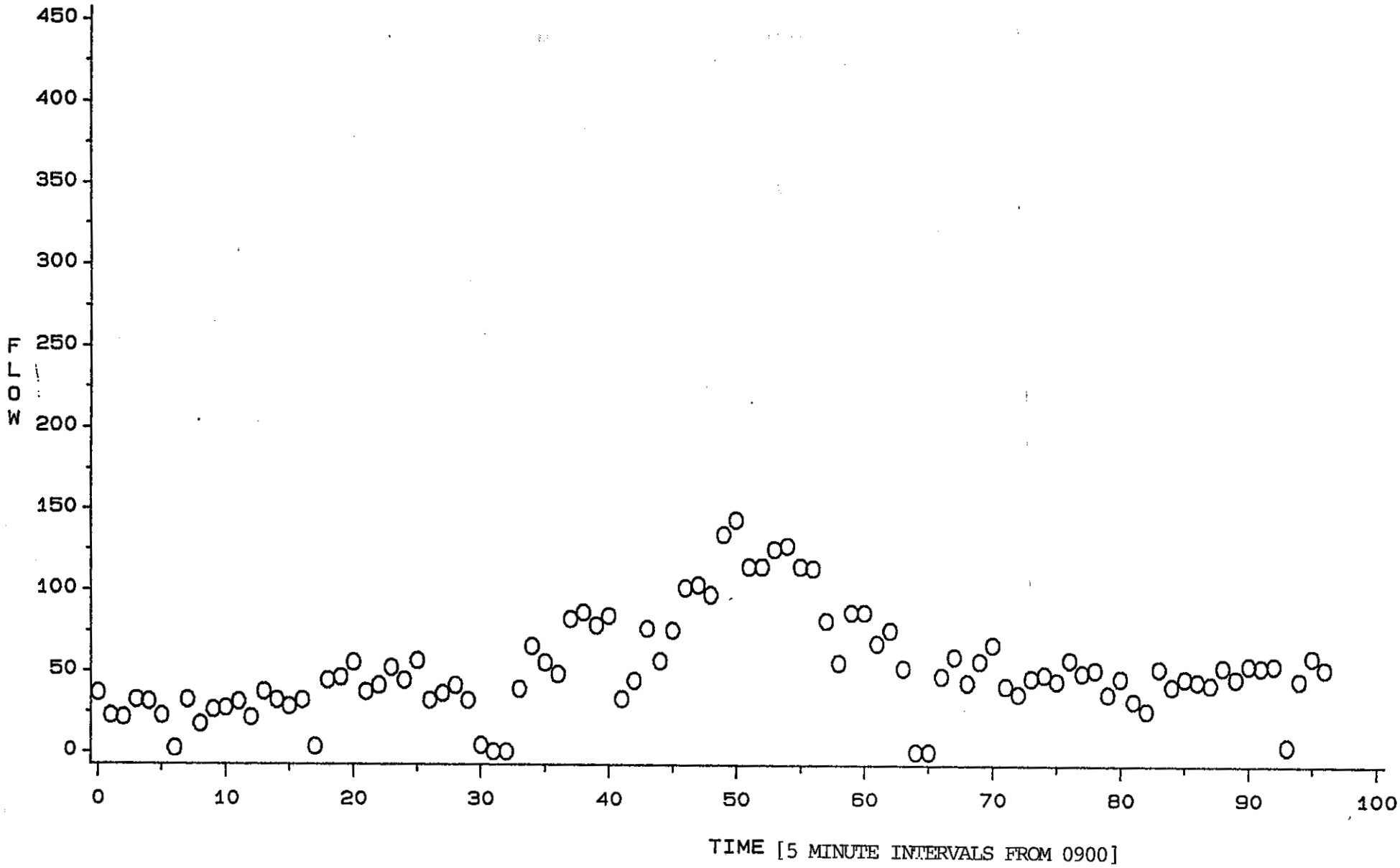
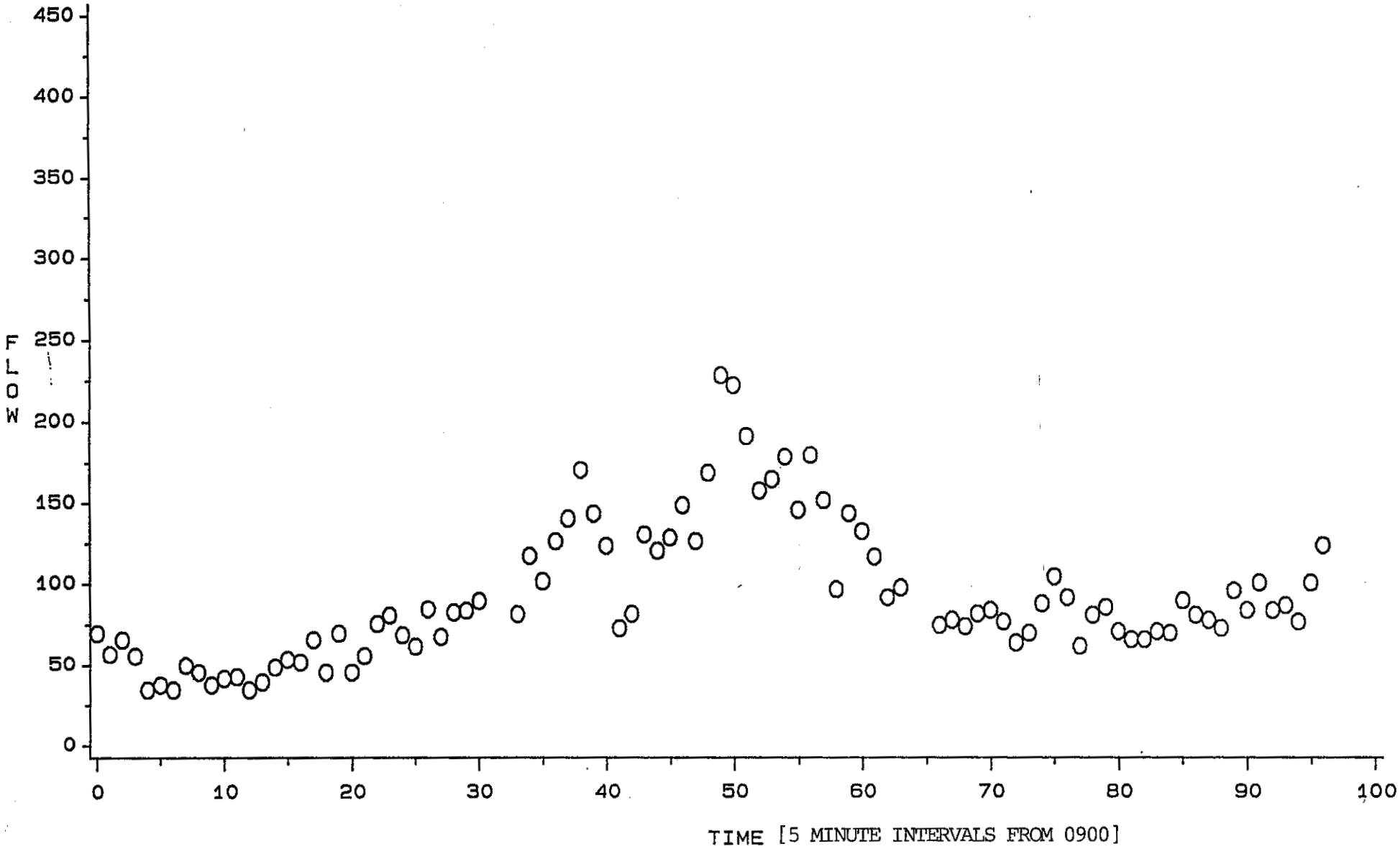


FIGURE 2 PEDESTRIAN FLOWS FOR MANCHESTER PILOT SURVEY, (14/05/86).



The data available for the AM and PM peaks was incomplete and as the study for TRRL was to concentrate on the periods between 0900 and 1700, only the middle periods P2, P3 and P4 are considered further.

The accuracy with which a sample of a given duration can be used to estimate flow for the analysis period will increase as the duration increases. This accuracy can be indicated by the coefficient of variation of the distribution of independent counts of given duration during the time period. However, as duration increases the number of independent counting periods falls, and estimates of coefficients of variation become less reliable.

Table 2 indicates, from the data for pavement B on Wednesday 14/5/86, the coefficients of variation for different sample count durations for the three analysis periods. These results are plotted in Figure 3.

Table 2

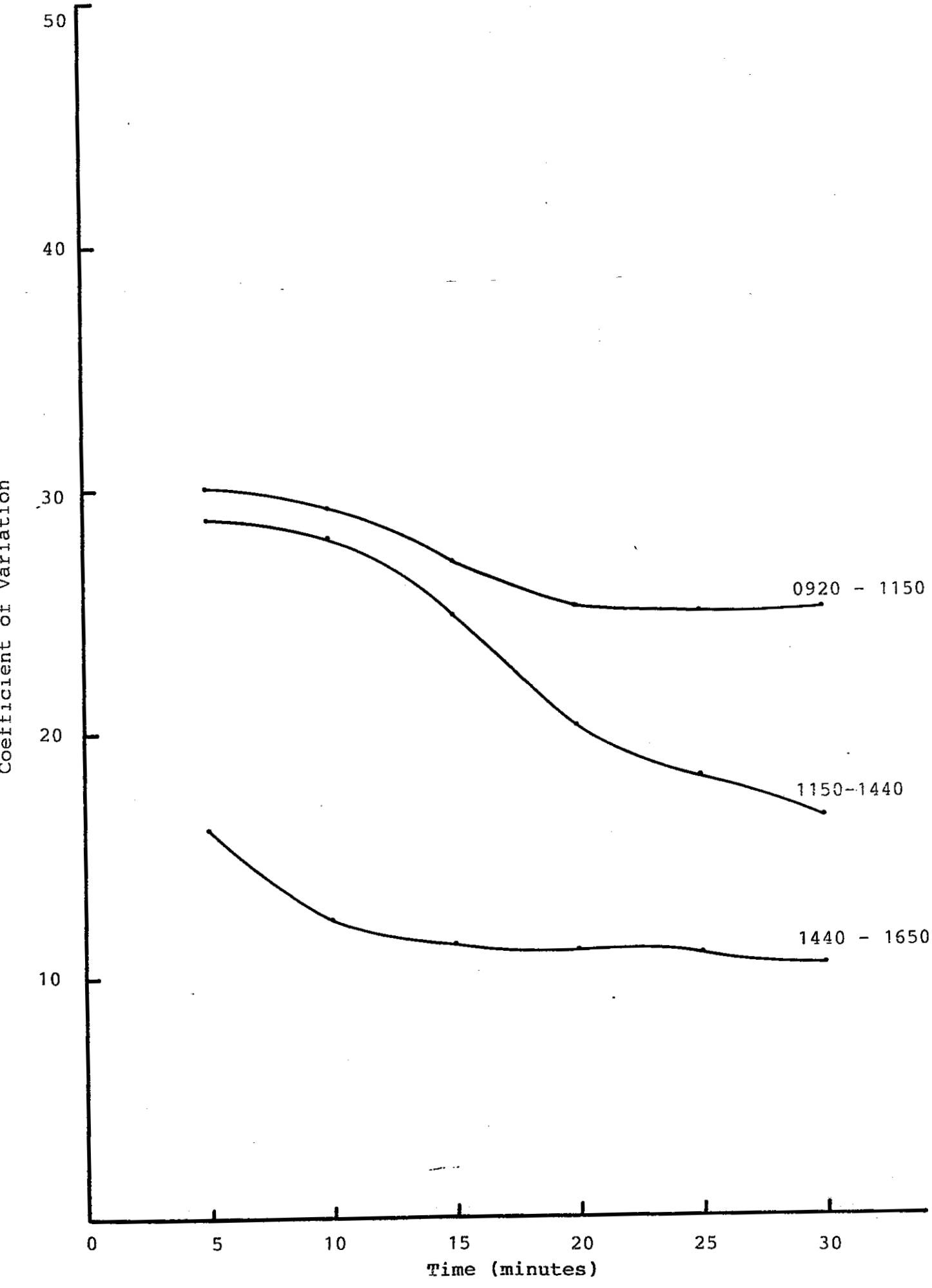
Coefficients of Variation (%) for Pilot Data for Different Sample Count Durations

Analysis Period	Duration of Sample Count (Mins.) 5	10	15	20	25	30	35*	40*
0920 - 1150	30.1	29.2	27.0	25.0	24.8	24.9	25.0	26.1
(n)	(30)	(15)	(10)	(7)	(6)	(5)	(4)	(3)
1150 - 1440	28.8	28.0	24.8	20.2	18.1	16.4	15.3	15.2
(n)	(34)	(17)	(11)	(8)	(6)	(5)	(4)	(4)
1440 - 1650	16.1	12.3	11.4	11.0	10.8	10.4	9.9	9.4
(n)	(26)	(13)	(8)	(6)	(5)	(4)	(3)	(3)

Notes: (1) (n) = number of count periods in time slice
(2) * where values of n are below 5 coefficients of variation become less reliable
(3) data for pavement B; Wednesday 14/5/86

Ideally, a sample count duration should be chosen in terms of the accuracy of count required. No guidance has been given by the Department of Transport on required accuracy, but as a result of the literature review, very tentative suggestions were made for obtaining counts at higher flow sites accurate to $\pm$ 10%. Since a count is within plus or minus two standard deviations of the mean of a normal distribution on approximately 95% of occasions, this suggests that a coefficient of variation of 5% is required to achieve this level of accuracy with 95% confidence. Table 2 and Figure 3 indicate that, for Manchester at least, this is unachievable. Indeed, for the morning off-peak the best that can

Figure 3: Effects of Sample Count Duration on Coefficient of Variation for Pavement Flows: Manchester Pilot Data



be achieved is an estimate to within ± 50%. This clearly needs reappraisal in the light of the Survey results obtained in the main study.

As an alternative approach, it is possible to identify for all three analysis periods a 'knee' in the curve beyond which the rate of increase in accuracy with increased duration is less. In two cases these occurred at 20 minutes, and in the third at 10 minutes. On this basis 20 minutes was taken as the duration for manual sample counts; the use of video throughout the day would permit this to be further checked.

3.5 Start Time for Sample Counts

Ideally, the most appropriate start time for a sample count of a given duration needs to be determined by comparing the total count for the analysis period to the sample count over several days. The start time selected should be that which gives the lowest coefficient of variation of the resulting distribution of expansion factors. In practice, such data was not available for the Manchester pilot, and the choice had therefore to be based, somewhat arbitrarily, on the results of Figure 1. The sample count periods selected for the main study were:

(1) 1000 - 1020
(2) 1200 - 1220
(3) 1500 - 1520

In addition a further count was carried out at 0840 - 0900.

3.6 Expansion Factors for Estimation

Given 20 minute counts starting at 1000, 1200 and 1500 the expansion factors required to estimate the total pedestrian flow for the periods 0920-1150, 1150-1440 and 1440-1650 were derived as indicated in Table 3. Table 3 shows the pavement totals for each analysis period from the Manchester video data, the sample counts and the appropriate expansion factors from the 20 minute counts. Averaged over the two days, these are 8.7, 10.0 and 7.4 respectively.

3.7 Crossing Counts

As Figure 4 indicates, similar temporal trends exist from the Manchester data for pavement flows and for crossing flows. On this basis it was decided that, for the main study, 20 minute counts should again be carried out at 0840, 1000, 1200 and 1500.

3.8 Pavement Concentration

In the Manchester study pavement concentration was observed from the video film and the numbers of persons per unit area of observed pavement at 30 second intervals through the day. However, since it was clear, from Section 2.2, that concentration could only be recorded reliably from video, and this would permit any sampling frequency, choice of the most appropriate frequency was left until the analysis stage of the main study.

Table 3

Expansion Factors for Pavement Flows from Pilot Data

Analysis Period	0920-1150	1150-1440	1440-1650
Wednesday 14/5/86			
Total Count	1710	4290	2060
Sample Count	175	419	351
Expansion Factor	9.8	10.2	5.9
Thursday 15/5/86			
Total Count	1448	5307	2885
Sample Count	191	548	323
Expansion Factor	7.6	9.7	8.9
Average Factor	8.7	10.0	7.4

4. Methodology for the Main Study

4.1 General Approach

The survey strategy and site selection procedure are described fully in a companion report (Hopkinson et al, 1987a). The brief required each site to be studied on three days, and it was decided to record the pedestrian count data using a combination of manual and video techniques. Video was to be the main recording medium because it provided a permanent record from which any analysis of data could later be conducted, enabled classified flow to be recorded at no extra cost, and was the only reliable means of measuring pavement concentration. However, manual records were also to be kept to enable the accuracy of this method to be assessed, and because they provided the only reliable means of pedestrian classification.

4.2 Video Data

A tripod mounted Panasonic F2 CCD video camera was used at all sites. The camera had the facility to superimpose both time and date on the film and also had a zoom facility. This enabled a closer view of the street and a better definition of people and traffic to be achieved.

Each video cassette was of 3 hours' duration and filming took place on two site survey days from 0900 to 1700. Resources and the timetable did not permit the use of video on all three survey days. However, extra video data was collected at three sites in the spring of 1987, to enable seasonal comparisons to be made. Table 4 shows the dates of video data collection. The choice of dates is described in Hopkinson et al (1987a).

FIGURE 4. CROSSING FLOWS FOR MANCHESTER PILOT SURVEY, (BOTH PAVEMENTS) (14,05,86)

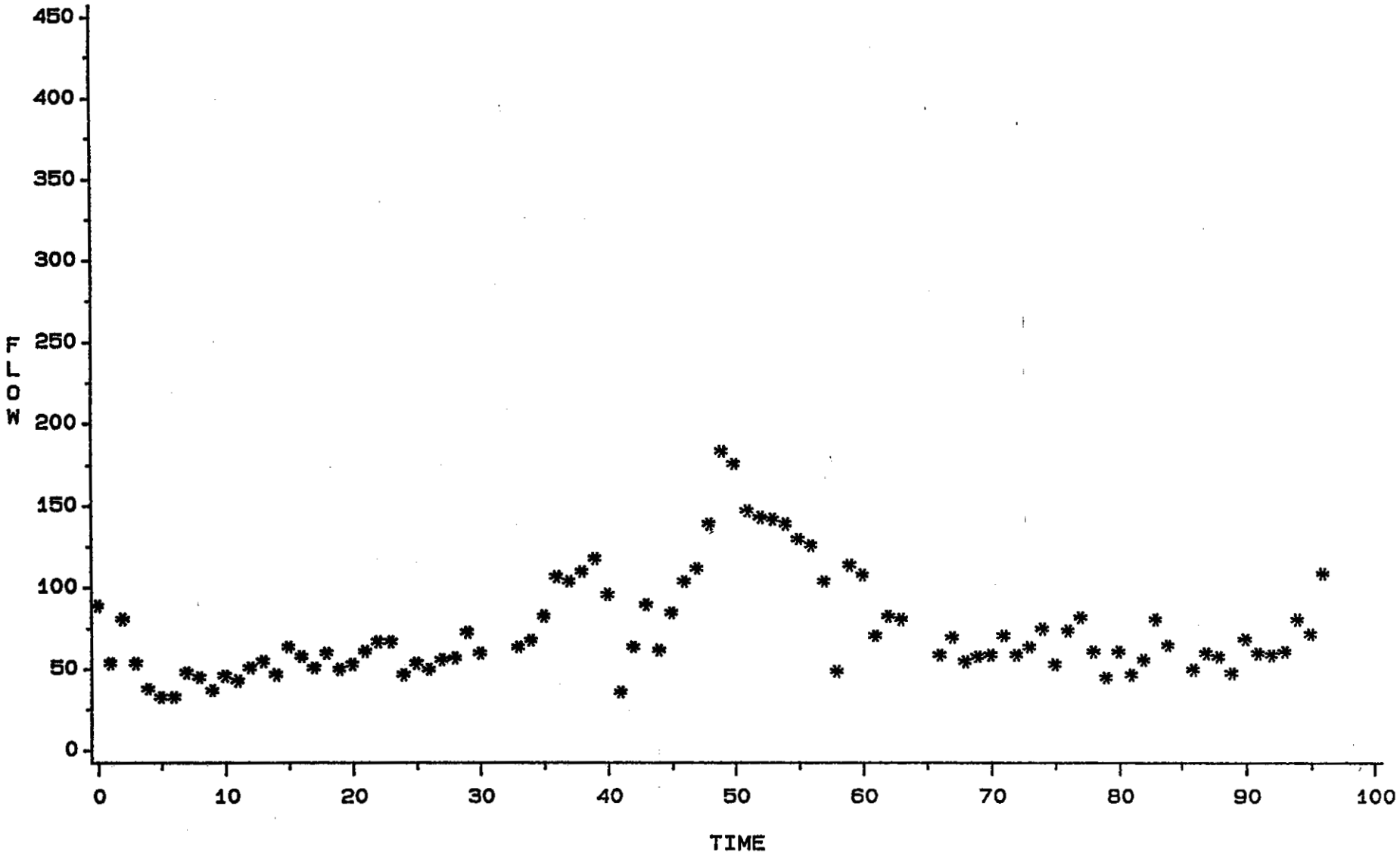


Table 4

Dates of Video Data Collection

01	Chesterfield	18/10	(Sat),	20/10	(Mon)	
02	Sheffield	24/10	(Fri),	25/10	(Sat)	
03	Lanark	27/10	(Mon),	28/10	(Tue)	
04	Hebden Bridge	30/10	(Thu),	31/10	(Fri)	*1
05	Kilmarnock	30/10	(Thu),	31/10	(Fri)	
06	Aberdeen	1/11	(Sat),	3/11	(Mon)	
07	Lewisham	6/11	(Thu),	7/11	(Fri)	*2
08	Epsom	10/11	(Mon),	11/11	(Tue)	
09	Winchester	12/11	(Wed),	13/11	(Thu)	
10	Guildford	14/11	(Fri),	15/11	(Sat)	
11	Twickenham	17/11	(Mon),	18/11	(Tue)	
12	Bristol	19/11	(Wed),	20/11	(Thu)	
13	Manchester	20/11	(Thu),	21/11	(Fri)	*3
14	Coventry	24/11	(Mon),	25/11	(Tue)	
15	Hazel Grove	27/11	(Thu),	28/11	(Fri)	

NB: All dates in 1986 except where stated

*1 Also 8/4/87 (Wed)
*2 Also 26/2/87 (Thu), 27/2/87 (Fri)
*3 Also 6/3/87 (Fri)

Ideally the camera was sited at a first floor vantage point with a good view of the street to include crossing facilities and pavement count locations. The maximum range of the camera within which pedestrians could be identified clearly was 100m. Care was taken to obtain the best vantage point in the selected street, rather than choosing an alternative street because of the availability of a suitable vantage point. In practice, it was not always possible to achieve an 'ideal' location for the camera. On several occasions the building used to locate the camera was parallel to the survey street and this only enabled one pavement to be counted rather than two. In all cases a clear view of the carriageway was able to be achieved.

Each survey site yielded around 16 hours' data for the two days although short periods of data (typically 5 to 10 minutes) were lost during cassette changes. Otherwise the midday analysis period data was complete. The morning and afternoon periods were, however, affected by other sources of lost data. In the morning, 20 minutes was lost at Bristol and Manchester, and 30 minutes at Twickenham, because of problems of access to recording sites. In Lewisham 110 minutes' data was lost because heavy rain obliterated the field of view. In the afternoon 95 minutes' data was lost at Twickenham, 65 minutes at Lewisham and 20 minutes at Hebden Bridge, Guildford and Coventry because of access problems. 75 minutes' data was lost at Hazel Grove and 25 minutes at Sheffield because of strong sunlight, and 80 minutes at Bristol, 60 minutes at Lanark, 50 minutes at Kilmarnock and 30 minutes at Chesterfield because of heavy rain or poor light. In all cases the counts for the periods filmed were expanded pro rata to the total analysis period.

These problems with video siting suggest that one vantage point

may not be appropriate throughout the day, and that, provided that sufficiently robust equipment and secure locations can be obtained an outside filming location may be preferable. In this study the additional resources needed to supervise an outside location were not available.

The incidence of poor weather may also have affected pedestrian flows; the time periods affected were:

03	Lanark	:	Monday pm
04	Hebden Bridge	:	Thursday am
05	Kilmarnock	:	Friday pm
07	Lewisham	:	Thursday am
09	Winchester	:	Thursday pm
11	Twickenham	:	Monday pm

These need to be allowed for in assessing the results in Chapters 5 and 6.

Rather than analyse all film, it was decided initially to analyse one day's data at each site. A second full day's data was analysed at Chesterfield and Sheffield, to cover Saturdays, and Manchester and Hebden Bridge, where manual counts suggested markedly different conditions. At other sites counts were taken from the video for the sampling periods of 1000-1020, 1200-1220 and 1500-1520 only.

The following data was extracted from the video tapes:

(a) directional pavement flow (both pavements where possible)
(b) directional vehicular flow (classified)
(c) pedestrian concentration (1 pavement)
(d) directional crossing flow
(e) site characteristics/location of survey staff.

Crossing flows were recorded at pedestrian crossing facilities or, where none existed, along the length of the street in view.

All pedestrian data was collated in 5 minute time intervals, except for pedestrian concentration data which was initially collected at 10 minute intervals.

In collecting this type and volume of data at 15 sites with different survey teams conducting and analysing both video and manual count data it is important to derive a convention to define a particular flow or count or interview location. Figure 5 shows the convention adopted. It was found that flows of over 80 pedestrians per minute were difficult to record from the video film.

4.3 Manual Counts

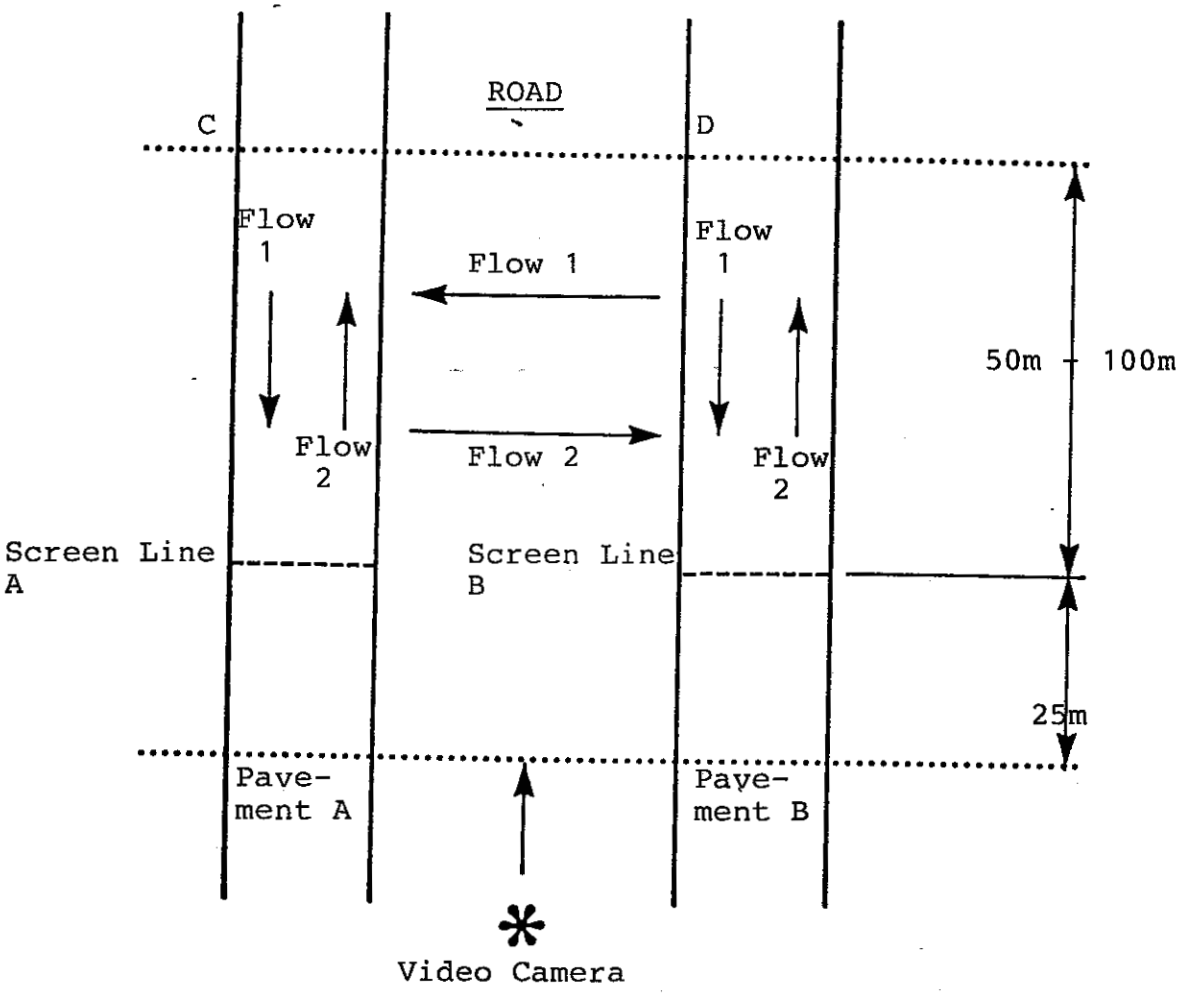
Two types of count were required in the 'video' street:

(A) Pavement Flow Counts

These counts took place on one pavement only with one person counting both directions separately along the pavement

FIGURE 5: CONVENTION FOR PEDESTRIAN FLOW COUNTS

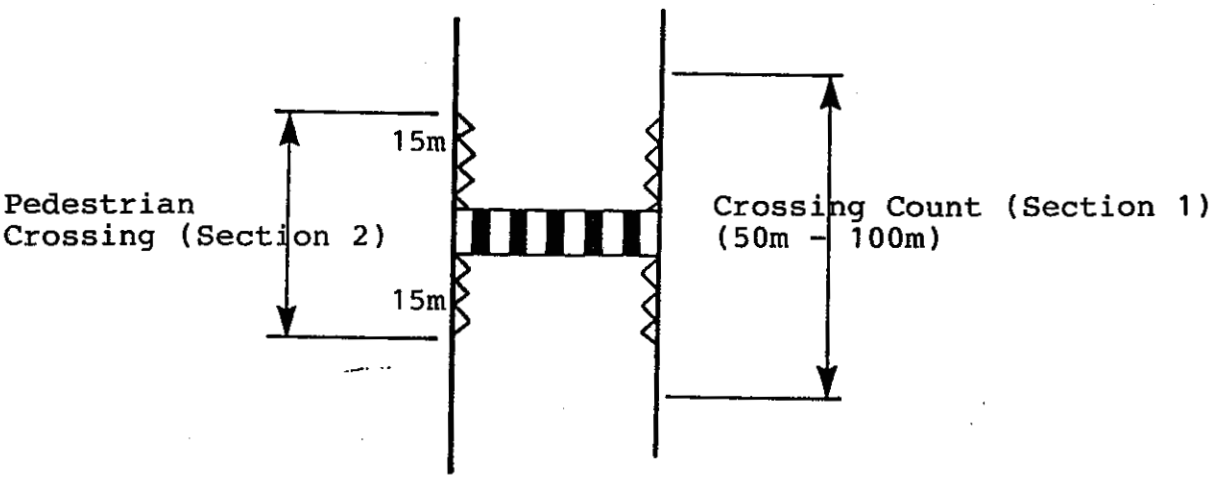
CODING PLAN (Adopted Convention - All Sites)



NB:

(1) Pavement Counts taken at Screen Line A and B
(2) Crossing Counts taken in the segment ABDC (Section 1) (B)
or at a pedestrian crossing (Section 2) (A)
(15m limits)

e.g.:



and classifying as described below. Locations for these counts were selected to be within view of the video camera, away from major generators of traffic, and at least 15m from a pedestrian crossing, and to avoid impeding the normal flow of pedestrians.

(B) Crossing Flow Counts

These counts took place on pedestrian crossings or along a specified length of road (see Figure 5). One person counted and classified each direction of flow.

Pavement and crossing counts were conducted on all three days, as determined in Chapter 3, for 20 minutes from 0840, 1000, 1200 and 1500.

Figure 6 shows an example of the count form used to record pedestrian numbers. Each pedestrian passing the specified count point in the appropriate direction was recorded on the form by placing a '1' in the appropriate box. In this way the numbers of persons passing in any 5 minute period were recorded.

The use of a record sheet proved preferable to six hand held tally counters, once the observers were familiar with the task.

In the interview respondents were asked to compare a number of environmental attributes within the interview street (street A) and also in two other streets in the centre (streets B and C). For these two additional streets a total pedestrian count along one pavement was recorded for one ten minute interval three times daily to compare magnitude of flows with the video street. Figure 7 shows the count form used for these counts.

These unclassified counts were carried out by an additional member of the survey team each day at:

Street (B)	:	0930 - 0940
		1230 - 1240
		1530 - 1540
Street (C)	:	0945 - 0955
		1245 - 1255
		1545 - 1555

Appendix 1 shows the streets concerned.

Directional flows exceeding 300 persons in every 5 minute period were impossible to record accurately where a classification was required. Also, the bunched nature of flow across controlled pedestrian crossings made data recording very difficult at peak times.

The counting periods appeared of short enough duration not to promote boredom and hence observer error. Each observer was employed to interview between the required count periods and it was found that the two tasks, because of the variation in work, complemented each other. However, the on-street supervisor had to make sure that interviews ceased prior to the required count period beginning.

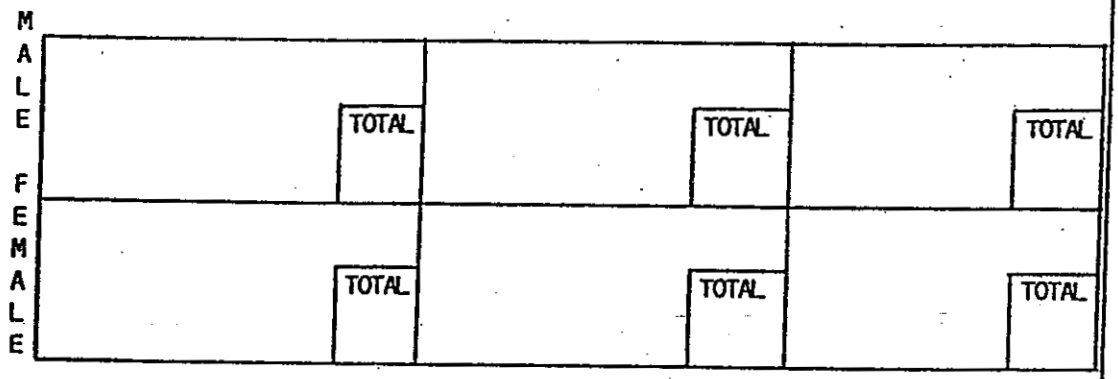
VIDEO LOCATION ONLY (FOR PAVEMENT FLOWS) FIGURE 6 COUNNT FORM FOR ON-STREET COUNTS (INTERVIEW STREET)

OFFICIAL USE

CODING COLM.

(A) UNDER 18 (B) 18-65 (C) OVER 65

TIME : _____ (5 MINS)

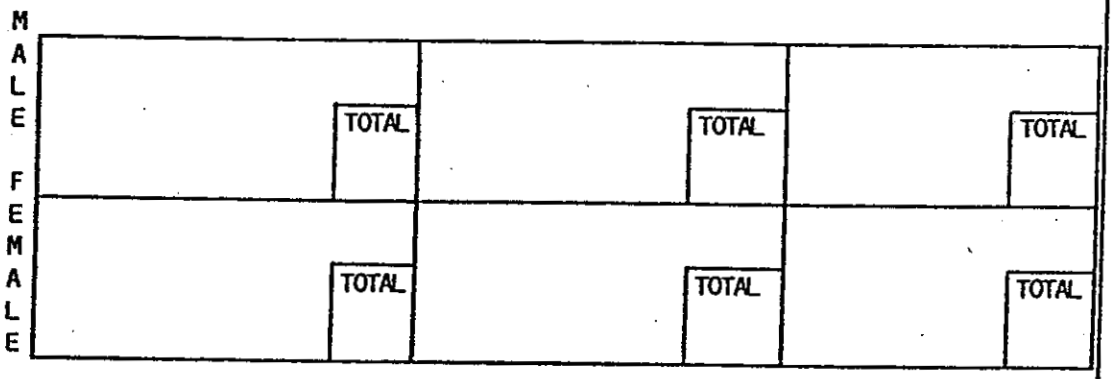


(A) ☐☐ (13-14)
(B) ☐☐☐ (15-17)
(C) ☐☐ (18-19)

(A) ☐☐ (20-21)
(B) ☐☐☐ (22-24)
(C) ☐☐ (25-26)

TOTAL ☐☐☐ (27-29)

TIME : _____ (5 MINS)

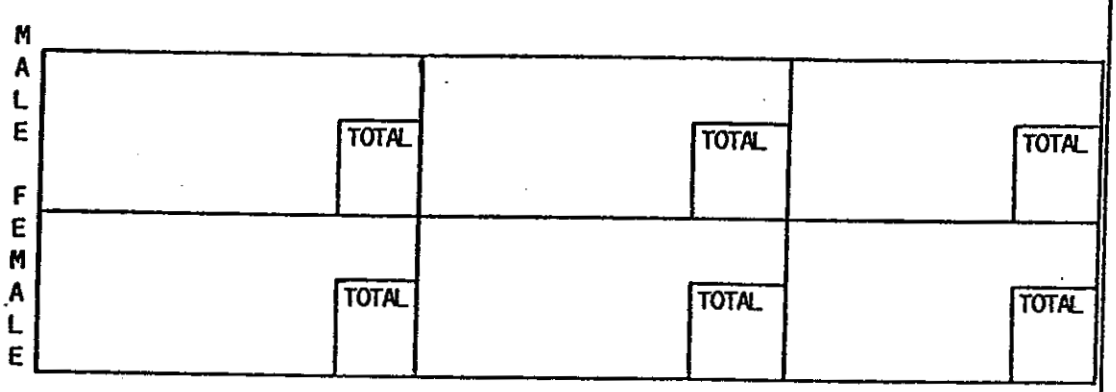


(A) ☐☐ (30-31)
(B) ☐☐☐ (32-34)
(C) ☐☐ (35-36)

(A) ☐☐ (37-38)
(B) ☐☐☐ (39-41)
(C) ☐☐ (42-43)

TOTAL ☐☐☐ (44-46)

TIME : _____ (5 MINS)

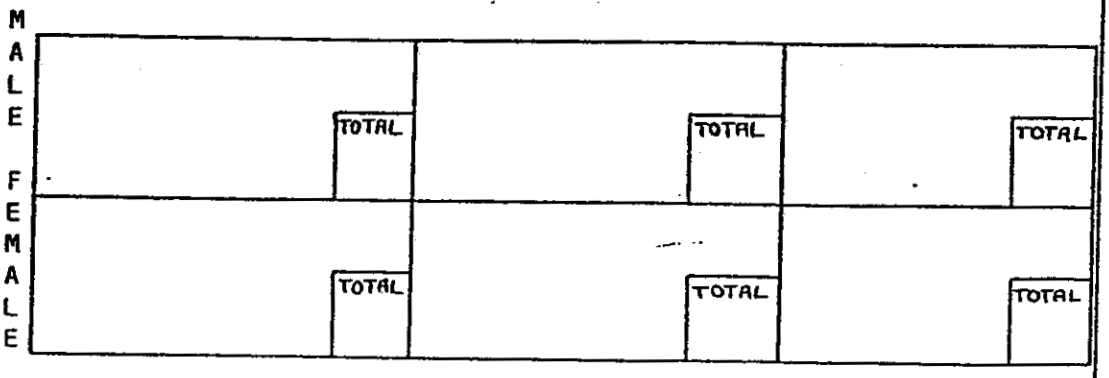


(A) ☐☐ (47-48)
(B) ☐☐☐ (49-51)
(C) ☐☐ (52-53)

(A) ☐☐ (54-55)
(B) ☐☐☐ (56-58)
(C) ☐☐ (59-60)

TOTAL ☐☐☐ (61-63)

TIME : _____ (5 MINS)



(A) ☐☐ (64-65)
(B) ☐☐☐ (66-68)
(C) ☐☐ (69-70)

(A) ☐☐ (71-72)
(B) ☐☐☐ (73-75)
(C) ☐☐ (76-77)

TOTAL ☐☐☐ (78-80)

FIGURE 7 COUNT FORM FOR MANUAL ON-STREET COUNTS (COMPARISON STREET)

COUNT FORM FOR LOCATION B AND C

CENTRE _____ :

DAY _____ :

LOCATION _____ :

TIME _____ : (24 HR CLOCK)

UNCLASSIFIED COUNT :

TIME _____ (5 MIN INTERVAL)

PAVEMENT A / BOTH PAVEMENTS (delete as necessary)

TOTAL _____

TIME _____ (5 MIN INTERVAL)

PAVEMENT B / BOTH PAVEMENTS (delete as necessary)

TOTAL _____

Combined total: _____

Return to :

Ian Turvey
Institute for Transport Studies
University of Leeds
LEEDS LS2 9JT.

Figure 6 shows that pedestrians were classified by observation by sex and age. The age categories used were under 18 years, 18-65 years, and over 65 years. The lower category used the 18 years of age cut off rather than twelve because it seemed more appropriate for the attitudinal work, and appeared to be an easier age to judge than 12.

5. Results : Pavement Flows

5.1 Total Counts

The total numbers of pedestrians counted on one pavement in each of the analysis periods and for the total period 0920 - 1650 are shown in Table 5. Table 6 shows the total counts for the centres grouped into the five categories suggested in Table 1.

Total counts vary substantially from a high of 41068 in Sheffield to a low of 1424 in Hebden Bridge. Saturdays, where counted, are higher, particularly in Chesterfield. There is no clear relationship between the total flows and the categories initially chosen, except that the District Centres appear to have the lowest flows and, with the exception of Sheffield and Guildford, the highest flows are to be found in the large urban (active) centres.

The lack of uniformity between sites of the same classification may be explained to some extent by the nature of the video street. Whilst the video street was required to be a main shopping street, the inclusion of traffic precluded the use of pedestrian only facilities, which in some centres form the basis of the shopping centre and therefore attract higher flows of pedestrians.

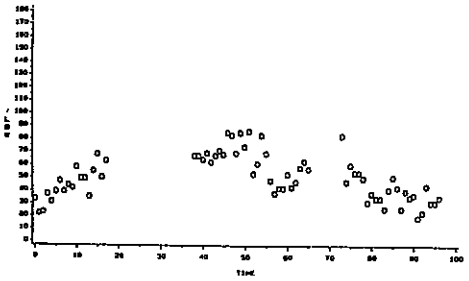
5.2 Temporal Distributions

Appendix 2 gives graphical plots of the temporal distribution of pavement flows at each of the 15 survey sites. From these plots it can be observed that Saturdays show a markedly different distribution from weekdays, for the same site. The midday peak appears to be later in the day, followed by higher afternoon flows. A gradual build up of pedestrians through the day results in a maximum pavement flow in the mid-afternoon period.

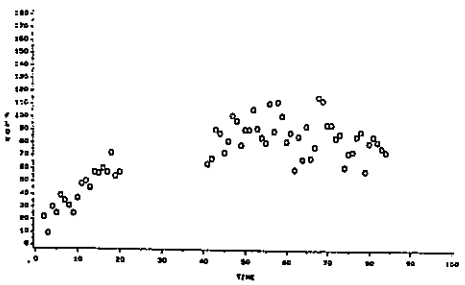
For comparison purposes, all weekday distributions have been reproduced together in Figure 8. Care needs to be taken in interpreting this figure, since the flow scales are not all identical. Three patterns appear to occur. The first has a pronounced midday peak with troughs either side. This is equivalent to the Manchester distribution in Chapter 3, with the omission of the a.m. and p.m. peaks, which occurred outside the 0920 - 1650 period under study. This pattern is most obvious at Chesterfield, Sheffield, Winchester, Bristol, Manchester and Coventry (sites 01, 02, 09, 12, 13, 14). Four of these are city centres with high flows peaking at around 250 pedestrians per 15 minutes. The others, however, are smaller centres with peaks of around 100 pedestrians per 5 minutes. The second group exhibit a gradual rise to a flatter peak, with a smaller decline in the afternoon. The clearest examples are Kilmarnock, Epsom and Twickenham (sites 05, 08, 11), with Lewisham (07) and Guildford (10) less certain members of this group. Most have peaks at around 100 pedestrians per 5 minutes, but Twickenham is lower at around 50, and Guildford much higher at 170. The final group has very uniform flows throughout the day and is represented by Lanark, Hebden Bridge and Hazel Grove (03, 04, 15), all of which have peak flows of around 40 per 5 minutes.

FIGURE 8: PEDESTRIAN TWO WAY PAVEMENT FLOW FOR 5 MINUTE INTERVALS BY SITE (0900-1700)

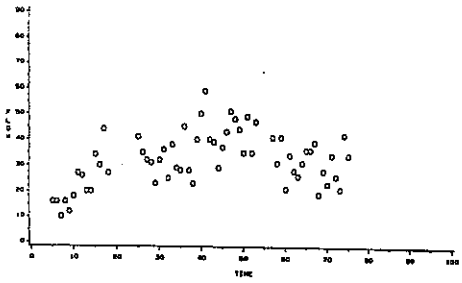
01 CHESTERFIELD (20/10/86, MON) VIDEO DATA



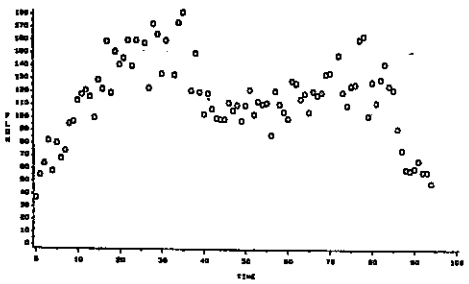
05 KILMARNOCK (31/10/86, FRI) VIDEO DATA



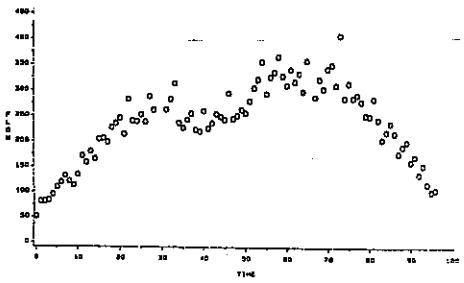
11 TWICKENHAM (18/11/86, TUE) VIDEO DATA



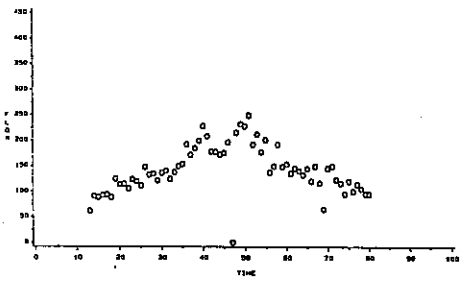
01 CHESTERFIELD (18/10/86, SAT) VIDEO DATA



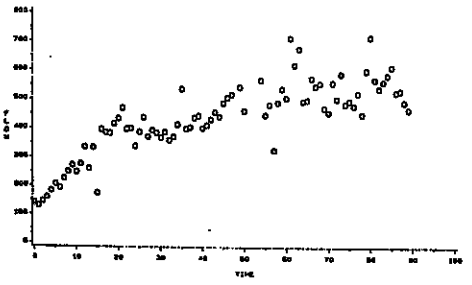
06 ABERDEEN (1/11/86, SAT) VIDEO DATA



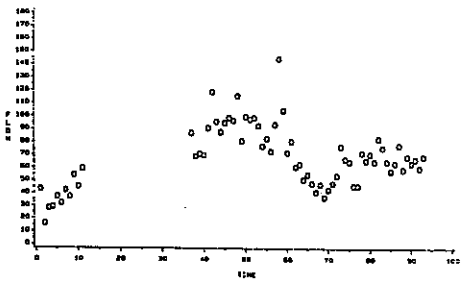
12 BRISTOL (20/11/86, THUR) VIDEO DATA



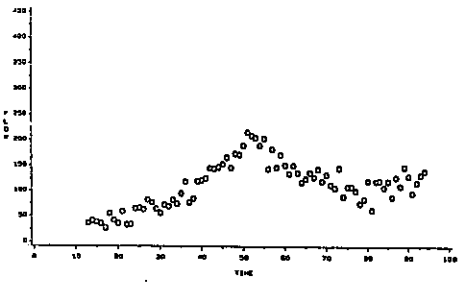
02 SHEFFIELD (25/10/86, SAT) VIDEO DATA



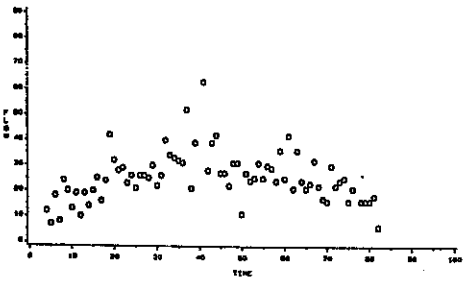
07 LEWISHAM (6/11/86, THUR) VIDEO DATA



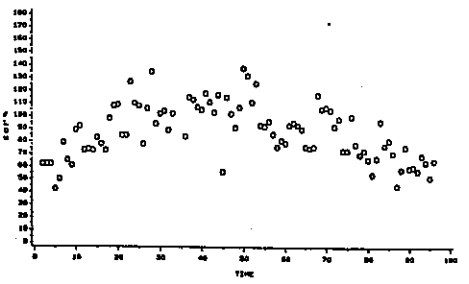
13 MANCHESTER (20/11/86, THUR) VIDEO DATA



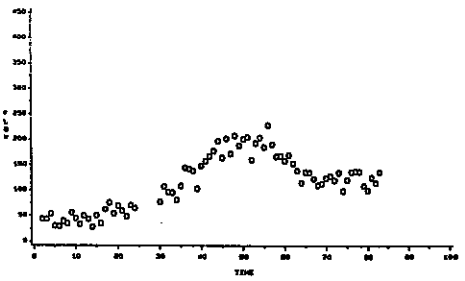
03 LANARK (27/10/86, MON) VIDEO DATA



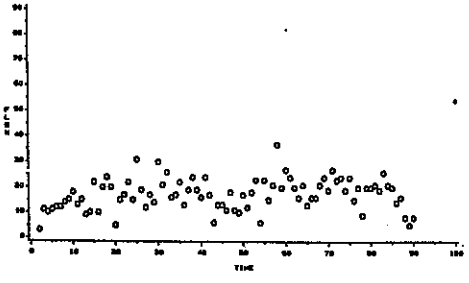
08 EPSOM (10/11/86, MON) VIDEO DATA



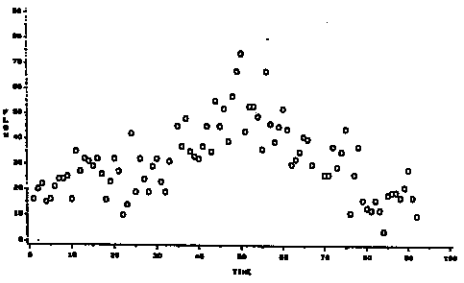
13 MANCHESTER (21/11/86, FRI) VIDEO DATA



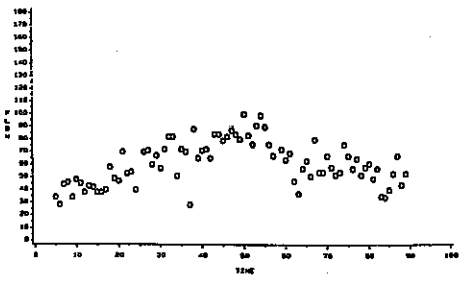
04 HEBDEN BRIDGE (30/10/86, THUR) VIDEO DATA



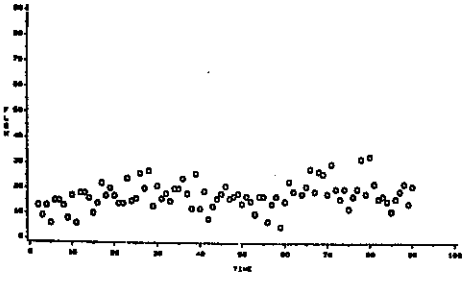
09 WINCHESTER (12/11/86, WED) VIDEO DATA



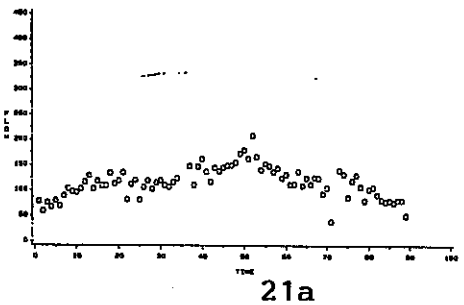
14 COVENTRY (24/11/86, MON) VIDEO DATA



04 HEBDEN BRIDGE (31/10/86, FRI) VIDEO DATA



10 GUILDFORD (14/11/86, FRI) VIDEO DATA



15 HAZEL GROVE (27/11/86, THUR) VIDEO DATA

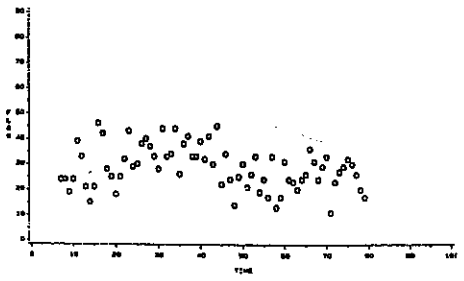


Table 5

Pavement Flows by Site and Analysis Period (Video Data)

Site		Day	Analysis Periods 0920-1150	1150-1440	1440-1650	Total 0920-1650
01	Chesterfield	SAT	3402	3240	2298	8941
		MON	718	2190	991	3900
02	Sheffield	FRI	12281	19282	9505	41068
		SAT	10245	14894	11199	36338
03	Lanark	MON	700	993	243	1936
04	Hebden Bridge	THU	444	603	376	1424
		FRI	447	626	416	1489
05	Kilmarnock	FRI	748	2452	1321	4521
06	Aberdeen	SAT	5824	9405	6377	21586
07	Lewisham	THU	306	2665	1569	4540
08	Epsom	MON	2572	3269	1975	7816
09	Winchester	WED	730	1543	493	2766
10	Guildford	FRI	3235	4539	1872	9646
11	Twickenham	TUE	638	1153	208	1995
12	Bristol	THU	2541	5799	1322	9662
13	Manchester	THU	1206	5075	2939	9220
		FRI	1426	5556	1836	8818
14	Coventry	MON	1501	968	443	2912
15	Hazel Grove	THU	730	1471	493	2694

Table 6

Pavement Flows by Site Classification and Day of Week (Video Data)

(0920 - 1650)

		Weekday	Saturday
Large Urban Active			
06	Aberdeen	17097	21586
12	Bristol	9662	
13	Manchester	9019 *	
Large Urban Depressed			
02	Sheffield	41068	36338
07	Lewisham	4540	
14	Coventry	2912	
Small Urban Historic			
03	Lanark	1936	
09	Winchester	2766	
10	Guildford	9646	
Small Urban Other			
01	Chesterfield	3900	8941
05	Kilmarnock	4521	
08	Epsom	7816	
District Centre			
04	Hebden Bridge	1457 *	
11	Twickenham	1995	
15	Hazel Grove	2694	

* Average for 2 days

In general it appears that there is a relationship between type of centre, with major centres on weekdays having a symmetrical pattern around a pronounced midday peak, intermediate centres which have a strong shopping role (and major centres on Saturdays) tending to have higher flows in the afternoon than the morning, but still with a pronounced midday peak, and smaller centres having little variation throughout the day.

In all cases the midday period provides the highest flow, and studies which simply need this information can be more clearly focused. The initially selected analysis periods seem reasonable, although there is a case for simplifying them to 0930 - 1130, 1130 - 1430 and 1430 - 1630.

5.3 Sampling Periods

The data analysed provided the opportunity to reassess the relationship between coefficient of variation and length of sampling period developed in Table 2 and Figure 3. Table 7 and Figure 9 present the results for the 0920 - 1150 analysis period. Tables 8 and 9 and Figures 10 and 11 present the results for the 1150 - 1440 and 1440 - 1650 analysis periods respectively.

For the 0920 - 1150 analysis period most sites follow a similar pattern of a rapid reduction in coefficient of variation between a 10 minute and 15 minute sampling period, with little further reduction. Only sites 13, 14 and 15 show further reductions to 20 minutes. Most coefficients of variation are less than that for the pilot site, but only sites 9 and 10 achieve values of under 15%.

For the 1150 - 1440 analysis period, coefficients of variation are typically lower than for the pilot survey, and much less sensitive to sampling period. Sites, 3, 4, 5 and 7 are the only ones which show substantial reductions as sampling period rises, and all suggest 20 minutes as an appropriate sampling period. Only site 11 has a higher value for 20 minutes than for 15 minutes. Sites 2, 3, 4, 5, 6, 8 and 10 achieve a coefficient of variation of around 15% or less, but at sites 1 and 2 values differ substantially between days of the week.

Fewer results are available for the 1440 - 1650 period. Most sites have a similar pattern to that for the pilot site, but with higher coefficients of variation at 25 minutes than 20 minutes. Generally 20 minutes appears to be the optimum sampling period. Only sites 7, 8 and 13 achieve coefficients of variation below 15%.

These results confirm the use of a 20 minute sampling period, but suggest that 15 minutes could be used in the morning period and at some sites in the midday period. Even at these sampling periods a coefficient of variation of 25% must be assumed; in the morning period some sites produce higher values than this.

Table 7

Coefficients of Variation (%) and Sampling Periods by Site for Pavement Flow : 0920 - 1150 Analysis Period

Site	Day	Sampling Period Length (Mins) 10	15	20	25	30
01	Sat	35.5 (15)	24.6 (10)	25.8 (7)	25.1 (6)	25.7 (5)
01	Mon	46.3 (7)	* (4)	* (3)	* (2)	* (2)
02	Fri	35.5 (15)	21.0 (10)	20.6 (7)	21.4 (6)	21.6 (5)
02	Sat	35.4 (15)	24.4 (10)	25.6 (7)	23.4 (6)	25.1 (5)
03	Mon	41.4 (15)	32.9 (10)	29.4 (7)	31.8 (6)	30.3 (5)
04	Thu	35.0 (15)	19.7 (10)	20.3 (7)	19.2 (6)	20.3 (5)
04	Fri	33.7 (15)	19.9 (10)	18.4 (7)	18.1 (6)	20.3 (5)
05	Fri	49.2 (8)	31.5 (5)	* (4)	* (3)	* (2)
06	Sat	41.7 (13)	31.4 (9)	30.6 (6)	31.0 (5)	* (4)
07	Thu	* (4)	* (2)	* (2)	* (1)	* (1)
08	Mon	33.6 (15)	21.2 (10)	20.6 (7)	20.7 (6)	20.8 (5)
09	Wed	34.4 (15)	14.1 (10)	16.1 (7)	13.3 (6)	11.4 (5)
10	Fri	30.1 (15)	13.6 (10)	13.6 (7)	11.8 (6)	12.8 (5)
11	Tue	46.5 (11)	29.1 (7)	* (3)	* (3)	* (2)
12	Thu	15.0 (10)	18.4 (7)	* (4)	* (4)	* (3)
13	Thu	30.6 (10)	28.9 (7)	* (4)	* (4)	* (3)
13	Fri	49.5 (12)	36.8 (8)	21.6 (5)	* (4)	* (3)
14	Mon	40.1 (14)	24.8 (8)	19.7 (5)	* (4)	* (3)
15	Thu	25.0 (13)	23.8 (9)	17.5 (6)	11.0 (5)	* (4)

Note: Figures in brackets indicate number of independent sampling periods for which data was available.

* Too few values to justify calculation.

Table 8

Coefficients of Variation (%) and Sampling Periods by Site for Pavement Flow : 1150 - 1440 Analysis Period

Site	Day	Sampling Period Length (Mins) 10	15	20	25	30
01	Sat	6.5 (16)	4.1 (10)	4.2 (7)	4.7 (5)	* (4)
01	Mon	20.7 (13)	20.8 (9)	21.7 (6)	21.4 (5)	* (4)
02	Fri	7.0 (16)	4.2 (10)	5.6 (7)	* (4)	* (4)
02	Sat	15.0 (14)	14.5 (8)	14.7 (6)	* (4)	* (3)
03	Mon	21.5 (16)	22.1 (10)	13.9 (7)	14.2 (5)	* (4)
04	Thu	17.6 (17)	12.7 (11)	11.1 (8)	12.5 (6)	9.3 (5)
04	Fri	17.3 (15)	13.9 (9)	10.7 (6)	* (4)	* (4)
05	Fri	12.6 (14)	12.6 (9)	8.6 (6)	* (4)	* (4)
06	Sat	14.6 (16)	14.9 (10)	15.3 (7)	14.7 (6)	15.4 (5)
07	Thu	25.0 (16)	23.0 (10)	18.1 (7)	15.5 (5)	* (4)
08	Mon	15.0 (16)	15.1 (10)	13.3 (8)	14.5 (5)	* (4)
09	Wed	19.8 (16)	18.6 (11)	16.4 (8)	14.9 (6)	15.4 (5)
10	Fri	14.3 (16)	14.0 (10)	13.2 (7)	13.0 (5)	* (4)
11	Tue	20.1 (15)	16.6 (9)	19.2 (6)	* (4)	* (4)
12	Thu	17.8 (16)	16.7 (10)	15.7 (7)	15.0 (5)	* (4)
13	Thu	22.0 (17)	22.4 (11)	27.5 (8)	23.3 (6)	21.7 (5)
13	Fri	18.1 (17)	16.9 (11)	16.4 (8)	15.7 (6)	16.2 (5)
14	Mon	18.6 (16)	19.5 (10)	19.1 (7)	19.0 (5)	* (4)
15	Thu	21.8 (17)	20.7 (11)	20.3 (8)	23.6 (6)	22.3 (5)

Note: Figures in brackets indicate number of independent sampling periods for which data was available.

* Too few values to justify calculation.

Table 9

Coefficients of Variation (%) and Sampling Periods
by Site for Pavement Flow : 1440 - 1650 Analysis Period

Site	Day	Sampling Period Length (Mins) 10	15	20	25	30
01	Sat	28.2 (12)	24.7 (7)	25.3 (5)	* (4)	* (3)
01	Mon	19.7 (10)	16.6 (6)	18.8 (5)	* (4)	* (3)
02	Fri	19.4 (12)	16.4 (7)	* (4)	* (4)	* (3)
02	Sat	10.5 (10)	7.4 (7)	* (4)	* (4)	* (3)
03	Mon	28.3 (6)	* (3)	* (1)	* (1)	* (1)
04	Thu	31.3 (11)	27.6 (7)	* (4)	* (4)	* (3)
04	Fri	19.2 (11)	14.9 (7)	* (4)	* (4)	* (3)
05	Fri	13.8 (8)	12.5 (5)	* (3)	* (3)	* (2)
06	Sat	28.4 (13)	25.4 (8)	24.8 (5)	27.8 (5)	* (4)
07	Thu	15.8 (12)	16.5 (8)	5.5 (5)	12.2 (5)	* (4)
08	Mon	21.2 (13)	20.4 (8)	13.0 (5)	19.8 (5)	* (4)
09	Wed	40.2 (11)	34.8 (7)	34.0 (5)	* (3)	* (3)
10	Fri	19.8 (9)	17.3 (6)	* (4)	* (3)	* (2)
11	Tue	* (13)	* (2)	* (1)	* (1)	* (1)
12	Thu	12.4 (6)	* (4)	* (2)	* (2)	* (2)
13	Thu	13.6 (13)	10.3 (8)	9.8 (5)	11.4 (5)	* (4)
13	Fri	8.4 (7)	5.2 (5)	* (3)	* (3)	* (2)
14	Mon	16.1 (10)	13.8 (7)	* (4)	* (4)	* (3)
15	Thu	23.1 (5)	* (3)	* (2)	* (2)	* (1)

Note: Figures in brackets indicate number of independent sampling periods for which data was available.

* Too few values to justify calculation.

Figure 9: Effects of Sample Count Duration on Coefficient of Variation for Pavement Flows: 0920-1150 Analysis Period

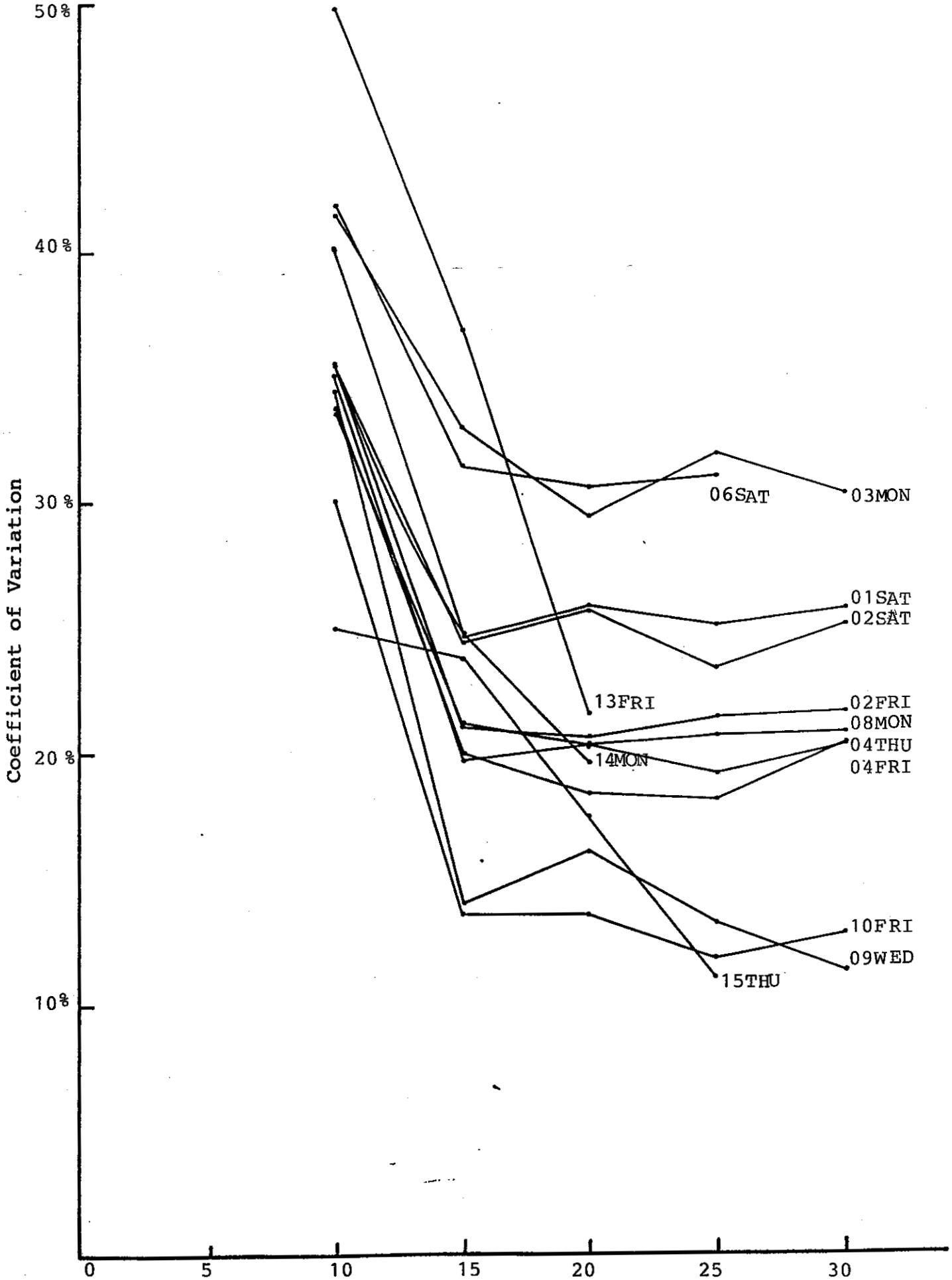


Fig 10: Effects of Sample Count Duration on Coefficient of Variation for Pavement Flows: 1150-1440 Analysis Period

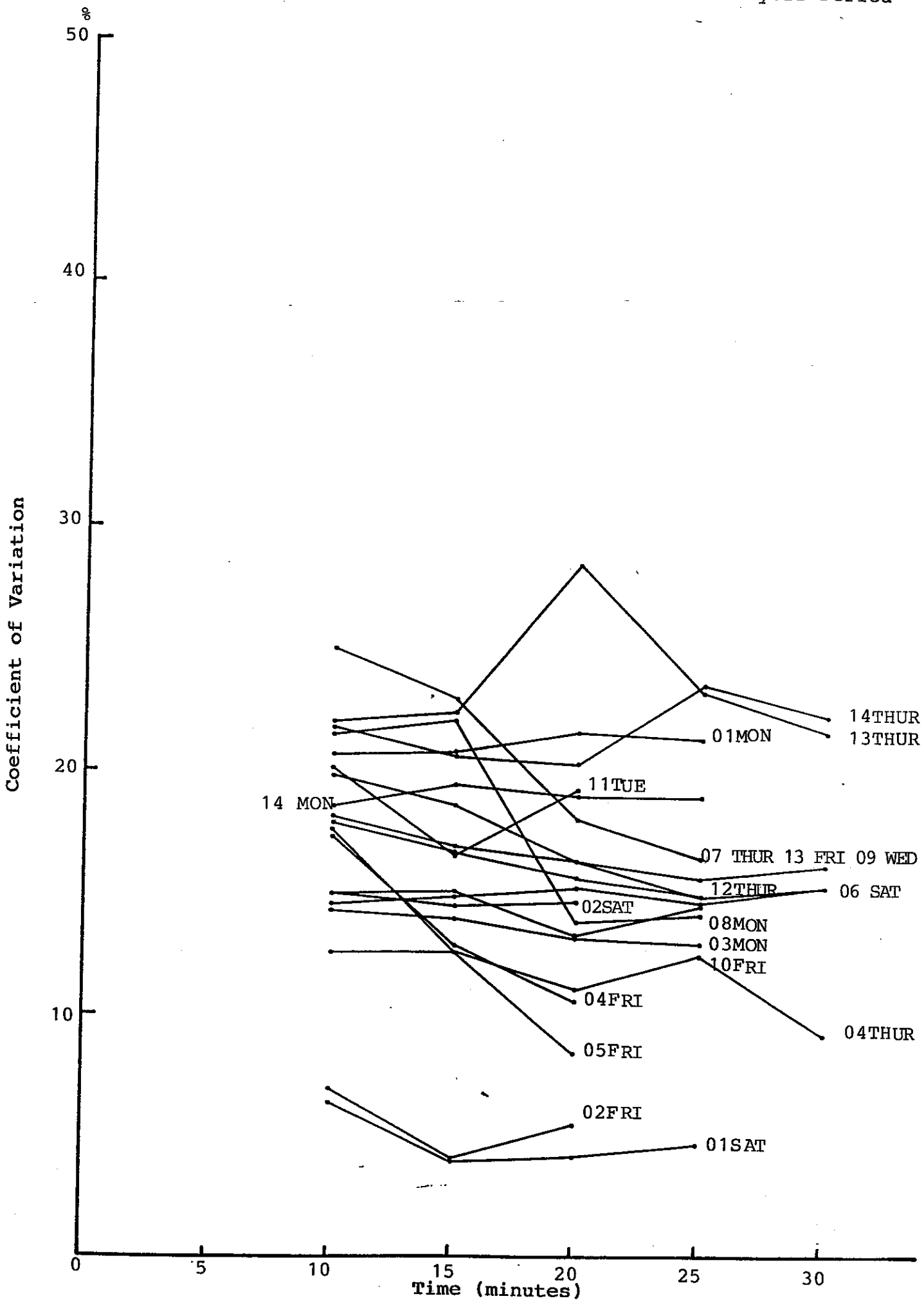
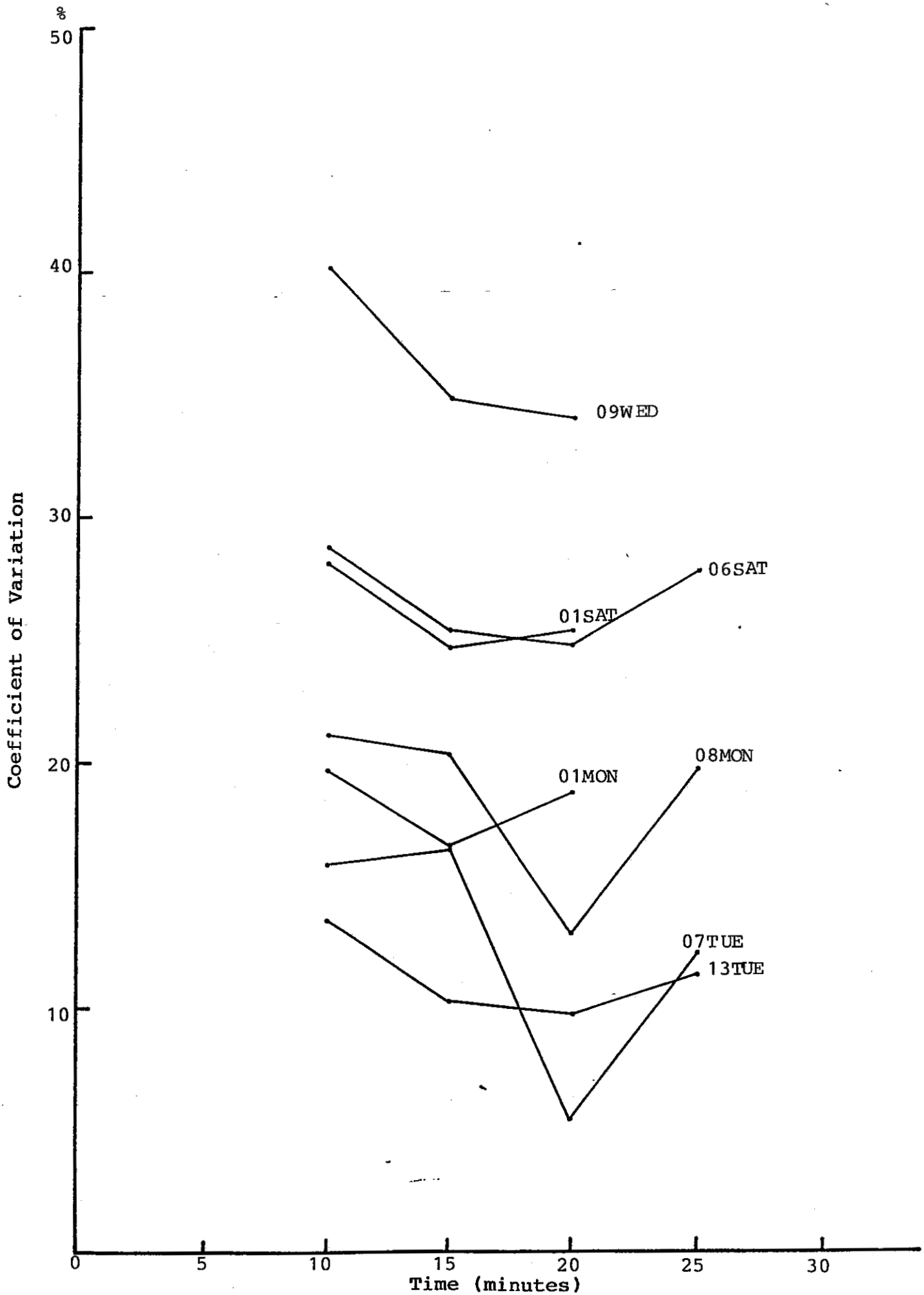


Fig 11: Effects of Sample Count Duration on Coefficient of Variation for Pavement Flows: 1440-1650 Analysis Period



5.4 Comparison of Manual and Video Data

Table 10 compares the manual and video counts of pavement flow for each site and analysis period. Assuming that the video count is correct, the percentage error of the manual count has been calculated. Over all sites the manual count underestimated the video count by 9%. However, this includes some extreme over- and under-estimates. Most of these are at low flows and may be due to errors in start times for counts. This seems the most obvious reason for the extreme errors at Lanark and Manchester. Excluding these, the bulk of the observations are within ± 30% of the video count and on average represent a 6% undercount.

If the video analysis is to be taken as a bench mark against which to assess the accuracy of manual count data we should also consider possible inaccuracies caused by fatigue etc. which may creep into the video data analysis. Table 11 shows, for each of the validation sites, how counts for the same period varied over three recounts. Overall an average variation from the initial count of ± 2.2% was observed with a maximum variation of 7.5% occuring in a count of the Coventry site. It appears therefore that the video counts can be treated as sufficiently accurate, but that manual methods may introduce substantial over- or under-estimates.

5.5 Expansion Factors for Manual and Video Data

As indicated in Section 3, by observing the total number of persons on street from video film in a given time slice and by taking a sample period count within that period an expansion factor can be derived by dividing the total count by the sample count. Expansion factors have been derived for both manual and video sample counts, despite the demonstrated inaccuracy of manual counts, because the latter are often likely to be the only source of data. In both cases the video count for the analysis period has been used as the estimated total count.

Table 12 shows these expansion factors for all 15 sites combined. Tables 13, 14 and 15 explain in more detail the expansion factors for the three time slices 0920 - 1150, 1150 - 1440 and 1440 - 1650 respectively.

Tables 13-15 show considerable variation in the best fit expansion factors between sites. To check whether this variation could be explained by site classification, averages for all three sites in each of the original classifications were obtained, as shown in Table 16. Those for Saturdays are obtained from one site only in each case. Table 17 tests the expansion factors for the two study sites in each classification by comparing them with the validation site. This exercise could only be performed for weekday data. As might be expected the video data shows a better fit, but even here several classes and analysis periods have errors in excess of 50%. It must be concluded that there is no justification for using a value other than the average for all sites combined, as shown in Tables 13-15.

Table 10

Comparison of Manual and Video Pavement Flow Data by Analysis Period

Site		Analysis Period								
		M	V	% error	M	V	% error	M	V	% error
01	Chesterfield	276	386	- 28	374	409	- 9	394	424	- 7
02	Sheffield	1276	1535	- 17	1412	1136	+ 24	1310	1876	- 30
03	Lanark	236	76	+211	189	112	+ 68	90	86	+ 5
04	Hebden Bridge	53	53	0	77	69	+ 12	70	78	- 10
05	Kilmarnock	172	218	- 21	229	242	- 5	262	297	- 12
06	Aberdeen	566	755	- 25	1166	954	+ 22	1257	1292	- 3
07	Lewisham	142	*	*	266	297	- 10	291	514	- 43
08	Epsom	302	308	- 2	510	440	+ 16	105	344	- 69
09	Winchester	100	124	- 19	135	148	- 9	68	119	- 43
10	Guildford	330	459	- 28	553	568	- 3	390	481	- 19
11	Twickenham	88	104	- 15	167	141	+ 18	124	97	+ 27
12	Bristol	96	331	- 71	270	782	- 65	236	431	- 45
13	Manchester	309	150	+106	653	402	+ 62	519	454	+ 14
14	Coventry	100	161	- 38	369	252	+ 46	134	254	- 47
15	Hazel Grove	134	103	+ 30	174	146	+ 19	123	118	+ 4
Overall Totals		4180	4763	- 12	6544	6098	+ 7	5373	6865	- 22

Note: M = Manual Count) 20 minutes duration
V = Video Count)
% = 100 (M-V)/V

Table 11

Accuracy of Video Counts

(Validation Sites)

Site	Date	Time (24 Hr Clock)	20 Minute Video Count	Re-counts A	Re-counts B	Re-counts C	Average Variation %
Large Urban Active							
12 Bristol	20/11/86	1200	782	785	763	760	2.26
Large Urban Depressed							
13 Coventry	24/11/86	1200	252	240	233	248	4.63
Small Urban Historic							
10 Guildford	14/11/86	1200	568	566	566	561	0.61
Small Urban Other							
08 Epsom	10/11/86	1200	440	443	441	434	0.66
District Centre							
15 Hazel Grove	27/11/86	1200	146	154	145	149	2.74

Mean Variation = 2.18%

Table 12

Expansion Factors by Period of Day
and Type of Count for Pavement Flows : All Sites

	PERIOD		
All Sites (All Days)	0920-1150	1150-1440	1440-1650
Manual Counts	9.9	8.6	5.8
Video Counts	7.9	9.3	4.3
All Sites (Weekdays)			
Manual Counts	9.0	8.3	5.5
Video Counts	7.5	9.4	4.1
All Sites (Saturdays)			
Manual Counts	14.5	10.1	7.4
Video Counts	10.0	8.8	5.3

Table 13

PAVEMENT FLOW: EXPANSION FACTORS

TIME PERIOD: 0920 - 1150

EXPECTED EXPANSION FACTOR: 8.7 *

Site		Total Period Count (Video)	Manual Count **	Using Expected Expansion Factor	Error (%)	Best Fit Expansion Factor	Video Count **	Using Expected Expansion Factor	Error (%)	Best Fit Expansion Factor
01	Chesterfield (1)(s)	3402	276	2401	- 29	12.3	386	3358	- 2	8.8
	(2)	718	106	922	+ 28	6.8	240	2088	+190	3.0
02	Sheffield (1)	12281	1276	11101	- 10	9.6	1535	13355	+ 8	8.0
	(2)(s)	10245	701	6099	- 30	14.6	1161	10101	- 2	8.8
03	Lanark	700	236	2053	+ 85	3.0	78	679	- 4	8.9
04	Hebden Bridge (1)	444	53	461	+ 3	8.4 ***	43	374	- 23	10.3 ***
	(2)	447	53	461	+ 3	8.4	46	400	- 15	9.7
05	Kilmarnock	748	172	1496	+100	4.4	218	1897	+153	3.4
06	Aberdeen (s)	9405	566	4924	- 48	16.6	755	6569	- 61	12.5
07	Lewisham	306	142	1235	+303	2.2 ***		MISSING DATA		
08	Epsom	2572	302	2627	+ 2	8.5	308	2680	+ 4	9.4
09	Winchester	730	100	870	+ 20	7.3	124	1079	+ 48	5.9
10	Guildford	3235	330	2871	- 11	9.8	459	3993	+ 24	7.1
11	Twickenham	638	88	766	+ 20	7.3	104	905	+ 41	6.1
12	Bristol	2541	96	835	- 67	36.8	331	2880	+ 13	7.7
13	Manchester (1)	1206	309	2688	+123	3.9	150	1305	+ 8	8.0
	(2)	1426	298	2593	+ 82	4.8	156	1357	- 6	9.1
14	Coventry	1501	100	870	- 42	15.0	161	1401	- 10	9.3
15	Hazel Grove	730	134	1166	+ 60	5.5	103	896	+ 23	7.1
										Av. 7.9

Note:
- * From Pilot Data (Av. 2 days)
- ** 20 minute classified count : from 1000 to 1020
- *** Possibly affected by poor weather
- (s) Saturday
- (1) Day 1 of 2 days data
- (2) Day 2 of 2 days data

Table 14

PAVEMENT FLOW: EXPANSION FACTORS

TIME PERIOD: 1150 - 1440

EXPECTED EXPANSION FACTOR: 10.0 *

Site		Total Period Count (Video)	Manual Count **	Using Expected Expansion Factor	Error (%)	Best Fit Expansion Factor	Video Count **	Using Expected Expansion Factor	Error (%)	Best Fit Expansion Factor
01	Chesterfield (1)(s)	3240	374	3740	+ 15	8.7	409	4090	+ 26	7.9
	(2)	2190	401	4010	+ 83	5.5	224	2240	+ 2	9.8
02	Sheffield (1)	19282	1412	14120	- 27	13.7	1136	11360	- 41	17.0
	(2)(s)	14894	1109	11090	- 26	13.4	1684	16840	+ 13	8.9
03	Lanark	993	189	1890	+ 90	5.3	112	1120	+ 13	8.9
04	Hebden Bridge (1)	603	77	770	+ 28	7.8	69	690	+ 14	8.7
	(2)	626	97	970	+ 55	6.5	67	670	+ 7	9.3
05	Kilmarnock	748	229	2290	+206	3.3	80	800	+ 7	9.3
06	Aberdeen (s)	9405	1166	11660	+ 24	8.1	954	9540	+ 1	9.9
07	Lewisham	2665	266	2660	0	10.0	297	2970	+ 11	9.0
08	Epsom	3269	510	5100	+ 56	6.4	440	4400	+ 35	7.4
09	Winchester	1543	135	1350	- 13	11.4	148	1480	- 4	10.4
10	Guildford	4539	553	5530	+ 22	8.2	568	5680	+ 25	8.0
11	Twickenham	1153	167	1670	+ 45	6.9	141	1410	+ 22	8.2
12	Bristol	5799	270	2700	- 53	21.5	782	7820	+ 35	7.4
13	Manchester (1)	5075	653	6530	+ 29	7.8	402	4020	- 21	12.6
	(2)	5556	761	7610	+ 37	7.3	531	5310	- 4	10.5
14	Coventry	968	369	3690	+281	2.6	252	2520	+160	3.8
15	Hazel Grove	1471	174	1740	+ 18	8.5	146	1460	0	10.1
										Av. 9.3

Note:
* From Pilot Data (Av. 2 days)
** 20 minute classified count : from 1000 to 1020
(s) Saturday
(1) Day 1 of 2 days data
(2) Day 2 of 2 days data

Table 15

PAVEMENT FLOW: EXPANSION FACTORS

TIME PERIOD: 1440 - 1650

EXPECTED EXPANSION FACTOR: 7.4 *

Site		Total Period Count (Video)	Manual Count **	Using Expected Expansion Factor	Error (%)	Best Fit Expansion Factor	Video Count **	Using Expected Expansion Factor	Error (%)	Best Fit Expansion Factor
01	Chesterfield (1)(s)	2298	394	2916	+ 27	5.8	424	3138	+ 37	5.4
	(2)	991	242	1791	+ 81	4.1	242	1791	+ 81	4.1
02	Sheffield (1)	9505	1310	9694	+ 2	7.3	1867	13816	+ 45	5.1
	(2)(s)	11199	999	7393	- 34	11.2	2047	15148	+ 35	5.5
03	Lanark	243	90	666	+174	2.7 ***	86	636	+162	2.8 ***
04	Hebden Bridge (1)	376	70	518	+ 38	5.4	78	577	+ 53	4.8
	(2)	416	100	740	+ 78	4.2	73	540	+ 30	5.7
05	Kilmarnock	1321	262	1939	+ 47	5.0 ***	297	2198	+ 66	4.5 ***
06	Aberdeen (s)	6377	1257	9302	+ 46	5.1	1292	9561	+ 50	4.9
07	Lewisham	1569	291	2154	+ 37	5.4	514	3804	+142	3.1
08	Epsom	1975	105	777	- 61	18.8	344	2546	+ 29	5.7
09	Winchester	493	68	503	+ 2	7.3	119	881	+ 79	4.1
10	Guildford	1872	390	2886	+ 54	4.8	418	3093	+ 65	4.5
11	Twickenham	208	124	918	+341	1.7	97	718	+245	2.1
12	Bristol	1322	236	1746	+ 32	5.6	431	3189	+141	3.1
13	Manchester (1)	2939	519	3841	+ 31	5.7	454	3360	+ 14	6.5
	(2)	1836	757	5602	+205	2.4	491	3633	+ 98	3.7
14	Coventry	443	134	992	+124	3.3	254	1880	+324	1.7
15	Hazel Grove	493	123	910	+ 85	4.0	118	873	+ 77	4.2
										Av. 4.3

Note:
- * From Pilot Data (Av. 2 days)
- ** 20 minute classified count : from 1000 to 1020
- *** Possibly affected by poor weather
- (s) Saturday
- (1) Day 1 of 2 days data
- (2) Day 2 of 2 days data

Table 16

MEAN EXPANSION FACTORS FOR PAVEMENT FLOW
BY SITE CLASSIFICATION (ALL SITES)

Period		Classification				
		LUA	LUD	SUH	SUO	DC
Weekdays						
0920 - 1150	M	15.2	8.9	6.7	6.5	7.4
	V	8.3	8.7	7.3	4.9	8.3
1150 - 1440	M	12.2	8.8	8.3	5.1	7.4
	V	10.2	9.9	9.1	8.6	9.1
1440 - 1650	M	4.6	5.3	4.9	9.3	3.8
	V	4.4	3.3	3.8	4.8	4.2
Saturdays						
0920 - 1150	M	16.6	14.6		12.3	
	V	12.5	8.8		8.8	
1150 - 1440	M	8.1	13.4		8.7	
	V	9.9	8.8		7.9	
1440 - 1650	M	5.1	11.2		5.8	
	V	4.9	5.5		5.4	

Note:
M = Manual Count
V = Video Count
LUA = Large Urban Active
LUD = Large Urban Depressed
SUH = Small Urban Historic
SUO = Small Urban Other
DC = District Centre

Table 17

PAVEMENT FLOW EXPANSION FACTORS FOR STUDY SITES AND VALIDATION SITES BY SITE CLASSIFICATION

Period		Classification														
		IIA			IID			SUH			SUO			DC		
		1	2	%	1	2	%	1	2	%	1	2	%	1	2	%
Weekdays																
0920-1150	M	4.4	36.8	+736	5.9	15.0	+154	5.2	9.8	+ 90	5.6	8.5	+ 52	7.9	5.5	- 30
	V	8.6	7.7	- 11	8.0	9.3	+ 16	7.4	7.1	- 4	3.2	8.4	+163	8.1	7.1	- 12
1150-1440	M	7.6	21.5	+182	11.8	2.6	- 78	8.4	8.2	- 2	4.4	6.4	+ 45	7.5	8.5	- 13
	V	11.5	7.4	- 36	13.0	3.8	- 71	9.2	8.0	- 13	9.6	7.4	- 23	8.7	10.1	+ 16
1440-1650	M	4.1	5.6	+ 37	6.4	3.3	- 48	5.0	4.8	- 4	4.6	18.8	+309	3.8	4.0	+ 5
	V	5.2	3.1	- 40	4.1	1.7	- 59	3.5	4.5	+ 29	4.3	5.7	+ 33	4.2	4.2	0

NB:
M = Manual Count
V = Video Count
IIA = Large Urban Area
IID = Large Urban Depressed
SUH = Small Urban Historic
SUO = Small Urban Other
DC = District Centre
1 = Mean Value from Two Study Sites
2 = Validation Site
% = Percentage Difference Between 1 and 2

5.6 Validation by Survey Day

The collection of data on two days enabled 20 minute sample counts on day 2 to be tested as estimators of flows in the relevant analysis period for day 1. Since the expansion factor derived from day 1 would be used for this exercise, the test becomes simply a comparison of the 20 minute sample counts on the two days. Table 18 shows this comparison, based on video data, for each site, grouped by classification.

The day 2 pavement flow data underestimates overall day 1 data by about 4%. However site to site variation is between +48% and -59%. When comparing midweek flows the daily variation is usually small, although even here some substantial variations are obtained (e.g. sites 03, 13, 14). The way in which our data was collected over two consecutive days does not lend itself to rigorous day to day comparison. To facilitate this form of analysis further data would need to be collected allowing in the initial stages a day of the week comparison with like days over an extended perod.

5.7 Seasonal Variation

Further count data was collected in Lewisham, Manchester and Hebden Bridge for one day at each site in either February or March 1987. This data enables a seasonal comparison to be made as shown in Table 19. In Hebden Bridge no variation in flows was observed. A difference of only 1% was recorded between the two survey periods, taken on the same weekday. In Manchester the March survey revealed an 8% fall compared to the original survey data. This is possibly due to the effects of the Christmas period where, because Manchester was originally surveyed in late November, inflated Christmas flows may have distorted the normal picture. In Lewisham, results are not so encouraging. The February data shows a 125% increase over the earlier period. No particular reason is apparent; weather conditions may however have reduced pedestrian numbers on both occasions.

5.8 Pedestrian Classification

Table 20 describes the manual count classification of pedestrians by site for all times on all survey days. For all sites 41% of pedestrians are male and 59% female. The range across all sites is 41% $\pm$ 6% male; there is no obvious pattern to the inter-site differences.

15% of the population are young (< 18 yrs) with a range of $\pm$ 6%; again there is no obvious pattern to the inter-site differences. 13% of the population are elderly (> 65 yrs). Here the range is much greater with only 2% at Aberdeen and over 20% at Chesterfield, Epsom, Coventry and Hazel Grove. Otherwise the ranges 12% $\pm$ 6%. Appendix 4 provides more detailed data.

Table 18

COMPARISON OF PAVEMENT FLOW DATA FOR SAMPLE PERIODS ON TWO DAYS

Site		Day 1	Day 2	Count Period								
				1000–1020			1200–1220			1500–1520		
				Day 1	Day2	% error	Day 1	Day 2	% error	Day 1	Day 2	% error
Large Urban Active												
06	Aberdeen	Sat	Mon	755	734	−3	954	1062	+11	1292	861	−33
13	Manchester	Thur	Fri	150	156	+4	402	531	+32	454	491	+8
*12	Bristol	Wed	Thur	331	–	–	782	–	–	431	–	–
Large Urban Depressed												
02	Sheffield	Fri	Sat	1535	1161	−24	1136	1684	+48	1867	2047	+10
07	Lewisham	Thur	Fri	–	–	–	297	–	–	514	314	−39
*14	Coventry	Mon	Tue	161	157	−2	252	197	−22	254	105	−59
Small Urban Historic												
03	Lanark	Mon	Tue	76	86	+13	112	155	+38	86	99	+15
09	Winchester	Wed	Thur	124	122	−2	148	139	−6	119	90	−24
*10	Guildford	Fri	Sat	459	–	–	568	–	–	481	576	+20
Small Urban Other												
01	Chesterfield	Sat	Mon	386	240	−38	409	224	−45	424	242	−43
05	Kilmarnock	Fri	Sat	218	218	0	–	298	–	297	318	+7
*08	Epsom	Mon	Tue	308	–	–	440	429	−3	344	–	–
District Centre												
04	Hebden Bridge	Thur	Fri	53	46	−13	69	67	−3	78	73	−6
11	Twickenham	Mon	Tue	104	–	–	141	105	−26	97	–	–
*15	Hazel Grove	Thur	Fri	103	103	0	146	144	−1	118	123	+4
	All sites	(all days)		340	302	−11	418	420	+1	457	445	−3

* Validation Site.

Table 19

SEASONAL VARIATION IN PAVEMENT FLOWS

(Feb 1987 cf Nov 1986)

Site	20 Min Video Count From 1000	1200	1500	All Periods
07 Lewisham				
Feb 1987	570	831	767	1598 *
Nov 1986	-	297	414	711 *
% Error	-	+ 180%	+ 85%	+ 125% *
13 Manchester				
Feb 1987	157	404	448	1009
Nov 1986	153	467	473	1093
% Error	+ 3%	- 13%	- 5%	- 8%
04 Hebden Bridge				
Feb 1987	49	70	74	193
Nov 1986	50	68	76	194
% Error	- 2%	+ 3%	- 3%	- 1%

* Two periods only.

Table 20

Manual Count Classification of Pedestrians By Site

(All Times, All Days)

Site	Males (%)				Females (%)			
	All	<18 Yrs	18-65 Yrs	>65 Yrs	All	<18 Yrs	18-65 Yrs	>65 Yrs
01 Chesterfield	36	7	23	6	64	11	38	15
02 Sheffield	35	9	20	6	65	12	43	10
03 Lanark	38	12	21	5	62	8	49	5
04 Hebden Bridge	46	9	32	5	54	7	43	4
05 Kilmarnock	37	6	27	4	63	12	47	4
06 Aberdeen	44	5	38	1	56	5	50	1
07 Lewisham	45	5	31	9	55	5	41	9
08 Epsom	43	5	27	11	57	9	38	10
09 Winchester	46	6	34	6	54	7	43	4
10 Guildford	35	4	24	7	65	5	50	10
11 Twickenham	45	4	34	7	55	6	41	8
12 Bristol	38	5	30	3	62	7	52	3
13 Manchester	42	7	32	3	58	9	44	5
14 Coventry	47	12	24	11	53	7	34	12
15 Hazel Grove	39	8	22	9	61	6	42	13
All Sites	41	7	28	6	59	8	44	7

6. Results : Crossing Flows

6.1 Total Counts

Counts were conducted at crossing facilities where they existed, or otherwise over the field of view (see Figure 5).

The sites with crossing facilities were:

Hebden Bridge
Kilmarnock
Lewisham
Winchester
Twickenham
Manchester
and Coventry.

The sites without planned crossing facilities were:

Chesterfield
Sheffield
Lanark
Aberdeen
Epsom
Guildford
and Bristol.

The Hazel Grove site did not allow any crossing movements across the section of road used as the survey location due to the presence of barriers along the carriageway.

Table 21 shows the magnitude of crossing movements at the 15 sites for each period of the survey day. Table 22 shows the total counts for the centres grouped into the five categories suggested in Table 1, and separately by type of crossing facility. Total counts vary substantialy from 14694 in Guildford to 281 in Hebden Bridge. There is no obvious pattern by classification, but counts are typically higher where there is no crossing facility. Crossing counts are usually lower than pavement flows (Table 6), but the reverse is the case in Lewisham, Guildford, Chesterfield and Twickenham.

Table 21

Crossing Flows By Site and Analysis Period

	Site	Day	Analysis Period 0920-1150	1150-1440	1440-1650	Total 0920-1650	Crossing Facility Y/N
01	Chesterfield	Sat	2861	3105	2056	8022	N
02	Sheffield	Fri	4812	6107	2463	13382	N
03	Lanark	Mon	315	547	127	989	N
04	Hebden Bridge	Thu	65	109	107	281	Y
05	Kilmarnock	Fri	691	909	1075	2675	Y
06	Aberdeen	Sat	680	1287	1116	3083	N
07	Lewisham	Thu	398	3523	2113	6034	Y
08	Epsom	Mon	863	1382	851	3096	N
09	Winchester	Wed	659	1241	792	2692	Y
10	Guildford	Fri	4501	6686	3507	14694	N
11	Twickenham	Tue	856	1774	285	2915	Y
12	Bristol	Thu	747	1762	404	2913	N
13	Manchester	Thu	237	631	608	1476	Y
14	Coventry	Mon	488	974	449	1911	Y
15	Hazel Grove	Thu	- No Crossing Data -				

Table 22

Crossing Flows by Site Classification and Crossing Facility

(Video Data 0920 - 1650)

		Crossing	No Crossing
Large Urban Active			
06	Aberdeen		3083 (S)
12	Bristol		2913
13	Manchester	1476	
Large Urban Depressed			
02	Sheffield		13382
07	Lewisham	6034	
14	Coventry	1911	
Small Urban Historic			
03	Lanark		989
09	Winchester	2692	
10	Guildford		14694
Small Urban Other			
01	Chesterfield		8022 (S)
05	Kilmarnock	2675	
08	Epsom		3096
District Centre			
04	Hebden Bridge	281	
11	Twickenham	2915	
15	Hazel Grove	Crossing not possible	

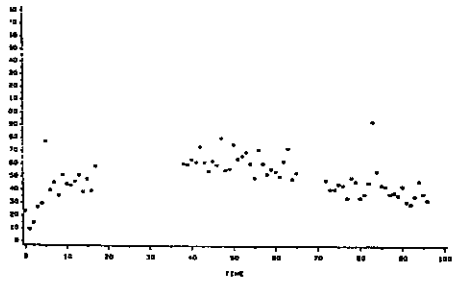
Note: (S) = Saturday.

6.2 Temporal Distributions

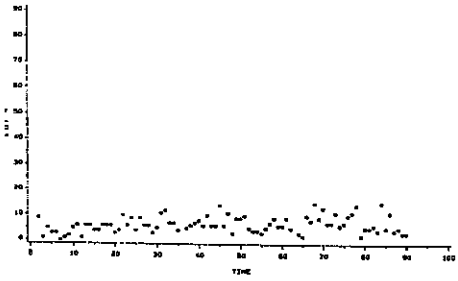
Appendix 2 gives graphical plots of the temporal distribution of crossing flows at the 14 sites at which crossing is possible. For comparison purposes, all distributions have been reproduced together in Figure 12. There appear to be two patterns. The first rises to a pronounced midday peak and falls again to a later afternoon level which is similar to that in the morning. This pattern occurs at sites 01, 02, 03, 09, 12, 13 and 14 with peak five minute flows ranging from 40 to 220. The second has a similar rise in the morning, but little or no reduction during the afternoon. This pattern can be seen in sites 05, 06, 07, 08, 10 and 14; sites 04 and 11 also exhibit it, but rather less

FIGURE 12: PEDESTRIAN TWO WAY CROSSING FLOW FOR 5 MINUTE INTERVALS BY SITE (0900-1700)

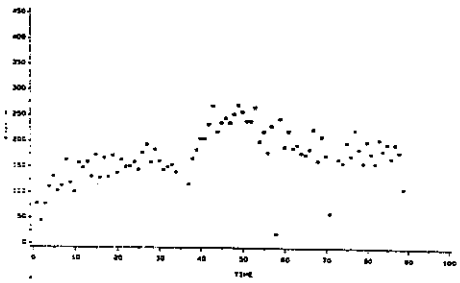
01 CHESTERFIED (20/10/86, MON) VIDEO DATA



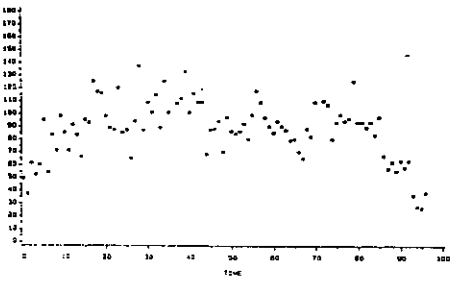
04 HEBDEN BRIDGE (31/10/86, FRI) VIDEO DATA



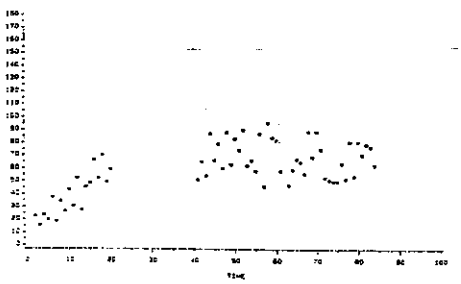
10 GUILDFORD (14/11/86, FRI) VIDEO DATA



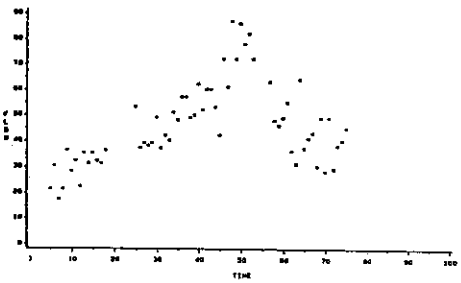
01 CHESTERFIELD (18/10/86, SAT) VIDEO DATA



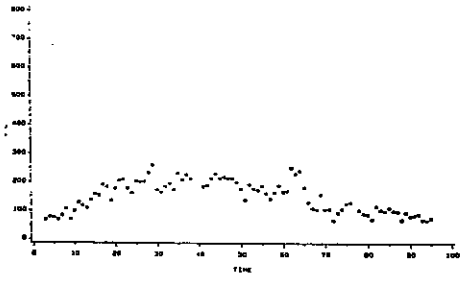
05 KILMARNOCK (31/10/86, FRI) VIDEO DATA



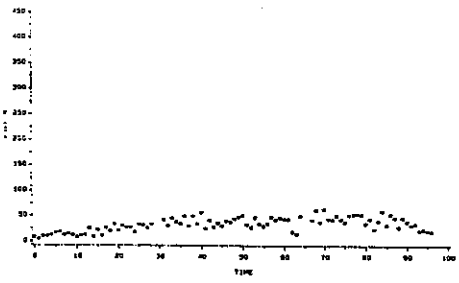
11 TWICKENHAM (18/11/86, TUE) VIDEO DATA



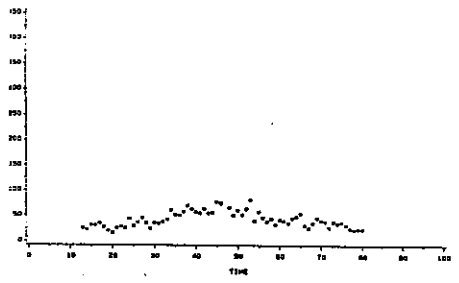
02 SHEFFIELD (24/10/86, FRI) VIDEO DATA



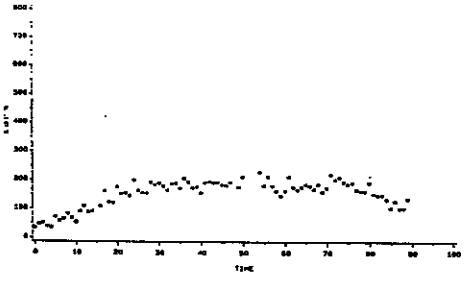
06 ABERDEEN (1/11/86, SAT) VIDEO DATA



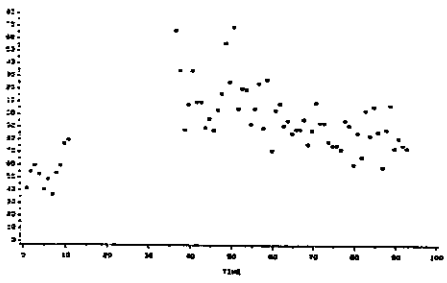
12 BRISTOL (20/11/86, THUR) VIDEO DATA



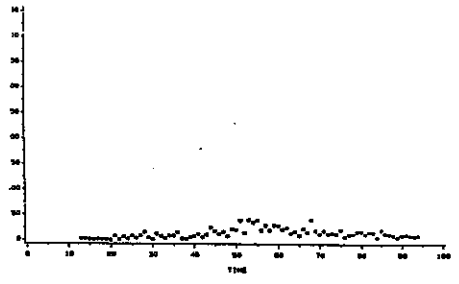
02 SHEFFIELD (25/10/86, SAT) VIDEO DATA



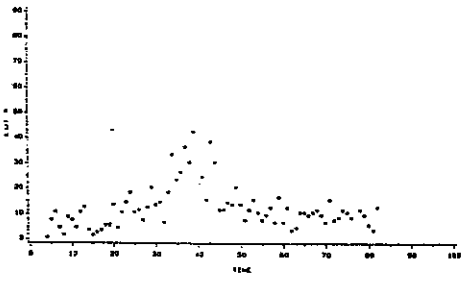
07 LEWISHAM (6/11/86, THUR) VIDEO DATA



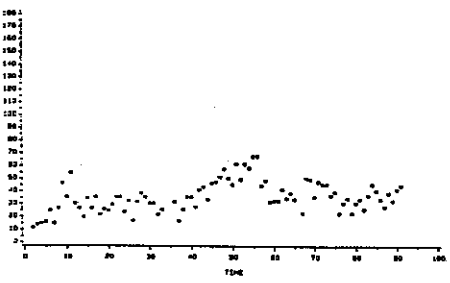
13 MANCHESTER (20/11/86, THUR) VIDEO DATA



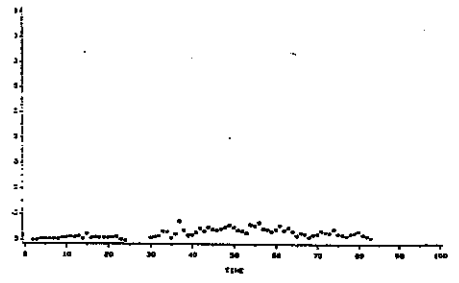
03 LANARK (27/10/86, MON) VIDEO DATA



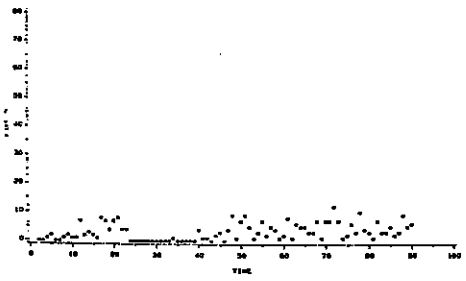
08 EPSOM (10/11/86, MON) VIDEO DATA



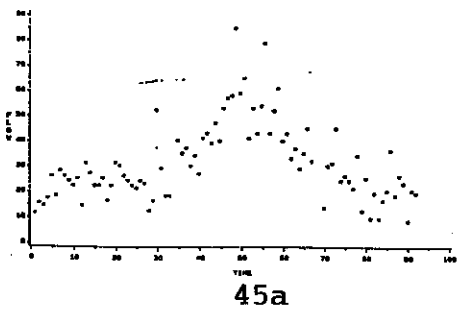
13 MANCHESTER (21/11/86, FRI) VIDEO DATA



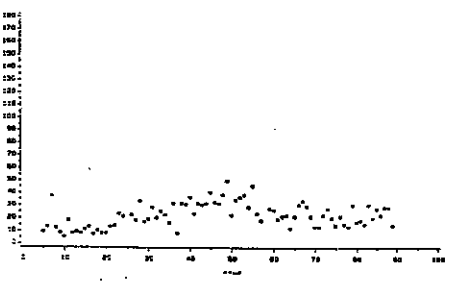
04 HEBDEN BRIDGE (30/10/86, THUR) VIDEO DATA



09 WINCHESTER (12/11/86, WED) VIDEO DATA



14 COVENTRY (24/11/86, MON) VIDEO DATA



clearly. Peak five minute flows range from 10 to 250. There appears to be no clear explanation for these different patterns.

6.3 Sampling Periods

The data provided more information on the relationship between coefficient of variation and length of sampling period. Table 23 and Figure 13 present the results for the 0920-1150 analysis period. Tables 24 and 25 and Figures 14 and 15 present the results for the 1150-1440 and 1440-1650 analysis periods respectively.

For the 0920-1150 analysis period all sites show a marked reduction in coefficient of variation for an increase in the sampling period from 10 to 15 minutes. Further increase in sampling period usually show no further improvement, except at sites 04 and 13. There is a substantial variation in coefficients of variation; only sites 01, 09 and 10 achieve levels of around 15% or less, while sites 02, 03, 06 and (for 15 but not 20 minutes) 04 and 13 have values of over 30%.

For the 1150-1440 sampling period coefficients of variation are much more uniform. Most sites show little improvement in coefficient of variation for sampling periods in excess of 15 minutes; the main exceptions to this being sites 04 and 06. Sites 01, 02, 05, 06, 07 and 10 achieve coefficients of variation of around 15% or less; only site 03 (and sites 04 and 13 on one day) have coefficients of variation in excess of 30%. The difference in coefficient of variation between days at sites 04 and 13 is however a cause for concern.

For the 1440-1650 sampling period there are fewer data for longer sampling periods but those sites which have such data again tend to demonstrate a marked reduction in coefficient of variation at 15 minutes compared with 10 minutes, with little further improvement for longer sampling periods. Sites 06 and 07 achieve coefficients of variation of around 15% or less; only one site on one day has a coefficient of variation in excess of 30%.

These results suggest that a 15 minute sampling period is sufficient for crossing flows. Coefficients of variation of 15% can be achieved at around a third of sites, and 20% at around two thirds of sites, except in the morning analysis period when values are much higher.

6.4 Comparison of Manual and Video Data

Table 26 compares the manual and video counts of crossing flow for each site and analysis period. Assuming that the video count is correct, the percentage error of the manual count has been calculated. Overall the manual counts overestimated by between 5% in the midday period and 27% in the morning period. However, these figures disguise a wide range of very substantial errors; only 12 of the 36 values are within $\pm$ 30% of the true value. There is no clear pattern to the errors, and it must be concluded that manual counts of crossing flows, at least as conducted in the study, are extremely inaccurate.

Table 23

COEFFICIENTS OF VARIATION (%) AND SAMPLING PERIODS BY SITE FOR CROSSING FLOW: 0920 - 1150 ANALYSIS PERIOD

Site	Day	Sampling Period Length (Mins) 10	15	20	25	30
01	Sat	32.0 (15)	15.3 (10)	16.4 (7)	12.1 (6)	14.7 (5)
01	Mon	44.6 (7)	*	*	*	*
02	Fri	41.1 (15)	21.7 (10)	32.8 (7)	31.6 (6)	32.6 (5)
02	Sat	45.0 (14)	37.0 (9)	40.5 (6)	41.4 (7)	*
03	Mon	54.8 (15)	44.3 (10)	44.5 (7)	45.6 (6)	43.3 (5)
04	Thu	69.4 (9)	*	*	*	*
04	Fri	49.5 (14)	36.7 (9)	24.0 (6)	23.8 (5)	*
05	Fri	51.1 (8)	37.1 (5)	*	*	*
06	Sat	47.1 (13)	39.9 (9)	30.5 (6)	32.9 (5)	*
07	Thu	*	*	*	*	*
08	Mon	36.1 (15)	20.0 (10)	24.5 (7)	21.4 (6)	12.5 (5)
09	Wed	37.6 (15)	11.6 (10)	9.9 (7)	9.9 (6)	2.1 (5)
10	Fri	30.1 (15)	11.3 (10)	11.8 (7)	10.2 (6)	10.1 (5)
11	Tue	38.2 (11)	19.9 (7)	*	*	*
12	Thu	20.5 (10)	18.4 (7)	*	*	*
13	Thu	48.4 (10)	46.7 (7)	*	*	*
13	Fri	52.1 (12)	41.0 (7)	26.1 (5)	*	*
14	Mon	51.0 (14)	38.7 (8)	43.4 (5)	*	*
15	Thu	No Crossing Data				

Note: Figures in brackets indicate number of independent sampling periods for which data was available.

* Too few values to justify calculation.

Table 24

COEFFICIENTS OF VARIATION (%) AND SAMPLING PERIODS BY SITE FOR CROSSING FLOW: 1150 - 1440 ANALYSIS PERIOD

Site	Day	Sampling Period Length (Mins) 10	15	20	25	30
01	Sat	14.0 (16)	15.2 (10)	13.5 (7)	8.8 (5)	*
01	Mon	6.9 (13)	6.7 (9)	6.9 (6)	6.3 (5)	*
02	Fri	17.7 (16)	16.7 (10)	11.6 (7)	*	*
02	Sat	6.7 (14)	4.7 (8)	2.7 (6)	*	*
03	Mon	55.1 (16)	48.5 (10)	50.9 (7)	61.6 (5)	*
04	Thu	44.7 (12)	28.4 (7)	19.1 (5)	*	*
04	Fri	28.7 (15)	19.9 (9)	14.8 (6)	*	*
05	Fri	11.8 (13)	12.6 (8)	8.3 (5)	*	*
06	Sat	17.5 (16)	15.1 (10)	9.4 (7)	5.6 (6)	8.9 (5)
07	Thu	17.5 (16)	13.4 (10)	13.3 (7)	10.9 (5)	*
08	Mon	27.9 (15)	23.8 (9)	22.4 (6)	19.8 (5)	*
09	Wed	24.9 (16)	24.0 (11)	22.6 (8)	22.8 (6)	22.7 (5)
10	Fri	18.2 (16)	16.1 (10)	15.5 (7)	13.8 (5)	*
11	Tue	23.0 (15)	23.1 (9)	20.7 (6)	*	*
12	Thu	22.3 (16)	21.1 (10)	18.8 (7)	16.0 (5)	*
13	Thu	45.6 (17)	46.8 (11)	45.1 (8)	44.3 (6)	43.8 (5)
13	Fri	30.9 (17)	21.3 (11)	18.8 (8)	14.1 (6)	16.3 (5)
14	Mon	21.0 (16)	24.0 (10)	20.9 (7)	24.1 (5)	*
15	Thu	No Crossing Data				

Note: Figures in brackets indicate number of independent sampling periods for which data was available.

* Too few values to justify calculation.

Table 25

COEFFICIENTS OF VARIATION (%) AND SAMPLING PERIODS BY SITE FOR CROSSING FLOW: 1440 - 1650 ANALYSIS PERIOD

Site	Day	Sampling Period Length (Mins) 10	15	20	25	30
01	Sat	27.7 (12)	21.5 (7)	20.8 (5)	*	*
01	Mon	25.0 (11)	17.9 (7)	19.5 (5)	*	*
02	Fri	18.4 (12)	13.5 (7)	*	*	*
02	Sat	21.7 (10)	20.7 (7)	*	*	*
03	Mon	16.0 (6)	*	*	*	*
04	Thu	39.0 (11)	26.5 (7)	*	*	*
04	Fri	41.1 (11)	31.7 (7)	*	*	*
05	Fri	13.7 (8)	18.1 (5)	*	*	*
06	Sat	20.0 (13)	12.8 (8)	10.3 (5)	13.4 (5)	*
07	Thu	10.9 (12)	7.5 (8)	2.9 (5)	5.8 (5)	*
08	Mon	16.9 (11)	16.8 (7)	*	*	*
09	Wed	30.6 (11)	29.1 (7)	28.4 (5)	*	*
10	Fri	7.0 (9)	9.9 (6)	*	*	*
11	Tue	*	*	*	*	*
12	Thu	22.5 (6)	*	*	*	*
13	Thu	22.7 (13)	18.1 (8)	15.8 (5)	20.1 (5)	*
13	Fri	23.9 (7)	26.6 (5)	*	*	*
14	Mon	21.6 (10)	14.7 (7)	*	*	*
15	Thu	No Crossing Data				

Note: Figures in brackets indicate number of independent sampling periods for which data was available.

* Too few values to justify calculation.

Table 26

COMPARISON OF MANUAL AND VIDEO CROSSING FLOW DATA
BY ANALYSIS PERIODS

	Site		Analysis Period 1000-1020			1200-1220			1500-1520		
			M	V	% error	M	V	% error	M	V	% error
01	Chesterfield	C	312	341	- 9	289	458	- 37	302	357	- 15
02	Sheffield	C	419	569	- 24	357	443	- 19	440	715	- 38
03	Lanark	C	89	33	+170	106	111	- 5	84	69	+ 22
04	Hebden Bridge	C	39	19	+105	40	40	0	71	22	+223
05	Kilmarnock	C	37	190	- 81	26	90	- 63	340	314	+ 8
06	Aberdeen	C	447	171	+161	409	224	+ 82	528	209	+153
07	Lewisham	C	*	*	*	*	498	*	*	558	*
08	Epsom	C	242	140	+ 73	368	145	+154	382	267	+ 43
09	Winchester	C	64	106	- 40	144	132	+ 89	144	254	- 43
10	Guildford	C	*	596	*	*	675	*	*	1013	*
11	Twickenham	C	161	160	+ 1	100	222	- 55	132	322	- 59
12	Bristol	C	520	116	+348	519	304	+ 71	501	299	+ 68
13	Manchester	C	488	499	- 2	565	631	- 10	605	567	+ 7
14	Coventry	C	212	45	+371	133	99	+ 34	227	86	+164
15	Hazel Grove	C		NONE			NONE			NONE	
Comparative Totals		C	3030	2389	+ 27	3056	2899	+ 5	3756	3483	+ 8

NB: M = Manual Count) 20 minutes duration
V = Video Count)
% Error = '+' indicated video exceeds manual count
C = Crossing Flow
* = Missing Data

Fig 13: The Effects of Sample Count Duration on Coefficient of Variation for Crossing Flows: 0920-1150 Analysis Period

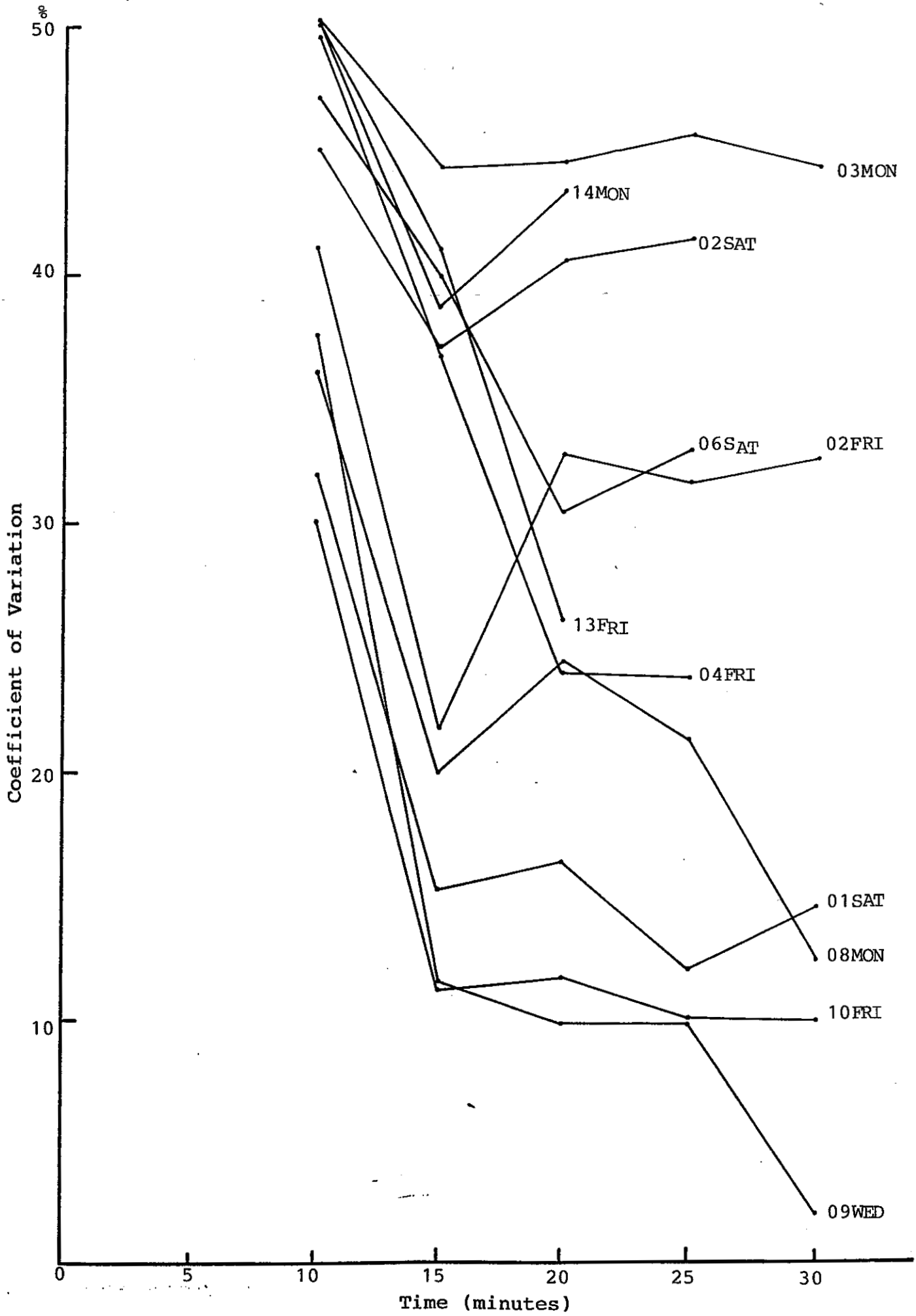


Fig 14: Effects of Sample Count Duration on Coefficient of Variation for Crossing Flows: 1150-1440 Analysis Period

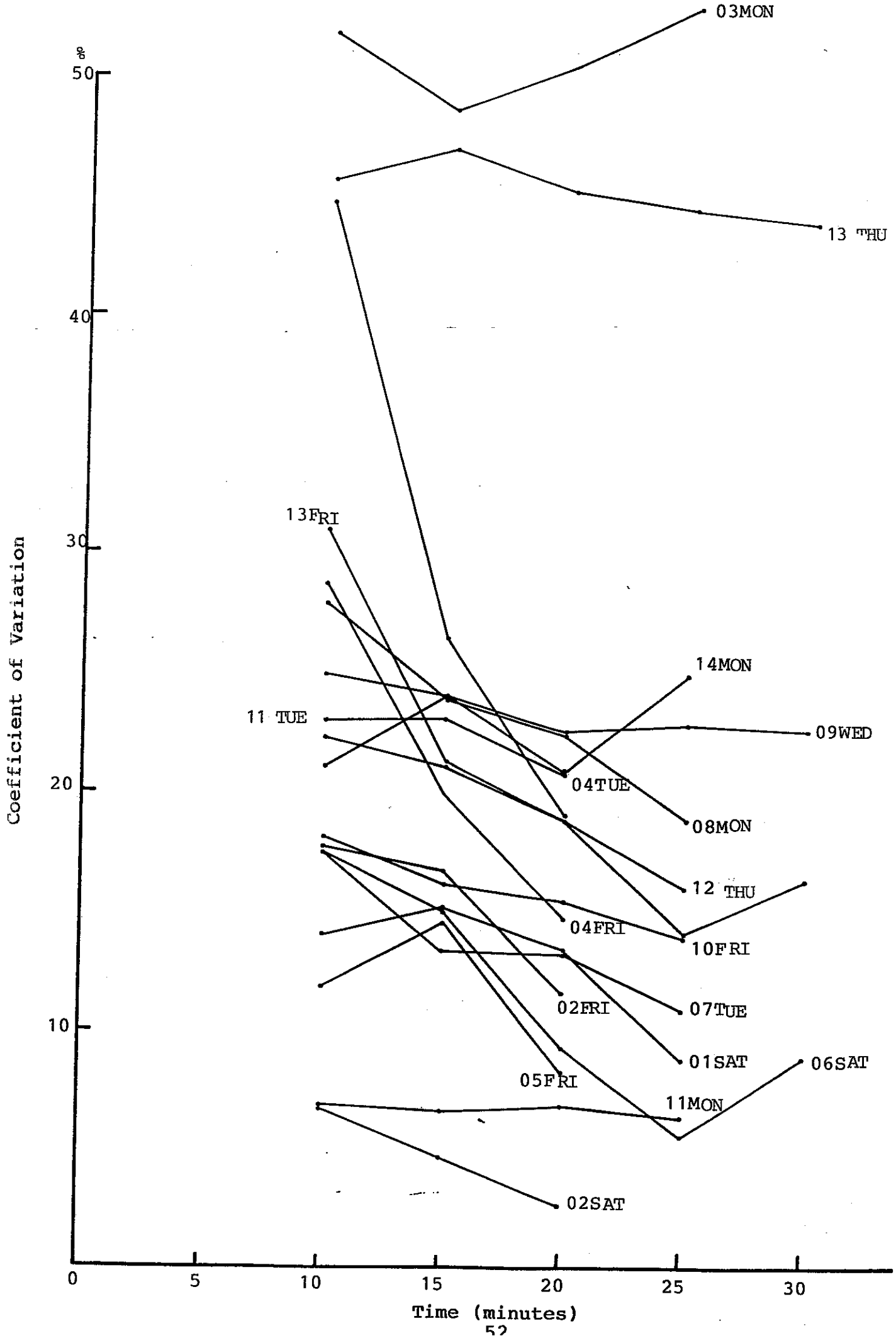
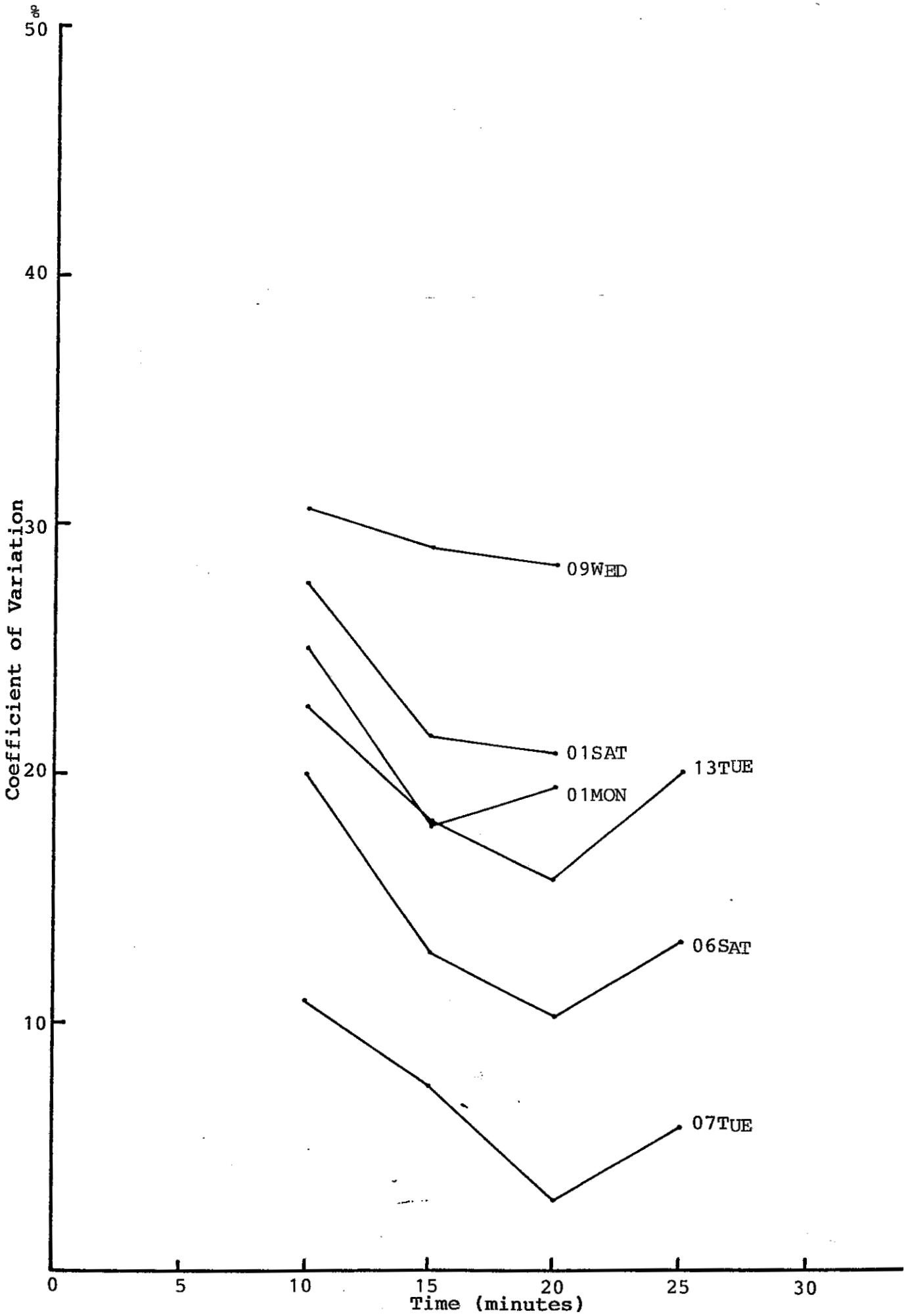


Fig 15: Effects of Sample Count Duration on Coefficient of Variation for Crossing Flows: 1440-1650 Analysis Period



6.5 Expansion Factors for Video Data

Given the errors in the manual data, expansion factors have only been derived for the video data. Tables 27-29 present the expansion factors by site for each of the three analysis periods. Table 30 presents a summary by site classification.

For the 0920-1150 analysis period the average expansion factor is 7.1, which is close to the ratio of total period to sample period. However, there is considerable scatter about this value, with three sites having factors of 4.0 or less. A similar result occurs for the midday analysis period, where the average expansion factor is 8.5. For the 1440-1650 analysis period the average expansion factor at 3.8 is much lower than that which would be derived from the ratio of analysis to sample period, but there is less scatter in the results. All three average expansion factors are slightly lower than those derived for pavement flows.

When compared by site type it appears that the large urban active centres have lower expansion factors and the large urban depressed ones higher factors. However, there does not appear to be a strong case for employing other than the overall average values, and it is clear that the confidence limits on using these values are quite wide.

Table 27

EXPANSION FACTORS FOR CROSSING FLOWS:
VIDEO DATA FOR ANALYSIS PERIOD 0920-1150

Site		Day	Total Count	Video Sample Count	Expansion Factor
01	Chesterfield	SAT	2861	341	8.4
02	Sheffield	FRI	4812	569	8.5
03	Lanark	MON	315	33	9.5
04	Hebden Bridge	THU	65	19	3.4
05	Kilmarnock	FRI	691	190	3.6
06	Aberdeen	SAT	680	171	4.0
07	Lewisham	THU	(398)	*	*
08	Epsom	MON	863	140	6.2
09	Winchester	WED	659	105	6.3
10	Guildford	FRI	4501	596	7.6
11	Twickenham	TUE	856	160	5.4
12	Bristol	THU	747	116	6.4
13	Manchester	THU	*	(499)	*
14	Coventry	MON	488	45	10.8
	Total		17538	2485	7.1

* Missing Data.

Table 28

EXPANSION FACTORS FOR CROSSING FLOWS:
VIDEO DATA FOR ANALYSIS PERIOD 1150-1440

Site		Day	Total Count	Video Sample Count	Expansion Factor
01	Chesterfield	SAT	3105	458	6.8
02	Sheffield	FRI	6107	443	13.8
03	Lanark	MON	547	111	4.9
04	Hebden Bridge	THU	109	40	2.7
05	Kilmarnock	FRI	909	90	10.1
06	Aberdeen	SAT	1287	224	5.7
07	Lewisham	THU	3523	498	7.1
08	Epsom	MON	1382	145	9.5
09	Winchester	WED	1241	132	9.4
10	Guildford	FRI	6686	675	9.9
11	Twickenham	TUE	1774	222	8.0
12	Bristol	THU	1762	304	5.8
13	Manchester	THU	*	(631)	*
14	Coventry	MON	974	99	9.8
	Total		29406	3441	8.5

* Missing Data.

Table 29

EXPANSION FACTORS FOR CROSSING FLOWS:
VIDEO DATA FOR ANALYSIS PERIOD 1440-1650

Site		Day	Total Count	Video Sample Count	Expansion Factor
01	Chesterfield	SAT	2056	357	5.8
02	Sheffield	FRI	2463	715	3.4
03	Lanark	MON	127	69	1.8
04	Hebden Bridge	THU	107	22	4.9
05	Kilmarnock	FRI	1075	314	3.4
06	Aberdeen	SAT	1116	209	5.3
07	Lewisham	THU	2113	558	3.8
08	Epsom	MON	851	267	3.2
09	Winchester	WED	792	254	3.1
10	Guildford	FRI	3507	1013	3.5
11	Twickenham	TUE	*	(322)	*
12	Bristol	THU	*	(299)	*
13	Manchester	THU	*	(567)	*
14	Coventry	MON	449	86	5.2
	Total		14656	3864	3.8

* Missing Data.

Table 30

EXPANSION FACTORS FOR CROSSING FLOWS BY SITE TYPE AND ANALYSIS PERIOD

Analysis Period	Site Type				
	LUA	LUD	SUH	SUD	DC
0920 - 1150	5.0	8.6	7.5	2.7	5.1
1150 - 1440	5.8	10.2	9.2	7.8	7.2
1440 - 1650	3.4	3.7	3.3	4.2	4.9

Key:
LUA = Large Urban Active
LUD = Large Urbran Depressed
SUH = Small Urban Historic
SUD = Small Urban Depressed
DC = District Centre

7. Results : Pavement Concentration

7.1 Analysis of Pilot Data

As noted in Section 3, consideration of the analysis procedure for the pilot data was deferred until the main study because sampling intervals could be determined once the video record was available. Figure 16 shows the distribution of concentrations measured each 30 seconds for the pilot data. The concentration values have been grouped into three of Pushkarev's levels of service (Pushkarev, 1975; May et al, 1985) which are defined as:

A	0	-	0.2	peds/sq.m	open flow
B	0.2	-	0.4	peds/sq.m	unimpeded flow
C	0.4	-	1.0	peds/sq.m	dense flow
D	1.0	-	2.0	peds/sq.m	jammed flow

It can be seen that concentration levels fluctuate considerably, but never exceed level of service A before 1220, and even after then are more predominantly level of service A, with a small number of values at level B, and none at level C.

A test was made of the effects of different sampling intervals on the mean, standard deviation and percentage of observations above 0.2 peds/sq.m., as shown in Table 31. There was no significant difference between the estimated means, and the percentages at level of service B were in all cases very small. However, there was a marked reduction in the standard deviation at a 20 minute sampling interval. It appeared from this analysis unlikely that frequent measurements of concentration would be justified, and it was decided to base further analysis on measurements taken every 10 minutes. Even so it was felt that the fluctuations would make the analysis of concentration difficult, and it was decided instead to develop cumulative distributions of concentration for each of the three analysis periods as well as considering overall means.

Table 31

Parameters of the Distribution of Pedestrian Concentrations for Different Sampling Intervals

Sampling Interval	Mean (peds/m^2)	Standard Deviation (peds/m^2)	CV (%)	% > 0.2 peds/m^2
30 secs	0.056	0.040	71	0.4
1 min	0.059	0.040	68	0.2
5 mins	0.060	0.041	68	0
10 mins	0.067	0.038	57	0
20 mins	0.067	0.033	49	0

7.2 Distributions of Concentration

Table 32 indicates the percentage of concentration measurements in each 0.05 peds/sq m range for the three analysis periods at each of the 15 sites.

It can be seen that only seven of the sites have any concentration values at level of service B, and only three of the sites have 20% or more of the observations in any period at this level. While ten of the sites have their highest concentrations in the midday period, sites 01 and 08 have their highest concentrations in the morning, and sites 06, 11 and 15 in the afternoon.

The levels recorded appear generaly lower than might be expected from observations of the video film, which also indicates that pedestrians in practice only make use of part of the pavement. This suggests the use instead of effective pavement width as a basis for measuring concentration.

7.3 Effective Pavement Width

There is little information in the literature on the extent to which pavement width is unused, but observations of the video suggested that it was common for up to 1 m of pavement to be unused. For simplicity, concentrations were recalculated for an effective pavement width 0.5 m or 1 m less than actual width, the choice between these being based on observation of the video. Table 33 indicates the values used and the resulting mean pavement concentration.

Fig. 16 PEDESTRIAN LEVELS OF SERVICE: MANCHESTER PILOT DATA, PAVEMENT 3

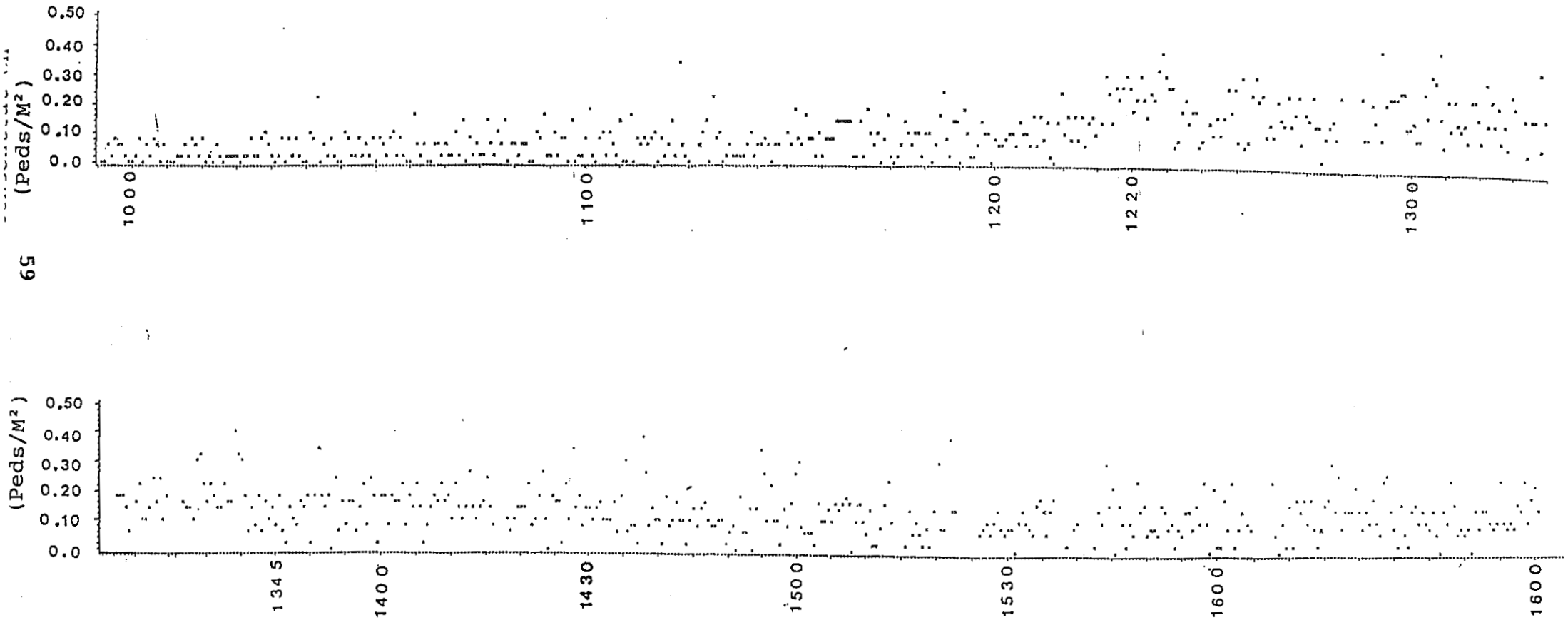


Table 32

Distribution of Pavement Concentrations

Site	Pavement Width (m)	Period	Percentage of Observations with Concentration (peds/sq m) and level of service A/B				
			0.00-0.05 A	0.05-0.10 A	0.10-0.15 A	0.15-0.20 A	> 0.20 B
01 Chesterfield (Sat)	3	0920-1150	7	26	48	19	
		1150-1440	3	32	53	12	
		1440-1650	4	54	37	4	
02 Sheffield (Fri)	6	0920-1150	35	60	5		
		1150-1440	15	30	40	15	
		1440-1650	20	31	34	14	1
03 Lanark (Mon)	3	0920-1150	71	22	7		
		1150-1440	35	38	27		
		1440-1650	64	36			
04 Hebden Bridge (Thu)	3	0920-1150	65	33	2		
		1150-1440	61	29			
		1440-1650	61	34	5		
05 Kilmarnock (Fri)	3	0920-1150	32	38	17	3	10
		1150-1440	6	23	33	23	15
		1440-1650	7	46	27		20
06 Aberdeen (Sat)	4	0920-1150	3	30	47	17	3
		1150-1440	3	3	50	36	8
		1440-1650	4	15	31	42	8
07 Lewisham (Thu)	4	0920-1150	75	25			
		1150-1440	33	48	19		
		1440-1650	67	33			
08 Epsom (Mon)	2	0920-1150	10	45	17	17	11
		1150-1440	7	44	32	17	
		1440-1650	24	57	19		
09 Winchester (Wed)	3	0920-1150	77	23			
		1150-1440	48	52			
		1440-1650	78	22			
10 Guildford (Fri)	4	0920-1150		14	27	42	17
		1150-1440			24	43	23
		1440-1650	11	31	21	16	21
11 Twickenham (Tue)	2	0920-1150	87	13			
		1150-1440	84	16			
		1140-1650	71	29			
12 Bristol (Thu)	5	0920-1150	23	32	40	5	
		1150-1440	3	23	42	20	12
		1440-1650	15	65	20		
13 Manchester (Thu)	3	0920-1150	45	34	10	8	3
		1150-1440	5	15	14	28	37
		1440-1650	13	27	18	26	16
14 Coventry (Mon)	4	0920-1150	100				
		1150-1440	85	15			
		1440-1650	95	5			
15 Hazel Grove (Thu)	2	0920-1150	74	26			
		1150-1440	72	28			
		1440-1650	50	28	22		

Table 33

Real and Effective Pavement Area

Site	Real Pavement Width (m)	Effective Pavement Width (m)	Pavement Length (m)	Real Pavement Area (m^2)	Effective Pavement Area (m^2)	Real Mean Concentration (peds/m^2)	Effective Mean Concentration (peds/m^2)
01 Chesterfield	3	2	35	105	70	0.072	0.107
02 Sheffield	6	5	50	300	250	0.049	0.059
03 Lanark	3	2.5	35	105	87.5	0.044	0.053
04 Hebden Bridge	3	2	35	105	70	0.037	0.055
05 Kilmarnock	3	2.5	20	60	50	0.097	0.117
06 Aberdeen	4	3	40	160	120	0.105	0.140
07 Lewisham	4	3.5	25	100	87.5	0.049	0.056
08 Epsom	2	1.5	45	90	67.5	0.076	0.102
09 Winchester	3	2	30	90	60	0.027	0.040
10 Guildford	4	3	25	100	75	0.125	0.167
11 Twickenham	2	1.5	40	80	60	0.022	0.030
12 Bristol	5	4	15	75	60	0.084	0.105
13 Manchester	3	2	10	30	20	0.094	0.140
14 Coventry	4	3	30	120	90	0.016	0.022
15 Hazel Grove	2	1.5	40	80	60	0.035	0.047

Appendix 3 presents the cumulative distributions for each site and for each time period, with both apparent and effective pavement concentrations.

Table 34 summarises the results, indicating the percentage of observations at level of service B for each site and analysis period. When considering effective concentration, Guildford and Manchester appear as the most crowded, with over 70% of observations in the midday period at level of service B, including occasional observations at level of service C. Chesterfield and Aberdeen register observations in excess of 30% at level of service B, and Kilmarnock, Epsom and Bristol observations in excess of 20%. All other sites except Sheffield have no observations at level B. While the midday period emerges as usually the most congested, four of the eight congested sites are more congested in either the a.m. or p.m. period.

The overall averages in Table 33 give a similar grouping of sites, but with Aberdeen included amongst the highest concentration sites, Chesterfield grouped with Kilmarnock, Epsom and Bristol, and Twickenham and Coventry having particularly low concentrations.

Table 34

Percentage of Pavement Concentration Values at Level of Service B (>0.2 peds/m^2) by Site and Analysis Period

Site		Real Concentration			Effective Concentration		
		0920-1150	1150-1440	1440 1650	0920-1150	1150-1440	1440 1650
01	Chesterfield	0	0	0	33	24	10
02	Sheffield	0	0	1	0	8	8
03	Lanark	0	0	0	0	0	0
04	Hebden Bridge	0	0	0	0	0	0
05	Kilmarnock	10	15	20	12	17	28
06	Aberdeen	3	8	8	13	33	40
07	Lewisham	0	0	0	0	0	0
08	Epsom	11	0	0	25	13	0
09	Winchester	0	0	0	0	0	0
10	Guildford	17	23	21	50	71	34
11	Twickenham	0	0	0	0	0	0
12	Bristol	0	12	0	4	28	0
13	Manchester	3	37	16	14	72	50
14	Coventry	0	0	0	0	0	0
15	Hazel Grove	0	0	0	0	0	0

8. Conclusions

8.1 Types of Count

It is important to distinguish between three different types of count:

- flow along pavements in a given time period (pavement flow)
- flow crossing roads for a given length of road and a given time period (crossing flow)
- concentration of pedestrians in a given area of pavement at a specific instant (pavement concentration).

Each provides a different measure of exposure to environmental and traffic conditions, and all may be of value in assessing pedestrian amenity.

8.2 Counting Methods

8.2.1 Pavement and Crossing Flows : Video

Counts can be made either manually or by video. Video counts are more expensive in equipment and analysis time but are highly accurate. Recounts of the same flow over a 20 minute period suggested that counts were accurate to within ± 5%. Video counts are, however, unsuitable for classification of pedestrians by age and sex unless very high resolution equipment is used. Some problems were experienced in counting flows in excess of 80 pedestrians per minute on video. Indoor sites were chosen for security purposes, but presented problems during rain or strong sunlight. Where security can be ensured, outdoor sites may be preferable.

8.2.2. Pavement and Crossing Flows : Manual

Manual counts are more labour-intensive at the time, but less expensive in terms of combined data collection and analysis costs. They are virtually essential for classification, but even manual classification is likely to be difficult at flows in excess of 60 per minute. Comparison with video counts indicated considerable error in manual counts. Of the pavement flows around two thirds of the observations were within ± 30% of the video count. For crossing flows only one third were within this range. While these inaccuracies may in part be caused by employing surveyors both to interview and count, they suggest that the irregular and unpredictable movement of pedestrians makes manual observation open to substantial error.

8.2.3 Pavement Concentration

The 'moving observer' method for measuring concentration has been found to be highly inaccurate, and is not recommended. The only suitable approach is to use video or, once sampling intervals have been determined, to take still photographs at those intervals.

8.3 Pavement Flow Characteristics and Sampling Procedures

8.3.1 Over the 7.5 hour (0920-1650) study period, total pavement flows in both directions on one pavement in the 15 sites ranged from 41,000 to 1,400. There was no clear relationship between these flows and site type. A more detailed analysis of relationships with potential explanatory variables is covered elsewhere (May, 1987).

8.3.2 Distributions of flow throughout the day were of three types. Major centres on weekdays had a symmetrical pattern around a pronounced midday peak. Intermediate centres which have a strong shopping role (and major centres on Saturdays) had higher flows in the afternoon than the morning, but still with a pronounced midday peak. Smaller centres had little variation throughout the day.

8.3.3 In all cases the midday period provided the highest flow within the 7.5 hour (0920-1650) study period, with the highest flows averaging 250 pedestrians per 5 minutes. Studies which are only concerned with peak flows can be concentrated on the period 1130-1430; otherwise separate analyses of the midmorning (0930-1130) and mid afternoon (1430-1630) periods may be necessary. Because of the timing of the surveys, little data was obtained on pedestrian flows during the main traffic peaks.

8.3.4 Rather than count throughout these analysis periods, sample counts may be taken. Generally 20 minutes was found to be an optimum sampling period, representing the point beyond which reductions in coefficient of variation were less marked. In the mid-morning analysis period a 15 minute sampling period would have been as satisfactory as 20 minutes, but on the basis of consistency 20 minutes is recommended. Even at this level coefficients of variation are typically 25%. However, half the sites achieved coefficients of variation of 15% during the midday period. While it was not possible to test the effect of different start times for sample counts, counts starting at 10.00, 12.00 and 15.00 seemed suitable.

8.3.5 Expansion factors for sample counts varied substantially by site. For video data counted for 20 minutes from 1000 the average expansion factor to a 150 minute (0920-1150) total was 7.9, with a range for all but four sites of 5.9 to 9.7. For a 20 minute count from 1200 expanded to 170 minutes (1150-1440) the average was 9.3 with a range for all but three sites of 7.4 to 10.5. For a 20 minute count from 1500 expanded to 130 minutes (1440-1650) the average was 4.3 with a range for all but three sites of 2.8 to 5.7.

8.3.6 Comparisons of counts on consecutive days at all sites and between November and February at selected sites demonstrated considerable stability for weekdays at the majority of sites; 21 of the 29 analysis periods studied produced counts within 15% on the two days studied. However, some of the remaining sites produced substantial differences. It is probably sensible to record two days of counts to check for variability at any site.

8.3.7 Pedestrian classifications at the 15 sites were similar. Men represented 41% ± 6% of the pavement flow. Young people (under 18) represented 15% ± 6% of the flow and the elderly 12% ± 6%. However, five sites had elderly proportions outside this range. It is probably reasonable to take these central estimates unless local conditions suggest a different proportion.

8.3.8 There are clearly substantial errors associated both with manual counts and with the use of sample counts and expansion factors. To avoid this it is strongly recommended that video counts be conducted throughout the chosen analysis period. Provided that the assumptions in 8.4.7 are made classification is not necessary, but a second day's survey to check on stability of flow may be desirable.

8.4 Crossing Flow Characteristics and Sampling Procedures

8.4.1 Crossing flows were recorded either at a crossing facility or over a length of up to 100 m of street. Over the 7.5 hour (0920-1650) study period total two way crossing flows at the 14 sites where crossing was possible ranged from 14,700 to 300. Flows were typically higher where no crossing facility was provided. Otherwise no clear relationship between flow and site type emerged.

8.4.2 Distributions of flow throughout the day were of two types. The first had a symmetrical pattern around a pronounced midday peak; the second had a similar rise in the morning, but little or no reduction in the afternoon. There was no clear relationship between flow distribution and site type.

8.4.3 In all cases the midday period provided the highest flow within the 7.5 hour (0920-1650) study period, with the highest flows averaging 250 pedestrians per 5 minutes. Studies which are only concerned with peak flows can be concentrated on the period 1130-1430; otherwise separate analyses of the midmorning (0930-1130) an mid afternoon (1430-1630) periods may be necessary. Because of the timing of the surveys, little data was obtained on pedestrian flows during the main traffic peaks.

8.4.4 Rather than count throughout these analysis periods, sample counts may be taken. Generally 15 minutes was found to be the optimum sampling period, representing the point beyond which reductions in coefficient of variation were less marked. Coefficients of variation of around 15% were achieved at around a third of the sites, and 20% at two thirds. Coefficients of variation were typically lower in the midday period, and higher in the mid morning period.

8.4.5 Expansion factors for sample counts varied substantially by site. For video data counted for 20 minutes from 1000 the average expansion factor to a 150 minute (0920-1150) total was 7.1 with all but four sites in the range 5.4 to 9.5. For a 20 minute count from 1200 the average expansion factor to a 170 minute (1150-1440) total was 8.5, with all but five sites in the range 6.8 to 10.1. For a 20 minute count from 1500 the average expansion factor to a 130 minute (1440-1650) count was 3.8 with all but three sites in the range 3.1 to 4.9.

There was some evidence that expansion factors were lower at 'large urban active' sites and higher at 'large urban depressed' sites.

8.4.6 While sampling errors appear smaller for crossing flows than pavement flows, manual count errors are greater. Again it is strongly recommended that video counts be made throughout the analysis period of interest.

8.5 Pavement Concentration Characteristics and Sampling Procedures

8.5.1 Over the 15 sites studied, concentration averaged over the full pavement width rarely exceeded 0.2 pedestrians per square metre, which has been suggested as the level at which friction between pedestrians starts to occur (level of service B) (Pushkarev, 1975). However, observation suggested that pedestrians were only using part of the pavement, and effective concentrations were calculated based on deducting between 0.5 m and 1.0 m from the pavement width. It is recommended that effective pavement width be determined by observation before calculating pavement concentrations.

8.5.2 Tests on the pilot data suggested that a 10 minute sampling interval for calculation of concentrations from video or still photograph was sufficient. Coefficients of variation are still very high at this sampling interval; for the pilot data they exceeded 50%. The cumulative distribution of concentrations was found to be a useful measure, indicating the chance of experiencing concentrations at level of service B.

8.5.3 Using this approach, only 8 of the 15 sites had effective concentrations at level of service B. The most congested sites had around 70% of observations in the midday period at level of service B, with occasional values at level C (over 0.4 pedestrians per square metre). The midday period was most commonly the most congested, but two of the eight sites had more values at level B in the mid morning period, and two had more in the mid afternoon period.

8.5.4 As noted earlier, concentration can only be reliably measured by video or still photography. Since one video record will provide both pavement and crossing flows as well, this appears to be the most appropriate method.

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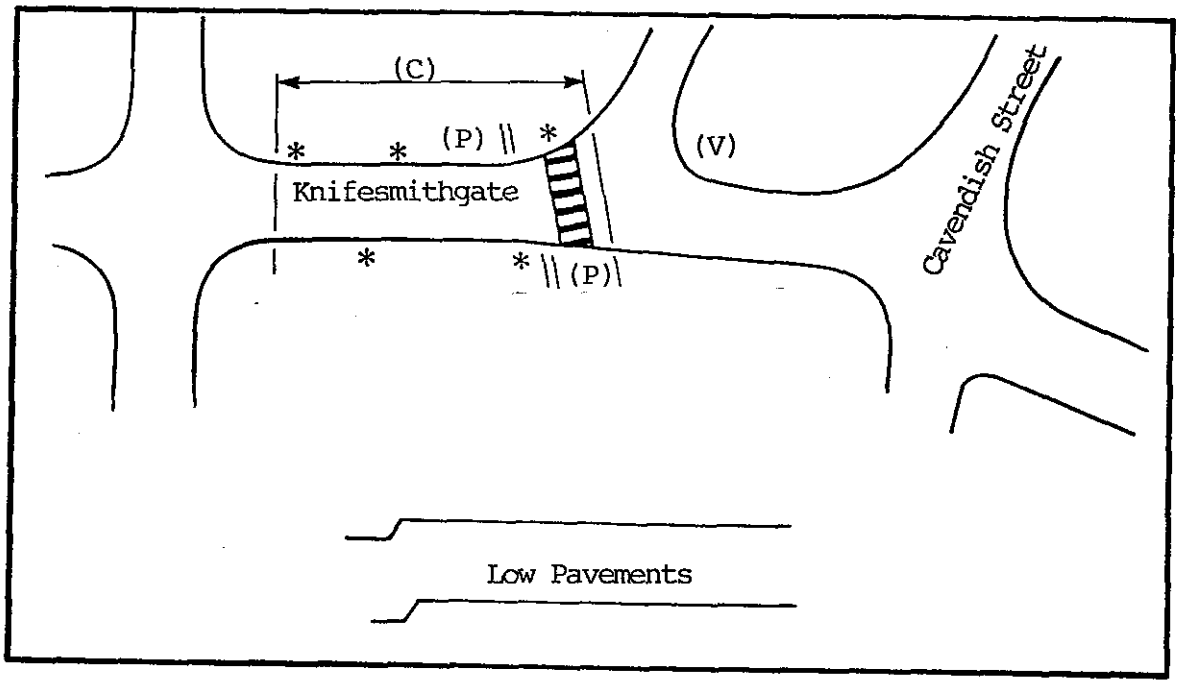
APPENDIX 1: SITE PLANS AND DESCRIPTIONS

01 Knifesmithgate - Chesterfield



(V) Video Location
* Interview Staff

Pavement Counts | |(P)
Crossing Counts | |(C)

Road Width 7m
Pavement Width 3m

Analysis Pavement B

Traffic Conditions: Bus Priority
Access Only for Other Traffic

Shopping Facilities: 3 Department Stores
Various Small Shops

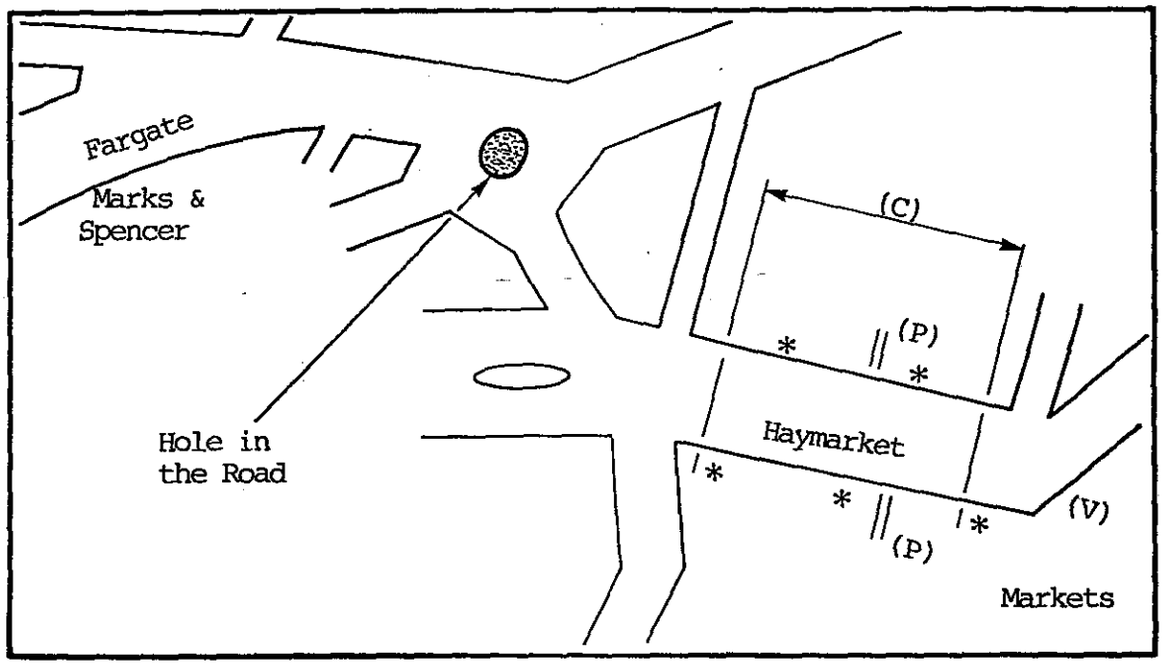
Crossing Facilities: Pedestrian Crossing

Comparison Streets: (1) Low Pavements (Pedestrianised)
(2) Cavendish Street

Surveys:			
	Video	✓	)
	On Street Interviews	✓ 21/10/86	) 19, 20/10/86
	Manual Classified Counts	✓ 21/10/86	)
	CO, Noise	x	
	Household Interviews	x	

Comment: 'Small Urban Other'

02 Haymarket - Sheffield



(V) Video Location
* Interview Staff

Pavement Counts | |(P)
Crossing Counts | |(C)

Road Width 15m
Pavement Width 6m

Traffic Conditions: Bus Priority
Other Vehicles Limited Access

Shopping Facilities: Markets
1 Department Store
Various Other Stores

Crossing Facilities: Pedestrian Bridge
Section of Road

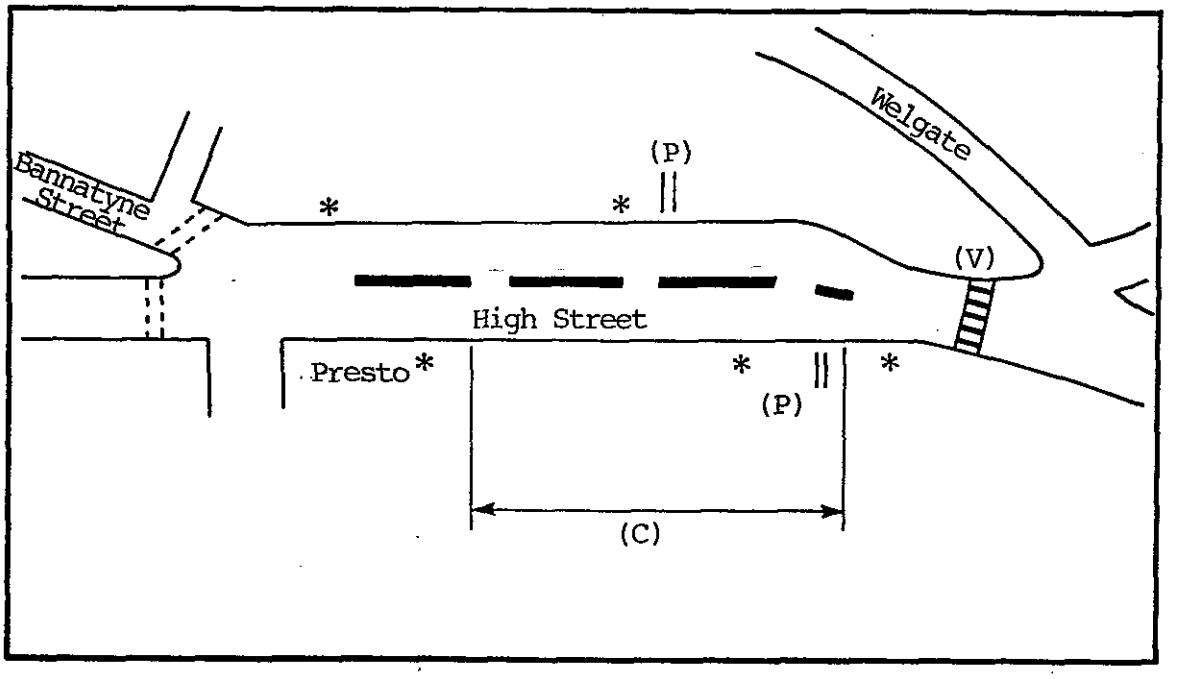
Comparison Streets: (1) Fargate
(2) Hole in the Road (Pedestrianised)

Surveys:

Video	✓	)
On Street Interviews	✓ 27/10/86	) 24, 25/10/86
Manual Classified Counts	✓ 27/10/86	)
CO, Noise	x	
Household Interviews	x	

Comments: 'Large Urban Depressed'

03 High Street - Lanark



(V) Video Location
* Interview Staff

Pavement Counts | | (P)
Crossing Counts | | (C)

Road Width 15m
Pavement Width 3m

Traffic Conditions: Dual Carriageway

Shopping Facilities: Various Small Shops
No Department Stores
1 Supermarket

Crossing Facilities: Pelican Crossing
Section of Road

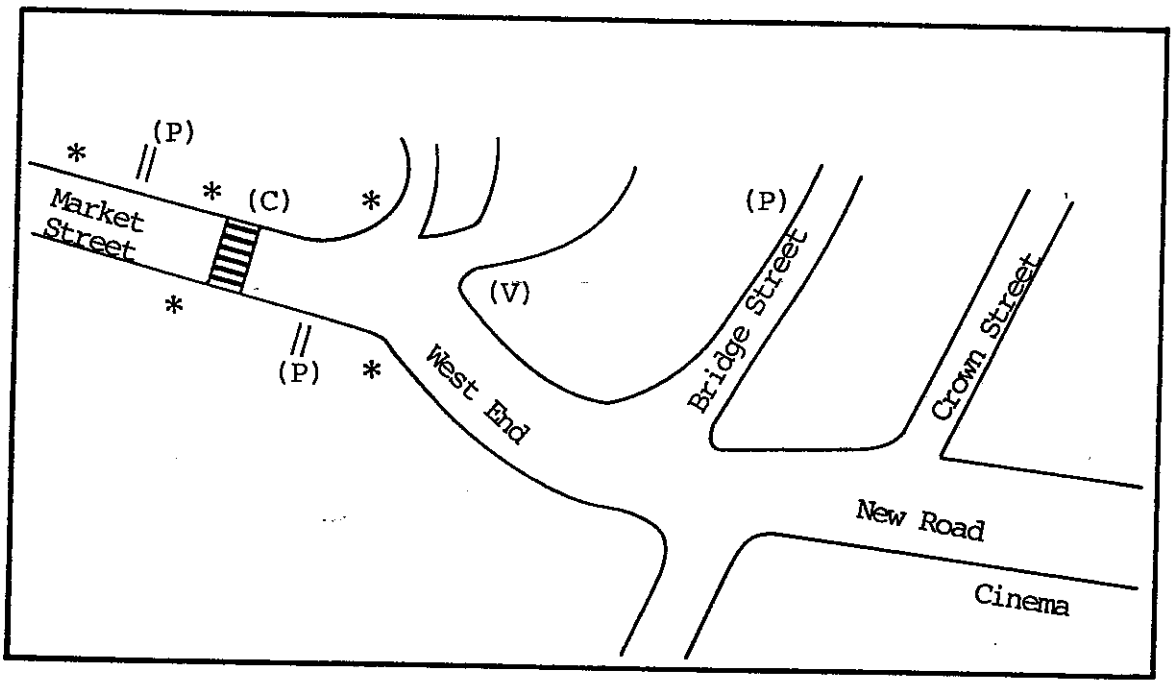
Comparison Streets: (1) Bannatyne Street
(2) Welgate

Surveys:

Video	✓	)
On Street Interviews	✓ 29/10/86	) 27, 28/10/86
Manual Classified Counts	✓ 29/10/86	)
CO, Noise	x	
Household Interviews	✓ From 2/3/87	

Comments: 'Small Urban Historic'

04 Market Street - Hebden Bridge



(V) Video Location
* Interview Staff

Pavement Counts | |(P)
Crossing Counts | |(C)

Road Width 9m
Pavement Width 3m

Traffic Conditions: Two Way
No Parking

Shopping Facilities: Two Way
No Parking

Shopping Facilities: Small Shops (mainly Banks, Tourist, etc)
1 Supermarket

Crossing Facilities: Pedestrian Crossing

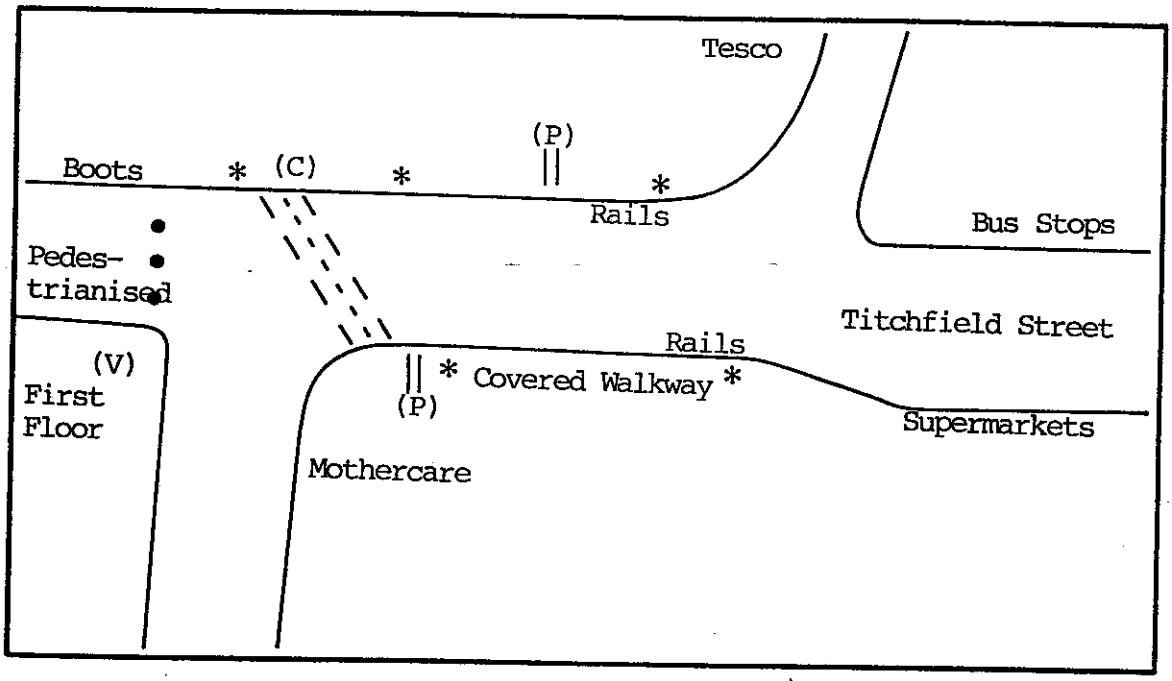
Comparison Streets: (1) Crown Street
(2) New Road

Surveys:

Video	✓	)
On Street Interviews	✓ 29/10/86	) 30, 31/10/86
Manual Classified Counts	✓ 29/10/86	)
CO, Noise	x	
Household Interviews	x	

Comments: 'District Centre'

05 King Street - Kilmarnock



(V) Video Location
* Interview Staff

Pavement Counts (P)
Crossing Counts (C)

Road Width 11m
Pavement Width 3m

Traffic Conditions: 1 Way King Street to St Marnock Street

Shopping Facilities: New Shopping Facilities
Varied

Crossing Facilities: Pelican

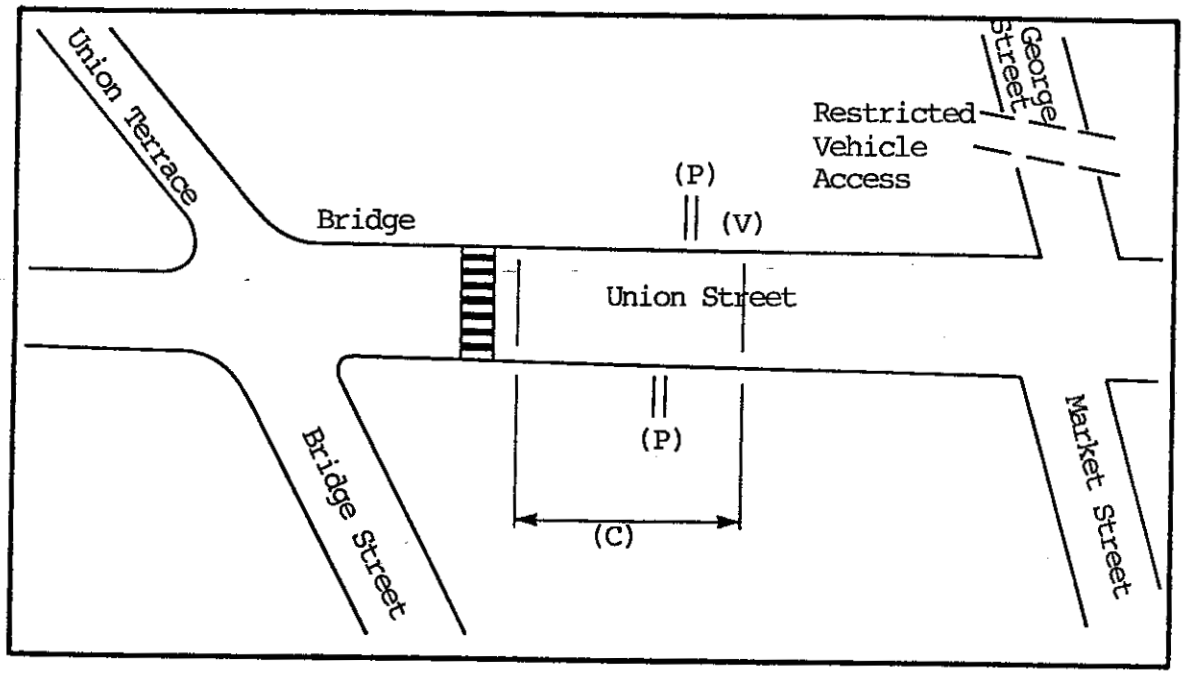
Comparison Streets: (1) King Street (Pedestrianised)
(2) Titchfield Street

Surveys:

Video	✓	)
On Street Interviews	✓ 1/11/86	) 30, 31/10/86
Manual Classified Counts	✓ 1/11/86	)
CO, Noise	x	
Household Interviews	x	

Comments: 'Small Urban Other'

06 Union Street - Aberdeen



(V) Video Location
* Interview Staff

Pavement Counts | |(P)
Crossing Counts | |(C)

Road Width 15m
Pavement Width 4m

Traffic Conditions: Two Way

Shopping Facilities: Non-Food Department Stores
Hotels
Various Others

Crossing Facilities: Pelican
Section of Road

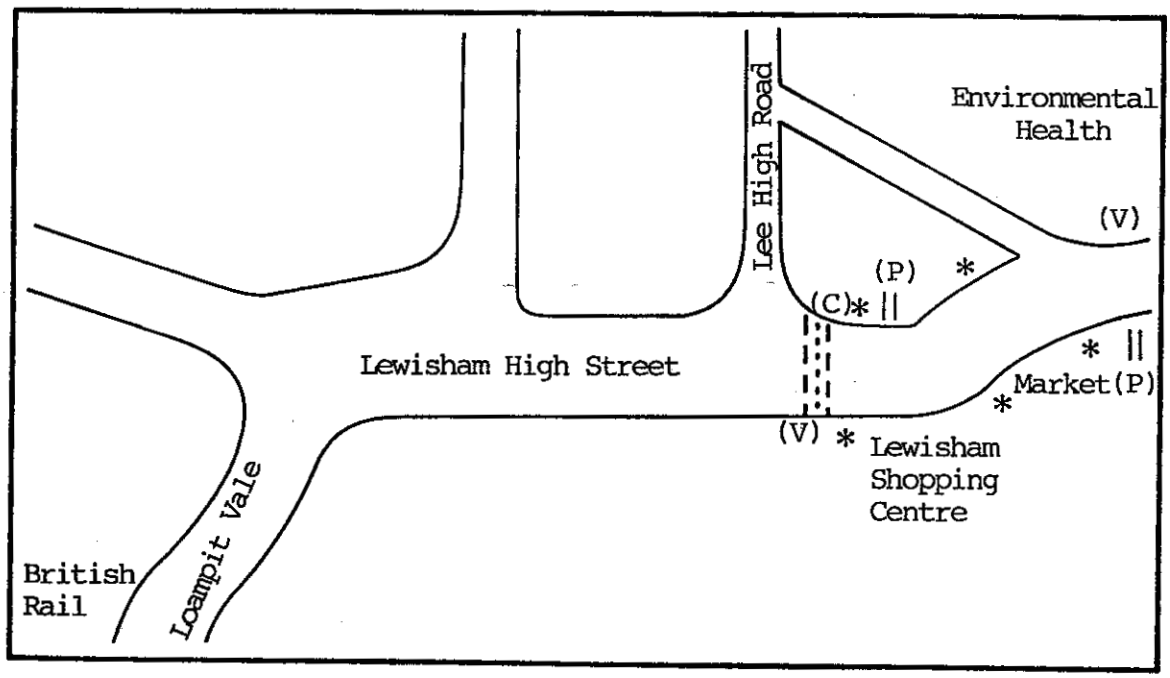
Comparison Streets: (1) Market Street
(2) George Street (Pedestrian Priority)

Surveys:

Video	✓	)
On Street Interviews	✓ 5/11/86	) 1, 3/11/86
Manual Classified Counts	✓ 5/11/86	)
CO, Noise	x	
Household Interviews	x	

Comments: 'Large Urban Active'

07 High Street - Lewisham



(V) Video Location
* Interview Staff

Pavement Counts | | (P)
Crossing Counts | | (C)

Road Width 15m
Pavement Width 4m

Traffic Conditions: Two Way

Shopping Facilities: Street Market
Major Shopping Centre
Various Shops

Crossing Facilities: Pelican

Comparison Streets: (1) Loampit Vale
(2) Lee High Road

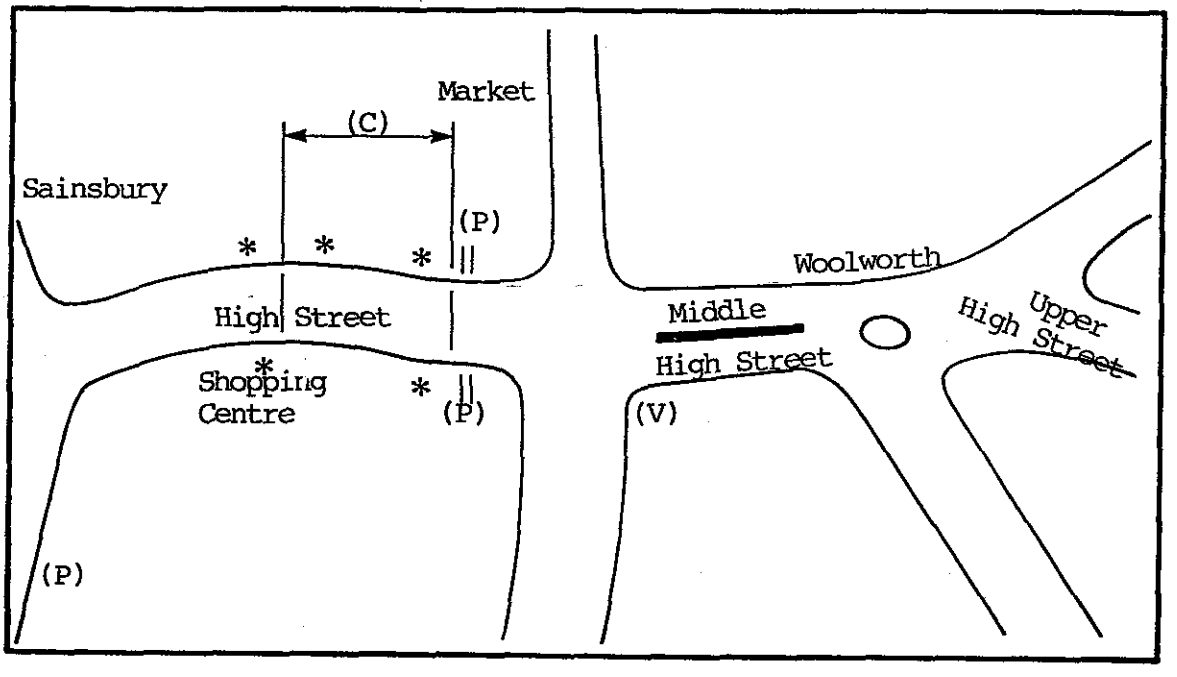
Surveys:

Video	✓	)
On Street Interviews	✓ 8/11/86	) 6, 7/11/86 *
Manual Classified Counts	✓ 8/11/86	)
CO, Noise	x 26, 27/2/87	
Household Interviews	x	

* then 26, 27/2/87

Comments: 'Large Urban Depressed'

08 Market Place - Epsom



(V) Video Location
* Interview Staff

Pavement Counts | | (P)
Crossing Counts | | (C)

Road Width 10m
Pavement Width 2m

Traffic Conditions: Two Way Flow

Shopping Facilities: Supermarkets
Markets
Shopping Centre

Crossing Facilities: Section of Road

Comparison Streets: (1) Middle High Street
(2) Upper High Street

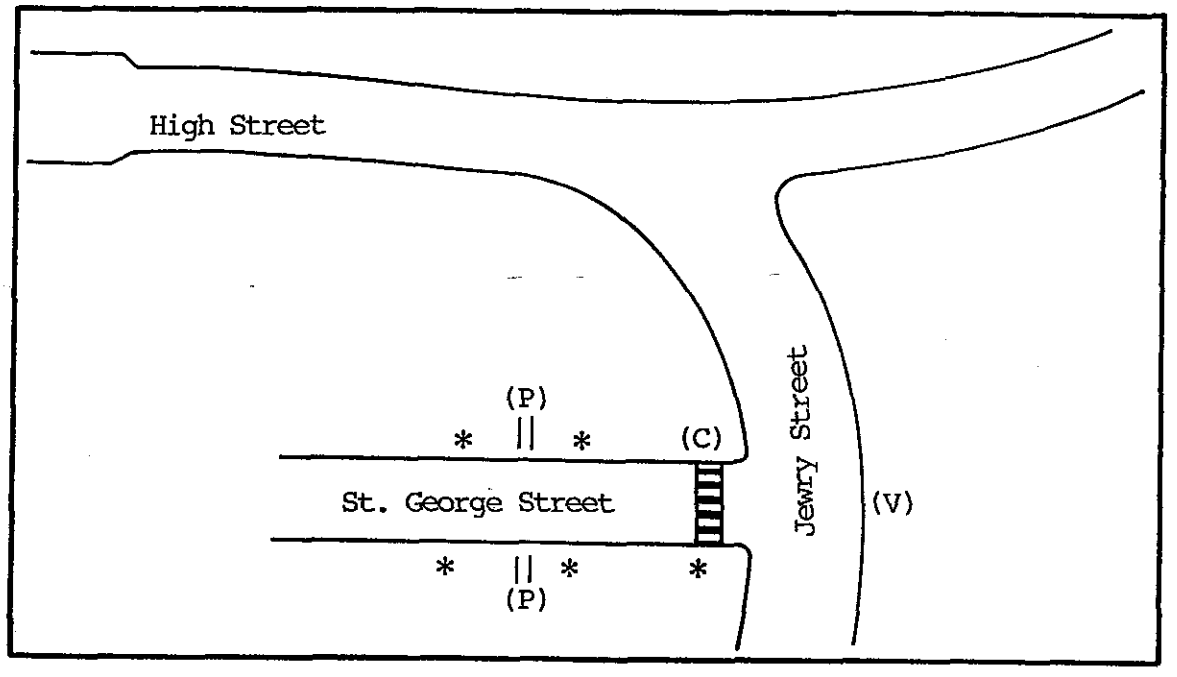
Surveys:

Video	✓	)
On Street Interviews	✓ 8/11/86	) 10, 11/11/86 *
Manual Classified Counts	✓ 8/11/86	)
CO, Noise	✓ 26, 27/3/86	
Household Interviews	x	

* then 18-21/2/87

Comments: 'Small Urban Other'

09 St Georges Street - Winchester



(V) Video Location
* Interview Staff

Pavement Counts | | (P)
Crossing Counts | | (C)

Road Width 10m
Pavement Width 3m

Traffic Conditions: One Way into Jewry Street

Shopping Facilities: Small Shops
No Supermarkets

Crossing Facilities: Pelican at Junction

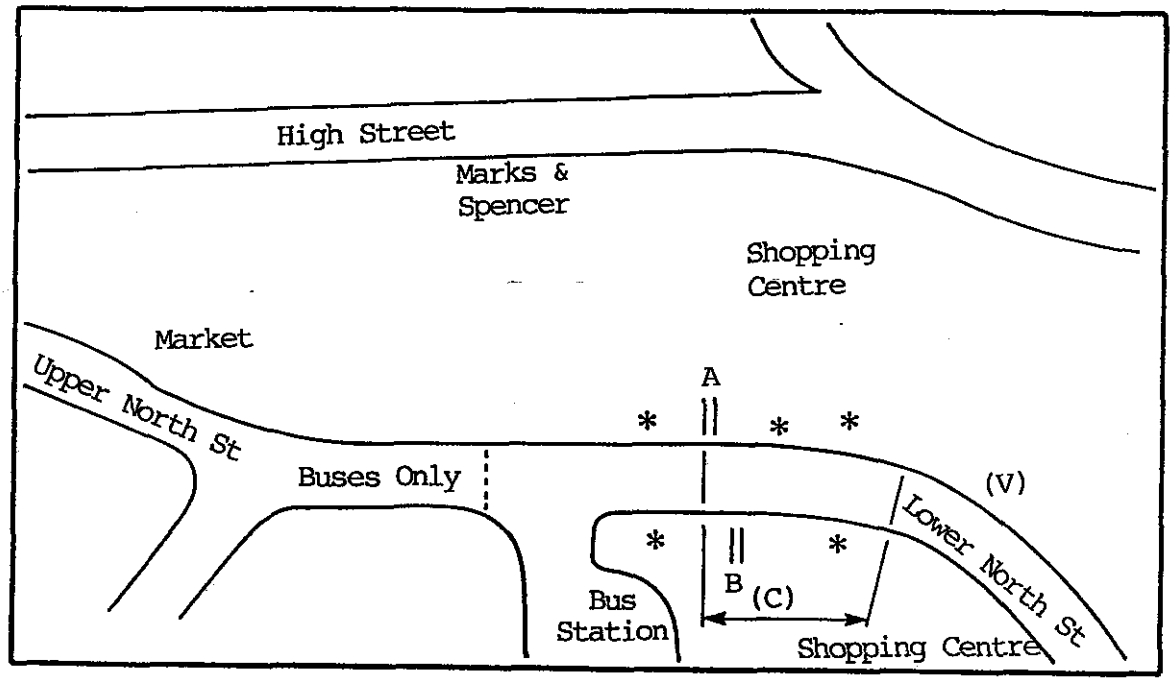
Comparison Streets: (1) High Street (Pedestrianised)
(2) Jewry Street

Surveys:

Video	✓	)
On Street Interviews	✓ 14/11/86	) 12, 13/11/86
Manual Classified Counts	✓ 14/11/86	)
CO, Noise	x	
Household Interviews	x	

Comments: 'Small Urban Historic'

10 Lower North Street - Guildford



(V) Video Location
* Interview Staff

Pavement Counts | | (P)
Crossing Counts | | (C)

Road Width 11m
Pavement Width 4m

Traffic Conditions: One Way

Shopping Facilities: 2 Shopping Centres
Markets

Crossing Facilities: Section of Road

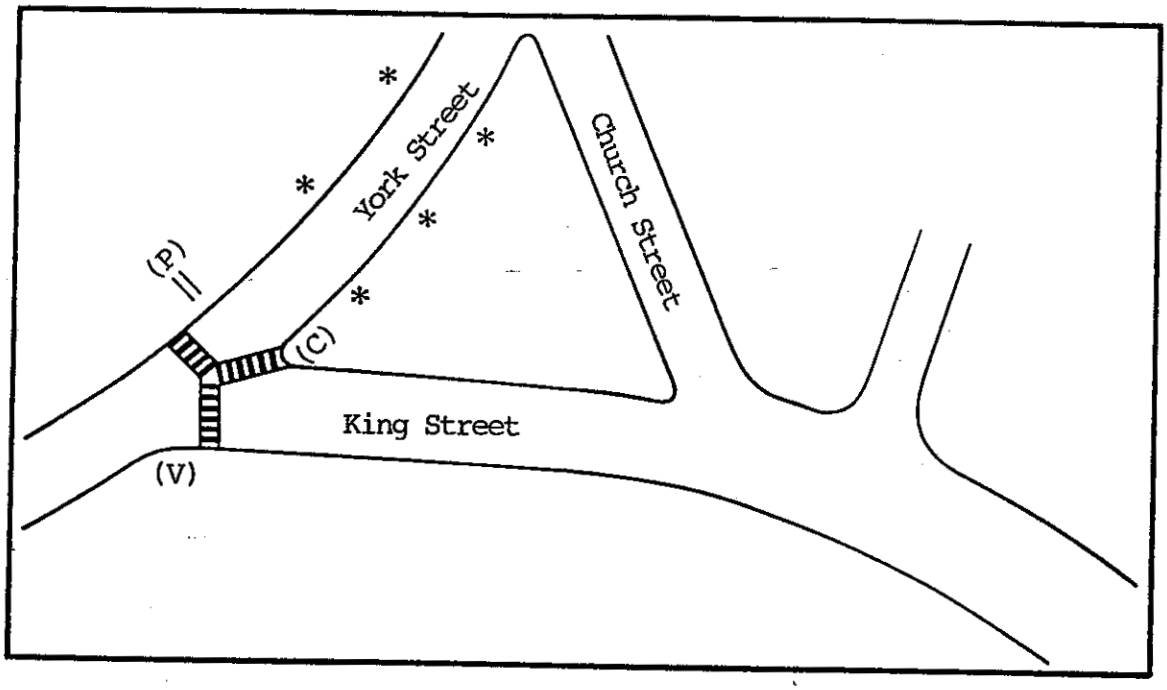
Comparison Streets: (1) Upper North Street
(2) High Street (Pedestrianised)

Surveys:			
	Video	✓	)
	On Street Interviews	✓ 17, 18/11/86	) 14, 15/11/86 *
	Manual Classified Counts	✓	)
	CO, Noise	x	
	Household Interviews	x	

* then 16-21/2/87

Comments: 'Small Urban Historic'

11 York Road - Twickenham



(V) Video Location
* Interview Staff

Pavement Counts || (P)
Crossing Counts || (C)

Road Width 10m
Pavement Width 2m

Traffic Conditions: Two Way Flow

Shopping Facilities: Small Shops
No Department Stores
1 Supermarket

Crossing Facilities: Pelican at Junction of York Street and King Street

Comparison Streets: (1) King Street
(2) Church Street

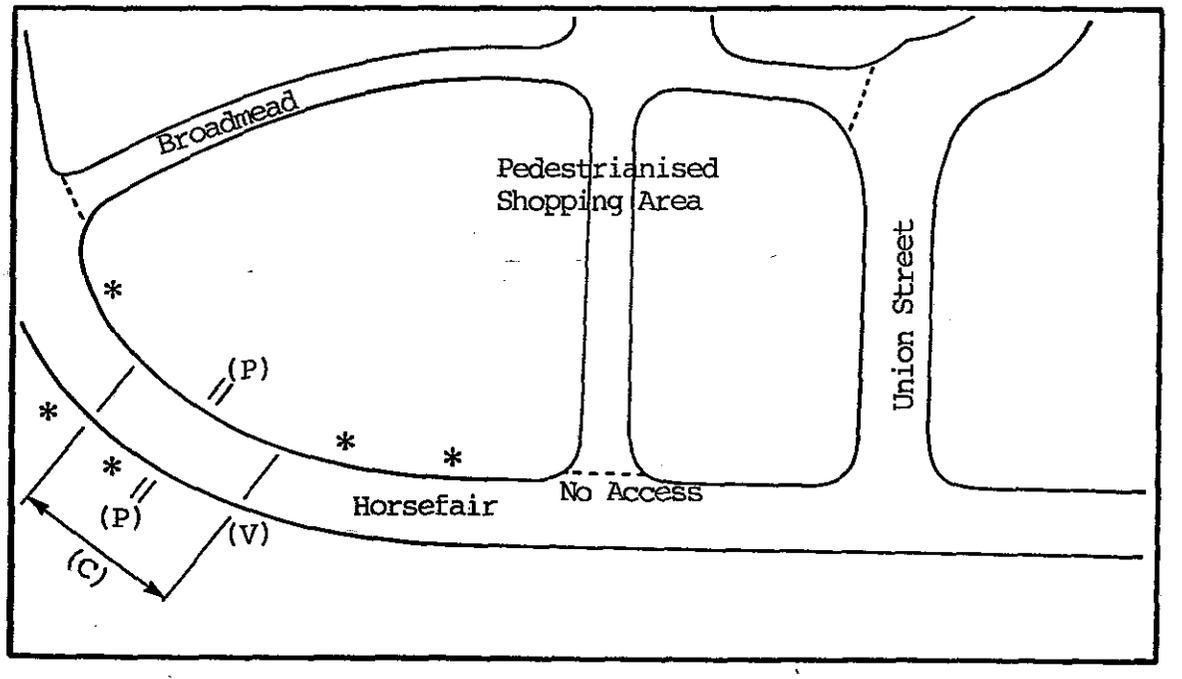
Surveys:

Video	✓	)
On Street Interviews	✓ 19/11/86	) 17, 18/11/86 *
Manual Classified Counts	✓ 19/11/86	)
CO, Noise	x	
Household Interviews	x	

* then 16, 17/2/87

Comments: 'District Centre'

12 The Horsefair - Bristol



(v) Video Location
* Interview Staff

Pavement Counts | | (P)
Crossing Counts | | (C)

Road Width 11m
Pavement Width 5m

Traffic Conditions: 1 Way along Horsefair

Shopping Facilities: Pedestrianised Central Area
Small National Chain Stores
2 Department Stores
Supermarkets

Crossing Facilities: Section of Road

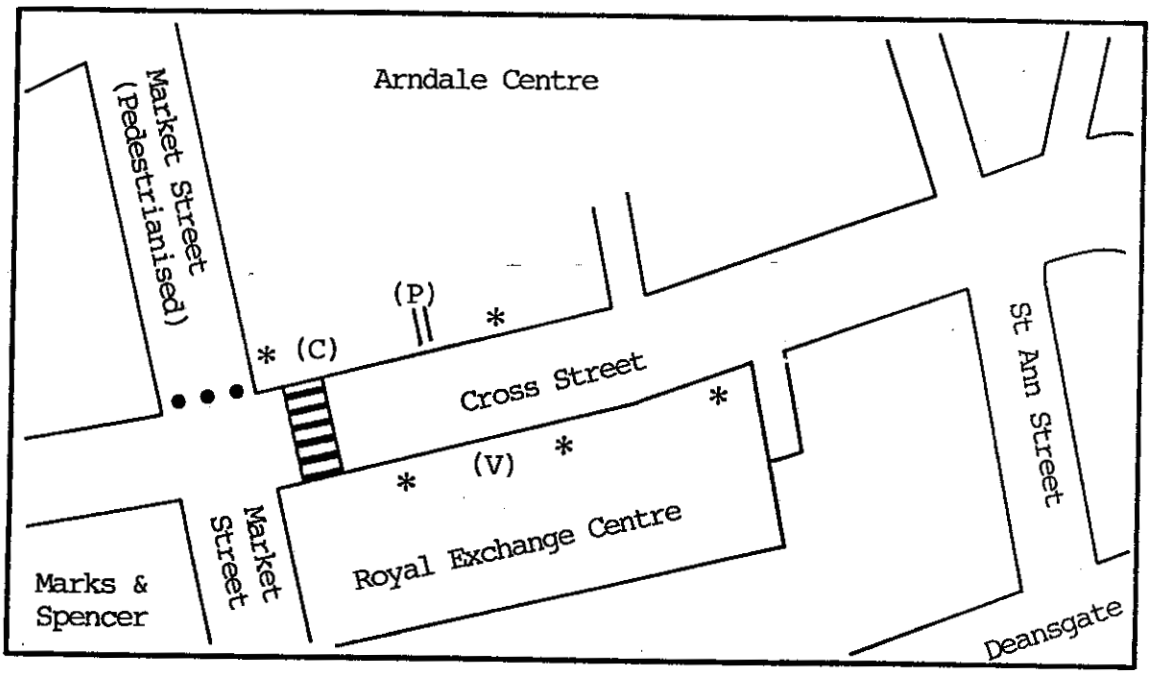
Comparison Streets: (1) Broadmead (Pedestrianised)
(2) Union Street

Surveys:

Video	✓)	
On Street Interviews	✓)	19, 20, 21/11/86
Manual Classified Counts	✓)	
CO, Noise	x	
Household Interviews	x	

Comments: 'Large Urban Active'

13 Cross Street - Manchester



(V) Video Location
* Interview Staff

Pavement Counts || (P)
Crossing Counts || (C)

Road Width 10m
Pavement Width 3m

Traffic Conditions: 2 Way Flow

Shopping Facilities: Arndale Centre
Exchange Centre
Department Stores

Crossing Facilities: Pedestrian Crossing

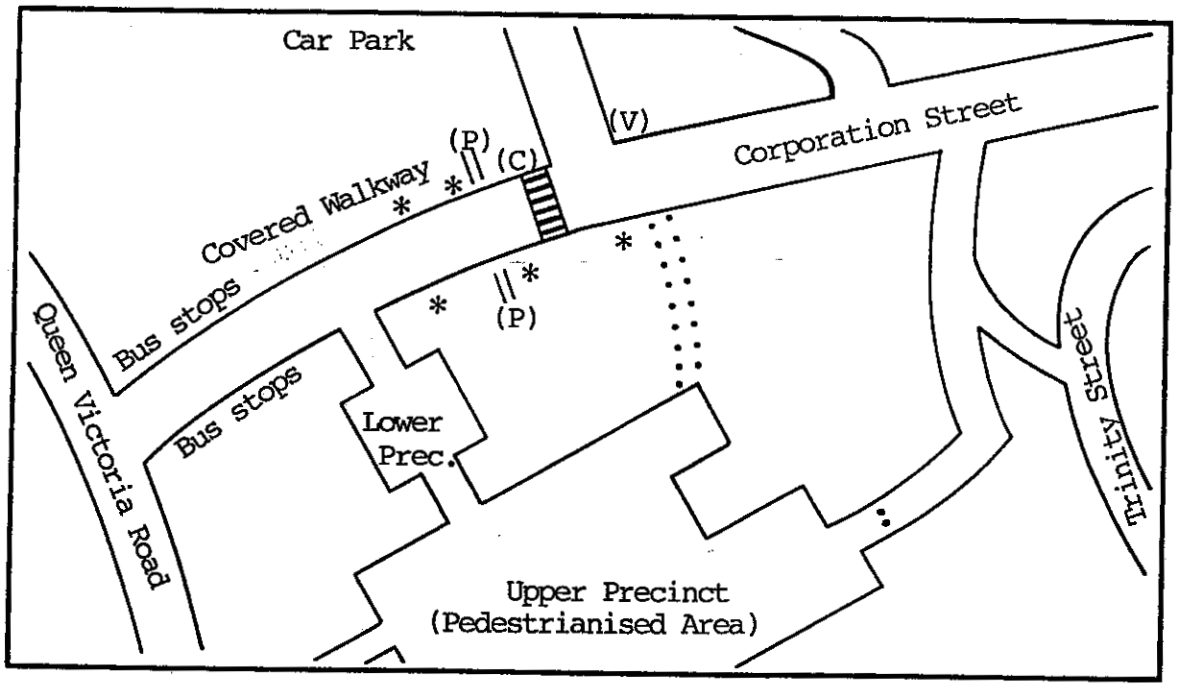
Comparison Streets: (1) Deansgate
(2) Market Street (Pedestrianised)

Surveys:

Video	✓ 14, 15/5/86	)
On Street Interviews	✓ 22/11/86	) 20, 21/11/86
Manual Classified Counts	✓ 22/11/86	)
CO, Noise	✓ 6/3/87	
Household Interviews	x	

Comments: 'Large Urban Active'

14 Corporation Street - Coventry



(V) Video Location
* Interview Staff

Pavement Counts || (P)
Crossing Counts || (C)

Road Width 15m
Pavement Width 4m

Traffic Conditions: Two Way Flow

Shopping Facilities: Small Shops
Access to Pedestrianised Central Area

Crossing Facilities: Pedestrian Crossing

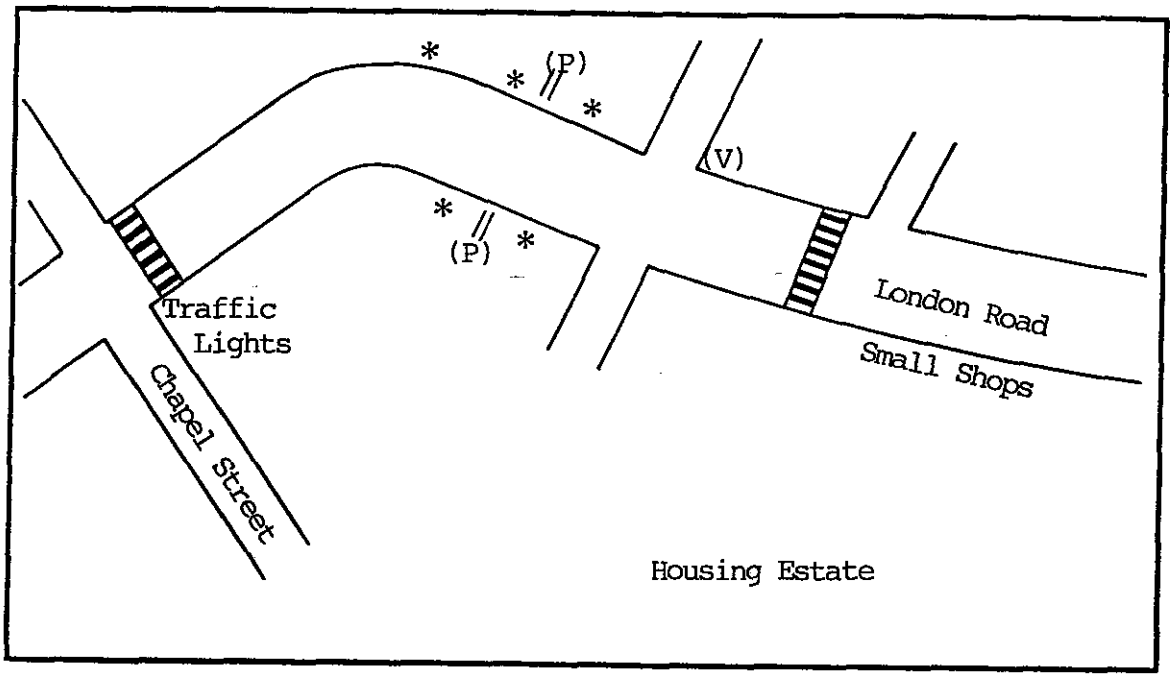
Comparison Streets: (1) Lower Precinct (Pedestrianised)
(2) Trinity Street

Surveys:

Video	✓	)
On Street Interviews	✓ 26/11/86	) 24, 25/11/86
Manual Classified Counts	✓ 26/11/86	)
CO, Noise	x	
Household Interviews	x	

Comments: 'Large Urban Depressed'

15 London Road - Hazel Grove



(V) Video Location
* Interview Staff

Pavement Counts || (P)
Crossing Counts || (C)

Road Width 10m
Pavement Width 2m

Traffic Conditions: Two Way Flow

Shopping Facilities: Small Shops
Banks
Grocery

Crossing Facilities: None

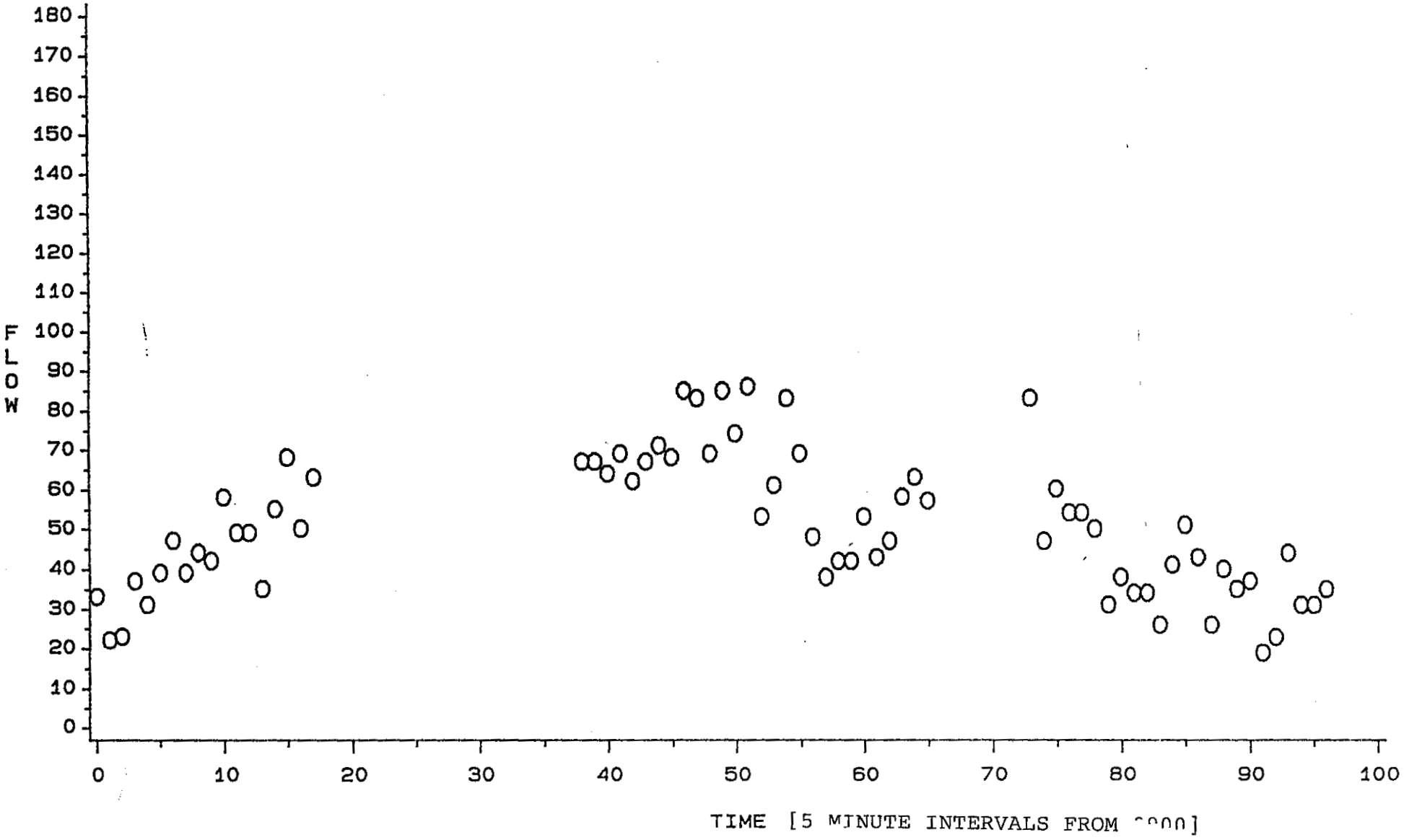
Comparison Streets: (1)) Not
(2)) Available

Surveys:

Video	✓	)
On Street Interviews	✓ 29/11/86	) 27, 28/11/86
Manual Classified Counts	✓ 29/11/86	)
CO, Noise	x	
Household Interviews	/ from 9/3/87	

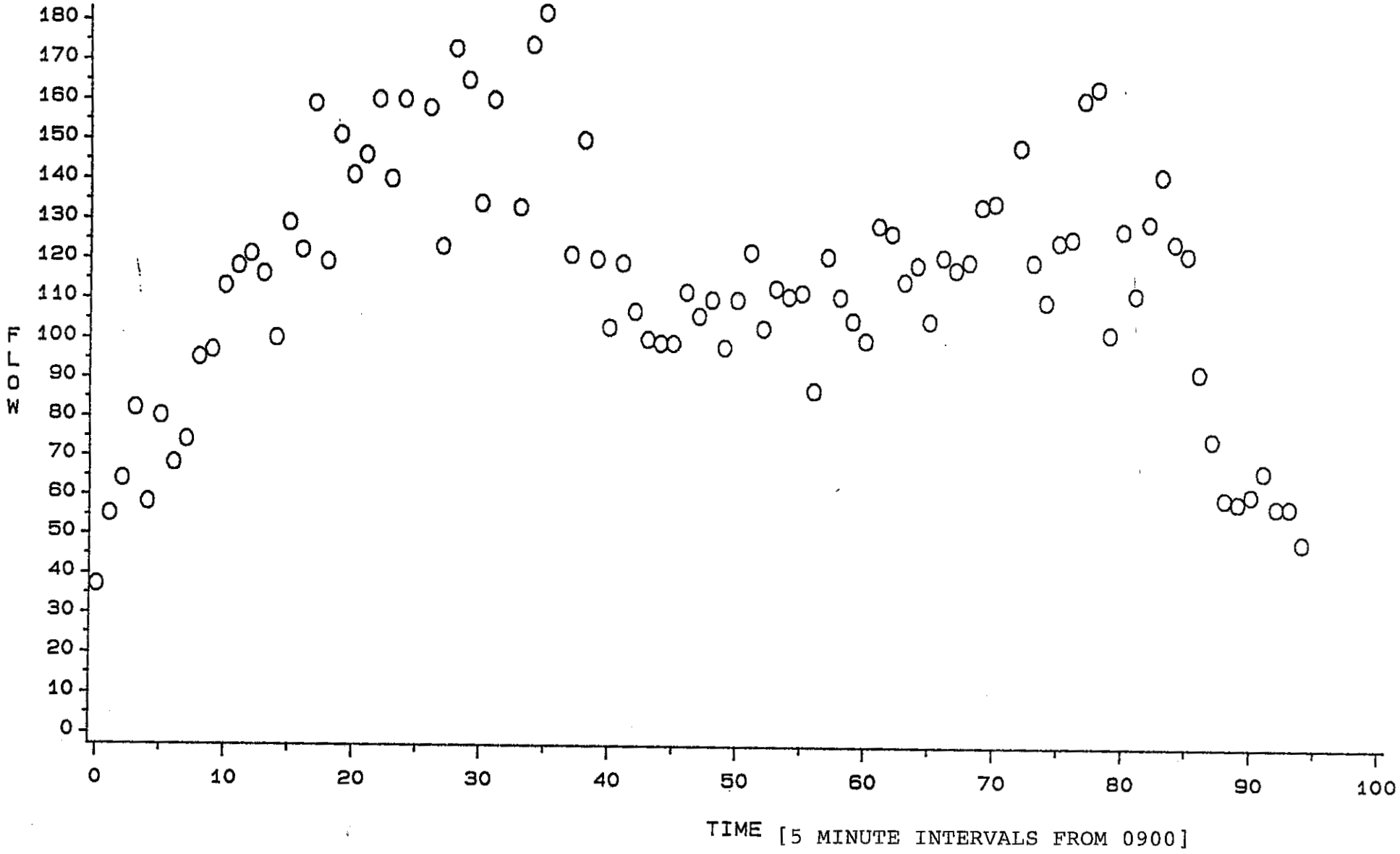
Comments: 'District Centre'

01 CHESTERFIELD (20/10/86, MON) VIDEO DATA

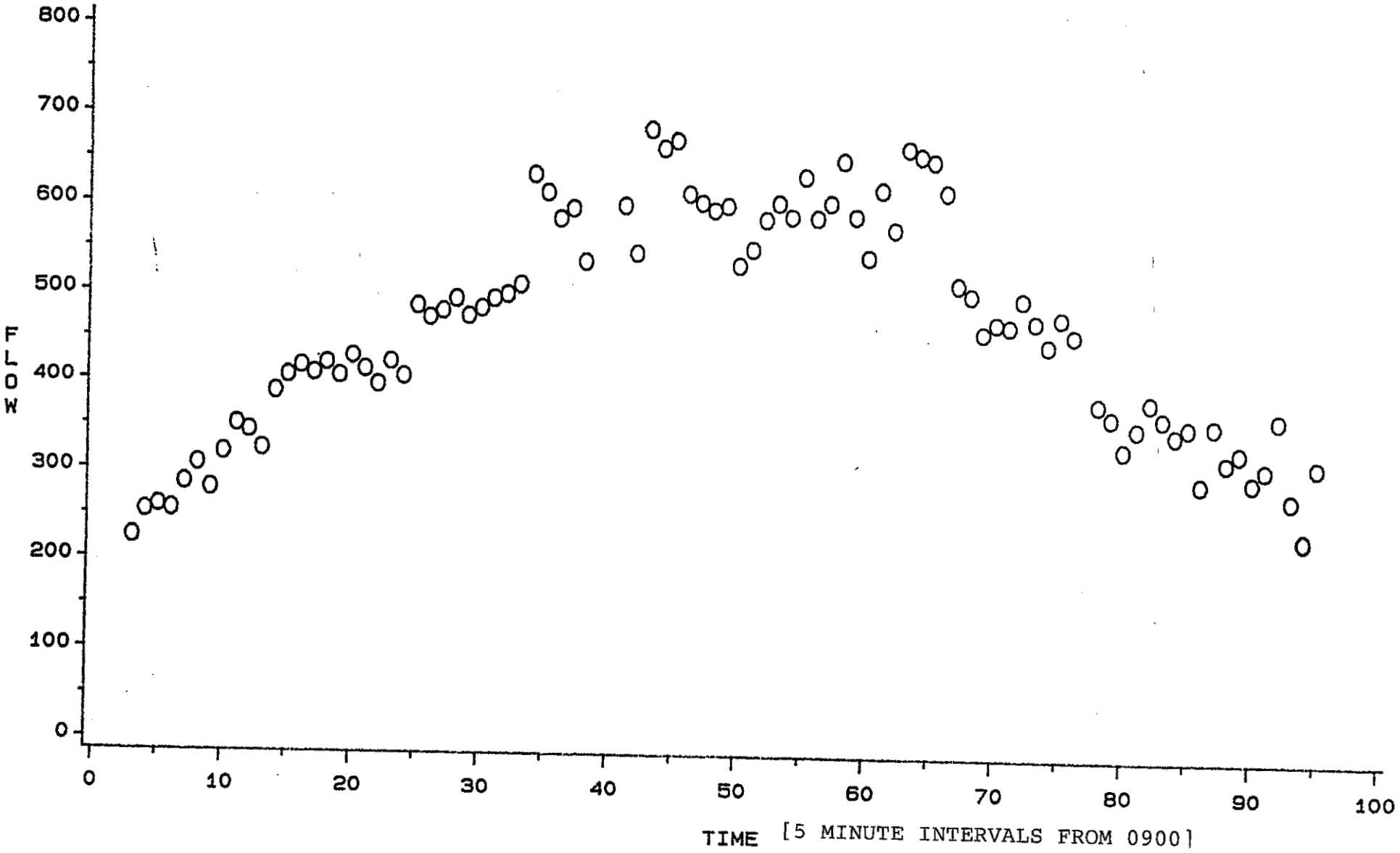


APPENDIX 2: GRAPHS OF PEDESTRIAN PAVEMENT FLOW/ CROSSING FLOW FOR EACH SITE

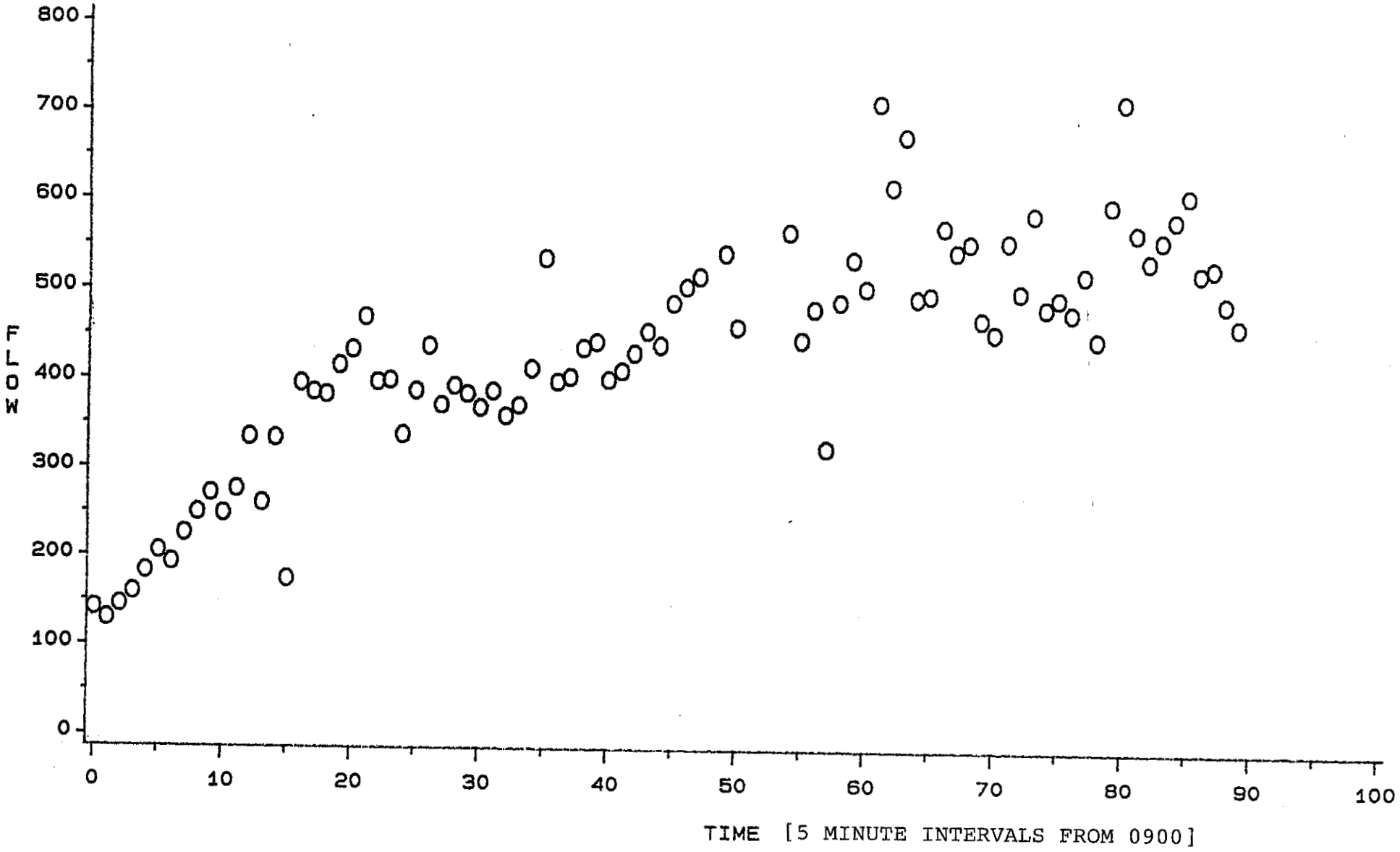
01 CHESTERFIELD (18/10/86, SAT) VIDEO DATA



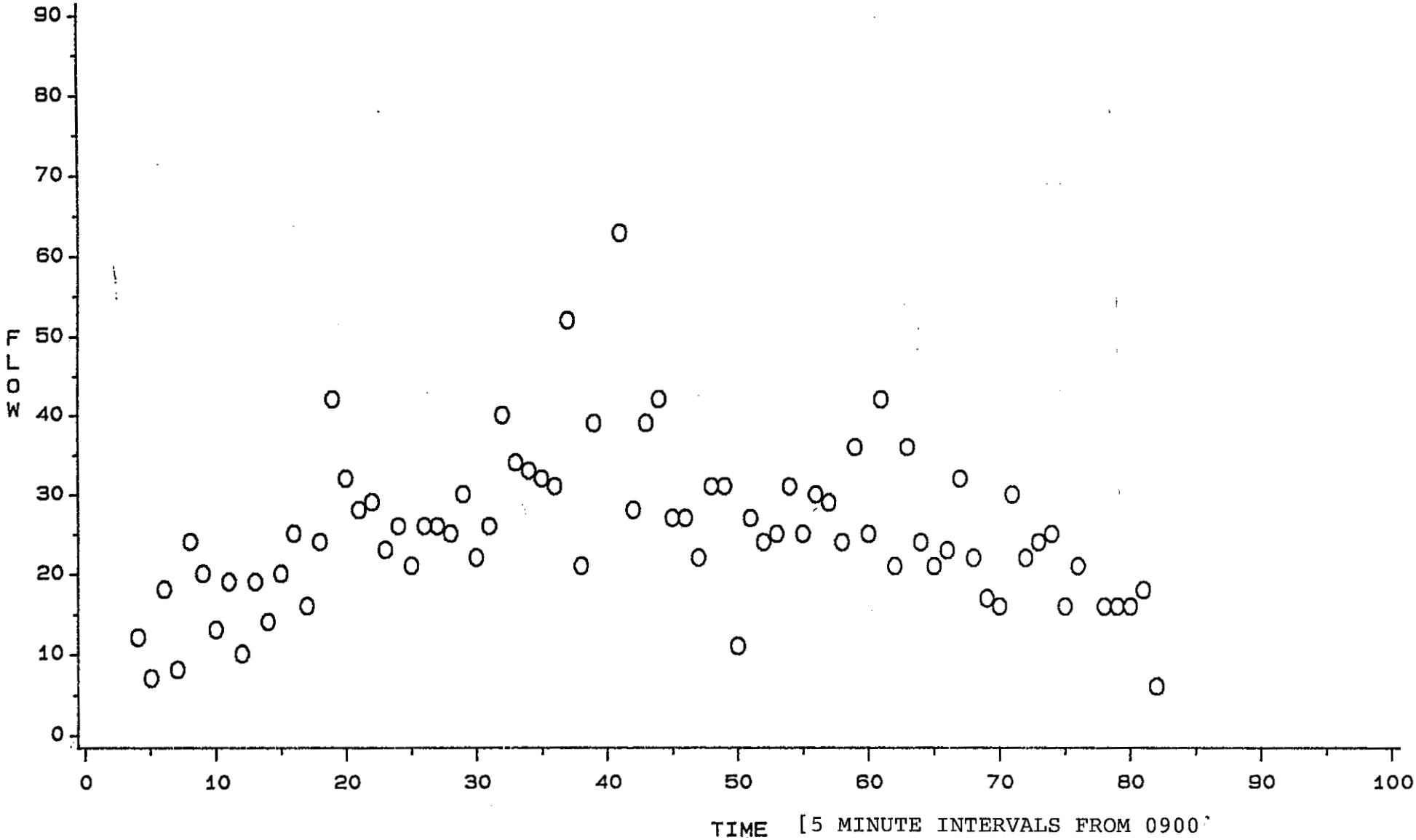
02 SHEFFIELD (24/10/86, FRI) VIDEO DATA



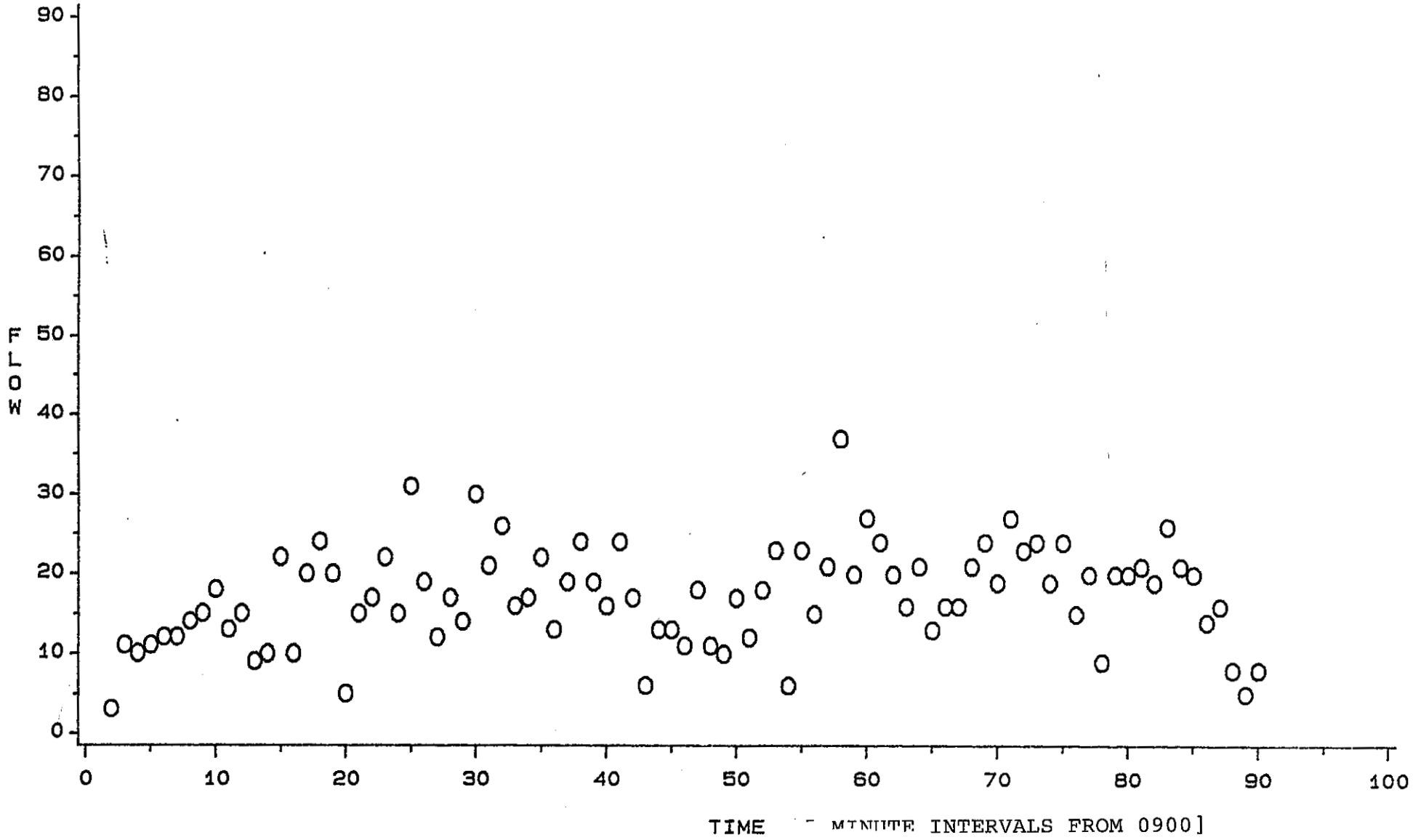
02 SHEFFIELD (25/10/86, SAT) VIDEO DATA



03 LANARK (27/10/86, MON) VIDEO DATA



04 HEBDEN BRIDGE (30/10/86, THUR) VIDEO DATA



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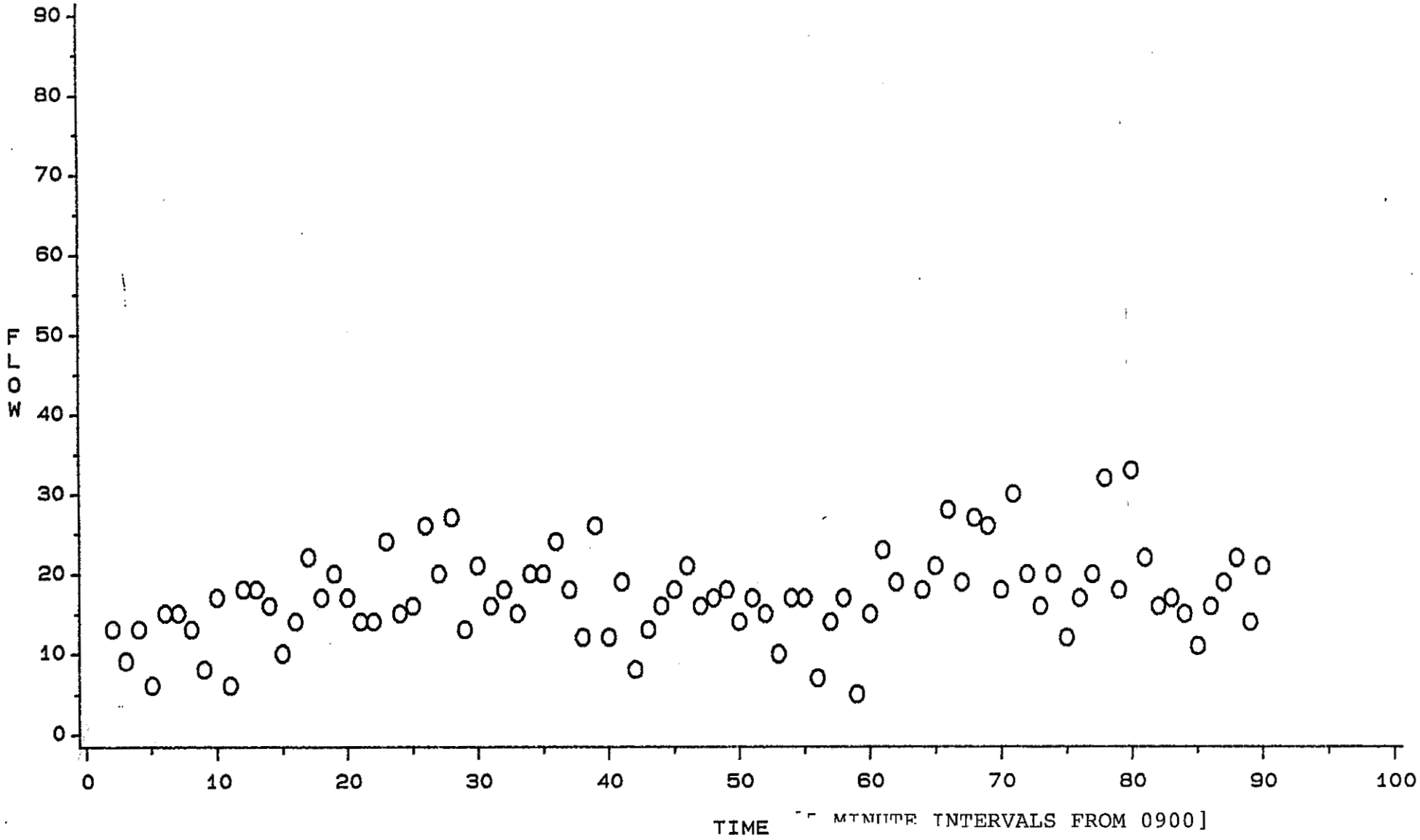
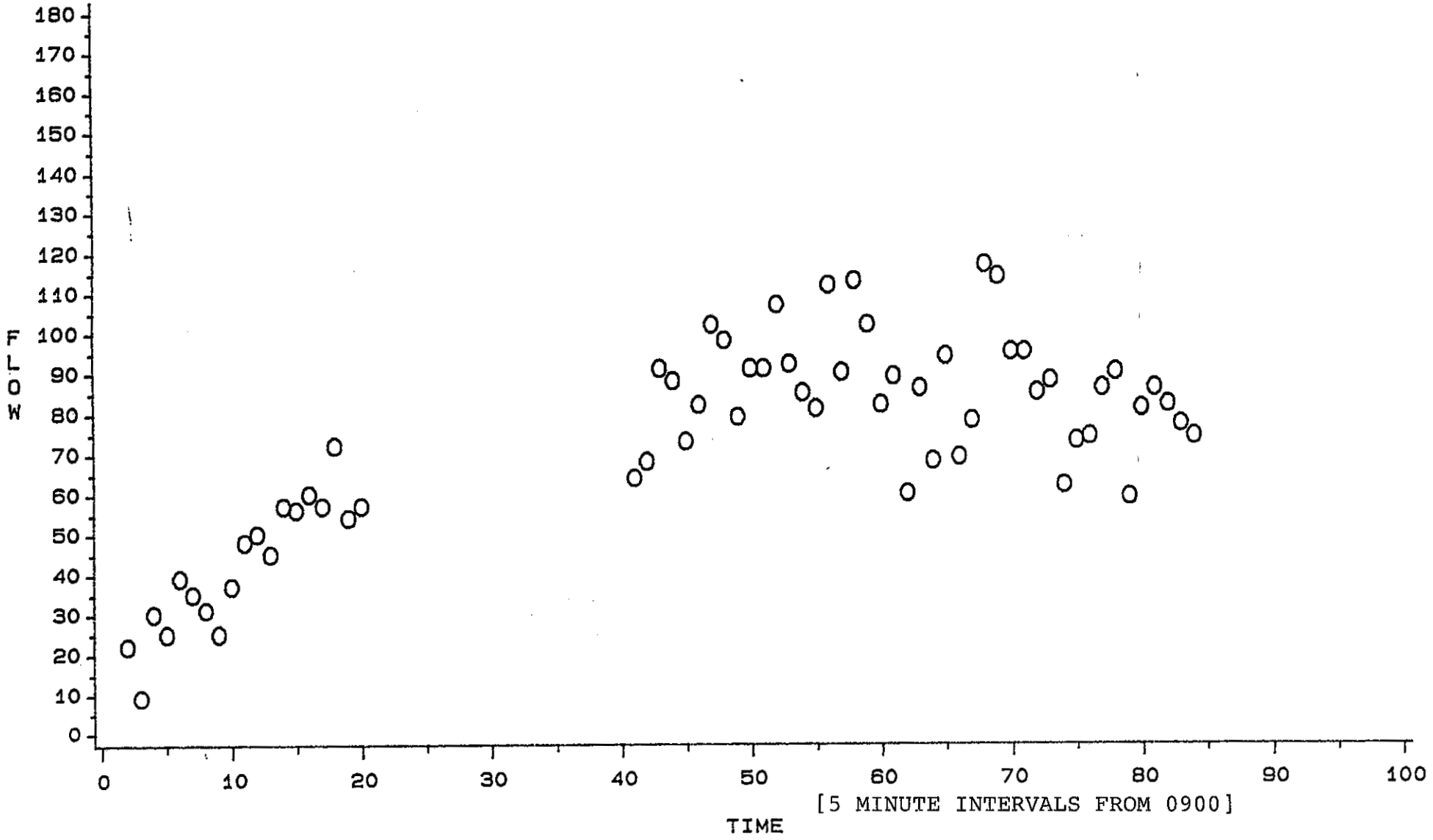


05 KILMARNOCK (31/10/86, FRI) VIDEO DATA



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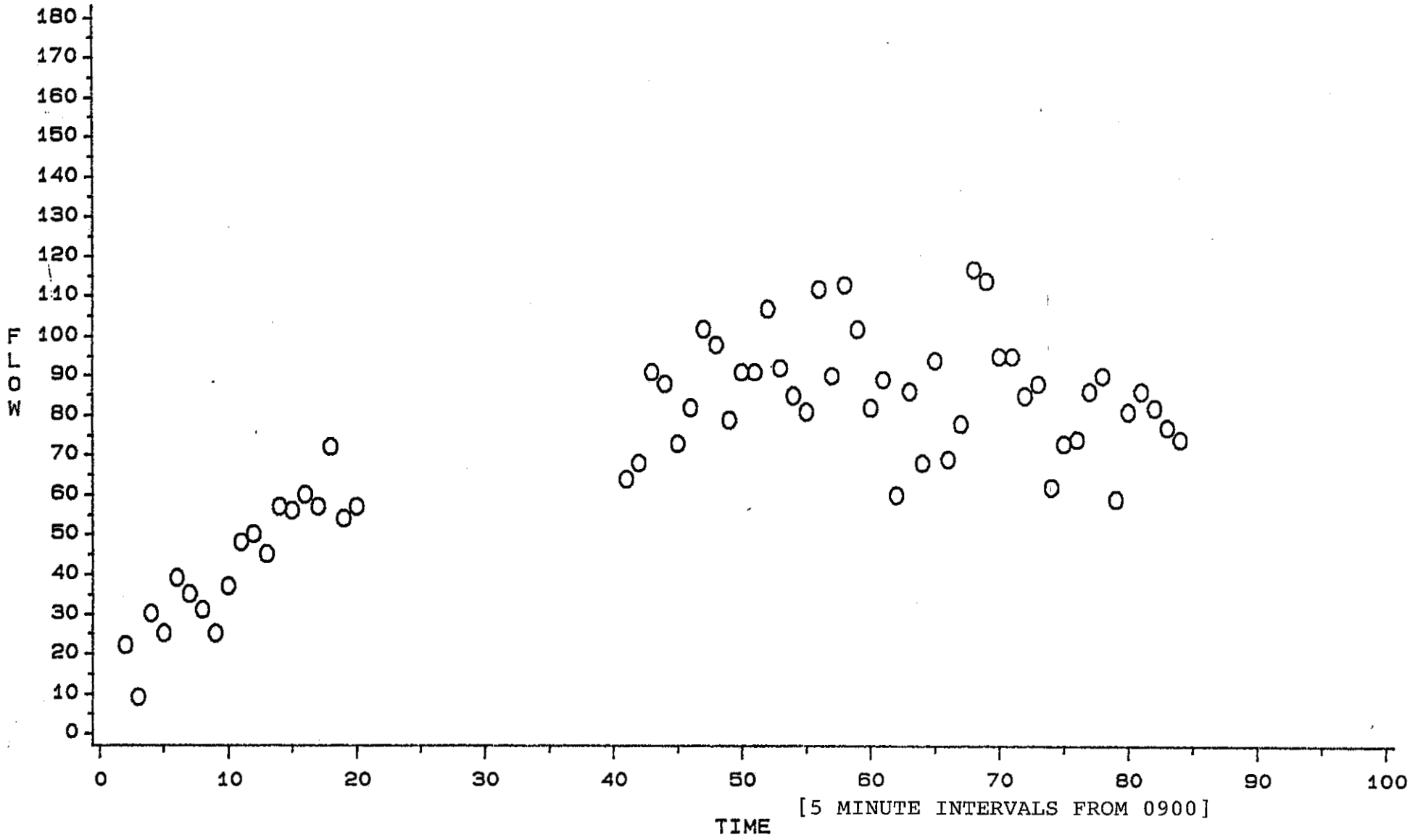
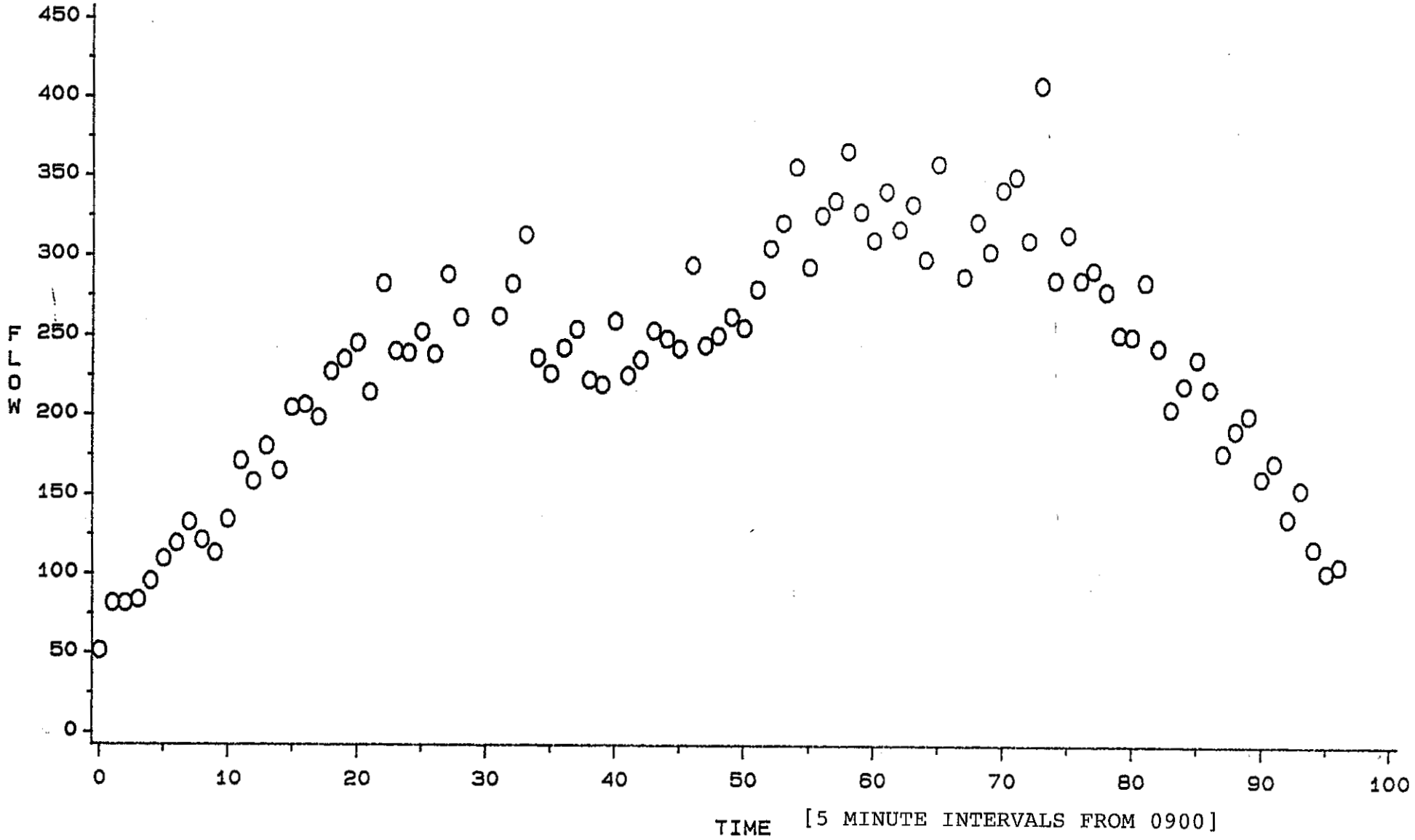
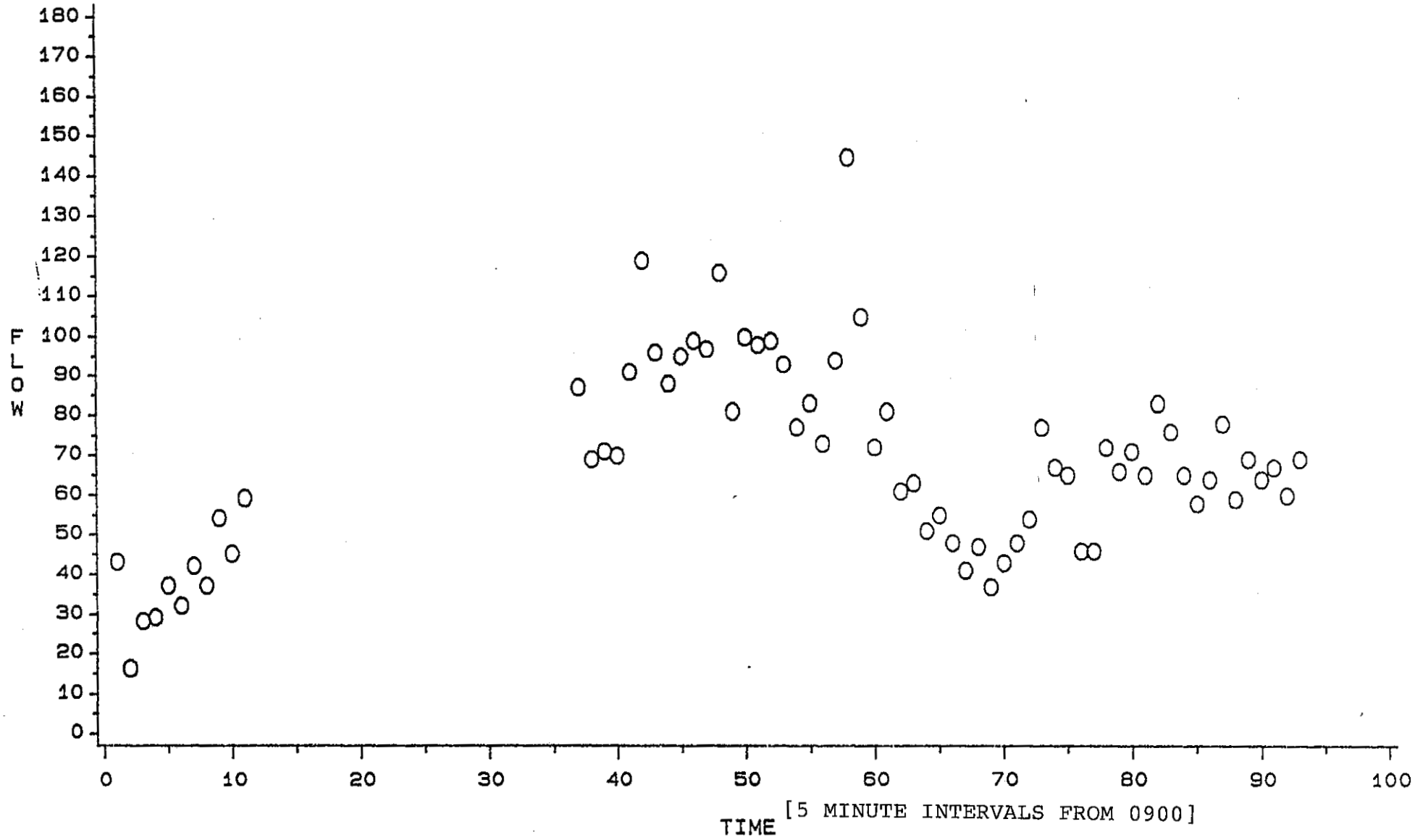


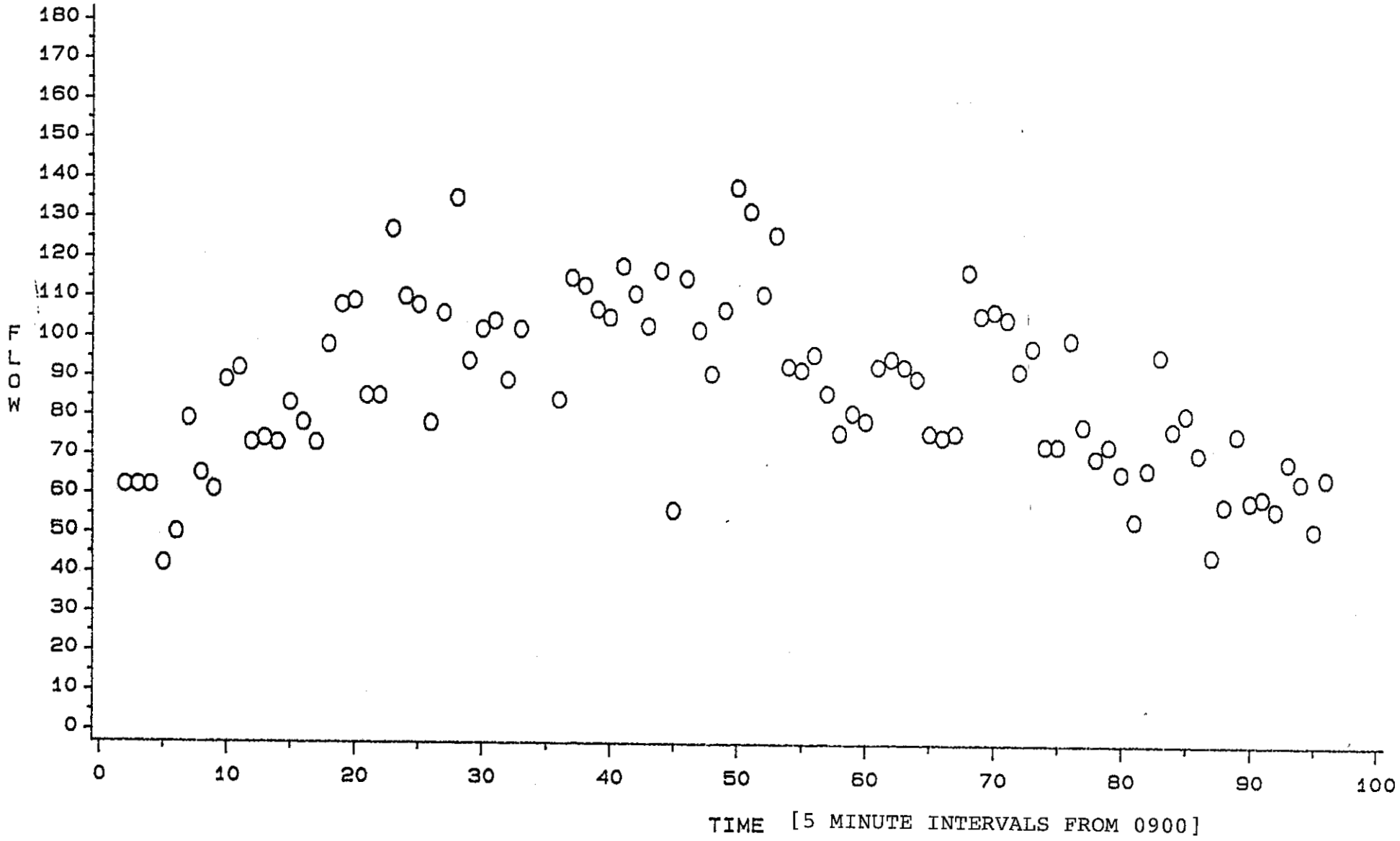
06 ABERDEEN (1/11/86, SAT) VIDEO DATA



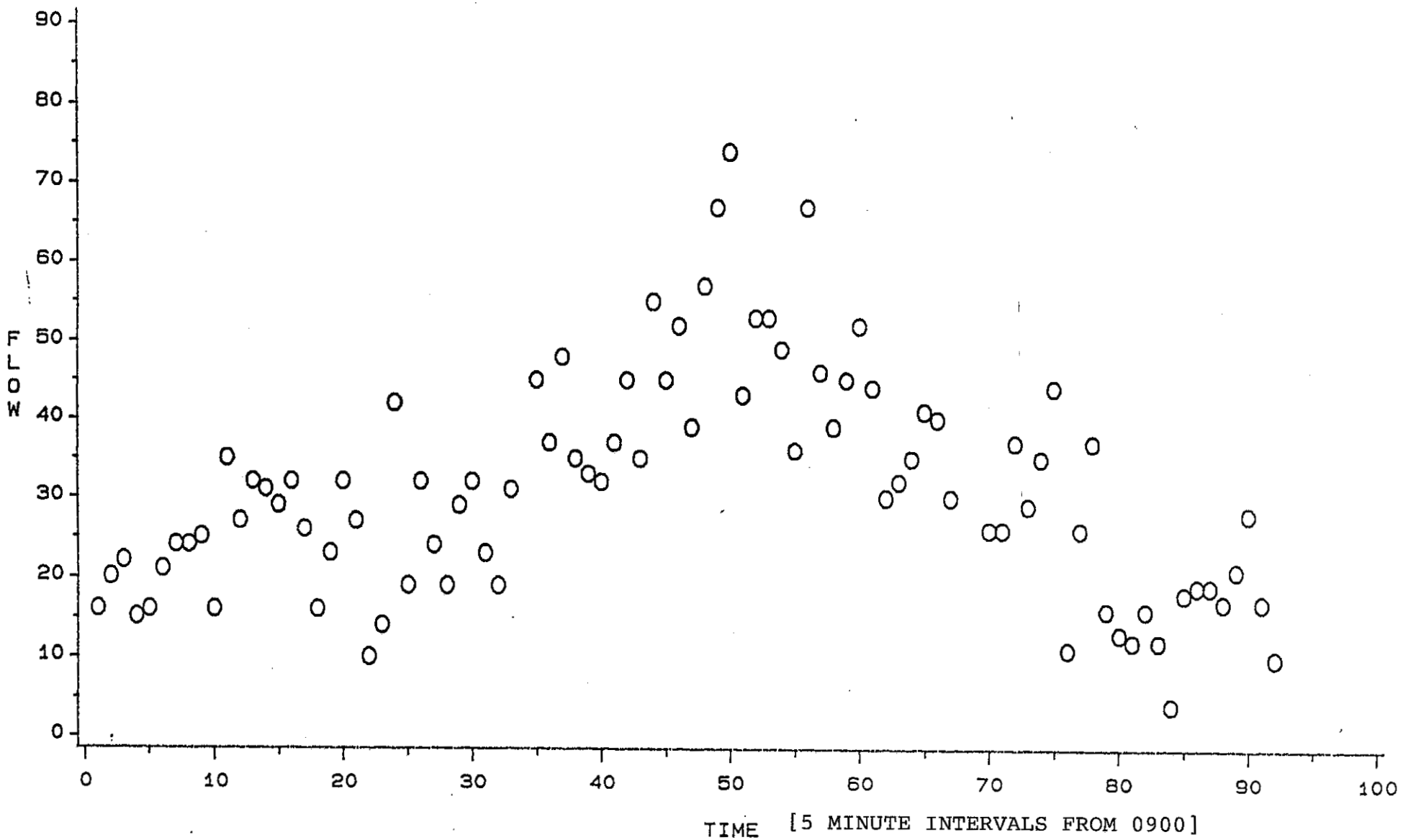
07 LEWISHAM (6/11/86, THUR) VIDEO DATA



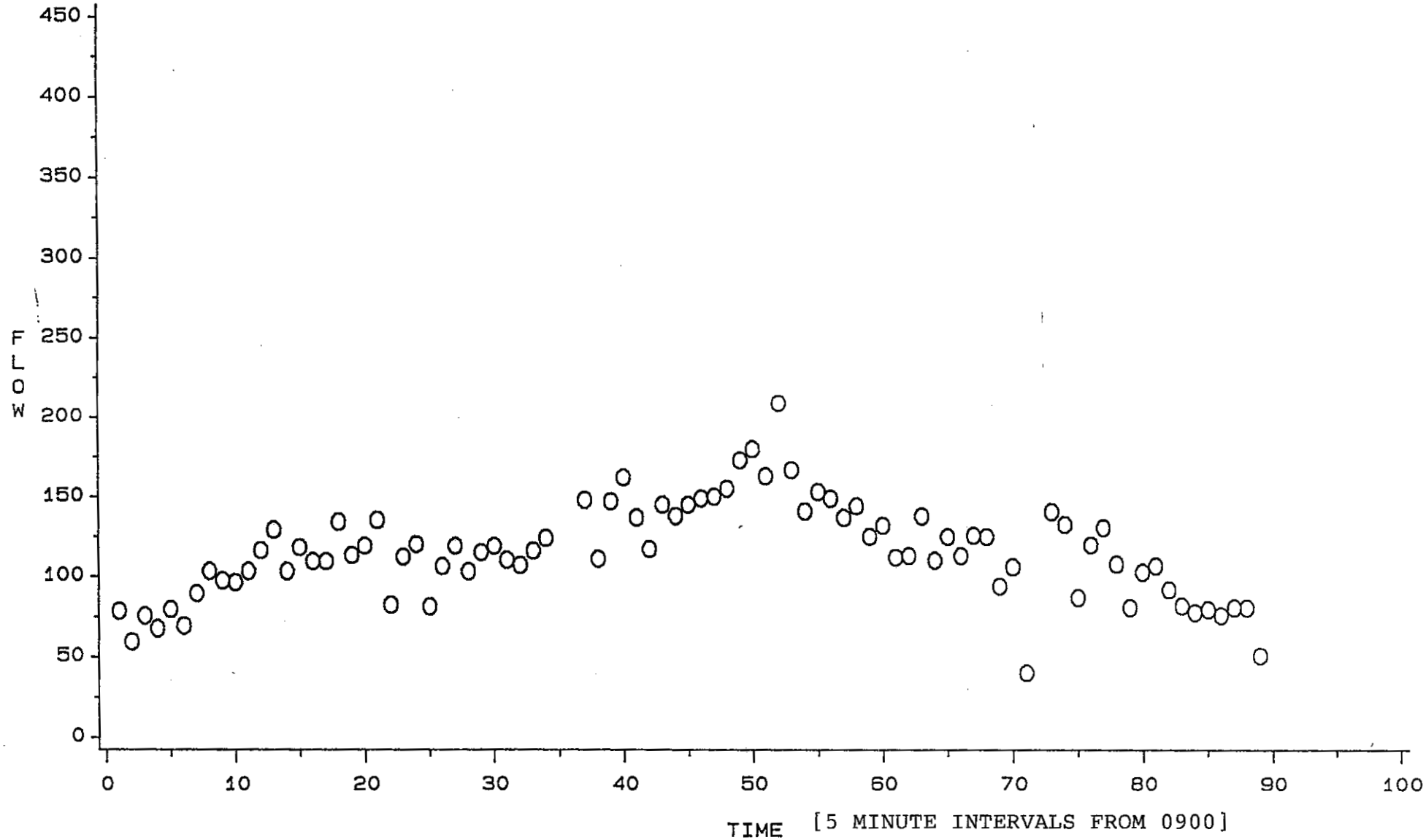
08 EPSOM (10/11/86, MON) VIDEO DATA



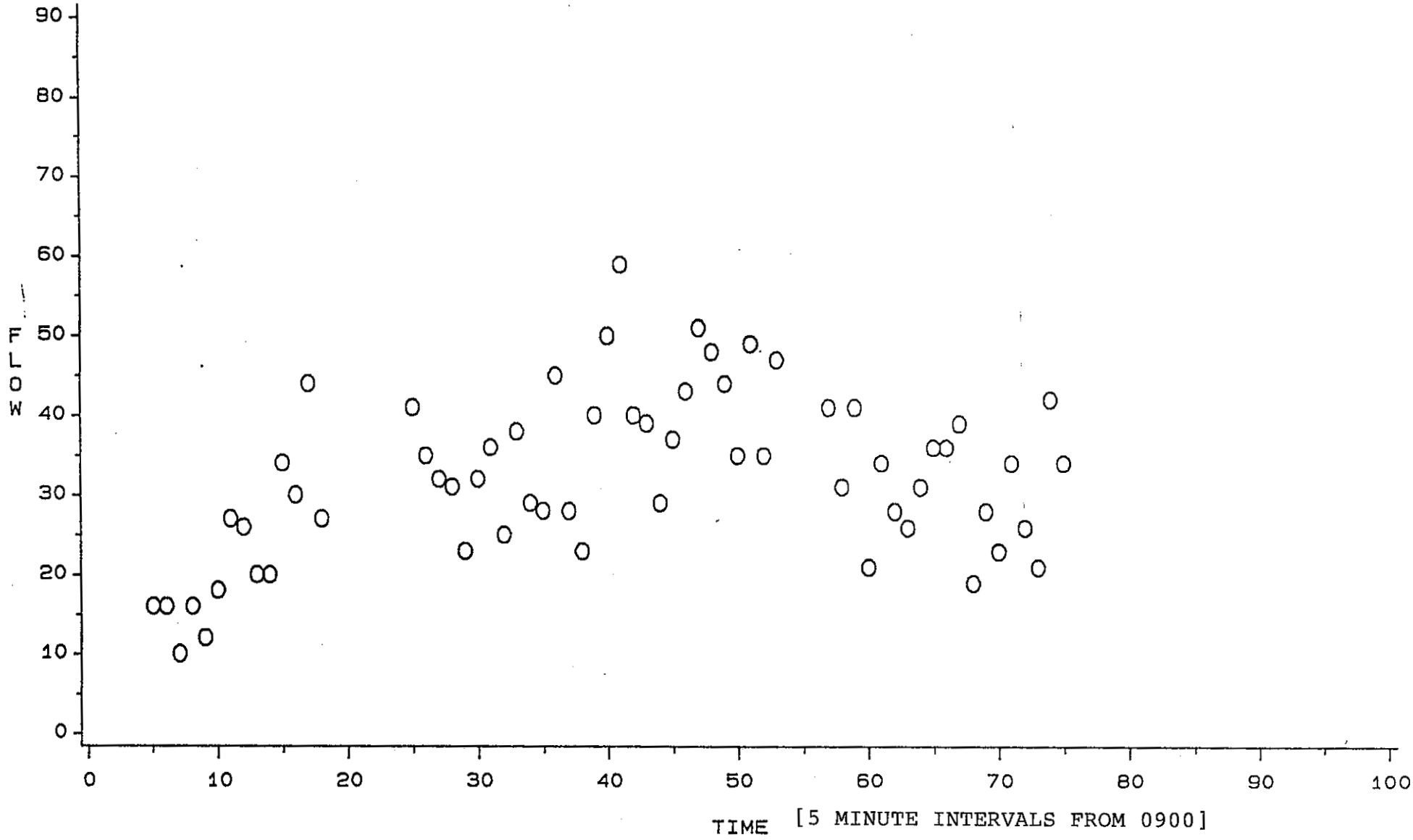
09 WINCHESTER (12/11/86, WED) VIDEO DATA



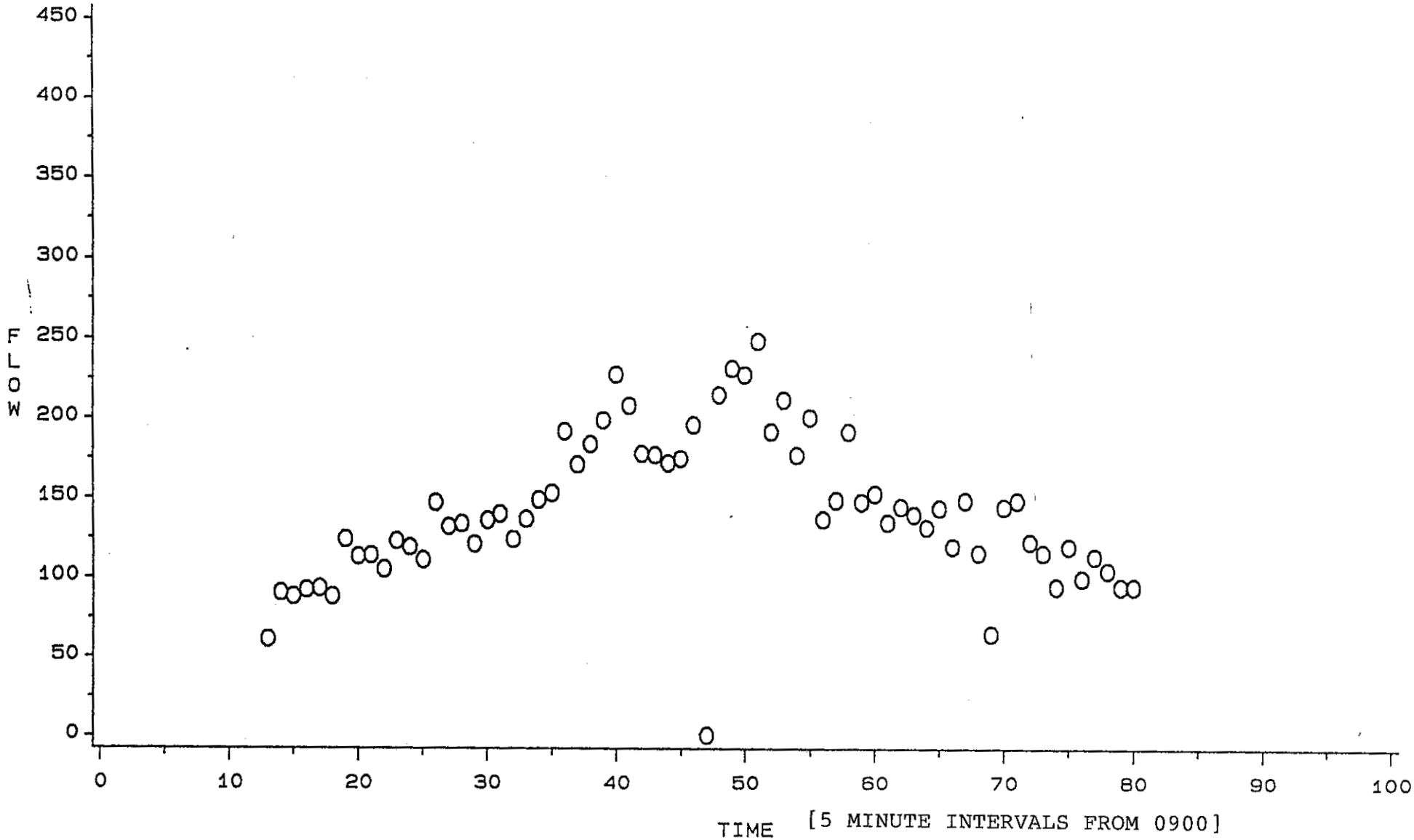
10 GUILDFORD (14/11/86, FRI) VIDEO DATA



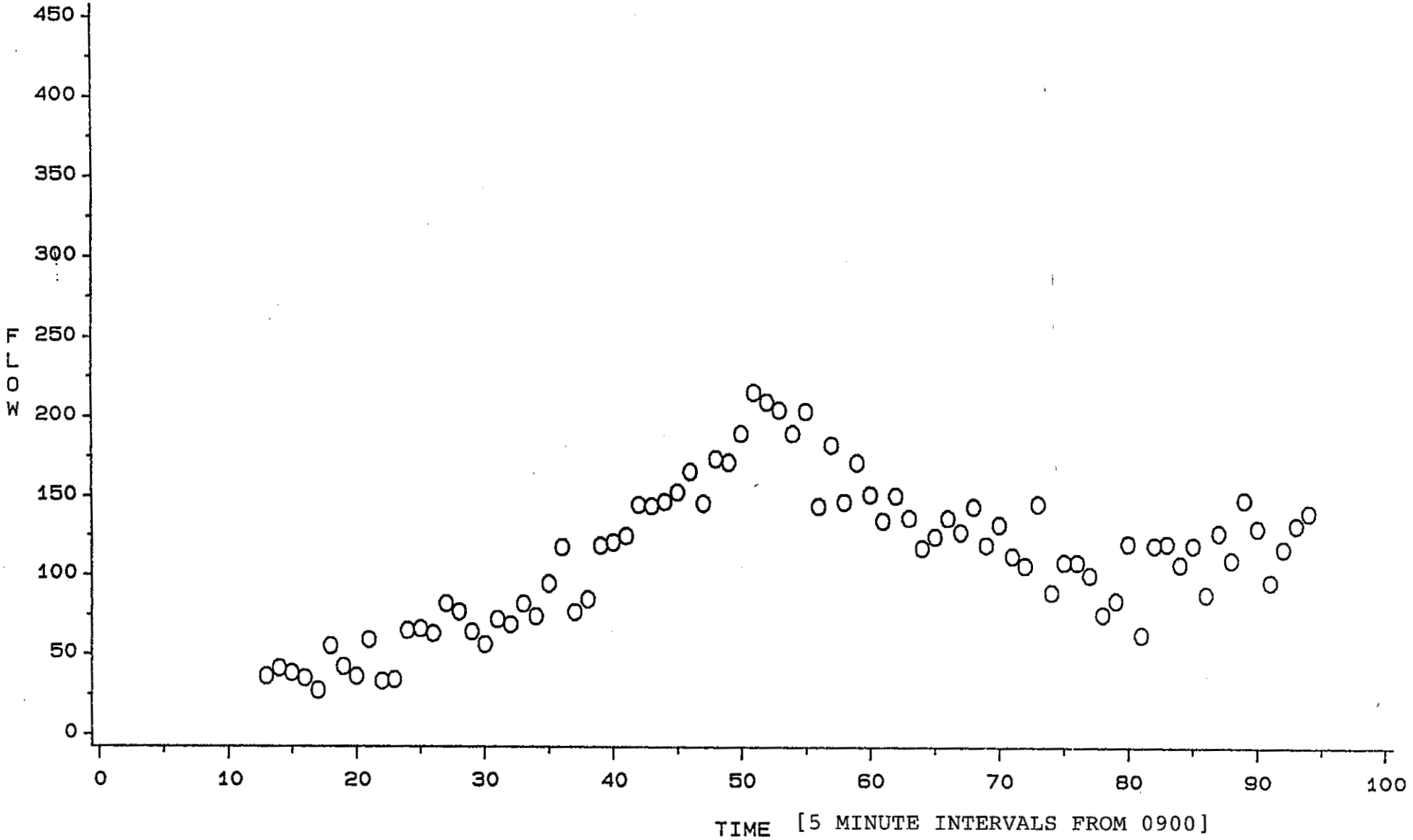
11 TWICKENHAM (18/11/86, TUE) VIDEO DATA



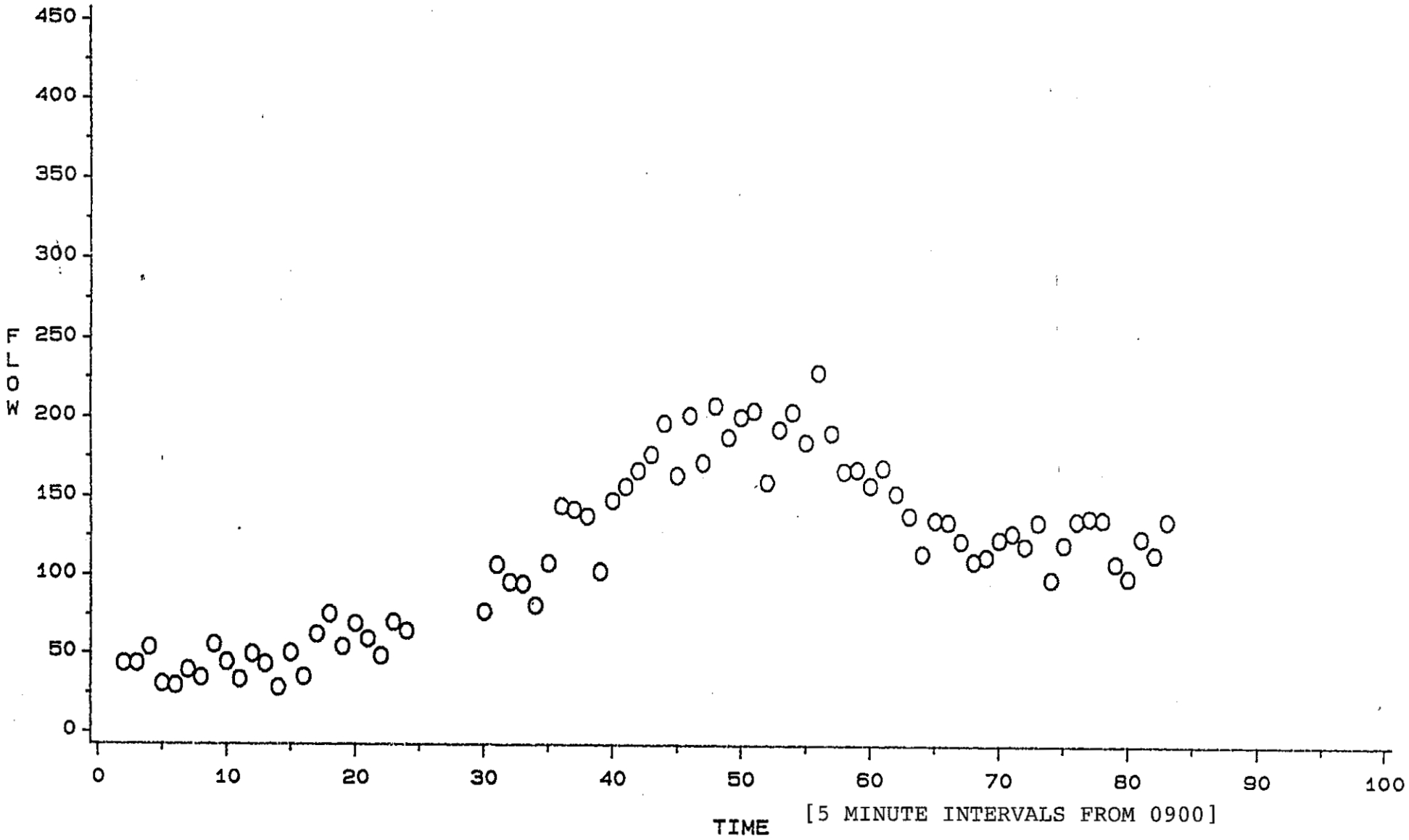
12 BRISTOL (20/11/86, THUR) VIDEO DATA



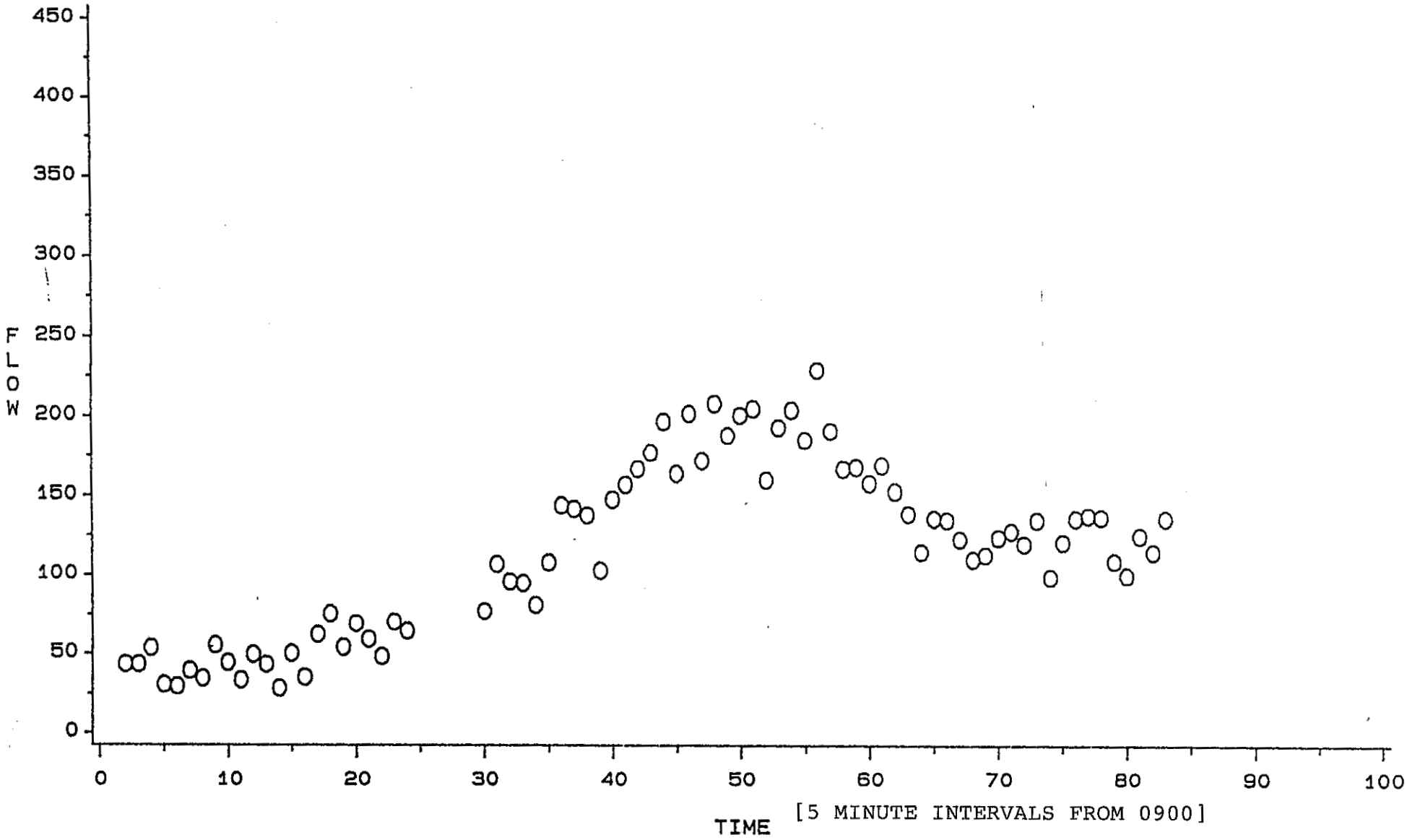
13 MANCHESTER (20/11/86, THUR) VIDEO DATA



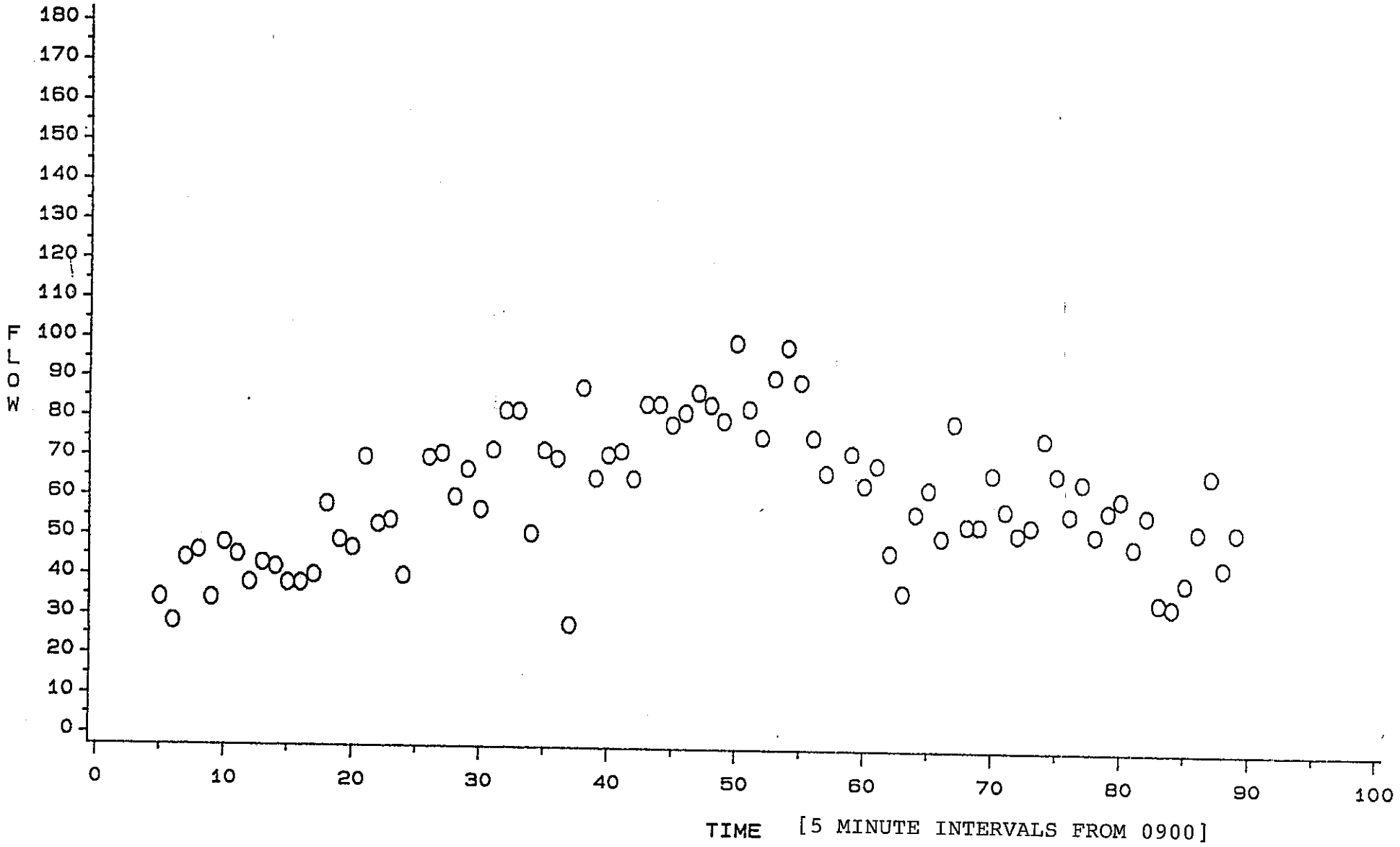
13 MANCHESTER (21/11/86, FRI) VIDEO DATA



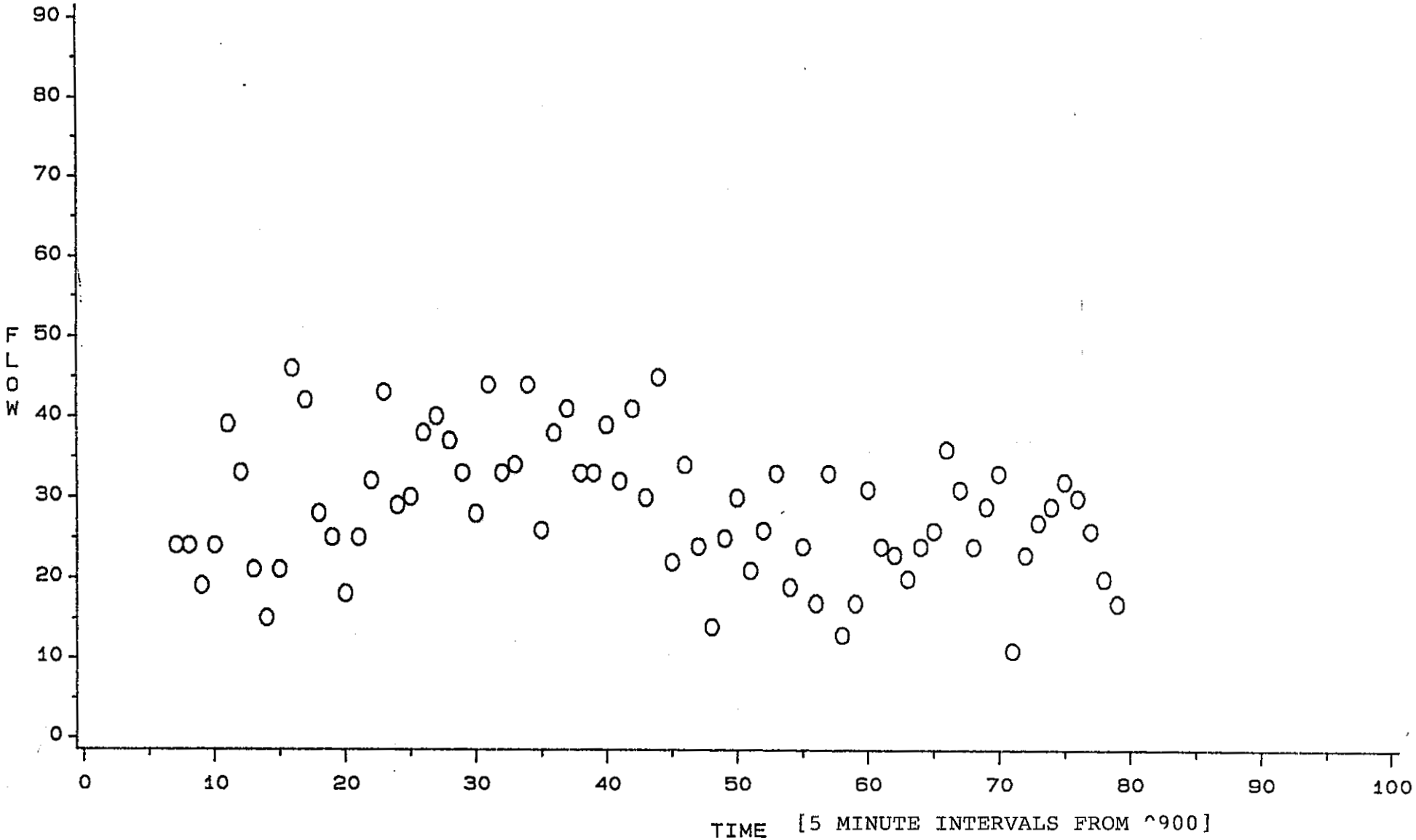
13 MANCHESTER (21/11/86, FRI) VIDEO DATA



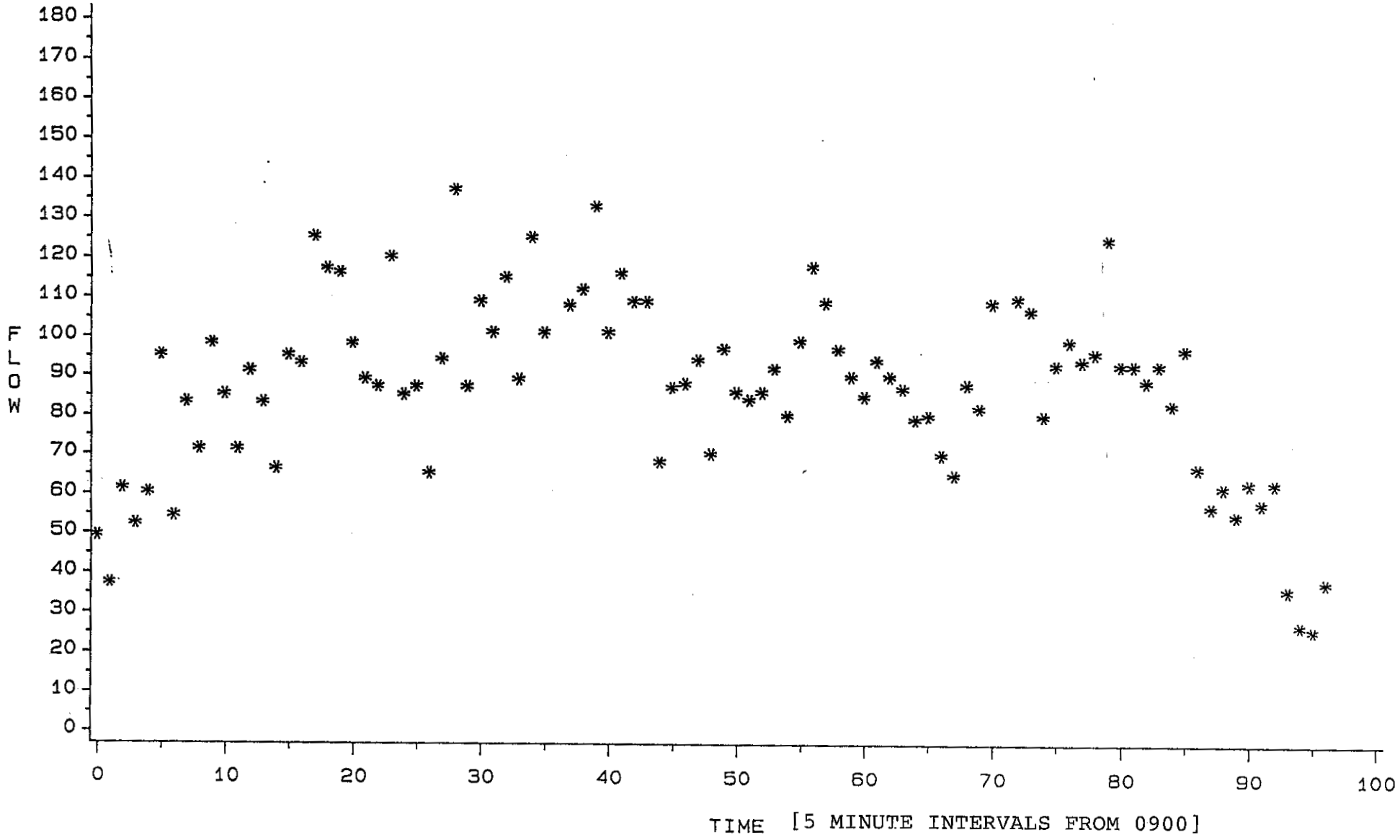
14 COVENTRY (24/11/86, MON) VIDEO DATA



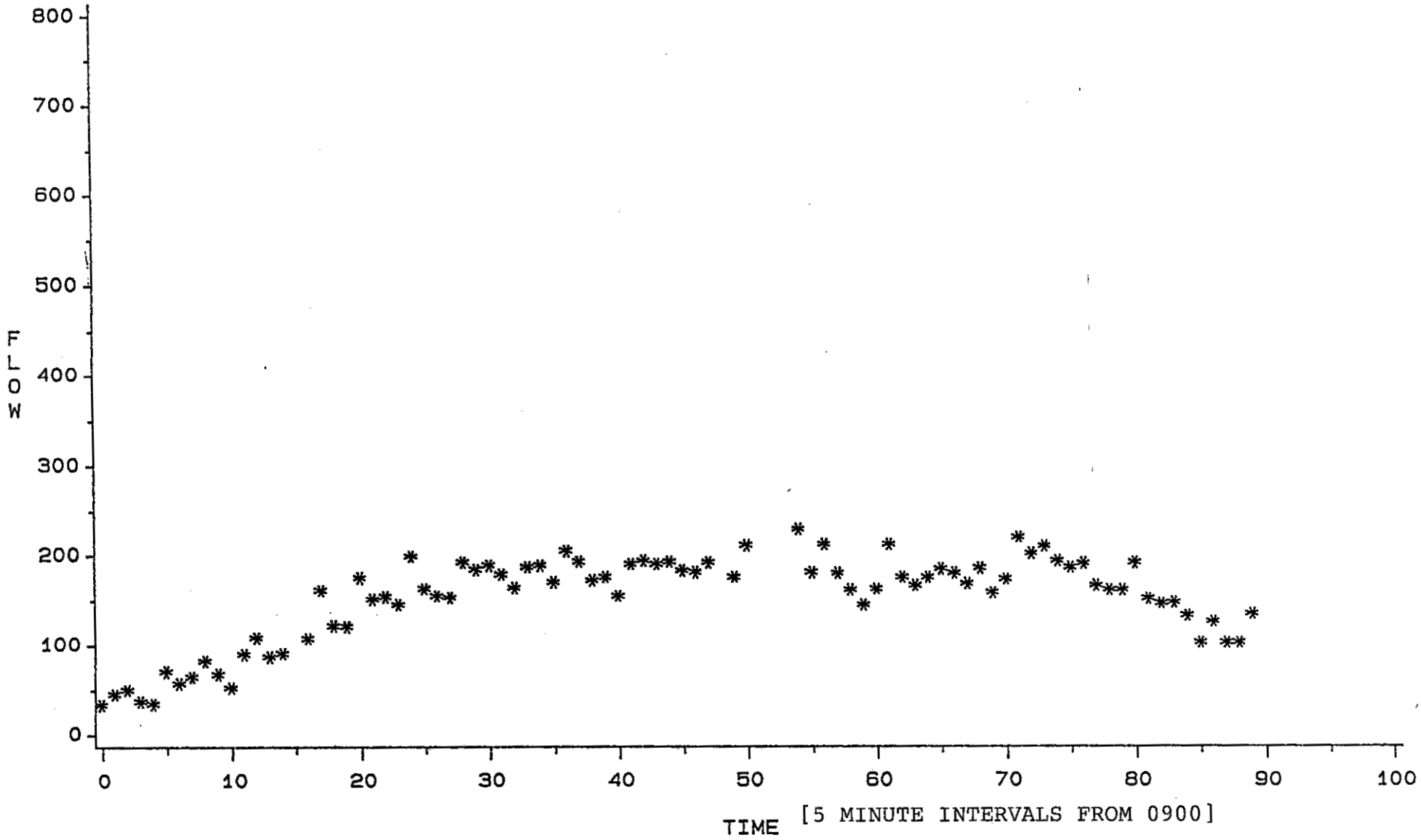
15 HAZEL GROVE (27/11/86, THUR) VIDEO DATA



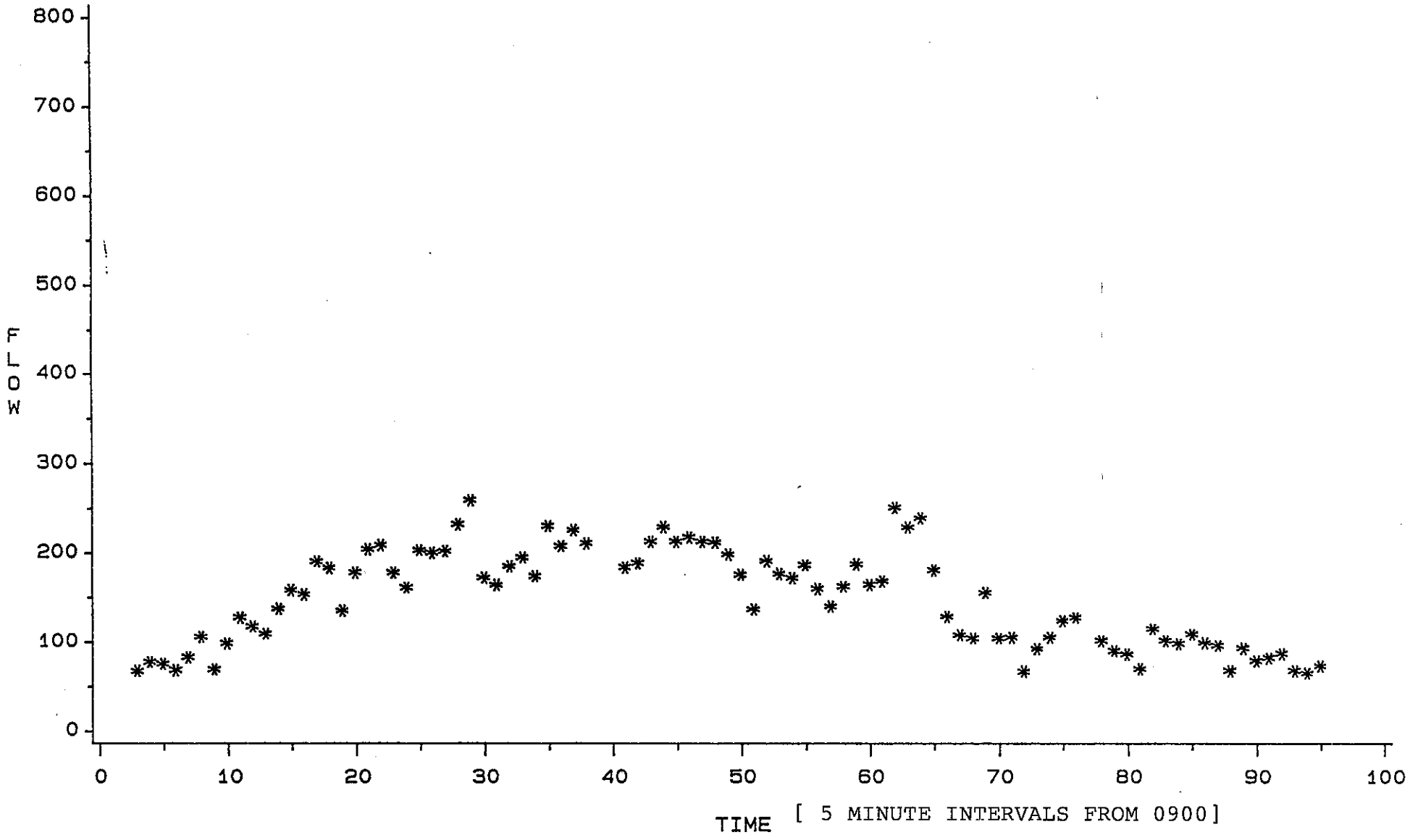
01 CHESTERFIELD (18/10/86, SAT) VIDEO DATA



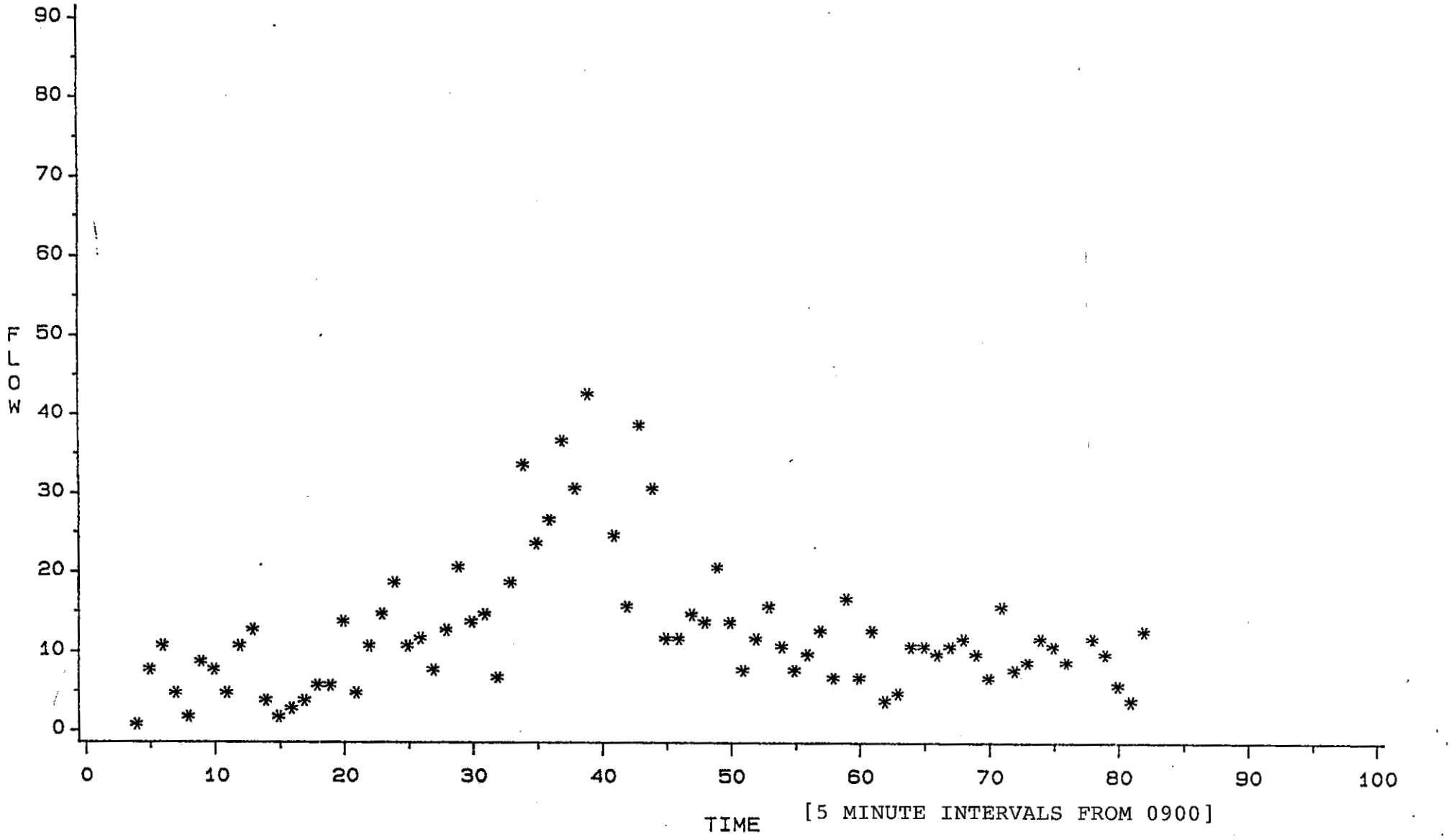
02 SHEFFIELD (25/10/86, SAT) VIDEO DATA



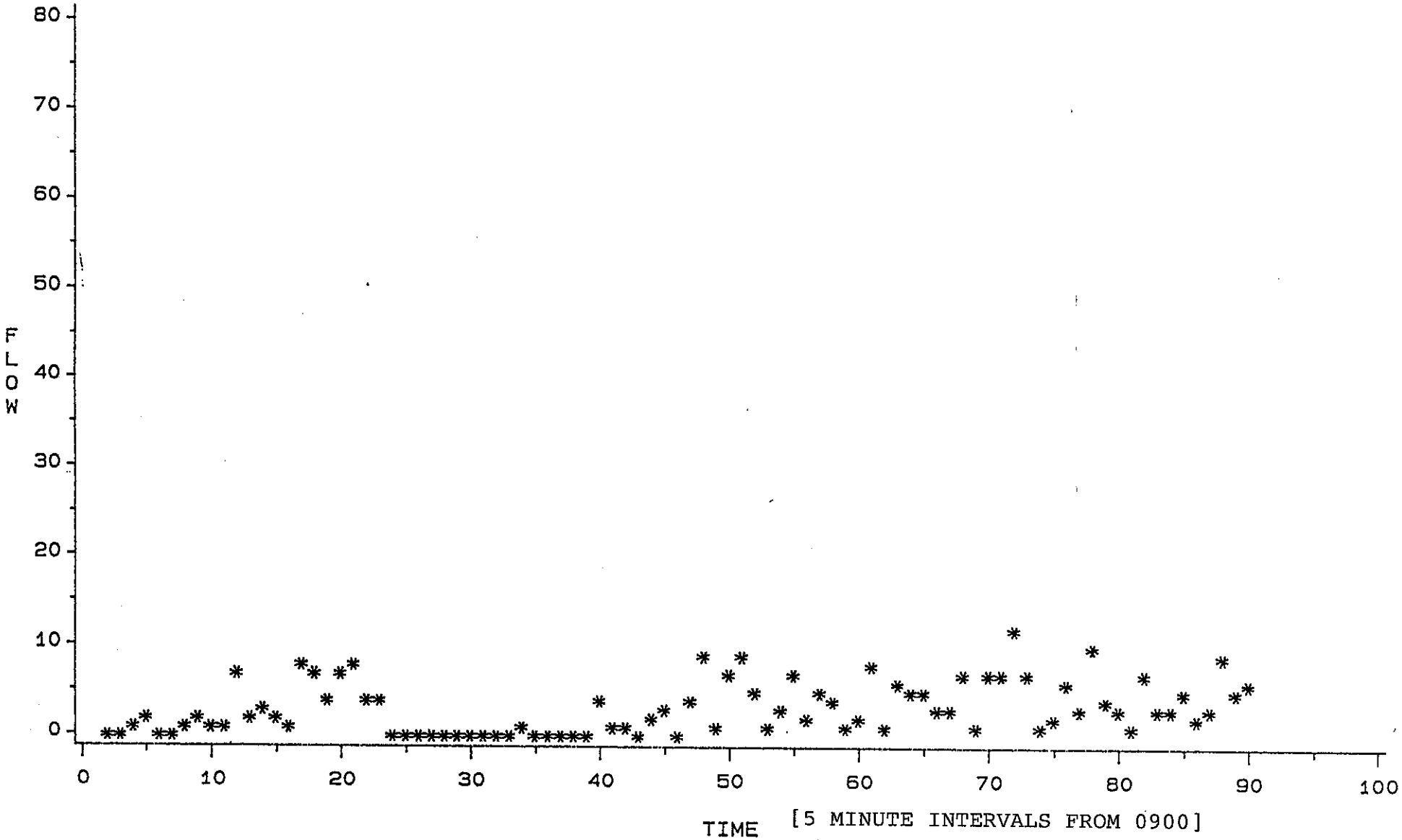
02 SHEFFIELD (24/10/86, FRI) VIDEO DATA



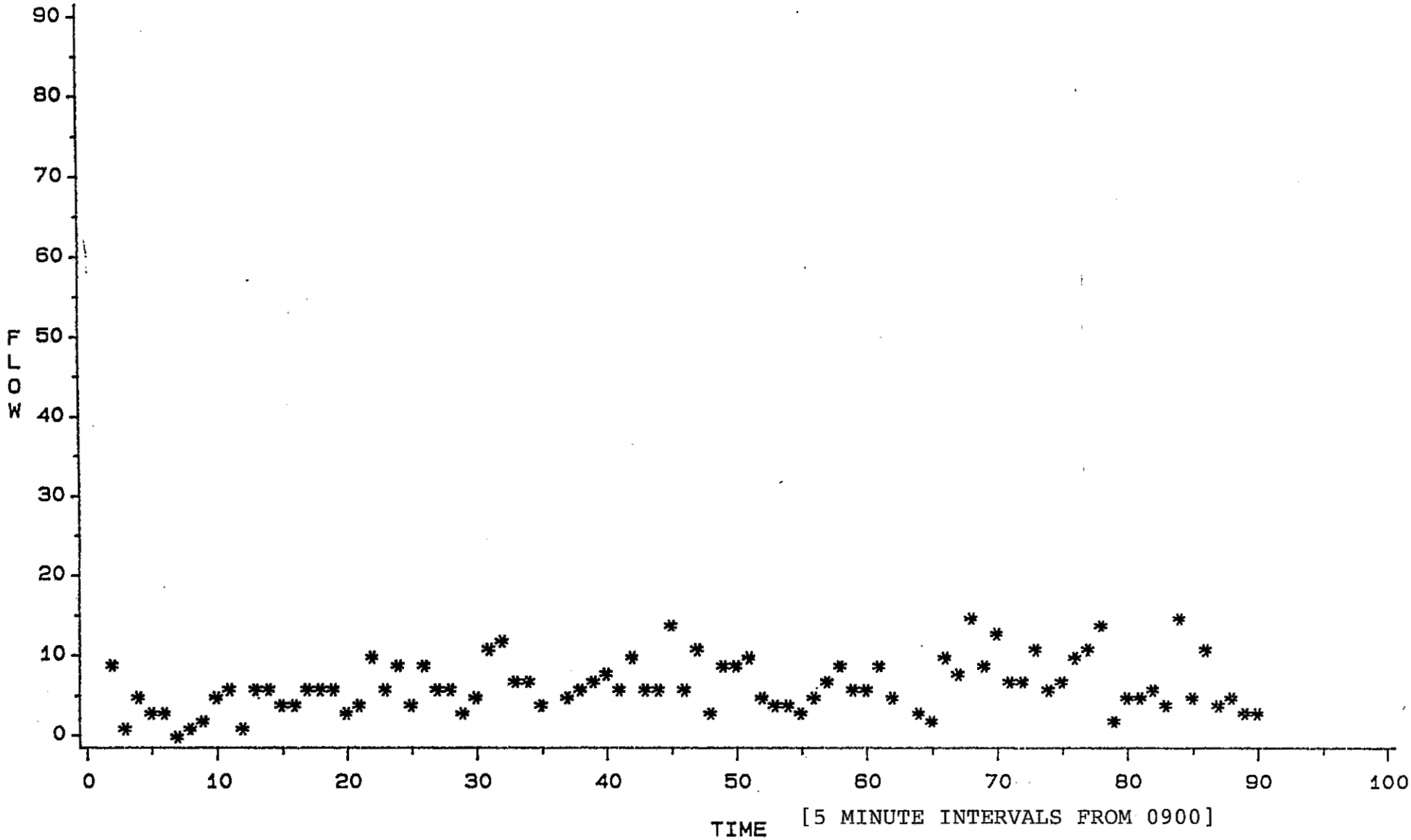
03 LANARK (27/10/86, MON) VIDEO DATA



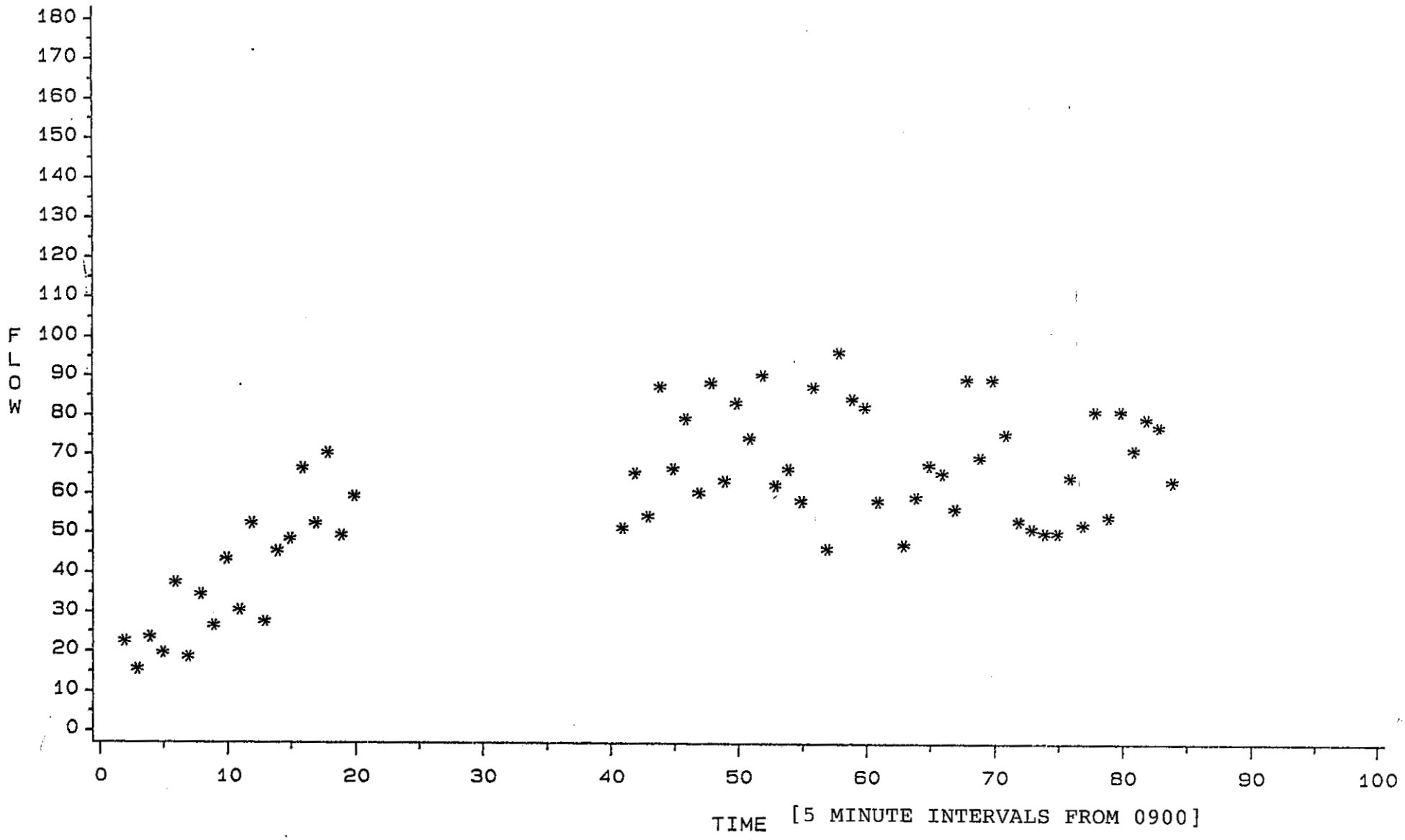
04 HEBDEN BRIDGE (30/10/86, THUR) VIDEO DATA



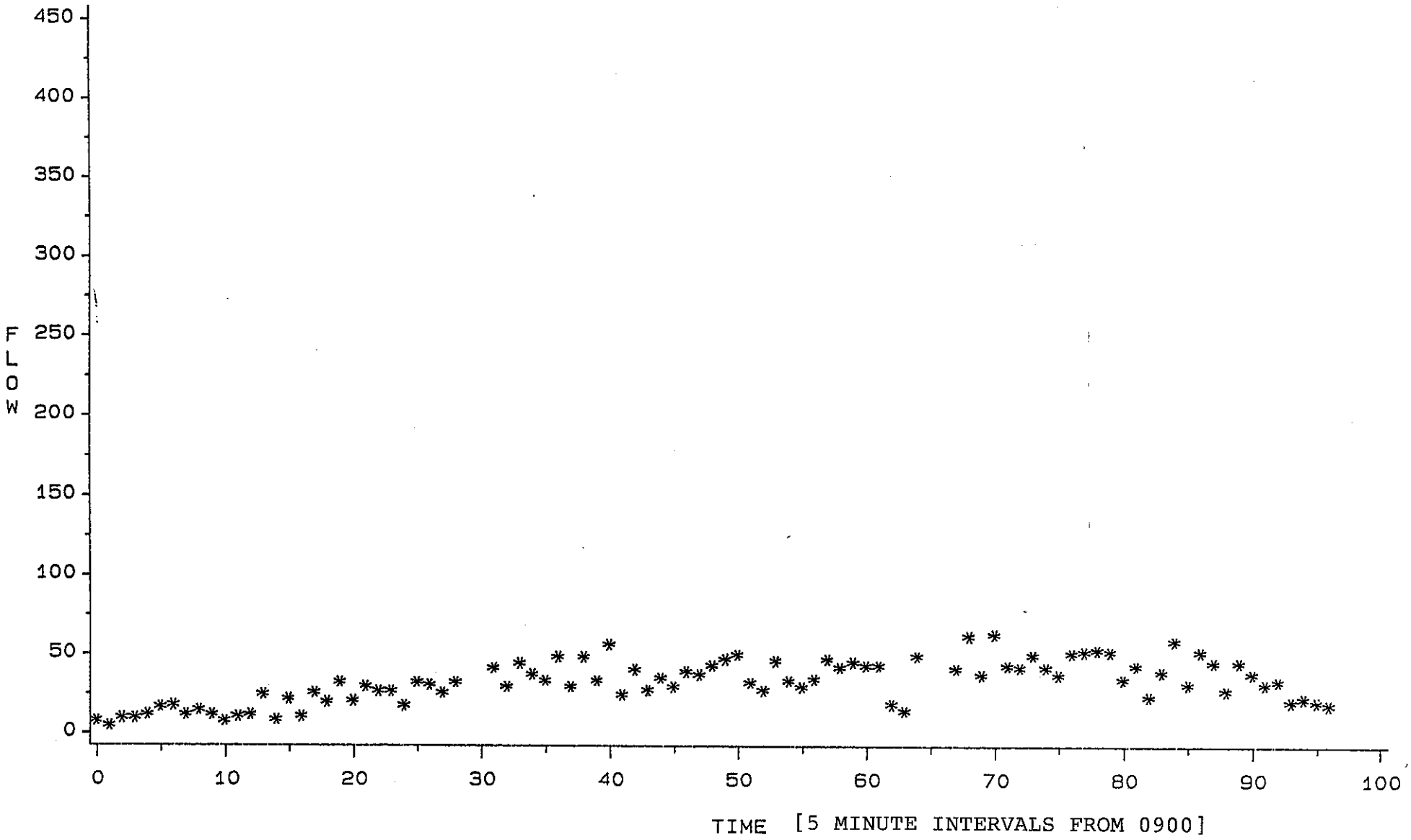
04 HEBDEN BRIDGE (31/10/86, FRI) VIDEO DATA



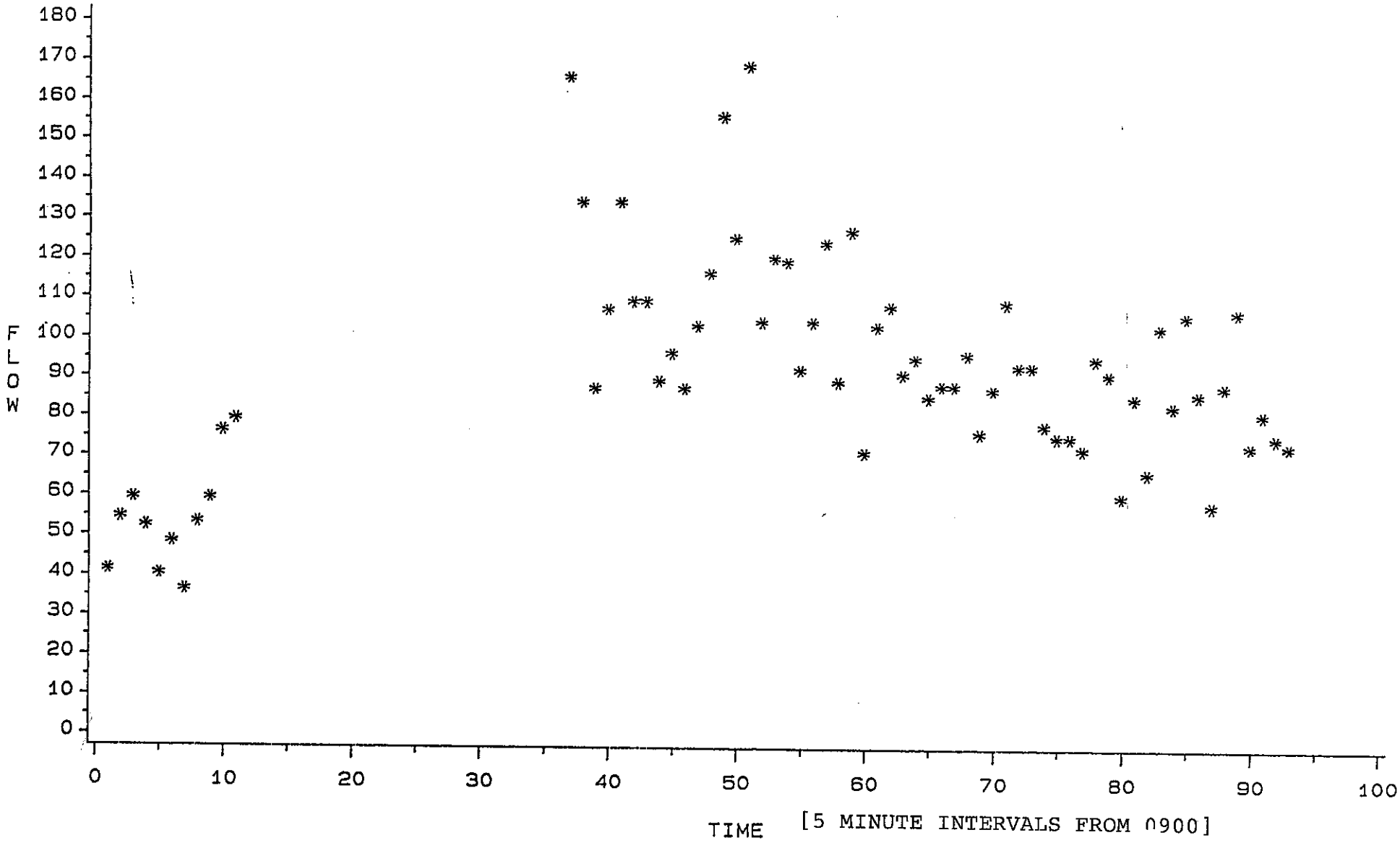
05 KILMARNOCK (31/10/86, FRI) VIDEO DATA



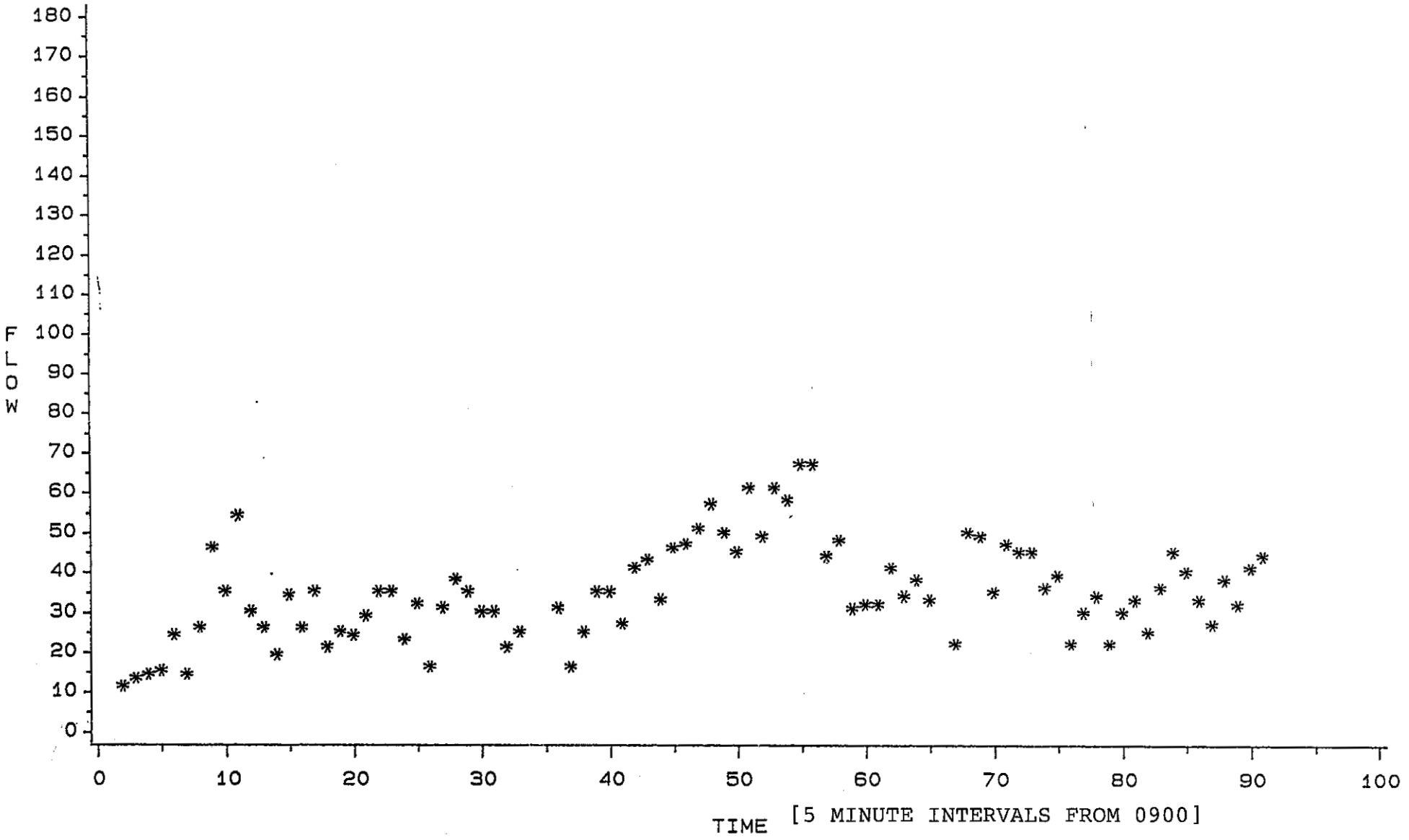
06 ABERDEEN (1/11/86, SAT) VIDEO DATA



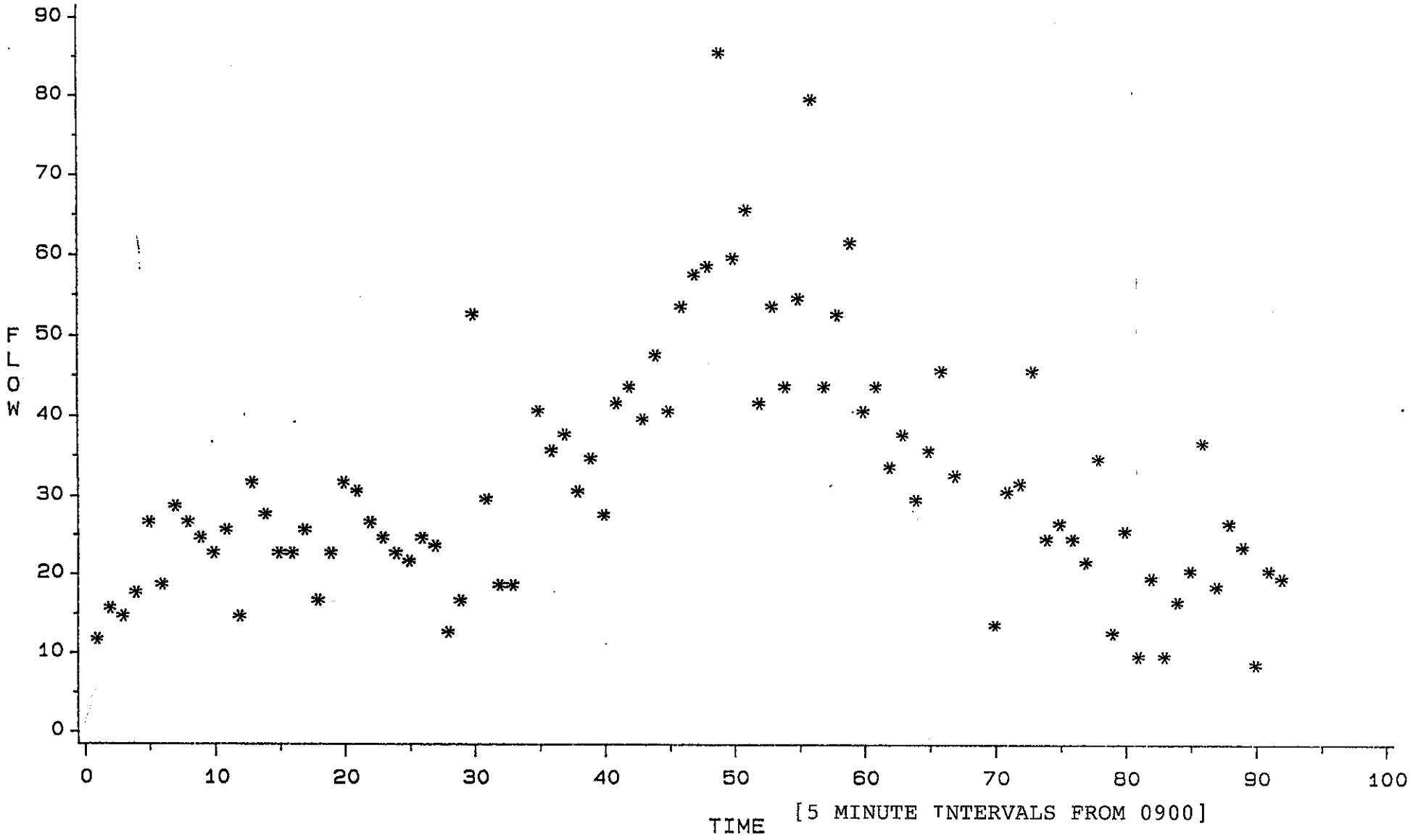
07 LEWISHAM (6/11/86, THUR) VIDEO DATA



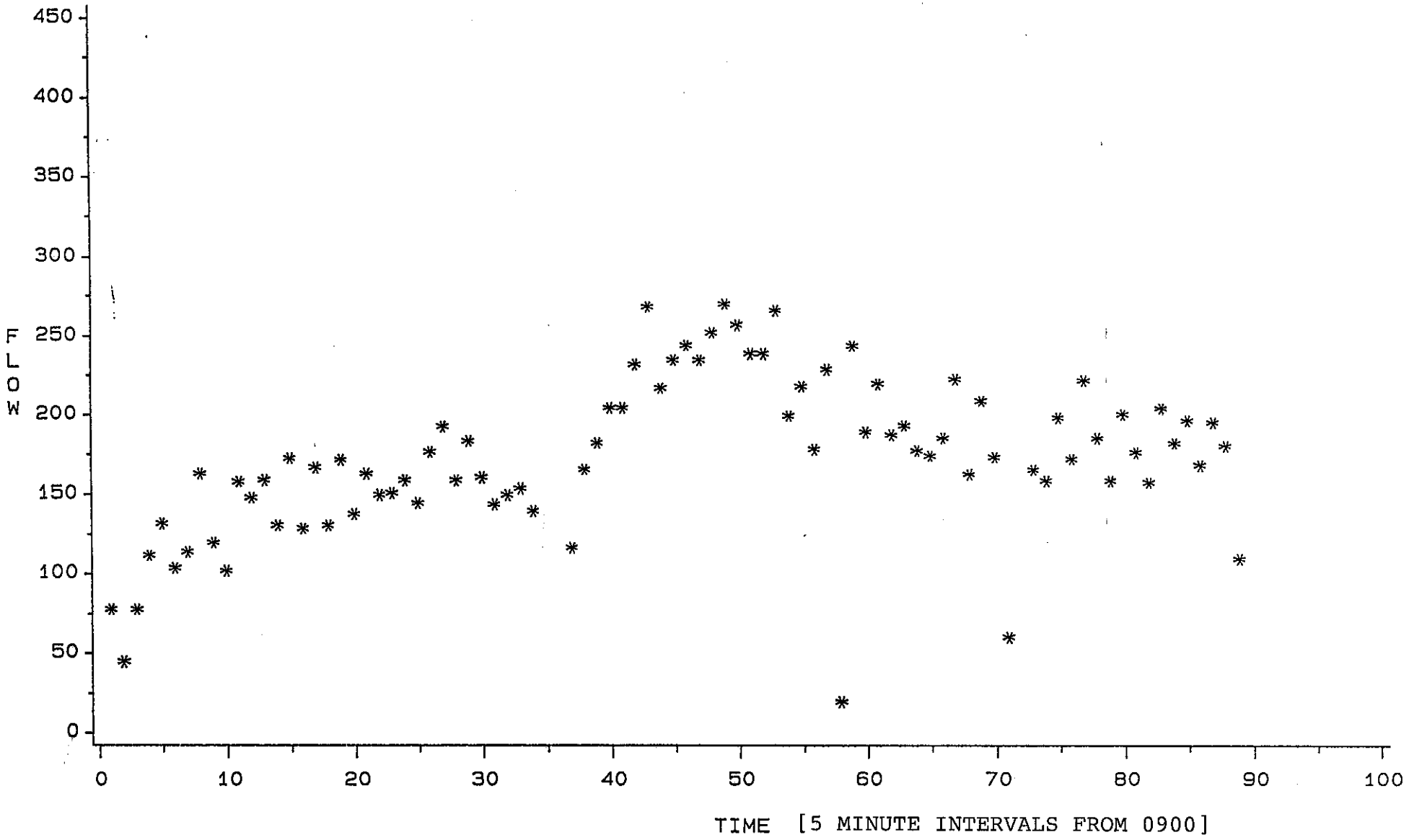
08 EPSOM (10/11/86, MON) VIDEO DATA



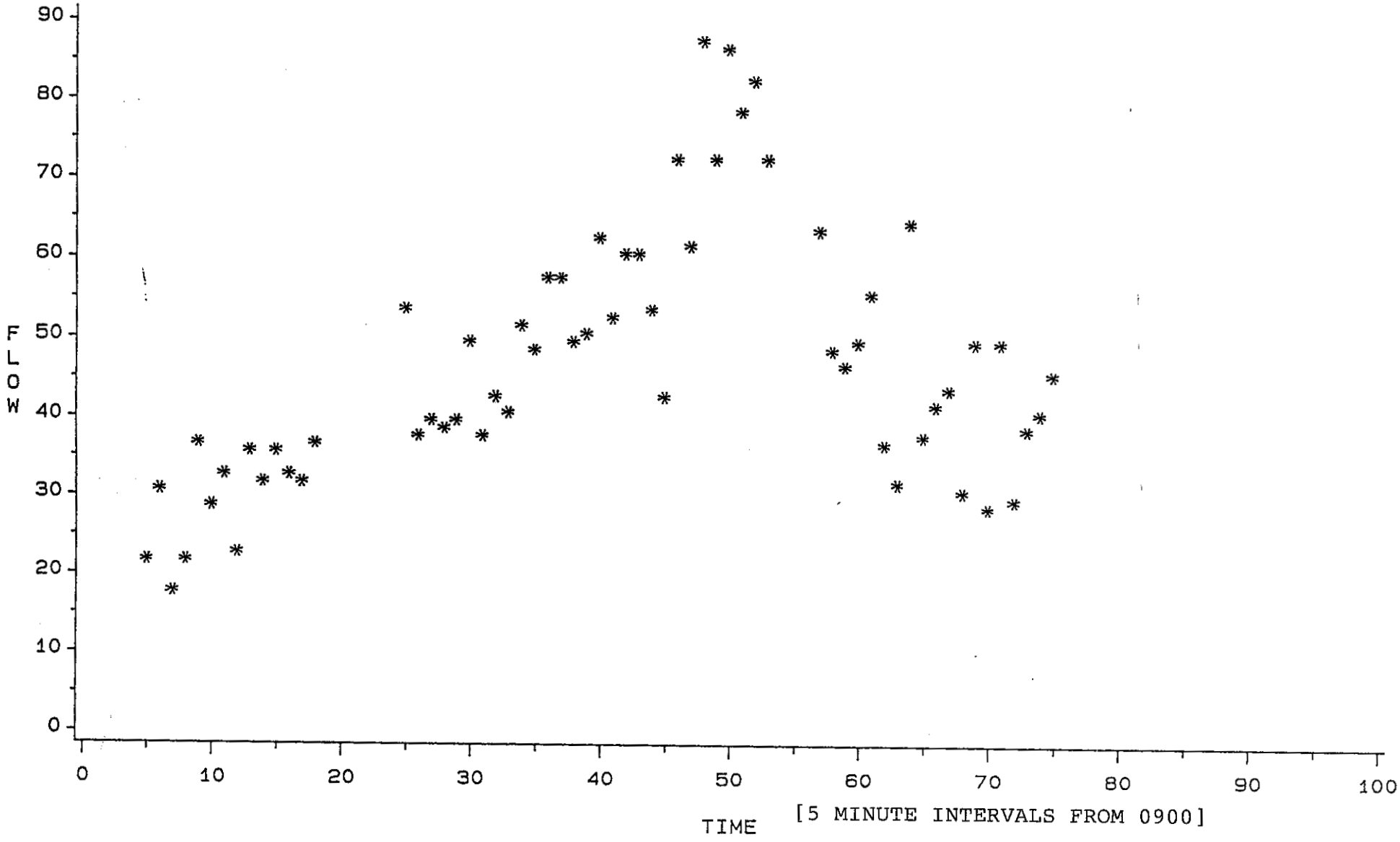
09 WINCHESTER (12/11/86, WED) VIDEO DATA



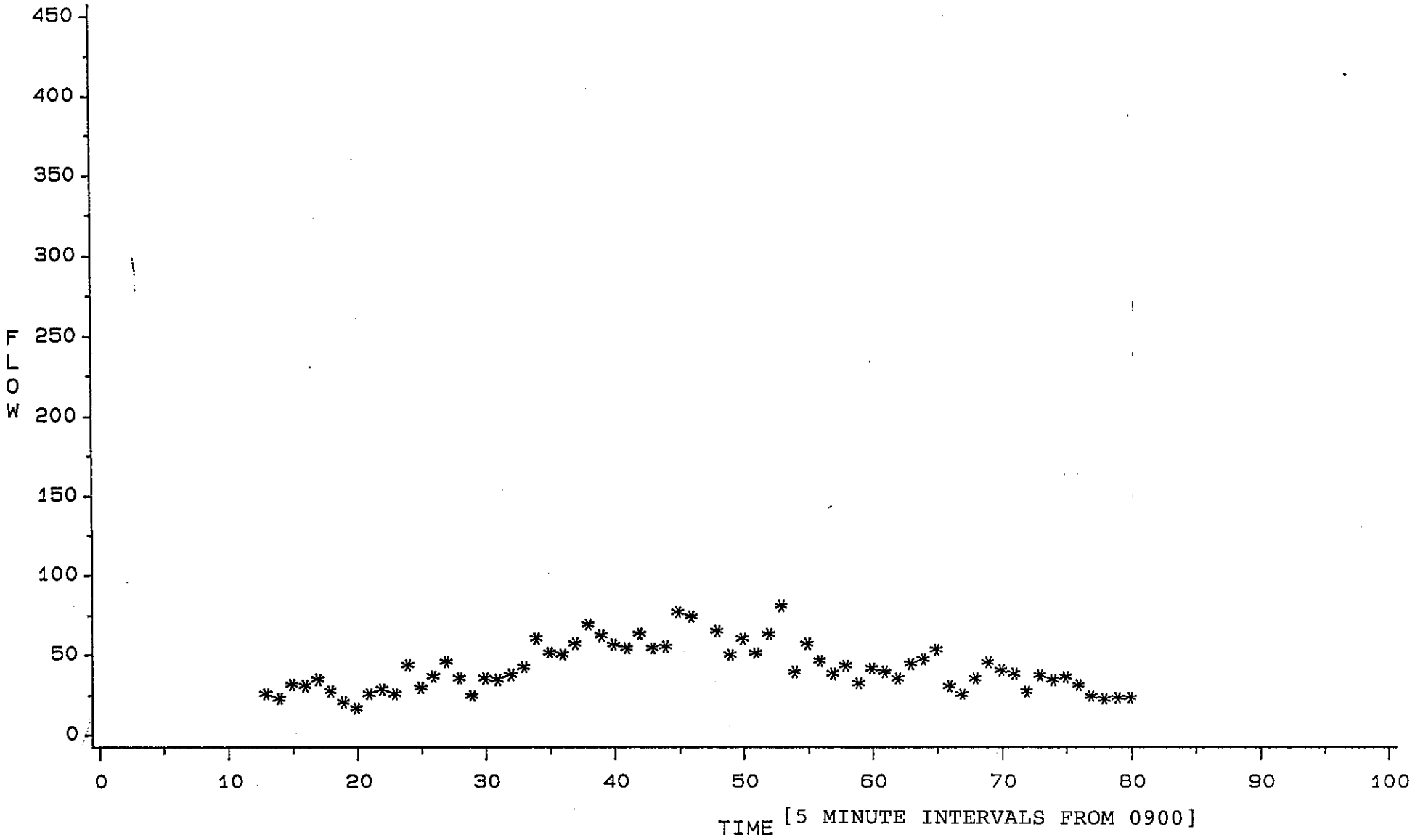
10 GUILDFORD (14/11/86, FRI) VIDEO DATA



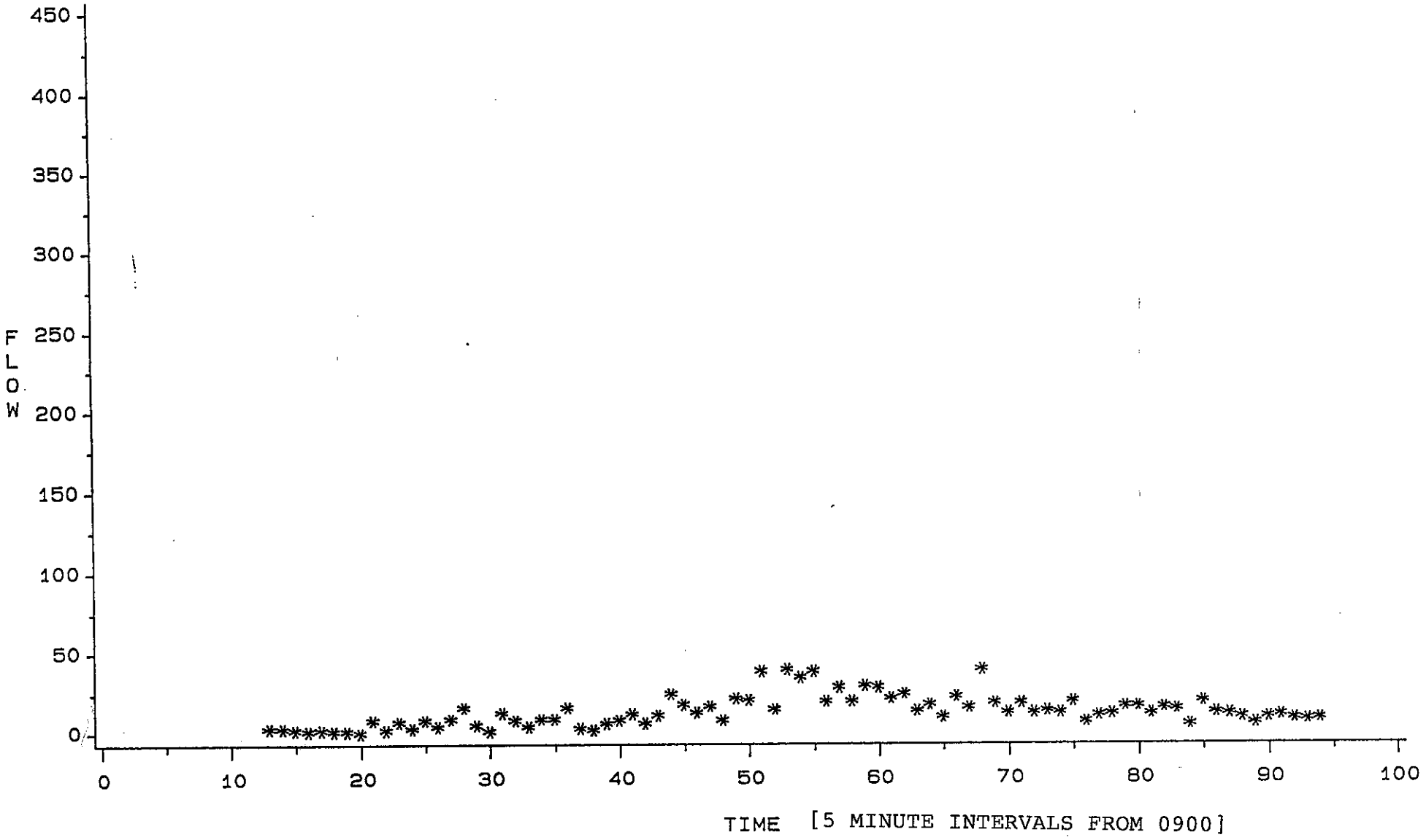
11 TWICKENHAM (18/11/86, TUE) VIDEO DATA



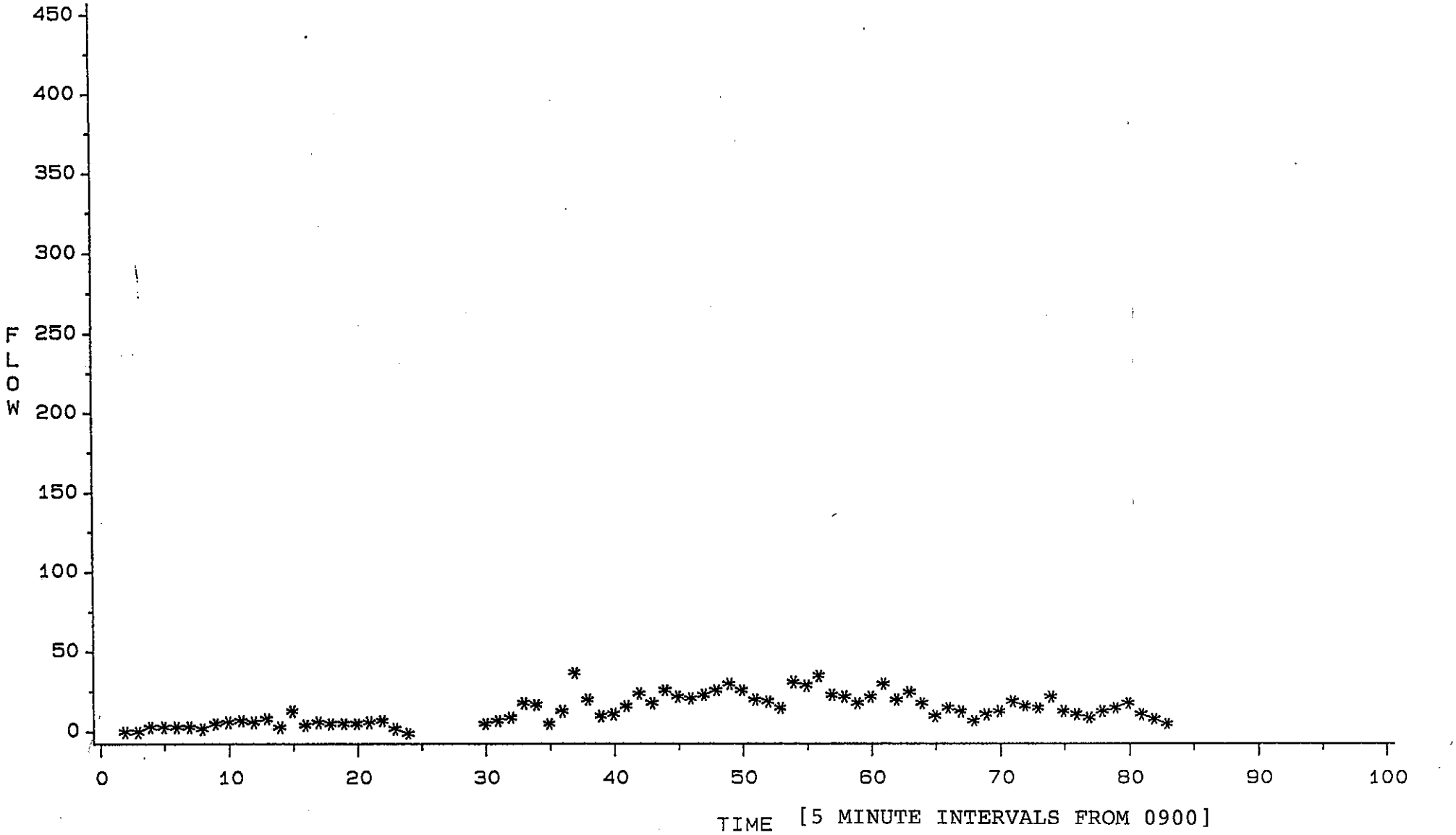
12 BRISTOL (20/11/86, THUR) VIDEO DATA



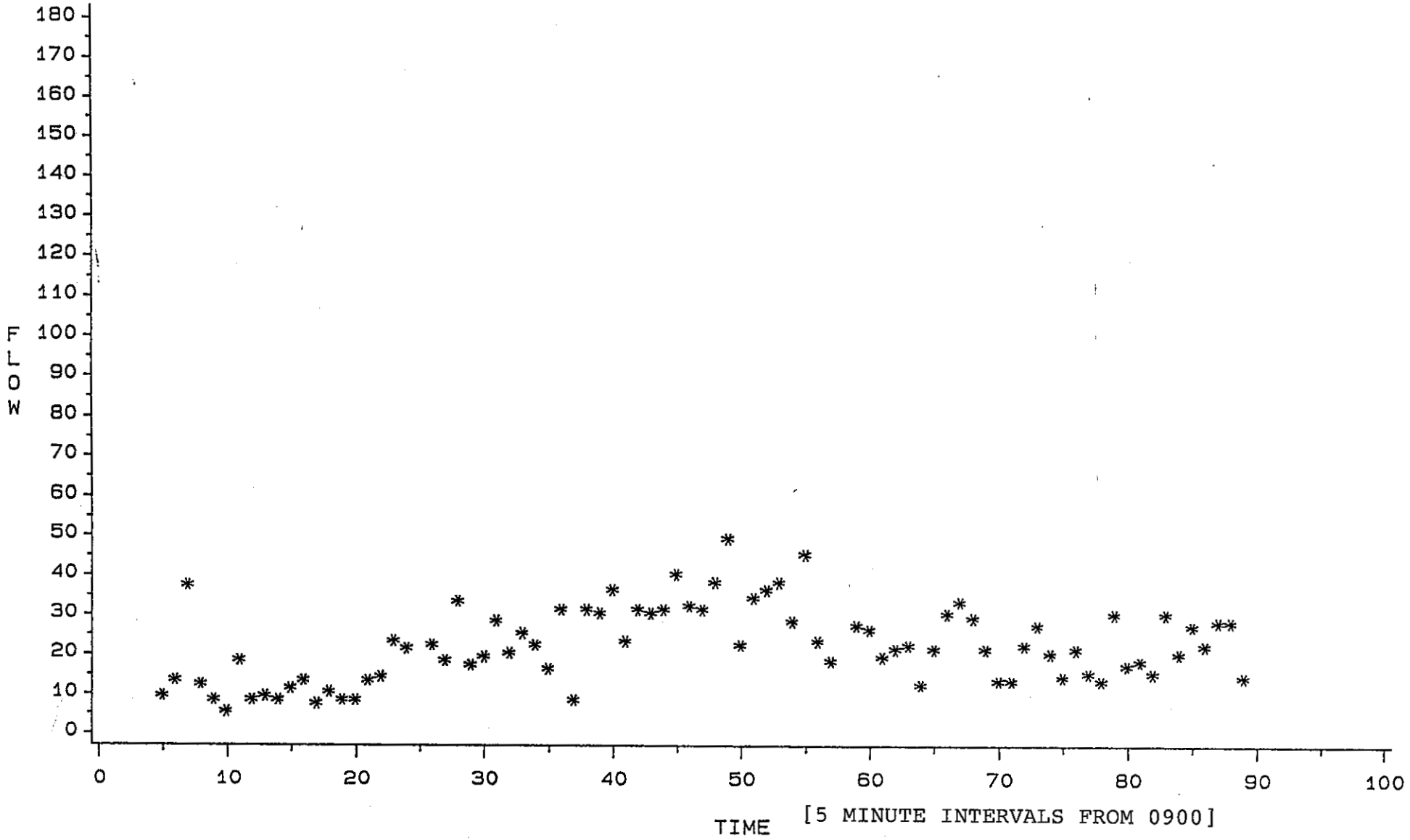
13 MANCHESTER (20/11/86, THUR) VIDEO DATA



13 MANCHESTER (21/11/86, FRI) VIDEO DATA



14 COVENTRY (24/11/86, MON) VIDEO DATA



APPENDIX 3 : CUMULATIVE PERCENTAGES OF REAL AND EFFECTIVE PAVEMENT CONCENTRATIONS AT ALL 15 SITES

Concentration is defined as either

a) Real Pavement Concentration
   - where the real pavement width is used in the calculation of the pavement concentration, or

b) Effective Pavement Concentration
   - where the effective pavement width is used (ie the real pavement width minus the width of the pavement taken up by street furniture, window shoppers etc..)

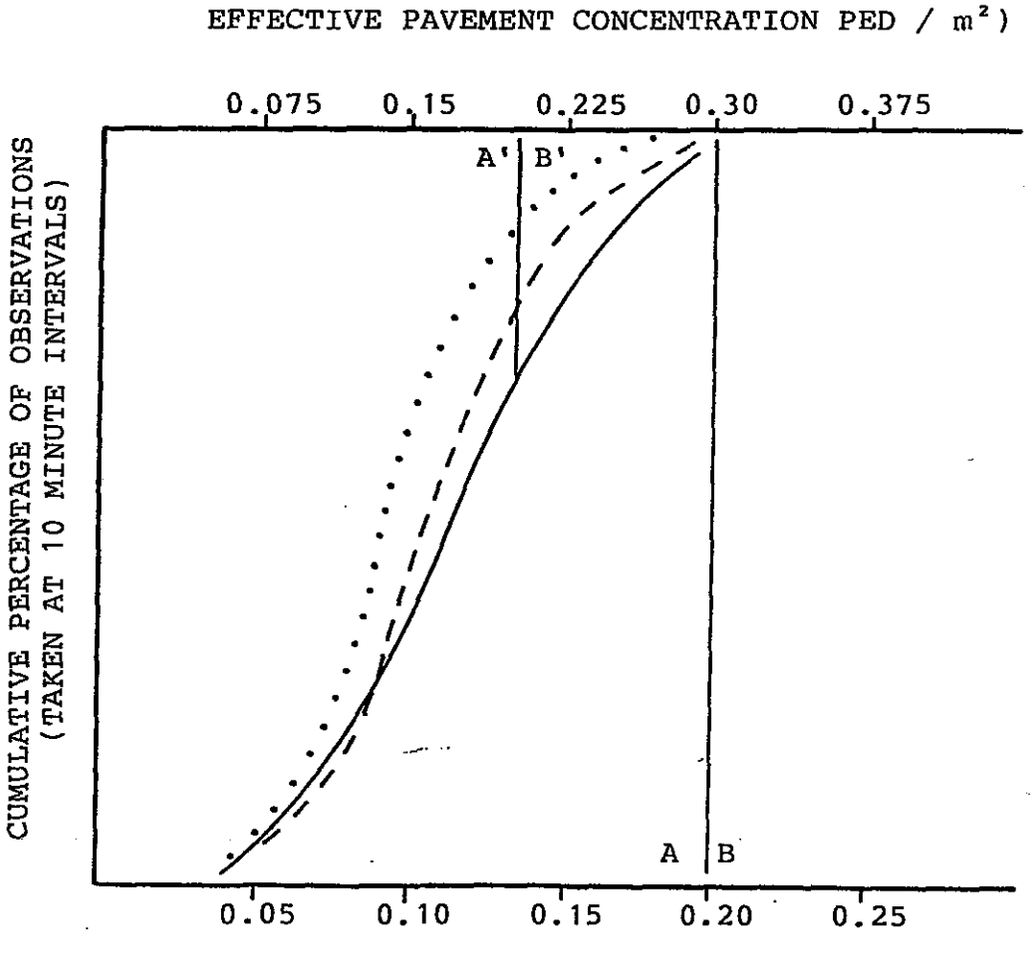
For further details see Table 32

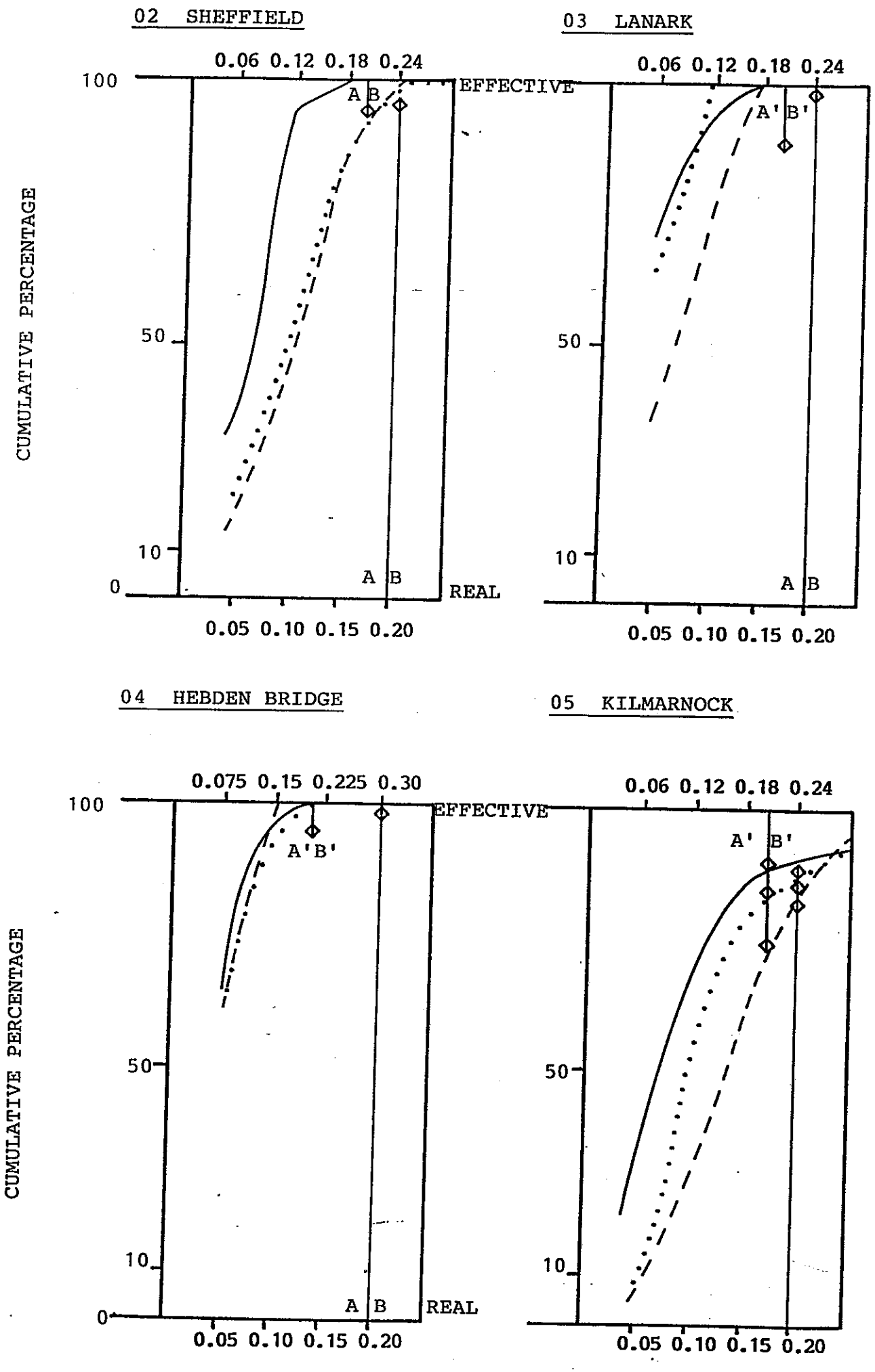
For each site the cumulative distributions are shown for three time periods of the survey day:

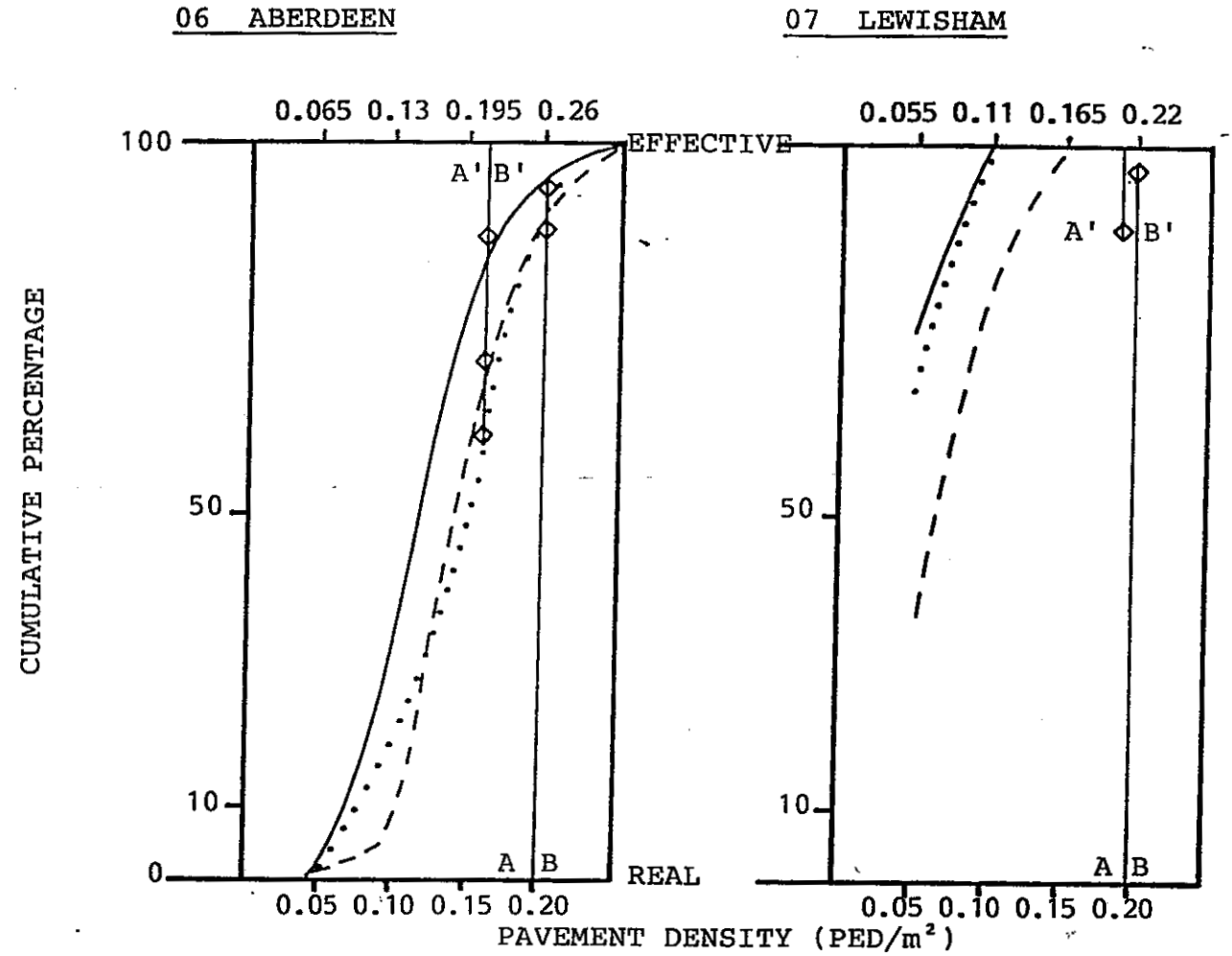
0920-1150 ———
1150-1440 - - - - - -
1440-1650 . . . . . .

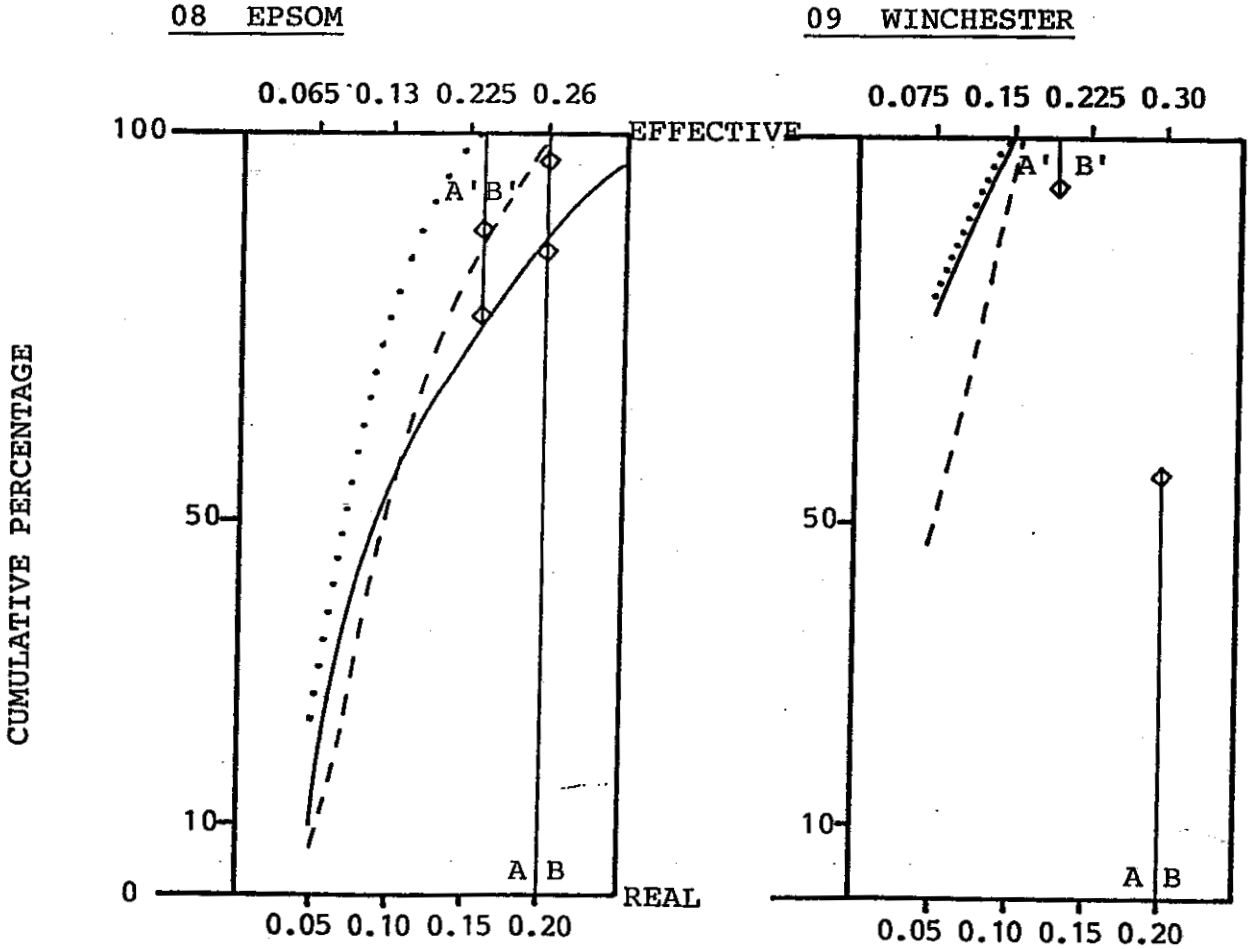
Superimposed on these distributions are two lines which show the Pushkarev divisions between levels of service A and B densities. Levels of service A/B apply to real concentrations and levels of service A'/B' apply to effective concentrations.

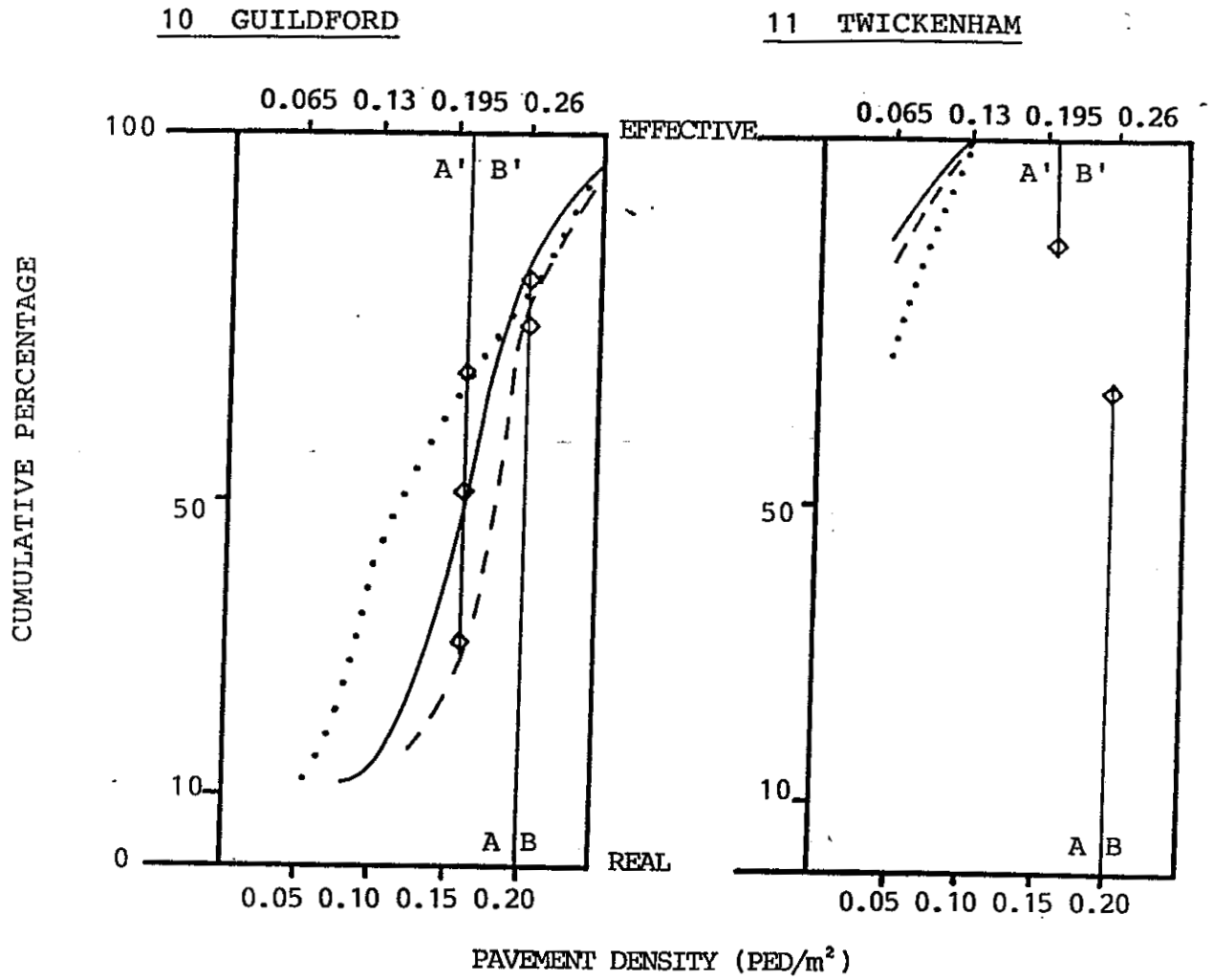
For example 01 Chesterfield

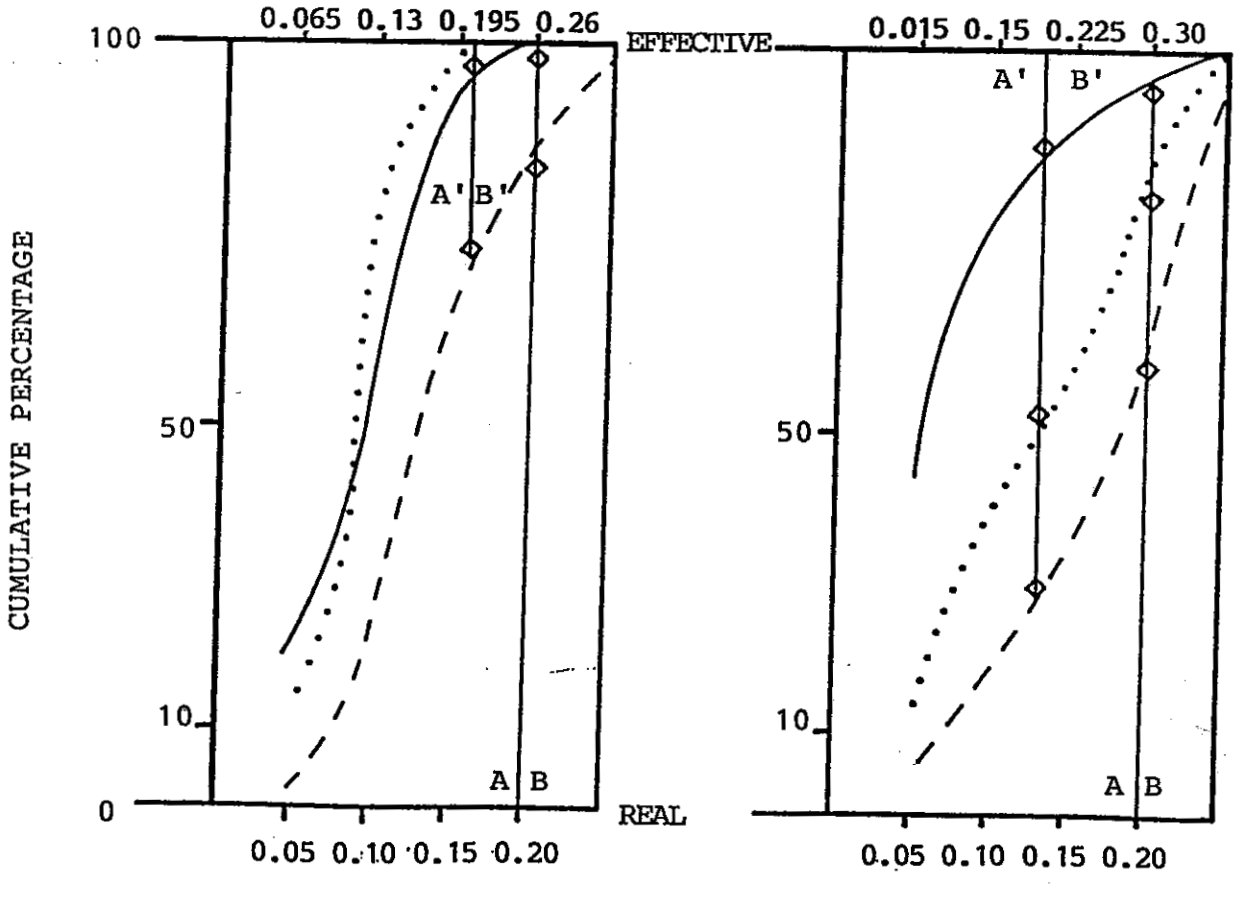


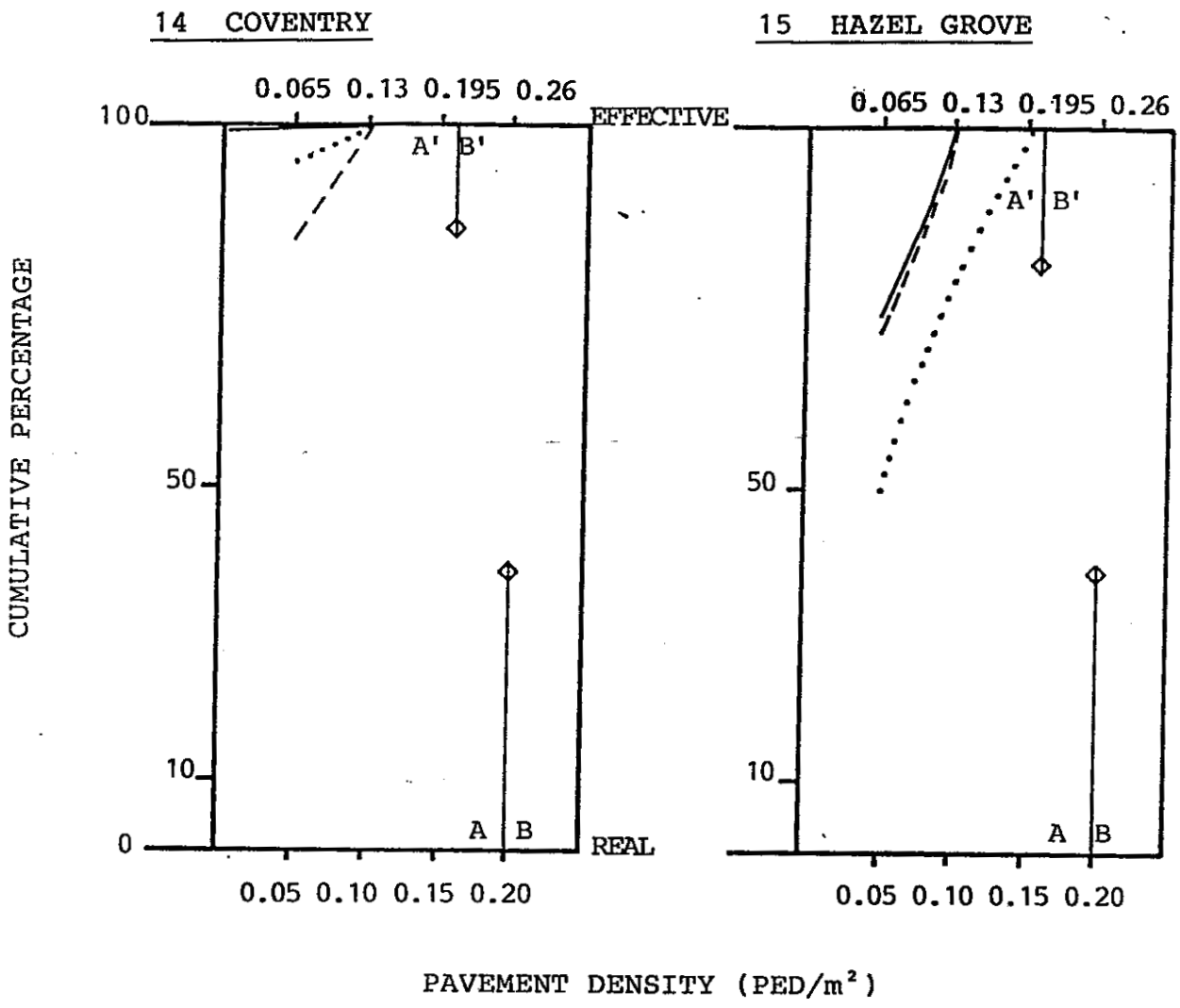

02 SHEFFIELD
03 LANARK
04 HEBDEN BRIDGE
05 KILMARNOCK
CUMULATIVE PERCENTAGE
EFFECTIVE
REAL
A B
A' B'
100
50
10
0
0.06 0.12 0.18 0.24
0.05 0.10 0.15 0.20
0.075 0.15 0.225 0.30


06 ABERDEEN
07 LEWISHAM
0.065 0.13 0.195 0.26
0.055 0.11 0.165 0.22
100
50
10
0
EFFECTIVE
REAL
A' B'
A B
CUMULATIVE PERCENTAGE
0.05 0.10 0.15 0.20
PAVEMENT DENSITY (PED/m²)


08 EPSOM
09 WINCHESTER
0.065 0.13 0.225 0.26
0.075 0.15 0.225 0.30
100
50
10
0
EFFECTIVE
REAL
A' B'
A B
CUMULATIVE PERCENTAGE
0.05 0.10 0.15 0.20


10 GUILDFORD
11 TWICKENHAM
0.065 0.13 0.195 0.26
EFFECTIVE
100
50
10
0
A' B'
A B
REAL
0.05 0.10 0.15 0.20
CUMULATIVE PERCENTAGE
PAVEMENT DENSITY (PED/m²)


12 BRISTOL
13 MANCHESTER
0.065 0.13 0.195 0.26
0.015 0.15 0.225 0.30
EFFECTIVE
100
50
10
0
A' B'
A B
REAL
0.05 0.10 0.15 0.20
CUMULATIVE PERCENTAGE


14 COVENTRY
15 HAZEL GROVE
0.065 0.13 0.195 0.26
EFFECTIVE
REAL
A' B'
A B
100
50
10
0
0.05 0.10 0.15 0.20
CUMULATIVE PERCENTAGE
PAVEMENT DENSITY (PED/m²)

APPENDIX 4: PEDESTRIAN PAVEMENT FLOW CLASSIFICATION BY SITE (%)

01 Chesterfield

	A AGE (Yrs)			B AGE (Yrs)			C AGE (Yrs)			D AGE (Yrs)		
	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65
Day 1 (Sat)												
M:	2	19	7	5	24	9	7	23	5	10	25	1
F:	4	45	23	7	36	20	12	42	10	16	40	8
Day 2 (Mon)												
M:	9	19	2				6	26	6	5	20	7
F:	22	43	5				6	47	9	9	44	15
Day 3 (Tue)												
M:	7	21	4									
F:	18	44	5									
All Weekdays												
M:	8	20	3				6	26	6	5	20	7
F:	20	44	5				6	47	9	9	44	15
All Saturdays												
M:	2	19	7	5	24	9	7	23	5	10	25	1
F:	4	45	23	7	36	20	12	42	10	16	40	8
All Days												
M:	6	20	4	5	24	9	7	25	6	8	23	4
F:	15	30	11	7	36	20	9	45	10	13	42	12

All Days/ All Times		< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	(36%)	7	23	6
F:	(64%)	11	38	15

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

02 Sheffield

	A AGE (Yrs) <18	18-65	>65	B AGE (Yrs) <18	18-65	>65	C AGE (Yrs) <18	18-65	>65	D AGE (Yrs) <18	18-65	>65
Day 1 (Fri)												
M:	6	18	6	2	20	10	4	22	6	7	27	4
F:	7	46	17	3	48	17	4	50	15	6	49	7
Day 2 (Sat)												
M:	6	25	7	9	24	8	12	22	2	13	21	2
F:	9	48	7	13	37	10	16	42	6	23	38	3
Day 3 (Mon)												
M:	16	19	5	10	20	12	9	20	6	14	2	6
F:	16	33	10	13	34	11	15	42	8	20	49	8
All Weekdays												
M:	11	19	6	6	20	11	7	21	6	11	15	5
F:	12	40	14	8	41	14	5	46	12	13	49	8
All Saturdays												
M:	6	25	7	9	24	8	12	22	2	13	21	2
F:	9	48	7	13	37	10	16	42	6	23	38	3
All Days												
M:	9	21	6	7	21	10	8	21	5	11	17	4
F:	11	42	11	10	40	13	12	45	10	16	45	6

All Days/ All Times		< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	(35%)	9	20	6
F:	(65%)	12	43	10

NB:
- M Male
- F Female
- A 0840 - 0900
- B 1000 - 1020
- C 1200 - 1220
- D 1500 - 1520

03 Lanark

	A AGE (Yrs)			B AGE (Yrs)			C AGE (Yrs)			D AGE (Yrs)		
	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65
Day 1 (Mon)												
M:	25	21	5	9	25	5	13	24	4	10	21	0
F:	15	33	1	11	48	2	13	39	10	11	55	2
Day 2 (Tue)												
M:	13	16	3	3	24	13	27	10	4	7	17	8
F:	10	56	3	1	57	2	17	38	5	4	57	7
Day 3 (Wed)												
M:	17	29	1	4	25	5	15	18	5	8	22	5
F:	3	49	1	3	57	6	10	46	5	3	46	17
All Weekdays												
M:	18	22	3	5	25	8	18	17	4	8	20	4
F:	9	46	2	5	54	3	13	41	7	6	53	9
All Saturdays												
M:												
F:												
All Days												
M:	18	22	3	5	25	8	18	17	4	8	20	4
F:	9	46	2	5	54	3	13	41	7	6	53	9

All Days/ All Times		< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	(38%)	12	21	5
F:	(62%)	8	49	5

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

04 Hebden Bridge

	A AGE (Yrs)			B AGE (Yrs)			C AGE (Yrs)			D AGE (Yrs)		
	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65
Day 1 (Wed)												
M:	3	33	13	10	27	8	8	22	2	5	30	5
F:	0	40	10	6	40	8	16	49	2	7	43	11
Day 2 (Thu)												
M:	0	70	0	10	22	8	17	24	1	7	29	2
F:	0	30	0	6	37	18	5	47	5	7	47	7
Day 3 (Fri)												
M:	6	28	0	5	30	10	22	28	2	17	32	2
F:	0	67	0	5	50	0	19	26	3	9	39	1
All Weekdays												
M:	3	47	4	8	26	9	16	25	2	10	30	3
F:	0	46	0	6	42	9	13	41	3	8		6
All Saturdays												
M:												
F:												
All Days												
M:	3	47	4	8	26	9	16	25	2	10	30	3
F:	0	46	0	6	42	9	13	41	3	8	43	6

All Days/ All Times		< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	(46%)	9	32	5
F:	(54%)	7	43	4

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

05 Kilmarnock

	A AGE (Yrs) <18	18-65	>65	B AGE (Yrs) <18	18-65	>65	C AGE (Yrs) <18	18-65	>65	D AGE (Yrs) <18	18-65	>65
Day 1 (Thu)												
M:	6	20	2	3	20	10	5	27	5	2	31	7
F:	21	45	6	5	51	9	7	50	5	4	46	10
Day 2 (Fri)												
M:	12	25	2	2	25	6	2	16	1	7	30	3
F:	23	39	0	1	63	3	50	30	1	6	49	5
Day 3 (Sat)												
M:	3	36	0	10	37	5	8	29	5	10	23	2
F:	3	58	0	5	41	2	6	45	7	13	48	4
All Weekdays												
M:	9	23	2	3	23	8	4					
F:	22	47	3	3	57	6	29					
All Saturdays												
M:	3	36	0	10	37	5	8	29	5	10	23	2
F:	3	58	0	5	41	2	6	45	7	13	48	4
All Days												
M:	7	27	1	5	27	7	5	24	4	6	28	4
F:	16	47	2	4	51	5	21	42	4	8	48	6

All Days/ All Times		< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	(37%)	6	27	4
F:	(63%)	12	47	4

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

06 Aberdeen

	A AGE (Yrs) <18	18-65	>65	B AGE (Yrs) <18	18-65	>65	C AGE (Yrs) <18	18-65	>65	D AGE (Yrs) <18	18-65	>65
Day 1 (Sat)												
M:	4	38	1	7	34	2	8	35	0	10	35	0
F:	4	52	1	9	43	4	8	48	2	10	45	1
Day 2 (Mon)												
M:	4	38	0	4	40	1	4	42	0	5	38	1
F:	4	54	0	3	50	3	2	52	1	6	49	3
Day 3 (Wed)												
M:	5	38	0	3	37	2	2	37	0	3	38	2
F:	3	53	1	3	53	3	3	55	3	4	50	4
All Weekdays												
M:	5	38	0	4	39	2	3	40	0	4	38	2
F:	4	54	1	3	52	3	2	53	2	5	50	4
All Saturdays												
M:	4	38	1	7	34	2	8	35	0	10	35	0
F:	4	52	1	9	43	4	8	48	2	10	45	1
All Days												
M:	5	38	0	5	37	2	5	38	0	6	37	1
F:	4	53	1	5	49	3	4	52	2	7	48	3

All Days/ All Times	< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	5	38	1
F:	5	50	1

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

SITE	A AGE (Yrs) <18	18-65	>65	B AGE (Yrs) <18	18-65	>65	C AGE (Yrs) <18	18-65	>65	D AGE (Yrs) <18	18-65	>65
07 Lewisham												
Day 1 (Thu)												
M:	5	24	12	1	29	12	2	22	13	2	31	10
F:	4	43	12	4	42	13	1	41	21	3	41	13
Day 2 (Fri)												
M:	5	32	5				2	29	10	4	34	5
F:	9	46	2				3	42	14	5	44	8
Day 3 (Sat)												
M:	8	29	5	8	44	8	8	29	7	11	28	6
F:	11	42	6	4	31	6	9	40	8	13	38	4
All Weekdays												
M:	5	28	9	1	29	12	2	26	12	3	33	8
F:	7	45	7	4	42	13	2	42	18	4	43	11
All Saturdays												
M:	8	29	5	8	44	8	8	29	7	11	28	6
F:	11	42	6	4	31	6	9	40	8	13	38	4
All Days												
M:	6	28	7	5	37	10	4	27	10	6	31	7
F	5	44	7	4	37	10	4	41	14	7	41	8

All Days/ All Times	< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	5	31	9
F:	5	41	9

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

SITE	A AGE (Yrs) <18	18-65	>65	B AGE (Yrs) <18	18-65	>65	C AGE (Yrs) <18	18-65	>65	D AGE (Yrs) <18	18-65	>65
08 Epsom												
Day 1 (Sat)												
M:	4	33	13	5	32	9	10	28	4			
F:	4	40	6	9	40	6	18	36	5			
Day 2 (Mon)												
M:	2	40	9	5	27	14	3	28	10	4	20	14
F:	3	45	2	7	38	9	4	43	13	11	27	24
Day 3 (Tue)												
M:	10	27	7	2	25	12	5	21	11			
F:	14	40	2	5	39	18	8	46	10			
All Weekdays												
M:	6	34	8	4	26	13	4	25	11			
F:	9	43	2	6	39	12	6	45	12			
All Saturdays												
M:	4	33	13	5	32	9	10	28	4			
F:	4	40	6	9	40	6	18	36	5			
All Day												
M:	5	33	10	4	28	12	6	26	8	4	20	14
F:	7	42	3	7	39	11	10	42	9	11	27	24

All Days/ All Times	< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	5	27	11
F:	9	38	10

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

09 Winchester

	A AGE (Yrs)			B AGE (Yrs)			C AGE (Yrs)			D AGE (Yrs)		
	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65
Day 1 (Wed)												
M:	14	27	1	8	29	6	4	36	4	12	36	10
F:	20	37	1	14	36	6	8	42	6	8	29	5
Day 2 (Thu)												
M:	0	53	0	4	43	7	6	36	8	5	23	2
F:	0	47	0	7	33	7	6	38	7	2	66	3
Day 3 (Fri)												
M:	1	29	13	0	40	0	10	24	4	5	36	11
F:	3	47	8	0	60	0	10	46	6	5	37	7
All Weekdays												
M:	5	36	5	4	37	4	7	32	5	7	32	8
F:	8	44	3	7	43	4	8	42	6	5	44	5
All Saturdays												
M:												
F:												
All Days												
M:	5	36	5	4	37	4	7	32	5	7	32	8
F:	8	44	3	7	43	4	8	42	6	5	44	5

All Days/ All Times	< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	6	34	6
F:	7	43	4

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

10 Guildford

	A AGE (Yrs)			B AGE (Yrs)			C AGE (Yrs)			D AGE (Yrs)		
	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65
Day 1 (Fri)												
M:	2	18	5	2	16	13	3	25	7	1	32	6
F:	4	70	2	2	43	25	2	46	16	2	49	11
Day 2 (Sat)												
M:	3	24	7	8	28	9	7	29	6			
F:	7	53	7	11	37	7	10	39	9			
Day 3 (Mon)												
M:	5	28	2	6	22	11	3	16	5	5	26	7
F:	7	56	1	8	43	10	3	62	12	2	47	12
All Weekdays												
M:	3	23	3	4	19	17	3	20	6	3	29	6
F:	5	63	2	5	43	18	3	54	14	2	48	12
All Saturdays												
M:	3	24	7	8	28	9	7	29	6			
F:	7	53	7	11	37	7	10	39	9			
All Days												
M:	3	23	5	5	22	11	4	23	6	3	29	6
F:	6	60	3	7	41	14	5	49	12	2	48	12

All Days/ All Times	< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	4	24	7
F:	5	50	10

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

11 Twickenham

	A AGE (Yrs) <18	18- 65	>65	B AGE (Yrs) <18	18- 65	>65	C AGE (Yrs) <18	18- 65	>65	D AGE (Yrs) <18	18- 65	>65
Day 1 (Wed)												
M:				2	32	10	2	34	7	6	32	6
F:				5	39	11	4	47	7	5	42	9
Day 2 (Thu)												
M:	10	23	3	4	57	11	3	36	6	2	48	8
F:	13	48	3	2	6	20	3	43	9	3	33	6
Day 3 (Fri)												
M:	8	29	1	1	29	14	2	29	11	5	33	6
F:	13	47	1	0	46	11	3	46	9	6	43	6
All Weekdays												
M:	9	26	2	2	39	12	2	33	8	4	38	7
F:	13	48	2	2	30	14	3	45	8	5	39	7
All Saturdays												
M:												
F:												
All Days												
M:	9	26	2	2	39	12	2	33	8	4	38	7
F:	13	48	2	2	30	14	3	45	8	5	39	7

All Days/ All Times	< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	4	34	7
F:	6	41	8

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

12 Bristol

	A AGE (Yrs)			B AGE (Yrs)			C AGE (Yrs)			D AGE (Yrs)		
	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65
Day 1 (Mon)												
M:	5	39	2	5	25	5	3	30	4	2	21	5
F:	4	46	4	14	50	5	3	48	13	5	57	10
Day 2 (Tue)												
M:	0	40	0	1	31	0	2	26	3	3	32	3
F:	0	60	0	4	62	2	5	55	9	1	52	9
Day 3 (Wed)												
M:	0	42	0	5	22	6	4	25	5	4	34	4
F:	0	58	0	8	43	16	5	48	12	4	48	9
All Weekdays												
M:	2	40	1	4	26	3	9	27	4	3	28	4
F:	1	55	1	9	52	23	13	50	11	3	52	10
All Saturdays												
M:												
F:												
All Days												
M:	2	40	1	4	26	3	9	27	4	3	28	4
F:	1	55	1	9	52	23	13	50	11	3	52	10

All Days/ All Times	< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	5	30	3
F:	7	52	3

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

13 Manchester

	A AGE (Yrs)			B AGE (Yrs)			C AGE (Yrs)			D AGE (Yrs)		
	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65	<18	18-65	>65
Day 1 (Thu)												
M:	6	30	2	4	31	2	3	34	1	7	25	4
F:	5	56	1	8	45	10	8	50	3	7	51	6
Day 2 (Fri)												
M:	5	38	0	8	33	3	4	31	3	2	42	5
F:	4	53	0	7	39	10	8	50	5	2	45	3
Day 3 (Sat)												
M:	7	30	5	12	30	5	12	32	4	15	29	3
F:	15	39	5	9	36	9	13	35	5	17	33	3
All Weekdays												
M:	6	34	1	6	32	3	4	33	2	5	34	5
F:	5	55	1	8	42	10	8	50	4	5	48	5
All Saturdays												
M:	7	30	5	12	30	5	12	32	4	15	29	3
F:	15	39	5	9	36	9	13	35	5	17	33	3
All Days												
M:	6	33	2	8	31	3	6	32	3	8	32	4
F:	8	49	2	8	40	10	10	45	4	9	43	4

All Days/ All Times	< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	7	32	3
F:	9	44	5

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

14 Coventry

	A AGE (Yrs) <18	18-65	>65	B AGE (Yrs) <18	18-65	>65	C AGE (Yrs) <18	18-65	>65	D AGE (Yrs) <18	18-65	>65
Day 1 (Mon)												
M:	25	20	4	7	25	19	8	26	10	8	28	13
F:	13	36	3	4	21	24	4	38	14	4	36	13
Day 2 (Tue)												
M:	28	23	3	3	20	17	10	24	12	8	31	14
F:	12	32	3	3	33	24	5	30	19	4	32	11
Day 3 (Wed)												
M:	21	24	4	6	16	18	13	24	10	8	27	10
F:	8	41	2	4	35	22	8	29	16	8	40	8
All Weekdays												
M:	25	22	4	5	20	18	10	25	11	8	29	12
F:	11	36	3	4	30	23	6	32	16	5	36	11
All Saturdays												
M:												
F:												
All Days												
M:	25	22	4	5	20	18	10	25	11	8	29	12
F:	11	36	3	4	30	23	6	32	16	5	36	11

All Days/ All Times	< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	12	24	11
F:	7	34	12

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520

15 Hazel Grove

SITE	A AGE (Yrs) <18	18-65	>65	B AGE (Yrs) <18	18-65	>65	C AGE (Yrs) <18	18-65	>65	D AGE (Yrs) <18	18-65	>65
Day 1 (Thu)												
M:	0	25	6	3	20	16	6	26	9	7	21	3
F:	0	50	19	6	28	27	9	36	15	7	39	18
Day 2 (Fri)												
M:	7	17	6	6	14	8	4	21	11	4	19	9
F:	0	60	9	7	49	17	6	45	14	3	54	13
Day 3 (Sat)												
M:	28	24	2	6	30	7	8	24	9	14	23	12
F:	4	36	6	8	37	11	13	36	10	12	28	11
All Weekdays												
M:	4	21	6	5	17	12	5	24	10	6	20	9
F:	0	55	14	7	39	22	8	41	15	5	47	16
All Saturdays												
M:	28	24	2	6	30	7	8	24	9	14	23	12
F:	4	36	6	8	37	11	13	36	10	12	28	11
All Days												
M:	12	22	5	5	21	10	6	24	10	8	21	10
F:	1	49	11	7	38	18	9	39	13	7	40	14

All Days/ All Times	< 18 Yrs	18-65 Yrs	> 65 Yrs
M:	8	22	9
F:	6	42	13

NB: M Male
F Female
A 0840 - 0900
B 1000 - 1020
C 1200 - 1220
D 1500 - 1520