An Analysis of Before and After Pedestrian and Cycling Surveys in two Pilot Areas of Bristol with 20mph Signed-only Speed Limits

Malcolm Heymer, B.Sc, M.Sc
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Contents **Page No.**

Summary 3

1. Background 5
2. Bristol City Council Reports and Survey Data 5
3. Survey Station Data 7
4. Analysis of Before-and-After Data – Inner South Pilot Area 8
5. Analysis of Before-and-After Data – Inner East Pilot Area 9
6. Discussion and Conclusions 10
7. References 12

Appendices:

Appendix 1. Before and After Survey Days Weather Comparison 13
Appendix 2. Inner South Pilot Area Before & After Pedestrian & Cyclist Counts 15
Appendix 3. Calculating Average Weekly Increases in Walking and Cycling, Inner South Pilot Area 17
Appendix 4. Inner East Pilot Area Before & After Pedestrian & Cyclist Counts 19
Appendix 5. Inner East Pilot Area Before & After Pedestrian & Cyclist Counts, Further Adjustments by Author 23
Appendix 6. Calculating Average Weekly Increases in Walking and Cycling, Inner East Pilot Area 25

Summary

S.1 In December 2013 the Local Government Information Unit issued a briefing note[1] extolling the claimed benefits of 20mph speed limits. One claim was that walking and cycling had increased by an average of 23% and 20.5% respectively, after 20mph limits were introduced in two pilot areas of Bristol. Since these figures were much higher than reported in other cities with signed-only 20mph limits, the author decided to investigate their origin.

S.2 The figures were traced to a Bristol City Council report[2] in which it was claimed that walking had increased by between 10 and 36%, and cycling by between 4 and 37%. So the 'averages' had been produced by simply adding the high and low figures and dividing by two! This is clearly an abuse of statistics, so a Freedom of Information request was made to the council for the original before-and-after survey data.

S.3 A monitoring report by the council[3] showed that the bottom end of the pedestrian range was actually 1%, not 10%, and the upper figures were taken from survey results that had not been corrected for the rain that affected some count sites in the before period. Using the council's rain-corrected figures means that the range of increases was between 1 and 21% for walking and between 4 and 22% for cycling. In both cases, the lower figures were from weekday counts and the higher ones from those at the weekend.

S.4 In both pilot areas, all the before counts were conducted in August 2009. The after counts were carried out in August 2010 in the Inner South area (two months after the 20mph limits were introduced) and in August 2011 in the Inner East area (ten months after the limits came into effect). There were nine survey sites in each pilot area, where 12-hour manual counts were undertaken on just one weekday and one weekend day in the before and after months. The council supplied the author with a summary sheet for each of the pilot areas in addition to the full 12-hour data from the individual survey sites.

S.5 The weather can affect levels of walking and cycling and some of the individual survey records included a note of weather conditions during the counts, while others did not. Daily records of weather at a site to the north of Bristol[4] were used by the author to check the information on the survey records, or fill in the blanks (Appendix 1).

S.6 In the Inner South area, the average increases shown on the summary sheet for all survey stations combined matched the figures quoted in the monitoring report[3] (Appendix 2). The council had not adjusted any of the figures for rain, but weather records showed significant rainfall during one of the weekday before counts. This site also showed higher increases in walking and cycling than others in the pilot area, suggesting that rain had been a factor, so the author produced revised figures by setting the after count equal to the before count. This is the method the council had used to correct for rain at some sites in the Inner East area.

Inner South Pilot Area Increases	Pedestrians			Cyclists		
	Weekday	Weekend	Average	Weekday	Weekend	Average
Survey results	1.1%	11.6%	3.0%	3.9%	11.8%	5.1%
Adjusted by author for rain	0.5%	11.6%	2.5%	2.0%	11.8%	3.6%

S.7 The table above summarises the increases within the Inner South area, calculated from both the original survey results and those adjusted for rain by the author. The average figures are for a 7-day week, calculated by combining the weekday and weekend results in the ratio 5:2, as described in Appendix 3.

S.8 In the Inner East area, the average increases shown on the summary sheet for all survey stations combined were significantly higher than the figures quoted in the monitoring report. The council had evidently made adjustments beyond those applied to rain-affected sites, but these were not documented. One of the other sites showed very high increases in walking and cycling. By deleting this site from the calculations, the monitoring report figures were replicated, precisely in five cases and very closely in the other three (Appendix 4). The council has subsequently confirmed that this site's data was discarded as unrepresentative.

S.9 At a further site the weekend after counts were much higher than the before counts. This was probably due to the after count having been conducted on the bank holiday weekend, with the before count during a normal weekend. So the author has produced revised average increases for the Inner East area with the after weekend count set equal to the before count at this site (Appendix 5). The three sets of figures are shown in the table below, including weekly averages calculated in the same way as for the Inner South area (Appendix 6).

Inner East Pilot Area Increases	Pedestrians			Cyclists		
	Weekday	Weekend	Average	Weekday	Weekend	Average
Survey results	14.6%	36.7%	20.1%	23.0%	36.6%	25.5%
BCC adjusted for rain	9.7%	20.5%	12.4%	8.2%	19.7%	10.3%
Further adjusted by author	9.7%	7.0%	9.1%	8.2%	11.6%	8.8%

S.10 The weekly averages show that walking and cycling both increased by around 3% in the Inner South area and around 9% in the Inner East area. Weekday flows increased more in the Inner East Area but the weekend increases were similar.

S.11 It is not possible to attribute all the increases in walking and cycling to the 20mph speed limits. Variability in one-day counts, especially in the August school holiday period, make the results particularly unreliable. In addition, the effects of the economic downturn following the financial crisis of 2008 continued to be felt throughout the three years of the Bristol surveys. It is possible that, as the recession bit, people walked or cycled more to cut the cost of car use. They may also have taken more holidays at home, which could have affected the increases in walking and cycling, especially at weekends.

S.12 It is impossible to quantify the impact these factors might have played in the observed increases in walking and cycling. If the council had undertaken control counts at the same time, in areas where 30mph speed limits were retained, the changes in the pilot areas could have been compared with those in the control areas. In the absence of such a comparison, however, the observed increases in the pilot areas, even when properly calculated as described in this report, should not be assumed to be due solely to the 20mph speed limits.

1. Background

1.1 In December 2013, the Local Government Information Unit (LGiU) issued a briefing note, entitled *Area-wide 20mph neighbourhoods: a win, win, win for local authorities*[1]. This note reviewed evidence claimed to be supportive of the widespread introduction of signed-only 20mph speed limits in urban areas. One of the claimed benefits was that 20mph speed limits encourage increased physical activity, citing findings in Bristol that walking and cycling increased by an average of 23% and 20.5% respectively, after 20mph limits were introduced in two pilot areas.

1.2 These figures are surprisingly high, since other local authorities that have introduced 20mph speed limits have not reported significant changes in modal shift. So the author decided to check the origins of the figures, starting with the Bristol City Council Cabinet report referred to in the LGiU report[2]. In paragraph 5 of the Bristol report it states: *"The pilot areas saw an increase in walking ranging from between 10% and 36% and for cycling between 4% and 37%."* Later in that paragraph it says: *"Using a mean of a 23% increase in walking and a 20.5% increase in cycling..."* It then calculates financial benefits from those increases.

1.3 It is statistically invalid to calculate an average of percentages by simply adding the highest and lowest and dividing by two. The individual percentage changes have to be weighted according to the absolute figures involved to give a true average. That such an elementary error could be made in a local authority report is both extraordinary and concerning, especially when the figures so derived are used by others to justify speed limit changes that could affect millions of people. The next stage, therefore, was to submit a Freedom of Information request to Bristol City Council for the original survey data from which the walking and cycling increases were derived.

2. Bristol City Council Reports and Survey Data

2.1 The initial response to the author's Freedom of Information request was to provide a link to the council's monitoring report on the 20mph pilot areas[3]. In the executive summary of that report, in the paragraph on key headline findings, are the following claims:

- *Increase in counts for walking range from 10% increase to 36% increase according to whether one looks at South pilot or East, weekends or weekdays, and correcting (or not) for rainy days.*
- *Increase in counts for cycling range from 4% increase to 37% increase, according to the same variables.*

2.2 These are the same figures quoted in the council cabinet report of July 2012 and reproduced in the LGiU report. Within the body of the pilot areas monitoring report, however, in the section on pedestrian and pedal cyclist levels, is the following, more detailed summary:

- *Pedestrian activity increased by 1% on a weekday and 12% on the weekend in the Inner South area.*
- *Cycling levels increased by 4% on a weekday and 12% on the weekend in the Inner South area.*

- *Pedestrian activity increased by between 10% (rain affected) and 15% on a weekday and between 21% (rain affected) and 36% on the weekend in the Inner East area.*
- *The Inner East area saw a total increase in weekday cycling levels of between 8% (rain affected) and 23% and weekend cycling by between 22% (rain affected) and 37%.*

2.3 The more precise percentage changes in each of the two areas, for weekdays and weekends, for both pedestrians and cyclists, are shown in Table 1 of the monitoring report, reproduced below.

	PEDESTRIAN COUNT		PEDAL CYCLIST COUNT	
Study Site	WEEKDAY CHANGE	WEEKEND CHANGE	WEEKDAY CHANGE	WEEKEND CHANGE
Inner South Pilot Area				
Survey Results	1.1%	11.6%	3.9%	11.8%
Surveys factored for rain effects	1.1%	11.6%	3.9%	11.8%
Inner East Pilot Area				
Survey Results	14.6%	35.6%	23.0%	36.6%
Surveys factored for rain effects	9.7%	20.7%	8.2%	21.9%

Percentage Change in Pedestrian and Cycling Levels (Table 1, BCC Monitoring Report)

2.4 It is immediately clear that these results are not correctly reflected in the headline figures in the executive summary. For a start, the bottom of the range for increases in pedestrian numbers is not 10% but 1%. In the Inner East pilot area, some of the before counts were affected by rain, which is likely to have reduced the numbers of pedestrians and cyclists. Comparing a rain-affected before count with a dry after one will give, therefore, exaggerated figures for the increases in walking and cycling. The council has clearly recognised this problem by providing an alternative set of figures, factored for rain effects. This has been done by making the after counts equal to the before counts for those survey stations affected by rain in the before surveys.

2.5 It is misleading, therefore, for the council to quote upper figures for increases in walking and cycling that are based on rain-affected surveys. The adjusted figures should be used instead. If this were the case, and the correct figure used for the lower end of the pedestrian range, the increases in pedestrians would be from 1% to 21% and for cyclists from 4% to 22%. Even using the statistically unacceptable method of 'averaging' these ranges in the council's report of July 2012, figures of 11% and 13% would result for walking and cycling increases respectively. This is much lower than the 23% and 20.5% given in the July 2012 report and seized upon by the LGiU.

2.6 To obtain statistically valid average increases it is necessary to know the actual numbers of pedestrians and cyclists recorded at the individual survey stations. To this end the author requested, and received, copies of data sheets for the stations in the monitoring programme.

3. Survey Station Data

3.1 Within each of the pilot areas there were nine monitoring sites where pedestrians and cyclists were counted. Manual 12-hour counts (7.00am to 7.00pm) were carried out on one weekday (Tuesday, Wednesday or Thursday) and one weekend day, both before and after the 20mph speed limits were implemented. In all cases, pedestrians and cyclists were counted separately on the same days.

3.2 All the before counts were carried out in August 2009. In the Inner South pilot area, all the after counts were undertaken in August 2010, two months after the speed limit became operational. In the Inner East area, all but one of the after counts were undertaken in August 2011 (ten months after the speed limit came into effect), the other in September 2011.

3.3 In the Inner South area, there is no data at one of the sites from the weekday before survey and no data at a different site from the weekend after survey. In these cases, no before-and-after comparisons were possible at those sites. At another weekend site, only afternoon data (1.00pm to 7.00pm) is available from both the before and after counts.

3.4 In the Inner East area, there is no data at one of the sites from the weekday before survey, so no before-and-after comparison is possible at that site.

3.5 All the counts were carried out during school summer holidays, although traffic engineers generally prefer April or October as the most 'neutral' months. Since pedestrians and cyclists are exposed to the elements, weather can play a significant part in their levels of activity. This is especially the case at weekends, when more trips are likely to be discretionary. Some of the survey sheets recorded weather conditions, although the descriptions were sometimes rather vague and others were missing.

3.6 A more objective assessment of weather conditions has been obtained from the website of Martyn Hicks, who has recorded daily weather data for the Horfield/Filton area of north Bristol since 2004[4]. Appendix 1 shows the survey sites in the two pilot areas, the dates when the individual weekday and weekend counts were undertaken, and the weather conditions as recorded on the survey sheets. Where no weather information was recorded on the sheets, conditions were deduced from the Horfield/Filton data. Where the recorded information appears to conflict with the Horfield/Filton data, the latter has been summarised along with the survey sheet description.

3.7 Weather can vary within quite small geographical areas, so data from the Horfield/Filton records is not necessarily a true reflection of the weather at the actual survey sites. It does, however, provide a reasonable proxy where direct observations are missing or limited.

3.8 As noted in section 2 above, Bristol City Council has made adjustments to some of the before-and-after comparisons where rain was recorded during the before survey. No such adjustments have been made, however, to any of the Inner South area comparisons. This may need correcting, as the following section will explain.

4. Analysis of Before-and-After Data – Inner South Pilot Area

4.1 In addition to data sheets for each of the survey stations, Bristol City Council has supplied a summary sheet for each of the two pilot areas, showing the before and after figures at each of the nine survey locations for the weekday and weekend surveys, and for pedestrians and cyclists separately. That summary data is reproduced for the Inner South area in Appendix 2 as four tables:

Table S2A – Weekday pedestrian counts, before and after
Table S2B – Weekend pedestrian counts, before and after
Table S3A – Weekday cyclist counts, before and after
Table S3B – Weekend cyclist counts, before and after

4.2 It will be seen in each case that the overall average increase for all survey stations combined (bottom right cell of table) is the same as that in the summary table of the BCC monitoring report (para 2.3 above), when rounded to one place of decimals. It will also be seen that there is a wide range of changes in pedestrian and cyclist numbers between the before and after counts at different survey sites, including falls at some of them. This reflects the variability of day-to-day movements and the limitations of one-day counts, especially in school holiday periods.

4.3 As noted in para 3.8 above, the council did not make any adjustments for weather-affected counts in the Inner South area. As can be seen from Table S1A (Appendix 1) however, the weather at five of the weekday before counts is described as 'sun and showers'. At one of these, Duckmoor, weather records for Horfield/Filton show 14.8mm of rain, with no sun and a relatively cool maximum temperature of 18.8^{o}C. While it does not follow that identical conditions occurred at the survey site, it is probable that the showers would have been particularly heavy. The figures in Tables S2A and S3A show that Duckmoor exhibited the second highest increase in pedestrian weekday flow and the highest increase in weekday cyclist flow, supporting the view that poor weather during the before survey may have contributed. The figures in blue in those two tables show the results of setting the after counts equal to the before counts for the Duckmoor weekday surveys.

4.4 In order to calculate an overall weekly increase in pedestrian or cycling activity, it is not acceptable to simply average the weekday and weekend increases. Although only one weekday and one weekend count were undertaken, those counts must be assumed to be representative of all five weekdays and both weekend days. Overall weekly averages must be calculated, therefore, weighting the weekday to weekend counts in the ratio of 5:2. The method for carrying out the calculations is shown in Appendix 3, where it is then applied to the data in the tables of Appendix 2.

4.5 Using Bristol City Council's figures without adjusting for weather, the weekly increase in pedestrians is calculated as 3.0%. For cyclists it is 5.1%.

4.6 Using adjusted Duckmoor weekday figures, the weekly increase in pedestrians is 2.5% and for cyclists it is 3.6%. These are the best estimates of the weekly increases in walking and cycling that can be derived from the survey data.

5. Analysis of Before-and-After Data – Inner East Pilot Area

5.1 The Inner East area data is less straightforward than that for the Inner South area, as the overall percentage increases shown in the summary sheet (referred to in para 4.1 above) do not match those in the summary table of the BCC monitoring report (para 2.3 above). The increases in the summary sheet are much higher than those shown in the summary table. This indicates that the council must have made adjustments beyond those for rain-affected before counts at some survey sites, although no such adjustments are documented in the monitoring report[3] or the report to Cabinet in July 2012[2].

5.2 In Appendix 4 are eight tables showing the results of the before-and-after surveys in the summary sheet:

Table E2A – Weekday pedestrian counts, before and after (unadjusted for rain)
Table E2B – Weekend pedestrian counts, before and after (unadjusted for rain)
Table E3A – Weekday cyclist counts, before and after (unadjusted for rain)
Table E3B – Weekend cyclist counts, before and after (unadjusted for rain)
Table E4A – Weekday pedestrian counts, before and after (adjusted for rain)
Table E4B – Weekend pedestrian counts, before and after (adjusted for rain)
Table E5A – Weekday cyclist counts, before and after (adjusted for rain)
Table E5B – Weekend cyclist counts, before and after (adjusted for rain)

5.3 In all cases it can be seen that the results from the Stokes Croft survey site show very large increases in pedestrian and cyclist activity, not only in percentage terms but in absolute numbers. By removing the data from this site, the overall increases (bottom right cell of the tables) are either identical with or very close to the figures shown in the summary table of the BCC Monitoring Report. This can be seen in the following table.

	Pedestrians		Cyclists	
	Weekday	Weekend	Weekday	Weekend
	Not Rain Adjusted			
Inc Stokes Croft	51.1%	73.9%	29.2%	40.2%
Ex Stokes Croft	14.6%	**36.7%**	23.0%	36.6%
Monitoring Report	14.6%	**35.6%**	23.0%	36.6%
	Rain Adjusted by BCC			
Inc Stokes Croft	47.8%	61.5%	20.0%	28.5%
Ex Stokes Croft	9.7%	**20.5%**	8.2%	**19.7%**
Monitoring Report	9.7%	**20.7%**	8.2%	**21.9%**

Comparative percentage increases with and without Stokes Croft, and with table in para 2.3

5.4 In five of the eight combinations of pedestrians, cyclists, not rain adjusted and rain adjusted, the figures from the survey summary sheet, with Stokes Croft data removed, are identical to those in the monitoring report summary table. In the other three combinations, highlighted in bold, there are small discrepancies that cannot be explained. They may be

due to errors in the council's calculations when removing the Stokes Croft data, but the differences are small enough not to have any significant impact on further analysis.

5.5 It is clear the council recognised that the results from Stokes Croft were not representative, so removed them before calculating the percentage increases shown in the monitoring and cabinet reports (subsequently confirmed by BCC). The author considers, however, that a further adjustment is needed to the weekend counts at the St Mark's Road survey site, where the after counts were conducted during the August bank holiday weekend (the before counts were not). As can be seen from tables E2B, E3B, E4B and E5B (Appendix 4), the weekend counts at the site increased by more than 100% in some cases, while the weekday counts increased by less than 11%. In order to remove the distortion caused by including the bank holiday after count, the author has set the pedestrian and cyclist weekend after counts equal to the before counts, with the results shown in the tables of Appendix 5.

5.6 Appendix 6 shows how average weekly increases in walking and cycling were calculated, weighting the weekday to weekend counts in the ratio 5:2 in the same way as for the Inner South area. Three sets of figures were produced, in all cases with Stokes Croft data removed: without adjustment for rain-affected before surveys; with adjustment for rain-affected before surveys; and with additional adjustment to St Mark's Road, weekend after surveys. The results are summarised in the following table.

	Pedestrians	Cyclists
Without adjustments for rain	20.1%	25.5%
With BCC adjustments for rain	12.4%	10.3%
With adjustments to St Mark's Road	9.1%	8.8%

Average weekly increases in walking and cycling in Inner East area (Appendix 6)

6. Discussion and Conclusions

6.1 Looking first at the Inner South Pilot Area, the increases in walking and cycling are summarised in the following table.

Inner South Pilot Area	Pedestrians			Cyclists		
	Weekday	Weekend	Average	Weekday	Weekend	Average
Survey results	1.1%	11.6%	3.0%	3.9%	11.8%	5.1%
Adjusted by author for rain	0.5%	11.6%	2.5%	2.0%	11.8%	3.6%

6.2 It can be seen that there was a very small increase in pedestrian weekday numbers and a slightly larger increase in cyclist weekday numbers. At weekends, however, both pedestrian and cyclist numbers increased by just under 12%. Over a seven-day week, pedestrian numbers increased by 2.5% and cyclists by 3.6%.

6.3 The increases in the Inner East Pilot Area are summarised in the following table:

Inner East Pilot Area	Pedestrians			Cyclists		
	Weekday	Weekend	Average	Weekday	Weekend	Average
Survey results	14.6%	36.7%	20.1%	23.0%	36.6%	25.5%
BCC adjusted for rain	9.7%	20.5%	12.4%	8.2%	19.7%	10.3%
Further adjusted by author	9.7%	7.0%	9.1%	8.2%	11.6%	8.8%

6.4 In this case, the unadjusted survey results are included only for completeness and to show the effect that different weather conditions between the before and after surveys can have. The fact that the council decided to adjust the after figures at some survey sites because of rain confirms that the unadjusted figures are misleading and should not be quoted. The author's further adjustments relate to one survey site where the weekend after count was conducted during the August bank holiday weekend, whereas the before count was not.

6.5 Over a seven-day week, both pedestrian and cycle figures increased by around 9%. There is a less marked difference between weekday and weekend increases than that seen in the Inner South area.

6.6 The before and after counts in the Inner South area were carried out one year apart, whereas those in the Inner East area were two years apart. Also, the after counts were conducted two months after implementation of the 20mph speed limits in the Inner South area, but ten months after implementation in the Inner East area. For these reasons, there seems little value in calculating average increases across the two areas combined, as the results would have little meaning and would simply mask the differences between the areas.

6.7 As the council's monitoring report[3] concedes (para 9.4), it is not possible to attribute the increases in walking and cycling solely to the introduction of the 20mph speed limits. There are other factors that could have affected the results in Bristol, not least the decision to undertake the surveys in August, during the school summer holidays. Traffic counts are normally held outside holiday periods, due to their greater variability in levels of travel.

6.8 Economic factors may also have played a part. Following the financial crisis of 2008, the effects of the economic downturn continued to be felt throughout the three years of the Bristol surveys. It is possible that, as the recession bit, people walked or cycled more to cut the cost of car use. They may also have taken fewer holidays away from home, which could have affected the increases in weekend walking and cycling.

6.9 It is not possible to quantify the impact these factors might have played in the observed increases in walking and cycling. If the council had undertaken control counts at the same time, in areas where 30mph speed limits were retained, the changes in the pilot areas could have been compared with those in the control areas. In the absence of such a comparison, however, the observed increases in the pilot areas, even when properly calculated as described in this report, should not be assumed to be due solely to the 20mph speed limits.

7. References

1. LGiU Policy Briefing. *Area-wide 20mph neighbourhoods: a win, win, win for local authorities*. 10 December 2013.
2. Bristol City Council Cabinet. *Citywide Rollout of 20mph speed limits*. 26 July 2012.
3. Bristol City Council. *20mph Speed Limit Pilot Areas: Monitoring Report*. March 2012.
4. http://www.martynhicks.co.uk/weather/data.php?page=months

Appendix 1

Before and After Survey Days Weather Comparison

(Weather conditions as recorded on survey summary sheets, except as indicated)

Table S1A: Inner South Area, Weekday (Pedestrians & Cyclists)

Survey Site	Before			After		
	Date	Day of wk	Weather	Date	Day of wk	Weather
Bedminster Parade	12/08/2009	Wednesday	Overcast	10/08/2010	Tuesday	Rain
Dean Lane	11/08/2009	Tuesday	Dry & warm	12/08/2010	Thursday	Dry, cool*
Duckmoor	04/08/2009	Tuesday	Sun, showers[1]	03/08/2010	Tuesday	'Lovely'[2]
Greenway Bush	05/08/2009	Wednesday	Sun, showers	04/08/2010	Wednesday	Sun, showers
Luckwell	06/08/2009	Thursday	Sun, showers	03/08/2010	Tuesday	Warm, showers*[2]
North Street	06/08/2009	Thursday	Sun, showers	05/08/2010	Thursday	Dry, av. temp*
St John's Lane	11/08/2009	Tuesday	Dry & warm	05/08/2010	Thursday	Dry, av. temp*
St Luke's Road	N/A			10/08/2010	Tuesday	Rain
West Street	05/08/2009	Wednesday	Sun, showers	04/08/2010	Wednesday	Sun, showers

*Weather conditions not shown on summary sheet, deduced from weather records for Horfield and Filton

[1] Horfield and Filton records show 18.8C max, no sun and 14.8mm rain

[2] Horfield and Filton records show 22.0C max, 0.5 hours sun and 0.6mm rain

Table S1B: Inner South Area, Weekend (Pedestrians & Cyclists)

Survey Site	Before			After		
	Date	Day of wk	Weather	Date	Day of wk	Weather
Bedminster Parade	22/08/2009	Saturday	Hot, sunny[1]	N/A		
Dean Lane	23/08/2009	Sunday (PM)	Warm, dry*	22/08/2010	Sunday (PM)	Warm, sunny*
Duckmoor	02/08/2009	Sunday	Sunny all day	08/08/2010	Sunday	Warm, sunny*
Greenway Bush	16/08/2009	Sunday	Dry, cloudy[2]	15/08/2010	Sunday	Hot, sunny*[3]
Luckwell	02/08/2009	Sunday	Sunny all day	08/08/2010	Sunday	Warm, sunny*
North Street	23/08/2009	Sunday	Warm, dry	14/08/2010	Saturday	Cool, showers*[4]
St John's Lane	08/08/2009	Saturday	Dry, sunny	14/08/2010	Saturday	Cool, showers*[4]
St Luke's Road	22/8/2009	Saturday	Hot, sunny[1]	21/08/2010	Saturday	Warm, showers*[5]
West Street	16/8/2009	Sunday	Dry, cloudy[2]	15/08/2010	Sunday	Hot, sunny*[3]

*Weather conditions not shown on summary sheet, deduced from weather records for Horfield and Filton

[1] Horfield and Filton records show 21.1C max, 2.3 hours sun, 0.2mm rain

[2] Horfield and Filton records show 18.6C max, 0.1 hours sun, no rain

[3] Horfield and Filton records show 24.1C max, 4.5 hours sun, no rain

[4] Horfield and Filton records show 17.5C max, 0.3 hours sun, 9.0mm rain

[5] Horfield and Filton records show 22.6C max, 0.1 hours sun, 8.8mm rain

Table E1A: Inner East Area, Weekday (Pedestrians & Cyclists)

Survey Site	Before			After		
	Date	Day of wk	Weather	Date	Day of wk	Weather
Ashley Hill	19/08/2009	Wednesday	Cloud & sun[1]	25/08/2011	Thursday	Fine and dry[2]
Devon Road	25/08/2009	Tuesday	Dry, sun	11/08/2011	Thursday	Cloud*[3]
Lawfords Gate	20/08/2009	Thursday	Some rain[4]	18/08/2011	Thursday	Cool, some rain*[5]
Lawrence Hill	N/A			11/08/2011	Thursday	Cloud*[3]
Midland Road	26/08/2009	Wednesday	Some rain[6]	11/08/2011	Thursday	Cloud*[3]
Queen Ann Road	27/08/2009	Thursday	Fine & dry	31/08/2011	Thursday	Fine & dry
St Mark's Road	20/8/2009	Thursday	Some rain[4]	24/08/2011	Wednesday	Some rain[7]
Stokes Croft	18/08/2009	Tuesday	Dry, sunny	25/08/2011	Thursday	Sun and rain*[2]
Whitehall Road	26/08/2009	Wednesday	Some rain[6]	18/08/2011	Thursday	Cool, some rain*[5]

*Weather conditions not shown on summary sheet, deduced from weather records for Horfield and Filton
[1] Horfield and Filton records show 25.1C max, 9.2 hours sun, no rain
[2] Horfield and Filton records show 19.7C max, 3.5 hours sun, 8.4mm rain
[3] Horfield and Filton records show 19.3C max, no sun, 3.6mm rain
[4] Horfield and Filton records show 21.3c max, 3.9 hours sun, 1.8mm rain
[5] Horfield and Filton records show 13.5C max, no sun, 2.0mm rain
[6] Horfield and Filton records show 18.7C max, no sun, 2.4mm rain
[7] Horfield and Filton records show 20.6C max, 4.3 hours sun, 11.8mm rain

Table E1B: Inner East Area, Weekend (Pedestrians & Cyclists)

Survey Site	Before			After		
	Date	Day of wk	Weather	Date	Day of wk	Weather
Ashley Hill	09/08/2009	Sunday	Sun, showers[1]	28/08/2011	Sunday BH	Fine and dry[2]
Devon Road	01/08/2009	Saturday	Showery[3]	13/08/2011	Saturday	Some rain*[4]
Lawfords Gate	09/08/2009	Sunday	Sun, showers[1]	20/08/2011	Saturday	Mainly dry[5]
Lawrence Hill	15/08/2009	Saturday	Sunny	13/08/2011	Saturday	Some rain*[4]
Midland Road	15/08/2009	Saturday	Sunny	13/08/2011	Saturday	Some rain*[4]
Queen Ann Road	01/08/2009	Saturday	Showery[3]	03/09/2011	Saturday	Fine and dry
St Mark's Road	09/08/2009	Sunday	Sun, showers[1]	28/08/2011	Sunday BH	Some rain[2]
Stokes Croft	08/08/2009	Saturday	Dry, sunny	27/08/2011	Saturday BH	Mainly dry*[6]
Whitehall Road	15/08/2009	Saturday	Sunny	21/08/2011	Sunday	Dry, sunny*[7]

BH indicates count taken during the August bank holiday weekend
*Weather conditions not shown on summary sheet, deduced from weather records for Horfield and Filton
[1] Horfield and Filton records show 24.0C max, 11.1 hours sun, no rain
[2] Horfield and Filton records show 19.2C max, 3.5 hours sun, 0.4mm rain
[3] Horfield and Filton records show 16.9C max, no sun, 2.0mm rain
[4] Horfield and Filton records show 19.9C max, 0.1 hours sun, 1.0mm rain
[5] Horfield and Filton records show 20.0C max, 1.3 hours sun, 0.2mm rain
[6] Horfield and Filton records show 18.8C max, 3.3 hours sun, 0.2mm rain
[7] Horfield and Filton records show 22.2C max, 6.4 hours sun, no rain

Appendix 2

Inner South Pilot Area Before & After Pedestrian & Cyclist Counts
(Data from BCC manual classified count summary sheet)

Table S2A: Inner South Area Weekday Pedestrian Counts

Count Site	Before Count	After Count	Change +/- (%)
Bedminster Parade	3310	4042	+22.11
Dean Lane	4643	3900	-16.00
Duckmoor	555	661 (555)	+19.10 (0.0)
Greenway Bush	1195	1145	-4.18
Luckwell	1321	1458	+10.37
North Street	2647	2580	-2.53
St John's Lane	1131	1108	-2.03
St Luke's Road	No data	1351	N/A
West Street	2600	2704	+4.00
All Sites (Ex St Luke's Rd)	17402	17598 (17492)	+1.13 (+0.52)

Figures in blue denote adjusted by author for rain during before count

Table S2B: Inner South Area Weekend Pedestrian Counts

Count Site	Before Count	After Count	Change +/- (%)
Bedminster Parade	3187	No data	N/A
Dean Lane	950	957	+0.74
Duckmoor	856	749	-12.50
Greenway Bush	1026	1798	+75.24
Luckwell	1341	1168	-12.90
North Street	2782	2977	+7.01
St John's Lane	836	718	-14.11
St Luke's Road	466	815	+74.89
West Street	1205	1380	+14.52
All Sites (Ex Bedminster Pd)	9462	10562	+11.63

Table S3A: Inner South Area Weekday Cyclist Counts

Count Site	Before Count	After Count	Change +/- (%)
Bedminster Parade	603	694	+15.09
Dean Lane	1695	1545	-8.85
Duckmoor	104	185 (104)	+77.88 (0.0)
Greenway Bush	412	370	-10.19
Luckwell	236	251	+6.36
North Street	362	431	+19.06
St John's Lane	272	258	-5.15
St Luke's Road	360	340	-5.56
West Street	348	487	+39.94
All Sites	4392	4561 (4480)	+3.85 (+2.00)

Figures in blue denote adjusted by author for rain during before count

Table S3B: Inner South Area Weekend Cyclist Counts

Count Site	Before Count	After Count	Change +/- (%)
Bedminster Parade	349	549*	+57.31
Dean Lane	295	292	-1.02
Duckmoor	168	172	+2.38
Greenway Bush	291	418	+43.64
Luckwell	126	120	-4.76
North Street	248	198	-20.16
St John's Lane	132	101	-23.48
St Luke's Road	153	179	+16.99
West Street	288	263	-8.68
All Sites	2050	2292	+11.80

*No data sheet provided for cyclist weekend after count

Appendix 3

Calculating Average Weekly Increases in Walking and Cycling, Inner South Pilot Area

For pedestrians and cyclists separately, where:

WDb = Weekday before count, total all sites
WDa = Weekday after count, total all sites
WEb = Weekend before count, total all sites
WEa = Weekend after count, total all sites

The average percentage increase for a complete week of seven days is given by:

$$\frac{[(WDa \times 5) + (WEa \times 2)] - [(WDb \times 5) + (WEb \times 2)]}{[(WDb \times 5) + (WEb \times 2)]} \times 100$$

Pedestrians

Using BCC figures unadjusted for rain, the weekly increase is:

$$\frac{[(17598 \times 5) + (10562 \times 2)] - [(17402 \times 5) + (9462 \times 2)]}{[(17402 \times 5) + (9462 \times 2)]} \times 100$$

$$= \frac{[87990 + 21124] - [87010 + 18924]}{[87010 + 18924]} \times 100 = \frac{109114 - 105934}{105934} \times 100$$

$$= \frac{3180}{105934} \times 100 = 3.00\%$$

Using figures adjusted for rain by the author at one weekday site, the increase is:

$$\frac{[(17492 \times 5) + (10562 \times 2)] - [(17402 \times 5) + (9462 \times 2)]}{[(17402 \times 5) + (9462 \times 2)]} \times 100$$

$$= \frac{[87460 + 21124] - [87010 + 18924]}{[87010 + 18924]} \times 100 = \frac{108584 - 105934}{105934} \times 100$$

$$= \frac{2650}{105934} \times 100 = 2.50\%$$

Cyclists

Using BCC figures unadjusted for rain, the weekly increase is:

$$\frac{[(4561 \times 5) + (2292 \times 2)] - [(4392 \times 5) + (2050 \times 2)]}{[(4392 \times 5) + (2050 \times 2)]} \times 100$$

$$= \frac{[22802 + 4584] - [21960 + 4100]}{[21960 + 4100]} \times 100 = \frac{27386 - 26060}{26060} \times 100$$

$$= \frac{1326}{26060} \times 100 = 5.09\%$$

Using figures adjusted for rain by the author at one weekday site, the weekly increase is:

$$\frac{[(4480 \times 5) + (2292 \times 2)] - [(4392 \times 5) + (2050 \times 2)]}{[(4392 \times 5) + (2050 \times 2)]} \times 100$$

$$= \frac{[22400 + 4584] - [21960 + 4100]}{[21960 + 4100]} \times 100 = \frac{26984 - 26060}{26060} \times 100$$

$$= \frac{924}{26060} \times 100 = 3.55\%$$

Appendix 4

Inner East Pilot Area Before & After Pedestrian & Cyclist Counts
(Data from BCC manual classified count summary sheet)

Table E2A: Inner East Area Weekday Pedestrian Counts (unadjusted for rain)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	1440	1508	+4.72
Devon Road	526	563	+7.03
Lawfords Gate	2454	2770	+12.88
Lawrence Hill	No data	2946	N/A
Midland Road	879	1331	+51.42
Queen Ann Road	1101	1334	+21.16
St Mark's Road	2530	2737	+8.18
Stokes Croft	4231 (0)	9797 (0)	+131.55 (0)
Whitehall Road	385	431	+11.95
All Sites (Ex Lawrence Hill)	13546 (9315)	20471 (10674)	+51.12 (+14.59)

Figures in yellow denote BCC adjustments (see Section 5)

Table E2B: Inner East Area Weekend Pedestrian Counts (unadjusted for rain)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	1063	1046 (BH)	-1.60
Devon Road	421	396	-5.94
Lawfords Gate	1423	2327	+63.53
Lawrence Hill	2118	2431	+14.78
Midland Road	711	869	+22.22
Queen Ann Road	719	1091	+51.74
St Mark's Road	1005	2037 (BH)	+102.69
Stokes Croft	2434 (0)	7086 (BH) (0)	+191.13 (0)
Whitehall Road	224	309	+37.95
All Sites	10118 (7684)	17592 (10506)	+73.87 (+36.73)

Figures in yellow denote BCC adjustments (see Section 5)
BH denotes count was undertaken during the August bank holiday weekend

Table E3A: Inner East Area Weekday Cyclist Counts (unadjusted for rain)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	910	983	+8.02
Devon Road	132	172	+30.30
Lawfords Gate	533	574	+7.69
Lawrence Hill	No data	526	N/A
Midland Road	1280	1848	+44.38
Queen Ann Road	198	285	+43.94
St Mark's Road	550	609	+10.73
Stokes Croft	2326 (0)	3241 (0)	+39.34 (0)
Whitehall Road	216	228	+5.56
All Sites (Ex Lawrence Hill)	6145 (3819)	7940 (4699)	+29.21 (23.04)

Figures in yellow denote BCC adjustments (see Section 5)

Table E3B: Inner East Area Weekend Cyclist Counts (unadjusted for rain)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	408	362 (BH)	-11.27
Devon Road	66	95	+43.94
Lawfords Gate	299	437	+46.15
Lawrence Hill	278	302	+8.63
Midland Road	719	907	+26.15
Queen Ann Road	51	240	+370.59
St Mark's Road	194	366 (BH)	+88.66
Stokes Croft	922 (0)	1370 (BH) (0)	+48.59 (0)
Whitehall Road	102	182	+78.43
All Sites	3039 (2117)	4261 (2891)	+40.21 (+36.56)

Figures in yellow denote BCC adjustments (see Section 5)
BH denotes count was undertaken during the August bank holiday weekend

Table E4A: Inner East Area Weekday Pedestrian Counts (adjusted for rain)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	1440	1508	+4.72
Devon Road	526	563	+7.03
Lawfords Gate	2454	2770	+12.88
Lawrence Hill	No data	2946	N/A
Midland Road	879	879	0.0
Queen Ann Road	1101	1334	+21.16
St Mark's Road	2530	2737	+8.18
Stokes Croft	4231 (0)	9797 (0)	+131.55 (0)
Whitehall Road	385	431	+11.95
All Sites (Ex Lawrence Hill)	13546 (9315)	20019 (10222)	+47.79 (+9.74)

Figures in yellow denote BCC adjustments (see Section 5)
Figures in blue denote BCC adjustment for rain during before count

Table E4B: Inner East Area Weekend Pedestrian Counts (adjusted for rain)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	1063	1046 (BH)	-1.60
Devon Road	421	421	0.0
Lawfords Gate	1423	1423	0.0
Lawrence Hill	2118	2431	+14.78
Midland Road	711	869	+22.22
Queen Ann Road	719	719	0.0
St Mark's Road	1005	2037 (BH)	+102.69
Stokes Croft	2434 (0)	7086 (BH) (0)	+191.13 (0)
Whitehall Road	224	309	+37.95
All Sites	10118 (7684)	16341 (9255)	+61.50 (+20.45)

Figures in yellow denote BCC adjustments (see Section 5)
Figures in blue denote BCC adjustment for rain during before count
BH denotes count was undertaken during the August bank holiday weekend

Table E5A: Inner East Area Weekday Cyclist Counts (adjusted for rain)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	910	983	+8.02
Devon Road	132	172	+30.30
Lawfords Gate	533	574	+7.69
Lawrence Hill	No data	526	N/A
Midland Road	1280	1280	0.0
Queen Ann Road	198	285	+43.94
St Mark's Road	550	609	+10.73
Stokes Croft	2326 (0)	3241 (0)	+39.34 (0)
Whitehall Road	216	228	+5.56
All Sites (Ex Lawrence Hill)	6145 (3819)	7372 (4131)	+19.97 (+8.17)

Figures in yellow denote BCC adjustments (see Section 5)
Figures in blue denote BCC adjustment for rain during before count

Table E5B: Inner East Area Weekend Cyclist Counts (adjusted for rain)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	408	362 (BH)	-11.27
Devon Road	66	66	0.0
Lawfords Gate	299	299	0.0
Lawrence Hill	278	302	+8.63
Midland Road	719	907	+26.15
Queen Ann Road	51	51	0.0
St Mark's Road	194	366 (BH)	+88.66
Stokes Croft	922 (0)	1370 (BH) (0)	+48.59 (0)
Whitehall Road	102	182	+78.43
All Sites	3039 (2117)	3905 (2535)	+28.50 (+19.74)

Figures in yellow denote BCC adjustments (see Section 5)
Figures in blue denote BCC adjustment for rain during before count
BH denotes count was undertaken during the August bank holiday weekend

Appendix 5

Inner East Pilot Area Before & After Pedestrian & Cyclist Counts
Further Adjustments by Author

Table E6A: Inner East Area Weekday Pedestrian Counts (no further adjustments)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	1440	1508	+4.72
Devon Road	526	563	+7.03
Lawfords Gate	2454	2770	+12.88
Lawrence Hill	No data	2946	N/A
Midland Road	879	879	0.0
Queen Ann Road	1101	1334	+21.16
St Mark's Road	2530	2737	+8.18
Stokes Croft	0	0	0.0
Whitehall Road	385	431	+11.95
All Sites (Ex Lawrence Hill)	9315	10222	+9.74

Table E6B: Inner East Area Weekend Pedestrian Counts (further adjustments)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	1063	1046 (BH)	-1.60
Devon Road	421	421	0.0
Lawfords Gate	1423	1423	0.0
Lawrence Hill	2118	2431	+14.78
Midland Road	711	869	+22.22
Queen Ann Road	719	719	0.0
St Mark's Road	1005	2037 (1005) (BH)	+102.69 (0.0)
Stokes Croft	0	0	0
Whitehall Road	224	309	+37.95
All Sites	7684	9255 (8223)	+20.45 (+7.01)

BH denotes count was undertaken during the August bank holiday weekend
Figures in pink denote author's further adjustments (see Section 5)

Table E7A: Inner East Area Weekday Cyclist Counts (no further adjustments)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	910	983	+8.02
Devon Road	132	172	+30.30
Lawfords Gate	533	574	+7.69
Lawrence Hill	No data	526	N/A
Midland Road	1280	1280	0.0
Queen Ann Road	198	285	+43.94
St Mark's Road	550	609	+10.73
Stokes Croft	0	0	0
Whitehall Road	216	228	+5.56
All Sites (Ex Lawrence Hill)	3819	4131	+8.17

Table E7B: Inner East Area Weekend Cyclist Counts (further adjustments)

Count Site	Before Count	After Count	Change +/- (%)
Ashley Hill	408	362 (BH)	-11.27
Devon Road	66	66	0.0
Lawfords Gate	299	299	0.0
Lawrence Hill	278	302	+8.63
Midland Road	719	907	+26.15
Queen Ann Road	51	51	0.0
St Mark's Road	194	366 (194) (BH)	+88.66 (0.0)
Stokes Croft	0	0	0.0
Whitehall Road	102	182	+78.43
All Sites	2117	2535 (2363)	+19.74 (+11.62)

BH denotes count was undertaken during the August bank holiday weekend
Figures in pink denote author's further adjustments (see Section 5)

Appendix 6

Calculating Average Weekly Increases in Walking and Cycling, Inner East Pilot Area

For pedestrians and cyclists separately, where:

WDb = Weekday before count, total all sites
WDa = Weekday after count, total all sites
WEb = Weekend before count, total all sites
WEa = Weekend after count, total all sites

The average percentage increase for a complete week of seven days is given by:

$$\frac{[(WDa \times 5) + (WEa \times 2)] - [(WDb \times 5) + (WEb \times 2)]}{[(WDb \times 5) + (WEb \times 2)]} \times 100$$

Pedestrians

Using BCC figures unadjusted for rain (excluding Stokes Croft), the weekly increase is:

$$\frac{[(10674 \times 5) + (10506 \times 2)] - [(9315 \times 5) + (7684 \times 2)]}{[(9315 \times 5) + (7684 \times 2)]} \times 100$$

$$= \frac{[53370 + 21012] - [46575 + 15368]}{[46575 + 15368]} \times 100 = \frac{74382 - 61943}{61943} \times 100$$

$$= \frac{12439}{61943} \times 100 = 20.08\%$$

Using figures adjusted for rain by BCC (excluding Stokes Croft), the weekly increase is:

$$\frac{[(10222 \times 5) + (9255 \times 2)] - [(9315 \times 5) + (7684 \times 2)]}{[(9315 \times 5) + (7684 \times 2)]} \times 100$$

$$= \frac{[51110 + 18510] - [46575 + 15368]}{[46575 + 15368]} \times 100 = \frac{69620 - 61943}{61943} \times 100$$

$$= \frac{7677}{61943} \times 100 = 12.39\%$$

Using weekend after figures further adjusted by the author, the weekly increase is:

$$\frac{[(10222 \times 5) + (8223 \times 2)] - [(9315 \times 5) + (7684 \times 2)]}{[(9315 \times 5) + (7684 \times 2)]} \times 100$$

$$= \frac{[51110 + 16446] - [46575 + 15368]}{[46575 + 15368]} \times 100 = \frac{67556 - 61943}{61943} \times 100$$

$$= \frac{5613}{61943} \times 100 = 9.06\%$$

Cyclists

Using BCC figures unadjusted for rain (excluding Stokes Croft), the weekly increase is:

$$\frac{[(4699 \times 5) + (2891 \times 2)] - [(3819 \times 5) + (2117 \times 2)]}{[(3819 \times 5) + (2117 \times 2)]} \times 100$$

$$= \frac{[23495 + 5782] - [19095 + 4234]}{[19095 + 4234]} \times 100 = \frac{29277 - 23329}{23329} \times 100$$

$$= \frac{5948}{23329} \times 100 = 25.50\%$$

Using figures adjusted for rain by BCC (excluding Stokes Croft), the weekly increase is:

$$\frac{[(4131 \times 5) + (2535 \times 2)] - [(3819 \times 5) + (2117 \times 2)]}{[(3819 \times 5) + (2117 \times 2)]} \times 100$$

$$= \frac{[20655 + 5070] - [19095 + 4234]}{[19095 + 4234]} \times 100 = \frac{25725 - 23329}{23329} \times 100$$

$$= \frac{2396}{23329} \times 100 = 10.27\%$$

Using weekend after figures further adjusted by the author, the weekly increase is:

$$\frac{[(4131 \times 5) + (2363 \times 2)] - [(3819 \times 5) + (2117 \times 2)]}{[(3819 \times 5) + (2117 \times 2)]} \times 100$$

$$= \frac{[20655 + 4726] - [19095 + 4234]}{[19095 + 4234]} \times 100 = \frac{25381 - 23329}{23329} \times 100$$

$$= \frac{2052}{23329} \times 100 = 8.80\%$$