CULWORTH HIGH STREET

A Traffic Survey

July 2002

Summary from full report carried out by Roger Day

1. 1. Introduction & Summary

1. 1.1. Background & Objectives

This document sets out the results of a traffic survey that was conducted on a section of Culworth High Street adjacent to the Red Lion Pub for one week between Wednesday 3rd July and Tuesday 9th July 2002.

The aims of the survey were to:

1. 1. Collect quantitative data regarding the volume and type of traffic passing through the High Street, by each day of the week and each hour of the day.
2. 2. Measure, on a sample basis, typical speeds of the traffic.
3. 3. Identify and record instances where vehicles travelling up the High Street mount the pavement when confronted with oncoming traffic.

2. 1.2. Summary Of Results

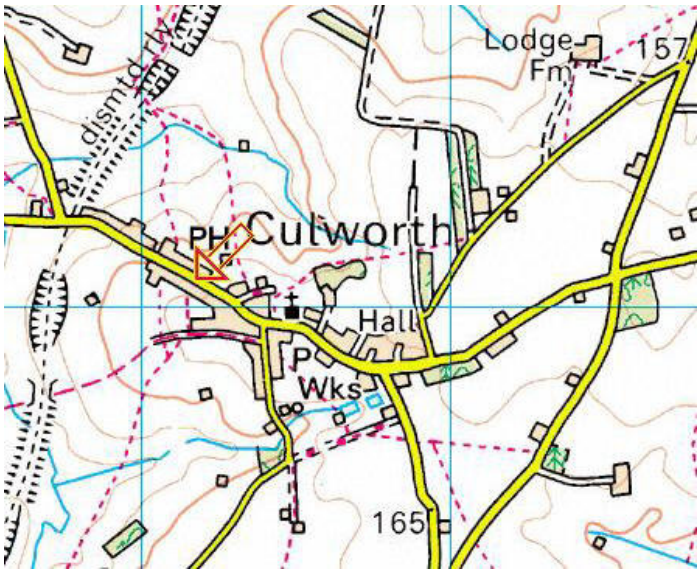
The principal results and observations were as follows:

- There were 8,876 traffic movements during the week, of which the significant majority (84%) were private cars.
- Daily traffic volumes on working week days were broadly the same at 1,350-1,400 per day. Traffic volumes were 26% less at the weekend.
- The distribution of traffic volume through the day was quite varied, especially during weekdays, reflecting the commuter and school run hours.
- The average speed of a sample of vehicles was found to be 28.9 mph. However, 29% of the vehicles within the sample were travelling in excess of 30 mph.
- There were 75 instances of kerb mounting. These instances occurred proportionately more frequently between 4pm and 7pm.
- Several still photos of typical kerb mounts have been obtained.

The remainder of this document provides a discussion of the survey method and detailed analysis of the survey results.

2. 2. Survey Method

3. 2.1. Survey Location



The 'survey zone' was a stretch of the High Street, approximately 140 metres in length, starting at the bus stop on the Green, proceeding down past the Red Lion Pub and finishing outside Dalmar House. The map below indicates the location:

4. 2.2. Survey Time Duration

To obtain a realistic picture of typical traffic flows, and anticipating the significance of school traffic, the survey was conducted over an entire week during school term, from Wednesday 3rd July to Tuesday 9th July, between 8am and 7pm each day. Thus, the survey comprised 77 hours of traffic flow.

2.1. 2.1. Survey Recording Method

Given the length of time involved, a 'manual survey' (i.e. someone sitting on the road counting traffic) would have been very time consuming and boring. Further, it would not have been easy to capture speed data or to record instances of kerb mounting. To overcome these problems, a video camera was set up looking onto the section of road and the activity recorded onto tape for later analysis. The still below shows the view obtained with the camera:

As can be seen, in addition to a view of the traffic flows, the shot provided a good view of the uphill kerb and also a record of the date and time.

The camera was hidden in a bush and not visible to passing traffic. Very few people knew that the survey was taking place and therefore, the survey did not, in itself, cause any change in the behaviour of the traffic.

5. 2.2. Survey Collation

Once all the video footage had been obtained, it was manually viewed and the traffic movements recorded on count sheets. Specifically, for each hour within the survey period, the following information was recorded:

- Each vehicle movement, including:
  - The direction of movement (Uphill or Downhill).
  - The type of vehicle (Private Car, Light Commercial Vehicle, Heavy Commercial Vehicle, Agricultural Vehicle, Bus, Motorcycle).
- The time of each instance of kerb mounting.

The use of the fast forward feature on a video tape enabled the analysis to be conducted in about 20 hours. (Nonetheless, it was still a boring exercise!).

Once all the count sheets had been completed, the information was keyed into a spreadsheet, from which various summary statistics and graphics were produced.

6. 2.3. Speed Measurements

After the main survey work had been completed, a random sample of 98 vehicles were selected. Only vehicles which moved through the entire survey zone without stopping were included. Using the video footage and a stopwatch, the time taken for each vehicle to move between two fixed points on the road was measured. Having measured the actual distance between the fixed points, the speed of each vehicle was calculated.

2.2. 2.1. Kerb Mounting

Finally, as mentioned above, any instance where a vehicle mounted the kerb as it travelled up the hill was recorded. (Vehicles stopping or parking on the kerb were not included). Still photos of each of these instances where then taken and a sample are included in the full document.

7. 2.2. Error Analysis

Appendix I provides a discussion of sources and impact of errors and bias in the survey

3. 3. Results – Traffic Volumes

3.1. 3.1. Total Traffic Volumes, Vehicle Type and Direction Of Travel

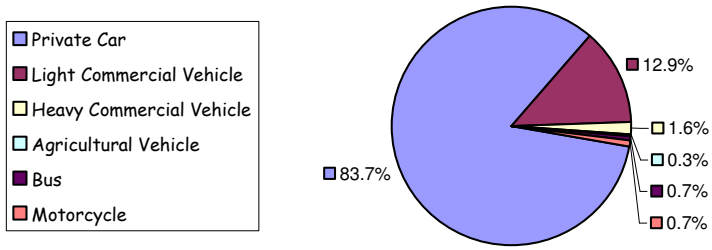
Table 1 below shows the total number of vehicle movements observed, analysed by direction and vehicle type:

Table 1 : Analysis Of Total Traffic Volume By Vehicle Type And Direction

Type Of Vehicle	Downhill	Uphill	Total	%
Private Car	3,804	3,626	7,430	83.7%
Light Commercial Vehicle	573	576	1,149	12.9%
Heavy Commercial Vehicle	67	79	146	1.6%
Agricultural Vehicle	13	14	27	0.3%
Bus	33	28	61	0.7%
Motorcycle	29	34	63	0.7%
Total	4,519	4,357	8,876	100%
	50.9%	49.1%	100.0%	

The vehicle type data is shown graphically below:

Figure 1 : Analysis Of Total Traffic Volume By Vehicle Type



Observations

- There were nearly 9,000 traffic movements in the survey week.
- The vast majority (83.7%) were private cars.
- Heavy vehicles comprised only a very small proportion of the traffic (1.6%).
- Over the entire duration of the survey, the traffic flow in each direction was virtually the same. This parity was also observed in each of the different categories of vehicle type.

3.2. 3.2. Traffic Volume By Day Of The Week

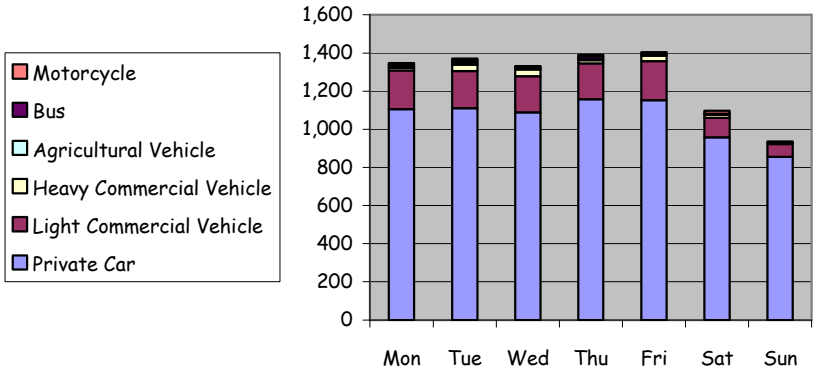
Table 2 below shows how the total volume of traffic analysed by day of week.

Table 2 : Analysis Of Total Traffic Volume By Day Of Week

Type Of Vehicle								
Private Car	1,106	1,110	1,089	1,157	1,153	959	856	7,430
Light Commercial Vehicle	203	195	190	189	204	102	66	1,149
Heavy Commercial Vehicle	14	34	34	16	28	16	4	146
Agricultural Vehicle	4	11	4	6	0	2	0	27
Bus	10	10	11	15	13	2	0	61
Motorcycle	10	10	2	8	6	17	10	63
Total	1,347	1,370	1,330	1,391	1,404	1,098	936	8,876
	15.2%	15.4%	15.0%	15.7%	15.8%	12.4%	10.5%	100.0%

Again, Figure 2 below shows this data graphically:

Figure 2 : Analysis Of Total Traffic Volume By Day Of Week



Observations

- • Traffic volumes on Monday to Friday were very similar – all around 1,350 to 1,400 movements per day.
- • Traffic volumes at the weekend were less, but not greatly – average daily volume at the weekend was 26% less than the average week day volume.
- • The reduction in traffic at the weekend was proportionately much greater for commercial vehicles (down 57%) compared to cars (down 19%).

3.3. 3.3. Total Traffic Volumes By Hour Of Day

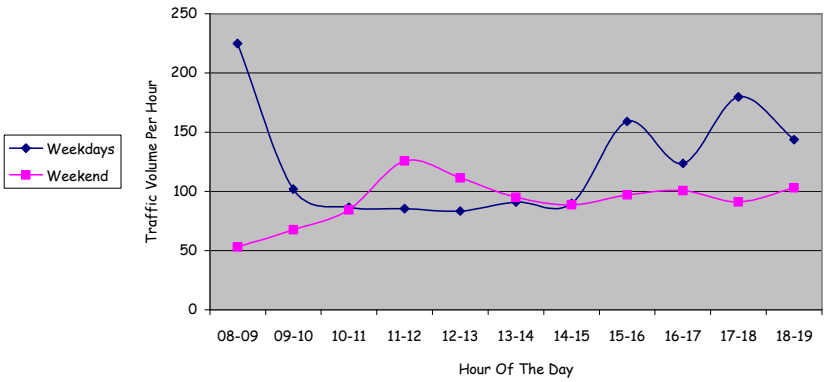
Table 3 below shows the average volume of traffic by hour of the day. Anticipating a significant difference between the two, averaging has been undertaken separately for weekdays and weekends.

Table 3 : Average Traffic Volume By Hour Of The Day

	Hour Of Day										
	08-09	09-10	10-11	11-12	12-13	13-4	14-5	15-16	16-17	17-18	18-19
Period Of Averaging											
Weekdays	225	102	86	85	83	91	90	159	124	180	144
Weekend	53	68	85	126	112	95	89	97	101	91	103

Figure 3 below shows this data graphically:

Figure 3 : Average Traffic Volume By Hour Of The Day



Observations

- During weekdays, the traffic volumes were substantially (2 to 3 times) higher in commuter and school run hours – 8-9am, 3-4pm and 5-6pm. These three hours account for over 40% of the traffic volume over the 11 hour survey period.
- Further analysis of volumes by vehicle type shows that these fluctuations were almost entirely due to private cars – commercial traffic volume was broadly the same from hour to hour within the day.
- The pattern of traffic at the weekend was radically different from the weekdays, reflecting the absence of school and commuter traffic
- Nonetheless, during lunchtime, the High Street was busier during the weekend than on an average weekday – traffic movements to and from the Pub are a major contributor to this peak.

3.4. 3.4. Traffic Direction By Hour Of Day

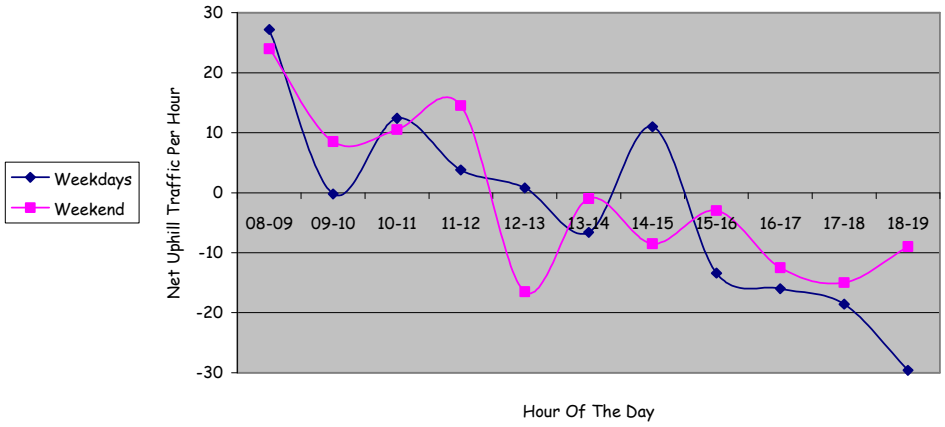
Table 4 below shows the average 'net uphill' volume of traffic by hour of the day. For this purpose, 'net uphill' is defined as the number of vehicles travelling up the High Street, towards the centre of the village, less the number travelling down it. (This a positive number means more traffic flowing up hill and negative one means more traffic flowing downhill). Again, the averaging has been undertaken separately for weekdays and weekends.

Table 4 : Net Uphill Traffic Volume By Hour Of The Day

	Hour Of Day										
	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19
Period Of Averaging											
Weekdays	27	0	12	4	1	-7	11	-13	-16	-19	-30
Weekend	24	9	11	15	-17	-1	-9	-3	-13	-15	-9

Figure 4 below shows this data graphically:

Figure 4 : Net Uphill Traffic Volume By Hour Of The Day



Observations

- On both weekdays and weekends, there was a positive net flow of traffic uphill in the morning i.e. more traffic moving towards the village centre.
- In the afternoons, this was reversed, with more traffic travelling downhill. The only exception to this was between 2pm and 3pm on weekdays – presumably this was vehicles travelling into Banbury for the afternoon.

4. 4. Results - Traffic Speeds

4.1. 4.1. Average Speeds

Table 5 below shows a summary of the results of the average speed calculations for the sample of vehicles measured.

Table 5 : Average Speeds (Mph) By Vehicle Type And Direction

	Downhill		Uphill		Total		
Type Of Vehicle	**No**	**Avg Speed**	**No**	**Avg Speed**	**No**	**Avg Speed**	
Private Car	39	28.9	37	29.8	76	29.3	1.0%
Light Commercial Vehicle	10	29.9	6	27.5	16	29.0	1.4%
Heavy Commercial Vehicle	4	21.6	1	27.0	5	22.7	3.4%
Agricultural Vehicle	0	n/a	0	n/a	0	n/a	0.0%
Bus	0	n/a	1	29.1	1	29.1	1.6%
Motorcycle	0	n/a	0	n/a	0	n/a	0.0%
Total	53	28.5	45	29.5	98	28.9	
	1.2%		1.0%		1.1%		

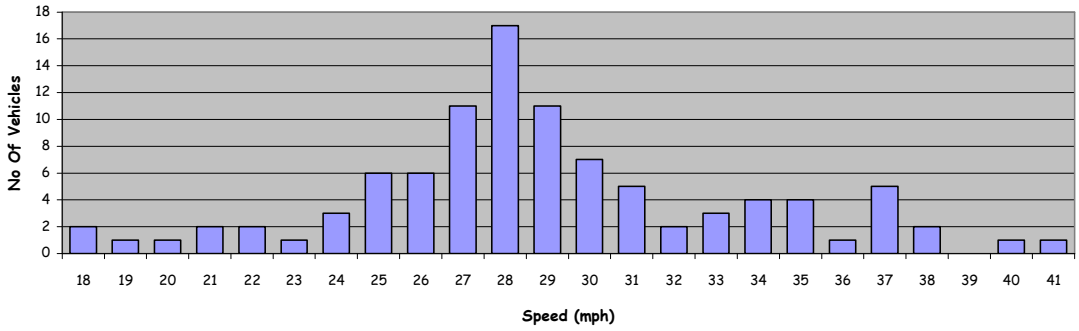
Observations

- The random sample amounted to 1.1% of the entire vehicle population in the survey. However, the sample was slightly skewed, proportionately favouring downhill traffic and commercial vehicles.
- Nonetheless, the average speed for all vehicles was measured at **28.9 mph**. (Rebalancing the sample to remove the skew makes no material difference to this.)
- The average speed is just within the legal limit. However, the long distance of the survey zone (140 metres) combined with the observation that vehicles travel more slowly round the bend at the bus stop, suggests that average speeds close to Dalmar house may be routinely in excess of the legal limit.
- The data does not indicate any significant differences in speed between the various types of vehicle types or their direction of travel.

4.2. 4.2. Variations In Speed

Tables 5 shows average speeds but does not give any insight into the variation of speed between vehicles. Figure 5 below plots the number of vehicles in the sample by their individual speed.

Figure 5 : Variation In Speed



Observations

- The largest group of vehicles were travelling at around the average speed of 28mph.
- The highest recorded speed was 41 mph.
- A significant number – 28 vehicles (or 29% of sample) - were travelling, on average, in excess of the 30 mph speed limit.
- Given that the above speeds are averages over 140 metres, the proportion of vehicles exceeding 30mph at any point must be even higher.

4.3. 4.3. Average Speeds By Hour Of The Day

Table 6 below shows how average speeds varied by hour of the day.

Table 6 : Average Speeds (Mph) By Hour Of Day

	Hour Of Day										
	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19
No Of Vehicles	6	6	12	6	10	12	7	9	7	10	13
Average Speed (mph)	28	30	27	27	26	30	30	29	29	31	30

Observations

- Whilst the sample size is not large enough to be certain, the data indicates that traffic on the whole is travelling slightly faster in the afternoon – presumably as commuters make their way home.

5. 5. Results – Kerb Mounting

5.1. 5.1. Instances Of Kerb Mounting By Day Of Week

Table 7 below shows an analysis of the occurrences of cars mounting the pavement, by each day of the survey, and compares this to the average uphill traffic volume for that day.

Table 7 : Instances Of Kerb Mounting By Day Of Week

	Day Of Week							
	Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**	**Total**
Vehicles Mounting Kerb	17	8	11	16	5	13	5	75
Total Vehicles Travelling Uphill	659	663	653	691	682	553	456	4,357
Percentage	2.6%	1.2%	1.7%	2.3%	0.7%	2.4%	1.1%	1.7%

Observations

- During the course of the week, 75 instances of kerb mounting were recorded. This amounts to 1.7% of all uphill traffic.
- These instances vary in terms of severity. However, in the author's opinion, 25-30 were dangerous because the vehicle mounted the kerb at speed and/or when pedestrians were on the pavement.
- In many cases, there was plenty of room for two vehicles to pass one another – why the drivers felt the need to mount the kerb is not apparent.
- Appendix I shows some stills of the video footage indicating the typical mount occurrences.

The following further observations were made from viewing the video tape:

- Many vehicles, when confronted with oncoming traffic did stop and didn't mount the kerb.
- Although not formally counted as a 'kerb mount', many vehicles travelled very close to the kerb, again potentially threatening pedestrians.

5.2. 5.2. Instances Of Kerb Mounting By Hour Of The Day

Table 8 below shows an analysis of the occurrences of cars mounting the pavement, by each hour of the day, and compares this to the average uphill traffic volume for that hour.

Table 7 : Instances Of Kerb Mounting By Hour Of The Day

	Hour Of Day											
	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	Avge
Vehicles Mounting Curb	1	1	0	1	0	1	1	1	1	2	3	11
Average Vehicles Traveling Uphill	101	47	49	52	44	44	47	65	51	68	54	622
Percentage	0.6%	1.5%	0.9%	1.1%	0.0%	1.6%	1.2%	2.0%	1.7%	2.7%	5.8%	1.7%

Observations

- There are on average 11 cases of kerb mounting in a day.
- These occur more commonly toward the end of the day.
- The most dangerous time to be on the pavement is between 6pm and 7pm, when nearly 1 in 17 vehicles travelling uphill mounts the kerb.

6. 6. Appendix I - Survey Bias, Errors And Tolerance Analysis

Whilst best endeavours were made to ensure the survey was as accurate and as representative as possible, there are a number of issues that may have had an impact on the survey and these are considered below:

6.1. 6.1. Survey Bias

It is hoped that, although the survey was only conducted for one week, that the results are broadly representative of general traffic flows within the High Street. Nonetheless, there are some points to make regarding the timing of the survey which may threaten this. These are discussed below:

Name	Nature of Bias	Expected Impact
Season	The survey was undertaken during summer. Accordingly, there was broad daylight during the entire survey. Further the weather, albeit variable, was typical of a British summer, with a mixture of sunny spells, overcast skies and heavy rains.	• • It is difficult to estimate likely impact on traffic volume – arguably it would be lower than an annual average as more people use cars in winter and perhaps more people would be away on holiday in summer. • • Possibly, it would increase traffic speeds relative to an annual average, as vehicles likely to travel more slowly in winter weather and when in the dark.
School term	The survey was deliberately undertaken during school time, as it is known that the school run contributes a great deal to the volume of traffic through the village.	• • Compared to holiday times, recorded volumes are likely to be significantly higher in school times. • • A 'rough' estimate would suggest that school traffic might account for about 700 traffic movements a week, or 8% of total traffic volume.

Name	Nature of Bias	Expected Impact
Special Events	There were two main events taking place during the survey week: • • The final week of Wimbledon • • It was the British Grand Prix	• • Again, it is difficult to speculate on the impact of these. It is likely that the majority of any effect would have been on the weekend data, when both events were reaching their climax. • • However, in both cases, each event was relatively short in duration (2-3 hours). • • Observations of the video tape did not indicate any unusual patterns of traffic – if anything the weekend seemed quieter than usual.

6.2. 6.2. Recording Glitches

Approximately 28 minutes of traffic between 18:32 and 19:00 on Sunday July 7th were not recorded, due to a failure in the video. The traffic volume data for this hour was therefore derived by extrapolating from the first 32 minutes of the hour. No data regarding kerb mounting or speed was available.

From about 14:30 onwards on the Same Sunday, the camera was accidentally moved. As a consequence, a clear view of the entire length of the High Street was not possible. It was still possible to record traffic movements. However, no kerb mounting instances could be identified.

Neither of these glitches are considered to have materially affected the survey. However, the main impact would have been to understate the incidences of kerb mounting.

6.3. 6.3. Measurement Error

In addition to the above, all surveys are subject to an unavoidable measurement error. The main types are considered below:

Name	Sources Of Error	Estimated Impact
Volume	Human error in identifying traffic movements on the video and recording them accurately on the count sheets	• • Not considered very significant. • • Likely to understate volume • • Estimated at 1% of total volume – 90 more vehicles over the week
Vehicle Type	Human error in identifying the vehicle type – primary risk area is distinguishing between private cars and light commercial vehicles (LCV's).	• • Likely to understate LCV volume and overstate cars • • Estimated at 2% of car volume indicating 148 fewer cars and 148 more LCV's.
Vehicle Direction	Human error in recording it accurately on the count sheets	• • Estimated at up to 4% of movements - it happened!. • • However, few of the results in the survey show much dependence on the direction of travel, so of limited significance
Time Of Event	Camera error	Negligible
Speed	Error in measurement of distance between fixed points and of time of transfer between fixed points.	• • Distance is considered accurate up to within 3 metres – 2% • • Time is considered accurate to 0.2 sec – approximately 2%. • • This gives a total speed error of up to 4% or 1.2 mph.

Name	Sources Of Error	Estimated Impact
Kerb Mounting	Human error in identifying occurrences on the video	• Not significant • Likely to understate occurrences since all recorded occurrences have been reviewed and verified.